Lower Colorado River Multi-Species Conservation Program

Balancing Resource Use and Conservation

Lower Colorado River Riparian Bird Surveys

2013 Annual Report

U.S. DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION

June 2014

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Multi-Species Conservation Program

Lower Colorado River Riparian Bird Surveys

2013 Annual Report

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June 2014

Great Basin Bird Observatory. 2014. Lower Colorado River Riparian Bird Surveys, 2013 Annual Report. Unpublished report submitted to the Bureau of Reclamation, Lower Colorado Region, Boulder City, Nevada. June 2014.

ACRONYMS AND ABBREVIATIONS

Bill Williams River NWR	Bill Williams River National Wildlife Refuge
CI	confidence interval
CRIT	Colorado River Indian Tribe
CV	coefficient of variation
CVCA	Cibola Valley Conservation Area
DR	detection ratio
DS	Double Sampling
EI	enhanced intensive (area search)
GBBO	Great Basin Bird Observatory
GIS	Geographic Information System
GME	Geospatial Modeling Environment
GPS	Global Positioning System
ha	hectare(s)
Havasu NWR	Havasu National Wildlife Refuge
HOBO	environmental data logger unit
LCR	lower Colorado River
LCR MSCP	Lower Colorado River Multi-Species Conservation Program
MCP	minimum convex polygon
MODIS	Moderate Resolution Imaging Spectrometer
PVER	Palo Verde Ecological Reserve
Reclamation	Bureau of Reclamation
SE	standard error
USGS	U.S. Geological Survey
UTM	Universal Transverse Mercator

Symbols

≈	approximately equal to
>	greater than
≥	greater than or equal to
<	less than
%	percent

CONTENTS

Page

Executive Summary ES-1

Introduction 1

Component 1: Population Estimates of Avian Species within the Lower Colorado River Multi-Species Conservation Program Boundaries and Habitat Creation Sites 3
Introduction 3
Methods 3
Study Area and Sampling Plan 3
Plot Selection: Systemwide Survey Rapid Area Search Plots 9
Habitat Creation Site Plot Selection 9
Rapid Area Search Plots 9
Intensive Area Search Plots, Systemwide and Habitat Creation Sites 11
Avian Monitoring Methods 12
Rapid Area Searches 15
Intensive Area Searches 18
Double Sampling 21
Population Size Analyses 22
Results 23
Overall Species Richness Patterns 23
Systemwide Surveys 24
Systemwide Rapid Area Searches 24
Systemwide Intensive Area Searches 32
Habitat Creation Sites: Rapid Area Searches 38
Beal Lake Habitat Conservation Area 38
Colorado River Indian Tribe (CRIT 9 'Ahakhav Tribal Preserve) Habitat Creation Site 38
Palo Verde Ecological Reserve 44
Cibola Valley Conservation Area 48
Cibola National Wildlife Refuge, Farm Unit 1 52
Pretty Water Conservation Area 56
Yuma East Wetlands 59
Habitat Creation Sites: Intensive Area Searches 62
Overall Population Size Estimates 66
Systemwide Population Size Estimates Using Combined Detectabilities 66
Individual Species Detectabilities 80
Habitat Creation Site Population Size Estimates 81
Discussion 89
Systemwide Surveys 89
Habitat Creation Sites 90

Page

Component 3: Testing the Assumptions of the Double-Sampling Method 93
Introduction 93
Methods 94
Plot Selection, 2013 94
Survey Techniques 95
Data Analysis 96
Results 97
Double-Sampling Results, 2011–13 97
Summary Statistics 97
Seasonal Effects on Detectability 111
Discussion 116
Detection Ratios and Summary Statistics 116
Habitat Effects 117
Effects of Survey Methods 118
Natural History Effects on Species Detectabilities 118
Covered Species 119
Bell's Vireo 119
Gila Woodpecker 119
Sonoran Yellow Warbler 120
Summer Tanager 121
Other Riparian Obligate Species 123
Abert's Towhee 123
Anna's Hummingbird 124
Ash-Throated Flycatcher 125
Bewick's Wren 126
Black-Chinned Hummingbird 127
Black-Tailed Gnatcatcher 128
Blue Grosbeak 130
Brown-Crested Flycatcher 130
Common Yellowthroat 131
Crissal Thrasher 132
Lesser Goldfinch 133
Lucy's Warbler 134
Verdin 135
Yellow-Breasted Chat 136

Component 4: Habitat Surveys 139
Methods 139
Vegetation Plot Selection 139
Use Plots 140
Non-Use Plots 141
Creating Vegetation Plots Using a Geographic Information System 142
HOBO Site Selection 143
Vegetation Plots Selected in 2013 144

Page

Component 5: Monitoring Impacts of Saltcedar Beetle on Riparian Bird Populations 147
Introduction 147
Methods 148
Plot Selection 148
Virgin River Plots 149
Topock Marsh and Bill Williams River National Wildlife Refuge 151
Monitoring Methods 151
Data Analysis 152
Results 152
Discussion 162
Literature Cited 165

Tables

Table Page

1 Codes of dominant vegetation type (from Anderson and Ohmart 1976; Bart 2007) 4
2 Crosswalk of 2010 habitat strata (also used in 2011) with Anderson and Ohmart (1976) 6
3 List of all regions in the LCR MSCP study area, whether they were included in the 2013 plot selection, and reasons for exclusion 7
4 Area, in hectares, of each habitat stratum per region from the 2010 plot delineation in the LCR MSCP project area 8
5 Number of plots, available by region and habitat stratum, based on the 2010 plot delineation of the LCR MSCP project area 8
6 Number of systemwide area search plots per region and habitat stratum surveyed in 2013 10
7 Habitat creation sites, number of plots surveyed, habitat type, and area surveyed using rapid area searches in 2013 11
8 Summary of component 1 plots that were surveyed using the intensive area search method in 2013 12
9 Behavioral information collected to determine breeding status during area searches 15
10 Breeding justification codes entered into Reclamation's Access database for the riparian bird survey project 20
11 Total number of breeding territories, by species, in the 80 systemwide rapid area search plots in 2013 25
12 Detected, but not confirmed breeding, during systemwide rapid area searches in 80 plots in 2013 27

Tables (continued)

Table Page

13 Total number of breeding territories of territorial bird species detected during systemwide intensive area searches in 2013 33
14 Species detected, but not confirmed as breeding, on the intensive systemwide area search plots in 2013 (n = 8) 34
15 **Beal Lake Habitat Conservation Area**: Number of breeding territories detected during rapid area search plots in 2013 39
16 **Beal Lake Habitat Conservation Area**: Number of non-breeding birds detected during rapid area search plots in 2013..... 40
17 **CRIT 9 'Ahakhav Tribal Preserve**: Number of breeding territories of territorial species detected during rapid area search plots in 2013 42
18 **CRIT 9 'Ahakhav Tribal Preserve**: Number of non-breeding birds detected during rapid area search plots in 2013..... 43
19 **PVER**: Number of breeding territories of territorial species detected during rapid area search plots in 2013..... 45
20 **PVER**: Number of non-breeding birds detected during rapid area search plots in 2013..... 46
21 **CVCA**: Number of breeding territories of territorial species detected during rapid area search plots in 2013..... 49
22 **CVCA**: Number of non-breeding birds detected during rapid area search plots in 2013..... 50
23 **Cibola National Wildlife Refuge Farm Unit 1**: Number of breeding territories of territorial species detected during rapid area search plots in 2013..... 52
24 **Cibola National Wildlife Refuge Farm Unit 1**: Number of non-breeding birds detected during rapid area search plots in 2013..... 53
25 **Pretty Water Conservation Area**: Number of breeding territories of territorial species detected during rapid area search plots in 2013 56
26 **Pretty Water Conservation Area**: Number of non-breeding birds detected during rapid area search plots in 2013..... 57
27 **Yuma East Wetlands and Hunter's Hole Conservation Area**: Number of breeding territories of territorial species detected during area search plots by Fred Phillips Consulting, LLC, in 2013 59
28 **Yuma East Wetlands and Hunter's Hole Conservation Area**: Non-breeding species detected during area search plots by Fred Phillips Consulting, LLC, in 2013..... 60

Tables (continued)

Table Page

29 Total number of breeding territories by species detected during intensive area searches at a subset of four habitat creation sites in 2013 62
30 Species detected, but not confirmed breeding, during intensive area searches at Cibola Farm Unit 1 sites in 2013 63
31 Species detected, but not confirmed breeding, during intensive area searches at PVER sites in 2013 65
32 Estimated number of territories of covered species (and 95% confidence intervals [CI]), by region-habitat combinations, based on systemwide surveys completed in 2013 68
33a Estimated number of breeding pairs (and 95% confidence intervals [CI]) of a first set of five of the most abundant species breeding along the lower Colorado River, by region-habitat combination, based on systemwide surveys completed in 2013 72
33b Estimated number of breeding pairs (and 95% confidence intervals [CI]) of a second set of five of the most abundant species breeding along the LCR, by region-habitat combination, based on systemwide surveys completed in 2013 76
34 Detection ratio (DR) by species of LCR MSCP covered species and the 10 most common breeding species in component 1 systemwide surveys, 2013 80
35 Estimated number of breeding pairs (and 95% confidence intervals [CI]) of covered species breeding in habitat creation sites along the LCR, by site, based on double-sampling surveys completed in 2013 82
36a Estimated number of breeding pairs (and 95% confidence intervals [CI]) of the first set of five most common riparian species breeding in habitat creation sites along the LCR, by habitat type, based on double-sampling surveys completed in 2013 84
36b Estimated number of breeding pairs (and 95% confidence intervals [CI]) of the second set of five most common riparian species breeding in habitat creation sites along the LCR, by habitat type, based on double–sampling surveys completed in 2013 86
37 Estimated number of breeding pairs of the most common riparian species breeding in habitat creation sites along the LCR, by habitat type, based on double–sampling surveys completed in 2013 87
38 Summary statistics for the estimated number territories for intensive (I) and enhanced intensive (EI) sampling for 2011–13 for species that had more than three non-zero sites sampled 98

Tables (continued)

Table Page

39 Summary statistics for the difference in estimated number territories for intensive (I) and enhanced intensive (EI) (I-EI) sampling for 2011–13 for all species that had at least three non-zero samples in each habitat 101
40 Intensive – EI sampling difference summary statistics by year..... 103
41 The detection ratios of rapid versus EI and rapid versus intensive surveys for 20 species and the all species total over 3 years, 2011–13 (85% confidence interval [CI]) 104
42 Number of vegetation plots selected by region and habitat for Bell's vireo at use and non-use sites 144
43 Number of vegetation plots selected by region and habitat for Gila woodpecker at use and non-use sites 145
44 Number of vegetation plots selected by region and habitat for summer tanager at use and non-use sites 145
45 Number of vegetation plots selected by region and habitat for yellow warbler at use and non-use sites..... 146
46 Southwestern willow flycatcher sites and number of riparian bird plots within the Virgin River (n = 42 plots), Topock Marsh (n = 37 plots), and Bill Williams River NWR (n = 29 plots) 150
47 Number of breeding territories of territorial species detected in saltcedar beetle study plots on the Virgin river during rapid area search plots in 2013..... 153
48 Species detected, but not confirmed breeding, during rapid area searches at saltcedar beetle study plots at Virgin River sites in 2013 154
49 Number of breeding territories of territorial species detected in saltcedar beetle study plots in the Topock Marsh and the Bill Williams River plots during rapid area search plots in 2013 156
50 Species detected, but not confirmed breeding, during rapid area searches at saltcedar beetle study plots at Topock Marsh and the Bill Williams River in 2013..... 158

Figures

Figure Page

1 Differences between intensive and EI sampling within a plot reported for relatively common species. 99
2 Differences between EI and intensive sampling within a plot for relatively common species in “hard” and “medium” difficulty habitats. 102
3 Scatterplot of error in territory estimates (I-EI) versus “true” bird density over all species for hard and medium habitat types. 103
4 Comparison of the detection ratios of EI and rapid (blue bars) versus intensive and rapid (red bars) for seven species, including 3 years of data, 2011–13. 106
5 Comparison of data collected between 2011–13 showing the detection ratios of EI and rapid (blue bars) versus intensive and rapid (red bars) for four species. 107
6 Comparison of data collected from 2011–13 showing the detection ratios of EI and rapid (blue bars) versus intensive and rapid (red bars) for four species. 108
7 Comparison of data collected from 2011–13 showing the detection ratios of EI and rapid (blue bars) versus intensive and rapid (red bars) for two species. 109
8 Comparison of data collected from 2011–13 showing the detection ratios of EI and rapid (blue bars) versus intensive and rapid (red bars) for two species. 110
9 Comparison of 85% confidence intervals (n = 24) for each species-specific detection ratio in relation to the all-species detection ratios (EI = 0.86, yellow horizontal line; intensive = 1.05, orange horizontal line). 111
10 Comparison of estimated numbers of Arizona Bell’s vireo territories using three different survey methods (rapid, standard intensive, and EI area searches) on Plot #2865 in 2013. 112
11 Comparison of estimated numbers of summer tanager territories using three different survey methods (rapid, standard intensive, and EI area searches) on Plot #2865 in 2013. 113
12 Comparison of estimated numbers of Sonoran yellow warbler territories using three different survey methods (rapid, standard intensive, and EI area searches) on Plot #2864 in 2013. 114
13 Comparison of estimated numbers of Gila woodpecker territories using three different survey methods (rapid, standard intensive, and EI area searches) on Plot #2856 in 2013. 115

Attachments

Attachment

1 Systemwide and Habitat Creation Plot Maps, 2013
2 Sample Plot Maps
3 Access Data Entry Protocol
4 Geographic Information System Data Entry Protocol
5 Comprehensive Species List
6 List of All Area Search Plots
7 Number of Pairs of Non-Territorial Breeding Species
8 Crosswalk Between Southwestern Willow Flycatcher Site Names and Lower Colorado River Riparian Bird Plots
9 Vegetation Plot Selection Process

EXECUTIVE SUMMARY

The overarching goals of the lower Colorado River (LCR) riparian bird surveys continue to be to: (1) provide a baseline for monitoring long-term population trends of obligate riparian birds throughout the LCR, including Lower Colorado River Multi-Species Conservation Program (Bureau of Reclamation 2006). habitat creation sites; (2) estimate population sizes of obligate riparian birds; and (3) define habitat requirements of LCR MSCP covered species.

This report summarizes the results of the 2013 field surveys that were completed as part of the LCR MSCP's riparian bird survey project. The first component of this project was to conduct systemwide monitoring of riparian birds. The data collected and analyzed for five 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)*, and summer tanager (*Piranga rubra*), as well as the most common riparian land bird species, resulted in population estimates for the habitat creation sites and the systemwide project area.

We completed rapid area searches on 80 plots selected randomly from the systemwide plot grid and intensive area searches on a random subset of 8 of those plots. We also completed rapid area searches on 79 plots within the habitat creation sites 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 five LCR MSCP covered species as well as the most common territorial riparian land bird species.

During rapid surveys of habitat creation sites, surveyors recorded 17.25 territories of Arizona Bell's vireo, 20 of Sonoran yellow warbler, and 1.75 of summer tanager at the Beal Lake Habitat Conseravation Area; 2.75 of summer tanager, 1.75 of vermilion flycatcher, and 1 of Sonoran yellow warbler at Colorado River Indian Tribe land; 2 of Sonoran yellow warbler and 0.75 of summer tanager at the Palo Verde Ecological Reserve (PVER); no territories of covered species at the Cibola Valley Conservation Area, the Pretty Water Conservation Area, nor Yuma East Wetlands; and 1 territory of Arizona Bell's vireo at the Cibola Farm Unit (Nature Trail habitat creation area). Intensive area searches were conducted on four habitat creation site plots, including PVER 1A, PVER 4, Cibola Farm Unit Area 1 Plot B, and Cibola Farm Unit Nature Trail North. During these surveys, we found evidence for one covered species, the summer tanager, breeding at PVER 4B.

During systemwide rapid surveys, we found the most common breeders of the covered species to be the Sonoran yellow warbler (211 territories), followed by Arizona Bell's vireo (58 territories), Gila woodpecker (21.75 territories), summer tanager (15.5 territories), vermilion flycatcher (2.75), and gilded flicker (0.25).

During the systemwide intensive area searches (n = 8 plots) in 2013, we found breeding evidence for three covered species, including the Sonoran yellow warbler (42.75 territories), Gila woodpecker (1.75 territories), and summer tanager (0.75 territories). Overall, we recorded 182 species in 2013 on rapid and intensive surveys (these numbers don't include super species, sub species, or unknowns), 173 systemwide, with over one-half being classified as migrants or other non-breeding populations. We also recorded a total of 120 species using the habitat creation sites, and 111 species species were present on both the systemwide and habitat creation plots in 2013.

In 2013, we also began collecting data for component 5 of the project, which evaluates the effects of the saltcedar beetle (*Diorhabda carinulata*) on riparian birds at southwestern willow flycatcher *(Empidonax traillii extimus*) sites. Population estimates for these sites can be used for evaluating the effects of the progressing invasion of the beetle. The preliminary results of the first year suggest that populations are similar in beetle-infested sites compared to unaffected sites. However, beetle defoliation was relatively minor at the Virgin River sites during the 2013 survey season, and a statistical difference between invaded areas (Virgin River) and uninvaded areas (Topock Marsh and Bill Williams River) was therefore unlikely in this first year of the study.

The main objective for component 3 of this project was to test the assumptions of the double-sampling design. The double-sampling method developed for LCR MSCP riparian bird surveys was based on three important assumptions, and the purpose of this project component was to test the only assumption that currently carries some uncertainty in the monitoring plan, which is that intensive area searches result in unbiased estimates of bird numbers. To address this uncertainty, we conducted a third and final season of a triple-sampling effort (rapid area search, intensive area search, and enhanced intensive [EI] area search) on eight randomly selected plots. The overall difference between the intensive and EI results was only 16 percent, and the species that contributed most to this difference differed in their natural history from most others. The species with the largest deviations from a detection ratio of 1 were those that breed early, arrive late, are challenging to detect, or have poorly defined territories. The intensive and EI surveys were also conducted in the most difficult to survey plots in the project area, and it is likely that the actual detectability of most species is higher in many other areas, which are easier to survey and have lower bird densities. In this report, we interpret these findings in detail based on the natural history knowledge we have gained over the years of surveys.

The results of this study varied among the covered species. Intensive, EI, and rapid surveys showed similar total numbers of Bell's vireo territories. This species is relatively easy to detect and map because breeding pairs of Arizona Bell's vireo almost continuously vocalize throughout the breeding season and often sing from the same perch day after day. For Gila woodpecker, intensive surveys slightly underestimated the number of territories compared with the other

methods, but rapid and EI surveyors obtained similar numbers. Possible causes of the difference include the fact that both sexes engage in vocalizations and drumming, often out of view, and the fact that Gila woodpeckers have large territories that often overlap with others. For Sonoran yellow warbler, rapid surveys overestimated, and intensive surveys underestimated, this species compared to EI results. Factors that may have caused high rapid survey numbers include: (1) breeding Sonoran yellow warblers arrive in late March, while migrant populations usually arrive after mid-April; and (2) the detection of singing migrants likely inflates the numbers on rapid surveys. Rapid surveyors commonly reported breeding evidence from individuals that were likely migrants because territorial behaviors are common during migration stopovers in this species. One factor that may cause underestimation from intensive surveys includes very high densities of territories coupled with small territory sizes. Furthermore, the species is quiet on breezy days and may therefore not always be detected, which affects their classification as breeders. Finally, summer tanager territory numbers were underestimated in rapid and intensive surveys compared to EI surveys. This species is particularly difficult to survey due to their late arrival from migration to the study area, which causes many of them to be absent during the first visit of a rapid survey. Also, males only sing for a brief period in spring, and usually only before dawn, and their singing ceases when they have a nest. Summer tanager counter-singing is also fairly rare, which makes it difficult to delineate territory boundaries, and females are cryptic and seldom seen during breeding.

Component 3 was an important reality check for the difficult process of monitoring many species across a large landscape and over a long period of time. It confirmed that the basic approach of the double-sampling method produced the desired monitoring data, and it resulted in additional indepth information about birds and their natural history on the LCR that was previously unavailable. The natural history information gathered about the four covered species (summer tanager, yellow warbler, Gila woodpecker, and Arizona Bell's vireo) and other non-covered species common in the study area will help future surveyors produce more accurate results and thus continue to decrease bias.

For component 4 of the 2013 project, we collected a third year of standardized LCR MSCP habitat monitoring data, including biotic and abiotic variables. We discuss the methods for this component in the 2013 report, and the results will be summarized in future reports.

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 the six LCR MSCP covered bird species, Gila woodpecker (*Melanerpes uropygialis)*, vermilion flycatcher (*Pyrocephalus rubinus)*, gilded flicker (*Colaptes chrysoides*), Arizona Bell's vireo (*Vireo bellii arizonae)*, Sonoran yellow warbler (*Dendroica petechia sonorana)*, and summer tanager (*Piranga rubra*), as well as other riparian obligate birds (GBBO 2008, 2009, 2010). We also began to collect habitat data for these six covered 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 LCR MSCP 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 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 using the systemwide and habitat creation site sampling plans and added three new components to the project, including component 2 – obtaining a 1-year baseline bird population size estimate on a pre-development site in the Laguna Division Conservation Area, component 3 – testing assumptions of the double-sampling method, and component 4 – collecting biotic and abiotic data at use and non-use areas for four LCR MSCP covered species. In 2013, we continued collecting data for components 1, 3, and 4. For component 3, 2013 was the final year of data collection, and in this report, we will present detailed results, discussions, and conclusions for this portion of the project.

In 2013, we also began work on component 5 of the project, which was established to evaluate the potential effects of the saltcedar beetle (*Diorhabda carinulata*) on breeding bird populations at southwestern willow flycatcher *(Empidonax traillii extimus)* sites in order to predict the beetle's potential effects on riparian bird populations within the LCR MSCP planning area.

Systemwide monitoring of the LCR MSCP's riparian birds emphasizes six species covered under the program (hereafter referred to as covered species), including the gilded flicker, Gila woodpecker, vermilion flycatcher, Arizona Bell's vireo, Sonoran yellow warbler, and summer tanager. The other LCR MSCP covered bird species, including southwestern willow flycatcher (*Empidonax traillii extimus*), elf owl *(Micrathene whitneyi*), western yellow-billed cuckoo (*Coccyzus americanus occidentalis*), black rail (*Laterallus jamaicensis*), Virginia rail (*Rallus limicola*), and Yuma clapper rail (*Rallus longirostris yumanensis*) are monitored separately using species-specific protocols and are therefore not covered in this report, except for the reporting of incidental detections.

The project area for systemwide bird monitoring includes the Colorado River from Separation Canyon, upstream of Lake Mead, to the Southerly International Boundary with Mexico. In 2013, we were granted access to survey the habitat creation sites located within the Colorado River Indian Tribe (CRIT) site, the 'Ahakhav Tribal Preserve. Except in 2010, the 'Ahakhav Tribal Preserve sites were surveyed in all previous years of the project. The project area also includes portions of the Bill Williams and Virgin Rivers. For habitat creation site monitoring, we included all LCR MSCP habitat creation sites within the historic flood plain of the Colorado River's main stem in the sampling plan.

In this annual report, we provide an abridged description of methods that have been previously provided in more detail in GBBO (2010) and Bart et al. (2010). In addition, we summarize the results for the project tasks covered in 2013, including a 3-year summary of component 3 (testing assumptions of the double-sampling method), and refer the reader to previous annual reports on this project (GBBO 2008, 2009, 2010, 2011) for results from previous surveys.

Component 1: Population Estimates of Avian Species within the Lower Colorado River Multi-Species Conservation Program 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 habitat conservation areas to obtain population size estimates, trends, and distribution for the six LCR MSCP 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 in 2007–10 (Bart and Manning 2008; Bart et al. 2010; GBBO 2009, 2010).

The rationale and methods for population monitoring based on double-sampling that we used in this contract 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 next section and in GBBO (2010).

METHODS

Study Area and Sampling Plan

Our 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 (attachment 1, figures 1-1 through 1-39). The portion from Separation Canyon to Lake Mead was not surveyed because it was inaccessible due to fluctuating water levels.

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" and areas not suitable as "unsuitable" and "marsh" (for more details on the original stratification, see Bart 2007). This stratification optimized 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 (table 1).

Table 1.—Codes of dominant vegetation type
(from Anderson and Ohmart 1976; Bart 2007)

Code	Description
AG	Agriculture
ATW	Atriplex
AW	Arrowweed
CW	Cottonwood-willow
HM	Honey mesquite
SC	Saltcedar
SH	Saltcedar-honey mesquite
SM	Saltcedar-screwbean mesquite
OW	Open water
SOW	Structured open water
BW	Backwater
UD	Undeveloped bare ground
NC	No classification

During the first stratification (Bart 2007), survey plots were delineated to divide the entire project area into approximately (≈) 9-hectare (ha) plots that were each assigned to the habitat type that covered the majority of the plot. It is important to note that other habitat types may be present in any plot that is designated as one habitat type. For instance, an "unsuitable" plot may have in a *minority* of its area highly suitable habitat for a covered species, thus explaining survey results that indicate that a small portion of a covered species' population occurs in unsuitable plots.

In the spring of 2010, we revised the sampling design to create a new plot layer to focus our data collection on the riparian habitat within the LCR MSCP project area. This new layer largely retained the original grid delineation of ≈9-ha plots. We were 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. Historically, the Colorado River flood plain was mostly covered by riparian habitat, but today, much of that historic flood plain area is covered by non-riparian habitat or agriculture due to river management. To update the sampling plot grid, we first clipped the old plot layer to fit the project's current LCR MSCP boundary, and second, we reduced some plot sizes to better reflect the survey area that can effectively be covered in an area search.

Everything outside the LCR MSCP project area was excluded from our new plot layer. All habitats within the plot layer and the project area (riparian or non-riparian) had the same chance of selection for survey regardless of their habitat type. We continued to use both vegetation and regional strata for our plot selection.

The original habitat stratification was further updated in 2010 when we (1) revised the names of most habitat categories (so as not to presume suitability for covered species) and (2) combined the original six strata (unsuitable, good-tall, good-low, fair, poor, and marsh) to create just four habitat strata: tall woody, low woody, herbaceous, and unsuitable. The "unsuitable" strata were just named unsuitable, which should not imply that the plots within that stratum are unsuitable bird habitat. We selected habitat strata in an effort to keep the tall and medium woody and the low woody cover types separate (tall and low woody), combine various herbaceous vegetation types into herbaceous, and to combine all other habitat strata into unsuitable. In table 2, we provide the crosswalk from the original Anderson and Ohmart (1976) vegetation types to the habitat strata used for restratification in 2010. Further details on habitat strata and plot assignments can be found in Bart et al. (2010).

Furthermore, the project area was originally divided into 13 geographic regions (table 3), resulting in the following breakdown of the area by the revised habitat strata (table 4; further description of regions in table 3). The geographic regions of the original sampling plan were retained in 2011, 2012, and 2013 without changes. The area of each habitat stratum by region is needed for estimating systemwide population sizes for the purpose of this report. In table 5, we report the number of available plots by habitat strata and region in the 2010 plot layer (hereafter 2010 plot delineation), which we continued to use in 2011, 2012, and 2013.

In 2013, as in 2012, we did not combine the herbaceous and unsuitable plots into one stratum as we had done in previous years. Over the past 2 years, we realized that the plots categorized as herbaceous are mostly covered by cattail/bulrush marsh. This habitat type should therefore be treated separately from the plots categorized as unsuitable. The unsuitable category has a range of habitats that sometimes includes some good bird habitat and sometimes barren areas such as a parking lot. Due to the variation in cover, the "unsuitable" category results can be challenging to interpret. In addition, plot changes from the 2010 layer resulted in Region 4 consisting of only 25 plots, which is the reason we continue to combine Regions 4 and 5 for plot selection and statistical analyses (J. Bart 2010, personal communication).

Table 2.—Crosswalk of 2010 habitat strata (also used in 2011) with Anderson and Ohmart (1976)

Type (Bart et al. 2010)	**Habitats (Anderson and Ohmart 1976)**	
Tall woody (TW)	CW-1	CW-3
	CW-2	
Low woody (LW)	CR-0*	SC-5
	CW-4	SC-6
	CW-5	SH-1
	CW-6	SH-3
	HM-3	SH-4
	HM-4	SH-5
	HM-5	SH-6
	HM-6	SM-3
	SC-1	SM-4
	SC-2	SM-5
	SC-3	SM-6
	SC-4	
Herbaceous (H)	AG-0	MA-3
	ATX-0*	MA-4
	AW-0	MA-5
	MA-1*	MA-6
	MA-2	MA-7
Unsuitable (U)	BW-0	UD-0
	NC-0	

* CR = creosote, ATX = atriplex, and MA = marsh.

Table 3.—List of all regions in the LCR MSCP study area, whether they were included in the 2013 plot selection, and reasons for exclusion

Region number (LCR MSCP reach)	Region name	Included in 2013 plot selection?	Reasons for exclusion
1 (1)	Separation Canyon to Lake Mead	No	Not accessible
2 (1)	Virgin River	No	Outside LCR MSCP, for beetle study only
3 (1)	Lake Mead	No	Fluctuating water levels
4 (2)	Hoover Dam to Davis Dam	Yes	Added to Region 5 in 2010
5 (3)	Davis Dam to Bill Williams River (excluding Havasu National Wildlife Refuge)	Yes	
6 (3)	Havasu National Wildlife Refuge (excluding Bill Williams unit)	Yes	
7 (3)	Bill Williams unit of the Havasu National Wildlife Refuge	Yes	
8 (4)	Bill Williams unit to Cibola National Widlife Refuge, excluding the Colorado River Indian Tribal Land	Yes	
9 (4)	CRIT land	No	Permits unattainable for systemwide plots in Region 9
10 (4)	Cibola National Wildlife Refuge	Yes	
11 (5)	Imperial National Wildlife Refuge	Yes	
12 (6)	Colorado River from the Imperial National Wildlife Refuge to Yuma	Yes	
13 (7)	Yuma to Southerly International Boundary with Mexico	No	Border safety concerns

Table 4.—Area, in hectares, of each habitat stratum per region from the 2010 plot delineation in the LCR MSCP project area

Geographic regions	Habitat strata				Total
	Herbaceous	Low woody	Tall woody	Unsuitable	
1	11.81	2,723.45	637.67	1,197.44	**4,570.38**
2	145.82	1,927.66	67.04	453.53	**2,594.05**
3	0.00	7,684.46	0.00	8,056.50	**15,740.96**
4+5	40.30	6,027.48	82.17	6,612.92	**12,762.88**
6	762.51	2,953.16	241.71	661.76	**4,619.14**
7	72.83	2,789.73	475.81	4,414.66	**7,753.03**
8	27.00	2,392.52	19.30	8,252.11	**10,690.92**
9	107.41	9,350.29	124.15	15,363.48	**24,945.34**
10	157.67	5,605.03	48.85	3,387.81	**9,199.36**
11	620.64	2,862.68	151.57	438.74	**4,073.63**
12	234.85	2,829.05	621.69	6,045.60	**9,731.18**
13	0.00	1,443.74	588.69	3,879.52	**5,911.95**
Total	**2,180.84**	**48,589.25**	**3,058.65**	**58,764.05**	**112,592.80**

Table 5.—Number of plots, available by region and habitat stratum, based on the 2010 plot delineation of the LCR MSCP project area

Geographic regions	Habitat strata				Total
	Herbaceous	Low woody	Tall woody	Unsuitable	
1	1	298	66	109	**474**
2	14	212	7	41	**274**
3	0	844	0	656	**1,500**
4+5	3	650	10	463	**1,126**
6	70	319	24	54	**467**
7	6	301	50	337	**694**
8	3	249	2	439	**693**
9	9	995	10	925	**1,939**
10	16	614	5	198	**833**
11	51	291	15	31	**388**
12	22	291	56	309	**678**
13	0	160	61	204	**425**
Total	**195**	**5,224**	**306**	**3,766**	**9,491**

Plot Selection: Systemwide Survey Rapid Area Search Plots

For the 2013 systemwide area searches, we randomly selected a total of 80 ≈ 9-ha plots from the 2010 plot delineation, covering four habitat strata (low woody, tall woody, herbaceous, and unsuitable) in eight geographic regions (table 5 and attachment 1). The region was not used to stratify the random site selection in 2013 because, based on plot selections in previous years, we expected a random selection to provide sufficient coverage across available regions. As in 2010–12, several regions were purposely excluded from sampling in 2013, including Regions 1 (access problems), 3 (lack of riparian vegetation and fluctuating lake levels), 9 (non-Federal land where the access permit was unattainable), and 13 (safety concerns as it was along the US-Mexico border); however, in 2013, we surveyed Region 2 as part of the saltcedar beetle portion of this project.

We used a stratified random plot selection, with strata defined by habitat, to select the 2013 plots. Using the same methods as in 2011 and 2012, 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, Boise) and the LCR MSCP, resulting in an initial selection of 25 tall woody, 35 low woody, 7 herbaceous, and 13 unsuitable plots (table 6).

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; if plots were inhabited by squatters; or if plots contained wetlands that were inaccessible by boat or foot or were otherwise unsafe. In 2013, 12 plots were replaced with alternates in the same region and stratum due to 1 or more of the above reasons.

Habitat Creation Site Plot Selection

Rapid Area Search Plots

When the project began in 2007, double sampling with rapid and intensive area searches was done on the habitat creation sites (J. Bart 2007, 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,

Table 6.—Number of systemwide area search plots per region and habitat stratum surveyed in 2013

Region number	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**
4+5	Hoover Dam to Bill Williams River (excluding Havasu National Wildlife Refuge)	3	11	0	6	**20**
6	Havasu National Wildlife Refuge (excluding Bill Williams unit)	3	4	3	0	**10**
7	Bill Williams unit of the Havasu National Wildlife Refuge	7	6	0	1	**14**
8	Bill Williams unit to Cibola excluding the Colorado River Indian Reservation	0	1	0	2	**3**
9	Colorado River Indian Reservation, ‘Ahakhav Tribal Preserve only	0	0	0	1	**1**
10	Cibola National Wildlife Refuge	1	9	0	2	**12**
11	Imperial National Wildlife Refuge	1	3	1	0	**5**
12	Colorado River from the Imperial National Wildlife Refuge to Yuma	10	1	3	1	**15**
13	Yuma to Southerly International Boundary with Mexico	0	0	0	0	**0**
	Total	**25**	**35**	**7**	**13**	**80**

during the LCR MSCP bird surveys of 2008–10, we surveyed all post-development habitat conservation area (= habitat creation site) 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 habitat creation sites is provided in attachment 1 as figure 1-33, and plot maps for each of the habitat creation sites are provided in attachment 1 as figures 1-34 through 1-39.

Beginning in 2011, we implemented a double-sampling protocol for habitat creation sites 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. In 2011, we surveyed all of the habitat conservation area survey plots currently delineated by Reclamation (n = 60) with the rapid area search method. With the added acreage in 2013, we expanded our coverage of the habitat conservation area survey plots to the additional plots delineated by Reclamation (total n = 79, from n = 71 in 2012) with the rapid area search method. A subset (n = 4) of the 79 plots was randomly selected for intensive area searches, mirroring the approach of systemwide sampling (J. Bart 2010, personal communication). Three additional plots compose the Yuma East Wetlands habitat creation project, and those sites were surveyed with intensive area searches by Fred Phillips Consulting, LLC, in

2012 and 2013. In addition, we surveyed four pre-development plots using the rapid survey method in 2013. These plots are part of the Pretty Water Conservation Area just south of Cibola National Wildlife Refuge Farm Unit 1.

In habitat creation sites, we collected bird survey data using the same methods as we did for the systemwide intensive area searches. All habitat creation sites were larger than typical systemwide area search plots, so we subdivided the sites into plots that were a reasonable size (5 – 18 ha) to be surveyed in one morning. We worked closely with the Reclamation GIS staff to prepare to add new plots in 2012 and 2013 as additional LCR MSCP habitat was planted and matured. We classified the plots into the same four woodland habitat strata as we used for the systemwide plots, and the herbaceous or unsuitable strata were empty. The 2013 habitat creation site plots are summarized in table 7.

Table 7.—Habitat creation sites, number of plots surveyed, habitat type, and area surveyed using rapid area searches in 2013

(The Yuma East Wetlands and Hunter's Hole Conservation Area were surveyed by Fred Phillips Consulting, LLC, in 2013.)

Habitat creation project	Number of survey plots 2013	Low woody (ha)	Tall woody (ha)	Total
'Ahakhav Tribal Preserve	5	4.99	51.69	**56.68**
Beal Lake Habitat Conservation Area	4	0	41.61	**41.61**
Cibola National Wildlife Refuge Farm Unit 1	13	19.94	91.09	**111.03**
Cibola Valley Conservation Area	23	125.20	108.40	**233.60**
Hunters Hole Conservation Area	1	16.06	0	**16.06**
Palo Verde Ecological Reserve	34	199.83	174.94	**374.77**
Yuma East Wetlands	3	59.88*		**59.88**
Total (2013)	**83**	**366.02**	**467.73**	**893.63**

* Yuma East Wetlands habitat-specific acreage not available.

Intensive Area Search Plots, Systemwide and Habitat Creation Sites

We surveyed a total of 12 plots with the intensive area search method in 2013, eight of which were randomly selected from the 2013 pool of systemwide plots for rapid area searches, and four of which were randomly selected from the habitat creation site plots. The Yuma East Wetlands plots were surveyed with the intensive area search method by Fred Phillips Consulting, LLC, and their data are included here (table 8).

Table 8.—Summary of component 1 plots that were surveyed using the intensive area search method in 2013
(Plots listed in numerical order)

Plots surveyed with intensive method, 2013	Systemwide intensive (n = 8)	Habitat creation site intensive (n = 4)
S2183 (attachment 1 – figure 1-8)	X	
S2477 (attachment 1 – figure 1-9)	X	
S2550 (attachment 1 – figure 1-9)	X	
S2864 (attachment 1 – figure 1-17)	X	
S5620 (attachment 1 – figure 1-25)	X	
S6056 (attachment 1 – figure 1-26)	X	
S7838 (attachment 1 – figure 1-29)	X	
S7985 (attachment 1 – figure 1-29)	X	
C2301 (attachment 1 – figure 1-36)		X
C2309 (attachment 1 – figure 1-36)		X
C2703 (attachment 1 – figure 1-38)		X
C2706 (attachment 1 – figure 1-38)		X
Yuma East Wetlands (attachment 1 – figure 1-39)		X

Avian Monitoring Methods

We conducted rapid and intensive area searches to monitor birds of the LCR in systemwide and in habitat creation plots. Our goal for the rapid area search effort was to obtain the most accurate possible 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 approaches, using double sampling in a random subset of systemwide survey plots, we can also use the data to estimate detection ratios and the density of breeding birds in the study area. Further information on 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 by only visiting the plot twice. Intensive area searches involved a greater effort to accurately delineate breeding territories of 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 breed 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 Legend H and Garmin GPSMap 60CSx) and an aerial photo of the plot overlaid with a 50-meter 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 meters 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, intensive, and EI) 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 8 and June 12, 2013. We have spent the last several years getting the seasonal timing of surveys adjusted to maximize the breeding window for as many species as possible while working within our study design and contract restrictions. Starting surveys later in the spring would not work since most species the LCR MSCP is interested in start breeding in April or earlier. 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 5 or 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 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-meter UTM grid, which also included imagery of the immediate surroundings of the plot (between 20 and 100 meters 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 9 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 (at least three consecutive visits for intensive surveys), even if the only breeding evidence we observed was singing, it was generally determined 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 and willow flycatcher, 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. These two species were therefore never determined to be breeders in this study. These species are surveyed separately for the LCR MSCP using single-species survey protocols that could not be included in this study (McLeod and Koronkiewicz 2010; Halterman et al. 2009). Other exceptions included birds, such as the yellow warbler, that defend territories during stopover migration on the LCR. Yellow warblers both breed and migrate through the LCR each spring, so special consideration was given to this species when determining breeding status on a plot. Table 9 illustrates how we ranked breeders (confirmed breeding or possible/probable breeding on three consecutive visits) and non-breeders (observed only or possible/probable breeding on less than three consecutive visits) based on behavioral cues at each visit. Please see our area search protocol (GBBO 2012) for further details on the process of summarizing breeding observations into our Access database.

If we observed a flock, its location was circled on the survey map, and the number of individuals was recorded on the data sheet. 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). For non-territorial and colonial breeders we recorded individuals and their observed breeding behaviors as one entry per species per visit in the Access database. 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. We continued data entry for non-territorial birds in 2013 the same way as in 2012 (although a new data entry system for the Access database was developed with Reclamation for surveyor-based end-of-season breeding pair estimates for these species, but this was not yet available for implementation in the 2013 season). Thus, as done in previous reports, we are reporting conservative estimates of the

Table 9.—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

number of pairs of each of these species breeding on the plots based on the number of males seen on each visit, averaged, and any breeding evidence recorded. Non-territorial and colonial breeders included red-winged blackbird, yellow-headed blackbird, brown-headed cowbird, mourning dove, white-winged dove, Eurasian collared-dove, Gambel's quail, European starling, great-tailed grackle, house finch, and greater roadrunner.

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 by 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 2013.

In rapid area searches, we delineated territories of covered species to the best of our ability during the two visits. 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. Each surveyor digitized the territories for each of the six covered species that they had delineated themselves in the field. To record 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 (attachment 4).

For all non-covered species, we focused our efforts on obtaining a complete count, avoiding double counts, recording breeding evidence (see table 9), and determining the percentage of the territory that was inside the plot. 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 of 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 possible evidence of breeding on both visits to their plot in order to record the bird as a breeder. If the surveyor was unable to confirm breeding using our established set of rules, but still felt strongly that the bird was a breeder, the surveyor could choose to record the bird as a breeder but had to explain thoroughly within the "Comments" field of our database why they believed the bird was actually breeding on the plot (see table 10). In some cases, we could not determine the breeding status of a bird detected within a plot, although the species is known to be a resident breeder on the LCR. If breeding status was not determined in two visits, it was thus classified as a non-breeder for the plot.

In 2013, we also introduced new breeding justification codes for territorial breeding birds to the Access database to help ensure consistency in the data entry process. 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 9). The third 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 and cannot be used for migratory species. The fourth 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 fifth and last code, "No Standard Scenarios," described the scenario in which the surveyor strongly felt that the bird was breeding on the plot, but they were not able to obtain standard evidence to classify it a breeder. If the surveyors chose this code, they had to elaborate on 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; and Gill and Poole 1992–2003) were provided during training to aid the field crews' understanding of breeding bird behaviors of the species encountered.

In 2013, field data collection methods were the same as in previous years, and only data entry methods changed to better accommodate Reclamation's new data management system. In the field, data were collected on a map with a 50-meter grid of the plot and the gray-scale aerial photography in the background (attachment 2). Within several hours of completing a survey, surveyors transferred the survey data from the field map (attachment 2) 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 a 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 was set up with the default of "No Justification Required." This field could remain as "No Justification Required" only if the territory was entered as TI000 in the "Territory In" field, indicating that the bird was not a breeder on the plot. Otherwise, the surveyor needed to replace the code for "Breeding Justification" according to their field observations (see above for description).

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) within the plot but with primary focus on covered species and other territorial riparian obligate birds. Our knowledge of territory locations from previous intensive area search 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 during the whole survey period 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 9). 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). 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. In 2011, 2012, and 2013, we entered these final territory maps for covered and non-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 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 10). The first additional code, "On Territory Consecutive" described a given bird or pair being observed on a territory for at least three consecutive weeks of the intensive survey. The second additional code, "On Territory Season," described the scenario of a given bird or pair being recorded on a 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 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-meter grid of the plot and gray-scale aerial photography in the background (attachment 2). 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. 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 the 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.

Table 10.—Breeding justification codes entered into Reclamation's Access database for the riparian bird survey project

("Number" shows the actual code entered in Access, "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).

Number	Short	Survey type	Long
BJ0000	No justification required	RAP INT ENH*	No justification required
BJ0001	Observed confirmed	RAP INT ENH	For rapid, intensive, and EI – observed confirmed breeding evidence
BJ0002	On territory consecutive	INT ENH	For intensive and EI – observed the bird/pair "on territory" the required number of times (intensives) and weeks (EIs) in a row
BJ0003	On territory season	INT ENH	For intensive and EI – observed the bird/pair "on territory" the required number of times (intensives) and weeks (EIs) during the 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
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 ENH	For rapid, intensive, and EI – called it breeding but does not fit any of the standard scenario explanations in notes

Note: ENH is the actual code entered for enhanced intensive; EI is otherwise used throughout this report.

Additionally, after the last visit to the plot, surveyors filled in the "Breeding Justification" field, which is defaulted to "No Justification Required." This default can remain only if the surveyor entered TI000, indicating that the bird was not a breeder on the plot. All other entries in the "Territory In" field require a different breeding justification code. The final data approval process by project managers included confirming that these two fields were filled out correctly.

All bird data collected during the 2013 field season were entered immediately into separate surveyor copies of the Access database. We then combined all surveyors' Access datasets into a single Access database for the season. To ensure that the data were entered completely and correctly (quality assurance), GBBO staff checked all surveyors' field data sheets (daily field maps), Access data, and GIS data for accuracy and completeness immediately at 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 100% of the data together. During this vetting process, we also confirmed that all field maps and species summary maps were scanned into a digital format and that that each species had a percent territory recorded in the dataset. The datasets were later final-proofed by comparing summary species maps to the Access database and the Access database to the GIS shapefiles. In addition, over 10% of all daily survey data were final-proofed by comparing the daily survey map to the species summary map, the Access dataset, and the ArcGIS data file. To determine whether or not all the GIS data were entered for EI and intensive plots or for all survey types, we compared all 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 observations to enter as territories in GIS. If a territory was digitized in GIS (see GIS data entry protocol attachment 4), then it also had to be recorded as a territory in Access and vice versa.

If we found a 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. We estimate that 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 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 each pair, pair details, pair breeding justifications, and TI_IN numbers to ensure that all were entered and that there was no conflicting information for each pair. The final vetting of the data occurred when the data were converted into program 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 more detailed number of territories detected on the plot during the intenstive area searches, the detection ratio of each species present can be estimated. The details on how detection ratios are derived can be reviewed in Bart and Earnst (2002) and Bart (2007).

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 that were not confirmed to be breeding within the plot. 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 territories, and the number of birds considered non-breeders (resident non-breeding birds and migrants) were averaged together between the two surveys.

Detection ratios were calculated using the methods of Thompson (2002), revised by Bart and Earnst (2002). A detailed explanation of the mathematical formulas is provided in Bart (2007). We only included breeders in our calculations of detection ratios and the resulting 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, we used the program DS (Bart and Hartley 2010) (version 2.0.114.11) to calculate all detection ratio calculations and population size estimates for systemwide surveys and habitat creation sites.

For this report, we also used the 2013 survey data and program DS to estimate systemwide territory numbers of the covered species and of the 10 most abundant species, excluding colonial nesters and other non-territorial species. Since not all regions were surveyed in the systemwide 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 species (red-winged blackbird, brown-headed cowbird, mourning dove, white-winged dove, Gambel's quail, European starling, great-tailed grackle, Eurasian collared-dove, house finch, and greater roadrunner). 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 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 the six LCR MSCP covered species, totaling 40 species. For these, we performed two separate calculations: one for systemwide plots and another for habitat creation plots. The resulting overall detection ratios were 1.08 for systemwide plots (standard error [SE] = 0.14, coefficient of variance [CV] = 0.13) and 1.5 for habitat creation plots (SE = 0.56, CV = 0.37). When the detection ratio is above 1, 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 systemwide project area and the habitat creation sites using program DS.

A review of DS results by Reclamation identified an error in within-stratum SEs (i.e., for a single region/habitat combination). In addition, DS does not provide the option for applying a finite population correction to variances when > 5% of the total sampling universe is surveyed, as was the case for habitat conservation areas. Applying a finite population correction increases precision by reducing the SE (Thompson 2012). Corrected stratum SE (systemwide) and finite population-corrected SE by and over strata (habitat conservation areas) were calculated by Reclamation with version 9.4 of the SAS System for Windows (SAS Institute 2012).

RESULTS

Overall Species Richness Patterns

We detected a total of 182 species (which doesn't include super species, sub species or unknowns) of birds in all systemwide and habitat creation site surveys along the LCR in 2013 (attachment 5). Of the 182 species, approximately one-half were species that use the LCR project area only during migration or wintering (attachment 5). We also detected all of the covered species that are subject to this project in at least one site. The highest concentrations of covered species were recorded in the Bill Williams River riparian areas and in the habitat creation sites. We also recorded Yuma clapper rail, yellow-billed cuckoo, and willow flycatcher, 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 173 species in systemwide surveys, compared to 120 species on habitat creation sites, and 111 species were present on both systemwide and habitat creation plots in 2013 (attachment 5).

Systemwide Surveys

Systemwide Rapid Area Searches

We recorded a total of 161 species on 80 systemwide rapid area search plots surveyed in 2013 (see attachment 6 for a list of all plots surveyed). Of these, we classified 73 species as territorial breeders (3,409 total territories; table 11), 13 species as non-territorial breeders (attachment 7 – table 7-1), and 170 species as migrants or non-breeders (table 12). Breeding evidence differed by plot. The number of breeding territories varied widely among species, with the most abundant species being either riparian-associated or generalist species. Approximately one-half of the breeding birds were of species that were not strictly territorial (and thus excluded from the DS analyses), and some of these species were also the most numerous systemwide, including white-winged dove, mourning dove, brown-headed cowbird, and red-winged blackbird. The most common territorial species included song sparrow, common yellowthroat, yellow-breasted chat, Lucy's warbler, and verdin.

We found the most common breeders of the covered species to be the Sonoran yellow warbler (211 territories), followed by Arizona Bell's vireo (58 territories), Gila woodpecker (21.75 territories), summer tanager (15.5 territories), vermilion flycatcher (2.75), and gilded flicker (0.25, table 11). Breeding evidence for the vermilion flycatchers included one male at Plot #2972 (Esquerra Ranch) doing many flight displays high above cottonwoods (female was not detected despite surveyor's best efforts); one pair observed at Plot #3536 (Deer Island) with confirmed nest evidence on both rapid survey visits, including nest and dependent young on second visit; and pair courtship on Plot #3536 (Deer Island) during both rapid survey visits with 75% of the territory in the plot (several other pairs were heard, but breeding was not confirmed). Other possible breeding records included Santa Fe Plot #5198 with two males on the first rapid survey visit, Palo Verde Plot #5620 with a female seen once in late April, and Fox Wash Plot #2865 with a female foraging during one visit in June.

All gilded flicker detections of 2013 were from Lincoln Ranch plots. In Plot #7776, we recorded one detection on each rapid survey visit with the bird calling > 300 meters off plot. These encounters could have been with the same individual. A breeding gilded flicker pair was also found on Lincoln Ranch Plot #7733. The pair was observed on both rapid survey visits, and courtship was observed on the second visit in early June. The pair was observed both on the plot and hundreds of meters from the plot flying long distances to and from the riparian area.

Table 11.—Total number of breeding territories, by species, in the 80 systemwide rapid area search plots in 2013

(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 for details). Non-territorial species are excluded from this list.)

Species (n = 73)	Number of territories
Song sparrow	724
Common yellowthroat	440.75
Yellow-breasted chat	390
Sonoran yellow warbler*	211
Lucy's warbler	209.75
Verdin	176.75
Abert's towhee	161.25
Marsh wren	156
Bewick's wren	152.75
Black-tailed gnatcatcher	150.75
Arizona Bell's vireo*	58
Ash-throated flycatcher	49.75
Black-chinned hummingbird	45.5
Ladder-backed woodpecker	45.25
Phainopepla	32.5
Blue grosbeak	32
Pied-billed grebe	30.25
Crissal thrasher	27.75
Lesser nighthawk	27.5
Common gallinule	27.25
American coot	23.5
Gila woodpecker*	21.75
Brown-crested flycatcher	21.5
Least bittern	18.5
Western kingbird	17
Anna's hummingbird	16.75
Clapper rail	16.5
Summer tanager*	15.5
Canyon wren	11.75
Bullock's oriole	11.25
Green heron	10.25
Killdeer	7.5
Black phoebe	6.75
Virginia rail	6.75
Cactus wren	6.25
Lesser goldfinch	5.75
Horned lark	3.75
Northern mockingbird	3
Northern rough-winged swallow	3

Table 11.—Total number of breeding territories, by species, in the 80 systemwide rapid area search plots in 2013

(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 for details). Non-territorial species are excluded from this list.)

Species (n = 73)	Number of territories
Mallard	2.75
Say's phoebe	2.75
Vermilion flycatcher*	2.75
Lawrence's goldfinch	2
Cliff swallow	1.75
Black-crowned night-heron	1.5
Black-necked stilt	1.5
Great horned owl	1.5
Black rail	1.25
Common raven	1.25
Western grebe	1.25
Burrowing owl	1
Eared grebe	1
Sora	1
White-tailed kite	1
Black-throated sparrow	0.75
Clark's grebe	0.75
Costa's hummingbird	0.75
Loggerhead shrike	0.75
Rock wren	0.75
Common poorwill	0.5
Cooper's hawk	0.5
Indigo bunting	0.5
Ruddy duck	0.5
Sharp-shinned hawk	0.5
Spotted sandpiper	0.5
White-throated swift	0.5
American kestrel	0.25
Gilded flicker*	0.25
Great blue heron	0.25
Northern harrier	0.25
Nutting's flycatcher	0.25
Redhead	0.25
Red-tailed hawk	0.25
Total	**3,409**

* LCR MSCP covered species.

Table 12.—Detected, but not confirmed breeding, during systemwide rapid area searches in 80 plots in 2013

Species (n = 170)	Males	Females	Unknown sex	Young of the year	Flyovers	Incidentals
Abert's towhee	0	0	5	5	0	0
American avocet	0	0	0	0	49	0
American coot	0	0	25	0	0	0
American goldfinch	0	0	0	0	17	0
American kestrel	2	0	0	0	3	0
American pipit	0	0	4	0	35	0
American white pelican	0	0	0	0	276	0
American wigeon	1	0	0	0	0	0
Anna's hummingbird	0	0	3	2	1	0
Ash-throated flycatcher	0	0	0	7	0	0
Audubon's warbler	35	23	110	0	39	1
Bank swallow	0	0	0	0	102	0
Barn swallow	0	0	10	0	171	3
Bell's vireo*	3	0	0	0	0	0
Belted kingfisher	1	13	3	0	0	4
Black phoebe	2	0	2	0	1	0
Black-chinned hummingbird	1	1	0	13	0	0
Black-crowned night-heron	0	0	7	3	2	0
Black-headed grosbeak	63	24	51	0	0	8
Black-necked stilt	0	0	7	0	34	2
Black-tailed gnatcatcher	2	2	4	13	0	0
Black-throated gray warbler	3	1	1	0	2	3
Black-throated sparrow	0	0	1	0	1	0
Blue grosbeak	0	0	0	1	1	2
Brewer's sparrow	23	0	47	0	0	0
Brewer's blackbird	1	0	0	0	39	0
Broad-tailed hummingbird	0	1	0	0	0	0
Brown-crested flycatcher	0	0	0	0	0	3
Brown-headed cowbird	8	8	57	1	937	7
Bullock's oriole	16	6	5	1	9	4
California gull	0	0	0	0	10	0

Table 12.—Detected, but not confirmed breeding, during systemwide rapid area searches in 80 plots in 2013

Species (n = 170)	Males	Females	Unknown sex	Young of the year	Flyovers	Incidentals
Canada goose	0	0	0	0	2	0
Canyon wren	2	0	3	4	0	0
Caspian tern	0	0	0	0	20	4
Cassin's vireo	18	2	2	0	0	0
Cattle egret	0	0	0	0	11	0
Cedar waxwing	0	0	10	0	4	0
Chipping sparrow	1	0	22	0	0	1
Cinnamon teal	2	4	3	0	1	0
Cliff swallow	0	0	67	0	1,321	0
Common black-hawk	0	0	1	1	0	0
Common gallinule	0	0	1	0	0	0
Common ground-dove	0	0	2	0	0	0
Common loon	0	0	0	0	3	0
Common merganser	0	0	0	0	10	0
Common poorwill	0	0	0	0	0	1
Common raven	0	0	2	0	51	4
Common tern	0	0	11	0	0	0
Common yellowthroat	2	0	5	0	1	0
Cooper's hawk	1	2	2	0	7	1
Costa's hummingbird	0	0	1	1	0	0
Crissal thrasher	0	0	1	0	0	0
Dark-eyed junco	0	0	1	0	0	0
Double-crested cormorant	0	0	16	0	179	0
Dusky flycatcher	6	0	2	0	0	0
Eared grebe	0	0	35	0	0	2
Elf owl	0	0	2	0	0	6
Eurasian collared-dove	0	0	1	0	21	0
European starling	0	0	0	0	15	0
Forster's tern	0	0	4	0	8	0
Gadwall	5	4	0	0	4	0
Gambel's quail	0	0	0	0	0	10

Table 12.—Detected, but not confirmed breeding, during systemwide rapid area searches in 80 plots in 2013

Species (n = 170)	Males	Females	Unknown sex	Young of the year	Flyovers	Incidentals
Gambel's white-crowned sparrow	0	0	38	0	0	5
Gila woodpecker	0	0	0	0	0	2
Gilded flicker*	0	0	0	0	0	2
Gray flycatcher	0	0	6	0	0	0
Great blue heron	0	0	8	0	72	1
Great egret	0	0	8	0	100	0
Great horned owl	1	1	0	0	1	0
Greater roadrunner	0	0	4	0	0	6
Great-tailed grackle	1	0	109	0	882	22
Green heron	0	0	4	0	10	1
Green-tailed towhee	17	0	46	0	0	17
Green-winged teal	0	1	0	0	0	0
Hammond's flycatcher	4	0	22	0	0	0
Hermit thrush	0	0	4	0	0	0
Hermit warbler	1	1	2	0	0	0
Hooded oriole	1	1	2	2	0	0
Horned lark	0	0	0	0	9	0
House finch	11	4	20	31	326	93
House wren	5	0	3	0	0	0
Indigo bunting	1	0	0	0	1	1
Killdeer	0	0	4	0	15	0
Lark sparrow	0	0	2	0	0	0
Lawrence's goldfinch	2	2	5	0	21	0
Lazuli bunting	93	47	53	0	2	0
Least bittern	0	0	0	0	0	2
Least sandpiper	0	0	12	0	0	0
Lesser goldfinch	4	14	13	3	61	0
Lesser nighthawk	1	0	1	0	96	2
Lincoln's sparrow	6	1	14	0	0	0
Loggerhead shrike	1	1	15	8	2	5
Long-billed curlew	0	0	0	0	11	0

Table 12.—Detected, but not confirmed breeding, during systemwide rapid area searches in 80 plots in 2013

Species (n = 170)	Males	Females	Unknown sex	Young of the year	Flyovers	Incidentals
Lucy's warbler	5	1	6	13	0	0
Macgillivray's warbler	13	8	14	0	0	5
Mallard	3	2	7	0	31	0
Marbled godwit	0	0	0	0	2	0
Merlin	0	1	0	0	0	0
Mountain white-crowned sparrow	0	0	6	0	0	1
Mourning dove	0	0	162	10	760	25
Myrtle's warbler	1	1	0	0	1	0
Nashville warbler	3	3	19	0	0	0
Neotropic cormorant	0	0	0	0	1	0
Northern harrier	1	1	2	0	5	1
Northern mockingbird	0	0	4	2	3	1
Northern pintail	0	1	0	0	0	0
Northern rough-winged swallow	0	0	125	0	1,364	0
Nutting's flycatcher	3	1	0	2	0	8
Olive-sided flycatcher	4	0	6	0	0	0
Orange-crowned warbler	40	11	55	0	1	0
Oregon junco	0	0	2	0	0	0
Osprey	0	0	1	0	10	1
Pacific-slope flycatcher	127	2	148	0	1	0
Peregrine falcon	0	0	0	0	2	1
Phainopepla	33	27	5	29	144	0
Pied-billed grebe	0	0	0	0	0	1
Plumbeous vireo	2	0	1	0	0	0
Prairie falcon	0	0	1	0	1	0
Red-breasted nuthatch	1	0	1	0	0	0
Red-tailed hawk	0	0	5	2	19	1
Red-winged blackbird	1	3	150	0	1,874	0
Ring-billed gull	0	0	4	0	9	0
Ring-necked duck	9	3	0	0	0	0
Rock pigeon	0	0	0	0	15	0

Table 12.—Detected, but not confirmed breeding, during systemwide rapid area searches in 80 plots in 2013

Species (n = 170)	Males	Females	Unknown sex	Young of the year	Flyovers	Incidentals
Rock wren	0	0	0	3	0	0
Rose-breasted grosbeak	2	0	0	0	0	0
Ruby-crowned kinglet	4	0	14	0	0	0
Ruddy duck	1	0	4	0	0	0
Savannah sparrow	0	0	9	0	0	0
Say's phoebe	0	0	9	5	0	0
Scott's oriole	1	0	0	0	0	0
Semipalmated plover	0	0	0	0	1	0
Sharp-shinned hawk	0	1	0	0	4	0
Snowy egret	0	0	8	0	86	0
Solitary sandpiper	0	0	2	0	0	0
Song sparrow	1	0	15	92	0	0
Sora	0	0	16	0	0	0
Spotted sandpiper	0	0	3	0	0	1
Spotted towhee	1	0	2	0	0	0
Summer tanager*	0	0	0	0	0	2
Swainson's thrush	0	0	15	0	0	1
Swainson's hawk	0	0	8	0	24	159
Townsend's warbler	32	11	19	0	2	0
Tree swallow	0	0	1,310	0	23,297	20
Turkey vulture	0	0	15	0	211	5
Vaux's swift	0	0	0	0	30	0
Verdin	0	0	5	54	0	0
Violet-green swallow	1	1	19	0	43	4
Virginia rail	0	0	0	0	0	1
Warbling vireo	37	5	146	0	1	0
Western flycatcher	1	1	31	0	0	0
Western grebe	0	0	0	0	0	4
Western kingbird	3	1	10	1	31	0
Western sandpiper	0	0	11	0	0	0
Western tanager	95	33	33	0	13	8

Table 12.—Detected, but not confirmed breeding, during systemwide rapid area searches in 80 plots in 2013

Species (n = 170)	Males	Females	Unknown sex	Young of the year	Flyovers	Incidentals
Western wood-pewee	22	0	62	0	3	2
White-crowned sparrow	13	4	117	0	0	0
White-faced ibis	0	0	29	0	3,603	0
White-throated swift	0	0	8	0	95	0
White-winged dove	0	0	28	5	2,293	62
Willet	0	0	0	0	1	0
Willow flycatcher**	16	0	27	0	0	1
Wilson's warbler	209	50	339	0	6	44
Wilson's snipe	0	0	1	0	0	0
Yellow warbler*	73	18	17	0	7	7
Yellow-billed cuckoo	0	0	0	0	0	1
Yellow-breasted chat	0	0	0	0	2	0
Yellow-headed blackbird	0	0	3	0	166	0
Yellow-rumped warbler	3	2	174	0	1	1
Zone-tailed hawk	0	0	0	1	0	0

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

Systemwide Intensive Area Searches

During systemwide intensive area searches (n = 8 plots) in 2013, we recorded and mapped 401.25 breeding territories of 28 species (table 13; see attachment 6 for a list of the 2013 intensive area search plots). Breeding evidence differed by plot. Additionally, we detected non-territorial and colonial species breeding that made up ≈15% of the breeding birds (≈67 breeding pairs), including white-winged dove (≈17 pairs), mourning dove (≈10 pairs), Gambel's quail (≈7 pairs), brown-headed cowbird (≈13 pairs), house finch (≈2 pairs), greater roadrunner (≈1 pair), great-tailed grackle (≈1 pair), red-winged blackbird (≈6 pairs), and yellow-headed blackbird (≈10 pairs). Breeding non-territorial and colonial species were present in a smaller percentage in the intensive plots than in rapid survey plots due to differences in habitat types present.

Table 13.—Total number of breeding territories of territorial bird species detected during systemwide intensive area searches in 2013

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

Species (n = 28)	Number of territories
Song sparrow	90.5
Yellow-breasted chat	44.5
Common yellowthroat	44.25
Sonoran yellow warbler*	42.75
Marsh wren	36.75
Black-tailed gnatcatcher	24
Lucy's warbler	22.75
Abert's towhee	22.5
Verdin	17.75
Bewick's wren	13.75
Black-chinned hummingbird	7.25
Ladder-backed woodpecker	5.25
Yuma clapper rail*	5
Ash-throated flycatcher	3.75
Crissal thrasher	3.25
Blue grosbeak	2.5
Brown-crested flycatcher	2.25
Western kingbird	2.25
Lesser nighthawk	2
Gila woodpecker*	1.75
Least bittern	1.25
Bullock's oriole	1
Canyon wren	1
Common gallinule	1
Pied-billed grebe	0.75
Summer tanager*	0.75
Black-crowned night-heron	0.5
Great horned owl	0.25
Total	**401.25**

* LCR MSCP covered species.

We found breeding evidence for three covered species during the systemwide surveys, including the Sonoran yellow warbler (42.75 territories), Gila woodpecker (1.75 territories), and summer tanager (0.75 territory; table 13). A total of 123 additional species that were classified as migrants or non-breeders were also detected on the eight plots throughout the season (table 14).

Table 14.—Species detected, but not confirmed as breeding, on the intensive systemwide area search plots in 2013 (n = 8)
(Listed in alphabetical order)

Species (n = 123)	Males	Females	Unknown sex	Young of the year	Flyovers	Incidentals
Abert's towhee	0	0	0	2	0	0
American goldfinch	0	0	0	0	2	0
American kestrel	0	0	0	0	2	0
American pipit	0	0	4	0	5	0
American white pelican	0	0	0	0	250	0
Anna's hummingbird	0	0	2	1	0	0
Audubon's warbler	3	5	34	0	15	1
Bank swallow	0	0	0	0	3	0
Barn swallow	0	0	0	0	34	0
Belted kingfisher	1	1	0	0	0	3
Black phoebe	0	0	1	0	0	0
Black-chinned hummingbird	0	1	0	3	0	0
Black-headed grosbeak	26	7	20	0	0	0
Black-necked stilt	0	0	0	0	3	2
Black-throated gray warbler	1	0	0	0	1	1
Black-throated sparrow	0	0	1	0	0	0
Blue grosbeak	0	0	0	1	1	0
Brewer's blackbird	0	0	0	0	2	0
Brewer's sparrow	6	0	7	0	0	0
Brown-crested flycatcher	0	0	0	0	0	2
Brown-headed cowbird	0	0	20	0	128	2
Bullock's oriole	4	0	2	0	5	0
California gull	0	0	0	0	7	0
Canyon wren	0	0	0	3	0	0
Caspian tern	0	0	0	0	15	2
Cassin's vireo	3	1	1	0	0	0
Cattle egret	0	0	0	0	6	0
Cedar waxwing	0	0	1	0	2	0
Chipping sparrow	0	0	12	0	0	0
Cliff swallow	0	0	0	0	267	0
Common ground-dove	0	0	2	0	0	0
Common merganser	0	0	0	0	10	0
Common raven	0	0	0	0	14	0

Table 14.—Species detected, but not confirmed as breeding, on the intensive systemwide area search plots in 2013 (n = 8)
(Listed in alphabetical order)

Species (n = 123)	Males	Females	Unknown sex	Young of the year	Flyovers	Incidentals
Common yellowthroat	2	0	0	0	0	0
Cooper's hawk	1	1	0	0	5	0
Costa's hummingbird	0	0	0	1	0	0
Crissal thrasher	0	0	1	0	0	0
Double-crested cormorant	0	0	0	0	114	0
Dusky flycatcher	0	0	1	0	0	0
Elf owl	0	0	0	0	0	5
Eurasian collared-dove	0	0	0	0	5	0
Gadwall	0	0	0	0	4	0
Gambel's white-crowned sparrow	0	0	15	0	0	0
Gray flycatcher	0	0	4	0	0	0
Great blue heron	0	0	2	0	23	0
Great egret	0	0	0	0	34	0
Greater roadrunner	0	0	1	0	0	1
Great-tailed grackle	0	0	4	0	194	22
Green heron	0	0	0	0	3	0
Green-tailed towhee	0	0	12	0	0	7
Green-winged teal	0	1	0	0	0	0
Hammond's flycatcher	0	0	8	0	0	0
Hermit thrush	0	0	1	0	0	0
Hermit warbler	1	0	0	0	0	0
Hooded oriole	0	0	0	1	0	0
House finch	4	1	12	1	73	0
House wren	2	0	2	0	0	0
Indigo bunting	1	0	0	0	0	0
Killdeer	0	0	0	0	1	0
Lawrence's goldfinch	0	0	0	0	11	0
Lazuli bunting	31	20	22	0	1	0
Least sandpiper	0	0	1	0	0	0
Lesser goldfinch	0	0	0	0	18	0
Lesser nighthawk	0	0	0	0	17	2
Lincoln's sparrow	1	0	5	0	0	0
Loggerhead shrike	0	0	1	0	2	0

Table 14.—Species detected, but not confirmed as breeding, on the intensive systemwide area search plots in 2013 (n = 8)
(Listed in alphabetical order)

Species (n = 123)	Males	Females	Unknown sex	Young of the year	Flyovers	Incidentals
Long-billed curlew	0	0	0	0	9	0
Lucy's warbler	1	0	0	0	0	0
Macgillivray's warbler	4	6	4	0	0	1
Mallard	0	0	0	0	2	0
Mourning dove	0	0	1	0	190	0
Nashville warbler	0	0	8	0	0	0
Neotropic cormorant	0	0	0	0	1	0
Northern harrier	0	0	0	0	3	0
Northern mockingbird	0	0	2	1	1	0
Northern pintail	0	1	0	0	0	0
Northern rough-winged swallow	0	0	6	0	365	0
Nutting's flycatcher	2	1	0	2	0	5
Olive-sided flycatcher	0	0	3	0	0	0
Orange-crowned warbler	9	10	15	0	0	0
Oregon junco	0	0	2	0	0	0
Osprey	0	0	0	0	3	0
Pacific-slope flycatcher	51	1	35	0	0	0
Peregrine falcon	0	0	0	0	1	1
Phainopepla	2	1	1	20	41	0
Red-breasted nuthatch	0	0	1	0	0	0
Red-tailed hawk	0	0	1	1	5	0
Red-winged blackbird	1	3	4	0	216	0
Ring-necked duck	1	1	0	0	0	0
Rock wren	0	0	0	3	0	0
Ruby-crowned kinglet	1	0	0	0	0	0
Savannah sparrow	0	0	1	0	0	0
Say's phoebe	0	0	2	1	0	0
Sharp-shinned hawk	0	1	0	0	3	0
Snowy egret	0	0	1	0	9	0
Solitary sandpiper	0	0	1	0	0	0
Song sparrow	1	0	0	19	0	0
Sora	0	0	3	0	0	0
Spotted towhee	0	0	1	0	0	0

Table 14.—Species detected, but not confirmed as breeding, on the intensive systemwide area search plots in 2013 (n = 8)
(Listed in alphabetical order)

Species (n = 123)	Males	Females	Unknown sex	Young of the year	Flyovers	Incidentals
Summer tanager*	0	0	0	0	0	1
Swainson's hawk	0	0	0	0	5	0
Swainson's thrush	0	0	2	0	0	0
Townsend's warbler	11	6	8	0	0	0
Tree swallow	0	0	32	0	4,185	0
Turkey vulture	0	0	0	0	75	0
Vaux's swift	0	0	0	0	7	0
Verdin	0	0	3	12	0	0
Violet-green swallow	0	0	11	0	23	0
Warbling vireo	19	1	55	0	1	0
Western flycatcher	0	1	8	0	0	0
Western grebe	0	0	0	0	0	1
Western kingbird	0	0	1	0	10	0
Western tanager	28	19	13	0	7	0
Western wood-pewee	3	0	22	0	0	0
White-crowned sparrow	1	0	49	0	0	0
White-faced ibis	0	0	0	0	488	0
White-throated swift	0	0	0	0	10	0
White-winged dove	0	0	5	0	750	2
Willow flycatcher**	7	0	4	0	0	1
Wilson's warbler	38	12	107	0	0	0
Yellow warbler*	24	9	10	0	2	0
Yellow-headed blackbird	0	0	0	0	61	0
Yellow-rumped warbler	0	0	67	0	1	0

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

Habitat Creation Sites: Rapid Area Searches

During rapid area searches on habitat creation sites in 2013 (n = 79 plots), we recorded a total of 119 species, 56 of which were classified as territorial breeders (see attachment 6 for a list of all habitat creation plots surveyed in 2013). Breeding evidence differed by plot. We also classified four of the six covered species, including Sonoran yellow warbler, Arizona Bell's vireo, summer tanager, and vermilion flycatcher, as breeders in habitat creation sites. Gila woodpecker and gilded flicker were not detected in our 2013 surveys of these sites (see attachment 5 for a complete list of detected species).

Over the course of the field season, we detected 108 species that we classified as non-breeders or migrants in habitat creation plots and 41 species that were found both breeding and not breeding in habitat creation sites. All species of migrants and non-breeders are listed in attachment 7 – tables 7-1 and 7-2.

Beal Lake Habitat Conservation Area

In 2013, we conducted rapid area searches on the four Beal Lake Habitat Conservation Area plots (attachment 1 – figure 1-34). We detected 146.5 breeding territories (table 15) and 53 non-breeding species in these plots (table 16). Breeding evidence differed by plot. We found Sonoran yellow warbler to be the most abundant breeder of all covered species, with 20 territories, followed closely by Arizona Bell's vireo with 17.25 territories at the Beal Lake Habitat Conservation Area. Summer tanagers were also found nesting at the Beal Lake Habitat Conservation Area. Non-territorial breeding species included brown-headed cowbird, Gambel's quail, mourning and white-winged doves, and yellow-headed blackbird (attachment 7 – table 7-1). We also suspected American coot to be breeding at the Beal Lake Habitat Conservation Area but were unable to confirm nesting in these plots.

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

Five plots in the CRIT 9 'Ahakhav Tribal Preserve habitat creation site (attachment 1 – figure 1-35) were surveyed with rapid area searches in 2013, resulting in 47.5 breeding territories (table 17) and 47 species of non-breeders (table 18). Breeding evidence differed by plot. In these plots, we confirmed breeding of three covered species, including vermilion flycatcher, summer tanager, and Sonoran yellow warbler. Some of the most common species we found breeding at CRIT 9 'Ahakhav Tribal Preserve were non-territorial species, including mourning and white-winged doves, brown-headed cowbird, Gambel's

Table 15.—**Beal Lake Habitat Conservation Area**: Number of breeding territories detected during rapid area search plots in 2013
(Listed in descending order of abundance. Non-territorial species are not listed.)

