Lower Colorado River Multi-Species Conservation Program

Balancing Resource Use and Conservation

Lower Colorado River Riparian Bird Surveys

2014 Annual Report

U.S. DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION

November 2014

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Multi-Species Conservation Program

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ACRONYMS AND ABBREVIATIONS

Bill Williams River NWR	Bill Williams River National Wildlife Refuge
BLCA	Beal Lake Conservation Area
cm	centimeter(s)
CV	coefficient of variance
CVCA	Cibola Valley Conservation Area
DBH	diameter at breast height
DC	diameter class(es)
GBBO	Great Basin Bird Observatory
GIS	Geographic Information System
GPS	Global Positioning System
ha	hectare(s)
Havasu NWR	Havasu National Wildlife Refuge
HC	height class(es)
HOBO	environmental data logger units
HTP	hits to pole
LCR	lower Colorado River
LCR MSCP	Lower Colorado River Multi-Species Conservation Program
m	meter(s)
MEFF	mobile electronic field forms
OTH	other
PVER	Palo Verde Ecological Reserve
QA/QC	quality assurance/quality control
Reclamation	Bureau of Reclamation
SC	size class(es)
SE	standard error
USGS	U.S. Geological Survey
UTM	Universal Transverse Mercator

Symbols

≈	approximately equal to
°	degrees
>	greater than
≥	greater than or equal to
<	less than
≤	less than or equal to
#	number
%	percent
±	plus or minus

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EXECUTIVE SUMMARY

The overarching goals of the lower Colorado River (LCR) riparian bird surveys continue to be to provide a baseline for monitoring long-term population trends of obligate riparian birds throughout the LCR, including the Lower Colorado River Multi-Species Conservation Program's (LCR MSCP) conservation and habitat creation areas, estimate population sizes of obligate riparian birds, and define habitat requirements of LCR MSCP covered species (Bureau of Reclamation 2006, 2008).

This report summarizes the results of the 2014 field surveys that were completed as part of the LCR MSCP riparian bird survey project. The first component of this project was to conduct system-wide monitoring of riparian birds. Data were collected and analyzed for six of the LCR MSCP covered species (Gila woodpecker [*Melanerpes uropygialis*], vermilion flycatcher [*Pyrocephalus rubinus*], Arizona Bell's vireo [*Vireo bellii arizonae*], Sonoran yellow warbler [*Dendroica petechia sonorana*], gilded flicker [*Colaptes chrysoides*], and summer tanager [*Piranga rubra*] as well as the most common riparian land bird species. These data resulted in population estimates for conservation and habitat creation areas and the system-wide project area.

For component 1 of the riparian bird survey project, we addressed the goals of baseline for monitoring long-term population trends of obligate riparian birds throughout the LCR, including the LCR MSCP's conservation and habitat creation areas, and estimating population sizes of obligate riparian birds. To do this, we completed rapid area searches on 80 plots selected randomly from the system-wide plot grid and intensive area searches on a random subset of 8 of those plots. We also completed rapid area searches on a subset of 80 plots within conservation and habitat creation areas, selected randomly from all conservation and habitat creation areas in 2014, and intensive area searches on 4 of those plots. The rapid and intensive area search data were analyzed using the double-sampling method to generate a corrected estimate for the total number of territories of the six LCR MSCP covered species as well as the most common territorial riparian land bird species.

During rapid surveys of conservation and habitat creation area plots, surveyors recorded a total of 17 territories of Arizona Bell's vireo, 13.5 of Sonoran yellow warbler, 3.25 of summer tanager, and 3 of vermilion flycatcher. Survey results for covered species at conservation and habitat creation area plots included 13 Arizona Bell's vireo, 7.5 Sonoran yellow warbler, and 1.75 summer tanager territories at the Beal Lake Conservation Area; 3 vermilion flycatcher and 1.5 summer tanager territories at a habitat creation area located within the Colorado River Indian Tribe (CRIT) Reservation ('Ahakhav Tribal Preserve CRIT 9); 5 Sonoran yellow warbler territories at the Palo Verde Ecological Reserve (PVER); 4 Arizona Bell's vireo and one Sonoran yellow warbler territory at the Cibola National Wildlife Refuge Unit #1 Conservation Area (Cibola NWR

Unit #1); and no territories at the Cibola Valley Conservation Area or Yuma East Wetlands. Intensive area searches were conducted on conservation and habitat creation area plots CRIT 9 D, PVER 7H, Cibola NWR Unit #1 Research Area 1 Genetics A, and Cibola NWR Unit #1 Crane Roost A. During these surveys, we found territories of two covered species: the Sonoran yellow warbler at Cibola NWR Unit #1 Crane Roost and the vermilion flycatcher at ‘Ahakhav Tribal Preserve CRIT 9.

During system-wide rapid surveys, we calculated the most common covered species to be the Sonoran yellow warbler (160.75 territories), followed by Arizona Bell’s vireo (44.75 territories), Gila woodpecker (18.5 territories), summer tanager (11 territories), vermilion flycatcher (0.25 territory), and gilded flicker (0.25 territory). During system-wide intensive area searches (n = 8 plots) in 2014, we found breeding evidence, including singing around a territory, pairs, nests, and fledglings for 4 covered species, including the Sonoran yellow warbler (95.25 territories), Arizona Bell’s vireo (16.5 territories), Gila woodpecker (8.75 territories), and summer tanager (6 territories). Overall, we recorded a total of 195 species on all surveys, including 181 species in system-wide surveys, compared with 147 species on conservation and habitat creation are plots, and 133 species were present on both system-wide and conservation and habitat creation area plots in 2014.

Components 2 (pre-development surveys of the Laguna Division Conservation Area) and 3 (testing the accuracy of the double-sampling method of the riparian bird survey project) were completed in previous years, and the results were reported in the Great Basin Bird Observatory (2011, 2013). This report thus covers data collection and the results of surveys conducted for components 1, 4, and 5.

For component 4 to address the goal of defining habitat requirements of LCR MSCP covered species, in 2014 we collected a fourth year of standardized LCR MSCP habitat monitoring data that covered a large set of biotic and abiotic variables. We discuss the methods, sampling design, and data collection for component 4 within this report; however, the results are not included at this time.

In 2014, we also continued component 5 of the project, which evaluates effects of the salt cedar beetle (*Diorhabda carinulata*) on riparian birds that share sites with the southwestern willow flycatcher (*Empidonax traillii extimus*). On all 30 study plots surveyed at the Havasu and the Bill Williams River National Wildlife Refuges in 2014, we recorded 109 species. We found territories of 44 breeding species, including 4 LCR MSCP covered species. The most common breeders included the song sparrow (*Melospiza melodia*), yellow-breasted chat (*Icteria virens*), common yellowthroat, (*Geothylypis trichas*) Lucy’s warbler (*Oreothylpis luciae*), and Sonoran yellow warbler. Because this project component will be discontinued after 2014, we will report the final survey results for it in this report.

INTRODUCTION

The Bureau of Reclamation (Reclamation) has been conducting bird surveys within the Lower Colorado Region since 2002. In 2007, the U.S. Geological Survey (USGS) designed and implemented a bird sampling plan for Reclamation that would produce density and trend estimates for six of the Lower Colorado River Multi-Species Conservation Program (LCR MSCP) covered riparian birds and other non-covered birds within the riparian habitat of the LCR MSCP planning area (Bart et al. 2010). The Great Basin Bird Observatory (GBBO) continued this project from 2008 through 2010, during which time we continued rapid and intensive effort surveys and refined field protocols (GBBO 2008, 2009, 2010), which were implemented in 2011–13. Using data from the first 4 years of the project, we calculated population densities for six of the LCR MSCP birds (Gila woodpecker [*Melanerpes uropygialis*], vermilion flycatcher [*Pyrocephalus rubinus*], Arizona Bell's vireo [*Vireo bellii arizonae*], Sonoran yellow warbler [*Dendroica petechia sonorana*], gilded flicker [*Colaptes chrysoides*], and summer tanager [*Piranga rubra*] as well as the most common riparian land bird species (GBBO 2008, 2009, 2010). We also began to collect habitat data for these six covered LCR MSCP species in 2009 (GBBO 2009, 2010). From this study, we and USGS collaborators generated several products, including a final sampling design (USGS), a field protocol (GBBO), the software program DS to analyze the data (USGS with GBBO), Geographic Information System (GIS) tools for sampling design (USGS), preliminary habitat models (GBBO), and preliminary population estimates (Bart et al. 2010; GBBO 2008, 2009, 2010). The final study design for the lower Colorado River (LCR) riparian bird survey project, A Sampling Plan for Riparian Birds of the Lower Colorado River – Final Report (Bart et al. 2010), along with all previous annual reports on this project from the GBBO and USGS are available on the LCR MSCP Web site (www.lcrmscp.gov).

In 2011–12, we continued the original two-part component of the project of monitoring riparian birds at system-wide and conservation and habitat creation area plots and added three new components to the project, including component 2 of obtaining a 1-year baseline bird population size estimate on a pre-development site in the Laguna Division Conservation Area, component 3 of testing assumptions of the double-sampling method, and component 4 of collecting biotic and abiotic data at use and non-use areas for four LCR MSCP covered species. In 2013, we also began work on component 5 to the project, which was established to evaluate the potential effects of the salt cedar beetle (*Diorhabda carinulata*) on breeding bird populations at southwestern willow flycatcher *(Empidonax traillii extimus)* sites in order to predict the beetle's potential effects to riparian bird populations within the LCR MSCP planning area. In 2014, we continued collecting data for components 1, 4, and 5.

System-wide monitoring of the LCR MSCP's riparian birds emphasizes six species covered under the program (hereafter: covered species), including the gilded flicker, Gila woodpecker, vermilion flycatcher, Arizona Bell's vireo, Sonoran yellow warbler, and summer tanager.

The project area for system-wide bird monitoring includes the Colorado River from Separation Canyon, upstream of Lake Mead, to the Southerly International Boundary with Mexico. The LCR MSCP project area also includes portions of the Bill Williams and Virgin Rivers. In 2014, we were again granted access to survey a habitat creation area located within the Colorado River Indian Tribe (CRIT) Reservation ('Ahakhav Tribal Preserve CRIT 9). Except in 2010, 'Ahakhav Tribal Preserve CRIT 9 was also surveyed in all previous years of the project. For conservation area and habitat creation area monitoring, we included in the sampling plan all LCR MSCP conservation areas and habitat creation areas located within the historic flood plain of the Colorado River's main stem.

In this annual report, we provide an abridged description of methods that have been previously provided in more detail in previous reports (GBBO 2008–2013) and Bart et al. (2010).

Component 1: Population Estimates of Avian Species within the LCR MSCP Boundaries and Habitat Creation Sites

INTRODUCTION

As in past years, we conducted area search surveys in the LCR MSCP riparian bird survey project area and conservation and habitat creation areas to obtain population size estimates, trends, and distributions of the six covered bird species (Gila woodpecker, vermilion flycatcher, gilded flicker, Arizona Bell's vireo, Sonoran yellow warbler, and summer tanager) as well as for non-covered species throughout the Lower Colorado River Valley. We generated population estimates using the avian double-sampling survey method developed for the LCR MSCP bird monitoring program in 2007–10 (Bart and Manning 2008; GBBO 2009, 2010; Bart et al. 2010).

The rationale and methods for population monitoring based on double sampling that we used in this project were developed in the first 3 years of riparian area search monitoring for the LCR MSCP project (Bart and Manning 2008; Bart et al. 2010; GBBO 2010). The double-sampling method requires both rapid and intensive area searches, which are described in more detail in the "Methods" section under the component and in GBBO (2010). This section of the report summarizes the results from the surveys conducted for component 1 in 2014.

METHODS

Study Area and Sampling Plan

The study area spans the main stem of the LCR from Separation Canyon (just upstream of Lake Mead) to the Southerly International Boundary with Mexico, just south of Yuma, Arizona (attachments 1a and 1b). The USGS surveyed the section extending from Separation Canyon to Lake Mead in 2007; however, since 2007, because of inaccessibility due to fluctuating water levels, we have excluded that area from our surveys.

To roughly delineate vegetation types that are important for the covered species, we originally defined potentially suitable habitat patches as "good/fair/poor" and further as "tall/low" (plus "unsuitable" and "marsh"; for more details on the original stratification, see Bart 2007a) This stratification was done so that we could adjust survey-effort distribution in order to optimize survey effectiveness for covered species (Bart et al. 2010). Our original habitat stratification was

based on combined vegetation classes from the Anderson-Ohmart vegetation classification system that was originally used to map vegetation types throughout the project area (Anderson and Ohmart 1976). During the first stratification (Bart 2007a), survey plots were delineated to divide the entire project area into approximately (≈) 9-hectare (ha) plots and were each assigned to the habitat type that covered the majority of the plot.

In spring 2010, the sampling design was revised to create a new plot layer to focus data collection on the riparian habitat within the LCR MSCP project area, reducing the overall number of plots and combining habitat stratum. This new layer largely retained the original grid delineation of ≈ 9-ha plots. We were also able to resolve several issues by creating the new plot layer, including achieving a better fit with the LCR MSCP project boundary, addressing more appropriately the amount of non-riparian habitat, and creating plots of optimal size to maximize survey efforts. For a thorough explanation of how the riparian plot layer was created, see GBBO (2013).

Plot Selection: System-Wide Surveys Rapid Area Search Plots

For the 2014 system-wide area searches, we randomly selected a total of 80 plots from the 2010 plot delineation (GBBO 2013), covering 4 habitat strata (tall woody, low woody, herbaceous, and unsuitable) in 8 geographic regions (table 1 and attachments 1b–1z). The region was not used to stratify the random site selection in 2014 because, based on plot selections in previous years, we expected a random selection to provide sufficient coverage across available regions. As in 2010–13, several regions were purposely excluded from sampling in 2014, including Regions 1 (access problems), 3 (lack of riparian vegetation and fluctuating lake levels), 9 (permit unattainable), and 13 (border safety concerns). In 2013, we surveyed Region 2 as part of the salt cedar beetle portion of this project, but due to safety concerns along the Virgin River, we were unable to survey these sites again in 2014.

We used a stratified random plot selection, with strata defined by habitat, to select the 2014 plots. We separated the plots into Excel spreadsheets by the four habitat strata that describe each plot's dominant vegetation type (tall woody, low woody, herbaceous, and unsuitable). In each sheet, we created a column of random numbers, sorted the plots by the random number column, and then selected from the beginning of the list. We weighted the number of plots per stratum toward high and low woody habitats for more intensive survey coverage of LCR MSCP covered species, as decided by Jon Bart (USGS Forest and Ecosystem Science Center, Boise, Idaho) and the LCR MSCP, resulting in an initial selection of 25 tall woody, 35 low woody, 6 herbaceous, and 14 "unsuitable" plots (table 1).

Table 1.—Number of system-wide area search plots per region and habitat stratum surveyed in 2014

Region #	Region name	Tall woody	Low woody	Herbaceous	Unsuitable	Total
1	Separation Canyon to Lake Mead	0	0	0	0	0
2	Virgin River	0	0	0	0	0
3	Lake Mead	0	0	0	0	0
5	Hoover Dam to the Bill Williams River (excluding the Havasu National Wildlife Refuge)	2	9	0	4	15
6	Havasu National Wildlife Refuge	5	0	3	1	9
7	Bill Williams River	9	2	0	1	12
8	Parker Dam to the Cibola National Wildlife Refuge (excluding the Colorado River Indian Tribe Reservation)	0	6	0	2	8
9	Colorado River Indian Tribe Reservation	0	0	0	0	0
10	Cibola National Wildlife Refuge	2	10	0	4	16
11	Imperial National Wildlife Refuge	2	4	0	0	6
12	Colorado River from the Imperial National Wildlife Refuge to Yuma, Arizona	5	4	3	2	14
13	Yuma, Arizona, to the Southerly International Boundary with Mexico	0	0	0	0	0
	Total	**25**	**35**	**6**	**14**	**80**

These vegetation categories were named early in the project, and the names do not necessarily describe all the habitats within that category. For example, “unsuitable” habitat contains a variety of habitat types, and covered species are found breeding in plots within this category each year. Although “unsuitable” may be misleading, Reclamation has decided to keep the name for the time being.

If randomly selected plots were inaccessible, we used the same randomly generated sequential list to select alternate plots in the same habitat and region. If no alternate plots were available within the same region-habitat combination, the closest region with the same habitat type was used as an alternate. We used alternate plots when the selected plots were farther than 2 kilometers from the nearest road, trail, or waterway; if private landowners denied us access to the site; or if plots contained wetlands that were inaccessible by boat or foot or were otherwise unsafe. In 2014, 10 plots were replaced with alternates from the same region and stratum due to 1 or more of the above reasons.

Conservation and Habitat Creation Area Plot Selection

Rapid Area Search Plots

When the project began in 2007, double sampling with rapid and intensive area searches was done on conservation and habitat creation areas (J. Bart 2007b, personal communication). After these data were analyzed, however, it was found that the total acreage of habitat creation was too small at that time to provide accurate population size estimates based on the double-sampling method. Therefore, during the LCR MSCP bird surveys of 2008–10, we surveyed all post-development conservation and habitat creation area plots using the intensive area search method to obtain a complete baseline inventory, while pre-development plots were covered with rapid area searches (GBBO 2010). An overview map of all conservation and habitat creation areas is provided in attachment 1aa.

Beginning in 2011, we implemented a double-sampling protocol for conservation and habitat creation areas to provide monitoring for the rapidly increasing total area (200–400 acres per year) of these sites, which necessitated a sampling plan rather than continued complete coverage using intensive surveys. With the added acreage in 2013 and 2014, we expanded our coverage of the conservation and habitat creation area plots to the maximum number of 80 randomly selected plots (table 2). These 80 conservation and habitat creation area plots were selected first by conservation and habitat creation area and then by habitat type within that area. The number of plots randomly selected from each area was determined by taking the total number of plots within that area and dividing that number by the total number of conservation and habitat creation area plots overall. Once that percentage was determined, the percentage was then multiplied by the total number of conservation and habitat creation area plots we would be surveying in 2014 (80 plots). Multiplying the percentage by 80 gave us the number of plots we would be surveying within each area. Once we determined how many plots would be surveyed within each habitat creation area, we figured out how many plots would be in each habitat stratum. Survey plots in conservation and habitat creation areas were divided into three habitat strata (cottonwood-willow [*Populus fremontii*, *Salix gooddingii*], mesquite [*Prosopis* spp.], and mixed), so selected plots were further divided among available habitat types in each area. To select the number of surveyed plots of each habitat stratum within each conservation and habitat creation area, the total number of plots for a given habitat stratum within an area was divided by the total number of plots in that area and then multiplied by the number of plots selected to be surveyed in that area.

So, for example, within the 35 plots on the Palo Verde Ecological Reserve (PVER), 21 plots are in cottonwood-willow, 3 plots are in mesquite, and 11 plots are in mixed. We divided each of these numbers by 35 (total number of survey

Table 2.—Habitat creation sites, number of plots, habitat type, and area surveyed using rapid area searches in 2014
(Hunters Hole was surveyed by Reclamation in 2014.)

Conservation and habitat creation area project	# survey plots, 2014	Cottonwood-willow (ha)	Mesquite (ha)	Mixed (ha)	Total (ha)
‘Ahakhav Tribal Preserve CRIT 9	5	51.7	5.0	0.0	56.7
Beal Lake Conservation Area	4	30.2	11.4	0.0	41.6
Cibola NWR Unit #1	11	61.6	0.0	33.1	94.7
Cibola Valley Conservation Area	21	79.8	111.2	17.2	208.2
Hunters Hole	1	17.7	0.0	0.0	17.7
Palo Verde Ecological Reserve	31	206.6	29.2	113.6	349.4
Yuma East Wetlands	8	26.8	34.4	39.0	100.2
Total (2014)	**81**	**474.4**	**191.2**	**202.9.0**	**868.6**

plots in the PVER) and then multiplied by 31 (number of plots we will be surveying in the PVER) to get the total number of plots we needed to survey within each habitat type in each area. For example, in the PVER, 21 plots were in cottonwood-willow, so we divided 21 by 35 to get 0.60. We multiplied by 31 and got 18.6, which was rounded to 19. Nineteen of the 31 plots selected from the PVER were in cottonwood-willow habitat.

A subset (n = 4) of the 80 plots was randomly selected for intensive area searches, mirroring the approach of system-wide sampling (J. Bart 2010, personal communication).

In conservation and habitat creation areas, we collected bird survey data using the same methods as we did for the system-wide intensive area searches. All conservation and habitat creation areas were larger than typical system-wide area search plots, so in 2011 we subdivided the sites into plots that were a reasonable size to be surveyed in one morning (5–18 ha) and worked closely with Reclamation’s GIS expert to add new plots in 2012–14.

Intensive Area Search Plots, System-Wide and Conservation and Habitat Creation Areas

We surveyed a total of 12 plots with the intensive area search method in 2014, 8 of which were randomly selected from the 2014 pool of system-wide plots for rapid area searches and 4 of which were randomly selected from the conservation and habitat creation area plots (table 3).

Table 3.—Summary of component 1 plots that were surveyed using the intensive area search method in 2014
(Plots are listed in numerical order.)

Plots surveyed with intensive method, 2014	System-wide, intensive (n = 8)	Conservation and habitat creation areas, intensive (n = 4)
S2636 (attachment 1g)	X	
S2872 (attachment 1l)	X	
S2926 (attachment 1o)	X	
S7059 (attachment 1g)	X	
S7334 (attachment1 l)	X	
S8011 (attachment 1w)	X	
S8219 (attachment 1l)	X	
S8261 (attachment 1k)	X	
C2104 (attachment 1cc)		X
C2334 (attachment 1dd)		X
C2704 (attachment 1ff)		X
C2722 (attachment 1ff)		X

Avian Monitoring Methods

To monitor birds of the LCR in system-wide and in conservation and habitat creation area plots, we conducted rapid and intensive area searches. Our goal for the rapid area search effort was to obtain the most accurate estimate of breeding territories while optimizing the balance between geographic survey coverage and survey effort. Our goal for the intensive area search effort was to find and document all territories present on each plot. By combining these two methods and using double sampling in a random subset of system-wide survey plots, we can also use the data to estimate detection ratios and density of breeding birds in the study area. Further information for this approach can be reviewed in GBBO (2008) and Bart et al. (2010).

Rapid area searches for this project employ the same field methods as intensive area searches, but the reduced number of visits (two, compared with eight in intensive area searches) may result in a different number of total breeding densities, as some breeding birds may be missed during both visits. Intensive area searches involved accurate delineation of breeding territories of all birds present on the plot, using the cumulative knowledge from eight visits. We counted the birds that were either known to be or presumed to be non-breeders (species known to only occur as migrants in the project area, resident LCR birds using but not breeding in the plot, or birds that bred outside the plot but foraged in the plot post-breeding) separately from breeders.

To conduct area searches, we used a combination of a hand-held Global Positioning System (GPS) unit (Garmin Etrex 20 or Garmin GPS Map 60CSx) and an aerial photo of the plot overlaid with a 50-meter (m) Universal Transverse Mercator (UTM) grid (attachment 2 – figures 2-1 through 2-3). We systematically grid-searched the plot walking at a slow enough pace to stop and record all bird sightings, locations, and breeding evidence on and around the plot. We passed within at least 50 m of every UTM grid point within the plot to ensure that all sections of the plot were adequately covered. We surveyed one plot per morning, with the exception of some of the habitat creation sites, where we surveyed two plots per morning due to low breeding bird densities. All visits of the same survey type (rapid or intensive) on a given plot were done by the same surveyor, who was different from surveyors of other survey types on the same plot.

We conducted all area searches between April 10 and June 5, 2014. We adjusted the seasonal timing of surveys over the past years to optimize coverage of the breeding window for as many species as possible while working within the original study design and contract restrictions. Starting surveys later in spring would exclude the land bird species that start breeding in April or earlier, and starting them earlier would increase the confusion over separating northbound migrants from breeders. All surveys began at sunrise and ended no later than noon in order to minimize surveys during high temperatures (> 100 degrees Fahrenheit) and periods of low bird activity. The period of time we spent for each survey visit depended on the difficulty of the terrain, vegetation density, and the amount of bird activity, with plots that were easy to hike with low bird densities taking less time (2–3 hours) and plots that had dense vegetation and high bird activity taking more time (up to 6 hours).

Whether the survey was a rapid or an intensive area search, our goal was to identify and record data on all birds present within the plot on each visit. During each visit, for both rapid and intensive area searches, we spent enough time observing birds and collecting location and breeding behavior data on the plot to detect as close as possible to 100% of all individual birds present on the plot during that visit. During each area search visit, bird locations were mapped and behaviors recorded as accurately as possible in order to estimate the number of territories at the end of the season using cumulative territory observations.

We recorded all bird sightings and territory boundaries directly onto a gray-scale aerial photograph with a 50-m UTM grid, which also included imagery of the immediate surroundings of the plot (between 20 and 100 m depending on plot shape). We also recorded birds near the edge or just outside the plot on the map in order to prevent double counting of birds and to assess if those birds were also using the plot. At the end of the season, we classified birds that were on the edge, and with partial territories in the plot, by approximating how much of the territory was within the plot to the nearest 25% (resulting in 0, 25, 50, 75, or 100% of a territory in a plot).

We marked all observed breeding evidence on the map using shorthand codes (adapted from Bibby et al. 2000), and our knowledge of breeding status was recorded explicitly on the data sheet (table 4 and attachment 2 – figure 2-4). If we observed confirmed breeding evidence on at least one visit, the bird was determined a breeder. If we detected an adult bird of a species known to breed in the area on the same territory over multiple visits, even if the only breeding evidence we observed was singing, it was generally determined to be a "breeder," and it was thus included in the total number of breeding territories regardless of direct evidence of nesting. Exceptions to this rule were repeated sightings of yellow-billed cuckoo (*Coccyzus americanus*) and willow flycatcher (*Empidonax traillii*), both of which breed later than most other land birds in the project area and are known to occur as migrants in the study area; thus, these two species were never determined to be breeders in this study. They are, however, studied by others for the LCR MSCP using single-species survey protocols (McLeod and Koronkiewicz 2010; Halterman et al. 2009). Other exceptions included birds that defend territories during migration on the LCR, such as the yellow warbler (*Setophaga petechia*) . Table 4 illustrates how we ranked breeding evidence, and observations were classified as breeders if confirmed breeding occurred on at least one visit or possible/probable breeding on three consecutive visits. Observations were classified as non-breeders if birds were observed only or displayed possible/probable breeding evidence on less than three consecutive visits. The data entry protocol (GBBO 2012) provides further detail on the process of summarizing breeding observations into the Access database (attachment 3).

We recorded birds at the site of first detection as either a pair, male, female, individual of unknown sex/age, juvenile, flyover (i.e., flying over but not landing in the plot), or incidental (i.e., detected in the plot's general area but not in the plot–same as a casual observation). If we observed a flock, its location was circled on the survey map, and the number of individuals was recorded on the data sheet. For non-territorial and colonial breeders (including the white-winged dove [*Zenaida asiatica*], mourning dove [*Zenaida macroura*], Eurasian collared-dove [*Streptopelia decaocto*], rock pigeon [*Columbo livia*], brown-headed cowbird [*Molothrus ater*], European starling, [*Sturnus vulgaris*] Gambel's quail [*Callipepla gambelii*], ring-necked pheasant [*Phasianinus colchicus*], greater roadrunner [*Geococcyx californianus*], red-winged blackbird [*Agelaius phoeniceus*], yellow-headed blackbird [*Xanthocephalus xanthocephalus*], great-tailed grackle [*Quiscalus mexicanus*], house finch [*Haemorhous mexicanus*], house sparrow [*Passer domesticus*], cliff swallow [*Petrochelidon pyrrhonota*], black-crowned night-heron [*Nycticorax nycticorax*], snowy egret [*Egretta thula*], great blue heron [*Ardea Herodias*], great egret [*Ardea alba*] cattle egret [*Bubulcus ibis*], double-crested cormorant [*Phalacrocorax auritus*], and white-faced ibis [*Plegadis chihi*]), we recorded the number of individuals and breeding evidence as one entry per species per visit in the Access database (refer to Access data entry instructions in attachment 3).

Table 4.—Behavioral information collected to determine breeding status during area searches

Categories	Behavior
Observed	Seen or heard only
Possible	Singing
	Pair seen or heard together
Probable	Territorial display
	Pair in suitable nesting habitat
	Courtship and/or mate guarding
	Agitated behavior
Confirmed	Nest building
	Carrying nest material
	Prolonged distraction behavior
	Occupied nest
	Food carrying
	Dependent young present
	Fecal sac carrying
	Nest with eggs
	Nest with young

In previous years, the number of non-territorial birds using the plot was estimated at the end of the season by averaging the number of possible breeders over each visit the species was detected during the season. In 2014, however, the surveyor estimated the number of pairs of non-territorial species using their plots at the end of the season. This was accomplished by reviewing the number of pairs they had recorded for that particular species throughout the season and then making a determination of how many pairs were breeding on the plot. If the surveyor determined after reviewing all records that the species was not breeding on the plot, they entered it under the "Non-breeder" tab for each visit in which it was recorded and deleted any entry under the "Breeders" tab in the Access database. This allowed us to better estimate the number of pairs of each of these species breeding on the plot than previously because it took advantage of the surveyor's cumulative knowledge of the bird records.

Rapid Area Searches

In their implementation, rapid and intensive area searches differed primarily in the amount of data that we recorded for species that are not covered under the LCR MSCP and by the number of visits to the plot. Rapid area searches occurred in two visits spaced by at least 3 weeks, with the first round of visits in early April through mid-May and the second round in mid-May through mid-June 2014.

If we found one of the six covered species during a rapid area search, we mapped several locations where the bird/pair/family group was observed and worked hard to document breeding evidence during each survey. Locations were digitized in ArcGIS at the end of the season. To digitize the locations, we brought scanned territory maps into GIS and georeferenced them for each of the six covered species. Each surveyor digitized the territories that they had delineated themselves in the field. To record the locations of the birds in GIS, the surveyors created a point shapefile with the following attributes: surveyor, date the bird was observed, species, territory code that they assigned to that species, and survey type. Using their georeferenced map, the surveyor could visualize where to place a dot corresponding to an observation point for the bird (see attachment 4).

For all non-covered species, we focused our efforts on obtaining a complete count, avoiding double counts, recording breeding evidence (see table 4), and determining the percentage of the territory that was inside the plot. In rapid area searches, we delineated territories of covered species to the best of our ability during the two visits. We automatically classified all species known only as migrants in the project area (e.g., Wilson's warbler [*Wilsonia pusilla*]) as non-breeders. If we observed a species that is a known breeder in the project area in the same location, and if it displayed possible or probable breeding behaviors on both visits, we determined it to be a "breeder." If we observed evidence that confirmed breeding (e.g., a nest with young) on one or both visits, the species was also recorded as a breeder. If evidence of breeding was observed only on one visit for birds that do not migrate and are known breeders within the project area, we also listed these birds as breeders. For migratory species, the surveyors needed to either confirm breeding or have probable/possible breeding evidence on both visits to the plot in order to record the bird as a breeder. If the surveyor was unable to confirm breeding using this set of rules, but still felt strongly that a bird was a breeder, the surveyor could record it as a breeder but had to explain additional breeding evidence thoroughly in the "Comments" field of the database. In some cases, the breeding status of a detected bird of a species known to be a resident breeder on the LCR could not be determined. If breeding status was not determined in two visits, a detected bird was classified as a non-breeder for the plot.

In 2013, we also introduced new breeding evidence justification codes for territorial breeding birds to the Access database to help ensure consistency in the data entry process. We maintained use of these codes in 2014. For each breeding pair, and for all survey types, a code was required to be entered by the surveyor at the end of the season. For rapid surveys, five different breeding justification codes could be used. The first option was "No Justification Required," which the surveyors entered if they determined after their final visit that a given bird was not actually a breeder (or that there was not enough evidence of breeding), classifying it as a "non-breeder." The second option was "Observed Confirmed," which surveyors entered if they found positive confirmation of breeding (e.g., a nest with young) (see table 4). The third code, "Probable Evidence Both," means that

the bird was confirmed to be present and territorial on both visits to the plot, but no confirmed breeding evidence was obtained. The fourth code was "Probable Evidence Local," which was entered when a given bird was only observed on one of the rapid survey visits but was determined to be a local breeder rather than a migrant based on field evidence or natural history. This code is only used for year-round residents or migratory species that arrive or depart during the field season and therefore cannot be expected to be present on both surveys. The fifth and last code, "No Standard Scenarios," was used when the surveyor strongly felt that the bird was breeding on the plot, but they were not able to obtain standard evidence to classify it as a breeder. If the surveyors chose this code, they had to elaborate their reasons in the "Comments" field.

Extensive training of and ongoing communication with the field surveyors by experienced biologists was implemented throughout the survey season to evaluate specific bird observations and breeding evidence data for the recorded birds. In addition, detailed reference materials (e.g., Floyd et al. 2007; Corman and Wise-Gervais 2005 Rosenberg et al. 1991; Gill and Poole 1992–2003) were provided during training to aid the field crews' understanding of status and breeding behaviors of the species likely to be encountered.

Survey data were recorded on a map with a 50-m grid of the plot and the gray-scale aerial photography in the background (attachment 2 – figure 2-3). Within several hours of completing a survey, surveyors transferred the survey data from the field map (attachment 2 – figure 2-4) to Reclamation's Access database for this project. In this database, the raw data from each plot visit, including specific records on each breeding and presumed non-breeding species, were entered and immediately checked for accuracy (see attachment 3 for data entry protocol). For each pair of an LCR MSCP covered species that was ranked at least as a possible breeder, locations, dates, and territory codes from each survey were transferred onto a master copy of the plot map for each species. At the end of the field season, after surveyors completed both surveys of the plot, their cumulative knowledge from the surveys was used to enter the final number of breeding pairs per species for each plot in both the field data sheets and a summary table in the database.

Upon completion of the surveyor's second visit to the plot, and once all of their data had been entered into the Access database, the surveyor re-examined each record in their dataset to determine whether or not the recorded birds had a territory on their plot. Using the knowledge from their surveys, they entered the percentage of each territory for each pair in the "Territory In" field. Until the last visit to a given plot, the "Territory In" field in the database was left open and labeled TIOpen. At the end of the surveys, the crew filled out the "Territory In" field with TI000, TI025, TI050, TI075, or TI100 to indicate the percentage of the territory that was inside the plot. For approval of a crew member's final dataset at the end of the season, we reviewed their data to make certain that the "Territory

In" field was correctly filled out. In this final step of dataset processing and approval, the surveyor also needed to complete the "Breeding Justification" field, which supervisors checked for completeness and correctness.

Intensive Area Searches

We conducted weekly intensive area searches in each intensive area search plot during the breeding season for a total of eight visits per plot. We delineated territories for all territorial species (LCR MSCP covered and non-covered) to the extent possible within the plot, but with primary focus on covered species and other territorial riparian obligate birds. Our knowledge of territory locations from previous visits was used in a cumulative manner to arrive at a total territory count at the end of the season (as described above for rapid area searches). For this, we used the observation territory maps from previous visits to confirm known territory locations and territory boundaries, and to add previously undetected or poorly delineated territories with each visit. During intensive area searches, we could determine the breeding status of individuals with much greater accuracy than was possible in rapid area searches because of the increased number of visits and decreased time between visits to the plot. We used our data from all eight visits to determine how many breeding territories were active on the plot and which individuals were only passing through the plot but not breeding.

During each visit, we recorded the highest-ranking breeding evidence (confirmed, followed by probable, followed by possible) for the breeding status of individual birds (see table 4). At the end of the eight surveys, we classified a bird as a "breeder" on a given plot if confirmed breeding evidence was recorded during any visit, or if probable or possible breeding evidence was recorded during three or more consecutive visits, or at least five non-consecutive visits. Therefore, we emphasize that our definition of a "breeder" in this project does not automatically imply that positive nesting evidence was recorded but rather that a breeding attempt most likely took place in the delineated territory during our surveys. Also at the end of the season, we determined the final locations and layouts of breeding territories within the plot based on all visits (attachment 2 – figure 2-5). For this, we combined all maps drafted during intensive area searches into final maps of territories by species using the cumulative data from all visits. From 2011–14, we entered these final territory maps for covered species into ArcGIS as shapefiles by species and plot in order to provide a digital format for future comparisons.

Entries in the database for breeding justifications from intensive surveys were slightly different from the justification codes used for rapid surveys. The "No Justification Required," "Observed Confirmed," and "No Standard Scenarios" were the same codes describing the same scenarios as in rapid surveys (see above), but two additional codes were necessary for intensive surveys (table 5). The first additional code, "On Territory Consecutive," described a given bird or pair being observed on territory for at least three consecutive weeks of the

Table 5.—Breeding justification codes entered into Reclamation's Access database for the riparian bird project

("Number" shows the actual code entered in the Access database, "Short" provides a brief code description, "Survey type" describes the type of area search to which the code applies, and "Long" provides a description (see the "Methods" section under this component).

Number	Short	Survey type	Long
BJ0000	No Justification Required	RAP INT[1]	No justification required
BJ0001	Observed Confirmed	RAP INT	For rapid and intensive –observed confirmed breeding evidence
BJ0002	On Territory Consecutive	INT[2]	For intensive – observed the bird/pair "on territory" the required number of times in a row
BJ0003	On Territory Season	INT	For intensive – observed the bird/pair "on territory" the required number of times during the season
BJ0004	Probable Evidence Local	RAP[3]	For rapid – observed probable evidence at least one time for known local breeders within the LCR MSCP planning area
BJ0005	Probable Evidence Both	RAP	For rapid – observed probable evidence at least two times for birds that are both migrants and breeders within the LCR MSCP planning area
BJ0006	No Standard Scenarios	RAP INT	For rapid and intensive – called it breeding but does not fit any of the standard scenario explanations in notes

[1] Rapid intensive.
[2] Intensive.
[3] Rapid.

intensive survey. The second additional code, "On Territory Season," described the scenario of a given bird or pair being recorded on territory during at least 5 weeks of the intensive survey but not necessarily in consecutive visits.

The protocol for transferring data from the intensive area search data format to Reclamation's new Access database was similar to the process used for rapid area search data. In the field, intensive data were collected on a map with a 50-m grid of the plot and gray-scale aerial photography in the background (attachment 2 – figure 2-3). Within several hours of completing a survey, surveyors transferred the survey data from the field map (attachment 2 – figure 2-4) to Reclamation's Access database for this project. In this database, the raw data from each plot visit, including specific records on each breeding and presumed non-breeding species, were entered and immediately checked for accuracy (see attachment 3 for data entry protocol). For all species that were ranked at least as a possible breeder, locations, dates, and territory codes from each survey were

transferred onto a master copy of the plot map for each species. Surveyors continued to add observations to the master copy of the maps throughout the season to accumulate locations of individuals (attachment 2 – figure 2-5). At the end of the field season, after surveyors completed all surveys of the plot, their cumulative knowledge from the surveys was used to enter the final number of breeding pairs per species for each plot in both the field data sheets and a summary table in the database.

As with rapid surveys, surveyors re-examined each record in their dataset after the final plot visit to determine whether or not each observed bird had a territory on their plot. Using the knowledge from all surveys and final species maps, they entered the number of territories for each species in the "Territory In" field. As described above for rapid surveys, the "Territory In" field in Access was left open and labeled TIOpen until the final plot visit. After the final plot visit, the crew filled in the "Territory In" field with TI000, TI025, TI050, TI075, or TI100 for each record, indicating the percentage of the territory that was inside the plot. Additionally, after the last visit to the plot, surveyors filled in the "Breeding Justification" field. This field was filled in according to their field observations. The final data approval process by project managers included confirming that these two fields were filled out correctly.

Data Quality Assurance/Quality Control

All bird data collected during the 2014 field season were entered during the field season. We then combined all surveyors' Access datasets into a single Access database for the 2014 field season. To ensure that the data were entered completely and correctly (quality assurance), GBBO staff checked for accuracy and completeness of field data sheets (daily field maps), Access data, and GIS data for all surveyors during and immediately following the end of the field season. To ensure that all data were collected and entered completely into the Access database, each field technician and supervisor examined the data together at the end of the field season. During this vetting process, we also confirmed that all field maps and species summary maps were scanned into a digital format and that each pair had a percent territory recorded in the Access database. To determine whether or not all the GIS data were entered for the covered species for the intensive and rapid plots, we compared all covered species records listed as having a territory in Access to those recorded as territories in GIS. The initial GIS data entry process itself also acted as a data check for the Access database since the person entering the data needed to compare their final species maps to the Access database in order to determine which species to enter as territories in GIS. If a covered species territory was digitized in GIS (see attachment 4), then it also had to be recorded as a territory in Access and vice versa.

If we found a covered species territory in GIS that was not listed as a territory in Access during the vetting process, we examined the details entered in Access, breeding justification entries, and the daily survey maps to resolve the discrepancy. This way, we were able to determine whether or not a territory should have been entered in GIS and, if not, the record was deleted. In these thousands of rows of data checked, our error rate was < 1%. All errors found were corrected in the final Access database and GIS files. In addition to this vetting process, project managers again checked each dataset to make sure all surveys of each survey type were entered in Access by the end of the field season. We also checked pair details, and pair breeding justifications and TI_IN numbers for all pairs on every plot to ensure that all were entered and there was no conflicting information for each pair. The final vetting of the data occurred when the data were converted into DS files and report tables (see below).

Double Sampling

All rapid bird survey techniques may result in biased estimates of species that differ in their detectability. For instance, densities of birds that have a soft song, vocalize rarely, behave secretively, or show strong seasonal changes in detectability may be systematically underestimated in rapid survey techniques such as point counts, belt transects, and single rapid area searches. In addition, birds that are temporarily undetectable, such as those sitting quietly on a nest or having departed the area for long foraging bouts, may be missed entirely by the surveyor. To quantify this bias, intensive and rapid area searches can be used in a double-sampling approach. For this, a surveyor, other than the one conducting intensive area searches, visits the intensive area search plot to conduct a standard rapid area search without any prior knowledge of the plot and its birds. Using the detections during the rapid area search and the actual number of territories present on the plot, as determined in the intensive area search effort, the detection ratio of each species present can be estimated. Details on how detection ratios are derived can be reviewed in Bart and Earnst (2002) and Bart (2007a).

Population Size Analyses

For all intensive area searches, we summarized the data in two ways by reporting (1) the total number of breeding territories based on end-of-season summaries of all breeders and (2) a list of species that were either migrants or residents but were not confirmed to be breeding within the plot. For birds not confirmed breeding, we tallied the number seen over the eight surveys by males, females, unknown sex, juveniles, flyovers, and incidentals. We only included flyovers and incidental sightings in summary species lists, and they were excluded from all quantitative analyses in this report. We summarized rapid area search data by the number of breeding bird territories and a tally of birds considered non-breeders (resident non-breeding birds and migrants) summed over the two surveys.

Detection ratios can be calculated using the methods of Thompson (2002), revised by Bart and Earnst (2002). A detailed explanation of the mathematical formulas for detection rates and calculating population estimates is provided in Bart (2007a). We only included confirmed breeders in our calculations of detection ratio and the resulting breeding bird population size estimates, which were expressed in total number of breeding territories of a species. To automate detection ratio calculations for double sampling using rapid and intensive area searches, the USGS (J. Bart 2008, personal communication) wrote program DS (Bart and Hartley 2010), which we used for all detection ratio calculations and population size estimations for system-wide surveys and conservation and habitat creation areas.

For this report, we used the 2014 survey data and program DS (version 2.0.114.11) to estimate system-wide territory numbers of the covered species and the 10 most abundant species, excluding colonial nesters and other non-territorial species. Since not all regions were surveyed in the system-wide effort (see "Study Area and Sampling Plan," above), the overall population size estimate by species should be considered a minimum population size estimate for the LCR MSCP project area.

For population size estimates, we first removed all non-territorial and colonial species (white-winged dove, mourning dove, Eurasian collared-dove, rock pigeon, brown-headed cowbird, European starling, Gambel's quail, ring-necked pheasant, greater roadrunner, red-winged blackbird, yellow-headed blackbird, great-tailed grackle, house finch, house sparrow, cliff swallow, black-crowned night-heron, snowy egret, great blue heron, great egret, cattle egret, double-crested cormorant, and white-faced ibis). Although we included these species, as well as shore birds, water birds, and raptors in our report tables, we did not include them in the detection ratio calculations because it is often impossible to determine the breeding status and territory location of these species during our area searches due to their large home ranges (some raptors), clustered occurrences (shore birds), or secretive nature (shore birds and several water birds). The only species we used in the detection ratio calculations were therefore moderately common or common territorial passerines and raptors, and the 6 LCR MSCP covered species, totaling 40 species. For these, we performed two separate calculations, one for system-wide plots and another for habitat creation plots. The resulting overall detection ratios were 0.83 for system-wide plots (standard error [SE] = 0.18, coefficient of variance [CV] = 0.21) and 0.62 for habitat creation plots (SE = 0.12, CV = 0.20). When the detection ratio is above one, the rapid effort surveyor is overestimating the number of breeding territories on the plot compared to the intensive effort surveyor. The detection ratios were then applied to calculate overall population size estimates for the system-wide project area and the conservation and habitat creation areas using program DS.

RESULTS

Overall Species Richness Patterns

The species totals reported within the text of this report do not include various subspecies (e.g., Audubon's warbler (*Setophaga auduboni auduboni*), Mexican duck (*Anas platyrhynchos diazi*), super species (e.g., solitary vireo [*Vireo cassinii*]), western flycatcher (*Empidonax difficilis*), or anything that starts with unidentified or unknown or ends with spp. The only time an unidentified, super species, or subspecies is counted toward the species richness is if none of the true species within that taxon were recorded for that site. For example, if within the Beal Lake Conservation Area (BLCA) there were no plumbeous vireos (*Vireo plumbeus*) or cassin's vireos (*Vireo cassinii*) recorded, but a solitary vireo was recorded, then the solitary vireo would count toward species richness for that particular site. If, however, a plumbeous vireo was recorded, then the solitary vireo would not count in the overall tally of species for that site. This would be a similar case for subspecies, in that if Audubon's warblers (*Setophaga auduboni auduboni*), Myrtle warblers (*Dendroica coronata coronata*), and yellow-rumped warblers (*Setophaga coronata*) were all recorded at one location, then only the yellow-rumped warbler would be included in the total species tally for that location since Audubon's and Myrtle warblers are subspecies of the yellow-rumped warbler. The total "n" for each table (tables 7–27 and 37–38) reflects all subspecies, super species, and unknown categories and, therefore, will not match the total species richness reported within the text.

We detected a total of 195 species of birds in all system-wide and habitat creation site surveys (including flyovers) along the LCR in 2014 (attachment 5). Of the 195 species, 52% were species that use the LCR project area but were not confirmed as breeders on any plot (attachment 5). We also detected each of this project's LCR MSCP covered species in at least one plot. The highest concentrations of covered species were recorded in the Bill Williams River National Wildlife Refuge (Bill Williams River NWR) and the Havasu National Wildlife Refuge (Havasu NWR) riparian areas and the conservation and habitat creation areas. We also recorded yellow-billed cuckoos and willow flycatchers, but since these species are monitored separately from this effort, we do not discuss them in detail in this report nor have any information on their breeding status. We recorded a total of 186 species in system-wide surveys, compared with 147 species on conservation and habitat creation areas, and 135 species were present on both system-wide and habitat creation area plots in 2014 (attachment 5).

System-Wide Surveys

System-Wide Rapid Area Searches

On 80 system-wide rapid area search plots surveyed in 2014 (see attachment 6 – table 6-1 for a list of all plots surveyed), we recorded a total of 171 species

(attachment 5); of these, 60 were classified as territorial breeders (3,228.75 territories) (table 6), 15 species were non-territorial breeders (attachment 7 – table 7-1), and 96 were exclusively migrants or otherwise non-breeders. A total of 155 species (table 7) were recorded as non-breeders on individual plots; these included both migrant species and local breeders confirmed breeding on other plots. This also includes 49 species recorded only as flyover or incidental records. The number of breeding territories varied widely among species, with the most abundant species being either riparian associated or generalist. Approximately one-half of the breeding birds were of species that were not strictly territorial (and thus excluded from the double-sampling analyses), and some of these species were also the most numerous system-wide, including the white-winged dove, mourning dove, brown-headed cowbird, and red-winged blackbird. The most common territorial species included the song sparrow (*Melospiza melodia*), common yellowthroat (*Geothylpis trichas*), yellow-breasted chat (*Icteria virens*), Lucy's warbler (*Oreothylpis luciae*), Bewick's wren (*Thryomanes bewickii*), and verdin (*Auriparus flaviceps*).

We found the most common breeders of the six focal covered species to be the Sonoran yellow warbler (160.75 territories), followed by Arizona Bell's vireo (44.75 territories), Gila woodpecker (18.5 territories), summer tanager (11 territories), gilded flicker (0.25 territory), and vermilion flycatcher (0.25 territory), and (see table 6). Breeding evidence for the vermilion flycatchers included a family group with two dependent young recorded in the Giers Basin area on Plot S2965.

There was only one detection of a gilded flicker in 2014, and it was from a single bird calling on Plot S3425 near Alamo Dam. In past years, surveyors have typically detected at least one gilded flicker on the Alamo Dam and Reid Valley plots.

System-Wide Intensive Area Searches

During system-wide intensive area searches (n = 8 plots) in 2014, we recorded a total of 123 species (attachment 5; see also attachment 6 – table 6-2 for a list of the 2014 intensive area search plots); of these, 39 were classified as territorial breeders (823.25 territories) (table 8), 9 species were non-territorial breeders, and 75 were exclusively migrants or otherwise non-breeders. A total of 96 species (table 9) were recorded as non-breeders on individual plots; these included both migrant species and local breeders confirmed breeding on other plots. This also included 22 species recorded only as flyover or incidental records.

Table 6.—Total number of breeding territories, by species, in the 80 system-wide rapid area search plots in 2014

(The number of territories in each plot was determined by the surveyor after the second survey. Species are listed in descending order of abundance. Partial territories are represented in decimals [see the "Methods" section under this component for details]. Non-territorial species are excluded from this list.)

Species (n = 62)	Number of territories
Song sparrow	573
Common yellowthroat	542
Yellow-breasted chat	306.25
Lucy's warbler	208
Marsh wren	207
Verdin	168
Black-tailed gnatcatcher	162.5
Sonoran yellow warbler*	160.75
Abert's towhee	125.75
American coot	122.75
Bewick's wren	121.5
Black-chinned hummingbird	48.25
Pied-billed grebe	47.75
Arizona Bell's vireo*	44.75
Ladder-backed woodpecker	44
Least bittern*	38.75
Common gallinule	37
Ash-throated flycatcher	33.75
Lesser nighthawk	21.5
Crissal thrasher	19.5
Gila woodpecker*	18.5
Brown-crested flycatcher	16.25
Canyon wren	12
Blue grosbeak	11.75
Anna's hummingbird	11.25
Green heron	11.25
Summer tanager*	11
Killdeer	10.5
Yuma clapper rail*	9.75
Phainopepla	9.75
Virginia rail	9
Northern rough-winged swallow	8.25
Bullock's oriole	5.25
Clark's grebe	5.25

Table 6.—Total number of breeding territories, by species, in the 80 system-wide rapid area search plots in 2014

(The number of territories in each plot was determined by the surveyor after the second survey. Species are listed in descending order of abundance. Partial territories are represented in decimals [see the "Methods" section under this component for details]. Non-territorial species are excluded from this list.)

Species (n = 62)	Number of territories
Horned lark	5.25
Western kingbird	5
Lesser goldfinch	4.5
Unidentified hummingbird	4.25
Black phoebe	3.25
Costa's hummingbird	2.75
Northern mockingbird	2.75
Say's phoebe	2.75
Western grebe	2.5
Cooper's hawk	1.5
American kestrel	1.25
Mallard	1.25
California black rail*	1
Black-necked stilt	1
Cactus wren	1
Common ground-dove	1
White-throated swift	1
Loggerhead shrike	0.75
Great horned owl	0.5
Hooded oriole	0.5
"Mexican" mallard	0.5
Western meadowlark	0.5
Belted kingfisher	0.25
Common raven	0.25
Gilded flicker*	0.25
Northern harrier	0.25
Osprey	0.25
Vermilion flycatcher*	0.25
Total	**3228.75**

* LCR MSCP covered species.

Table 7.—Number of non-breeding birds detected during system-wide rapid area searches in 80 plots in 2014

(Tally is the sum of birds observed on both rapid surveys. Note that this table does not include individuals or species entered as possible breeders but not confirmed breeding; all such species are listed as non-breeders in attachment 5.)

Species (n = 167)	Males	Females	Unknown sex	Juveniles	Flyovers	Incidentals
American avocet	0	0	0	0	20	0
American coot†	0	0	109	0	0	18
American kestrel†	0	0	0	0	5	1
American pipit	0	0	0	0	24	0
American white pelican	0	0	0	0	13	0
American wigeon	0	0	0	0	50	0
Anna's hummingbird†	1	0	0	0	1	0
Arizona Bell's vireo*†	2	0	0	0	0	0
Ash-throated flycatcher†	0	0	0	0	2	0
Audubon's warbler	22	11	77	0	18	0
Baird's sandpiper	0	0	1	0	0	0
Bank swallow	0	0	3	0	18	0
Barn swallow	2	0	35	0	321	0
Belted kingfisher	0	0	0	0	1	1
Bewick's wren†	0	0	0	1	0	0
Black swift	0	0	0	0	1	0
Black tern	0	0	0	0	0	1
Black-and-white warbler	0	1	0	0	0	0
Black-chinned hummingbird†	0	0	0	2	2	0
Black-crowned night-heron†	1	1	2	0	7	0
Black-headed grosbeak	22	8	11	0	18	1
Black-necked stilt†	0	0	11	0	70	0
Black-tailed gnatcatcher†	0	1	0	8	0	0
Black-throated gray warbler	0	0	2	0	0	0
Blue grosbeak†	4	0	0	0	0	0
Blue-gray gnatcatcher	0	2	3	0	0	0
Brewer's sparrow	33	0	56	0	0	0
Brown-headed cowbird†	2	1	0	0	283	0
Bullock's oriole†	9	2	5	1	8	0
Burrowing owl†	0	0	0	0	0	1
Cactus wren†	0	0	0	1	0	0
California gull	0	0	0	0	4	0
Canada goose†	0	0	1	0	0	0

Table 7.—Number of non-breeding birds detected during system-wide rapid area searches in 80 plots in 2014

(Tally is the sum of birds observed on both rapid surveys. Note that this table does not include individuals or species entered as possible breeders but not confirmed breeding; all such species are listed as non-breeders in attachment 5.)

Species (n = 167)	Males	Females	Unknown sex	Juveniles	Flyovers	Incidentals
Canvasback	0	0	0	0	2	1
Caspian tern	0	0	0	0	5	0
Cassin's vireo	9	0	3	0	0	0
Cattle egret†	0	0	0	0	51	0
Cedar waxwing	0	0	3	0	0	0
Chipping sparrow	8	3	11	0	0	0
Cinnamon teal†	4	5	0	0	0	0
Cliff swallow†	0	0	15	0	761	0
Common/Forster's tern	0	0	0	0	1	0
Common loon	0	0	0	0	1	1
Common raven†	0	0	0	0	30	0
Common yellowthroat†	13	2	42	0	0	0
Cooper's hawk†	0	0	0	0	6	0
Double-crested cormorant†	0	0	2	0	49	0
Eared grebe	0	0	1	0	0	0
Eurasian collared-dove†	0	0	0	0	37	0
European starling†	0	0	2	0	41	0
Forster's tern	0	0	0	0	0	20
Gadwall†	0	0	0	0	2	0
Gambel's quail†	6	5	0	0	0	2
Gambel's white-crowned sparrow	6	0	86	0	0	0
Gila woodpecker*†	0	0	0	0	0	3
Gilded flicker†	0	0	0	0	0	2
Gray flycatcher	0	0	7	0	0	0
Great blue heron†	0	0	7	0	31	0
Great egret†	0	0	5	0	35	1
Great horned owl†	0	0	0	0	1	0
Greater roadrunner†	0	0	0	0	0	3
Greater yellowlegs	0	0	0	0	3	0
Great-tailed grackle†	4	2	4	0	505	0
Green heron†	0	0	0	0	4	0
Green-tailed towhee	4	1	26	0	0	0
Green-winged teal	0	0	13	0	0	0

Table 7.—Number of non-breeding birds detected during system-wide rapid area searches in 80 plots in 2014

(Tally is the sum of birds observed on both rapid surveys. Note that this table does not include individuals or species entered as possible breeders but not confirmed breeding; all such species are listed as non-breeders in attachment 5.)

Species (n = 167)	Males	Females	Unknown sex	Juveniles	Flyovers	Incidentals
Hammond's/dusky flycatcher	0	0	1	0	0	0
Hammond's flycatcher	3	0	23	0	0	0
Hermit thrush	0	0	1	0	0	0
Hermit warbler	6	1	0	0	0	0
Hooded oriole†	0	0	0	0	1	0
Horned grebe	0	0	0	0	0	5
Horned lark†	0	0	4	0	0	6
House finch†	5	0	15	0	84	0
House wren	2	0	0	0	0	0
Hutton's vireo	0	0	0	0	0	1
Killdeer†	0	0	2	0	11	0
Ladder-backed woodpecker†	0	0	1	0	2	0
Lazuli bunting	22	11	23	0	6	0
Least bittern*†	0	0	0	0	1	0
Least sandpiper	0	0	9	0	34	0
Lesser goldfinch†	0	0	3	0	13	0
Lesser nighthawk†	0	0	0	0	32	0
Lesser scaup	0	0	0	0	0	4
Lincoln's sparrow	0	0	22	0	0	0
Loggerhead shrike†	0	0	2	0	0	1
Long-billed curlew	0	0	0	0	6	0
Long-billed dowitcher	0	0	4	0	0	0
Lucy's warbler†	5	0	8	9	0	0
Macgillivray's warbler	7	3	13	0	0	0
Mallard†	0	0	0	0	32	3
Mountain white-crowned sparrow	0	0	4	0	0	0
Mourning dove†	7	2	44	2	294	1
Nashville warbler	13	0	13	0	0	0
Neotropic cormorant	0	0	0	0	2	0
Northern flicker	0	0	1	0	0	0
Northern harrier†	0	0	0	0	6	0
Northern mockingbird†	0	0	0	0	1	0
Northern rough-winged swallow†	0	0	21	0	585	0

Table 7.—Number of non-breeding birds detected during system-wide rapid area searches in 80 plots in 2014

(Tally is the sum of birds observed on both rapid surveys. Note that this table does not include individuals or species entered as possible breeders but not confirmed breeding; all such species are listed as non-breeders in attachment 5.)

Species (n = 167)	Males	Females	Unknown sex	Juveniles	Flyovers	Incidentals
Northern shoveler	2	2	0	0	39	0
Olive-sided flycatcher	0	0	6	0	0	0
Orange-crowned warbler	9	1	50	0	0	0
Oregon junco	1	0	0	0	0	0
Osprey	0	0	1	0	3	0
Pacific-slope flycatcher	36	0	217	0	0	0
Peregrine falcon†	0	0	0	0	1	0
Phainopepla†	4	0	11	4	19	13
Pied-billed grebe†	0	0	0	0	0	3
Plumbeous vireo	1	0	0	0	0	0
Prairie falcon†	0	0	0	0	2	0
Redhead†	1	1	0	0	0	0
Red-tailed hawk†	0	0	0	0	2	0
Red-winged blackbird†	17	2	1	0	2,322	0
Ring-billed gull	0	0	0	0	1	0
Ring-necked duck	0	0	5	0	1	0
Rock pigeon†	0	0	0	0	47	0
Ruby-crowned kinglet	0	0	3	0	0	0
Ruddy duck†	0	0	12	0	0	17
Savannah sparrow	0	0	10	0	0	2
Sharp-shinned hawk	1	0	2	0	2	0
Snowy egret†	0	0	13	0	21	6
Solitary sandpiper	0	0	1	0	0	1
Song sparrow†	0	0	0	1	0	0
Sora	9	0	14	0	0	3
Spotted sandpiper	0	0	7	0	21	0
Spotted towhee	1	0	0	0	0	0
Swainson's hawk	0	0	1	1	7	30
Swainson’s thrush	0	0	4	0	0	0
Townsend’s warbler	33	13	4	0	1	0
Tree swallow	0	0	177	0	15,116	0
Turkey vulture†	0	0	16	0	110	1
Unidentified duck	0	0	0	0	8	0

Table 7.—Number of non-breeding birds detected during system-wide rapid area searches in 80 plots in 2014

(Tally is the sum of birds observed on both rapid surveys. Note that this table does not include individuals or species entered as possible breeders but not confirmed breeding; all such species are listed as non-breeders in attachment 5.)

Species (n = 167)	Males	Females	Unknown sex	Juveniles	Flyovers	Incidentals
Unidentified *Empidonax* flycatcher	0	0	28	0	0	0
Unidentified flycatcher	0	0	1	0	0	0
Unidentified hummingbird	0	0	0	1	1	0
Unidentified sparrow	0	0	9	0	0	0
Unidentified swallow	0	0	0	0	29	0
Unidentified warbler	1	0	31	0	6	0
Unknown	0	0	1	0	2	0
Vaux's swift	0	0	12	0	38	0
Verdin†	0	0	1	6	0	0
Vermilion flycatcher*†	0	0	0	0	1	0
Vesper sparrow	0	0	1	0	0	0
Violet-green swallow†	0	1	1	0	7	0
Virginia’s warbler	1	0	0	0	0	0
Warbling vireo	7	0	133	0	0	1
Western flycatcher	1	0	43	0	0	0
Western grebe†	0	0	0	0	0	5
Western kingbird†	2	0	4	0	29	0
Western sandpiper	0	0	4	0	0	0
Western screech-owl†	0	0	0	3	0	0
Western tanager	51	25	33	0	58	0
Western wood-pewee	4	0	109	0	0	0
Whimbrel	0	0	0	0	6	0
White ibis	0	0	0	0	1	0
White-crowned sparrow	19	5	169	0	0	0
White-faced ibis†	0	0	5	0	1,153	22
White-throated swift†	0	0	0	0	47	0
White-winged dove†	6	1	6	0	1,053	0
Willet	0	0	0	0	50	0
Willow flycatcher**†	6	0	19	0	0	1
Wilson's snipe	0	0	3	0	1	0
Wilson’s warbler	125	33	562	0	37	0
Yellow warbler*†	57	28	51	0	10	0
Yellow-breasted chat†	0	0	1	0	0	0

Table 7.—Number of non-breeding birds detected during system-wide rapid area searches in 80 plots in 2014

(Tally is the sum of birds observed on both rapid surveys. Note that this table does not include individuals or species entered as possible breeders but not confirmed breeding; all such species are listed as non-breeders in attachment 5.)

Species (n = 167)	Males	Females	Unknown sex	Juveniles	Flyovers	Incidentals
Yellow-headed blackbird†	2	0	4	0	81	0
Yellow-rumped warbler	0	2	60	0	13	0
Total	**619**	**176**	**2,603**	**40**	**23,887**	**182**

* LCR MSCP covered species.

** Willow flycatcher indicates both migrants and the southwestern subspecies because they cannot be differentiated in this study.

† Species occurs as a breeder in the study area, but numbers reported here are of migrant, flyover, or otherwise non-breeding individuals.

