Lower Colorado River Multi-Species Conservation Program

Balancing Resource Use and Conservation

Lower Colorado River Vegetation Monitoring

2014 Annual Report

U.S. DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION

April 2015

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Lower Colorado River Vegetation Monitoring

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ACRONYMS AND ABBREVIATIONS

BLCA	Beal Lake Conservation Area
cm	centimeter(s)
CNU1	Cibola National Wildlife Refuge Unit 1 Conservation Area
CVCA	Cibola Valley Conservation Area
DBH	diameter at breast height
DC	diameter class
GPS	Global Positioning System
HC	height class
m	meter(s)
m^2	square meter(s)
MEFFs	mobile electronic field forms
LCR MSCP	Lower Colorado River Multi-Species Conservation Program
NT	Nature Trail
Project Team	Parametrix, Inc., and GeoSystems Analysis, Inc.
PVER	Palo Verde Ecological Reserve
QA/QC	quality assurance/quality control
Reclamation	Bureau of Reclamation
SC	size class
SD	standard deviation
SE	standard error
TVV	total vegetation volume
YEW	Yuma East Wetlands

Symbols

>	greater than
<	less than
≤	less than or equal to
%	percent

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EXECUTIVE SUMMARY

In 2014, Parametrix, Inc., and GeoSystems Analysis, Inc. (the Project Team), completed the fourth consecutive year of vegetation surveys to support habitat creation site evaluations for the Lower Colorado River Multi-Species Conservation Program (LCR MSCP). The Project Team assisted with reviewing several iterations of the Bureau of Reclamation (Reclamation) vegetation data collection mobile electronic field forms and used the forms to collect habitat data at five conservation areas (Beal Lake Conservation Area, Palo Verde Ecological Reserve, Cibola Valley Conservation Area, Cibola National Wildlife Refuge Unit 1 Conservation Area, and Yuma East Wetlands). Field measurements were recorded at 227 plots during approximately 24 days in the field between September 7 and November 1, 2014.

Several changes were made to previous vegetation data collection protocols to: (1) focus the data collection on attributes of primary interest to the LCR MSCP, (2) collect habitat data only within designated polygons of interest, and (3) facilitate migration from paper data sheets to electronic field forms. The protocols used for 2014 surveys are termed "modified intensive." Compared to 2013 "enhanced" protocols, the 2014 survey methods increased sample points for some attributes while other attributes were no longer recorded. Key changes to protocols from 2013 were:

- The same protocols (modified intensive) were used for all plots. In previous years, different levels of data collection were completed at different sites.

- The number of hits to pole/vegetation volume sampling points was increased from 5 to 9 locations per plot.

- There was no data collection for foliar cover estimates, small-diameter dead trees, small-diameter (less than 2.5-centimeter diameter at breast height) coyote willow density and height, arrowweed (*Pluchea sericea*) density and height, presence of surface water, or herbaceous and ground cover.

- Sampling was conducted at random plot locations nested within polygons of interest rather than repeated, "permanent" monitoring plots.

- All data collection was completed prior to November 7 to minimize the effects of winter senescence on vegetation results.

During previous project years, data were summarized by "site" within each conservation area (e.g., Palo Verde Ecological Reserve Phase 01). Conversely, 2014 vegetation data were summarized by "inference polygons," which are areas

targeted by Reclamation for a combination of moist soils and dense vegetation for the LCR MSCP covered species. The following vegetation data were summarized by inference polygons:

- Canopy closure
- Tree and shrub density
- Tree size class distributions
- Tree and shrub height class distributions
- Total vegetation volume
- Vertical foliar density

Habitat creation areas were generally comprised of a dense overstory of native trees and shrubs, resulting in a mean inference polygon canopy closure of 89 percent. A variably dense mix of primarily native understory vegetation was observed, most often comprised of willow baccharis and/or mule fat. Tamarisk (*Tamarix* spp.) was abundant when it was present at Cibola Valley Conservation Area and Cibola National Wildlife Refuge Unit 1 Conservation Area (mean density of approximately 400 plants per acre for inference polygons at these conservation areas). Tree density ranged from 64 trees per acre at Yuma East Wetlands inference polygon I_1403 to 4,971 trees per acre at Cibola Valley Conservation Area Phase 01 inference polygon 1404. The mean density of trees across polygons was 1,114 trees per acre. The high canopy closure and tree and shrub density resulted in a mean total vegetation volume of 1.04 (standard error of 0.07) between polygons.

No noxious or invasive species were encountered at Beal Lake Conservation Area, Cibola National Wildlife Refuge Unit 1 Conservation Area, or Yuma East Wetlands. Spanish false fleabane (*Pulicaria paludosa*), a non-native plant that can become invasive if not treated, was observed at Palo Verde Ecological Reserve within Sites 1 and 6. Morning glory (*Ipomea purpurea*), a noxious weed, continues to be prevalent at the Cibola Valley Conservation Area, particularly in Sites 1 and 2. Morning glory was also encountered throughout Sites 4 and 6 at the Palo Verde Ecological Reserve.

The 2014 monitoring protocol adjustments allowed for efficient transition to electronic data collection, which was used for all plots. An overall average of three plots was completed per two-person crew per day, which was higher than the survey efficiency for “enhanced” plots at the same conservation areas during previous years. This indicates that survey protocol changes and mobile electronic field forms allowed similar or higher efficiency compared to previous surveys. While an additional crew member was required in the field for daily quality assurance/quality control, very little post-field data correction was required.

INTRODUCTION

The Lower Colorado River Multi-Species Conservation Program (LCR MSCP) is a 50-year effort aimed at balancing the use of lower Colorado River water resources with the conservation of native species and habitats. To achieve these goals, the Bureau of Reclamation (Reclamation) is tasked with creating and maintaining habitat to help conserve 26 covered LCR MSCP species while potentially benefitting 5 additional "evaluation" species that might be listed in the future. To achieve these objectives, the Habitat Conservation Plan specifies the creation of 8,132 acres of various habitat types, including 5,940 acres of cottonwood-willow land cover and 1,320 acres of honey mesquite (*Prosopis glandulosa*) cover (Reclamation 2004, 2011). Key vegetation species, which are either directly planted or establish passively at these habitat creation areas, include:

- Cottonwood (*Populus fremontii*)
- Goodding's willow (*Salix gooddingii*)
- Coyote willow (*Salix exigua*)
- Willow baccharis (*Baccharis salicina*)
- Mule fat (*Baccharis salicifolia*)
- Desert broom (*Baccharis sarothroides*)
- Honey mesquite
- Screwbean mesquite (*Prosopis pubescens*)
- Heliotrope (*Heliotropium curassavicum)*
- Quail bush (*Atriplex lentiformis*)
- Tamarisk
- Arrowweed

Reclamation implements annual vegetation surveys at LCR MSCP conservation areas to inform adaptive management and determine if vegetation conditions are achieving habitat creation objectives. Protocols and the vegetation monitoring design are detailed in Reclamation (2014a).

Parametrix, Inc., and GeoSystems Analysis, Inc. (the Project Team), conducted vegetation surveys for Reclamation during 2014 through Contract GS10F0013N/R11PD30179. The Project Team worked with Reclamation to clarify changes to the survey methodology and develop revised field instructions and paper data sheets. These instructions were adapted for data collection with the mobile electronic field forms (MEFFs), which were used for all surveys during the 2014 project year. Field surveys were conducted between September 7 and November 1, 2014, at five habitat creation areas on the LCR: Beal Lake Conservation Area (BLCA), Palo Verde Ecological Reserve (PVER), Cibola Valley Conservation Area (CVCA), Cibola National Wildlife Refuge Unit 1 Conservation Area (CNU1), and Yuma East Wetlands (YEW). An

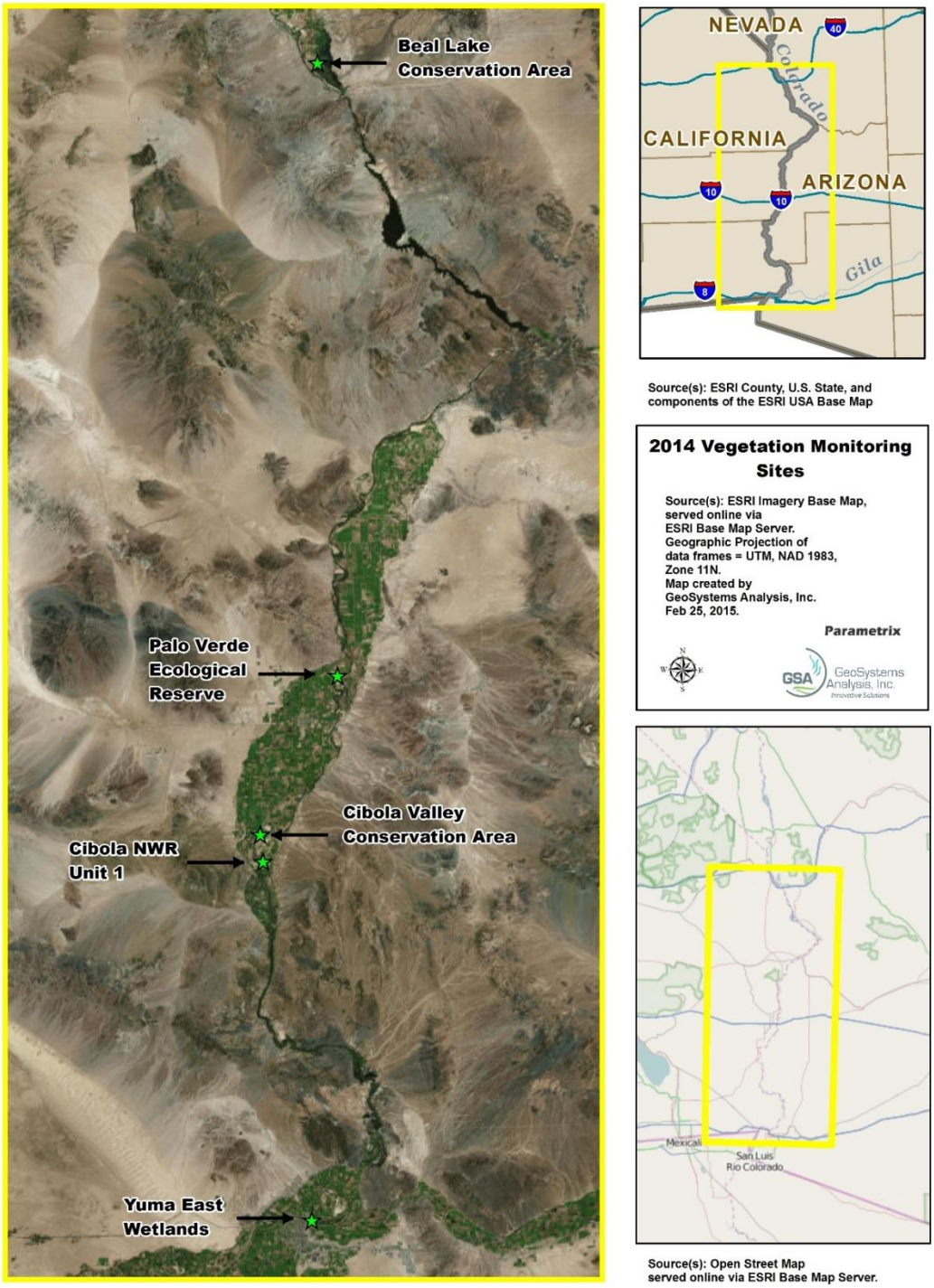

Figure 1.—2014 Vegetation monitoring locations: regional map.

overview of survey locations is provided on figure 1. Following quality assurance/quality control (QA/QC), electronic data were submitted to Reclamation following the procedures detailed in Reclamation (2014b).