Species (n = 20)	C1501 (Beal A)	C1502 (Beal B)	C1503 (Beal C)	C1504 (Beal D)	Total
Yellow-breasted chat	4	4.75	15.25	1.75	**25.75**
Sonoran yellow warbler*	0.25	4	15	0.75	**20**
Black-tailed gnatcatcher	2.75	3.5	10	2.25	**18.5**
Arizona Bell's vireo*	3.75	4.5	9	0	**17.25**
Lucy's warbler	2.5	3.25	6.25	3.25	**15.25**
Abert's towhee	2.5	5.25	2.75	2	**12.5**
Verdin	1.25	5	3.5	2.25	**12**
Bullock's oriole	0	0.75	5.5	0	**6.25**
Common yellowthroat	1.5	3	0	0	**4.5**
Blue grosbeak	0.25	0.75	1.75	1	**3.75**
Black-chinned hummingbird	0.5	1	1	0	**2.5**
Ladder-backed woodpecker	0.75	0.75	0.25	0.5	**2.25**
Summer tanager*	0	0.25	1.5	0	**1.75**
Anna's hummingbird	0	0	1	0	**1**
Crissal thrasher	0	0.5	0	0.5	**1**
Brown-crested flycatcher	0.25	0	0.25	0	**0.5**
Indigo bunting	0	0.5	0	0	**0.5**
Song sparrow	0.5	0	0	0	**0.5**
Ash-throated flycatcher	0	0	0	0.25	**0.25**
Killdeer	0.25	0	0	0	**0.25**
Total	**21**	**37.75**	**73**	**14.50**	**146.25**

* LCR MSCP covered species.

Table 16.—**Beal Lake Habitat Conservation Area**: Number of non-breeding birds detected during rapid area search plots in 2013
(Listed in descending order of abundance)

Species (n = 53)	Males	Females	Unknown sex	Young of the year	Flyovers	Incidentals
Anna's hummingbird	0	1	0	0	0	0
Audubon's warbler	0	0	1	0	0	0
Barn swallow	0	0	0	0	1	0
Black-chinned hummingbird	0	0	0	1	0	0
Black-headed grosbeak	0	0	1	0	0	0
Brown-headed cowbird	0	0	0	0	17	0
Bullock's oriole	0	0	2	0	0	0
Cattle egret	0	0	0	0	3	0
Cliff swallow	0	0	0	0	9	0
Common raven	0	0	0	0	1	0
Cooper's hawk	0	0	0	0	1	0
Eurasian collared-dove	0	0	0	0	2	0
Gila woodpecker*	0	0	0	0	1	0
Great blue heron	0	0	0	0	3	0
Great egret	0	0	0	0	2	0
Great-tailed grackle	1	4	0	0	14	0
Green-tailed towhee	0	0	2	0	0	0
House finch	0	0	0	0	9	0
House wren	0	0	1	0	0	0
Killdeer	0	0	0	0	1	0
Lazuli bunting	1	1	0	0	0	0
Lesser goldfinch	0	0	0	0	4	0
Lesser nighthawk	0	0	0	0	3	0
Lucy's warbler	0	0	0	3	0	0
Macgillivray's warbler	1	0	0	0	0	0
Mallard	0	0	0	0	2	0
Mourning dove	0	0	0	0	6	0
Nashville warbler	0	1	0	0	0	0
Northern harrier	0	0	0	0	1	0
Northern rough-winged swallow	0	0	0	0	17	0

Table 16.—**Beal Lake Habitat Conservation Area**: Number of non-breeding birds detected during rapid area search plots in 2013
(Listed in descending order of abundance)

Species (n = 53)	**Males**	**Females**	**Unknown sex**	**Young of the year**	**Flyovers**	**Incidentals**
Orange-crowned warbler	1	0	0	0	0	0
Pacific-slope flycatcher	0	0	21	0	0	0
Peregrine falcon	0	0	0	0	1	0
Plumbeous vireo	1	0	0	0	0	0
Red-winged blackbird	0	0	0	0	28	0
Ruby-crowned kinglet	0	0	1	0	0	0
Say's phoebe	0	0	1	0	0	0
Swainson's thrush	0	0	2	0	0	0
Tree swallow	0	0	0	0	37	0
Turkey vulture	0	0	0	0	2	0
Vaux's swift	0	0	0	0	3	0
Verdin	0	0	0	2	0	0
Warbling vireo	1	0	2	0	0	0
Western flycatcher	0	0	1	0	0	0
Western tanager	4	0	1	0	1	0
Western wood-pewee	2	0	14	0	0	0
White-crowned sparrow	2	0	18	0	0	0
White-faced ibis	0	0	1	1	0	0
White-winged dove	0	0	0	0	34	0
Willow flycatcher**	2	0	0	0	0	0
Wilson's warbler	5	4	6	0	0	0
Yellow warbler*	6	2	1	0	0	0
Yellow-headed blackbird	0	0	0	0	7	15
Total	**27**	**13**	**76**	**7**	**210**	**15**

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

Table 17.—**CRIT 9 'Ahakhav Tribal Preserve**: Number of breeding territories of territorial species detected during rapid area search plots in 2013
(Listed in descending order of abundance. Non-territorial species are not listed.)

Species (n = 17	C2101 (CRIT 9 Plot A)	C2102 (CRIT 9 Plot B)	C2103 (CRIT 9 Plot C)	C2104 (CRIT 9 Plot D)	C2105 (CRIT 9 Plot E)	Total
Abert's towhee	1.5	1	1.5	5	3.25	**12.25**
Verdin	2.75	0.75	0.5	2.5	0	**6.5**
Anna's hummingbird	1	0	0.5	2.25	2	**5.75**
Western kingbird	2	2.25	0.5	0.5	0	**5.25**
Black-tailed gnatcatcher	1	0	0.75	1	0	**2.75**
Bullock's oriole	0.5	1.25	0.5	0.5	0	**2.75**
Summer tanager*	0	0.5	0.75	1.25	0.25	**2.75**
Ladder-backed woodpecker	0.25	0.25	1	0.75	0.25	**2.5**
Lucy's warbler	1	1	0	0	0	**2**
Vermilion flycatcher*	1.5	0	0	0.25	0	**1.75**
Sonoran yellow warbler*	0	0	1	0	0	**1**
Ash-throated flycatcher	0	0	0.25	0.5	0	**0.75**
Crissal thrasher	0	0	0.5	0	0	**0.5**
Great horned owl	0	0	0.5	0	0	**0.5**
Black phoebe	0	0	0	0	0.25	**0.25**
Black-chinned hummingbird	0	0	0	0.25	0	**0.25**
Tropical kingbird	0	0	0	0.25	0	**0.25**
Total	**11.5**	**7**	**8.25**	**15**	**6**	**47.75**

* LCR MSCP covered species.

Table 18.—**CRIT 9 'Ahakhav Tribal Preserve**: Number of non-breeding birds detected during rapid area search plots in 2013
(Listed in alphabetical order)

Species (n = 47)	Males	Females	Unknown sex	Young of the year	Flyovers	Incidentals
American goldfinch	0	0	3	0	0	0
Audubon's warbler	2	0	1	0	0	0
Black-headed grosbeak	1	0	0	0	0	0
Brown-headed cowbird	0	0	0	0	12	0
Cassin's vireo	0	0	1	0	0	0
Cedar waxwing	0	0	1	0	0	0
Cliff swallow	0	0	0	0	8	0
Common raven	0	0	0	0	2	0
Double-crested cormorant	0	0	0	0	1	0
European starling	0	0	0	0	51	0
Gray flycatcher	0	0	1	0	0	0
Great-tailed grackle	0	0	0	0	76	0
Green-tailed towhee	0	0	2	0	0	0
Hammond's flycatcher	0	0	1	0	0	0
Hooded oriole	0	0	2	0	0	0
Horned lark	0	0	0	0	1	0
House finch	0	0	0	0	25	0
Lazuli bunting	0	0	3	0	0	0
Lesser goldfinch	0	0	0	0	3	0
Lesser nighthawk	0	0	0	0	1	0
Lucy's warbler	9	0	13	8	0	0
Mallard	0	0	0	0	2	0
Mourning dove	0	0	0	0	22	0
Nashville warbler	0	0	3	0	0	0
Northern rough-winged swallow	0	0	0	0	9	0
Olive-sided flycatcher	0	0	2	0	0	0
Orange-crowned warbler	1	0	3	0	0	0
Pacific-slope flycatcher	0	0	7	0	0	0
Phainopepla	0	0	0	0	1	0
Plumbeous vireo	0	0	2	0	0	0

Table 18.—**CRIT 9 'Ahakhav Tribal Preserve**: Number of non-breeding birds detected during rapid area search plots in 2013
(Listed in alphabetical order)

Species (n = 47)	Males	Females	Unknown sex	Young of the year	Flyovers	Incidentals
Red-winged blackbird	0	0	0	0	61	0
Ruby-crowned kinglet	0	0	1	0	0	0
Rufous hummingbird	0	0	1	0	0	0
Swainson's thrush	0	0	2	0	0	0
Townsend's warbler	2	0	0	0	0	0
Tropical kingbird	0	0	0	0	0	1
Turkey vulture	0	0	0	0	2	0
Verdin	0	0	0	0	1	0
Violet-green swallow	0	0	0	0	2	0
Warbling vireo	0	0	22	0	0	0
Western flycatcher	0	0	1	0	0	0
Western tanager	0	0	1	0	0	0
Western wood-pewee	0	0	3	0	0	0
White-faced ibis	0	0	0	0	77	0
White-winged dove	0	0	0	0	63	0
Wilson's warbler	1	1	28	0	0	0
Yellow-rumped warbler	0	0	1	0	0	0
Total	**16**	**1**	**105**	**8**	**420**	**1**

quail, house finch, and great-tailed grackle (attachment 7 – table 7-1). Blue grosbeak, Eurasian collared-dove, hooded oriole, lesser goldfinch, northern rough-winged swallow, and red-tailed hawk were detected and possibly breeding in or around CRIT, but breeding could not be confirmed.

Palo Verde Ecological Reserve

During rapid area searches of 36 plots at Palo Verde Ecological Reserve (PVER) (attachment 1 – figure 1-36), we detected 261 breeding territories (table 19) and 66 species of migrants and other non-breeders (table 20). Breeding evidence

Table 19.—**PVER**: Number of breeding territories of territorial species detected during rapid area search plots in 2013
(Listed in descending order of abundance. Non-territorial species are not listed.)

Species (n = 16)	Phase 1	Phase 2	Phase 3	Phase 4	Phase 5	Phase 6	Phase 7	Total PVER
Common yellowthroat	6	0	0.5	1.5	18	52.5	47.75	**126.25**
Blue grosbeak	1	2.5	3	7.75	12	3.75	7.5	**37.5**
Song sparrow	10.5	0	0	3.5	7	11	0	**32**
Abert's towhee	1	6	2.5	3	6.25	0.5	0.5	**19.75**
Black-chinned hummingbird	0	3.5	3.25	4	1	1	0	**12.75**
Western kingbird	0.5	5.25	0.5	1	0	0	1.75	**9**
Bullock's oriole	0	3.5	0.75	1.75	0	0	1	**7**
Indigo bunting	0	0	0	0	3.75	0.75	0.75	**5.25**
Ladder-backed woodpecker	0	1	0.5	1	0.75	0	0	**3.25**
Anna's hummingbird	0	0	0	2	0	0	0	**2**
Sonoran yellow warbler*	0	0	0	2	0	0	0	**2**
Yellow-breasted chat	0	0	0	0	1.75	0	0	**1.75**
Common raven	0	0	0.25	0	0.5	0	0	**0.75**
Great horned owl	0.5	0	0.25	0	0	0	0	**0.75**
Summer tanager*	0	0	0	0.75	0	0	0	**0.75**
Verdin	0	0	0	0.25	0	0	0	**0.25**
Total	**19.5**	**21.75**	**11.5**	**28.5**	**51**	**69.5**	**59.25**	**261**

* LCR MSCP covered species.

Table 20.—**PVER**: Number of non-breeding birds detected during rapid area search plots in 2013 (Listed in alphabetical order)

Species (n = 66)	Males	Females	Unknown sex	Young of the year	Flyovers	Incidentals
American kestrel	0	0	0	0	1	0
American redstart	2	0	0	0	0	1
Audubon's warbler	2	0	9	0	2	0
Barn swallow	0	0	0	0	2	0
Black-chinned hummingbird	0	0	0	2	0	0
Black-headed grosbeak	4	4	9	0	1	0
Blue grosbeak	2	0	0	0	0	0
Brewer's sparrow	1	0	1	0	0	0
Brown-headed cowbird	0	0	0	0	318	0
Bullock's oriole	0	0	0	0	2	0
Caspian tern	0	0	0	0	0	4
Cassin's vireo	0	0	2	0	0	0
Cattle egret	0	0	0	0	10	0
Cedar waxwing	0	0	1	0	9	0
Cliff swallow	0	0	0	0	52	0
Common ground-dove	0	0	0	0	1	0
Common raven	0	0	0	0	30	0
Cooper's hawk	0	0	0	0	2	0
European starling	0	0	0	0	37	0
Forster's tern	0	0	0	0	0	1
Great blue heron	0	0	0	0	1	0
Great egret	0	0	0	0	11	0
Great-tailed grackle	0	0	0	0	2	0
House finch	0	0	0	0	21	0
Lazuli bunting	15	17	29	0	0	0
Lesser goldfinch	0	0	0	0	1	0
Lesser nighthawk	0	0	0	0	6	0

Table 20.—**PVER**: Number of non-breeding birds detected during rapid area search plots in 2013 (Listed in alphabetical order)

Species (n = 66)	**Males**	**Females**	**Unknown sex**	**Young of the year**	**Flyovers**	**Incidentals**
Lincoln's sparrow	0	0	3	0	0	0
Lucy's warbler	10	1	185	12	0	0
Macgillivray's warbler	0	1	0	0	0	0
Marsh wren	0	0	2	0	0	0
Mountain white-crowned sparrow	0	0	18	0	0	0
Mourning dove	0	0	0	0	96	0
Myrtle's warbler	0	0	1	0	0	0
Nashville warbler	2	0	2	0	0	0
Northern harrier	0	2	0	0	4	0
Northern mockingbird	0	0	0	2	1	0
Northern rough-winged swallow	0	0	0	0	23	0
Orange-crowned warbler	5	0	12	0	0	0
Osprey	0	0	0	0	1	0
Pacific-slope flycatcher	5	0	13	0	0	0
Plumbeous vireo	0	0	1	0	0	0
Red-shouldered hawk	0	0	0	0	0	1
Red-tailed hawk	0	0	0	0	2	0
Red-winged blackbird	0	0	0	0	3,616	0
Sharp-shinned hawk	0	0	1	0	1	0
Swainson's thrush	1	0	1	0	0	0
Townsend's warbler	4	1	0	0	0	0
Tree swallow	0	0	0	0	72	0
Turkey vulture	0	0	0	0	23	0
Vaux's swift	0	0	0	0	6	0
Verdin	1	1	0	2	0	0
Warbling vireo	10	0	53	0	0	0

Table 20.—**PVER**: Number of non-breeding birds detected during rapid area search plots in 2013 (Listed in alphabetical order)

Species (n = 66)	Males	Females	Unknown sex	Young of the year	Flyovers	Incidentals
Western flycatcher	0	0	3	0	0	0
Western kingbird	0	0	10	0	5	0
Western tanager	16	7	7	0	3	0
Western wood-pewee	2	0	31	0	0	0
Whimbrel	0	0	0	0	0	18
White-crowned sparrow	1	0	6	0	0	0
White-faced ibis	0	0	0	0	9	0
White-winged dove	0	0	0	0	161	0
Willow flycatcher	5	0	4	0	0	0
Wilson's warbler	15	3	70	0	0	0
Yellow warbler*	11	2	5	0	0	0
Yellow-headed blackbird	0	0	0	0	13	0
Yellow-rumped warbler	0	0	15	0	1	0
Total	**114**	**39**	**494**	**18**	**4,546**	**25**

*LCR MSCP covered species.

differed by plot. Numbers of breeding territories decreased in PVER Phases 1–4 compared to 2012, but with the increased acreage from PVER Phase 7 in the 2013 surveys (10 plots) the total number of breeding territories recorded at PVER was the same as last year. We found Sonoran yellow warbler and summer tanager breeding in planting Phase 4. No other covered species were found breeding at PVER this year. The most common non-territorial species breeding at PVER included white-winged dove, brown-headed cowbird, and red-winged blackbird, followed by mourning dove and house finch (attachment 7 – table 7-1).

Cibola Valley Conservation Area

In 23 rapid area search plots at Cibola Valley Conservation Area (CVCA), attachment 1 – figure 1-37, we documented 119.50 breeding territories (table 21)

Table 21.—**CVCA**: Number of breeding territories of territorial species detected during rapid area search plots in 2013
(Listed in descending order of abundance)

Species 2013 (n = 13)	Phase 1	Phase 2	Phase 3	Phase 4	Phase 5	Phase 6	Total CVCA
Abert's towhee	6	3	8.25	6	5.25	8.5	**37**
Black-tailed gnatcatcher	0	0	0.5	9.75	8	1	**19.25**
Western kingbird	0.5	6	6.5	1.5	0	0	**14.5**
Bullock's oriole	2.75	2.5	7.5	0.5	0	0	**13.25**
Verdin	0	0	1.5	6.5	1	4	**13**
Blue grosbeak	4.5	2	0.5	3.5	0	1.5	**12**
Black-chinned hummingbird	3.25	0	0	0.5	0	0	**3.75**
Ladder-backed woodpecker	1.25	0	2	0	0	0	**3.25**
Anna's hummingbird	1	0	0	0	0	0	**1**
Killdeer	0	0	0	1	0	0	**1**
Crissal thrasher	0	0	0	0	0	0.75	**0.75**
Great horned owl	0	0	0.5	0	0	0	**0.5**
Ash-throated flycatcher	0.25	0	0	0	0	0	**0.25**
Total	**19.5**	**13.5**	**27.25**	**29.25**	**14.25**	**15.75**	**119.50**

* LCR MSCP covered species.

and a total of 58 species of migrants and other non-breeders (table 22) in 2013. Breeding evidence differed by plot. We found Sonoran yellow warbler and summer tanager in CVCA Phase 1 plots, but the surveyors were unable to confirm breeding this year. Again, we found many non-territorial breeding species breeding at CVCA, including mourning and white-winged doves, brown-headed cowbird, Eurasian collared-dove, red-winged blackbird, house finch, and Gambel's quail (attachment 7 – table 7-1). Other non-territorial species, including greater roadrunner, house finch, Eurasian collared-dove, European starling, and greater roadrunner, were also found breeding at CVCA in small numbers. Several species, including common yellowthroat, Cooper's hawk, Inca dove, indigo bunting, lesser goldfinch, lesser nighthawk, loggerhead shrike, Lucy's warbler, northern mockingbird, Sonoran yellow warbler, and yellow-breasted chat, were observed and suspected to be breeding, but the surveyor was unable to confirm it.

Table 22.—**CVCA**: Number of non-breeding birds detected during rapid area search plots in 2013
(Listed in alphabetical order)

Species (n = 58)	Males	Females	Unknown sex	Young of the year	Flyovers	Incidentals
Ash-throated flycatcher	1	1	0	3	0	0
Audubon's warbler	0	0	1	0	0	0
Barn swallow	0	0	0	0	17	0
Black-chinned hummingbird	0	0	0	1	0	0
Black-headed grosbeak	0	1	2	0	0	0
Black-tailed gnatcatcher	0	1	4	4	0	0
Black-throated gray warbler	1	0	0	0	0	0
Brewer's sparrow	0	0	1	0	0	0
Brown-crested flycatcher	0	0	1	0	0	0
Brown-headed cowbird	0	0	0	0	267	0
Bullock's oriole	0	1	0	2	2	0
Cassin's vireo	0	0	2	0	0	0
Cedar waxwing	0	0	0	0	1	0
Cliff swallow	0	0	0	0	64	0
Common raven	0	0	0	0	2	0
Eurasian collared-dove	0	0	0	0	4	0
European starling	0	0	0	0	58	0
Great-tailed grackle	0	0	0	0	12	0
Green-tailed towhee	0	0	4	0	0	0
Horned lark	0	0	0	0	30	0
House finch	0	0	0	0	15	0
Indigo bunting	2	2	0	0	0	0
Lazuli bunting	8	10	5	0	5	0
Lesser goldfinch	0	0	0	0	6	0
Lesser nighthawk	0	0	0	0	11	0
Lucy's warbler	3	0	26	2	0	0
Macgillivray's warbler	2	0	3	0	0	0
Marbled godwit	0	0	0	0	1	0
Mourning dove	0	0	0	0	133	0
Nashville warbler	3	0	6	0	0	0
Northern mockingbird	0	0	0	0	1	0

Table 22.—**CVCA**: Number of non-breeding birds detected during rapid area search plots in 2013
(Listed in alphabetical order)

Species (n = 58)	**Males**	**Females**	**Unknown sex**	**Young of the year**	**Flyovers**	**Incidentals**
Northern rough-winged swallow	0	0	0	0	24	0
Orange-crowned warbler	1	0	4	0	0	0
Pacific-slope flycatcher	15	0	12	0	0	0
Phainopepla	0	0	0	0	14	0
Red-winged blackbird	2	1	0	0	476	0
Ruby-crowned kinglet	1	0	1	0	0	0
Sharp-shinned hawk	0	0	0	0	2	0
Spotted sandpiper	0	0	0	0	1	0
Swainson's hawk	0	0	0	0	2	1
Swainson's thrush	0	0	3	0	0	0
Townsend's warbler	3	1	0	0	0	0
Tree swallow	0	0	0	0	1,480	0
Turkey vulture	0	0	0	0	3	0
Verdin	0	0	0	18	3	0
Warbling vireo	6	0	34	0	0	0
Western flycatcher	0	0	2	0	0	0
Western kingbird	0	0	2	0	16	0
Western tanager	3	3	4	0	1	0
Western wood-pewee	4	0	6	0	0	0
White-crowned sparrow	1	0	0	0	0	0
White-faced ibis	0	0	0	0	44	0
White-winged dove	0	0	0	0	303	0
Willow flycatcher*	6	0	2	0	0	0
Wilson's warbler	10	6	49	0	1	0
Yellow warbler*	2	0	7	0	1	0
Yellow-headed blackbird	0	0	0	0	32	0
Yellow-rumped warbler	3	0	13	0	2	0
Total	**77**	**27**	**194**	**30**	**3034**	**1**

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

Cibola National Wildlife Refuge, Farm Unit 1

The rapid area search plots surveyed in 2013 at the Cibola National Wildlife Refuge Farm Unit 1 included 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 1 – figure 1-38). In these 13 plots, we documented over 151 breeding territories (table 23) and a total of 61 species of migrants and other non-breeders (table 24). Breeding evidence differed plot. Sonoran yellow warbler and summer tanagers were found on the site, but the surveyors were unable to confirm breeding this year. Several other species, including barn owl, brown-crested flycatcher, Cooper's hawk, loggerhead shrike, Lucy's warbler, red-shouldered hawk, and Say's phoebe, were also detected and suspected to be nesting. Yellow-billed cuckoos were also detected on several occasions. Non-territorial species found breeding at this site included mourning and white-winged doves, brown-headed cowbird, red-winged blackbird, yellow-headed blackbird, house finch, European starling, Gambel's quail, Eurasian collared-dove, and great-tailed grackle (attachment 7 – table 7-1).

Table 23.—**Cibola National Wildlife Refuge Farm Unit 1**: Number of breeding territories of territorial species detected during rapid area search plots in 2013
(Listed in descending order of abundance. Non-territorial species excluded.)

Species (n = 19)	**Cibola Farm Unit Area 1**	**Crane Roost**	**Nature Trail North**	**Nature Trail South**	**Total**
Abert's towhee	6	18.5	7.5	3.25	**35.25**
Song sparrow	0	28	0	0	**28**
Western kingbird	12	1.5	2	2	**17.5**
Blue grosbeak	2.75	10.25	1.25	0.75	**15**
Yellow-breasted chat	1	10	1	0	**12**
Verdin	0.5	2	4.5	3.75	**10.75**
Bullock's oriole	4	2.25	2	0.75	**9**
Black-chinned hummingbird	2	1.75	2	0	**5.75**
Common yellowthroat	0	2.5	1	1	**4.5**

Table 23.—**Cibola National Wildlife Refuge Farm Unit 1**: Number of breeding territories of territorial species detected during rapid area search plots in 2013

(Listed in descending order of abundance. Non-territorial species excluded.)

Species (n = 19)	**Cibola Farm Unit Area 1**	**Crane Roost**	**Nature Trail North**	**Nature Trail South**	**Total**
Ash-throated flycatcher	1.25	0	0.5	0.5	**2.25**
Black-tailed gnatcatcher	0	1	1.25	0	**2.25**
Anna's hummingbird	0	0	1	1	**2**
Ladder-backed woodpecker	0.25	0	0.5	0.5	**1.25**
Arizona Bell's vireo*	0	0	0	1	**1**
Crissal thrasher	0	0	1	0	**1**
Killdeer	0	1	0	0	**1**
Lesser goldfinch	0	0	1	0	**1**
Great horned owl	0.5	0	0	0.25	**0.75**
Northern mockingbird	0	0.75	0	0	**0.75**
Total	**30.25**	**79.5**	**26.5**	**14.75**	**151**

* LCR MSCP covered species.

Table 24.—**Cibola National Wildlife Refuge Farm Unit 1**: Number of non-breeding birds detected during rapid area search plots in 2013

(Listed in alphabetical order)

Species (n = 61)	**Males**	**Females**	**Unknown sex**	**Young of the year**	**Flyovers**	**Incidentals**
American kestrel	0	0	0	0	2	0
American pipit	0	0	0	0	2	0
Audubon's warbler	0	0	4	0	1	0
Baltimore oriole	1	0	0	0	0	0

Table 24.—**Cibola National Wildlife Refuge Farm Unit 1**: Number of non-breeding birds detected during rapid area search plots in 2013
(Listed in alphabetical order)

Species (n = 61)	Males	Females	Unknown sex	Young of the year	Flyovers	Incidentals
Barn swallow	0	0	0	0	27	0
Black-chinned hummingbird	0	0	0	4	0	0
Black-headed grosbeak	2	0	5	0	1	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	159	0
Bullock's oriole	0	0	0	0	0	0
Chipping sparrow	0	0	1	0	0	0
Cliff swallow	0	0	0	0	1	0
Common raven	0	0	0	0	3	0
Crissal thrasher	0	0	0	1	0	0
European starling	0	0	0	0	32	0
Great blue heron	0	0	0	0	2	0
Great egret	0	0	0	0	9	0
Great-tailed grackle	0	0	0	0	32	0
Green-tailed towhee	0	0	1	0	0	0
Hammond's flycatcher	0	0	1	0	0	0
House finch	0	0	0	3	22	0
House wren	1	0	2	0	0	0
Lazuli bunting	2	1	5	0	0	0
Lesser goldfinch	0	0	0	3	0	0
Lesser nighthawk	0	0	0	0	1	0
Lincoln's sparrow	0	0	2	0	0	0
Lucy's warbler	5	2	21	25	0	0
Macgillivray's warbler	1	0	1	0	0	0
Mourning dove	0	0	0	0	86	0
Nashville warbler	0	0	1	0	0	0
Northern harrier	0	0	0	0	2	0

Table 24.—**Cibola National Wildlife Refuge Farm Unit 1**: Number of non-breeding birds detected during rapid area search plots in 2013
(Listed in alphabetical order)

Species (n = 61)	Males	Females	Unknown sex	Young of the year	Flyovers	Incidentals
Northern rough-winged swallow	0	0	0	0	39	0
Orange-crowned warbler	1	0	3	0	0	0
Pacific-slope flycatcher	1	0	46	0	0	0
Phainopepla	0	0	0	0	1	0
Plumbeous vireo	1	0	0	0	0	0
Red-winged blackbird	0	0	0	0	621	0
Ruby-crowned kinglet	0	0	1	0	0	0
Sharp-shinned hawk	0	0	0	0	1	0
Snowy egret	0	0	0	0	1	0
Swainson's hawk	0	0	0	1	0	0
Swainson's thrush	0	0	9	0	0	0
Townsend's warbler	0	2	1	0	0	0
Tree swallow	0	0	0	0	2,298	0
Turkey vulture	0	0	0	0	10	0
Vaux's swift	0	0	0	0	2	0
Verdin	0	0	1	2	0	0
Warbling vireo	3	0	63	0	0	0
Western kingbird	0	0	8	0	3	0
Western tanager	6	2	7	0	0	0
Western wood-pewee	9	0	39	0	0	0
White-crowned sparrow	0	0	15	0	0	0
White-faced ibis	0	0	0	0	14	0
White-tailed kite	0	0	0	0	1	0
White-winged dove	0	0	0	0	137	0
Willow flycatcher**	1	0	8	0	0	0
Wilson's warbler	9	0	84	0	0	0
Yellow warbler*	3	0	1	0	0	0
Yellow-headed blackbird	0	0	0	0	18	0

Table 24.—**Cibola National Wildlife Refuge Farm Unit 1**: Number of non-breeding birds detected during rapid area search plots in 2013
(Listed in alphabetical order)

Species (n = 61)	Males	Females	Unknown sex	Young of the year	Flyovers	Incidentals
Yellow-rumped warbler	0	0	1	0	0	0
Total	**46**	**7**	**333**	**39**	**3528**	**0**

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

Pretty Water Conservation Area

For the first time in 2013, we surveyed four plots in the Pretty Water Conservation Area using rapid area searches. Throughout the four plots, we found ≈35 territories of 11 territorial breeding species with verdin, Lucy's warbler, and black-tailed gnatcatcher being the most common (table 25). Forty five non-breeders and migrants were also documented on the plots (table 26). Breeding evidence differed by plot. Surveyors found evidence of possible or probable breeding on or near the plots for common yellowthroat, great horned owl, horned lark, Lawrence's goldfinch, loggerhead shrike, western kingbird, and yellow-breasted chat but were not able to confirm breeding in two site visits. Non-territorial breeders were also present on the plots and included mourning and white-winged doves, brown-headed cowbird, red-winged blackbird, house finch, and Gambel's quail (attachment 7 – table 7-1).

Table 25.—**Pretty Water Conservation Area**: Number of breeding territories of territorial species detected during rapid area search plots in 2013
(Listed in descending order of abundance. Non-territorial species excluded.)

Species (n = 11)	S5663	S5665	S5675	S5676	Total
Verdin	0.75	4.5	3.25	1.5	10
Lucy's warbler	0	5.5	1.5	2	9
Black-tailed gnatcatcher	1.5	0.75	2.5	2.5	7.25
Abert's towhee	1.5	0.5	0.25	1.5	3.75
Crissal thrasher	0.25	0.25	0.25	0.5	1.25
Ash-throated flycatcher	0	0.25	0	0.5	0.75
Ladder-backed woodpecker	0	0.25	0.25	0.25	0.75

Table 25.—**Pretty Water Conservation Area**: Number of breeding territories of territorial species detected during rapid area search plots in 2013
(Listed in descending order of abundance. Non-territorial species excluded.)

Species (n = 11)	S5663	S5665	S5675	S5676	Total
Phainopepla	0	0	0.75	0	0.75
Black-chinned hummingbird	0	0	0.5	0	0.5
Blue grosbeak	0	0.5	0	0	0.5
Lesser nighthawk	0	0	0	0.25	0.25
Total	**4**	**12.5**	**9.25**	**9**	**34.75**

Table 26.—**Pretty Water Conservation Area**: Number of non-breeding birds detected during rapid area search plots in 2013
(Listed in alphabetical order)

Species (n = 45)	Males	Females	Unknown sex	Young of the year	Flyovers	Incidentals
Barn swallow	0	0	0	0	5	0
Black-headed grosbeak	1	0	0	0	0	0
Black-tailed gnatcatcher	2	2	0	10	0	0
Brown-headed cowbird	0	0	0	0	31	0
Bullock's oriole	0	0	0	1	0	0
Cattle egret	0	0	0	0	3	0
Chipping sparrow	0	0	1	0	0	1
Cliff swallow	0	0	0	0	158	0
Eurasian collared-dove	0	0	0	0	1	0
Great blue heron	0	0	0	0	3	0
Great egret	0	0	0	0	2	0
Great-tailed grackle	0	0	0	0	8	0
Hooded oriole	0	0	2	0	0	0
Horned lark	0	0	0	0	1	0
House finch	0	0	0	0	3	0
Lazuli bunting	0	0	1	0	0	0
Lesser nighthawk	0	0	0	0	3	0
Lucy's warbler	1	1	0	3	0	0
Macgillivray's warbler	0	0	1	0	0	0

Table 26.—**Pretty Water Conservation Area**: Number of non-breeding birds detected during rapid area search plots in 2013
(Listed in alphabetical order)

Species (n = 45)	Males	Females	Unknown sex	Young of the year	Flyovers	Incidentals
Mallard	0	0	0	0	1	0
Mourning dove	0	0	0	0	9	0
Northern mockingbird	0	0	0	0	1	0
Northern rough-winged swallow	0	0	0	0	6	0
Orange-crowned warbler	0	0	5	0	0	0
Osprey	0	0	0	0	1	0
Pacific-slope flycatcher	0	0	3	0	0	0
Phainopepla	9	8	2	4	13	0
Red-winged blackbird	0	0	0	0	299	0
Ruby-crowned kinglet	0	0	1	0	0	0
Snowy egret	0	0	0	0	10	0
Tree swallow	0	0	0	0	22	0
Turkey vulture	0	0	0	0	7	0
Vaux's swift	0	0	0	0	8	0
Verdin	0	0	0	5	0	0
Warbling vireo	0	0	10	0	0	0
Western flycatcher	0	0	1	0	0	0
Western kingbird	0	0	0	0	5	0
Western tanager	1	1	1	0	2	0
Western wood-pewee	0	0	3	0	0	0
White-throated swift	0	0	0	0	6	0
White-winged dove	0	0	0	0	157	0
Wilson's warbler	6	0	31	0	0	0
Yellow warbler*	1	0	0	0	0	0
Yellow-headed blackbird	0	0	0	0	14	0
Yellow-rumped warbler	0	0	2	0	0	0
Total	**21**	**12**	**64**	**23**	**779**	**1**

* LCR MSCP covered species.

Yuma East Wetlands

In the springs of 2012 and 2013, Fred Phillips Consulting, LLC, conducted area searches at the Yuma East Wetlands habitat creation site using methods similar to our intensive area searches (attachment 1 – figure 1-39). Reclamation provided us these data and requested that we include the results in annual reports for both years. During Fred Phillip's surveys at Yuma East Wetlands in 2013, three plots were surveyed with intensive area searches, and one plot at Hunter's Hole Conservation Area (S6785) was covered with a rapid area search. Based on these data, surveyors detected more than 53 breeding territories of 10 territorial breeding species (table 27), and 54 species of migrants and other non-breeders (table 28). Breeding evidence differed by plot. Breeding was not confirmed for any LCR MSCP covered species in these plots. Many non-territorial birds were found breeding at these sites and included brown-headed cowbird, red-winged blackbird, and great-tailed grackle (attachment 7 – table 7-4).

Table 27.—**Yuma East Wetlands and Hunter's Hole Conservation Area**: Number of breeding territories of territorial species detected during area search plots by Fred Phillips Consulting, LLC, in 2013
(Listed in alphabetical order. Non-territorial breeders excluded.)

Species (n = 10)	C4701 (intensive)	C4702 (intensive)	C4703 (intensive)	S6785 (rapid)	Total
Abert's towhee	3	4	1.75	2	10.75
Anna's hummingbird	1.75	2	4	0	7.75
Ash-throated flycatcher	0	2.5	0	0	2.5
Black-tailed gnatcatcher	0.25	0	0	0	0.25
Blue grosbeak	0	1	3	0	4
Crissal thrasher	1	0	0	0	1
Killdeer	0.5	0.25	0	0	0.75
Ladder-backed woodpecker	0.75	0.5	0.75	0	2
Verdin	11.5	7.25	5	0	23.75
Western kingbird	0	0	0	0.75	0.75
Total	**18.75**	**17.5**	**14.5**	**2.75**	**53.5**

Table 28.—**Yuma East Wetlands and Hunter's Hole Conservation Area**: Non-breeding species detected during area search plots by Fred Phillips Consulting, LLC, in 2013
(Listed in alphabetical order)

Species (n = 54)	C4701	C4702	C4703	S6785
Abert's towhee	X	X	X	
American kestrel	X			
Anna's hummingbird	X	X	X	X
Ash-throated flycatcher	X	X	X	
Audubon's warbler			X	
Barn swallow	X			
Arizona Bell's vireo	X	X		
Black-chinned hummingbird	X			
Black-crowned night-heron			X	
Black-headed grosbeak	X		X	
Black-necked stilt	X	X		X
Black phoebe	X			X
Black-tailed gnatcatcher	X	X	X	
Black-throated gray warbler	X			
Blue grosbeak	X	X	X	X
Bullock's oriole	X	X	X	
Cliff swallow	X	X	X	X
Common yellowthroat	X	X		
Costa's hummingbird			X	
Crissal thrasher	X			
Double-crested cormorant			X	
Gila woodpecker*	X			
Great blue heron	X	X		X
Great egret	X	X	X	X
Green heron		X		
Hermit warbler			X	
Killdeer	X	X	X	
Ladder-backed woodpecker	X	X	X	
Lazuli bunting	X			
Lesser goldfinch	X	X	X	

Table 28.—**Yuma East Wetlands and Hunter's Hole Conservation Area**: Non-breeding species detected during area search plots by Fred Phillips Consulting, LLC, in 2013
(Listed in alphabetical order)

Species (n = 54)	C4701	C4702	C4703	S6785
Lesser nighthawk			X	
Macgillivray's warbler	X	X	X	
Nashville warbler	X			
Northern mockingbird	X	X		
Northern rough-winged swallow	X			
Northern shoveler		X		
Olive-sided flycatcher	X			X
Orange-crowned warbler	X	X		
Pacific-slope flycatcher	X	X	X	
Sharp-shinned hawk		X		
Song sparrow	X	X		
Snowy egret	X	X	X	
Swainson's thrush	X			
Townsend's warbler	X		X	
Turkey vulture	X	X		
Verdin	X	X	X	
Warbling vireo	X	X	X	
Western kingbird	X	X		X
Western tanager	X	X	X	
Western wood-pewee			X	
White-faced ibis	X	X		
Willow flycatcher**		X	X	X
Wilson's warbler	X	X	X	
Yellow warbler*	X	X	X	

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

Habitat Creation Sites: Intensive Area Searches

Intensive area searches were conducted on four habitat creation site plots, C2301 (PVER 1A), C2309 (PVER 4B), C2703, (Cibola Farm Unit Area 1 Plot B), and C2706 (Nature Trail North). During these surveys, we detected 71 bird species (tables 29–31), including 12 breeding species with 43 territories (table 29) and 67 species classified as non-breeders and migrants (tables 30 and 31). Breeding evidence differed by plot. We found evidence for one covered species, the summer tanager, breeding in plots at PVER 4B.

Some of the breeding birds, including white-winged and mourning doves, brown-headed cowbird, red-winged blackbird, and house finch, on these plots were non-territorial species that are not included in our population size estimates, (attachment 7 – table 7-2). Of the territorial species included in breeding population estimates, song sparrow was the most common, followed by Abert's towhee and western kingbird (table 29).

Table 29.—Total number of breeding territories by species detected during intensive area searches at a subset of four habitat creation sites in 2013
(Listed in descending order of abundance. Territorial species only.)

Species (n = 12)	Number of territories				
	C2301 (PVER 1A)	C2309 (PVER 4B)	C2703 (Cibola Farm Unit Area 1 Plot B)	C2706 (Nature Trail North)	Total
Song sparrow	9.75	0	0	0	9.75
Abert's towhee	2.25	0	3	2	7.25
Western kingbird	0	0	5.25	1	6.25
Common yellowthroat	5	0	0	0	5
Verdin	0	0	0	4.25	4.25
Blue grosbeak	1	2.5	0.5	0	4
Bullock's oriole	0.5	0	3.5	0	4
Black-chinned hummingbird	0	0.25	0	0.75	1
Great horned owl	0.25	0	0.5	0	0.75
Ash-throated flycatcher	0	0	0	0.25	0.25
Ladder-backed woodpecker	0	0	0	0.25	0.25
Summer tanager*	0	0.25	0	0	0.25
Total	**18.75**	**3**	**12.75**	**8.5**	**43**

* LCR MSCP covered species.

Table 30.—Species detected, but not confirmed breeding, during intensive area searches at Cibola Farm Unit 1 sites in 2013
(Listed in alphabetical order)

Species (n = 49)	Cibola Farm Unit 1 intensive plots, 2013											
	C2703						C2706					
	Males	Females	Unknown sex	Young of the year	Flyovers	Incidentals	Males	Females	Unknown sex	Young of the year	Flyovers	Incidentals
Abert's towhee	0	0	0	0	0	0	0	0	0	3	0	0
Arizona Bell's vireo*	0	0	0	0	0	0	0	0	0	0	0	1
Black-headed grosbeak	0	0	0	0	0	0	1	0	0	0	0	0
Black-tailed gnatcatcher	0	0	0	0	0	0	1	0	3	0	0	0
Blue grosbeak	0	0	0	0	2	0	0	0	0	0	0	0
Brown-headed cowbird	0	0	0	0	46	0	0	0	0	0	56	0
Bullock's oriole	0	0	0	0	2	0	0	0	0	0	0	0
Cassin's vireo	1	0	0	0	0	0	0	0	0	0	0	0
Chipping sparrow	0	0	5	0	0	0	0	0	0	0	0	0
Cliff swallow	0	0	0	0	2	0	0	0	0	0	0	0
European starling	0	0	0	0	0	0	0	0	0	0	38	0
Gray flycatcher	0	0	1	0	0	0	0	0	0	0	0	0
Great blue heron	0	0	0	0	2	0	0	0	0	0	0	0
Great egret	0	0	0	0	0	0	0	0	0	0	2	0
Great horned owl	0	0	0	0	1	0	0	0	0	0	0	0
Great-tailed grackle	0	0	0	0	3	0	0	0	0	0	3	0
Green-tailed towhee	0	0	0	0	0	0	0	0	3	0	0	0
Hermit thrush	0	0	0	0	0	0	0	0	3	0	0	0
Killdeer	0	0	0	0	1	0	0	0	0	0	0	0
Ladder-backed woodpecker	0	0	0	0	1	0	0	0	0	0	0	0
Lazuli bunting	2	0	0	0	0	0	7	5	5	0	0	0
Lesser goldfinch	0	0	0	0	10	0	0	0	0	0	0	0
Lesser nighthawk	0	0	0	0	2	0	0	0	0	0	0	0
Lucy's warbler	0	0	0	0	0	0	1	0	4	2	0	0
Macgillivray's warbler	1	0	0	0	0	0	0	0	0	0	0	0
Mourning dove	0	0	8	0	39	0	0	0	0	0	12	0
Nashville warbler	1	0	0	0	0	0	12	0	7	0	0	0
Northern mockingbird	0	0	0	0	0	0	0	0	0	0	1	0

Table 30.—Species detected, but not confirmed breeding, during intensive area searches at Cibola Farm Unit 1 sites in 2013
(Listed in alphabetical order)

Species (n = 49)	Cibola Farm Unit 1 intensive plots, 2013											
	C2703						C2706					
	Males	Females	Unknown sex	Young of the year	Flyovers	Incidentals	Males	Females	Unknown sex	Young of the year	Flyovers	Incidentals
Northern rough-winged swallow	0	0	0	0	5	0	0	0	0	0	41	0
Orange-crowned warbler	0	0	1	0	0	0	1	0	15	0	0	0
Pacific-slope flycatcher	0	0	12	0	0	0	0	0	13	0	0	0
Phainopepla	0	0	0	0	10	0	1	0	0	0	0	0
Red-winged blackbird	0	0	0	0	244	0	0	0	0	0	72	0
Snowy egret	0	0	0	0	0	0	0	0	0	0	5	0
Swainson's thrush	0	0	3	0	0	0	0	0	1	0	0	0
Townsend's warbler	0	0	0	0	0	0	2	0	0	0	0	0
Tree swallow	0	0	0	0	40	0	0	0	0	0	72	0
Turkey vulture	0	0	0	0	6	0	0	0	0	0	1	0
Vaux's swift	0	0	0	0	2	0	0	0	0	0	20	0
Warbling vireo	0	0	16	0	0	0	0	0	29	0	0	0
Western tanager	5	0	0	0	3	0	3	0	0	0	0	0
Western wood-pewee	4	0	6	0	0	0	0	0	7	0	0	0
White-crowned sparrow	0	0	1	0	0	0	0	0	0	0	0	0
White-faced ibis	0	0	0	0	51	0	0	0	0	0	0	0
White-winged dove	0	0	0	0	55	0	0	0	0	0	26	0
Willow flycatcher**	0	0	0	0	0	0	0	0	0	0	0	1
Wilson's warbler	4	0	9	0	0	0	31	0	42	0	0	0
Yellow-headed blackbird	0	0	0	0	20	0	0	0	0	0	0	0
Yellow-rumped warbler	0	0	0	0	0	0	5	0	11	0	0	0
Total	**18**	**0**	**83**	**0**	**557**	**0**	**65**	**5**	**148**	**5**	**349**	**2**

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

Table 31.—Species detected, but not confirmed breeding, during intensive area searches at PVER sites in 2013
(Listed in alphabetical order)

Species (n = 48)	PVER intensive surveys, 2013											
	C2301						C2309					
	Males	Females	Unknown sex	Young of the year	Flyovers	Incidentals	Males	Females	Unknown sex	Young of the year	Flyovers	Incidentals
American redstart	1	0	0	0	0	0	0	0	0	0	0	0
Audubon's warbler	1	0	5	0	0	0	0	0	0	0	0	0
Barn swallow	0	0	0	0	0	0	0	0	0	0	9	0
Black-chinned hummingbird	0	0	0	2	0	0	0	0	0	0	0	0
Black-headed grosbeak	0	0	1	0	2	0	0	0	1	0	0	0
Brown-headed cowbird	0	0	0	0	43	0	0	0	0	0	146	0
Cliff swallow	0	0	0	0	1	0	0	0	0	0	1	0
Cooper's hawk	0	0	0	0	1	0	0	0	0	0	0	0
European starling	0	0	0	0	0	0	0	0	0	0	115	0
Great blue heron	0	0	0	0	1	0	0	0	0	0	1	0
Great egret	0	0	0	0	1	0	0	0	0	0	0	0
Great-tailed grackle	0	0	0	0	2	0	0	0	0	0	0	0
House wren	0	0	0	0	0	0	1	0	0	0	0	0
Lazuli bunting	2	0	6	0	0	0	1	0	2	0	0	0
Lincoln's sparrow	0	0	1	0	0	0	0	0	0	0	0	0
Lucy's warbler	0	0	2	0	0	0	0	0	0	0	0	0
Macgillivray's warbler	0	0	1	0	0	0	0	0	0	0	0	0
Mallard	0	0	0	0	3	0	0	0	0	0	0	0
Mourning dove	0	0	0	0	44	0	0	0	0	0	2	0
Myrtle's warbler	1	0	0	0	0	0	0	0	0	0	0	0
Nashville warbler	1	0	4	0	0	0	0	0	0	0	0	0
Northern harrier	0	0	0	0	2	0	0	0	0	0	0	0
Northern rough-winged swallow	0	0	0	0	3	0	0	0	0	0	34	0
Orange-crowned warbler	1	0	10	0	0	0	0	0	5	0	0	0
Pacific-slope flycatcher	1	0	4	0	0	0	0	0	0	0	0	0
Phainopepla	0	0	0	0	1	0	0	0	0	0	0	0
Red-winged blackbird	0	0	0	0	325	0	0	0	0	0	341	0
Ruby-crowned kinglet	0	0	1	0	0	0	0	0	0	0	0	0
Say's phoebe	0	0	0	0	0	0	0	0	1	0	0	0

Table 31.—Species detected, but not confirmed breeding, during intensive area searches at PVER sites in 2013
(Listed in alphabetical order)

Species (n = 48)	PVER intensive surveys, 2013											
	C2301						C2309					
	Males	Females	Unknown sex	Young of the year	Flyovers	Incidentals	Males	Females	Unknown sex	Young of the year	Flyovers	Incidentals
Sharp-shinned hawk	0	0	0	0	1	0	0	0	0	0	0	0
Snowy egret	0	0	0	0	0	0	0	0	0	0	1	0
Spotted towhee	0	0	1	0	0	0	0	0	0	0	0	0
Townsend's warbler	1	0	0	0	0	0	1	0	0	0	0	0
Tree swallow	0	0	0	0	1	0	0	0	0	0	30	0
Turkey vulture	0	0	0	0	1	0	0	0	0	0	4	0
Vaux's swift	0	0	0	0	17	0	0	0	0	0	3	0
Verdin	0	0	1	0	0	0	0	0	0	0	0	0
Warbling vireo	0	0	4	0	0	0	0	0	4	0	0	0
Western kingbird	0	0	0	0	4	0	0	0	0	0	2	0
Western tanager	1	0	0	0	2	0	2	0	0	0	0	0
Western wood-pewee	0	0	2	0	0	0	0	0	5	0	0	0
Whimbrel	0	0	0	0	20	0	0	0	0	0	0	0
White-crowned sparrow	0	0	2	0	0	0	0	0	0	0	0	0
White-winged dove	0	0	0	0	82	0	0	0	0	0	27	0
Wilson's warbler	3	2	8	0	0	0	11	0	3	0	0	0
Yellow warbler*	0	1	0	0	0	0	1	0	0	0	0	0
Yellow-headed blackbird	0	0	0	0	3	0	0	0	0	0	0	0
Yellow-rumped warbler	0	0	0	0	0	0	0	0	11	0	0	0
Total	**13**	**3**	**53**	**2**	**560**	**0**	**17**	**0**	**32**	**0**	**716**	**0**

* LCR MSCP covered species.

Overall Population Size Estimates

Systemwide Population Size Estimates Using Combined Detectabilities

Using program DS for analyzing data from systemwide random plots, we obtained an overall detection ratio of 1.08 (SE = 0.14, CV = 0.13) for territorial

riparian land bird species from the 2013 data. With this detection ratio, the 2013 systemwide minimum population size estimates for LCR MSCP covered species resulted in 1,180 Arizona Bell's vireo and 1,534 Sonoran yellow warbler territories, more than 400 Gila woodpecker territories, almost 200 summer tanager territories, almost 50 vermilion flycatcher territories, and just under 20 gilded flicker territories (table 32). The low precision of population estimates, as reflected by large SE relative to population size, was due to highly skewed distributions characteristic of species with very low densities (i.e., most plots with zero counts and a varying range of non-zero values). As in previous years, we detected only a few gilded flickers and vermilion flycatchers in 2013; therefore, the population estimates for these two species are almost certainly inflated and more likely represent the availability of the tall woody and low woody habitat types that were also present at the detection sites. Tall woody habitat is available elsewhere in the project area, but we have not detected gilded flickers in most of these sites over the past several years.

Descriptive comparisons of population size within or among habitats and years in this report do not reflect a formal assessment of statistical significance. Confidence intervals (CI) may be used to identify some statistical differences. For example, population estimates for which 95% CI (1.96*SE) do not overlap are different at the 0.05 level. However, estimates can still be statistically different even if intervals overlap to some degree.

As in previous years, we found that the Sonoran yellow warbler had the highest estimated population size systemwide of all covered species, and it occurred in 6 of the 22 habitat-region combinations surveyed. We recorded yellow warbler as the second most abundant and widespread of the covered species, occurring in five habitat-region combinations. Vermilion flycatcher and gilded flicker had the lowest population size estimates and also occurred in the lowest number of habitat-region combinations (one), and the remaining covered species were moderately rare, with summer tanager in four and Gila woodpecker in nine habitat-region combinations. As in previous years, our surveys showed that Region 7 (Bill Williams River National Wildlife Refuge, table 32) had the largest abundance of covered species compared with other regions of the project area.

For the 10 most abundant territorial species detected systemwide in 2013, we estimated population sizes using the same methods as for covered species. Based on our data, the most abundant species were common yellowthroat and song sparrow, with more than 11,000 territories estimated for each, followed by black-tailed gnatcatcher, verdin, and Abert's towhee, with over 5,000 territories each (tables 33a and 33b). Red-winged blackbird, white-winged and mourning doves, European starling, Gambel's quail, and brown-headed cowbird may have been

Table 32.—Estimated number of territories of covered species (and 95% confidence intervals [CI]), by region-habitat combinations, based on systemwide surveys completed in 2013

(For details on strata definitions, see the "Methods" section. 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 2013.)

		Arizona Bell's vireo		Sonoran yellow warbler		Gila woodpecker		Summer tanager		Vermilion flycatcher		Gilded flicker	
Region	**Habitat**	**Pop. size**	**95% CI**	**Pop. size**	**95% CI**	**Pop. size**	**95% CI**	**Pop. size**	**95% CI**	**Pop. size**	**95% CI**	**Pop. size**	**95% CI**
4+5	Tall woody	65	10	153	53	0	0	0	0	0	0	0	0
6	Tall woody	2	1	20	9	5	4	6	3	0	0	0	0
7	Tall woody	66	11	532	146	36	10	44	12	0	0	0	0
8	Tall woody	–	–	–	–	–	–	–	–	–	–	–	–
10	Tall woody	0	0	0	0	3	1	0	0	0	0	0	0
11	Tall woody	0	0	0	0	2	0	6	1	0	0	0	0
12	Tall woody	5	1	0	0	15	4	0	0	0	0	0	0
All	**Tall woody**	**112**	**52**	**587**	**312**	**57**	**30**	**54**	**30**	**0**	**0**	**0**	**0**

Table 32.—Estimated number of territories of covered species (and 95% confidence intervals [CI]), by region-habitat combinations, based on systemwide surveys completed in 2013

(For details on strata definitions, see the "Methods" section. 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 2013.)

		Arizona Bell's vireo		Sonoran yellow warbler		Gila woodpecker		Summer tanager		Vermilion flycatcher		Gilded flicker	
Region	**Habitat**	**Pop. size**	**95% CI**	**Pop. size**	**95% CI**	**Pop. size**	**95% CI**	**Pop. size**	**95% CI**	**Pop. size**	**95% CI**	**Pop. size**	**95% CI**
4+5	Low woody	0	0	0	0	53	17	0	0	0		0	0
6	Low woody	0	0	64	34	0	0	0	0	0	0	0	0
7	Low woody	1,102	174	856	287	82	24	141	43	47	20	12	5
8	Low woody	0	0	0	0	0	0	0	0	0	0	0	0
10	Low woody	0	0	0	0	0	0	0	0	0	0	0	0
11	Low woody	0	0	0	0	79	58	0	0	0	0	0	0
12	Low woody	0	0	0	0	0	0	0	0	0	0	0	0
All	**Low woody**	**1,073**	**553**	**906**	**1,064**	**200**	**188**	**137**	**139**	**46**	**90**	**11**	**23**

Table 32.—Estimated number of territories of covered species (and 95% confidence intervals [CI]), by region-habitat combinations, based on systemwide surveys completed in 2013

(For details on strata definitions, see the "Methods" section. 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 2013.)

		Arizona Bell's vireo		Sonoran yellow warbler		Gila woodpecker		Summer tanager		Vermilion flycatcher		Gilded flicker	
Region	**Habitat**	**Pop. size**	**95% CI**	**Pop. size**	**95% CI**	**Pop. size**	**95% CI**	**Pop. size**	**95% CI**	**Pop. size**	**95% CI**	**Pop. size**	**95% CI**
4+5	Herbaceous	–	–	–	–	–	–	–	–	–	–	–	–
6	Herbaceous	9	6	0	0	4	3	0	0	0	0	0	0
7	Herbaceous	–	–	–	–	–	–	–	–	–	–	–	–
8	Herbaceous	–	–	–	–	–	–	–	–	–	–	–	–
10	Herbaceous	–	–	–	–	–	–	–	–	–	–	–	–
11	Herbaceous	0	0	0	0	0	0	0	0	0	0	0	0
12	Herbaceous	0	0	0	0	6	2	0	0	0	0	0	0
All	**Herbaceous**	**10**	**18**	**0**	**0**	**11**	**9**	**0**	**0**	**0**	**0**	**0**	**0**

Table 32.—Estimated number of territories of covered species (and 95% confidence intervals [CI]), by region-habitat combinations, based on systemwide surveys completed in 2013

(For details on strata definitions, see the "Methods" section. 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 2013.)

		Arizona Bell's vireo		Sonoran yellow warbler		Gila woodpecker		Summer tanager		Vermilion flycatcher		Gilded flicker	
Region	**Habitat**	**Pop. size**	**95% CI**	**Pop. size**	**95% CI**	**Pop. size**	**95% CI**	**Pop. size**	**95% CI**	**Pop. size**	**95% CI**	**Pop. size**	**95% CI**
4+5	Unsuitable	0	0	0	0	0	0	0	0	0	0	0	0
6	Unsuitable	–	–	–	–	–	–	–	–	–	–	–	–
7	Unsuitable	0	0	0	0	0	0	0	0	0	0	0	0
8	Unsuitable	0	0	0	0	195	199	0	0	0	0	0	0
10	Unsuitable	0	0	0	0	0	0	0	0	0	0	0	0
11	Unsuitable	–	–	–	–	–	–	–	–	–	–	–	–
12	Unsuitable	0	0	0	0	0	0	0	0	0	0	0	0
All	**Unsuitable**	**0**	**0**	**0**	**0**	**144**	**286**	**0**	**0**	**0**	**0**	**0**	**0**
	Total	**1,180**	**1,071**	**1,534**	**1,129**	**417**	**357**	**194**	**144**	**45**	**88**	**11**	**22**

Table 33a.—Estimated number of breeding pairs (and 95% confidence intervals [CI]) of a first set of five of the most abundant species breeding along the lower Colorado River, by region-habitat combination, based on systemwide surveys completed in 2013

(For details on strata definitions, see the "Methods" section. 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 2013.)

		Common yellowthroat		Song sparrow		Black–tailed gnatcatcher		Verdin		Abert's towhee	
Region	**Habitat**	**Pop. size**	**95% CI**	**Pop. size**	**95% CI**	**Pop. size**	**95% CI**	**Pop. size**	**95% CI**	**Pop. size**	**95% CI**
4+5	Tall woody	54	25	97	29	30	11	22	8	33	10
6	Tall woody	41	21	32	24	25	10	31	9	33	9
7	Tall woody	672	180	2,047	555	39	12	66	20	98	27
8	Tall woody	–	–	–	–	–	–	–	–	–	–
10	Tall woody	36	10	44	11	3	1	15	4	11	3
11	Tall woody	22	6	17	4	0	0	0	0	2	0
12	Tall woody	141	38	111	31	58	16	164	44	93	25
All	**Tall woody**	868	326	2,021	1,004	143	68	279	121	252	82

Table 33a.—Estimated number of breeding pairs (and 95% confidence intervals [CI]) of a first set of five of the most abundant species breeding along the lower Colorado River, by region-habitat combination, based on systemwide surveys completed in 2013

(For details on strata definitions, see the "Methods" section. 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 2013.)

		Common yellowthroat		Song sparrow		Black–tailed gnatcatcher		Verdin		Abert's towhee	
Region	**Habitat**	**Pop. size**	**95% CI**	**Pop. size**	**95% CI**	**Pop. size**	**95% CI**	**Pop. size**	**95% CI**	**Pop. size**	**95% CI**
4+5	Low woody	266	83	493	143	1,198	319	692	190	732	193
6	Low woody	1,256	432	1,335	675	604	294	429	241	366	119
7	Low woody	1,196	330	3237	872	375	107	539	155	375	107
8	Low woody	0	0	0	0	609	160	243	64	1156	304
10	Low woody	821	273	548	176	612	185	306	95	676	185
11	Low woody	4,260	2,320	2,090	1,028	582	210	979	316	688	184
12	Low woody	861	227	459	121	172	45	689	181	230	60
All	**Low woody**	8,208	5,392	7,976	4,218	4,107	1,873	3,848	1,668	4,091	1,253

Table 33a.—Estimated number of breeding pairs (and 95% confidence intervals [CI]) of a first set of five of the most abundant species breeding along the lower Colorado River, by region-habitat combination, based on systemwide surveys completed in 2013

(For details on strata definitions, see the "Methods" section. 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 2013.)

		Common yellowthroat		Song sparrow		Black–tailed gnatcatcher		Verdin		Abert's towhee	
Region	**Habitat**	**Pop. size**	**95% CI**	**Pop. size**	**95% CI**	**Pop. size**	**95% CI**	**Pop. size**	**95% CI**	**Pop. size**	**95% CI**
4+5	Herbaceous	–	–	–	–	–	–	–	–	–	–
6	Herbaceous	522	149	138	55	69	39	86	30	43	12
7	Herbaceous	–	–	–	–	–	–	–	–	–	–
8	Herbaceous	–	–	–	–	–	–	–	–	–	–
10	Herbaceous	–	–	–	–	–	–	–	–	–	–
11	Herbaceous	202	53	50	13	63	17	63	17	38	10
12	Herbaceous	173	67	29	16	23	10	57	19	29	10
All	**Herbaceous**	931	344	227	149	154	124	207	89	110	39

Table 33a.—Estimated number of breeding pairs (and 95% confidence intervals [CI]) of a first set of five of the most abundant species breeding along the lower Colorado River, by region-habitat combination, based on systemwide surveys completed in 2013

(For details on strata definitions, see the "Methods" section. 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 2013.)

		Common yellowthroat		Song sparrow		Black–tailed gnatcatcher		Verdin		Abert's towhee	
Region	**Habitat**	**Pop. size**	**95% CI**	**Pop. size**	**95% CI**	**Pop. size**	**95% CI**	**Pop. size**	**95% CI**	**Pop. size**	**95% CI**
4+5	Unsuitable	806	274	681	225	945	260	598	164	528	143
6	Unsuitable	–	–	–	–	–	–	–	–	–	–
7	Unsuitable	0	0	0	0	166	44	0	0	250	66
8	Unsuitable	0	0	0	0	0	0	65	66	0	0
10	Unsuitable	0	0	0	0	495	317	297	272	371	205
11	Unsuitable	–	–	–	–	–	–	–	–	–	–
12	Unsuitable	371	98	186	49	0	0	417	110	0	0
All	**Unsuitable**	1,519	1,364	1,098	1,053	1,765	990	1661	764	1216	568
	Total	11,497	5,802	11,374	4,851	6,123	2,360	5,970	2,129	5,620	1,669

Table 33b.—Estimated number of breeding pairs (and 95% confidence intervals [CI]) of a second set of five of the most abundant species breeding along the LCR, by region-habitat combination, based on systemwide surveys completed in 2013

(For details on strata definitions, see the "Methods" section. 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 2013.)

		Marsh wren		Lucy's warbler		Yellow–breasted chat		Bewick's wren		Lesser nighthawk	
Region	**Habitat**	**Pop. size**	**95% CI**	**Pop. size**	**95% CI**	**Pop. size**	**95% CI**	**Pop. size**	**95% CI**	**Pop. size**	**95% CI**
4+5	Tall woody	0	0	59	17	54	15	0	0	0	0
6	Tall woody	0	0	37	13	47	20	12	9	0	0
7	Tall woody	0	0	181	50	1212	322	420	113	0	0
8	Tall woody	–	–	–	–	–	–	–	–	–	–
10	Tall woody	0	0	0	0	15	4	0	0	0	0
11	Tall woody	7	2	6	1	4	1	0	0	0	0
12	Tall woody	0	0	5	2	47	14	0	0	22	6
All	**Tall woody**	**12**	**3**	**258**	**117**	**1191**	**446**	**370**	**174**	**20**	**17**

Table 33b.—Estimated number of breeding pairs (and 95% confidence intervals [CI]) of a second set of five of the most abundant species breeding along the LCR, by region-habitat combination, based on systemwide surveys completed in 2013

(For details on strata definitions, see the "Methods" section. 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 2013.)

		Marsh wren		Lucy's warbler		Yellow–breasted chat		Bewick's wren		Lesser nighthawk	
Region	**Habitat**	**Pop. size**	**95% CI**	**Pop. size**	**95% CI**	**Pop. size**	**95% CI**	**Pop. size**	**95% CI**	**Pop. size**	**95% CI**
4+5	Low woody	0	0	2,556	676	53	17	0	0	80	23
6	Low woody	0	0	986	306	1,160	431	381	181	159	92
7	Low woody	0	0	1,525	411	2,076	589	1,372	390	0	0
8	Low woody	0	0	0	0	0	0	0	0	243	64
10	Low woody	3,672	1,265	209	64	161	55	0	0	322	97
11	Low woody	873	640	106	78	953	442	0	0	344	227
12	Low woody	0	0	0	0	0	0	0	0	402	106
All	**Low woody**	**4,269**	**7,220**	**5,483**	**1,910**	**4,350**	**2,403**	**1,772**	**1,177**	**1,550**	**866**

Table 33b.—Estimated number of breeding pairs (and 95% confidence intervals [CI]) of a second set of five of the most abundant species breeding along the LCR, by region-habitat combination, based on systemwide surveys completed in 2013

(For details on strata definitions, see the "Methods" section. 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 2013.)

		Marsh wren		Lucy's warbler		Yellow–breasted chat		Bewick's wren		Lesser nighthawk	
Region	**Habitat**	**Pop. size**	**95% CI**	**Pop. size**	**95% CI**	**Pop. size**	**95% CI**	**Pop. size**	**95% CI**	**Pop. size**	**95% CI**
4+5	Herbaceous	–	–	–	–	–	–	–	–	–	–
6	Herbaceous	164	75	91	29	86	25	9	6	0	0
7	Herbaceous	–	–	–	–	–	–	–	–	–	–
8	Herbaceous	–	–	–	–	–	–	–	–	–	–
10	Herbaceous	–	–	–	–	–	–	–	–	–	–
11	Herbaceous	252	66	0	0	164	43	0	0	25	7
12	Herbaceous	216	118	0	0	2	1	0	0	14	4
All	**Herbaceous**	**612**	**374**	**102**	**61**	**237**	**73**	**10**	**18**	**35**	**11**

Table 33b.—Estimated number of breeding pairs (and 95% confidence intervals [CI]) of a second set of five of the most abundant species breeding along the LCR, by region-habitat combination, based on systemwide surveys completed in 2013

(For details on strata definitions, see the "Methods" section. 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 2013.)

		Marsh wren		Lucy's warbler		Yellow–breasted chat		Bewick's wren		Lesser nighthawk	
Region	**Habitat**	**Pop. size**	**95% CI**	**Pop. size**	**95% CI**	**Pop. size**	**95% CI**	**Pop. size**	**95% CI**	**Pop. size**	**95% CI**
4+5	Unsuitable	56	23	111	34	0	0	0	0	28	11
6	Unsuitable	–	–	–	–	–	–	–	–	–	–
7	Unsuitable	0	0	0	0	0	0	0	0	0	0
8	Unsuitable	0	0	0	0	0	0	0	0	0	0
10	Unsuitable	0	0	0	0	0	0	0	0	0	0
11	Unsuitable	–	–	–	–	–	–	–	–	–	–
12	Unsuitable	464	122	0	0	0	0	0	0	46	12
All	**Unsuitable**	**741**	**226**	**135**	**127**	**0**	**0**	**0**	**0**	**101**	**70**
	Total	**5,578**	**7,098**	**5,875**	**1,979**	**5,812**	**2,587**	**2,147**	**1,203**	**1,673**	**860**

even more numerous, but as in previous reports, we excluded them from analysis due to their relative lack of territoriality or clustered distribution. Survey numbers listed in attachment 7 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 2013, we used program DS to calculate individual detection ratios by species to be able to compare these to the combined detection rate (table 34). Approximately 40% of the species examined had detection rates below 1.0, indicating that the rapid surveyor underestimated the number of territories compared to the intensive surveyor. Approximately 60% 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. Abert's towhee, Bewick's wren, verdin, and yellow-breasted chat all had similar species-specific detection ratios as were found in the triple-sampling study (see component 3), while Sonoran yellow warbler, black-tailed gnatcatcher, black-chinned hummingbird, summer tanager, and Gila woodpecker had different species-specific detection ratios than was reported in the triple-sampling study (table 34, and component 3). Because the sample size from a single year (compared to difficult plots for 3 years in component 3) is tenuous for many of the uncommon species, species-specific detection ratios may best be determined using data from multiple years in the future.

Table 34.—Detection ratio (DR) by species of LCR MSCP covered species and the 10 most common breeding species in component 1 systemwide surveys, 2013

(Rapid plots had a sample size of 80, whereas intensive plots had a sample size of 8. Vermilion flycatcher was the only LCR MSCP covered species not detected on systemwide surveys in 2013. Arizona Bell's vireos were not detected to be breeding on the 2013 intensive plots, so the detection ratio for this species is "undefined.")

Species (n = 16)	Number of pairs (rapid surveys)	Rapid density (pairs/ ha)	SE for rapid density	CV for rapid density	Number of pairs (intensive surveys)	DR	SE for DR	CV for DR
Gilded flicker*	0.25	0.00	0.00	1.00	0	**NA**	NA	NA
Arizona Bell's vireo*	53.5	0.03	0.01	0.44	0	**NA**	NA	NA
Sonoran yellow warbler*	144.25	0.03	0.01	0.35	42.75	**0.51**	0.02	0.04

Table 34.—Detection ratio (DR) by species of LCR MSCP covered species and the 10 most common breeding species in component 1 systemwide surveys, 2013

(Rapid plots had a sample size of 80, whereas intensive plots had a sample size of 8. Vermilion flycatcher was the only LCR MSCP covered species not detected on systemwide surveys in 2013. Arizona Bell's vireos were not detected to be breeding on the 2013 intensive plots, so the detection ratio for this species is "undefined.")

Species (n = 16)	Number of pairs (rapid surveys)	Rapid density (pairs/ ha)	SE for rapid density	CV for rapid density	Number of pairs (intensive surveys)	DR	SE for DR	CV for DR
Black-tailed gnatcatcher	123.5	0.13	0.02	0.14	24	**0.61**	0.33	0.54
Lucy's warbler	161	0.13	0.01	0.11	22.75	**0.62**	0.35	0.58
Abert's towhee	126.25	0.12	0.01	0.07	22.5	**0.81**	0.16	0.20
Bewick's wren	100.25	0.05	0.01	0.25	13.75	**0.89**	0.26	0.29
Black-chinned hummingbird	32.5	0.02	0.01	0.22	7.25	**0.97**	0.23	0.24
Verdin	145.75	0.13	0.02	0.12	17.75	**1.06**	0.23	0.22
Yellow-breasted chat	301.75	0.13	0.02	0.18	44.5	**1.12**	0.07	0.06
Common yellowthroat	358	0.25	0.06	0.22	44.25	**1.29**	0.25	0.20
Song sparrow	533.5	0.25	0.04	0.17	90.5	**1.33**	0.26	0.19
Marsh wren	119.25	0.12	0.08	0.64	36.75	**1.55**	0.00	0.00
Summer tanager*	11.75	0.00	0.00	0.35	0.75	**1.67**	1.05	0.63
Gila woodpecker*	16	0.01	0.00	0.41	1.75	**1.86**	1.14	0.62
Lesser nighthawk	23	0.04	0.01	0.23	2	**2.25**	1.33	0.59

* LCR MSCP covered species.

Habitat Creation Site Population Size Estimates

Based on DS analyses of data from habitat creation site plots in 2013, we determined an overall detection ratio of 1.5 (SE = 0.56, CV = 0.37) for territorial riparian species. Of the four covered species detected in habitat creation sites, Sonoran yellow warbler was the most abundant with an estimated total of 15 territories, followed closely by Arizona Bell's vireo with 12 territories (table 35). Nine of the 10 most abundant territorial breeders were the same as in 2012, and only yellow-breasted chat replaced Anna's hummingbird on this list in 2013 (tabled 36a and 36b). Several of these species' population size estimates,

Table 35.—Estimated number of breeding pairs (and 95% confidence intervals [CI]) of covered species breeding in habitat creation sites along the LCR, by site, based on double-sampling surveys completed in 2013
(For details on habitat strata definitions, see the "Methods" section.)

		Sonoran yellow warbler		Arizona Bell's vireo		Summer tanager		Vermilion flycatcher	
Region	**Habitat**	**Pop. size**	**95% CI**	**Pop. size**	**95% CI**	**Pop. size**	**95% CI**	**Pop. size**	**95% CI**
'Ahakhav Tribal Preserve	Tall woody	1	0	0	0	2	1	0	0
Beal Lake Habitat Conservation Area	Tall woody	13	10	12	8	1	1	0	0
Cibola National Wildlife Refuge Farm Unit 1	Tall woody	0	0	1	0	0	0	0	0
Cibola Valley Conservation Area	Tall woody	0	0	0	0	0	0	0	0
Palo Verde Ecological Reserve	Tall woody	1	1	0	0	1	0	0	0
All HCAs	**Tall woody**	**15**	**11**	**12**	**9**	**4**	**3**	**0**	**0**

Table 35.—Estimated number of breeding pairs (and 95% confidence intervals [CI]) of covered species breeding in habitat creation sites along the LCR, by site, based on double-sampling surveys completed in 2013
(For details on habitat strata definitions, see the "Methods" section.)

		Sonoran yellow warbler		Arizona Bell's vireo		Summer tanager		Vermilion flycatcher	
Region	**Habitat**	**Pop. size**	**95% CI**	**Pop. size**	**95% CI**	**Pop. size**	**95% CI**	**Pop. size**	**95% CI**
'Ahakhav Tribal Preserve	Low woody	0	0	0	0	0	0	1	1
Beal Lake Habitat Conservation Area	Low woody		0		0		0		0
Cibola National Wildlife Refuge Farm Unit 1	Low woody	0	0	0	0	0	0	0	0
Cibola Valley Conservation Area	Low woody	0	0	0	0	0	0	0	0
Palo Verde Ecological Reserve	Low woody	0	0	0	0	0	0	0	0
All HCAs	**Low woody**	**0**	**0**	**0**	**0**	**0**	**0**	**1**	**1**
	Total	**15**	**11**	**12**	**9**	**4**	**3**	**1**	**1**

Table 36a.—Estimated number of breeding pairs (and 95% confidence intervals [CI]) of the first set of five most common riparian species breeding in habitat creation sites along the LCR, by habitat type, based on double-sampling surveys completed in 2013
(For details on habitat strata definitions, see the "Methods" section. Dashes means stratums not surveyed.)

		Common yellowthroat		Abert's towhee		Blue grosbeak		Song sparrow		Western kingbird	
Region	**Habitat**	**Pop. size**	**95% CI**	**Pop. size**	**95% CI**	**Pop. size**	**95% CI**	**Pop. size**	**95% CI**	**Pop. size**	**95% CI**
'Ahakhav Tribal Preserve	Tall woody	0	0	7	5	0	0	0	0	2	2
Beal Lake Habitat Conservation Area	Tall woody	3	2	8	6	3	2	0	0	0	0
Cibola National Wildlife Refuge Farm Unit 1	Tall woody	2	1	16	12	7	5	1	0	11	8
Cibola Valley Conservation Area	Tall woody	0	0	12	8	5	3	0	0	9	6
Palo Verde Ecological Reserve	Tall woody	16	12	11	8	15	11	14	10	5	3
All HCAs	**Tall woody**	**21**	**16**	**54**	**40**	**29**	**21**	**15**	**11**	**27**	**20**

Table 36a.—Estimated number of breeding pairs (and 95% confidence intervals [CI]) of the first set of five most common riparian species breeding in habitat creation sites along the LCR, by habitat type, based on double-sampling surveys completed in 2013
(For details on habitat strata definitions, see the "Methods" section. Dashes means stratums not surveyed.)