We found breeding evidence for the four focal covered species during the system-wide surveys, including the Sonoran yellow warbler (95.25 territories), Arizona Bell's vireo (16.5 territories), Gila woodpecker (8.75 territories), and summer tanager (6 territories) (table 8). Additionally, we detected non-territorial and colonial species breeding that made up roughly 19.5% of the breeding birds (≈ 161 breeding pairs), including the white-winged dove (41 pairs), mourning dove (35 pairs), Gambel's quail (9 pairs), brown-headed cowbird (40 pairs), house finch (15 pairs), greater roadrunner (5 pairs), great-tailed grackle (4 pairs), red-winged blackbird (11 pairs), and Eurasian collared-dove (1 pair).

Conservation and Habitat Creation Areas: Rapid Area Searches

During rapid area searches on conservation and habitat creation areas in 2014 (n = 80 plots; see attachment 6 – table 6-1 for a list of all habitat creation plots surveyed in 2014), we recorded a total of 145 species; of these, 44 were classified as territorial breeders (table 10), 13 species were non-territorial breeders, and 88 were exclusively migrants or otherwise non-breeders. A total of 129 species (table 11) were recorded as non-breeders on individual plots; these included both migrant species and local breeders confirmed breeding on other plots. This also includes 34 species recorded only as flyover or incidental records. We classified four of the six covered species as breeders in habitat creation sites, including the Arizona Bell's vireo (17 territories), Sonoran yellow warbler (13.5 territories), summer tanager (3.25 territories), and vermilion flycatcher (3 territories). Gila woodpeckers and gilded flickers were not detected in our 2014 surveys of habitat creation sites (see attachment 5 for a complete list of detected species).

Table 8.—Total number of breeding territories of territorial bird species detected during system-wide intensive area searches in 2014

(Species are listed in descending order of abundance. Non-territorial species not listed.)

Species (n = 39)	Number of territories
Song sparrow	228.5
Yellow-breasted chat	121.75
Common yellowthroat	120.25
Sonoran yellow warbler*	95.25
Bewick's wren	50
Lucy's warbler	43.75
Verdin	24
Abert's towhee	20.25
Arizona Bell's vireo*	16.5
Ladder-backed woodpecker	13.75
American coot	9.75
Gila woodpecker*	8.75
Brown-crested flycatcher	8.25
Black-tailed gnatcatcher	8
Summer tanager*	6
Pied-billed grebe	5.75
Ash-throated flycatcher	5.25
Canyon wren	4.5
Marsh wren	4.5
Bullock's oriole	4.25
Black-chinned hummingbird	3.75
Crissal thrasher	3
Common gallinule	2.75
Virginia rail	2.5
Least bittern*	2
Lesser goldfinch	1.5
Yuma clapper rail*	1
Ruddy duck	1
Violet-green swallow	1
Black phoebe	0.75
Blue grosbeak	0.75
Green heron	0.75
Western kingbird	0.75
Common raven	0.5
Cooper's hawk	0.5
Great horned owl	0.5
Lawrence's goldfinch	0.5
Lesser nighthawk	0.5
Western screech-owl	0.25
Total	**823.25**

* LCR MSCP covered species.

Table 9.—Number of non-breeding birds detected on the intensive system-wide area search plots in 2014 (n = 8)

(Tally is the sum of birds observed on all eight surveys. Note that this table does not include individuals or species entered as possible breeders but not confirmed breeding; all such species are listed as non-breeders in attachment 5.)

Species (n = 106)	Males	Females	Unknown sex	Juveniles	Flyovers	Incidentals
American coot†	0	0	27	0	0	0
American robin†	0	0	2	0	0	0
Audubon's warbler	5	4	61	0	0	0
Bank swallow	0	0	0	0	4	0
Barn swallow	0	0	0	0	44	0
Arizona Bell's vireo*†	0	0	0	1	0	0
Belted kingfisher	0	0	1	0	1	0
Bewick’s wren†	0	0	0	3	0	0
Black-chinned hummingbird†	0	1	0	0	0	0
Black-crowned night-heron†	0	0	0	0	3	0
Black-headed grosbeak	8	1	9	0	0	0
Black-necked stilt†	0	0	0	0	25	0
Blue grosbeak†	1	0	0	0	0	0
Brewer’s sparrow	2	0	1	0	0	0
Brown-crested flycatcher†	0	0	2	0	0	0
Brown-headed cowbird†	0	0	0	0	23	0
Bufflehead	0	1	0	0	0	0
Bullock’s oriole†	1	0	1	0	0	0
Cactus wren†	0	0	0	0	0	1
Canyon wren†	1	0	0	0	0	0
Cassin’s vireo	4	1	3	0	0	0
Cedar waxwing	0	0	6	0	0	0
Cinnamon teal†	5	1	0	0	0	0
Clark's grebe†	0	0	1	0	0	0
Cliff swallow†	0	0	10	0	172	0
Common loon	0	0	5	0	0	0
Common raven†	0	0	0	0	11	0
Cooper’s hawk†	0	0	0	0	1	0
Double-crested cormorant†	0	0	0	0	15	0

Table 9.—Number of non-breeding birds detected on the intensive system-wide area search plots in 2014 (n = 8)

(Tally is the sum of birds observed on all eight surveys. Note that this table does not include individuals or species entered as possible breeders but not confirmed breeding; all such species are listed as non-breeders in attachment 5.)

Species (n = 106)	Males	Females	Unknown sex	Juveniles	Flyovers	Incidentals
Dusky flycatcher	0	0	1	0	0	0
Great blue heron†	0	0	7	0	13	0
Great egret†	0	0	3	0	14	0
Great horned owl†	1	1	1	0	0	0
Greater scaup	1	1	0	0	0	0
Greater/lesser scaup	4	2	0	0	0	0
Great-tailed grackle†	7	0	0	0	72	0
Green heron†	0	0	0	0	1	0
Green-tailed towhee	1	0	7	0	0	0
Hammond's flycatcher	8	0	9	0	0	0
Hermit thrush	1	0	0	0	0	0
House finch†	0	0	0	0	4	0
Killdeer†	0	0	0	0	2	0
Lazuli bunting	5	1	24	0	0	0
Lesser goldfinch†	0	0	2	0	8	0
Lesser nighthawk†	1	0	0	0	9	0
Lincoln's sparrow	0	0	26	0	0	0
Lucy's warbler†	1	0	0	8	0	0
Macgillivray's warbler	2	0	1	0	0	0
Mallard†	4	0	0	0	15	0
Mourning dove†	0	0	0	0	40	0
Nashville warbler	1	1	23	0	0	0
Northern rough-winged swallow†	0	0	17	0	98	0
Olive-sided flycatcher	0	0	5	0	0	0
Orange-crowned warbler	4	0	15	0	0	0
Osprey	0	0	0	0	1	0
Pacific-slope flycatcher	13	0	141	0	0	0
Phainopepla†	3	5	0	0	1	0
Plumbeous vireo	2	0	1	0	0	0

Table 9.—Number of non-breeding birds detected on the intensive system-wide area search plots in 2014 (n = 8)

(Tally is the sum of birds observed on all eight surveys. Note that this table does not include individuals or species entered as possible breeders but not confirmed breeding; all such species are listed as non-breeders in attachment 5.)

Species (n = 106)	Males	Females	Unknown sex	Juveniles	Flyovers	Incidentals
Redhead†	4	3	0	0	0	0
Red-tailed hawk†	0	0	0	0	3	0
Red-winged blackbird†	5	15	50	0	96	0
Rose-breasted grosbeak	1	0	0	0	0	0
Ruby-crowned kinglet	1	0	8	0	0	0
Ruddy duck†	4	9	0	0	0	0
Rufous hummingbird	1	0	0	0	0	0
Say's phoebe†	0	0	1	0	0	0
Sharp-shinned hawk	0	0	1	0	1	0
Snowy egret†	0	0	0	0	10	0
Song sparrow†	0	0	0	3	0	0
Sora	0	0	9	0	0	0
Spotted sandpiper	0	0	2	0	0	0
Spotted towhee	0	0	1	0	0	0
Summer tanager*†	1	0	0	0	0	0
Swainson's thrush	0	0	7	0	0	0
Townsend's warbler	5	0	1	0	0	0
Tree swallow	0	0	7	0	1,613	0
Tropical kingbird†	0	0	1	0	0	0
Turkey vulture†	0	0	2	0	25	0
Unidentified *Accipiter* hawk	0	0	0	0	3	0
Unidentified *Empidonax* flycatcher	0	0	9	0	0	0
Unidentified flycatcher	0	0	3	0	0	0
Unidentified hawk	0	0	0	0	1	0
Unidentified hummingbird	0	0	10	0	0	0
Unidentified swallow	0	0	8	0	42	0
Unidentified warbler	0	0	13	0	0	0
Unknown	1	0	0	0	1	0
Vaux's swift	0	0	0	0	3	0

Table 9.—Number of non-breeding birds detected on the intensive system-wide area search plots in 2014 (n = 8)

(Tally is the sum of birds observed on all eight surveys. Note that this table does not include individuals or species entered as possible breeders but not confirmed breeding; all such species are listed as non-breeders in attachment 5.)

Species (n = 106)	Males	Females	Unknown sex	Juveniles	Flyovers	Incidentals
Verdin†	0	0	0	4	0	0
Violet-green swallow†	0	0	0	0	6	0
Virginia rail†	0	0	0	0	0	1
Warbling vireo	1	0	63	0	0	0
Western flycatcher	0	0	13	0	0	0
Western kingbird†	1	1	2	0	1	0
Western tanager	21	7	2	0	1	0
Western wood-pewee	3	0	71	0	0	0
White-crowned sparrow	8	1	75	1	0	0
White-faced ibis†	0	0	0	0	149	0
White-throated sparrow	0	0	1	0	0	0
White-throated swift†	0	0	8	0	67	0
White-winged dove†	0	0	0	0	66	0
Willow flycatcher**†	1	0	14	0	0	0
Wilson's warbler	44	8	199	0	0	0
Yellow warbler*†	6	0	6	0	3	0
Yellow-headed blackbird†	0	12	0	0	17	0
Yellow-rumped warbler	0	3	19	0	2	0
Zone-tailed hawk	0	0	0	0	1	0
Total	**194**	**79**	**1,018**	**20**	**2,688**	**2**

* LCR MSCP covered species.

** Willow flycatcher indicates both migrants and the southwestern subspecies because they cannot be differentiated in this study.

† Species occurs as a breeder in the study area, but numbers reported here are of migrant, flyover, or otherwise non-breeding individuals.

Table 10.—Total number of breeding territories of territorial bird species detected during rapid surveys of the conservation and habitat creation area plots in 2014 (Species are listed in descending order of abundance. Non-territorial species not listed.)

Species (n = 45)	Number of territories
Abert's towhee	175.25
Verdin	169.5
Common yellowthroat	145.25
Blue grosbeak	123.5
Black-tailed gnatcatcher	80.5
Song sparrow	70.75
Western kingbird	60
Black-chinned hummingbird	54.5
Bullock's oriole	53
Anna's hummingbird	38.75
Lucy's warbler	38.25
Yellow-breasted chat	36.5
Ladder-backed woodpecker	32
Northern mockingbird	19
Ash-throated flycatcher	18
Arizona Bell's vireo*	17
Crissal thrasher	14.5
Sonoran yellow warbler*	13.5
Killdeer	11
Lesser goldfinch	10.25
Indigo bunting	7
Lesser nighthawk	5.75
Unidentified hummingbird	5.75
Black-necked stilt	4.25
Great horned owl	4
Inca dove	4

Table 10.—Total number of breeding territories of territorial bird species detected during rapid surveys of the conservation and habitat creation area plots in 2014 (Species are listed in descending order of abundance. Non-territorial species not listed.)

Species (n = 45)	Number of territories
Common ground-dove	3.5
Summer tanager*	3.25
Brown-crested flycatcher	3
Costa's hummingbird	3
Vermilion flycatcher*	3
Green heron	2.75
Common raven	2
Black phoebe	1.75
Yuma clapper rail*	1
Loggerhead shrike	1
American kestrel	0.75
Barn owl	0.5
Northern harrier	0.5
Northern rough-winged swallow	0.5
American coot	0.25
Bewick's wren	0.25
Common gallinule	0.25
Mallard	0.25
Tropical kingbird	0.25
Total	**1,239.5**

* LCR MSCP covered species.

Table 11.—Number of non-breeding birds detected in 2014 on all rapid conservation and habitat creation area plots (n = 80)

(Tally is the sum of birds observed on both rapid surveys. Note that this table does not include individuals or species entered as possible breeders but not confirmed breeding; all such species are listed as non-breeders in attachment 5.)

Species (n = 143)	Males	Females	Unknown sex	Juveniles	Flyovers	Incidentals
Abert's towhee†	0	0	2	1	1	0
American bittern	0	0	0	0	1	0
American coot†	0	0	21	0	0	0
American kestrel†	0	0	1	0	5	0
American pipit	0	0	0	0	5	0
American redstart	1	0	0	0	0	0
American robin†	1	0	2	0	3	0
Anna's hummingbird†	1	0	0	15	0	0
Arizona Bell's vireo*†	0	0	0	0	0	2
Ash-throated flycatcher†	0	0	1	1	1	0
Audubon's warbler	53	16	295	0	48	0
Bank swallow	0	0	0	0	4	0
Barn swallow	0	0	9	0	242	0
Bewick's wren†	1	0	0	0	0	0
Black-and-white warbler	0	1	0	0	0	0
Black-chinned hummingbird†	0	0	0	1	0	0
Black-crowned night-heron†	0	0	0	0	10	0
Black-headed grosbeak	38	10	26	0	6	0
Black-necked stilt†	0	0	8	0	45	1
Black-tailed gnatcatcher†	0	0	1	3	0	0
Black-throated gray warbler	6	2	3	0	0	0
Blue grosbeak†	4	0	3	0	0	0
Blue-winged teal	2	2	0	0	0	0
Brewer's sparrow	2	0	12	0	0	0
Brown-headed cowbird†	0	0	0	0	945	0
Bullock's oriole†	5	0	1	0	1	0
Canada goose†	0	0	0	0	1	0
Canvasback	0	0	0	0	4	0
Caspian tern	0	0	0	0	8	0
Cassin's vireo	2	0	8	0	0	0

Table 11.—Number of non-breeding birds detected in 2014 on all rapid conservation and habitat creation area plots (n = 80)

(Tally is the sum of birds observed on both rapid surveys. Note that this table does not include individuals or species entered as possible breeders but not confirmed breeding; all such species are listed as non-breeders in attachment 5.)

Species (n = 143)	Males	Females	Unknown sex	Juveniles	Flyovers	Incidentals
Cattle egret†	0	0	0	0	57	0
Cedar waxwing	2	2	8	0	8	0
Chipping sparrow	8	4	39	0	0	0
Cinnamon teal†	10	9	0	0	2	0
Clay-colored sparrow	0	0	1	0	0	0
Cliff swallow†	0	0	5	0	861	0
Common ground-dove†	0	0	1	0	0	0
Common loon	0	0	0	0	0	1
Common raven†	0	0	0	0	14	0
Cooper's hawk†	0	0	1	0	0	0
Costa's hummingbird†	0	0	0	1	0	0
Double-crested cormorant†	0	0	0	0	24	0
Eurasian collared-dove†	1	0	0	0	22	0
European starling†	0	0	0	0	31	0
Gadwall†	0	0	0	0	2	0
Gambel's quail†	2	0	0	0	0	0
Gambel's white-crowned sparrow	1	0	31	0	0	0
Gila woodpecker*†	0	0	0	0	0	1
Great blue heron†	0	0	1	0	11	0
Great egret†	0	0	4	0	36	0
Great horned owl†	0	0	0	0	1	2
Greater roadrunner†	2	0	3	0	0	0
Greater yellowlegs	0	0	0	0	5	0
Great-tailed grackle†	1	0	0	0	221	0
Green heron†	0	0	1	0	6	0
Green-tailed towhee	1	0	17	0	0	0
Hammond's flycatcher	6	0	27	0	0	0
Hermit thrush	0	0	2	0	0	0
Hermit warbler	2	2	0	0	0	0
Hooded oriole†	0	1	0	0	0	0

Table 11.—Number of non-breeding birds detected in 2014 on all rapid conservation and habitat creation area plots (n = 80)

(Tally is the sum of birds observed on both rapid surveys. Note that this table does not include individuals or species entered as possible breeders but not confirmed breeding; all such species are listed as non-breeders in attachment 5.)

Species (n = 143)	Males	Females	Unknown sex	Juveniles	Flyovers	Incidentals
Horned lark†	1	0	0	0	24	0
House finch†	7	5	6	0	146	0
House wren	3	0	2	0	0	0
Killdeer†	0	0	1	0	15	0
Ladder-backed woodpecker†	1	0	3	0	1	0
Lazuli bunting	46	35	74	0	1	0
Least bittern*†	0	0	0	0	0	1
Least sandpiper	0	0	55	0	1	0
Lesser goldfinch†	2	2	7	1	25	0
Lesser nighthawk†	0	0	0	0	18	0
Lesser yellowlegs	0	0	0	0	3	0
Lincoln's sparrow	4	0	11	0	0	0
Loggerhead shrike†	0	0	1	1	0	0
Long-billed curlew	0	0	0	0	2	0
Long-billed dowitcher	0	0	4	0	1	0
Lucy's warbler†	24	25	133	2	0	0
Macgillivray's warbler	14	3	25	0	0	0
Mallard†	0	0	0	0	10	0
Marsh wren†	0	0	1	0	0	0
Mississippi kite	0	0	0	0	1	0
Mountain white-crowned sparrow	1	0	22	0	0	0
Mourning dove†	2	0	10	0	295	0
Myrtle warbler	1	2	6	0	0	0
Nashville warbler	10	8	124	0	0	0
Northern flicker	0	0	3	0	2	0
Northern harrier†	1	1	0	0	4	0
Northern parula	1	0	0	0	0	0
Northern rough-winged swallow†	0	0	33	0	276	0
Northern shoveler	0	0	0	0	5	0
Olive-sided flycatcher	0	0	23	0	0	0

Table 11.—Number of non-breeding birds detected in 2014 on all rapid conservation and habitat creation area plots (n = 80)

(Tally is the sum of birds observed on both rapid surveys. Note that this table does not include individuals or species entered as possible breeders but not confirmed breeding; all such species are listed as non-breeders in attachment 5.)

Species (n = 143)	Males	Females	Unknown sex	Juveniles	Flyovers	Incidentals
Orange-crowned warbler	26	6	86	0	0	0
Osprey	0	0	1	0	3	0
Pacific-slope flycatcher	29	0	311	0	0	0
Peregrine falcon†	0	1	0	0	3	0
Phainopepla†	0	0	0	0	11	0
Plumbeous vireo	0	0	1	0	0	0
Prairie falcon†	0	0	0	0	1	0
Red-tailed hawk†	0	0	0	0	10	0
Red-winged blackbird†	219	189	6	0	7,142	0
Rock pigeon†	0	0	0	0	1	0
Ruby-crowned kinglet	5	0	26	0	0	0
Rufous hummingbird	1	1	0	0	0	0
Sharp-shinned hawk	0	0	2	0	4	0
Snowy egret†	0	0	3	0	14	0
Solitary sandpiper	0	0	4	0	0	0
Spotted sandpiper	0	0	1	0	0	0
Spotted towhee	0	0	0	0	0	1
Swainson's hawk	0	0	0	0	6	0
Swainson’s thrush	6	0	38	0	0	0
Townsend’s warbler	22	5	16	0	0	0
Tree swallow	8	0	106	0	5,211	0
Turkey vulture†	0	0	7	0	70	7
Unidentified *Accipiter* hawk	0	0	1	0	0	0
Unidentified *Empidonax* flycatcher	0	0	72	0	0	0
Unidentified flycatcher	0	0	4	0	0	0
Unidentified hawk	0	0	0	0	1	0
Unidentified hummingbird	0	1	1	0	0	0
Unidentified sparrow	0	0	4	0	0	0
Unidentified swallow	0	0	0	0	3	0
Unidentified warbler	0	0	109	0	43	0

Table 11.—Number of non-breeding birds detected in 2014 on all rapid conservation and habitat creation area plots (n = 80)

(Tally is the sum of birds observed on both rapid surveys. Note that this table does not include individuals or species entered as possible breeders but not confirmed breeding; all such species are listed as non-breeders in attachment 5.)

Species (n = 143)	Males	Females	Unknown sex	Juveniles	Flyovers	Incidentals
Unknown	0	0	4	0	1	0
Vaux's swift	0	0	4	0	27	0
Verdin†	0	0	0	3	0	0
Vermilion flycatcher*†	0	0	0	0	1	0
Virginia rail†	1	0	0	0	0	0
Warbling vireo	5	0	508	0	0	0
Western flycatcher	6	0	123	0	0	0
Western kingbird†	0	0	7	0	25	0
Western tanager	75	13	45	0	5	0
Western wood-pewee	18	3	210	0	0	0
White ibis	0	0	0	0	1	0
White-crowned sparrow	36	17	235	0	0	0
White-faced ibis†	0	0	15	0	890	2
White-tailed kite†	0	0	1	0	1	0
White-throated swift†	0	0	0	0	56	0
White-winged dove†	0	0	7	0	864	0
Willow flycatcher**†	29	0	33	0	0	0
Wilson's warbler	198	69	614	0	0	1
Wood duck	1	1	0	0	0	0
Yellow warbler*†	57	28	96	0	0	0
Yellow-headed blackbird†	2	2	0	0	118	0
Yellow-rumped warbler	34	12	142	0	3	0
Zone-tailed hawk	0	0	1	0	0	0
Total	**1,048**	**478**	**3,922**	**29**	**17,976**	**19**

* LCR MSCP covered species.

** Willow flycatcher indicates both migrants and the southwestern subspecies because they cannot be differentiated in this study.

† Species occurs as a breeder in the study area, but numbers reported here are of migrant, flyover, or otherwise non-breeding individuals.

Beal Lake Conservation Area

In 2014, we conducted rapid area searches on four BLCA plots (attachment 1bb). We recorded a total of 58 species; of these, 17 were classified as territorial breeders (101 territories) (table 12), 7 species were non-territorial breeders, and 34 were exclusively migrants or otherwise non-breeders. A total of 35 species (table 13) were recorded as non-breeders on individual plots; these included both migrant species and local breeders confirmed breeding on other plots. This also includes 22 species recorded only as flyover or incidental records. We found Arizona Bell's vireo to be the most abundant breeder of all covered species, with 13 territories, followed by Sonoran yellow warbler, with 7.5 territories at the BLCA. As in 2013, summer tanagers were also found nesting at BLCA B and C (1.75 territories). Non-territorial breeding species included brown-headed cowbird, Gambel's quail, greater roadrunner, lesser goldfinch (*Spinus psaltria*), great-tailed grackle, house finch, mourning dove, and white-winged dove (attachment 7 – table 7-1). We also observed ash-throated flycatchers (*Myiarchus cinerascens*), Gila woodpeckers, and western kingbirds (*Tyrannus verticalis*)at or near the BLCA, but we were unable to confirm their breeding.

Table 12.—**BLCA**: Number of breeding territories detected during rapid area search plots in 2014
(Species are listed in descending order of abundance. Non-territorial species are not listed.)

Species (n = 17)	C1501 (BLCA A)	C1502 (BLCA B)	C1503 (BLCA C)	C1504 (BLCA D)	Total
Yellow-breasted chat	4.25	8	5.75	0.25	18.25
Black-tailed gnatcatcher	1	7	6	2.25	16.25
Arizona Bell's vireo*	2.75	4.75	5	0.5	13
Verdin	2.25	6.5	3	1.25	13
Abert's towhee	0.75	6.75	3	0.5	11
Sonoran yellow warbler*	1	2	4.5	0	7.5
Lucy's warbler	0.5	2.5	0	2	5
Song sparrow	4.75	0	0	0	4.75
Ladder-backed woodpecker	0	0.75	2	0	2.75
Crissal thrasher	0.5	0.5	0.5	0.25	1.75
Summer tanager*	0	1	0.75	0	1.75
Blue grosbeak	0	0.5	0.5	0.5	1.5
Bullock's oriole	0	1	0.5	0	1.5
Common yellowthroat	1.25	0	0	0	1.25
Brown-crested flycatcher	0.25	0.75	0	0	1
Killdeer	0.5	0	0	0	0.5
Black-chinned hummingbird	0.25	0	0	0	0.25
Total	**20**	**42**	**31.5**	**7.5**	**101**

* LCR MSCP covered species.

Table 13.—**BLCA**: Number of non-breeding birds detected during rapid area search plots in 2014

(Tally is the sum of birds observed on both rapid surveys. Note that this table does not include individuals or species entered as possible breeders but not confirmed breeding; all such species are listed as non-breeders in attachment 5. Species are listed in alphabetical order.)

Species (n = 35)	Males	Females	Unknown sex	Juveniles	Flyovers	Incidentals
Anna's hummingbird†	1	0	0	0	0	0
Audubon's warbler	0	0	1	0	0	0
Barn swallow	0	0	0	0	10	0
Black-headed grosbeak	3	0	2	0	2	0
Black-necked stilt†	0	0	0	0	0	1
Brown-headed cowbird†	0	0	0	0	1	0
Canvasback	0	0	0	0	4	0
Caspian tern	0	0	0	0	7	0
Cliff swallow†	0	0	0	0	56	0
Double-crested cormorant†	0	0	0	0	3	0
Great egret†	0	0	0	0	4	0
Great-tailed grackle†	0	0	0	0	5	0
Green-tailed towhee	0	0	3	0	0	0
House finch†	0	0	0	0	3	0
Lazuli bunting	1	0	0	0	0	0
Least bittern*†	0	0	0	0	0	1
Lesser nighthawk†	0	0	0	0	5	0
Macgillivray's warbler	0	0	1	0	0	0
Mallard†	0	0	0	0	2	0
Mourning dove†	0	0	0	0	10	0
Northern rough-winged swallow†	0	0	0	0	17	0
Pacific-slope flycatcher	0	0	27	0	0	0
Red-winged blackbird†	0	0	0	0	17	0
Tree swallow	0	0	0	0	234	0
Turkey vulture†	0	0	0	0	1	0
Warbling vireo	0	0	4	0	0	0
Western kingbird†	0	0	0	0	1	0
Western tanager	7	0	0	0	0	0
Western wood-pewee	1	0	6	0	0	0
White-crowned sparrow	0	0	3	0	0	0
White-faced ibis†	0	0	0	0	0	2
White-winged dove†	0	0	0	0	10	0
Willow flycatcher**†	0	0	1	0	0	0
Wilson's warbler	1	0	4	0	0	0
Yellow-headed blackbird†	0	0	0	0	4	0
Total	**14**	**0**	**52**	**0**	**396**	**4**

* LCR MSCP covered species.

** Willow flycatcher indicates both migrants and the southwestern subspecies because they cannot be differentiated in this study.

† Species occurs as a breeder in the study area, but numbers reported here are of migrant, flyover, or otherwise non-breeding individuals.

Colorado River Indian Tribe ('Ahakhav Tribal Preserve CRIT 9) Habitat Creation Area

Five plots in the 'Ahakhav Tribal Preserve CRIT 9 habitat creation area (attachment 1cc) were surveyed with rapid area searches in 2014. We recorded a total of 83 species; of these, 22 were classified as territorial breeders (72.5 territories) (table 14), 6 species were non-territorial breeders, and 55 were exclusively migrants or otherwise non-breeders. A total of 67 species (table 15) were recorded as non-breeders on individual plots; these included both migrant species and local breeders confirmed breeding on other plots. This also included 26 species recorded only as flyover or incidental records. We confirmed breeding of two covered species: the vermilion flycatcher and summer tanager. Some of the most common species we found breeding at 'Ahakhav Tribal Preserve CRIT 9 were non-territorial species, including mourning and white-winged doves, brown-headed cowbirds, Gambel's quail, house finches, and great-tailed grackles (attachment 7 – table 7-1). Yellow warblers and *Phainopeplas* were detected and possibly breeding in or around 'Ahakhav Tribal Preserve CRIT 9, but breeding could not be confirmed.

Table 14.—**'Ahakhav Tribal Preserve CRIT 9 habitat creation area**: Number of breeding territories of territorial species detected during rapid area search plots in 2014
(Species are listed in descending order of abundance. Non-territorial species are not listed.)

Species (n = 22)	C2101 (CRIT 9 A)	C2102 (CRIT 9 B)	C2103 (CRIT 9 C)	C2104 (CRIT 9 D)	C2105 (CRIT 9 E)	Total
Abert's towhee	1	1	3	1.75	2	8.75
Ladder-backed woodpecker	1	1.25	2	1.25	1.75	7.25
Verdin	2	1.75	2	1.5	0	7.25
Lucy's warbler	2.5	0.5	0	4	0	7
Black-chinned hummingbird	0	0	1	3	2	6
Western kingbird	1.25	0.75	1.5	0.5	2	6
Anna's hummingbird	0	1.25	2.5	1.75	0	5.5
Bullock's oriole	1	1	1	0.5	2	5.5
Blue grosbeak	0.5	0.5	0	0.25	2.75	4
Vermilion flycatcher*	1.5	1.25	0	0	0.25	3
Ash-throated flycatcher	0.25	0	2	0.5	0	2.75
Brown-crested flycatcher	0	0	0	0.75	1	1.75
Summer tanager*	0	0	0.5	0	1	1.5
Crissal thrasher	0	0	1.25	0	0	1.25
Black-tailed gnatcatcher	0	0	0	1	0	1
Great horned owl	0	0	0.75	0.25	0	1
Lesser goldfinch	0	0	1	0	0	1
American kestrel	0	0	0	0.25	0.25	0.5
Common ground-dove	0	0	0	0	0.5	0.5
Common raven	0.25	0.25	0	0	0	0.5
Black phoebe	0	0	0	0	0.25	0.25
Tropical kingbird	0	0	0	0.25	0	0.25
Total	**11.25**	**9.5**	**18.5**	**17.5**	**15.75**	**72.5**

* LCR MSCP covered species.

Table 15.—**'Ahakhav Tribal Preserve CRIT 9 habitat creation area**: Number of non-breeding birds detected during rapid area search plots in 2014

(Tally is the sum of birds observed on both rapid surveys. Note that this table does not include individuals or species entered as possible breeders but not confirmed breeding; all such species are listed as non-breeders in attachment 5. Species are listed in alphabetical order.)

Species (n = 73)	Males	Females	Unknown sex	Juveniles	Flyovers	Incidentals
American pipit	0	0	0	0	2	0
American robin†	0	0	1	0	0	0
Anna's hummingbird†	0	0	0	6	0	0
Ash-throated flycatcher†	0	0	0	1	0	0
Audubon's warbler	0	0	60	0	0	0
Barn swallow	0	0	0	0	1	0
Black phoebe†	1	1	0	1	0	0
Black-headed grosbeak	2	0	1	0	0	0
Black-tailed gnatcatcher†	0	0	0	3	0	0
Brewer's sparrow	1	0	11	0	0	0
Brown-headed cowbird†	0	0	0	0	27	0
Cassin's vireo	0	0	7	0	0	0
Cedar waxwing	0	0	1	0	1	0
Chipping sparrow	0	0	36	0	0	0
Cliff swallow†	0	0	0	0	23	0
Common raven†	0	0	0	0	3	0
Cooper's hawk†	0	0	0	1	0	0
Eurasian collared-dove†	0	0	0	0	22	0
European starling†	0	0	0	0	1	0
Gambel's white-crowned sparrow	0	0	17	0	0	0
Gray flycatcher	0	0	4	0	0	0
Great blue heron†	0	0	0	0	1	0
Great egret†	0	0	0	0	3	0
Great-tailed grackle†	1	0	0	0	88	0
Green-tailed towhee	0	0	4	0	0	0
Hammond's flycatcher	3	0	4	0	0	0

Table 15.—**'Ahakhav Tribal Preserve CRIT 9 habitat creation area**: Number of non-breeding birds detected during rapid area search plots in 2014

(Tally is the sum of birds observed on both rapid surveys. Note that this table does not include individuals or species entered as possible breeders but not confirmed breeding; all such species are listed as non-breeders in attachment 5. Species are listed in alphabetical order.)

Species (n = 73)	Males	Females	Unknown sex	Juveniles	Flyovers	Incidentals
Hermit thrush	0	0	1	0	0	0
Horned lark†	0	0	0	0	1	0
House finch†	0	0	0	0	23	0
House wren	0	0	1	0	0	0
Lark sparrow	1	0	0	0	0	0
Lazuli bunting	3	3	3	0	0	0
Lesser goldfinch†	0	0	0	0	14	0
Lesser nighthawk†	0	0	0	0	1	0
Loggerhead shrike†	0	0	1	0	0	0
Macgillivray's warbler	3	0	2	0	0	0
Mallard†	0	0	0	0	1	0
Mississippi kite	0	0	0	0	1	0
Mountain white-crowned sparrow	0	0	3	0	0	0
Mourning dove†	0	0	0	0	16	0
Myrtle warbler	0	0	2	0	0	0
Nashville warbler	1	0	0	0	0	0
Northern rough-winged swallow†	0	0	0	0	39	0
Olive-sided flycatcher	0	0	1	0	0	0
Orange-crowned warbler	1	0	17	0	0	0
Pacific-slope flycatcher	9	0	56	0	0	0
Peregrine falcon†	0	0	0	0	1	0
Phainopepla†	0	0	2	0	0	0
Red-tailed hawk†	0	0	0	0	1	0
Red-winged blackbird†	0	0	0	0	224	0
Ruby-crowned kinglet	0	0	3	0	0	0
Rufous hummingbird	1	1	0	0	0	0

Table 15.—**'Ahakhav Tribal Preserve CRIT 9 habitat creation area**: Number of non-breeding birds detected during rapid area search plots in 2014

(Tally is the sum of birds observed on both rapid surveys. Note that this table does not include individuals or species entered as possible breeders but not confirmed breeding; all such species are listed as non-breeders in attachment 5. Species are listed in alphabetical order.)

Species (n = 73)	Males	Females	Unknown sex	Juveniles	Flyovers	Incidentals
Swainson's thrush	0	0	9	0	0	0
Swainson's hawk	0	0	0	1	2	0
Townsend's warbler	1	0	3	0	0	0
Tree swallow	0	0	0	0	64	0
Turkey vulture†	0	0	4	0	17	7
Unidentified *Empidonax* flycatcher	0	0	32	0	0	0
Vaux's swift	0	0	0	0	8	0
Warbling vireo	0	0	46	0	0	0
Western flycatcher	0	0	4	0	0	0
Western kingbird†	0	0	0	0	2	0
Western tanager	6	0	9	0	0	0
Western wood-pewee	12	3	36	0	0	0
White-crowned sparrow	0	0	12	0	0	0
White-faced ibis†	0	0	0	0	2	0
White-throated swift†	0	0	0	0	1	0
White-winged dove†	0	0	0	0	37	0
Willow flycatcher**†	2	0	2	0	0	0
Wilson's warbler	16	6	106	0	0	0
Yellow warbler*†	4	0	1	0	0	0
Yellow-rumped warbler	0	0	7	0	0	0
Zone-tailed hawk	0	0	2	0	0	0
Total	**68**	**14**	**511**	**13**	**627**	**7**

* LCR MSCP covered species.

** Willow flycatcher indicates both migrants and the southwestern subspecies because they cannot be differentiated in this study.

† Species occurs as a breeder in the study area, but numbers reported here are of migrant, flyover, or otherwise non-breeding individuals.

Palo Verde Ecological Reserve

During rapid area searches of 31 plots at the PVER (attachment 1dd), we recorded a total of 106 species; of these, 24 were classified as territorial breeders (410.25 territories) (table 16), 11 species were non-territorial breeders, and 71 were exclusively migrants or otherwise non-breeders. A total of 92 species (table 17) were recorded as non-breeders on individual plots; these included both migrant species and local breeders confirmed breeding on other plots. This also includes 36 species recorded only as flyover or incidental records. Of the covered species, we found Sonoran yellow warblers breeding in planting Phases 4, 5, and 6 this year. One territory of Arizona Bell's vireo was detected using the buffer zone north of Phase 2, but not using the planting area, and outside of the plot's boundaries. Several other breeding species, including Gila woodpecker, summer tanager, lesser goldfinch, lesser nighthawk (*Chordeiles acutipennis*), and marsh wren (*Cistothorus palustris*) were detected and suspected to be breeding, but breeding could not be confirmed. The most common non-territorial species breeding at the PVER was the red-winged blackbird (1,075 pairs), followed by the white-winged dove (242 pairs), brown-headed cowbird (223 pairs), and mourning dove (147 pairs). The Eurasian collared dove, European starling, Gambel's quail, greater roadrunner, great-tailed grackle, house finch, and yellow-headed blackbird were also recorded (attachment 7 – table 7-1).

Table 16.—**PVER**: Number of breeding territories of territorial species detected during rapid area search plots in 2014 (Species are listed in descending order of abundance. Non-territorial species are not listed. For a list of corresponding bird plots associated with each conservation and habitat creation area phase, see attachment 8 – table 8-1.)

Species (n = 25)	Phase 1	Phase 2	Phase 3	Phase 4	Phase 5	Phase 6	Phase 7	Phase 8	Total PVER
Common yellowthroat	1	1.25	0	2.5	39.75	54.75	21.75	15	136
Blue grosbeak	1.5	2.5	6.75	5	25.25	19.25	7	1.25	68.5
Abert's towhee	2.25	10	4	3.75	15.5	12	1.75	2	51.25
Song sparrow	5	0	0	5	8.5	12.25	0	0	30.75
Black-chinned hummingbird	1.5	3.75	6.5	5	4.5	1.5	0	0	22.75
Bullock's oriole	0.75	4.5	0.75	2	8.75	4.5	1	0	22.25
Western kingbird	1.5	4.25	1	1.5	2	0.5	1.75	0	12.5
Yellow-breasted chat	0	0	0	2	8.75	1.25	0	0	12
Lucy's warbler	0	2	0	5.75	1.75	0	0	0	9.5
Verdin	1	4.25	0	2.75	0	0	0	0	8
Ladder-backed woodpecker	1	1.25	0.5	0.25	2.25	0	0.75	0	6
Indigo bunting	0	0	0	0	1.5	3.75	0.25	0	5.5
Sonoran yellow warbler*	0	0	0	3	1	1	0	0	5
Black-tailed gnatcatcher	0	0	0	2	1	1.75	0	0	4.75
Ash-throated flycatcher	0	0	0.25	0	0.5	1.75	0.25	0	2.75
Anna's hummingbird	0	2	0	0	0	0	0	0	2
Great horned owl	0.25	0	0	0.25	0.25	1	0.25	0	2
Common ground-dove	0	0	0.25	0	0.75	0	0.25	0.5	1.75
Unidentified hummingbird	0	1.25	0	0	0.5	0	0	0	1.75
Common raven	0	0.25	0.25	0	0.75	0.25	0	0	1.5
Crissal thrasher	0	0.5	0	0.25	0.5	0	0	0	1.25
Northern mockingbird	0	0	1	0	0	0	0	0	1
Barn owl	0	0.5	0	0	0	0	0	0	0.5
Inca dove	0	0	0	0.5	0	0	0	0	0.5
Northern harrier	0	0.25	0.25	0	0	0	0	0	0.5
Total	**15.75**	**38.5**	**21.5**	**41.5**	**123.75**	**115.5**	**35**	**18.75**	**410.25**

* LCR MSCP covered species.

Table 17.—**PVER**: Number of non-breeding birds detected during rapid area search plots in 2014

(Tally is the sum of birds observed on both rapid surveys. Note that this table does not include individuals or species entered as possible breeders but not confirmed breeding; all such species are listed as non-breeders in attachment 5. Species are listed in alphabetical order.)

Species (n = 97)	Males	Females	Unknown sex	Juveniles	Flyovers	Incidentals
Abert's towhee†	0	0	2	0	0	0
American bittern	0	0	0	0	1	0
American kestrel†	0	0	1	0	2	0
American pipit	0	0	0	0	1	0
American robin†	1	0	1	0	0	0
Arizona Bell's vireo*†	0	0	0	0	0	2
Ash-throated flycatcher†	0	0	1	0	0	0
Audubon's warbler	37	14	168	0	44	0
Bank swallow	0	0	0	0	1	0
Barn swallow	0	0	0	0	43	0
Bewick's wren†	1	0	0	0	0	0
Black-chinned hummingbird†	0	0	0	1	0	0
Black-headed grosbeak	18	6	13	0	2	0
Black-necked stilt†	0	0	0	0	3	0
Black-tailed gnatcatcher†	0	0	1	0	0	0
Black-throated gray warbler	0	0	1	0	0	0
Blue grosbeak†	2	0	2	0	0	0
Brewer's sparrow	0	0	3	0	0	0
Brown-headed cowbird†	0	0	0	0	462	0
Caspian tern	0	0	0	0	1	0
Cassin's vireo	0	0	4	0	0	0
Cattle egret†	0	0	0	0	39	0
Cedar waxwing	0	0	5	0	5	0
Chipping sparrow	0	0	6	0	0	0
Clay-colored sparrow	0	0	1	0	0	0

Table 17.—**PVER**: Number of non-breeding birds detected during rapid area search plots in 2014

(Tally is the sum of birds observed on both rapid surveys. Note that this table does not include individuals or species entered as possible breeders but not confirmed breeding; all such species are listed as non-breeders in attachment 5. Species are listed in alphabetical order.)

Species (n = 97)	Males	Females	Unknown sex	Juveniles	Flyovers	Incidentals
Cliff swallow†	0	0	0	0	344	0
Common ground-dove†	0	0	1	0	0	0
Common loon	0	0	0	0	0	1
Common raven†	0	0	0	0	9	0
Double-crested cormorant†	0	0	0	0	4	0
European starling†	0	0	0	0	1	0
Gambel's quail†	1	0	0	0	0	0
Gambel's white-crowned sparrow	0	0	2	0	0	0
Great blue heron†	0	0	0	0	4	0
Great egret†	0	0	0	0	4	0
Great horned owl†	0	0	0	0	0	2
Greater roadrunner†	2	0	2	0	0	0
Greater yellowlegs	0	0	0	0	1	0
Great-tailed grackle†	0	0	0	0	69	0
Green-tailed towhee	1	0	6	0	0	0
Hammond's flycatcher	0	0	7	0	0	0
Horned lark†	1	0	0	0	0	0
House finch†	3	5	2	0	28	0
House wren	0	0	1	0	0	0
Killdeer†	0	0	1	0	1	0
Ladder-backed woodpecker†	1	0	2	0	0	0
Lark sparrow	0	0	1	0	0	0
Lazuli bunting	44	34	47	0	0	0
Lesser goldfinch†	0	2	0	0	7	0
Lincoln's sparrow	0	0	3	0	0	0

Table 17.—**PVER**: Number of non-breeding birds detected during rapid area search plots in 2014

(Tally is the sum of birds observed on both rapid surveys. Note that this table does not include individuals or species entered as possible breeders but not confirmed breeding; all such species are listed as non-breeders in attachment 5. Species are listed in alphabetical order.)

Species (n = 97)	Males	Females	Unknown sex	Juveniles	Flyovers	Incidentals
Long-billed curlew	0	0	0	0	2	0
Lucy's warbler†	20	24	119	2	0	0
Macgillivray's warbler	3	0	3	0	0	0
Mallard†	0	0	0	0	2	0
Marsh wren†	0	0	1	0	0	0
Mississippi kite	0	0	0	0	1	0
Mountain white-crowned sparrow	1	0	15	0	0	0
Mourning dove†	0	0	0	0	70	0
Myrtle warbler	1	1	6	0	0	0
Nashville warbler	0	0	38	0	0	0
Northern flicker	0	0	0	0	2	0
Northern harrier†	1	1	0	0	1	0
Northern parula	1	0	0	0	0	0
Northern rough-winged swallow†	0	0	0	0	84	0
Northern shoveler	0	0	0	0	4	0
Olive-sided flycatcher	0	0	11	0	0	0
Orange-crowned warbler	10	4	35	0	0	0
Osprey	0	0	0	0	1	0
Pacific-slope flycatcher	5	0	74	0	0	0
Plumbeous vireo	0	0	1	0	0	0
Prairie falcon†	0	0	0	0	1	0
Red-tailed hawk†	0	0	0	0	6	0
Red-winged blackbird†	205	189	6	0	4,689	0
Ruby-crowned kinglet	2	0	11	0	0	0
Sharp-shinned hawk	0	0	1	0	2	0

Table 17.—**PVER**: Number of non-breeding birds detected during rapid area search plots in 2014

(Tally is the sum of birds observed on both rapid surveys. Note that this table does not include individuals or species entered as possible breeders but not confirmed breeding; all such species are listed as non-breeders in attachment 5. Species are listed in alphabetical order.)

Species (n = 97)	Males	Females	Unknown sex	Juveniles	Flyovers	Incidentals
Spotted towhee	0	0	0	0	0	1
Swainson's hawk	0	0	0	0	4	0
Swainson's thrush	5	0	15	0	0	0
Townsend's warbler	6	0	10	0	0	0
Tree swallow	0	0	0	0	1,540	0
Turkey vulture†	0	0	1	0	28	0
Vaux's swift	0	0	0	0	14	0
Verdin†	0	0	0	1	0	0
Warbling vireo	0	0	245	0	0	0
Western flycatcher	4	0	25	0	0	0
Western kingbird†	0	0	5	0	6	0
Western tanager	38	8	24	0	0	0
Western wood-pewee	0	0	94	0	0	0
White-crowned sparrow	20	4	172	0	0	0
White-faced ibis†	0	0	0	0	61	0
White-throated swift†	0	0	0	0	14	0
White-winged dove†	0	0	0	0	332	0
Willow flycatcher**†	23	0	6	0	0	0
Wilson's warbler	58	30	301	0	0	1
Yellow warbler*†	28	12	66	0	0	0
Yellow-headed blackbird†	2	2	0	0	46	0
Yellow-rumped warbler	24	7	111	0	3	0
Total	**569**	**343**	**1,680**	**4**	**7,989**	**7**

*LCR MSCP covered species.

** Willow flycatcher indicates both migrants and the southwestern subspecies because they cannot be differentiated in this study.

† Species occurs as a breeder in the study area, but numbers reported here are of migrant, flyover, or otherwise non-breeding individuals.

Cibola Valley Conservation Area

In 21 rapid area search plots at the Cibola Valley Conservation Area (CVCA) (attachment 1ee), we recorded a total of 90 species; of these, 18 were classified as territorial breeders (236.75 territories) (table 18), 10 species were non-territorial breeders, and 62 were exclusively migrants or otherwise non-breeders. A total of 73 species (table 19) were recorded as non-breeders on individual plots; these included both migrant species and local breeders confirmed breeding on other plots. This also includes 33 species recorded only as flyover or incidental records. We found yellow warblers in CVCA planting Phase 3 plots, but the surveyors were unable to confirm breeding in 2014. Again, we found many non-territorial species breeding in large numbers at the CVCA, including mourning and white-winged doves (188 and 169 pairs, respectively), brown-headed cowbirds (106 pairs), and Gambel's quail (61 pairs). Other non-territorial nesting species included the red-winged blackbird (24 pairs), house finch (11 pairs), greater roadrunner (8 pairs), European starling (5 pairs), Eurasian collared-dove (4 pairs), and yellow-headed blackbird (4 pairs). Several species, including the common yellowthroat, American kestrel (*Falco sparverius*), barn owl (*Tyto alba*), Costa's hummingbird (*Calypte costae*), northern mockingbird (*Mimus polyglottos*), song sparrow, and red-tailed hawk (*Buteo jamaicensis*) were observed and possibly breeding, but the surveyor was unable to confirm breeding.

Table 18.—**CVCA**: Number of breeding territories of territorial species detected during rapid area search plots in 2014

(Species are listed in descending order of abundance. For a list of corresponding bird plots associated with each conservation and habitat creation area phase, see attachment 8 – table 8-2.)

Species (n = 18)	Phase 1	Phase 2	Phase 3	Phase 4	Phase 5	Phase 6	Total CVCA
Abert's towhee	8.5	5.25	6.25	16.75	6.5	6.5	49.75
Verdin	5	0.75	5.5	18.75	8.5	6.5	45
Black-tailed gnatcatcher	0	0	4	16.75	7	7.5	35.25
Western kingbird	4.25	6.5	10.25	1.75	0	1.25	24
Blue grosbeak	6.75	7.5	1.5	6.25	1.25	0	23.25
Bullock's oriole	5.75	2	3.75	1.25	0	0	12.75
Lucy's warbler	0.5	0	0	2.5	1.25	6.75	11
Black-chinned hummingbird	7	1	1	1.25	0	0	10.25
Ladder-backed woodpecker	3.75	1	1	0.5	0.25	0	6.5
Crissal thrasher	0	0	0.5	2.5	1	0.5	4.5
Inca dove	3.5	0	0	0	0	0	3.5
Lesser goldfinch	3.5	0	0	0	0	0	3.5
Ash-throated flycatcher	0	0.25	0	1	0	1.25	2.5
Lesser nighthawk	0	0	0	1	0.25	0.75	2
Common ground-dove	0.5	0	0	1	0	0	1.25
Great horned owl	0.75	0	0	0	0	0	0.75
Anna's hummingbird	0	0.5	0	0	0	0	0.5
Indigo bunting	0.5	0	0	0	0	0	0.5
Total	**50.25**	**24.75**	**33.75**	**71.25**	**26**	**31**	**236.75**

* LCR MSCP covered species.

Table 19.—**CVCA**: Number of non-breeding birds detected during rapid area search plots in 2014

(Tally is the sum of birds observed on both rapid surveys. Note that this table does not include individuals or species entered as possible breeders but not confirmed breeding; all such species are listed as non-breeders in attachment 5. Species are listed in alphabetical order.)

Species (n = 78)	Males	Females	Unknown sex	Juveniles	Flyovers	Incidentals
Abert's towhee†	0	0	0	0	1	0
American kestrel†	0	0	0	0	1	0
American pipit	0	0	0	0	4	0
Ash-throated flycatcher†	0	0	0	0	1	0
Audubon's warbler	5	2	77	0	0	0
Bank swallow	0	0	0	0	1	0
Barn swallow	0	0	7	0	173	0
Black-headed grosbeak	6	2	5	0	1	0
Black-throated gray warbler	1	2	1	0	0	0
Brewer's sparrow	0	0	6	0	0	0
Brown-headed cowbird†	0	0	0	0	256	0
Bullock's oriole†	5	0	1	0	1	0
Cassin's vireo	0	0	1	0	0	0
Cedar waxwing	2	2	1	0	3	0
Chipping sparrow	0	0	10	0	0	0
Cliff swallow†	0	0	0	0	178	0
Common raven†	0	0	0	0	2	0
Double-crested cormorant†	0	0	0	0	15	0
European starling†	0	0	0	0	14	0
Gambel's quail†	1	0	0	0	0	0
Gambel's white-crowned sparrow	0	0	19	0	0	0
Gila woodpecker*†	0	0	0	0	0	1
Great blue heron†	0	0	0	0	1	0
Great egret†	0	0	0	0	5	0
Great horned owl†	0	0	0	0	1	0
Great-tailed grackle†	0	0	0	0	34	0
Green-tailed towhee	0	0	2	0	0	0
Hammond's flycatcher	0	0	7	0	0	0

Table 19.—**CVCA**: Number of non-breeding birds detected during rapid area search plots in 2014

(Tally is the sum of birds observed on both rapid surveys. Note that this table does not include individuals or species entered as possible breeders but not confirmed breeding; all such species are listed as non-breeders in attachment 5. Species are listed in alphabetical order.)

Species (n = 78)	Males	Females	Unknown sex	Juveniles	Flyovers	Incidentals
Hermit warbler	1	2	0	0	0	0
Hooded oriole†	0	1	0	0	0	0
Horned lark†	0	0	0	0	24	0
House finch†	4	0	4	0	28	0
Killdeer†	0	0	0	0	3	0
Ladder-backed woodpecker†	0	0	0	0	1	0
Lazuli bunting	0	0	20	0	0	0
Lesser goldfinch†	2	0	6	1	5	0
Lesser nighthawk†	0	0	0	0	9	0
Lincoln's sparrow	0	0	1	0	0	0
Loggerhead shrike†	0	0	0	1	0	0
Lucy's warbler†	2	1	9	0	0	0
Macgillivray's warbler	7	3	21	0	0	0
Mountain white-crowned sparrow	0	0	2	0	0	0
Mourning dove†	2	0	10	0	118	0
Myrtle warbler	0	1	0	0	0	0
Nashville warbler	3	0	42	0	0	0
Northern flicker	0	0	3	0	0	0
Northern harrier†	0	0	0	0	3	0
Northern rough-winged swallow†	0	0	0	0	110	0
Olive-sided flycatcher	0	0	3	0	0	0
Orange-crowned warbler	4	0	24	0	0	0
Pacific-slope flycatcher	5	0	76	0	0	0
Peregrine falcon†	0	0	0	0	1	0
Phainopepla†	0	0	0	0	5	0
Red-tailed hawk†	0	0	0	0	1	0
Red-winged blackbird†	1	0	0	0	1,506	0
Ruby-crowned kinglet	1	0	6	0	0	0

Table 19.—**CVCA**: Number of non-breeding birds detected during rapid area search plots in 2014

(Tally is the sum of birds observed on both rapid surveys. Note that this table does not include individuals or species entered as possible breeders but not confirmed breeding; all such species are listed as non-breeders in attachment 5. Species are listed in alphabetical order.)

Species (n = 78)	Males	Females	Unknown sex	Juveniles	Flyovers	Incidentals
Sharp-shinned hawk	0	0	0	0	1	0
Swainson's hawk	0	0	0	0	2	0
Swainson's thrush	1	0	17	0	0	0
Townsend's warbler	11	3	5	0	0	0
Tree swallow	0	0	0	0	3,076	0
Turkey vulture†	0	0	0	0	18	0
Vaux's swift	0	0	2	0	4	0
Vermilion flycatcher*†	0	0	0	0	1	0
Warbling vireo	1	0	93	0	0	0
Western flycatcher	1	0	59	0	0	0
Western kingbird†	0	0	0	0	13	0
Western tanager	7	3	14	0	2	0
Western wood-pewee	1	0	44	0	0	0
White-crowned sparrow	3	1	14	0	0	0
White-faced ibis†	0	0	0	0	66	0
White-throated swift†	0	0	0	0	34	0
White-winged dove†	0	0	7	0	312	0
Willow flycatcher**†	4	0	21	0	0	0
Wilson's warbler	42	6	175	0	0	0
Yellow warbler*†	10	5	26	0	0	0
Yellow-headed blackbird†	0	0	0	0	19	0
Yellow-rumped warbler	0	0	8	0	0	0
Total	**133**	**34**	**849**	**2**	**6,054**	**1**

* LCR MSCP covered species.

** Willow flycatcher indicates both migrants and the southwestern subspecies because they cannot be differentiated in this study.

† Species occurs as a breeder in the study area, but numbers reported here are of migrant, flyover, or otherwise non-breeding individuals.

Cibola National Wildlife Refuge Unit #1 Conservation Area

Rapid area search plots surveyed in 2014 at Cibola NWR Unit #1 included research area 1 (research and development, Nature Trail, Mass Planting, seed feasibility, Cottonwood Genetics, and the existing cottonwoods on the northernmost section) and Area 5 (Crane Roost; attachment 1ff). In these 11 plots, we recorded a total of 89 species; of these, 28 were classified as territorial breeders (192.25 territories) (table 20), 9 species were non-territorial breeders, and 52 were exclusively migrants or otherwise non-breeders. A total of 69 species (table 21) were recorded as non-breeders on individual plots; these included both migrant species and local breeders confirmed breeding on other plots. This also includes 23 species recorded only as flyover or incidental records. Sonoran yellow warblers (at Crane Roost) and Arizona Bell's vireos (at Nature Trail – north and Nature Trail – south) were found breeding. Cooper's hawks (*Accipiter cooperii*) were detected and possibly nesting, but breeding was not confirmed. Non-territorial species breeding at Cibola NWR Unit #1 included the red-winged blackbird (201 pairs) white-winged and mourning doves (181 and 167 pairs, respectively), brown-headed cowbird (112 pairs), Gambel's quail (29 pairs), house finch (17 pairs), European starling (11 pairs), yellow-headed blackbird (9 pairs), and greater roadrunner (2 pairs).

Table 20.—**Cibola NWR Unit #1**: Number of breeding territories of territorial species detected during rapid area search plots in 2014

(Listed in descending order of abundance. Non-territorial species excluded. For a list of corresponding bird plots associated with each conservation and habitat creation area phase, see attachment 8 – table 8-3.)

Species (n = 28)	Research area 1	Crane Roost	Nature Trail – North	Nature Trail – South	Total
Abert's towhee	8.25	14.5	2.5	5	30.25
Verdin	2.25	13	4.75	9.25	29.25
Song sparrow	1.25	23.75	0	0	25
Blue grosbeak	7	9.5	1	2	19.5
Western kingbird	8.75	2	2.75	3	16.5
Bullock's oriole	4.75	3.25	1	2	11
Black-tailed gnatcatcher	1.75	5	0.75	0	7.5
Yellow-breasted chat	0	5.75	0.5	0	6.25
Ash-throated flycatcher	3.25	1.25	0.25	1	5.75
Northern mockingbird	1.5	4.25	0	0	5.75
Ladder-backed woodpecker	1.5	2.25	0.75	1	5.5
Black-chinned hummingbird	1.25	2	2	0	5.25
Crissal thrasher	1.75	1.25	0	1.25	4.25
Arizona Bell's vireo*	0	0	1	3	4
Common yellowthroat	0.5	2.75	0	0	3.25
Lucy's warbler	0.5	2.75	0	0	3.25
Lesser goldfinch	1.75	0.5	0	0	2.25
Costa's hummingbird	0.75	0	0	0.5	1.25
Indigo bunting	1	0	0	0	1
Killdeer	1	0	0	0	1
Lesser nighthawk	1	0	0	0	1
Loggerhead shrike	0	1	0	0	1
Sonoran yellow warbler*	0	1	0	0	1
Anna's hummingbird	0	0.5	0	0	0.5
American coot	0.25	0	0	0	0.25
American kestrel	0.25	0	0	0	0.25
Bewick's wren	0.25	0	0	0	0.25
Great horned owl	0.25	0	0	0	0.25
Total	**50.75**	**96.25**	**17.25**	**28**	**192.25**

* LCR MSCP covered species.

Table 21.—**Cibola NWR Unit #1**: Number of non-breeding birds detected during rapid area search plots in 2014

(Tally is the sum of birds observed on both rapid surveys. Note that this table does not include individuals or species entered as possible breeders but not confirmed breeding; all such species are listed as non-breeders in attachment 5. Species are listed in alphabetical order.)

Species (n = 73)	Males	Females	Unknown sex	Juveniles	Flyovers	Incidentals
Abert's towhee†	0	0	2	0	0	0
American kestrel†	0	0	0	0	2	0
American redstart	1	0	0	0	0	0
Audubon's warbler	10	3	50	0	4	0
Barn swallow	0	0	0	0	38	0
Black phoebe†	0	0	0	0	0	1
Black-and-white warbler	0	1	0	0	0	0
Black-headed grosbeak	13	4	10	0	0	2
Black-tailed gnatcatcher†	0	0	0	1	0	0
Black-throated gray warbler	0	0	1	0	0	0
Brewer's sparrow	0	0	1	0	0	0
Brown-headed cowbird†	0	0	0	0	261	0
Canada goose†	0	0	0	0	1	0
Cassin's vireo	0	0	8	0	0	0
Cattle egret†	0	0	0	0	17	0
Cedar waxwing	0	0	2	0	0	0
Chipping sparrow	9	4	0	0	0	0
Cliff swallow†	0	0	3	0	10	0
Common raven†	0	0	0	0	4	0
Cooper's hawk†	0	0	1	0	0	0
Eurasian collared-dove†	1	0	0	0	0	0
European starling†	0	0	0	0	8	0
Gambel's white-crowned sparrow	1	0	10	0	0	0
Great blue heron†	0	0	0	0	1	0
Great egret†	0	0	0	0	3	0
Great-tailed grackle†	0	0	0	0	28	0
Green heron†	0	0	1	0	1	0

Table 21.—**Cibola NWR Unit #1**: Number of non-breeding birds detected during rapid area search plots in 2014

(Tally is the sum of birds observed on both rapid surveys. Note that this table does not include individuals or species entered as possible breeders but not confirmed breeding; all such species are listed as non-breeders in attachment 5. Species are listed in alphabetical order.)

Species (n = 73)	Males	Females	Unknown sex	Juveniles	Flyovers	Incidentals
Green-tailed towhee	0	0	11	0	0	0
Hammond's flycatcher	0	0	17	0	0	0
Hermit thrush	0	0	3	0	0	0
House finch†	4	1	2	0	55	0
House wren	2	0	0	0	0	0
Indigo bunting†	0	2	0	0	0	0
Killdeer†	0	0	0	0	4	0
Lazuli bunting	4	9	18	0	0	0
Lesser goldfinch†	0	0	1	0	3	0
Lesser nighthawk†	0	0	0	0	5	0
Lincoln's sparrow	4	0	5	0	0	0
Lucy's warbler†	4	0	18	0	0	0
Macgillivray's warbler	5	2	2	0	0	1
Mallard†	0	0	0	0	2	0
Mountain white-crowned sparrow	0	0	5	0	0	0
Mourning dove†	0	0	0	0	39	0
Nashville warbler	5	4	42	0	0	1
Northern rough-winged swallow†	0	0	2	0	23	0
Olive-sided flycatcher	0	0	9	0	0	0
Orange-crowned warbler	8	1	25	0	0	0
Pacific-slope flycatcher	15	0	134	0	0	0
Peregrine falcon†	0	1	0	0	1	0
Phainopepla†	0	0	0	0	6	0
Red-tailed hawk†	0	0	0	0	2	0
Red-winged blackbird†	36	0	0	0	1,032	0
Ruby-crowned kinglet	3	0	8	0	0	0
Say's phoebe†	0	0	0	1	0	0

Table 21.—**Cibola NWR Unit #1**: Number of non-breeding birds detected during rapid area search plots in 2014

(Tally is the sum of birds observed on both rapid surveys. Note that this table does not include individuals or species entered as possible breeders but not confirmed breeding; all such species are listed as non-breeders in attachment 5. Species are listed in alphabetical order.)

Species (n = 73)	Males	Females	Unknown sex	Juveniles	Flyovers	Incidentals
Sharp-shinned hawk	0	0	2	0	1	0
Swainson's thrush	2	0	12	0	0	1
Townsend's warbler	1	1	0	0	0	0
Tree swallow	8	0	6	0	556	0
Turkey vulture†	0	0	0	0	14	0
Warbling vireo	0	0	140	0	0	0
Western flycatcher	7	0	71	0	0	0
Western kingbird†	0	0	0	0	2	0
Western tanager	18	1	7	0	0	0
Western wood-pewee	1	0	89	0	0	0
White-crowned sparrow	12	12	21	0	0	1
White-faced ibis†	0	0	0	0	720	0
White-throated swift†	0	0	0	0	17	0
White-winged dove†	0	0	0	0	275	0
Willow flycatcher**†	7	0	7	0	0	0
Wilson's warbler	56	13	140	0	0	0
Yellow warbler*†	4	3	4	0	0	0
Yellow-headed blackbird†	0	0	0	0	11	0
Yellow-rumped warbler	10	5	21	0	0	0
Total	**251**	**67**	**911**	**2**	**3,146**	**7**

* LCR MSCP covered species.