A new project database was deployed during the 2014 season to accommodate the new digital data structure utilized by the electronic forms. The Project Team provided multiple rounds of reviews, comments, and recommendations on the 2014 Reclamation database queries to facilitate data analysis for the 2014 field protocol. Once the final queries were received, the Project Team summarized data for each polygon of interest.

This report documents methods, recaps survey efforts, presents summary statistics for each inference polygon, and provides near-term recommendations for surveys conducted in subsequent years. The "Methods" section reviews the methods used, the "Site Conditions and Vegetation Characteristics" section provides monitoring results, and the last main section is the "Conclusions and Recommendations" section.

METHODS

Survey Overview

Crews surveyed a total of 227 vegetation monitoring plots in 2014. As opposed to previous project years, when up to three survey intensities were used, only one survey intensity was used during the 2014 field season. Reclamation refers to the 2014 survey protocol as "modified intensive." Specifications for these surveys are provided in Reclamation (2014a), and they are reviewed in the following sections.

The number, type, and plots surveyed for project years to date are detailed by conservation area and site in table 1. A list of all plots sampled is provided in attachment 1, and plot location maps for each conservation area are provided in attachment 2.

2014 Survey Methodology Adjustments

Several changes were implemented for the 2014 field methodologies. Protocol changes facilitated migration to MEFFs and focused the measured vegetation monitoring parameters toward key interests of the LCR MSCP. These changes are reflected in the 2014 LCR MSCP protocols (Reclamation 2014a). Specifications or deviations from enhanced-level surveys conducted during 2013 consisted of:

Table 1.—Summary of plots surveyed to date

Site	Number of plots			
	2011	2012	2013	2014
Beal Lake Conservation Area				
	35	35	35	9
Bill Williams River East				
	36	36	36	0
Cibola Valley Conservation Area				
	16	19	19	27
	19	19	19	16
	8	13	13	16
	4	6	6	0
	11	11	11	0
	13	13	13	0
	15	15	15	0
Cibola National Wildlife Refuge Unit 1 Conservation Area				
	6	6	6	0
	0	0	17	16
	24	24	24	10
	6	6	6	0
	18	27	27	8
Palo Verde Ecological Reserve				
PVER01	8	8	8	4
PVER02	18	17	17	8
PVER03	22	22	22	10
PVER04	20	20	20	16
PVER05	28	28	28	40
PVER06	40	40	40	32
PVER07	0	40	40	0
PVER08	0	0	6	0
Yuma East Wetlands				
YEW	0	0	0	15
Total:	**347**	**405**	**428**	**227**

Note: For 2011–13, unhighlighted cells indicate enhanced-level surveys; green highlighted cells indicate reduced-effort surveys, and; lavender highlighted cells indicate rotational surveys. For 2014, unhighlighted cells indicate modified intensive surveys.

- Methods and Protocol Changes

  - All data were collected using MEFFs developed by Reclamation in the Trimble® TerraSync™ platform. An accompanying data transfer and management protocol was developed, and QA/QC procedures were updated to accommodate electronic data collection (refer to the "Data QA/QC and Transfer" section. The only hardcopy sheets used in 2014 were a checklist and tally sheet (included as part of attachment 5). The checklist page contained a "Miscellaneous Tally Grid" for dot tallying measurements that were only entered once electronically (as a sum) after all individuals were tallied. A "Notes" section on the checklist was also used for noting irregularities or points of interest in the plot. A hardcopy Hits to Pole tally sheet was used to record values for "All" hits in each meter layer. The "All" count from the hardcopy sheet was entered into the MEFFs after species-level measurements were recorded in the Global Positioning System (GPS) unit.

  - Size class (SC) 1, which was formerly less than 2.5 centimeters (cm) diameter at breast height (DBH), was changed to less than *or equal* to 2.5 cm at DBH to be consistent with stem diameter class (DC) category 1. Resulting SCs were as follows:

    - SC1: $\leq$ 2.5 cm
    - SC2: 2.51–8.0 cm
    - SC3: 8.1–12.0 cm
    - SC4: 12.1–20.0 cm
    - SC5: 20.1–40.0 cm
    - SC6: 40.1–50.0 cm
    - SC7: 50.1–80.0 cm
    - SC8: > 80.0 cm

  - Addition of:

    - Four canopy closure and hits to pole locations (D6–D9) at the corners of the A Plot to better account for variability within the A Plot.

  - Removal of:

    - Foliar tree and shrub cover estimates for the B Plot.

    - C Plots, which were previously used to document ground cover, herbaceous foliar cover, herbaceous cover depth, and litter depth.

        - E Plots, which were previously used to document the density and height of live and dead arrowweed and SC1 coyote willow, along with dead SC1 trees

    - DBH measurement specifications were added for non-typical tree growth patterns such as trunk irregularities, forking near breast height, etc.

    - Vegetation plot locations are no longer consistent between years. This change was implemented by Reclamation to allow re-randomization between years and target monitoring within polygons of interest for adaptive management. New coordinates were provided for plot center locations.

Two versions of the crew field instructions document were created for the 2014 modified enhance protocol. One set of field instructions (attachment 3) was intended to accompany paper data sheets (attachment 4), while the other set (attachment 5) was developed to instruct data collection with the MEFFs. Updated paper data sheets were to be used as a backup if problems were encountered with the MEFFs. Final specifications for 2014 modified intensive protocols are discussed in the following section.

Survey Methodology

Vegetation attributes are monitored at several different scales using nested plots for capturing data on different plant life forms, growth habits, and SC. The nested and sometimes overlaying (sub) plots include one A Plot (10 by 40 meters [m]); one B Plot (5 by 15 m divided into four 2.5 by 7.5 m quadrants denoted B1, B2, B3, and B4); and nine D Points. The B Plots and the D Points are nested within the A Plot and assigned a distinguishing letter unique to the particular measurement subplot or point. Plot dimensions are shown on figure 2, and plot collection schematics for modified intensive surveys are shown on figure 3.

The data collection area for trees is dependent on SC. For all trees, except saltcedar and mesquite (*Prosopis* spp.), SC is determined based on DBH as described in the previous section. SC for saltcedar and mesquite was designated by height as follows:

- SC1: $\leq$ 3 m tall
- SC2: > 3 m tall

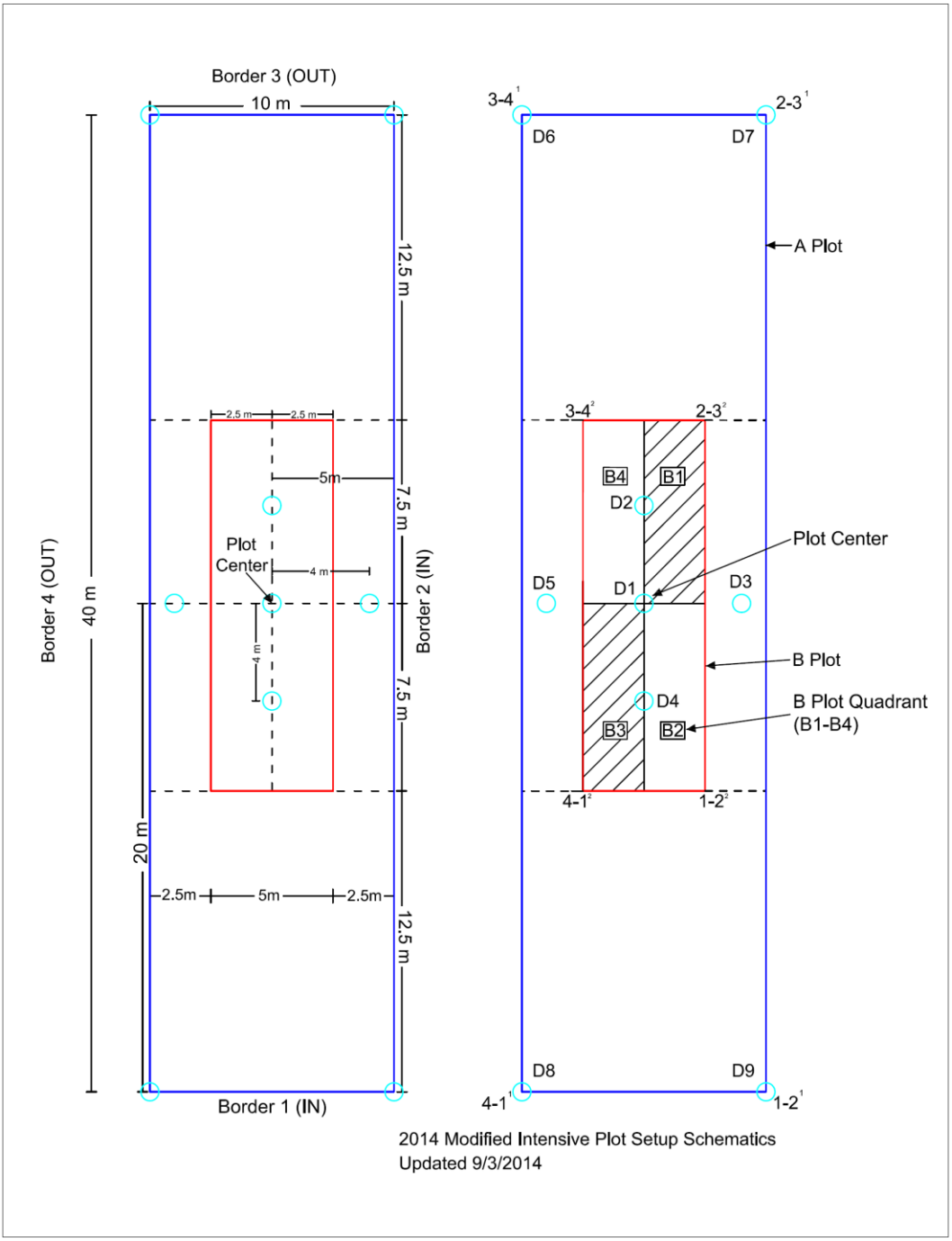

Figure 2.—Plot dimension and collection area naming conventions.