		Common yellowthroat		Abert's towhee		Blue grosbeak		Song sparrow		Western kingbird	
Region	**Habitat**	**Pop. size**	**95% CI**	**Pop. size**	**95% CI**	**Pop. size**	**95% CI**	**Pop. size**	**95% CI**	**Pop. size**	**95% CI**
'Ahakhav Tribal Preserve	Low woody	0	0	1	1	0	0	0	0	1	1
Beal Lake Habitat Conservation Area	Low woody		0		0		0		0		0
Cibola National Wildlife Refuge Farm Unit 1	Low woody	1	1	7	5	3	2	18	13	1	0
Cibola Valley Conservation Area	Low woody	0	0	13	10	3	2	0	0	1	1
Palo Verde Ecological Reserve	Low woody	68	50	2	2	10	8	8	6	1	1
All HCAs	**Low woody**	**69**	**51**	**24**	**18**	**17**	**12**	**26**	**19**	**4**	**3**
	Total	**90**	**67**	**78**	**57**	**46**	**34**	**40**	**30**	**31**	**23**

Table 36b.—Estimated number of breeding pairs (and 95% confidence intervals [CI]) of the second set of five most common riparian species breeding in habitat creation sites along the LCR, by habitat type, based on double–sampling surveys completed in 2013
(For details on habitat strata definitions, see the "Methods" section. Dashes means stratums not surveyed.)

		Black-tailed gnatcatcher		Verdin		Yellow-breasted chat		Bullock's oriole		Black-chinned hummingbird	
Region	**Habitat**	**Pop. size**	**95% CI**	**Pop. size**	**95% CI**	**Pop. size**	**95% CI**	**Pop. size**	**95% CI**	**Pop. size**	**95% CI**
'Ahakhav Tribal Preserve	Tall woody	1	1	3	2	0	0	2	1	0	0
Beal Lake Habitat Conservation Area	Tall woody	12	9	8	6	17	13	4	3	2	1
Cibola National Wildlife Refuge Farm Unit 1	Tall woody	2	1	6	4	1	1	5	4	3	2
Cibola Valley Conservation Area	Tall woody	0	0	1	1	0	0	9	6	2	2
Palo Verde Ecological Reserve	Tall woody	0	0	0	0	1	1	4	3	8	6
All HCAs	**Tall woody**	**15**	**11**	**17**	**13**	**20**	**15**	**23**	**17**	**15**	**11**
'Ahakhav Tribal Preserve	Low woody	1	0	2	1	0	0	0	0	0	0
Beal Lake Habitat Conservation Area	Low woody		0		0		0		0		0
Cibola National Wildlife Refuge Farm Unit 1	Low woody	0	0	1	1	7	5	1	1	1	0
Cibola Valley Conservation Area	Low woody	13	9	8	6	0	0	0	0	0	0
Palo Verde Ecological Reserve	Low woody	0	0	0	0	0	0	1	1	1	1
All HCAs	**Low woody**	**13**	**10**	**11**	**8**	**7**	**5**	**3**	**2**	**2**	**1**
	Total	**29**	**21**	**28**	**21**	**26**	**19**	**26**	**19**	**17**	**12**

Table 37.—Estimated number of breeding pairs of the most common riparian species breeding in habitat creation sites along the LCR, by habitat type, based on double–sampling surveys completed in 2013
(For details on habitat strata definitions, see the "Methods" section. Dashes means stratums not surveyed.)

		2012								2013							
Region	**Habitat**	**Common yellowthroat**	**Abert's towhee**	**Blue grosbeak**	**Song sparrow**	**Western kingbird**	**Black–tailed gnatcatcher**	**Verdin**	**Bullock's oriole**	**Common yellowthroat**	**Abert's towhee**	**Blue grosbeak**	**Song sparrow**	**Western kingbird**	**Black–tailed gnatcatcher**	**Verdin**	**Bullock's oriole**
'Ahakhav Tribal Preserve	Low woody	0	2	0	0	0	1	2	1	0	1	0	0	1	1	2	0
'Ahakhav Tribal Preserve	Tall woody	0	8	0	0	2	1	5	5	0	7	0	0	2	1	3	2
'Ahakhav Tribal Preserve	All habitats	0	10	0	0	2	2	7	6	0	8	0	0	3	2	5	2
Beal Lake Habitat Conservation Area	Low woody	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Beal Lake Habitat Conservation Area	Tall woody	7	9	0	0	0	7	3	1	3	8	3	0	0	12	8	4
Beal Lake Habitat Conservation Area	All habitats	7	9	0	0	0	7	3	1	3	8	3	0	0	12	8	4
Cibola National Wildlife Refuge Farm Unit 1	Low woody	0	6	12	2	2	0	1	0	1	7	3	18	1	0	1	1
Cibola National Wildlife Refuge Farm Unit 1	Tall woody	14	43	16	16	25	6	15	17	2	16	7	1	11	2	6	5
Cibola National Wildlife Refuge Farm Unit 1	All habitats	14	49	28	18	27	6	16	17	3	23	10	19	12	2	7	6

Table 37.—Estimated number of breeding pairs of the most common riparian species breeding in habitat creation sites along the LCR, by habitat type, based on double–sampling surveys completed in 2013
(For details on habitat strata definitions, see the "Methods" section. Dashes means stratums not surveyed.)

		2012								2013							
Region	**Habitat**	**Common yellowthroat**	**Abert's towhee**	**Blue grosbeak**	**Song sparrow**	**Western kingbird**	**Black–tailed gnatcatcher**	**Verdin**	**Bullock's oriole**	**Common yellowthroat**	**Abert's towhee**	**Blue grosbeak**	**Song sparrow**	**Western kingbird**	**Black–tailed gnatcatcher**	**Verdin**	**Bullock's oriole**
CVCA	Low woody	7	37	17	0	2	15	8	2	0	13	3	0	1	13	8	0
CVCA	Tall woody	2	42	20	5	28	3	4	14	0	12	5	0	9	0	1	9
CVCA	All habitats	9	79	37	5	30	18	12	16	0	25	8	0	10	13	9	9
PVER	Low woody	31	8	13	5	4	3	0	2	68	2	10	8	1	0	0	1
PVER	Tall woody	47	32	59	45	30	1	1	14	16	11	15	14	5	0	0	4
PVER	All habitats	78	40	72	50	34	4	1	16	84	13	25	22	6	0	0	5
	Total	**108**	**187**	**137**	**73**	**93**	**37**	**39**	**56**	**90**		**46**		**31**	**29**	**28**	**26**

including Abert's towhee and blue grosbeak, were substantially lower in 2013 compared with 2012. However, these differences are probably not statistically significant given that confidence interval half-widths are typically close to 100% of the territory estimates. In addition, this monitoring was designed for detecting trends over many years, and the differences over 2 years will usually not be statistically significant due to the large spatial variability (i.e., sampling a lot of area that is not very good habitat) within our study area.

DISCUSSION

Systemwide Surveys

Our population size estimates for the LCR MSCP covered species Sonoran yellow warbler and Gila woodpecker were overall higher in 2012 than in 2013, which may be due to the random plot selection representing a different proportion of their total population or environmental factors such as annual variation in migration arrival times, reproductive schedule, population variation, or fluctuating water levels. Summer tanager population size estimates were nearly the same in 2011, 2012, and 2013, while Arizona Bell's vireo estimates were slightly higher in 2013 than in 2012. Gilded flicker and vermilion flycatcher continued to be represented by low sample sizes in the systemwide surveys, so their annual population size estimates continue to be tenuous.

A very rare species, the Nutting's flycatcher, was also found nesting during our 2013 surveys. After reports of this species at the Bill Williams River NWR in the past winter, our surveyors detected at least two individuals in early April, one at Mosquito Flats and one at the North Burn site more than 3 kilometers from the other site. In late April, a fledgling Nutting's flycatcher was also recorded, along with two adults singing nearby, at Mosquito Flats. To the best of our knowledge, this was the first breeding record for Nutting's flycatcher in the United States (Lauren Harter and David Vander Pluym 2013, personal communication).

Our systemwide 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 insufficient 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 may be useful in the long term, particularly in light of the expected colonization of the tamarisk beetle of the Lower Colorado River Valley and other environmental changes in the region.

Habitat Creation Sites

The year 2013 was the third year of implementing the double-sampling protocol at habitat creation sites of the LCR MSCP. Due to the large amount of habitat created by spring of 2012, survey coverage was switched from complete coverage of habitat creation sites to a sampling approach that included rapid and intensive area searches, mirroring the double-sampling approach used for systemwide surveys. With 79 plots surveyed in 2013, this was also the last year that all habitat creation plots will be covered by rapid surveys. Beginning in 2014, a stratified random sampling approach will be needed to select 80 plots within the habitat creation areas due to the continuing creation of habitat.

Similar to our findings for 2008–12 (GBBO 2010, 2011, 2012), the habitat creation sites older than 2 years since the plantings occurred supported breeding populations of four of the six covered species: Bell's vireo, yellow warbler, vermilion flycatcher, and summer tanager. Gila woodpecker and gilded flicker were not detected in habitat creation sites most likely because the sites are still too young to produce (1) sufficient numbers of trees that are large enough for woodpecker cavities and (2) enough decadent (older trees nearing the end of their life) trees with snags. We believe that continued monitoring of the habitat creation sites will be particularly useful for determining whether or not populations of riparian bird species associated with old-growth forests can be restored, specifically given how uncommon tall woody vegetation is in the current landscape of the LCR.

Species composition at habitat creation sites has both constant and changing elements. The species assemblage and number of territories recorded at CRIT have been consistent over the past 3 years. Common breeding species at PVER, such as song sparrow, Abert's towhee, and blue grosbeak, were consistent by planting phase and across planting phases in 2012 and 2013. Common yellowthroat numbers were consistent with numbers from previous surveys in the older plantings of PVER, and they also had high numbers of breeders in the newer planting phases (PVER 6 and 7). This suggests that a young-tree component is equally suitable habitat for this species in this area as is more mature riparian habitat.

At CVCA, we documented some noticeable changes in several species and planting phases in 2013. Phases 1 and 2 had far fewer Abert's towhees and blue grosbeaks in 2013 than in 2012. We lacked evidence for yellow warblers and summer tanagers as breeders at CVCA 1 when, in the past, they were breeding at this site (2012, 2011, and 2010). This could be potentially a result of changes in irrigation practices during the breeding season if these were different in 2013 than in previous years. We recommend that the past irrigation schedule at this site be reviewed by Reclamation because, if this hypothesis stands, it would be invaluable information for future management of habitat creation sites in general.

However, other hypotheses could also explain these results, such as late arrival of migrants, natural local population fluctuations, or unknown environmental factors at this location. Conversations with field crew members who conducted field work on later projects (yellow-billed cuckoo and southwestern willow flycatcher projects) at this site revealed that summer tanagers continued to be observed more frequently at CVCA than other habitat creation sites after the end of our survey season.

In 2013, the Nature Trail North site also had no breeding Bell's vireos or yellow warblers in contrast to past years but had similar numbers of other common breeders compared with 2012. The Nature Trail South site showed a decrease in some common breeders compared to previous years, including Abert's towhee and blue grosbeak, and the reasons for this decrease are unclear. We also saw a noticeable decrease in Abert's towhee and blue grosbeak territories in other habitat creation sites with varying stages of plant growth. Continued monitoring of these sites will reveal whether this is a trend and whether this trend may be related to vegetation changes (e.g., trees maturing, less brushy undergrowth, and edge habitat) at these habitat creation sites.

In 2013, several old-growth associated species continued to have at least partial territories in the habitat creation plots. Ladder-backed woodpeckers were breeding in four planting phases at PVER (Phases 2, 3, 4 and 5) and two phases at CVCA (Phases 1 and 3) as well as all planting phases at Beal Lake Habitat Conservation Areaand CRIT. At Beal Lake Habitat Conservation Area, we again recorded a partial territory of a brown-crested flycatcher pair in 2013. Lucy's warblers were common breeders at Beal Lake Habitat Conservatioon Area and uncommon breeders at CRIT, while ash-throated flycatchers appear to be slowly moving in as breeders, at least with partial territories, on all habitat creation sites. Breeding evidence for most of the Lucy's warbler pairs at Beal Lake Habitat Conservation Area was a pair on a territory for both rapid survey visits, usually with dependent young on one of the visits. One of the rarer species we found nesting again in habitat creation sites was a tropical kingbird, which was found breeding at CRIT D. This species occupied a similar territory (25% in CRIT D) in 2012 and 2011, and it hatched chicks in 2011.

We also recorded several raptor species at habitat creation sites, including short-eared owl, white-tailed kite, and northern harrier, all of which were associated with the riparian shrub habitat type classified as low woody. Five habitat creation areas also had partial great horned owl breeding territories that were inside the plots in mature habitat in 2013.

Component 3: Testing the Assumptions of the Double-Sampling Method

INTRODUCTION

The double-sampling method developed for LCR MSCP riparian bird surveys (Bart et al. 2010; GBBO 2010) is based on three important assumptions:

- Random selection of intensive area search plots from the random set of rapid area search plots
- Uniformity in the implementation of rapid and intensive area searches
- Unbiased estimates of bird numbers during intensive area searches

There is no reason to doubt that the first two assumptions, random and uniform sampling, are met in the current implementation of the LCR MSCP monitoring plan. The goal of component 3 of this project was therefore to test the third assumption that unbiased estimates of bird numbers are obtained during the intensive surveys. Factors that could bias these estimates, or may differentially affect detection probability during intensive area searches, include (see also Farnsworth et al. 2005):

- Secretive species that are difficult to detect
- Density of vegetation
- Density of birds

In order to quantify if, and how many, birds are missed during standard intensive surveys, we performed a third, even more intensive survey effort on a set of plots. For the purpose of this project, we originally referred to this approach as a "triple-sampling" or "enhanced intensive" method, which was later shortened to "extra-intensive" or EI.

In 2013, our final year of this project component, we selected a set of triple-sampling plots that we surveyed with three different types of area searches within the field season: (1) the standard rapid area search used for systemwide surveys, (2) the standard intensive area search used for systemwide surveys, and (3) an EI area search, which is described in more detail below. In brief, the EI area search allowed us significantly more time to devote to delineating territories and detecting less conspicuous individuals than is possible during the standard intensive area search. For each triple-sampling plot, we conducted these three types of area searches using three independent surveyors, with stringent controls established to ensure that no communication occurred between surveyors

regarding their findings during the field season. After 3 years of data collection, the results of the three types of searches across multiple plots that exhibit variation in vegetation and population density are reported here. Specifically, we provide a quantitative estimate of the biases associated with standard intensive and rapid area search methods and the biases associated with different species.

The 3-year goals for this component of the project included the following:

- Evaluate the assumption that unbiased estimates are being obtained during intensive area searches
- Estimate the average error rate being made during intensive area search surveys and determine if differences in error rates exist between species or habitats
- Suggest improvements, if any are needed, to the intensive area search survey methods to achieve higher accuracy

Using the triple-sampling method, we were also able to gather additional life history data on breeding phenology, territory use, and seasonal behaviors for the four more common covered species: Gila woodpecker, summer tanager, Arizona Bell's vireo, and Sonoran yellow warbler, as well as other riparian obligate bird species. We found that gilded flickers and vermilion flycatchers were present on very few, if any, LCR MSCP plots in any given year, and thus concluded that the data are currently insufficient for these two species for this type of analysis. The additional insights into the natural history of riparian species were used to refine training and survey practices, and they are summarized in this report.

Methods

Plot Selection, 2013

To select our triple-sampling plots, we used a new ArcGIS plot layer created in 2011. This new "EI layer" was based on the knowledge GBBO acquired during surveys and data analyses in previous years (2008–10) regarding the actual distributions, areas of concentration, and habitat requirements of the covered species. The EI layer is comprised of some of the most difficult habitats to survey on the river, featuring mostly tall woody vegetation and dense understory. Because the covered species are usually concentrated in these habitat types, the EI layer by no means represents the landscapes of much of the current LCR corridor but was developed solely for the purpose of testing the assumptions of the double-sampling method.

Prior to EI plot selection, we divided the entire layer for EI plots into two strata that represented a "medium" and "hard" ranking for plot access and logistical difficulty. The layer does not have a stratum for "easy" plots. Plots were assigned to these two strata using aerial photography, habitat type, and our previous knowledge of the study area. To select triple-sampling plots in 2013, we first examined the eight plots already selected for intensive area searches as part of the systemwide monitoring effort in component 1. If up to two of these plots were located in the new EI layer, they were automatically included in the triple-sampling effort. This was done to ensure that some random coverage of the entire LCR MSCP study area is associated with the component 3 effort. Once we assigned two of the systemwide intensive plots to triple sampling, we randomly selected additional plots from the EI layer (adding up to four in the "medium" and four in the "hard" categories for a total of eight additional plots).

Because the selection of triple-sampling plots is not fully random for the systemwide sampling area, we did not use these plots for systemwide population size estimates. We only used them for testing the assumption of the double-sampling effort that unbiased counts can be achieved in standard intensive area searches. Attachments 5 and 6 present summaries of all plots selected for each of the project components, including the triple-sampling effort.

Survey Techniques

In 2013, as in 2011 and 2012, the triple-sampling plots received rapid, standard intensive, and EI area searches, using independent observers for each survey type on a given plot. Each of the surveyors conducted rapid and intensive area searches in systemwide plots as well, and some surveyors conducted all three survey types on different plots to ensure consistency in survey methods. We further ensured that surveyors were alternated among survey types in order to reduce observer bias.

The basic survey methods used for this project component were the same as those used for the double-sampling component. For a given plot, the rapid, intensive, and EI observers were different individuals who were not allowed to communicate their findings throughout the field season. No plot received more than one type of area search effort on a given day (i.e., there was never more than one surveyor on the plot each day). The surveys were scheduled as regularly as possible given the constraints of our field season, with rapid surveys occurring in the first and second month of the season, intensive surveys occurring approximately once a week for 8 weeks (8 visits), and EI surveys occurring approximately twice a week for 8 weeks (16 visits).

For the EI area searches, we delineated every territory within a plot with the highest level of precision possible. On each visit, the surveyor recorded one or

multiple bird locations of all observed individuals. Similar to the standard intensive surveys, an individual/pair was classified as a breeder if it was seen exhibiting some breeding behavior three consecutive weeks or if it was observed in the same territory on at least six consecutive visits. The additional visits allowed the EI surveyor to range outside the plot boundary for better territory delineation, focus on particular individuals or species that have wide-ranging territories (such as Gila woodpecker and summer tanager), map multiple singing perches during the same visit, and make any other adjustments to ensure that all bird territories in the plot area were completely delineated. As with other area searches, we were limited by the amount of time that birds were active on a given day (early mornings until it got very hot). In densely vegetated plots, surveyors were limited to identifying and mapping the birds mostly by sound as is typical for all surveys in these habitat conditions.

Data Analysis

All EI data were entered into an Access database that was created by Reclamation in 2012. The database was edited significantly between 2012 and 2013 to increase efficiency and effectiveness of the data entry and analysis. The data were entered using the same data standards described above in component 1 (see attachment 3 for further details). We processed the data in task-specific triple-sampling Excel data sheets and Access queries created for this project component.

Two plots were sampled in 2 years of the project: S8223 in 2011 and 2012 and S9124 in 2012 and 2013. Since these samples were not independent when combining all years, the values for the repeat surveys of each of the two plots were averaged, and the total number of plots in the summary statistics is 22. The averages between years were computed after all appropriate zeroes were added to the dataset.

Since territory counts from each sampling effort were paired by plot, we focused on using summary statistics to the estimate the bias, or difference between estimates (I-EI). For the purpose of comparing the standard intensive and EI efforts, plots that did not have a territory for a particular species in either type of survey were dropped, leaving 878 observations from the raw total of 3,784 for analysis. We generated summary statistics of territory counts and the difference between counts from each sampling effort for all species that had at least one non-zero territory plot. Summaries are also reported for each survey method by species and habitat type (hard and medium). We had an uneven sample size of medium and hard plots due to 2011 data, so we examined assumptions of normality and equal variance with box plots. The territory data for each sampling effort were right-skewed, but summary statistics were estimated on untransformed data to keep them in the same scale as differences, which were reasonably normal.

To examine the overall performance of intensive sampling compared to EI sampling, summary statistics and a 90% confidence interval for the set of all differences observed across species and plots were computed and reported. The percent difference was also calculated using the summed counts and differences over plots, computed as (I-EI)/EI for each species and for all species together. All analyses were done using R 2.14.2 statistical software (R Development Core Team 2012).

We used program DS to calculate detection ratios for each sampling effort over all three years (including SE and CV) for LCR MSCP covered species, common riparian obligate species, and an all-species average. We examined detection ratios and errors by species (i.e., difference in detection ratio for intensive and EI sampling) and compared them with the overall detection ratios and errors to give us a better idea of whether these errors "average out" for a relatively unbiased detection rates over species.

In addition to examining overall detection ratios, we also examined the change in detected territories through the course of the survey season for all three survey types in greater detail. For this, we graphed time trends of territory estimates for several species-plot combinations over the survey season (for 2 rapid, 8 standard intensive, and 16 EI visits) along with the final number of reported territories.

RESULTS

Double-Sampling Results, 2011–13

Summary Statistics

Comparing the survey types across all species when data were paired by plot, on average, EI sampling produced 11.2 (SD = 19.9, n = 22), or 16.5% additional territories compared to intensive sampling, and the 90% confidence interval for "I-EI" (-18.1, -4.2) shows this difference to be statistically significant. Although the summary statistics were estimated for all species, only those with samples in at least three plots are reported in table 39. For a few species, intensive sampling yielded more territories than EI sampling, but the differences in these instances are quite small (the 90% confidence intervals all contained zero). The only notable exception was the canyon wren, which was observed at six sites and had a 90% confidence interval that did not overlap zero, suggesting that intensive sampling yielded more birds than EI sampling (table 38; figure 1).

Some species showed substantial improvements in territory detection with EI surveys compared to I surveys (table 38; figure 1): at least one additional territory, on average, was discovered in the EI survey for Bewick's wren, California black rail, song sparrow, common yellowthroat, Lucy's warbler, marsh wren, verdin, and yellow-breasted chat, but these tended to be common species, and confidence intervals overlapped zero for the first three species (table 38).

Table 38.—Summary statistics for the estimated number territories for intensive (I) and enhanced intensive (EI) sampling for 2011–13 for species that had more than three non-zero sites sampled

(Summary statistics are also included for all species summed together by plot. Results are reported for both types of sampling alone and for the difference between EI and I sampling within each plot. The percent difference reflects all territories for each plot summed together for each sampling method divided by the total number of territories observed using EI sampling. Twenty-two plots were sampled, and the number of plots (No. Obs.) that included each species is also reported.)

	Intensive				Enhanced Intensive				Difference within plot (I - EI)						Percentage difference summing all territories: (I - EI)/EI	No. Obs.
	Mean	SD	Min	Max	Mean	SD	Min	Max	Mean	SD	Min	Max	90% confidence			
Abert's Towhee	2.86	1.58	0.00	5.75	3.16	1.80	0.00	7.50	-0.30	1.43	-2.50	2.50	-0.80	0.20	-9.53	22
American Coot	1.50	1.08	0.50	3.00	1.31	1.84	0.00	4.00	0.19	2.21	-3.00	2.00	-1.63	2.01	14.29	4
Anna's Hummingbird	1.48	2.00	0.00	7.00	1.27	1.45	0.00	5.50	0.21	1.05	-1.00	2.50	-0.24	0.65	16.45	15
Arizona Bell's Vireo	3.71	3.20	0.75	10.75	3.91	2.63	0.50	8.00	-0.20	1.90	-2.50	4.25	-1.19	0.79	-5.11	10
Ash-throated Flycatcher	1.13	0.56	0.00	2.25	1.06	0.82	0.00	3.50	0.07	0.93	-2.50	2.00	-0.26	0.41	6.74	21
Bewick's Wren	7.02	4.55	0.75	13.75	8.51	5.50	2.00	18.25	-1.49	4.75	-7.25	8.75	-3.84	0.86	-17.49	11
Black-chinned Hummingbird	1.44	1.48	0.00	5.25	1.51	1.21	0.00	5.00	-0.07	1.65	-3.00	3.75	-0.68	0.54	-4.56	20
Black-tailed Gnatcatcher	1.93	1.10	0.50	4.50	2.76	2.31	0.00	8.75	-0.83	1.83	-5.25	2.25	**-1.58**	**-0.07**	-30.03	16
Blue Grosbeak	0.99	0.86	0.00	2.75	1.03	0.98	0.00	3.25	-0.05	0.95	-1.00	2.75	-0.41	0.31	-4.46	19
Brown-crested Flycatcher	0.47	0.47	0.00	1.50	0.87	0.58	0.00	2.25	-0.39	0.75	-1.50	1.00	**-0.73**	**-0.05**	-45.56	13
Bullock's Oriole	1.05	1.10	0.00	3.25	1.12	1.22	0.00	3.75	-0.06	0.87	-1.75	1.00	-0.45	0.32	-5.60	14
California Black Rail	0.69	0.38	0.25	1.00	1.91	1.84	0.00	4.25	-1.22	2.10	-4.00	1.00	-2.94	0.51	-63.93	4
Canyon Wren	0.88	0.44	0.25	1.50	0.58	0.41	0.00	1.00	0.29	0.40	0.00	1.00	**0.02**	**0.56**	50.00	6
Common Yellowthroat	6.13	5.04	0.00	22.50	8.13	6.07	0.00	21.25	-2.01	3.47	-8.25	3.00	**-3.28**	**-0.73**	-24.67	20
Crissal Thrasher	0.46	0.38	0.00	1.00	0.92	0.55	0.00	1.75	-0.46	0.44	-1.00	0.75	**-0.66**	**-0.27**	-50.49	14
Gila Woodpecker	0.56	0.38	0.00	1.25	0.77	0.36	0.25	1.50	-0.21	0.35	-0.75	0.25	**-0.35**	**-0.07**	-27.62	17
Great Horned Owl	0.25	0.20	0.00	0.50	0.25	0.20	0.00	0.50	0.00	0.20	-0.25	0.25	-0.17	0.17	0.00	4
Green Heron	0.50	0.27	0.00	0.75	0.38	0.44	0.00	1.00	0.13	0.52	-0.75	0.50	-0.22	0.47	33.33	6
Ladder-backed Woodpecker	1.23	0.88	0.00	3.50	1.26	0.57	0.50	2.25	-0.04	0.81	-1.25	1.75	-0.33	0.26	-2.83	21
Lawrence's Goldfinch	1.00	0.20	0.75	1.25	0.63	0.95	0.00	2.00	0.38	0.92	-1.00	1.00	-0.39	1.14	60.00	4
Lesser Goldfinch	1.26	1.44	0.00	4.75	1.78	1.67	0.00	4.88	-0.52	2.00	-4.00	2.25	-1.51	0.47	-29.30	11
Lesser Nighthawk	0.86	0.84	0.00	2.00	1.50	2.08	0.00	6.00	-0.64	1.80	-4.00	2.00	-1.76	0.47	-42.86	7
Lucy's Warbler	3.69	3.47	0.50	13.50	5.55	5.12	0.00	16.00	-1.86	3.50	-9.75	2.00	**-3.26**	**-0.46**	-33.51	17
Marsh Wren	1.50	1.80	0.00	3.50	3.00	2.65	1.00	6.00	-1.50	1.32	-2.50	0.00	**-2.76**	**-0.24**	-50.00	3
Northern Rough-winged Swallow	1.50	1.75	0.25	3.50	0.92	1.01	0.00	2.00	0.58	2.02	-1.25	2.75	-1.34	2.50	63.64	3
Phainopepla	2.39	2.11	0.00	5.00	1.95	1.34	1.00	4.88	0.45	1.43	-1.00	3.00	-0.44	1.33	22.94	7
Pied-billed Grebe	0.63	0.95	0.00	2.00	1.38	1.11	0.50	3.00	-0.75	1.71	-3.00	1.00	-2.15	0.65	-54.55	4
Song Sparrow	15.98	19.50	0.00	76.50	18.19	19.74	1.00	77.50	-2.22	7.23	-23.00	11.50	-5.02	0.59	-12.18	18
Sonoran Yellow Warbler	6.87	11.37	0.00	41.75	7.06	10.71	0.00	38.00	-0.19	3.64	-9.00	6.00	-1.85	1.47	-2.72	13
Summer Tanager	1.03	0.55	0.00	2.00	1.47	0.96	0.00	2.75	-0.44	0.78	-2.00	0.75	**-0.81**	**-0.07**	-29.79	12
Verdin	2.90	2.22	0.00	7.50	4.03	2.89	0.25	10.00	-1.13	2.20	-7.50	2.75	**-2.01**	**-0.25**	-28.10	17
Virginia Rail	1.50	1.32	0.50	3.00	2.25	1.39	1.00	3.75	-0.75	0.75	-1.50	0.00	**-1.46**	**-0.04**	-33.33	3
Western Kingbird	1.46	1.58	0.00	4.00	1.33	1.18	0.00	3.00	0.13	0.61	-0.75	1.00	-0.28	0.53	9.38	6
Yellow-breasted Chat	7.30	7.60	0.00	29.50	9.54	10.26	0.75	41.25	-2.24	3.98	-11.75	6.00	**-3.70**	**-0.77**	-23.46	20
All Species	56.65	41.96	20.00	195.00	67.84	49.09	19.50	215.75	-11.18	19.86	-50.50	24.00	**-18.15**	**-4.22**	-16.49	22

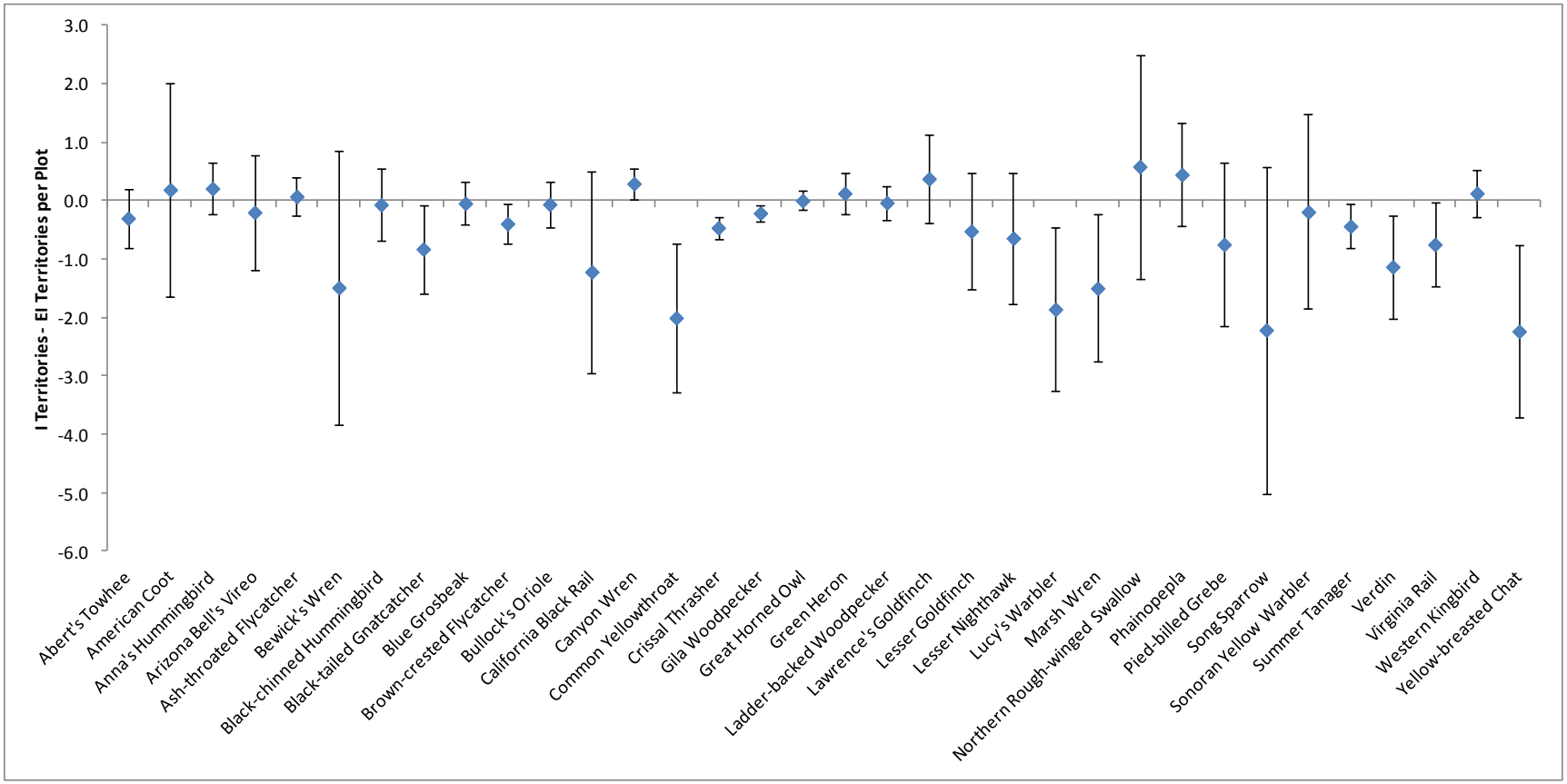

Figure 1.—Differences between intensive and EI sampling within a plot reported for relatively common species.
Data were reported in table 39, but this figure is provided for easy visualization. Data below the zero line show that the EI surveyor had more territories than the intensive surveyor. Error bars denote 90% confidence intervals.

This difference of one territory is not a surprising or significant difference for the common species with large sample sizes on most plots. Other species, such as black-tailed gnatcatcher, brown-crested flycatcher, crissal thrasher, Gila woodpecker, summer tanager, and Virginia rail, showed gains of less than one territory on average with EI sampling, but the 90% confidence intervals did not overlap zero. These are statistically significant, but the difference of less than one territory is not necessarily biologically significant in the habitats surveyed. Some of these species (Gila woodpecker and crissal thrasher) have territories that can be much larger than a plot, so potential problems with accurate delineation of territories of these species has a large effect.

More territories were detected by the EI surveyor in both "hard" (I-EI difference: -16.7; 24.3, 11: mean, SD, n) and "medium" (-5.6, 13.1, 11) plots, with relative differences of -17% and -15%, respectively. The range of differences between intensive and EI sampling was broader for "hard" (range: -50.5 to 24.0) than "medium" (range: -29.3 to 12.8) plots. The 90% confidence intervals for "hard" (-28.8 to -4.7) and "medium" (-12.1 to 0.9) plots overlapped substantially. For "hard" plots, use of EI surveying resulted in two or more additional territories found compared to intensive surveying for five species: common yellowthroat, Lucy's warbler, yellow-breasted chat, song sparrow, and verdin, and confidence intervals for the first three species did not intersect zero (table 39; figure 2). In "medium" plots, EI surveying improved the intensive estimate for the number of territories by 1.5 at most. Confidence intervals were too wide to make strong statements about the relative advantage of EI sampling in "hard" and "medium" plots (figure 2), reflecting the low sample sizes in both categories (table 39). Although EI sampling found more territories for some species, this was not always the case.

For both "medium" and "hard" plot types, there was a trend that the EI surveys detected increasingly more territories relative to intensive surveys where more birds were present on the plot (figure 3; Spearman rho, n, P-value, hard: -0.62, 11, 0.05; medium: -0.79, 11, < 0.01). It is important to note that most of the "hard" habitat plots hosted a higher density of birds than the "medium" type, so the "medium" slope is based on a more limited density range (see figures 9 and 10). There was no temporal trend between 2011–13 in the amount of error resulting from the different survey methods (I-EI; table 41). However, variation among plots was quite high and sample sizes within year low, so the only year that showed a significant difference in the number of territories observed using different sampling methods was 2013.

To better illustrate differences between the EI and standard intensive survey efforts, we used program DS to calculate detection ratios using EI and rapid survey data in one analysis and standard intensive and rapid survey data from these plots in another analysis. The detection ratio is 1.0 if all birds that are present on the plot are detected in both survey methods, and if the EI-derived and

Table 39.—Summary statistics for the difference in estimated number territories for intensive (I) and enhanced intensive (EI) (I-EI) sampling for 2011–13 for all species that had at least three non-zero samples in each habitat

(Results are reported for both an absolute and percentage basis for each type of habitat. Twenty-two plots, 11 "hard" and 11 "medium," were sampled. The number of observations (No. Obs.) in which each species is present for each habitat type is reported.)

	Difference within plot (I - EI)												Percentage difference summing all territories: (I - EI)/EI			
	Hard Habitat						Medium Habitat						Hard Habitat	Medium Habitat	Hard No. Obs.	Medium No. Obs.
	Mean	SD	Min	Max	90% confidence interval		Mean	SD	Min	Max	90% confidence interval					
Abert's Towhee	-0.24	1.65	-2.50	2.50	-1.06	0.58	-0.36	1.24	-1.75	2.00	-0.98	0.25	-8.40%	-10.46%	11	11
Anna's Hummingbird	0.08	0.85	-1.00	1.25	-0.42	0.57	0.36	1.29	-1.00	2.50	-0.44	1.16	8.62%	21.28%	8	7
Arizona Bell's Vireo	-1.00	1.31	-2.50	0.50	**-1.88**	**-0.12**	1.00	2.18	-0.25	4.25	-0.79	2.79	-24.12%	28.07%	6	4
Ash-throated Flycatcher	0.02	1.08	-2.50	1.50	-0.51	0.56	0.13	0.79	-0.50	2.00	-0.29	0.54	2.13%	11.90%	11	10
Bewick's Wren	-1.64	5.61	-7.25	8.75	-4.90	1.62	-1.08	1.51	-2.50	0.50	-2.51	0.35	-15.42%	-38.24%	8	3
Black-chinned Hummingbird	-0.38	1.47	-2.50	1.75	-1.18	0.43	0.18	1.81	-3.00	3.75	-0.72	1.08	-24.77%	12.12%	9	11
Black-tailed Gnatcatcher	0.60	1.31	-0.50	2.25	-0.36	1.56	-1.48	1.69	-5.25	0.50	**-2.32**	**-0.64**	39.34%	-44.52%	5	11
Blue Grosbeak	-0.18	0.90	-1.00	2.00	-0.67	0.31	0.08	1.03	-1.00	2.75	-0.46	0.61	-13.68%	9.68%	9	10
Brown-crested Flycatcher	-0.52	0.59	-1.50	0.63	**-0.86**	**-0.17**	-0.20	0.99	-1.00	1.00	-0.93	0.53	-48.53%	-36.36%	8	5
Bullock's Oriole	0.02	0.90	-1.25	1.00	-0.54	0.58	-0.14	0.91	-1.75	0.75	-0.71	0.42	2.86%	-8.89%	7	7
Common Yellowthroat	-2.92	3.78	-8.25	3.00	**-4.79**	**-1.05**	-0.89	2.86	-7.50	2.50	-2.46	0.68	-26.36%	-19.63%	11	9
Crissal Thrasher	-0.38	0.61	-1.00	0.75	-0.78	0.03	-0.53	0.28	-1.00	-0.25	**-0.69**	**-0.37**	-40.00%	-58.62%	6	8
Gila Woodpecker	-0.11	0.38	-0.75	0.25	-0.31	0.09	-0.36	0.24	-0.75	0.00	**-0.51**	**-0.21**	-12.68%	-58.82%	10	7
Ladder-backed Woodpecker	-0.09	0.90	-1.25	1.25	-0.54	0.35	0.03	0.75	-1.00	1.75	-0.36	0.41	-5.97%	2.56%	11	10
Lesser Goldfinch	-1.25	1.82	-4.00	1.00	**-2.31**	**-0.19**	1.42	0.72	1.00	2.25	**0.73**	**2.10**	-58.39%	170.00%	8	3
Lucy's Warbler	-3.39	4.43	-9.75	2.00	**-5.96**	**-0.82**	-0.50	1.73	-3.25	2.00	-1.45	0.45	-37.74%	-20.00%	8	9
Song Sparrow	-3.06	9.25	-23.00	11.50	-7.64	1.53	-0.89	1.48	-3.00	1.25	-1.81	0.03	-11.22%	-22.52%	11	7
Sonoran Yellow Warbler	-0.25	4.72	-9.00	6.00	-3.00	2.50	-0.10	0.89	-1.00	1.25	-0.76	0.56	-2.39%	-6.25%	8	5
Summer Tanager	-0.50	0.90	-2.00	0.75	**-0.99**	**-0.01**	-0.25	0.25	-0.50	0.00	**-0.49**	**-0.01**	-30.77%	-25.00%	9	3
Verdin	-2.00	3.04	-7.50	0.75	-4.04	0.04	-0.66	1.57	-3.00	2.75	-1.44	0.12	-44.04%	-17.58%	6	11
Yellow-breasted Chat	-3.20	5.06	-11.75	6.00	**-5.71**	**-0.70**	-1.06	1.69	-4.00	1.00	**-1.98**	**-0.13**	-21.76%	-33.04%	11	9
All Species	-16.73	24.27	-50.50	24.00	**-28.76**	**-4.69**	-5.64	13.10	-29.25	12.75	-12.14	0.86	-16.91%	-15.33%	11	11

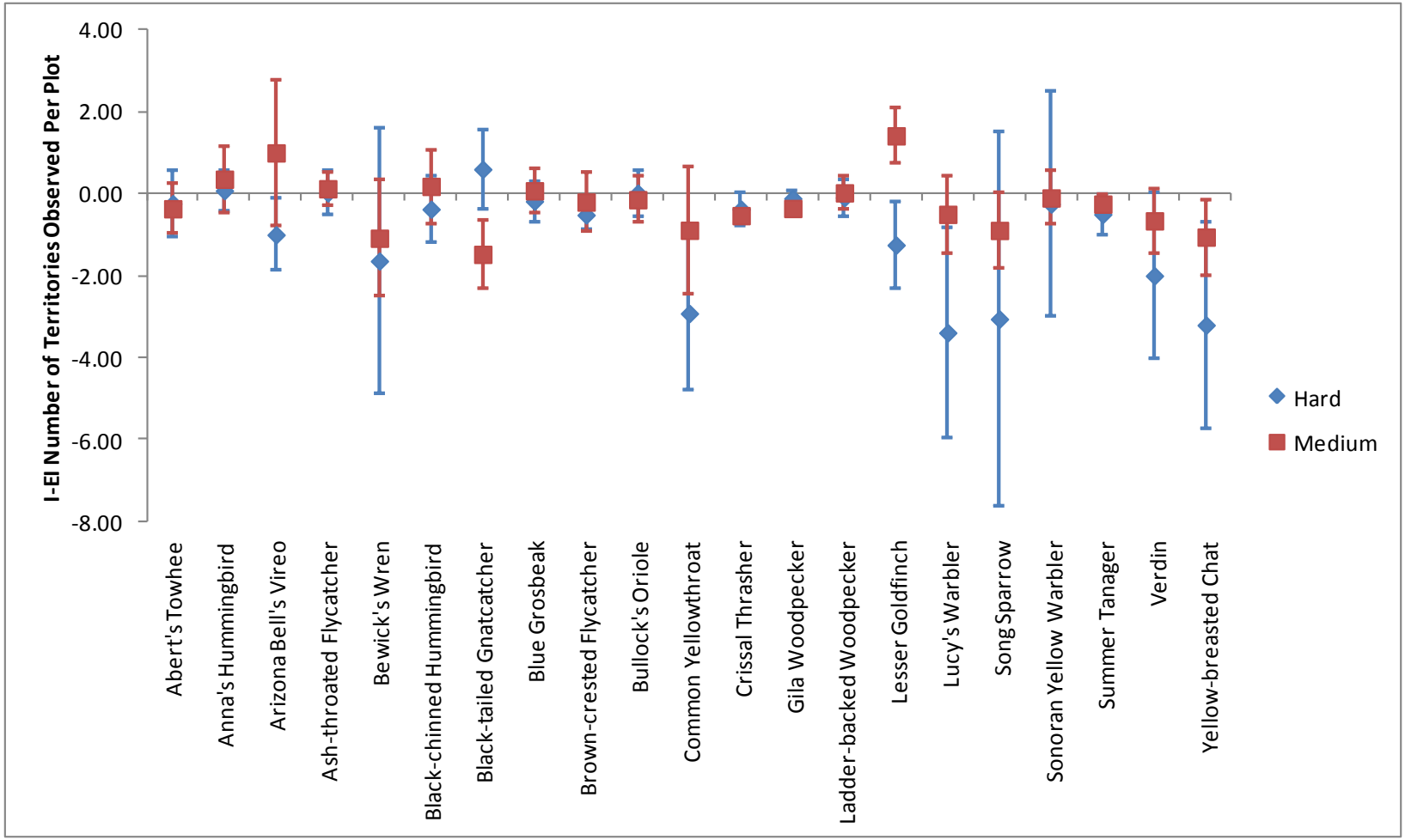

Figure 2.—Differences between EI and intensive sampling within a plot for relatively common species in "hard" and "medium" difficulty habitats.
Data are reported in table 40, but this figure is provided for easy visualization. Error bars represent 90% confidence intervals.

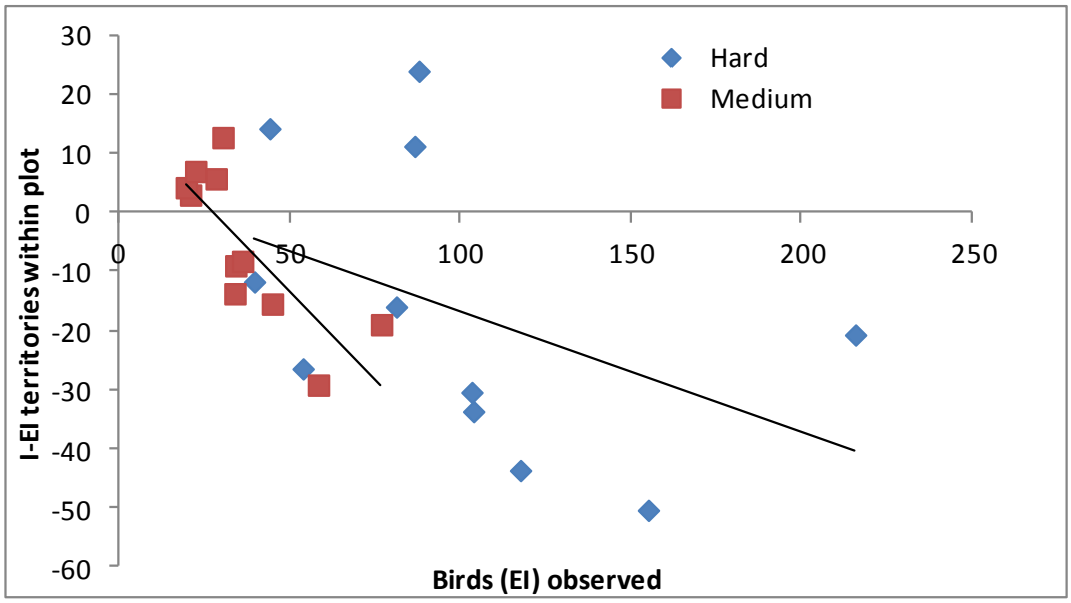

Figure 3.—Scatterplot of error in territory estimates (I-EI) versus "true" bird density over all species for hard and medium habitat types.
The lines show the simple linear relationship for each habitat type; Spearman's correlation coefficients are provided in the text.

Table 40.—Intensive – EI sampling difference summary statistics by year

Year	Mean	SD	Minimum	Maximum	90% confidence interval		Average number of territories per plot	Number of non-zero plots
2011	-9.0	22.5	-30.5	24.0	-24.1	6.2	66.0	6
2012	-3.1	15.5	-26.5	14.3	-12.7	6.6	44.5	7
2013	-14.9	18.9	-43.8	7.0	-26.7	-3.1	88.0	7

standard intensive-derived detection ratios were the same for a species, the EI surveys would not add any additional information to the standard intensive survey effort for that species.

Twenty-four plots were triple sampled over the 3 years of this study (2011–13). Two plots were sampled twice in different years. These surveys resulted in more than 1,600 breeding pairs comprised of more than 70 species detected with sufficient evidence to be classified as breeders on EI surveys alone. Of these, 21 species had a large enough sample size, meaning they were present in enough plots, from the EI surveys ($n \geq 10$) to be included in the analysis. Some of these species were common throughout the surveyed plots, and others were only present on a few plots (table 41).

Table 41.—The detection ratios of rapid versus EI and rapid versus intensive surveys for 20 species and the all species total over 3 years, 2011–13 (85% confidence interval [CI])

Species	N birds (rapid)	N birds (EI)	Detection ratio (EI)	Comparing rapid to EI	SE - detection ratio (EI)	CV - detection ratio (EI)	85% CI	N birds (int.)	Detection ratio (int.)	Comparing rapid to int.	SE - detection ratio (int.)	CV - detection ratio (int.)	85% CI
Abert's towhee	68.25	75.75	0.90	Rapid under-estimated	0.11	0.13	0.17	67	1.02	Rapid over-estimated	0.11	0.11	0.17
Anna's hummingbird	21.25	21.75	0.98	Rapid under-estimated	0.26	0.26	0.38	24.75	0.86	Rapid under-estimated	0.18	0.21	0.26
Bell's vireo*	44.25	44	1.01	Rapid over-estimated	0.15	0.15	0.22	42.25	1.05	Rapid over-estimated	0.19	0.18	0.28
Ash-throated flycatcher	18.75	23.75	0.79	Rapid under-estimated	0.17	0.21	0.25	26.25	0.71	Rapid under-estimated	0.12	0.16	0.18
Bewick's wren	91.25	112.5	0.81	Rapid under-estimated	0.15	0.19	0.23	95.75	0.95	Rapid under-estimated	0.20	0.21	0.30
Black-chinned hummingbird	17.5	32	0.55	Rapid under-estimated	0.16	0.29	0.23	32.5	0.54	Rapid under-estimated	0.14	0.26	0.21
Black-tailed gnatcatcher	50.75	44.75	1.13	Rapid over-estimated	0.21	0.31	0.18	33.25	1.53	Rapid over-estimated	0.22	0.14	0.32
Blue grosbeak	13.75	20.5	0.67	Rapid under-estimated	0.24	0.36	0.36	19.25	0.71	Rapid under-estimated	0.26	0.37	0.39
Brown-crested flycatcher	8.5	13	0.65	Rapid under-estimated	0.20	0.30	0.29	8	1.06	Rapid over-estimated	0.33	0.31	0.49
Bullock's oriole	13.5	15.75	0.86	Rapid under-estimated	0.16	0.19	0.24	15.25	0.89	Rapid under-estimated	0.19	0.21	0.28
Common yellowthroat	137.25	185.75	0.74	Rapid under-estimated	0.11	0.14	0.16	140.8	0.98	Rapid under-estimated	0.10	0.10	0.15
Crissal thrasher	9.25	14.5	0.64	Rapid under-estimated	0.19	0.29	0.28	7.25	1.28	Rapid over-estimated	0.36	0.28	0.53
Gila woodpecker*	16.25	16	1.02	Rapid over-estimated	0.18	0.17	0.26	11.5	1.41	Rapid over-estimated	0.28	0.20	0.42
Ladder-backed woodpecker	28.5	30.25	0.94	Rapid under-estimated	0.13	0.14	0.20	28.5	1.00	Rapid over-estimated	0.16	0.16	0.23
Lesser goldfinch	20.5	24.75	0.83	Rapid under-estimated	0.31	0.37	0.45	14.75	1.39	Rapid over-estimated	0.73	0.52	1.08
Lucy's warbler	73.75	108	0.68	Rapid under-estimated	0.15	0.22	0.22	73.5	1.00	Rapid over-estimated	0.22	0.22	0.33
Song sparrow	380	402.25	0.94	Rapid under-estimated	0.10	0.10	0.14	333	1.14	Rapid over-estimated	0.08	0.07	0.11
Yellow warbler*	135.50	109.75	1.23	Rapid over-estimated	0.36	0.53	0.29	97.75	1.39	Rapid over-estimated	0.45	0.33	0.67
Summer tanager*	10.75	22.5	0.48	Rapid under-estimated	0.11	0.24	0.17	15.5	0.69	Rapid under-estimated	0.24	0.35	0.36
Verdin	46.75	70.25	0.67	Rapid under-estimated	0.15	0.23	0.22	51.5	0.91	Rapid under-estimated	0.19	0.21	0.28
Yellow-breasted chat	200.5	224.5	0.89	Rapid under-estimated	0.16	0.17	0.23	169.8	1.18	Rapid over-estimated	0.14	0.12	0.22
All species	1,487.75	1,728.5	0.86	Rapid under-estimated	0.07	0.08	0.10	1,418	1.05	Rapid over-estimated	0.06	0.05	0.08

We found that territorial species' counts were not highly clumped, so the CV was low for most species, including almost all common riparian species (except yellow warbler; see table 41). The species with the highest CV (above 0.3) were blue grosbeak, brown-crested flycatcher, and lesser goldfinch.

The detection ratio was close to 1.0, and the EI and intensive detection ratios were similar for some species, including Bullock's oriole, ladder-backed woodpecker, song sparrow, Anna's hummingbird, and Arizona Bell's vireo (figure 4). For other species, EI and standard intensive surveys resulted in similar numbers of territories, but detection ratios were below 1.0, meaning that rapid surveyors underestimated the number of territories in light of standard intensive and EI results. Examples of these species included black-chinned hummingbird, blue grosbeak, and ash-throated flycatcher (figure 5). For some species, the detection ratio was slightly below 1.0 using standard intensive data, but much lower when using EI data, which means that both rapid and the intensive surveys underestimated the number of territories on the plot. Examples of these species included verdin, Lucy's warbler, common yellowthroat, and Bewick's wren (figure 6). For other species, the detection ratio was above 1.0 for EI and intensive surveys but consistently lower for EI. Rapid surveys overestimate birds relative to both EI and standard intensive, but the EI survey shows the bias is smaller than we would expect from a standard intensive survey. Examples of these species included black-tailed gnatcatcher and Sonoran yellow warbler (figure 7). Finally, in some cases, the EI detection ratio was below 1.0, and the intensive survey detection ratio was above 1.0, meaning the rapid surveyor underestimated territories compared to the EI but overestimated them compared to the intensive (figure 8). Some less common species, ones that are also harder to detect like summer tanagers, have large differences between detection ratios, but less common species that are easier to detect and map, such as the ladder-backed woodpecker, have smaller differences in detection ratios.

We compared species-specific detection ratios to the overall detection ratio using confidence intervals to determine whether variation in species detectability was greater than would be expected by sampling error (Bart and Earnst 2002). We used a relatively liberal 85% confidence interval to more readily identify species-specific detection rates potentially different from the all species detection rate (i.e., a 95% interval would have been more likely to include the all species detection ratio (J. Bart 2008, personal communication).

In our summary data, we thus expected for the 85% confidence interval that 15% (about 3 of 21) of the species would not be included the grand mean (average detection ratio). We found three species outside the average, so this variation is consistent with what we expect from sampling error. For the intensive survey confidence intervals, the following three species' error bars did not include the "all species" detection ratio (1.05): black-chinned hummingbird, ash-throated flycatcher, and black-tailed gnatcatcher. For the EI survey confidence intervals, two species' error bars did not include the "all species" detection ratio (0.86): black-chinned hummingbird and summer tanager (figure 9).

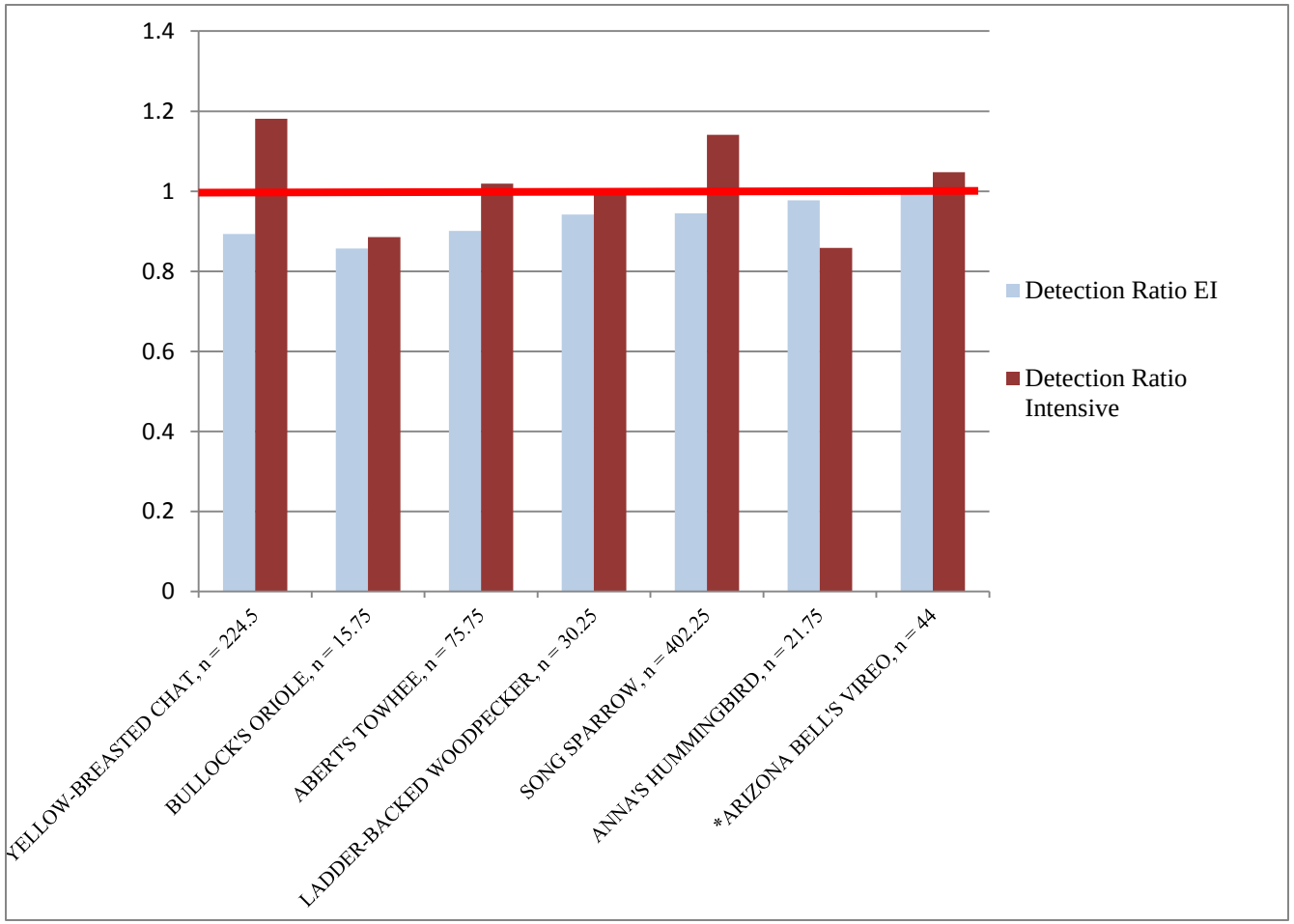

Figure 4.—Comparison of the detection ratios of EI and rapid (blue bars) versus intensive and rapid (red bars) for seven species, including 3 years of data, 2011–13.
We found that for some species, the detection ratio was close to 1.0, and the EI and intensive detection ratios were similar. The number of territories from EI surveys (n) is noted for each species.

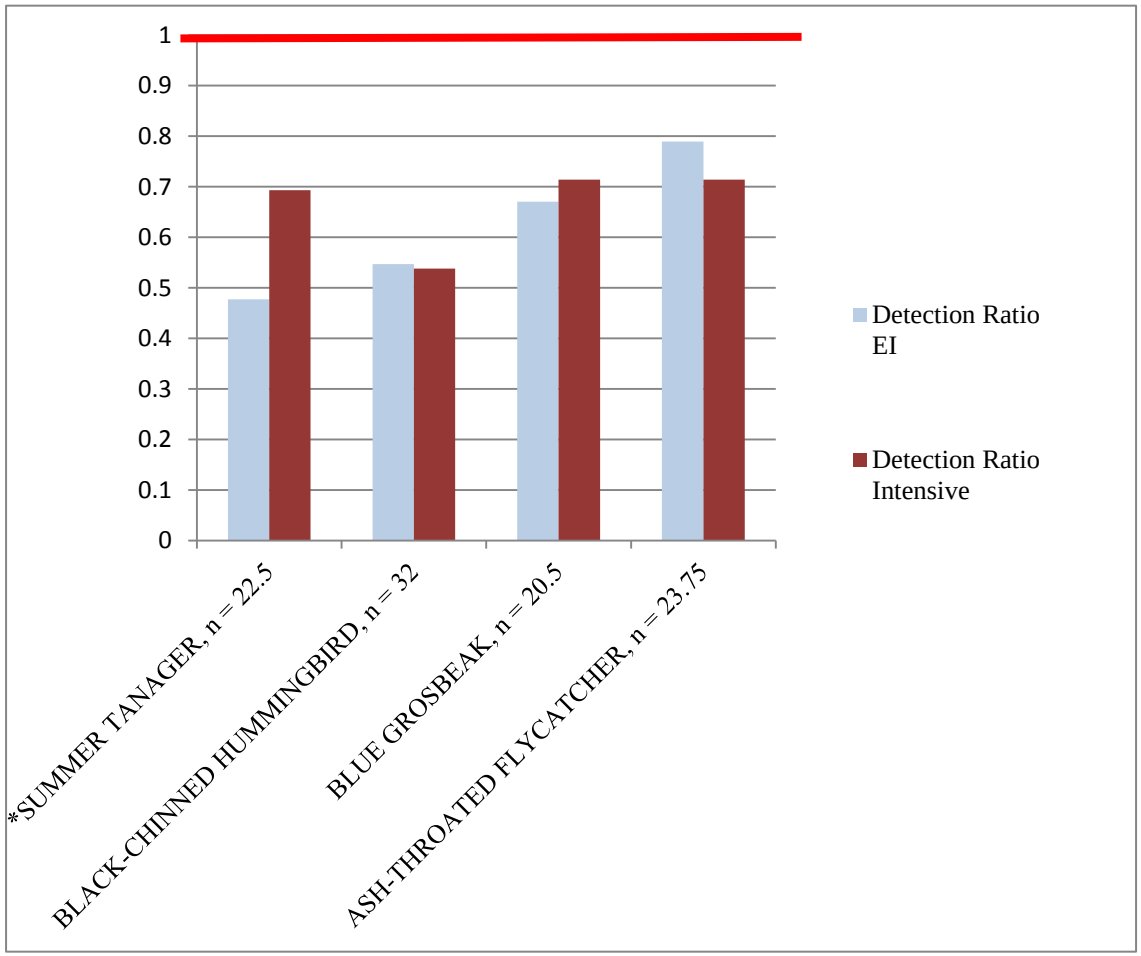

Figure 5.—Comparison of data collected between 2011–13 showing the detection ratios of EI and rapid (blue bars) versus intensive and rapid (red bars) for four species.
EI and intensive surveyors were detecting similar numbers of territories, but detection rates were below 1.0, meaning rapid surveyors were underestimating the number of territories compared to intensive and EI surveyors. The number of territories from EI surveys (n) is noted for each species.

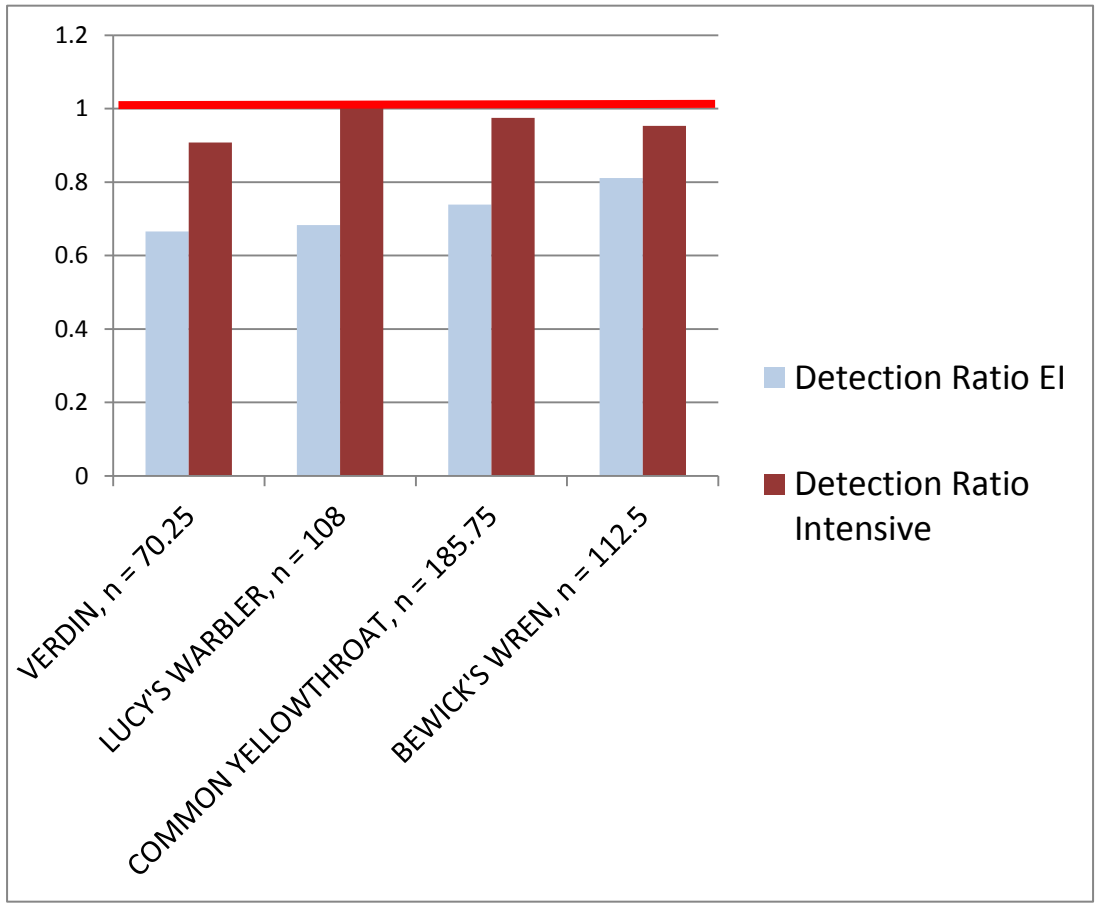

Figure 6.—Comparison of data collected from 2011–13 showing the detection ratios of EI and rapid (blue bars) versus intensive and rapid (red bars) for four species. In these species, the detection ratio was below 1.0 for EI and intensive, but consistently lower for EI, meaning the rapid and the intensive efforts both underestimated the actual number of territories on the plot (as counted by the EI effort). The number of territories from EI surveys (n) is noted for each species.

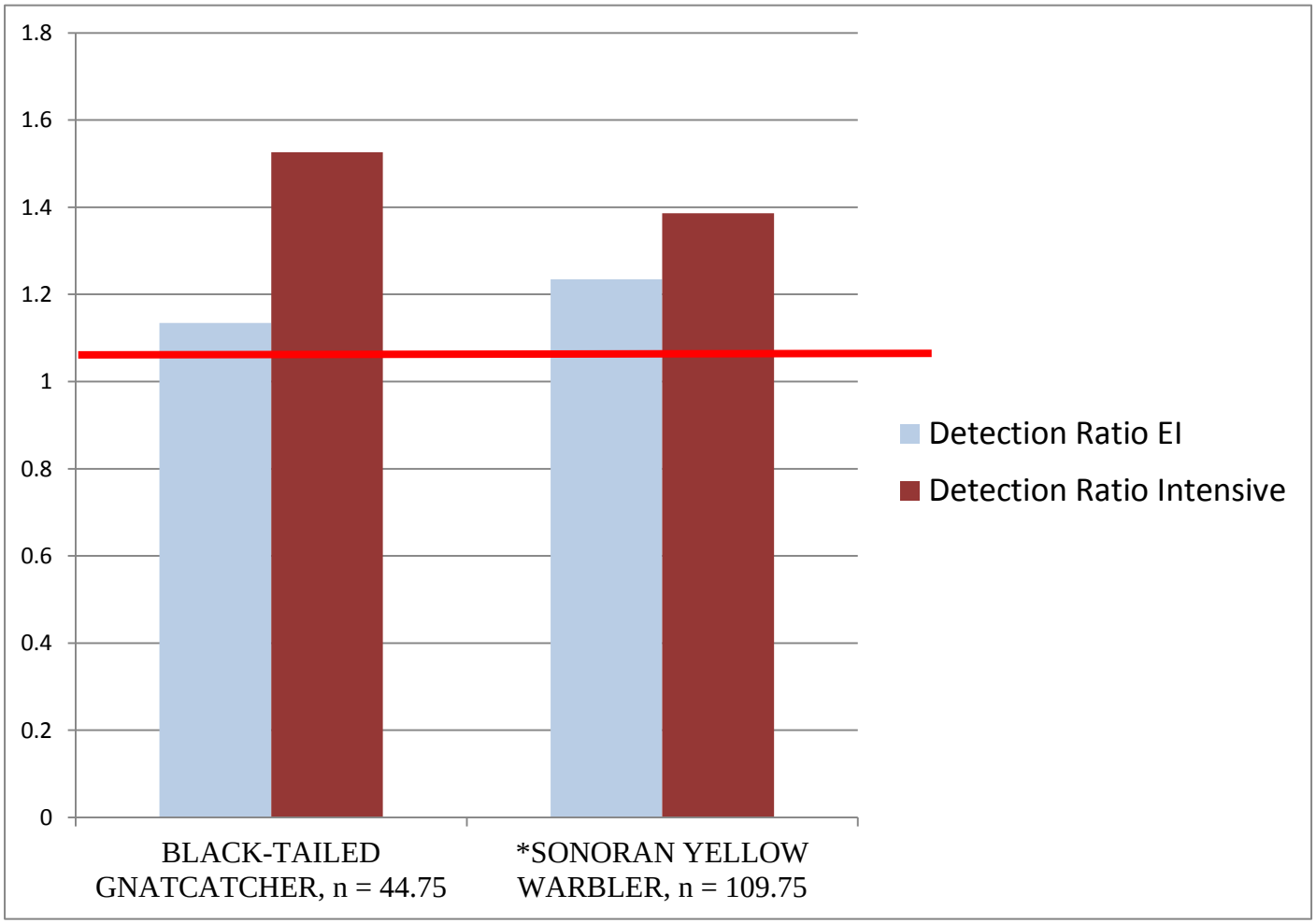

Figure 7.—Comparison of data collected from 2011–13 showing the detection ratios of EI and rapid (blue bars) versus intensive and rapid (red bars) for two species.
The detection ratio was above 1.0 for EI and intensive, and rapid surveys overestimate birds relative to both EI and intensive. EI survey shows the bias is smaller than we would expect from a standard intensive survey. The number of territories from EI surveys (n) is noted for each species.

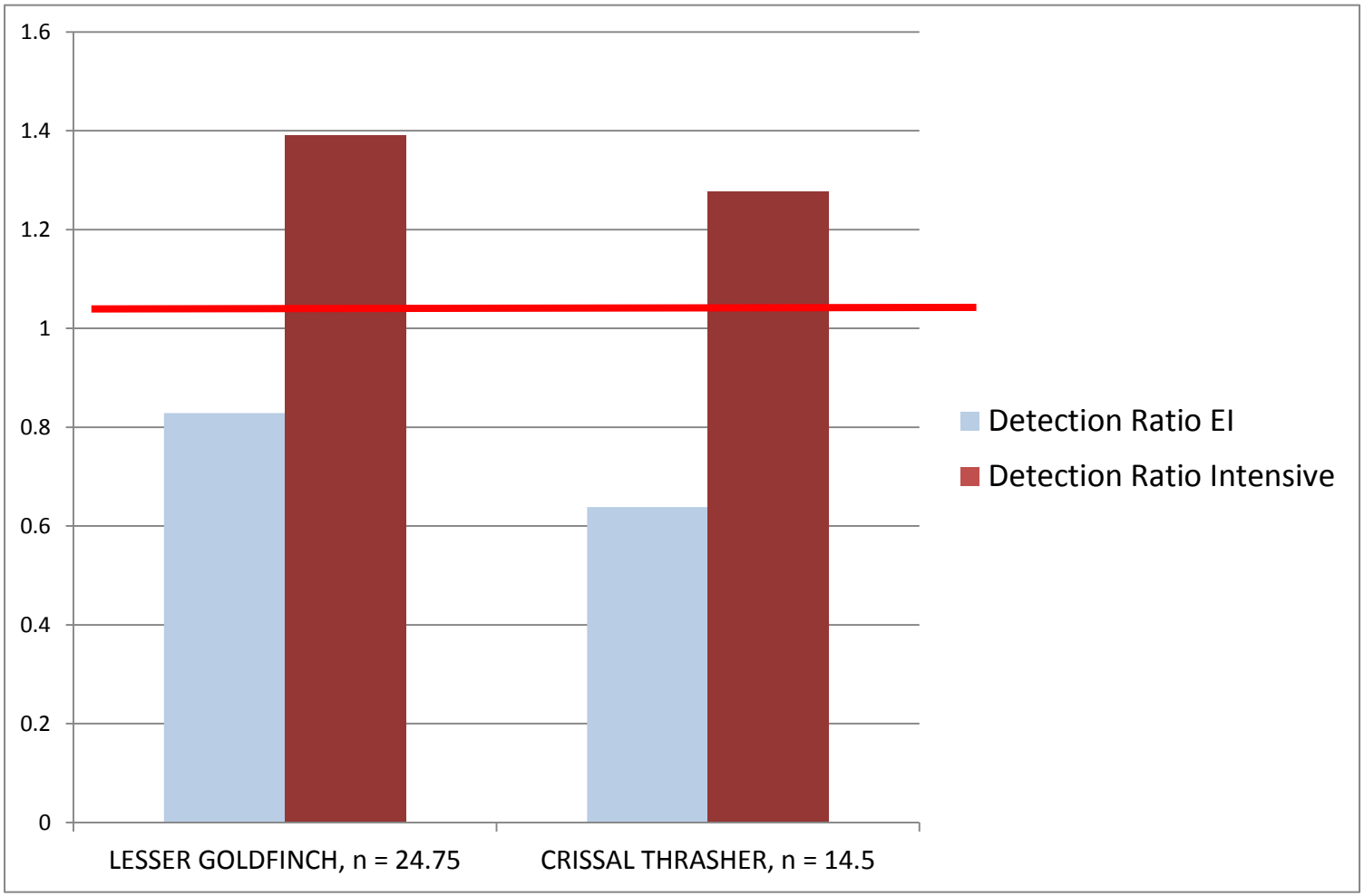

Figure 8.—Comparison of data collected from 2011–13 showing the detection ratios of EI and rapid (blue bars) versus intensive and rapid (red bars) for two species.
Here the EI detection ratio was below 1.0, and the intensive detection ratio was above 1.0, meaning the rapid surveyor underestimated compared to the EI but overestimated compared to the intensive. The number of territories from EI surveys (n) is noted for each species.