** Willow flycatcher indicates both migrants and the southwestern subspecies because they cannot be differentiated in this study.

† Species occurs as a breeder in the study area, but numbers reported here are of migrant, flyover, or otherwise non-breeding individuals.

Yuma East Wetlands

In spring 2012 and 2013, Fred Phillips Consulting conducted area searches at Yuma East Wetlands using methods similar to our intensive area searches (attachment 1gg). In 2014, the Yuma East Wetlands plots were added to the conservation and habitat creation area plots layers, and surveys were conducted by us on eight plots in Yuma East Wetlands. In 2014, surveyors recorded a total of 100 species; of these, 26 were classified as territorial breeders (222.75 territories, table 22), 13 species were non-territorial breeders, and 61 were exclusively migrants or otherwise non-breeders. A total of 83 species (table 23) were recorded as non-breeders on individual plots; these included both migrant species and local breeders confirmed breeding on other plots. This also includes 25 species recorded only as flyover or incidental records. Breeding was not confirmed for any LCR MSCP covered species in these plots, although Gila woodpeckers and yellow warblers were both observed using the area. Many non-territorial birds were found breeding at these sites (attachment 7 – table 7-1), including mourning (51 pairs) and white-winged doves (25 pairs), brown-headed cowbird (32 pairs), red-winged blackbird (14 pairs), house finch (10 pairs), greater roadrunner (8 pairs), Gambel's quail (8 pairs), yellow-headed blackbird (7 pairs), great-tailed grackle (4 pairs), snowy egret (2 pairs), Eurasian collared-dove (1 pairs), European starling (1 pairs), and great egret (1 pair).

Table 22.—**Yuma East Wetlands**: Number of breeding territories of territorial species detected during rapid area search plots in 2014

(Species are listed in descending order of abundance. Non-territorial breeders excluded. For a list of corresponding bird plots associated with each conservation and habitat creation area phase, see attachment 8 – table 8-4.)

Species (n = 26)	A North Channel	D	F	G	I	J	South C	Total
Verdin	9.75	4.5	16.25	5	19.5	4.5	7.5	67
Anna's hummingbird	4.75	0.75	4.75	3	8	6.25	2.75	30.25
Abert's towhee	3.25	2.75	5.75	0	8.25	2.5	1.75	24.25
Black-tailed gnatcatcher	3.25	2.25	5.5	1	1.5	1	1.25	15.75
Northern mockingbird	0	2	5.5	3	1	0	0.75	12.25
Song sparrow	0	5.5	2	0	1.75	0	1	10.25
Black-chinned hummingbird	4.75	1	0	1	0.75	1.75	0.75	10
Killdeer	0	1	5.25	1.25	1	0	1	9.5
Blue grosbeak	3	0	0	0	0.25	2.5	1	6.75
Common yellowthroat	3	0	0.5	0	0	0	1.25	4.75
Ash-throated flycatcher	0.5	0.25	0.75	0.5	0.75	1	0.5	4.25
Black-necked stilt	0	1	1.5	0.25	0.5	0	1	4.25
Ladder-backed woodpecker	0.75	0	0.75	0	1.5	0.75	0.25	4
Lesser goldfinch	0.5	0	0	0	3	0	0	3.5
Green heron	1.25	1	0.25	0.25	0	0	0	2.75
Lesser nighthawk	0	0	1.25	1.5	0	0	0	2.75
Lucy's warbler	0	0	0	0	2.5	0	0	2.5
Costa's hummingbird	0	1	0	0	0	0	0.75	1.75
Black phoebe	0	0	0	1	0	0	0.5	1.5
Crissal thrasher	1.5	0	0	0	0	0	0	1.5
Yuma clapper rail*	1	0	0	0	0	0	0	1
Western kingbird	0	1	0	0	0	0	0	1
Northern rough-winged swallow	0	0	0.5	0	0	0	0	0.5
Brown-crested flycatcher	0	0	0.25	0	0	0	0	0.25
Common gallinule	0	0	0.25	0	0	0	0	0.25
Mallard	0	0	0.25	0	0	0	0	0.25
Total	**37.25**	**24**	**51.25**	**17.75**	**50.25**	**20.25**	**22**	**222.75**

* LCR MSCP covered species.

Table 23.—Number of non-breeding birds detected during rapid area search plots at Yuma East Wetlands in 2014

(Tally is the sum of birds observed on both rapid surveys. Note that this table does not include individuals or species entered as possible breeders but not confirmed breeding; all such species are listed as non-breeders in attachment 5. Species are listed in alphabetical order.)

Species (n = 83)	Males	Females	Unknown sex	Juveniles	Flyovers	Incidentals
Abert's towhee†	0	0	0	1	0	0
American coot†	0	0	21	0	0	0
American robin†	0	0	0	0	3	0
Anna's hummingbird†	0	0	0	12	0	0
Audubon's warbler	1	0	11	0	0	0
Bank swallow	0	0	0	0	2	0
Barn swallow	0	0	2	0	4	0
Black-crowned night-heron†	0	0	0	0	10	0
Black-headed grosbeak	4	0	2	0	1	0
Black-necked stilt†	0	0	8	0	42	0
Black-throated gray warbler	5	0	0	0	0	0
Blue grosbeak†	2	0	1	0	0	0
Blue-winged teal	2	2	0	0	0	0
Brewer's sparrow	1	0	2	0	0	0
Brown-headed cowbird†	0	0	0	0	29	0
Cassin's vireo	2	0	2	0	0	0
Cattle egret†	0	0	0	0	1	0
Chipping sparrow	0	0	9	0	0	0
Cinnamon teal†	10	9	0	0	2	0
Cliff swallow†	0	0	2	0	272	0
Costa's hummingbird†	0	0	0	1	0	0
Double-crested cormorant†	0	0	0	0	2	0
Eurasian collared-dove†	0	0	0	0	2	0
European starling†	0	0	0	0	9	0
Gadwall†	0	0	0	0	2	0
Great blue heron†	0	0	1	0	5	0
Great egret†	0	0	4	0	18	0
Greater roadrunner†	0	0	1	0	0	0
Greater yellowlegs	0	0	0	0	4	0

Table 23.—Number of non-breeding birds detected during rapid area search plots at Yuma East Wetlands in 2014

(Tally is the sum of birds observed on both rapid surveys. Note that this table does not include individuals or species entered as possible breeders but not confirmed breeding; all such species are listed as non-breeders in attachment 5. Species are listed in alphabetical order.)

Species (n = 83)	Males	Females	Unknown sex	Juveniles	Flyovers	Incidentals
Great-tailed grackle†	0	0	0	0	61	0
Green heron†	0	0	0	0	5	0
Hammond's flycatcher	3	0	0	0	0	0
Hermit thrush	0	0	2	0	0	0
Hermit warbler	1	0	0	0	0	0
House finch†	0	0	0	0	20	0
House wren	3	0	0	0	0	0
Killdeer†	0	0	0	0	9	0
Ladder-backed woodpecker†	0	0	1	0	0	0
Lazuli bunting	0	0	1	0	1	0
Least sandpiper	0	0	55	0	1	0
Lesser goldfinch†	0	0	1	0	10	0
Lesser nighthawk†	0	0	0	0	1	0
Lesser yellowlegs	0	0	0	0	3	0
Lincoln's sparrow	0	0	3	0	0	0
Long-billed dowitcher	0	0	4	0	1	0
Macgillivray's warbler	2	0	0	0	0	0
Mallard†	0	0	0	0	6	0
Mourning dove†	0	0	0	0	58	0
Nashville warbler	2	4	4	0	0	0
Northern rough-winged swallow†	0	0	31	0	39	0
Northern shoveler	0	0	0	0	1	0
Orange-crowned warbler	5	1	5	0	0	0
Osprey	0	0	1	0	2	0
Pacific-slope flycatcher	1	0	19	0	0	0
Red-winged blackbird†	0	0	0	0	228	0
Rock pigeon†	0	0	0	0	1	0
Ruby-crowned kinglet	0	0	1	0	0	0
Sharp-shinned hawk	0	0	1	0	0	0

Table 23.—Number of non-breeding birds detected during rapid area search plots at Yuma East Wetlands in 2014

(Tally is the sum of birds observed on both rapid surveys. Note that this table does not include individuals or species entered as possible breeders but not confirmed breeding; all such species are listed as non-breeders in attachment 5. Species are listed in alphabetical order.)

Species (n = 83)	Males	Females	Unknown sex	Juveniles	Flyovers	Incidentals
Snowy egret†	0	0	3	0	14	0
Solitary sandpiper	0	0	4	0	0	0
Spotted sandpiper	0	0	1	0	0	0
Swainson's thrush	0	0	2	0	0	0
Townsend's warbler	4	1	1	0	0	0
Tree swallow	0	0	100	0	113	0
Turkey vulture†	0	0	2	0	10	0
Vaux's swift	0	0	2	0	7	0
Verdin†	0	0	0	2	0	0
Virginia rail†	1	0	0	0	0	0
Warbling vireo	4	0	31	0	0	0
Western kingbird†	0	0	2	0	3	0
Western tanager	6	2	3	0	3	0
Western wood-pewee	4	0	7	0	0	0
White ibis	0	0	0	0	1	0
White-crowned sparrow	1	0	14	0	0	0
White-faced ibis†	0	0	15	0	173	0
White-tailed kite†	0	0	1	0	1	0
White-throated swift†	0	0	0	0	6	0
White-winged dove†	0	0	0	0	59	0
Willow flycatcher**†	0	0	3	0	0	0
Wilson's warbler	34	15	48	0	0	0
Wood duck	1	1	0	0	0	0
Yellow warbler*†	13	11	1	0	0	0
Yellow-headed blackbird†	0	0	0	0	44	0
Total	**112**	**46**	**435**	**16**	**1,289**	**0**

* LCR MSCP covered species.

** Willow flycatcher indicates both migrants and the southwestern subspecies because they cannot be differentiated in this study.

† Species occurs as a breeder in the study area, but numbers reported here are of migrant, flyover, or otherwise non-breeding individuals.

Conservation and Habitat Creation Area: Intensive Area Searches

Intensive area searches were conducted on four conservation and habitat creation area plots: C2104, C2334, C2704, and C2722. During these surveys, we recorded a total of 93 species; of these, 21 were classified as territorial breeders (109.75 territories) (table 24), 7 species were non-territorial breeders, and 65 were exclusively migrants or otherwise non-breeders. A total of 72 species (tables 25–27) were recorded as non-breeders on individual plots; these included both migrant species and local breeders confirmed breeding on other plots. This also includes 28 species recorded only as flyover or incidental records. We found evidence for two breeding covered species, the Sonoran yellow warbler at Crane Roost, and the vermilion flycatcher at CRIT 9 D (table 24).

Table 24.—Total number of breeding territories by species detected during intensive area searches at a subset of four conservation and habitat creation area plots in 2014
(Species are listed in descending order of abundance. Non-territorial species are not listed.)

Species (n = 21)	C2104 (CRIT 9 D)	C2334 (PVER 7H)	C2704 (Cibola NWR Unit #1 Genetics A)	C2722 (Cibola NWR Unit #1 Crane Roost A)	Total
Song sparrow	0	0	0	23.5	23.5
Abert's towhee	4.75	0.5	0.75	5.75	11.75
Common yellowthroat	0	9.75	0	1	10.75
Lucy's warbler	2	0	0	8.5	10.5
Blue grosbeak	0	5	1	4.25	10.25
Verdin	2.5	0	0.5	5.75	8.75
Black-chinned hummingbird	0	0	3.75	3.5	7.25
Bullock's oriole	0.75	1	1.5	1.75	5
Western kingbird	0.75	0.75	2.5	0.75	4.75
Yellow-breasted chat	0	0	0	4	4
Ladder-backed woodpecker	1.5	0.5	0.25	0.75	3
Lesser goldfinch	0	0	0.75	2	2.75
Anna's hummingbird	1.5	0	0	0	1.5
Crissal thrasher	1	0	0	0.25	1.25
Ash-throated flycatcher	0.75	0	0	0.25	1
Black-tailed gnatcatcher	1	0	0	0	1
Sonoran yellow warbler*	0	0	0	1	1
Brown-crested flycatcher	0.75	0	0	0	0.75
Great horned owl	0	0	0.25	0.25	0.5
Tropical kingbird	0.25	0	0	0	0.25
Vermilion flycatcher*	0.25	0	0	0	0.25
Total	**17.75**	**17.5**	**11.25**	**63.25**	**109.75**

* LCR MSCP covered species.

Table 25.—Non-breeding species detected during intensive area searches at Cibola NWR Unit #1 in 2014 (Tally is the sum of birds observed on all eight intensive surveys. Note that this table does not include individuals or species entered as possible breeders but not confirmed breeding; all such species are listed as non-breeders in attachment 5. Species are listed in alphabetical order.)

	Cibola NWR Unit #1											
	C2704						C2722					
Species (n = 52)	Males	Females	Unknown sex	Juveniles	Flyovers	Incidentals	Males	Females	Unknown sex	Juveniles	Flyovers	Incidentals
Abert's towhee†	0	0	2	0	0	0	0	0	0	0	0	0
Audubon's warbler	0	2	0	0	0	0	0	1	12	0	0	0
Barn swallow	0	0	0	0	2	0	0	0	0	0	25	0
Black phoebe†	0	0	0	0	0	1	0	0	0	0	0	0
Black-headed grosbeak	4	2	1	0	0	2	4	0	5	0	0	0
Black-tailed gnatcatcher†	0	0	0	0	0	0	0	0	0	1	0	0
Brown-headed cowbird†	0	0	0	0	1	0	0	0	0	0	70	0
Cassin's vireo	0	0	7	0	0	0	0	0	0	0	0	0
Chipping sparrow	0	0	0	0	0	0	1	0	0	0	0	0
Cliff swallow†	0	0	0	0	0	0	0	0	0	0	10	0
Common raven†	0	0	0	0	0	0	0	0	0	0	3	0
European starling†	0	0	0	0	2	0	0	0	0	0	0	0
Great-tailed grackle†	0	0	0	0	2	0	0	0	0	0	3	0
Green-tailed towhee	0	0	2	0	0	0	0	0	4	0	0	0
Hammond's flycatcher	0	0	0	0	0	0	0	0	4	0	0	0
Hermit thrush	0	0	3	0	0	0	0	0	0	0	0	0
House finch†	4	1	2	0	3	0	0	0	0	0	0	0
House wren	0	0	0	0	0	0	2	0	0	0	0	0
Indigo bunting†	0	2	0	0	0	0	0	0	0	0	0	0
Killdeer†	0	0	0	0	1	0	0	0	0	0	1	0
Lazuli bunting	3	8	8	0	0	0	0	0	4	0	0	0
Lesser goldfinch†	0	0	0	0	1	0	0	0	1	0	0	0
Lesser nighthawk†	0	0	0	0	1	0	0	0	0	0	1	0
Lincoln's sparrow	0	0	1	0	0	0	0	0	0	0	0	0
Lucy's warbler†	0	0	0	0	0	0	2	0	13	0	0	0
Macgillivray's warbler	1	2	0	0	0	1	2	0	2	0	0	0
Mallard†	0	0	0	0	2	0	0	0	0	0	0	0
Mourning dove†	0	0	0	0	14	0	0	0	0	0	0	0
Nashville warbler	0	0	0	0	0	1	0	0	2	0	0	0
Northern rough-winged swallow†	0	0	0	0	2	0	0	0	0	0	2	0
Orange-crowned warbler	0	0	0	0	0	0	1	0	3	0	0	0

Table 25.—Non-breeding species detected during intensive area searches at Cibola NWR Unit #1 in 2014 (Tally is the sum of birds observed on all eight intensive surveys. Note that this table does not include individuals or species entered as possible breeders but not confirmed breeding; all such species are listed as non-breeders in attachment 5. Species are listed in alphabetical order.)

	Cibola NWR Unit #1											
	C2704						C2722					
Species (n = 52)	**Males**	**Females**	**Unknown sex**	**Juveniles**	**Flyovers**	**Incidentals**	**Males**	**Females**	**Unknown sex**	**Juveniles**	**Flyovers**	**Incidentals**
Pacific-slope flycatcher	0	0	0	0	0	0	1	0	44	0	0	0
Red-winged blackbird†	0	0	0	0	244	0	23	0	0	0	110	0
Ruby-crowned kinglet	0	0	0	0	0	0	1	0	1	0	0	0
Say's phoebe†	0	0	0	0	0	0	0	0	0	1	0	0
Sharp-shinned hawk	0	0	2	0	0	0	0	0	0	0	0	0
Swainson's thrush	0	0	1	0	0	1	2	0	8	0	0	0
Tree swallow	0	0	0	0	30	0	0	0	0	0	302	0
Turkey vulture†	0	0	0	0	2	0	0	0	0	0	6	0
Warbling vireo	0	0	21	0	0	0	0	0	17	0	0	0
Western flycatcher	0	0	19	0	0	0	6	0	13	0	0	0
Western tanager	5	0	0	0	0	0	2	1	3	0	0	0
Western wood-pewee	0	0	7	0	0	0	1	0	30	0	0	0
White-crowned sparrow	0	0	1	0	0	1	0	0	0	0	0	0
White-faced ibis†	0	0	0	0	81	0	0	0	0	0	50	0
White-throated swift†	0	0	0	0	0	0	0	0	0	0	15	0
White-winged dove†	0	0	0	0	81	0	0	0	0	0	60	0
Willow flycatcher**†	0	0	0	0	0	0	5	0	7	0	0	0
Wilson's warbler	3	0	17	0	0	0	6	1	44	0	0	0
Yellow warbler*†	0	0	0	0	0	0	2	3	1	0	0	0
Yellow-headed blackbird†	0	0	0	0	6	0	0	0	0	0	0	0
Yellow-rumped warbler	0	0	1	0	0	0	0	0	0	0	0	0
Total	**20**	**17**	**95**	**0**	**475**	**7**	**61**	**6**	**218**	**2**	**658**	**0**

* LCR MSCP covered species.

** Willow flycatcher indicates both migrants and the southwestern subspecies because they cannot be differentiated in this study.

† Species occurs as a breeder in the study area, but numbers reported here are of migrant, flyover, or otherwise non-breeding individuals.

Table 26.—Species detected but not confirmed breeding during intensive area searches at the PVER (PVER Phase 7, plot C2334) in 2014

(Tally is the sum of birds observed on all eight intensive surveys. Note that this table does not include individuals or species entered as possible breeders but not confirmed breeding; all such species are listed as non-breeders in attachment 5. Species are listed in alphabetical order.)

Species (n = 27)	Males	Females	Unknown sex	Juveniles	Flyovers	Incidentals
Black-headed grosbeak	4	3	0	0	0	0
Brown-headed cowbird†	0	0	0	0	190	0
Cliff swallow†	0	0	0	0	70	0
Great-tailed grackle†	0	0	0	0	7	0
House finch†	2	0	0	0	0	0
Killdeer†	0	0	0	0	1	0
Lazuli bunting	14	12	0	0	0	0
Lucy's warbler†	5	6	56	0	0	0
Mourning dove†	0	0	0	0	6	0
Northern harrier†	0	0	0	0	1	0
Northern rough-winged swallow†	0	0	0	0	23	0
Olive-sided flycatcher	0	0	17	0	0	0
Pacific-slope flycatcher	1	0	25	0	0	0
Prairie falcon†	0	0	0	0	2	0
Red-winged blackbird†	0	0	0	0	66	0
Sharp-shinned hawk	0	0	1	0	0	0
Tree swallow	0	0	0	0	7	0
Warbling vireo	0	0	58	0	0	0
Western tanager	1	0	0	0	0	0
Western wood-pewee	0	0	7	0	0	0
White-crowned sparrow	22	11	23	10	0	0
White-tailed kite†	0	0	0	0	1	0
White-winged dove†	0	0	0	0	8	0
Willow flycatcher**†	0	0	45	0	0	0
Wilson's warbler	24	13	10	0	0	0
Yellow-headed blackbird†	0	0	0	0	10	0
Yellow-rumped warbler	26	8	13	0	5	0
Total	**99**	**53**	**255**	**10**	**397**	**0**

* LCR MSCP covered species.

** Willow flycatcher indicates both migrants and the southwestern subspecies because they cannot be differentiated in this study.

† Species occurs as a breeder in the study area, but numbers reported here are of migrant, flyover, or otherwise non-breeding individuals.

Table 27.—Non-breeding species detected during intensive area searches at ‘Ahakhav Tribal Preserve CRIT 9, plot C2104, in 2014

(Tally is the sum of birds observed on all 8 intensive surveys. Note that this table does not include individuals or species entered as possible breeders but not confirmed breeding; all such species are listed as non-breeders in attachment 5. Species are listed in alphabetical order.)

Species (n = 62)	Males	Females	Unknown sex	Juveniles	Flyovers	Incidentals
American pipit	0	0	0	0	2	0
Anna’s hummingbird†	0	0	0	3	0	0
Audubon's warbler	0	0	60	0	0	0
Black phoebe†	1	1	0	1	0	0
Black-headed grosbeak	0	0	1	0	0	0
Brewer’s sparrow	0	0	11	0	0	0
Brown-headed cowbird†	0	0	0	0	20	0
Cassin’s vireo	0	0	7	0	0	0
Cedar waxwing	0	0	1	0	1	0
Chipping sparrow	0	0	22	0	0	0
Cliff swallow†	0	0	0	0	12	0
Common raven†	0	0	0	0	1	0
Cooper’s hawk†	0	0	0	1	0	0
Eurasian collared-dove†	0	0	0	0	2	0
Gambel’s white-crowned sparrow	0	0	17	0	0	0
Gray flycatcher	0	0	4	0	0	0
Great blue heron†	0	0	0	0	1	0
Great egret†	0	0	0	0	1	0
Great-tailed grackle†	0	0	0	0	59	0
Green-tailed towhee	0	0	3	0	0	0
Hammond’s flycatcher	0	0	4	0	0	0
Hermit thrush	0	0	1	0	0	0
Horned lark†	0	0	0	0	1	0
House finch†	0	0	0	0	8	0
Lark sparrow	1	0	0	0	0	0
Lazuli bunting	3	3	3	0	0	0
Lesser goldfinch†	0	0	0	0	13	0
Lesser nighthawk†	0	0	0	0	1	0
Macgillivray’s warbler	3	0	2	0	0	0
Mallard†	0	0	0	0	1	0
Mississippi kite	0	0	0	0	1	0
Mountain white-crowned sparrow	0	0	3	0	0	0
Mourning dove†	0	0	0	0	2	0
Myrtle warbler	0	0	2	0	0	0
Nashville warbler	1	0	0	0	0	0

Table 27.—Non-breeding species detected during intensive area searches at ‘Ahakhav Tribal Preserve CRIT 9, plot C2104, in 2014

(Tally is the sum of birds observed on all 8 intensive surveys. Note that this table does not include individuals or species entered as possible breeders but not confirmed breeding; all such species are listed as non-breeders in attachment 5. Species are listed in alphabetical order.)

Species (n = 62)	Males	Females	Unknown sex	Juveniles	Flyovers	Incidentals
Northern rough-winged swallow†	0	0	0	0	32	0
Olive-sided flycatcher	0	0	1	0	0	0
Orange-crowned warbler	1	0	17	0	0	0
Pacific-slope flycatcher	5	0	31	0	0	0
Phainopepla†	0	0	2	0	0	0
Red-winged blackbird†	0	0	0	0	200	0
Ruby-crowned kinglet	0	0	2	0	0	0
Swainson's hawk	0	0	0	1	2	0
Swainson’s thrush	0	0	8	0	0	0
Townsend’s warbler	1	0	3	0	0	0
Tree swallow	0	0	0	0	40	0
Turkey vulture†	0	0	0	0	10	0
Unidentified *Empidonax* flycatcher	0	0	17	0	0	0
Vaux's swift	0	0	0	0	6	0
Warbling vireo	0	0	13	0	0	0
Western flycatcher	0	0	4	0	0	0
Western kingbird†	0	0	0	0	2	0
Western tanager	0	0	9	0	0	0
Western wood-pewee	0	0	29	0	0	0
White-faced ibis†	0	0	0	0	1	0
White-throated swift†	0	0	0	0	1	0
White-winged dove†	0	0	0	0	20	0
Willow flycatcher**†	2	0	0	0	0	0
Wilson’s warbler	0	0	99	0	0	0
Yellow warbler*†	0	0	1	0	0	0
Yellow-rumped warbler	0	0	4	0	0	0
Zone-tailed hawk	0	0	1	0	0	0
Total	**18**	**4**	**382**	**6**	**440**	**0**

* LCR MSCP covered species.

** Willow flycatcher indicates both migrants and the southwestern subspecies because they cannot be differentiated in this study.

† Species occurs as a breeder in the study area, but numbers reported here are of migrant, flyover, or otherwise non-breeding individuals.

Some of the breeding birds on these plots were non-territorial species that are not included in our population size estimates (attachment 7 – table 7-2), including white-winged and mourning doves (56 and 48 pairs, respectively), brown-headed cowbird (47 pairs), house finch (10 pairs), Gambel's quail (8 pairs), Eurasian collared-dove (3 pairs), and great-tailed grackle (1 pair). Of the territorial species included in our breeding population estimates, the song sparrow was the most common, followed by the Abert's towhee (see table 24).

Overall Population Size Estimates

System-Wide Population Size Estimates Using Combined Detectabilities

Using program DS for analyzing data from system-wide random plots, we obtained an overall detection ratio of 0.83 (SE = 0.18, CV = 0.21) for territorial riparian land bird species from the 2014 data. With this detection ratio, the 2014 system-wide minimum population size estimates for LCR MSCP covered species resulted in 3,659 Sonoran yellow warbler territories, 1,186 Arizona Bell's vireo territories, 722 Gila woodpecker territories, 404 summer tanager territories, 14 vermilion flycatcher territories, and 2 gilded flicker territory (table 28). The low precision of population estimates, as reflected by extremely wide confidence intervals, was due to the large number of plots with zero counts. As in previous years, we detected only a few gilded flickers and vermilion flycatchers in 2014; therefore, the population estimates for these two species are almost certainly inaccurate.

As in previous years, we found that the Sonoran yellow warbler had the highest estimated population size system-wide of all covered species, and it occurred in 6 of the 21 habitat-region combinations surveyed. We recorded the Arizona Bell's vireo as the second most abundant of the covered species, and in 2014, it occurred in seven habitat-region combinations. The vermilion flycatcher and gilded flicker had the lowest population size estimates and also occurred in the lowest number of habitat-region combinations (one). The remaining covered species were moderately rare, with the summer tanager in only 4 habitat-region combinations, but the Gila woodpecker was the most widespread of the covered species, occurring across 13 habitat-region combinations. As in previous years, our surveys showed that Region 7 (Bill Williams River NWR) had the largest abundance of covered species compared with other regions of the project area.

For the 10 most abundant territorial species detected system-wide in 2014, we estimated population sizes using the same methods as for covered species. Based on our data, the most abundant species were the common yellowthroat and song sparrow, with more than 20,000 territories estimated for each, followed by Lucy's warbler and black-tailed gnatcatcher (*Polioptila melanura*), with over 10,000 territories each (tables 29a and 29b). The red-winged blackbird,

Table 28.—Estimated number of territories of covered species (and ± 95% confidence intervals), by region-habitat combinations, based on system-wide surveys completed in 2014

(For details on strata definitions, see the "Methods" section under this component. Regions 4 and 5 are combined here due to changes in the 2010 plot layer. Dashes indicate that no plots were surveyed in that region-habitat combination during 2014.)

Region	Habitat	Sonoran yellow warbler		Arizona Bell's vireo		Gila woodpecker		Summer tanager		Vermilion flycatcher		Gilded flicker	
		Population size	Standard error	Population size	Standard error	Population size	Standard error	Population size	Standard error	Population size	Standard error	Population size	Standard error
4+5	Tall woody	143	85.9	91	20.7	0	0.0	0	0.0	0	0.0	0	0.0
6	Tall woody	127	85.9	0	0.0	21	8.5	9	7.8	0	0.0	0	0.0
7	Tall woody	671	211.9	148	52.1	42	13.8	44	12.9	0	0.0	2	1.8
8	Tall woody	–	–	–	–	–	–	–	–	–	–	–	–
10	Tall woody	0	0.0	0	0.0	4	3.2	2	1.6	0	0.0	0	0.0
11	Tall woody	42	47.5	0	0.0	8	3.8	0	0.0	0	0.0	0	0.0
12	Tall woody	0	0.0	56	56.0	23	15.2	0	0.0	0	0.0	0	0.0
All	**Tall woody**	**978**	**302.2**	**268**	**89.8**	**102**	**29.6**	**57**	**18.1**	**0**	**0.0**	**2**	**1.8**
4+5	Low woody	0	0.0	354	355.8	0	0.0	0	0.0	0	0.0	0	0.0
6	Low woody	–	–	–	–	–	–	–	–	–	–	–	–
7	Low woody	1,941	1,767.1	283	61.2	202	46.7	243	143.6	0	0.0	0	0.0
8	Low woody	0	0.0	0	0.0	23	21.1	0	0.0	11	10.5	0	0.0
10	Low woody	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
11	Low woody	0	0.0	91	101.1	23	21.6	0	0.0	0	0.0	0	0.0
12	Low woody	0	0.0	0	0.0	74	30.0	0	0.0	0	0.0	0	0.0
All	**Low woody**	**2,471**	**2,489.2**	**855**	**447.8**	**385**	**103.0**	**309**	**211.8**	**14**	**14.3**	**0**	**0.0**

Table 28.—Estimated number of territories of covered species (and ± 95% confidence intervals), by region-habitat combinations, based on system-wide surveys completed in 2014

(For details on strata definitions, see the "Methods" section under this component. Regions 4 and 5 are combined here due to changes in the 2010 plot layer. Dashes indicate that no plots were surveyed in that region-habitat combination during 2014.)

Region	Habitat	Sonoran yellow warbler		Arizona Bell's vireo		Gila woodpecker		Summer tanager		Vermilion flycatcher		Gilded flicker	
		Population size	Standard error	Population size	Standard error	Population size	Standard error	Population size	Standard error	Population size	Standard error	Population size	Standard error
4+5	Herbaceous	–	–	–	–	–	–	–	–	–	–	–	–
6	Herbaceous	0	0.0	40	32.0	0	0.0	0	0.0	0	0.0	0	0.0
7	Herbaceous	–	–	–	–	–	–	–	–	–	–	–	–
8	Herbaceous	–	–	–	–	–	–	–	–	–	–	–	–
10	Herbaceous	–	–	–	–	–	–	–	–	–	–	–	–
11	Herbaceous	–	–	–	–	–	–	–	–	–	–	–	–
12	Herbaceous	0	0.0	0	0.0	2	2.5	0	0.0	0	0.0	0	0.0
All	**Herbaceous**	**0**	**0.0**	**67**	**56.6**	**3**	**3.6**	**0**	**0.0**	**0**	**0.0**	**0**	**0.0**
4+5	Unsuitable	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
6	Unsuitable	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
7	Unsuitable	0	0.0	0	0.0	77	16.6	0	0.0	0	0.0	0	0.0
8	Unsuitable	0	0.0	0	0.0	76	85.0	0	0.0	0	0.0	0	0.0
10	Unsuitable	144	147.3	0	0.0	36	36.8	36	36.8	0	0.0	0	0.0
11	Unsuitable	–	–	–	–	–	–	–	–	–	–	–	–
12	Unsuitable	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
All	**Unsuitable**	**140**	**143.7**	**0**	**0.0**	**220**	**97.5**	**35**	**35.9**	**0**	**0.0**	**0**	**0.0**
	Total	**3,659**	**2,553.1**	**1,186**	**485.2**	**722**	**190.1**	**404**	**221.7**	**14**	**14.3**	**2**	**1.9**

Table 29a.—Estimated number of breeding pairs (and ± 95% confidence intervals) of a first set of five of the most abundant species breeding along the LCR, by region-habitat combination, based on system-wide surveys completed in 2014

(For details on strata definitions, see the "Methods" section under this component. Regions 4 and 5 are combined here due to changes in the 2010 plot layer. Dashes indicate that no plots were surveyed in that region-habitat combination during 2014.)

		Common yellow-throat		Song sparrow		Lucy's warbler		Black-tailed gnatcatcher		Yellow-breasted chat	
Region	**Habitat**	**Population size**	**Standard error**	**Population size**	**Standard error**	**Population size**	**Standard error**	**Population size**	**Standard error**	**Population size**	**Standard error**
4+5	Tall woody	77	44.8	147	58.2	46	12.0	25	21.4	75	16.7
6	Tall woody	202	92.3	225	108.3	92	37.7	17	9.9	139	80.7
7	Tall woody	559	194.6	1554	471.4	401	133.7	53	36.1	1,151	309.1
8	Tall woody	-	-	-	-	-	-	-	-	-	-
10	Tall woody	83	52.7	102	43.4	13	15.7	22	18.4	33	29.1
11	Tall woody	378	238.3	325	186.2	0	0.0	42	31.1	68	43.4
12	Tall woody	165	143.0	120	116.2	8	7.3	255	97.5	229	161.0
All	**Tall woody**	**1,539**	**484.3**	**2,520**	**677.7**	**571**	**164.5**	**403**	**129.4**	**1,689**	**438.9**
4+5	Low woody	0	0.0	0	0.0	5,060	2,329.4	2,608	753.0	243	244.6
6	Low woody	-	-	-	-	-	-	-	-	-	-
7	Low woody	3,721	3,387.0	6,633	6,037.8	3,964	2,521.6	647	421.8	3,155	2,402.7
8	Low woody	135	139.4	0	0.0	271	111.7	926	283.4	90	94.5
10	Low woody	323	203.0	38	38.9	512	314.1	1,575	524.2	19.0	19.4
11	Low woody	9,255	4,549.2	6,436	3,068.2	0	0.0	1,273	319.1	1478	425.2
12	Low woody	372	262.1	298	201.8	397	404.7	794	434.9	0	0.0
All	**Low woody**	**15,764**	**6,601.5**	**15,825**	**9,245.0**	**12,008**	**4,900.1**	**8,835**	**2,163.4**	**6,039**	**3,568.1**

Table 29a.—Estimated number of breeding pairs (and ± 95% confidence intervals) of a first set of five of the most abundant species breeding along the LCR, by region-habitat combination, based on system-wide surveys completed in 2014

(For details on strata definitions, see the "Methods" section under this component. Regions 4 and 5 are combined here due to changes in the 2010 plot layer. Dashes indicate that no plots were surveyed in that region-habitat combination during 2014.)

		Common yellow-throat		Song sparrow		Lucy's warbler		Black-tailed gnatcatcher		Yellow-breasted chat	
Region	**Habitat**	**Population size**	**Standard error**	**Population size**	**Standard error**	**Population size**	**Standard error**	**Population size**	**Standard error**	**Population size**	**Standard error**
4+5	Herbaceous	-	-	-	-	-	-	-	-	-	-
6	Herbaceous	1,326	340.2	853	378.3	293	112.8	120	43.2	393	178.4
7	Herbaceous	-	-	-	-	-	-	-	-	-	-
8	Herbaceous	-	-	-	-	-	-	-	-	-	-
10	Herbaceous	-	-	-	-	-	-	-	-	-	-
11	Herbaceous	-	-	-	-		-	-	-	-	-
12	Herbaceous	618	279.1	145	132.6	0	0.0	41	27.8	0	0.0
All	**Herbaceous**	**3,111**	**845.2**	**1,635**	**658.5**	**490**	**172.1**	**260**	**89.1**	**657**	**306.8**
4+5	Unsuitable	237	230.6	0	0.0	749	413.0	1,262	510.4	0	0.0
6	Unsuitable	1,299	278.9	853	183.2	19	4.2	0	0.0	136	29.1
7	Unsuitable	5,397	1,158.6	3,238	695.2	1,311	281.4	771	165.5	1,234	264.8
8	Unsuitable	0	0.0	0	0.0	0	0.0	228	255.0	0	0.0
10	Unsuitable	2,376	1,992.9	810	623.9	0	0.0	0	0.0	288	212.9
11	Unsuitable	-	-	-	-	-	-	-	-	-	-
-	Unsuitable	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
All	**Unsuitable**	**11,606**	**3,146.9**	**6,293**	**1,489.9**	**2,656**	**683.6**	**2,565**	**746.9**	**2,204**	**519.6**
	Total	**31,425**	**9,006.1**	**26,040**	**10,236.2**	**15,573**	**5,362.3**	**11,998**	**2,821.5**	**10,555**	**4,022.2**

Table 29b.—Estimated number of breeding pairs (and ± 95% confidence intervals) of a second set of five of the most abundant species breeding along the LCR, by region-habitat combination, based on system-wide surveys completed in 2014

(For details on strata definitions, see the "Methods" section under this component. Regions 4 and 5 are combined here due to changes in the 2010 plot layer. Dashes indicate that no plots were surveyed in that region-habitat combination during 2014.)

		Verdin		Abert's towhee		Marsh wren		Bewick's wren		Black-chinned hummingbird	
Region	**Habitat**	**Population size**	**Standard error**	**Population size**	**Standard error**	**Population size**	**Standard error**	**Population size**	**Standard error**	**Population size**	**Standard error**
4+5	Tall woody	29	27.0	15	7.5	0	0.0	12	7.0	0	0.0
6	Tall woody	23	12.9	35	14.7	0	0.0	58	27.8	3	3.1
7	Tall woody	184	58.6	156	41.8	0	0.0	629	188.7	65	34.9
8	Tall woody	-	-	-	-	-	-	-	-	-	-
10	Tall woody	43	26.6	20	6.4	33	8.1	0	0.0	2	2.1
11	Tall woody	57	39.6	32	19.3	160	115.1	0	0.0	34	38.0
12	Tall woody	451	173.9	120	51.4	0	0.0	0	0.0	109	70.6
All	**Tall woody**	**763**	**226.9**	**381**	**98.4**	**217**	**144.4**	**698**	**200.1**	**208**	**91.2**
4+5	Low woody	88	69.5	1,127	370.3	0	0.0	0	0.0	22	22.7
6	Low woody	-	-	-	-	-	-	-	-	-	
7	Low woody	1,011	463.1	930	392.2	0	0.0	2,265	1,141.6	647	589.1
8	Low woody	892	278.1	666	207.8	0	0.0	0	0.0	339	171.4
10	Low woody	417	217.3	873	254.3	114	116.4	0	0.0	0	0.0
11	Low woody	1,410	424.7	364	126.0	1,205	865.8	0	0.0	296	244.7
12	Low woody	1,018	536.1	918	451.3	0	0.0	0	0.0	372	308.0
All	**Low woody**	**5,532**	**1,508.4**	**5,566**	**1,418.2**	**1,445**	**1,076.0**	**2,883**	**1,718.0**	**1,971**	**997.0**

Table 29b.—Estimated number of breeding pairs (and ± 95% confidence intervals) of a second set of five of the most abundant species breeding along the LCR, by region-habitat combination, based on system-wide surveys completed in 2014

(For details on strata definitions, see the "Methods" section under this component. Regions 4 and 5 are combined here due to changes in the 2010 plot layer. Dashes indicate that no plots were surveyed in that region-habitat combination during 2014.)

		Verdin		Abert's towhee		Marsh wren		Bewick's wren		Black-chinned hummingbird	
Region	**Habitat**	**Population size**	**Standard error**	**Population size**	**Standard error**	**Population size**	**Standard error**	**Population size**	**Standard error**	**Population size**	**Standard error**
4+5	Herbaceous	-	-	-	-	-	-	-	-	-	-
6	Herbaceous	80	35.8	93	26.9	746	423.5	0	0.0	33	18.3
7	Herbaceous	-	-	-	-	-	-	-	-	-	-
8	Herbaceous	-	-	-	-	-	-	-	-	-	-
10	Herbaceous	-	-	-	-	-	-	-	-	-	-
11	Herbaceous	-	-	-	-	-	-	-	-	-	-
12	Herbaceous	68	31.8	39	21.5	954	422.4	0	0.0	2	2.5
All	**Herbaceous**	**232**	**79.6**	**212**	**62.2**	**2,629**	**946.5**	**0**	**0.0**	**59**	**32.8**
4+5	Unsuitable	1,144	462.1	907	422.6	0	0.0	0	0.0	276	166.3
6	Unsuitable	0	0.0	19	4.2	0	0.0	19	4.2	78	16.7
7	Unsuitable	771	165.5	308	66.2	0	0.0	1,080	231.7	0	0.0
8	Unsuitable	0	0.0	228	255.0	0	0.0	0	0.0	912	1,020.1
10	Unsuitable	54	55.2	36	22.2	2,376	1,915.0	0	0.0	0	0.0
11	Unsuitable	-	-	-	-	-	-	-	-	-	-
12	Unsuitable	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
All	**Unsuitable**	**2,285**	**624.0**	**1,599**	**570.6**	**2,316**	**1,868.3**	**1,593**	**346.9**	**1,208**	**946.5**
	Total	**8,821**	**2,159.2**	**7,715**	**1,889.1**	**5,914**	**2,585.5**	**5,254**	**1,953.4**	**3,462**	**1,499.7**

white-winged and mourning doves, European starling, Gambel's quail, and brown-headed cowbird may have been even more numerous, but as in previous reports, we excluded these species from analyses due to their relative lack of territoriality or colonial distribution. Survey numbers listed in attachment 7 – tables 7-1 and 7-2 give a representation of their overall presence on the LCR. We determined that the 10 most abundant riparian species were also relatively widespread throughout the project area, with detections in most habitat-region combinations, and especially throughout the tall and low woody habitat strata.

Individual Species Detectabilities

In addition to combining species for detection ratio calculation, we also used program DS to calculate individual species detection ratios in order to compare these to the combined detection rate. We did not use these individual detection rates in any of our above population estimates. Approximately 60% of the species examined had detection ratios below 1.0, which indicates that the rapid surveyor underestimated the number of territories compared to the intensive surveyor (table 30). Roughly 33% of the species examined had detection rates above 1.0, indicating that the rapid surveyor overestimated the number of territories compared to the intensive surveyor. In 2014, we also had detection ratios close to 1.0 for a few species that had different detection rates in previous years. For example, the rapid surveyors overestimated summer tanagers by 60% in 2013, whereas the detection ratio for this species was 1.0 in 2014, meaning both the rapid and intensive surveyor recorded approximately the same number of territories on plots. Lucy's warblers were underestimated by about 40% by rapid surveyors in 2013, but in 2014, rapid surveyors detected them at almost the same frequency as the intensive surveyor, with the detection ratio at 0.94. The Sonoran yellow warbler detection ratio was similar among the 2 years, with the rapid surveyor underestimating the total number of breeding territories for this species likely due to the inherent difficulty of distinguishing migrant from breeding individuals in this species. Arizona Bell's vireo territories were recorded with a detection ratio of 0.70 in 2014 (in 2013, we could not report detection ratios for Arizona Bell's vireos because this species was not a confirmed breeder within the intensive survey plots). As in years past, we were unable to calculate a detection ratio for vermilion flycatchers and gilded flickers, as these were absent during our intensive surveys. Because the sample size from a single year is tenuous for many of the uncommon, and even common species, species-specific detection ratios may best be determined using data from multiple years in the future. For extremely uncommon species, accurate detectability will be difficult to calculate even with multiple years of data. We will have more detailed comparisons among years in the 5-year synthesis report in 2015.

Table 30.—Detection ratios by species of LCR MSCP covered species and the 10 most common breeding species in project component 1 system-wide surveys in 2014

(Rapid survey plots had a sample size of 80, whereas intensive plots had a sample size of 8. The vermilion flycatcher was the only LCR MSCP covered species not detected on system-wide surveys in 2014.)

Species (n = 15)	# of pairs (rapid surveys)	Rapid density (pairs/ha)	Standard error for rapid density	CV for rapid density	# of pairs (intensive surveys)	Detection ratio	Standard error for detection ratio	CV for detection ratio
Gilded flicker*	0.25	0.00	0.000032	1.00	0.00	**0.00**	0.00	0.00
Yellow warbler*	160.75	0.06	0.041306	0.67	95.25	**0.57**	0.16	0.28
Gila woodpecker*	18.5	0.01	0.001867	0.15	8.75	**0.60**	0.18	0.31
Bewick's wren	121.5	0.09	0.027126	0.31	50.00	**0.70**	0.20	0.28
Bell's vireo*	44.75	0.02	0.007026	0.35	16.50	**0.70**	0.26	0.37
Song sparrow	573	0.44	0.145795	0.33	228.50	**0.76**	0.19	0.25
Yellow-breasted chat	306.25	0.18	0.056506	0.32	121.75	**0.85**	0.15	0.18
Common yellow-throat	542	0.53	0.100715	0.19	120.25	**0.87**	0.22	0.26
Lucy's warbler	208	0.26	0.071300	0.27	43.75	**0.94**	0.37	0.39
Summer tanager*	11	0.01	0.003463	0.51	6.00	**1.00**	0.22	0.22
Abert's towhee	125.75	0.13	0.015431	0.12	20.25	**1.25**	0.28	0.22
Verdin	168	0.15	0.017622	0.12	24.00	**1.39**	0.40	0.29
Black-tailed gnatcatcher	162.5	0.20	0.019572	0.10	8.00	**1.78**	0.43	0.24
Black-chinned hummingbird	48.25	0.06	0.022078	0.38	3.75	**2.47**	1.38	0.56
Marsh wren	207	0.10	0.036400	0.37	4.50	**2.67**	1.93	0.72

* LCR MSCP covered species.

Conservation and Habitat Creation Area Population Size Estimates

Based on double-sampling analyses of data from habitat creation site plots in 2014, we determined an overall detection ratio of 0.62 (SE = 0.12, CV = 0.20) for territorial riparian species. Of the four covered species detected in conservation and habitat creation areas, the Arizona Bell's vireo was the most abundant species, with an estimated 29 territories, followed closely by the Sonoran yellow warbler, with 23 territories (table 31). In 2014, the most abundant territorial

Table 31.—Estimated number of breeding pairs (and ± 95% confidence interval) of covered species breeding in conservation and habitat creation areas along the LCR, by site, based on double–sampling surveys completed in 2014
(For details on habitat strata definitions, see the "Methods" section under this component.)

Habitat creation area	Habitat	Sonoran yellow warbler		Arizona Bell's vireo		Summer tanager		Vermilion flycatcher	
		Population size	Standard error	Population size	Standard error	Population size	Standard error	Population size	Standard error
'Ahakhav Tribal Preserve CRIT 9	Cottonwood–willow	0	0.0	0	0.0	2	0.5	2	0.5
'Ahakhav Tribal Preserve CRIT 9	Mesquite	0	0.0	0	0.0	0	0.0	2	0.5
'Ahakhav Tribal Preserve CRIT 9	Mixed	–	–	–	–	–	–	–	–
'Ahakhav Tribal Preserve CRIT 9	**All habitats**	**0**	**0.0**	**0**	**0.0**	**2**	**0.5**	**5**	**0.9**
BLCA	Cottonwood–willow	10	2.0	16	3.1	3	0.6	0	0.0
BLCA	Mesquite	–	–	–	–	–	–	–	–
BLCA	Mixed	2	0.3	5	1.0	0	0.0	0	0.0
BLCA	**All habitats**	**12**	**2.4**	**21**	**4.1**	**3**	**0.6**	**0**	**0.0**
Cibola NWR Unit #1	Cottonwood–willow	2	0.8	0	0.0	0	0.0	0	0.0
Cibola NWR Unit #1	Mesquite	–	–	–	–	–	–	–	–
Cibola NWR Unit #1	Mixed	0	0.0	8	3.2	0	0.0	0	0.0
Cibola NWR Unit #1	**All habitats**	**2**	**0.7**	**8**	**3.0**	**0**	**0.0**	**0**	**0.0**

Table 31.—Estimated number of breeding pairs (and ± 95% confidence interval) of covered species breeding in conservation and habitat creation areas along the LCR, by site, based on double–sampling surveys completed in 2014
(For details on habitat strata definitions, see the "Methods" section under this component.)

Habitat creation area	Habitat	Sonoran yellow warbler		Arizona Bell's vireo		Summer tanager		Vermilion flycatcher	
		Population size	Standard error	Population size	Standard error	Population size	Standard error	Population size	Standard error
CVCA	Cottonwood–willow	0	0.0	0	0.0	0	0.0	0	0.0
CVCA	Mesquite	0	0.0	0	0.0	0	0.0	0	0.0
CVCA	Mixed	0	0.0	0	0.0	0	0.0	0	0.0
CVCA	**All habitats**	**0**	**0.0**	**0**	**0.0**	**0**	**0.0**	**0**	**0.0**
PVER	Cottonwood–willow	9	2.5	0	0.0	0	0.0	0	0.0
PVER	Mesquite	0	0.0	0	0.0	0	0.0	0	0.0
PVER	Mixed	0	0.0	0	0.0	0	0.0	0	0.0
PVER	**All habitats**	**9**	**2.5**	**0**	**0.0**	**0**	**0.0**	**0**	**0.0**
Yuma East Wetlands	Cottonwood–willow	0	0.0	0	0.0	0	0.0	0	0.0
Yuma East Wetlands	Mesquite	0	0.0	0	0.0	0	0.0	0	0.0
Yuma East Wetlands	Mixed	0	0.0	0	0.0	0	0.0	0	0.0
Yuma East Wetlands	**All habitats**	**0**	**0.0**	**0**	**0.0**	**0**	**0.0**	**0**	**0.0**
	Total	**23**	**5.0**	**29**	**6.3**	**5**	**1.0**	**5**	**1.0**

breeders were the same as in 2013 (tables 32a and 32b); however, several of these species' population size estimates, including those for Abert's towhee and blue grosbeak, were substantially higher in 2014. This difference remains even after removing the Yuma East Wetland population size estimates, which were not estimated in 2013. Even though this difference appears to be substantial, it is probably not statistically significant given that the confidence interval half-widths were typically close to 100% of the territory estimates. In addition, the monitoring plan was designed for detecting trends over many years, and the differences over 2 years are usually not expected to be statistically significant due to the spatial variability within the study area.

DISCUSSION

System-Wide Surveys

The population size estimate for the LCR MSCP covered species Sonoran yellow warbler for 2014 represented an increase from 2013, with 2,821 and 1,320 pairs, respectively. Similarly, summer tanager population size estimates for 2014 increased compared with 2013 estimates (356 and 181, respectively). However, Arizona Bell's vireo population size estimates were 30% lower in 2014 than in 2013 (898 and 1,296 pairs, respectively). These differences over just 2 years are possibly due to the random plot selection representing a different proportion of their total population but also other factors such as annual variation in migration arrival times, reproductive schedule, population variation, or fluctuating water levels. Gila Woodpecker estimates were similar in both years (567 in 2013 and 666 in 2014). The gilded flicker and vermilion flycatcher continued to be represented by low sample sizes in the system-wide surveys, so their annual population size estimates continue to have high potential error. We are not trying to measure trend over just a 2-year period, and we hope that in 2015 when we compare 5 years of data, we may see more of a trend. We will certainly be able to show the range of annual variability in covered species. In 2014, the most abundant territorial breeders were similar to those recorded in 2013, with the common yellowthroat estimated to have the most breeding territories on the river. Similar to the covered species population estimates, we documented noticeable changes in several of the most common species with estimated territory numbers higher in 2014 than in 2013, some even by 50% or more.

In 2013, a pair of Nutting's flycatchers (*Myiarchus nuttingi*) was first found with fledglings on a salt cedar beetle plot at Sandy Wash in the Bill Williams River NWR, representing the first breeding record for the United States. In 2014, although one Nutting's flycatcher was observed in this area before and after our surveys, none were detected on these plots during the surveys, nor was there indication of breeding in 2014 at the Bill Williams River NWR. At an intensive

Table 32a.—Estimated number of breeding pairs and (and ± 95% confidence interval) of the first set of five most common riparian species breeding in conservation and habitat creation areas along the LCR, by habitat type, based on double–sampling surveys completed in 2014 (For details on habitat strata definitions, see the "Methods" section under this component.)

Habitat creation area	Habitat	Abert's towhee		Verdin		Common yellow–throat		Blue grosbeak		Black–tailed gnatcatcher	
		Population size	Standard error	Population size	Standard error	Population size	Standard error	Population size	Standard error	Population size	Standard error
'Ahakhav Tribal Preserve CRIT 9	Cottonwood–willow	12	2.4	8	1.7	0	0.0	6	1.1	2	0.3
'Ahakhav Tribal Preserve CRIT 9	Mesquite	2	0.3	3	0.6	0	0.0	1	0.2	0	0.0
'Ahakhav Tribal Preserve CRIT 9	Mixed	–	–	–	–	–	–	–	–	–	–
'Ahakhav Tribal Preserve CRIT 9	**All habitats**	**14**	**2.8**	**12**	**2.3**	**0**	**0.0**	**6**	**1.3**	**2**	**0.3**
BLCA	Cottonwood–willow	16	3.1	15	3.0	0	0.0	2	0.3	21	4.1
BLCA	Mesquite	–	–	–	–	–	–	–	–	–	–
BLCA	Mixed	2	0.4	6	1.1	2	0.4	1	0.2	5	1.0
BLCA	**All habitats**	**18**	**3.5**	**21**	**4.1**	**2**	**0.4**	**2**	**0.5**	**26**	**5.1**
Cibola NWR Unit #1	Cottonwood–willow	30	6.5	15	4.3	1	0.4	23	4.7	3	1.0
Cibola NWR Unit #1	Mesquite	–	–	–	–	–	–	–	–	–	–
Cibola NWR Unit #1	Mixed	27	7.0	42	11.0	6	2.6	14	2.8	12	3.7
Cibola NWR Unit #1	**All habitats**	**57**	**12.3**	**57**	**13.3**	**6**	**2.7**	**37**	**7.4**	**15**	**4.2**

Table 32a.—Estimated number of breeding pairs and (and ± 95% confidence interval) of the first set of five most common riparian species breeding in conservation and habitat creation areas along the LCR, by habitat type, based on double–sampling surveys completed in 2014 (For details on habitat strata definitions, see the "Methods" section under this component.)

Habitat creation area	Habitat	Abert's towhee		Verdin		Common yellow–throat		Blue grosbeak		Black–tailed gnatcatcher	
		Population size	Standard error	Population size	Standard error	Population size	Standard error	Population size	Standard error	Population size	Standard error
CVCA	Cottonwood–willow	29	5.9	14	3.4	0	0.0	25	5.9	5	1.7
CVCA	Mesquite	54	10.7	61	12.4	0	0.0	14	3.1	56	11.3
CVCA	Mixed	6	1.3	6	1.2	0	0.0	4	0.7	2	0.5
CVCA	**All habitats**	**89**	**17.7**	**81**	**16.3**	**0**	**0.0**	**42**	**9.0**	**63**	**12.8**
PVER	Cottonwood–willow	53	11.2	10	2.8	108	24.5	69	14.5	0	0.0
PVER	Mesquite	9	1.7	4	0.8	28	5.5	9	1.7	3	0.6
PVER	Mixed	29	6.4	0	0.0	104	21.5	45	9.4	5	1.4
PVER	**All habitats**	**91**	**18.6**	**14**	**3.4**	**239**	**49.2**	**122**	**24.8**	**8**	**1.9**
Yuma East Wetlands	Cottonwood–willow	12	4.4	31	14.7	6	5.3	12	4.0	9	5.2
Yuma East Wetlands	Mesquite	9	1.8	34	6.7	1	0.2	0	0.0	10	2.0
Yuma East Wetlands	Mixed	20	4.0	50	9.9	2	0.4	2	0.4	8	1.6
Yuma East Wetlands	**All habitats**	**42**	**9.3**	**114**	**27.6**	**10**	**5.1**	**15**	**3.4**	**28**	**7.5**
Total		**317**	**62.9**	**305**	**61.5**	**265**	**54.6**	**228**	**45.6**	**143**	**28.8**

Table 32b.—Estimated number of breeding pairs (and ± 95% confidence interval) of the second set of five most common riparian species breeding in conservation and habitat creation areas along the LCR, by habitat type, based on double–sampling surveys completed in 2014

(For details on habitat strata definitions, see the "Methods" section under this component.)

Habitat creation area	Habitat	Song sparrow		Western kingbird		Black–chinned hummingbird		Bullock's oriole		Anna's hummingbird	
		Population size	Standard error	Population size	Standard error	Population size	Standard error	Population size	Standard error	Population size	Standard error
'Ahakhav Tribal Preserve CRIT 9	Cottonwood–willow	0	0.0	8	1.5	10	1.9	7	1.4	9	1.7
'Ahakhav Tribal Preserve CRIT 9	Mesquite	0	0.0	2	0.4	0	0.0	2	0.3	0	0.0
'Ahakhav Tribal Preserve CRIT 9	Mixed	–	–	–	–	–	–	–	–	–	–
'Ahakhav Tribal Preserve CRIT 9	**All habitats**	**0**	**0.0**	**10**	**1.9**	**10**	**1.9**	**9**	**1.7**	**9**	**1.7**
BLCA	Cottonwood–willow	0	0.0	0	0.0	0	0.0	2	0.5	0	0.0
BLCA	Mesquite	–	–	–	–	–	–	–	–	–	–
BLCA	Mixed	8	1.5	0	0.0	0.4	0.01	0	0.0	0	0.0
BLCA	**All habitats**	**8**	**1.5**	**0**	**0.0**	**0.4**	**0.01**	**2**	**0.5**	**0**	**0.0**
Cibola NWR Unit #1	Cottonwood–willow	22	6.9	18	4.1	4	1.1	11	2.7	1	0.4
Cibola NWR Unit #1	Mesquite	–	–	–	–	–	–	–	–	–	–
Cibola NWR Unit #1	Mixed	26	8.0	14	4.1	6	2.2	10	2.6	0	0.0
Cibola NWR Unit #1	**All habitats**	**48**	**12.5**	**31**	**7.2**	**10**	**2.7**	**21**	**4.7**	**1**	**0.4**

Table 32b.—Estimated number of breeding pairs (and ± 95% confidence interval) of the second set of five most common riparian species breeding in conservation and habitat creation areas along the LCR, by habitat type, based on double–sampling surveys completed in 2014

(For details on habitat strata definitions, see the "Methods" section under this component.)

Habitat creation area	Habitat	Song sparrow		Western kingbird		Black–chinned hummingbird		Bullock's oriole		Anna's hummingbird	
		Population size	Standard error	Population size	Standard error	Population size	Standard error	Population size	Standard error	Population size	Standard error
CVCA	Cottonwood–willow	0	0.0	29	6.7	15	3.6	18	4.0	0	0.0
CVCA	Mesquite	0	0.0	5	1.3	2	0.6	2	0.6	0	0.0
CVCA	Mixed	0	0.0	8	1.6	2	0.3	2	0.5	1	0.2
CVCA	**All habitats**	**0**	**0.0**	**43**	**9.1**	**18**	**4.2**	**23**	**4.8**	**1**	**0.2**
PVER	Cottonwood–willow	17	5.2	17	4.3	29	6.5	26	5.7	4	1.6
PVER	Mesquite	8	1.6	2	0.3	6	1.3	1	0.2	0	0.0
PVER	Mixed	29	6.9	4	0.9	5	1.2	13	3.0	0	0.0
PVER	**All habitats**	**54**	**11.9**	**23**	**5.2**	**41**	**8.5**	**40**	**8.4**	**4**	**1.6**
Yuma East Wetlands	Cottonwood–willow	0	0.0	0	0.0	14	7.4	0	0.0	24	5.8
Yuma East Wetlands	Mesquite	3	0.6	0	0.0	2	0.3	0	0.0	12	2.4
Yuma East Wetlands	Mixed	13	2.6	2	0.3	4	0.8	0	0.0	18	3.6
Yuma East Wetlands	**All habitats**	**16**	**3.4**	**2**	**0.3**	**20**	**6.9**	**0**	**0.0**	**55**	**11.1**
Total		**128**	**27.4**	**109**	**22.1**	**102**	**21.1**	**96**	**19.4**	**72**	**14.4**

survey plot at Kohen Ranch, however, one individual may have been on territory early in the season (April 11–21, 2014), where it was observed by both rapid and intensive surveyors.

Our system-wide surveys showed that the LCR corridor continues to be occupied by a large diversity of breeding birds and migrants. Our field protocols tend to err on the conservative side for breeding evidence, classifying a bird as a presumed non-breeder if sufficient evidence of nesting was not found during the surveys. Therefore, the resulting population estimates are only based on observed territory numbers and need to be viewed as minimum breeding population size estimates. Nonetheless, these yearly estimates will be useful for long-term monitoring of environmental changes that potentially affect bird populations.

Conservation and Habitat Creation Areas

The year 2014 was the fourth year of implementing the double-sampling protocol at conservation and habitat creation areas of the LCR MSCP. Due to the large amount of habitat created by the LCR MSCP as of spring 2011, survey coverage was switched from complete coverage of conservation and habitat creation areas (intensive surveys of all plots) to a sampling design that included rapid and intensive area searches, mirroring the double-sampling approach used for system-wide surveys. Beginning in 2014, the first year that there were more than 80 total conservation and habitat creation area plots, we used a stratified random sampling approach to select 80 plots within the conservation and habitat creation areas.

Similar to our findings for 2008–12 (GBBO 2010, 2011, 2012), the conservation and habitat creation areas older than 2 years since the plantings occurred supported breeding populations of four of the six covered species: Arizona Bell's vireo, yellow warbler, vermilion flycatcher, and summer tanager. As in years past, Gila woodpeckers and gilded flickers were not confirmed as breeders in habitat creation sites most likely because the areas lack big trees and snags for cavities and do not have many saguaro cacti (*Carnegiea gigantea*) or snags nearby. Gila Woodpeckers were detected at the BLCA and Yuma East Wetlands; however, in these situations, the birds were only heard briefly and were was noted by the surveyor to be calling in the distance and possibly off their survey plot.

The number of territories at the BLCA in 2014 differed from 2013 results in varying ways, with dramatic increases in population estimates in some of the more common species (Abert's towhee, black-tailed gnatcatcher, and verdin) and decreases in other species (e.g., common yellowthroat). Interestingly, overall numbers were lower for most species in 2014 than previously, especially neotropical migrants such as the yellow-breasted chat, Lucy's warbler, Bullock's oriole (*Icterus bullockii*), black-chinned hummingbird (*Archilochus alexandri*), and black-tailed gnatcatcher. Among covered species, population estimates

suggest a slight decrease in Sonoran yellow warbler territories but slight increases in Arizona Bell's vireos and summer tanagers compared with previous years.

The number of recorded territories of covered species at 'Ahakhav Tribal Preserve CRIT 9 has been relatively consistent over the past several years, with vermilion flycatcher and summer tanager territories averaging around 3 and 1.5, respectively. One territory for the Sonoran yellow warbler was recorded in 2013 at 'Ahakhav Tribal Preserve CRIT 9, but in 2014, sufficient evidence for breeding was not recorded at this site. Although covered species territory numbers have remained relatively constant at 'Ahakhav Tribal Preserve CRIT 9, there was an overall increase in the number of territories and species of other riparian species compared with previous years. In 2013, 5 additional species were recorded as breeders, and an additional ≈25 total breeding territories were delineated compared with 2013. One of the rarer species we found nesting in habitat creation sites in previous years was a tropical kingbird (*Tyrannus melancholicus*), which was found breeding at CRIT 9 D again in 2014. This species occupied a similar territory (25% in CRIT 9 D) in 2011, 2012 and 2013.