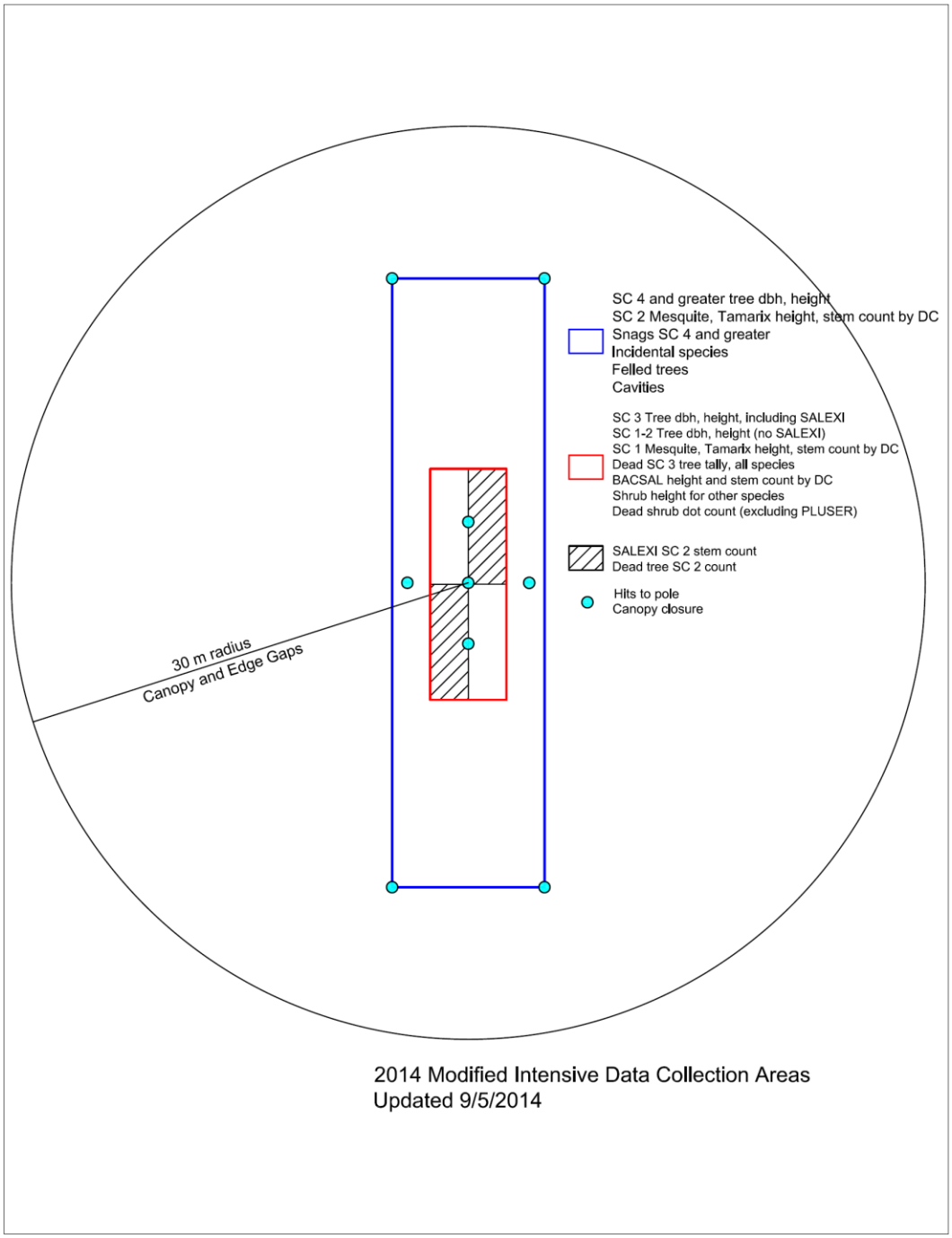

Figure 3.—2014 modified intensive plot schematics and data collection areas.

Detailed field instructions are included in attachments 3 (hardcopy data sheets) and 5 (MEFFs). Following final protocol revisions (as discussed above in the "2014 Survey Methodology Adjustments" section), modified intensive plot surveys included monitoring of:

- Total canopy closure, vegetation volume, and vertical foliar density at D Points
- Canopy gaps within 30 m of plot center (D1)
- SC4 and larger snags within the A Plot and the number of cavities they have
- Tree height and DBH for SC4 trees and larger (greater than 12 cm DBH), not including mesquite and saltcedar, in the A Plot
- Tree height and stem DC for mesquite and saltcedar SC2 (greater than 3 m tall) in the A Plot
- Dead or living "felled" trees in the A Plot
- Incidental species: Those occurring in the A Plot but not documented otherwise
- Tree height and DBH for SC1 through SC3 standard trees (less than or equal to 12 cm DBH) and SC3 coyote willow in the B Blot
- Tree height and stem DC for saltcedar and mesquite SC1 (less than or equal to 3 m tall) in the B Plot
- Shrub height within the B Plot, excluding arrowweed
- Shrub height and stem count by DC for willow baccharis and mule fat in the B Plot
- Dead SC3 trees, including saltcedar and mesquite measured like standard trees, in the B Plot
- Dead SC2 trees, including saltcedar and mesquite measured like standard trees, in B1 and B3
- Tree height and DBH for coyote willow SC2 in B1 and B3

Field crews navigated to within 5 m of plot center with Trimble® GPS units and used a measuring tape and compass to place color-coded pinflags, marking the plot

perimeter, as well as various plot collection points (B Plot perimeter, D Plots, etc.). After the plot area was established and marked, various plot data were recorded on the MEFFs.

More specifically, measured plot values were captured as data files (.ssf) in Trimble® TerraSync™ software. During previous project years, our team assisted the LCR MSCP Data Management Team with designing and testing a series of MEFFs to capture the LCR MSCP vegetation protocol in Trimble® TerraSync™ software. Under the Trimble® file structure model, a series of individual features are grouped into a single rover (or data) file (typically .ssf file type). A Trimble® "data dictionary" file (.ddf) establishes the data format, the type of features logged, etc., for a particular data (rover) file. Data dictionaries can be developed as templates with certain parameters and filters to ensure that quality and consistent data are collected across users in the field.

Due to the complexity of the field protocol, MEFFs designed for the vegetation project required development of two separate Trimble data dictionaries for each plot. The first data dictionary (the HTP .ddf file) was designed for attributes measured in the nine D Points. The second data dictionary (the OTH .ddf file), structured the data recorded for each of the remaining plot elements measured outside the D Plot. Thus, it was necessary for our crews to create two separate rover (.ssf) files for each plot.

Survey Summary

During the 2014 season, surveys were completed at the BLCA, PVER, CVCA, CNU1, and YEW. The 2014 season marked the first year that our crews surveyed YEW and also the first time we did not survey Bill Williams River East. A list of all the plots sampled is included in attachment 1. Site-specific observations are provided in the site reports (attachment 6); survey summaries and key observations are provided below in the order that 2014 surveys were completed.

Surveys were initiated earlier in 2014 than in previous years to avoid potential effects of leaf senescence on monitoring results. It was specified under the LCR MSCP that all plots must be measured prior to November 7. Surveys began on September 7, 2014. The survey schedule was designed to meet the survey deadlines while also avoiding dove hunting season (September 1 through September 14) and centerfire rifle deer hunting seasons at the PVER (November 1 to November 23) and the CVCA (began October 31 to November 9). All surveys were completed by November 1.

Survey efficiency for each conservation area (as presented in the following section) was estimated by dividing the total number of plots for the conservation area by the number of "team days." A team day consisted of one group of two or sometimes three individuals working together to complete plots surveys for the

typical field day duration (approximately 9 hours). Survey efficiency calculations did not include additional effort by one crew who completed daily data QA/QC and data transfer from the GPS data collection units.

Yuma East Wetlands

The YEW was surveyed between September 8 and 10, 2014. This survey period included training for all crew members on the use of MEFFs, revised survey methods, and new data management protocols. Approximately 2 plots were completed per crew team day (15 plots over 3 days), but this included training time, and is therefore a low estimate of data collection efficiency at the site. Aside from training time, the biggest obstacles for survey crews were flooded access routes due to rainfall, high temperatures and humidity as expected at this time of year, and intense mosquito activity. Considering that this was the first trip in which field crews used MEFFs, data collection went very well.

Palo Verde Ecological Reserve

The 110 vegetation monitoring plots at the PVER were surveyed during two field trips: September 17–22 and October 2–5, 2014 (a total of 10 days). The overall efficiency for PVER surveys was approximately 3.5 per team day, not including training time for new crew members. Between two and four teams were conducting surveys simultaneously, with another crew member completing daily QA/QC and data transfer. The primary obstacles encountered at the PVER were irrigation and archery deer hunting. Irrigation sometimes caused the crews to have to relocate to different plot locations, decreasing survey efficiency. Archery deer hunters had not been observed in previous years. This deer hunting season occurred between October 4 and October 26, 2014. In future years, surveys should be scheduled to be completed prior to the first Saturday in October.

Beal Lake Conservation Area

The BLCA was surveyed on October 1, 2014, by six field staff. Surveys required a total of three team days, for an efficiency of three plots per day per team. Surveys were much more efficient than for previous years primarily due to the fields that were selected for surveys. Dense screwbean mesquite and arrowweed areas, prevalent in many other fields, were not surveyed during 2014.

Cibola Valley Conservation Area

The CVCA was surveyed during two field trips. The first was for 1 day on October 6 (following completion at the PVER), and the second was October 14 to October 20. Fifty-nine plots were surveyed at this site. The overall survey efficiency for the CVCA was approximately three plots per team day. One crew member also completed daily QA/QC and data transfer from the field lodging

location. As for the PVER, irrigation sometimes obstructed plot surveys. During the survey period, updated data dictionaries for the MEFFs were provided by LCR MSCP staff. The dictionaries were transferred to all data collection units, but an error occurred during transfer to one of the units. The unit could not be used until the data dictionary was re-transferred. No further problems occurred with data recording. Deer hunters were not observed at the CVCA, and no other major obstacles to survey efficiency were encountered.

Cibola National Wildlife Refuge Unit 1 Conservation Area

CNU1 was surveyed during two field trips on October 20 and October 29 to November 1, 2014. Thirty-four plots were surveyed over approximately 15 field crew days for an overall efficiency of approximately 2.3 plots per team day. This efficiency did not include training provided for two new crew members nor daily QA/QC and data management. The primary limiter for survey efficiency at the site was dense seep willow and mesquite in Nature Trail and portions of Crane Roost. No major obstacles were encountered during these survey.