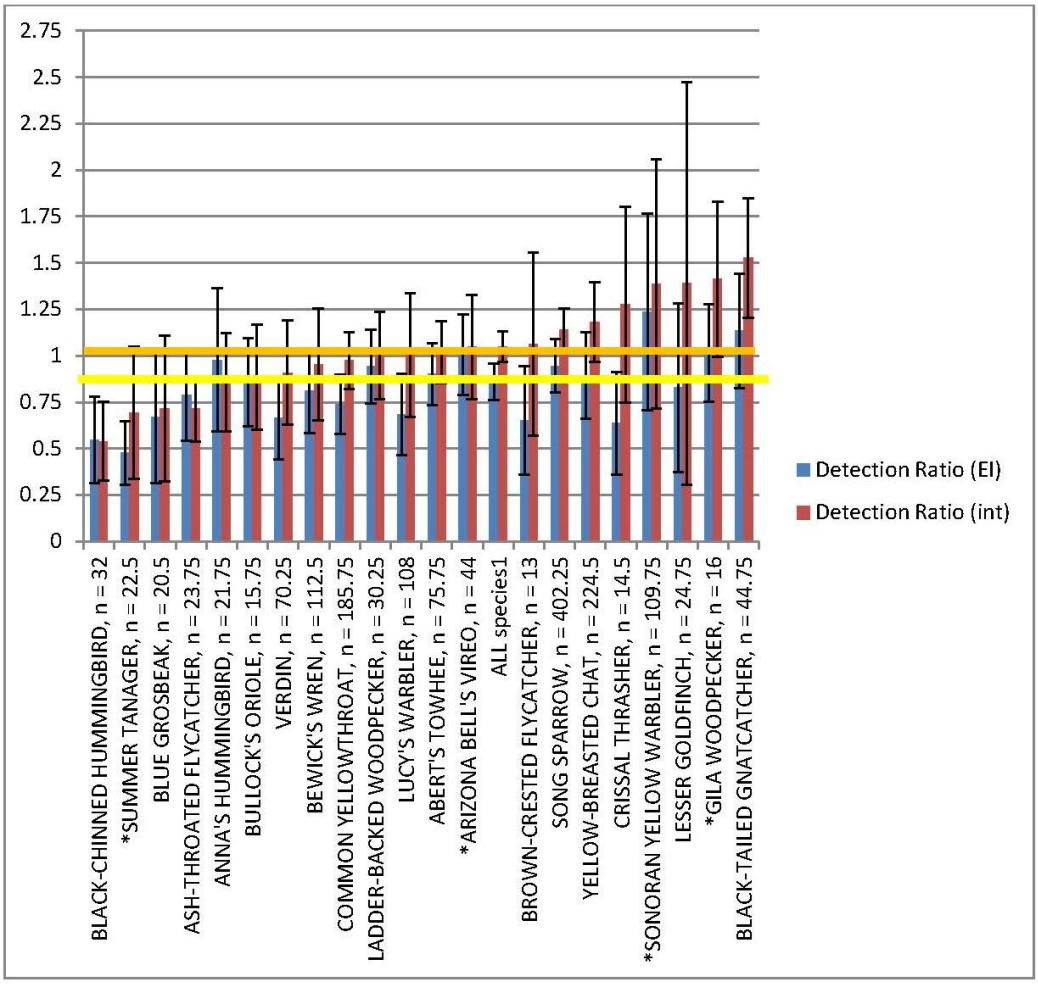

Figure 9.—Comparison of 85% confidence intervals (n = 24) for each species-specific detection ratio in relation to the all-species detection ratios (EI = 0.86, yellow horizontal line; intensive = 1.05, orange horizontal line).

Seasonal Effects on Detectability

We examined seasonal effects on the number of territories reported by each survey type using data from 2013, and here we show several examples of covered species on individual plots, showing a representative patterns for most plots where these species were detected in 2013. On figure 10, we show Arizona Bell's vireo territory numbers reported from the three survey types on Plot #2865. This plot was randomly selected to serve as an example, and it may not be representative of other plots we surveyed. The EI surveyor had some variation in the number of breeding pairs detected on each survey early and late in the season, but they were relatively consistent during the middle of the season. The standard intensive surveyor was consistent throughout the season, with the same one-pair detection variation as the EI surveyor. The rapid surveyor was very consistent with the other two surveyors detecting the same number of breeding pairs as the intensive

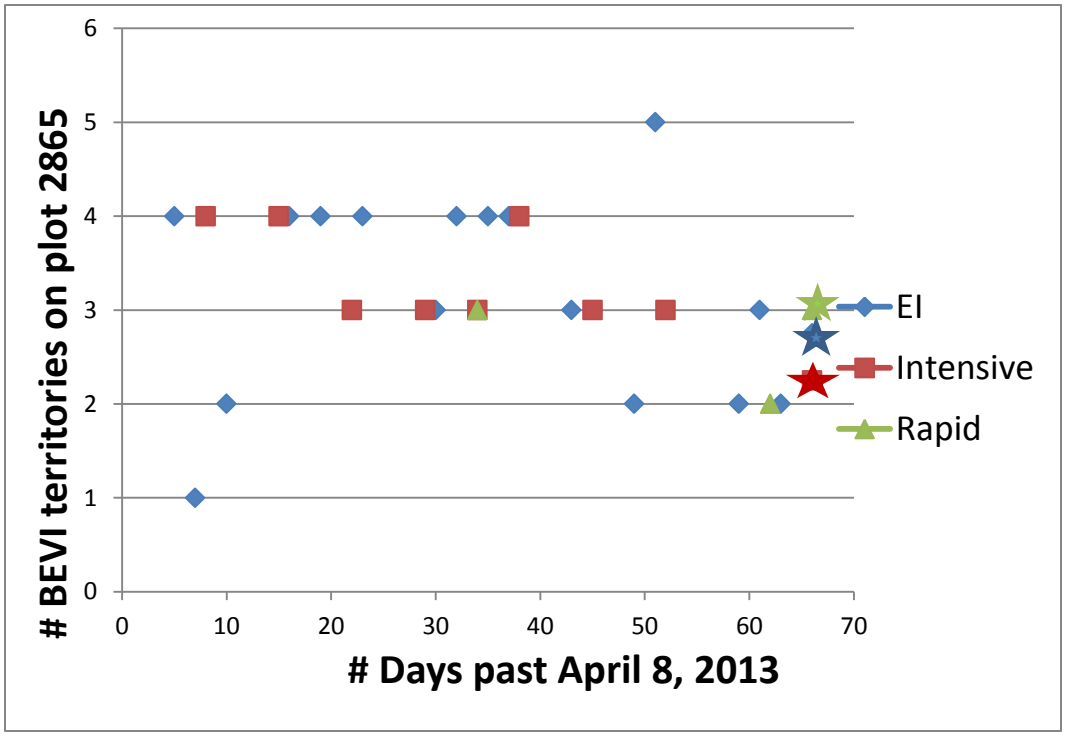

Figure 10.—Comparison of estimated numbers of Arizona Bell's vireo territories using three different survey methods (rapid, standard intensive, and EI area searches) on Plot #2865 in 2013.
The colored stars signify the final number of breeding territories determined by each survey effort at the end of the season.

surveyor mid-season and as the EI surveyor at the end of the season. Ultimately, all three surveyors determined a similar number of breeding territories at the end of the season. We suspect the small variation in these numbers was due to the percentage of the territories within the plot and not the detectability of the pairs.

On figure 11, we show the summer tanager results from the three survey types on Plot #2865. This plot was randomly selected to serve as an example, and it is in not necessarily representative of other plots we surveyed. Summer tanagers were not detected on the plot by surveyors until about 2 weeks into the survey season. After first detection, the EI surveyor saw one pair on the plot throughout the season. The standard intensive surveyor consistently detected one pair but also had several surveys when that pair was not detected. Both surveyors reported very similar numbers of final breeding territories at the end of the season. The surveyor conducting rapid area searches did not detect summer tanagers on either of their surveys and therefore had a zero as their final territory count. These data suggest that this species is difficult to detect and is likley missed by some rapid surveys.

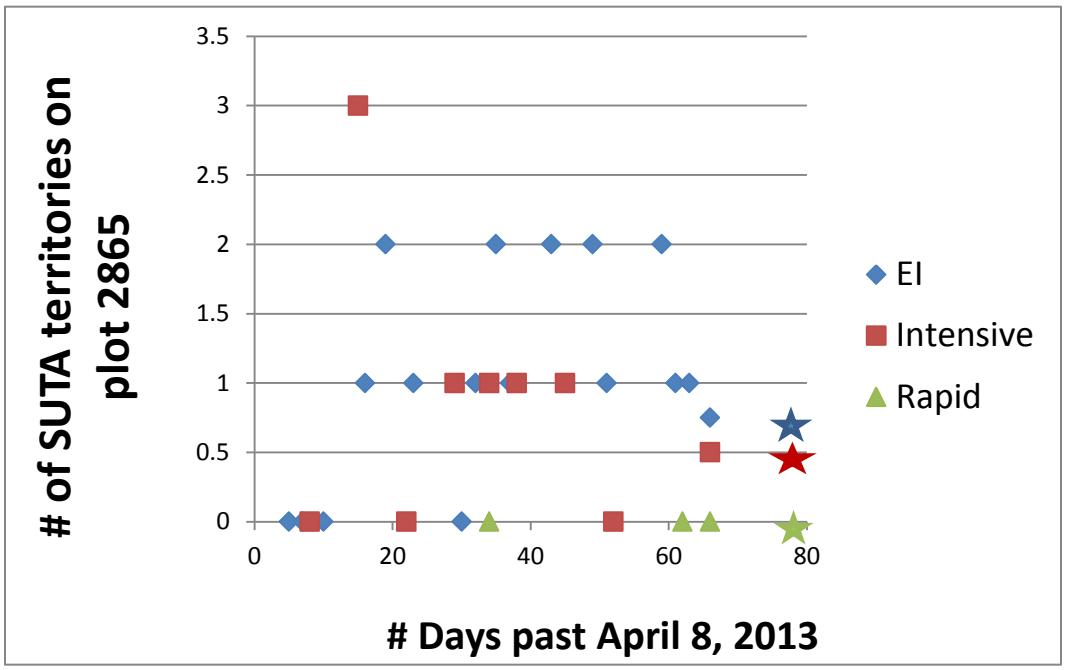

Figure 11.—Comparison of estimated numbers of summer tanager territories using three different survey methods (rapid, standard intensive, and EI area searches) on Plot #2865 in 2013.
The colored stars signify the final number of breeding territories determined by each survey effort at the end of the season.

In the third species example, we examined results from the three survey methods for yellow warbler on Plot #2864 (figure 12). This plot was randomly selected to serve as an example, and it is in no way representative of other plots we surveyed. Yellow warblers are present in significant numbers for both breeding and migration stopover throughout the study area. Migrating yellow warblers, like breeding pairs, are known to sing, defend territories, and copulate during migration stopovers. It is therefore nearly impossible to tell a migrant from a breeder early in the season (April and early May) unless confirmed breeding evidence is observed at that time. We thus rely on repeated surveys of individuals maintaining a territory for weeks at a time, as well as confirmed breeding evidence such as nest building, food carrying, or dependent young, to classify a breeding pair at the end of the season.

In our analysis, the EI surveyor reported a fluctuating number of yellow warbler breeding pairs throughout the season. The standard intensive surveyor reported a very similar fluctuation but with higher numbers of territories throughout the season. The rapid area search surveyor reported very similar numbers to the EI surveyor on the days when they surveyed. Ultimately, though, the EI and intensive surveyors determined similar numbers of breeding pairs at the end of the season, while the rapid surveyor estimated only half as many territories to be on the plot.

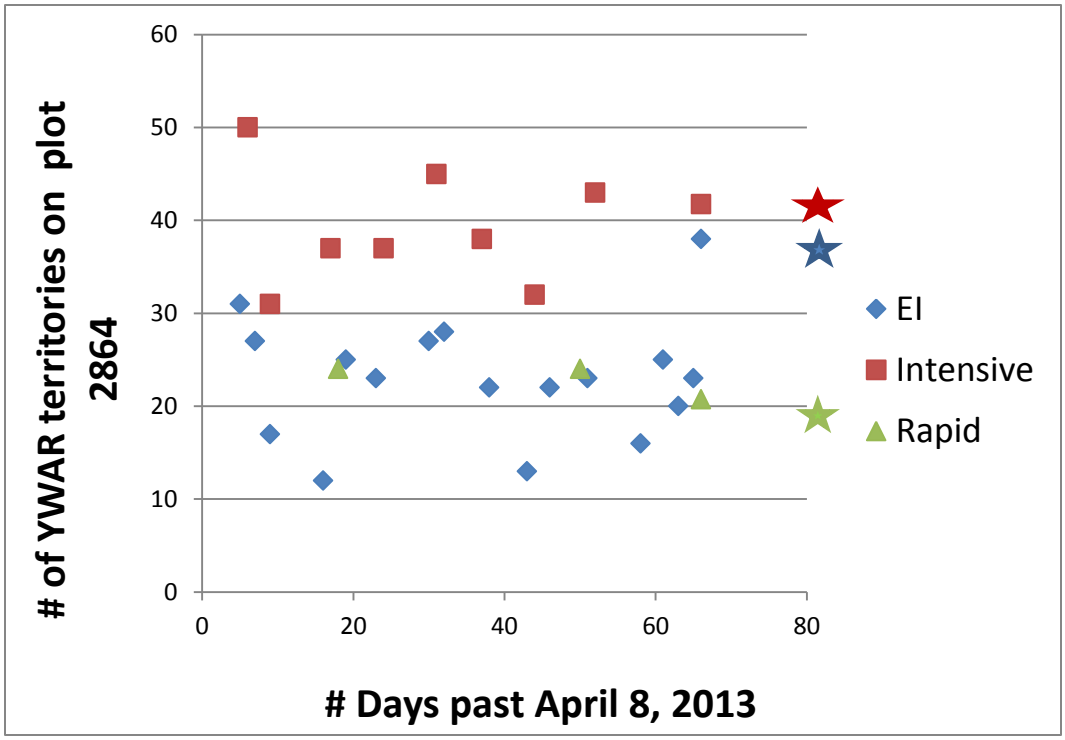

Figure 12.—Comparison of estimated numbers of Sonoran yellow warbler territories using three different survey methods (rapid, standard intensive, and EI area searches) on Plot #2864 in 2013.
The colored stars signify the final number of breeding territories determined by each survey effort at the end of the season.

This example illustrates several observations about detectability of territories. Both the EI and the standard intensive surveyors had visits with very high and very low yellow warbler detections throughout the season, ranging as much as 20 territories from 1 survey to the next. Despite these extremes, at the end of the season, the surveyors were within four pairs (≈10%) of each other's estimates, which seems very good considering the high density of yellow warbler on this plot. It seems that the intensive surveyor detected most of the pairs present each visit, while the EI surveyor did not, which may be due to different survey techniques of different surveyors. The rapid surveyor showed similar pair estimates as the EI surveyor, but the data here show that two visits were not enough to get an accurate, final estimate of yellow warbler territories. Although the rapid surveyor may have been detecting all birds that were present on the plot on the days they surveyed, there were other birds using that plot that were not detected that affected the final estimate. Also, the rapid surveyor may not have been able to get enough breeding evidence on two visits to determine breeding for some pairs.

In our last example, the Gila woodpecker, all three surveyors recorded consistent numbers of territories on Plot #2856 throughout most of the season (figure 13). The EI surveyor reported similar territory numbers per survey throughout the season until their last few visits. The standard intensive surveyor also reported consistent estimates throughout most of the season but reported on one more territories than the EI surveyor. The rapid surveyor reported consistent numbers for both surveys and reported the same final number of pairs as the EI surveyor. Ultimately, all three surveyors had very similar final territory counts: the rapid and EI surveyors estimated 0.5 territory for the plot, and the intensive surveyor reported 0.75 territory. Gila woodpecker territories are large and often span several plots. On this plot, all surveyors reported several pairs that all had partial territories on the plot.

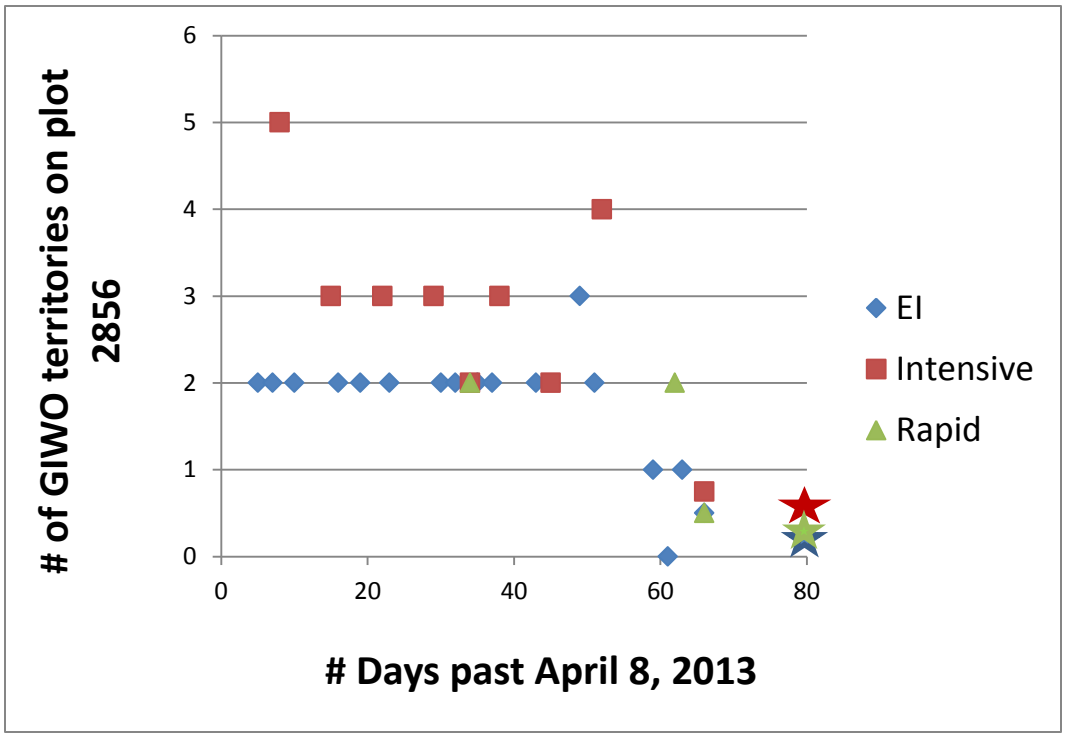

Figure 13.—Comparison of estimated numbers of Gila woodpecker territories using three different survey methods (rapid, standard intensive, and EI area searches) on Plot #2856 in 2013.
The colored stars signify the final number of breeding territories determined by each survey effort at the end of the season.

DISCUSSION

Detection Ratios and Summary Statistics

There are many biological reasons behind why detection rates were different among different sampling efforts (figures 1–5), including onset of breeding, migration arrival time, detectability throughout the season, territory size, breeding habitat, behavior, and parental care. Some of these were elaborated on in the "Results" section. For our final report in 2015, we will continue to explore ways of analyzing the data to find the optimal statistical design to address these differences. For instance, we will explore combining two or more groups of species with similar behavior and ecology to determine if we can find groups with similar detectabilities, which can then be used in a guild detectability approach. This could prove to be beneficial because it would increase the sampling size and potentially stabilize our estimate of population sizes. In addition to grouping by guild, we may explore the data to determine if detection ratios can be grouped for migrants and breeders, late arrivals, and secretive species.

Through the intensive and EI surveys, we also gained a wealth of life history knowledge for many of the riparian species in the project area, including a better understanding of arrival and departure times for migrants, unique calls and songs not previously documented, second clutches and renesting attempts, as well as a better understanding of territory sizes and partial territories. However, we also have to consider any reasons that the EI surveys would provide a biased estimate of certain species' territory numbers. In some cases, there is the possibility that the EI surveyor may have made a less accurate estimate of territory numbers than the rapid or intensive surveyors. While more visits generally yield more information, at times, they can also cause more confusion, especially for very abundant species (song sparrow, Bewick's wren, etc.). Some of the potential sources of confusion include shifting territories, counter-singing migrants that are present for a short period, and the presence of independent young. Although these variables might be a source of confusion for all survey efforts, they might be mitigated in rapid and intensive surveys because these surveyors spend comparatively less time during the season in each territory and may thus run a lower risk of double counting birds or getting confused by the sheer amount of territory data at the end of the season in these high-density sites. The only way we could fully resolve this, hypothetically, is with fully color-marked populations. After performing 3 years of surveys and analyzing the data, however, we still believe that the EI surveys provide the overall best estimate of territory numbers.

When reviewing the 85% confidence intervals, we expected 15% of species to not be included in the average detection ratio based on sampling error, and we indeed found three species outside the average for the intensive survey confidence interval and two species outside the average for the EI survey confidence interval. Natural history and the behavior of individual species can also explain why these

species, which included black-chinned hummingbird, ash-throated flycatcher, and black-tailed gnatcatcher, fell outside the 85% confidence interval. These species are somewhat difficult to survey; for example, the ash-throated flycatcher has large territory sizes and multiple types of vocalizations, and it is easily confused with brown-crested flycatchers. Black-chinned hummingbirds can be difficult to survey because only females are usually detected. Females, however, can be concealed on a nest, and they can be easily misidentified for juveniles or first-year males. Although fairly conspicuous, black-tailed gnatcatcher can be confusing because they have multiple clutches, and thus, independent young and family groups are often moving through the survey plots. The confidence interval for EI surveys also resulted in summer tanager estimates being outside the average confidence interval. Summer tanagers can also be difficult to survey because they arrive late in the season and spend most of their time in the tree canopy, making it more difficult to delineate territory boundaries and observe nesting behavior than in other species.

Habitat Effects

The plots selected for the triple-sampling effort were some of the most challenging plots of the study area, and they are not representative of most of the LCR MSCP project area. This was done in order to increase survey coverage for covered species, which tend to occur in their highest concentrations in plots that are very difficult to survey. Therefore, we attributed many of the discrepancies between the intensive survey and EI survey types to the inherent logistical difficulties of surveying very difficult plots. For instance, the detection ratios reported for first project component showed very little discrepancy between rapid and intensive surveys at habitat creation sites, which are easy to thoroughly cover during area searches. A larger discrepancy between rapid and intensive area searches was reported in systemwide surveys, which typically consist of plots with varying difficulties.

For the hard-to-survey plots, we found a 17% difference between the intensive and EI surveys, suggesting that, in challenging habitats with dense vegetation and/or dense bird territories, intensive surveyors record fewer breeding territories than EI surveyors. The difference on the medium/easy plots (15%) was not statistically significant, but the mean and most of the 90% confidence interval fell below zero. Most of the systemwide plots are in the easy or moderately difficult habitat categories, which were not sampled in the EI component, and thus, the EI study probably measured the worst-case scenario for monitoring today's bird populations of the LCR. It is important to note that the habitat effects on sampling for systemwide and habitat creation population estimates are likely not large.

Effects of Survey Methods

Based on our data, the intensive surveys captured ≈84% of the territories on a plot as determined by the EI study. Therefore, the error of the population estimates is relatively low. One way to refine the sampling plan is to increase the number of visits slightly, for example, from 8 to 10 visits, for the intensive surveys to determine if territory estimates are affected by this increase. Another option could be to isolate the difficult to survey species and simply set lower monitoring goals for these species, particularly if they are not covered by the LCR MSCP. Removing these difficult to survey species from the detectability analyses would possibly also improve detectability estimates for groups in which they were included previously. In the descriptions of the natural histories of each of the covered species and the most common other riparian obligate species, below, we provide possible reasons for the different survey intensities providing different territory number estimates.

Another topic for discussion is whether the current rules for classifying a breeder during intensive and rapid surveys would be worth revisiting. Different rules for different species would be ideal, but they would likely introduce confusion and surveyor error. Whether some species groupings could be treated differently can be further explored using the natural history knowledge we have gained over several years of intensive surveys (see "Natural History Effects on Species Detectabilities," below). Field surveyors also brought to our attention that the classification rules for intensive, compared with those for EI, present more of a challenge in that the intensive surveyors had to classify breeders more conservatively than EI surveyors. This is mainly due to the low number of surveys (8 visits) for intensive surveys compared to the EI surveys (16 visits). Because the current classification as breeders largely depends on the number of visits during which a bird was observed on a territory, an increase in visits for intensive surveys may also include a revision of setting the rules for how many repeat visits with birds on a territory are needed for this classification. Inherently, the EI surveyors had more data and more visits to determine breeding status, so even though the ratio of classification rules is the same for each survey type, EI surveyors have an easier time determining the breeding status.

Natural History Effects on Species Detectabilities

In this section, we discuss the main issues that may affect detectability of the covered species and other common riparian breeders that we have learned from conducting many years of area searches. We emphasize again that the factors that may affect detectability discussed here are expected to affect difficult-to-survey plots with high bird densities the most, and low density plots in open vegetation show low differences in territory number estimates among different survey intensities.

Covered Species

Bell's Vireo

Results: EI, intensive, and rapid surveys recorded very similar estimates of Bell's vireo territories.

Factors that may influence such similar numbers:

- Although at times these little guys can be difficult to see, when they are breeding in an area, they almost continuously vocalize.
- Sing throughout the breeding season and most of the day.
- Show strong site fidelity and will often sing from the same perch or the same tree day after day.
- Are known to sing while on their nests.

Training best practices:

- Our surveyor techniques for this species appear to be doing incredibly well.
- Stay consistent with our past training techniques.
- Make certain the crew learns the song of the Bell's vireo.
- Discuss species they could potentially visually confuse Bell's vireos with, specifically juvenile verdin and black-tailed gnatcatchers.

Gila Woodpecker

Results: Intensive surveys underestimated (rapid and EI surveyors obtained similar numbers of territories).

Factors that may cause low intensive survey numbers:

- Vocalizations and drumming can be difficult to interpret, as both members of a pair engage in these behaviors.
- This species has large territories that can overlap with other Gila woodpecker foraging areas, which can be confusing when delineating territories.

Training best practices:

- Particular attention should be paid to this species' biology.
- Project managers should discuss territory size and breeding behaviors in detail.
- Surveyors should review EI maps to familiarize themselves with typical territory layouts.
- Project managers should cover vocalizations and differences (or lack thereof) between the sexes.
- Breeding evidence is difficult to obtain without a nest location, and *revision to rules for classifying breeders* may be explored.
- When partial territories are present on the plot, the rapid surveyors are more likely to assign 50% territories than 25% territories. This problem should be discussed in training.

Sonoran Yellow Warbler

Results: Rapid surveys overestimated, and intensive surveys underestimated.

Factors that may cause high rapid survey numbers:

- Breeders arrive in late March, and migrants usually arrive later (after mid-April).
- Detection of singing migrants on rapid surveys likely inflates numbers.
- Rapid surveyors commonly reported breeding evidence from individuals that were likely migrants, as these often show territorial behaviors; these records likely inflate territory estimates.
- Misidentifications were harder to revise for rapid surveyors because they have less opportunity to observe individual birds.

Factors that may cause low intensive survey numbers:

- Intensive surveyors may be confused by very high densities of this species in some sites, which are further complicated by small territory sizes and the presence of migrants.

- On breezy days, this species is often quiet and may therefore not be detected, which affects the rules for classifying them as breeders.

Training best practices:

- This species needs to be discussed thoroughly in its migration and breeding phenology and territorial behaviors.

- Differences between the songs and habitat use of yellow warbler and Lucy's warbler need to be thoroughly covered.

- Rapid surveyors should be careful about counting territories away from willows and spend time looking for breeding evidence to rule out misidentification.

- Timing and behavior should also be considered when deciding whether or not to count a territory.

- Project managers should continue to stress that this is a difficult and important species despite its familiarity to most crews.

Summer Tanager

Results: Rapid surveys underestimated by a fair amount as do intensive surveys.

Factors that may cause low rapid and intensive survey numbers:

- This species is a migrant that arrives in the study area around mid-April; therefore, it can be absent on the first visits to a plot.

- Males only sing for a brief period in spring and are typically quiet once they have a nest.

- This species' song can be confused with black-headed grosbeak, which commonly occurs as a migrant in the project area.

- Summer tanager vocalizations can also be confused with migrating western tanagers, although summer tanagers call more frequently throughout the season.

- Summer tanager counter-singing is fairly rare, which makes it difficult to delineate territory boundaries.

- Females are cryptic and seldom seen during breeding.

- This species is a canopy species with regard to most of its behaviors and thus difficult to observe.

- Territory size can fluctuate over the course of the season.

- This species often only sings before dawn.

Training best practices:

- Once detected, surveyors should spend as much time with these birds as possible.

- Surveyors should learn how to distinguish the summer tanager song from black-headed grosbeak, a common migrant during the surveys.

- Surveyors should learn how to distinguish summer tanager calls and female morphology from those of western tanager, a common migrant during the surveys.

- Surveys in appropriate habitat should be timed to correspond with peak singing (mid- to late April).

- Project managers should also emphasize calls, including soft calls during training.

- One detection on one survey is not enough to call the summer tanager a breeder, and females are secretive. Therefore, many summer tanagers are declared non-breeders on rapid surveys.

- Due to migrants moving through the plots, rules for the rapid surveys have to be strict for this species.

- This species arrives a little earlier than other late-nesting species, so except for the very earliest surveys, birds should be on a territory in the early and late survey season (after mid- to late April).

- Potentially, rules for determining a breeder should be relaxed when behavior and habitat seem appropriate and the surveyor provides a solid identification.

Other Riparian Obligate Species

Abert's Towhee

Results: Rapid and intensive surveys underestimated by a small amount.

Factors that may cause low rapid and intensive survey numbers:

- The first few surveys to a plot are most useful in determining how many towhee territories are on the plot because once family groups move around, it is very difficult to discern individual territories.

- This species can also be very quiet for long periods of time during nesting and, therefore, could be easily missed during the first surveys to the plot. This might be the reason why the numbers for rapid and intensive surveys are slightly lower than for EI surveys (the EI surveyors simply had more opportunities to record individual territories at the beginning of the season).

- This species also stays within a small area while nest building and incubating. If this area is mostly off a plot, this species might be easily missed during the first visits to a plot.

- Once the young have fledged, the family group is not only very vocal but expands their area of activity. This means that on the second rapid survey or later visits to plots for intensive surveys, towhees can suddenly appear where there were none detected before, adding to the confusion of territory delineation.

- Unfortunately, with squeak duets occurring between various family members across a plot, it is essentially impossible to distinguish the squeak duets of one family group from those of another, and surveyors perhaps have the tendency to assume that all "squeaking" towhees are from a single family group. This possible inability to distinguish between different family groups would result in the rapid and intensive surveyor determining fewer towhee territories than the EI surveyor, who has more chances to detect quiet towhees during the first half of the season and distinguish between breeding pairs.

Training best practices:

- To get a better sense of how many pairs are actually on a plot, surveyors should be instructed to try to follow individuals when possible, particularly early in the season.

- Study territory sizes from years past (often smaller than surveyors expect).

- Address how to deal with wandering family groups. Abert's towhees often remain close to the nesting area early in the nesting cycle.

- Since this species can maintain a territory across several seasons, clarify how to identify family groups for this species during training.

- Specify that family groups can be counted as breeders, as they are non-migratory and tend to stay on the same territory across seasons.

- Territory mapping/partial territories: Territories can be very difficult to map, as towhees are most easily detected during the second half of the season when they are family groups. Perhaps boundary determinations should be weighted on data collected during the earlier part of the season, before the family groups occur.

- Rapid surveys do not provide as much opportunity to roam off plot and determine partial territories. The rapid surveyor usually focuses their attention on the area in a plot to try and determine the plot territories as accurately as possible. Therefore, the surveyor may only notice towhees when they are on a plot, and birds that in reality have a 75% or even 50% territory may be given a 100% territory. Intensive surveys provide more time for refinement, meaning that 25% and 75% territories are more likely to be assigned in intensive compared to rapid surveys. With rapid surveys favoring 100% and 50% territories and intensive surveys allowing for refinements that include 75% and 25%, it is understandable how rapid surveyors could estimate higher average territory numbers than do intensive surveyors.

Anna's Hummingbird

Results: Intensives surveys slightly overestimated territory numbers.

Factors that may cause high estimates from intensive surveys:

- Males often depart the nesting area around late April, leaving only females to detect.

- The intensive surveyor may underestimate territory size, including partial territories.

Training best practices:

- This species always get special attention during training since their breeding biology and detection situations are much different than most of the passerines we focus on for this project, particularly their unusual territorial behaviors and territory sizes, and the fact that males mate with multiple females and sometimes maintain a territory during nesting but sometimes leave the area altogether.

Ash-Throated Flycatcher

Results: Rapid surveys slightly underestimated, and intensive surveys slightly overestimated.

Factors that may cause low rapid survey numbers:

- This species departs in early May especially in areas were brown-crested flycatchers are present.

- Males tend to sing early in the morning and early in the season and can be very quiet otherwise.

- The territory of this species tends to be large, and a breeding bird might not be present on a plot during both rapid surveys even if part of its territory is in a plot.

Factors that may cause high estimates from intensive surveys:

- Intensive surveyors may have underestimated territory size.

- Possible confusion with brown-crested flycatcher at the end of the season, which the intensive surveys actually underestimated. Since ash-throated flycatchers are early breeders, there might be a problem with young moving about, which causes the intensive surveyor to overestimate territory numbers.

- Some may have a second nesting attempt at the end of the season, which could also inflate the intensive surveyors' estimates.

Training best practices:

- Surveyors should focus on identification differences between ash-throated and brown-crested flycatcher.

- Surveyors should focus on differences in vocalizations to distinguish territorial male vocalizations from other vocalizations.

- Project managers should emphasize the importance of keeping track of vocalization types for this species and recording these vocalizations on daily survey maps.

- Project managers should teach, in detail, what the vocalizations potentially mean. For example, the loud "Ka-BREER" of males is great to help delineate a territory, especially if two males are calling at the same time, which helps determine territory boundaries. Other vocalizations (such as soft pik calls) seem to only be given near the nest. Another vocalization ("Pretty Bob") seems to be female specific and cannot only be used to help distinguish a breeding pair but also to find the area of the nest.

- Surveyors should look at past EI and intensive survey maps to get a better idea of territory size and variation throughout the LCR.

- *Rules for classifying breeders could be refined for this species* by allowing them to be counted as breeders if detected only on the first survey but showing signs of being on territory. There is, however, some concern about migrants/wintering birds very early in the season.

Bewick's Wren

Results: Rapid and intensive surveys both underestimated.

Factors that may cause low rapid and intensive survey numbers:

- This species can be difficult to count, as they are rarely observed visually, and their young often move around a plot.

- This species is easily misidentified as song sparrows.

Training best practices:

- Instruct surveyors to listen carefully for counter-singing. When possible, try to cover an area twice in case counter-singing is occurring later in the morning.

- Test surveyors on local Bewick's wren and song sparrow calls and songs.

Black-Chinned Hummingbird

Results: Rapid surveys underestimated (and EI and intensive surveys differed by less than a territory).

Factors that may cause low rapid survey numbers:

- Males depart around mid-May, females and young remain until late May, and therefore, males may not have been present for the second survey.
- Because females build the nest and care for young alone, this species can easily be missed on a rapid survey.
- Intensive and EI surveyors have time to search for nests to determine the number of breeding females, while rapid surveyors have to rely mostly on easily visible adult behaviors.
- Even sightings of females without finding nests may lead surveyors to underestimate territory numbers, as nests are sometimes very close to others.
- This species is also a migrant in the area, and it is often classified as a non-breeder/migrant on a rapid survey because breeding evidence is difficult to obtain.
- This species is territorial during migration, making it difficult to distinguish migrants from breeders.
- Since males provide no parental care, they can have large territories and spend time defending multiple females rather than a single territory, which may result in birds being missed during just two visits to a plot.
- It can be very difficult/impossible to distinguish a hatch-year bird from a breeding female in the field. Therefore, any female-type bird is usually classified as a non-breeder unless breeding behavior is observed, which is rare.
- Territory mapping can be very difficult for this species due to a combination of some birds being migrants, hatch-year birds present later in the season, and similar hummingbird species display similar territorial behaviors.

Training best practices:

- We place special focus on hummingbirds during training and will continue to do so.

- Hummingbird identification, particularly of females and hatch-year birds, can be tricky. Project managers should focus training on species identification by size, shape, behavior, and vocalizations.

- Project managers should review hummingbird begging calls, as these can be heard and used to confirm breeding even if the nest is never actually located.

- Project managers should review hummingbird flight displays in detail during crew training.

- Project managers should discuss, in detail, territoriality and breeding biology of this species.

- Surveyors should always follow females when time allows.

- Rapid surveyors should make a targeted effort to relocate birds on the second survey, focusing on females in both visits.

Black-Tailed Gnatcatcher

Results: Rapid surveys slightly overestimated, intensive surveys underestimated.

Factors that may cause variation among rapid and intensive surveys:

- Dispersing and independent young may lead to confusion, possibly leading intensive surveyors to be more conservative and rapid surveyors to be more liberal when assigning territories.

Factors that may cause high rapid survey numbers:

- Independent young are present by the second visit for rapid surveys, which can cause confusion and result in being called a separate territory.

- The territorial behavior of males makes them easy to detect, and even a rapid surveyor should be able to detect most gnatcatchers on a plot. However, unless the surveyor is able to follow each black-tailed gnatcatcher from one location to another, it is hard to tell which of the multiple detections is associated with which territory, and a rapid surveyor might break up multiple detections into more territories than are present.

- Detections are frequently only by ear, and rapid surveyors may record some juvenile detections as new territories.

- This species appears to shift their territories on their second brood, making it more likely to be recorded as an additional territory.

- Males and females usually split their group of young to forage in different areas of a territory, which can cause the surveyor to believe that there are multiple territories.

Factors that may cause low intensive survey numbers:

- Intensive surveyors possibly gave smaller partial territories within plots if they assumed territories to be larger than they really were.

- This species can be "skulky" and difficult to follow.

- This species often moves to a new territory after raising their first clutch to build a second nest. Therefore, at the end of the season, a surveyor can have gnatcatchers in new areas where they may or may not be nesting, which can be difficult to determine at the end of the season given the rules for classifying breeders.

Training best practices:

- Surveyors should study, in detail, the differences between juveniles and females, focusing on feather quality, which can be determined visually.

- Project managers should treat this as a difficult species in their training.

- Surveyors should try to follow individual birds, as nests are usually fairly easy to confirm.

- Surveyors need to realize that this species often has multiple clutches and that their territory may shift somewhat throughout the breeding season.

- Surveyors should thus spend time determining if a new bird is actually truly a new bird or one that just shifted its territory for a second clutch. This can be done by trying to account for all birds recorded on previous visits to a plot and determining which stage each territory is within their breeding cycle at the current visit to ascertain possible renesting attempts. If nests failed, renesting attempts are also expected.

Blue Grosbeak

Results: Rapid surveys underestimated (intensive and EI surveyors had less than a territory difference).

Factors that may cause low rapid survey numbers:

- Males begin to arrive mid-April, but breeding activities usually only commence in May; therefore, the rapid surveyor may miss this species on the first visit.

- Fairly late breeding allows for additional opportunities for EI and intensive surveyors to detect them and get breeding evidence.

- This species has relatively complex territorial behaviors, especially in high-density areas where floating males attempt to establish territories near breeders. Despite the fact that they are not nesting, they may get counted as a breeding territory in the more intensive survey types, as they appear to defend a nesting territory.

Training best practices:

- Migration and breeding phenology need to be discussed in some detail.

- Project managers should discuss, in detail, the grosbeak's complex territorial behaviors.

- *Potential revisions to the rules for assigning breeders* in this species may include the possibility of determining breeders based on just the later rapid survey visit.

- Unless a pair is observed together, it can be difficult to distinguish a breeding male from one that is just moving through a plot.

Brown-Crested Flycatcher

Results: Rapid and intensive surveys underestimated.

Factors that may cause low rapid and intensive survey numbers:

- Species arrives only in late April and, therefore, might be missed on first survey visits.

- This species can take over ash-throated flycatcher territories, and this might go unnoticed by the surveyor because the two species are easily confused.

- This species is often not vocal; thus, EI surveyors were more likely to catch rare instances of counter-singing or territorial disputes.

- EI surveyors had more opportunities to correct misidentifications.

Training best practices:

- Project managers should emphasize differences between brown-crested and ash-throated flycatchers to prevent misidentifications.

- The timing of migration and its effects on classifying breeders, which are only present in May and June, need to be discussed.

- *Potential revisions to rules for classifying breeders* include exploring options under which conditions birds can be classified as breeders based on just the second rapid survey visit.

Common Yellowthroat

Results: Rapid and intensive surveys underestimated.

Factors that may affect low rapid and intensive survey numbers:

- This species is confusing to surveyors because of the possible presence of migrants and winter residents with breeders on a plot. Breeders typically arrive in mid-April to early May.

- This species is mostly migratory, but a small number of birds winter in the study area; both wintering and migrant individuals sing in the study area early in the season.

- This species will nest in poorly accessible marshes, and is often difficult to detect them visually.

- EI surveyors have more opportunities to confirm breeding by observing counter-singing, which is potentially missed by rapid and intensive surveyors.

- Changing water levels and growing herbaceous vegetation can cause territory abandonment and territory shifts during the survey season.

- Females tend to be secretive and "skulky" during the breeding season, so confirming the presence of a pair is difficult, especially for rapid surveyors.

- This species becomes quiet and sings much less frequently after 8 a.m.

Training best practices:

- Counter-singing and male "rattle" calls are commonly observed and provide good cues to territories (males will often counter-rattle as well).

- According to published literature, display flights are only performed by a breeding bird, and training should thus include identification of these flights.

- *Potential revisions to the rules for classifying breeders* of this species should be considered as for other later breeders.

- The revised rules may include accepting the simple presence of a territory as breeding evidence for areas where common yellowthroats are known to be common breeders. Otherwise, rapid surveyors will have no choice but to declare most common yellowthroats non-breeders based on insufficient breeding evidence.

Crissal Thrasher

Results: Rapid and intensive surveys underestimated.

Factors that may cause low rapid and intensive survey numbers:

- This species raises two broods along the Colorado River but only sings during two short periods of the season.

- This species is particularly cryptic and shy, and it is often quieter when raising a second brood.

- EI surveyors are more likely to catch the short singing periods than are surveyors with less frequent visits.

- This species has relatively large territories and might be missed if a large part of their territory is off a plot.

Training best practices:

- Discuss thoroughly the territory sizes for this species.
- Go over the difficulty of this species' song and potential confusion with northern mockingbird songs.
- Talk about the importance of using the crissal thrasher call notes for distinguishing species.
- Plots with desert/riparian edges are likely to have this species and should be surveyed earlier in the season to maximize detections of crissal thrasher.
- Desert edges should be covered early in the morning to maximize the chances of hearing crissal thrashers on a survey.
- Surveyors should be very familiar with the plumage differences between juveniles and adults.
- This species is extremely sedentary, so migrants are not a concern; however, independent young may remain on plots throughout the season.

Lesser Goldfinch

Results: Rapid surveys underestimated slightly, and intensive surveys underestimated by more.

Factors that may cause low rapid and intensive survey numbers:

- Migration in this species is poorly understood and fluctuates from year to year.
- This species generally departs in late April to early May and forms flocks before leaving, so they are frequently not seen on second rapid surveys.
- This species is an early breeder, and birds might have left by the second rapid survey and the second half of the intensive surveys, which may have prevented both surveyors from classifying breeders that were present earlier.
- Males typically sing very early in the season and are therefore easy to miss; singing is one of the best indications of breeding activity.

- Males only defend the female and the nest site, but they do not maintain a typical breeding territory as other passerines do, which makes them hard to track.

- Therefore, the best way to get an accurate estimate of territories is to find nests, which is extremely difficult in this species.

Training best practices:

- Focus, in detail, on goldfinch song and discuss the life history of this species (early breeders leave sites early).

- Surveyors should focus closely on evidence of breeding behavior and be aware of the restricted territory use.

- *Possibly relax rules for classifying breeders* for rapid surveyors because this species often leaves the site before the surveyors' second visit to a plot, which has poorly defined territories.

Lucy's Warbler

Results: Rapid and intensive surveys underestimated.

Factors that may cause low rapid and intensive survey numbers:

- Singing and counter-singing are extremely limited in duration and coincide only with parts of the breeding cycle; this species, therefore, can be easily missed by both rapid and intensive surveyors.

- Song is similar to yellow warbler, which can be confusing, especially in areas where both species occur.

- EI surveyors were more likely to catch singing and counter-singing events and therefore were able to record more territories.

- EI surveyors had more time to establish correct species identification, distinguishing this species from yellow warbler and other migrating warblers with similar songs.

- Migrating Lucy's warblers can move through sites in large numbers, especially family groups at the end of the season, adding to the confusion. This can make it difficult for a rapid surveyor to interpret observations from the two visits.

Training best practices:

- This species needs to be discussed in detail because poor data collection also affects estimates of other species, particularly yellow warbler.
- The differences between Lucy's and yellow warbler songs needs to be emphasized at training and reviewed throughout the season.
- Focus also on habitat differences among the two species, with Lucy's warbler being more of a habitat generalist than the yellow warbler.
- Stress that surveyors should focus their efforts on singing Lucy's warblers whenever they have the opportunity because it may be first and only time they are observed/detected at all.
- Surveyors need to learn the distinctive begging call of Lucy's warblers.
- Stress the difference between songs of Lucy's warbler and common migrant warblers, such as Audubon's, yellow, and Virginia's warbler.
- Surveyors should focus their efforts on Lucy's warbler in the early morning hours because they quiet down quickly later in the morning.
- It should be explored *if the rules for classifying breeders should be relaxed* for this species early in the season.
- Late in the season, individuals may wander, and independent young will appear. During the first half of the season, a Lucy's warbler detection almost certainly pertains to an adult on a territory.

Verdin

Results: Rapid and intensive surveys underestimated.

Factors that may cause low rapid and intensive survey numbers:

- Counter-singing might be missed on fewer visits to a plot.
- Actual territory sizes might be smaller than estimated by rapid and intensive surveyors.
- Males and females look alike, making it difficult to confirm a pair in a territory.

- Even if two of this species are observed at the same time, it can sometimes be difficult to distinguish between rival males and a mated pair.

- This species builds alternate nests, which adds the challenge of distinguishing a non-breeding nest from a breeding nest.

- This species can wander far from their territory for foraging, especially in open habitats.

Training best practices:

- As with crissal thrasher, desert edge plots should be surveyed early in the season when possible.

- Territory size should be discussed in detail during training.

- Surveyors should try to get a visual sighting of birds, especially later in the season, to ensure that independent young are not counted as new or separate territories.

Yellow-Breasted Chat

Results: Rapid surveys underestimated slightly, and intensive surveys underestimated by a lot.

Factors that may cause low rapid and intensive survey numbers:

- This species begins to arrive mid-April, but territories are often not established until around mid-May; therefore, this species might be missed or absent during the first surveys.

- It can be difficult to delineate territories for this species due to its late arrival and often high densities.

- This species counter-sings infrequently during the day.

- Territoriality is somewhat poorly defined, and individuals tend to wander outside territory boundaries.

- Singing chats are sometimes difficult to locate precisely.

- This species is a mimics other species and has been described as a "ventriloquist," meaning that it has highly variable and sometimes obscure vocalizations.

Training best practices:

- Spend time with crew discussing counter-singing. Surveyors should focus on this species early in the morning and listen for counter-singing. Detections of counter-singing males is absolutely critical for territory delineation.

- Surveyors should look at maps of territory sizes form surveys performed in previous years.

- Birds are not likely to be on a territory until around mid-May, so surveyors should take this into account, and *perhaps the rules for classifying breeders need to be relaxed accordingly*.

- Intensive surveyors may have to accept a cluster of regular singing as a confirmation of a territory even if counter-singing was never heard, since this is not a highly territorial species.

Component 4: Habitat Surveys

The goal of component 4 was to perform a detailed habitat assessment for four LCR MSCP covered species: Gila woodpecker, Arizona Bell's vireo, Sonoran yellow warbler, and summer tanager. For each species, this assessment was conducted in locations where the species has been documented to occur and in paired locations 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 the past 3 years (2011–13), we collected habitat data at 10 locations per year for each of these species where it was present ("use plots") and 10 locations where it was absent ("non-use plots"). 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) inside territories in 6 of the 10 use sites and in non-use sites for each of the 4 species. The vegetation and HOBO data collected over the 5-year project component will be combined and summarized together in the 2015 final report. In this report, we describe the methods that are currently used for selecting habitat assessment plots and summarize the 2013 data collection effort.

METHODS

Vegetation Plot Selection

The habitat assessment followed the LCR MSCP vegetation monitoring protocol, and a detailed protocol for vegetation plot selection is presented in attachment 9. The methods for conducting vegetation surveys were established by Reclamation and have been implemented for this project since 2011. Vegetation plots were selected using information on territory size and locations for the covered species using data obtained during the previous bird season. Specifically, we randomly selected vegetation plot locations within breeding bird territories that were delineated in ArcGIS during the bird season. For each territory, we selected one vegetation plot for every 2 acres, with a maximum number of 5 vegetation plots per territory.

Prior to 2013, half of the use plots were selected randomly from territories recorded during EI and standard intensive surveys, and the remaining territories were selected with a random sample from all survey types (rapid, intensive, and EI plots). We weighted the sample toward standard intensive and EI territories because more precise territory delineations were available from these surveys compared to rapid surveys. In 2013, however, we refined the sampling scheme by

selecting bird territories using a stratified random sampling design, with strata defined by geographic location and habitat type. The original weighting scheme became difficult to implement using this new sampling design combined with the requirement that the vegetation plots selected could not overlap vegetation plots surveyed in previous years. Therefore, after consultation with Reclamation, we kept the sample weighting flexible enough to allow for more rapid survey plots, and these were only used if the targeted territories were delineated from more than two data points.

The following section lists the weighting guidelines developed by Reclamation for different species, which we implemented to the extent possible given limited sample sizes in some strata. The weighting scheme was determined based on the distribution of the covered species' delineated territories that were recorded in 2011 and 2012 for each region of the river and habitat stratum.

Summer tanager: 7 in Region 7 (5–6 in tall woody and 1–2 in low woody) and 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 and 2 in low woody), 2 in Region 6, and 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 and 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 and 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 in 2013, all territories that were recorded for the four covered species in 2013 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 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 polygon 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 EI, intensive, and/or rapid surveyors recorded the same bird. Whichever surveyor's data were randomly selected first was used, 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). For territories detected in rapid survey plots, we only used those delineated with more than two observation points.

Once all territories were vetted in ArcGIS and final territories selected for vegetation assessment, we created minimum convex polygons (MCP) for the selected territories. We then calculated the total area of each territory within these MCPs 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 the number of points 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. 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 three 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. Nearest region was always used as the first selection criterion and nearest habitat type as the second.

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. We then compared the locations of the selected non-use plots, and if we found overlapping plots among two species, then a single vegetation survey was conducted and used for both species.

In some cases, a plot was randomly selected as a non-use plot for one species but was also a use plot for another species. In consultation with Reclamation, it was determined that we could combine the vegetation surveys for both species. For example, bird survey Plot #S9125 was selected as a non-use plot for Bell's vireo, but a summer tanager territory made it a use site for that species; in this case, a single vegetation survey was conducted to serve both as a use plot for summer tanager and a non-use plot for Bell's vireo.

Creating Vegetation Plots Using a Geographic Information System

We combined the shapefiles for use, non-use, and backup plot centers into one shapefile with the following attributes: Plot_Id, Survey, Species, Terrcode, Surveyor, Survey_typ, HOBO, and *x* and *y* coordinates. From this vegetation center plot feature class, we created the 40 by 10-meter plot polygons using the Geospatial Modeling Environment (GME). GME is a platform designed to help facilitate rigorous spatial analysis and modeling. The generated polygon requires a set of input points, a shape, and a dimension by radius. We used the optional rotation, so that all the vegetation plots along the river would be established in the same orientation. The polygon used was a rectangle with the dimension by radius of 20 by 5 meters because the rectangle requirements are 40 by 10 meters. We used Excel to select a random number between 1 and 360 for the bearing of the plots. The GME rotation is not based on a bearing but a rotation of the x (width) and y (height). To translate the compass bearing into a GME rotation, we subtracted the bearing from 450. Once all the plots were created, it was necessary to do a spatial join with the center points and export the newly created plot shapefile that was fully attributed (Plot_Id, Survey, Species, Terrcode, Surveyor, Survey_typ, HOBO, and *x* and *y* coordinates). We then also added the attributes Crosswalk and Keep. After all the vegetation plots were created prior to field work, the plots were reviewed using aerial imagery in ArcMap to determine whether or not they could 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 9 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 field, 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, squatters, or extremely steep terrain). Typically, safety concerns could only be determined by the crew once they were in the field.

Before 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 and included in the Access database. 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 where the 2013 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 meters 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 HOBO environmental data loggers. We covered each HOBO unit with a RS1 Solar Radiation Shield and secured it onto a fencepost approximately 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. 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 and HOBO locations were created through the methods discussed above, we submitted these shapefiles and Excel spreadsheets to Reclamation for vegetation plot creation.

Vegetation Plots Selected in 2013

For the 2013 season, we surveyed a total of 90 vegetation plots, including 59 use and 31 non-use plots (tables 42–45). Nine plots overlapped among species plot selections (see above). Specifically, we surveyed 10 use and 10 non-use plots for Bell's vireo within 4 regions and 4 habitat types (table 42) and 22 use and 10 non-use plots for Gila woodpecker within 5 regions and 4 habitat types (table 43). We also surveyed 17 use and 10 non-use plots for summer tanager within 4 regions and 3 habitat types (table 44) and 10 use and 10 non-use plots for yellow warbler within 5 regions and4 habitat types (table 45).

To ensure data quality and completeness, the crew supervisor examined all the data sheets in the field to ensure that all fields were filled out completely and correctly. Additionally, crew members worked in teams of two to enter data, proofing the data while entering them. Lastly, a third person vetted 100% of the data sheets by comparing each entry on the data sheet to its record in Access.

Table 42.—Number of vegetation plots selected by region and habitat for Bell's vireo at use and non-use sites
(Habitat codes: H = herbaceous, LW = low woody, TW = tall woody, and U = unknown)

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

Table 43.—Number of vegetation plots selected by region and habitat for Gila woodpecker at use and non-use sites
(Habitat codes: H = herbaceous, LW = low woody, TW = tall woody, and U = unknown)

	Region 6	Region 7	Region 10	Region 11	Region 12	Total
Non-use total	**6**	**0**	**1**	**1**	**2**	**10**
Habitat LW	2	0	0	1	1	4
Habitat TW	4	0	0	0	1	5
Habitat U	0	0	1	0	0	1
Use total	**1**	**18**	**0**	**1**	**2**	**22**
Habitat H	1	0	0	0	1	2
Habitat LW	0	10	0	1	0	11
Habitat TW	0	8	0	0	1	9
Total	**7**	**18**	**1**	**2**	**4**	**32**

Table 44.—Number of vegetation plots selected by region and habitat for summer tanager at use and non-use sites
(Habitat codes: LW = low woody, TW = tall woody, and U = unknown)

	Region 6	Region 7	Region 8	Region 9	Total
Non-use total	**3**	**5**	**1**	**1**	**10**
Habitat LW	0	2	0	0	2
Habitat TW	3	2	1	1	7
Habitat U	0	1	0	0	1
Use total	**1**	**12**	**1**	**3**	**17**
Habitat LW	1	5	0	0	6
Habitat TW	0	7	1	3	11
Total	**4**	**17**	**2**	**4**	**27**

Table 45.—Number of vegetation plots selected by region and habitat for yellow warbler at use and non-use sites
(Habitat codes: H = herbaceous, LW = low woody, TW = tall woody, and U = unknown)

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

Component 5: Monitoring Impacts of Saltcedar Beetle on Riparian Bird Populations

INTRODUCTION

The saltcedar beetle was released in St. George, Utah, in 2006. Defoliation of saltcedar stands of the Virgin River due to the beetle was subsequently noted in 2008–11 (McLeod and Koronkiewicz 2009, 2010; Dobbs et al. 2011; McLeod and Pellegrini 2011), and saltcedar defoliation at southwestern willow flycatcher monitoring sites at the Virgin River appears to be near 100% (McLeod and Koronkiewicz 2009, 2010; McLeod and Pellegrini 2011). The first year after defoliation occurred, high rates of willow flycatcher nest abandonment and failure were observed in affected areas. Willow flycatcher breeding at these sites continues, but territories are generally no longer established within saltcedar stands and have been relocated into native vegetation (McLeod and Koronkiewicz 2009, 2010; McLeod and Pellegrini 2011). The beetle is colonizing new sites, moving downstream from the release site, and it has recently been reported as far south as Lake Mohave.

The beetle is spreading from its release site faster than the original estimated diffusion rate likely due to their tendency to undergo so-called Lévy flights. Lévy flights are initiated by a male aggression pheromone, which leads to long-range dispersal flights by reproductive adults (Nagler et al. 2014). The rapid movement of the beetle along the river system might not allow enough time for suitable native vegetation to replace saltcedar, making sufficient nesting substrates unavailable for several riparian species. Nagler et al. (2014) also attempted to track the beetles' progression with the aid of remote sensing using satellite-based vegetation indices (Moderate Resolution Imaging Spectrometer [MODIS] imagery). Their research showed that MODIS could potentially be developed as an effective tool for monitoring beetle damage.

No comprehensive monitoring program is currently in place for the colonization by saltcedar beetles (Bateman et al. 2013), and because its arrival in the southwest was so recent, little research has been completed on its effects on birds nesting in saltcedar. There were attempts by the Tamarisk Coalition to create a standardized saltcedar beetle monitoring protocol, but we are not sure if and when it is being used at this time in the project area. It is also unknown what the eventual equilibrium state for saltcedar beetles and their host will be and how it will affect nesting and migrating birds in the long term.

In light of its documented effects on nesting willow flycatchers, the defoliation of saltcedar is also predicted to impact other riparian birds depending on their species-specific sensitivity to cover loss, amount of defoliation and mortality in

saltcedar stands, and the presence or absence of other riparian shrub and tree cover (Paxton et al. 2011). Other species-specific factors, such as timing of nesting relative to the onset of defoliation, degree of nest site fidelity, dependence on saltcedar for nesting, and other life history based requirements, likely also play a role in the response of riparian birds. Therefore, it is possible that if riparian restoration projects that remove saltcedar, without compensating by adding nearby high-quality native riparian habitat, may actually reduce the habitat value for riparian birds (Sogge et al. 2008).

To study the effects of saltcedar beetles on riparian birds of the LCR MSCP, we began monitoring potential impacts in the LCR MSCP planning area in 2013 by surveying populations of multiple bird species within sites that were previously delineated for monitoring the southwestern willow flycatcher. The study is located in the center of the area that is currently being invaded by the saltcedar beetle, and effects of defoliation can therefore be studied as the impact unfolds. Impacts of defoliation may be sudden (e.g., by nests being exposed to the sun and high temperatures and by insect populations being depressed by sun exposure) or they may occur over time by suitable habitat becoming less and less available because of the lack of canopy cover and the lack of recruitment of other suitable vegetation. The potential impacts to riparian birds are measured in two ways in component 5 of this project: (1) by comparing bird population metrics, such as bird and territory densities, among sites that have and have not yet been invaded by the beetle; and (2) by comparing these metrics over time for sites before and after beetle invasion. As a 3-year study, component 5 will focus most of its analysis efforts on comparisons between sites were the beetle is present and sites where it is absent.

METHODS

Plot Selection

Reclamation identified previously delineated southwestern willow flycatcher monitoring sites as suitable focal areas for this study, and these represented high-quality saltcedar or mixed native/non-native stands with a diverse community of other riparian birds, including some of the LCR MSCP covered species. Three regions were identified for study within the LCR MSCP planning area: the Virgin River (Region 2), which has already shown signs of defoliation; Topock Marsh (Region 6); and the Bill Williams River (Region 7), which have not yet been affected by the beetle.

We used the systemwide riparian bird plot layer (see component 1) to determine study plots within the willow flycatcher plots. For the Bill Williams River and Topock Marsh sites, we used the 2010 plot layer (Bart et al. 2010), which was clipped to the LCR MSCP project boundary and therefore excluded the Virgin

River. For the Virgin River area, we therefore used the original 2007 plot layer (Bart et al. 2007) that extended into the Virgin River corridor. Plots from these two layers were very similar in size and shape but differed in their vegetation type delineations, which did not affect the study design for this component.

Using ArcGIS 10.1, we overlayed the stitched riparian bird plot layer with the willow flycatcher plot 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 plot layer for this study. The total number and individual identification numbers of riparian bird plots selected this way are listed in table 46. Attachment 1 – figure 1-3 shows an example of how the riparian bird plot grid was overlaid with willow flycatcher plots.

For the bird surveys, we randomly selected 30 plots in the Virgin River and 30 plots in the Topock/Bill Williams River River, totaling 60 plots per year. At the Virgin River, 39 plots were available for sampling within the willow flycatcher survey areas. To select from these, we used GIS to overlay the plot layer with willow flycatcher nest locations from 2010 and 2011, which revealed that 12 plots had recent willow flycatcher nesting. We automatically picked these 12 plots to be surveyed, and randomly selected 18 additional plots from the remaining using a random number table in Excel. Four of the plots selected were too large to be surveyed in one morning, so (with the approval of Reclamation) we randomly dropped two of the large plots and split the remaining two in half, with each half to be surveyed in one morning and the survey data to be combined at the end of the season. These changes resulted in the same amount of surveyed area as in the Topock/Bill Williams region (see below) but using 28 plots instead of the 30 that were originally planned.

For the Topock/Bill Williams region plot selection, we used the same selection methods as for the Virgin River. Twenty-five of the 54 possible plots within the willow flycatcher survey area had active nests in 2010 or 2011, and these were first selected for our plot selection. The remaining five plots were selected randomly from the remaining plots. As in component 1, some originally selected plots had to be dropped due to access or safety issues in the Topock/Bill Williams regions, and these were replaced by randomly selected alternate plots. The final plot selection in all three regions will be used in all 3 years of this study.

Virgin River Plots

Willow flycatchers bred in three sites in the Virgin River area below Mormon Mesa in 2011, including Mormon Mesa South – south half (3.4 ha), Virgin Area #1 – north half (11.4 ha), and Virgin Area #1 – south half (11.1 ha). They were not found breeding at two sites where they had historically nested: Virgin Area #2 (11.2 ha) and Mormon Mesa South – north half (8.4 ha, table 46).

Table 46.—Southwestern willow flycatcher sites and number of riparian bird plots within the Virgin River (n = 42 plots), Topock Marsh (n = 37 plots), and Bill Williams River NWR (n = 29 plots)

Willow flycatcher site	Hectares	Site priority	Number of riparian bird plots
Virgin River			
Mormon Mesa South – north half	8.4	Non-breeding 2011	5
Mormon Mesa South – south half	3.4	Breeding	4
Virgin Area #1 – north half	11.4	Breeding	8
Virgin Area #1 – south half	11.1	Breeding	11
Virgin Area #2	11.2	Non-breeding 2011	14
Topock Marsh			
Pipes #1	5.2	Breeding site (1st priority)	3
Pipes #3	5.7	Breeding site (1st priority)	2
The Wallows	0.7	Breeding site (1st priority)	1
800 M	4.7	Breeding site (1st priority)	2
PC6-1	4.8	Non-breeding site (2nd priority)	4
Pig Hole	2.4	Non-breeding site (2nd priority)	3
In Between	7.7	Non-breeding site (2nd priority)	2
Pierced Egg	6.7	Non-breeding site (2nd priority)	2
Swine Paradise	0.9	Non-breeding site (2nd priority)	2
Barbed Wire	2.1	Non-breeding site (2nd priority)	3
Platform	1.9	Non-breeding site (2nd priority)	2
250 M	1.9	Non-breeding site (2nd priority)	2
Hell Bird	6.3	Non-breeding site (2nd priority)	1
Glory Hole	5.0	Non-breeding site (2nd priority)	2
Spaghetti	5.4	Non-breeding site (2nd priority)	3
Lost Lake	3.3	Non-breeding site (2nd priority)	3
Bill Williams River River			
Burn Edge	4.1	Breeding site (1st priority)	4
Site #4	9.9	Breeding site (1st priority)	2
Site #3	13.0	Breeding site (1st priority)	4
Cougar Point	1.3	Breeding site (1st priority)	5
Planet Ranch Road	3.3	Breeding site (1st priority)	3
Last Gasp	2.1	Non-breeding site (2nd priority)	2
Site #5	6.8	Non-breeding site (2nd priority)	5
Upstream of Site #8	1.5	Non-breeding site (2nd priority)	2
New River	0.6	Non-breeding site (2nd priority)	2

Breeding sites have varied from year to year, and historic and recent breeding sites encompass 600 acres (242 ha) that were used for our plot selection. Another Virgin River site west of the town of Mesquite, where willow flycatchers have recently nested, was excluded from this study because that site featured predominantly native riparian vegetation and was therefore not expected to show responses to the saltcedar beetle invasion. All other sites along the Virgin River that were used for this study showed signs of beetle invasion.

Access to Virgin River plots located near Overton and Mesquite was difficult, and therefore, all selected plots were visited prior to the survey season to scope out the best access routes, create trails to and within the plots, and determine safety issues. All-terrain vehicles were necessary for access to some plots.

Topock Marsh and Bill Williams River National Wildlife Refuge

Willow flycatchers nested at four sites within Topock Marsh and five sites within the Bill Williams River NWR in 2011. Twelve additional historic willow flycatcher sites are located in Topock Marsh and four in the Bill Williams River NWR area (see table 46), all of which were used in plot selection. There was total number of 54 riparian bird plots in these areas within willow flycatcher study plots, and through random selection from these, we arrived at 30 plots for this study in the Topock/Bill Williams River region. Unfortunately, we had to drop the Planet Ranch sites from the selection because we were unable to obtain permission from the current Planet Ranch landowner to access it. The selected sites were relatively easy to access, and permission from the refuges was obtained prior to the study.

MONITORING METHODS

The field methods used for surveying riparian birds in the saltcedar beetle study were the same as 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 systemwide LCR MSCP bird monitoring data to estimate population densities of priority riparian land birds in the saltcedar 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 saltcedar 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 activities.

DATA ANALYSIS

To investigate possible effects of the saltcedar beetle on bird populations of the study areas and predict the effects on overall bird populations in the LCR MSCP planning area, we used the data collected in 2013 for preliminary population size estimation for the study sites using program DS. We assume that detection ratios of birds on the Virgin River are the same as those quantified in components 1 and 3, and we thus used these for population estimation in this component. After 3 years of data collection, we may also be able to compare data from pre-beetle infestation with post-beetle infestation sites if the beetle continues to colonize the study areas. In the final report for this study, we also plan to use bird species composition and relative species abundance metrics for estimating the effects of beetle invasion on the bird community and particular riparian bird species.

RESULTS

On all 58 study plots surveyed in 2013, we recorded 144 species, not including subspecies, super species, or unknowns (attachment 5), including five LCR MSCP covered species. Vermilion flycatcher and gilded flicker were not detected in any of these plots. At the Virgin River plots, we found territories of 26 breeding species, including 3 LCR MSCP covered species. The most common breeders were song sparrow, Sonoran yellow warbler, Lucy's warbler, Bewick's wren, and yellow-breasted chat (table 47). Another 60 species were recorded as migrants or other birds that were not confirmed to be breeding in the Virgin River plots (table 48). Breeding evidence differed by plot.

We found territories of 48 species, including 5 LCR MSCP covered species (counting the Yuma clapper rail), at the 30 study plots at Topock Marsh and the Bill Williams River (table 49). The most common breeders included song sparrow, yellow-breasted chat, common yellowthroat, Lucy's warbler, and Sonoran yellow warbler (table 49). The study plots Topock Marsh and the Bill Williams River had more than double the number of migrants and non-breeders (n = 135) compared to the Virgin River plots (table 50). Breeding evidence differed by plot.

Table 47.—Number of breeding territories of territorial species detected in saltcedar beetle study plots on the Virgin river during rapid area search plots in 2013
(Listed in descending order of abundance)

Species (n = 26)	**Number of territories at Virgin River plots (n = 28)**
Song sparrow	225.5
Sonoran yellow warbler*	177
Lucy's warbler	122.25
Bewick's wren	95.75
Yellow-breasted chat	85
Abert's towhee	32.75
Arizona Bell's vireo*	25.5
Willow flycatcher	6
Crissal thrasher	4.25
Blue grosbeak	3.75
Ash-throated flycatcher	3.5
Brown-crested flycatcher	2.75
Ladder-backed woodpecker	2.25
Black-tailed gnatcatcher	2
Western kingbird	2
Lesser nighthawk	1.75
Summer tanager*	1.5
Verdin	1.5
Common yellowthroat	1
Say's phoebe	1
Sora	1
Killdeer	0.5
Northern rough-winged swallow	0.5
Snowy plover	0.5
Black-throated sparrow	0.25
Le Conte's thrasher	0.25
Total	**800**

*LCR MSCP covered species.

Table 48.—Species detected, but not confirmed breeding, during rapid area searches at saltcedar beetle study plots at Virgin River sites in 2013
(Listed in alphabetical order)

Species (n = 60)	Males	Females	Unknown sex	Young of the year	Flyovers	Incidentals
American avocet	0	0	192	0	30	40
American pipit	0	0	0	0	0	39
Audubon's warbler	90	64	9	0	0	0
Barn swallow	19	0	0	0	0	0
Black-chinned hummingbird	9	0	0	0	0	0
Black-throated gray warbler	16	0	0	0	0	0
Blue grosbeak	1	0	0	0	0	0
Brewer's blackbird	85	0	0	0	0	0
Brewer's sparrow	152	0	0	0	0	0
Brown-headed cowbird	16	11	0	0	218	0
Bullock's oriole	9	9	0	0	0	0
Canada goose	0	0	22	0	1,879	0
Common raven	0	0	29	0	105	0
Common yellowthroat	24	0	0	0	0	0
Cooper's hawk	0	11	28	0	0	95
Double-crested cormorant	0	0	0	0	285	30
Eurasian collared-dove	16	0	0	0	0	0
Gambel's quail	12	0	12	0	0	0
Great blue heron	0	0	27	0	33	18
Greater roadrunner	0	0	12	0	0	0
Great-tailed grackle	16	0	0	0	0	0
Green heron	0	0	0	0	0	10
Green-tailed towhee	0	0	13	0	0	0
Horned lark	0	0	0	0	35	0
House finch	0	0	0	0	12	0
Indigo bunting	0	0	0	0	0	11
Lazuli bunting	14	0	0	0	0	0
Lesser goldfinch	16	0	32	0	0	0
Lesser nighthawk	0	0	0	0	32	0
Long-billed curlew	0	0	0	0	100	0
Lucy's warbler	0	0	406	0	0	0
Mallard	0	0	0	0	43	0
Mourning dove	24	0	20	0	586	0

Table 48.—Species detected, but not confirmed breeding, during rapid area searches at saltcedar beetle study plots at Virgin River sites in 2013
(Listed in alphabetical order)

Species (n = 60)	Males	Females	Unknown sex	Young of the year	Flyovers	Incidentals
Northern rough-winged swallow	0	0	563	0	1,203	0
Orange-crowned warbler	0	0	24	0	0	0
Osprey	0	0	15	0	0	0
Phainopepla	45	0	72	0	0	0
Prairie falcon	0	0	0	0	11	0
Red-breasted nuthatch	0	0	16	0	0	0
Red-tailed hawk	0	0	16	0	0	0
Red-winged blackbird	72	18	12	0	54	0
Ring-billed gull	0	0	12	0	0	0
Ruby-crowned kinglet	0	0	32	0	0	0
Say's phoebe	0	0	0	9	0	0
Snowy plover	9	0	0	0	0	25
Song sparrow	0	0	21	0	0	0
Spotted sandpiper	0	0	0	0	11	0
Townsend's warbler	33	0	0	0	0	0
Turkey vulture	0	0	0	0	51	0
Verdin	9	0	0	0	0	0
Violet-green swallow	5	0	0	0	0	0
Western flycatcher	0	0	59	0	0	0
Western kingbird	0	0	0	0	17	0
Western tanager	31	0	0	0	0	0
Western wood-pewee	0	0	26	0	0	0
White-crowned sparrow	301	0	498	0	0	0
White-faced ibis	0	0	144	0	155	0
Wilson's warbler	51	15	98	0	0	0
Yellow warbler*	5	0	27	0	0	0
Yellow-headed blackbird	0	0	0	0	162	0

*LCR MSCP covered species.

Table 49.—Number of breeding territories of territorial species detected in saltcedar beetle study plots in the Topock Marsh and the Bill Williams River plots during rapid area search plots in 2013 (Listed in descending order of abundance)

Species (n = 48)	Number of territories at the Topock Marsh/ Bill Williams River plots (n = 30)
Song sparrow	389.75
Yellow-breasted chat	256
Common yellowthroat	245
Lucy's warbler	134.25
Sonoran yellow warbler*	105.75
Bewick's wren	99.5
Abert's towhee	48.75
Verdin	38.25
Arizona Bell's vireo*	34
Black-tailed gnatcatcher	31.5
Black-chinned hummingbird	17.5
Brown-crested flycatcher	15.5
Ladder-backed woodpecker	14.75
Blue grosbeak	12.75
Summer tanager*	12
Gila woodpecker*	10.75
Yuma clapper rail*	9.5
Ash-throated flycatcher	8
Crissal thrasher	6.25
Pied-billed grebe	6
Common gallinule	5.5
Bullock's oriole	5
Marsh wren	5
American coot	4.75
Phainopepla	4.75
Canyon wren	3.75

Table 49.—Number of breeding territories of territorial species detected in saltcedar beetle study plots in the Topock Marsh and the Bill Williams River plots during rapid area search plots in 2013 (Listed in descending order of abundance)

Species (n = 48)	**Number of territories at the Topock Marsh/ Bill Williams River plots (n = 30)**
Least bittern	3.5
Green heron	3.25
Lesser nighthawk	3
Lesser goldfinch	2.75
Black phoebe	1.75
Northern rough-winged swallow	1.75
Common raven	1.5
Anna's hummingbird	1.25
Costa's hummingbird	1.25
Virginia rail	1.25
Lawrence's goldfinch	1
Rock wren	1
Say's phoebe	1
Spotted sandpiper	1
Black-throated sparrow	0.75
Western grebe	0.75
White-throated swift	0.75
Cooper's hawk	0.5
Sora	0.5
Loggerhead shrike	0.25
Nutting's flycatcher	0.25
Red-tailed hawk	0.25
Total	**1,553.75**

*LCR MSCP covered species.