At the PVER, Sonoran yellow warblers increased overall as breeders, with five territories recorded in rapid surveys in 2014 compared with two territories recorded in 2013. Summer tanagers, however, were not recorded at this site unlike in past years. For several common breeding species, such as the Abert's towhee and blue grosbeak, overall increases in the estimated population size were recorded in 2014 compared to previous years. This increase may be related to the age of the plantings, as both species increased primarily in planting stages 5 and 6, which have larger tree heights that may contribute to increased suitability of these sites. Common yellowthroat numbers, on the other hand, remain consistently low in some of the older plantings (PVER 2 and 3), while their numbers have increased and are very high in the newer planting phases (PVER 5–7). This suggests that a young tree component is similarly suitable habitat for this species as the mature native riparian habitat in areas such as the Bill Williams River NWR.

At the CVCA, we documented some noticeable changes from previous years in several species, with relatively large increases (100% and greater) in breeding territories within planting Phases 1 and 4. Among the species with the greatest increase in numbers was the verdin, which had 45 documented territories in 2014 compared with 13 territories in 2013. Additionally, 11 Lucy's warbler territories were documented at the CVCA, while none were recorded in 2013 and only 0.25 recorded in 2012. Overall, there was roughly a 70% increase in the number of breeding territories recorded at the CVCA in 2014 compared to previous years. We found no vermilion flycatchers or yellow warblers breeding at the site. As in 2013, we also found no evidence of summer tanagers as breeders at the CVCA, when in the past, they were breeding at this site (2010, 2011, and 2012). This could be potentially a result of changes in irrigation practices during the breeding season if these were different in 2013–14 than in earlier years. We recommend

that irrigation schedules be monitored and analyzed to determine the correlation between breeding territories over time. However, other hypotheses could also explain these results as late arrival of migrants, natural local population fluctuations, or unknown environmental factors at this location.

At Cibola NWR Unit #1, Arizona Bell's vireos and Sonoran yellow warblers were found breeding in 2014, and Arizona Bell's vireos increased from 2013, with three territories at Nature Trail – South and one at Nature Trail – North, compared to only one at Nature Trail – South in 2013. The Crane Roost phase supported one Sonoran yellow warbler territory in 2014, whereas no breeding evidence was found for them at Cibola NWR Unit #1. Population size estimates showed increases in all common species from 2013, including common yellowthroat, Abert's towhee, blue grosbeak, black-tailed gnatcatcher, and especially verdin. Lucy's warblers were detected at Cibola NWR Unit #1, where none were detected in 2013. Indeed, many of the increases in territories recorded were from Crane Roost despite that fact that we surveyed one less plot in 2014 due to the random plot selection. The only species at Cibola NWR Unit #1 that decreased substantially was the yellow-breasted chat, with nearly 50% fewer territories in 2014 than in previous years.

This was the first year of surveys of Yuma East Wetlands by GBBO, and we did not confirm breeding of any covered species. The most common species recorded in 2014 were verdin, Anna's hummingbird (*Calypte anna*), Abert's towhee, black-tailed gnatcatcher, and northern mockingbird, all of which were generally found in higher concentrations at these sites than elsewhere in the LCR, including other conservation and habitat creation areas. Killdeer (*Charadrius vociferus*) and black-necked stilt (*Himantopus mexicanus*) were also especially numerous at Yuma East Wetlands.

In 2014, several cavity-nesting species continued to have at least partial territories within the conservation and habitat creation areas. Ladder-backed woodpeckers (*Dryobates scalaris*) were found breeding in two of the four planting phases at the BLCA (B and C) and within all of the phases at CRIT 9. This species was also found in six of the eight planting phases at the PVER (Phases 1, 2, 3, 4, 5, and 7) and five of the six phases at the CVCA (Phases 1, 2, 3, 4, and 5). At the BLCA, we again recorded a territory of a brown-crested flycatcher (*Myiarchus tyrannulus*) pair in 2014, and a partial territory for this species was also recorded at Yuma East Wetlands. In 2014, Lucy's warblers were found breeding within all of the conservation and habitat creation areas, and they were relatively common breeders at the BLCA, 'Ahakhav Tribal Preserve CRIT 9, PVER, and CVCA, but nested in smaller numbers at Cibola NWR Unit #1 and Yuma East Wetlands. Finally, we documented ash-throated flycatchers as an uncommon breeder at all of the conservation and habitat creation areas with the exception of the BLCA. Surprisingly, this cavity-nesting species was found to be using younger stands of trees in the more recently planted phases.

We also recorded several raptor species at conservation and habitat creation areas. One of the more notable records was a pair of northern harriers (*Circus cyaneus*) at the PVER present throughout the season, apparently breeding in nearby agricultural areas but also foraging over mature plantings. Great horned owls bred in four conservation and habitat creation areas (‘Ahakhav Tribal Preserve CRIT 9, PVER, CVCA, and CNWR Unit #1), and the PVER had a partial barn owl territory. A partial American kestrel territory was recorded at ‘Ahakhav Tribal Preserve CRIT 9 in mature planting phases. Finally, a white-tailed kite (*Elanus leucurus*) was observed foraging over wetland areas at Yuma East Wetlands, and another was recorded at the PVER. Rarities included a zone-tailed hawk (*Buteo albonotatus*) at ‘Ahakhav Tribal Preserve CRIT 9 and the extremely rare Mississippi kite (*Ictinia mississippiensis*) at ‘Ahakhav Tribal Preserve CRIT 9 and the PVER.

Component 4: Habitat Surveys

INTRODUCTION

The goal of component 4 was to perform a detailed habitat assessment for four LCR MSCP covered species: the Gila woodpecker, Arizona Bell's vireo, Sonoran yellow warbler, and summer tanager. For each species, this assessment was conducted at randomly selected vegetation plots within confirmed breeding territories and in paired plots where the species was not recorded that year. The assessment was comprised of a wide range of measured variables that describe vegetation structure, plant species composition, and abiotic factors.

In the falls of each of the past 4 years (2011–14), we collected habitat data at 10 randomly selected territories for each of these species ("use plots") and at 10 paired locations where the species was not documented to occur ("non-use plots"). These non-use locations were randomly selected from within bird plots where these species were not recorded during bird surveys and therefore presumed to be absent. Abiotic factors, including temperature and relative humidity, as well as plant structure and composition, may influence habitat selection by these species. To assess these factors, we deployed environmental data logger units (HOBOs) within territories in 6 of the 10 use sites and in 6 of the 10 non-use sites for each of the 4 species. The vegetation and HOBO data collected over the 5-year project will be combined and summarized together at a later date. In this report, we describe the methods that were used for selecting habitat assessment plots and summarize the 2014 data collection effort.

METHODS

Vegetation Plot Selection

The habitat assessment followed the LCR MSCP vegetation monitoring protocol (attachment 9). The methods for conducting vegetation surveys were established by Reclamation and have been implemented for this project since 2011. Vegetation plots are selected using information on territory size and locations for the covered species based on the data we obtained from the previous bird season. Use plots were randomly selected within breeding bird territories that were delineated in ArcGIS during the bird season. For each territory, we selected one use vegetation plot for every 2 acres, with a maximum number of five use vegetation plots per territory. Non-use vegetation plots were randomly selected within survey plots where that covered species was not recorded.

The weighting scheme used to select the plots was determined based on the distribution of the covered species delineated territories recorded in 2011 and 2012 for each region of the river and habitat stratum. When possible (and still within the confines of a random sampling), territories from intensive surveys were chosen for use vegetation plots because more precise territory delineations were available from these surveys compared to the rapid survey effort. In 2014, plots were selected using the following scheme:

Summer tanager: 7 in Region 7 (5–6 in tall woody, 1–2 in low woody), 1 in each of 3 other regions with the largest portion of territories for that year.

Arizona Bell's vireo: 6 in Region 7 (4 in tall woody, 2 in low woody), 2 in Region 6, 1 in each of 2 other regions that contain the largest portion of territories for that year.

Sonoran yellow warbler: 6 in Region 7 (4–5 in tall woody, 1–2 in low woody), 2 in Region 2, and 1 in each of 2 other regions with the largest portion of territories for that year.

Gila woodpecker: 7 in Region 7 (5–6 in tall woody, 1–2 in low woody), 2 in Region 12, and 1 in each of 2 other regions that contain the largest portion of territories for that year.

Use Plots

In order to obtain the center points for the vegetation plots, all territories that were recorded for the four covered species in 2014 were exported from Access to an Excel file. We created a spreadsheet for each covered species, and then created a random number column within each species spreadsheet. To accomplish stratified random sampling, we sorted the columns in the Excel spreadsheet by region of the river, habitat type, and then by the random number. We then picked the first territories in the list that matched the established weighting criteria (see above).

Once territories were randomly selected, we reviewed each territory to determine whether or not the same territory had been selected more than once (this is determined using the spatial location of the bird's territory in GIS). The same bird's territory could have been randomly selected on more than one occasion in situations where the intensive and rapid surveyors recorded the same bird. In this situation, whichever surveyor's data had more observations associated with the delineated territory would be selected first (typically the intensive surveyor's data), and an alternate territory would be selected using the other surveyors' data. We randomly selected five alternate territories that met the weighting criteria for

each species in case vegetation plots could not be established within a territory due to territory size or overlapping data for individual territories among surveyors (see above).

Once all territories were vetted in ArcGIS and final territories were selected for vegetation assessment, we created minimum convex polygons for the selected territories. We then calculated the total area of each territory within these polygons to determine how many vegetation sampling points needed to be established using one vegetation point per 2 acres. Ten vegetation sampling points were then created randomly within the territory polygon, and points were randomly sampled from these to arrive at the correct number for the territory's size.

Non-Use Plots

To be able to compare territory data for the covered species to non-use habitat, we collected data at sites that were unoccupied by a given covered species based on all bird survey data from the same year. We paired each non-use plot with an appropriate use plot. For example, if eight use plots for the summer tanager were selected within Region 7 in tall woody habitat, then eight non-use plots were selected randomly within that same region and habitat stratum for that species. In some cases, too few plots were available within the same region and habitat that were unoccupied by a given species; in these cases, a non-use site was selected from the nearest region within the same habitat type. The region was always the first criteria met and then habitat. For example, if there were only four non-use tall woody bird plots available for selection in Region 7, but there were also 3 non-use low woody bird plots within that region, then all those bird plots would be chosen before moving on to a different region and selecting tall woody within the next region.

To select the plots, a list of non-use plots was exported into Excel with a separate worksheet created for each species, and random selection was performed. Several alternate plots were also created in case some plots could not be surveyed (e.g., if unsafe conditions were encountered). Within the selected plots, we randomly selected several points within the survey plot boundary from which we then selected a random point as a vegetation point.

In some cases, a plot was randomly selected as a non-use plot for a covered species but was also selected as a use plot for another species. Additionally, there were some cases in which one bird plot would be selected as a non-use plot for multiple covered species. In consultation with Reclamation, it was determined that we could survey this single vegetation plot, and that vegetation plot could be used in the habitat assessment for multiple species.

Creating Vegetation Plots Using a Geographic Information System

Once all vegetation plot centers for use, non-use, and backup plots were created, we merged these files into one shapefile with the following attributes: Plot_Id, Area, Site, Survey, Species, Terrcode, Surveyor, Survey_typ, Hobo, and X and Y coordinates. This shapefile was then used to create 40 by 10-m vegetation plot polygons. To create these polygons, a special toolbox was constructed in ArcGIS with a tool that could be used to generate polygons of a given size and degree around a center point. The polygon we used was a rectangle with the dimension by radius of 20 by 5 m to create a plot size of 40 by 10 m. To randomly select the direction of the bearing associated with each vegetation plot, we used Excel to select 1 random number between 1 and 360 for all 2014 vegetation plots, which was 168. Once the 40 by 10-m plots were created around the center points, we performed a spatial join in order to attribute the newly created rectangle that had the following attributes: Plot_Id, Survey, Species, Terrcode, Surveyor, Survey_typ, Hobo, and X and Y coordinates. We then added the attributes "Comments" and "To Keep" in order to help us keep track of which plots were kept and which were discarded based on the criteria described below.

After all of the vegetation plots were created, the plots were reviewed using aerial imagery in ArcMap to determine whether or not they could likely be surveyed and whether alternate plots were necessary. We considered plots to be unsuitable or unsafe for surveying based on the following criteria established previously by GBBO and Reclamation (see attachment 10 for further details):

- We discarded plots if more than 25% of the plot contained a road, marsh, agricultural area, water, canal, parking lot, or had other manmade construction.

- However, we left naturally open areas (e.g., dirt/grass fields, upland desert, burned areas, etc.) in the sample even if they comprised 100% of the plot.

- We also discarded plots if there were safety concerns (e.g., a beehive or extremely steep terrain). Typically, safety concerns could only be determined by the crew once they were in the field.

For the field season, we provided the crews with a list of survey plots and maps as well as a list of alternate plots. If a plot was deemed unsafe, an alternate plot was selected based on the random selection provided to the crews.

Details on why plots were dropped were recorded by the field crews within the mobile electronic field forms (MEFFs) that were used to collect data in the field.

Notes on why a particular plot was dropped and the backup plots chosen were also written in the "Comment" sections of the data sheets. In 2013, Reclamation requested that plots also be discarded if they were located too close to vegetation plots surveyed in previous years. Because yellow warblers and Bell's vireos have relatively small territories, alternate plots were only used in cases when the new plot actually overlapped with plots from previous years. Summer tanagers and Gila woodpeckers typically have large territories, and for these species, alternate plots were used if plots used from previous years fell within 50 m of the selected plot. Additionally, non-use plot boundaries were not allowed to overlap plot boundaries used in previous years, and alternate plots were used in these cases.

HOBO Site Selection

From the 10 use and 10 non-use vegetation plots, we randomly selected 6 of each for deployment of HOBOs. We covered each HOBO unit with a RS1 Solar Radiation shield and secured it onto a fencepost ≈ 5.5 feet above the ground within the center of the vegetation plot. All HOBOs were placed facing the same direction, which was the random bearing selected for the vegetation plots that year. Additionally, all solar shields were covered with camouflage mosquito netting to prevent wasps or bees from nesting inside the shield. We set the HOBO units to record the temperature and relative humidity every 15 minutes for an entire year. Hobo data were downloaded off each recorder ≈ every 2–3 months throughout the year. As different plots were selected each year, HOBOs were moved to the new locations during the fall vegetation field season. Because HOBOs are permanently installed for a year, year-round access to sites needed to be secured from private and public land managers. We also provided maps and a shapefile of HOBO locations to refuge biologists for approval if HOBOs were to be sited within a refuge.

Once use and non-use vegetation plot center points were determined, we submitted these files to Reclamation for naming conventions.

Field Data Collection

At the beginning of the survey season, crews were provided overview maps (attachment 2 – figure 2-6) that depicted all vegetation sites within a given bird plot. For ease of navigation to the plots, a map of the vegetation plot with its name (established by Reclamation's naming conventions) were also provided to the crews (attachment 2 – figure 2-7), as were maps for associated backup plots. In 2014, we also began collecting data on Trimble units using MEFFs, following

protocols issued by Reclamation (details on these forms can be obtained from Reclamation). In order to ensure that all necessary field data were collected, we also used a data checksheet in the field (attachment 10), which was required to be filled out after each vegetation plot was surveyed, using a checkmark for each feature on the data sheet after it was entered on the Trimble units. The data checksheets also provided space for the data to be quality assured and corrected once the data files were offloaded from the Trimble units. After the data files were offloaded, all original MEFF documents and the raw data were saved.

The raw data files were delivered to Reclamation in their unedited version. Copies of the raw data files were retained for the data quality assurance/quality control (QA/QC) process. In order to review all the data collected in the field, the files were opened in GPS Pathfinder Office. Using this program, a differential correction was performed on all the files. Once the files were corrected, they were carefully reviewed for any mistakes the field crews could have made while collecting data in the field. If changes needed to be made to the original data during the QA/QC process, all changes were made to the copied or "Edited" data files. Furthermore, to ensure data quality and completeness, the crew examined all the data sheets in the field to ensure that all fields were filled out completely and correctly. Then, 100% of the data was reviewed using GPS Pathfinder Office . If we found an error, the error was corrected in the "Edited" file version, and the person who corrected the error and the change that was made to the data file were then recorded within the MEFF.

Vegetation Plots Selected in 2014

For the 2014 season, we surveyed a total of 83 vegetation plots, including 60 use and 23 non-use plots (tables 33–36). Specifically, we surveyed 10 use and 10 non-use plots for the Arizona Bell's vireo within 4 regions and 5 habitat types (table 33) and 23 use and 10 non-use plots for the Gila woodpecker within 5 regions and 2 habitat types (table 34). We also surveyed 17 use and 10 non-use plots for summer tanager within 4 regions and 4 habitat types (table 35) and 10 use and 10 non-use plots for the Sonoran yellow warbler within 5 regions and 3 habitat types (table 36). There were 20 plots this season that were randomly selected for more than 1 covered species. Due to safety concerns, construction, or marsh/water covering > 25% of the plot, six plots were discarded this season in the field, and backup plots were surveyed.

Table 33.—Number of vegetation plots selected in 2014 by region and habitat for the Arizona Bell's vireo at use and non-use sites
(Habitat codes: CW = cottonwood-willow, TW = tall woody, LW = low woody, U = unsuitable, and H = herbaceous.)

	Region 5	Region 6	Region 7	Region 9	Total
Non-use total	**1**	**2**	**6**	**1**	**10**
Habitat CW	0	0	0	1	1
Habitat TW	0	0	5	0	5
Habitat LW	1	1	0	0	2
Habitat U	0	1	1	0	2
Use total	**1**	**2**	**6**	**1**	**10**
Habitat H	0	1	0	0	1
Habitat TW	1	0	4	0	5
Habitat LW	0	0	2	0	2
Habitat U	0	1	0	1	2
Grand total	**2**	**4**	**12**	**2**	**20**

Table 34.—Number of vegetation plots selected in 2014 by region and habitat for the Gila woodpecker at use and non-use sites
(Habitat codes: TW = tall woody, and LW = low woody.)

	Region 10	Region 11	Region 12	Region 6	Region 7	Total
Non-use total	**1**	**1**	**2**	**6**	**0**	**10**
Habitat TW	0	0	1	2	0	3
Habitat LW	1	1	1	4	0	7
Use total	**3**	**0**	**6**	**1**	**13**	**23**
Habitat TW	0	0	1	0	7	8
Habitat LW	3	0	5	1	6	15
Grand total	**4**	**1**	**8**	**7**	**13**	**33**

Table 35.—Number of vegetation plots selected in 2014 by region and habitat for the summer tanager at use and non-use sites
(Habitat codes: CW = cottonwood-willow, TW = tall woody, LW = low woody, and U = unsuitable

	Region 10	Region 6	Region 7	Region 9	Total
Non-use total	**1**	**8**	**1**	**1**	**11**
Habitat CW	0	0	0	1	1
Habitat TW	0	2	0	0	2
Habitat LW	1	6	0	0	7
Habitat U	0	0	1	0	1
Use total	**1**	**4**	**10**	**2**	**17**
Habitat TW	0	0	8	0	8
Habitat LW	0	4	2	0	6
Habitat U	1	0	0	2	3
Grand total	**2**	**12**	**11**	**3**	**28**

Table 36.—Number of vegetation plots selected in 2014 by region and habitat for the Sonoran yellow warbler at use and non-use sites
(Habitat codes: TW = tall woody, LW = low woody, and U = unsuitable.)

	Region 10	Region 11	Region 5	Region 6	Region 7	Total
Non-use total	**1**	**1**	**2**	**5**	**1**	**10**
Habitat TW	0	0	0	2	0	2
Habitat LW	1	1	2	3	0	7
Habitat U	0	0	0	0	1	1
Use total	**1**	**1**	**1**	**1**	**6**	**10**
Habitat TW	0	1	1	0	4	6
Habitat LW	0	0	0	1	2	3
Habitat U	1	0	0	0	0	1
Grand total	**2**	**2**	**3**	**6**	**7**	**20**

Component 5: Monitoring Impacts of the Salt Cedar Beetle on Riparian Bird Populations

INTRODUCTION

Beginning in 2013, we monitored potential impacts of the salt cedar beetle on multiple riparian bird species of the LCR MSCP in three areas: the Virgin River (Region 2), Topock Marsh (Region 6), and the Bill Williams River (Region 7). Survey sites were located within areas that were previously delineated for monitoring the southwestern willow flycatcher. The Virgin River sites have seen defoliation events associated with the salt cedar beetle, which have in turn affected breeding success and habitat selection by the southwestern willow flycatcher (McLeod and Koronkiewicz 2009, 2010; Dobbs et al. 2011; McLeod and Pellegrini 2011). Sites at Topock Marsh and the Bill Williams River have yet to be affected by the salt cedar beetle.

In 2014, the Virgin River area was not accessible due to safety concerns, but we surveyed the plots in Topock Marsh and the Bill Williams River. Subsequently, it was the decision of Reclamation to discontinue component 5 in 2015. This monitoring was discontinued for a few reasons. The monitoring would have to occur for the long term in order to determine the impacts the beetle has on bird populations. It may be a few years before the beetle even populates the willow flycatcher habitat on the Havasu NWR and Bill Williams River NWR. Impacts may be high to certain species immediately after invasion, but populations may rebound. Although information gained from long-term monitoring would contribute needed information to the subject of salt cedar beetles and bird populations, this work does not fall within the mission of the LCR MSCP. Therefore, the LCR MSCP cannot make a long-term commitment to fund this monitoring. Also, access to the study sites within the Virgin River and Mormon Mesa is intermittent, and long-term and consistent access to these sites cannot be guaranteed. Data collected from this project will be stored in a long-term database, and bird numbers and methodology have been reported in the 2013 and 2014 report.

METHODS

Plot Selection

The plots used for this study were randomly selected in 2013 within areas where the southwestern willow flycatcher had been documented to occur (GBBO 2013). For the Bill Williams River and Topock Marsh sites, we used the system-wide riparian bird plots layer (Bart et al. 2010) to determine study plots within the

willow flycatcher plots. Using ArcGIS 10.1, we overlayed the stitched riparian bird plots layer with the willow flycatcher plots layer. Boundaries of the flycatcher plots and riparian bird plots differed slightly, and only riparian bird plots that covered ≥ 95% of the area of flycatcher plots were included in the final plots layer for this study. From that group, we randomly selected 30 plots that were surveyed in 2013 and 2014 within Topock Marsh (Havasu NWR) and the Bill Williams River regions. The 28 plots located at the Virgin River were not surveyed in 2014 due to lack of access (attachment 6).

Monitoring Methods

The field methods used for surveying riparian birds in the salt cedar beetle study were the same as those used for rapid area searches in component 1 of the project. The goal of the rapid area search effort is to obtain the most accurate possible estimate of breeding territories while optimizing the balance between survey coverage and survey effort. We combined the rapid area search methods with detection ratios calculated from the system-wide LCR MSCP bird monitoring data to estimate population densities of priority riparian land birds in the salt cedar beetle areas. Each plot was surveyed twice during the field season, with the first round of visits in early-April through mid-May and the second round in mid-May through mid-June.

Since the salt cedar beetle study plots often fell within active or previously active nesting areas of the southwestern willow flycatcher, we took extreme care not to disturb active territories while surveying. Additionally, we coordinated with the willow flycatcher survey crews to avoid interference with their survey activities.

RESULTS

On all 30 study plots surveyed at the Havasu NWR and the Bill Williams River NWR in 2014 (attachment 6, we recorded a total of 109 species; of these, 44 were classified as territorial breeders (table 37), 9 species were non-territorial breeders (attachment 7 – table 7-3), and 60 were exclusively migrants or otherwise non-breeders. A total of 83 species (table 38) were recorded as non-breeders on individual plots; these included both migrant species and local breeders confirmed breeding on other plots. This also includes 20 species recorded only as flyover or incidental records. The most common breeders included the song sparrow, yellow-breasted chat, common yellowthroat, Lucy's warbler, and Sonoran yellow warbler (table 37). Other covered species recorded breeding were the Arizona Bell's vireo, Gila woodpecker, and summer tanager. See table 39a and 39b for a comparison of detections of breeding pairs for the LCR MSCP covered species and the 10 most common species at the Havasu NWR and Bill Williams NWR between 2013 and 2014.

Table 37.—Number of breeding territories of territorial species detected in salt cedar beetle study plots in the Havasu NWR and Bill Williams River NWR sites during rapid area search plots in 2014 (Species are listed in descending order of abundance.)

Species (n = 45)	# Territories all plots (n = 30)
Song sparrow	534
Yellow-breasted chat	354
Common yellowthroat	338
Lucy's warbler	172.5
Sonoran yellow warbler*	158.5
Bewick's wren	139
Abert's towhee	61.25
Verdin	61
Black-tailed gnatcatcher	48.5
Black-chinned hummingbird	43.75
Arizona Bell's vireo*	33.25
Ladder-backed woodpecker	28
American coot	26.5
Brown-crested flycatcher	24.75
Gila woodpecker*	18.5
Common gallinule	12.25
Ash-throated flycatcher	11.75
Least bittern*	11
Canyon wren	10.75
Summer tanager*	9.5
Pied-billed grebe	9
Bullock's oriole	8.5
Yuma clapper rail*	7.5
Crissal thrasher	6.25
Unidentified hummingbird	4.75
Lesser nighthawk	3.75
Green heron	3
Lesser goldfinch	3
Blue grosbeak	2.75
Clark's grebe	2.75

Table 37.—Number of breeding territories of territorial species detected in salt cedar beetle study plots in the Havasu NWR and Bill Williams River NWR sites during rapid area search plots in 2014 (Species are listed in descending order of abundance.)

Species (n = 45)	# Territories all plots (n = 30)
Black phoebe	2.5
Northern rough-winged swallow	2.25
Phainopepla	2
Anna's hummingbird	1.5
Virginia rail	1.5
Cooper's hawk	1.25
Costa's hummingbird	1
Inca dove	1
Northern cardinal	1
Western grebe	0.75
California black rail*	0.5
Common raven	0.5
Sora	0.5
Red-tailed hawk	0.25
Western kingbird	0.25
Total	**2,164.75**

* LCR MSCP covered species.

Table 38.—Species detected but not confirmed breeding during rapid area searches at salt cedar beetle study plots in the Havasu NWR and Bill Williams River NWR sites in 2014 (Tally is the sum of birds observed on both rapid surveys. Species are listed in alphabetical order.)

Species (n = 85)	Males	Females	Unknown sex	Juveniles	Flyovers	Incidentals
American kestrel†	0	0	0	0	2	0
Audubon's warbler	9	4	44	0	0	0
Barn swallow	2	0	0	0	60	0
Bewick's wren†	0	0	0	1	0	0
Black-chinned hummingbird†	1	0	1	3	0	0
Black-crowned night-heron†	0	0	0	0	1	0
Black-headed grosbeak	8	2	9	0	5	0
Black-necked stilt†	0	0	0	0	6	0
Black-tailed gnatcatcher†	0	0	0	3	0	0
Black-throated gray warbler	3	0	0	0	0	0
Blue-gray gnatcatcher	0	0	1	0	0	0
Brewer's sparrow	0	0	6	0	0	0
Brown-headed cowbird†	0	1	0	0	51	0
Bullock's oriole†	1	0	0	0	2	0
Canada goose†	0	0	1	0	12	0
Caspian tern	0	0	0	0	1	0
Cassin's kingbird	0	0	1	0	0	0
Cassin's vireo	3	0	0	0	0	0
Cattle egret†	0	0	8	0	4	0
Cedar waxwing	0	0	4	0	0	0
Clay-colored sparrow	0	0	1	0	0	0
Cliff swallow†	0	0	10	0	85	0
Common raven†	0	0	0	1	11	0
Common yellowthroat†	1	0	5	0	0	0
Dark-eyed junco	0	0	1	0	0	0
Double-crested cormorant†	0	0	1	0	4	0
Dusky flycatcher	1	0	1	0	0	0
Golden eagle	0	0	0	0	1	0
Gray flycatcher	1	0	0	0	0	0
Great blue heron†	0	0	1	0	8	0

Table 38.—Species detected but not confirmed breeding during rapid area searches at salt cedar beetle study plots in the Havasu NWR and Bill Williams River NWR sites in 2014 (Tally is the sum of birds observed on both rapid surveys. Species are listed in alphabetical order.)

Species (n = 85)	Males	Females	Unknown sex	Juveniles	Flyovers	Incidentals
Great egret†	0	0	6	0	8	0
Greater roadrunner†	0	0	0	0	0	1
Great-tailed grackle†	0	0	0	0	55	0
Green-tailed towhee	0	0	7	0	0	0
Hammond's flycatcher	0	0	6	0	1	0
Hermit thrush	0	0	3	0	0	0
House finch†	0	0	0	0	17	0
Ladder-backed woodpecker†	0	0	0	0	1	0
Lazuli bunting	6	6	6	0	1	0
Lesser goldfinch†	0	0	14	0	0	0
Lesser nighthawk†	0	0	0	0	1	0
Lincoln's sparrow	0	0	9	0	0	0
Long-billed curlew	0	0	10	0	0	0
Lucy's warbler†	0	0	0	27	0	0
Macgillivray's warbler	7	0	4	0	0	0
Mallard†	0	0	3	0	0	0
Mourning dove†	0	0	0	0	17	0
Nashville warbler	1	1	0	0	0	0
Northern rough-winged swallow†	0	0	34	0	87	0
Orange-crowned warbler	4	0	17	0	0	0
Osprey†	0	0	0	0	1	0
Pacific-slope flycatcher	11	0	150	0	0	0
Peregrine falcon†	0	0	0	0	1	0
Red-tailed hawk†	0	0	0	0	1	0
Red-winged blackbird†	0	0	7	0	149	0
Ruby-crowned kinglet	0	0	2	0	0	0
Say's phoebe†	0	0	1	0	0	0
Sharp-shinned hawk	0	0	1	0	0	0
Snowy egret†	0	0	1	0	5	0
Song sparrow†	0	0	0	5	0	0
Sora	0	0	1	0	0	0

Table 38.—Species detected but not confirmed breeding during rapid area searches at salt cedar beetle study plots in the Havasu NWR and Bill Williams River NWR sites in 2014 (Tally is the sum of birds observed on both rapid surveys. Species are listed in alphabetical order.)

Species (n = 85)	Males	Females	Unknown sex	Juveniles	Flyovers	Incidentals
Spotted sandpiper	0	0	0	0	1	0
Summer tanager*†	1	0	0	0	0	0
Swainson's thrush	0	0	1	0	0	0
Townsend's warbler	1	0	5	0	0	0
Tree swallow	0	0	65	0	1,757	0
Turkey vulture†	0	0	5	0	26	0
Vaux's swift	0	0	0	0	7	0
Verdin†	0	0	0	2	0	0
Violet-green swallow†	0	0	5	0	3	0
Warbling vireo	0	0	27	0	0	0
Western flycatcher	1	0	6	0	0	0
Western kingbird†	0	0	0	0	1	0
Western tanager	6	1	3	0	0	0
Western wood-pewee	6	0	45	0	0	0
White-crowned sparrow	6	0	27	0	0	0
White-faced ibis†	0	0	0	0	46	0
White-throated swift†	0	0	4	0	10	0
White-winged dove†	0	0	0	0	95	0
Willow flycatcher**†	5	0	6	0	0	0
Wilson's warbler	11	5	143	0	0	0
Yellow warbler*†	37	4	14	0	0	0
Yellow-billed cuckoo*†	0	0	1	0	0	0
Yellow-headed blackbird†	0	0	0	0	10	0
Yellow-rumped warbler	0	0	89	0	0	0
Total	**133**	**24**	**823**	**42**	**2,554**	**1**

* LCR MSCP covered species.

** Willow flycatcher indicates both migrants and the southwestern subspecies because they cannot be differentiated in this study.

† Species occurs as a breeder in the study area, but numbers reported here are of migrant, flyover, or otherwise non-breeding individuals.

DISCUSSION

With surveys in 2014 being limited to the Topock Marsh and Bill Williams River NWR areas, where no salt cedar beetles or defoliation have yet been observed, we are unable to draw conclusions about the potential effects of salt cedar beetles on riparian birds. During the 2 years of this study, however, we did survey the same set of 30 plots in these 2 areas and obtained a directly comparable dataset of breeding birds without the influence of changing plot selection. While the relative abundance of species was nearly the same between years, we recorded an overall increase in territory numbers in 2014 (tables 39a and 39b). This effect was particularly strong in Topock Marsh (Region 6), with increases in all 10 of the most common species. Similar increases were noted in the Bill Williams River (Region 7), with some exceptions (for example, common yellowthroat and Sonoran yellow warbler numbers increased in Region 6 but were nearly the same in Region 7). Arizona Bell's vireo numbers were nearly equal among the 2 years, while Gila woodpecker numbers increased in 2014 in both areas and summer tanager numbers increased in Region at Topock Marsh but were nearly the same in the Bill Williams River NWR. These observed changes could of course reflect true population increases, but they could also be an effect of environmental factors such as fluctuating water levels or natural population fluctuations. Increased numbers on the Havasu NWR in 2014 could be linked to flooded tamarisk (*Tamarix* spp.) forests, which our surveyors noted as being inundated early and remaining wet for an extended period in 2014. On the Bill Williams River NWR, in contrast, our surveyors noted particularly dry conditions, with no standing water on most plots as early as March 2014.

Table 39a.—Comparison of the number of territories of the 10 most common species plus other LCR MSCP species between 2013 and 2014 during salt cedar beetle surveys in Region 6, Havasu NWR/Topock Marsh

Region 6 – species	# of territories, 2013	# of territories, 2014
Common yellowthroat	182.5	246
Song sparrow	187.75	233
Yellow-breasted chat	123	149.75
Lucy's warbler	103.25	118.5
Bewick's wren	43	61
Sonoran yellow warbler*	25.75	64.5
Abert's towhee	35.25	45
Verdin	27.75	33
Black-tailed gnatcatcher	21.5	38.75
Black-chinned hummingbird	11.75	29.25
Gila woodpecker*	5.5	9
Summer tanager*	6.75	3
Total	**773.75**	**1,030.75**

* LCR MSCP covered species.

Table 39b.—Comparison of the number of territories of the 10 most common species plus other LCR MSCP species between 2013 and 2014 salt cedar beetle surveys in Region 7, Bill Williams River

Region 7 – species	# of territories, 2013	# of territories, 2014
Song sparrow	241.5	301
Yellow-breasted chat	157.25	204.25
Common yellowthroat	98	92
Sonoran yellow warbler*	94.5	94
Bewick's wren	64.5	78
Lucy's warbler	38.5	54
Arizona Bell's vireo*	32.75	33.25
Verdin	12.25	28
Abert's towhee	15.5	16.25
Black-chinned hummingbird	8.5	14.5
Gila woodpecker*	4.5	9.5
Summer tanager*	7.5	6.5
Total	**775.25**	**931.25**

* LCR MSCP covered species.

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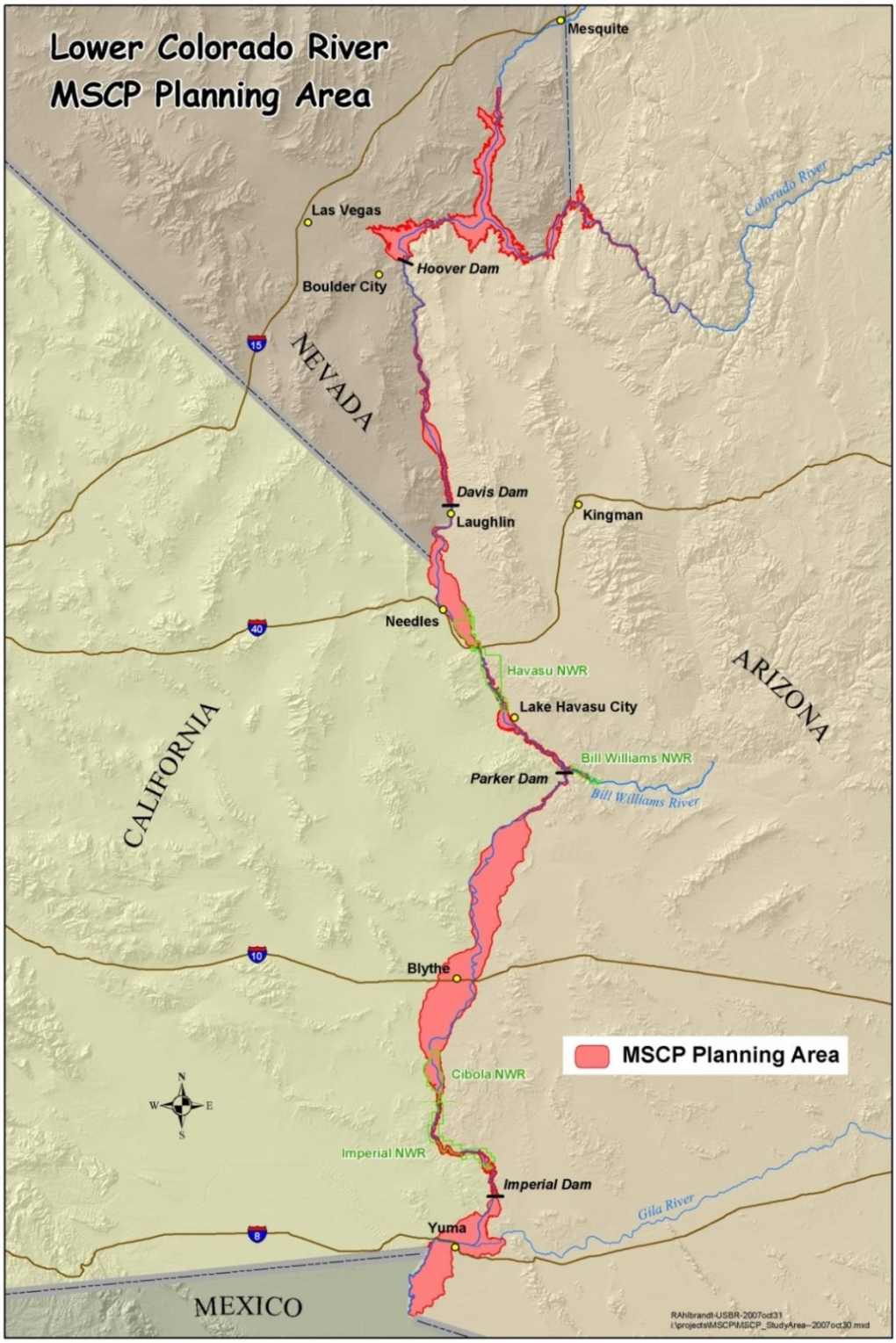
ATTACHMENT 1

System-Wide and Conservation and Habitat Creation Plot Area Plot Maps, 2014

Attachment 1a – Map of the Lower Colorado River Multi-Species Conservation Program study area for system-wide bird surveys (in pink)
(Map provided by the Bureau of Reclamation, Lower Colorado Region.)



Attachment 1b – Overview of the Lower Colorado Region Multi-Species Conservation Program Riparian Bird Project Regions

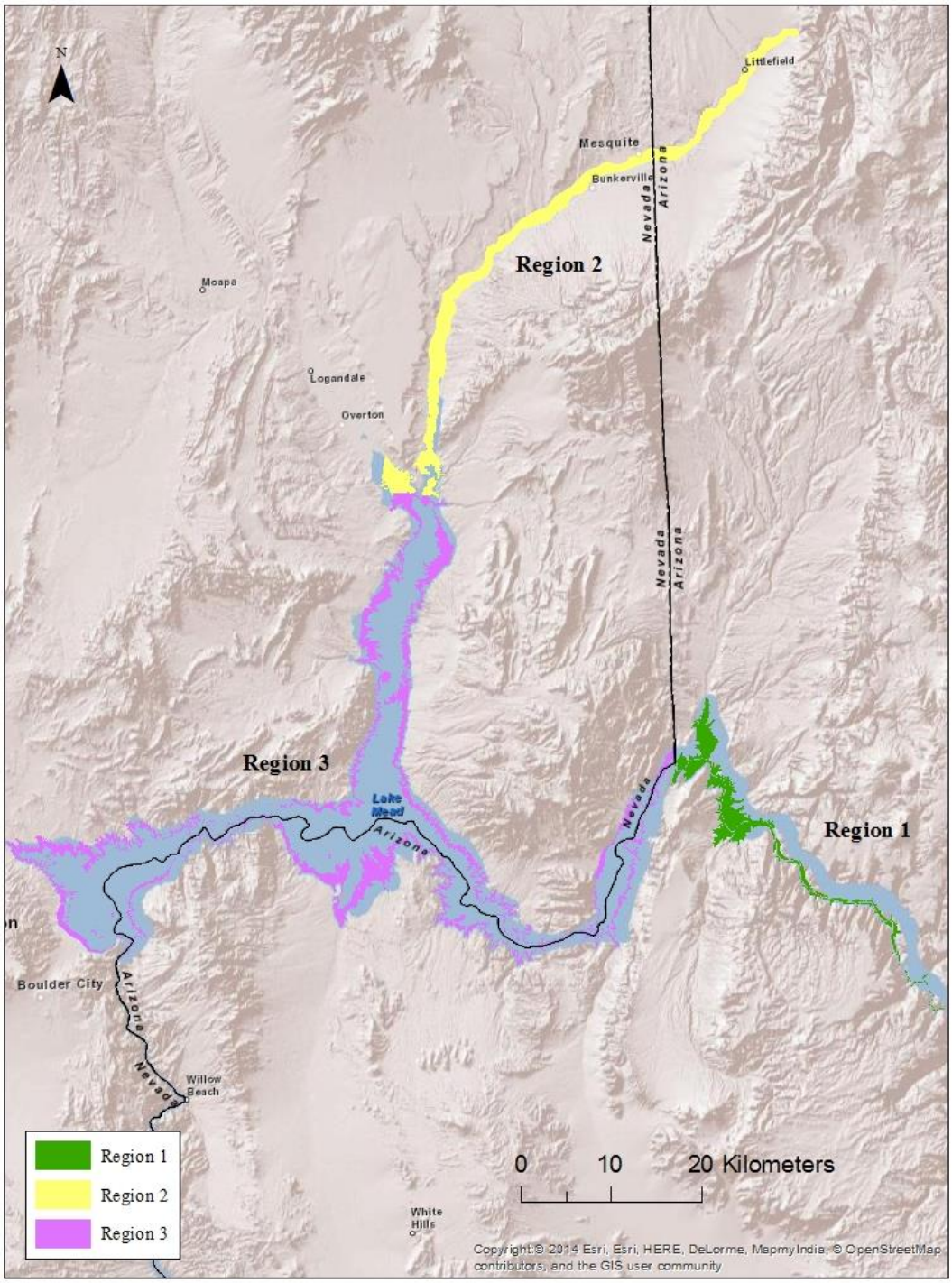


Figure 1b-1.—Region 1 (upper Lake Mead), Region 2 (Virgin River), and Region 3 (Lake Mead). No survey plots in 2014; 28 salt cedar beetle plots in Region 2 were not surveyed.

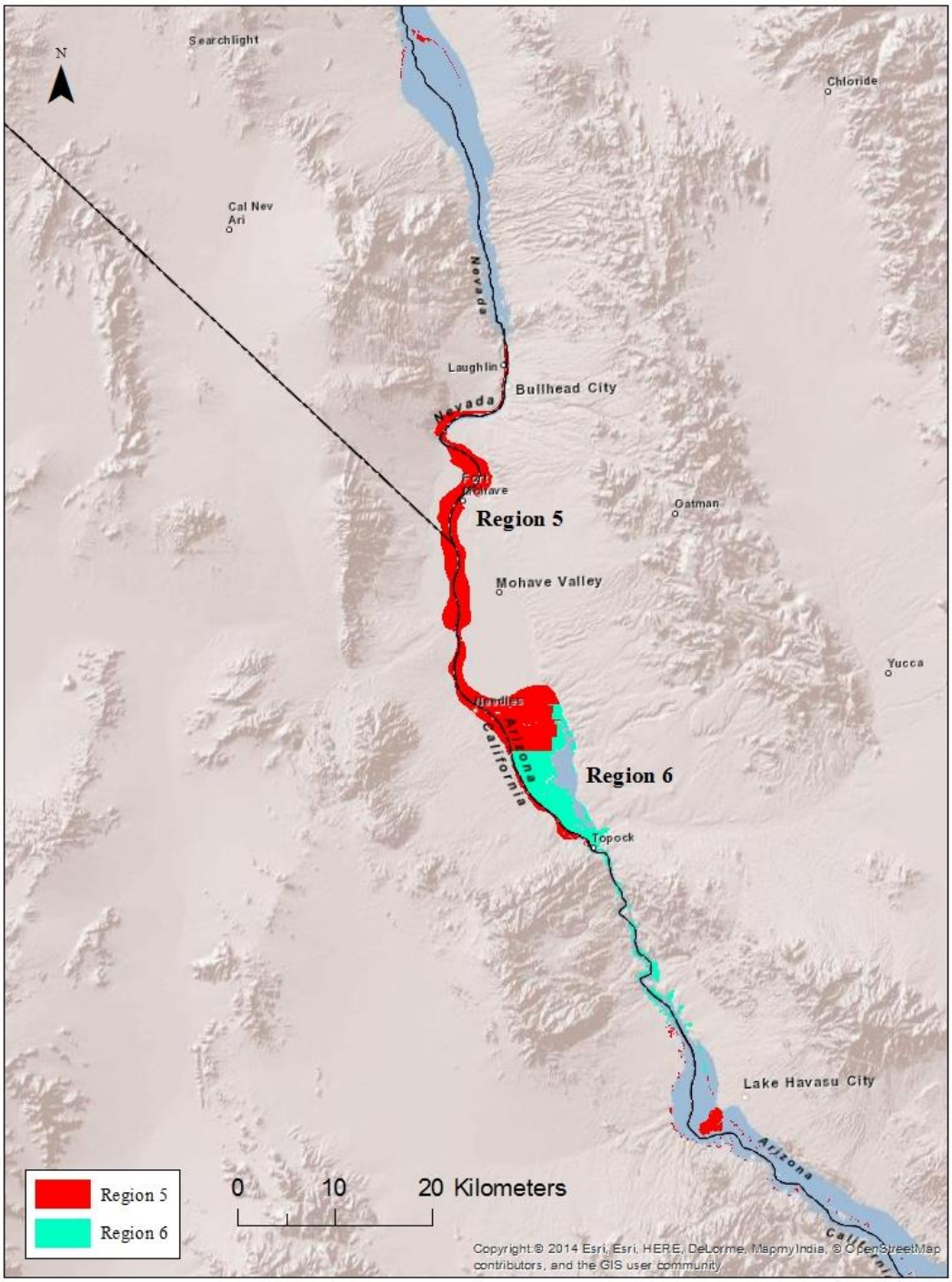


Figure 1b-2.—Region 5, Lake Mohave to Lake Havasu (15 system-wide rapid plots and 1 system-wide intensive plot), and Region 6, Havasu National Wildlife Refuge (4 conservation area plots, 8 system-wide rapid plots, 2 system-wide intensive plots, and 21 salt cedar beetle plots).

Figure 1b-3.—Region 7, Bill Williams River (12 system-wide rapid plots, 4 system-wide intensive plots, and 9 salt cedar beetle plots).

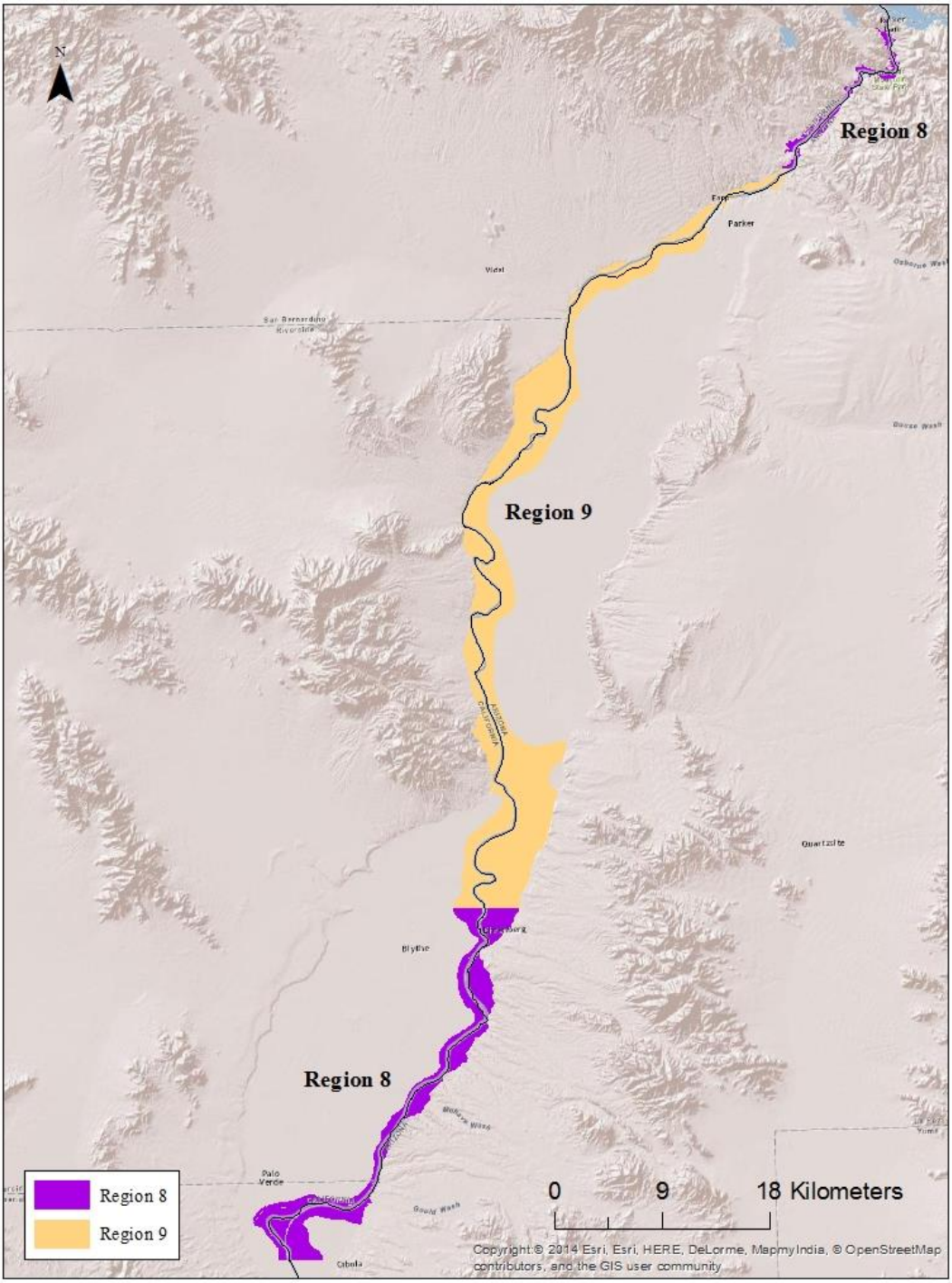


Figure 1b-4.—Region 8, Parker Dam to the Cibola National Wildlife Refuge (8 system-wide rapid plots and 21 conservation area rapid plots), and Region 9, Colorado River Indian Tribe land (36 conservation and habitat creation area rapid plots and 2 conservation and habitat creation area intensive plots).

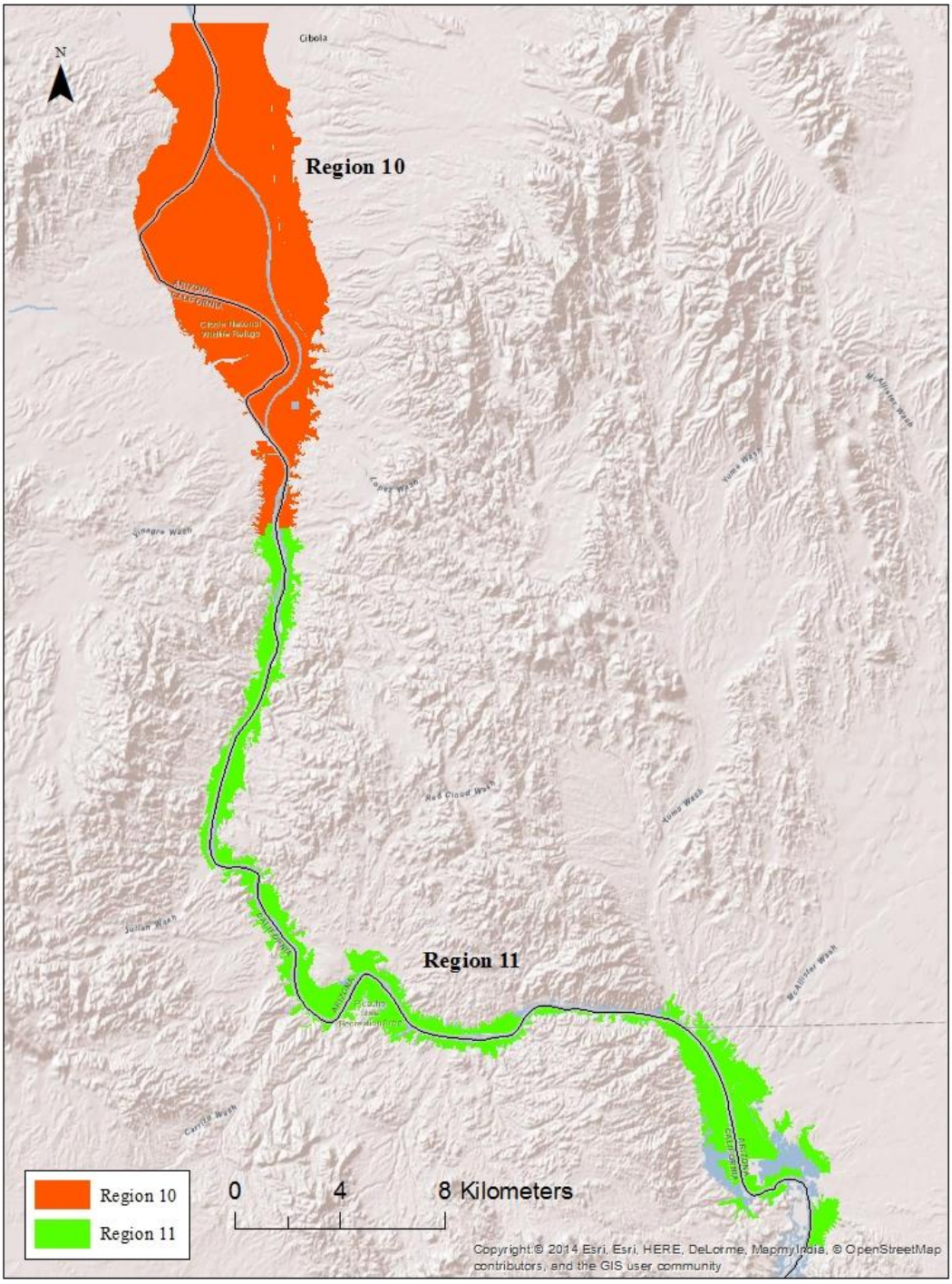


Figure 1b-5.—Region 10, Cibola National Wildlife Refuge (Cibola NWR) area (16 system-wide rapid plots, 1 system-wide intensive plot, 11 conservation area rapid plots, and 2 conservation area intensive plots), and Region 11, Cibola NWR to Martinez Lake (6 system-wide rapid plots).

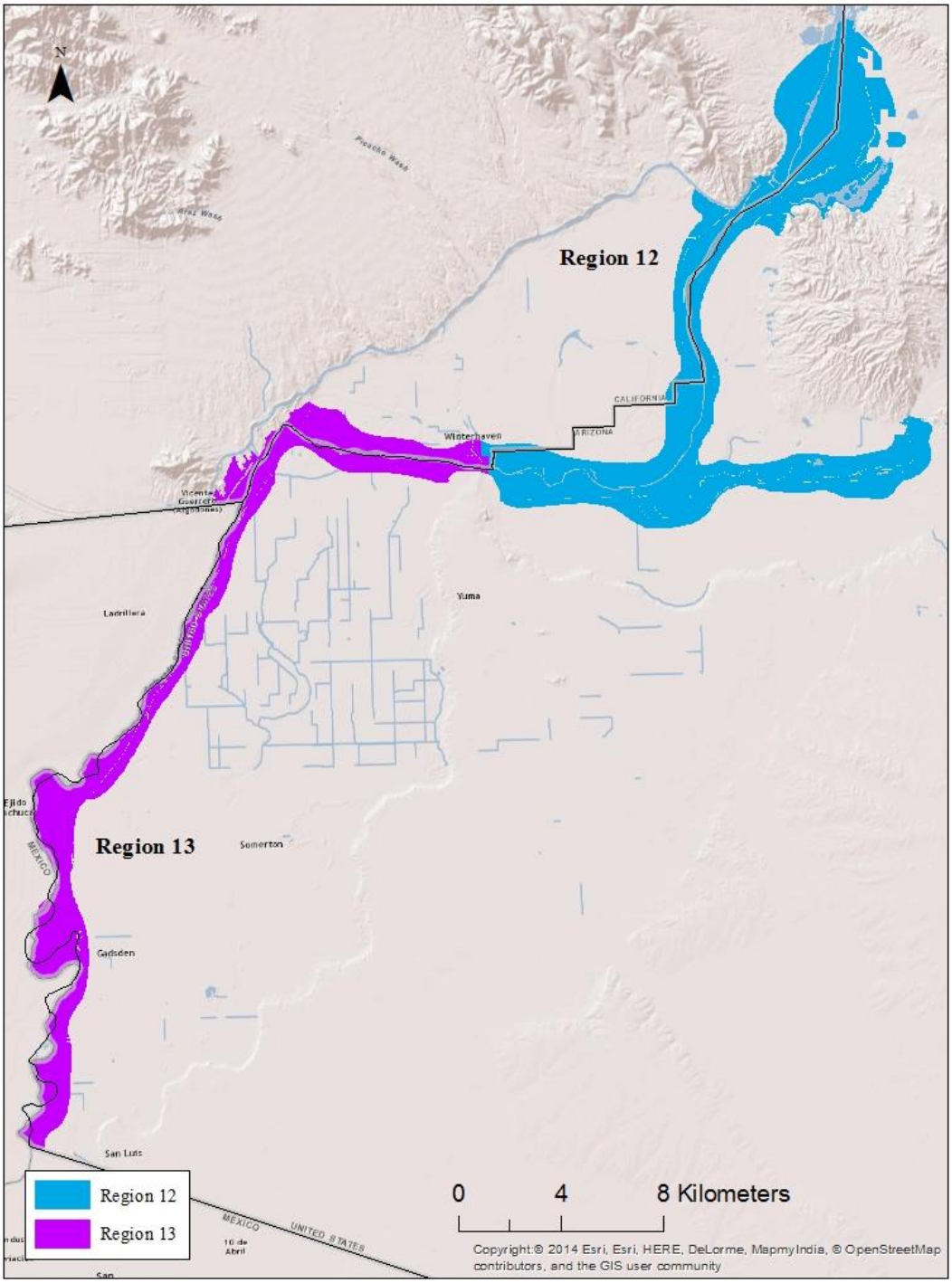
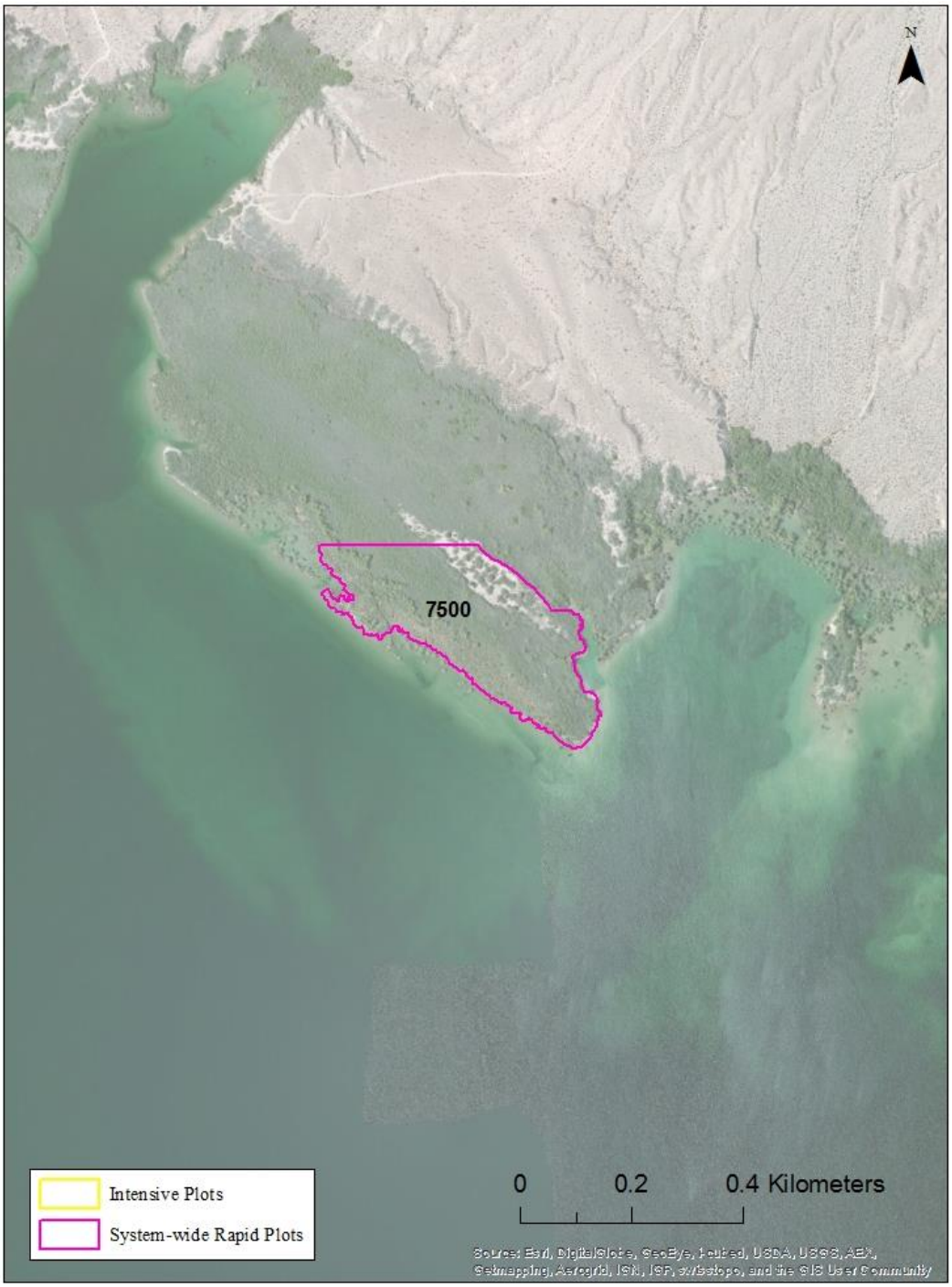


Figure 1b-6.—Region 12, Gila River and Imperial Dam to Yuma, Arizona (14 system-wide rapid plots and 8 conservation area rapid plots), and Region 13, Yuma to the Southerly International Border with Mexico (no plots surveyed).