Data QA/QC and Transfer

New QA/QC protocols and data management procedures were implemented during 2014 to facilitate deployment of MEFFs as detailed in Reclamation (2014b). Three levels of QA/QC were completed—in the field, in the field house, and in the office—as described in further detail below.

In the field, crews were required to complete a MEFF completion checklist for each plot. The hardcopy checklist was designed to prevent gross oversights (e.g., skipping an entire collection point or a mandatory component within a collection point) during electronic field data acquisition. The checklist also served as a paper trail to verify that field work and post-field QA/QC were completed for the specific data collection component. In practice, a crew reviewed the two data files (HTP and OTH) and checked off the creation and completion of each feature from the checklist before leaving the plot location. At the end of the survey day, the crew turned in the GPS units and checklists to a designated field data reviewer for a second level of QA/QC and data validation.

The field data reviewer downloaded all data from the Trimble® units to a laptop computer equipped with Trimble® Pathfinder Office™ software on a daily basis. Each rover/data file and any attached photographs were transferred, copied, and reorganized into folders for corresponding field sites per Reclamation (2014b). An unaltered version of each data file (the “Original” folder version) was preserved while data review and corrections were completed in a second version (the “Edited” folder version) of the file per LCR MSCP protocols (Reclamation 2014b). During daily data QA/QC reviews, our field data reviewer

checked that each plot file contained all mandatory features and that the data in each feature met the required protocol criteria. Any data revisions completed during post-field QA/QC were recorded in the electronic data file. Oftentimes, the plot checklist was a useful tool for resolving data discrepancies. If the checklist did not provide clear direction for resolving a data discrepancy, the crew responsible for that plot was asked to review the data and provide direction. The data reviewer then made crew-approved changes to the file.

After this second level of data validation, the "Edited" and "Original" files were transferred to the Project Data Manager for final QA/QC, differential correction, and export into Microsoft® Access™ format. The raw, edited, differentially corrected, and exported versions of our data files were delivered to LCR MSCP staff via the project SharePoint site (Reclamation 2014b) after a site was completed. A total of 908 data folders were delivered throughout the field season.

Vegetation Data Summaries

The Project Team analyzed key attributes captured during 2014 vegetation data collection to summarize pre-identified parameters. During previous project years, data were typically summarized by conservation area and site. These summaries were designed to simply document the conditions present at each site by calendar year. Conversely, for 2014, Reclamation requested that data be summarized by polygon of interest ("inference polygons"). Polygons were created by Reclamation based on specific biotic and abiotic screening criteria, and plots were randomly placed within the polygon.

The 2014 data summaries were designed to provide statistical summaries of and comparisons among polygons. The data summaries typically included mean values, standard error (SE), and in some cases, distribution of data across classes. Data were analyzed in Microsoft® Excel™ (Microsoft Corporation, Redmond, Washington) and JMP® (JMP 9.0.0, SAS Institute, Inc.) by polygon for the following parameters:

- Canopy closure
- Tree and shrub plant density
- Snag (dead tree SC4 or larger) density
- Tree and shrub height class (HC) distribution
- Tree SC distribution
- Total vegetation volume (TVV)
- Vertical foliar density

A data analysis was completed to document conditions within each polygon. To obtain summary statistics for each inference polygon, data were first summarized by plot. Means, SEs, etc., were determined from plot values. The two exceptions to this summary process were HC and SC distributions. Data summary methods for these attributes are described in the following sections.

For attributes that were collected in different areas based on SC (trees), results were scaled based on the data collection area within the plot. Procedures for scaling are discussed for relevant vegetation results below. When data were collected in the same areas at each nested plot location (e.g., canopy closure and hits to pole) and were not summarized in units of density, scaling was unnecessary. No snags were observed in monitored plots for 2014; therefore, the methods are not described in detail.

Terms specific to the data analysis are described below:

- *Area*: An LCR MSCP management area, which is further subdivided into sites. Areas measured during the 2014 field season were BLCA, PVER, CVCA, CNU1, and YEW.

- *Site*: A subarea LCR MSCP designation, which typically is comprised of a field or fields planted in the same year. For example, the PVER is subdivided into sites named PVER01, PVER02, PVER03, etc.

- *Inference polygon:* An area of interest for LCR MSCP for high-quality habitat for covered species to include adequate tree cover, structure, and patch size, along with soil textures that might be favorable for maintenance of high near-surface soil moisture. These were the areas for which vegetation data summaries were created for 2014 data. Inference polygon information is provided in table 2.

- *Standard tree*: Growth form that includes predetermined species that typically grow with a single trunk or dominant trunk. Standard tree diameter is measured at breast height (specified as 1.5 m above ground surface for this project), and SCs are represented by six individual classes. Species in this growth form are cottonwood and Goodding's willow. Palms (*Washingtonia* spp.) and palo verde (*Parkinsonia* spp.) species have also been measured as standard trees.

- *Saltcedar and mesquite*: Saltcedar and mesquite species and hybrids are grouped into their own growth form class primarily due to their multi-stemmed growth habit. LCR MSCP protocols specify that saltcedar is defined as a shrub for all LCR MSCP habitat creation areas. Saltcedar and mesquite are represented by two SCs determined by height of the tallest live branch instead of trunk diameter—SC1 trees are less than or equal to 3 m tall, and SC2 trees are taller than 3 m.

Table 2.—Inference polygons used for 2014 vegetation data summaries

Conservation area/polygon	Polygon area (acres)	Year planted	Number of plots
Beal Lake Conservation Area			
BLCA_K_1402	1.70	2003–04	3
BLCA_L_1403	2.16	2003–04	3
BLCA_P_1401	1.83	2004	3
Cibola National Wildlife Refuge Unit 1 Conservation Area			
CNU1_Crane Roost_1401	31.64	2006	8
CNU1_HB-11_1401	16.22	2013	8
CNU1_HB-12_1401	16.89	2013	8
CNU1_Nature Trail_1401	13.82	2005	10
Cibola Valley Conservation Area			
CVCA_Phase 01_1401	6.14	2006	4
CVCA_Phase 01_1402	1.84	2006	2
CVCA_Phase 01_1403	5.15	2006	4
CVCA_Phase 01_1404	6.51	2006	4
CVCA_Phase 01_1405	9.34	2006	4
CVCA_Phase 01_1406	9.22	2006	5
CVCA_Phase 01_1407	5.74	2006	4
CVCA_Phase 02_1401	17.31	2008	8
CVCA_Phase 02_1402	22.73	2008	8
CVCA_Phase 03_1401	12.18	2007	8
CVCA_Phase 03_1402	18.78	2007	8
Palo Verde Ecological Reserve			
PVER_Phase 01_1401	9.05	2006	4
PVER_Phase 02_1401	24.79	2007	8
PVER_Phase 03_1401	37.71	2008	10
PVER_Phase 04_1401	12.11	2009	8
PVER_Phase 04_1402	15.68	2009	8
PVER_Phase 05_1401	28.49	2010	8
PVER_Phase 05_1402	4.42	2010	4
PVER_Phase 05_1403	11.48	2010	9
PVER_Phase 05_1404	5.05	2010	5
PVER_Phase 05_1405	7.16	2010	5
PVER_Phase 05_1406	5.39	2010	5
PVER_Phase 05_1407	4.55	2010	4
PVER_Phase 06_1401	18.72	2011	7
PVER_Phase 06_1402	13.36	2011	8
PVER_Phase 06_1403	14.16	2011	7
PVER_Phase 06_1404	15.81	2011	7
PVER_Phase 06_1405	3.49	2011	3
Yuma East Wetlands			
YEW_C_1401	2.16	2005	3
YEW_I_1401	1.33	2009	2
YEW_I_1402	1.65	2009	3
YEW_I_1403	2.18	2009	3
YEW_J_1401	6.22	2009	4

- *Shrub*: Growth form composed of woody perennial species that typically emerge with multiple stems. Shrubs are generally shorter statured at maturity than multi-stemmed trees. As mentioned previously, saltcedar is considered a shrub at all LCR MSCP habitat creation areas.

- *Coyote willow*: Coyote willow spreads vegetatively from roots. This clonal growth precludes the determination of plant densities. Therefore, this species is represented by stem density and height measurements. For the LCR MSCP, coyote willow is considered a tree, and stems are designated into SCs based on DBH like standard trees. Coyote willow stems/ propagules were not counted in 2014 if the DBH was less than or equal to 2.5 cm (SC1). If coyote willow was present in a plot but only in SC1 and was not recorded at hits to pole locations, it was recorded as an incidental species.

- *Arrowweed*: Like coyote willow, arrowweed spreads vegetatively, so plant density cannot be easily determined. In previous years, arrowweed density and height was documented in E Plots. With omission of E Plots for 2014 modified intensive methods, this species was recorded as an incidental species or at hits to pole locations.

Canopy Closure

Canopy closure for each D Point was determined by multiplying the number of canopy "hits" by 2.702703 (100 divided by the number of line intersections on the densiometer), following methods used previously to analyze these data under the LCR MSCP (BioWest 2010). The mean canopy closure of the nine D Points was used as the canopy closure for a given plot location. Canopy closure statistics were then obtained by inference polygons using the plot means.

Tree and Shrub Density

To obtain tree and shrub density, each recorded plant was converted to a density value based on the area in which it was surveyed. For example, SC4 trees and above were recorded within the A Plot, which was 400 square meters (m^2), or 9.88×10^{-2} acres. Thus, every tree SC4 or above within a plot represented approximately 10.1 trees per acre. SC1 through SC3 trees were surveyed within the B plot, which was 75 m^2, or 1.85×10^{-2} acres, and each individual therefore represented approximately 54.0 trees per acre. This scaling process was applied for coyote willow stems, which could potentially be recorded in three different plot areas (A, B, or B1/B3) depending on SC. Density values were summed by species and plot using pivot tables in Excel to obtain a total density for the plot. Summary statistics were obtained on the between-plot values within each polygon.

Tree Height Class Distributions

Tree height was captured using a combination of measured and tallied trees. Up to five individuals per species per SC were measured. If only five individuals were present, all five were measured. If more than five were present, five representative individuals per species and SC were measured. For standard trees, the sixth and subsequent trees were tallied by a SC/HC combination and entered into the MEFFs as a number (e.g., the number of Fremont cottonwood in a plot that was SC4/HC4, SC4/HC5, etc.). For mesquite, up to five individuals per SC were measured. Subsequent trees were recorded individually with a HC and the number of stems per DC. For standard trees, coyote willow, and mesquite, the measured trees were assigned to a HC, and the percent of trees within each HC was determined by species. Due to different collection areas for different tree SCs, the percentages of each species within each HC was determined based on the area-scaled densities of each HC as described in the "Tree and Shrub Density" section.