Table 50.—Species detected, but not confirmed breeding, during rapid area searches at saltcedar beetle study plots at Topock Marsh and the Bill Williams River in 2013 (Listed in alphabetical order)

Species (n = 135)	Males	Females	Unknown sex	Young of the year	Flyovers	Incidentals
Abert's towhee	0	0	0	2	0	0
American avocet	0	0	0	0	47	0
American goldfinch	0	0	0	0	18	0
American pipit	0	0	0	0	1	0
American wigeon	1	0	0	0	0	0
Anna's hummingbird	0	0	1	2	0	0
Arizona bell's vireo*	3	0	0	0	0	0
Ash-throated flycatcher	0	0	0	7	0	0
Audubon's warbler	9	9	47	0	19	0
Bank swallow	0	0	0	0	1	0
Barn swallow	0	0	0	0	30	3
Belted kingfisher	1	13	3	0	0	2
Black phoebe	0	0	1	0	0	0
Black-chinned hummingbird	0	0	0	14	0	0
Black-crowned night heron	0	0	2	0	0	0
Black-headed grosbeak	37	18	27	0	0	14
Black-tailed gnatcatcher	0	0	1	2	0	0
Black-throated gray warbler	1	1	0	0	2	3
Black-throated sparrow	0	0	1	0	1	0
Blue grosbeak	0	0	0	0	0	2
Brewer's blackbird	0	0	0	0	18	0
Brewer's sparrow	1	0	8	0	0	0
Broad-tailed hummingbird	0	1	0	0	0	0
Brown-crested flycatcher	0	0	0	0	0	3
Brown-headed cowbird	0	1	1	0	180	7
Bullock's oriole	9	5	1	0	3	6
California gull	0	0	0	0	1	0
Canyon wren	1	0	2	4	0	0
Caspian tern	0	0	0	0	7	2
Cassin's vireo	3	1	1	0	0	0
Cedar waxwing	0	0	9	0	4	0
Chipping sparrow	0	0	5	0	0	0
Cliff swallow	0	0	0	0	94	0

Table 50.—Species detected, but not confirmed breeding, during rapid area searches at saltcedar beetle study plots at Topock Marsh and the Bill Williams River in 2013 (Listed in alphabetical order)

Species (n = 135)	Males	Females	Unknown sex	Young of the year	Flyovers	Incidentals
Common gallinule	0	0	1	0	0	0
Common ground-dove	0	0	2	0	0	0
Common raven	0	0	1	0	9	0
Common yellowthroat	1	0	0	0	1	0
Cooper's hawk	0	1	0	0	3	1
Costa's hummingbird	0	0	1	1	0	0
Crissal thrasher	0	0	1	0	0	0
Double-crested cormorant	0	0	0	0	12	0
Dusky flycatcher	0	0	1	0	0	0
Eared grebe	0	0	12	0	0	1
Elf owl	0	0	2	0	0	5
Eurasian collared-dove	0	0	0	0	4	0
European starling	0	0	0	0	2	0
Forster's tern	0	0	2	0	0	0
Gadwall	5	4	0	0	0	0
Gambel's quail	0	0	0	0	0	10
Gambel's white-crowned sparrow	0	0	15	0	0	5
Gila woodpecker*	0	0	0	0	0	1
Gray flycatcher	0	0	3	0	0	0
Great blue heron	0	0	4	0	14	0
Great egret	0	0	5	0	30	0
Greater roadrunner	0	0	3	0	0	6
Great-tailed grackle	0	0	4	0	176	0
Green heron	0	0	0	0	0	1
Green-tailed towhee	7	0	27	0	0	17
Green-winged teal	0	1	0	0	0	0
Hammond's flycatcher	2	0	11	0	0	0
Hermit thrush	0	0	2	0	0	0
Hermit warbler	1	0	0	0	0	1
Hooded oriole	0	1	0	1	0	0
House finch	7	3	17	28	161	93
House wren	2	0	3	0	0	0

Table 50.—Species detected, but not confirmed breeding, during rapid area searches at saltcedar beetle study plots at Topock Marsh and the Bill Williams River in 2013 (Listed in alphabetical order)

Species (n = 135)	Males	Females	Unknown sex	Young of the year	Flyovers	Incidentals
Indigo bunting	1	0	0	0	1	1
Killdeer	0	0	1	0	0	0
Lark sparrow	0	0	2	0	0	0
Lawrence's goldfinch	1	1	0	1	21	0
Lazuli bunting	31	21	33	0	0	2
Least bittern	0	0	0	0	0	2
Lesser goldfinch	2	2	1	3	45	0
Lesser nighthawk	1	0	0	0	11	2
Lincoln's sparrow	2	1	7	0	0	0
Loggerhead shrike	0	0	1	2	0	0
Lucy's warbler	0	0	0	10	0	0
Macgillivray's warbler	12	6	7	0	0	5
Mallard	0	0	0	0	4	0
Marbled godwit	0	0	0	0	2	0
Mountain white-crowned sparrow	0	0	5	0	0	1
Mourning dove	0	0	5	3	153	25
Myrtle's warbler	0	1	0	0	0	0
Nashville warbler	0	1	8	0	0	0
Northern harrier	1	0	0	0	0	0
Northern mockingbird	0	0	3	1	1	1
Northern rough-winged swallow	0	0	25	0	215	0
Nutting's flycatcher	2	1	0	2	0	5
Olive-sided flycatcher	1	0	4	0	0	0
Orange-crowned warbler	12	0	28	0	1	0
Osprey	0	0	1	0	3	1
Pacific-slope flycatcher	67	2	15	0	0	0
Peregrine falcon	0	0	0	0	2	1
Phainopepla	2	0	2	23	101	0
Red-breasted nuthatch	1	0	1	0	0	0
Red-tailed hawk	0	0	5	0	10	1
Red-winged blackbird	1	3	0	0	107	0
Ring-billed gull	0	0	0	0	8	0
Ring-necked duck	9	3	0	0	0	0

Table 50.—Species detected, but not confirmed breeding, during rapid area searches at saltcedar beetle study plots at Topock Marsh and the Bill Williams River in 2013 (Listed in alphabetical order)

Species (n = 135)	Males	Females	Unknown sex	Young of the year	Flyovers	Incidentals
Rock wren	0	0	0	3	0	0
Rose-breasted grosbeak	2	0	0	0	0	0
Ruby-crowned kinglet	4	0	7	0	0	0
Say's phoebe	0	0	1	1	0	0
Scott's oriole	1	0	0	0	0	0
Semipalmated plover	0	0	0	0	1	0
Sharp-shinned hawk	0	1	0	0	4	0
Snowy egret	0	0	6	0	31	0
Song sparrow	0	0	0	107	0	0
Sora	0	0	7	0	0	0
Spotted sandpiper	0	0	0	0	0	1
Spotted towhee	0	0	2	0	0	0
Swainson's hawk	0	0	0	0	4	0
Swainson's thrush	0	0	4	0	0	1
Townsend's warbler	16	10	12	0	2	0
Tree swallow	0	0	23	0	7778	20
Turkey vulture	0	0	3	0	77	1
Verdin	0	0	5	43	0	0
Violet-green swallow	1	1	28	0	24	4
Virginia rail	0	0	0	0	0	1
Warbling vireo	10	1	40	0	0	4
Western flycatcher	0	0	13	0	0	0
Western grebe	0	0		0	0	2
Western kingbird	2	0	5	0	16	0
Western tanager	23	10	15	0	10	9
Western wood-pewee	8	0	19	0	0	2
White-crowned sparrow	2	0	16	0	0	0
White-faced ibis	0	0	2	0	143	0
White-throated swift	0	0	4	0	63	0
White-winged dove	0	0	15	5	434	62
Willet	0	0	0	0	1	0
Willow flycatcher*	1	0	2	0	0	0

Table 50.—Species detected, but not confirmed breeding, during rapid area searches at saltcedar beetle study plots at Topock Marsh and the Bill Williams River in 2013 (Listed in alphabetical order)

Species (n = 135)	Males	Females	Unknown sex	Young of the year	Flyovers	Incidentals
Wilson's warbler	77	30	126	0	6	44
Yellow warbler*	33	11	6	0	3	7
Yellow-billed cuckoo*	0	0	0	0	0	1
Yellow-headed blackbird	0	0	0	0	3	0
Yellow-rumped warbler	3	2	0	0	0	1

*LCR MSCP covered species.

We analyzed the data from 58 rapid survey plots for this study with the data from 8 systemwide intensive plots of 2013 using program DS to calculate preliminary population size estimates for the saltcedar beetle study plots. This analysis showed signs of insufficient sample sizes in this first year of monitoring, and we are thus postponing the reporting of population estimates until future years of the study.

DISCUSSION

Paxton et al. (2011) provided three models of how saltcedar beetles can affect avian populations. In the first model, short-term availability of the beetles could provide a food source for insectivorous birds, potentially increasing bird populations prior to the trees' death. Long-term saltcedar mortality could lead to recovery of native vegetation and no net loss of riparian habitat, with the potential for an increase in habitat quality, leading to increased bird populations. In the second model, native vegetation recovers at the same rate as saltcedar mortality occurs, leaving no net loss of habitat, and bird populations remain stable. In the third model, short-term defoliation and mortality of saltcedar leads to reduced abundance of foliage-dependent insect prey, increased exposure of nests to predators, brood parasites, and extreme temperatures. Long-term consequences in this third model could include the net loss of suitable habitat if saltcedar mortality is not followed by rapid regrowth of other riparian vegetation, leading to decreased bird populations. The main effects of saltcedar mortality on birds

will thus likely depend on the rate of vegetation recovery after the saltcedar dies. The expected lag in native vegetation recovery could cause initial bird population declines, but long-term increases, if native vegetation can be recovered before bird populations decline to the point of being unrecoverable.

Shanahan et al. (2011) reported that, in the Las Vegas Wash, yellow warblers were found more often in native trees than in saltcedar, suggesting a positive response to habitat restoration by this species. Bewick's wrens, on the other hand, were abundant in stands dominated by saltcedar rather than by native trees, suggesting that this species is more likely to be affected by saltcedar loss without replacement by native vegetation. Further, no decreased overall bird abundance was observed in exotic vegetation stands (saltcedar and *Phragmites*) relative to native vegetation stands.

In a literature review, Sogge et al. (2008) found 11 species in Arizona and New Mexico (including Bell's vireo, summer tanager, yellow warbler, yellow-billed cuckoo, and southwestern willow flycatcher) that reportedly nested in stands with > 75% saltcedar cover. These species were therefore likely to be affected by impacts from saltcedar beetles. According to Paxton et al. (2011), 19 or more bird species that breed in saltcedar may be exposed to increased temperatures at the nest. Some riparian species (particularly the southwestern willow flycatcher), which have the greatest nesting success in dense vegetation, and other species that prefer dense nest sites, are likely to also be impacted through an increase in nest predation or nest abandonment. Saltcedar beetles may be unpalatable to most birds, and their increased abundance may not compensate for the reduction in a diverse array of foliage-feeding insects that is likely to result from the defoliation of the trees. Of the 42 species of breeding birds known to use saltcedar in the southwestern United States, at least 26 of these species, including southwestern willow flycatcher, Bell's vireo, yellow warbler, and summer tanager, could be affected by changes in the arthropod community (Paxton et al. 2011).

Migrant birds may also be negatively affected by saltcedar defoliation. Despite greater arthropod biomass in cottonwood-willow habitat, refueling rates of migrating Wilson's warblers (*Wilsonia pusilla*) stopping over along the San Pedro River, Arizona, were higher in saltcedar than in native vegetation (Cerasale and Guglielmo 2010). In this study, yellow warblers rarely used saltcedar stands, and their densities were also substantially higher in cottonwood-willow stands than those of Wilson's warblers, supporting the notion that this species is relatively intolerant of saltcedar even during migration.

Since most riparian areas associated with the LCR and its tributaries are dominated by saltcedar, saltcedar is often the only shrub cover available for riparian birds, and it is thus currently viewed as being critical for maintaining breeding bird populations. Some other mid-story species provide good habitat,

such as seep willows and shrub willows, but most are rare along the main stem of the river. Some species may compensate to some degree for the effects of defoliation by adjusting their timing of onset of breeding, avoiding heavily infested areas, or seeking other microsites for nesting, but the extent of such compensative behaviors, if they exist, are currently unknown. However, one study of southwestern willow flycatchers in central Arizona found that the species can apparently move from one breeding location to another, especially if another stand of suitable habitat (preferably dense riparian habitat within about 3–10 years of age) is no more than 30–40 kilometers away from an existing breeding area (Sogge et al. 2007). Only a method that delineates and monitors active breeding territories can reveal the extent to which territories become abandoned or continue to be occupied in areas of varying infestation levels.

Interestingly, in the first year of field work implementation (2013) of this study, GBBO surveyors observed little defoliation in the Virgin River sites after the beetle had already been present in the area and defoliated saltcedars in past seasons. Recent studies have shown that defoliation does not kill most saltcedars until several years of continued defoliation, and shrubs appear to recover after each defoliation event (Nagler et al. 2013). Further, beetle population levels can also decrease after a few cycles (Nagler et al. 2012), which emphasizes the need to monitor the area and further investigate the patterns of colonization by the beetle and its effects on bird habitats. It has been reported, and we observed recently, that many of the saltcedars on the Virgin River are already dead or severely defoliated, suggesting that there is little habitat for saltcedar beetles in our study area. In addition to this before-after-impact control study begun in 2013, we will, after the 3-year study, attempt to determine with GIS the type of habitat the breeding bird territories are using, including small islands of native vegetation or remaining saltcedar. These data will provide additional information needed for riparian habitat restoration activities in areas that have been invaded by the beetle.

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ATTACHMENT 1

Systemwide and Habitat Creation Plot Maps, 2013

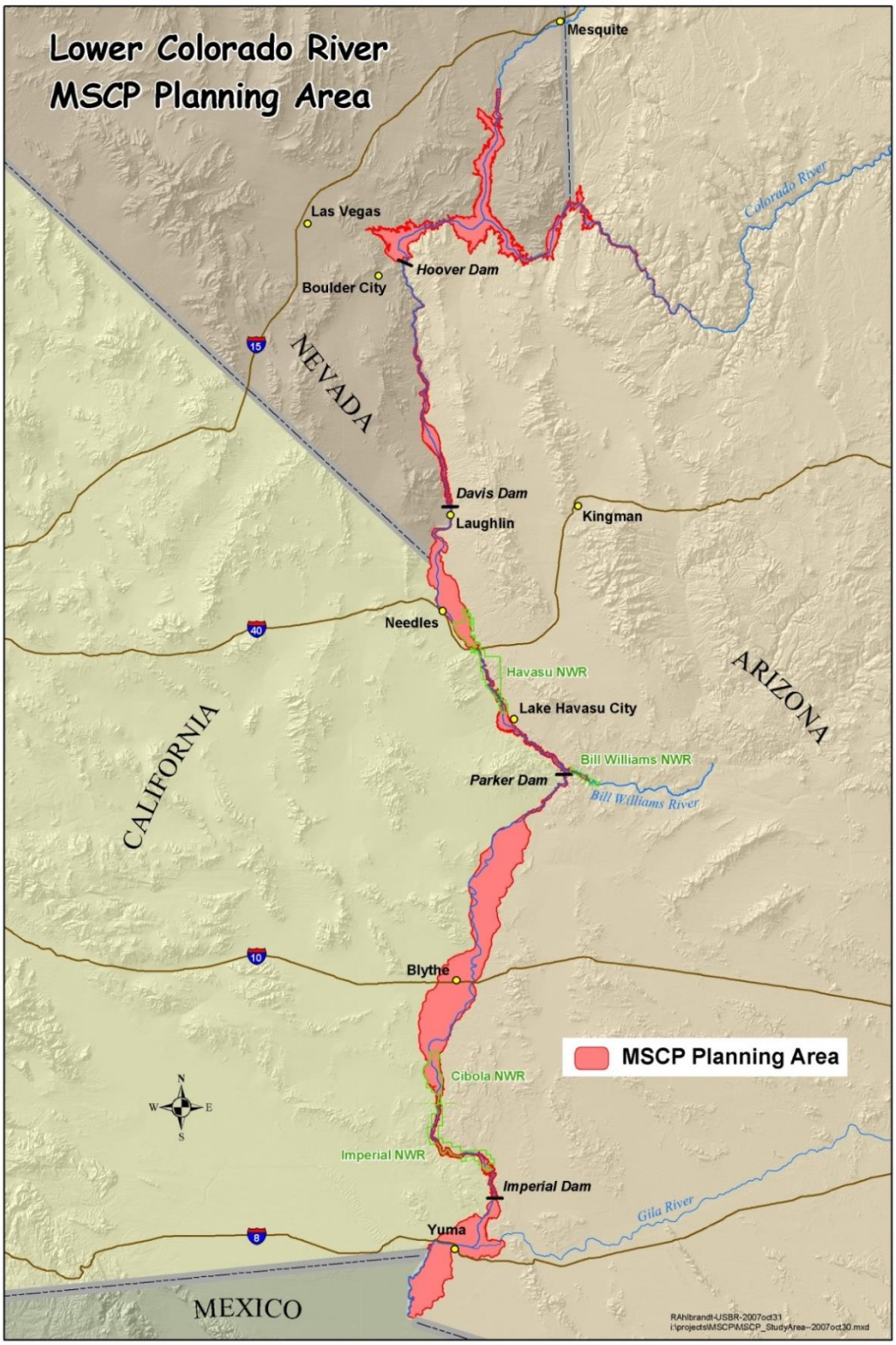


Figure 1-1.—Map of the Lower Colorado River Multi-Species Conservation Program study area for systemwide bird surveys (in pink). Map provided by the Bureau of Reclamation, Lower Colorado Region.

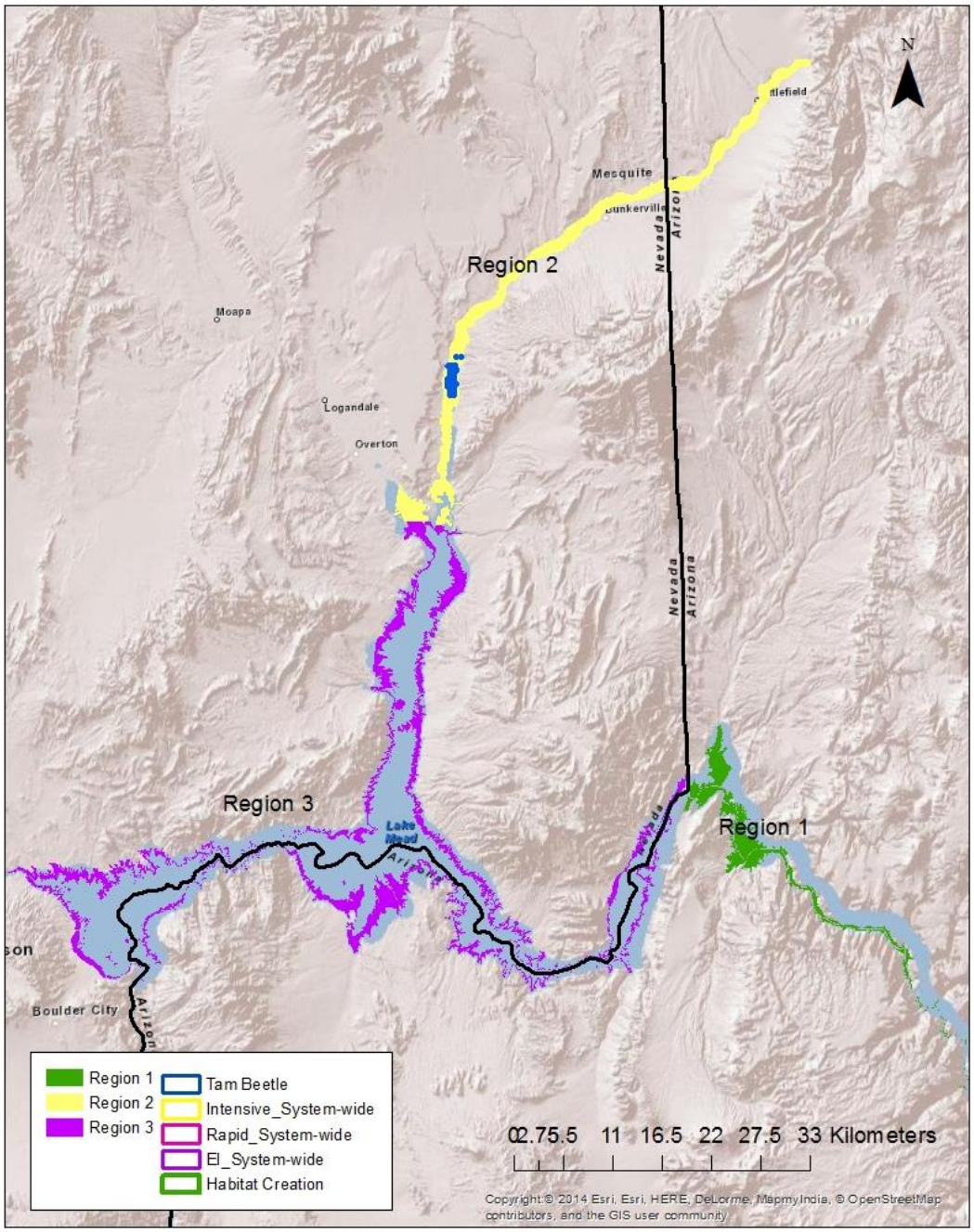
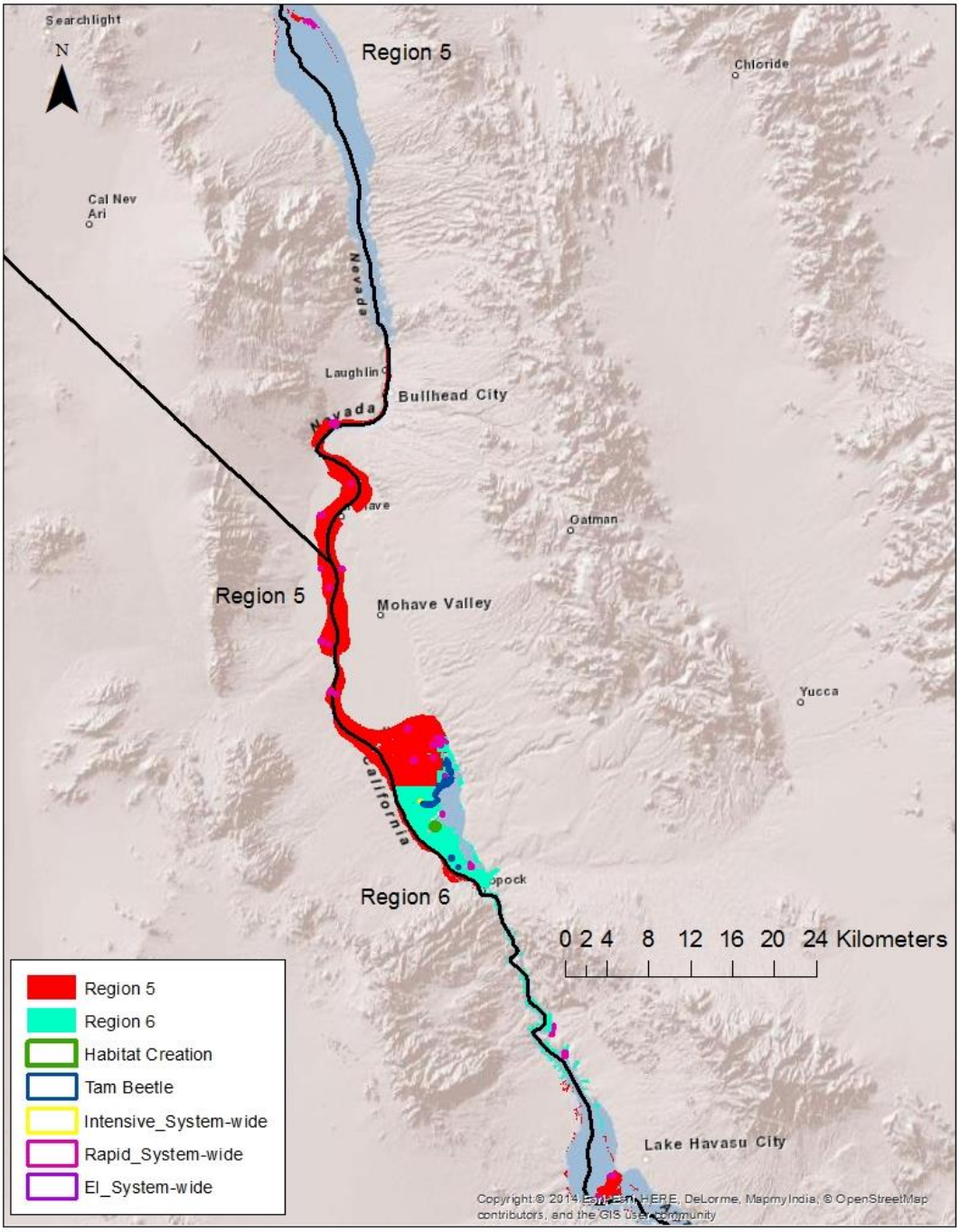


Figure 1-2.—Overview of systemwide plots surveyed in 2013 (rapid plots in pink, intensive plots in yellow, enhanced intensive plots in purple, saltcedar beetle plots in blue, and habitat creation plots in green) within the Lower Colorado River Multi-Species Conservation Program riparian bird survey project regions.

(Sheet 1 of 5)



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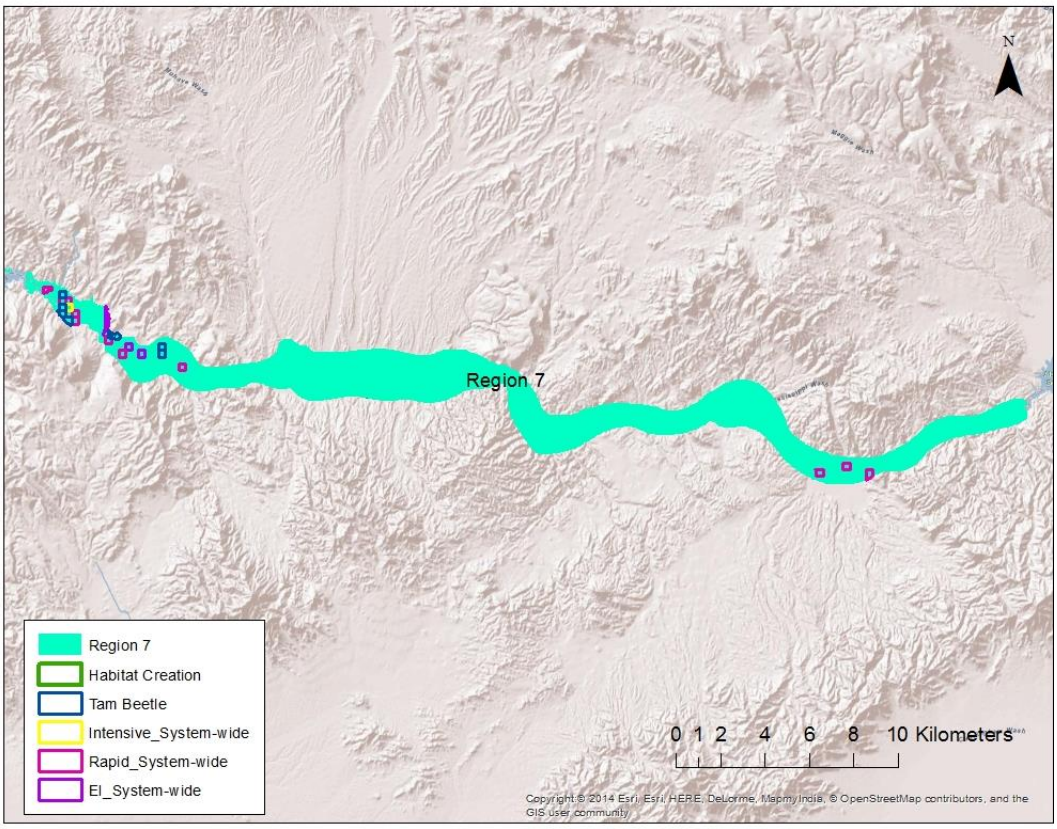
(Sheet 2 of 5)



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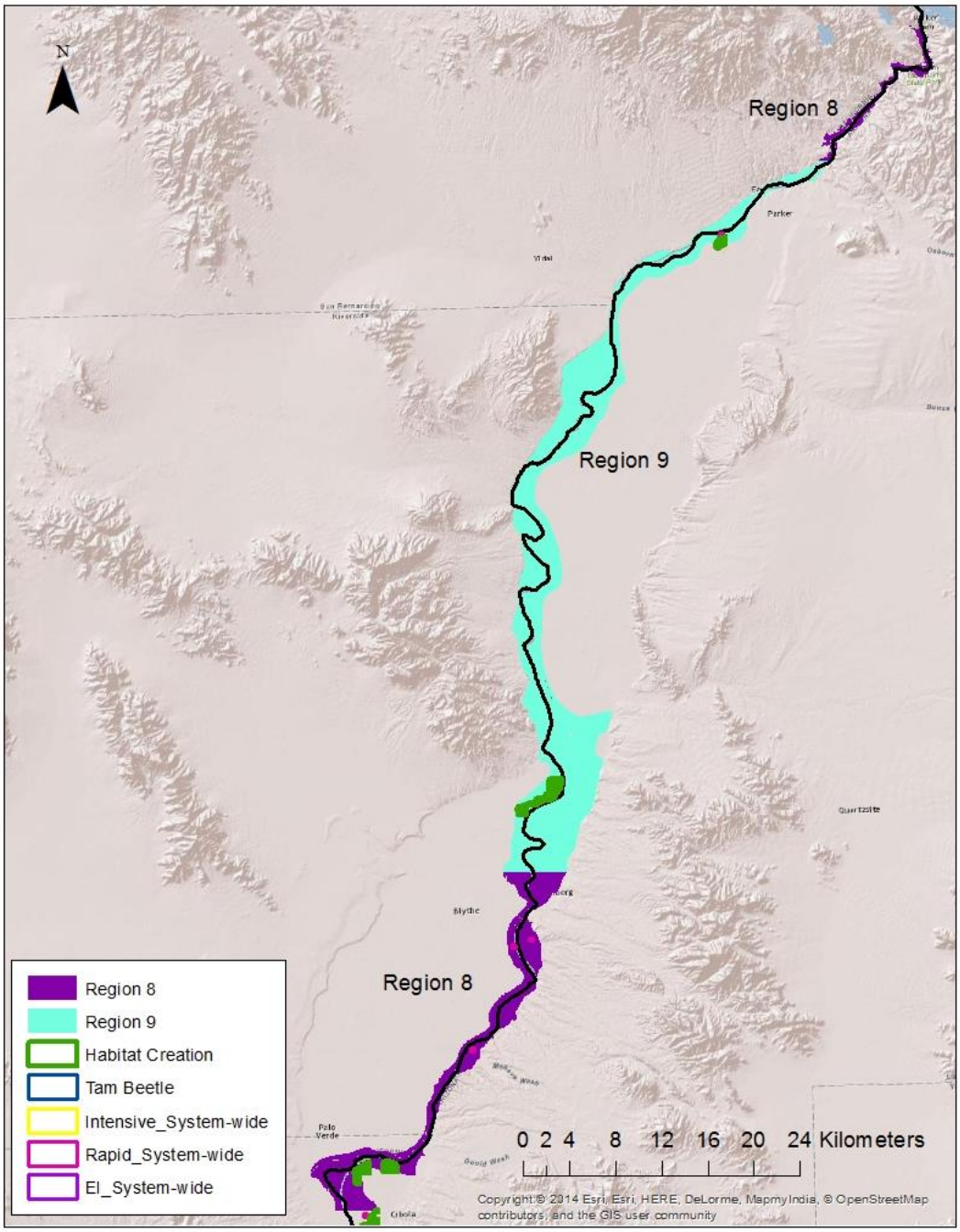

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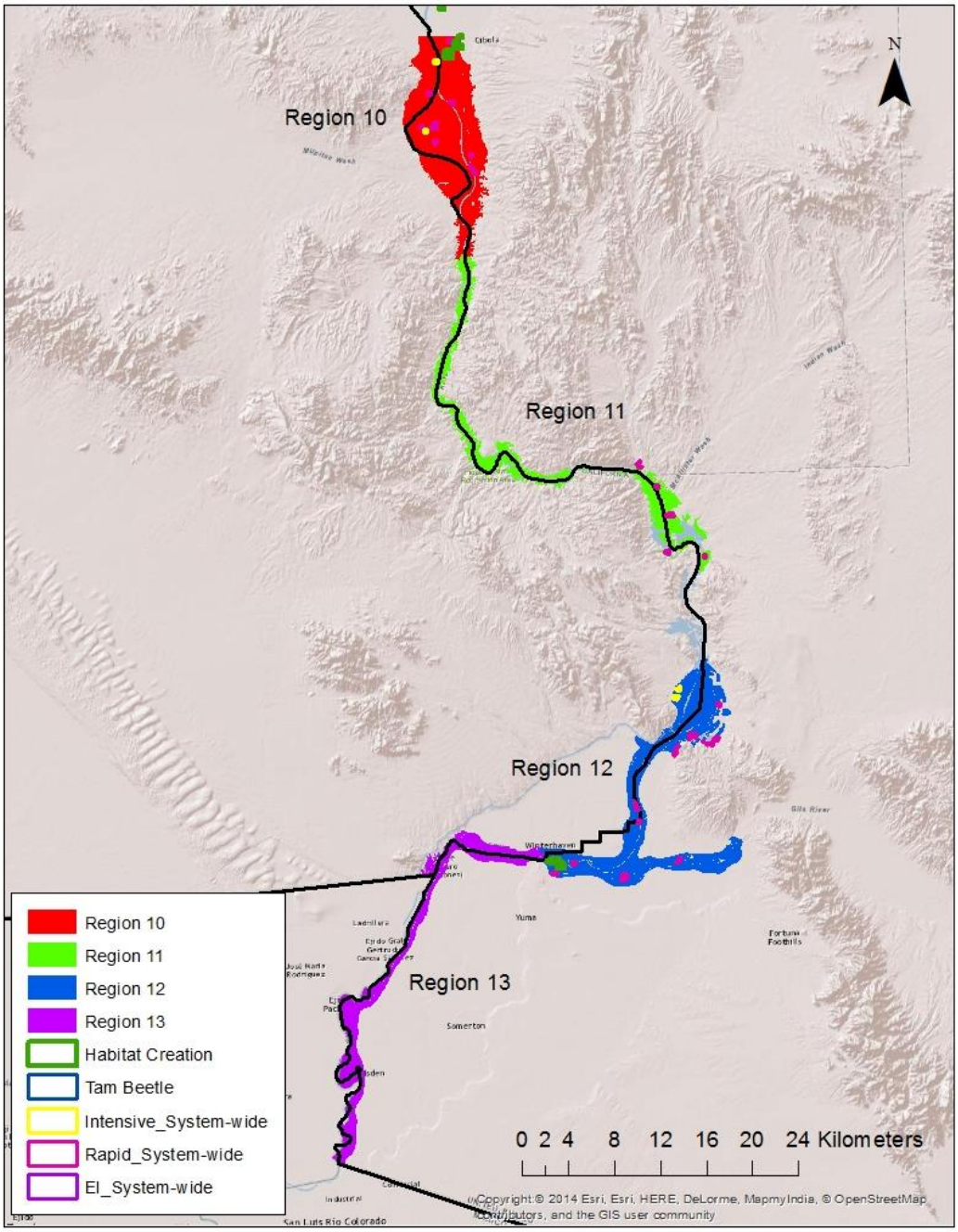

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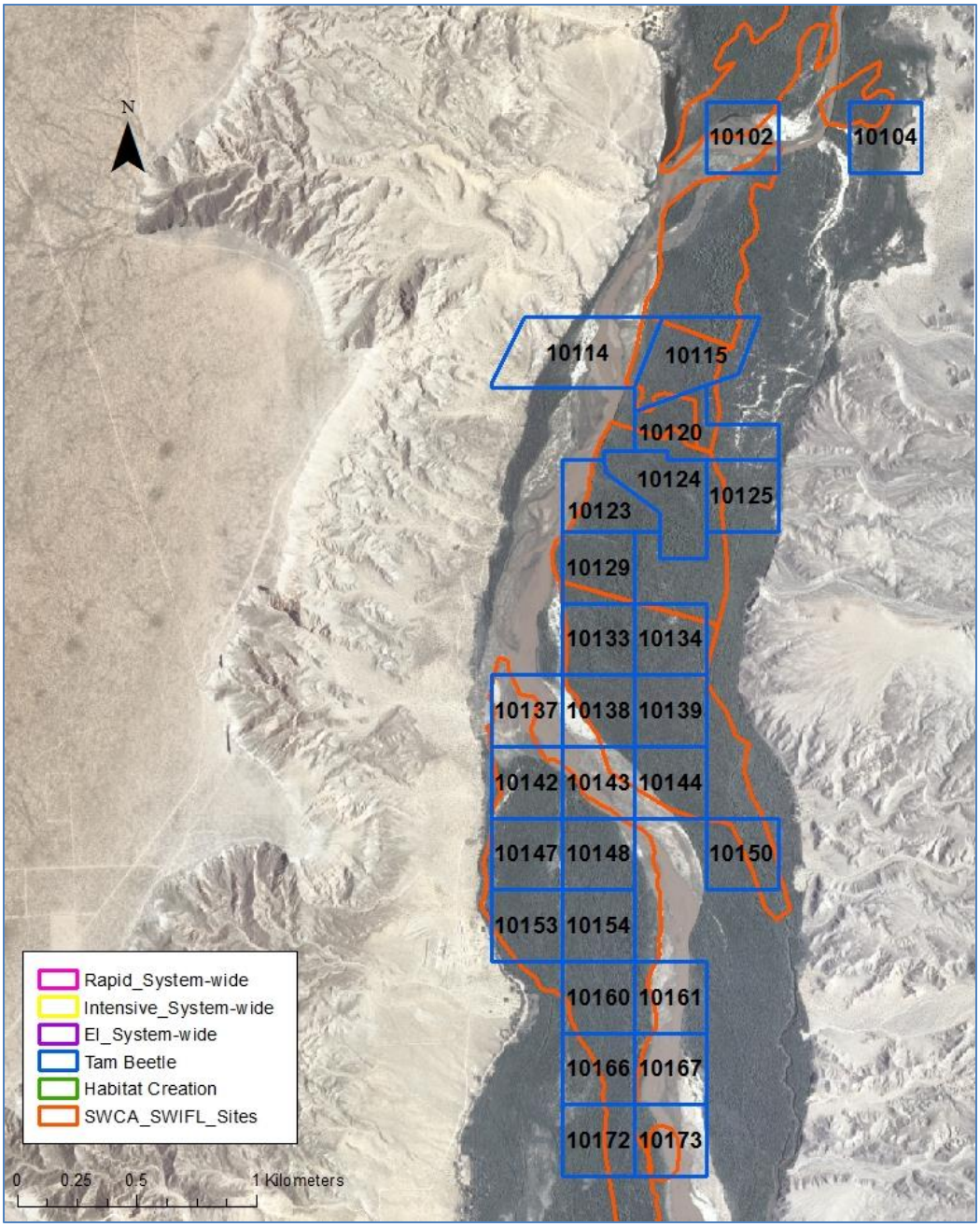


Figure 1-3.—Regional map of saltcedar study plots surveyed in 2013: Region 2, Virgin River. Saltcedar beetle plots are outlined in blue, and southwestern willow flycatcher survey areas are in orange.

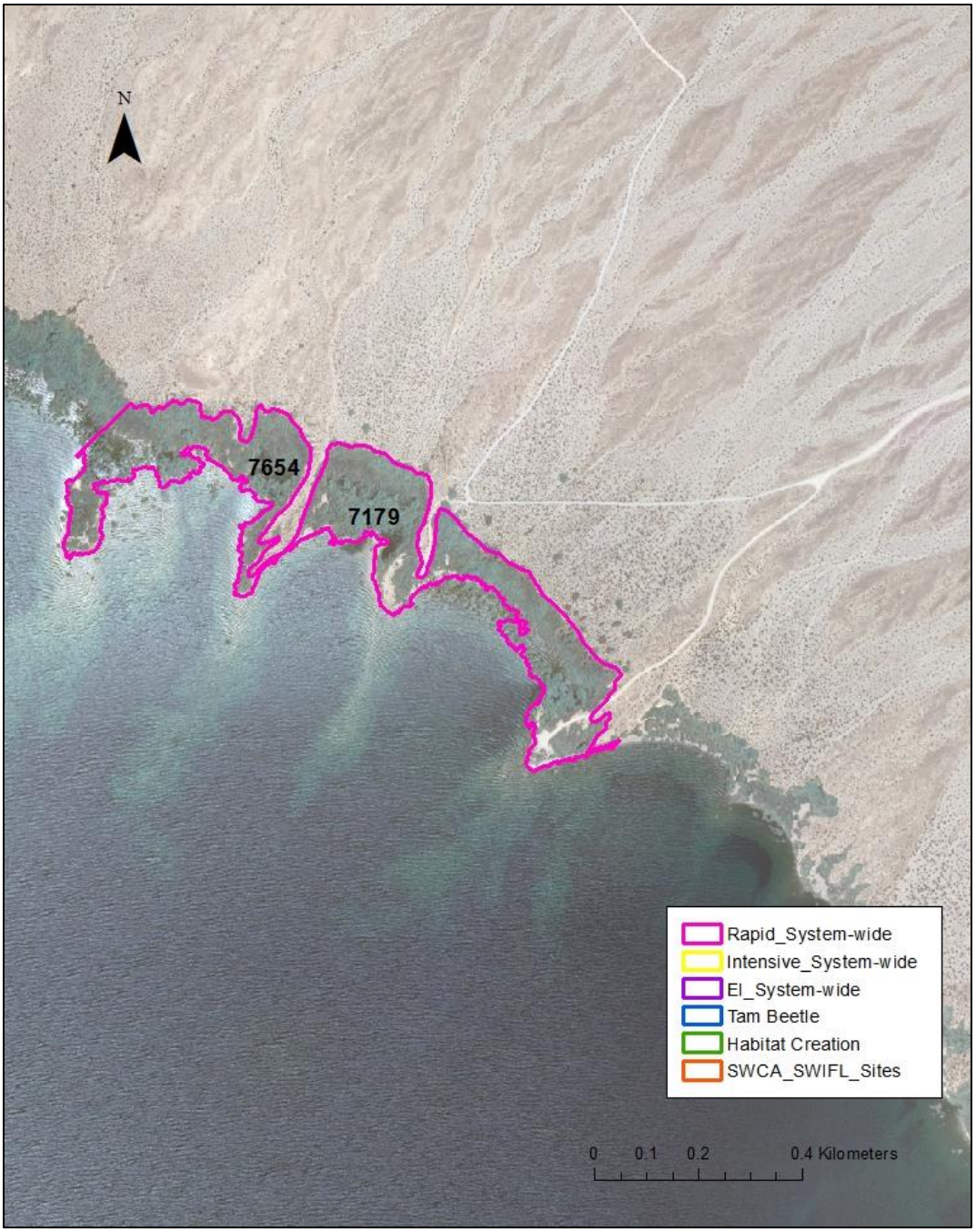


Figure 1-4.—Regional map of systemwide plots surveyed in 2013: Region 5 North, Lake Mohave plots. Rapid survey plots are outlined in pink, intensive survey plots in yellow, and enhanced intensive plots in purple.

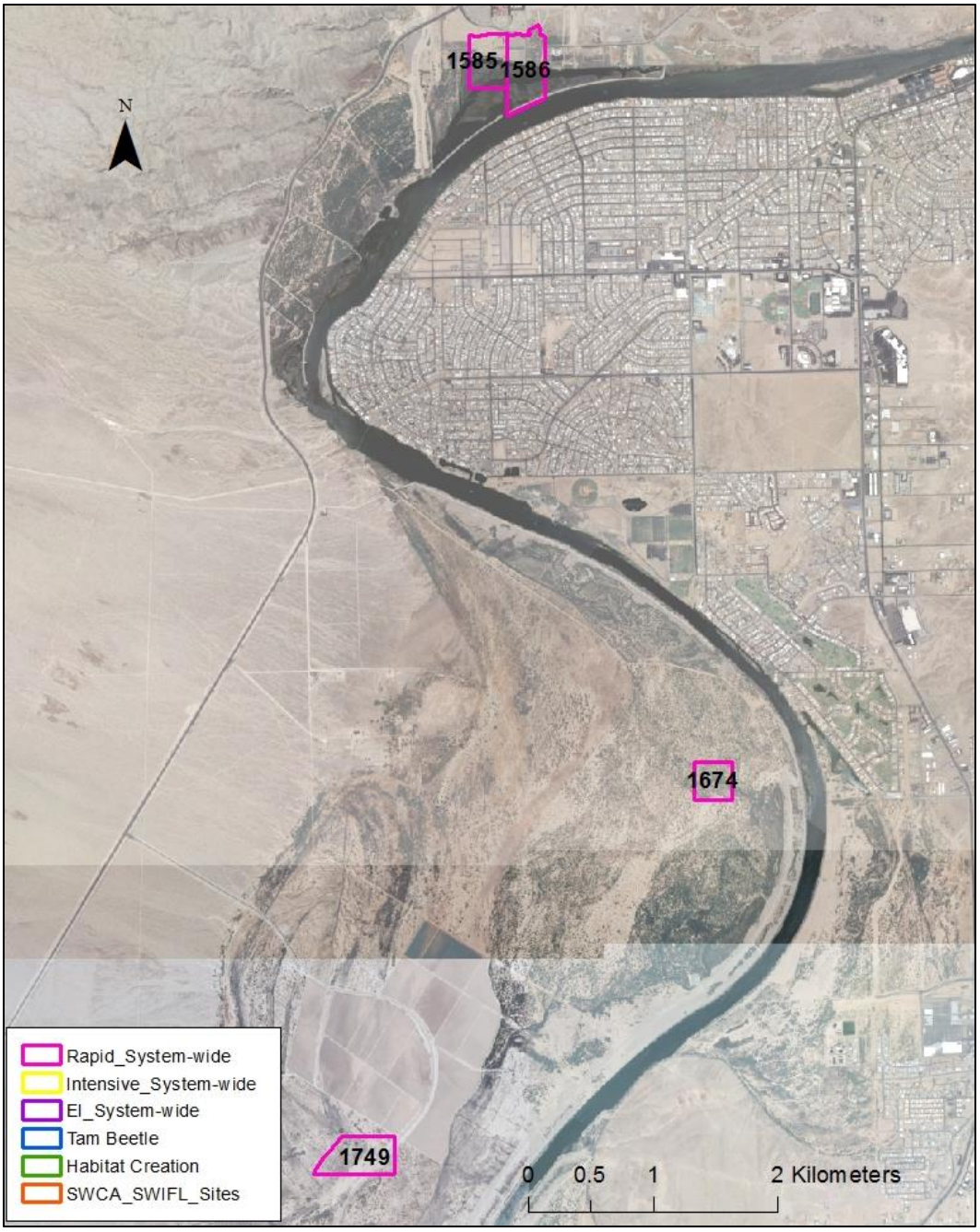


Figure 1-5.—Regional map of systemwide plots surveyed in 2013: Region 5 North, Laughlin area plots. Rapid survey plots are outlined in pink, intensive survey plots in yellow, and enhanced intensive plots in purple.

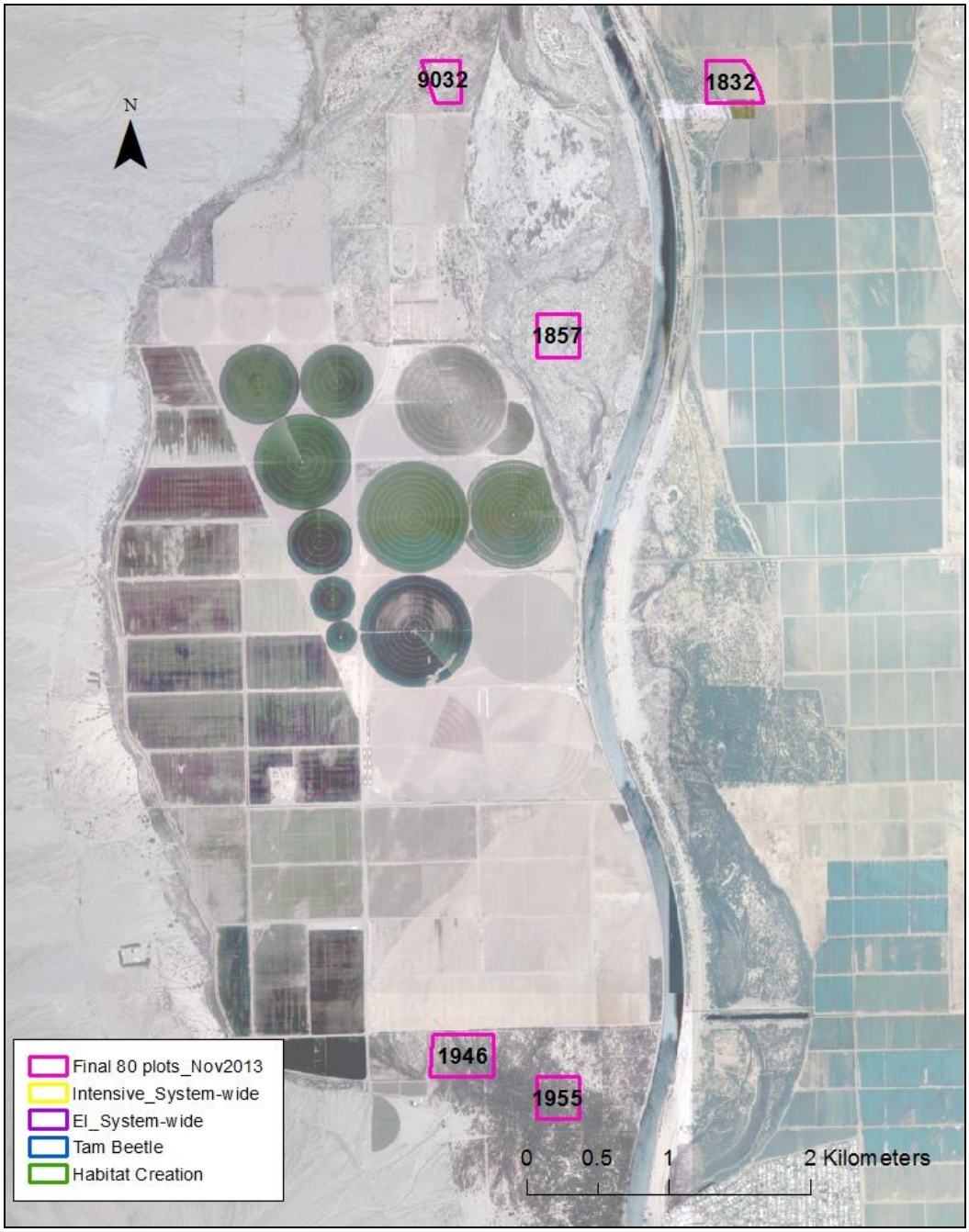


Figure 1-6.—Regional map of systemwide plots surveyed in 2013: Region 5 North, Ft. Mohave area plots. Rapid survey plots are outlined in pink, intensive survey plots in yellow, and enhanced intensive plots in purple.

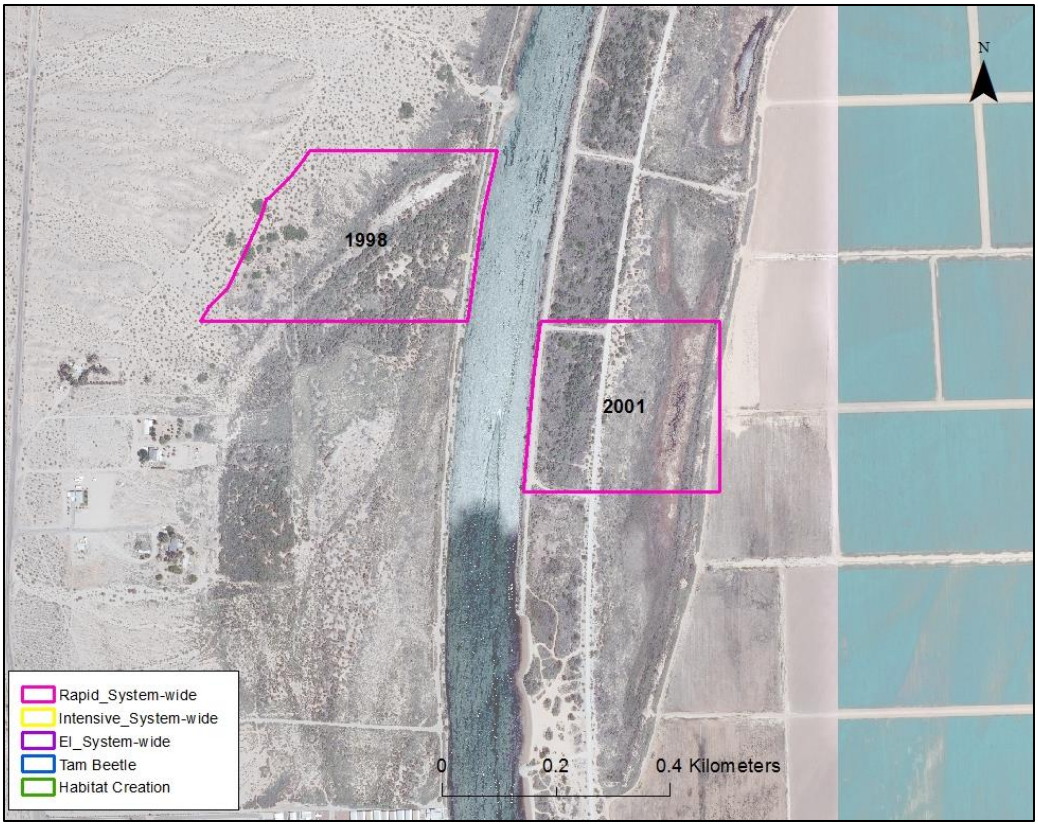


Figure 1-7.—Regional map of systemwide plots surveyed in 2013: Region 5 South, Havasu National Wildlife Refuge plots. Rapid survey plots are outlined in pink, intensive survey plots in yellow, and enhanced intensive plots in purple.

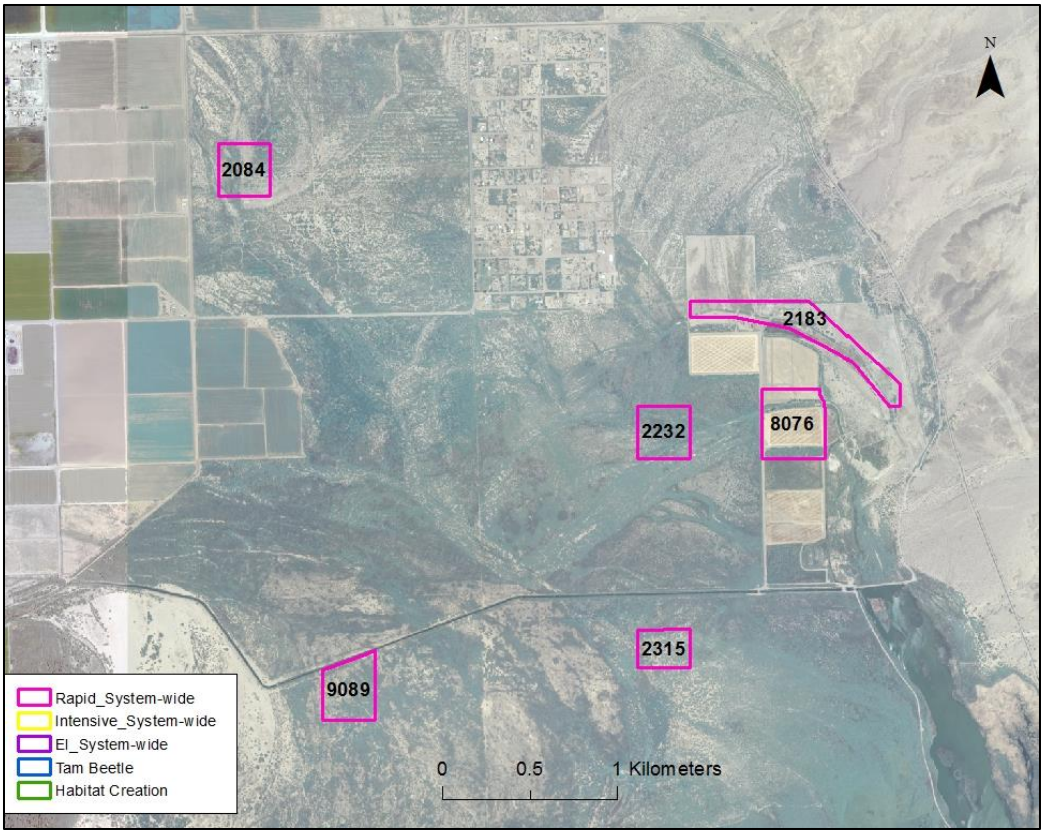


Figure 1-8.—Regional map of systemwide plots surveyed in 2013: Region 5 South, Havasu National Wildlife Refuge plots. Rapid survey plots are outlined in pink, intensive survey plots in yellow, and enhanced intensive plots in purple.

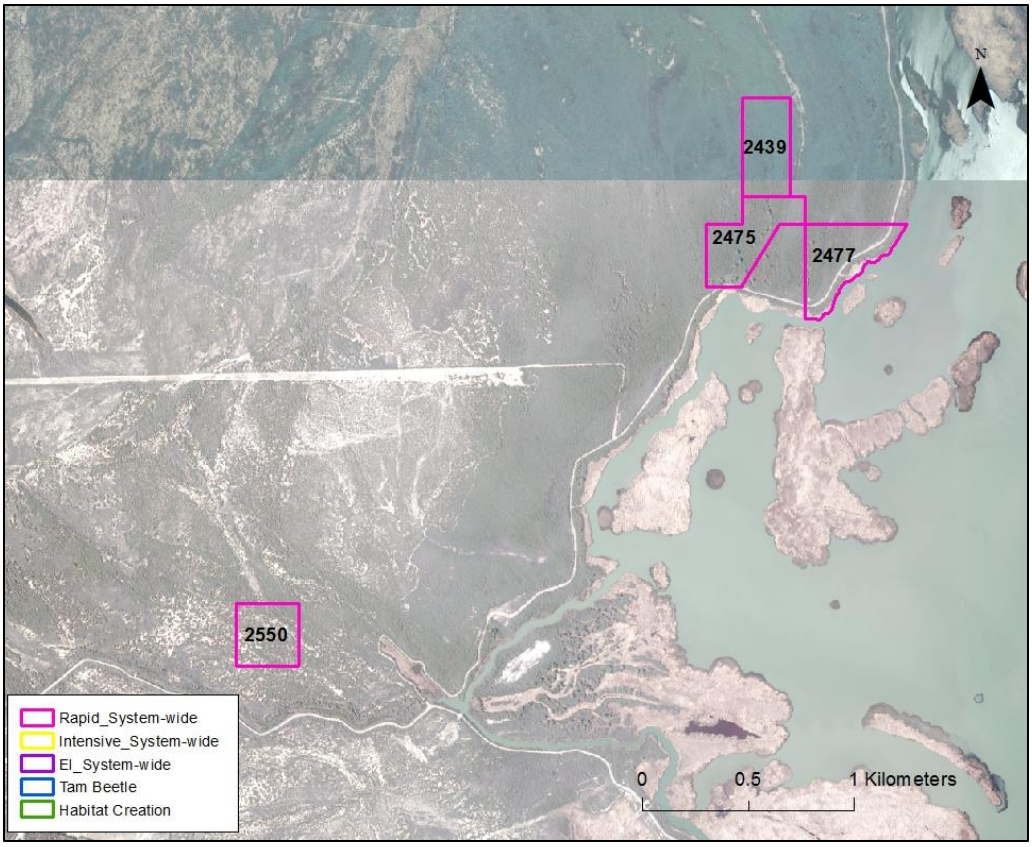


Figure 1-9.—Regional map of systemwide plots surveyed in 2013: Region 5 South, Havasu National Wildlife Refuge plots. Rapid survey plots are outlined in pink, intensive survey plots in yellow, and enhanced intensive plots in purple.

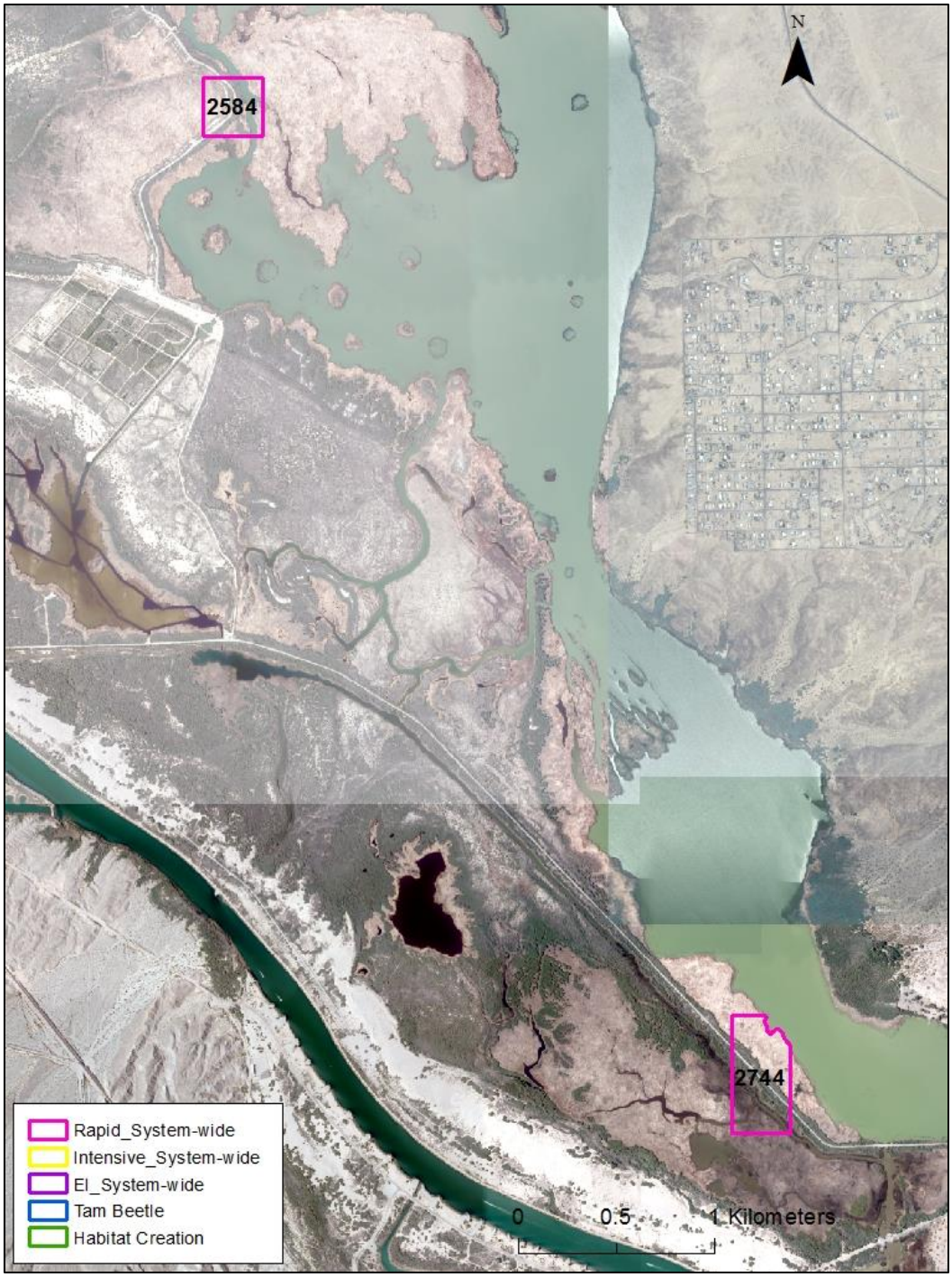


Figure 1-10.—Regional map of systemwide plots surveyed in 2013: Region 6 North, Havasu National Wildlife Refuge plots. Rapid survey plots are outlined in pink, intensive survey plots in yellow, and enhanced intensive plots in purple.

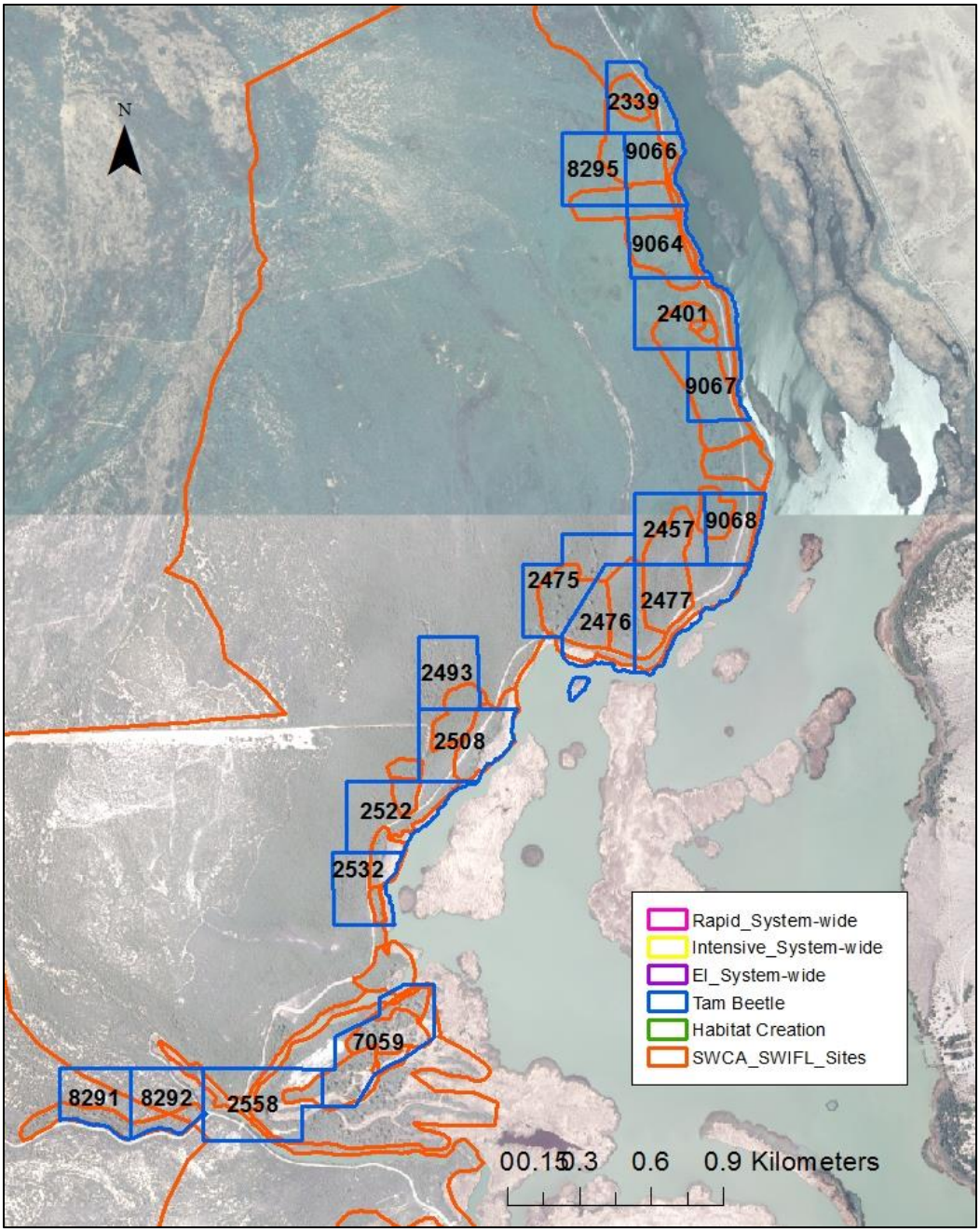


Figure 1-11.—Regional map of systemwide plots surveyed in 2013: Region 6 North, Havasu National Wildlife Refuge plots. Saltcedar beetle plots are outlined in blue, and southwestern willow flycatcher survey areas are in orange.

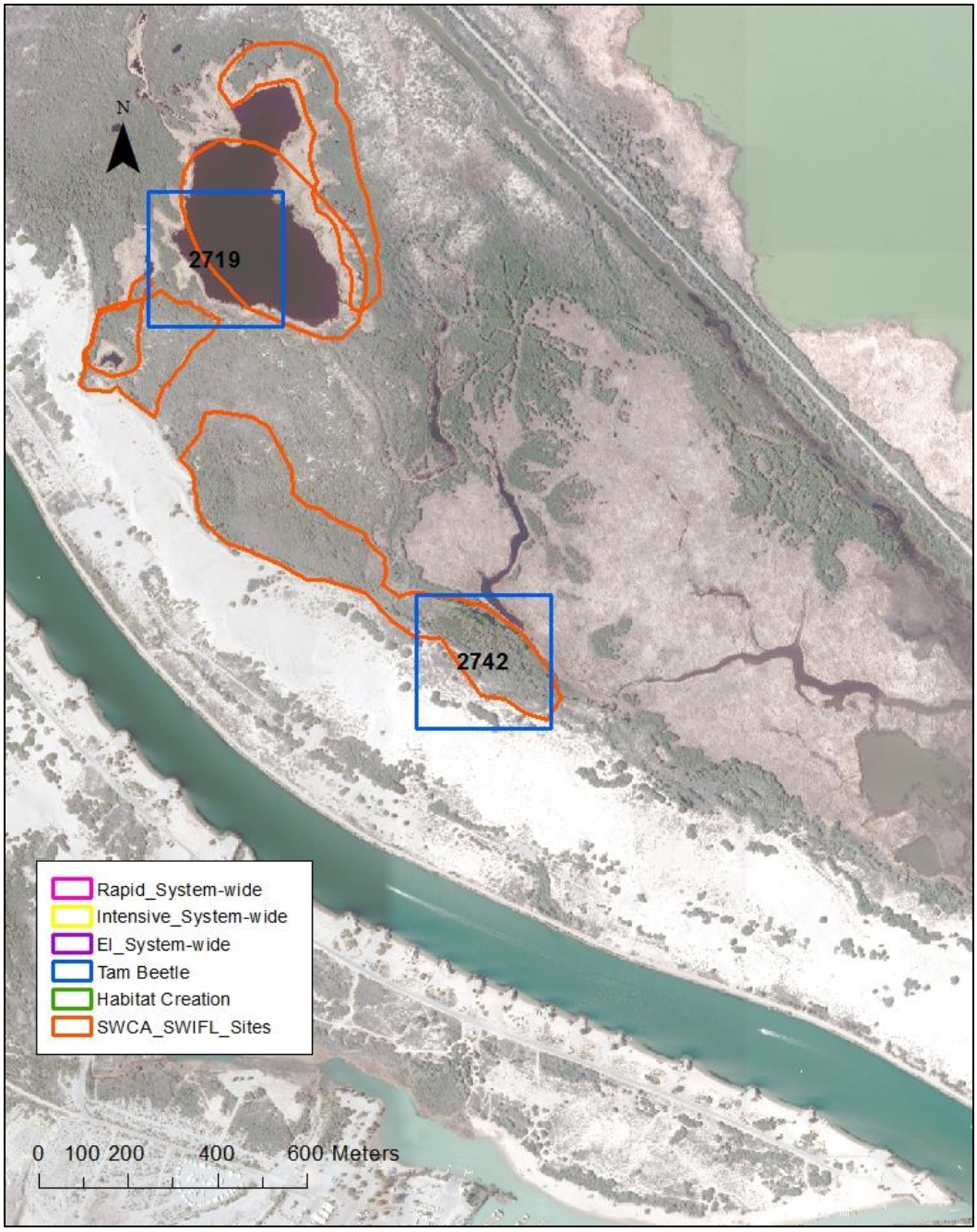


Figure 1-12.—Regional map of systemwide plots surveyed in 2013: Region 6 North, Havasu National Wildlife Refuge plots. Saltcedar beetle plots are outlined in blue, and southwestern willow flycatcher survey areas are in orange.

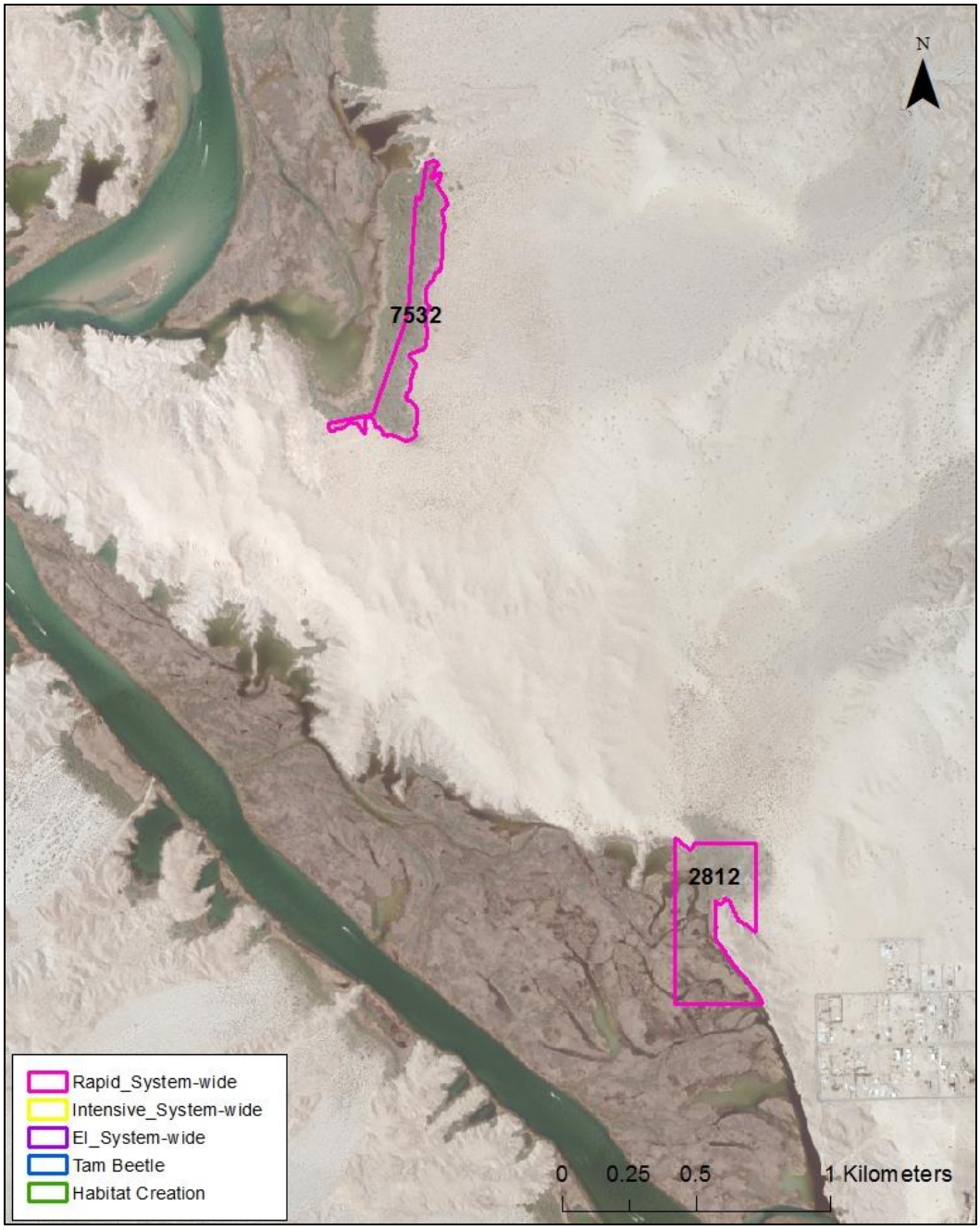


Figure 1-13.—Regional map of systemwide plots surveyed in 2013: Region 6 South, Havasu National Wildlife Refuge and Topock Gorge plots. Rapid survey plots are outlined in pink, intensive survey plots in yellow, and enhanced intensive plots in purple.