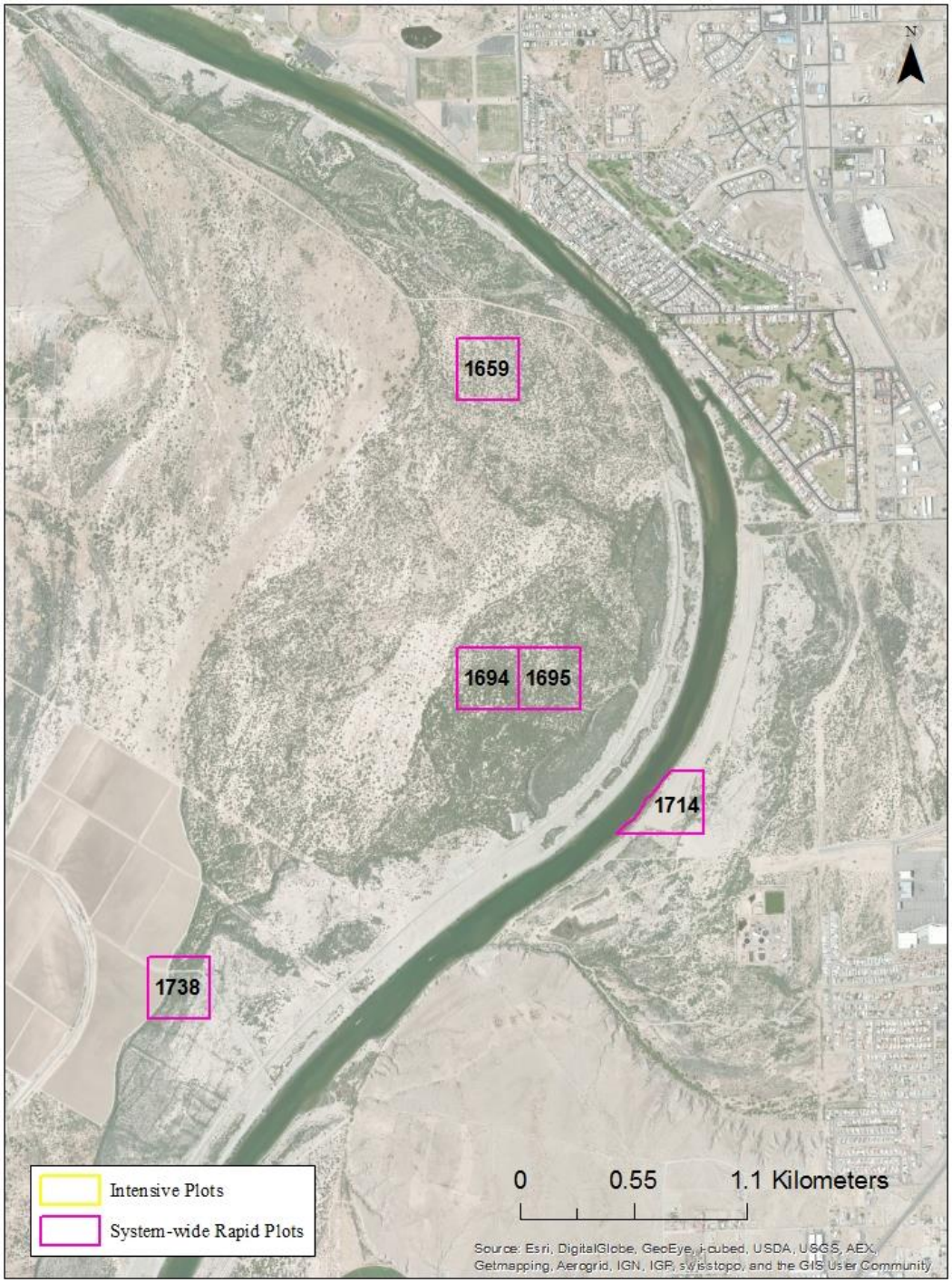
Attachment 1c – Regional map of system-wide plots surveyed in 2014: Region 5 North, Lake Mohave plots

(Rapid survey plots are outlined in pink and intensive survey plots in yellow.)



Attachment 1d – Regional map of system-wide plots surveyed in 2014: Region 5, Laughlin Area plots

(Rapid survey plots are outlined in pink and intensive survey plots in yellow.)

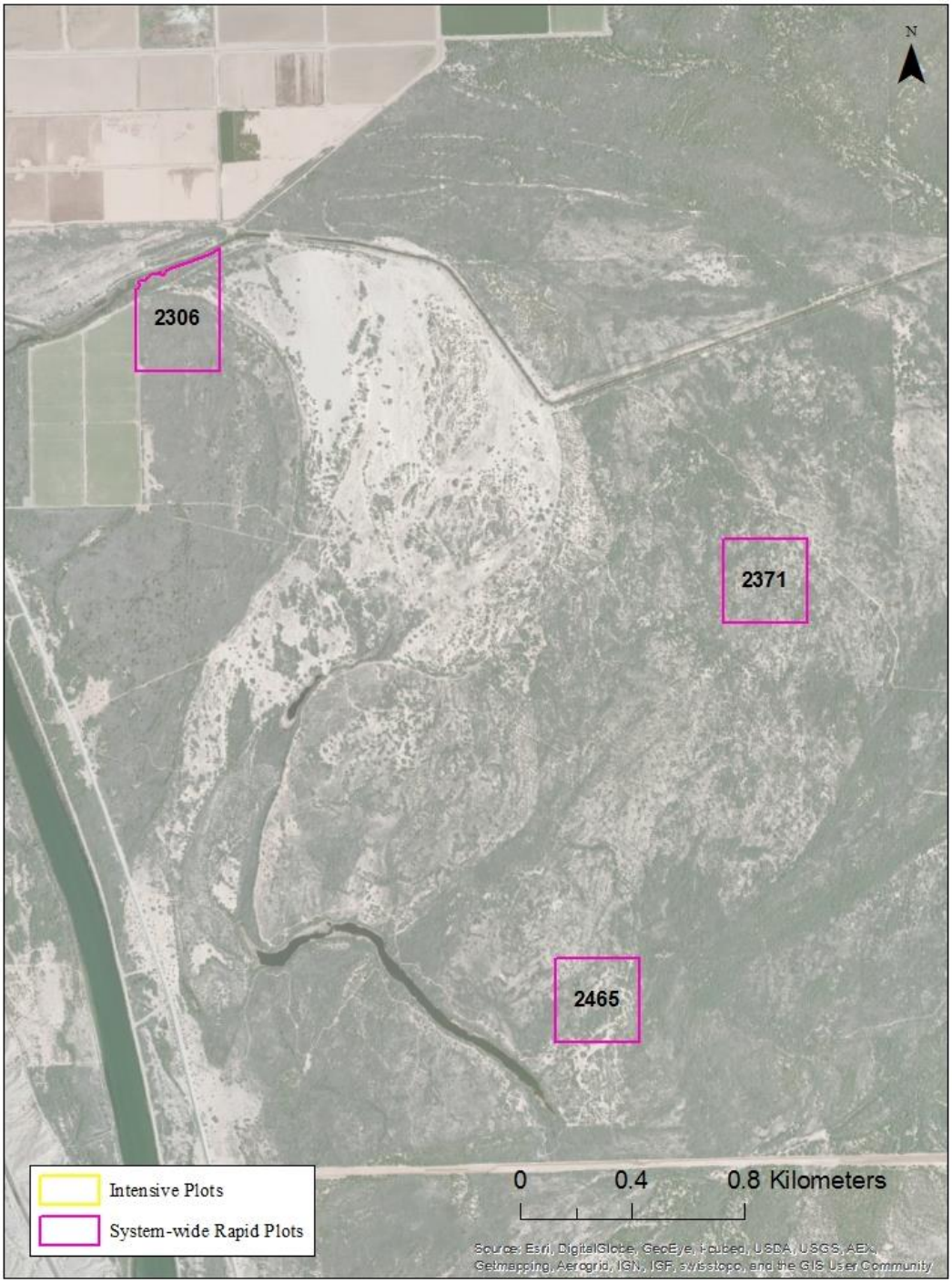


Attachment 1e – Regional map of system-wide plots surveyed in 2014: Region 5, Ft. Mohave area plots

(Rapid survey plots are outlined in pink and intensive survey plots in yellow.)

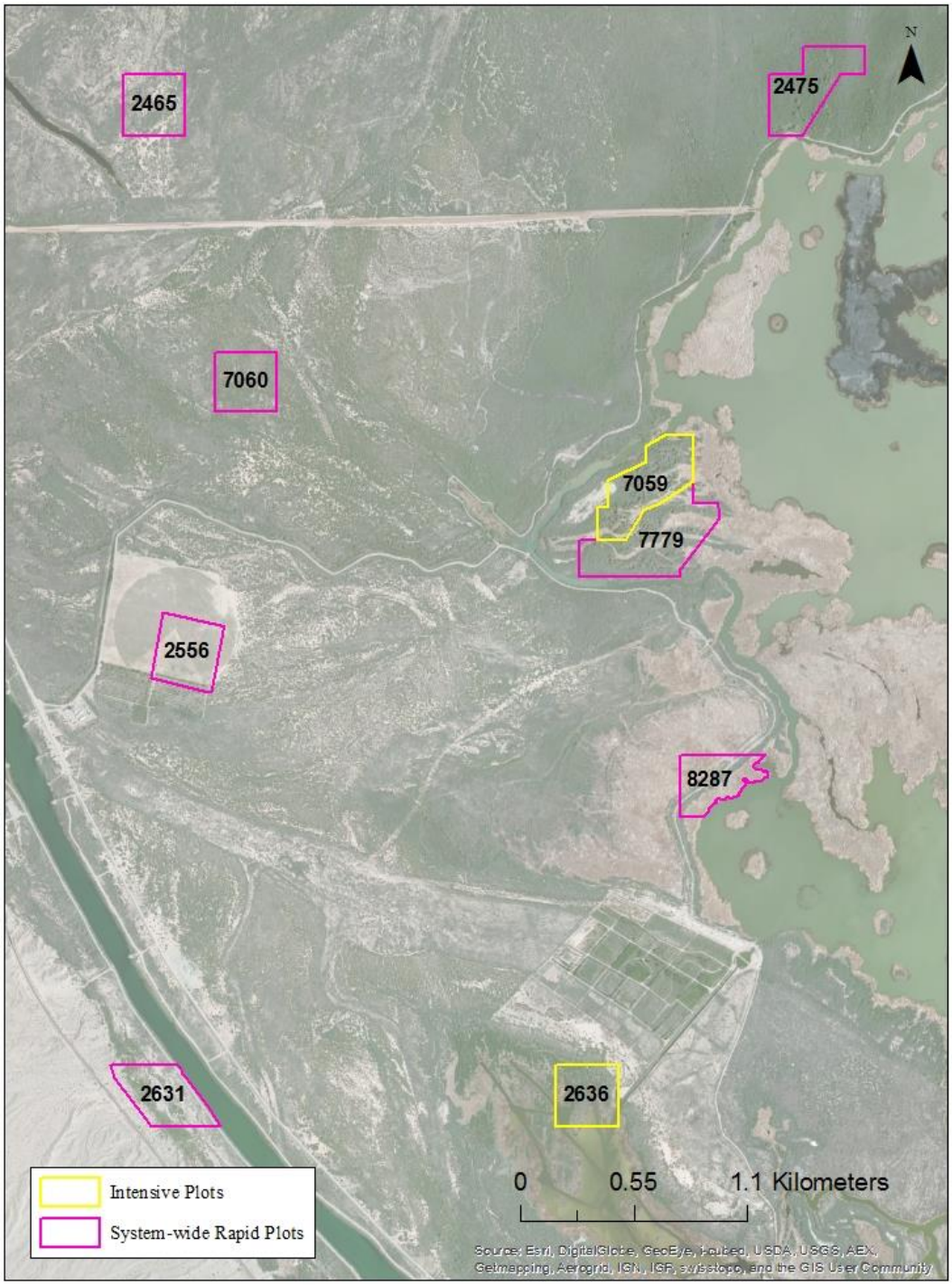
Attachment 1f – Regional map of system-wide plots surveyed in 2014: Region 5, Ft. Mohave area plots

(Rapid survey plots are outlined in pink and intensive survey plots in yellow.)



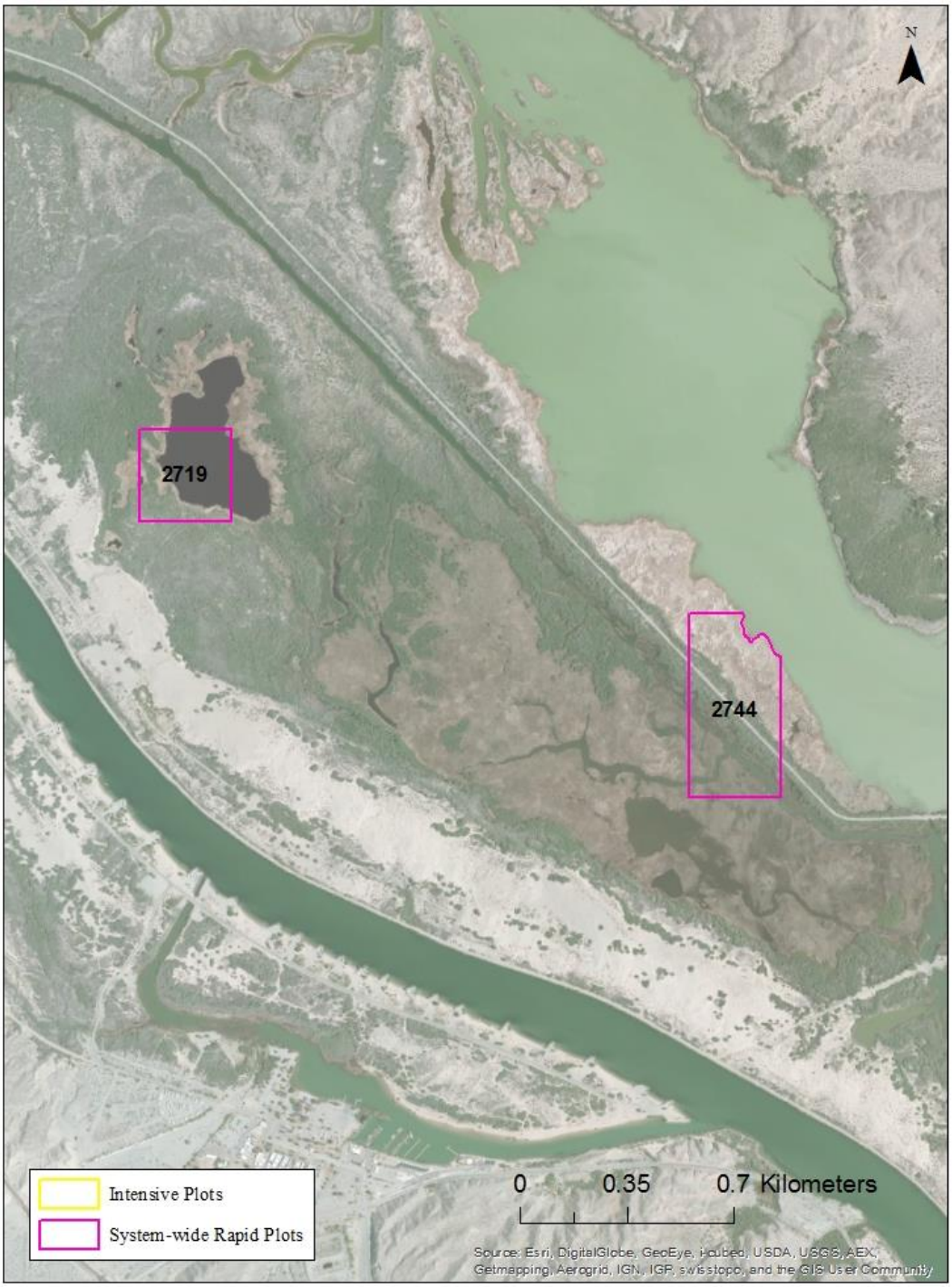
Attachment 1g – Regional map of system-wide plots surveyed in 2014: Region 6, Havasu National Wildlife Refuge plots

(Rapid survey plots are outlined in pink and intensive survey plots in yellow.)



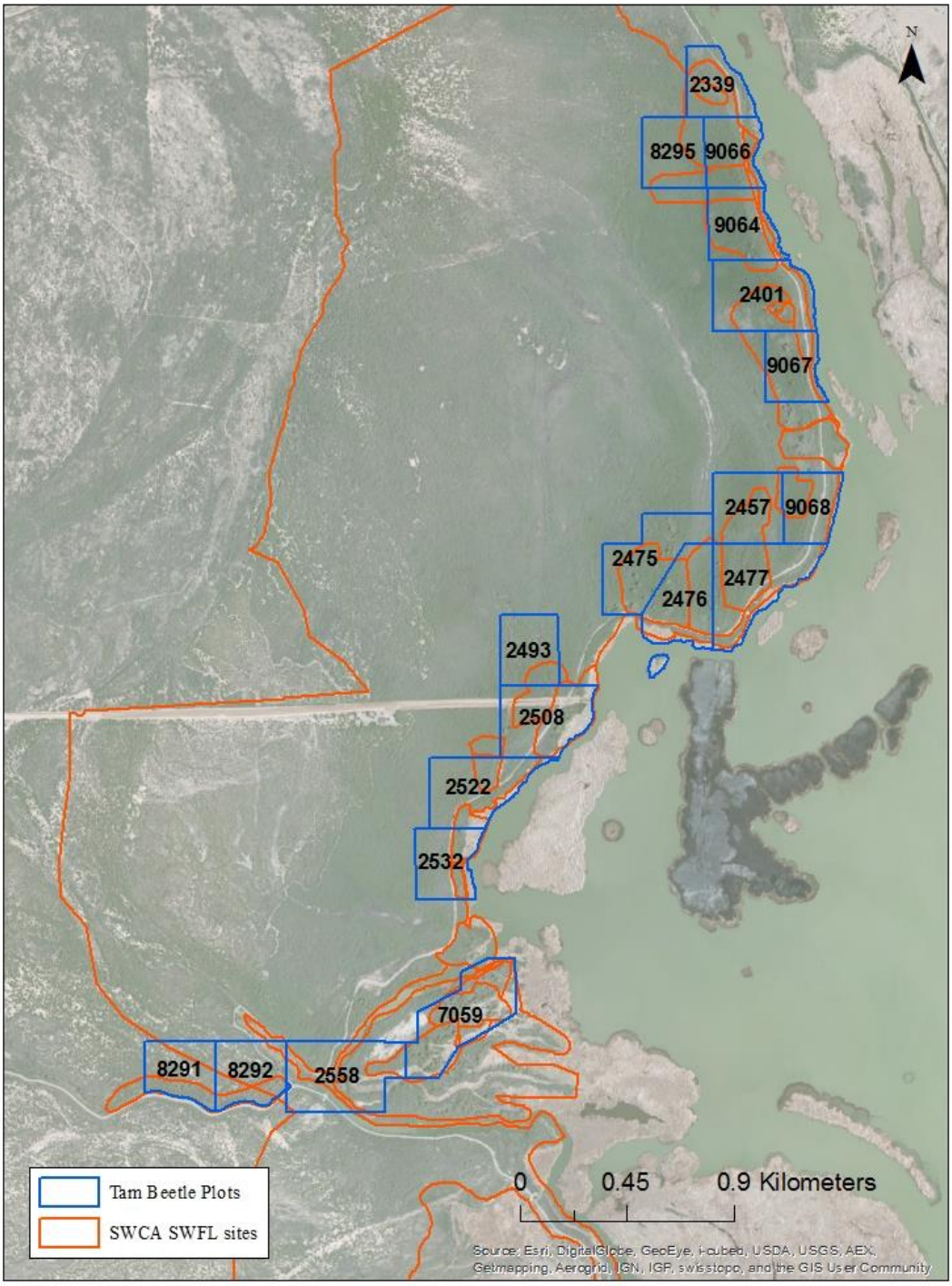
Attachment 1h – Regional map of system-wide plots surveyed in 2014: Region 6, Havasu National Wildlife Refuge plots

(Rapid survey plots are outlined in pink and intensive survey plots in yellow.)



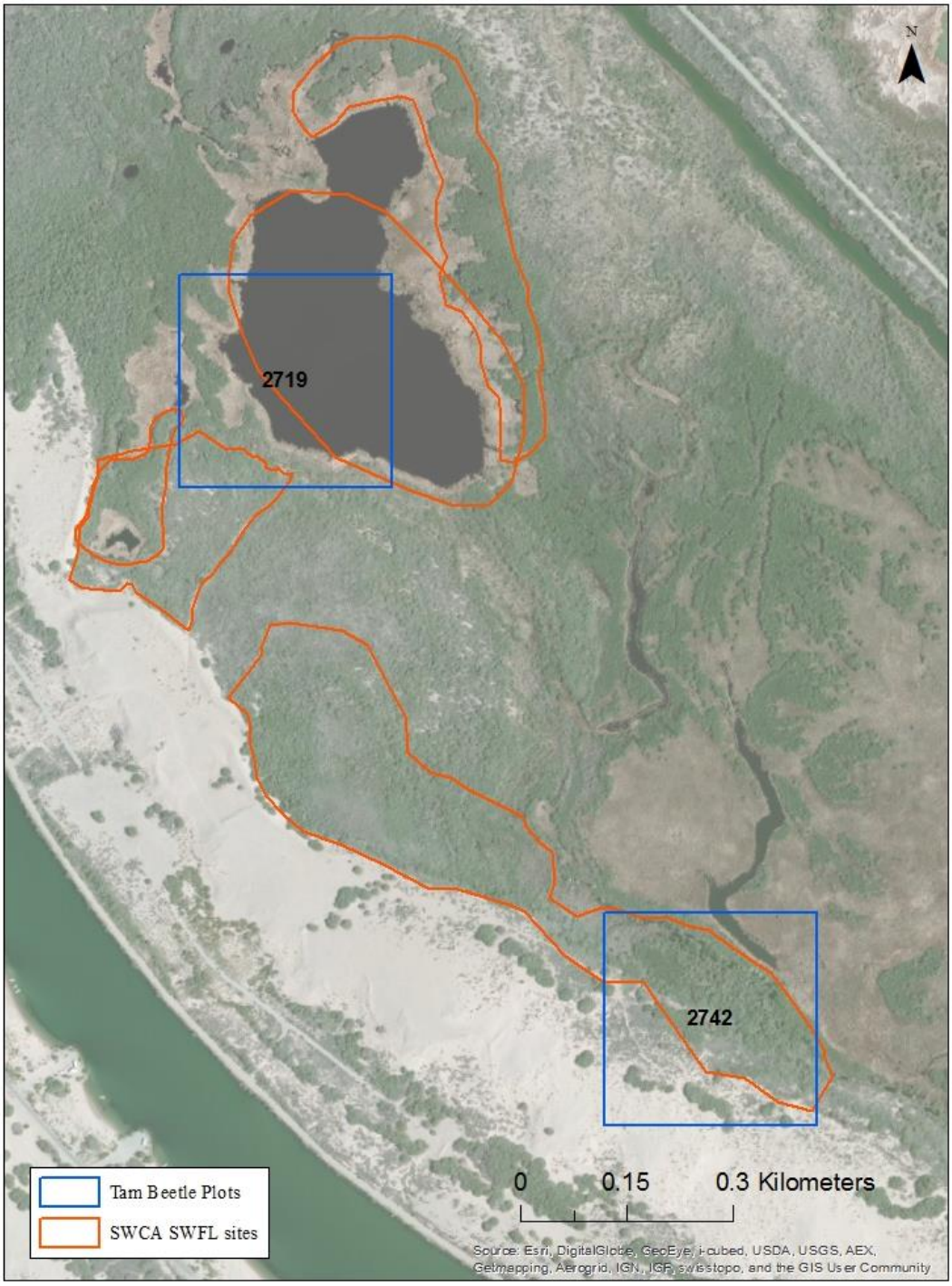
Attachment 1i – Regional map of system-wide plots surveyed in 2014: Region 6, Havasu National Wildlife Refuge plots

(Salt cedar beetle plots are outlined in blue and southwestern willow flycatcher [*Empidonax traillii extimus*] survey areas in orange.)



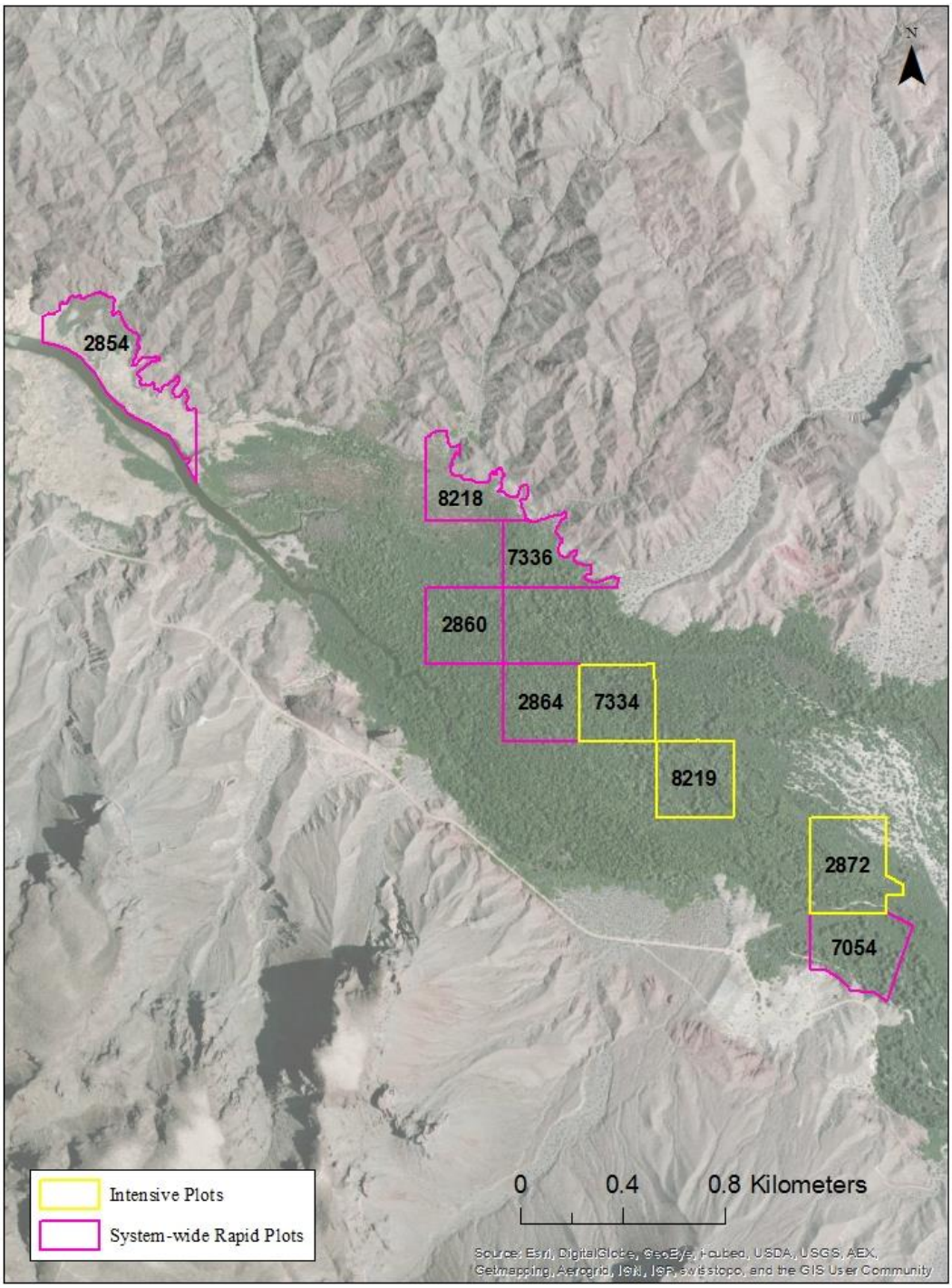
Attachment 1j – Regional map of system-wide plots surveyed in 2014: Region 6, Havasu National Wildlife Refuge plots

(Salt cedar beetle plots are outlined in blue and southwestern willow flycatcher survey areas in orange.)



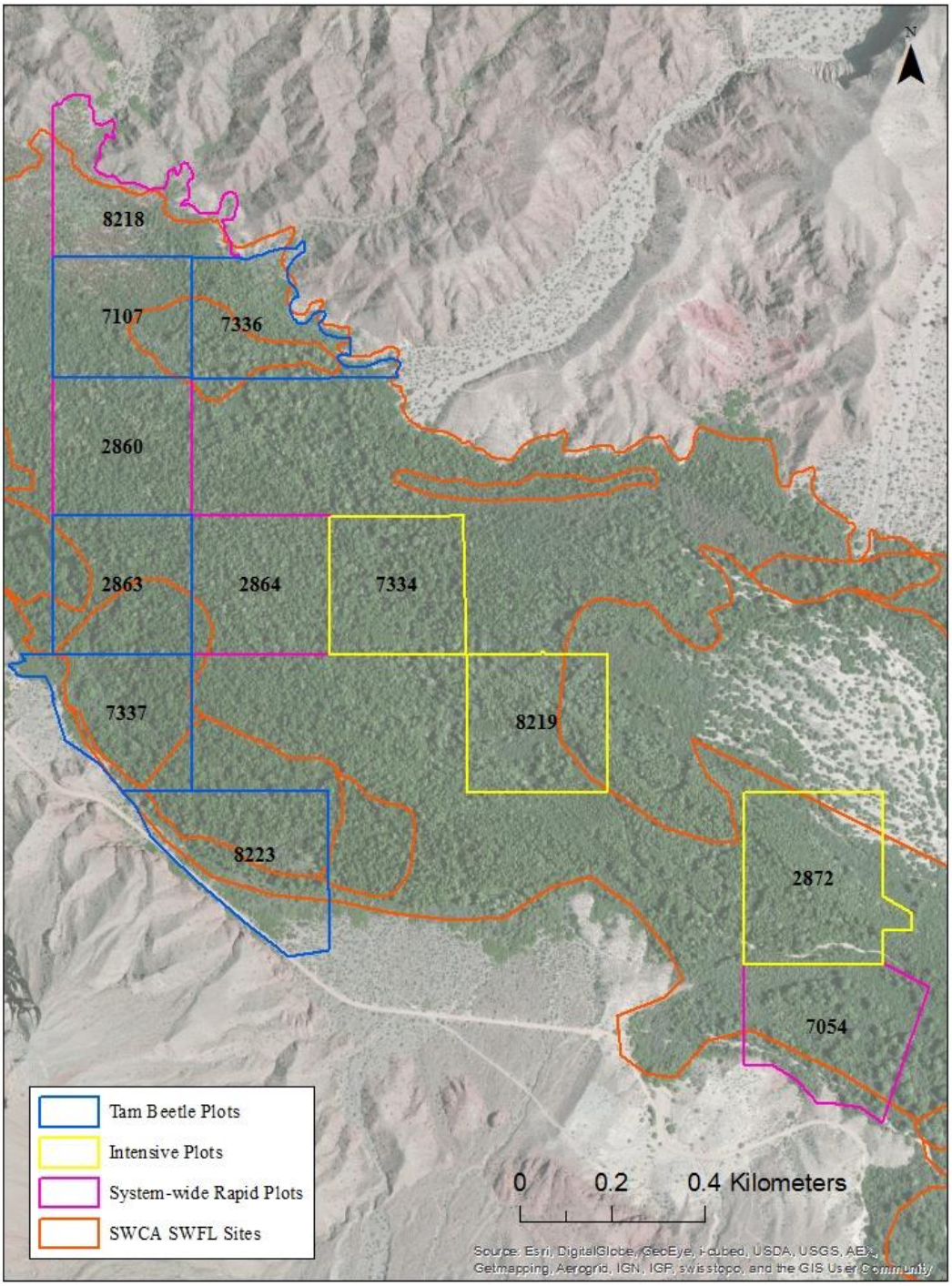
Attachment 1k – Regional map of system-wide plots surveyed in 2014: Region 5 South, north of the Bill Williams River National Wildlife Refuge
(Rapid survey plots are outlined in pink and intensive survey plots in yellow.)

Attachment 1l – Regional map of system-wide plots surveyed in 2014: Region 7 West, Bill Williams River National Wildlife Refuge plots
(Rapid survey plots are outlined in pink and intensive survey plots in yellow.)



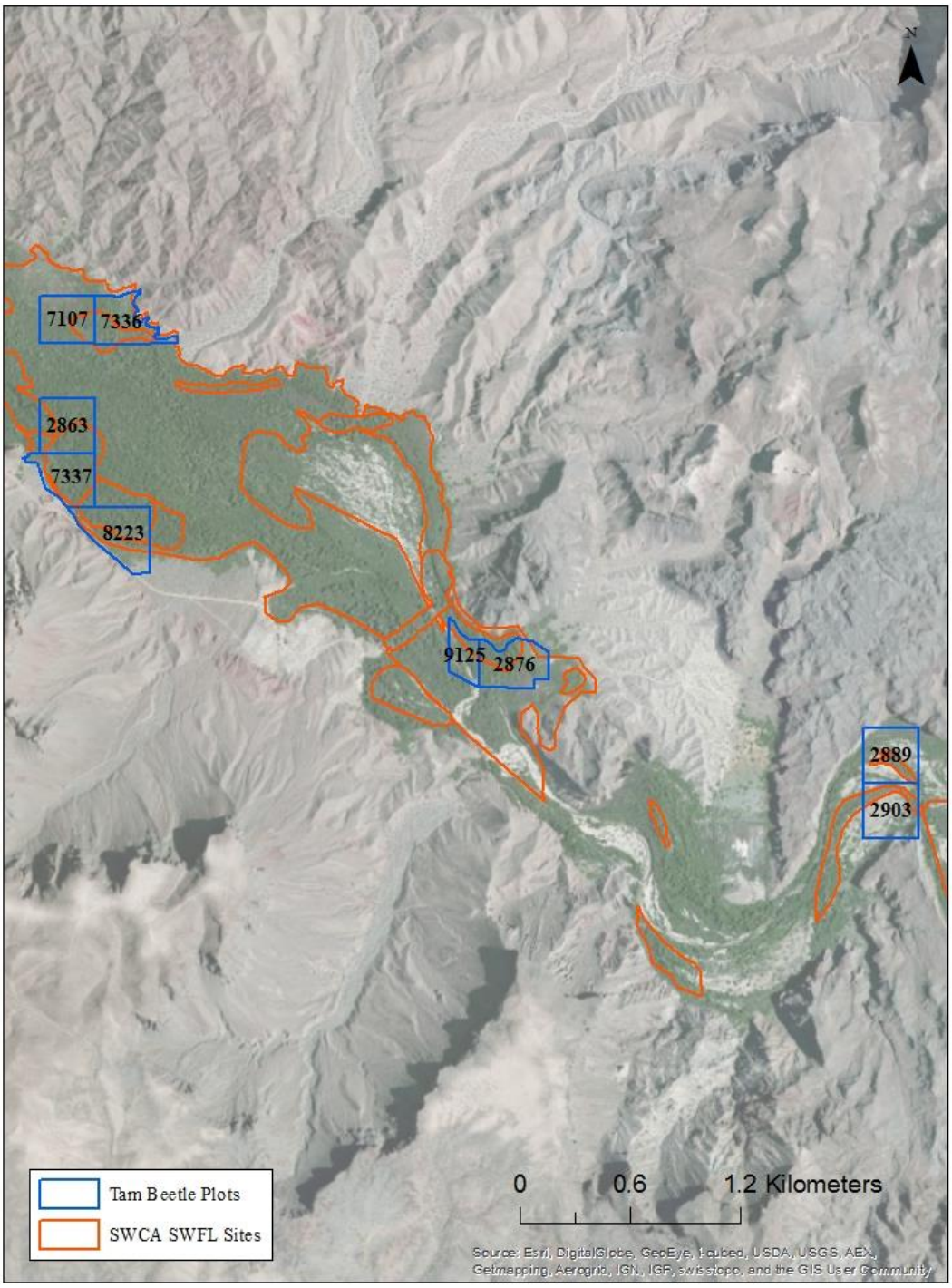
Attachment 1m – Regional map of system-wide plots surveyed in 2014: Region 7 West, Bill Williams River National Wildlife Refuge plots

(Rapid survey plots are outlined in pink, intensive survey plots in yellow, salt cedar beetle plots in blue, and southwestern willow flycatcher survey areas in orange.)

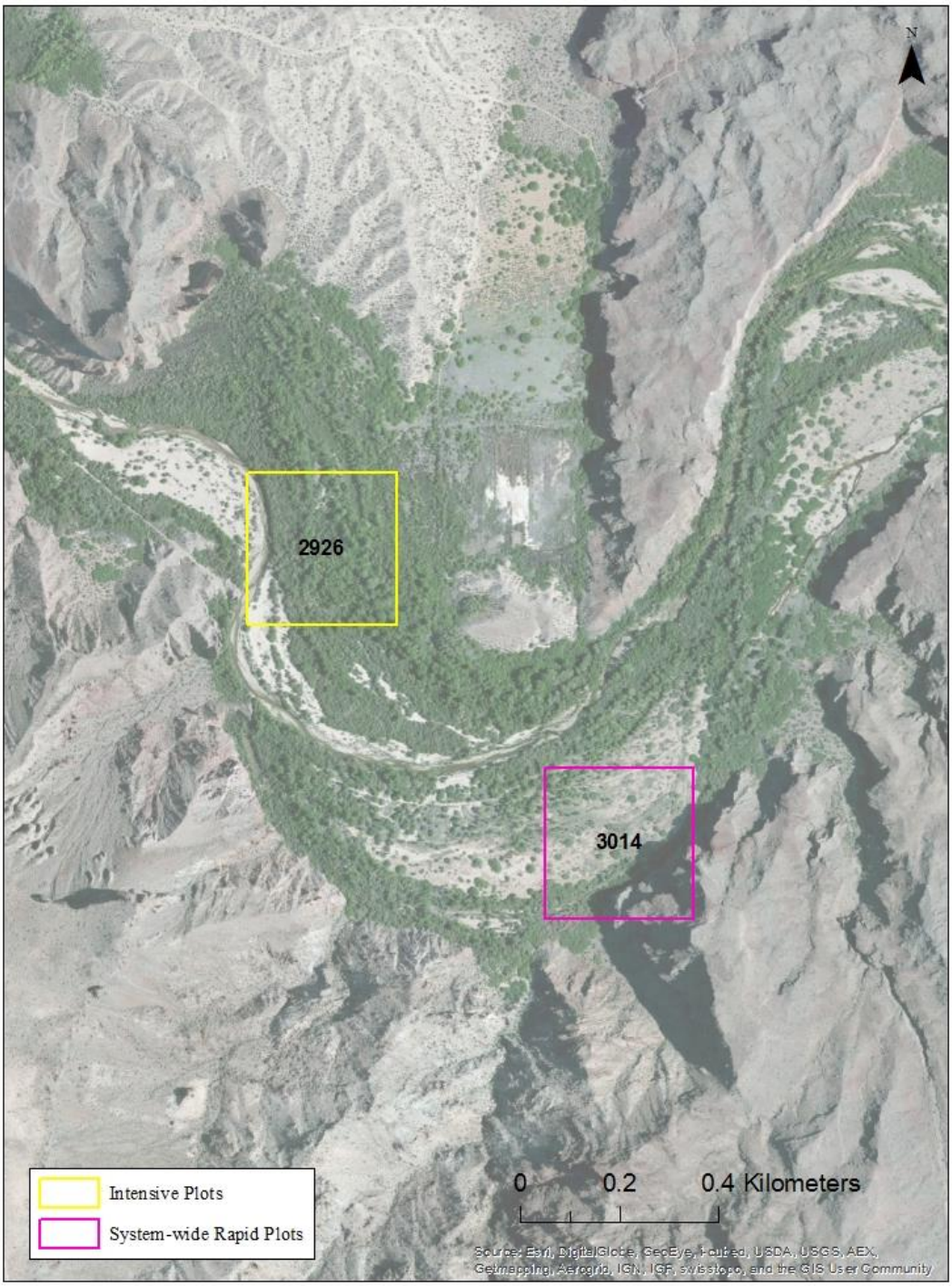


Attachment 1n – Regional map of system-wide plots surveyed in 2014: Region 7 West, Bill Williams River National Wildlife Refuge plots

(Salt cedar beetle plots are outlined in blue and southwestern willow flycatcher survey areas in orange.)

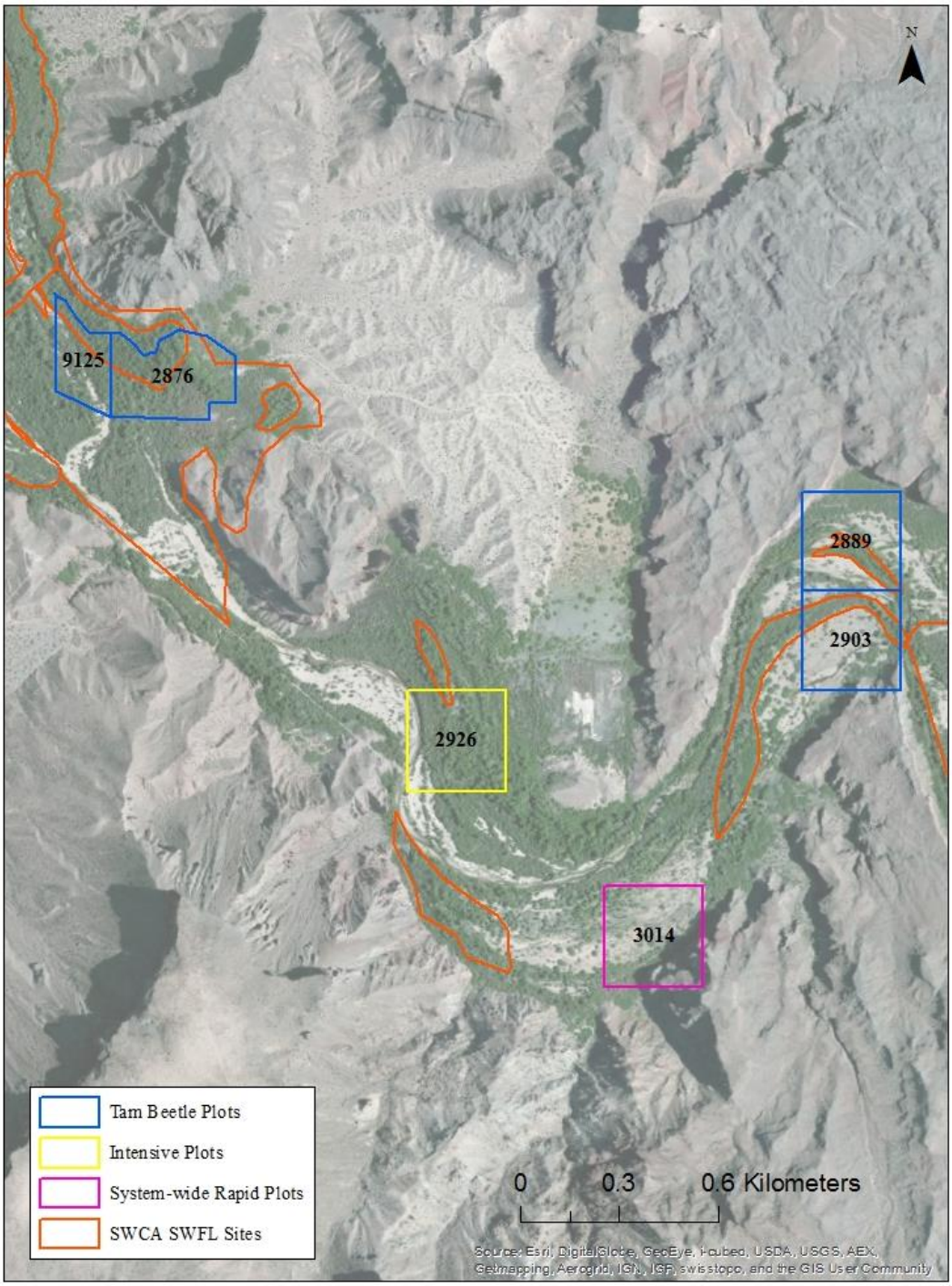


Attachment 1o – Regional map of system-wide plots surveyed in 2014: Region 7 West, Bill Williams River National Wildlife Refuge plots
(Rapid survey plots are outlined in pink and intensive survey plots in yellow.)



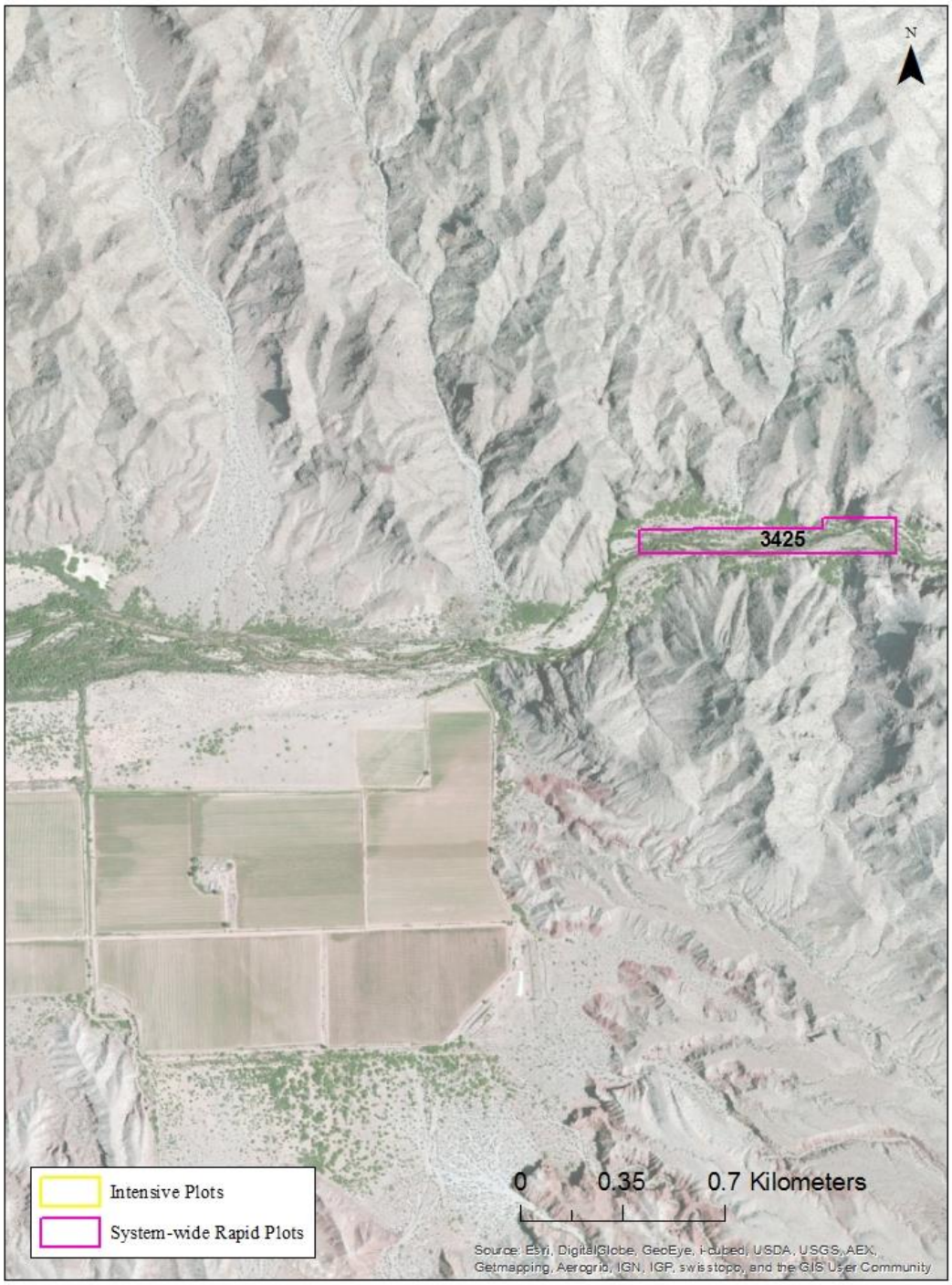
Attachment 1p – Regional map of system-wide plots surveyed in 2014: Region 7 West, Bill Williams River National Wildlife Refuge plots

(Rapid survey plots are outlined in pink, intensive survey plots in yellow, salt cedar beetle plots in blue, and southwestern willow flycatcher survey areas in orange.)



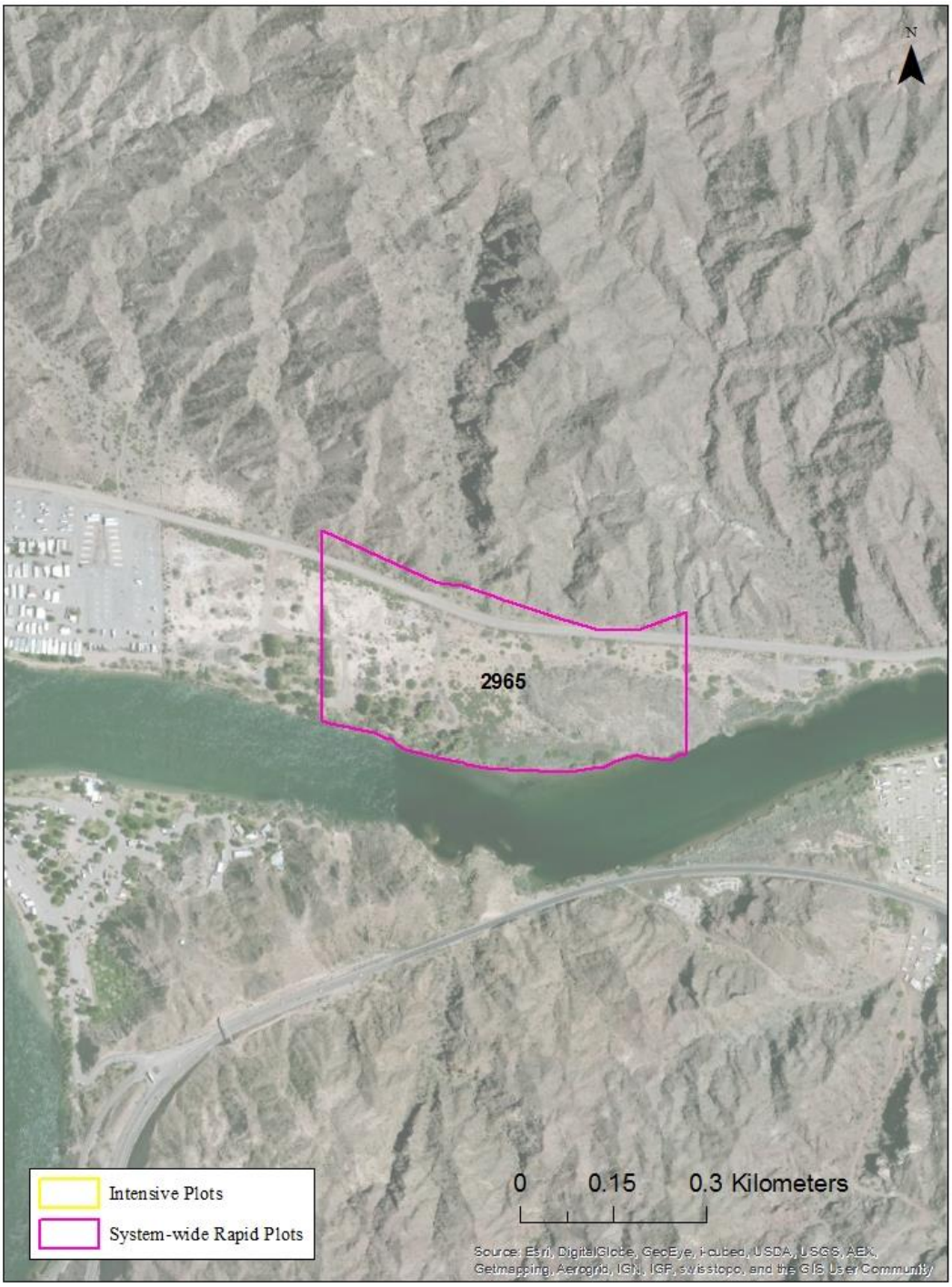
Attachment 1q – Regional map of system-wide plots surveyed in 2014: Region 7 East, Lincoln Ranch plots

(Rapid survey plots are outlined in pink and intensive survey plots in yellow.)



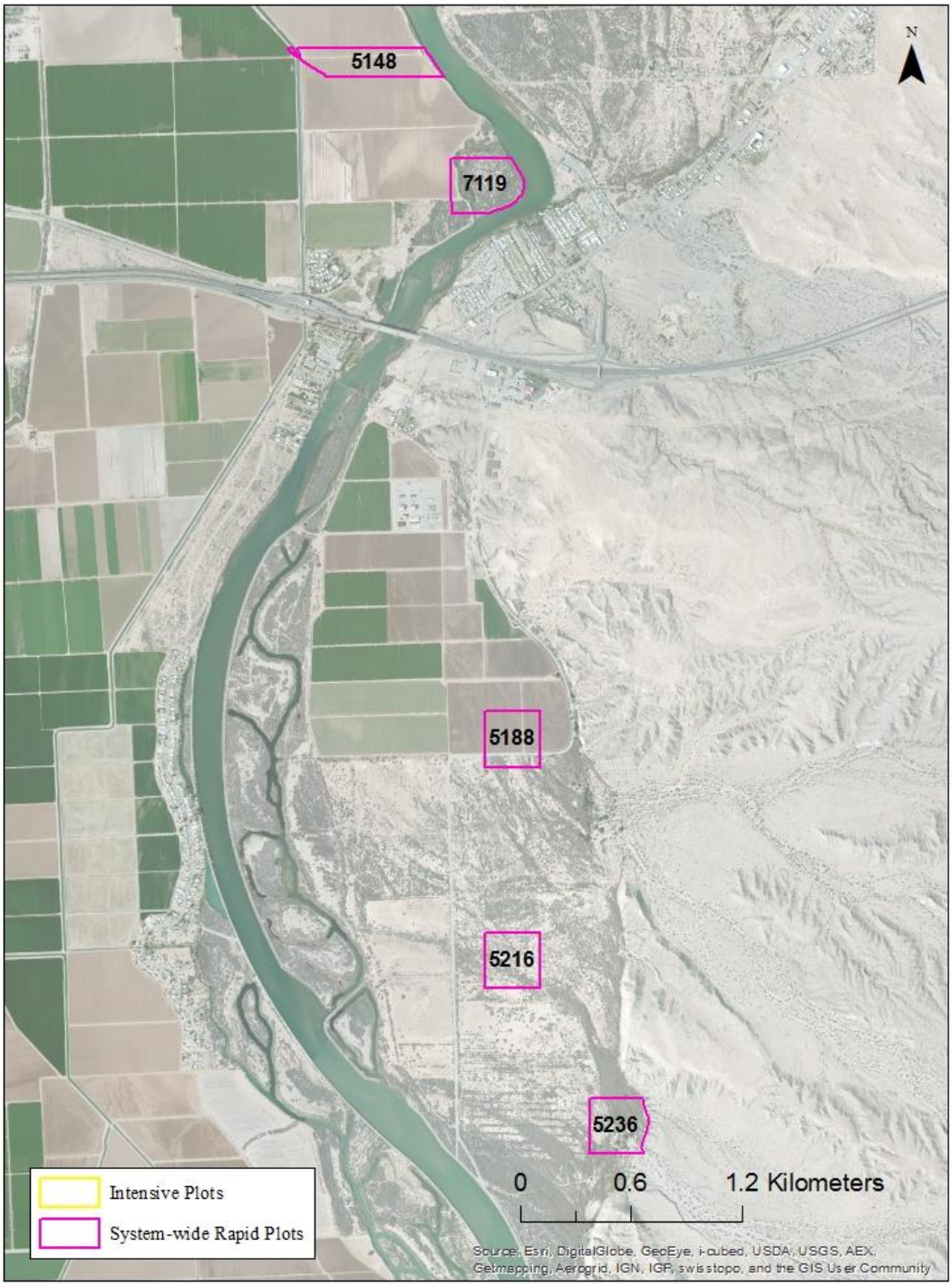
Attachment 1r – Regional map of system-wide plots surveyed in 2014: Region 8 North, below Parker Dam

(Rapid survey plots are outlined in pink and intensive survey plots in yellow.)



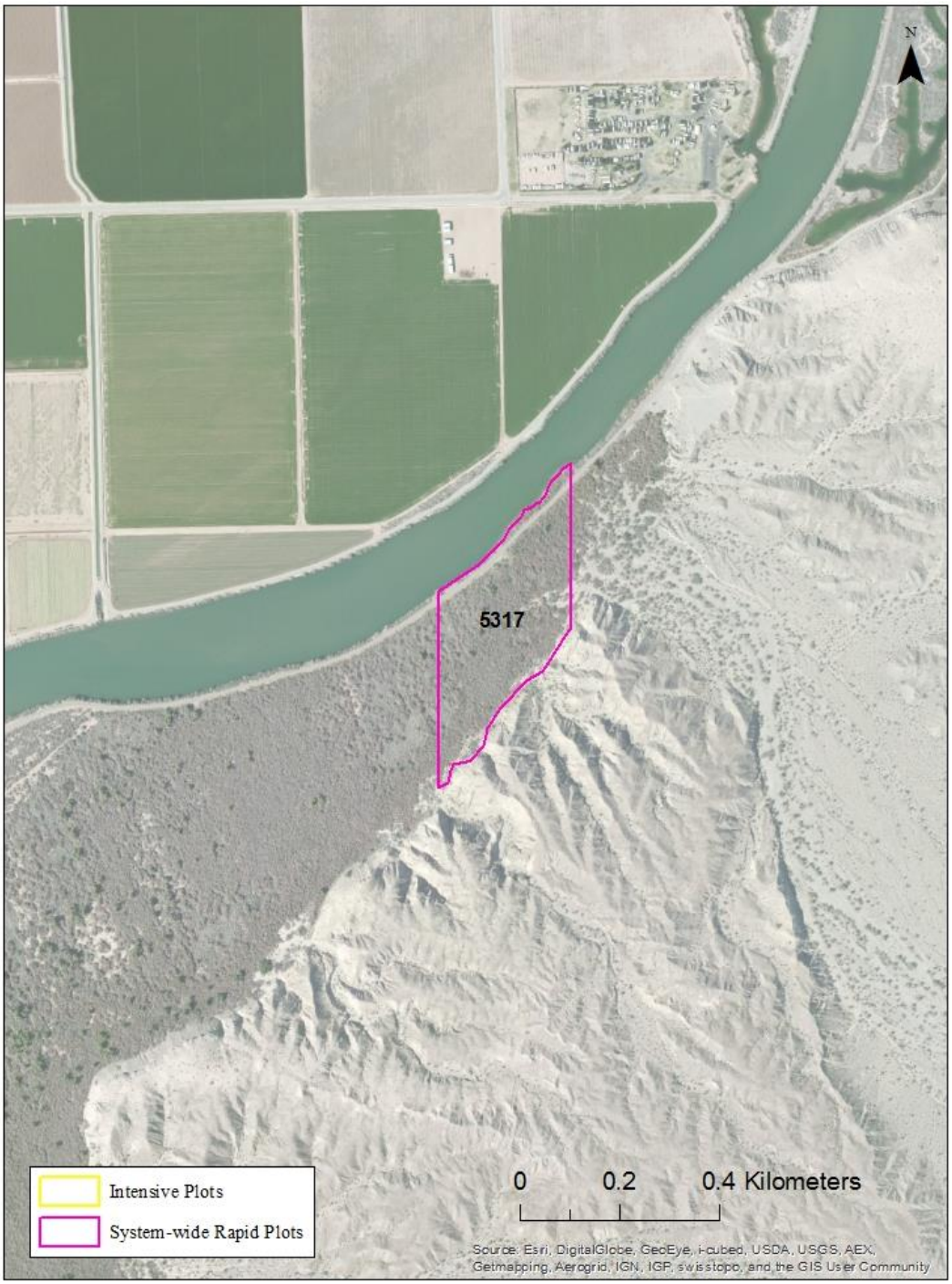
Attachment 1s – Regional map of system-wide plots surveyed in 2014: Region 8, Blythe area

(Rapid survey plots are outlined in pink and intensive survey plots in yellow.)



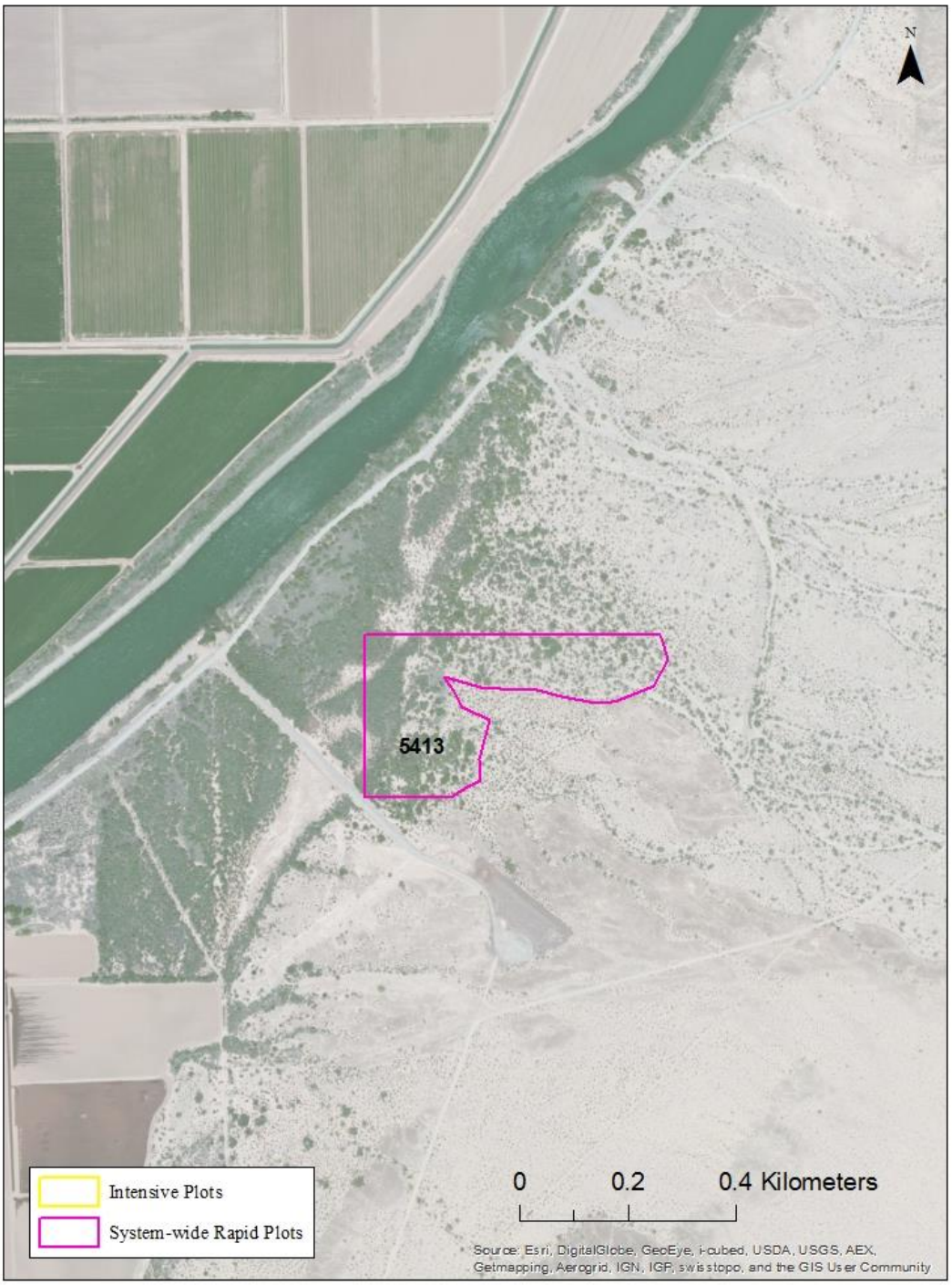
Attachment 1t – Regional map of system-wide plots surveyed in 2014: Region 8, south of Blythe plots

(Rapid survey plots are outlined in pink and intensive survey plots in yellow.)