Instead of determining the mean percent between plots, summary statistics were determined for the percent of trees over plots for each HC within each polygon. The proportion SE was calculated as:

$$SE = \sqrt{\frac{\hat{p}(1-\hat{p})}{n}}$$

where $\hat{p}$ is the observed proportion across the polygon, and n is the number of trees in the polygon.

Tree Size Class Distributions

Tree DBH was recorded two different ways. Within each SC, the DBH of five representative individuals for each species was recorded. Subsequent individuals were tallied. To obtain SC distributions, measured trees were added to the tallied trees list. The distribution of trees between SCs for each polygon was then determined as described above for tree HC distributions.

Vegetation Volume and Vertical Foliar Density

Vegetation structure and vertical foliar density were characterized using hits to pole data. TVV was calculated using the equation provided by Mills et al. (1991).

$$TVV = \frac{h}{10p}$$

where *h* is the number of "hits" (the number of decimeter intervals with vegetation for the plot, combined from all D Points), and *p* is the number of monitoring points (nine D Points per plot). Per previous instructions from LCR MSCP staff, we only included hits from the ground surface to 7 m for each D Point since this was the height for which field crews count the actual number of hits (classes are used above 7 m). Statistics were obtained on between-plot values within each inference polygon.

Vertical foliar density was characterized by species via the number of hits per meter layer across the plot (i.e., number of hits divided by 90 [10 decimeter intervals per meter for nine locations] for each meter layer). Statistics were obtained on the plot means within each inference polygon.

SITE CONDITIONS AND VEGETATION CHARACTERISTICS

At YEW, the majority of plots contained a mix of cottonwood and mule fat, and screwbean mesquite. The understory was primarily alkali sacaton (*Sporobolus airoides*) and Bermudagrass (*Cynodon dactylon*). Honey mesquite and willow baccharis abundance varied. Velvet mesquite (*Prosopis velutina*) was observed at some locations in YEW and as an incidental species at CVCA Phase 03. One plot (YWI14332) was dominated by coyote willow. Aside from saltcedar in inference polygon J_1401, no noxious or other non-native potentially invasive species were observed at YEW.

Vegetation across the PVER varied in accordance with the planting plans implemented by Reclamation. These vegetation types included dominant cottonwood with scattered coyote and Goodding's willow, a mixture of cottonwood and willows, dominant cottonwood with little understory, dominant Goodding's and coyote willow, variable cover of Bermudagrass in the understory of Goodding's willow-dominated plots, and minor amounts of honey mesquite and arrowweed. Two undesirable herbaceous species were observed at the PVER: Spanish false fleabane, a non-native plant of interest, was observed throughout PVER01 and in the southern portion of PVER06. Morning glory was identified in PVER04 and PVER06.

Fields at the BLCA were primarily either dominated by cottonwood with a mixed understory of mesquite and willow, or arrowweed with scattered mesquite and willows. An herbaceous understory was uncommon. Saltcedar was observed within two plots but was not prevalent. No other non-native species of interest were observed.

Dominant species at CVCA Phases 01 and 02 were cottonwood, Goodding's willow, and/or coyote willow. Phase 03 was primarily cottonwood overstory with a mix of willow species (Goodding's and coyote). Saltcedar and arrowweed were also observed. Morning glory was common in Phases 01 and 02.

Vegetation at CNU1 varied greatly between Nature Trail, Hippie Burn, and Crane Roost. The overstory at Nature Trail was primarily cottonwood, Goodding's willow, and/or willow baccharis. Scattered honey mesquite, screwbean mesquite, and Johnson grass were observed. Dominant species in Crane Roost were cottonwood, Goodding's willow, and/or mesquites. Finally, the dominant species in Hippie Burn were Goodding's willow and cottonwood. Aside from occasional Johnson grass at Nature Trail and saltcedar (abundant in Crane Roost), no non-native species of concern were observed.

A list of all species encountered during field surveys is presented in table 3. Vegetation results are summarized by parameter and discussed in the following sections. Box plots for vegetation results are provided in attachment 7. No snags (dead, standing trees SC4 or larger) were observed in any plots; therefore, these results are not included.

Canopy Closure

Canopy closure results are summarized by conservation area and inference polygon in tables 4 through 8. Canopy closure was generally highest at the PVER, with most polygons having a mean canopy closure above 90 percent. Closure was generally lowest at YEW and CNU1, with many polygons having canopy closure less than 85 percent.

Tree and Shrub Density

Tree density is summarized by conservation area and inference polygon in tables 9 through 13. Shrub density is summarized by conservation area and inference polygon in tables 14 through 18. At YEW, tree density was less than 500 per acre for four of the five polygons, whereas tree density at other conservation areas was typically higher than 500 per acre. Conversely, native shrub density was much higher at YEW than other conservation areas. Excluding YEW inference polygon J_1401, mean shrub density at YEW was between 297 and 917 shrubs per acre. The maximum native shrub density by inference polygon at other conservation areas was 129 per acre at the PVER, 36 per acre at the BLCA, 94 per acre at the CVCA, and 194 per acre at CNU1.

Table 3.—Species encountered during 2013 vegetation surveys[a]

Scientific name	Common name	Native status	Species code
Atriplex lentiformis	Quail bush	Native	Atrlen
Baccharis salicina	Willow baccharis	Native	Bacsal
Baccharis salicifolia	Mule fat	Native	Bacsal2
Baccharis sarothroides	Desert broom	Native	Bacsar
Chamaesyce sp.	Sandmat	Native	CHASPP
Chenopodium sp.	Goosefoot	Native	CHESPP
Conyza canadensis	Canadian horseweed	Native	Concan
Cynodon dactylon	Bermudagrass	Introduced	CYNDAC
Cyperus sp.	Nutsedge	Native	CYPSPP
Distichlis spicata	Saltgrass	Native	DISSPI
Echinochloa colona	Junglerice	Introduced	ECHCOL
Eriochloa acuminata	Tapertip cupgrass	Native	Eriacu
Ipomoea purpurea	Morning glory	Introduced	Ipopur
Lactuca serriola	Prickly lettuce	Introduced	Lacser
Malvella leprosa	Alkali mallow	Native	Mallep
Medicago sativa	Alfalfa	Introduced	MEDSAT
Panicum dichotomiflorum	Fall panicgrass	Native	Pandic
Pascopyrum smithii	Western wheatgrass	Native	PASSMI
Phragmites australis	Common reed	Native	PHRAUS
Pluchea odorata	Sweetscent	Native	PLUODO
Pluchea sericea	Arrowweed	Native	PLUSER
Populus fremontii	Cottonwood	Native	POPFRE
Prosopis chilensis	Algarrobo	Introduced	Prochi
Prosopis glandulosa	Honey mesquite	Native	Progla
Prosopis pubescens	Screwbean mesquite	Native	Propub
Prosopis velutina	Velvet mesquite	Native	Provel
Pulicaria paludosa	Spanish false fleabane	Introduced	Pulpal
Salix exigua	Coyote willow	Native	Salexi
Salix gooddingii	Goodding's willow	Native	Salgoo
Setaria pumila	Yellow bristlegrass	Introduced	Setpum
Setaria pumila	Yellow bristlegrass	Introduced	Setspp
Sonchus oleraceus	Common sowthistle	Introduced	Sonole
Sorghum halepense	Johnsongrass	Introduced	SORHAL
Sporobolus airoides	Alkali sacaton	Native	Spoair
Sporobolus cryptandrus	Sand dropseed	Native	Spocry
Tamarix spp.	Saltcedar	Introduced	TAMSPP
Washingtonia filifera	California fan palm	Native	Wasfil

[a] Native status listed as described in USDA PLANTS Database (www.plants.usda.gov). LCR MSCP common names were used; when not available, USDA PLANTS Database common names were used.

Table 4.—Percent canopy closure summary for polygons at Yuma East Wetlands

Polygon	Mean (SE) range	Median	SD[a]	N[b]	95% confidence interval
C_1401	81.8 (7.2) 68.8–93.7	82.9	12.5	3	50.7–112.8
I_1401	83.0 (0.2) 82.9–83.2	83.0	0.2	2	81.1–84.9
I_1402	79.7 (10.2) 59.5–91.9	87.7	17.6	3	35.9–123.5
I_1403	81.8 (3.8) 74.8–88.0	82.6	6.6	3	65.3–98.3
J_1401	93.8 (2.5) 87.7–98.2	94.6	4.9	4	85.9–101.6

[a] Standard deviation.
[b] Number of plots in the polygon.

Table 5.—Percent canopy closure summary for polygons at the Palo Verde Ecological Reserve

Polygon	Mean (SE) range	Median	SD[a]	N[b]	95% confidence interval
Phase 01_1401	94.4 (3.1) 85.6–99.7	96.1	6.1	4	84.6–104.1
Phase 02_1401	95.9 (0.7) 93.7–98.8	95.3	2.1	8	94.1–97.6
Phase 03_1401	94.7 (1.7) 85.6–100.0	95.2	5.3	10	91.0–98.5
Phase 04_1401	91.8 (1.5) 83.8–96.7	92.3	4.3	8	88.2–95.4
Phase 04_1402	97.7 (0.9) 93.1–100.0	98.9	2.5	8	95.7–99.8
Phase 05_1401	63.8 (10.2) 12.3–96.1	72.1	28.9	8	39.6–88.0
Phase 05_1402	95.6 (1.3) 91.9–97.9	96.4	2.6	4	91.5–99.8
Phase 05_1403	96.0 (1.3) 87.1–100.0	97.6	3.9	9	93.0–99.0
Phase 05_1404	94.6 (0.6) 93.1–95.8	94.9	1.3	5	93.0–96.2
Phase 05_1405	94.6 (1.6) 89.5–98.2	94.6	3.5	5	90.2–99.0
Phase 05_1406	95.9 (1.2) 92.5–98.2	97.6	2.7	5	92.5–99.3
Phase 05_1407	96.5 (1.2) 93.1–97.9	97.6	2.3	4	92.9–100.2
Phase 06_1401	95.6 (0.7) 93.1–97.6	96.4	1.8	7	93.9–97.2
Phase 06_1402	97.4 (0.7) 95.5–100.0	96.2	2.0	8	95.7–99.0
Phase 06_1403	99.1 (0.3) 97.6–100.0	99.4	0.9	7	98.3–100.0
Phase 06_1404	97.2 (0.8) 92.8–99.7	97.6	2.2	7	95.2–99.2
Phase 06_1405	94.4 (2.2) 90.1–97.3	95.8	3.8	3	84.9–103.4

[a] Standard deviation.
[b] Number of plots in the polygon.

Table 6.—Percent canopy closure summary for polygons at the Beal Lake Conservation Area

Polygon	Mean (SE) range	Median	SD[a]	N[b]	95% confidence interval
K_1402	82.8 (8.5) 65.8–91.9	90.7	14.7	3	46.1–119.4
L_1403	93.8 (2.2) 89.8–97.3	94.3	3.8	3	84.4–103.2
P_1401	93.8 (3.6) 87.7–100.0	93.7	6.2	3	78.5–109.1

[a] Standard deviation.
[b] Number of plots in the polygon.