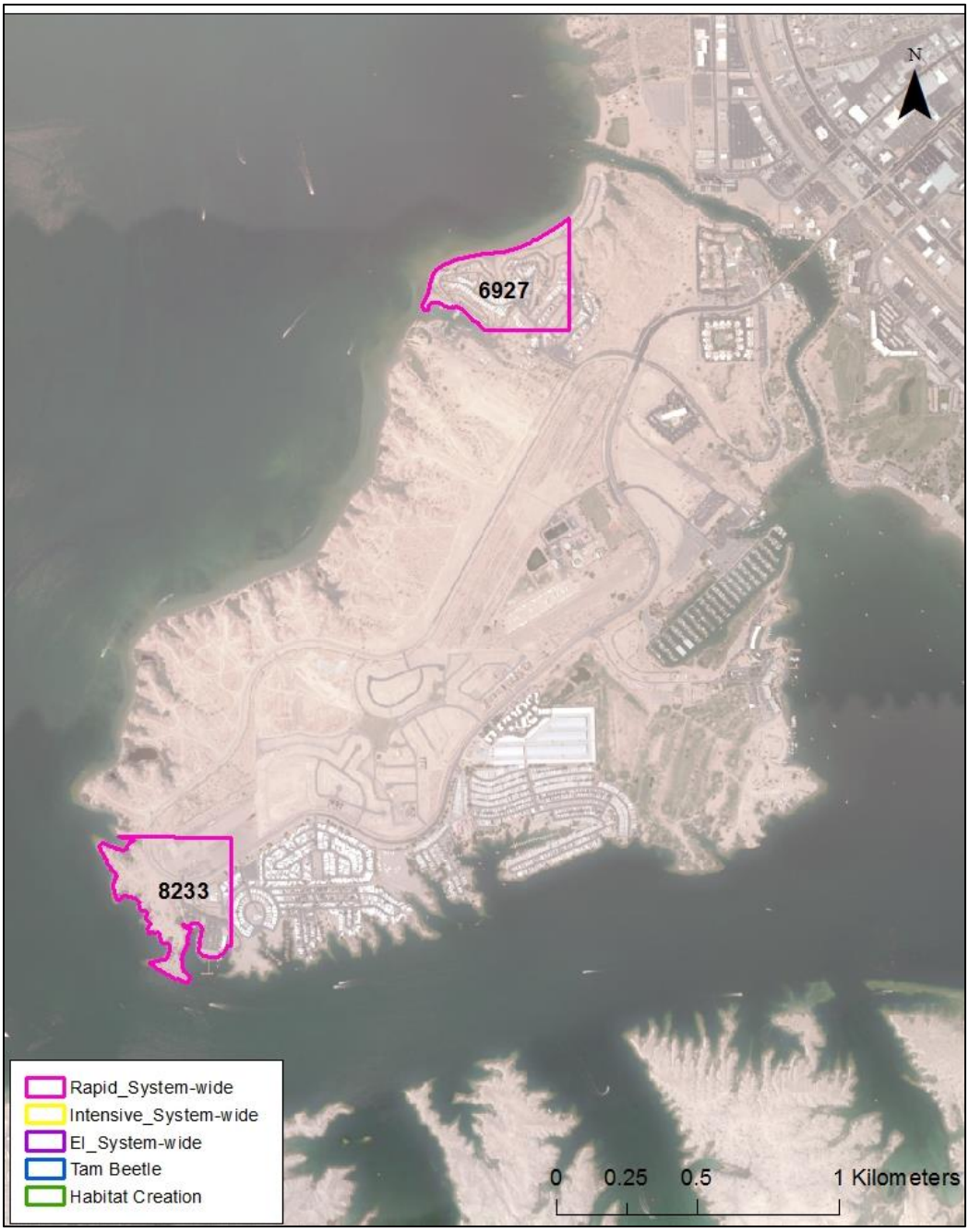


Figure 1-14.—Regional map of systemwide plots surveyed in 2013: Region 6 South, Lake Havasu plots. Rapid survey plots are outlined in pink, intensive survey plots in yellow, and enhanced intensive plots in purple.

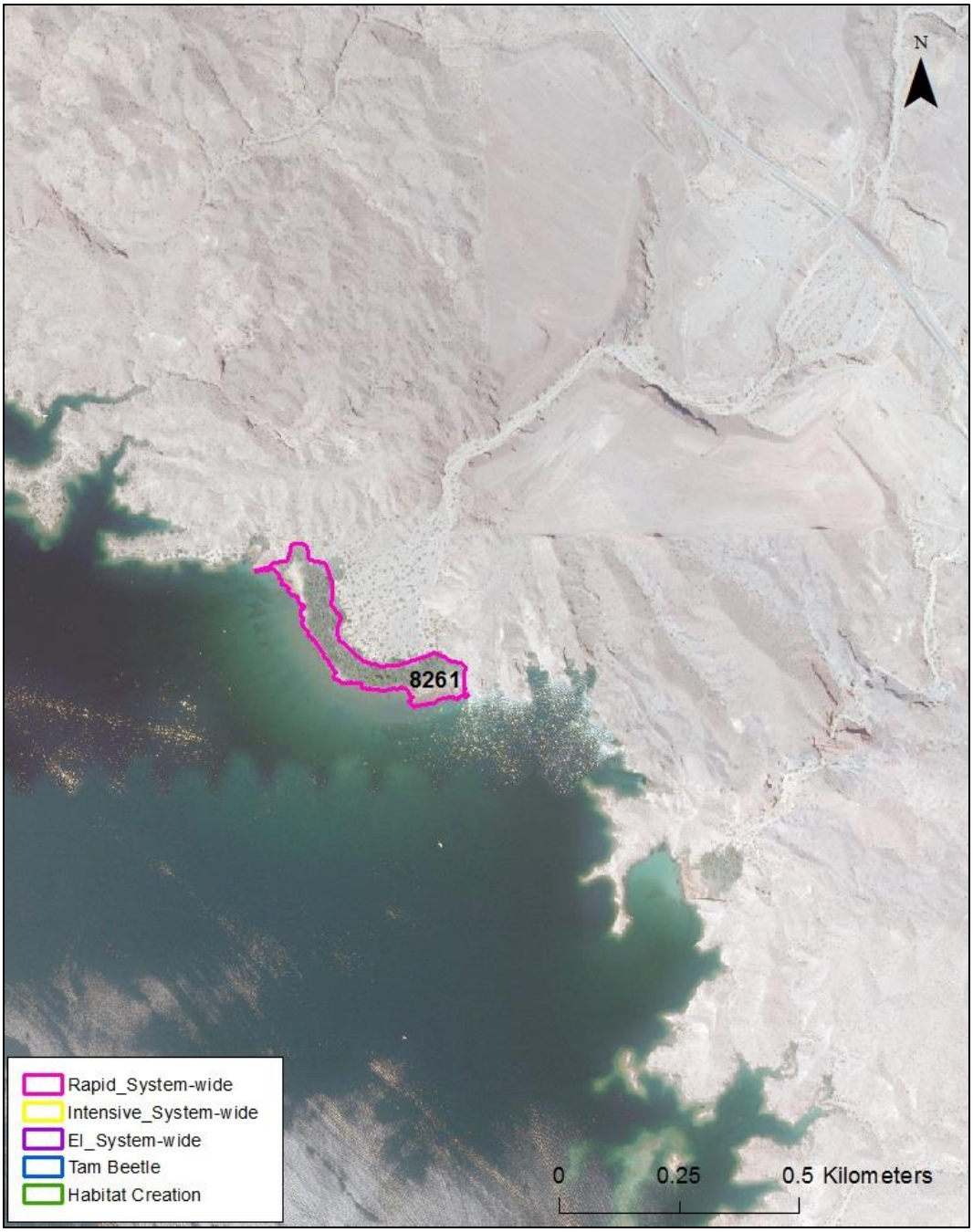


Figure 1-15.—Regional map of systemwide plots surveyed in 2013: Region 5 South, north of Bill Williams River National Wildlife Refuge. Rapid survey plots are outlined in pink, intensive survey plots in yellow, and enhanced intensive plots in purple.

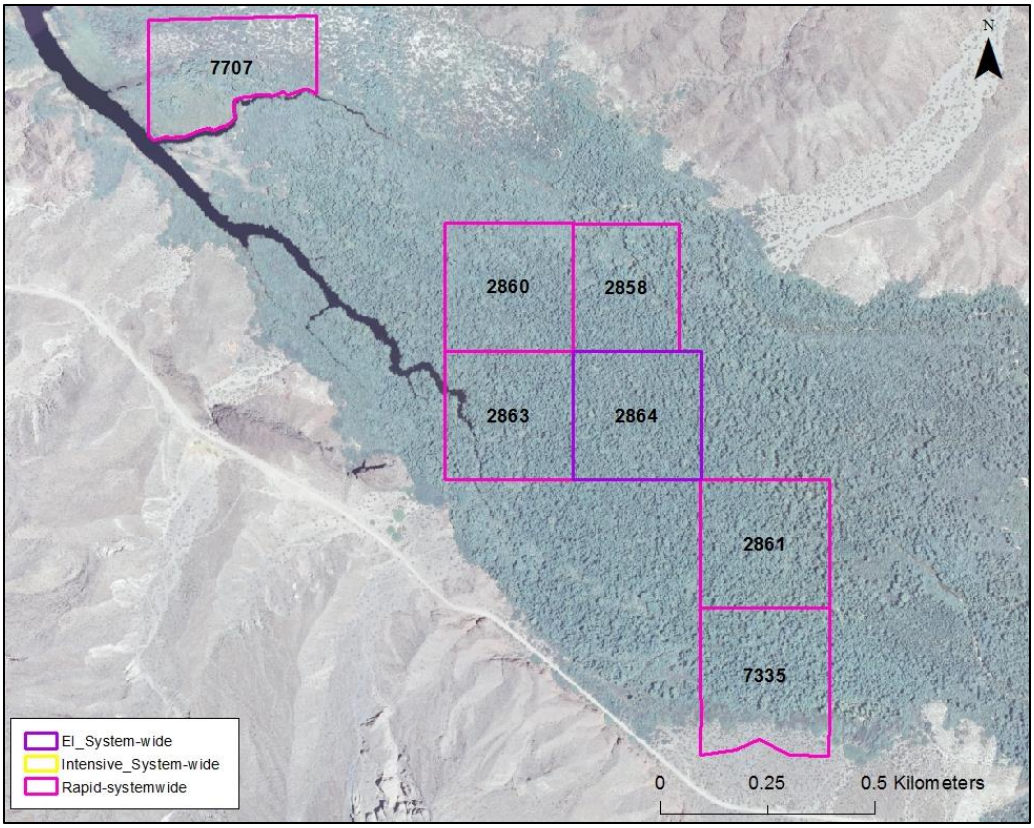


Figure 1-16.—Regional map of systemwide plots surveyed in 2013: Region 7 West, Bill Williams River National Wildlife Refuge plots. Rapid survey plots are outlined in pink, intensive survey plots in yellow, and enhanced intensive plots in purple.

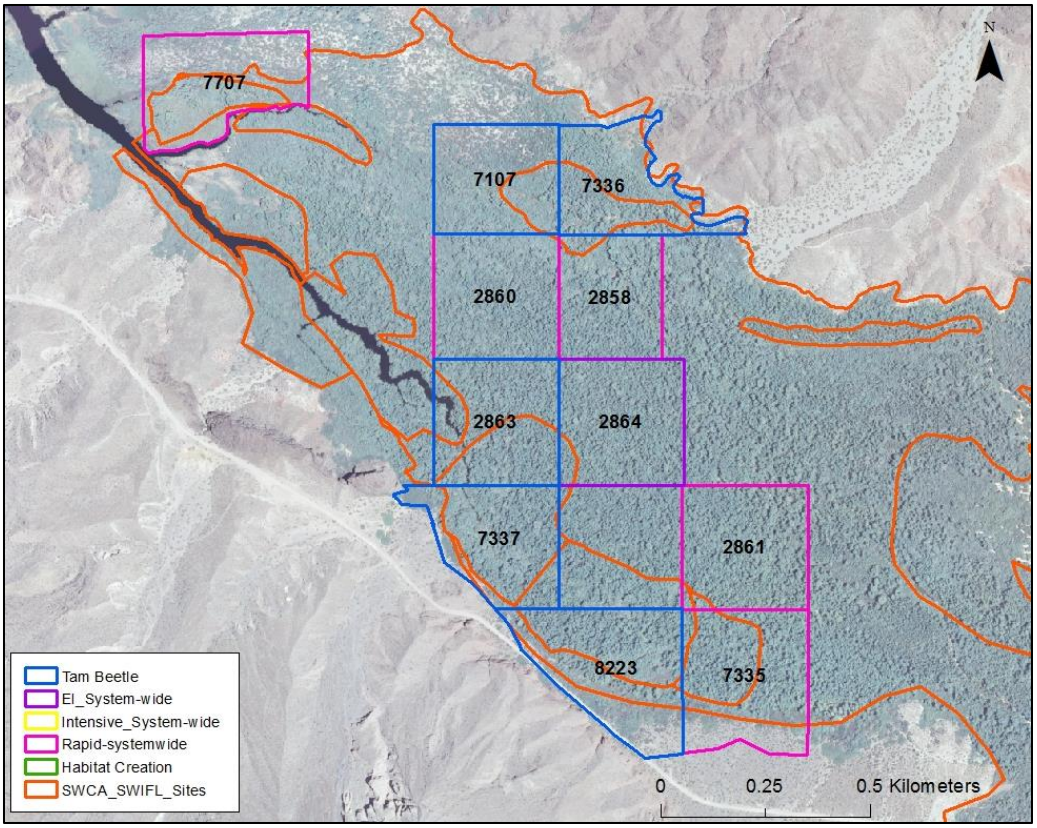


Figure 1-17.—Regional map of systemwide plots surveyed in 2013: Region 7 West, Bill Williams River National Wildlife Refuge plots. Rapid survey plots are outlined in pink, intensive survey plots in yellow, and enhanced intensive plots in purple. Saltcedar beetle plots are outlined in blue, and southwestern willow flycatcher survey areas are in orange.

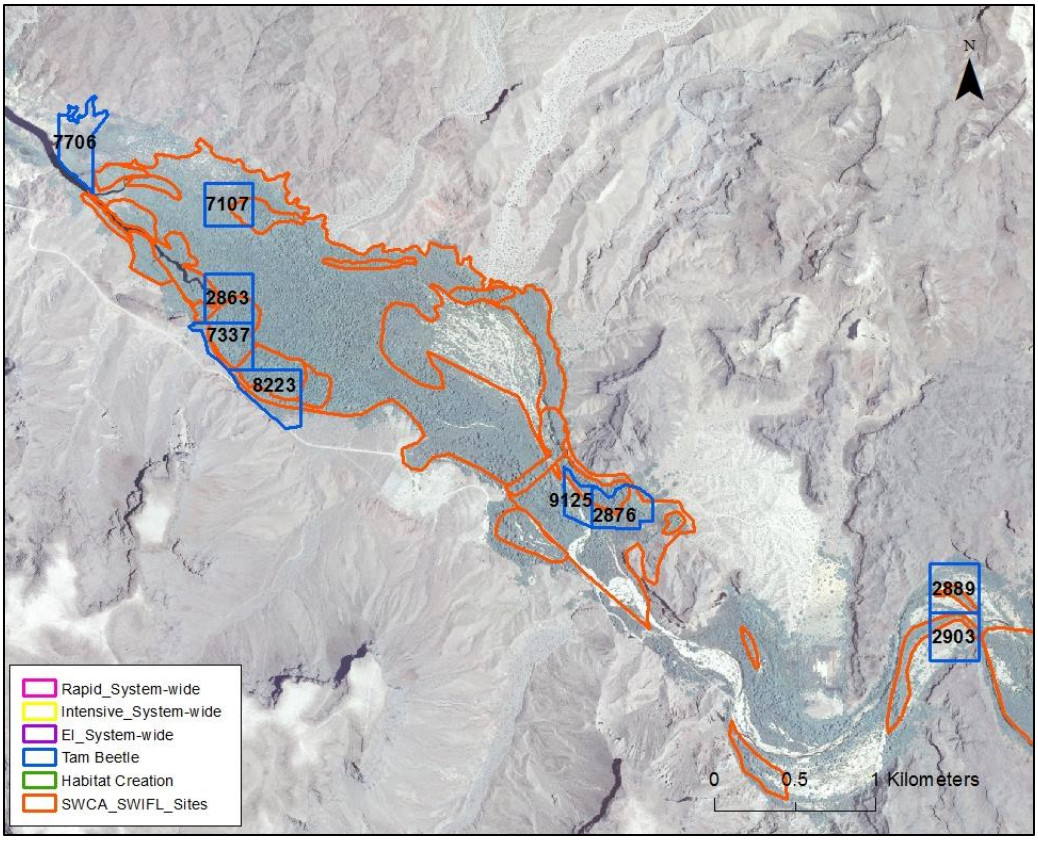


Figure 1-18.—Regional map of systemwide plots surveyed in 2013: Region 7 West, Bill Williams River National Wildlife Refuge plots. Saltcedar beetle plots are outlined in blue, and southwestern willow flycatcher survey areas are in orange.

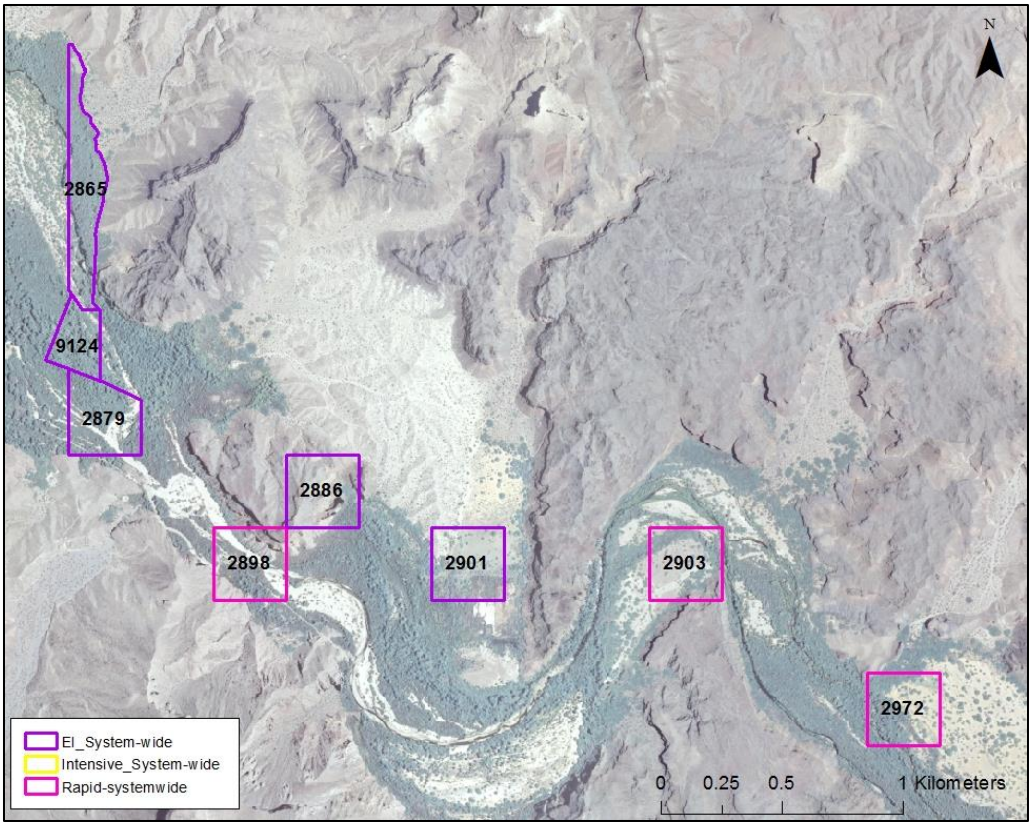


Figure 1-19.—Regional map of systemwide plots surveyed in 2013: Region 7 West, Bill Williams River National Wildlife Refuge plots. Rapid survey plots are outlined in pink, intensive survey plots in yellow, and enhanced intensive plots in purple.

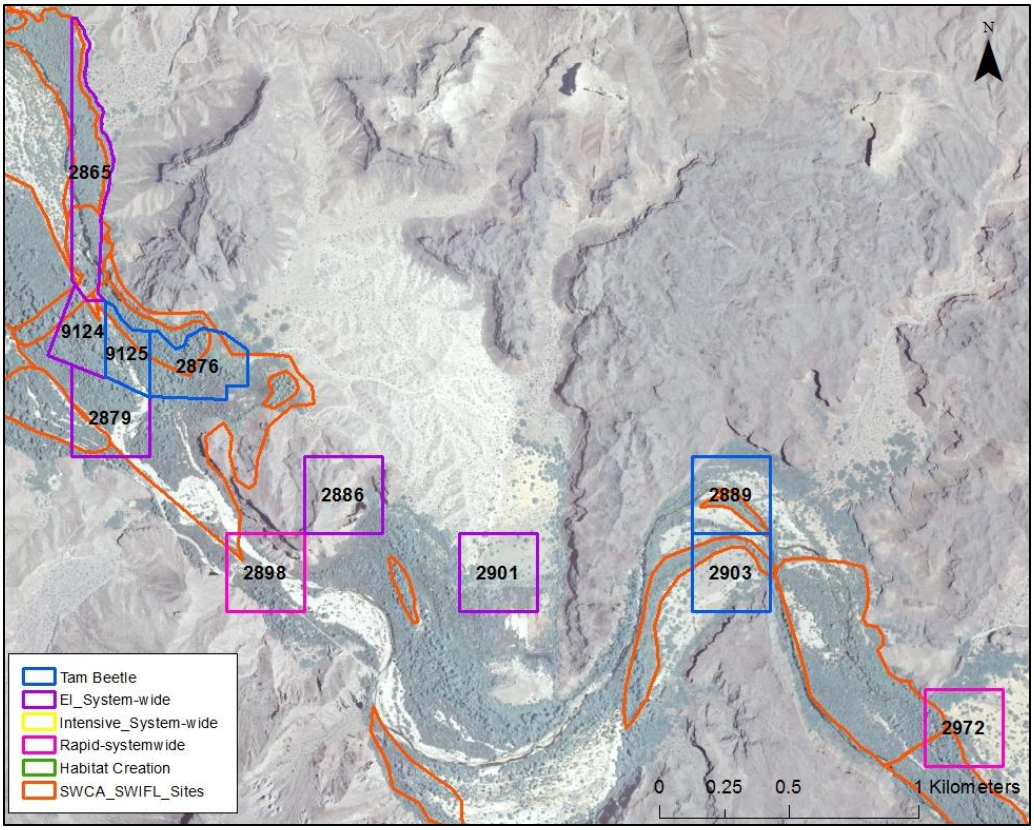


Figure 1-20.—Regional map of systemwide plots surveyed in 2013: Region 7 West, Bill Williams River National Wildlife Refuge plots. Rapid survey plots are outlined in pink, intensive survey plots in yellow, and enhanced intensive plots in purple. Saltcedar beetle plots are outlined in blue, and southwestern willow flycatcher survey areas are in orange.

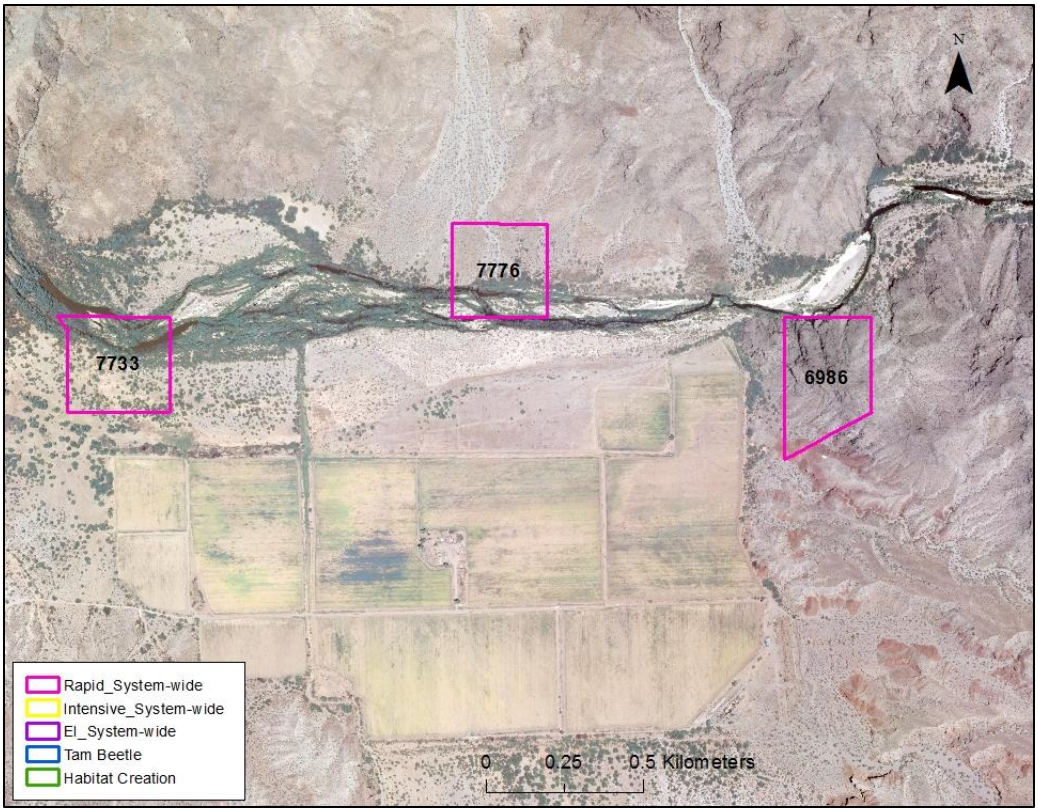


Figure 1-21.—Regional map of systemwide plots surveyed in 2013: Region 7, Lincoln Ranch plots. Rapid survey plots are outlined in pink, intensive survey plots in yellow, and enhanced intensive plots in purple.

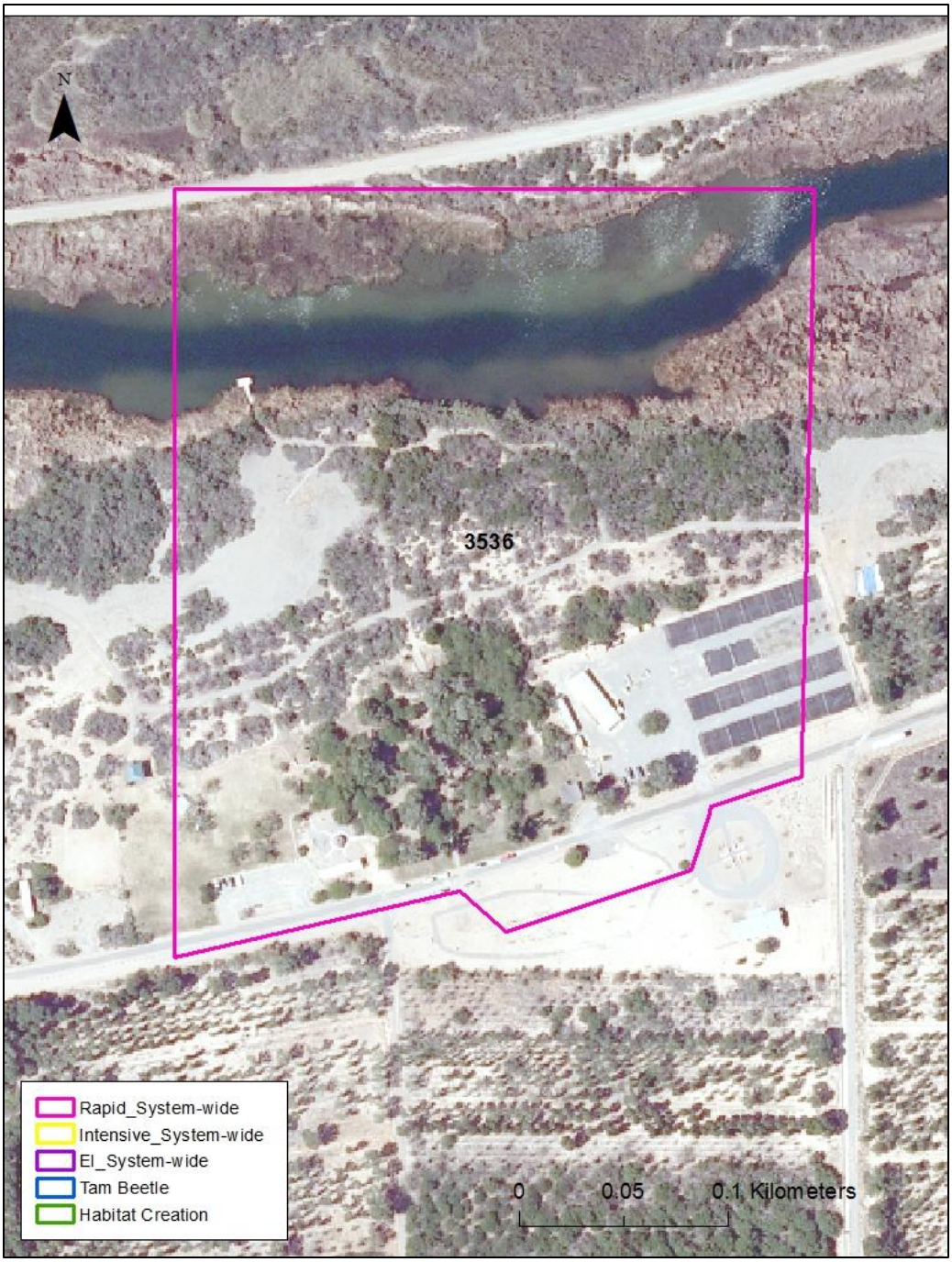


Figure 1-22.—Regional map of systemwide plots surveyed in 2013: Region 9, Colorado River Indian Tribe land. Rapid survey plots are outlined in pink, intensive survey plots in yellow, and enhanced intensive plots in purple.

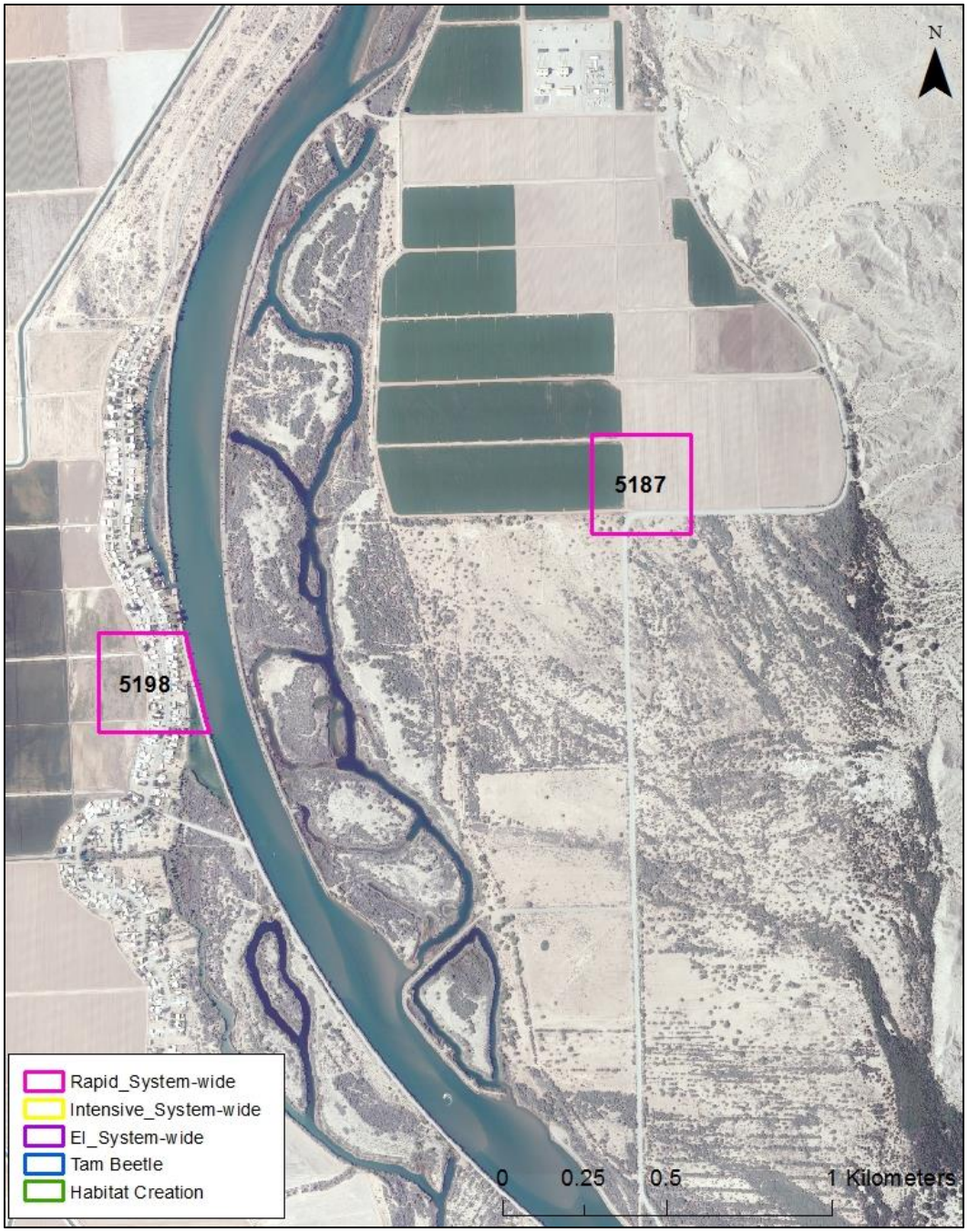


Figure 1-23.—Regional map of systemwide plots surveyed in 2013: Region 8, Central. Rapid survey plots are outlined in pink, intensive survey plots in yellow, and enhanced intensive plots in purple.

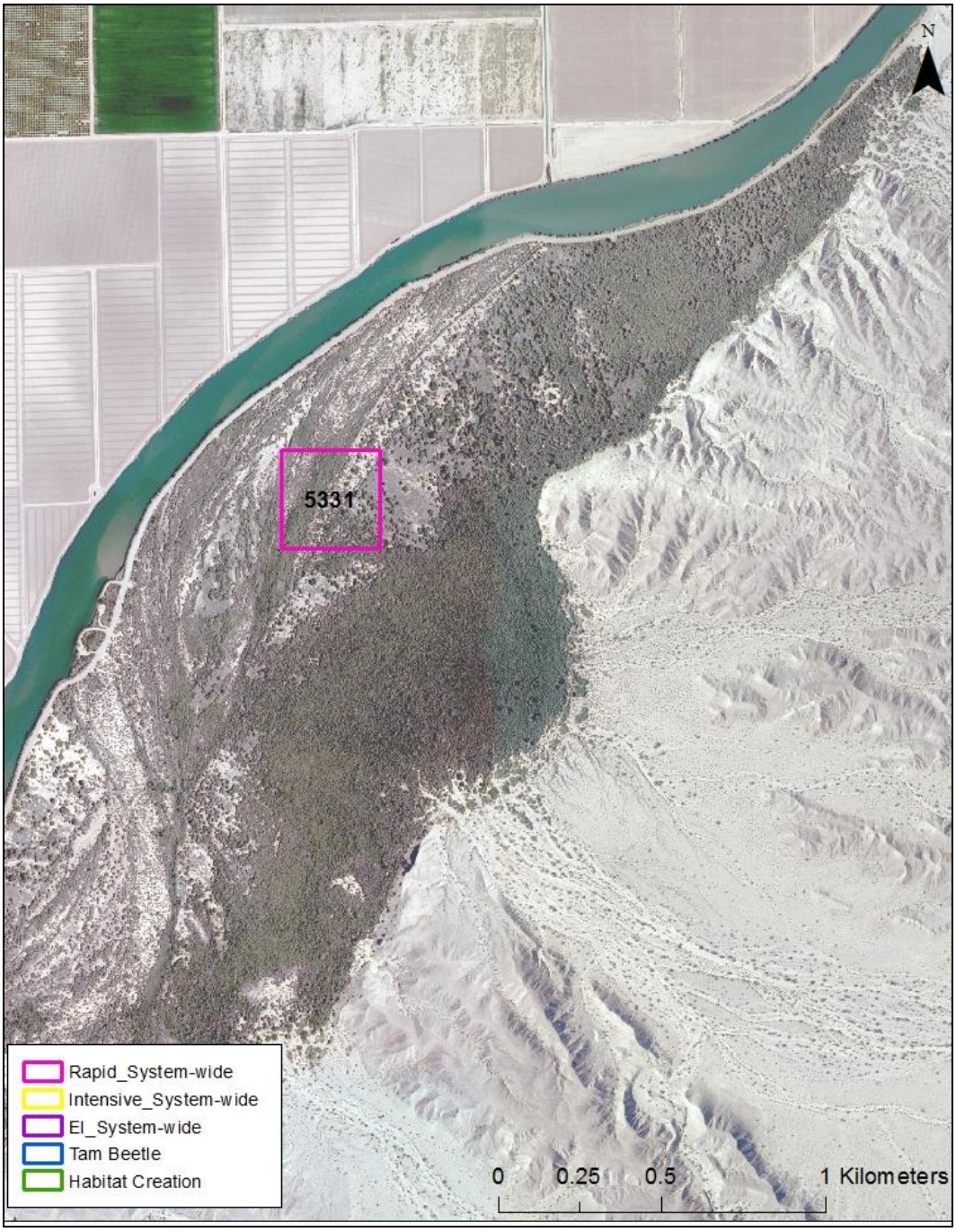


Figure 1-24.—Regional map of systemwide plots surveyed in 2013: Region 8 Central, south of Blythe plots. Rapid survey plots are outlined in pink, intensive survey plots in yellow, and enhanced intensive plots in purple.

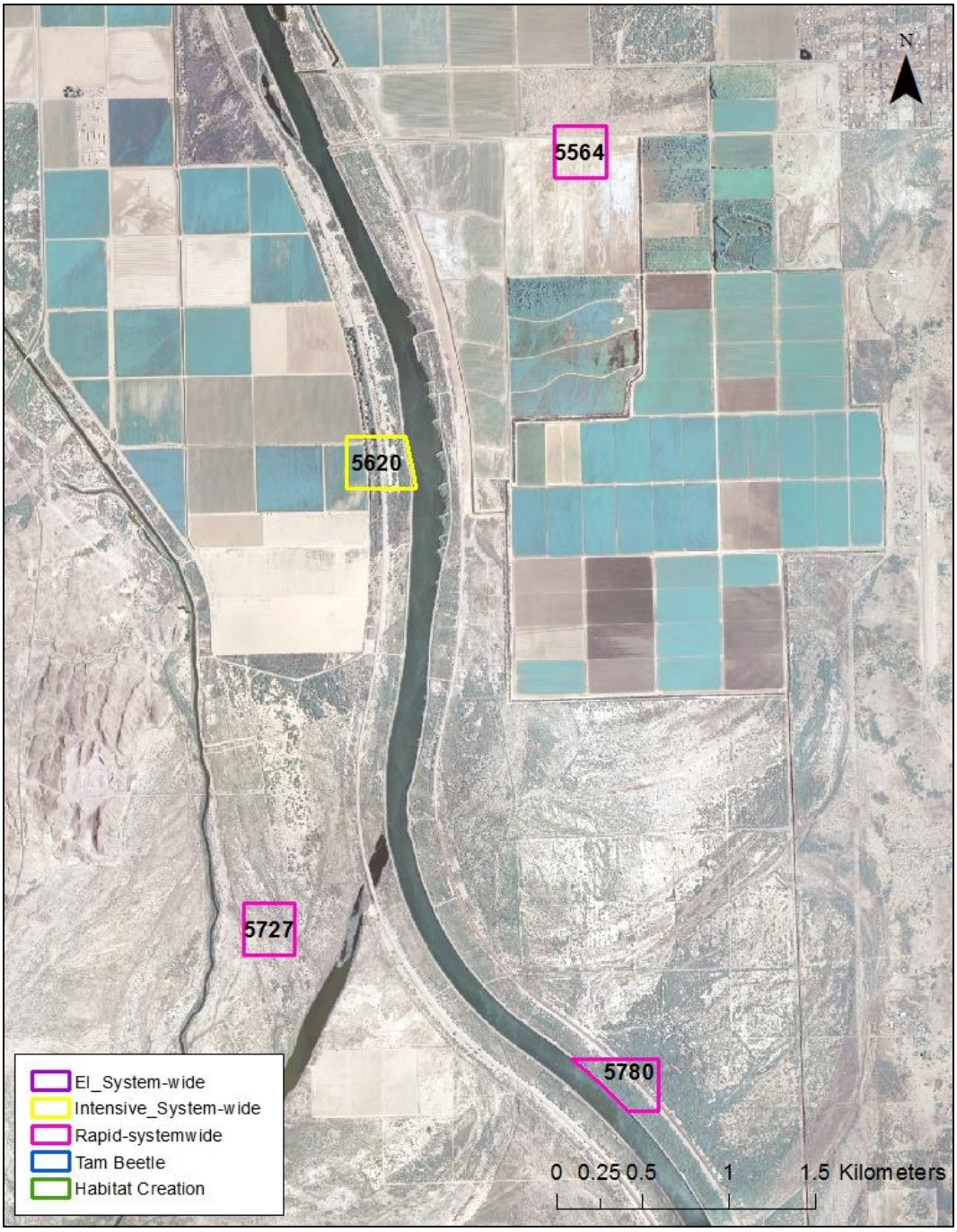


Figure 1-25.—Regional map of systemwide plots surveyed in 2013: Region 10 North, Cibola National Wildlife Refuge. Rapid survey plots are outlined in pink, intensive survey plots in yellow, and enhanced intensive plots in purple.

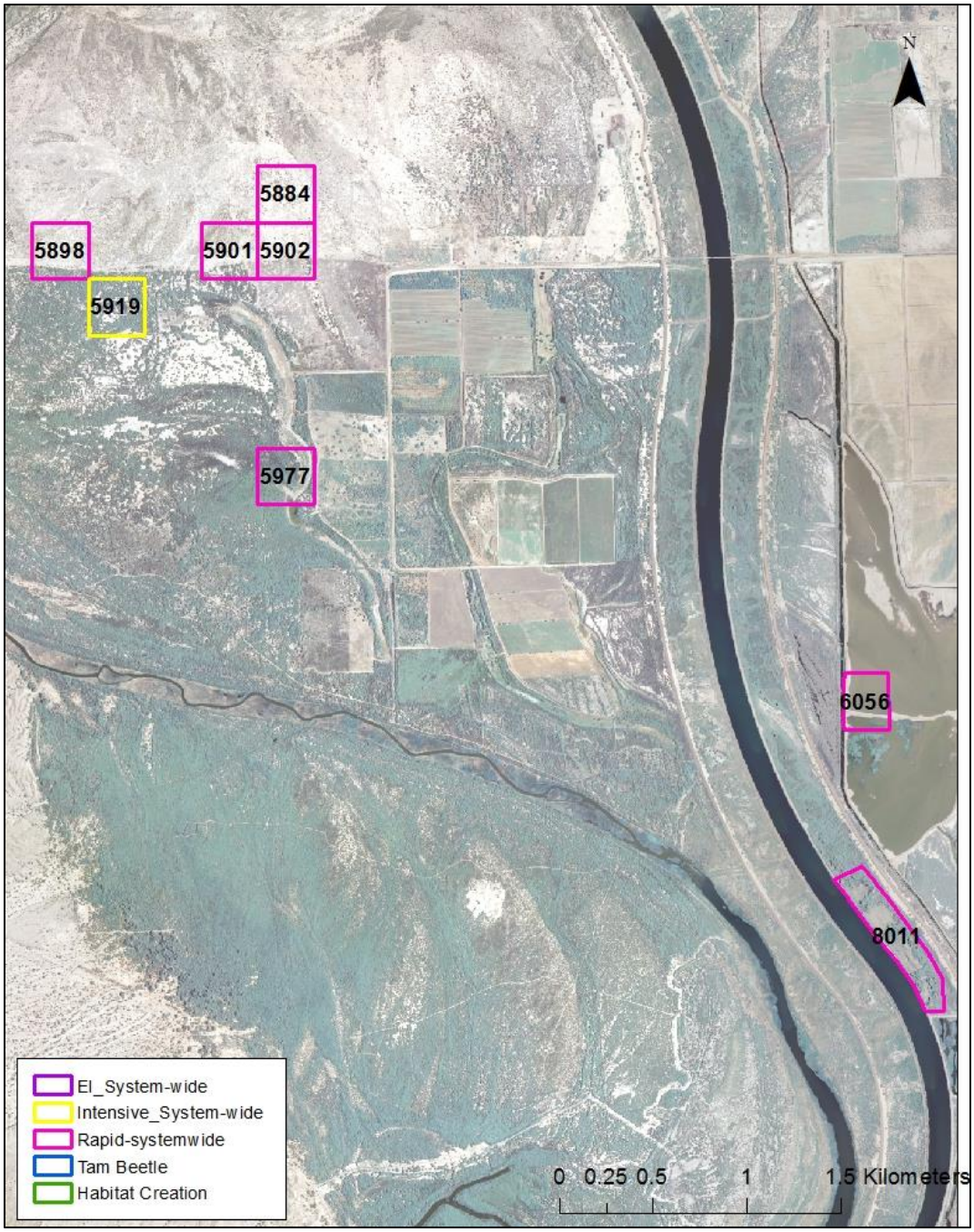


Figure 1-26.—Regional map of systemwide plots surveyed in 2013: Region 10, Cibola National Wildlife Refuge. Rapid survey plots are outlined in pink, intensive survey plots in yellow, and enhanced intensive plots in purple.

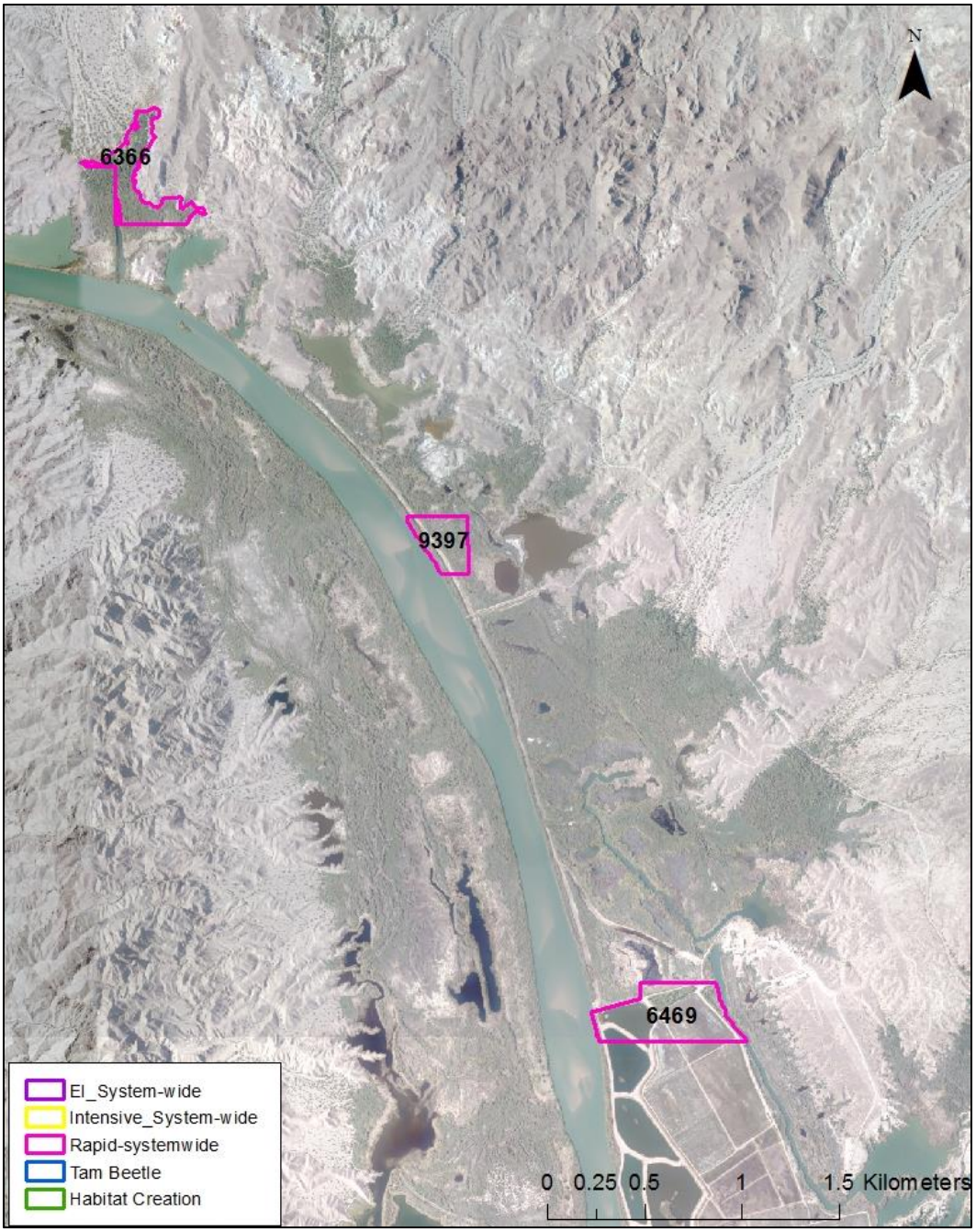


Figure 1-27.—Regional map of systemwide plots surveyed in 2013: Region 11, North. Rapid survey plots are outlined in pink, intensive survey plots in yellow, and enhanced intensive plots in purple.

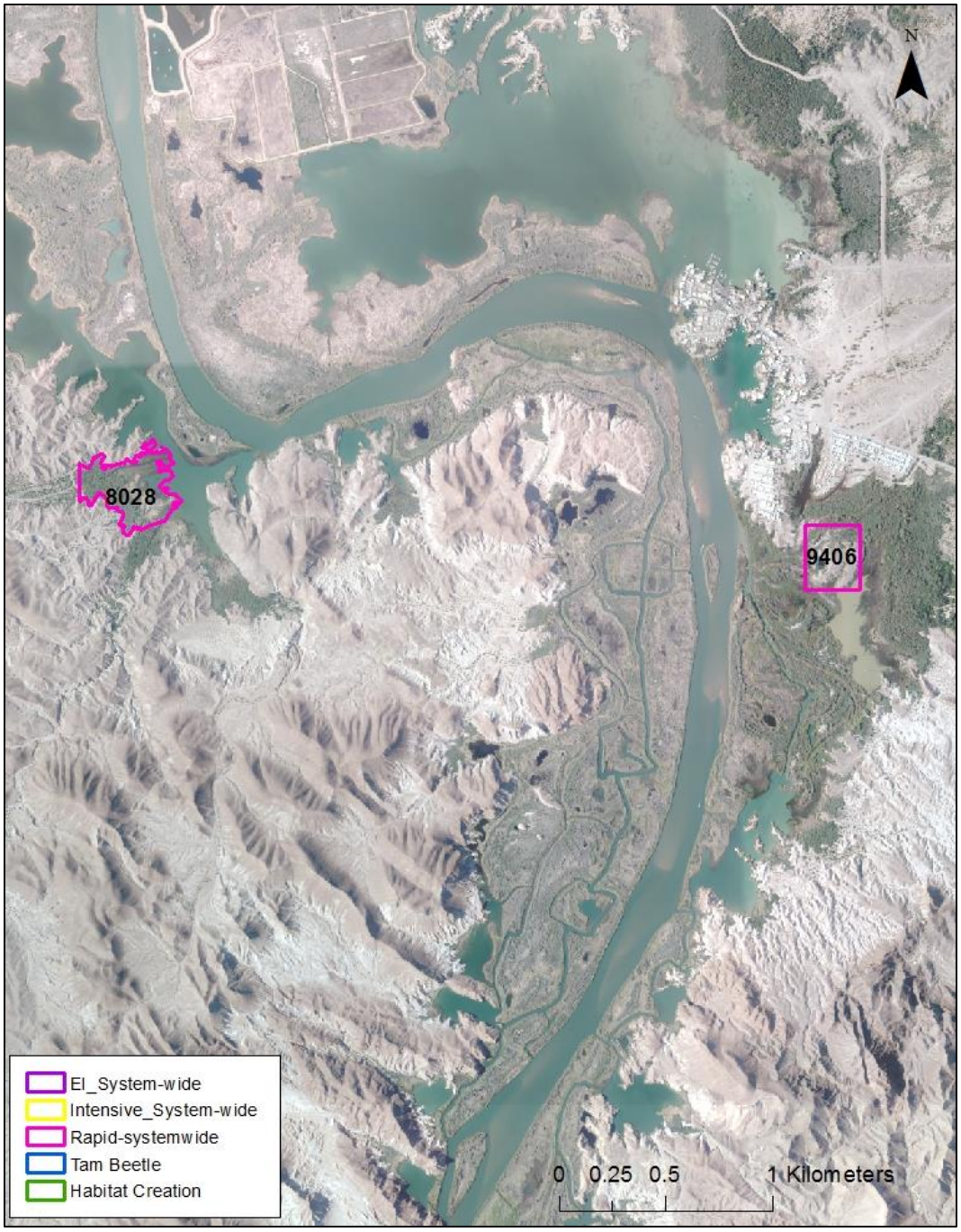


Figure 1-28.—Regional map of systemwide plots surveyed in 2013: Region 11, North. Rapid survey plots are outlined in pink, intensive survey plots in yellow, and enhanced intensive plots in purple.

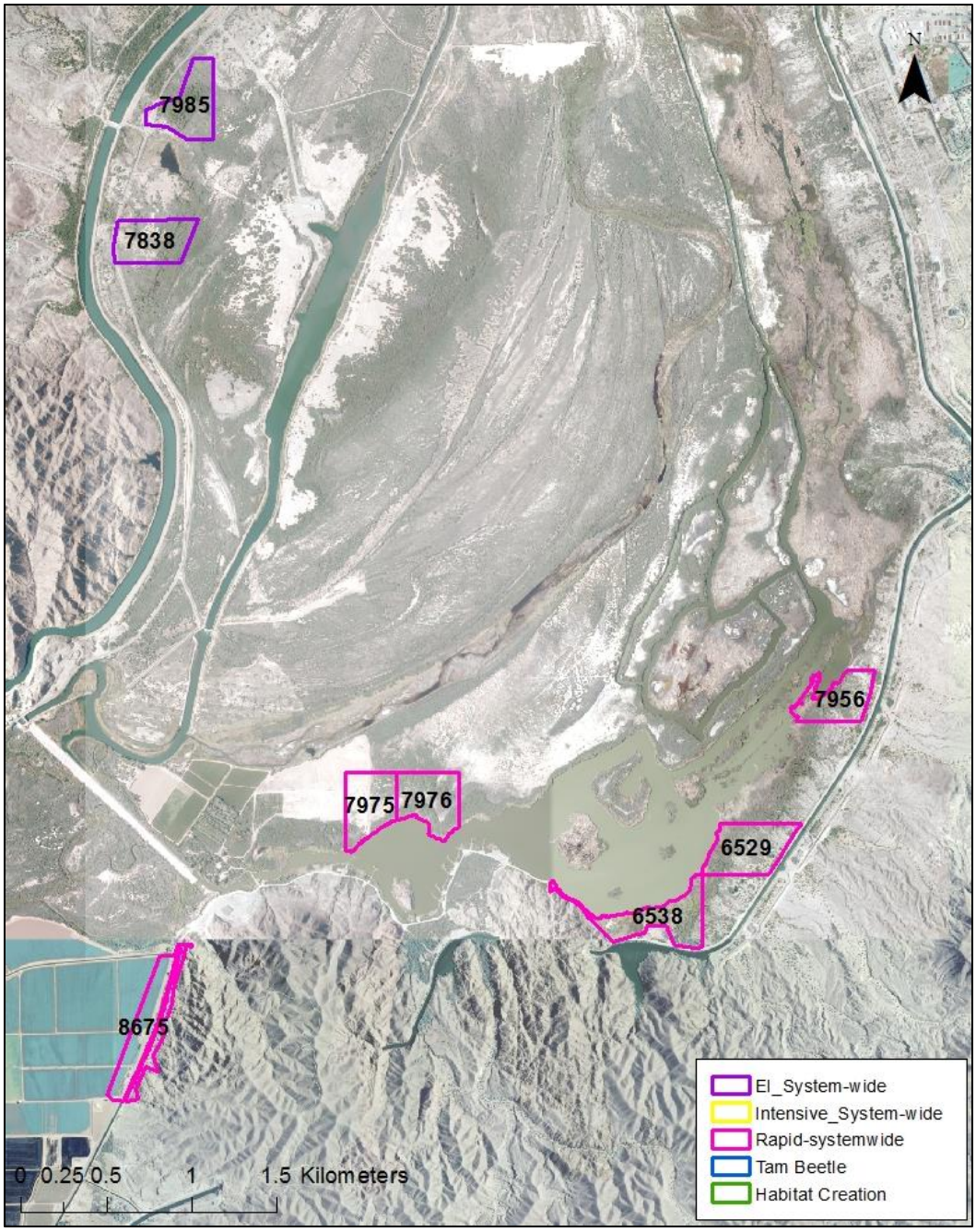


Figure 1-29.—Regional map of systemwide plots surveyed in 2013: Region 12, North. Rapid survey plots are outlined in pink, intensive survey plots in yellow, and enhanced intensive plots in purple.

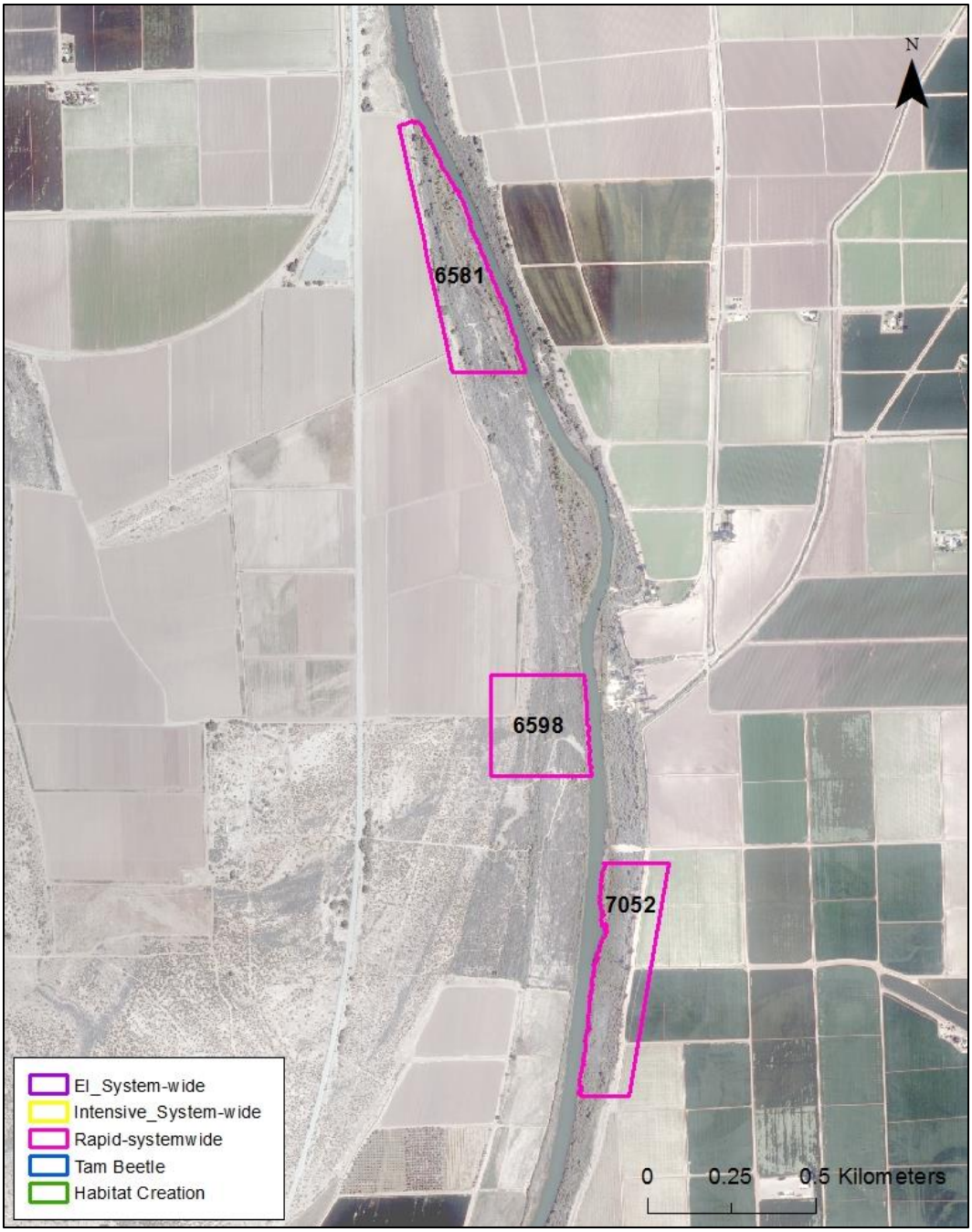


Figure 1-30.—Regional map of systemwide plots surveyed in 2013: Region 12, South. Rapid survey plots are outlined in pink, intensive survey plots in yellow, and enhanced intensive plots in purple.

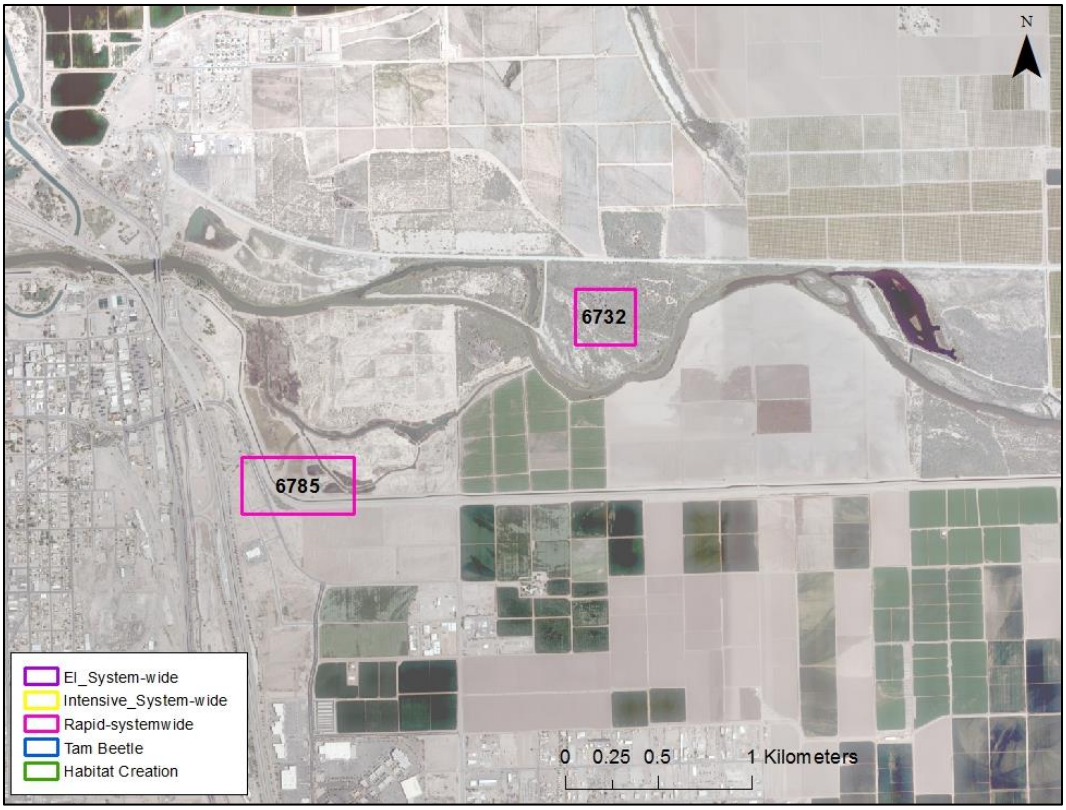


Figure 1-31.—Regional map of systemwide plots surveyed in 2013: Region 12, South. Rapid survey plots are outlined in pink, intensive survey plots in yellow, and enhanced intensive plots in purple.

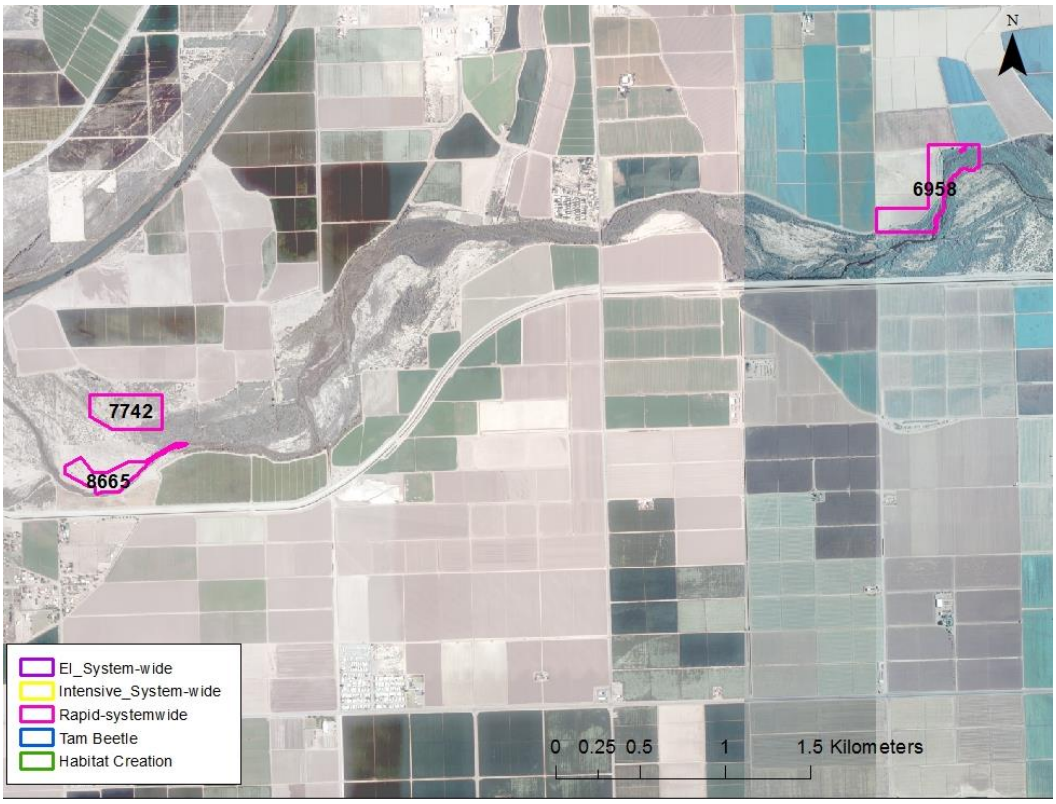


Figure 1-32.—Regional map of systemwide plots surveyed in 2013: Region 12, South. Rapid survey plots are outlined in pink, intensive survey plots in yellow, and enhanced intensive plots in purple.

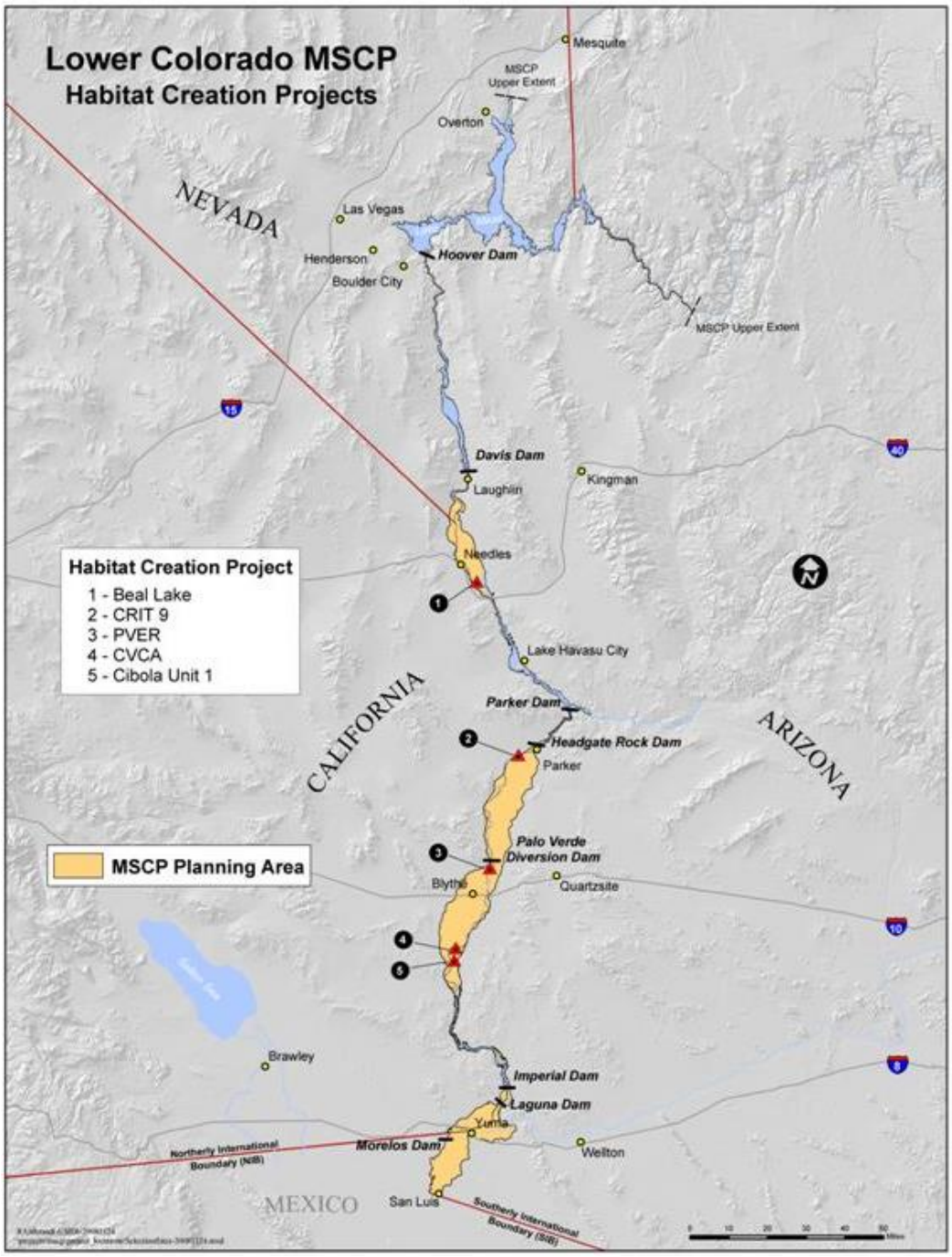


Figure 1-33.—Overview of habitat creation sites of the Lower Colorado River Multi-Species Conservation Program in 2013. Map provided by the Bureau of Reclamation, Lower Colorado Region.

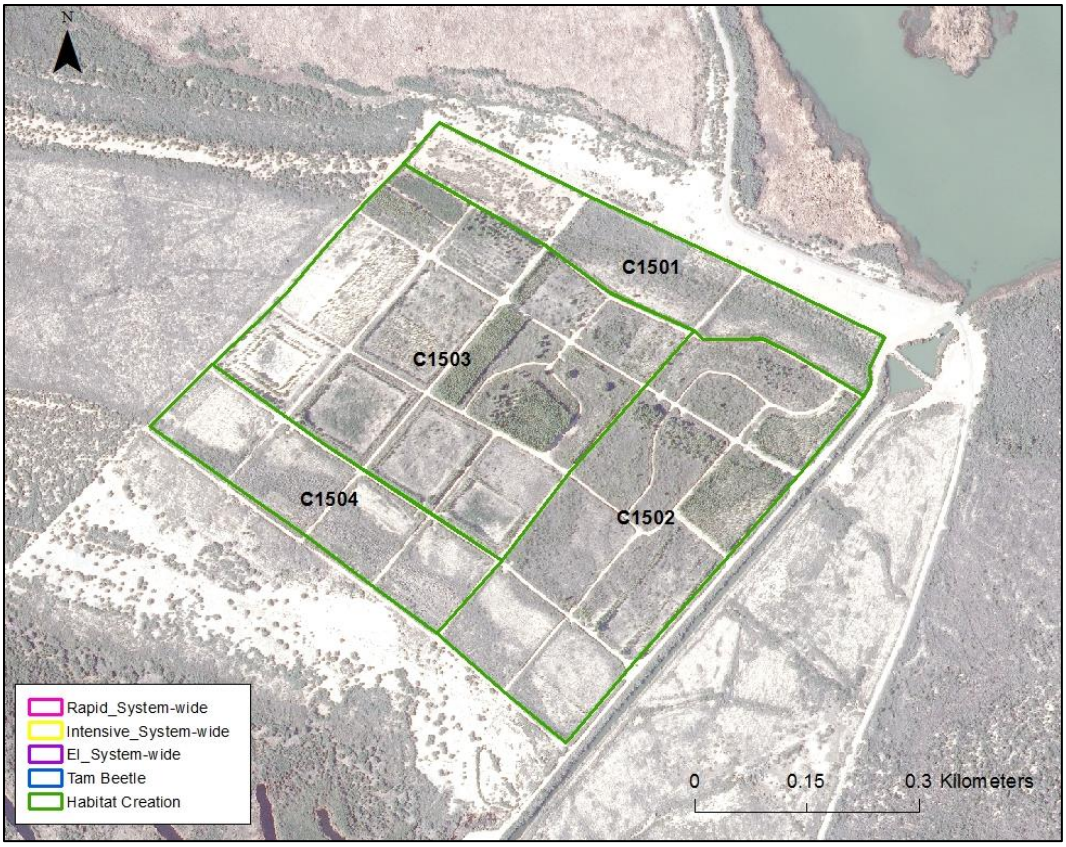


Figure 1-34.—Overview of Beal Lake Habitat Conservation Areasite and four riparian bird survey plots, 2013.