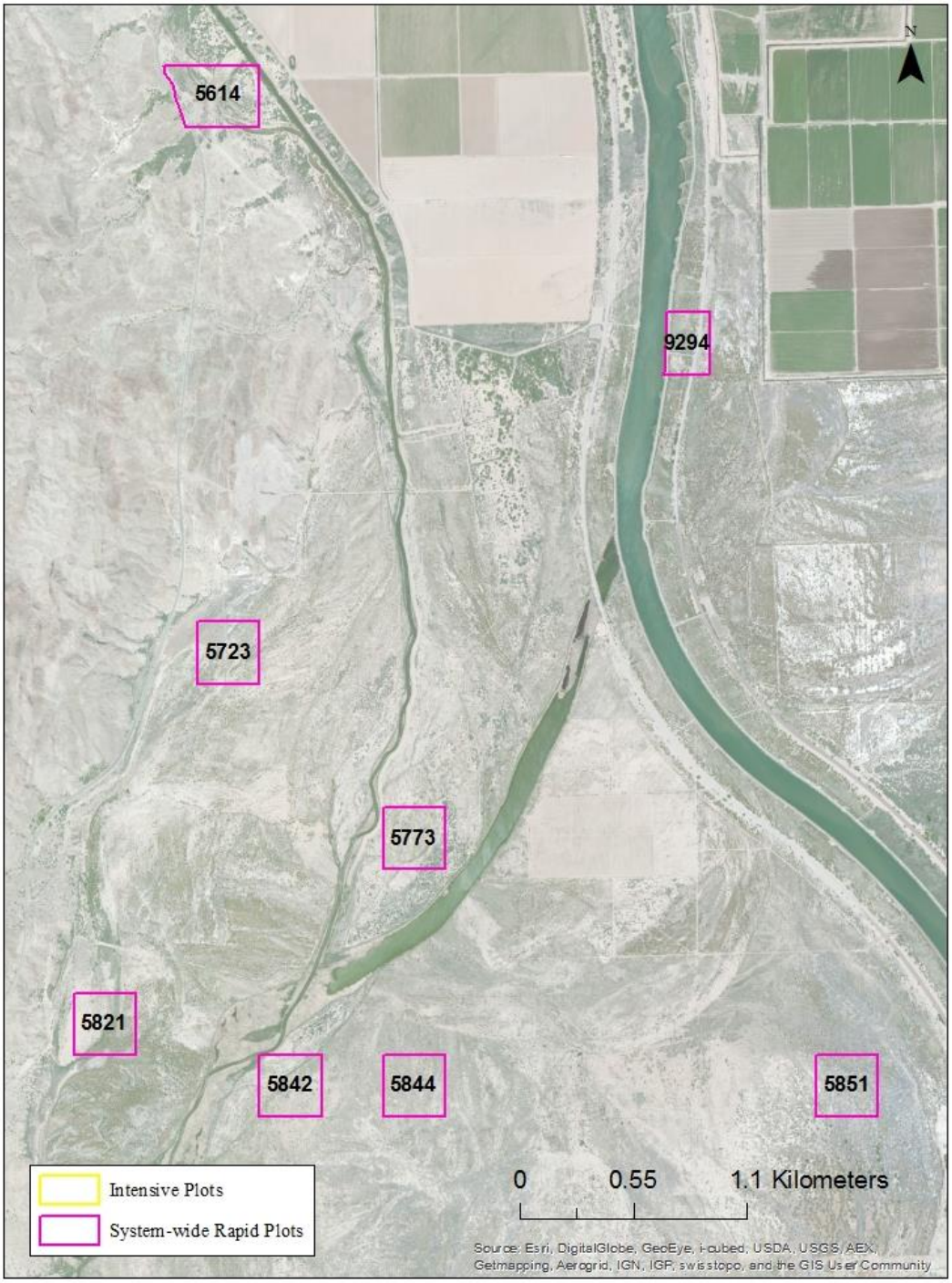
Attachment 1u – Regional map of system-wide plots surveyed in 2014: Region 8, south of Blythe plots

(Rapid survey plots are outlined in pink and intensive survey plots in yellow.)



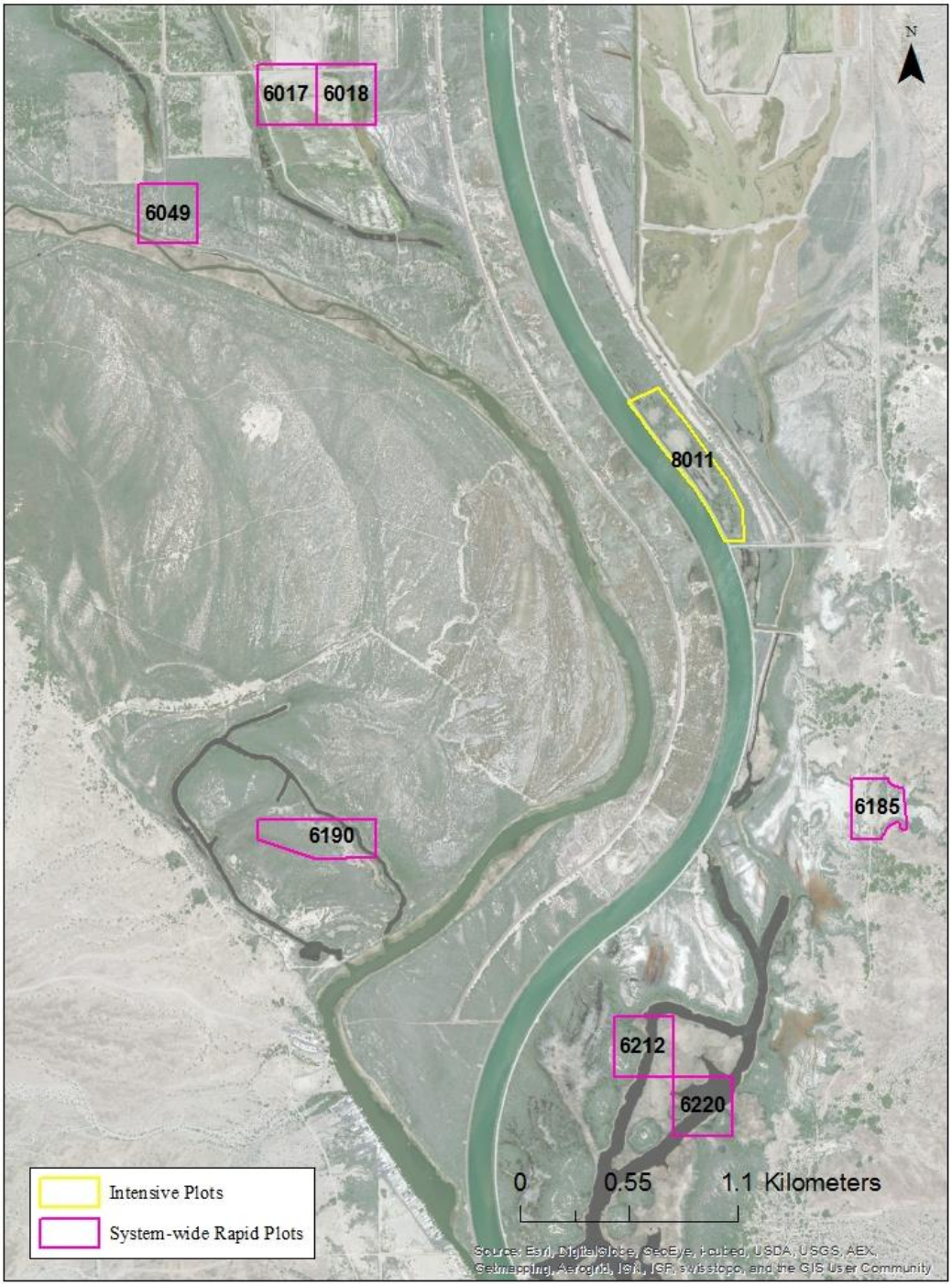
Attachment 1v – Regional map of system-wide plots surveyed in 2014: Region 10, Cibola National Wildlife Refuge area

(Rapid survey plots are outlined in pink and intensive survey plots in yellow.)



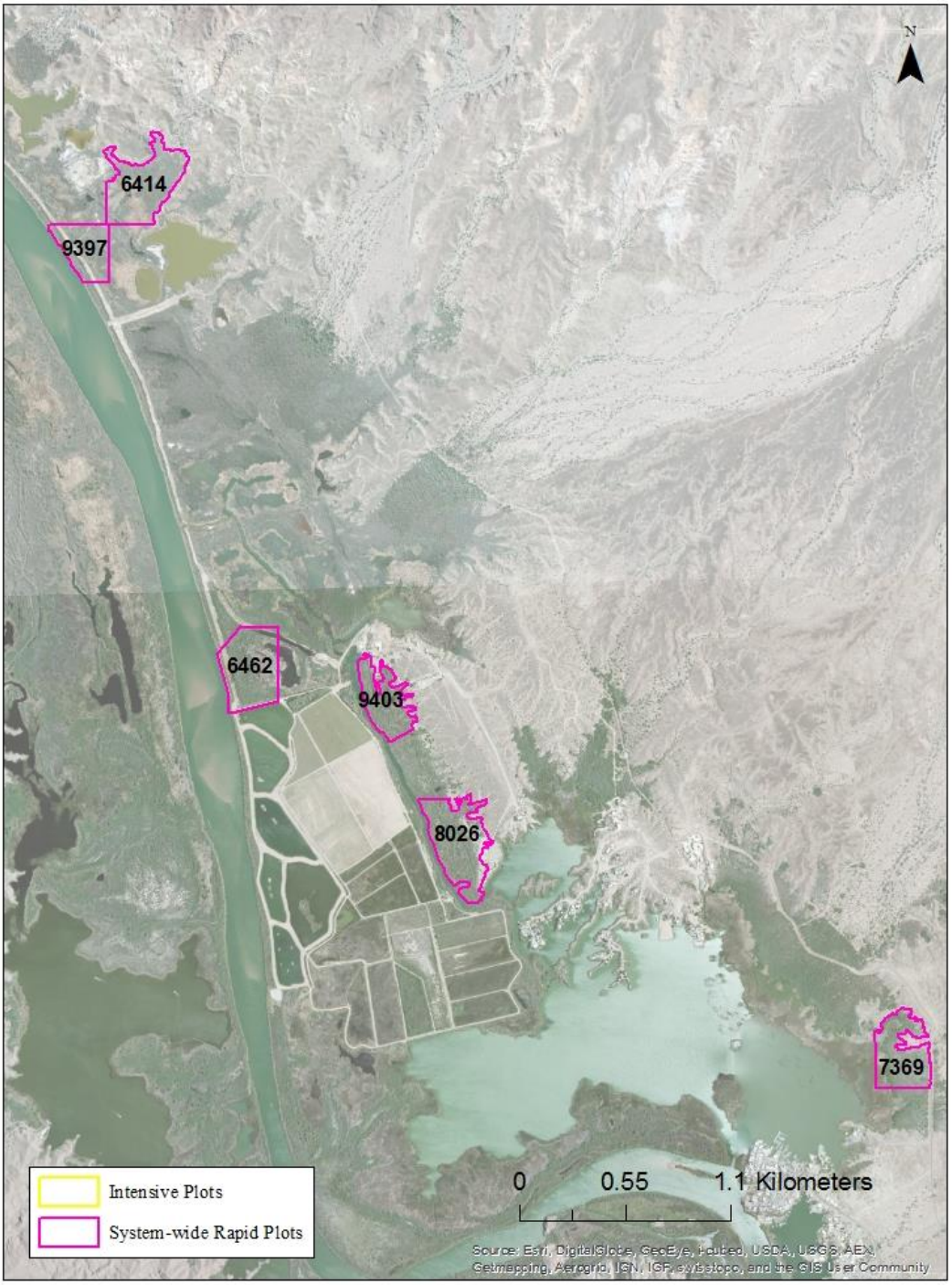
Attachment 1w – Regional map of system-wide plots surveyed in 2014: Region 10, Cibola National Wildlife Refuge

(Rapid survey plots are outlined in pink and intensive survey plots in yellow.)



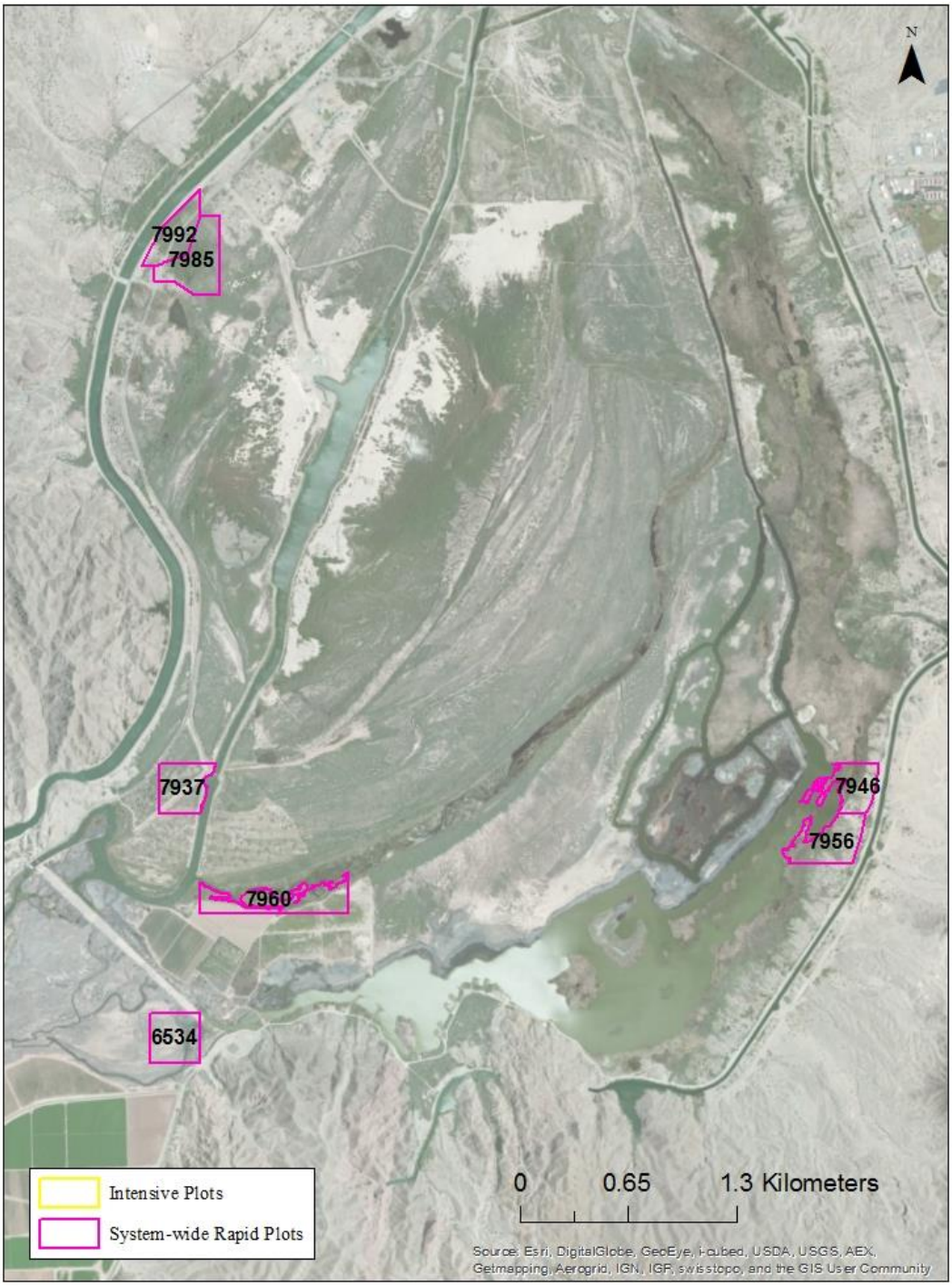
Attachment 1x – Regional map of system-wide plots surveyed in 2014: Region 11, Imperial National Wildlife Refuge area

(Rapid survey plots are outlined in pink and intensive survey plots in yellow.)



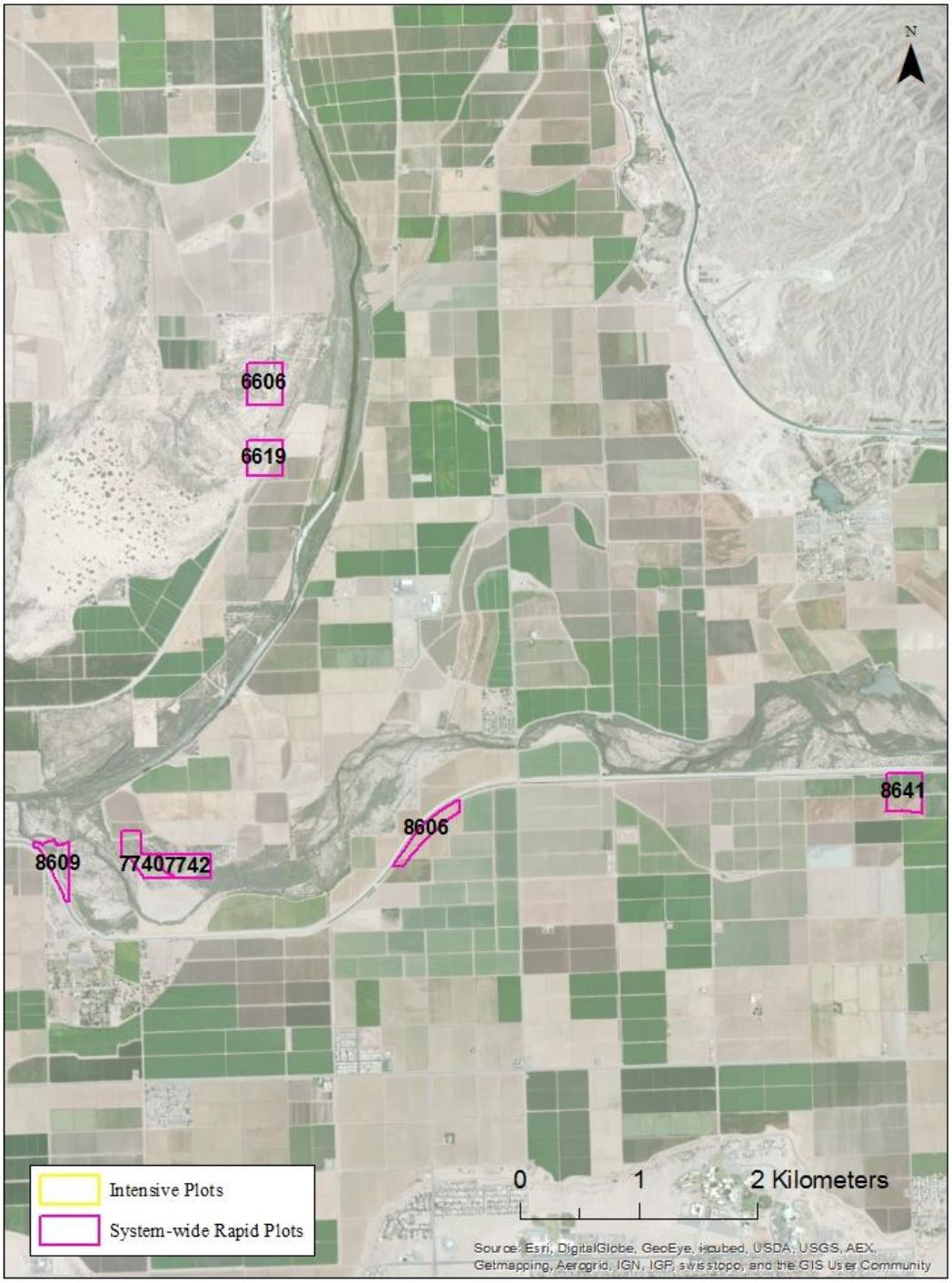
Attachment 1y – Regional map of system-wide plots surveyed in 2014: Region 12 North

(Rapid survey plots are outlined in pink and intensive survey plots in yellow.)

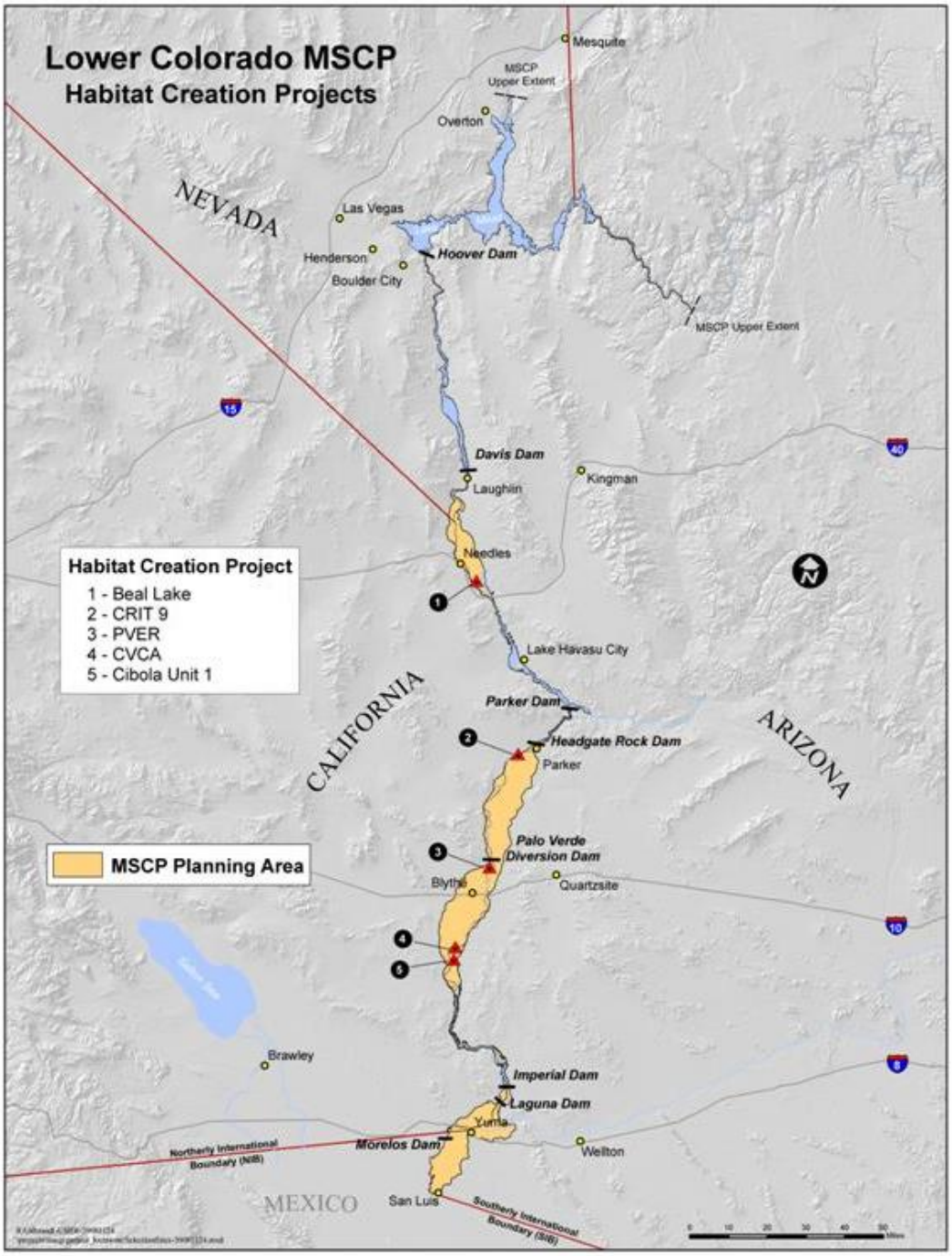


Attachment 1z – Regional map of system-wide plots surveyed in 2014: Region 12 South

(Rapid survey plots are outlined in pink and intensive survey plots in yellow.)



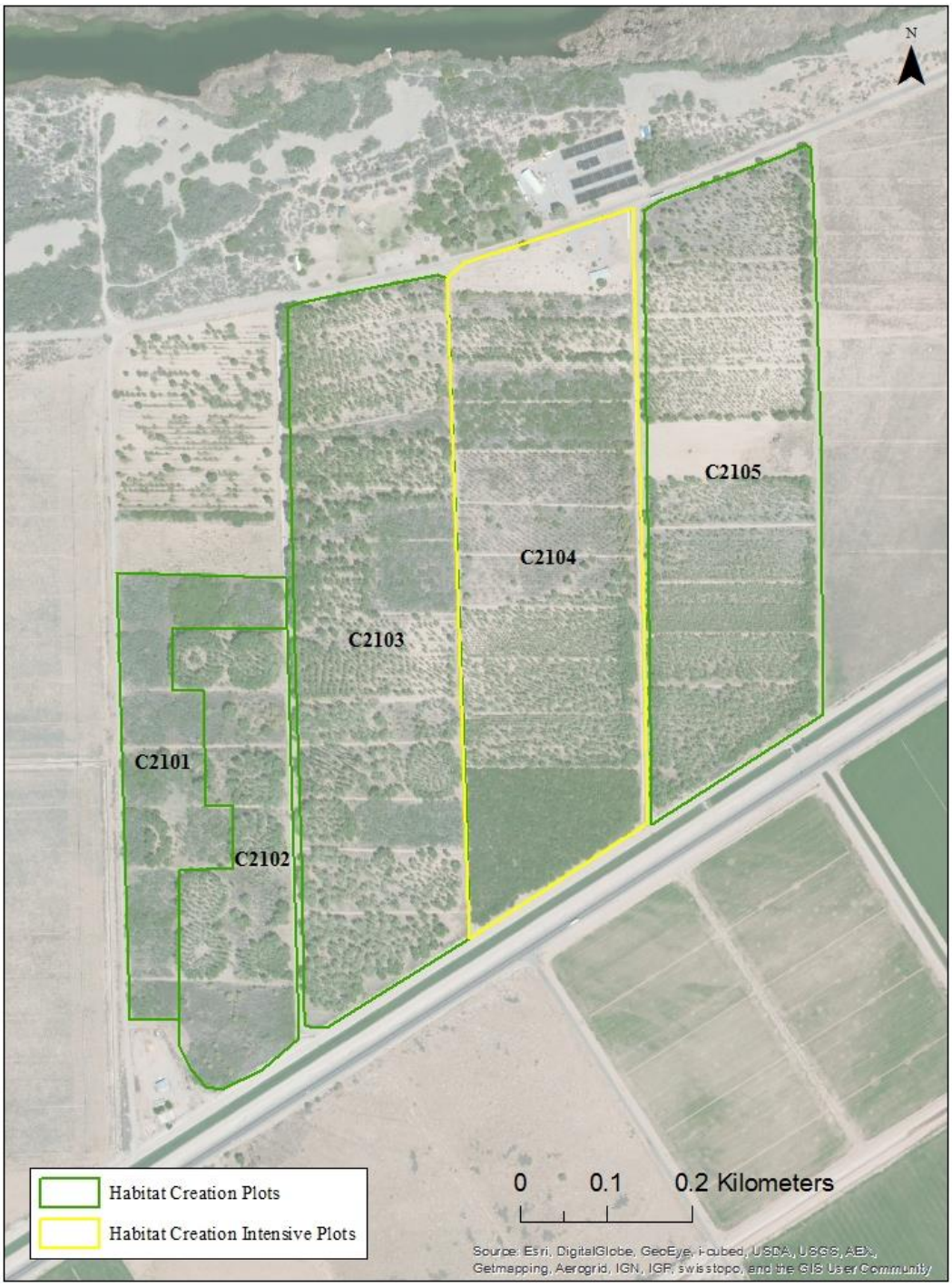
Attachment 1aa – Overview of conservation and habitat creation areas of the Lower Colorado River Multi-Species Conservation Program in 2014
(Map provided by the Bureau of Reclamation, Lower Colorado River Region.)



Attachment 1bb – Overview of Beal Lake Conservation Area and four riparian bird survey plots in 2014

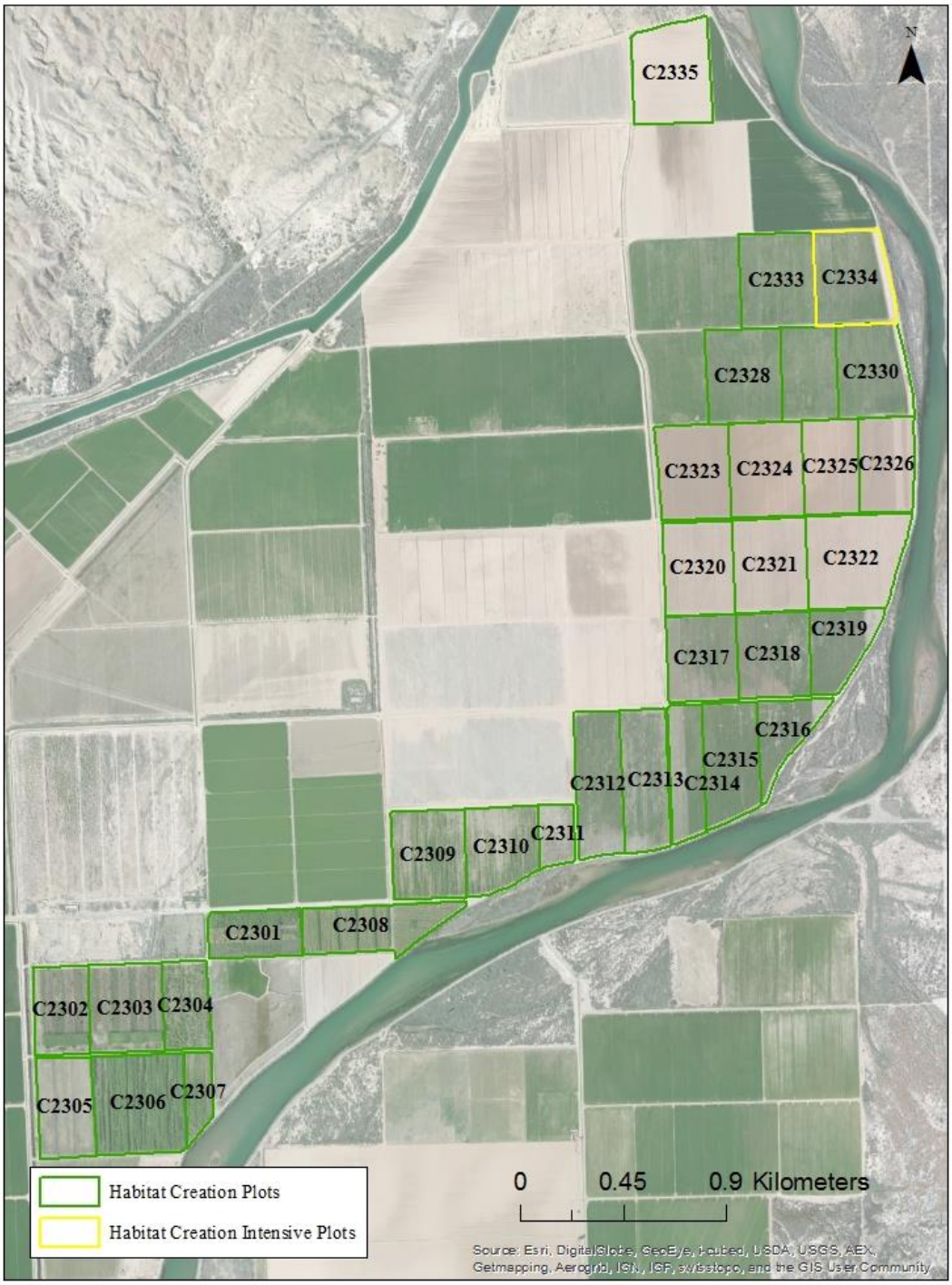
(Rapid survey plots are outlined in green and intensive survey plots in yellow.)

Attachment 1cc – Overview of Colorado River Indian Tribe ('Ahakhav Tribal Preserve CRIT 9) habitat creation area with five riparian bird survey plots in 2014
(Rapid survey plots are outlined in green and intensive survey plots in yellow.)



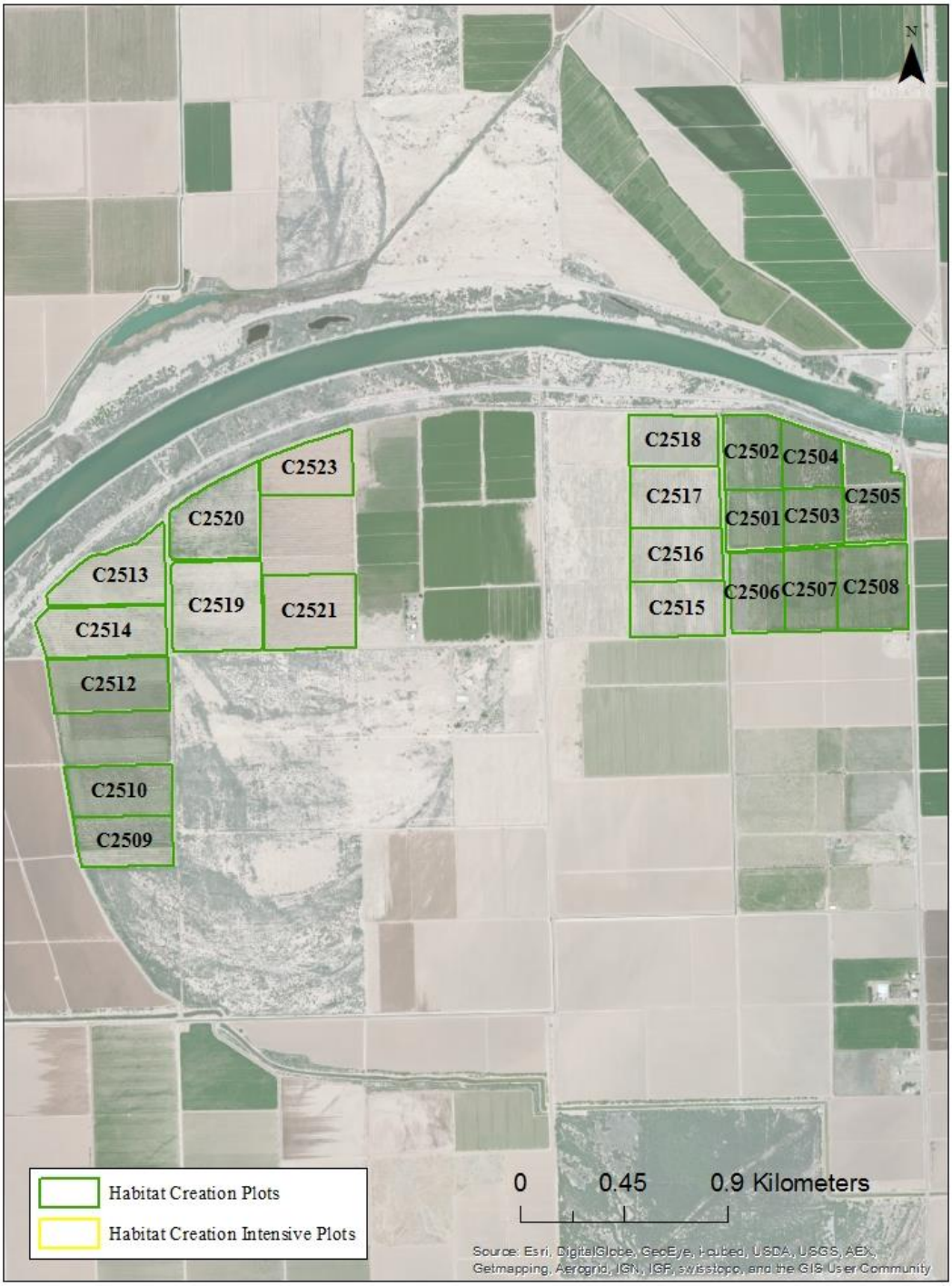
Attachment 1dd – Overview of the Palo Verde Ecological Reserve with 31 riparian bird survey plots in 2014

(Rapid survey plots are outlined in green and intensive survey plots in yellow.)



Attachment 1ee – Overview of the Cibola Valley Conservation Area with 21 riparian bird survey plots in 2014

(Rapid survey plots are outlined in green and intensive survey plots in yellow.)



Attachment 1ff – Overview of Cibola National Wildlife Refuge Unit #1 Conservation Area with 11 riparian bird survey plots in 2014

(Rapid survey plots are outlined in green and intensive survey plots in yellow.)

Attachment 1gg – Overview of Yuma East Wetlands with eight riparian bird survey plots in 2014

(Rapid survey plots are outlined in green and intensive survey plots in yellow.)

ATTACHMENT 2

Sample Plot Maps

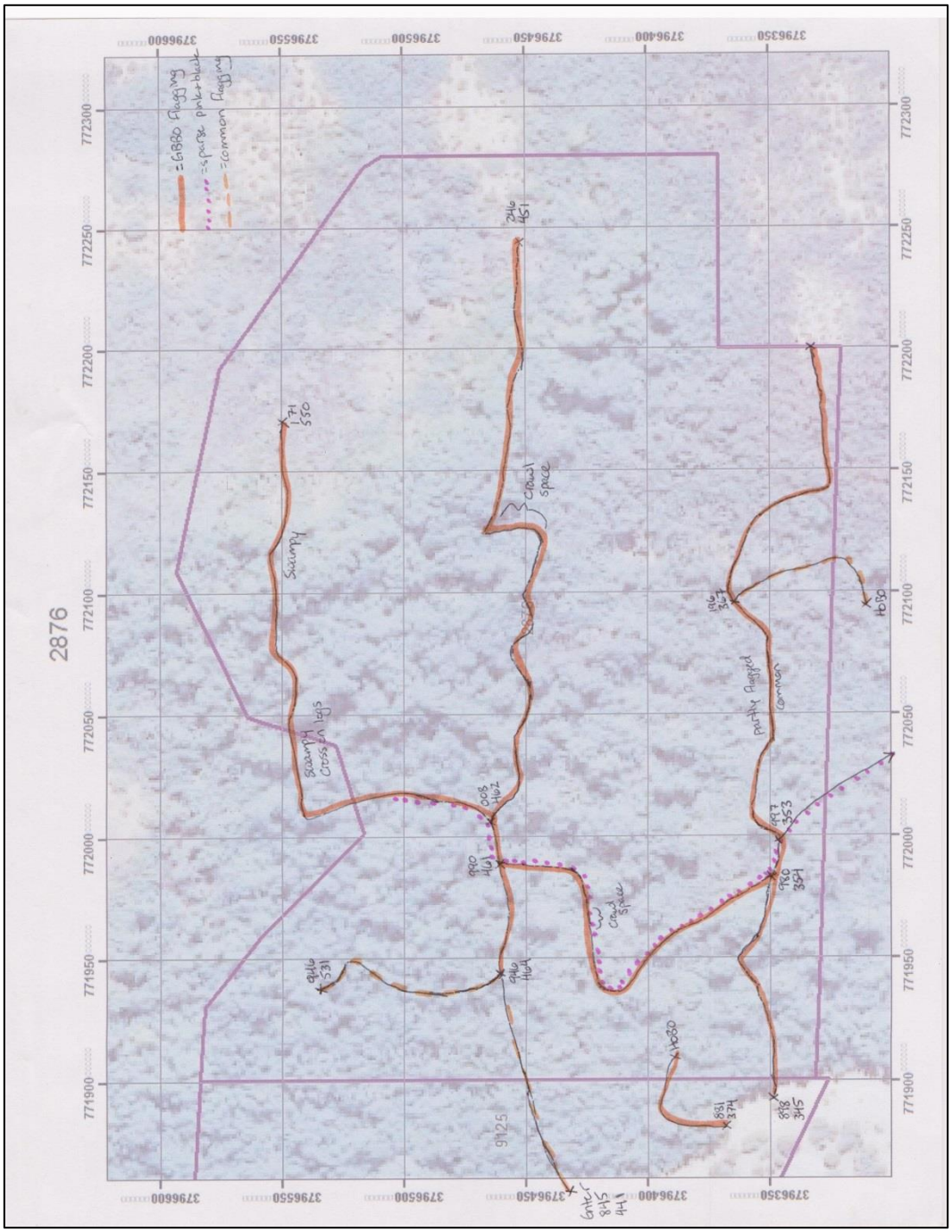


Figure 2-1.—Example of a system-wide bird monitoring plot map with trails.

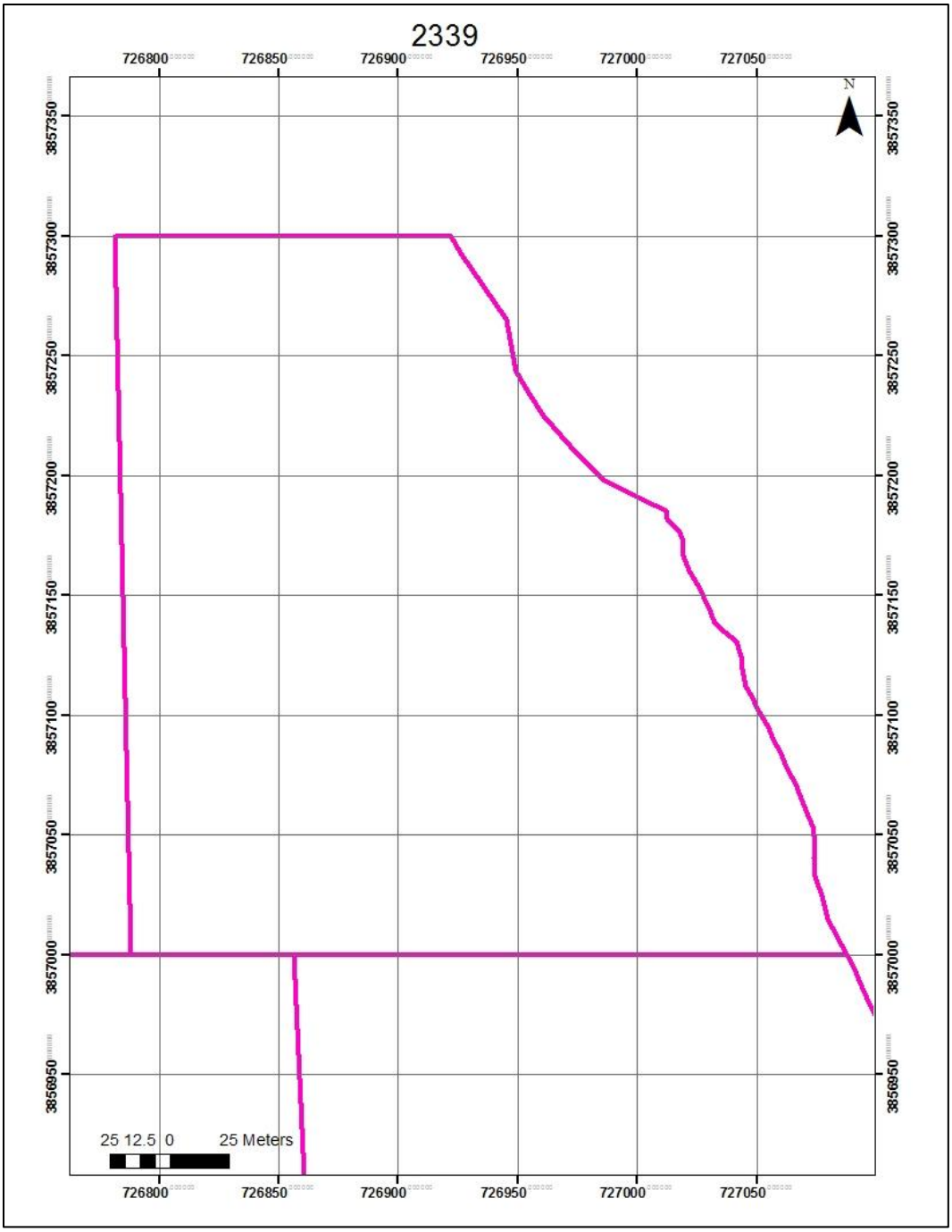


Figure 2-2.—Example of a grid bird survey plot (when aerial photo coverage is not useful for reference).

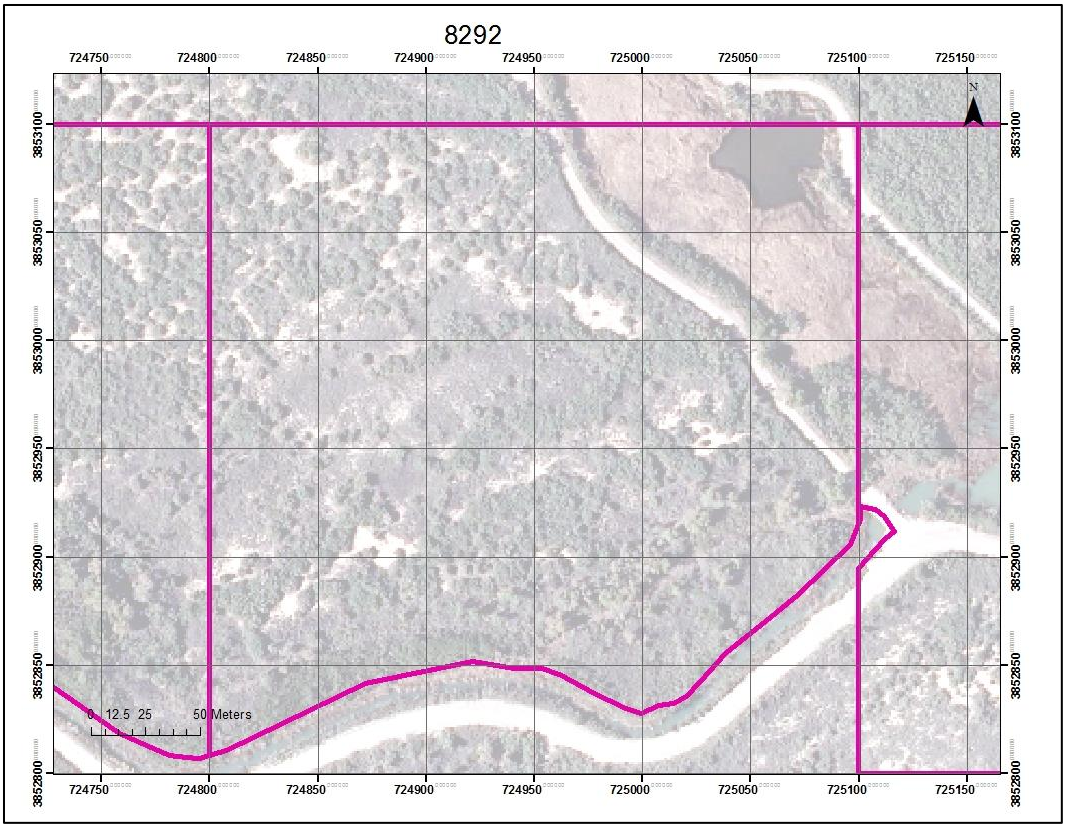


Figure 2-3.—Example of a bird survey plot map with grid, including aerial imagery for reference.

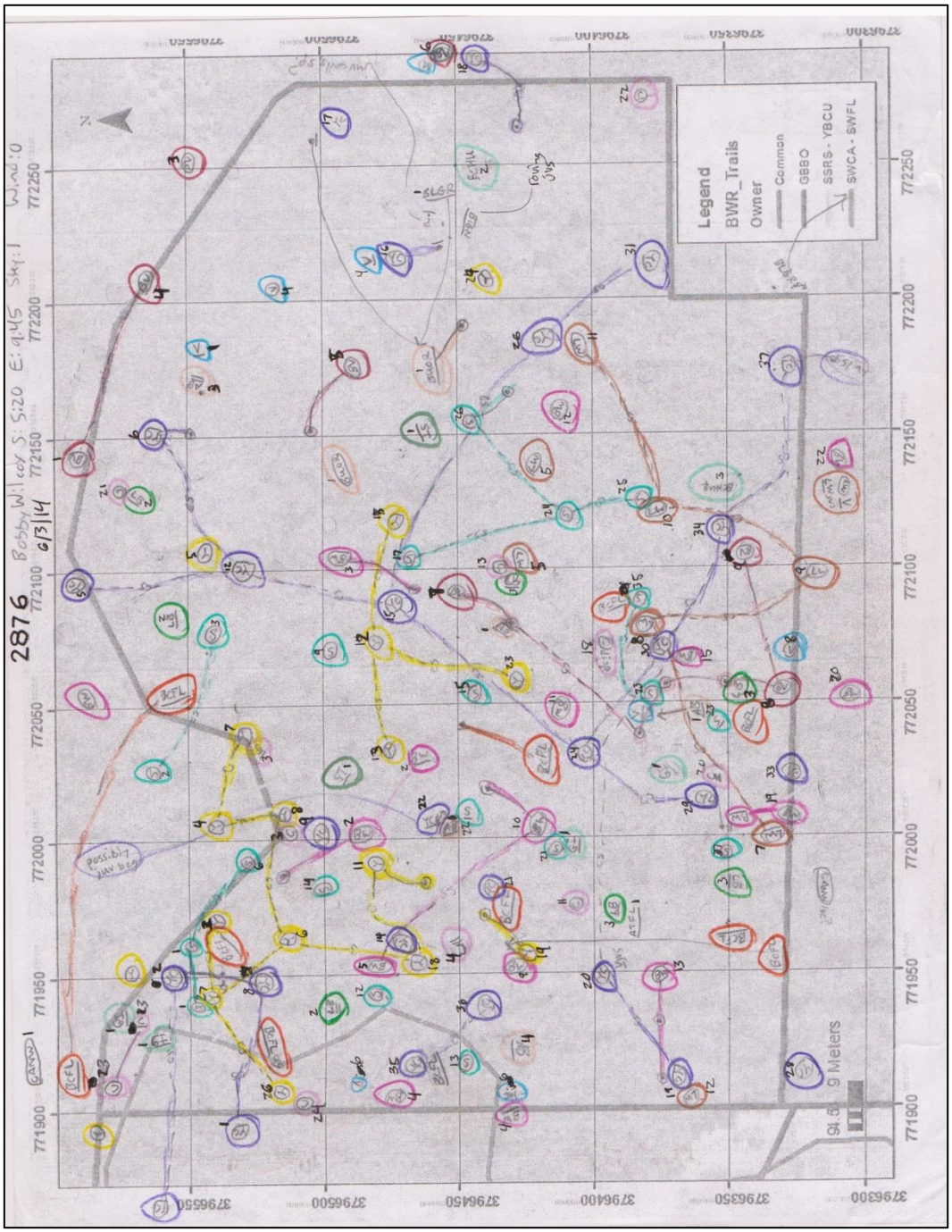


Figure 2-4.—Example of a filled-out bird survey plot map from a rapid area search.

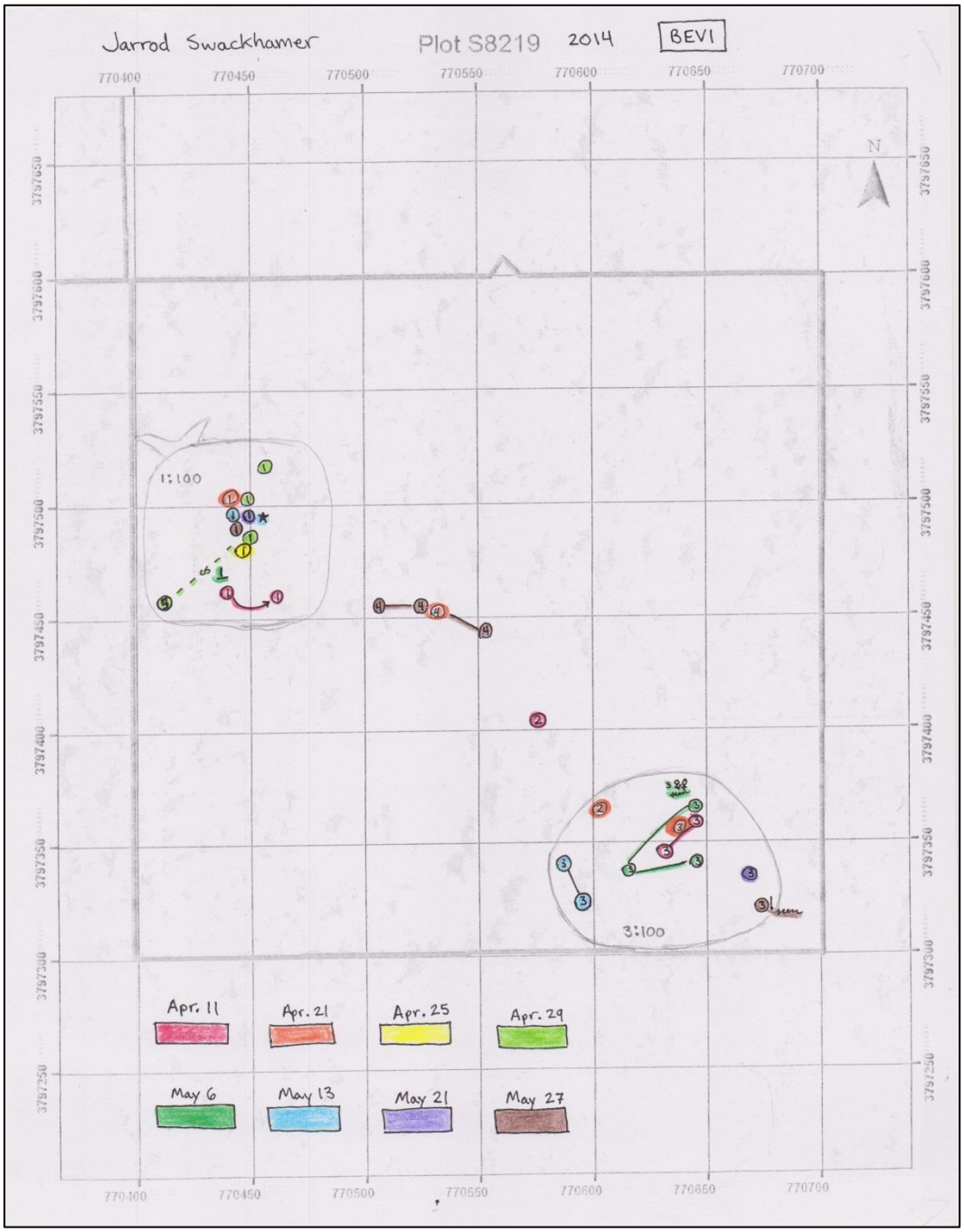


Figure 2-5.—Example of a species territory map (Arizona Bell's vireo) compiled at the end of an intensive survey effort for each species on the plot.

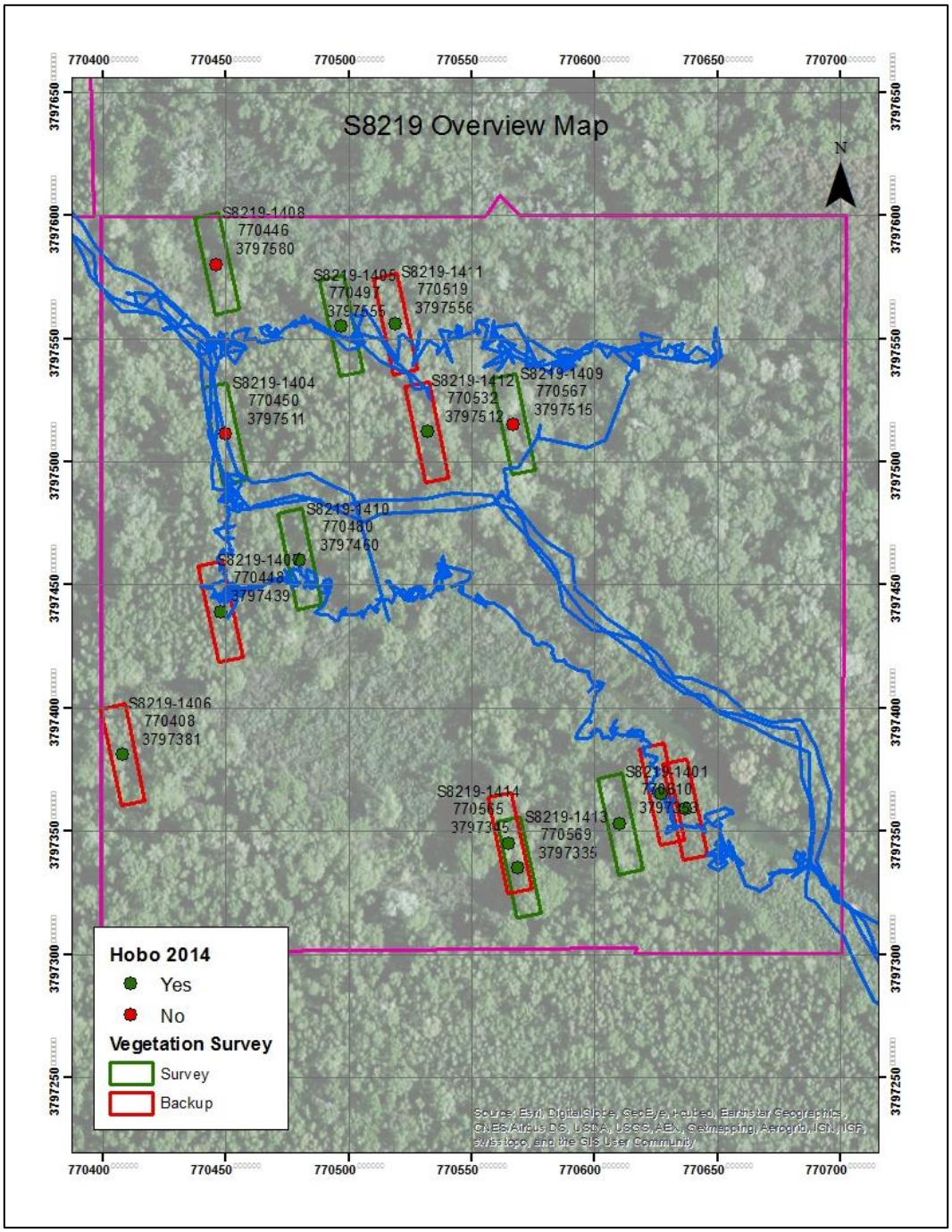


Figure 2-6.—Overview vegetation plot map.
Vegetation plots outlined in green were first selected and surveyed, and plots outlined in red were alternate plots. Bird survey plots are outlined in pink, and the trails created to access the plots are blue lines.

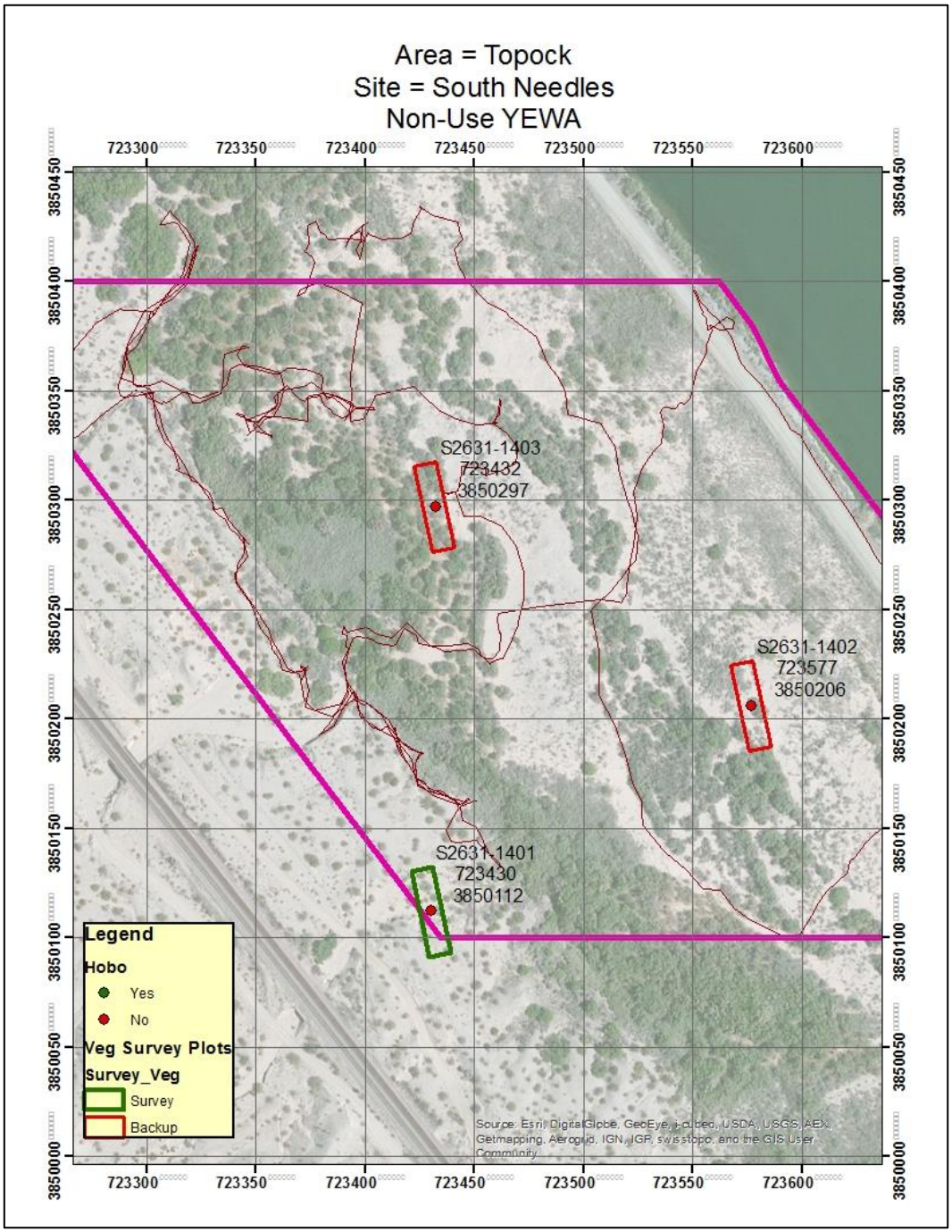


Figure 2-7.—Example of a vegetation plot map within a bird survey plot.
Vegetation plots outlined in green were surveyed, and those outlined in red were alternate plots. Bird survey plots are outlined in pink, and the trails created to survey the plots are red lines.

ATTACHMENT 3

Access Data Entry Protocol

Access Data Entry Protocol

1. Open database in Microsoft Access 2010.

2. There will be a security warning bar across the top of the window – click on the "Options" button, then the button for "Enable this Content," and press "Enter."

3. Now you can begin using the database.

4. Click on the top button for "Surveys."

    - This is where you will add each of the plots that you are surveying this season.
    - This only needs to be done once for each plot – after the first time, you will be able to select your plot from a list.
    - Click the "Add" button.
    - A new screen titled "Survey Editor" will pop up.
    - The first two boxes are grayed out – meaning that you will not enter anything in them, and the program will auto-fill them later.
    - Next, select the type of survey you will be doing on this plot – will you be doing rapid (RAP) or intensive (INT)? Remember, this is the type of survey YOU are doing on the plot (not is it an INT overall or not).
    - Next, select your name from the surveyor drop-down – All your names should now be in the database, but if not, all you need to do is go into the "Surveyors" tab and then click on "Add." A box will then appear where you can fill in your information.
    - Next, hit the "Section" button to find your plot: Use the naming conventions Excel file found in the "LCR Crew Files 2014" folder in Dropbox. Within the naming conventions Excel sheet, you will first find your plot and determine which "Area" and "Site" this plot occurs. Then, within the Access database, you will find your "Area" from the drop-down list and click on it, which will then pull up a box showing "Sites" within that "Area." Click on your "Site," and another window will appear that should contain your "Section" (your plot).
    - Next, enter the beginning date: Beg date = the first date that you survey the plot.
    - Next, enter the end date – for this year, we will use June 15 for all plots.