Table 7.—Percent canopy closure summary for polygons at the Cibola Valley Conservation Area

Polygon	Mean (SE) range	Median	SD[a]	N[b]	95% confidence interval
Phase 01_1401	98.2 (1.2) 95.2–100	98.8	2.3	4	94.5–101.9
Phase 01_1402	97.3 (0.3) 97.0–97.6	97.3	0.4	2	93.5–101.1
Phase 01_1403	91.3 (4.1) 79.9–98.5	93.4	8.2	4	78.2–104.4
Phase 01_1404	91.4 (3.2) 82.9–98.5	92.0	6.4	4	81.1–101.6
Phase 01_1405	90.2 (1.3) 86.2–91.9	91.3	2.7	4	85.9–94.4
Phase 01_1406	90.8 (5.0) 76.9–100.0	96.1	11.1	5	77.0–104.5
Phase 01_1407	77.8 (4.1) 70.3–88.6	76.1	8.1	4	64.8–90.7
Phase 02_1401	82.5 (3.9) 65.2–98.5	83.9	11.0	8	73.3–91.8
Phase 02_1402	94.9 (1.4) 88.3–99.7	96.4	3.8	8	91.7–98.1
Phase 03_1401	77.6 (3.4) 64.0–89.8	78.2	9.6	8	69.6–85.6
Phase 03_1402	82.9 (3.5) 66.1–97.9	82.6	9.9	8	74.7–91.2

[a] Standard deviation.
[b] Number of plots in the polygon.

Table 8.—Percent canopy closure summary for polygons at the Cibola National Wildlife Refuge Unit 1 Conservation Area

Polygon	Mean (SE) range	Median	SD[a]	N[b]	95% confidence interval
CR_1401	89.2 (2.3) 82.6–97.0	88.4	6.4	8	83.8–94.5
HB-11_1401	90.0 (2.9) 78.1–97.6	93.8	8.3	8	83.0–96.9
HB-12_1401	39.7 (8.3) 11.4–76.6	38.1	23.6	8	20.0–59.4
Nature Trail (NT) _1401	84.5 (1.9) 73.6–91.6	86.0	6.1	10	80.2–88.9

[a] Standard deviation.
[b] Number of plots in the polygon.

Table 9.—Tree density (trees per acre or stems per acre for coyote willow) summary for polygons at Yuma East Wetlands

Polygon	Species	Mean (SE) range	Median	SD[a]	N[b]	95% confidence interval
C_1401	Cottonwood	119 (42) 51–196	111	73	3	-62–300
C_1401	Screwbean mesquite	208 (27) 172–260	192	46	3	94–322
C_1401	**All trees:**	**327 (20) 304–368**	**310**	**35**	**3**	**240–415**
I_1401	Cottonwood	137 (12) 125–148	137	17	2	-13–287
I_1401	Honey mesquite	5 (5) 0–10	5	7	2	-59–69
I_1401	Screwbean mesquite	182 (10) 172–192	182	14	2	54–311
I_1401	**All trees:**	**324 (7) 317–330**	**324**	**10**	**2**	**238–409**
I_1402	Cottonwood	160 (60) 94–280	105	104	3	-99–419
I_1402	Goodding's willow	18 (18) 0–54	0	31	3	-59–95
I_1402	Honey mesquite	13 (9) 0–30	10	15	3	-25–52
I_1402	Screwbean mesquite	234 (84) 121–398	182	145	3	-127–595
I_1402	Velvet mesquite	54 (31) 0–108	54	54	3	-80–188
I_1402	**All trees:**	**479 (68) 364–600**	**472**	**118**	**3**	**185–772**
I_1403	Cottonwood	54 (54) 0–162	0	93	3	-178–286
I_1403	Screwbean mesquite	10 (6) 0–20	10	10	3	-15–35
I_1403	**All trees:**	**64 (59) 0–182**	**10**	**102**	**3**	**-190–318**
J_1401	Cottonwood	101 (21) 51–152	101	42	4	34–168
J_1401	Coyote willow	917 (917) 0–3669	0	1835	4	-2,002–3,837
J_1401	Goodding's willow	54 (38) 0–162	27	76	4	-67–175
J_1401	Honey mesquite	8 (8) 0–30	0	15	4	-17–32
J_1401	Screwbean mesquite	59 (32) 0–142	47	63	4	-42–160
J_1401	**All Trees:**	**1,139 (939) 152–3,956**	**224**	**1879**	**4**	**-1,851–4,129**

[a] Standard deviation.
[b] Number of plots in the polygon.

Table 10.—Tree density (trees per acre or stems per acre for coyote willow) summary for polygons at the Palo Verde Ecological Reserve

Polygon	Species	Mean (SE) range	Median	SD[a]	N[b]	95% confidence interval
Phase 01_1401	Coyote willow	3,211 (1,236) 0–5720	3,561	2,472	4	-724–7,145
Phase 01_1401	Goodding's willow	5 (5) 0–20	0	10	4	-11–21
Phase 01_1401	**All trees:**	**3,216 (1,232) 20–5,720**	**3,561**	**2,464**	**4**	**-705–7,136**
Phase 02_1401	Cottonwood	56 (20) 0–142	56	56	8	9–102
Phase 02_1401	Coyote willow	229 (90) 0–755	162	254	8	17–442
Phase 02_1401	Goodding's willow	319 (93) 54–840	199	263	8	99–539
Phase 02_1401	**All trees:**	**604 (121) 273–1,056**	**504**	**342**	**8**	318–890
Phase 03_1401	Cottonwood	511 (53) 283–853	465	169	10	390–632
Phase 03_1401	Goodding's willow	54 (43) 0–432	0	137	10	-44–152
Phase 03_1401	**All trees:**	**565 (73) 283–1,039**	**502**	**231**	**10**	**399–730**
Phase 04_1401	Cottonwood	352 (124) 0–934	302	351	8	59–646
Phase 04_1401	Coyote willow	40 (20) 0–108	0	56	8	-6–87
Phase 04_1401	Goodding's willow	594 (111) 61–880	703	314	8	332–857
Phase 04_1401	**All trees:**	**987 (65) 735–1,261**	**985**	**184**	**8**	**833–1,141**
Phase 04_1402	Cottonwood	337 (50) 115–546	330	142	8	219–456
Phase 04_1402	Coyote willow	54 (54) 0–432	0	153	8	-74–182
Phase 04_1402	Goodding's willow	159 (57) 0–432	113	160	8	24–293
Phase 04_1402	**All trees:**	**550 (74) 287–900**	**572**	**210**	**8**	**374–726**
Phase 05_1401	Cottonwood	112 (56) 0–374	37	158	8	-20–244
Phase 05_1401	Goodding's willow	209 (61) 0–486	162	171	8	66–352
Phase 05_1401	**All trees:**	**320 (80) 108–749**	**315**	**226**	**8**	**132–509**
Phase 05_1402	Cottonwood	819 (121) 536–1,110	816	242	4	434–1,205
Phase 05_1402	Goodding's willow	218 (51) 108–334	216	102	4	56–381
Phase 05_1402	**All trees:**	**1,038 (137) 644–1,271**	**1,118**	**275**	**4**	**601–1,475**
Phase 05_1403	Cottonwood	326 (60) 0–536	341	179	9	188–464
Phase 05_1403	Coyote willow	12 (12) 0–108	0	36	9	-16–40
Phase 05_1403	Goodding's willow	238 (73) 0–543	233	218	9	70–405
Phase 05_1403	Honey mesquite	6 (6) 0–51	0	17	9	-7–19
Phase 05_1403	**All trees:**	**582 (71) 327–921**	**553**	**212**	**9**	**418–745**
Phase 05_1404	Cottonwood	411 (154) 71–877	297	344	5	-15–838
Phase 05_1404	Coyote willow	43 (26) 0–108	0	59	5	-30–117
Phase 05_1404	Goodding's willow	299 (118) 40–742	233	263	5	-28–625
Phase 05_1404	**All trees:**	**753 (122) 411–1,005**	**917**	**273**	**5**	**414–1,093**

Table 10.—Tree density (trees per acre or stems per acre for coyote willow) summary for polygons at the Palo Verde Ecological Reserve

Polygon	Species	Mean (SE) range	Median	SD[a]	N[b]	95% confidence interval
Phase 05_1405	Cottonwood	407 (108) 101–772	371	242	5	107–708
Phase 05_1405	Goodding's willow	643 (217) 216–1457	540	485	5	41–1,244
Phase 05_1405	**All trees:**	**1,050 (149) 664–1,558**	**1,018**	**332**	**5**	**638–1,463**
Phase 05_1406	Cottonwood	525 (115) 304–819	381	256	5	207–844
Phase 05_1406	Goodding's willow	552 (151) 216–1025	486	338	5	133–972
Phase 05_1406	**All trees:**	**1,078 (208) 550–1,814**	**1,059**	**466**	**5**	**500–1,656**
Phase 05_1407	Cottonwood	61 (37) 0–152	46	74	4	-58–179
Phase 05_1407	Goodding's willow	876 (135) 506–1,143	927	269	4	447–1,304
Phase 05_1407	**All trees:**	**937 (148) 506–1,143**	**1,049**	**297**	**4**	**464–1,409**
Phase 06_1401	Cottonwood	53 (18) 0–132	51	49	7	8–99
Phase 06_1401	Coyote willow	108 (74) 0–540	0	197	7	-74–290
Phase 06_1401	Goodding's willow	663 (54) 513–951	644	143	7	531–795
Phase 06_1401	**All trees:**	**825 (70) 674–1,120**	**695**	**185**	**7**	**654–996**
Phase 06_1402	Cottonwood	94 (14) 30–145	103	40	8	60–127
Phase 06_1402	Coyote willow	13 (13) 0–108	0	38	8	-18–45
Phase 06_1402	Goodding's willow	538 (73) 266–836	558	208	8	365–712
Phase 06_1402	**All trees:**	**645 (81) 354–911**	**641**	**228**	**8**	**455–836**
Phase 06_1403	Cottonwood	228 (61) 0–465	246	162	7	79–378
Phase 06_1403	Goodding's willow	928 (162) 334–1511	971	429	7	532–1,325
Phase 06_1403	**All trees:**	**1,157 (171) 580–1,878**	**1,130**	**453**	**7**	**738–1,576**
Phase 06_1404	Cottonwood	115 (32) 0–229	125	85	7	36–193
Phase 06_1404	Coyote willow	62 (40) 0–216	0	105	7	-36–159
Phase 06_1404	Goodding's willow	455 (67) 266–772	469	177	7	291–619
Phase 06_1404	**All trees:**	**631 (62) 489–948**	**563**	**165**	**7**	**478–784**
Phase 06_1405	Cottonwood	27 (12) 10–51	20	21	3	-25–79
Phase 06_1405	Coyote willow	72 (72) 0–216	0	125	3	-238–381
Phase 06_1405	Goodding's willow	894 (197) 553–1,234	894	341	3	48–1,740
Phase 06_1405	**All trees:**	**993 (133) 819–1,255**	**904**	**231**	**3**	**419–1,566**

[a] Standard deviation.
[b] Number of plots in the polygon.