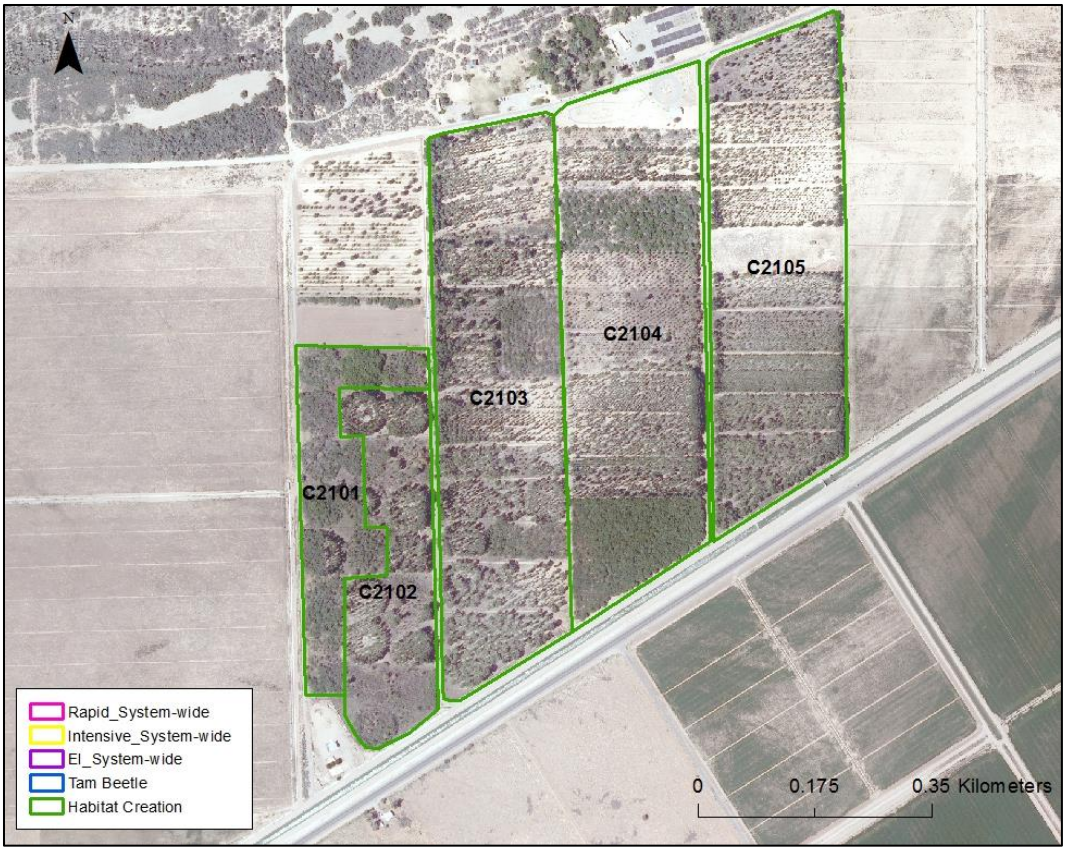


Figure 1-35.—Overview of Colorado River Indian Tribe habitat creation sites with five riparian bird survey plots, 2013.

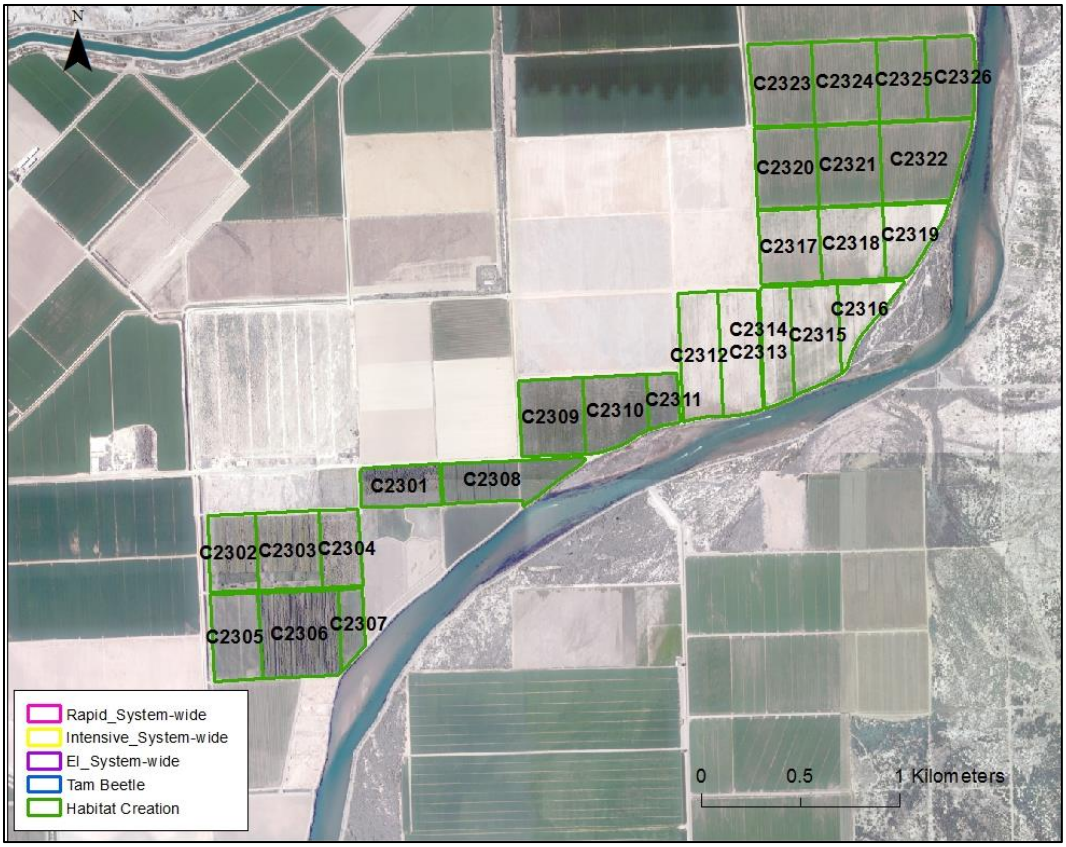


Figure 1-36.—Overview of Palo Verde Ecological Reserve habitat creation site with 26 riparian bird survey plots, 2013.

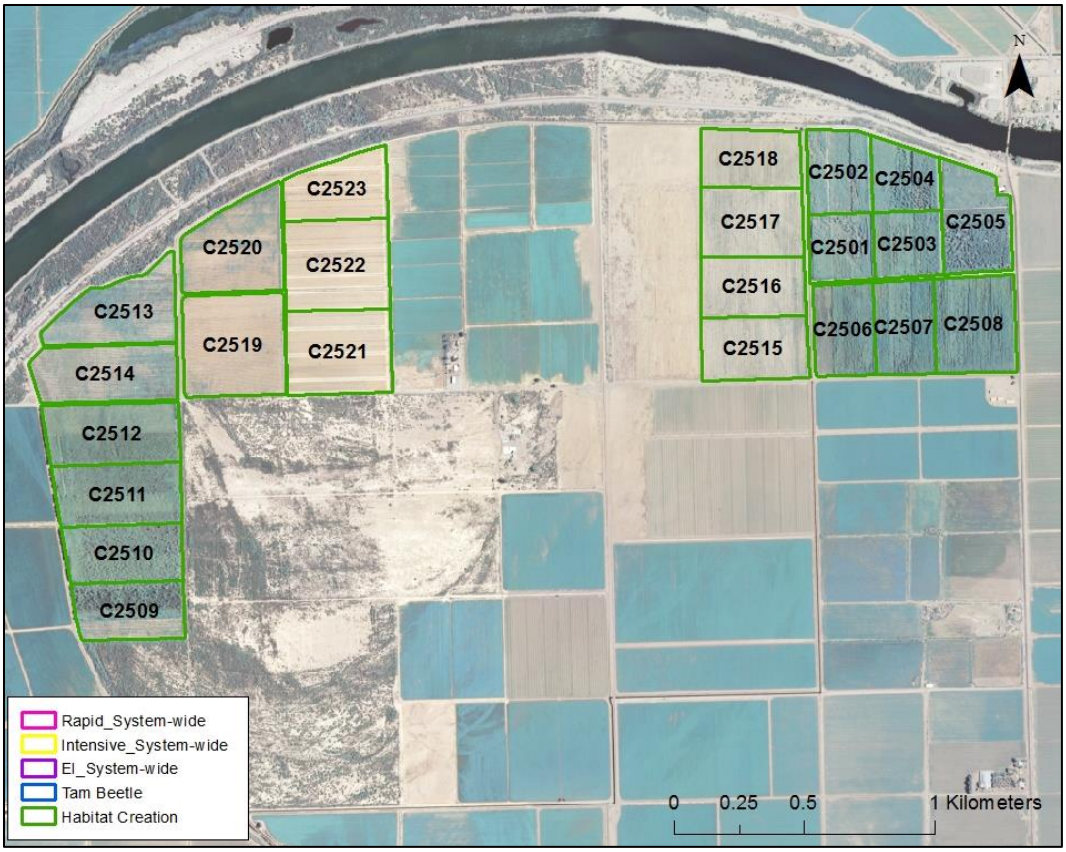


Figure 1-37.—Overview of Cibola Valley Conservation Area habitat creation site with 23 riparian bird survey plots, 2013.

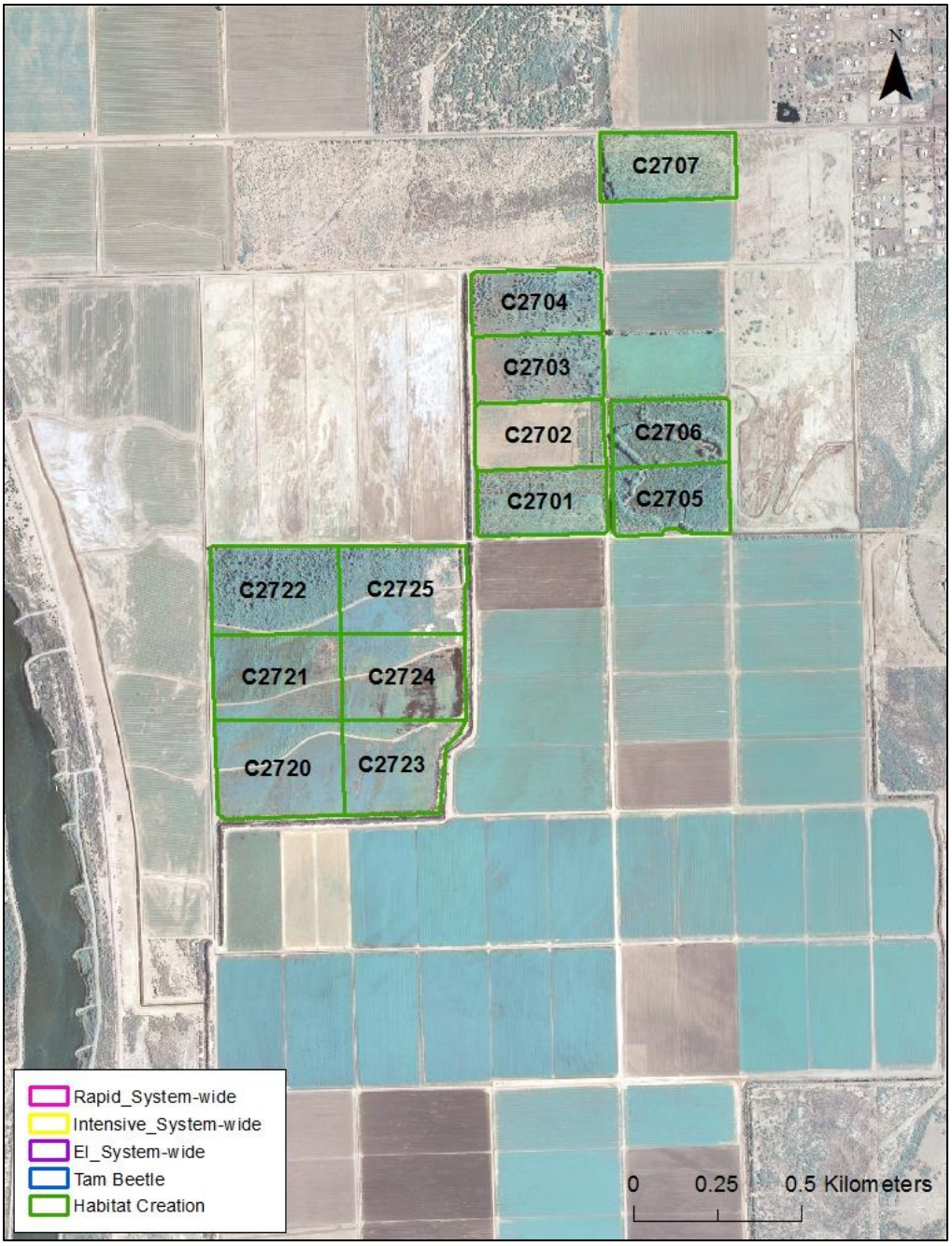


Figure 1-38.—Overview of Cibola Farm Unit 1 habitat creation sites with 13 riparian bird survey plots, 2013.

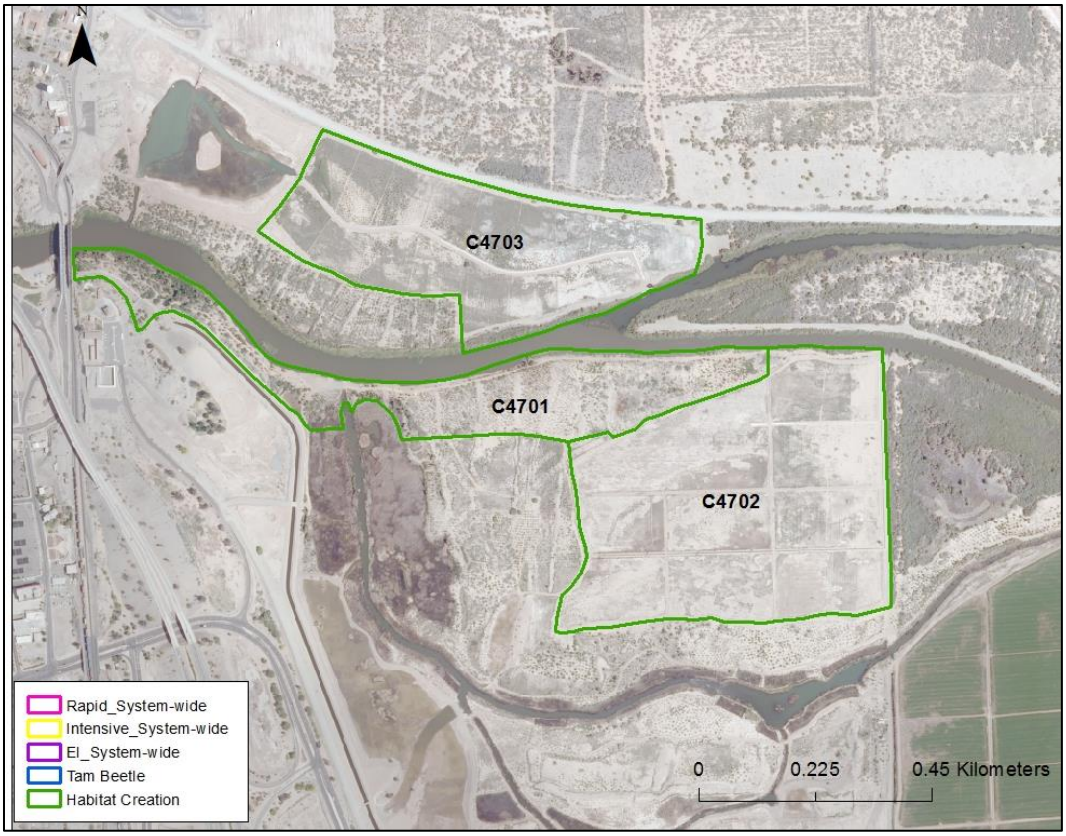


Figure 1-39.—Overview of Yuma East Wetlands habitat creation sites with three riparian bird survey plots (surveyed by Fred Phillips Consulting, LLC, in 2013).

ATTACHMENT 2

Sample Plot Maps

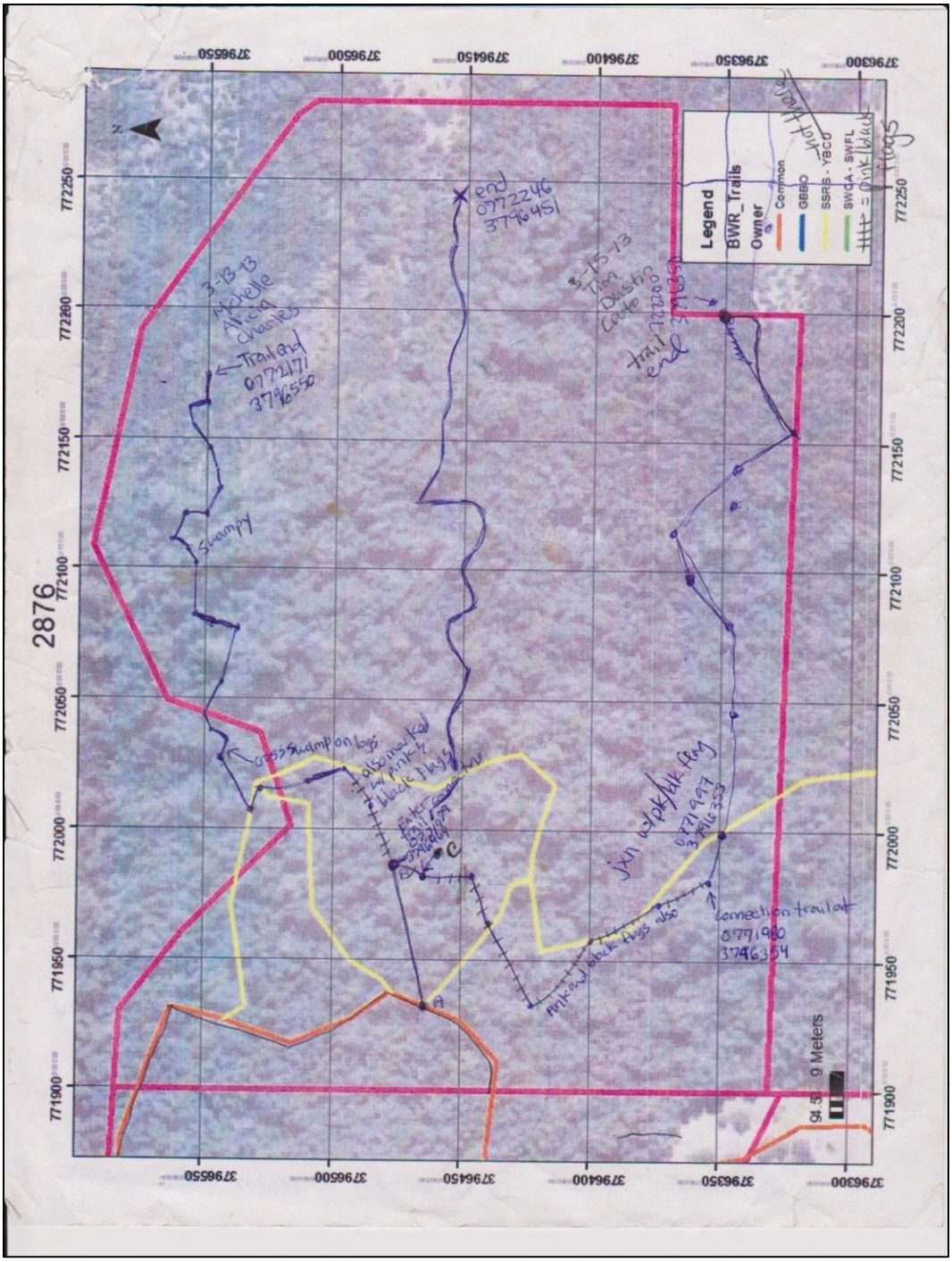


Figure 2-1.—Example of a systemwide bird monitoring plot.

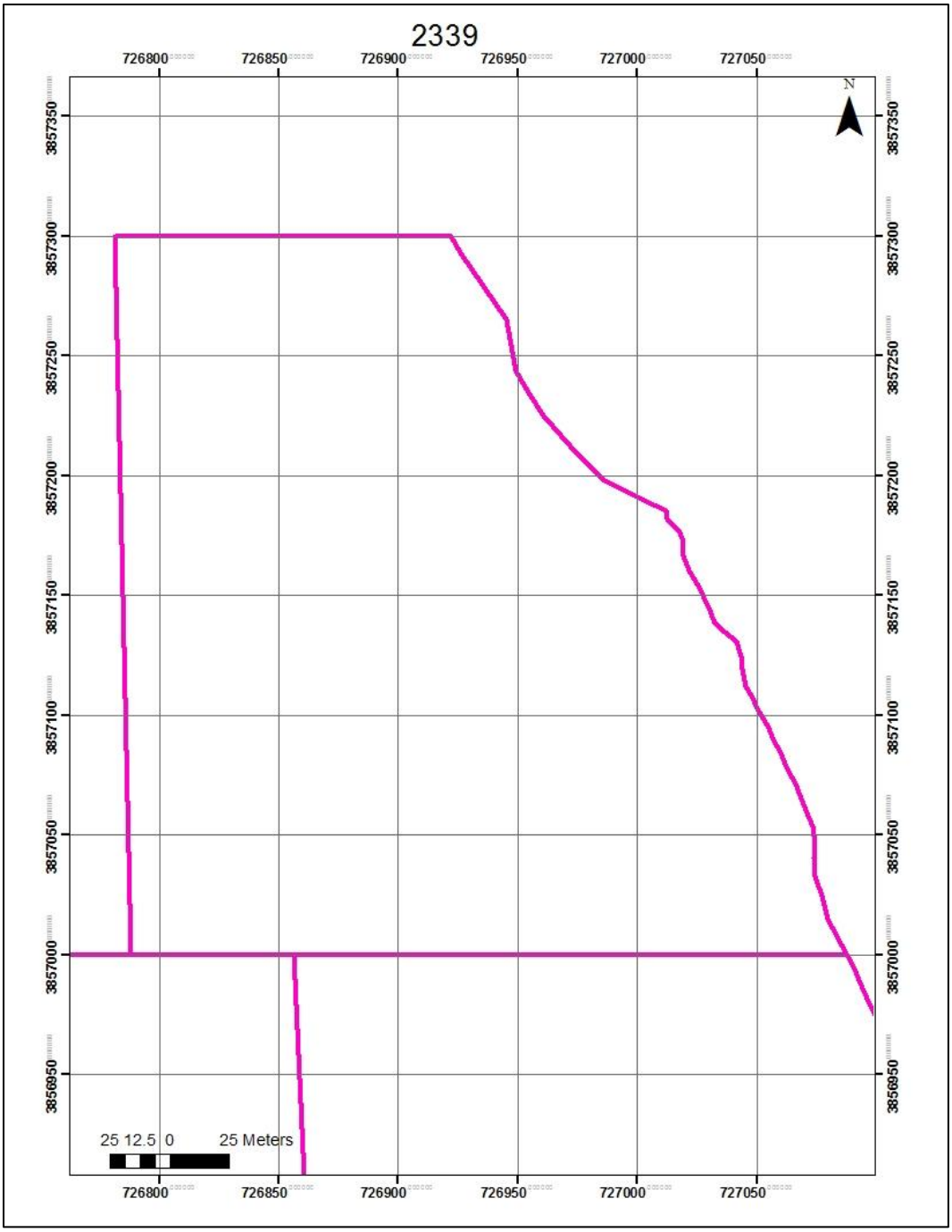


Figure 2-2.—Example of a grid bird survey plot (when no aerial photo coverage is available).

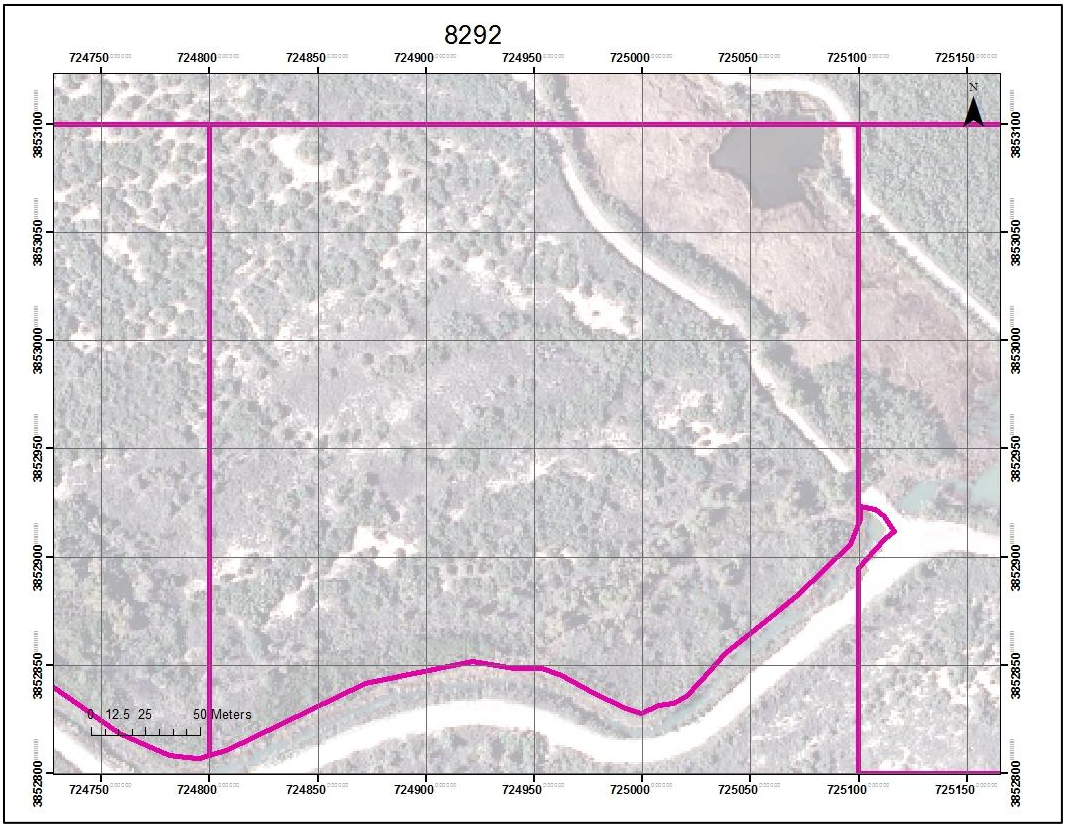


Figure 2-3.—Example of a bird survey plot map with grid, including gray-scale aerial imagery for reference.

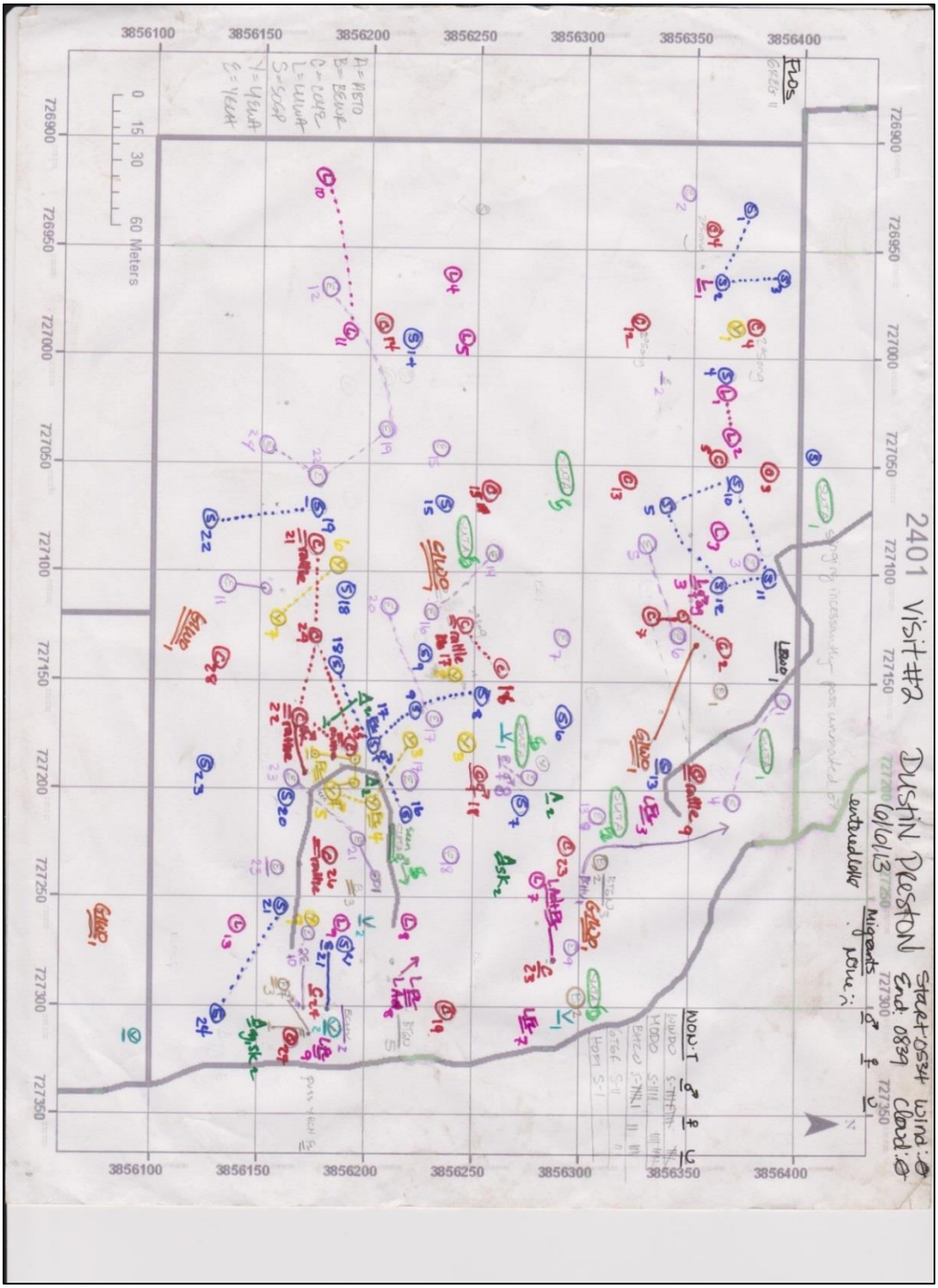


Figure 2-4.—Example of a filled-out bird survey plot map from a rapid area search.

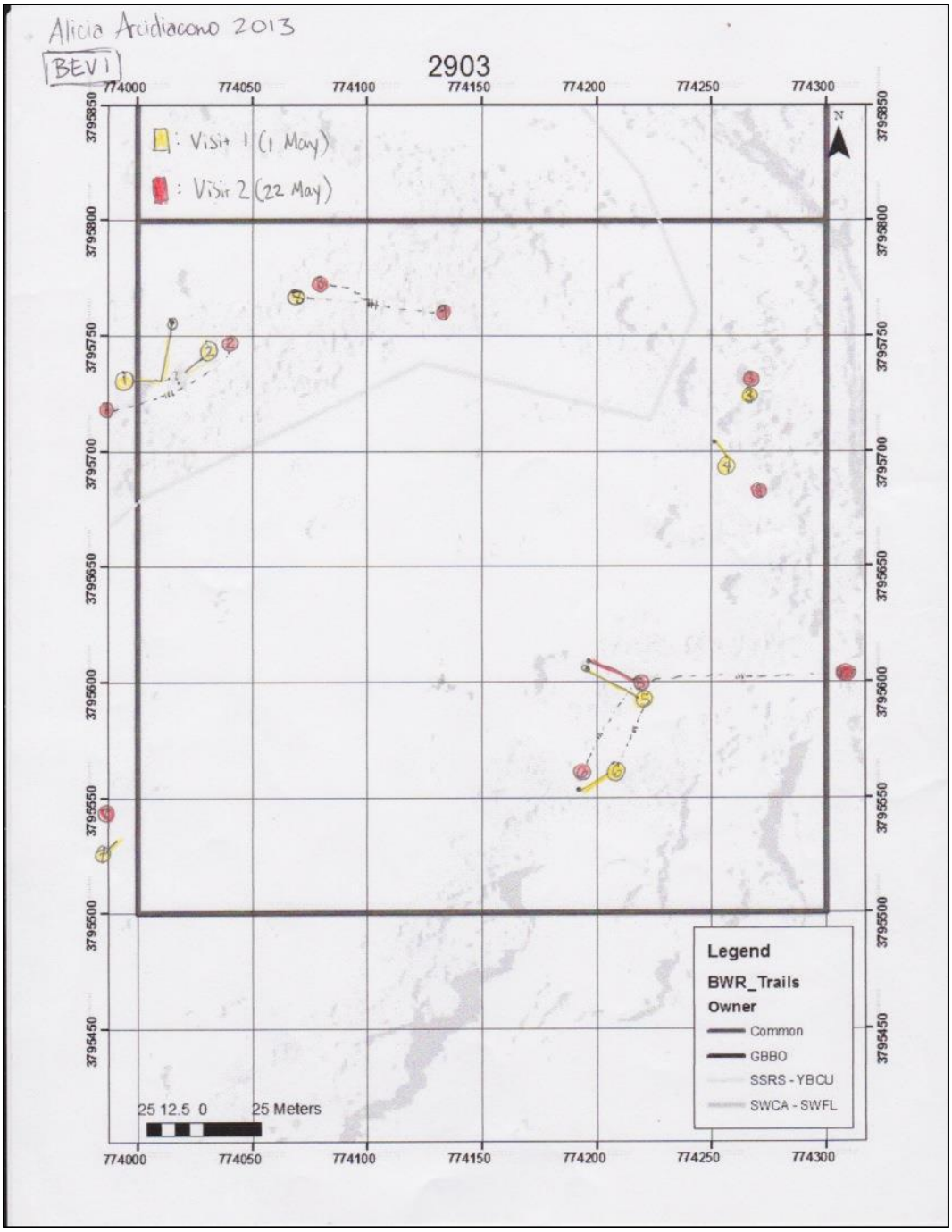


Figure 2-5.—Example of a species territory map (Arizona Bell's vireo) compiled at the end of an intensive survey effort for each species on the plot.

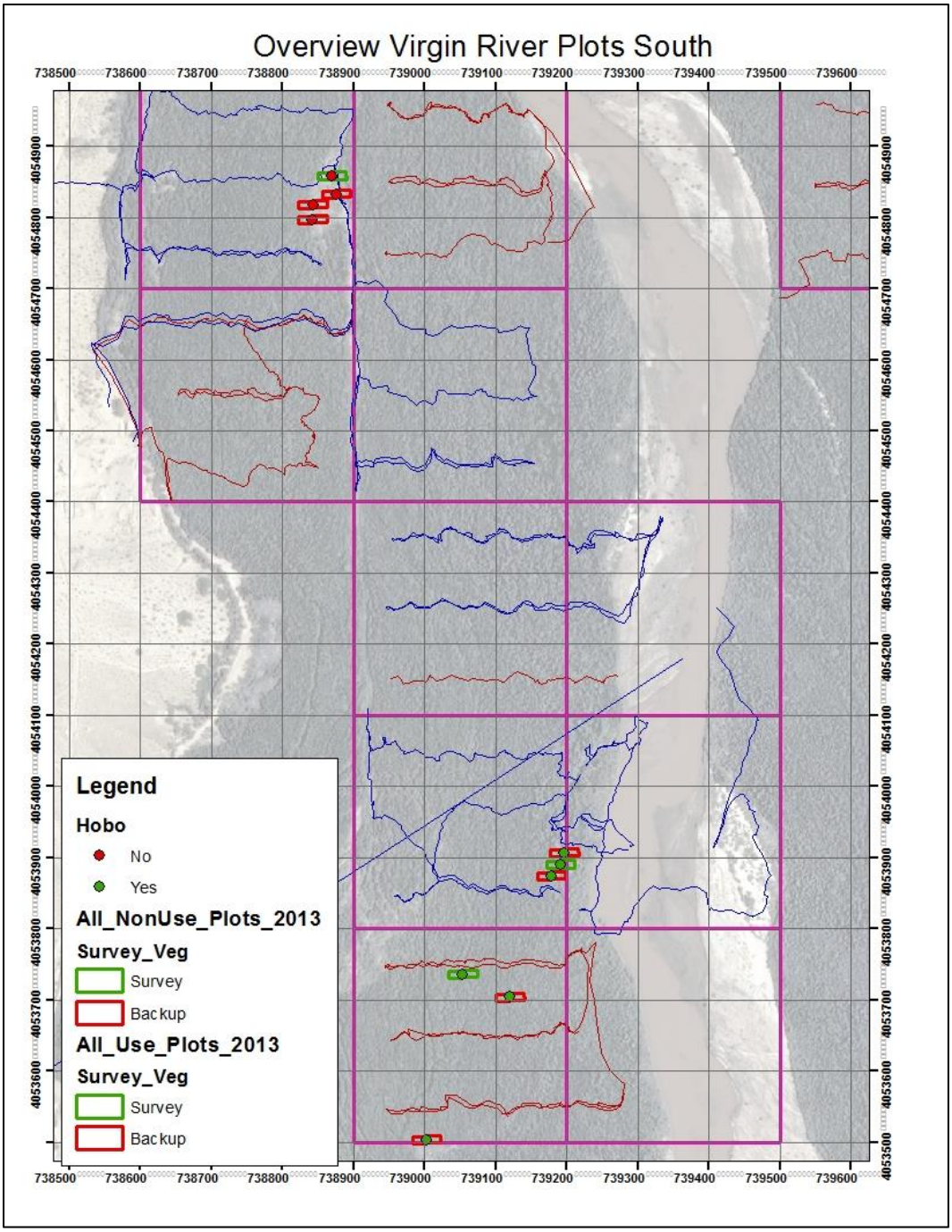


Figure 2-6.—Overview vegetation plot map.
Vegetation plots outlined in green were first selected and surveyed, and plots outlined in red were alternate plots. Bird survey plots are outlined in pink, and the trails created to access the plot are blue and red lines.

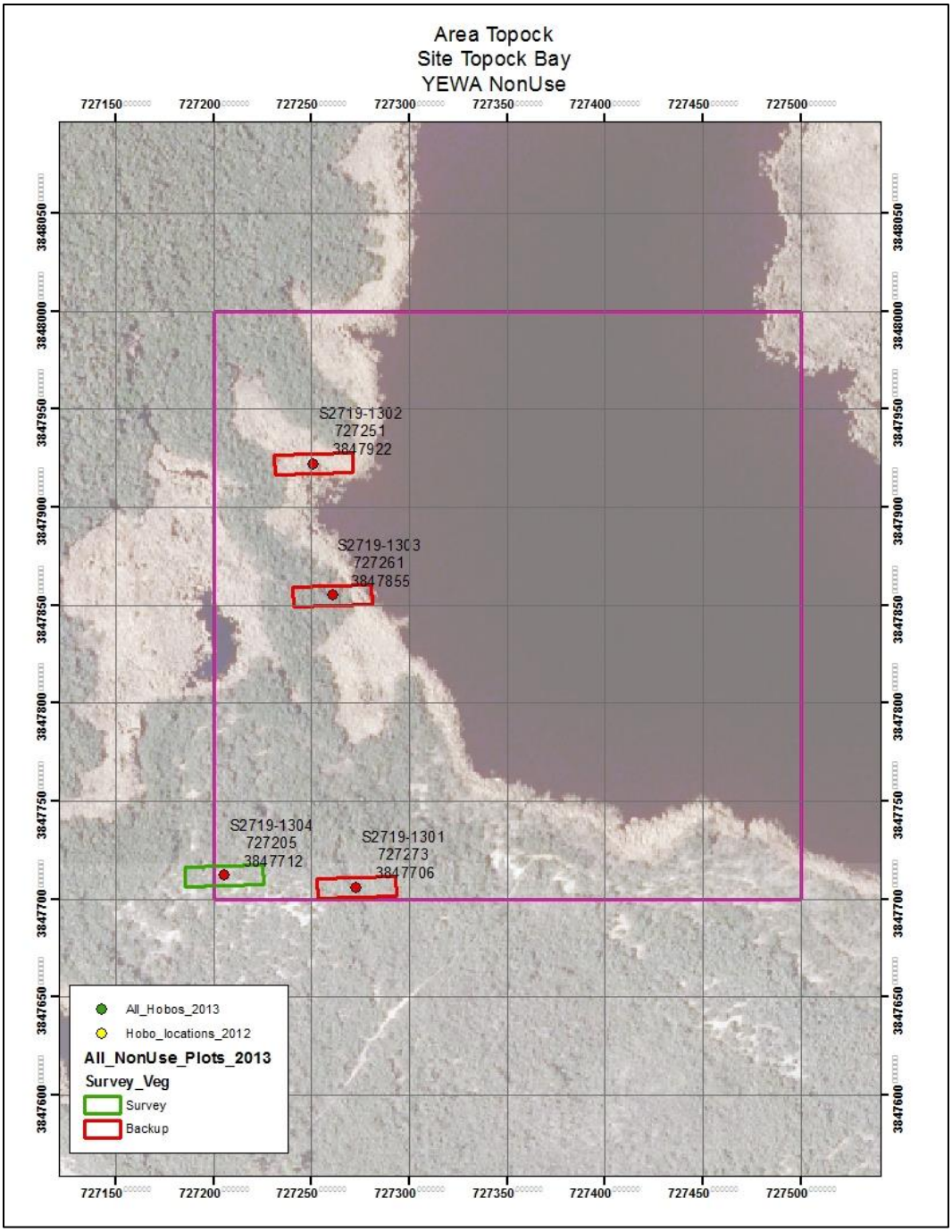


Figure 2-7.—Example of a vegetation plot map within a bird survey plot. Vegetation plots outlined in green were surveyed, and those outlined in red were alternate plots.

ATTACHMENT 3

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 a rapid (RAP), intensive (INT), or enhanced intensive (ENH). Remember, this is the type of survey YOU are doing on the plot (not is it an enhanced intensive overall or not).
   - Next, select your name from the surveyor drop-down – All your names should now be in the database (I think everyone figured out how to add their names to the list, 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 2013" folder in the drop box. 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 are 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 "TI OPEN" (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, Brown-headed Cowbird, European Starling, Gambel's Quail, Greater Roadrunner, Red-winged Blackbird, Great-tailed Grackle, and House Finch.
- 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 at the Bill Williams NWR 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 within the "Territory in" box 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 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.

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 intensives, but "observed confirmed" will show up in all survey types.

Number	Short	Survey type	Long
BJ0000	No justification required	RAP INT ENH	No justification required.
BJ0001	Observed confirmed	RAP INT ENH	For rapid, intensive, and enhanced intensive – observed confirmed breeding evidence.
BJ0002	On territory consecutive	INT ENH	For intensive and enhanced intensive – observed the bird/pair "on territory" the required number of times (intensives) and weeks (enhanced intensives) **in a row** (three times in a row for intensives and 3 weeks in a row for enhanced intensive).
BJ0003	On territory season	INT ENH	For intensive and enhanced intensive – observed the bird/pair "on territory" the required number of times (intensives) and weeks (enhanced intensives) **during the season** (five times in a season for intensives and 5 weeks in a season for enhanced intensive).
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 DROP BOX.
BJ0006	No standard scenarios	RAP INT ENH	For rapid, intensive, and enhanced 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, enhanced intensive/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 and enhanced intensive final surveys:

Similar methods as described above for your rapid second visit will be followed for subsequent visits to your intensives and enhanced 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 intensives and enhanced 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.

   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.

2. 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.

3. Once you have entered all of your final survey data (either your eighth visit for intensives or your sixteenth visit for enhanced intensives) 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.**

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

5. 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 intensives, but "observed confirmed" will show up in all survey types.

ATTACHMENT 4

Geographic Information System Data Entry Protocol

The following explains how to digitize species maps in ArcMap10 (if you have a Geographic Information System [GIS] on your personal computers, Dawn can help you get your map projects set up on your own laptops; if not, all the work laptops have GIS, and ArcMap projects will be set up on these).

1. First, open the ArcMap project:

   a) Go to the GIS 2013 folder (on the desktop)

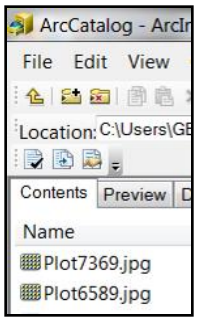
   b) Open a file called GIS 2013.mxd

2. Double click on this file to open the ArcMap project. Immediately save this file with your name attached to it in your folder on the desktop (this folder will have everything you need for GIS and should be labeled with your name and GIS2013). This way, any changes you make to the project will not be reflected in the main project file, but your changes will be saved to your own map project. For example, name the map project GIS_2013_Dawn.mxd

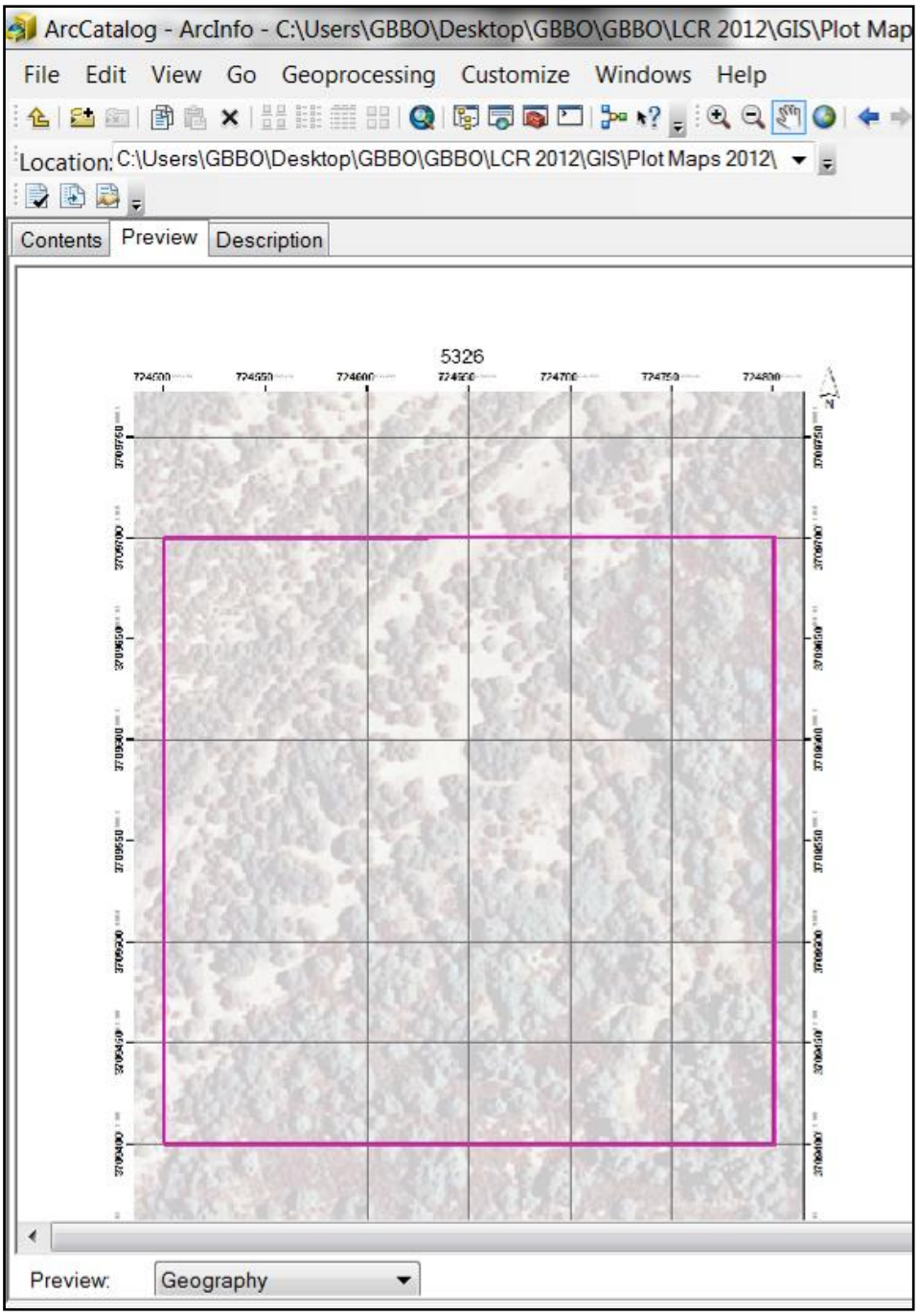
   Note: Remember that in all GIS work, no spaces! Please use the _ where you may be tempted to put a space, and not wacky symbols – just letters and underscores.

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

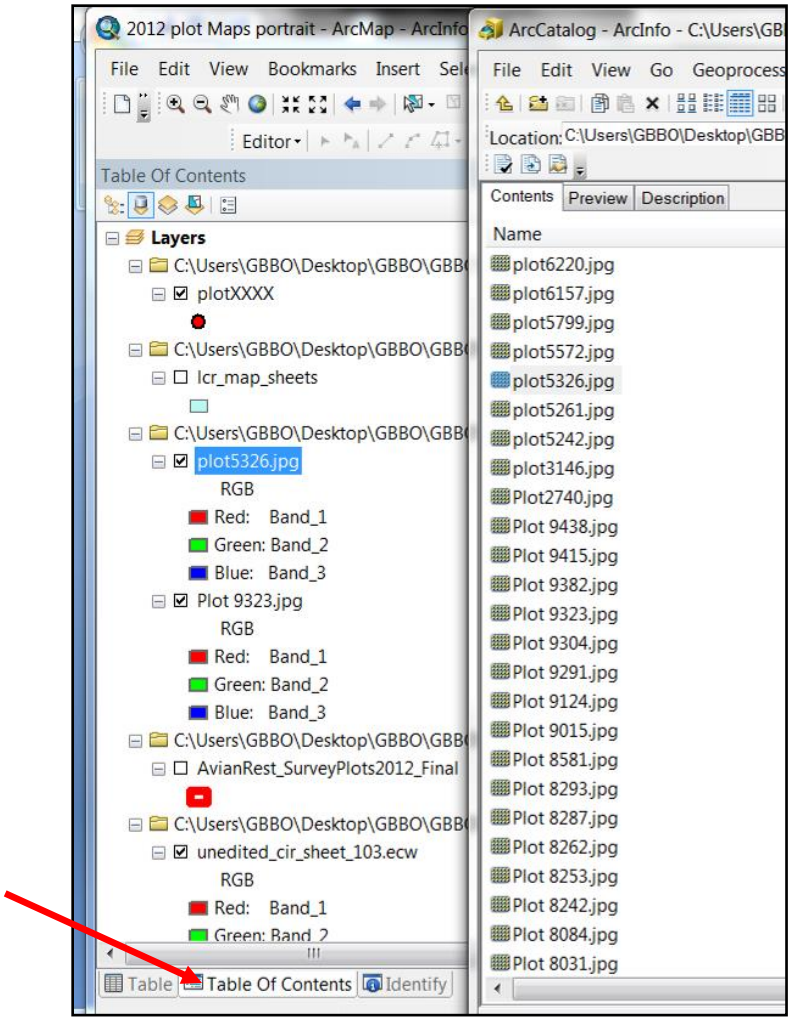
   a) Find the scanned map (jpg or tiff?) of your plot (note all plot maps will be found within the GIS2013 folder on the desktop).



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

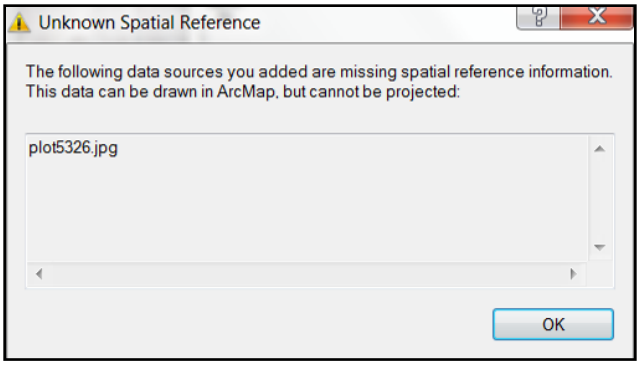


4. Drag the file into the project (note ArcMap10 will only allow you to drag the file into the project when the table of contents tab is open under layers. See figure below and red arrow).



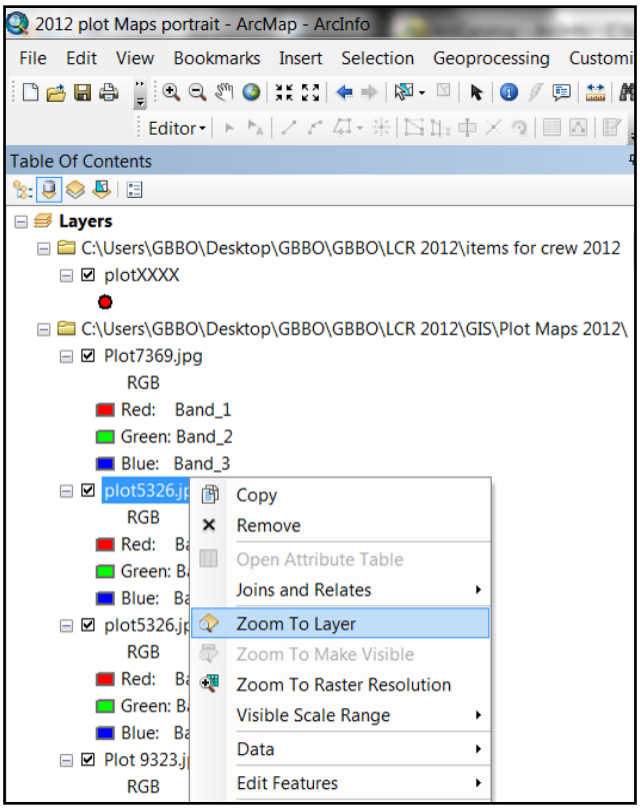
5. If a dialogue box appears that asked if you want to add pyramids, click “No”).

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!)



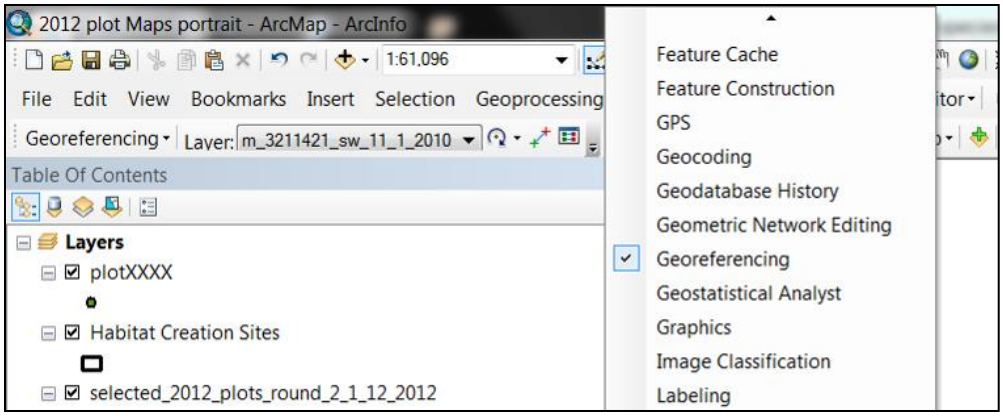
Be patient – after you drag the file into the map project, it will take several moments for the file to show up.

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."



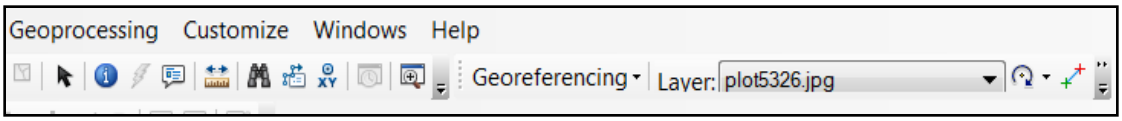
Now, you are ready to start digitizing.

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.

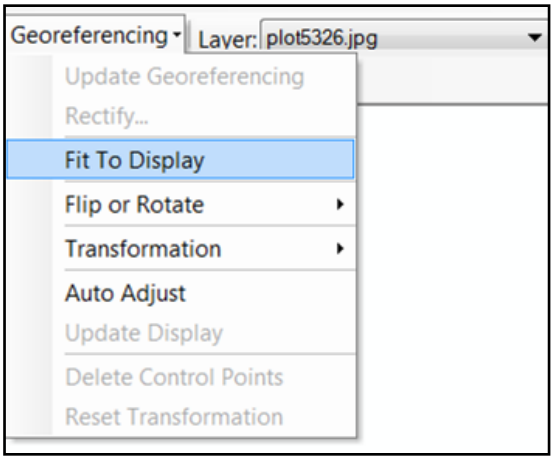


They are listed alphabetically, so scroll to georeferencing and check next to the item. Once you check georeferencing, the box will disappear, and the toolbar should have been added somewhere at the top of your map project.

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.



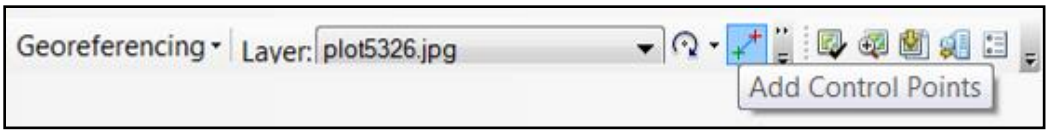
10. In the "Georeferencing" toolbar, go to "Fit To Display."



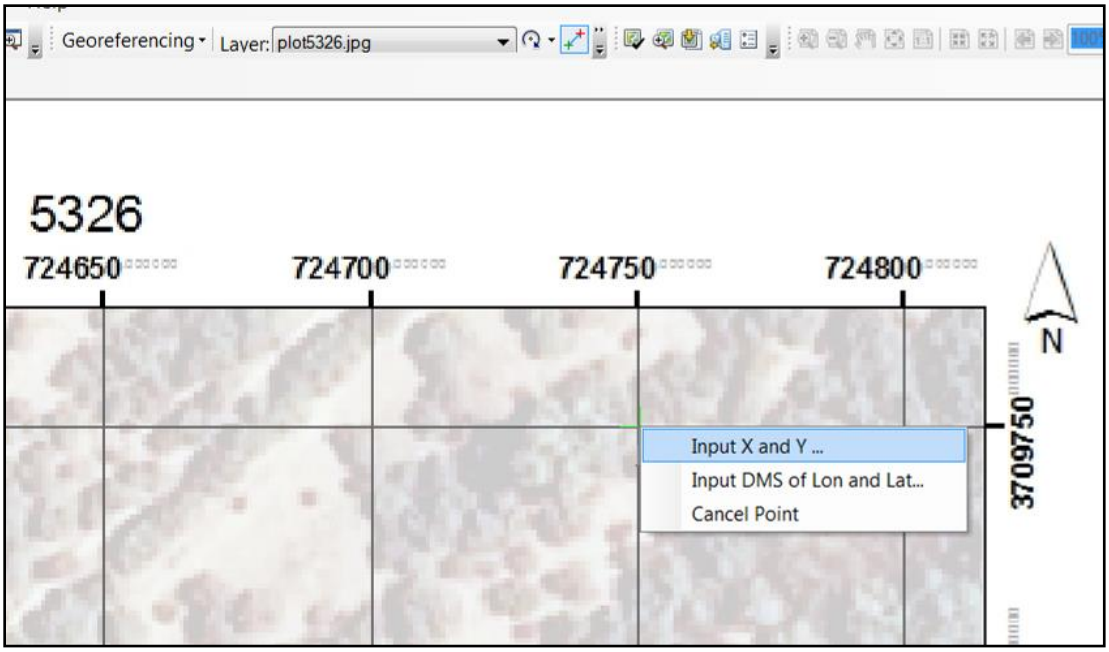
11. Use the + button to zoom into a corner of your plot – when you zoom in, use the magnifying glass with a plus

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

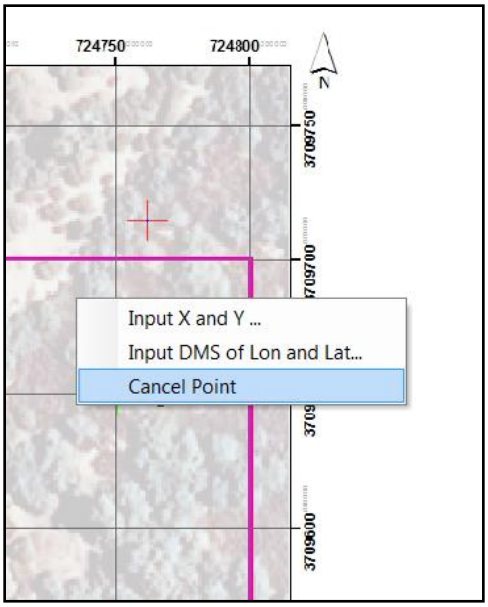
12. Next, click on the control point tool (a green **X** connected to a red **X**, shown below).



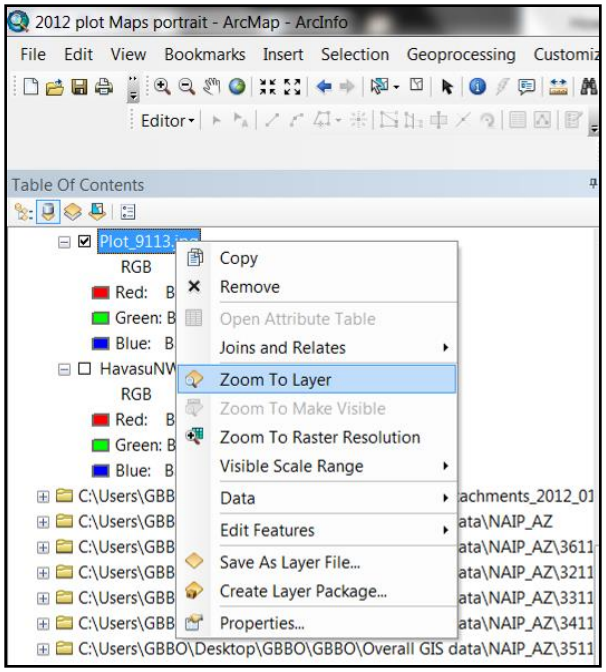
13. Use the "Control Point" tool to line up with a plot corner – or any point that you can label the UTMs correctly – be as exact as possible. Then, left click on the point.



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.”

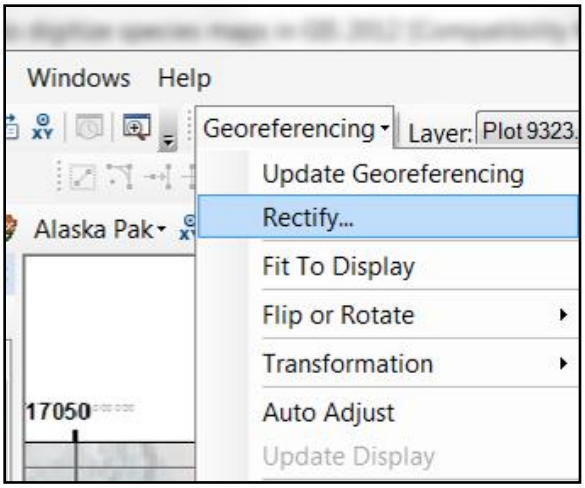


15. If the image of your map disappears after you enter the first set of UTM coordinates, don’t be alarmed – this is normal because you are starting to orient the image spatially. To get back to your image, go to the left side of the screen and right click on the title of your plot map and select “Zoom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

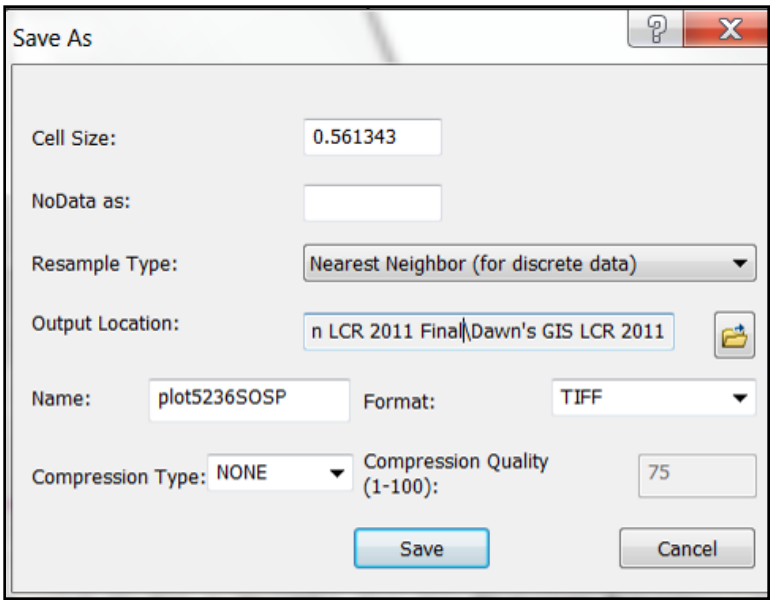


16. Repeat adding the control points for all four corners of your plot map.

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



18. In the "Rectify" save window, ignore the number 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."



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

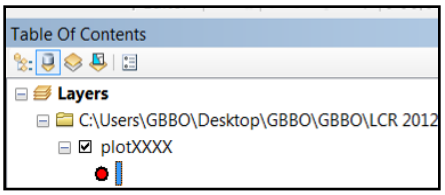
20. The last step in this process is to click the “Add Data” button and add the tiff file you just saved to the project…the “Add Data” button is a black plus sign with a yellow background.

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

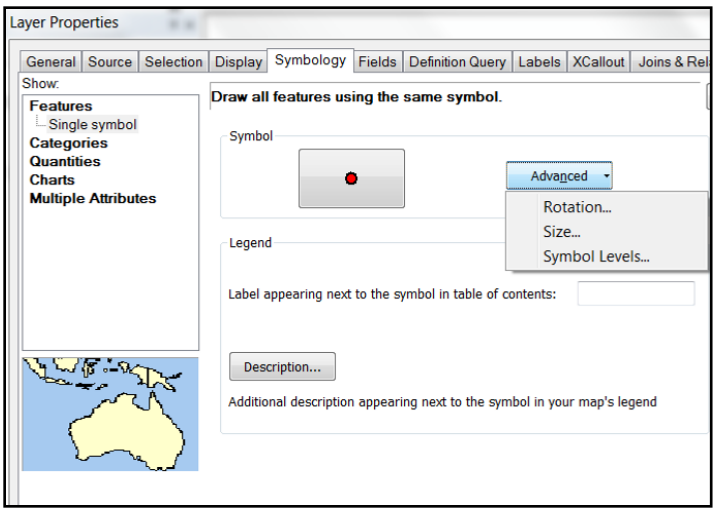
21. Open ArcCatalog. Select your folder and find the shapefile. It will be labeled “plotXXXX.shp”

22. 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.

23. 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.

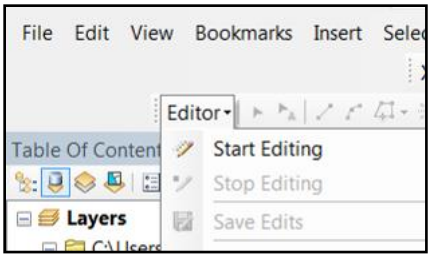


24. You may want to make this dot/point easier to see by making it larger and red or something that stands out – to do this, right click on the dot and you can change the color. To change the size, right click on the name of the file, scroll down to the bottom, and select “Properties.” Then, click on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



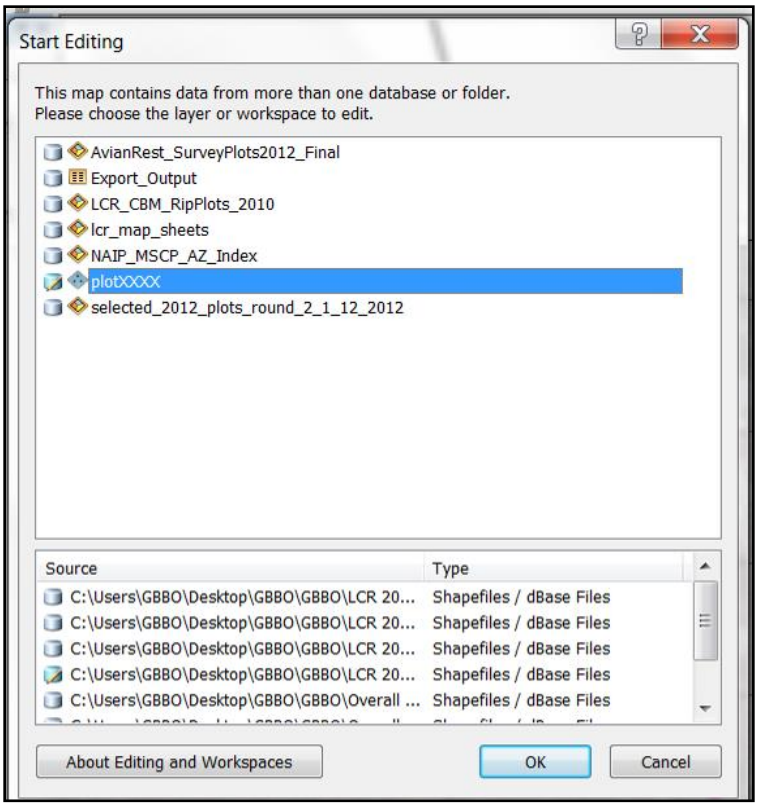
25. Go ahead and close ArcCatalog – it will need to be closed to do some of the steps later on.

26. 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.

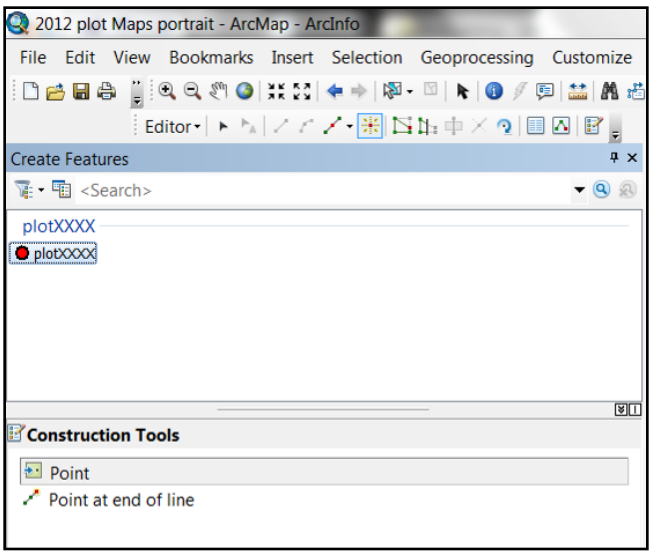


If you do not see the editor toolbar at the top of your map project, you may need to add the toolbar. To add the toolbar, right click at the top of the project, and a window will appear listing the various toolbars that can be added to the project. Make sure the “Editor” function is checked.

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.”



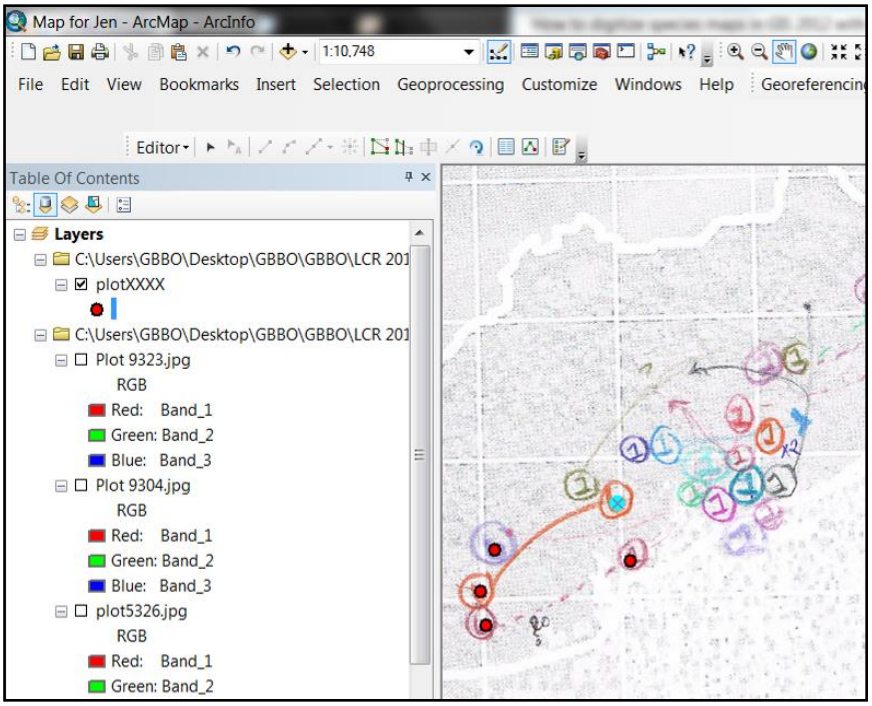
28. Then, a box will appear on the left-hand side of your screen that says "Create Feature," and it will have your shapefile listed.



29. Click on the "Point" tool.

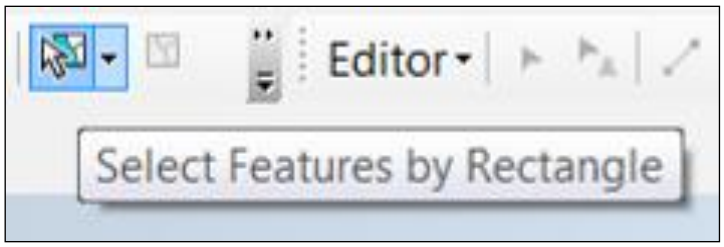
You will use this tool to move around the map and click on bird locations to make point data on the map (e.g., the individual bird locations.)

30. 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.



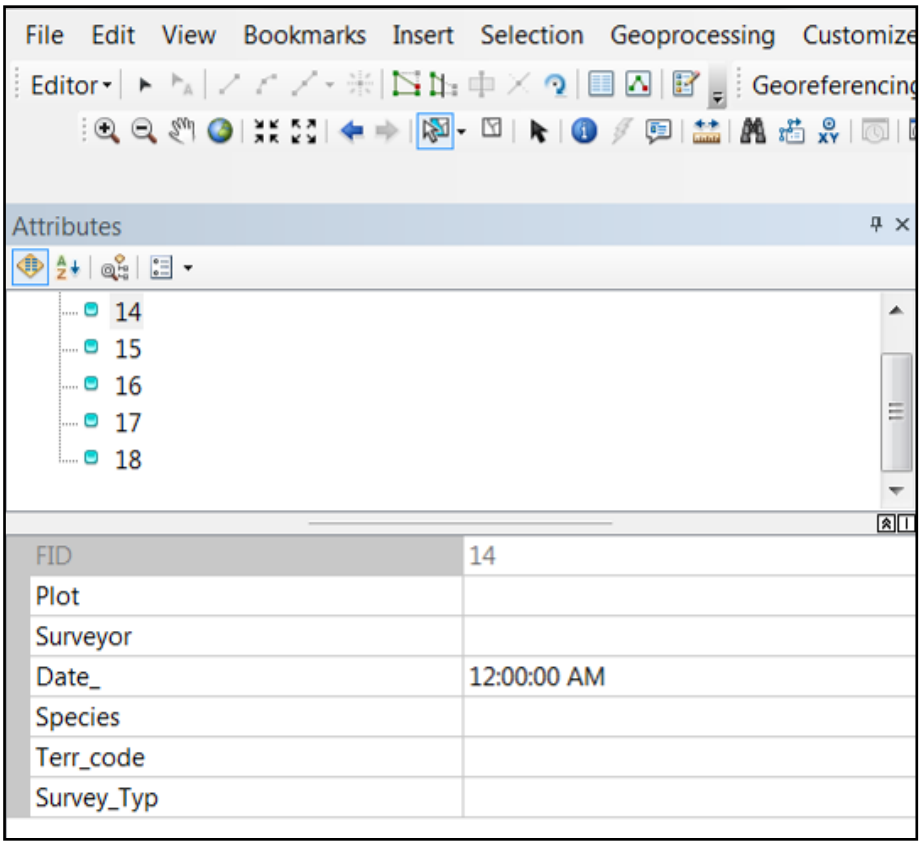
31. After you have clicked on several points (e.g., all the locations for SOPS1), you might want to start entering information for the points you just created.