- In the Data entry box, you will also enter your initials.
- "Notes" is for any notes about the plot as a whole during the whole season, such as a fire on the plot, a construction project, access issues, etc.
- Finally, make sure that all you have entered is correct and save and leave the window.
- You will see all of your plots now in the "Surveys View" window. You can now close this window.

5. Within the main list of tabs, click on the third button for "Events."

- Here you will add basic information about your survey of a plot on a certain date.
- Within the "Events View" window, select the plot that you have surveyed on this day.
- Enter the data that you collected for that survey (should be the same date that you are doing the data entry and that you conducted the survey).
- Enter the sky and wind codes using the drop-down list.
- Enter the time in (start time of your survey) and time out (end time of your survey). You can right click in the white box for these to see the clock (this is the fastest method of entering the time). Otherwise, you need to enter it with a colon.
- The last two boxes in this window are grayed out. The "Breeders" and "Non-breeders" boxes will be updated automatically once bird data are entered for that plot.
- Finally, make sure that all you have entered is correct and save.
- Now, within the "Events View" window, you can click on the event that you just entered, and the " Breeders" and Non-breeders" buttons will be available for use at the bottom of this window.

6. Next, you can enter the non-breeders. Click on the fourth button, the "Non-breeders" tab at the bottom of the "Events View" window.

- Press the "Add" button to enter new data.
- Press the "Species" button to enter the species. Select a species by clicking on the blue box to the left of the species name and scrolling through the list until you find the species you wish to enter. You can also start typing the four-letter code in the box at the bottom.

- Next, use the drop-down to select your plot and the correct date for the "Surveyor-Event"– or, if you started in the "Events View" window, this should already be filled in.
- Next, enter the number of males, females, unknown sex, independent young, flyovers, and incidentals. Each individual should be in only one of these six categories (e.g., we are not sexing young, flyovers, or incidentals.)
- If you have notes for yourself about that species for that survey, enter them here.
- Check your work and save.
- Repeat these above instructions for each non-breeding species you recorded for your plot.
- Finally, you will enter your pairs under the "Breeders" button in the "Events View" window. Make certain that the plot you wish to enter data in is highlighted – if not, the "Breeders" and "Non-breeders" tabs will not be available for editing. Click to add a new male/pair/family group that is a potential breeder on the plot.
- You will have already highlighted all of one species on your field map with one color, numbered the male/pair/family groups, and started your species map at this point (see "Area Search Protocol" for detailed instructions).
- Click the "Species" button to add the species. Remember to click the blue box to the left of the species name to select it.
- The event should already be filled in since you can only select the "Breeders" and "Non-breeders" tabs when you are highlighted on a specific event within the "Events View" window. Make sure the event that has been automatically filled in is correct.
- Within the "Territory in" box, please select "TIOpen" (meaning not determined) until the end of the season.
- If it is a non-territorial species, please check the "Non-territorial" box – the non-territorial species for this project are: white-winged dove, mourning dove, Eurasian collared-dove, rock pigeon, brown-headed cowbird, European starling, Gambel's quail, ring-necked pheasant, greater roadrunner, red-winged blackbird, yellow-headed blackbird, great-tailed grackle, house finch, and house sparrow. Also, birds that breed in rookeries or colonies: cliff swallow, black-crowned night-heron, snowy egret, great blue heron, great egret, cattle egret, double-crested cormorant, and white-faced ibis.

- Breeding justification will need to be filled in at the end of the season.
- Check your work and save.
- **IF YOU HAVE MULTIPLE RECORDS FOR THE SAME SPECIES, CLICK SAVE AND ADD, AND YOU CAN ENTER THEM ALL AT ONCE!!**
- REMEMBER – it is critical that you enter the male/pair/family groups in the same order as you numbered them on your maps because at this point the database will auto-number the male/pair/family groups you just entered.

7. Once you have added in your species, click on the pair you just entered.

8. Next, click the "Details" button to add the breeding information about the male/pair/family group you just entered.

    - Click the "Add" button to add new information on that pair from that day's survey.
    - Select the correct "Survey-Event" (plot and date) from the drop-down list.
    - Add the number of birds you saw associated with that male/pair/family group. Use the "Tab" or "Enter" keys to move through the boxes quickly.
    - Next, click on the "Attribute" button to add observed behaviors. Please add all the behaviors that you observed on that survey and press the "Save" button.
    - Add any notes (that you think might be useful in determining whether or not that bird bred on your plot) about that male/pair/family group on that date only.
    - Check what you have entered and press "Done" when you are finished.

That is it…until the next survey.

Second rapid:

1. After performing the second survey of your rapid plot, you will need to try and determine if the birds you saw on your first visit are the same birds that you had on your second visit. You can do this by matching up your maps (as much as you can) from the two visits.

- This should be possible for most potential breeding species on your plots such as woodpeckers, flycatchers, warblers, etc. In some situations, it is just too crazy to match up every pair a month later (prime example being song sparrow [SOSP] at the Bill Williams National Wildlife Refuge where there are 20–50/plots, so in those extreme cases, just match up as best you can – it does not need to be perfect.) The important thing is to make sure that you ultimately enter the correct number of "Territory in" numbers for each pair.

2. Once you have determined the birds that were present on both your first and second visits, go into your Access database and find those birds within the "Pairs View" window.

3. Within this window, highlight the pair you wish to add the second visit's data to (for example, COYE1).

4. Highlight this pair and then click on the "Details" tab at the bottom of the window.

5. The "Pairs Details" window will appear, showing you the data you entered on your first visit.

6. You then will click on the "Add" button to add information about this pair that you observed during your second visit.

7. Non-territorial species will be entered the same way as the breeders you had on both visits.

   - So, for example, if you had a white-winged dove (WWDO) on your first visit, find that bird within the "Pairs View" window, highlight it, and then click the "Details" tab and add data for that date.

8. The non-breeders will be entered the same way as you entered them for your first visit. Just make sure that you are within the correct event – so, in this case, your second visit is highlighted within the "Events View" window. This way, your non-breeders will be tied to that date.

9. To enter new birds (i.e., birds you didn't record on your first survey), first make sure you are in the correct date. WITHIN THE "EVENTS VIEW" WINDOW, CLICK ON THE EVENT FOR THE SECOND SURVEY DATE BEFORE YOU START ENTERING YOUR NEW BREEDERS FOR THAT VISIT. This will allow the birds you observed on the second visit to be tied to that "Event." Next, enter any new **non**-territorial species within the "Events View" window for that second survey.

Now that you have entered all your pairs and determined whether or not the pair was observed on the previous visit, you are now ready to go back and fill in the percentage of the territory within the plot as well as the justification for determining that the pair was breeding within your plot. **This must be filled in for every bird you recorded within the database.**

1. In the "Pair Editor" window, fill in T000–T100. Do not leave the "Territory in" box as TIOpen.

2. Within the same window, the "Pair Editor" window, fill in the "Breeding Justification" box: The number and short code will appear in the data forms. The long code does not show up. The codes will only appear for the respective survey types. For example, you won't see "Probable Evidence Local" when the survey type selected is intensive, but "Observed Confirmed" will show up in all survey types.

Number	Short	Survey type	Long
BJ0000	No Justification Required	RAP INT	No justification required.
BJ0001	Observed Confirmed	RAP INT	For rapid and intensive – observed confirmed breeding evidence.
BJ0002	On Territory Consecutive	INT	For intensive – observed the bird/pair "on territory" the required number of surveys **in a row** (three times in a row).
BJ0003	On Territory Season	INT	For intensive – observed the bird/pair "on territory" the required number of times **during the season** (five times in a season).
BJ0004	Probable Evidence Local	RAP	For rapid – observed probable evidence at least one time **for known local breeders** within the LCR MSCP planning area (e.g., ABTO, VERD, etc.). Late-arriving breeders such as YBCH, BLGR, etc., will probably fall in this category if they are only seen on your second survey.
BJ0005	Probable Evidence Both	RAP	For rapid – observed probable evidence at least two times **for birds that are both migrants and breeders** within the LCR MSCP planning area (e.g., YWAR, COYE, BUOR, WEKI, BLGR, etc.) SEE ANNOTATED LIST OF BREEDERS IN DROPBOX.
BJ0006	No Standard Scenarios	RAP INT	For rapid and intensive – called it breeding but does not fit any of the standard scenario explanations in notes. MUST PROVIDE A DETAILED EXPLANATION IN THE NOTES FOR THIS PAIR!! **Examples:** Marsh birds, secretive birds, and intensive pairs that are there most of the season but do not quite make the 3/5 rule…etc.

3. Please make sure your “Details” window is filled in for each event with a number of birds and all the relevant attributes.

For your intensive final surveys:

Similar methods as described above for your rapid second visit will be followed for subsequent visits to your intensive plots. The most important thing to remember is **to enter any new birds you record for that specific visit under that event**.

1. For subsequent visits to your intensive plots, you will enter your event information in the “Event” tab (i.e., date, weather, etc.), and while still within this event, you will enter any new breeding territories and non-territorial species that you recorded for that day/event.

2. That event is highlighted when you are entering your bird data for that specific date. Those birds are then linked to that event as the first time you recorded that individual bird’s territory.

3. For species you observed on earlier visits, you will simply find that bird within the “Pairs View” window and add information for that specific date within the “Details” tab.

4. Once you have entered all of your final survey data (eighth visit), you are then ready to determine the percentage of the territory within the plot as well as the justification for determining that the pair was breeding within your plot. **This must be filled in for every bird you recorded within the database.**

5. In the “Pair Editor” window, fill in T000–T100. Do not leave the “Territory in” box as TIOpen.

6. Within the same window, the “Pair Editor” window, fill in the “Breeding Justification” box: The number and short code will appear in the data forms. The long code does not show up. The codes will only appear for the respective survey types. For example, you won’t see “Probable Evidence Local” when the survey type selected is intensive, but “Observed Confirmed” will show up in all survey types.

ATTACHMENT 4

Geographic Information System (GIS) Data Entry Protocol

GIS Data Entry Protocol

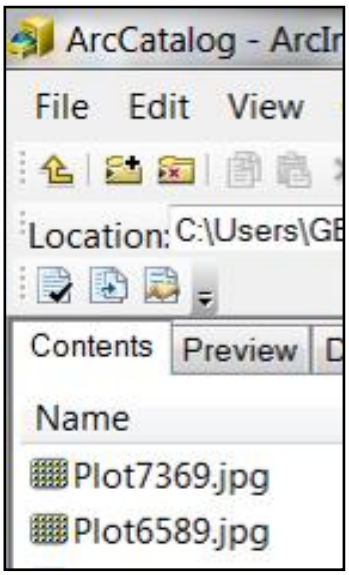
How to digitize species maps in ArcMap10:

1. **Note**: Remember, in all GIS work, no spaces! Please use the _ where you may be tempted to put in a spa or wacky symbols – use just letters and underscores.

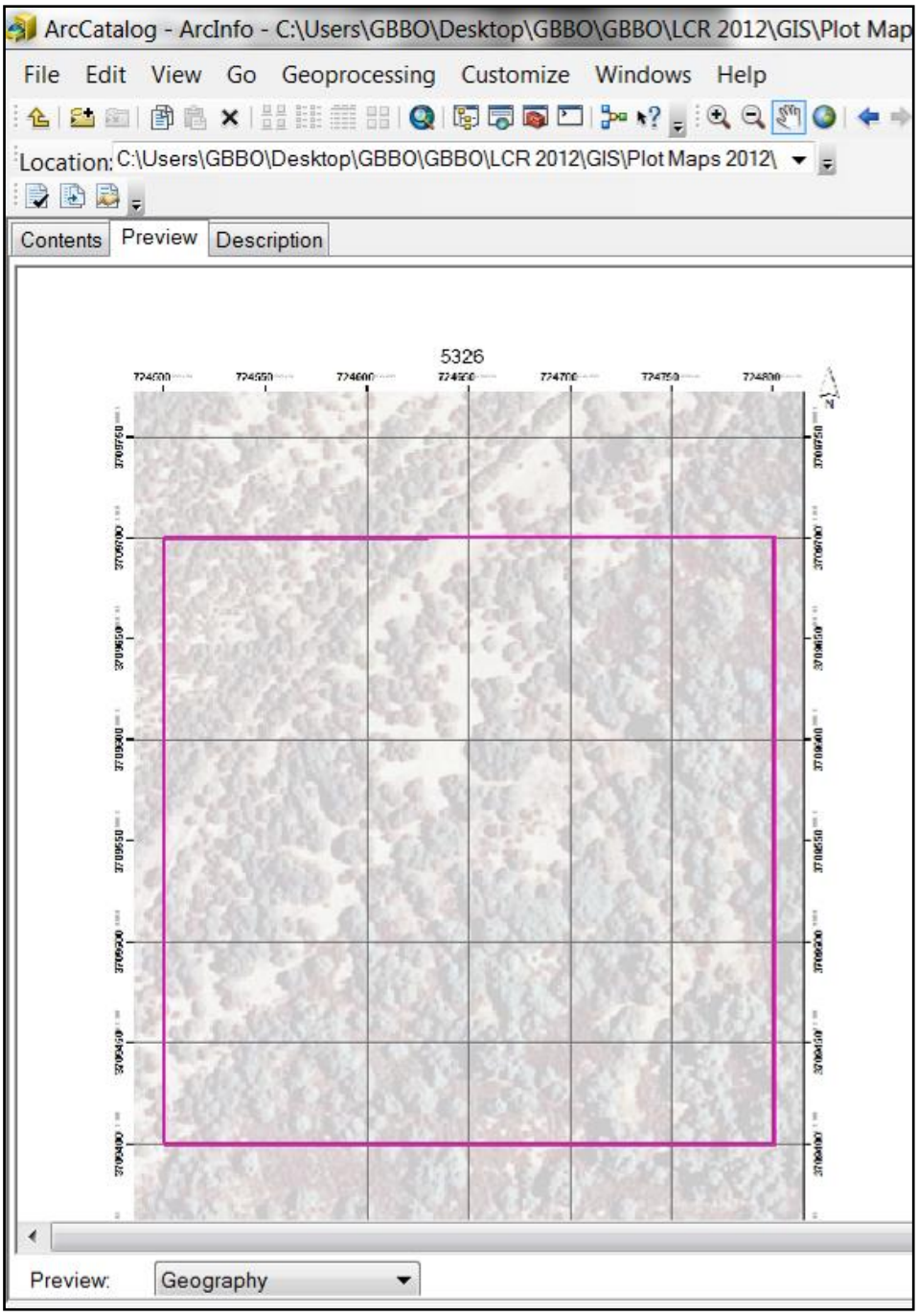
2. Find your personal map project in your folder in Dropbox

3. Once you have opened your map project, you need to open ArcCatalog (button looks like a yellow file cabinet with a globe in it).

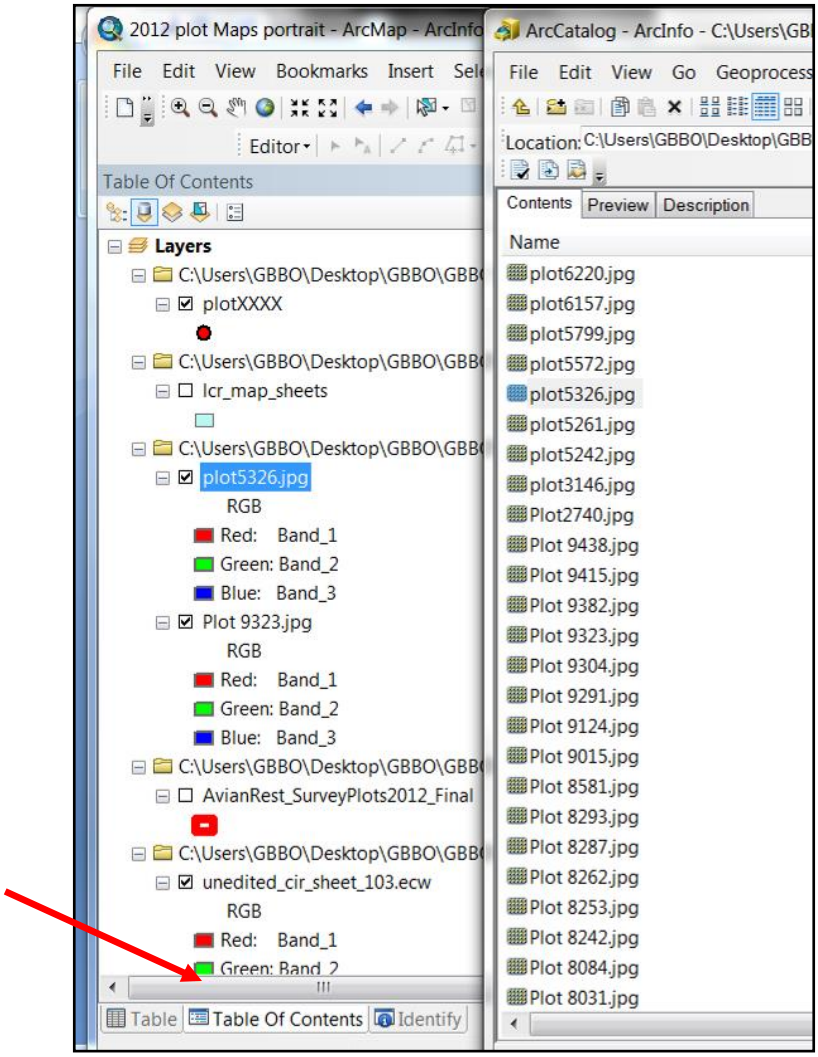
   a) Find the scanned map (.jpg) of your plot



b) Preview the image to make sure it is compatible.

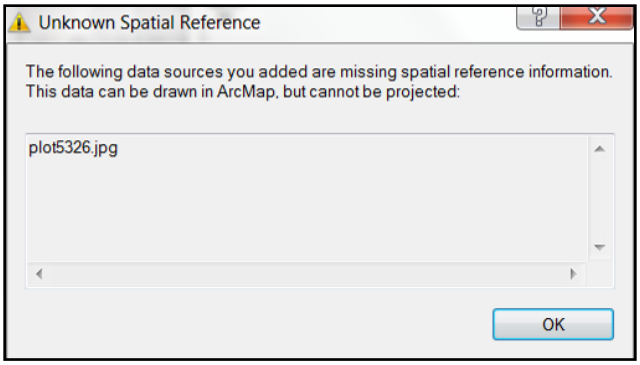


4. Drag the file into the project (Note: ArcMap10 will only allow you to drag the file into the project when the "Table Of Contents" tab is open under "Layers." See figure below and red arrow).



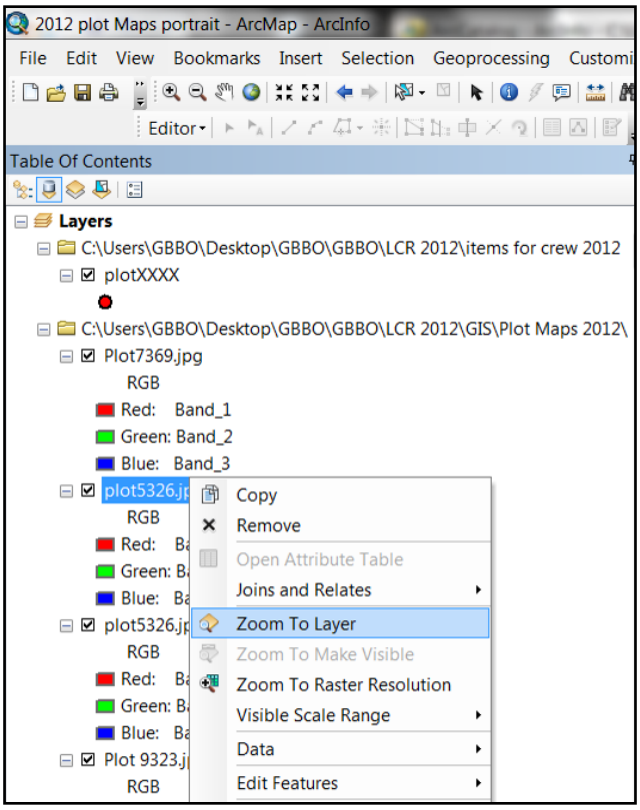
5. If a dialogue box appears that asks if you want to add pyramids, click "No".

6. Next, there should be a message that says that the layer is not georeferenced – this is good (we are going to do the georeferencing ourselves!)



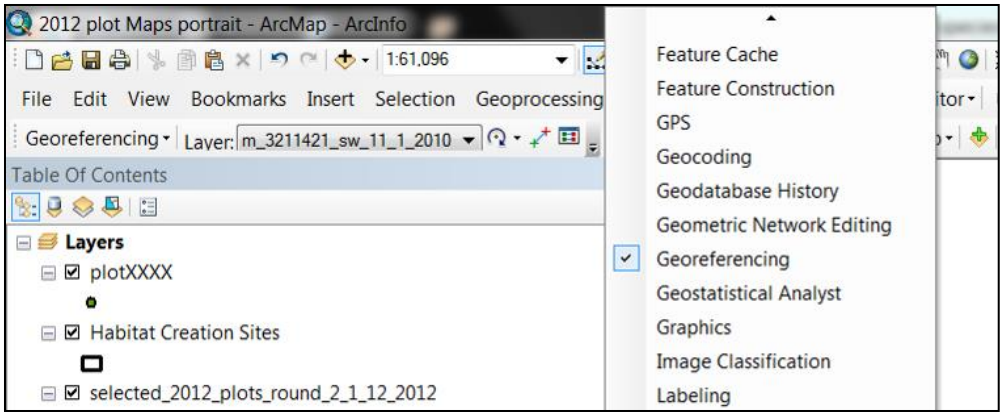
Be patient – after you drag the file into the map project, it will take several moments for the file to show up.

7. When it does appear, the file will be on the left side of the screen under "**Layers**." If you do not see the imagery on the right side of the screen (where you should see your plot map), right click on the name of the file you just imported and click on "Zoom To Layer."



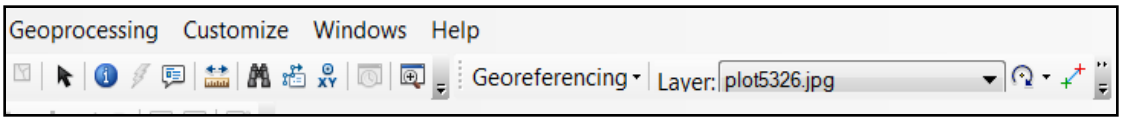
Now, you are ready to start digitizing.

8. If it doesn't appear at the top of your map project already, you will need to add the georeferencing toolbar. Right mouse click at the top of the screen or map project in the area where the other toolbars are located. After you right click, a box will open, listing every possible toolbar you could add to your map project.

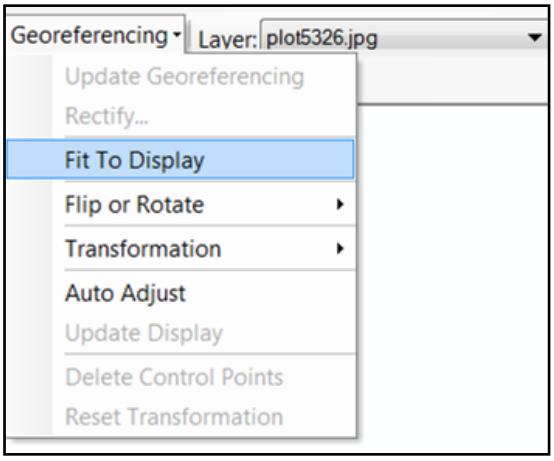


They are listed alphabetically, so scroll to "Georeferencing" and check next to the item. Once you check "Georeferencing," the box will disappear, and the toolbar should have been added somewhere at the top of your map project.

9. In your project, make sure the correct target shows up in the "Layer" box (so in this example, we are georeferencing plot 5326). If not, click on the down arrow and find your plot map in the list.



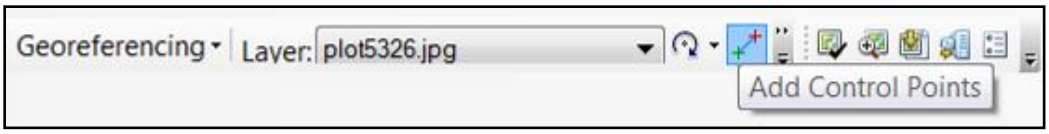
10. In the "Georeferencing" toolbar, go to "Fit To Display."



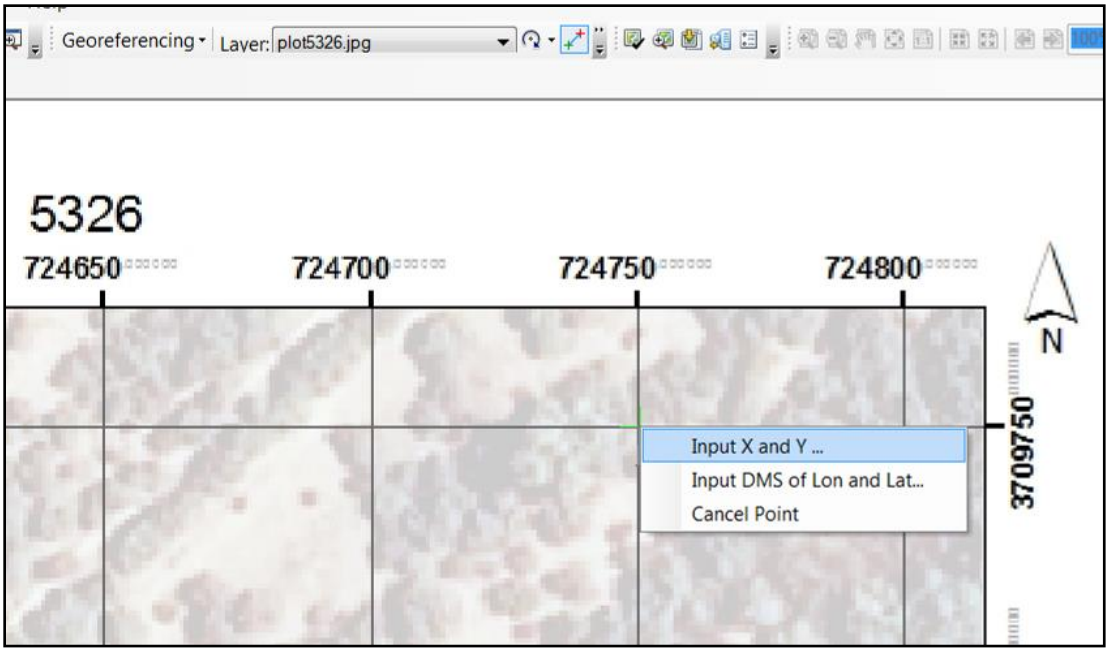
11. Use the + button to zoom into a corner of your plot – when you zoom in, use the magnifying glass with a plus

Zoom in enough so that you can read the Universal Transverse Mercators (UTMs) down each side. Best practice is to zoom into where you can see 1/4 of your plot map sheet on the screen.

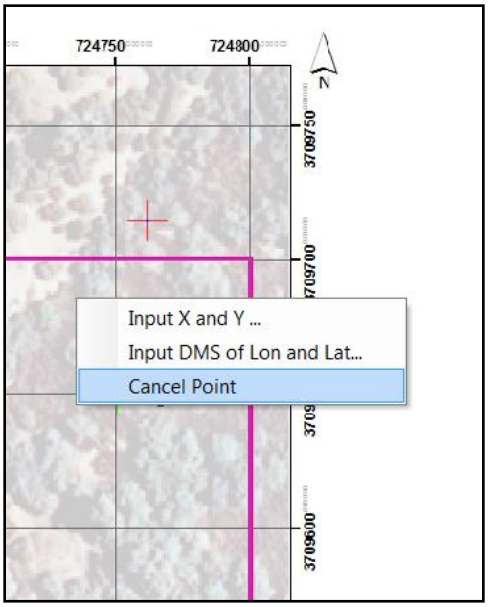
12. Next, click on the control point tool (a green **X** connected to a red **X**, shown below).



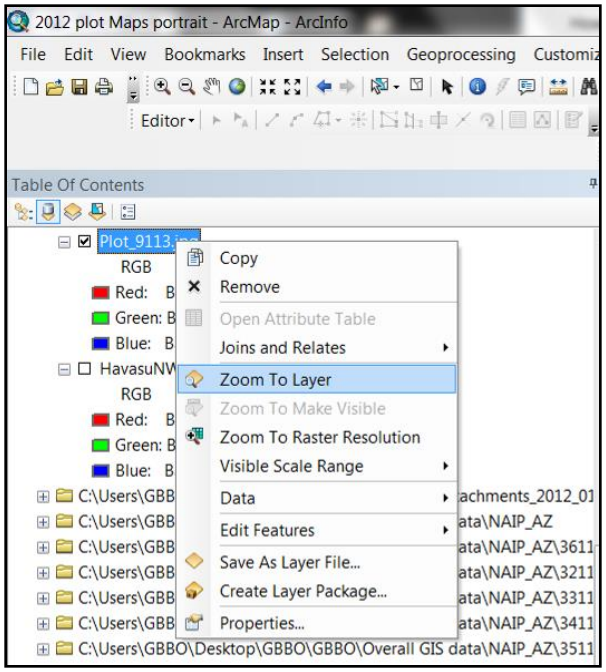
13. Use the "Control Point" tool to line up with a plot corner – or any point that you can label the UTMs correctly – be as exact as possible. Then, left click on the point.



14. Next, without moving the mouse, right click, select “Input X and Y,” and input the correct *x* and *y* coordinates (or the UTMs) – you should be pretty close. If you accidently add a point in a location where it was not supposed to be, simply right click and select “Cancel Point.”



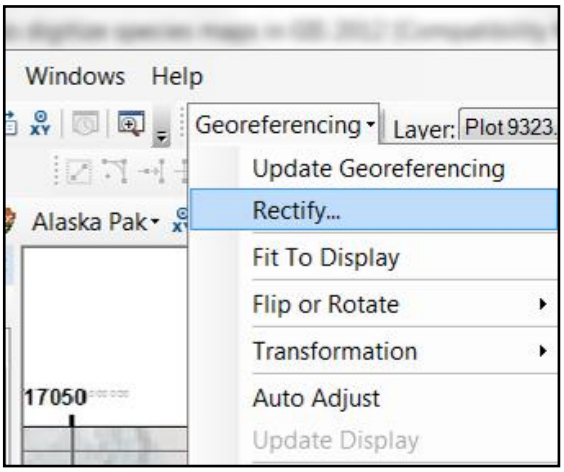
15. If the image of your map disappears after you enter the first set of UTM coordinates, don’t be alarmed – this is normal because you are starting to orient the image spatially. To get back to your image, go to the left side of the screen and right click on the title of your plot map and select “Zoom To Layer.”



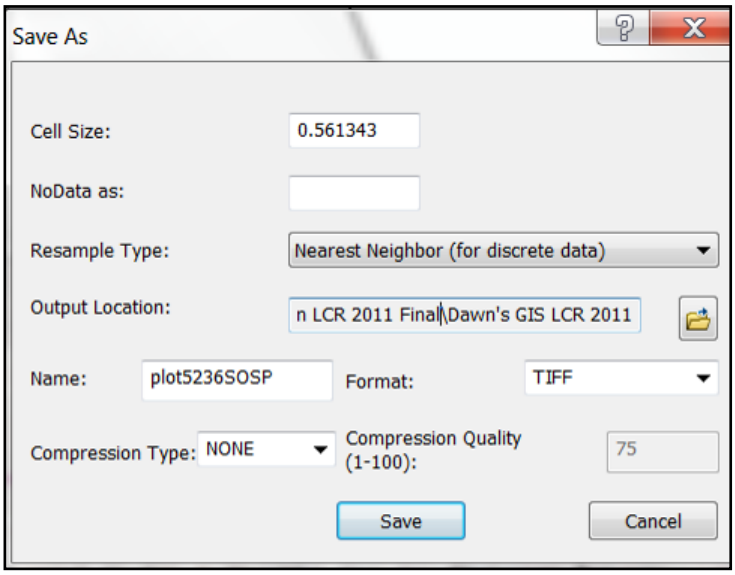
16. Repeat adding the control points for 2–4 corners of your plot map until it lines up with the plot outline.

17. If you want to save this georeferenced map to come back to later, you will need to rectify it. Otherwise, skip to step 22.

18. After you have added the control points for the four corners, go to the "Georeferencing" toolbar and select "Rectify."



19. In the "Rectify" save window, ignore the "Cell Size" and "Nearest Neighbor" – these are both fine. Give the file a new name (the plot number and species), show it where to save (your folder), and then click "Save."



20. This will take several minutes – a window will pop up that shows the progress of this new file saving.

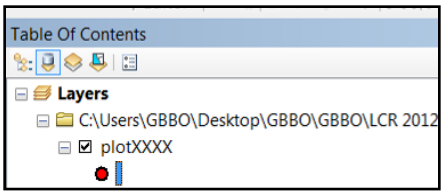
21. The last step in this process is to click the “Add Data” button and add the .tiff file you just saved to the project…the “Add Data” button is a black plus sign with a yellow background.

Next, it’s time to add the bird locations to the shapefile we created for you.

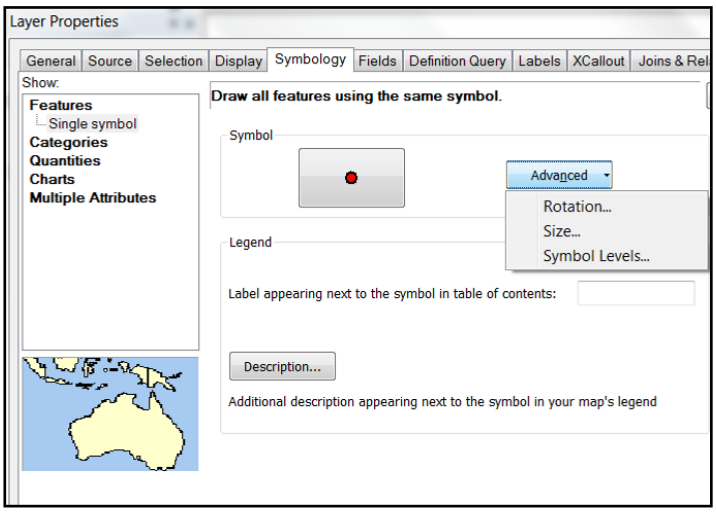
22. Open ArcCatalog. Select your folder and find the shapefile.

23. Drag this shapefile into the map project, or you can also use the “Add Data” black and yellow button shown below to add the shapefile.

24. You should see the shapefile show up on the left side of the screen – it will have a symbol under the name – it should be a colored dot.

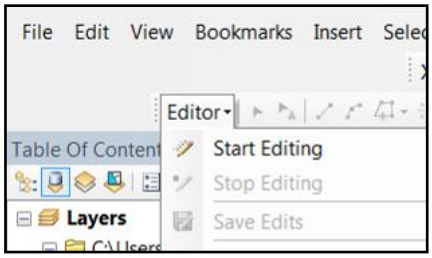


25. You may want to make this dot/point easier to see by making it larger and red or something that stands out – to do this, right click on the dot and you can change the color. To change the size, right click on the name of the file, scroll down to the bottom, and select “Properties.” Then, click on the “Symbology” tab, then “Advanced,” and you can change the symbol, size, and color.

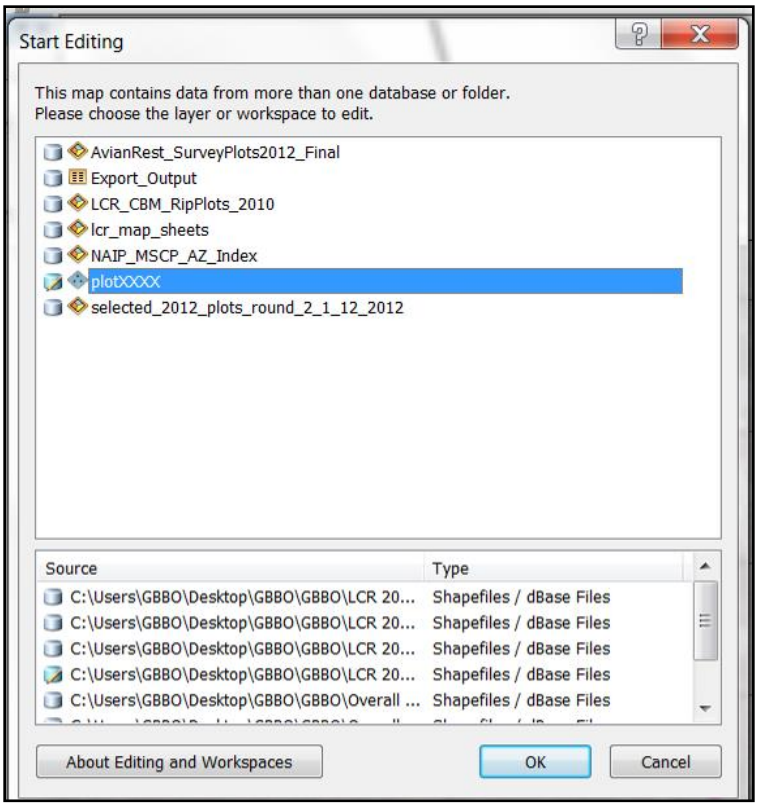


26. Go ahead and close ArcCatalog – it will need to be closed to do some of the steps later on.

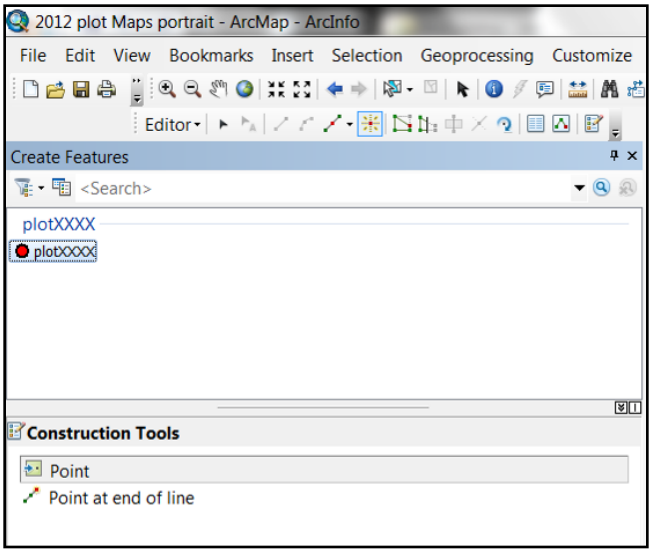
27. Next, you are ready to edit the layer – while you are editing, you will frequently need to "Start Editing" and "Stop Editing"– these two choices are found under the "Editor" toolbar. If you do not see the "Editor" toolbar at the top of your map project, you may need to add the toolbar. To add the toolbar, right click at the top of the project, and a window will appear, listing the various toolbars that can be added to the project. Make sure the "Editor" function is checked.



27. Start your editing session by selecting "Start Editing" from the "Editor" toolbar. In the window that pops up, click on your plot name and then click "OK."



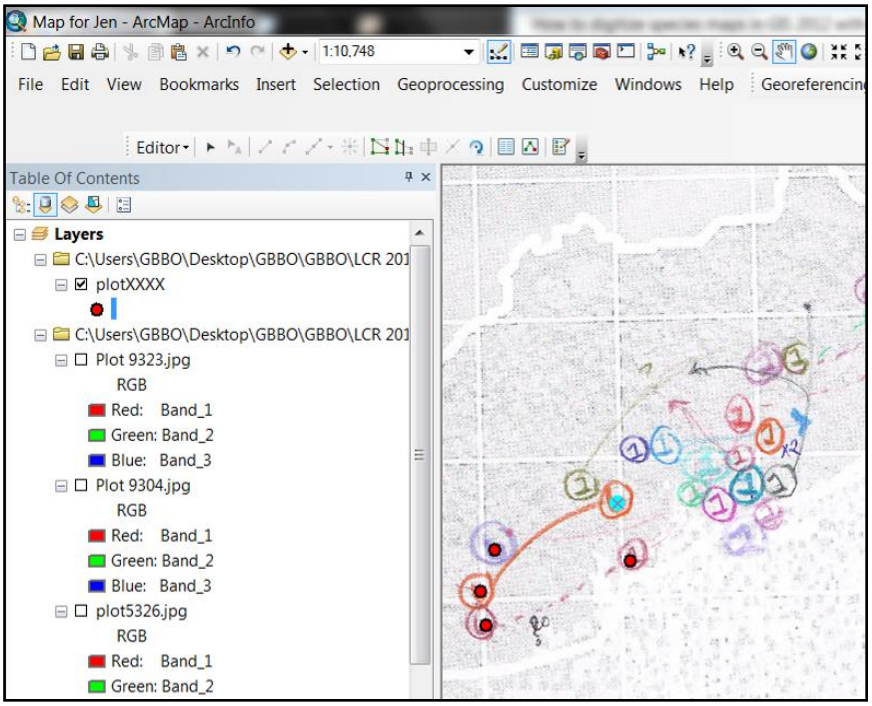
29. Then, a box will appear on the left-hand side of your screen that says "Create Feature," and it will have your shapefile listed.



30. Click on the "Point" tool.

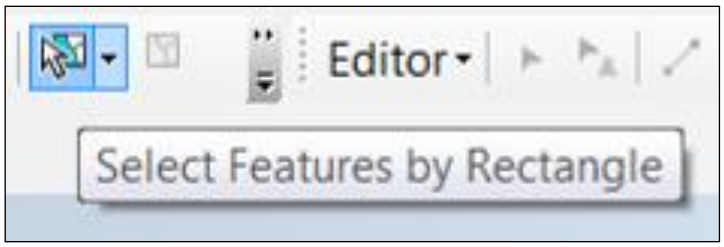
You will use this tool to move around the map and click on bird locations to make point data on the map (e.g., the individual bird locations.)

31. Click on all the points you have for one pair/individual. These clicks will leave behind points of the size and color you selected – except for the last one you click – it will remain light blue.



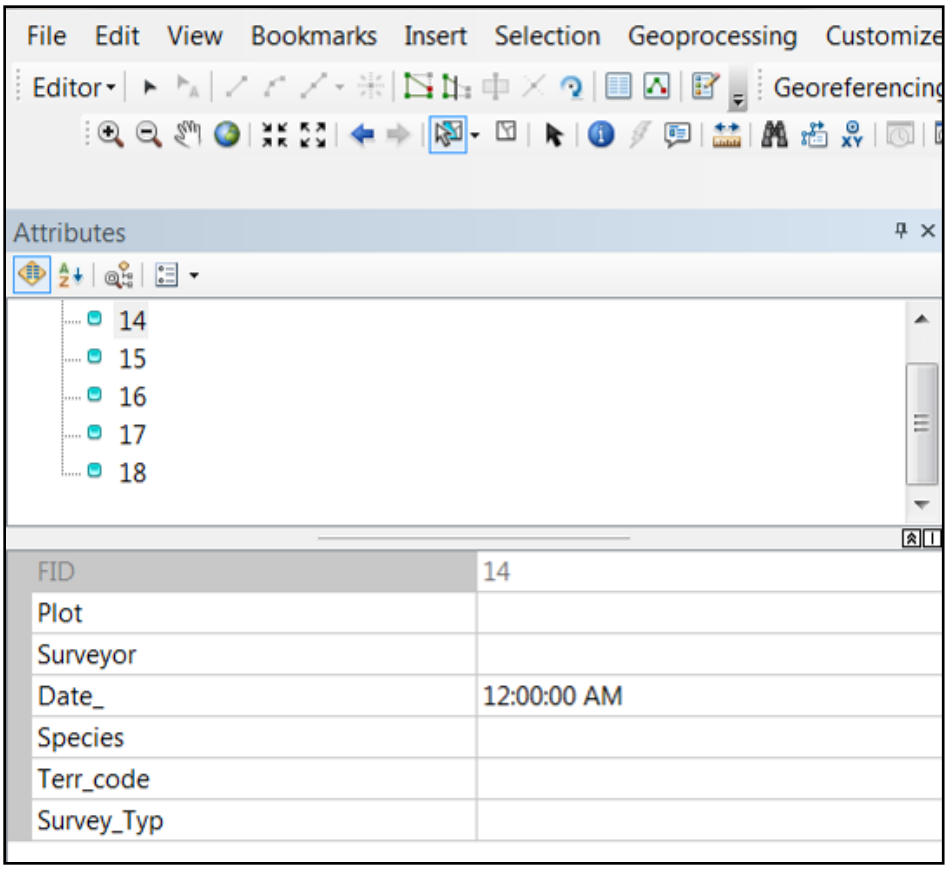
32. After you have clicked on several points (e.g., all the locations for SOSP1), you might want to start entering information for the points you just created.

33. To add information about the points you just created, go to the “Select Features by Rectangle” tool.



34. Using this tool, highlight the points on your map.

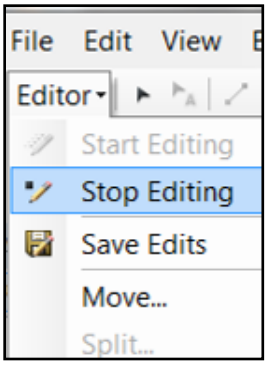
35. Once points are highlighted, click on the table button located in the toolbar at the top of your map project. The attribute window shown below should appear.



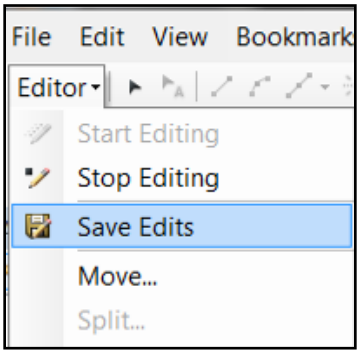
36. Highlight the point that you want to edit (Note: You can do batch edits by highlighting all the numbers). Once highlighted, your selection will turn light blue. In the example above, we are only editing number 14.

37. Now you can start adding data to this attribute table – click in the boxes to add data.

38. Next, go to the “Editor” button and choose “Save Edits.” If you do not save and stop editing, your work will be lost.



39. You can now go to the “Editor” tab and select “Stop Editing.” The layer changes should be saved!



ATTACHMENT 5

Comprehensive Species List

Table 5-1.—Comprehensive species list from component 1 avian surveys conducted along the lower Colorado River in 2014 (Species are listed in alphabetic order of common name. Scientific names available in GBBO 2010, 2011.)

Species (n = 215)	Rapid				Intensive				Flyovers: all sites
	Detected, not confirmed breeding		Breeders		Detected, not confirmed breeding		Breeders		
	System-wide	Conservation and habitat creation area	System-wide	Conservation and habitat creation area	System-wide	Conservation and habitat creation area	System-wide	Conservation and habitat creation area	
Abert's towhee		X	X	X		X	X	X	X
American avocet	X								X
American bittern		X							X
American coot	X	X	X	X	X		X		
American kestrel	X	X	X	X				X	X
American pipit	X	X				X			X
American redstart		X							
American robin		X			X				X
American white pelican	X								X
American wigeon	X								X
Anna's hummingbird	X	X	X	X	X	X		X	X
Ash-throated flycatcher	X	X	X	X			X	X	X
Audubon's warbler	X	X			X	X			X
Baird's sandpiper	X								
Bank swallow	X	X			X				X
Barn owl				X					
Barn swallow	X	X			X	X			X
Bell's vireo	X	X	X	X	X		X	X	
Belted kingfisher	X		X		X				X

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	Detected, not confirmed breeding		Breeders		Detected, not confirmed breeding		Breeders		
	System-wide	Conservation and habitat creation area	System-wide	Conservation and habitat creation area	System-wide	Conservation and habitat creation area	System-wide	Conservation and habitat creation area	
Bewick's wren	X	X	X	X	X		X		
Black phoebe			X	X		X	X		
Black rail			X						
Black-and-white warbler	X	X							
Black-chinned hummingbird	X	X	X	X	X		X	X	X
Black-crowned night-heron	X	X	X		X				X
Black-headed grosbeak	X	X			X	X			X
Black-necked stilt	X	X	X	X	X				X
Black-tailed gnatcatcher	X	X	X	X		X	X	X	
Black-throated gray warbler	X	X							
Black swift	X								X
Black tern	X								X
Blue grosbeak	X	X	X	X	X		X	X	
Blue-gray gnatcatcher	X								
Blue-winged teal		X							
Brewer's sparrow	X	X			X	X			
Brown-crested flycatcher			X	X	X		X	X	
Brown-headed cowbird	X	X	X	X	X	X	X	X	X
Bufflehead					X				

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	System-wide	Conservation and habitat creation area	System-wide	Conservation and habitat creation area	System-wide	Conservation and habitat creation area	System-wide	Conservation and habitat creation area	
Bullock's oriole	X	X	X	X	X		X	X	X
Burrowing owl	X								
Cactus wren	X		X		X				
California gull	X								X
Canada goose	X	X							X
Canvasback	X	X							X
Canyon wren			X		X		X		
Caspian tern	X	X							X
Cassin's vireo	X	X			X	X			
Cattle egret	X	X							X
Cedar waxwing	X	X			X	X			X
Chipping sparrow	X	X				X			
Cinnamon teal	X	X			X				X
Clapper rail			X	X			X		
Clark's grebe			X		X				
Clay-colored sparrow		X							
Cliff swallow	X	X	X		X	X			X
Common/Forster's tern	X								X
Common gallinule			X	X			X		

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	Detected, not confirmed breeding		Breeders		Detected, not confirmed breeding		Breeders		
	System-wide	Conservation and habitat creation area	System-wide	Conservation and habitat creation area	System-wide	Conservation and habitat creation area	System-wide	Conservation and habitat creation area	
Common ground-dove		X	X	X					
Common loon	X	X			X				X
Common poorwill		X							
Common raven	X	X	X	X	X	X	X		X
Common yellowthroat	X		X	X			X	X	
Cooper's hawk	X	X	X		X	X	X		X
Costa's hummingbird		X	X	X	X			X	
Crissal thrasher			X	X			X	X	
Double-crested cormorant	X	X			X				X
Dusky flycatcher					X				
Eared grebe	X								
Eurasian collared-dove	X	X	X	X		X	X	X	X
European starling	X	X	X	X		X			X
Forster's tern	X								
Gadwall	X	X							X
Gambel's quail	X	X	X	X			X	X	
Gambel's white-crowned sparrow	X	X				X			
Gila woodpecker	X	X	X				X	X	
Gilded flicker	X		X						

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	Detected, not confirmed breeding		Breeders		Detected, not confirmed breeding		Breeders		
	System-wide	Conservation and habitat creation area	System-wide	Conservation and habitat creation area	System-wide	Conservation and habitat creation area	System-wide	Conservation and habitat creation area	
Gray flycatcher	X					X			
Great blue heron	X	X	X		X	X			X
Great egret	X	X	X	X	X	X			X
Great horned owl	X	X	X	X	X		X	X	X
Greater roadrunner	X	X	X	X			X		
Greater scaup					X				
Greater/lesser scaup					X				
Greater yellowlegs	X	X							X
Great-tailed grackle	X	X	X	X	X	X	X	X	X
Green heron	X	X	X	X	X		X		X
Green-tailed towhee	X	X			X	X			
Green-winged teal	X								
Hammond’s flycatcher	X	X			X	X			X
Hammond's/dusky flycatcher	X								
Hermit thrush	X	X			X	X			
Hermit warbler	X	X							
Hooded oriole	X	X	X						X
Horned grebe	X								
Horned lark	X	X	X			X			X

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	Detected, not confirmed breeding		Breeders		Detected, not confirmed breeding		Breeders		
	System-wide	Conservation and habitat creation area	System-wide	Conservation and habitat creation area	System-wide	Conservation and habitat creation area	System-wide	Conservation and habitat creation area	
House finch	X	X	X	X	X	X	X	X	X
House wren	X	X				X			
Hutton's vireo	X				X				
Inca dove				X					
Indigo bunting				X		X			
Killdeer	X	X	X	X	X	X			X
Ladder-backed woodpecker	X	X	X	X			X	X	X
Lark sparrow		X				X			
Lawrence's goldfinch	X						X		
Lazuli bunting	X	X			X	X			X
Least bittern	X	X	X				X		X
Least sandpiper	X	X							X
Lesser goldfinch	X	X	X	X	X	X	X	X	X
Lesser yellowlegs		X							X
Lesser nighthawk	X	X	X	X	X	X	X		X
Lesser scaup	X								
Lincoln’s sparrow	X	X			X	X			
Loggerhead shrike	X	X	X	X	X				
Long-billed curlew	X	X							X

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	Detected, not confirmed breeding		Breeders		Detected, not confirmed breeding		Breeders		
	System-wide	Conservation and habitat creation area	System-wide	Conservation and habitat creation area	System-wide	Conservation and habitat creation area	System-wide	Conservation and habitat creation area	
Long-billed dowitcher	X	X							X
Lucy's warbler	X	X	X	X	X	X	X	X	
Macgillivray's warbler	X	X			X	X			
Mallard	X	X	X	X	X	X			X
Marsh wren		X	X				X		
Mexican duck			X						
Mississippi kite		X				X			X
Mountain white-crowned sparrow	X	X				X			
Mourning dove	X	X	X	X	X	X	X	X	X
Myrtle warbler		X				X			
Nashville warbler	X	X			X	X			
Neotropic cormorant	X								X
Northern flicker	X	X							X
Northern harrier	X	X	X	X	X	X			X
Northern mockingbird	X		X	X	X			X	X
Northern parula		X							
Northern rough-winged swallow	X	X	X	X	X	X			X
Northern shoveler	X	X							X
Nutting's flycatcher	X				X				

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	Detected, not confirmed breeding		Breeders		Detected, not confirmed breeding		Breeders		
	System-wide	Conservation and habitat creation area	System-wide	Conservation and habitat creation area	System-wide	Conservation and habitat creation area	System-wide	Conservation and habitat creation area	
Olive-sided flycatcher	X	X			X	X			
Orange-crowned warbler	X	X			X	X			
Oregon junco	X								
Osprey	X	X	X		X				X
Pacific-slope flycatcher	X	X			X	X			
Peregrine falcon	X	X							X
Phainopepla	X	X	X		X	X			X
Pied-billed grebe	X		X				X		
Plumbeous vireo	X	X			X				
Prairie falcon	X	X				X			X
Redhead	X				X				
Red-tailed hawk	X	X			X				X
Red-winged blackbird	X	X	X	X	X	X	X		X
Ring-billed gull	X								X
Ring-necked duck	X								X
Rock pigeon	X	X							X
Rock wren	X								
Rose-breasted grosbeak					X				
Ruby-crowned kinglet	X	X			X	X			

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	Detected, not confirmed breeding		Breeders		Detected, not confirmed breeding		Breeders		
	System-wide	Conservation and habitat creation area	System-wide	Conservation and habitat creation area	System-wide	Conservation and habitat creation area	System-wide	Conservation and habitat creation area	
Ruddy duck	X				X		X		
Rufous hummingbird		X			X				
Savannah sparrow	X								
Say's phoebe			X		X	X			
Sharp-shinned hawk	X	X			X	X			X
Snowy egret	X	X		X	X				X
Solitary sandpiper	X	X							
Solitary vireo		X				X			
Song sparrow	X		X	X	X		X	X	
Sora	X				X				
Spotted sandpiper	X	X			X				X
Spotted towhee	X	X			X				
Summer tanager	X		X	X	X		X	X	
Swainson's thrush		X			X	X			
Swainson's hawk	X	X				X			X
Townsend's warbler	X	X			X	X			X
Tree swallow	X	X			X	X			X
Tropical kingbird				X	X			X	
Turkey vulture	X	X			X	X			X

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Species (n = 215)	Rapid				Intensive				Flyovers: all sites
	Detected, not confirmed breeding		Breeders		Detected, not confirmed breeding		Breeders		
	System-wide	Conservation and habitat creation area	System-wide	Conservation and habitat creation area	System-wide	Conservation and habitat creation area	System-wide	Conservation and habitat creation area	
Unidentified *Accipiter* hawk	X	X			X				X
Unidentified duck	X					X			X
Unidentified *Empidonax* flycatcher	X	X			X	X			
Unidentified flycatcher	X	X			X				
Unidentified hawk		X			X				X
Unidentified hummingbird	X	X	X		X			X	X
Unidentified sparrow	X	X							
Unidentified swallow	X	X			X				X
Unidentified warbler	X	X			X	X			X
Unknown	X	X			X	X			X
Vaux's swift	X	X			X	X			X
Verdin	X	X	X	X	X		X	X	
Vermilion flycatcher	X	X	X	X	X			X	X
Vesper sparrow	X								
Violet-green swallow	X				X		X		X
Virginia rail		X	X		X		X		
Virginia's warbler	X								
Warbling vireo	X	X			X	X			
Western flycatcher	X	X			X	X			

Table 5-1.—Comprehensive species list from component 1 avian surveys conducted along the lower Colorado River in 2014 (Species are listed in alphabetic order of common name. Scientific names available in GBBO 2010, 2011.)

Species (n = 215)	Rapid				Intensive				Flyovers: all sites
	Detected, not confirmed breeding		Breeders		Detected, not confirmed breeding		Breeders		
	System-wide	Conservation and habitat creation area	System-wide	Conservation and habitat creation area	System-wide	Conservation and habitat creation area	System-wide	Conservation and habitat creation area	
Western grebe	X		X		X				
Western kingbird	X	X	X	X	X	X	X	X	X
Western meadowlark			X						
Western sandpiper	X								
Western screech-owl	X						X		
Western tanager	X	X			X	X			X
Western wood-pewee	X	X			X	X			
Whimbrel	X								X
White-crowned sparrow	X	X			X	X			
White-faced ibis	X	X			X	X			X
White-tailed kite		X				X			X
White-throated sparrow					X				
White-throated swift	X	X	X		X	X			X
White-winged dove	X	X	X	X	X	X	X	X	X
White ibis	X	X							X
Willet	X								X
Willow flycatcher	X	X			X	X			
Wilson’s warbler	X	X			X	X			X
Wilson's snipe	X								X

Table 5-1.—Comprehensive species list from component 1 avian surveys conducted along the lower Colorado River in 2014 (Species are listed in alphabetic order of common name. Scientific names available in GBBO 2010, 2011.)

Species (n = 215)	Rapid				Intensive				Flyovers: all sites
	Detected, not confirmed breeding		Breeders		Detected, not confirmed breeding		Breeders		
	System-wide	Conservation and habitat creation area	System-wide	Conservation and habitat creation area	System-wide	Conservation and habitat creation area	System-wide	Conservation and habitat creation area	
Wood duck		X							
Yellow warbler	X	X	X	X	X	X	X	X	X
Yellow-breasted chat	X		X	X			X	X	
Yellow-headed blackbird	X	X	X	X	X	X			X
Yellow-rumped warbler	X	X			X	X			X
Zone-tailed hawk		X			X	X			X

ATTACHMENT 6

List of All Area Search Plots

Table 6-1.—List of all area search plots surveyed for project components 1 and 5 in 2014 (Xs indicate plots surveyed in 2014.)

Plot/ section	System-wide plots (n = 80)	Conservation and habitat creation area plots (n = 80)	Intensive area search plots (n = 12)	Salt cedar beetle (*Diorhabda carinulata*) plots (Havasu and Bill Williams River National Wildlife Refuges only), 2014, (n = 30)
C1501		X		
C1502		X		
C1503		X		
C1504		X		
C2101		X		
C2102		X		
C2103		X		
C2104		X	X	
C2105		X		
C2301		X		
C2302		X		
C2303		X		
C2304		X		
C2305		X		
C2306		X		
C2307		X		
C2308		X		
C2309		X		
C2310		X		
C2311		X		
C2312		X		
C2313		X		
C2314		X		
C2315		X		
C2316		X		
C2317		X		
C2318		X		
C2319		X		
C2320		X		
C2321		X		
C2322		X		
C2323		X		
C2324		X		
C2325		X		

Table 6-1.—List of all area search plots surveyed for project components 1 and 5 in 2014 (Xs indicate plots surveyed in 2014.)

Plot/ section	System-wide plots (n = 80)	Conservation and habitat creation area plots (n = 80)	Intensive area search plots (n = 12)	Salt cedar beetle (*Diorhabda carinulata*) plots (Havasu and Bill Williams River National Wildlife Refuges only), 2014, (n = 30)
C2326		X		
C2328		X		
C2330		X		
C2333		X		
C2334		X	X	
C2335		X		
C2501		X		
C2502		X		
C2503		X		
C2504		X		
C2505		X		
C2506		X		
C2507		X		
C2508		X		
C2509		X		
C2510		X		
C2512		X		
C2513		X		
C2514		X		
C2515		X		
C2516		X		
C2517		X		
C2518		X		
C2519		X		
C2520		X		
C2521		X		
C2523		X		
C2701		X		
C2702		X		
C2704		X	X	
C2705		X		
C2706		X		
C2707		X		
C2720		X		

Table 6-1.—List of all area search plots surveyed for project components 1 and 5 in 2014 (Xs indicate plots surveyed in 2014.)

Plot/ section	System-wide plots (n = 80)	Conservation and habitat creation area plots (n = 80)	Intensive area search plots (n = 12)	Salt cedar beetle (*Diorhabda carinulata*) plots (Havasu and Bill Williams River National Wildlife Refuges only), 2014, (n = 30)
C2721		X		
C2722		X	X	
C2724		X		
C2725		X		
C4702		X		
C4703		X		
C4704		X		
C4705		X		
C4706		X		
C4708		X		
C4709		X		
C4710		X		
S1659	X			
S1694	X			
S1695	X			
S1714	X			
S1738	X			
S1861	X			
S1975	X			
S1987	X			
S2038	X			
S2306	X			
S2339				X
S2371	X			
S2401				X
S2457				X
S2465	X			
S2475	X			X
S2476				X
S2477				X
S2493				X
S2508				X
S2522				X
S2532				X

Table 6-1.—List of all area search plots surveyed for project components 1 and 5 in 2014 (Xs indicate plots surveyed in 2014.)

Plot/ section	System-wide plots (n = 80)	Conservation and habitat creation area plots (n = 80)	Intensive area search plots (n = 12)	Salt cedar beetle (*Diorhabda carinulata*) plots (Havasu and Bill Williams River National Wildlife Refuges only), 2014, (n = 30)
S2556	X			
S2558				X
S2631	X			
S2636	X		X	
S2719	X			X
S2742				X
S2744	X			
S2854	X			
S2860	X			
S2863				X
S2864	X			
S2872	X		X	
S2876				X
S2889				X
S2903				X
S2926	X		X	
S2965	X			
S3014	X			
S3425	X			
S5148	X			
S5188	X			
S5216	X			
S5236	X			
S5317	X			
S5413	X			
S5614	X			
S5723	X			
S5773	X			
S5821	X			
S5842	X			
S5844	X			
S5851	X			
S6017	X			
S6018	X			

Table 6-1.—List of all area search plots surveyed for project components 1 and 5 in 2014 (Xs indicate plots surveyed in 2014.)