Table 11.—Tree density (trees per acre or stems per acre for coyote willow) summary for polygons at the Beal Lake Conservation Area

Polygon	Species	Mean (SE) range	Median	SD[a]	N[b]	95% confidence interval
K_1402	Cottonwood	27 (27) 0–81	0	47	3	-89–143
K_1402	Coyote willow	540 (436) 0–1,403	216	755	3	-1,337–2,416
K_1402	Goodding's willow	144 (144) 0–432	0	249	3	-475–763
K_1402	Screwbean mesquite	253 (116) 40–438	280	200	3	-245–751
K_1402	**All trees:**	**963 (439) 496–1,841**	**553**	**761**	**3**	**-927–2,853**
L_1403	Cottonwood	532 (383) 71–1,292	233	663	3	-1,115–2,179
L_1403	Goodding's willow	615 (355) 10–1,241	594	616	3	-915–2,144
L_1403	Screwbean mesquite	64 (50) 0–162	30	86	3	-150–278
L_1403	**All trees:**	**1,211 (184) 857–1,474**	**1302**	**318**	**3**	**420–2,002**
P_1401	Cottonwood	943 (506) 71–1,824	934	877	3	-1,235–3,121
P_1401	Goodding's willow	252 (252) 0–755	0	436	3	-832–1,335
P_1401	Honey mesquite	13 (7) 0–20	20	12	3	-16–43
P_1401	**All trees:**	**1,208 (310) 846–1,824**	**954**	**536**	**3**	**-124–2,540**

[a] Standard deviation.
[b] Number of plots in the polygon.

Table 12.—Tree density (trees per acre or stems per acre for coyote willow) summary for polygons at the Cibola Valley Conservation Area

Polygon	Species	Mean (SE) range	Median	SD[a]	N[b]	95% confidence interval
Phase 01_1401	Coyote willow	3,237 (569) 2,050–4,317	3,291	1,139	4	1,426–5,049
Phase 01_1401	**All trees:**	**3,237 (569) 2,050–4,317**	**3,291**	**1,139**	**4**	**1,426–5,049**
Phase 01_1402	Coyote willow	2,671 (81) 2,590–2,752	2,671	114	2	1,643–3,699
Phase 01_1402	**All trees:**	**2,671 (81) 2,590–2,752**	**2,671**	**114**	**2**	1,643–3,699
Phase 01_1403	Cottonwood	334 (176) 40–799	248	353	4	-227–895
Phase 01_1403	Coyote willow	135 (135) 0–540	0	270	4	-294–564
Phase 01_1403	Goodding's willow	3 (3) 0–10	0	5	4	-6–11
Phase 01_1403	**All trees:**	**471 (152) 81–799**	**502**	**304**	**4**	**-12–955**

Table 12.—Tree density (trees per acre or stems per acre for coyote willow) summary for polygons at the Cibola Valley Conservation Area

Polygon	Species	Mean (SE) range	Median	SD[a]	N[b]	95% confidence interval
Phase 01_1404	Cottonwood	8 (8) 0–30	0	15	4	-17–32
Phase 01_1404	Coyote willow	4,951 (997) 2,374–7,015	5,207	1,995	4	1,776–8,125
Phase 01_1404	Goodding's willow	13 (8) 0–30	10	15	4	-12–37
Phase 01_1404	**All trees:**	**4,971 (999) 2,374–7,035**	**5,237**	**1,998**	**4**	**1,792–8,150**
Phase 01_1405	Cottonwood	518 (229) 0–1,015	528	459	4	-213–1,248
Phase 01_1405	Coyote willow	108 (76) 0–324	54	153	4	-135–351
Phase 01_1405	Goodding's willow	498 (337) 0–1,487	253	674	4	-574–1,571
Phase 01_1405	Honey mesquite	5 (5) 0–20	0	10	4	-11–21
Phase 01_1405	**All trees:**	**1,129 (198) 631–1,595**	**1,145**	**395**	**4**	**500–1,758**
Phase 01_1406	Cottonwood	867 (409) 0–2,108	809	915	5	-269–2,003
Phase 01_1406	Coyote willow	518 (319) 0–1,403	0	713	5	-368–1,404
Phase 01_1406	Goodding's willow	4 (4) 0–20	0	9	5	-7–15
Phase 01_1406	**All trees:**	**1,389 (212) 809–2,108**	**1,416**	**473**	**5**	**801–1,976**
Phase 01_1407	Cottonwood	59 (35) 0–135	51	70	4	-52–170
Phase 01_1407	Coyote willow	108 (76) 0–324	54	153	4	-135–351
Phase 01_1407	Goodding's willow	426 (267) 0–1,106	298	534	4	-424–1,275
Phase 01_1407	Honey mesquite	13 (13) 0–54	0	27	4	-29–56
Phase 01_1407	**All trees:**	**606 (190) 209–1,106**	**555**	**379**	**4**	**3–1,210**
Phase 02_1401	Cottonwood	247 (58) 20–540	250	165	8	109–385
Phase 02_1401	Coyote willow	337 (155) 0–1,295	216	437	8	-28–703
Phase 02_1401	Goodding's willow	469 (177) 0–1,207	329	501	8	50–887
Phase 02_1401	Honey mesquite	8 (7) 0–54	0	19	8	-8–24
Phase 02_1401	**All trees:**	**1,061 (172) 371–1,835**	**1,067**	**487**	**8**	**653–1,469**
Phase 02_1402	Cottonwood	775 (300) 61–2,479	524	849	8	65–1,485
Phase 02_1402	Coyote willow	985 (417) 0–3,022	432	1179	8	-1–1,970
Phase 02_1402	Goodding's willow	301 (127) 0–971	189	358	8	1–600
Phase 02_1402	Honey mesquite	9 (7) 0–54	0	19	8	-6–25
Phase 02_1402	**All trees:**	**2,070 (233) 1,275–3,092**	**1,784**	**660**	**8**	**1,518–2,622**
Phase 03_1401	Cottonwood	196 (97) 20–836	81	274	8	-33–425
Phase 03_1401	Coyote willow	81 (34) 0–216	54	96	8	1–161
Phase 03_1401	Goodding's willow	191 (122) 0–1,025	81	345	8	-97–479
Phase 03_1401	Honey mesquite	27 (27) 0–216	0	76	8	-37–91
Phase 03_1401	Screwbean mesquite	1 (1) 0–10	0	4	8	-2–4
Phase 03_1401	**All trees:**	**496 (136) 138–1,228**	**400**	**383**	**8**	**176–817**

Table 12.—Tree density (trees per acre or stems per acre for coyote willow) summary for polygons at the Cibola Valley Conservation Area

Polygon	Species	Mean (SE) range	Median	SD[a]	N[b]	95% confidence interval
Phase 03_1402	Cottonwood	617 (251) 0–1,841	354	710	8	24–1,210
Phase 03_1402	Coyote willow	621 (534) 0–4,317	0	1,511	8	-642–1,883
Phase 03_1402	Goodding's willow	144 (71) 0–432	10	200	8	-23–311
Phase 03_1402	Honey mesquite	8 (8) 0–64	0	23	8	-11–27
Phase 03_1402	**All trees:**	**1,389 (467) 30–4,347**	**1,017**	**1,321**	**8**	**285–2,493**

[a] Standard deviation.
[b] Number of plots in the polygon.

Table 13.—Tree density (trees per acre or stems per acre for coyote willow) summary for polygons at the Cibola National Wildlife Refuge Unit 1 Conservation Area

Polygon	Species	Mean (SE) range	Median	SD[a]	N[b]	95% confidence interval
CR_1401	Cottonwood	412 (253) 10–1,996	35	715	8	-185–1,009
CR_1401	Goodding's willow	238 (153) 0–1,079	0	433	8	-124–600
CR_1401	Honey mesquite	77 (21) 0–152	83	58	8	28–125
CR_1401	Screwbean mesquite	1 (1) 0–10	0	4	8	-2–4
CR_1401	**All trees:**	**728 (362) 121–3,130**	**258**	**1,024**	**8**	**-128–1,584**
HB-11_1401	Cottonwood	472 (102) 270–1,025	297	289	8	230–714
HB-11_1401	Coyote willow	13 (13) 0–108	0	38	8	-18–45
HB-11_1401	Goodding's willow	762 (159) 270–1,673	621	451	8	385–1,139
HB-11_1401	**All trees:**	**1,248 (129) 809–1,942**	**1,268**	**365**	**8**	**942–1,553**
HB-12_1401	Cottonwood	688 (245) 0–1,942	405	694	8	108–1,268
HB-12_1401	Coyote willow	13 (13) 0–108	0	38	8	-18–45
HB-12_1401	Goodding's willow	391 (121) 0–971	243	342	8	105–677
HB-12_1401	**All trees:**	**1,093 (304) 270–2,806**	**890**	**860**	**8**	**373–1,812**
NT_1401	Cottonwood	7 (3) 0–30	0	11	10	-1–15
NT_1401	Goodding's willow	290 (109) 0–873	111	344	10	45–536
NT_1401	Honey mesquite	36 (8) 0–71	46	25	10	19–54
NT_1401	Screwbean mesquite	28 (16) 0–152	0	49	10	-7–63
NT_1401	**All trees:**	**362 (97) 61–904**	**268**	**307**	**10**	**143–582**

[a] Standard deviation.
[b] Number of plots in the polygon.

Table 14.—Shrub density (shrubs per acre) summary for polygons at Yuma East Wetlands

Polygon	Species	Mean (SE) range	Median	SD[a]	N[b]	95% confidence interval
C_1401	Willow baccharis	737 (303) 162–1,187	863	524	3	-564–2,039
C_1401	**Total shrubs:**	**737 (303) 162–1,187**	**863**	**524**	**3**	**-564–2,039**
I_1401	Willow baccharis	297 (27) 270–324	297	38	2	-46–640
I_1401	**Total shrubs:**	**297 (27) 270–324**	**297**	**38**	**2**	-46–640
I_1402	Mule fat	90 (90) 0–270	0	156	3	-297–477
I_1402	Willow baccharis	899 (157) 647–1,187	863	272	3	225–1,574
I_1402	**Total shrubs:**	**989 (100) 863–1,187**	**917**	**173**	**3**	**558–1,420**
I_1403	Willow baccharis	755 (432) 324–1,619	324	748	3	-1,102–2,613
I_1403	**Total shrubs:**	**755 (432) 324–1,619**	**324**	**748**	**3**	**-1,102–2,613**
J_1401	Saltcedar	13 (13) 0–54	0	27	4	-29–56
J_1401	**Total shrubs:**	**13 (13) 0–54**	0	27	4	-29–56

[a] Standard deviation.
[b] Number of plots in the polygon.