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



33. Using this tool, highlight the points in your map.

34. 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.

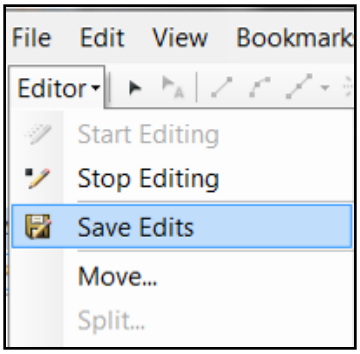


35. Highlight the point that you want to edit (Note: you can do batch edits by highlighting all the numbers). Once highlighted, your selection will turn light blue. In the example above, we are only editing number 14.

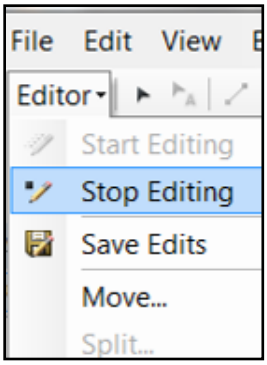
36. Now you can start adding data to this attribute table – click in the boxes to add data.

37. Remember, in all GIS, no spaces! Just use letters, numbers, and underscores.

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 avian surveys conducted along the lower Colorado River in 2013
(Listed in alphabetic order of common name. Scientific names available in Great Basin Bird Observatory 2010, 2011.)

	Rapid						Intensive				Enhanced intensive				
	Detected not confirmed breeding			Breeders			Detected not confirmed breeding		Breeders		Detected not confirmed breeding		Breeders		
Species (n = 208)	Systemwide	Tamarisk beetle	Habitat conservation	Systemwide	Tamarisk beetle	Habitat conservation	Systemwide	Habitat conservation	Systemwide	Habitat conservation	Systemwide	Habitat conservation	Systemwide	Habitat conservation	Flyovers
Abert's towhee	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓		✓		
American avocet		✓													✓
American coot	✓			✓	✓	✓			✓				✓		
American goldfinch	✓	✓	✓				✓				✓				✓
American kestrel	✓		✓	✓			✓		✓	✓					✓
American pipit	✓	✓	✓				✓				✓				✓
American redstart			✓					✓							
American white pelican	✓						✓								✓
American wigeon		✓									✓				
Anna's hummingbird	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓		✓		✓
Ash-throated flycatcher		✓	✓	✓	✓	✓			✓	✓	✓		✓		
Audubon's warbler	✓	✓	✓				✓	✓			✓				✓

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	Detected not confirmed breeding			Breeders			Detected not confirmed breeding		Breeders		Detected not confirmed breeding		Breeders		
Species (n = 208)	**Systemwide**	**Tamarisk beetle**	**Habitat conservation**	**Systemwide**	**Tamarisk beetle**	**Habitat conservation**	**Systemwide**	**Habitat conservation**	**Systemwide**	**Habitat conservation**	**Systemwide**	**Habitat conservation**	**Systemwide**	**Habitat conservation**	**Flyovers**
Baltimore oriole			✓												
Bank swallow	✓	✓					✓								✓
Barn owl						✓				✓					
Barn swallow	✓	✓	✓				✓	✓			✓				✓
Bell's vireo		✓		✓	✓	✓		✓	✓	✓	✓		✓		
Belted kingfisher	✓	✓		✓			✓				✓				
Bewick’s wren				✓	✓				✓				✓		
Black phoebe	✓	✓		✓	✓	✓	✓				✓		✓		✓
Black rail				✓											
Black-chinned hummingbird	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓		
Black-crowned night heron	✓	✓		✓					✓						✓
Black-headed grosbeak	✓	✓	✓				✓	✓			✓				✓
Black-necked stilt	✓			✓			✓								✓
Black-tailed gnatcatcher	✓	✓	✓	✓	✓	✓		✓	✓		✓		✓		
Black-throated gray warbler	✓	✓	✓				✓				✓				✓
Black-throated sparrow		✓		✓	✓		✓		✓		✓		✓		✓

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Species (n = 208)	**Systemwide**	**Tamarisk beetle**	**Habitat conservation**	**Systemwide**	**Tamarisk beetle**	**Habitat conservation**	**Systemwide**	**Habitat conservation**	**Systemwide**	**Habitat conservation**	**Systemwide**	**Habitat conservation**	**Systemwide**	**Habitat conservation**	**Flyovers**
Blue grosbeak	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓		✓
Brewer’s sparrow	✓	✓	✓				✓				✓				
Brewer's blackbird	✓	✓					✓				✓				✓
Broad-tailed hummingbird		✓									✓				
Brown-crested flycatcher		✓	✓	✓	✓	✓	✓		✓		✓		✓		
Brown-headed cowbird	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓		✓		✓
Bullock’s oriole	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓		✓
Burrowing owl				✓											
Cactus wren				✓											
California gull	✓	✓					✓								✓
Canada goose	✓	✓		✓											✓
Canyon wren	✓	✓		✓	✓		✓		✓		✓		✓		
Caspian tern	✓	✓	✓				✓								✓
Cassin’s vireo	✓	✓	✓				✓	✓			✓				
Cattle egret	✓		✓				✓				✓				✓
Cedar waxwing		✓	✓				✓				✓				✓

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Species (n = 208)	**Systemwide**	**Tamarisk beetle**	**Habitat conservation**	**Systemwide**	**Tamarisk beetle**	**Habitat conservation**	**Systemwide**	**Habitat conservation**	**Systemwide**	**Habitat conservation**	**Systemwide**	**Habitat conservation**	**Systemwide**	**Habitat conservation**	**Flyovers**
Chipping sparrow	✓	✓	✓				✓	✓			✓				
Cinnamon teal	✓														✓
Clapper rail		✓		✓	✓				✓						
Clark's grebe				✓											
Cliff swallow	✓	✓	✓	✓			✓	✓			✓				✓
Common black-hawk	✓			✓											
Common gallinule		✓		✓	✓				✓		✓				
Common ground-dove		✓	✓	✓		✓	✓								✓
Common loon	✓														✓
Common merganser							✓								✓
Common poorwill				✓							✓				
Common raven	✓	✓	✓	✓	✓	✓	✓		✓		✓		✓		✓
Common tern	✓														
Common yellowthroat	✓	✓		✓	✓	✓	✓		✓	✓	✓		✓		✓
Cooper’s hawk	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓		✓
Costa’s hummingbird		✓		✓	✓		✓		✓		✓		✓		

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Species (n = 208)	**Systemwide**	**Tamarisk beetle**	**Habitat conservation**	**Systemwide**	**Tamarisk beetle**	**Habitat conservation**	**Systemwide**	**Habitat conservation**	**Systemwide**	**Habitat conservation**	**Systemwide**	**Habitat conservation**	**Systemwide**	**Habitat conservation**	**Flyovers**
Crissal thrasher		✓	✓	✓	✓	✓	✓		✓	✓			✓		
Dark-eyed junco											✓				
Double-crested comorant	✓	✓	✓				✓				✓				✓
Dusky flycatcher	✓	✓					✓				✓				
Eared grebe	✓	✓		✓											
Elf owl		✓					✓				✓				
Eurasian collared-dove	✓	✓	✓	✓		✓	✓		✓	✓	✓		✓		✓
European starling	✓	✓	✓	✓		✓		✓	✓	✓					✓
Forster's tern	✓	✓	✓												✓
Gadwall		✓					✓				✓				✓
Gambel’s quail	✓	✓	✓	✓		✓			✓	✓	✓		✓		✓
Gambel’s white-crowned sparrow	✓	✓					✓				✓				
Gila woodpecker	✓	✓	✓	✓	✓				✓				✓		✓
Gilded flicker	✓			✓											
Gray flycatcher	✓	✓	✓				✓	✓							
Great blue heron	✓	✓	✓	✓			✓	✓			✓		✓		✓

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Species (n = 208)	**Systemwide**	**Tamarisk beetle**	**Habitat conservation**	**Systemwide**	**Tamarisk beetle**	**Habitat conservation**	**Systemwide**	**Habitat conservation**	**Systemwide**	**Habitat conservation**	**Systemwide**	**Habitat conservation**	**Systemwide**	**Habitat conservation**	**Flyovers**
Great egret	✓	✓	✓	✓			✓	✓			✓		✓		✓
Great horned owl	✓			✓		✓		✓	✓	✓	✓		✓		✓
Greater roadrunner	✓	✓		✓		✓	✓		✓	✓	✓		✓		
Great-tailed grackle	✓	✓	✓	✓		✓	✓	✓	✓		✓		✓		✓
Green heron	✓	✓		✓	✓		✓		✓		✓		✓		✓
Green-tailed towhee	✓	✓	✓				✓	✓			✓				
Green-winged teal		✓					✓								
Hammond's flycatcher	✓	✓	✓				✓				✓				
Hermit thrush	✓	✓					✓	✓			✓				
Hermit warbler	✓	✓					✓				✓				
Hooded oriole	✓	✓	✓	✓		✓	✓				✓				
Horned lark	✓	✓	✓	✓					✓						✓
house finch	✓	✓	✓	✓		✓	✓		✓	✓	✓		✓		✓
House sparrow				✓											
House wren	✓	✓	✓				✓	✓			✓				
Inca dove				✓		✓									

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Species (n = 208)	**Systemwide**	**Tamarisk beetle**	**Habitat conservation**	**Systemwide**	**Tamarisk beetle**	**Habitat conservation**	**Systemwide**	**Habitat conservation**	**Systemwide**	**Habitat conservation**	**Systemwide**	**Habitat conservation**	**Systemwide**	**Habitat conservation**	**Flyovers**
Indigo bunting	✓	✓	✓	✓		✓	✓		✓		✓				✓
Killdeer	✓	✓	✓	✓	✓	✓	✓	✓			✓				✓
Ladder-backed woodpecker				✓	✓	✓		✓	✓	✓			✓		✓
Lark sparrow		✓				✓					✓				
Lawrence's goldfinch	✓	✓		✓	✓		✓		✓		✓		✓		✓
Lazuli bunting	✓	✓	✓				✓	✓			✓		✓		✓
Le Conte's thrasher					✓										
Least bittern	✓	✓		✓	✓				✓						
Least sandpiper	✓						✓								
Lesser goldfinch	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓		✓
Lesser nighthawk	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓		✓		✓
Lincoln’s sparrow	✓	✓	✓				✓	✓			✓				
Loggerhead shrike	✓	✓		✓	✓	✓	✓		✓		✓				✓
Long-billed curlew	✓	✓					✓								✓
Long-eared owl													✓		
Lucy’s warbler	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓		✓		

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Species (n = 208)	**Systemwide**	**Tamarisk beetle**	**Habitat conservation**	**Systemwide**	**Tamarisk beetle**	**Habitat conservation**	**Systemwide**	**Habitat conservation**	**Systemwide**	**Habitat conservation**	**Systemwide**	**Habitat conservation**	**Systemwide**	**Habitat conservation**	**Flyovers**
Macgillivray's warbler	✓	✓	✓				✓	✓			✓				
Mallard	✓	✓	✓	✓			✓	✓	✓		✓				✓
Marbled godwit		✓	✓												✓
Marsh wren			✓	✓	✓				✓						
Merlin	✓														
Mountain white-crowned sparrow	✓	✓	✓								✓				
Mourning dove	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓		✓		✓
Myrtle warbler	✓	✓	✓					✓							✓
Nashville warbler	✓	✓	✓				✓	✓			✓				
Neotropic Cormarant							✓								✓
Northern harrier	✓	✓	✓	✓			✓	✓	✓		✓				✓
Northern mockingbird	✓	✓	✓	✓		✓	✓	✓			✓		✓		✓
Northern pintail							✓								
Northern rough-winged swallow	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓		✓		✓
Nutting's flycatcher		✓			✓		✓		✓		✓		✓		
Olive-sided flycatcher	✓	✓	✓				✓				✓				

Table 5-1.—Comprehensive species list from avian surveys conducted along the lower Colorado River in 2013
(Listed in alphabetic order of common name. Scientific names available in Great Basin Bird Observatory 2010, 2011.)

	Rapid						Intensive				Enhanced intensive				
	Detected not confirmed breeding			Breeders			Detected not confirmed breeding		Breeders		Detected not confirmed breeding		Breeders		
Species (n = 208)	**Systemwide**	**Tamarisk beetle**	**Habitat conservation**	**Systemwide**	**Tamarisk beetle**	**Habitat conservation**	**Systemwide**	**Habitat conservation**	**Systemwide**	**Habitat conservation**	**Systemwide**	**Habitat conservation**	**Systemwide**	**Habitat conservation**	**Flyovers**
Orange-crowned warbler	✓	✓	✓				✓	✓			✓				✓
Oregon junco							✓								
Osprey	✓	✓	✓				✓		✓		✓				✓
Pacific-slope flycatcher	✓	✓	✓				✓	✓			✓				✓
Peregrine falcon		✓	✓				✓				✓				✓
Phainopepla	✓	✓	✓	✓	✓		✓	✓	✓		✓		✓		✓
Pied-billed grebe	✓			✓	✓				✓						
Plumbeous vireo	✓		✓								✓				
Prairie falcon	✓	✓													✓
Red-breasted nuthatch	✓	✓					✓				✓				
Redhead				✓											
Red-shouldered hawk			✓			✓									
Red-tailed hawk	✓	✓	✓	✓	✓	✓	✓		✓		✓		✓		✓
Red-winged blackbird	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓		✓		✓
Ring-billed gull	✓	✓													✓
Ring-necked duck		✓					✓				✓				

Table 5-1.—Comprehensive species list from avian surveys conducted along the lower Colorado River in 2013
(Listed in alphabetic order of common name. Scientific names available in Great Basin Bird Observatory 2010, 2011.)

	Rapid						Intensive				Enhanced intensive				
	Detected not confirmed breeding			Breeders			Detected not confirmed breeding		Breeders		Detected not confirmed breeding		Breeders		
Species (n = 208)	**Systemwide**	**Tamarisk beetle**	**Habitat conservation**	**Systemwide**	**Tamarisk beetle**	**Habitat conservation**	**Systemwide**	**Habitat conservation**	**Systemwide**	**Habitat conservation**	**Systemwide**	**Habitat conservation**	**Systemwide**	**Habitat conservation**	**Flyovers**
Rock pigeon	✓			✓											✓
Rock wren		✓		✓	✓		✓		✓				✓		
Rose-breasted grosbeak	✓	✓									✓				
Ruby-crowned kinglet	✓	✓	✓				✓	✓			✓				
Ruddy duck	✓			✓											
Rufous hummingbird			✓												
Savannah sparrow	✓						✓				✓				
Say's phoebe	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓		✓
Scott's oriole		✓									✓				
Semipalmated plover		✓													✓
Sharp-shinned hawk		✓	✓	✓			✓	✓			✓		✓		✓
Snowy egret	✓	✓	✓	✓			✓	✓			✓		✓		✓
Snowy plover		✓			✓										
Solitary sandpiper	✓						✓								
Song sparrow	✓	✓		✓	✓	✓	✓		✓	✓	✓		✓		
Sora	✓	✓		✓	✓		✓				✓				

Table 5-1.—Comprehensive species list from avian surveys conducted along the lower Colorado River in 2013
(Listed in alphabetic order of common name. Scientific names available in Great Basin Bird Observatory 2010, 2011.)

	Rapid						Intensive				Enhanced intensive				
	Detected not confirmed breeding			Breeders			Detected not confirmed breeding		Breeders		Detected not confirmed breeding		Breeders		
Species (n = 208)	**Systemwide**	**Tamarisk beetle**	**Habitat conservation**	**Systemwide**	**Tamarisk beetle**	**Habitat conservation**	**Systemwide**	**Habitat conservation**	**Systemwide**	**Habitat conservation**	**Systemwide**	**Habitat conservation**	**Systemwide**	**Habitat conservation**	**Flyovers**
Southwestern willow flycatcher				✓											
Spotted sandpiper	✓	✓	✓	✓	✓										✓
Spotted towhee	✓	✓					✓	✓			✓				
Summer tanager	✓			✓	✓	✓	✓		✓	✓			✓		
Swainson’s thrush	✓	✓	✓				✓	✓			✓				
Swainson's hawk	✓	✓	✓				✓				✓				✓
Towsend’s warbler	✓	✓	✓				✓	✓			✓				✓
Tree swallow	✓	✓	✓				✓	✓			✓				✓
Tropical kingbird			✓			✓									
Turkey vulture	✓	✓	✓	✓		✓	✓	✓			✓				✓
Unidentified accipiter hawk	✓						✓								✓
Unidentified blackbird	✓		✓				✓								✓
Unidentified duck			✓												✓
Unidentified empidonax flycatcher	✓		✓				✓	✓							
Unidentified flycatcher	✓		✓				✓	✓			✓				
Unidentified hawk			✓								✓				✓

Table 5-1.—Comprehensive species list from avian surveys conducted along the lower Colorado River in 2013
(Listed in alphabetic order of common name. Scientific names available in Great Basin Bird Observatory 2010, 2011.)

	Rapid						Intensive				Enhanced intensive				
	Detected not confirmed breeding			Breeders			Detected not confirmed breeding		Breeders		Detected not confirmed breeding		Breeders		
Species (n = 208)	**Systemwide**	**Tamarisk beetle**	**Habitat conservation**	**Systemwide**	**Tamarisk beetle**	**Habitat conservation**	**Systemwide**	**Habitat conservation**	**Systemwide**	**Habitat conservation**	**Systemwide**	**Habitat conservation**	**Systemwide**	**Habitat conservation**	**Flyovers**
Unidentified hummingbird	✓		✓	✓		✓		✓		✓			✓		✓
Unidentified sparrow	✓		✓				✓								
Unidentified swallow	✓		✓				✓	✓							✓
Unidentified warbler	✓		✓				✓	✓							✓
Unidentified woodpecker						✓									
Unknown	✓		✓	✓			✓	✓			✓				✓
Vaux's swift	✓		✓				✓	✓			✓				✓
Verdin	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓		✓
Vermilion flycatcher				✓		✓			✓				✓		
Violet-green swallow	✓	✓	✓				✓		✓		✓				✓
Virginia rail	✓	✓		✓	✓				✓	✓					
Warbling vireo	✓	✓	✓				✓	✓			✓				✓
Western flycatcher	✓	✓	✓				✓				✓				
Western grebe	✓	✓		✓	✓		✓								
Western kingbird	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓		✓
Western meadowlark			✓	✓					✓						✓

Table 5-1.—Comprehensive species list from avian surveys conducted along the lower Colorado River in 2013
(Listed in alphabetic order of common name. Scientific names available in Great Basin Bird Observatory 2010, 2011.)

	Rapid						Intensive				Enhanced intensive				
	Detected not confirmed breeding			Breeders			Detected not confirmed breeding		Breeders		Detected not confirmed breeding		Breeders		
Species (n = 208)	**Systemwide**	**Tamarisk beetle**	**Habitat conservation**	**Systemwide**	**Tamarisk beetle**	**Habitat conservation**	**Systemwide**	**Habitat conservation**	**Systemwide**	**Habitat conservation**	**Systemwide**	**Habitat conservation**	**Systemwide**	**Habitat conservation**	**Flyovers**
Western sandpiper	✓														
Western screech-owl													✓		
Western tanager	✓	✓	✓				✓	✓			✓				✓
Western wood-pewee	✓	✓	✓	✓			✓	✓			✓				✓
Whimbrel			✓					✓							✓
White-crowned sparrow	✓	✓	✓				✓	✓			✓				
White-faced ibis	✓	✓	✓				✓	✓			✓				✓
White-tailed kite			✓	✓		✓									✓
White-throated swift	✓	✓		✓	✓		✓		✓		✓		✓		✓
White-winged dove	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓		✓		✓
Willet		✓													✓
Willow flycatcher	✓	✓	✓		✓	✓	✓	✓			✓		✓		
Wilson’s warbler	✓	✓	✓				✓	✓			✓				✓
Wilson's snipe	✓														
Yellow warbler	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓		✓
Yellow-billed cuckoo		✓				✓	✓								

Table 5-1.—Comprehensive species list from avian surveys conducted along the lower Colorado River in 2013
(Listed in alphabetic order of common name. Scientific names available in Great Basin Bird Observatory 2010, 2011.)

	Rapid						Intensive				Enhanced intensive				
	Detected not confirmed breeding			Breeders			Detected not confirmed breeding		Breeders		Detected not confirmed breeding		Breeders		
Species (n = 208)	**Systemwide**	**Tamarisk beetle**	**Habitat conservation**	**Systemwide**	**Tamarisk beetle**	**Habitat conservation**	**Systemwide**	**Habitat conservation**	**Systemwide**	**Habitat conservation**	**Systemwide**	**Habitat conservation**	**Systemwide**	**Habitat conservation**	**Flyovers**
Yellow-breasted chat	✓	✓		✓	✓	✓			✓	✓			✓		✓
Yellow-headed blackbird	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓				✓
Yellow-rumped warbler	✓	✓	✓				✓	✓			✓				✓
Zone-tailed hawk											✓				

ATTACHMENT 6

List of All Area Search Plots

Table 6-1.—List of all area search plots surveyed for project components 1, 3, and 5 in 2013
(X indicates plots surveyed in 2013.)

Plot/ section	Systemwide plots (n = 80)	Habitat creation plots (n = 79)	Intensive area search plots	Enhanced intensive area search plots	*Saltcedar beetle (Diorhabda carinulata)* plots
C1501		X			
C1502		X			
C1503		X			
C1504		X			
C2101		X			
C2102		X			
C2103		X			
C2104		X			
C2105		X			
C2301		X	Yes – habitat creation		
C2302		X			
C2303		X			
C2304		X			
C2305		X			
C2306		X			
C2307		X			
C2308		X			

Table 6-1.—List of all area search plots surveyed for project components 1, 3, and 5 in 2013 (X indicates plots surveyed in 2013.)

Plot/ section	Systemwide plots (n = 80)	Habitat creation plots (n = 79)	Intensive area search plots	Enhanced intensive area search plots	*Saltcedar beetle (Diorhabda carinulata)* plots
C2309		X	Yes – habitat creation		
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			
C2326		X			
C2327		X			
C2328		X			
C2329		X			

Table 6-1.—List of all area search plots surveyed for project components 1, 3, and 5 in 2013 (X indicates plots surveyed in 2013.)

Plot/ section	Systemwide plots (n = 80)	Habitat creation plots (n = 79)	Intensive area search plots	Enhanced intensive area search plots	*Saltcedar beetle (Diorhabda carinulata)* plots
C2330		X			
C2331		X			
C2332		X			
C2333		X			
C2334		X			
C2501		X			
C2502		X			
C2503		X			
C2504		X			
C2505		X			
C2506		X			
C2507		X			
C2508		X			
C2509		X			
C2510		X			
C2511		X			
C2512		X			
C2513		X			
C2514		X			
C2515		X			
C2516		X			

Table 6-1.—List of all area search plots surveyed for project components 1, 3, and 5 in 2013 (X indicates plots surveyed in 2013.)

Plot/ section	Systemwide plots (n = 80)	Habitat creation plots (n = 79)	Intensive area search plots	Enhanced intensive area search plots	*Saltcedar beetle (Diorhabda carinulata)* plots
C2517		X			
C2518		X			
C2519		X			
C2520		X			
C2521		X			
C2522		X			
C2523		X			
C2701		X			
C2702		X			
C2703		X	Yes – habitat creation		
C2704		X			
C2705		X			
C2706		X	Yes – habitat creation		
C2707		X			
C2720		X			
C2721		X			
C2722		X			
C2723		X			
C2724		X			
C2725		X			
C4701		X	Yes – by Fred Phillips		

Table 6-1.—List of all area search plots surveyed for project components 1, 3, and 5 in 2013 (X indicates plots surveyed in 2013.)

Plot/ section	Systemwide plots (n = 80)	Habitat creation plots (n = 79)	Intensive area search plots	Enhanced intensive area search plots	*Saltcedar beetle (Diorhabda carinulata)* plots
			Consulting, LLC		
C4702		X	Yes – by Fred Phillips Consulting, LLC		
C4703		X	Yes – by Fred Phillips Consulting, LLC		
S1585	X				
S1586	X				
S1674	X				
S1749	X				
S1832	X				
S1857	X				
S1946	X				
S1955	X				
S1998	X				
S2001	X				
S2084	X				
S2183	X		Yes – systemwide		
S2232	X				
S2315	X				
S2339					X – Topock Marsh/Bill Williams River
S2401					X – Topock Marsh/Bill Williams River

Table 6-1.—List of all area search plots surveyed for project components 1, 3, and 5 in 2013 (X indicates plots surveyed in 2013.)

Plot/ section	Systemwide plots (n = 80)	Habitat creation plots (n = 79)	Intensive area search plots	Enhanced intensive area search plots	*Saltcedar beetle (Diorhabda carinulata)* plots
S2439	X				
S2457					X – Topock Marsh/Bill Williams River
S2475	X				X – Topock Marsh/Bill Williams River
S2476					X – Topock Marsh/Bill Williams River
S2477	X		Yes – systemwide		X – Topock Marsh/Bill Williams River
S2493					X – Topock Marsh/Bill Williams River
S2508					X – Topock Marsh/Bill Williams River
S2522					X – Topock Marsh/Bill Williams River
S2532					X – Topock Marsh/Bill Williams River
S2550	X		Yes – systemwide		
S2558					X – Topock Marsh/Bill Williams River
S2584	X				
S2719					X – Topock Marsh/Bill Williams River
S2742					X – Topock Marsh/Bill Williams River
S2744	X				
S2812	X				
S2858	X				
S2860	X				
S2861	X				
S2863	X				X – Topock Marsh/Bill Williams River
S2864	X		Systemwide intensive and	Yes	

Table 6-1.—List of all area search plots surveyed for project components 1, 3, and 5 in 2013 (X indicates plots surveyed in 2013.)

Plot/ section	Systemwide plots (n = 80)	Habitat creation plots (n = 79)	Intensive area search plots	Enhanced intensive area search plots	*Saltcedar beetle (Diorhabda carinulata)* plots
			component 3		
S2865			Yes – for component 3 only	Yes	
S2876					X – Topock Marsh/Bill Williams River
S2879			Yes – for component 3 only	Yes	
S2886			Yes – for component 3 only	Yes	
S2889					X – Topock Marsh/Bill Williams River
S2898	X				
S2901			Yes – for component 3 only	Yes	
S2903	X				X – Topock Marsh/Bill Williams River
S2972	X				
S3536	X				
S5187	X				
S5198	X				
S5331	X				
S5564	X				
S5620	X		Yes – systemwide		
S5663	X	Pretty Water			
S5665	X	Pretty Water			
S5675	X	Pretty Water			
S5676	X	Pretty Water			
S5727	X				

Table 6-1.—List of all area search plots surveyed for project components 1, 3, and 5 in 2013 (X indicates plots surveyed in 2013.)

Plot/ section	Systemwide plots (n = 80)	Habitat creation plots (n = 79)	Intensive area search plots	Enhanced intensive area search plots	*Saltcedar beetle (Diorhabda carinulata)* plots
S5780	X				
S5884	X				
S5898	X				
S5901	X				
S5902	X				
S5919	X				
S5977	X				
S6056	X		Yes – systemwide		
S611					X – Virgin River (2004 plot layer)
S613					X – Virgin River (2004 plot layer)
S623					X – Virgin River (2004 plot layer)
S624					X – Virgin River (2004 plot layer)
S629					X – Virgin River (2004 plot layer)
S632					X – Virgin River (2004 plot layer)
S633					X – Virgin River (2004 plot layer)
S634					X – Virgin River (2004 plot layer)
S6366	X				
S638					X – Virgin River (2004 plot layer)
S642					X – Virgin River (2004 plot layer)
S643					X – Virgin River (2004 plot layer)
S646					X – Virgin River (2004 plot layer)

Table 6-1.—List of all area search plots surveyed for project components 1, 3, and 5 in 2013 (X indicates plots surveyed in 2013.)

Plot/ section	Systemwide plots (n = 80)	Habitat creation plots (n = 79)	Intensive area search plots	Enhanced intensive area search plots	*Saltcedar beetle (Diorhabda carinulata)* plots
S6469	X				
S647					X – Virgin River (2004 plot layer)
S648					X – Virgin River (2004 plot layer)
S651					X – Virgin River (2004 plot layer)
S652					X – Virgin River (2004 plot layer)
S6529	X				
S653					X – Virgin River (2004 plot layer)
S6538	X				
S656					X – Virgin River (2004 plot layer)
S657					X – Virgin River (2004 plot layer)
S6581	X				
S659					X – Virgin River (2004 plot layer)
S662					X – Virgin River (2004 plot layer)
S663					X – Virgin River (2004 plot layer)
S669					X – Virgin River (2004 plot layer)
S670					X – Virgin River (2004 plot layer)
S6732	X				
S675					X – Virgin River (2004 plot layer)
S676					X – Virgin River (2004 plot layer)
S6785	X				
S681					X – Virgin River (2004 plot layer)

Table 6-1.—List of all area search plots surveyed for project components 1, 3, and 5 in 2013 (X indicates plots surveyed in 2013.)

Plot/ section	Systemwide plots (n = 80)	Habitat creation plots (n = 79)	Intensive area search plots	Enhanced intensive area search plots	*Saltcedar beetle (Diorhabda carinulata)* plots
S682					X – Virgin River (2004 plot layer)
S6927	X				
S6958	X				
S6986	X				
S7052	X				
S7059					X – Topock Marsh/Bill Williams River
S7107					X – Topock Marsh/Bill Williams River
S7179	X				
S7335	X				
S7336					X – Topock Marsh/Bill Williams River
S7337					X – Topock Marsh/Bill Williams River
S7532	X				
S7654	X				
S7707	X				
S7733	X				
S7742	X				
S7776	X				
S7838	X		Systemwide intensive and component 3	Yes	
S7956	X				
S7975	X				

Table 6-1.—List of all area search plots surveyed for project components 1, 3, and 5 in 2013 (X indicates plots surveyed in 2013.)

Plot/ section	Systemwide plots (n = 80)	Habitat creation plots (n = 79)	Intensive area search plots	Enhanced intensive area search plots	*Saltcedar beetle (Diorhabda carinulata)* plots
S7976	X				
S7985	X		Systemwide intensive and component 3	Yes	
S7985	X				
S8011	X				
S8028	X				
S8076	X				
S8223					X – Topock Marsh/Bill Williams River
S8233	X				
S8261	X				
S8291					X – Topock Marsh/Bill Williams River
S8292					X – Topock Marsh/Bill Williams River
S8295					X – Topock Marsh/Bill Williams River
S8665	X				
S8675	X				
S9032	X				
S9064					X – Topock Marsh/Bill Williams River
S9066					X – Topock Marsh/Bill Williams River
S9067					X – Topock Marsh/Bill Williams River
S9068					X – Topock Marsh/Bill Williams River
S9089	X				

Table 6-1.—List of all area search plots surveyed for project components 1, 3, and 5 in 2013 (X indicates plots surveyed in 2013.)

Plot/ section	**Systemwide plots (n = 80)**	**Habitat creation plots (n = 79)**	**Intensive area search plots**	**Enhanced intensive area search plots**	***Saltcedar beetle (Diorhabda carinulata)* plots**
S9124			Yes – for component 3 only	Yes	
S9125					X – Topock Marsh/Bill Williams River
S9397	X				
S9406	X				

Table 6-2.—Summary table of all plots surveyed in 2013 using the standard intensive area search method

Plot/ section	Systemwide standard intensive (n = 8)	Habitat creation standard intensive (n = 4)	Enhanced intensive (n = 9)
C2301		Yes	
C2309		Yes	
C2703		Yes	
C2706		Yes	
S2183	Yes		
S2477	Yes		
S2550	Yes		
S2864	Yes		Yes
S2865			Yes
S2879			Yes
S2886			Yes
S2901			Yes
S5620	Yes		
S6056	Yes		
S7838	Yes		Yes
S7985	Yes		Yes
S9124			Yes

ATTACHMENT 7

Number of Pairs of Non-Territorial Breeding Species

Table 7-1.—Number of pairs of non-territorial breeding species on all rapid survey plots in 2013
(The number is the average of number of breeding males observed with some breeding evidence on either of two visits.)

Plot	Brown-headed cowbird	Eurasian collared-dove	European starling	Gambel's quail	Greater roadrunner	Great-tailed grackle	House finch	House sparrow	Inca dove	Mourning dove	Red-winged blackbird	White-winged dove	Yellow-headed blackbird
C1501	2.5	0	0	1	0	0	0	0	0	0	0	2	0
C1502	3.5	0	0	0	0	0	0	0	0	0	0	0	0
C1503	8	0	0	4.5	0	0	0	0	0	0	2	5.5	1
C1504	2	0	0	0	0	0	0	0	0	1	0	0	0
C2101	2.5	1	0	0	0	0	1.5	0	0	7.5	0	11	0
C2102	2.5	0	0	0	0	0	2	0	0	6.5	0	4	0
C2103	2.5	0	0	2	0	2	5.5	0	0	3	0	4	0
C2104	7	0	0	1.5	0	4	2.5	0	0	0	0	0	0
C2105	0	0	0	1	0	0	0	0	0	1.5	0	2	0
C2301	4	0	0	0.5	0	0	1	0	0	0	500	0	0
C2302	5	0	0	0	0	0	7	0	0	6.5	12.5	15	0
C2303	4	0	0	0	0	0	0	0	0	2	0.5	3	0
C2304	5	0	0	0	0	0	3	0	0	11.5	1	5.5	0
C2305	8	0	0	0	0	0	0.5	0	0	0	12	0	0
C2306	0.5	2	0	0	0	0	1	0	0	4.5	0	8	0
C2307	1.5	0	0	0	0	0	3.5	0	0	1	5	2.5	0
C2308	3	0	0	0	0	0	1	0	1	2	0	2.5	0
C2309	5	0	0	0	0	0	1	0	0	1	0	2	0
C2310	2.5	0	0	0	0	0	2	0	0	0	0	3.5	0

Table 7-1.—Number of pairs of non-territorial breeding species on all rapid survey plots in 2013
(The number is the average of number of breeding males observed with some breeding evidence on either of two visits.)

Plot	Brown-headed cowbird	Eurasian collared-dove	European starling	Gambel's quail	Greater roadrunner	Great-tailed grackle	House finch	House sparrow	Inca dove	Mourning dove	Red-winged blackbird	White-winged dove	Yellow-headed blackbird
C2311	2.5	0	0	0	0.5	0	0	0	0	2	0	0	0
C2312	2.5	0	0	0	0	0	1	0	0	1.5	0	1.5	0
C2313	2	0	0	0	0	0	0	0	0	1	0	2	0
C2314	1	1	0	0.5	0	0	1	0	0	2	0	2.5	0
C2315	3	2	0	0	0	0	0	0	0	4.5	0	10	0
C2316	3	0	0	0	0	0	0.5	0	0	0	0	1.5	0
C2317	2	0	0	0	0	0	1	0	0	0.5	6	5	0
C2318	5	0	0	0	0	0	1	0	0	1	0	0	0
C2319	1	0	0	0	0	0	0	0	0	1	0	1.5	0
C2320	1	0	0	0	0	0	0	0	0	0.5	5	1	0
C2321	2.5	0	0	0	0	0	1	0	0	0	0.5	3	0
C2322	4.5	0	0	0	0	0	0.5	0	0	1	14	4	1
C2323	4.5	0	0	0	0	0	4	0	0	0	0.5	0	0
C2324	1.5	0	0	0	0	0	0	0	0	0	0	0	0
C2325	10	0	0	0	0	0	0.5	0	0	1	16	9	0
C2326	7	0	0	0	0	0	3	0	0	2	48	2	1
C2327	2	0	0	0	0	0	0	0	0	3	20	2	0
C2328	5	0	0	0	0	0	0	0	0	0.5	8	2	0
C2329	3	0	0	0	0	0	0	0	0	0	2.5	2	0

Table 7-1.—Number of pairs of non-territorial breeding species on all rapid survey plots in 2013
(The number is the average of number of breeding males observed with some breeding evidence on either of two visits.)

Plot	Brown-headed cowbird	Eurasian collared-dove	European starling	Gambel's quail	Greater roadrunner	Great-tailed grackle	House finch	House sparrow	Inca dove	Mourning dove	Red-winged blackbird	White-winged dove	Yellow-headed blackbird
C2330	10	0	0	2	0.5	0	0	0	0	3	10.5	2	0
C2331	2.5	0	0	0	0	0	0	0	0	1	70	0	0
C2332	2.5	0	0	0	0	0	2	0	0	0	52.5	2	0
C2333	7	0	0	0	1	1	0	0	0	1	24	2	0
C2334	2.5	0	0	0	0.5	0	0	0	0	2	7.5	2	0
C2501	8	0	0	0	0	0	0	0	0	2	0	4	0
C2502	2	0	0	0	1	0	0	0	0	9	0	6.5	0
C2503	3.5	0	0	0	0	0	0	0	0	3	0	3.5	0
C2504	2.5	1.5	0	0	0	0	0	0	0	5.5	0	7	0
C2505	4	0.5	0	0	0	0	0	0	1	2.5	0	3.5	0
C2506	3	0	0	1	0	0	0	0	0	0	0	2	0
C2507	4	0	0	0	0	0	0	0	0	2	0	3	0
C2508	4	0	0	0	0	0	0	0	0	7	1	3	0
C2509	4	1	0	3	0	0	0	0	0	3.5	0	2	0
C2510	5	0	0	1	0	0	0	0	0	4.5	0	3	0
C2511	7.5	0	0	4	0	0	4	0	0	0	0	0	0
C2512	5	0	0	0	0	0	0	0	0	0	0	0	0
C2513	8	0	0	1.5	0	0	0	0	0	0	0	1.5	0
C2514	2	0	0	1	0	0	0	0	0	0	0	0	0

Table 7-1.—Number of pairs of non-territorial breeding species on all rapid survey plots in 2013
(The number is the average of number of breeding males observed with some breeding evidence on either of two visits.)

Plot	Brown-headed cowbird	Eurasian collared-dove	European starling	Gambel's quail	Greater roadrunner	Great-tailed grackle	House finch	House sparrow	Inca dove	Mourning dove	Red-winged blackbird	White-winged dove	Yellow-headed blackbird
C2515	2	0	0	2	0	0	0	0	0	0	0	0	0
C2516	3	0	0	1	0	0	0	0	0	0	0	0	0
C2517	0	0	0	3	0	0	1	0	0	1	0	1	0
C2518	0	0	0	0	0	0	0	0	0	0	0	0.5	0
C2519	3.5	0	0	0	0	0	0	0	0	0	0	0	0
C2520	3	0	0	0	0	0	0	0	0	0	0	0	0
C2521	0.5	0	0	3.5	0	0	0	0	0	0	0	0	0
C2522	1	0	0	3.5	0	0	0	0	0	0	0	0	0
C2523	2	0	0	7.5	0	0	0	0	0	0	0	0	0
C2701	4	0	0	0	0	0	0	0	0	0	0	3	0
C2702	3	0	0	0	0	0	1.5	0	0	1.5	0	1	0
C2703	3.5	0	0	0	0	0	4	0	0	5	0.5	1	0
C2704	3.5	1	0	0	0	0	3	0	0	8	0	1	0
C2705	4.5	2	0	0	0	0	2	0	0	12	0	9.5	0
C2706	10	0	0	0	0	0	4.5	0	0	0	0	0	0
C2707	2	0	0	0	0	0	0	0	0	1.5	0	1	0
C2720	11.5	0	0	0	0	0	0	0	0	1	77.5	2	4
C2721	13	0	0	0	0	0	0	0	0	2	55	3	0
C2722	15	0	0	0	0	0	0	0	0	0	0	0	0

Table 7-1.—Number of pairs of non-territorial breeding species on all rapid survey plots in 2013
(The number is the average of number of breeding males observed with some breeding evidence on either of two visits.)

Plot	Brown-headed cowbird	Eurasian collared-dove	European starling	Gambel's quail	Greater roadrunner	Great-tailed grackle	House finch	House sparrow	Inca dove	Mourning dove	Red-winged blackbird	White-winged dove	Yellow-headed blackbird
C2724	5	0	0	0	0	0	0	0	0	2	0	2	0
C2725	10.5	0	0	2	0	0	0	0	0	3.5	71.5	2.25	0
S10104	0	0	0	1	0	0	0	0	0	2	0	0	0
S10114	1	0	0	0	0	0	0	0	0	0	0	0	0
S10115	2	0.5	0	0	0	0	0	0	0	4.5	0	0	0
S10120	0.5	0	0	0	0	0	0	0	0	1.5	0	0	0
S10123	2	0	0	0	0	0	0	0	0	2	0	0	0
S10124	0	0	0	0	0	0	0	0	0	3.5	0	0	0
S10125	0	0	0	0	1	0	0	0	0	1	0	0	0
S10129	4	0	0	0	0	0	0	0	0	1	0	0	0
S10133	0	0	0	0	0.5	0	0	0	0	2.5	21.5	0	0
S10134	1.5	0	0	0	0	0	0	0	0	1	0	0	0
S10138	1	0	0	0	0	0	0	0	0	1	2	0	0
S10139	1.5	0	0	0	0	0	0	0	0	1	0	0	0
S10142	0	0	0	0	0	0	0	0	0	1	0	0	0
S10143	2	0	0	0	0	0	0	0	0	0	0	0	0
S10144	1	0	0	0	0	0	0	0	0	2	0	0	0
S10147	1	0	0	0	0	0	0	0	0	1	0	0	0
S10148	0	0	0	1	0	0	0	0	0	2	0	0	0

Table 7-1.—Number of pairs of non-territorial breeding species on all rapid survey plots in 2013
(The number is the average of number of breeding males observed with some breeding evidence on either of two visits.)

Plot	Brown-headed cowbird	Eurasian collared-dove	European starling	Gambel's quail	Greater roadrunner	Great-tailed grackle	House finch	House sparrow	Inca dove	Mourning dove	Red-winged blackbird	White-winged dove	Yellow-headed blackbird
S10150	3	0	0	0	0.5	0	0	0	0	2	0	0	0
S10153	0	0	0	0	0	0	0	0	0	0	0	0	0
S10154	1	0	0	0	0	0	0	0	0	0.5	0	0	0
S10160	1	0	0	0	0	0	0	0	0	2	0	0	0
S10161	0	0	0	1	0	0	0	0	0	0	0	0	0
S10166	1	0	0	0	0	0	0	0	0	2	0	0	0
S10167	1.5	0	0	0	0	0	0	0	0	0	0	0	0
S10172	0	0	0	0	0	0	0	0	0	0	0	0	0
S10173	1	0	0	0	0	0	0	0	0	0	0	0	0
S1585	1.5	1	0	2	1	0	0	0	0	1	0	3	8
S1586	2	0	0	1	0	6.5	1	0	0	1	0	3	36
S1674	0.5	0	0	2	0.5	0	0	0	0	0	0	0	0
S1749	4.5	0	0	4.5	1.5	0	0.5	0	0	1	0	1.5	0
S1832	0	0	0	0	0	0	0	0	0	0	0	0	0
S1946	4.5	0	0	1	0	0	0	0	0	7.5	0	14.5	0
S1955	0	0	0	0.5	0	0	0	0	0	6	0	13	0
S1998	0	0	0	1.5	0.5	0	0	0	0	0	0	0	0
S2001	2.5	1	0	2	0	40	0	0	0	1.5	40	2	250
S2084	2	0	0	1	1	0	0	0	0	2	0	1	0

Table 7-1.—Number of pairs of non-territorial breeding species on all rapid survey plots in 2013
(The number is the average of number of breeding males observed with some breeding evidence on either of two visits.)

Plot	Brown-headed cowbird	Eurasian collared-dove	European starling	Gambel's quail	Greater roadrunner	Great-tailed grackle	House finch	House sparrow	Inca dove	Mourning dove	Red-winged blackbird	White-winged dove	Yellow-headed blackbird
S2183	0	0	0	0	0	0	0	0	0	0	0	0	0
S2232	0	0	0	1	0	0	0	0	0	8.5	0	1.5	0
S2315	0	0	0	1	0	0	0	0	0	2	0	1	0
S2339	1.5	0	0	0	0	1	0	0	0	1	0	5	0
S2401	7.5	0	0	0	0	0	0.5	0	0	2.5	0	12.5	0
S2439	1	0	0	0	0	0	0	0	0	0.5	0	5	0
S2457	1	0	0	0	0	0	0	0	0	0	0	0	0
S2475	3.5	0	0	0	0	0	0	0	0	0	0	0	0
S2476	5	0	0	0	0	3	1	0	0	1.5	0	7	0
S2477	1.5	0	0	0	0	0	0	0	0	2	0	2.5	0
S2493	0	0	0	0	0	0	0	0	0	0	0	0	0
S2508	0.5	0	0	0	0	2.5	0.5	0	0	0	0	0	0
S2522	1	0	0	0	0	0.5	1	0	0	2.5	1.5	5	0
S2532	7.5	0	0	0	0	3.5	0	0	0	9	0.5	6	0
S2550	0	0	0	0	0	0	0	0	0	1	0	1.5	0
S2558	6	0	0	0.5	0	6	0.5	0	0	2.5	2	9.5	0
S2584	1	0	0	0	0	2.5	0	0	0	0	0	0	0
S2719	0	0	0	0	0	12.5	0	0	0	0.5	2	3	0
S2742	1.5	0.5	0	0	0	6	0	0	0	0.5	0	3.5	0

Table 7-1.—Number of pairs of non-territorial breeding species on all rapid survey plots in 2013
(The number is the average of number of breeding males observed with some breeding evidence on either of two visits.)

Plot	Brown-headed cowbird	Eurasian collared-dove	European starling	Gambel's quail	Greater roadrunner	Great-tailed grackle	House finch	House sparrow	Inca dove	Mourning dove	Red-winged blackbird	White-winged dove	Yellow-headed blackbird
S2744	1.5	0	0	0	0	3	0	0	0	0	0	1.5	0
S2812	3.5	0	0	0.5	0.5	8.5	0	0	0	0	0	2	0
S2858	1.5	0	0	0	0	0	0	0	0	0	0	0	0
S2860	1	0	0	0	0	0	0	0	0	3.5	0	5.5	0
S2863	8.5	0	0	0	0	0	0	0	0	15.5	0	16	0
S2864	2.5	0	0	0	0	0	0	0	0	0	0	5	0
S2865	2	0	0	1	1	0	0	0	0	1	0	3	0
S2876	1	0	0	0	1	0	0	0	0	1	0	1.5	0
S2879	2	0	0	0	1	0	0	0	0	5	0	4	0
S2886	0	0	0	0	0	0	0	0	0	0	0	1	0
S2889	5	0	0	1	0	0	0	0	0	3	4.5	4	0
S2898	3.5	0	0	1.5	0	0	2	0	0	3.5	0	2.5	0
S2901	1.5	0	0	0.5	0.5	0	0	0	0	0	0	0	0
S2903	5.5	0	0	0.5	0.5	0	1.5	0	0	6	0.5	4	0
S2972	4	0	0	2	0	0	1.5	0	0	1	0	0	0
S3536	6.5	0	0	4	0	19	10.5	0	0	1.5	7	14.5	0
S5187	0	0	0	0	0	0	0	0	0	0	1	0	0
S5198	0	2	0	0	0	4.5	5	2	1.5	0	0	2	0
S5331	1.5	0	0	2	0	0	2	0	0	3.5	0	10.5	0

Table 7-1.—Number of pairs of non-territorial breeding species on all rapid survey plots in 2013
(The number is the average of number of breeding males observed with some breeding evidence on either of two visits.)

Plot	Brown-headed cowbird	Eurasian collared-dove	European starling	Gambel's quail	Greater roadrunner	Great-tailed grackle	House finch	House sparrow	Inca dove	Mourning dove	Red-winged blackbird	White-winged dove	Yellow-headed blackbird
S5564	4.5	0	0	3	0	0	0	0	0	1	0.5	0	0
S5620	3	0	1	0.5	0	0	1	0	0	5.5	0	4	0
S5663	2	0	0	1.5	0	0	1	0	0	1	0	1.5	0
S5665	5.5	0	0	5	0	0	1	0	0	1.5	4	12	0
S5675	2	0	0	3	0	0	1	0	0	2	0	7.5	0
S5676	1	0	0	1	0	0	0	0	0	2	0	4	0
S5727	0.5	0	0	0	0.5	0	2	0	0	1	0	8	0
S5780	4	0	0	0	1	0	0	0	0	0	0	0	0
S5884	0	0	0	2	0	0	0	0	0	1.5	0	1	0
S5898	0	0	0	0	0	0	1	0	0	2	0	4.5	0
S5901	0	0	0	1	0	0	0.5	0	0	0.5	0	1.5	0
S5902	0	0	0	1.5	0	0	0	0	0	0.5	0	0.5	0
S5919	0	0	0	0	0	0	1.5	0	0	3	0	5	0
S5977	1	0	0	0.5	0	0	0	0	0	1.5	1.5	3	1
S6056	2.5	0	0	0	0	0	0	0	0	0	6.5	0	8
S6366	0	0	0	2.5	0	0	0	0	0	0	0	3	0
S6469	0	0	0	0	0	6	0	0	0	0	1	2	1
S6529	1	0	0	0	0	1.5	0	0	0	1.5	0	2	0
S6538	2.5	0	0	0	0	1.5	0	0	0	0	0	3	0

Table 7-1.—Number of pairs of non-territorial breeding species on all rapid survey plots in 2013
(The number is the average of number of breeding males observed with some breeding evidence on either of two visits.)

Plot	Brown-headed cowbird	Eurasian collared-dove	European starling	Gambel's quail	Greater roadrunner	Great-tailed grackle	House finch	House sparrow	Inca dove	Mourning dove	Red-winged blackbird	White-winged dove	Yellow-headed blackbird
S6581	4.5	1.5	0	0	0	6	1	0	0	13.5	0	6.5	0
S6732	1	0	0	0	0	0	4	0	0	5	1	0	0
S6785	2	0	0	0	0	0	0.5	0	0	0	1	0	2.5
S6927	1.5	1.5	0	9.5	0	9	3.5	0	0	3.5	0.5	1.5	0
S6958	3	0	0	0	0	2	0	0	0	4	41.5	5.5	75
S6986	0	0	0	0.5	0	0	0.5	0	0	2.5	0	0	0
S7052	5.5	0	0	0	0	1.5	1	0	0	0	9.5	1.5	0
S7059	6	0	0	0	0	1	1	0	0	6	1	5	0
S7107	1.5	0	0	0	0	0	0	0	0	0.5	0	3.5	0
S7179	3	0	0	1	0	18	0	0	0	4	16	3	0
S7335	2	0	0	0.5	0	0	1	0	0	0	0	11	0
S7336	2	0	0	0.5	0	0	0	0	0	0.5	0	2	0
S7337	1.5	0	0	0	0.5	0	0	0	0	0	0	0	0
S7532	6.5	0	0	0.5	0	3.5	0	0	0	10	4.5	8.5	0
S7654	2	0	0	0	0	3	1	0	0	1	11	6	0
S7707	1	0	0	0	0	1.5	0.5	0	0	1.5	0	4	0
S7733	2.5	0	0	3	0	0	0	0	0	3	0	0.5	0
S7742	6	0	0	2.5	0	0	2.5	0	0	0	0	1.5	0
S7776	2.5	0	0	1.5	0	9	2	0	0	3	25	2	0

Table 7-1.—Number of pairs of non-territorial breeding species on all rapid survey plots in 2013
(The number is the average of number of breeding males observed with some breeding evidence on either of two visits.)

Plot	Brown-headed cowbird	Eurasian collared-dove	European starling	Gambel's quail	Greater roadrunner	Great-tailed grackle	House finch	House sparrow	Inca dove	Mourning dove	Red-winged blackbird	White-winged dove	Yellow-headed blackbird
S7838	3.5	0	0	2	0	0	0	0	0	3	0	6	0
S7956	1	0	0	0	0	0	0	0	0	1	0	1.5	0
S7975	5.5	3	0	0	0	13	0	0	0	2.5	0	9.5	0
S7976	1	0	0	1	0	2	0	0	0	0.5	2	3	0
S7985	1	0	0	2.5	0	0	0	0	0	5	1	4.5	0
S8011	6	0	0	0	0	0	0.5	0	0	2	1	11.5	0
S8028	1	0	0	1	0	0	0	0	0	0.5	1	2.5	0
S8076	2.5	0	0	1	1	0	0	0	0	2	7.5	1	0
S8223	5.5	0	0	0	0	0	1.5	0	0	0.5	0	1.5	0
S8233	1.5	0.5	0	5	0	7.5	1.5	0	0	1	1	2	0
S8261	1	0	0	2	0	0	4	0	0	1	4	4	0
S8291	1	0	0	0	0	0	0	0	0	1	0	2.5	0
S8292	3	0	0	0	0	0	0	0	0	1.5	0	1.5	0
S8295	0	0	0	0	0	0	0	0	0	1	0	5	0
S8665	10.5	0	0	0.5	0	3.5	3	0	0	0	2	4	0
S8675	3.5	5	0	0	0	1	0.5	0	0	1.5	4	15	0
S9032	0.5	0	0	0	0	0	0	0	0	0.5	0	0	0
S9064	3	0	0	1	0	0	0	0	0	1.5	0	6.5	0
S9066	3.5	0	0	0	0	0	0	0	0	0	0	0	0

Table 7-1.—Number of pairs of non-territorial breeding species on all rapid survey plots in 2013
(The number is the average of number of breeding males observed with some breeding evidence on either of two visits.)

Plot	Brown-headed cowbird	Eurasian collared-dove	European starling	Gambel's quail	Greater roadrunner	Great-tailed grackle	House finch	House sparrow	Inca dove	Mourning dove	Red-winged blackbird	White-winged dove	Yellow-headed blackbird
S9067	7	0.5	0	0	1	3.5	0	0	0	11	0	13.5	0.5
S9068	0	0	0	0	0	0	0	0	0	0	0	0	0
S9089	0	0	0	0	0	0	0	0	0	2.5	0	1	0
S9124	2	0	0	0	0	0	3	0	0	4	0	3	0
S9125	1	0	0	0	0	0	0	0	0	0	0	0	0
S9397	3	0	0	0	0	0	0	0	0	1.5	0	3	0
S9406	1	0	0	1	0	12	0	0	0	2	0	2.5	0
Total	**604.5**	**29**	**1**	**139**	**18.5**	**232**	**136**	**2**	**3.5**	**414.5**	**1,254**	**600.75**	**389**

Table 7-2.—Number of pairs of non-territorial breeding species on all intensive survey plots in 2013
(The number is the average number of breeding males observed with some breeding evidence on any visit.)

Plot	Brown-headed cowbird	Eurasian collared-dove	European starling	Gambel's quail	Greater roadrunner	Great-tailed grackle	House finch	Mourning dove	Red-winged blackbird	White-winged dove	Yellow-headed blackbird
C2301	6	1	0	0	0	0	2	4	146	8	0
C2309	5	0	0	0	0	0	0	1	0	4	0
C2703	5	0	0	0	0	0	5	0	1	0	0
C2706	6	0	0	0	0	0	2	5	0	7	0
S2183	3.75	0	0	3.13	0.83	0.2	0.13	3	0.88	1.29	0
S2477	0	0	0	0	0	0	0	0	0	0	0
S2550	0	0	0	0	0	0	0	0.17	0	0.8	0
S5620	3.5	0	0.75	1.38	0	0	1	2.5	0.5	1.5	0
S6056	0.43	0	0	0	0	0.67	0	0	4.25	0	9.75
S7838 – EI* and intensive	2.75	0	0	2.43	0	0	0.5	0.86	0	4	0
S7985 – EI and intensive	0.57	0	0	0.43	0	0.33	0	2.13	0	5.67	0
S2864 – EI and intensive	2.17	0	0	0	0	0	0	1.38	0	3.63	0
S9124 – EI	2	0	0	0	0	0	0	2.88	0	3.88	0
S2865 – EI	2.75	0	0	0.2	0	0	1.13	3.13	0	5.5	0
S2886 – EI	0.5	0	0	0.5	0	0	1.13	0.25	0	0.25	0
S2901– EI	0	0.13	0	0.57	0.83	0	0	0.83	0	0.17	0
S2879 – EI	2.75	0	0	0	0.4	0	0.2	4.38	0	3.38	0

EI = enhanced intensive.

Table 7-3.—Number of pairs of non-territorial breeding species on all enhanced intensive surveyed plots in 2013

(The number is the average number of breeding males observed with some breeding evidence on any visit.)

Plot	Brown-headed cowbird	Eurasian collared-dove	Gambel's quail	Greater roadrunner	Great-tailed grackle	House finch	Mourning dove	Red-winged blackbird	White-winged dove
S2864	4.33	0	0	0	0	0	1.63	0	4.00
S2865	2.00	0	1.88	0	0	0.75	0.25	0	1.69
S2879	5.38	0	0.20	0.73	0	0	11.00	0	8.33
S2886	0	0	0	0	0	0.40	0	0	0.13
S2901	0.38	0	0	0	0	0	0	0	0
S7838	1.13	0.64	0.75	0	0	0.25	2.06	0	12.23
S7985	2.08	0	1.42	0	0.50	0	2.43	0	3.31
S9124	2.40	0	0	0.19	0	0	0.19	0	0

Table 7-4.—Number of pairs of non-territorial breeding species on Yuma East Wetlands and Hunter's Hole Conservation Area in 2013 (Data provided by the Bureau of Reclamation. Based on differences in data collection and entry methods, we only report range values here.)

Species	C4701	C4702	C4703	S6785
Brown-headed cowbird	< 20	< 20	0	< 20
Eurasian collared-dove	< 20	0	0	0
Gambel's quail	< 20	0	< 20	< 20
Great-tailed grackle	< 20	< 20	< 20	< 20
Greater roadrunner	< 20	0	< 20	0
House finch	< 20	< 20	< 20	0
Mourning dove	< 20	< 20	< 20	< 20
Rock pigeon	< 20	0	0	0
Red-winged blackbird	< 20	< 20	< 20	< 20
White-winged dove	< 20	< 20	< 20	0
Yellow-headed blackbird	0	< 20	< 20	0

ATTACHMENT 8

Crosswalk Between Southwestern Willow Flycatcher Site Names and Lower Colorado River Riparian Bird Plots

Table 8-1.—Crosswalk between southwestern willow flycatcher site names and lower Colorado River riparian bird plots at the Topock Marsh and Bill Williams River National Wildlife Refuge sites in 2013

Southwestern willow flycatcher sites	Hectares	Site priority	Number of plots	Plot numbers				
Topock Marsh sites								
Pipes #1	5.2	Breeding site (1st priority)	3	2339	8295	9066		
Pipes #3	5.7	Breeding site (1st priority)	2	9064	2401			
The Wallows	0.7	Breeding site (1st priority)	1	2401				
800 m	4.7	Breeding site (1st priority)	2	2476	2477			
PC6-1	4.8	Non breeding site (2nd priority)	4	9067	2401	9065	8293	
Pig Hole	2.4	Non breeding site (2nd priority)	3	9068	8293	2457		
In Between	7.7	Non breeding site (2nd priority)	2	2457	2477			
Pierced Egg	6.7	Non breeding site (2nd priority)	2	2476	2475			
Swine Paradise	0.9	Non breeding site (2nd priority)	2	2508	9071			
Barbed Wire	2.1	Non breeding site (2nd priority)	3	2508	2493	9071		
Platform	1.9	Non breeding site (2nd priority)	2	2522	2532			
250 M	1.9	Non breeding site (2nd priority)	2	2543	7059			
Hell Bird	6.3	Non breeding site (2nd priority)	1	7059				
Glory Hole	5.0	Non breeding site (2nd priority)	2	7059	2558			
Spaghetti	5.4	Non breeding site (2nd priority)	3	8286	8291	8292		
Lost Lake	3.3	Non breeding site (2nd priority)	3	2712	2719	2720		

Table 8-1.—Crosswalk between southwestern willow flycatcher site names and lower Colorado River riparian bird plots at the Topock Marsh and Bill Williams River National Wildlife Refuge sites in 2013

Southwestern willow flycatcher sites	Hectares	Site priority	Number of plots	Plot numbers				
Bill Williams River National Wildlife Refuge sites								
Burn Edge	4.1 ha	Breeding site (1st priority)	4	7704	2857	7107	7336	
Site #4	9.9 ha	Breeding site (1st priority)	2	2863	7337			
Site #3	13.0 ha	Breeding site (1st priority)	4	7337	8223	7338	7335	
Cougar Point	1.3 ha	Breeding site (1st priority)	5	2968	2929	2902	2903	2889
Planet Ranch Road	3.3 ha	Breeding site (1st priority)	3	3030	3082	3089		
Last Gasp	2.1 ha	Non breeding site (2nd priority)	2	8221	8220			
Site #5	6.8 ha	Non breeding site (2nd priority)	5	2865	2875	9124	9125	2876
Upstream from Site #8	1.5 ha	Non breeding site (2nd priority)	2	2979	3030			
New River	0.6 ha	Non breeding site (2nd priority)	2	3084	3085			
		Total (excluding repeat plots):	54					

Table 8-2.—Crosswalk between southwestern willow flycatcher site names and lower Colorado River riparian birds plots at the Virgin River in 2013

Southwestern willow flycatcher sites	Hectares	Site priority	Number of plots	Plot numbers								
Virgin River												
Mormon Mesa South – north half	8.4	Breeding	5	624	620	619	613	611				
Mormon Mesa South– south half	3.4	Breeding	4	624	623	625	629					
Virgin Area #1 – north half	11.4	Breeding	8	628	629	632	633	634	638	639	643	
Virgin Area #1 – south half	11.1	Breeding	11	638 665	642 666	643	647	648	652	653	654	659
Virgin Area #2	11.2	Breeding	14	646 675	651 681	656 682	657 687	662 688	663	664	669	670
Historic breeding habitat adjacent to breeding sites	242											

ATTACHMENT 9

Vegetation Plot Selection Process

DEFINITIONS

Covered species – Gila woodpecker (*Melanerpes uropygialis)*, Arizona Bell's vireo (*Vireo bellii arizonae)*, Sonoran yellow warbler (*Dendroica petechia sonorana)*, and summer tanager (*Piranga rubra*).

Use vegetation plot – A vegetation plot created within a territory of a covered species (see below for a description on how territories are determined). The territories are defined as "use" from bird surveys conducted during the field season of the current year. The use vegetation plot center location is randomly generated within the estimated territory of a covered species (see below).

Non-use vegetation plot – A vegetation plot occurring within a systemwide or habitat creation site where a specific covered species was not found during bird surveys conducted at those sites that year. The non-use vegetation plot center is randomly generated within the selected systemwide or habitat creation plot where the covered species did not occur.

VEGETATION PLOT SELECTION

Since 2011, we have conducted vegetation surveys using methodologies established by the Bureau of Reclamation (Reclamation). Each year, we randomly selected vegetation plot locations within territories delineated for the Arizona Bell's vireo, Gila woodpecker, summer tanager, and Sonoran yellow warbler using ArcGIS. These include our use vegetation plots. Additionally, we randomly selected paired non-use vegetation plots to survey for these same species. Prior to 2013, we selected bird territories using simple random sampling; however, in an effort to improve data collection in 2013, our methodology changed, and bird territories were selected using a stratified random sampling design with strata defined by geographic location and habitat. For this method, we weighted regions of the study area based on the total number of bird territories for each species that occurred within that region. We decided to weight the bird territories for selection using the following criteria:

> **Summer tanager**: 7 in Region 7 (5–6 in tall woody and 1–2 in low woody) and 1 in each of 3 other regions with the largest distribution of territories for that year.
>
> **Arizona Bell's vireo**: 6 in Region 7 (4 in tall woody and 2 in low woody), 2 in Region 6, and 1 in each of 2 other regions that contain the largest distribution of territories for that year.

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

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

Use Plots

Each year, we randomly selected 10 territories per species (here referred to as use plots). We also randomly selected 10 corresponding plots where each species was not recorded (non-use plots). To obtain the use vegetation plots, all territories that were recorded for the four covered species that year were exported from Access to an Excel file. A spreadsheet was then created for each covered species. The table exported to Excel contained the following pertinent information: Plot ID, surveyor, survey type, species, territory code, region of river, and habitat type. Once this information was exported to Excel, we created a random number column. We generated the random number using the function **rand()**. We then copied the formula down that column so that every row was assigned a random number. By copying and pasting the values, the numbers will not change each time the screen is refreshed. We then sorted the column by the strata we wanted to use for the selection process. In our situation, we sorted by region of river, habitat type, and then by the random number. Based on the established weighting system, territories were then selected. For example, if we needed four yellow warblers from Region 7 habitat (tall woody), the first four territories meeting this requirement were selected. Once the territories were selected, we reviewed each territory to be certain that the same territory was not selected twice (this was determined using the spatial location of the bird's territory in a Geographic Information System [GIS]). This could happen in situations where the enhanced intensive (EI), intensive, and/or rapid surveyor all saw the same bird. For example, if a summer tanager was randomly selected from a bird plot using the EI surveyor's data and also randomly selected from the same bird plot using the intensive surveyor's data. Originally, there was discussion of possibly using nest sites or nest trees for one of vegetation survey plots for the Gila woodpecker; however, because there are usually a limited number of nests found, we decided to use random locations within the bird's delineated territory instead.

Prior to 2013, a majority of our "use" vegetation plots were selected using simple random sampling from the EI and intensive surveyor's territories (50 percent) with the remaining territories selected from all survey types (rapids, intensives, and EIs combined). We decided to select the majority of territories from intensive and EI surveys because these territories tended to be more precisely defined due to the greater number of visits to the bird plots (8 and 16 visits, respectively) and, therefore, there were more opportunities to map birds' territories. Rapid surveys

are typically a snapshot of use on two occasions, and the locations recorded during those surveys may be less biologically significant and potentially less accurate.

In 2013 however, in an effort to improve data collection, our methodology changed, and we began selecting bird territories using a stratified random sampling design with strata defined by geographic location and habitat. Given this new stratified sampling design and the newly defined weighting system, along with the requirement that the vegetation plots selected could not overlap vegetation plots surveyed in previous years, it was difficult to meet the requirement that 50 percent of the vegetation plots fall within territories delineated by the EI or intensive surveyor. However, when possible, we did make an effort to select rapid plots that were based off of more than two observations. We also randomly selected five alternate territories (meeting the weighting criteria) for each species in case vegetation plots could not be established within that bird's territory due to territory size (i.e., the surveyor was only able to record one observation for that bird, and therefore, a territory polygon could not be created) or due to potential overlap in territories from the EI, intensive, and/or rapid surveyor (see above paragraph).

After the territories were randomly selected, minimum convex polygons (MCP) were created for the selected territories in ArcGIS. To create MCPs, we used the observation points for each species that were entered into GIS by the observer (see GIS data entry protocol, attachment 4). If there was only one observation recorded for that territory, it was removed from the selection because a MCP could not be created. To create the MCPs, we split the shapefiles that contained the observation points for the four covered species by observer. We created territory polygons from those observation points using minimum bounding geometry in ArcMap10. We grouped the territory code and the bird plot for each observer's shapefile. For example, a territory polygon for YWAR1 plot 8011 was created. There was no overlap in polygon generation as long as the points were split up by territory code, survey type, and bird plot within each surveyor's shapefile.

Once the territory polygons had been generated, we added a field to each attribute table to calculate the geometry of the territories. The geometry, or area of the territories, was calculated in acres. The total acres for each territory were calculated because protocols call for one vegetation plot to be established within every 2 acres, with a maximum of five vegetation plots created within a given territory. Therefore, territories larger than 10 acres contained a maximum of five use vegetation plots. Once the number of use vegetation plots was determined, based on the size of the bird's territory, we randomly created the vegetation plot centers within the territory polygons. We randomly created a total of 10 vegetation plot centers within each of the territory polygons. When random points are generated in ArcGIS, the created points do not have any information (or attributes) associated with them. Therefore, once the vegetation plot centers were

created, we did a spatial join in ArcGIS to the territory shapefile so that the points could be attributed (i.e., YWAR1 plot 8011). Depending on the size of the bird's territory, some of these 10 vegetation plot centers were randomly chosen as vegetation survey plots, and some were randomly chosen as vegetation backup plots. For example, if a Gila woodpecker territory was chosen that was 10 acres, then five vegetation plot centers were randomly chosen as survey points, and the remaining five would be used as backup vegetation plots. We only used the backup points if a survey point was deemed unsafe or unsuitable for vegetation data collection(e.g., road or in a marsh). See below for a thorough list of criteria for plot discard.

Non-Use Plots

To compare use habitat for the covered species to non-use habitat, we also recorded vegetation at sites that were determined to not be in use by a specific covered species. Non-use vegetation plots were paired with use vegetation plots, meaning that if there were eight use vegetation plots within Region 7 in tall woody habitat for the summer tanager, then there were also eight non-use vegetation plots that were selected within Region 7 and in the tall woody habitat strata. On a few occasions, there were no avaialbe non-use bird plots surveyed within that region for that year that did not contain the covered species of interest; therefore, we selected a non-use bird plot from the closest corresponding region within the same habitat type. Region was always the first criteria met and then habitat. For example, if there were only four non-use tall woody bird plots in Region 7, but there were three non-use low woody bird plots within that region, then those bird plots would be chosen first before moving on to a different region and selecting tall woody within the next closest region. Non-use vegetation plot selection was also determined in Excel. A list of all the bird plots that did not have a specific covered species was exported into Excel with a separate worksheet created for each species. We also generated several alternate non-use bird plots just in case an entire plot could not be surveyed. Note that this situation would be very rare – this would mean that for some reason (possibly the whole plot burned) all of the randomly generated vegetation survey plots and vegetation backup plots within the bird plot could not be surveyed.

After completing the selection process for the non-use bird plots, we randomly created vegetation plot centers in ArcGIS within each of these selected plots. We chose one of these random centers as the survey point, and the others were selected to be backups. We used the bird plot boundaries as the bounding geometry for random number generation. We compared all non-use bird plots between the four species worksheets. Our goal in comparing the randomly selected bird plots between covered species was to determine if the same non-use bird plot was randomly selected for more than one of the covered species. Note that a non-use bird plot means that the species of interest was not recorded within the entire bird plot; therefore, any random point generated within this bird plot

could be used as a non-use vegetation survey. For this reason, it was determined that if more than one covered species was randomly selected for that non-use bird plot, one vegetation plot could be surveyed and used as a non-use vegetation plot for multiple species as long as the bird plot was randomly selected and the species of interest did not occur within the bird plot. There were also a few instances in which a bird plot was randomly chosen as a non-use vegetation plot for one species and also had already been selected as a use vegetation plot for another species. In this situation, the use vegetation plot could be surveyed, and this one vegetation survey would represent both the use and non-use vegetation plot for each of the corresponding species. For example, bird plot S9125 was chosen as a non-use plot for Bell's vireo, but within that same bird plot, a use territory for a summer tanager was already selected. In this situation, it was determined that this use plot for the Bell's vireo could also be selected as a non-use plot for the summer tanager. The reverse situation could never happen because use vegetation plots are always established within the species territory boundary.

HOBO Selection

From the 10 use and non-use vegetation plots, we randomly selected 6 use and 6 non-use plots for deployment of HOBO environmental data loggers. We covered each HOBO unit with a RS1 Solar Radiation Shield and secured it onto a fencepost approximately 5.5 feet above the ground within the center of the vegetation plot. All HOBOs were placed facing the same direction, and this direction was determined by the random bearing chosen for the vegetation plots that year. Additionally, all the 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 temperature and relative humidity every 15 minutes at that site for an entire year. As different plots were selected each year, HOBOs were moved to the new locations during the fall vegetation season. Because HOBOs are permanently installed for approximately a year, sites were carefully selected, and access to site was 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 National Wildlife Refuge.

Once use and non-use vegetation plot center points were created through the processes discussed above, the data were submitted to the Bureau of Reclamation for vegetation plot creation.

Creating Vegetation Plots Using GIS

We combined the shapefile for use, non-use, and backup plots centers into one shapefile. The shapefile included the following attributes: Plot_Id, Survey, Species, Terrcode, Surveyor, Survey_typ, HOBO, and *x* and *y* coordinates. From this vegetation center plot feature class, we created the 40 by 10-meter plot

polygons using the Geospatial Modeling Environment (GME). GME is a platform designed to help facilitate rigorous spatial analysis and modeling. The generated shape (polygon) requires a set of input points, a shape, and a dimension by radius. We used the optional rotation so that all the vegetation plots along the river would be established in the same orientation. The shape used was a rectangle, and the dimension by radius was 20 by 5 meters because the rectangle requirements are 40 by 10 meters. We used Microsoft Excel to select a random number between 1 and 360 for the bearing of the plots. The bearing is randomly selected each year. The GME rotation is not based on a bearing but a rotation of the x (width) and y (height). To translate the compass bearing into a GME rotation, we subtracted the bearing from 450 to give the rotation.

Once all the plots were created, it was necessary to do a spatial join with center points and export the newly created plot shapefile fully attributed (Plot_Id, Survey, Species, Terrcode, Surveyor, Survey_typ, HOBO, and *x* and *y* coordinates). It was also necessary to add additional attributes, Crosswalk and Keep. After all the vegetation plots were created, the plots were reviewed in ArcMap and Google Earth prior to field work to determine whether or not they could be surveyed. We chose backup plots if the original plot chosen could not be surveyed. Plots were considered not able to be surveyed based on the following conditions established by the Great Basin Bird Observatory and Reclamation:

> Plots were discarded if more than 25 percent of the plot contained a road, marsh, agricultural area, water, canal, parking lot, or manmade construction. We also discarded plots if there were safety concerns (e.g., a beehive in the middle of the plot, squatters, or if the plot fell on extremely steep terrain). Typically, safety concerns could only be determined by the crew once they were out in the field. The crews were always provided with a list of survey plots and maps as well as a list of backup plots and corresponding locations. If a plot was deemed unsafe, a backup plot was chosen in the field. Notes were made as to why the backup plot was chosen, and these notes are included in the Access database. We left natural open areas (e.g., dirt/grass field, upland desert, burned areas, etc.) in the sample even if they comprised 100 percent of the vegetation plot.
>
> In 2013, it was determined that plots would also be discarded based on the proximity to previous vegetation plots surveyed in 2011 and 2012. Since yellow warblers and Bell's vireos have relatively small territories, it was determined that a new vegetation plot would be selected if the 2013 vegetation plot overlapped plots from 2011 or 2012. Typically, summer tanagers and Gila woodpeckers have much larger territories, so we decided that vegetation plots would only be discarded (and a backup plot chosen) if vegetation plots surveyed in 2011 or 2012 fell within 50 meters of the plot selected to be surveyed for 2013. Additionally, non-use vegetation plot boundaries selected should not overlap vegetation plot boundaries from previous years. We determined these criteria visually using ArcMap. These rules will be followed in all subsequent years of the contract.