Plot/ section	System-wide plots (n = 80)	Conservation and habitat creation area plots (n = 80)	Intensive area search plots (n = 12)	Salt cedar beetle (*Diorhabda carinulata*) plots (Havasu and Bill Williams River National Wildlife Refuges only), 2014, (n = 30)
S6049	X			
S6185	X			
S6190	X			
S6212	X			
S6220	X			
S6414	X			
S6462	X			
S6534	X			
S6606	X			
S6619	X			
S7054	X			
S7059	X		X	X
S7060	X			
S7107				X
S7119	X			
S7334	X		X	
S7336	X			X
S7337				X
S7369	X			
S7500	X			
S7740	X			
S7742	X			
S7779	X			
S7937	X			
S7946	X			
S7956	X			
S7960	X			
S7985	X			
S7992	X			
S8011	X		X	
S8026	X			
S8218	X			
S8219	X		X	
S8223				X

Table 6-1.—List of all area search plots surveyed for project components 1 and 5 in 2014 (Xs indicate plots surveyed in 2014.)

Plot/ section	System-wide plots (n = 80)	Conservation and habitat creation area plots (n = 80)	Intensive area search plots (n = 12)	Salt cedar beetle (*Diorhabda carinulata*) plots (Havasu and Bill Williams River National Wildlife Refuges only), 2014, (n = 30)
S8261	X		X	
S8287	X			
S8291				X
S8292				X
S8295				X
S8606	X			
S8609	X			
S8641	X			
S9064				X
S9066				X
S9067				X
S9068				X
S9125				X
S9294	X			
S9397	X			
S9403	X			

Table 6-2.—Summary table of all plots surveyed in 2014 using the standard intensive area search method

Plot/section	System-wide standard intensive (n = 8)	Conservation and habitat creation area intensive (n = 4)
C2104 (CRIT 9 D)		Yes
C2334 (PVER 7H)		Yes
C2704 (Cibola National Wildlife Refuge Unit #1 Conservation Area Genetics A)		Yes
C2722 (Cibola National Wildlife Refuge Unit #1 Conservation Area Crane Roost A)		Yes
S8261	Yes	
S2636	Yes	
S7059	Yes	
S2872	Yes	
S2926	Yes	
S7334	Yes	
S8219	Yes	
S8011	Yes	

ATTACHMENT 7

Number of Pairs of Non-Territorial Breeding Species

Table 7-1.—Number of pairs of non-territorial breeding species on all system-wide and conservation and habitat creation area rapid survey plots in 2014

Plot	Black-crowned night-heron	Brown-headed cowbird	Cliff swallow	Eurasian collared-dove	European starling	Gambel's quail	Great blue heron	Great egret	Greater roadrunner	Great-tailed grackle	House finch	Killdeer	Lesser goldfinch	Mourning dove	Red-winged blackbird	Snowy egret	White-winged dove	Yellow-headed blackbird
C1501	0	3				2				2							2	
C1502	0	2				5			1		1			1			3	
C1503	0					2			1					2			3	
C1504	0	2				2											1	
C2101	0	7				1				1	1			7			9	
C2102	0	4				1								4			8	
C2103	0	9									3			9			6	
C2104	0	4				1				2	6			15			30	
C2105	0	3				2					5			10			5	
C2301	0	4		2		2					2			8	900		14	
C2302	0	25				8			1		6			15	20		14	3
C2303	0	6				2			1		1			3			3	
C2304	0	7				2			1		2			9			11	
C2305	0	2							1									
C2306	0	2												2			3	
C2307	0	5				2					5			2			4	

Table 7-1.—Number of pairs of non-territorial breeding species on all system-wide and conservation and habitat creation area rapid survey plots in 2014

Plot	Black-crowned night-heron	Brown-headed cowbird	Cliff swallow	Eurasian collared-dove	European starling	Gambel's quail	Great blue heron	Great egret	Greater roadrunner	Great-tailed grackle	House finch	Killdeer	Lesser goldfinch	Mourning dove	Red-winged blackbird	Snowy egret	White-winged dove	Yellow-headed blackbird
C2308	0	10									2			9			9	
C2309	0	6			1				1	1				3			9	
C2310	0	7									2			1			13	
C2311	0	10									2			1			1	
C2312	0	7							1		7			3			5	
C2313	0	7									2			3			4	
C2314	0	10							2					5	5		10	3
C2315	0	2												10			20	
C2316	0	3									1			2			4	
C2317	0	8							1		1			5			15	
C2318	0	5												2			8	
C2319	0	2												6			6	
C2320	0	6							1		2			6			11	
C2321	0	6									2			10			10	
C2322	0	2							1		1			4			10	
C2323	0	20												10			5	

Table 7-1.—Number of pairs of non-territorial breeding species on all system-wide and conservation and habitat creation area rapid survey plots in 2014

Plot	Black-crowned night-heron	Brown-headed cowbird	Cliff swallow	Eurasian collared-dove	European starling	Gambel's quail	Great blue heron	Great egret	Greater roadrunner	Great-tailed grackle	House finch	Killdeer	Lesser goldfinch	Mourning dove	Red-winged blackbird	Snowy egret	White-winged dove	Yellow-headed blackbird
C2324	0	2												1			4	
C2325	0	2												1			6	
C2326	0	10									1			10			10	
C2328	0	17									2			8			12	
C2330	0	2				1					1			3			6	
C2333	0	13												1			5	
C2334	0	5									2			2			9	
C2335	0	10				1			1	1	1			2	150		1	
C2501	0	3												4			5	
C2502	0	10			1	1								40			6	
C2503	0	4									3			11			8	
C2504	0	12		2							1			12			13	
C2505	0	7			3	2							3	4			8	
C2506	0	3				1								5			8	
C2507	0	10												7			8	
C2508	0	12												33	6		30	

Table 7-1.—Number of pairs of non-territorial breeding species on all system-wide and conservation and habitat creation area rapid survey plots in 2014

Plot	Black-crowned night-heron	Brown-headed cowbird	Cliff swallow	Eurasian collared-dove	European starling	Gambel's quail	Great blue heron	Great egret	Greater roadrunner	Great-tailed grackle	House finch	Killdeer	Lesser goldfinch	Mourning dove	Red-winged blackbird	Snowy egret	White-winged dove	Yellow-headed blackbird
C2509	0	7		2		6			1		2			11			10	
C2510	0	15				3			1		1			15	3		10	
C2512	0	4				2			1		1			6			12	
C2513	0	2				6					1			1			2	
C2514	0	2				5								2			7	
C2515	0	2				4			1					5				
C2516	0	1			1	6			1					2			2	
C2517	0	4				2			1									
C2519	0	3				2			1					3			3	
C2520	0	2				4					1			5			4	
C2521	0					15			1					20	15		30	4
C2523	0	3				2					1			2			3	
C2701	0	9									3			10	14		11	
C2702	0					1								15			5	7
C2704	0	3				1					3			4			8	
C2705	0	30				5						1		50			40	

Table 7-1.—Number of pairs of non-territorial breeding species on all system-wide and conservation and habitat creation area rapid survey plots in 2014

Plot	Black-crowned night-heron	Brown-headed cowbird	Cliff swallow	Eurasian collared-dove	European starling	Gambel's quail	Great blue heron	Great egret	Greater roadrunner	Great-tailed grackle	House finch	Killdeer	Lesser goldfinch	Mourning dove	Red-winged blackbird	Snowy egret	White-winged dove	Yellow-headed blackbird
C2706	0	7			1	2					6			12			15	
C2707	0	8			10	5					2			15			25	
C2720	0	10				2								4	100		4	2
C2721	0					3								7	83		9	
C2722	0	15				4			1		2			28			40	
C2724	0	15				1								13	4		10	
C2725	0	15				5			1		1			9			14	
C4702	0	5				1			1					5	4		6	2
C4703	0	2				1			1					5			6	
C4704	0	2												11			5	
C4705	0	6			1	4				1				15		1		
C4706	0	2							2		2			6			1	4
C4708	0	6		1		1			2	2				2				
C4709	0	2							1	1	8			3			2	
C4710	0	7				1		1	1					4	10	1	5	1
S1659	0					6				3				10				

Table 7-1.—Number of pairs of non-territorial breeding species on all system-wide and conservation and habitat creation area rapid survey plots in 2014

Plot	Black-crowned night-heron	Brown-headed cowbird	Cliff swallow	Eurasian collared-dove	European starling	Gambel's quail	Great blue heron	Great egret	Greater roadrunner	Great-tailed grackle	House finch	Killdeer	Lesser goldfinch	Mourning dove	Red-winged blackbird	Snowy egret	White-winged dove	Yellow-headed blackbird
S1694	0	2				2			1					3			6	
S1695	0	1				3								2			6	
S1714	0									4				13			8	1
S1738	0	1				1								3	19		3	
S1861	0					1								2				
S1975	0	1				1					1			2			2	
S1987	0													1	3			
S2038	0	2				2					1			3	12		6	
S2306	0					1								1	2		1	1
S2371	0													5			7	
S2465	0					3			1					4			2	
S2475	0	8				1			1	1				7			10	
S2556	0					1								2				
S2631	0	1				2					1			1			1	
S2636	0	3								5							2	4
S2719	0	2							1	10				2			2	

Table 7-1.—Number of pairs of non-territorial breeding species on all system-wide and conservation and habitat creation area rapid survey plots in 2014

Plot	Black-crowned night-heron	Brown-headed cowbird	Cliff swallow	Eurasian collared-dove	European starling	Gambel's quail	Great blue heron	Great egret	Greater roadrunner	Great-tailed grackle	House finch	Killdeer	Lesser goldfinch	Mourning dove	Red-winged blackbird	Snowy egret	White-winged dove	Yellow-headed blackbird
S2744	0	6		1						1				4	2		5	
S2854	0	6				2			1	3	2			1	30		7	1
S2860	0	4												1			10	
S2864	0	9												9			13	
S2872	0	3				3			1		1			2			8	
S2926	0	1				1								2			5	
S2965	0	1		3	1	2					1			2			2	
S3014	0	2				2			1					1				
S3425	0	3				3					2			2	2		3	
S5148	0	2													10			
S5188	0	5				16					1			3			5	
S5216	0	4				2			1		2			1			4	
S5236	0	1				1			1		1			4			5	
S5317	0	4				3			1		2			10			10	
S5413	0	15				4					5			10				
S5614	0	2		1		1				1	1			5			3	

Table 7-1.—Number of pairs of non-territorial breeding species on all system-wide and conservation and habitat creation area rapid survey plots in 2014

Plot	Black-crowned night-heron	Brown-headed cowbird	Cliff swallow	Eurasian collared-dove	European starling	Gambel's quail	Great blue heron	Great egret	Greater roadrunner	Great-tailed grackle	House finch	Killdeer	Lesser goldfinch	Mourning dove	Red-winged blackbird	Snowy egret	White-winged dove	Yellow-headed blackbird
S5723	0																	
S5773	0					1								2			1	
S5821	0	2				2								2			7	
S5842	0	1				1								3			3	
S5844	0					1								1			1	
S5851	0	3				2					1			10			20	
S6017	0	1				1												
S6018	0									5				1	9		1	4
S6049	0	1				1												2
S6185	0	1				1			1					3			2	
S6190	0	2								6					5		4	
S6212	0	7					5	1		6				4	12		10	
S6220	0	1								1				1			1	
S6414	0	1				1								1			3	
S6462	0	3								10				10	1		30	
S6534	0	3	30	1		3					3			10			2	

Table 7-1.—Number of pairs of non-territorial breeding species on all system-wide and conservation and habitat creation area rapid survey plots in 2014

Plot	Black-crowned night-heron	Brown-headed cowbird	Cliff swallow	Eurasian collared-dove	European starling	Gambel's quail	Great blue heron	Great egret	Greater roadrunner	Great-tailed grackle	House finch	Killdeer	Lesser goldfinch	Mourning dove	Red-winged blackbird	Snowy egret	White-winged dove	Yellow-headed blackbird
S6606	0	3				1					1			1			2	
S6619	0	1		5	2	2				4	4			6				
S7054	0	2				1								2			4	
S7059	0	4								6	1			1			8	
S7060	0													1			2	
S7119	0								1	2				5				
S7334	0	10							1					20				
S7336	0	2				2					2						13	
S7369	1	6				1				2				3			5	
S7500	0	2								10	1			1	21		3	2
S7740	0					1								2				
S7742																		
S7779	0	2								3	2			2			5	
S7937	0	3				2								6			10	
S7946	0									1				1				
S7956	0	4				1				3				1	3		5	

Table 7-1.—Number of pairs of non-territorial breeding species on all system-wide and conservation and habitat creation area rapid survey plots in 2014

Plot	Black-crowned night-heron	Brown-headed cowbird	Cliff swallow	Eurasian collared-dove	European starling	Gambel's quail	Great blue heron	Great egret	Greater roadrunner	Great-tailed grackle	House finch	Killdeer	Lesser goldfinch	Mourning dove	Red-winged blackbird	Snowy egret	White-winged dove	Yellow-headed blackbird
S7960	0	2				2				1	2			2	3		8	1
S7985	0	4												1			4	
S7992	0	5		1		7								5			3	
S8011	0	2				3			1	1	4			8	2		11	
S8026	1	6				1	1	1		1	1			9	1		4	
S8218	0	2				1					3						4	
S8219	0	3		1					1					3			5	
S8261	0	1		1		5					2			1	1		1	
S8287	0									1								
S8606	0														100			
S8609	0	5		1					1		2			3	1		4	
S8641	0		75											1	100			
S9294	0	1				1			1					1			2	
S9397	0	6															4	
S9403	0	2				1				2							2	

Table 7-2.—Number of pairs of non-territorial breeding species on all intensive survey plots in 2014

Intensive plots, 2014	Brown-headed cowbird	Eurasian collared-dove	Gambel's quail	Greater roadrunner	Great-tailed grackle	House finch	Mourning dove	Red-winged blackbird	White-winged dove
C2104	5	1	3	0	0	2	8	0	25
C2334	20	0	2	0	1	0	10	0	10
C2704	7	0	2	0	0	4	7	0	4
C2722	15	2	1	0	0	4	23	0	17
S2636	2	0	0	0	0	0	1	0	4
S2872	5	0	1	1	0	2	5	0	5
S2926	6	0	1	1	0	1	7	0	8
S7059	4	0	0	0	4	5	5	0	3
S7334	5	0	0	1	0	2	3	0	4
S8011	14	0	3	1	0	4	11	11	11
S8219	2	1	1	1	0	1	2	0	4
S8261	2	0	3	0	0	0	1	0	2

Table 7-3.—Number of pairs of non-territorial breeding species on all salt cedar beetle (*Diorhabda carinulata*)survey plots in 2014

Plot	Black-crowned night-heron	Brown-headed cowbird	Gambel's quail	Greater roadrunner	Great-tailed grackle	House finch	Mourning dove	Red-winged blackbird	White-winged dove
S2339		6			5		6	4	12
S2401		3			1		5		6
S2457		3		1			13	6	
S2475		8	1	1	1		7		10
S2476		8		1	8		12		12
S2477		3					4		4
S2493				1	3		20		20
S2508		3	1	1	7	1	5	1	8
S2522		1			1	1	1		6
S2532		2							5
S2558	1	15		1	18	4	10	31	
S2719		2		1	10		2		2
S2742		1			10		3	10	23
S2863		5					3		6
S2876		3	1				1		4
S2889		4	2	1		1	4	1	4
S2903		3	3	1		1	4	2	3
S7059		4			6	1	1		8
S7107		2					2		8
S7336		2	2			2			13
S7337		1	1	1		1			2
S8223		2	2						3
S8291		7	1		4	2	5	5	10
S8292		2	1			1	2	1	2
S8295		1			1		1		5
S9064		9			6		10		11
S9066		1			2		10		50
S9067		3					1		4
S9068		3			2		1		6
S9125		1		1			11		15

ATTACHMENT 8

Crosswalk of Conservation and Habitat Creation Area Plots Surveyed by Phase

Table 8-1.—Random selection of plots in the Palo Verde Ecological Reserve by phase

Phase 1	Phase 2	Phase 3	Phase 4	Phase 5	Phase 6	Phase 7	Phase 8
C2301	C2302	C2305	C2308	C2312	C2320	C2328	C2335
	C2303	C2306	C2309	C2313	C2321	C2330	
	C2304	C2307	C2310	C2314	C2322	C2333	
			C2311	C2315	C2323	C2334	
				C2316	C2324		
				C2317	C2325		
				C2318	C2326		
				C2319			

Table 8-2.—Random selection of plots in the Cibola Valley Conservation Area by phase

Phase 1	Phase 2	Phase 3	Phase 4	Phase 5	Phase 6
C2501	C2506	C2509	C2513	C2519	C2521
C2502	C2507	C2510	C2514	C2520	
C2503	C2508	C2512	C2515		
C2504			C2516		
C2505			C2517		
			C2518		

Table 8-3.—Random selection of plots in Cibola National Wildlife Refuge Unit #1 Conservation Area site by phase

Cibola National Wildlife Refuge research area 1	Crane Roost	Nature Trail – North	Nature Trail – South
C2701	C2720	C2706	C2705
C2702	C2721		
C2704	C2722		
C2707	C2724		
	C2725		

Table 8-4.—Random selection of plots in Yuma East Wetlands by phase

A North Channel	D	F	G	I	J	South C
C4708	C4704	C4705	C4709	C4702	C4703	C4710
		C4706				

ATTACHMENT 9

Vegetation Monitoring Protocol Using Mobile Electronic Field Forms

2013 Intensive Plot Method Field Instructions:
Vegetation Monitoring at Lower Colorado River Multi-Species Conservation Program Habitat Creation and Existing Riparian Sites – Mobile Electronic Field Form Version

Updated September 2014

Plot Setup

Setup Instructions—PLOTS NOT PREVIOUSLY MARKED:

1. Use a Global Positioning System (GPS) to navigate to plot center marker. Plot centers are stored as waypoint files on the Trimble units.

2. Determine the azimuth bearing ("Bearing 1") for the long plot edge (Borders 2 and 4) from the field map or plot table. Note that the same bearing is used for all of the plots in a phase.

3. Subtract 90° to determine the azimuth bearing ("Bearing 2") for the short plot edge (Borders 1 and 3).

4. From the plot center, use a compass to line up the measuring tape with Bearing 2 between the plot center and A Plot Border 4.

5. With one person holding the coiled tape at the plot center, pull the 0 mark on the tape out 5 meters (m) to the midpoint of A Plot Border 4. Check the bearing of this line with a compass. Place a pin flag at this location—the midpoint of A Plot Border 4.

6. With one person staying at the midpoint of A Plot Border 4, extend the tape to 10 m total (5 m from plot center) along the bearing line. Place a pin flag at the 10-m mark (the midpoint of A Plot Border 2).

7. Add pin flags at the: 1 m (point D5), 2.5 m (double flag, midpoint of B Plot Border 4), 5 m (plot center/D1), 7.5 m (double flag, midpoint of B Plot Border 2), 9 m (D3), and 10 m (midpoint of A Plot Border 2). Place two pin flags each at 0 , 2.5, 7.5, and 10 m.

8. Reel in the tape and move to the midpoint of A Plot Border 2. Determine the direction of Bearing 1 from this location. Have one person stand at this location with the reeled tape and compass and the second person extend the tape 20 m down A Plot Border 2 to Corner 1-2.

9. Once the tape has been extended to 20 m, backsight the tape at several locations to ensure that the azimuth remains at Bearing 1.

10. Place a piece of rebar at Corner 1-2.

11. Attach the clip of the tape at 0 m to the rebar stake. Place double pin flags at the 12.5-m mark of Border 2. The double flag in this location marks the center of Plot C2.

12. Continue extending tape along Bearing 1 to the 40-m mark of Border 2 (Corner 2-3). Place double pin flags at the 27.5-m mark of Border 2. The double flag here marks the center of Plot C1. Continue to the 40-m mark. Place a rebar stake at Corner 2-3.

13. From Corner 2-3, extend the tape on Bearing 2 for 10 m along Border 3 to reach Corner 3-4. Place a rebar stake at this corner.

14. From the 27.5-m mark of Border 2, extend the tape 10 m along Bearing 2. Place pin flags at 2.5, 5 (double flag), 7.5, and 10 m (double flag). Reel in the tape.

15. Repeat step 14 for the 12.5-m mark of Border 2.

16. Fill in pin flags along A Plot and B Plot borders.

17. From plot center, extend the tape 4 m in each direction along Bearing 1 (this should direct you to double flags on Border 1 and Border 3 of the B Plot) and place a pin flag at these two points (D2 and D4).

18. After conducting the surveys, remove the corner rebar stakes for the Bill Williams River National Wildlife Refuge plots. At other locations, leave the rebar and flag with blue/white striped flagging.

Mobile Electronic Field Form (MEFF) Background

1. The Lower Colorado River Multi-Species Conservation Program (LCR MSCP) Data Management Group has developed a series of mobile electronic field forms (MEFFs) to capture the LCR MSCP vegetation protocol in Trimble® TerraSync™ software. Under the Trimble® file structure model, a series of individual features are grouped into a single rover (or data) file (typically .ssf or .cor depending on whether or not the data were post-processed using differential correction). A Trimble® "data dictionary" file (.ddf) establishes the data format, the type of features logged, etc., for a particular data (rover) file. Data dictionaries can be developed as templates with certain parameters and filters to ensure that quality and consistent data are collected across users in the field. As this document explains, you'll save a rover file and select the appropriate data dictionary reference depending on the particular survey intensity employed and the collection point.

2. The LCR MSCP Data Management Group has also developed a user manual titled, "LCR MSCP Mobile Electronic Field Form Guidebook – Vegetation" (or "MEFF Guidebook" hereafter). Use that source as a guide to manage and transfer Trimble data dictionaries received from the Data Management Group as well as using specific forms, quality assurance/quality control (QA/QC), and managing data after you return to the office.

3. Two data dictionaries are required for capturing the mandatory field data for an enhanced plot as shown in the following list of data dictionaries:

    - Enhanced – Hits to Pole (HTP): Data dictionary that is used to enter data from D Collection Points at an enhanced plot. Only canopy closure (densiometer) and vertical foliage volume (HTP) measurements are recorded in this data dictionary.

    - Enhanced – Other (OTH): Data dictionary that is used for entering data collected at the A, B, C, and E collection points. This dictionary establishes the format for capturing all of the data required at an enhanced plot at each of the collection points besides D1–D5.

4. In addition to completed MEFF forms, **two hard-copy pages are required for every field plot – the hard-copy checklist/tally sheet (hardcopy Page 1) and the Hits To Pole "All" sheet (Page 2)**. Directions on how to use these hard-copy pages are discussed later in this document.

5. A **hard-copy checklist** has been developed to prevent gross oversights (e.g., skipping an entire collection point or a mandatory component within a collection point) during electronic field data acquisition. The checklist serves as a paper trail to verify that field work and post-field QA/QC were completed for the specific data collection component. During field work, ensure that the checklist data sheet is entirely filled out prior to moving on to the next collection point or next plot. Clean, complete, and legible hard-copy checklists need to be maintained for each measured plot. These will be delivered to the LCR MSCP at the end of the field season.

6. Each plot measured needs to have a **COMPLETE** Trimble® data file associated with the plot. The hard-copy checklist is meant to be used as a guide to ensure that a full series of forms was captured for the plot. Even if certain mandatory components are not present in the monitoring plot, a feature should still be created to acknowledge that the collection point or mandatory plot component wasn't skipped altogether in the field (similar to crossing something off a hard-copy data sheet). The pre-established protocol for logging a blank feature is specifically listed for each GPS form later in this document.

7. The hard-copy checklist sheet also includes a space for tallying trees/ shrubs/stems and other components that are tallied or dot counted through the plot data collection process and then only entered into the GPS unit once, after all of the tallying is completed.

8. Page 2 of the hard-copy sheets includes a section for determining "All" HTP intercepts for each meter layer measured at the D collection points.

9. A "**cheat sheet**" has also been developed to serve as a quick reference for the specific value ranges that define various diameter, height, distance, cover, or size classes (SCs). The cheat sheet also includes a table referencing tree heights determined via the clinometer.

Survey Protocols

General Notes:

1. **Field and data sheet instructions are to be used to guide survey efforts. If inconsistencies or ambiguities are found, immediately notify the Field Supervisor, who will then notify the Project Supervisor. If crews are at a remote location where cell service is unavailable (i.e., the Bill Williams River), crews shall refer to the LCR MSCP vegetation monitoring methods. At the end of the field day, the Field Supervisor will contact the Project Supervisor.**

2. If serious management issues are observed, (e.g., the presence of noxious weeds or frequent planting stress and/or mortality), notify the Field Supervisor, who will then notify the Project Supervisor. The LCR MSCP will be notified of these observations as soon as possible.

3. Trees and shrubs will be considered IN a given plot if any portion of the base (or trunk in the case of a tree for example) intersects Border 1 or Border 2 of the given survey area. They will be considered OUT of a given plot if any portion of the base intersects Border 3 or Border 4 of the given survey area.

4. With the exception of arrowweed and coyote willow, plant counts will be conducted by individual. Arrowweed and coyote willow are clonal species for which individuals are not easily distinguished. These plants will be measured and/or tallied by stems that emerge separately from the ground. In order to be measured or tallied separately, stems must be entirely separated at the ground surface. NOTE: THIS IS DIFFERENT FROM STEM COUNT PROTOCOLS FOR TAMARIX AND MESQUITE.

5. For B Plot foliar cover, all species providing cover in the B Plot will be recorded regardless if the plant is "IN" for B Plot counts (i.e., overhanging branches will be included).

6. For the C Plots, if herbaceous foliage is above the quadrant (regardless of the location of the herbaceous base), it will be included for herbaceous canopy cover; if the basal area of a plant is on the border, the portion of the vegetation inside the quadrant will be considered for basal cover.

7. Height of vegetation (trees/shrubs) is measured as the maximum distance of live foliage above the ground surface in a vertical direction. We are NOT measuring stem length, so do not straighten or extend branches during height measurements.

8. For plant species that generally have a multi-stemmed morphology, including Mesquites, *Tamarix* spp., and willow baccharis, stems are tallied in diameter classes (DCs) based on stem diameter at 10 centimeters (cm) above ground surface. Standard trees (e.g., Fremont cottonwood, Gooding's willow, and Salgoo) are plants that are typically single boled; thus, standard trees are measured at diameter at breast height (DBH), 1.4 m above ground.

9. SCs for standard trees are designated by DBH as follows: SC1 is ≤ 2.5 cm DBH, SC2 is 2.5–8 cm DBH, SC3 is 8.1–12 cm DBH, SC4 is 12.1–20 cm DBH, SC5 is 20.1–40 cm DBH, SC6 is 40.1–50 cm DBH, SC7 is 50.1–80 cm, and SC8 is > 80 cm DBH. All DBH measurements will be ROUNDED UP to the next 0.5-cm interval. For example, a trunk that measures 2.1 cm would be recorded as 2.5 cm and would fall into SC1, a trunk measured as 11.6 cm would be recorded as 12 cm and would fall into SC3, and a trunk measuring exactly 12.0 cm would be recorded as 12 cm.

10. DBH measurement specifications are provided later in this document. Follow these specifications.

11. SCs for mesquite and *Tamarix* spp. are as follows: SC1 is ≤ 3 m tall, and SC2 is > 3 m tall.

12. DCs for mesquite, *Tamarix* spp., and willow baccharis (BACSAL1 and BACSAL 2) stems are as follows: DC 1 is ≤ 2.5 cm diameter, DC2 is 2.51–5 cm diameter, DC3 is 5.1–8 cm diameter, DC4 is 8.1–12 cm diameter, DC5 is 12.1–20 cm diameter, and DC6 is 20.1–40 cm diameter. **DC is determined at 10 cm above ground surface**. No true measurements are recorded, but it may be necessary to use the calipers on certain stems to initially develop a mental image for stem SCs or determine the DC when the stem diameter appears close to a break in the DC ranges. The DCs are intended to increase plot efficiency; thus, the process is meant to require minimal use of the calipers. **NOTE: Tree SCs and stem SCs are NOT identical.**

13. *Baccharis salicina* is considered BACSAL1, while *Baccharis salicifolia* is considered BACSAL 2.

14. Height classes (HCs) for all trees are as follows:

    1. HC1 = 0.1–1.5 m
    2. HC2 = 1.6–3.0 m
    3. HC3 = 3.1–6.0 m
    4. HC4 = 6.1–12.0 m
    5. HC5 = 12.1–20.0 m
    6. HC6 = > 20 m

15. As previously mentioned, the enhanced plot protocol is entered using two different data dictionaries. Thus, it's mandatory that two rover files are completely attributed within the enhanced plot. One data dictionary contains forms for entering only the data collected at the D collection points. The other data dictionary contains forms for all of the other (A–C and E) collection points measured at the plot plus incidentals, snags, gaps, and other plot-wide measurements.

16. The Trimble® unit logs GPS positions while the features are being attributed; however, (as specified later in this document) only two types of features actually require an accurate location: canopy gaps and cavities.

17. **It is important to follow the protocols for distinguishing 0 versus -98 as discussed throughout these instructions. In practice, 0 denotes "measured but absent," and -98 denotes "not measured, value unknown." Thus, the values are approached differently during data analysis and post-field QA/QC.**

18. **Many of the species drop-downs throughout the data dictionaries create "New," "Unknown," and/or "Other" as potential selections. If these are selected, a space for recording additional species information will appear. In this space, enter the scientific name or a six-digit species acronym (in the case of "Other" or "New"). If the species is unknown, in this space describe the species and any samples taken. It is mandatory that you enter notes in this cell to later determine which species the measurements correspond with.**

D COLLECTION POINTS – HTP Data Dictionary

1. Create a new data file, **name the file according to file naming standards from the MEFF Guidebook**, and make sure to select the HTP data dictionary from the "Dictionary Name" drop-down.

2. There are two primary measurement components at the D collection points – canopy closure and HTP. Individual forms have been developed for each of the primary measurement components that are specific to the five D collection points (D1–D5). Navigate to each collection point and enter both measurement components into the appropriate feature (form) on the Trimble®.

3. Measure the canopy closure using a convex densiometer. Proceed to points D1–D5. Place the densiometer level on top of a post, 1.2 m directly above the D points. Count the number of hits for either vegetation (**including both live and dead branches/trees**) or open sky at each line intersection AND corners. Note that the total number of "crosshairs" plus corners assessed sums to 37. Always enter the total number of **open sky** hits into Trimble® form. The orientation of the densiometer measurements is as follows: D1 – face "up" the plot, and D2–D5 – face out from plot center.

4. Conduct HTP surveys at D1–D5. At each location, extend the stadia rod vertically to a height slightly above the canopy or to its full extent if required. A level should be rested against the side of the stadia rod to ensure it is vertical.

5. From 0 to 7 m, count the number of hits per meter **by species**. When more than one species is present within a meter, tally the total hits into the **"All"** category. When more than one species is present, we recommend recording hits for the "All" category on a hard-copy data sheet initially. After the HTP measurements are complete for each species at the collection point, enter the tallied values for "All" into the Trimble®.

6. An individual feature should be developed for every meter layer that contains foliage that is intercepted during the HTP measurements. There are drop-downs available for up to six species within the meter layer. So, in practice, create a new feature, select the meter layer that is being measured from the drop-down, select the first species, enter the number of hits for that species within the meter layer, and then follow that same procedure for each additional species in the meter layer. After all individual species are recorded for the meter layer, enter the information for "All" species, which represents the total number of decimeter sections that contained a hit, regardless of species. After all hits are recorded for the meter layer, close that feature and create a new feature for the next meter layer.

7. The "All" category measures the total number of hits within the meter layer. Note that this is not the sum of all species combined but rather the total number of decimeter intervals that contain a hit, regardless of species.

8. A "hit" occurs when **LIVE** plant material (leaves or live stem) is within 10 cm of the center of the rod for a given 10-cm interval.

9. For 7–8 m and each meter layer above, estimate if the number of hits per meter is 0, ≤ 5, or > 5.

10. **If no hits are present at the collection point, select "NONE" and "ML 0_1" from the drop-downs and save the feature.**

11. Update the hard-copy checklist as data are captured at each collection point by checking the box alongside the data collection component and circling the collection point.

12. Use the hard-copy checklist to double-check that canopy closure and HTP measurements were completed at each of the D collection points (D1–D5) and double-check that a feature was created and attributed for each collection point on the GPS. Close the data file and move on to the next series of collection points.

OTH Data Dictionary

1. Create a new rover (data) file and name the file per the MEFF Guidebook instructions. Use the OTH data dictionary this time when selecting the dictionary name.

2. A Trimble® data file established with the OTH data dictionary contains a feature for each of the remaining data collection components captured in the plot.

Collection Point A

"Trees – Measure A" Form

1. Survey the entire A Plot area for standard trees (including SALEXI with DBH > 12.0 cm) with a DBH > 12.0 cm (SC4 and above).

    a. Measure and record the height (to the nearest tenth of a meter) and DBH for five trees of SC of each species that represent the size range observed in the plot for the given species/SC. If trees are shorter than the length of the stadia rod, use the rod to measure the height to the nearest tenth of a meter. If trees are taller than the stadia rod, use a clinometer to estimate the tree heights to the nearest half meter (per clinometer instructions presented later in this document).

        i. For each measured tree recorded in the A Plot, record if the tree is also within the B Plot area.

        ii. To enter this information on the Trimble®, create a new "Trees – Measure" feature, select the appropriate species and SC from the drop-down, and enter the height and DBH. The form allows the DBH and height to be entered for five individuals of each species/SC combination. Five measured trees is the threshold number of measurements after which tallying begins.

        iii. **Each time a new species/SC combination is encountered, create a new feature specific to that combination on the GPS and also circle the species/SC from the list on the hard-copy checklist**. For example, SC4 Fremont cottonwood individuals are entered into a separate "Trees – Measure" form than SC5 Fremont cottonwood individuals. It is **NOT necessary**, however, to enter all of the measured individuals for the SC at the same time. It's relatively easy to close the form and relocate the form for a particular species/SC. Use the "Update Features" menu to enter additional individuals for the species/SC if a different feature is currently open.

iv. **Cross off all species/SC combinations not encountered in the A Plot from the hard-copy checklist. Check the box on the hard-copy checklist when all measurements are completed for standard trees SC4 and greater.**

v. **If no tree measurements are required (no SC4 standard trees or SALEXI observed in the plot), create a new feature, select "None" as the species, and leave -98 for specific measurements.**

"Trees – Tally A" Form

1. Similar to the "Trees – Measure A" feature, the "Trees – Tally A" feature is meant to capture standard tree species in SC4 and greater. After five trees are recorded for the species/SC combination, use the hard-copy tally grid to dot tally all remaining trees by HC in a grid on the hard-copy tally sheet (paper data sheet 1) by creating a column for the species/SC and rows for each HC. The HC categories should be separated to allow separate tallies for trees within and outside the B Plot (e.g., HC1, HC1B, HC2, HC2B, and so on). If a tallied tree from the A Plot also falls in the B Plot, make sure to record the dot tallies in the area designated "In B Plot" on each grid.

2. After a tree is recorded, chalk and/or flag it to prevent re-measuring during A Plot OR B Plot surveys.

3. After the tallies are completed, enter the results from the tally sheet into the "Trees – Tally A" form on the Trimble® by summing the total number of tallies within each SC/HC/In or Out of B cell. **Only one total feature is needed for entering all of the tallies for each species/SC.**

4. **"0" should be entered into each HC/B cell without any tallied individuals. Please DO NOT leave -98 in these cells.**

5. **If no tallied trees need to be recorded at the plot (l5 or fewer individuals for all species/SC combinations), create a new feature, select "None" as the species, and leave the -98 values in measurement cells.**

6. Reminder: Update the hard-copy checklist as data collection components are completed and double-check that all mandatory plot components are captured before moving on to the next collection point.

"Mesq-Tam – Measure A" Form

1. Survey the entire A Plot area for mesquite trees and *Tamarix* spp. that are > 3 m tall (SC2).

    a. Measure and record the heights of five trees per species that represent the size range observed in the plot. As for standard trees, tree height will be recorded to the nearest tenth of a meter if the tree is shorter than the stadia rod. If the tree is taller than the stadia rod, estimate the height to the nearest half meter using a clinometer. Record the number of stems in each DC for each individual. **A "0" is entered for all stem DCs not present on the individual.**

    b. Also record whether each individual was located within the B Plot.

    c. Enter your measurements into the "Mesq-Tam – Measure A" form on the Trimble®. **One form (feature) accommodates all five measured individuals for each species/SC combination.**

    d. **If no Mesq or Tam individuals are encountered for SC2, select "None" from the species list and leave -98 for measurement values.**

    e. Circle each species/SC combination observed on the hard-copy checklist. As with all mandatory plot components, check the box alongside the data collection component on the hard-copy checklist after it's completed for the collection point.

"Mesq-Tam – Tally A" Form

1. After the five measured tree heights are completed, record a HC for each tree. Record the number of stems in each DC for the remaining individuals in the SC.

2. Chalk and/or flag tallied trees to prevent re-measuring the same individual during A Plot OR B Plot surveys.

3. **Each "tallied" tree is recorded as a separate feature in the Trimble®**. As each new tallied Mesq-Tam tree is encountered, create a new feature, enter the HC, record the number of stems in each DC category, and record whether that tree is also within the B Plot area. **"0" is entered for all DCs absent on the individual. If no Mesq-Tam tallying is required because the plot area only contains 5 or fewer trees, create a new feature, select "None," and leave the -98 values in measurement cells.**

Collection Point B

"Trees – Measure B" Form

1. Survey the B Plot for standard trees with a DBH of < 12 cm (SC1–SC3), including SALEXI with a DBH between 8.1–12 cm (SC3). Standard trees in SC1–SC3 are documented in the "Trees – Measure B" form.

    a. Collect data per the A Plot, but this time for smaller SCs —DBH and height for five representative individuals for each species/SC combination, SC/HC tally for additional individuals (in the "Trees – Tally B" Form). Note that all trees in SC4 (DBH > 12 cm) have already been measured, and we recorded whether or not the tree occurred within the B Plot area.

    b. Trees shorter than 1.4 m (DBH) in the B Plot will be recorded with a DBH of "0." Trees > 1.4 m with branching or non-woody stems at DBH will be recorded with a DBH of 0.5.

2. Record the measured individuals in the "Trees – Measure B" form on the Trimble® following the same protocol as the A Plot. Each species/SC combination is entered into its own GPS feature, but that feature stores the attributes for all five measured trees.

3. Similar to the A Plot, Border 1 and 2 are "IN" for the B Plot.

4. The B Plot is divided into four quadrants, and SALEXI SC2 trees are only tallied in Quads B1 and B3. The "Trees – Measure" form includes "Salexi SC2 B1" and "Salexi SC2 B3" in the species drop-down. Enter measured DBH and height for SC2 SALEXI encountered in either B1 or B3.

5. If no standard trees in SC3 or lower or SALEXI SC2 or SC3 are located in the B Plot, create a new feature, select "None" as the species, and leave -98 as the measured values.

"Trees – Tally B" Form

1. Follow same general concept utilized for tallied trees in the A Plot, but in this case for individuals in the smaller SCs (SC1–SC3).

2. After five measured trees are recorded for the species/SC combination, use the hard-copy tally sheet to dot tally all remaining trees in the appropriate grid by SC and HC.

3. Enter the data into the "Trees – Tally B" form on the GPS after the dot tallying is completed in the collection point.

4. Tally SALEXI SC2 in Quads B1 and B3 by HC.

5. As with the "Trees- Tally – A" form, enter a "0" for all HCs that did not contain an individual, and record a feature with "None" as a species if the "Trees – Tally B" form is not required for the plot.

"Mesq-Tam – Measure B" Form and "Mesq-Tam – Tally B" Form

1. Survey the entire B Plot area for mesquite trees or salt cedar that are < 3.01 m tall.

   a. Collect mesquite and salt cedar data as for the A Plot—height and number of stems in each DC for five representative individuals. Measured individuals are entered in the "Mesq-Tam – Measure B" form. Then, HC and number of stems in each DC are recorded for additional individuals and entered into the "Mesq-Tam – Tally" form. Note that all SC2 mesquite and salt cedar plants (≥ 3.01 m tall) have already been measured.

   b. **As per the A Plot versions, enter "0" for DCs that are not represented on the individual and follow the same protocol for documenting "None" if the feature is not required for capturing plot data (i.e., no mesquite or Tamarix SC1 are observed).**

"Bacsal – Measure" Form and "Bacsal – Tally" Form

1. Survey the B Plot area for baccharis (BACSAL). Determine and record whether the species is *Baccharis salicina* (BACSAL1) or *B. salicifolia* (BACSAL2).

    a. For five representative individuals, record the shrub height to the nearest 0.1 m and tally the number of stems in each DC. Enter these measurements in the "Bacsal – Measure" form on the Trimble®. **"0" is are entered for each DC that does not contain stems if an individual was measured. All five measured** individuals are entered into one feature.

    b. For all additional BACSAL, record the shrub class (height to nearest 0.5 m) and the number of stems in each DC (1, 2, and/or 3). Enter the tallies into the "Bacsal – Tally" form. A **separate** feature is created for each tallied individual. Enter "0" values to denote DCs not present on the measured individual.

    c. "None" is documented as follows:

        i. If BACSAL is absent from the collection point, create a new feature for both the "Bacsal – Measure" and "Bacsal – Tally" features, select "None" as the species, and leave measurements as -98.

        ii. If only five or fewer individuals occur in the collection point, record measurements for the measured individuals in the "Bacsal – Measure" feature. Then, create a "Bacsal – Tally" feature, select "None" as the species, and save.

"Shrubs B – Measure" Form and "Shrubs B – Tally" Form

1. Survey the entire B Plot area for shrub species, **NOT** including BACSAL, PLUSER, or SALEXI (remember SALEXI is always considered a tree rather than a shrub under this monitoring protocol).

    a. Measure and record the height (to the nearest tenth of a meter) for five individuals of each species that represent the size range observed in the plot for the given species. A separate feature is created for each species, and the form includes all five true measurements for the species.

    b. Dot tally all additional individuals of each species by shrub classes (height to the nearest 0.5 m) on a hard-copy tally grid. After the dot tallies are completed, use the "Shrubs B – Tally" Form on the Trimble® to enter the total number of shrubs that fell in each HC. Enter a "0" for each HC without an individual (do not leave the -98).

c. As for the A Plot, Border 1 and 2 are "IN" for the B Plot and each quadrant within.

d. If no measured and/or tallied shrub features are required, utilize a similar approach for documenting "None" as discussed in the "Bacsal" section above.

"Shrubs B – Dead" Form

1. Dot count all dead shrubs, including BACSAL, but excluding PLUSER. Dead shrubs do not need to be tallied by species. After the "dead" tallies are completed, enter the total count into the "Shrubs B – Dead" form.

2. **If no dead shrubs occur in the B Plot, create a new feature and enter "0" for the dead count.**

"Foliar Cover B" Form

1. Estimate the foliar cover classes **within the B Plot** for EVERY woody species that contributes foliar cover in the B Plot area regardless if the plant is rooted in the B Plot or which collection point the plant is measured for SC/HC/DC. Cover is recorded according to the pre-determined cover classes. ****This should include cover estimates for SALEXI and PLUSER and other species not normally measured in the B Plot.**

2. Create a new feature on the Trimble® for each species present. Select the most representative cover class for that species from the drop-down list on the GPS.

   a. After species-level cover estimates are recorded, estimate foliar cover classes within the B Plot for "All Trees," "All Shrubs," and "All" (trees and shrubs combined) and record the data on the "Foliar Cover B" form. "All," "All Trees," and "All Shrubs" are available selections beneath the species list drop-down box and are also saved as a single feature.

   b. Remember that measurements are by species, so cover classes CAN add up to > 100%.

   c. **A minimum of three "Foliar Cover B" features need to be recorded at each plot – one for "All," "All Trees," and "All Shrubs," respectively. If total shrub cover in the B Plot for example was "0," then three features, one each for "All," "All Trees," and "All Shrubs," shall be recorded with a cover class "0."**

E COLLECTION POINTS

"E-Quad Pluser" Form

1. Record measured heights for five representative PLUSER in E-Quads. For the remaining PLUSER stems, dot tally by half-meter HCs (i.e., shrub class) on a hard-copy data sheet per the classes. Select the specific E-Quad and record PLUSER measurements **and** tallies on the "E-Quad Pluser" form.

2. Count the total number of dead PLUSER stems. Enter this total into the "Dead Count" section on the "E-Quad Pluser" form.

3. Circle each of the four E-Quads on the hard-copy checklist as they are completed and check the box after you have measured all four collection points.

4. **It's mandatory that a feature is captured for PLUSER in each of the four E-Quads** regardless of the presence of live and/or dead PLUSER in the collection point. For example, if no live/dead PLUSER are located in Quad E1, select E1, enter "0" under the "Dead Count" and select "No" in the "Pluser Found?" section.

"E-Quad Salexi" Form

1. Record a measured height and DBH for five representative SALEXI SC1 trees (i.e., stems separated where they emerge from the ground) in E-Quads. For the remaining SALEXI SC1, dot tally by HC and enter the tallies into the same feature. Select the specific E-Quad on the GPS form and record SALEXI SC1 measurements and tallies on the "E-Quad Salexi" form.

2. Enter the tally for dead SC1 trees (all species combined) in the E-Quads. Dead SC1 trees are entered into the "Trees – Dead/Felled" form by E collection point. Note that dead SC1 trees are tallied and entered separately from dead PLUSER. (Dead PLUSER are entered into the "E-Quad Pluser" feature.

3. Per the "E-Quad-Pluser" feature discussed above, it's mandatory that a feature is captured for each of the four E-Quads. If no SALEXI are present in the collection point, select the specific quad and "No" for "Salexi Found?"

4. Circle each of the four collection points on the hard-copy checklist as they are completed. Check the box after all four collection points are measured.

C COLLECTION POINTS

"Foliar Cover C" Form

1. Select the specific C collection point from the drop-down menu on the "Foliar Cover C" form. Estimate total foliar cover **OF HERBACEOUS PLANT SPECIES** within each C Plot collectively and select the most representative cover class from the drop-down alongside "All Cover Class:" on the "Foliar Cover C" form. Estimate cover by species (i.e., one cover class for total herbaceous cover followed by one cover class for each species). The form allows for entries for up to six species. Create additional features if more than six herbaceous species are present and therefore need to be recorded. If no herbaceous species occur in quads, select "0" from the "All Cover Class:" drop-down, select "None" as the first species, and save the feature for that collection point. A "Foliar Cover C" feature needs to be recorded for all four C collection points regardless of whether or not herbaceous cover is present.

    a. For C Plots, there are no "OUT" and "IN" borders—if herbaceous foliage is above the open space within the quadrant, it counts for foliar cover.

2. Circle the collection point name (C1–C4) on the hard-copy checklist after the form is saved for a collection point and check the box after a feature has been saved for each of the four collection points.

"Ground Cover C" Form

1. Select the specific C collection point from the drop-down list and estimate **ground** cover for:

    a. Herbaceous species (annual or perennial species that still have living tissue)

    b. Woody species

    c. Dead (dead plants still attached to the ground [e.g., snags, annual species that have died but are still attached to roots, etc.])

    d. Litter (dead plant material unattached to ground but laying on the ground surface)

    e. Bare ground

    f. Rock/gravel

    g. Water

2. If no cover is present in a category, enter “0” in the “Cover Class” column for the attribute.

3. As for foliar cover, there are no “IN” or “OUT” borders. If a portion of a given cover is within the quadrant, it is included for ground cover.

4. Estimate the depth of litter and herbaceous vegetation to the nearest centimeter at three points in each quad.

    a. The measuring point will be the center point of each third of the 0.5 by 2-m quad. If this point is occupied by woody basal cover, the measuring point shall be the nearest point not occupied by woody basal cover.

    b. Litter depth is the depth of **continuous plant litter** above the ground surface. If no litter is present, record a depth of “0.” If litter is present, but < 0.5 cm deep (e.g., a leaf flat on the ground), record a litter depth of 0.5 cm. If litter depth is > 0.5 cm, round to the nearest centimeter. Litter depths are recorded in the three “Depth” cells.

    c. Herbaceous vegetation height is the height AT THE MEASURING POINT. If herbaceous vegetation is present but < 0.5 cm deep, record a height of 0.5 cm. If the height is > 0.5 cm, round to the nearest centimeter. DO NOT INCLUDE NON-WOODY SHRUBS AND TREES IN HERBACEOUS DEPTH MEASUREMENTS. The three measured herb heights are entered in the three cells marked “Herb HT” on the GPS.

5. **Ensure that a feature was recorded for all four collection points. Circle the collection point on the hard-copy checklist after completion and check the box after the component was measured at all necessary collection points.**

A COLLECTION POINT/GENERAL PLOT INFORMATION

“Trees – Dead/Felled” Form

1. Depending on SC, dead trees are tallied at different locations throughout the plot. **Dead trees are always placed into SCs based on DBH regardless of species**. Large dead trees (SC4 and greater) are considered snags and discussed later (“Snags” form). Dead SC3 trees are measured through the entire B Plot, while dead SC2 trees are only measured in B1 and B3. Dead SC1 trees are tallied in the E-Quads. The “Trees – Dead/Felled” feature captures each of these dead SCs; thus, the feature is used for multiple collection points.

2. If dead SC3 trees are encountered in the B Plot, dead SC2 trees are present in either B1 or B3, or dead SC1 trees are encountered in the E Plots, enter the tally by SC into the "Trees – Dead/Felled" form. The total number of dead individuals for each dead SC/collection point is entered in the Dead Tally box. To do this, select the SC/collection point combination from the drop-down and enter the total dead tally but leave -98 in both felled tree-related attributes.

3. Felled trees are tallied throughout the entire A collection point according to whether they are alive or dead. A tally of live or dead felled trees is also captured in the "Trees – Dead/Felled" form. When documenting felled trees, select "Felled" from the "Species" drop-down and enter the total number of live and or dead trees. Enter "0" if either attribute (live and felled/dead and felled) but not both are absent and leave -98 as the "Dead Tally."

4. Protocols for documenting the absence of dead and/or felled trees are listed below:

    a. If there are no felled trees **and** no dead trees at any of the various dead collection points, select "None" as the species and enter "0" for "Dead Tally," "Felled Alive Tally," and "Felled Dead Tally." Cases in which both dead and felled trees are absent, represent the only situation where dead and felled measurements should be combined under the same form.

    b. If felled trees are present but dead trees are absent, record felled trees per the instructions above. Then, to document the absence of dead trees, create a new feature, select "None" as the "Species," and enter "0" as the "Dead Tally."

    c. If dead trees are present but felled trees are absent, record dead trees per the instructions above. Then, to document the absence of felled trees, create a new feature, select "Felled" as the "Species," and enter "0" for both the "Felled Alive" and "Felled Dead" tallies.

"Snag" Form

1. Determine the presence of snags (dead trees in SC4–SC6 [DBH > 12.0 cm]) regardless of species within the A Plot. Record the total number of snags within each SC on the Trimble® unit. If no snags are found in the plot, create a new "Snag" feature and select "No" alongside "Snags Found?"

"Cavities" Form

1. If snags have cavities, GPS the location by creating a new "Cavities" feature on the Trimble®. Count and record the number of cavities present on the snag and record the snag DBH on the GPS while the location is being logged.

    a. **The recorder should stand stationary at the snag with the cavity while marking this feature so an accurate geographic location can be obtained.**

    b. **Each cavity is marked as an independent feature. If no cavities are present, create a new feature and select "No" for "Cavities Found?"**

"Gaps" Form

1. Determine the presence of open canopy space (gaps) with an area of ≥ 9 square meters (e.g., 3 by 3 m) within 30 m of **plot center**. Like cavities, gaps require an accurate GPS location, so the recorder should stand still while the GPS is recording positions.

2. "Gap" is defined as an area without foliated vegetation > 3 m off the ground surface. As gaps are located, denote whether it is a canopy gap (space within the planted area) or edge gap (open space outside of planted area [e.g., road, edge of field, or stream edge]), select the most representative distance category (using the distance to the edge of the canopy gap from plot center), and stand at the center (canopy gap) or edge (edge gap) of the gap while recording attributes on the GPS unit **so an accurate location is captured**. Each gap will be marked as its own GPS feature on the Trimble®. If no gaps occur, create a new feature and select "None" for the "Edge Gap" type designation.

"Incidentals" Form

1. Record a list of all "incidental" species on the "Incidentals" form. This list will include ALL species observed in the primary plot that are not recorded otherwise.

2. General plot notes are also recorded in the "Notes" section of the "Incidentals" feature. In this section, please record whether or not any of the covered species were still present on the plot.

3. The “Incidentals” form can also be used to note any major problems with the site, which might include prevalence of invasive species or patches of vegetation mortality. If serious conditions such as these are encountered, notify the Field Supervisor, who will then notify the Project Supervisor.

HARD-COPY CHECKLISTS AND QUALITY ASSURANCE/QUALITY CONTROL

1. The hard-copy checklist plus tally sheet (Sheet 1) and HTP All (Sheet 2) are required documentation for every plot. Please provide those hard-copy sheets to the Field Supervisor at the end of each field day.

2. Before leaving the plot location, make sure that each of the mandatory elements are checked, circled, or crossed off (as appropriate) from the hard-copy checklist.

3. Ensure that a feature is also created for every feature/collection point following the instructions in this document and as guided by the hard-copy checklist.

DBH Measurement Specifications

DBH measurements will generally follow U.S. Forest Service Standard Stand Exam guidelines, which are interpreted on figure 9-1 (modified from http://www.fs.fed.us/nrm/fsveg/). However, for the LCR MSCP, we will be following different protocols for cases 3 and 5.

Descriptions on how to deal with each case of trunk irregularities are observed:

- Case 1: Tree on a slope
    - Tree DBH shall be recorded 1.4 m above the ground surface on the upslope side of the tree.
- Case 2: Tree on level ground
    - Standard case. Record DBH for 1.4 m above ground surface.

- Case 3: Leaning tree (and felled, but re-growing tree; DIFFERENT FROM FIGURE)
    - **Record DBH at 1.4 m above ground surface**. Measure diameter perpendicular to the direction of tree growth at that level as illustrated on figure 9-1.
- Case 4: Tree forking at or above 1.4 m (the fork is incomplete at 1.4 m)
    - Measure DBH below the split as near as possible to 1.4 m but beneath trunk irregularities occurring due to the split.
- Case 5: Tree fork completed below 1.4 m (DIFFERENT FROM FIGURE)
    - Measure the diameter of the **LARGEST TRUNK** at DBH breast height or as near DBH as possible while avoiding trunk irregularities caused by the trunk split.
- Case 6: Tree irregularity at DBH
    - Measure DBH away from irregularity but as near to 1.4 m as possible (can be either immediately above or below).
- Case 7: Bottleneck tree
    - Treat as you would a tree irregularity. Increase the height at which the diameter is measured to be above the zone of irregularity.
- Case 8: Oval tree trunks
    - When oval trunks are present at DBH, use a DBH tape to measure DBH and/or place the tree into the appropriate SC.

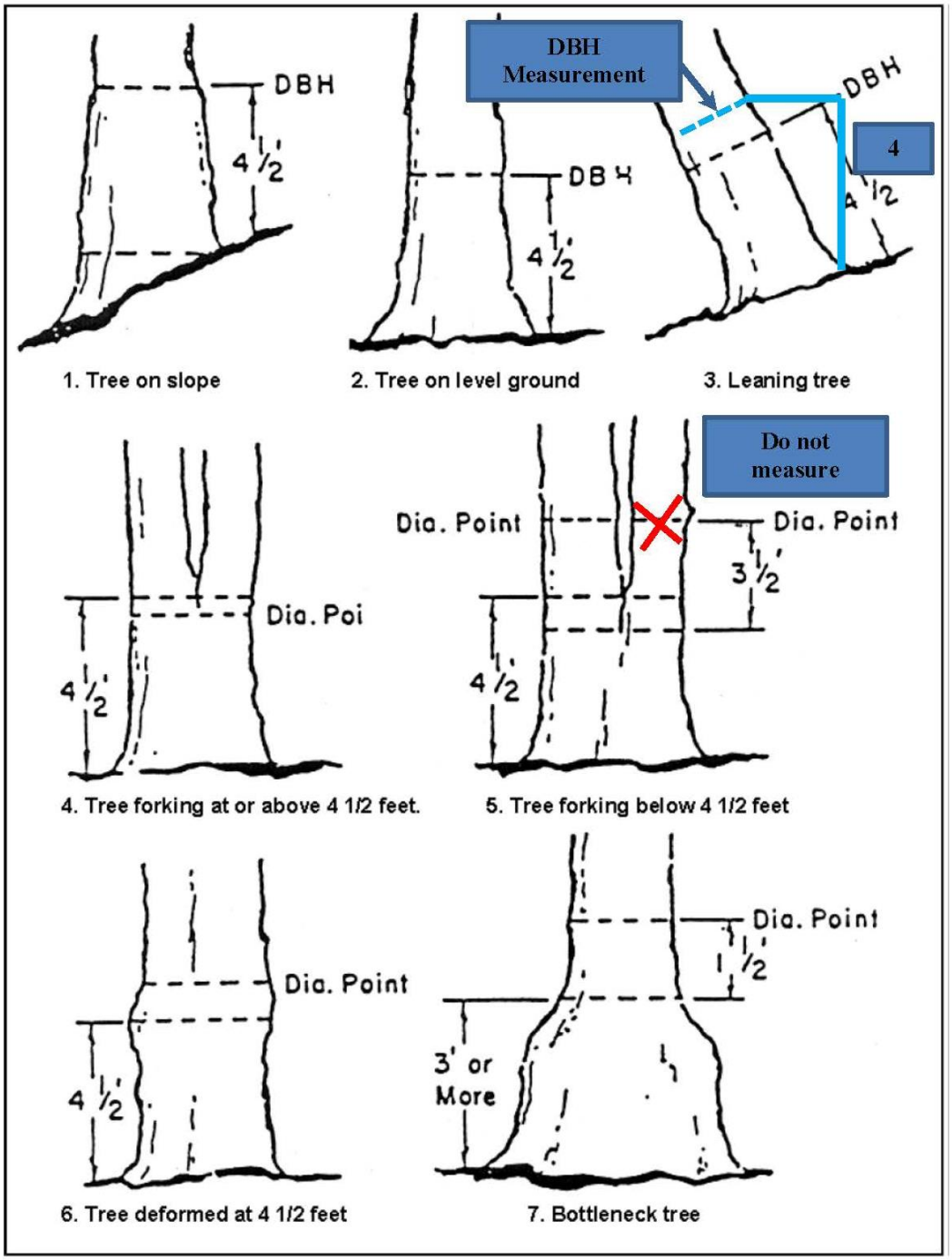

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Figure 9-1

Clinometer Methods

Table 9-1 should be used to estimate the height of trees that are taller than the fully extended stadia rod. For the following methods, it is assumed that two individuals are surveying: an observer (the one holding the clinometer) and the recorder.

1. Determine where the highest point of live foliage is for the given tree. For reference, the data recorder should stand directly below this point and hold the 0-m point of the measuring tape.

2. The observer will stand as far as possible from the tree/data recorder while maintaining line of site with the highest point of live stem. For ease of measurement, the horizontal distance from the tree should be either 5, 10, 15, or 20 m.

3. The observer will determine the angle from his or her eye height to the point of highest live foliage on the tree.

4. Reference the clinometer table (table 9-1) to estimate the height of the tree above eye height for the given distance from the tree foliage column.

5. Correct for the observer's eye height:

    a. If the ground is level, add the observer's eye height to the height estimate.

    b. If the ground is not level, determine the angle for the data recorder's feet to estimate the difference between the observer's eye height and the ground surface below the tallest point of the tree. Add the calculated heights together.

Table 9-1.—Clinometer calculations (degrees)

Distance from highest foliage:	5	10	15	20
Angle (degrees)	**Vertical meters (add your eye height)**			
5	0.4	0.9	1.3	1.7
10	0.9	1.8	2.6	3.5
15	1.3	2.7	4.0	5.4
20	1.8	3.6	5.5	7.3
25	2.3	4.7	7.0	9.3
30	2.9	5.8	8.7	11.5
35	3.5	7.0	10.5	14.0
37.5	3.8	7.7	11.5	15.3
40	4.2	8.4	12.6	16.8
42.5	4.6	9.2	13.7	18.3
45	5.0	10.0	15.0	20.0
47.5	5.5	10.9	16.4	21.8
50	6.0	11.9	17.9	23.8
52.5	6.5	13.0	19.5	26.1
55	7.1	14.3	21.4	28.6
57.5	7.8	15.7	23.5	31.4
60	8.7	17.3	26.0	34.6
62.5	9.6	19.2	28.8	38.4
65	10.7	21.4	32.2	42.9
67.5	12.1	24.1	36.2	48.3
70	13.7	27.5	41.2	54.9

ATTACHMENT 10

Data Checksheet for Vegetation Surveys

Plot:			**Date:**
Hobo #:		**Species/Use:**	
HTP Rover File Name:		**OTH Rover File Name:**	
Time start:		**Time end:**	**Trimble #:**
Field Observers:			**QC By:**

LCR MSCP VEG MEFF FORM COMPLETION CHECKLIST - ENHANCED PLOT

Check boxes below as forms are completed during field data collection and post field QA/QC

Completed in Field	QA/QC complete	**NOTES (Please record presence of covered species here, distance to water, and any other info about the plot):**

HITS TO POLE Data Dictionary File

D COLLECTION POINTS

		D1 Cnpy Clsr			D1 Hits to Pole
		D2 Cnpy Clsr			D2 Hits to Pole
		D3 Cnpy Clsr			D3 Hits to Pole
		D4 Cnpy Clsr			D4 Hits to Pole
		D5 Cnpy Clsr			D5 Hits to Pole

OTHER Data Dictionary File

A COLLECTION POINTS

		Trees - Measure A (standard trees SC4 and greater)	Circle if present/Cross if not: Popfre SC4 SC5 SC6 SC7 SC8 Salgoo SC4 SC5 SC6 SC7 SC8 OTHER SPP (Note)
		Trees - Tally A (SC4 and greater)	
		Mesq-Tam - Measure A (SC2)	Circle if present/Cross if not: MesqSC2 TamSC2
		Mesq-Tam - Tally A (SC2)	
		Trees - Felled	
		Snags	
		Cavities	
		Canopy - Edge	
		Incidentals	

B COLLECTION POINTS

		Trees - Measure B (standard trees SC3 and lower)	Circle if present/Cross if not: Popfre SC1 SC2 SC3 Salgoo SC1 SC2 SC3 OTHER SPP (Note)
		Trees - Tally B (SC3 and lower)	
		Mesq-Tam - Measure B (SC1)	Circle if present/Cross if not: MesqSC1 TamSC1
		Mesq-Tam - Tally B (SC1)	
		Trees - Dead	Circle as completed (Mandatory Features) SC2 (B1) SC2 (B3) SC3 (B)
		BACSAL - Measure	
		BACSAL - Tally	
		Shrubs B - Measure	
		Shrubs B -Dead	
		Shrubs B - Tally	
		Foliar Cover B	Circle as completed (Mandatory Features) All All Trees All Shrubs

		C COLLECTION POINTS	
		Foliar Cover C Circle from following list as completed -- --- C1 C2 C3 C4	
		Ground Cover C Circle from following list as completed -- --- C1 C2 C3 C4	
		E COLLECTION POINTS	
		E-Quad Pluser Circle from following list as completed -- --- E1 E2 E3 E4	
		E-Quad Salexi Circle from following list as completed -- --- E1 E2 E3 E4	
		E-Quad Dead (SC1) Circle from following list as completed -- --- E1 E2 E3 E4	