Table 15.—Shrub density (shrubs per acre) summary for polygons at the Palo Verde Ecological Reserve

Polygon	Species	Mean (SE) range	Median	SD[a]	N[b]	95% confidence interval
Phase 01_1401	Willow baccharis	13 (13) 0–54	0	27	4	-29–56
Phase 01_1401	**Total shrubs:**	**13 (13) 0–54**	**0**	**27**	**4**	**-29–56**
Phase 04_1402	Willow baccharis	20 (14) 0–108	0	40	8	-13–54
Phase 04_1402	**Total shrubs:**	**20 (14) 0–108**	**0**	**40**	**8**	**-13–54**
Phase 05_1401	Desert broom	34 (34) 0–270	0	95	8	-46–113
Phase 05_1401	Mule fat	27 (20) 0–162	0	58	8	-21–75
Phase 05_1401	**Total shrubs:**	**61 (36) 0–270**	**0**	**102**	**8**	**-24–146**

Table 15.—Shrub density (shrubs per acre) summary for polygons at the Palo Verde Ecological Reserve

Polygon	Species	Mean (SE) range	Median	SD[a]	N[b]	95% confidence interval
Phase 05_1402	Willow baccharis	67 (51) 0–216	27	102	4	-95–230
Phase 05_1402	**Total shrubs:**	**67 (51) 0–216**	**27**	**102**	**4**	**-95–230**
Phase 05_1403	Mule fat	24 (18) 0–162	0	55	9	-18–66
Phase 05_1403	Willow baccharis	12 (12) 0–108	0	36	9	-16–40
Phase 05_1403	**Total shrubs:**	**36 (20) 0–162**	**0**	**60**	**9**	**-10–82**
Phase 05_1404	Mule fat	32 (22) 0–108	0	48	5	-28–92
Phase 05_1404	**Total shrubs:**	**32 (22) 0–108**	**0**	**48**	**5**	**-28–92**
Phase 05_1405	Desert broom	129 (81) 0–378	0	181	5	-96–355
Phase 05_1405	**Total shrubs:**	**129 (81) 0–378**	**0**	**181**	**5**	**-96–355**
Phase 05_1406	Mule fat	11 (11) 0–54	0	24	5	-19–41
Phase 05_1406	Willow baccharis	22 (22) 0–108	0	48	5	-38–82
Phase 05_1406	**Total shrubs:**	**32 (32) 0–162**	**0**	**72**	**5**	**-58–122**
Phase 05_1407	Desert broom	67 (67) 0–270	0	135	4	-147–282
Phase 05_1407	Mule fat	27 (27) 0–108	0	54	4	-59–113
Phase 05_1407	**Total shrubs:**	**94 (64) 0–270**	**54**	**127**	**4**	**-108–297**
Phase 06_1402	Mule fat	88 (50) 0–378	0	141	8	-30–206
Phase 06_1402	**Total shrubs:**	**88 (50) 0–378**	**0**	**141**	**8**	**-30–206**
Phase 06_1403	Mule fat	8 (8) 0–54	0	20	7	-11–27
Phase 06_1403	**Total shrubs:**	**8 (8) 0–54**	**0**	**20**	**7**	**-11–27**
Phase 06_1404	Mule fat	62 (34) 0–216	0	90	7	-22–145
Phase 06_1404	**Total shrubs:**	**62 (34) 0–216**	**0**	**90**	**7**	**-22–145**
Phase 06_1405	Mule fat	18 (18) 0–54	0	31	3	-59–95
Phase 06_1405	**Total shrubs:**	**18 (18) 0–54**	**0**	**31**	**3**	**-59–95**

[a] Standard deviation.
[b] Number of plots in the polygon.

Table 16.—Shrub density (shrubs per acre) summary for polygons at the Beal Lake Conservation Area

Polygon	Species	Mean (SE) range	Median	SD[a]	N[b]	95% confidence interval
K_1402	Willow baccharis	36 (36) 0–108	0	62	3	-119–191
K_1402	**Total shrubs:**	**36 (36) 0–108**	**0**	**62**	**3**	**-119–191**

[a] Standard deviation.
[b] Number of plots in the polygon.

Table 17.—Shrub density (shrubs per acre) summary for polygons at the Cibola Valley Conservation Area

Polygon	Species	Mean (SE) range	Median	SD[a]	N[b]	95% confidence interval
Phase 01_1401	Saltcedar	25 (9) 0–40	30	18	4	-3–53
Phase 01_1401	**Total shrubs:**	**25 (9) 0–40**	**30**	**18**	**4**	**-3–53**
Phase 01_1403	Willow baccharis	27 (16) 0–54	27	31	4	-23–77
Phase 01_1403	**Total shrubs:**	**27 (16) 0–54**	**27**	**31**	**4**	**-23–77**
Phase 01_1404	Saltcedar	3 (3) 0–10	0	5	4	-6–11
Phase 01_1404	Willow baccharis	40 (26) 0–108	27	52	4	-42–123
Phase 01_1404	**Total shrubs:**	**43 (25) 0–108**	**32**	**49**	**4**	**-35–121**
Phase 01_1405	Willow baccharis	67 (51) 0–216	27	102	4	-95–230
Phase 01_1405	**Total shrubs:**	**67 (51) 0–216**	**27**	**102**	**4**	**-95–230**
Phase 02_1401	Saltcedar	564 (150) 128–1,187	558	426	8	208–920
Phase 02_1401	Willow baccharis	94 (74) 0–594	0	209	8	-81–270
Phase 02_1401	**Total shrubs:**	**658 (181) 128–1,308**	**560**	**512**	**8**	**230–1,086**
Phase 02_1402	Mule fat	7 (7) 0–54	0	19	8	-9–23
Phase 02_1402	Saltcedar	225 (59) 61–600	211	167	8	85–364
Phase 02_1402	**Total shrubs:**	**231 (57) 71–600**	**211**	**161**	**8**	**97–366**
Phase 03_1401	Saltcedar	230 (117) 0–762	0	330	8	-46–506
Phase 03_1401	**Total shrubs:**	**230 (117) 0–762**	**0**	**330**	**8**	**-46–506**
Phase 03_1402	Saltcedar	48 (36) 0–280	0	101	8	-36–133
Phase 03_1402	**Total shrubs:**	**48 (36) 0–280**	**0**	**101**	**8**	**-36–133**

[a] Standard deviation.
[b] Number of plots in the polygon.

Table 18.—Shrub density (shrubs per acre) summary for polygons at the Cibola National Wildlife Refuge Unit 1 Conservation Area

Polygon	Species	Mean (SE) range	Median	SD[a]	N[b]	95% confidence interval
CR_1401	Quail bush	34 (34) 0–270	0	95	8	-46–113
CR_1401	Saltcedar	2,170 (1,010) 0–7,780	1,034	2,857	8	-219–4,558
CR_1401	Willow baccharis	27 (14) 0–108	0	41	8	-7–61
CR_1401	**Total shrubs:**	**2,230 (1,002) 54–7,834**	**1,035**	**2,833**	**8**	**-138–4,599**
HB-11_1401	Mule fat	34 (34) 0–270	0	95	8	-46–113
HB-11_1401	**Total shrubs:**	**34 (34) 0–270**	**0**	**95**	**8**	**-46–113**
HB-12_1401	Desert broom	34 (34) 0–270	0	95	8	-46–113
HB-12_1401	Mule fat	135 (91) 0–647	0	256	8	-79–349
HB-12_1401	**Total shrubs:**	**169 (120) 0–917**	**0**	**338**	**8**	**-114–451**
NT_1401	Willow baccharis	194 (75) 0–701	108	236	10	25–363
NT_1401	**Total shrubs:**	**194 (75) 0–701**	**108**	**236**	**10**	**25–363**

[a] Standard deviation.
[b] Number of plots in the polygon.

Tree Height Class Distributions

Distribution of trees between HCs is summarized by conservation area, inference polygon, and species in tables 19 through 23. Cottonwood was prevalent in HC4 through HC6, with the exception of CNU1 CR_1401, where approximately one-half of the cottonwoods were HC2 and HC3. As documented in previous years, this species is showing signs of stress at Crane Roost likely due to elevated soil and groundwater salinity at this site. Goodding's willow was primarily in HC3 and HC4 at YEW, with a broader range and taller trees at the PVER (distributed between HC3 and HC5). More HC2 trees were observed at the BLCA and CVCA. Coyote willow was most common in HC3 and HC4. Honey mesquite was most often in HC3 and HC4, with the exception of the PVER, where many smaller (HC1) trees were observed. Screwbean mesquite height varied more widely between HCs, likely indicating new seedling establishment and/or low growth rates within dense canopies of taller native trees.

Table 19.—Tree height class distribution summary for polygons at Yuma East Wetlands

Polygon	Species	N[a]	Percent (SE)					
			HC1	HC2	HC3	HC4	HC5	HC6
C_1401	Cottonwood	31	0 (0)	0 (0)	0 (0)	80 (7)	20 (7)	0 (0)
C_1401	Screwbean mesquite	53	17 (5)	2 (2)	78 (6)	3 (2)	0 (0)	0 (0)
I_1401	Cottonwood	14	0 (0)	0 (0)	0 (0)	100 (0)	0 (0)	0 (0)
I_1401	Honey mesquite	1	0 (N/A)	0 (N/A)	100 (N/A)	0 (N/A)	0 (N/A)	0 (N/A)
I_1401	Screwbean mesquite	36	0 (0)	3 (3)	94 (4)	3 (3)	0 (0)	0 (0)
I_1402	Cottonwood	17	0 (0)	11 (8)	34 (11)	55 (12)	0 (0)	0 (0)
I_1402	Goodding's willow	1	0 (N/A)	0 (N/A)	100 (N/A)	0 (N/A)	0 (N/A)	0 (N/A)
I_1402	Honey mesquite	4	0 (0)	0 (0)	100 (0)	0 (0)	0 (0)	0 (0)
I_1402	Screwbean mesquite	65	0 (0)	9 (4)	91 (4)	0 (0)	0 (0)	0 (0)
I_1402	Velvet mesquite	3	67 (27)	33 (27)	0 (0)	0 (0)	0 (0)	0 (0)
I_1403	Cottonwood	16	0 (0)	0 (0)	0 (0)	94 (6)	6 (6)	0 (0)
I_1403	Screwbean mesquite	3	0 (0)	0 (0)	100 (0)	0 (0)	0 (0)	0 (0)
J_1401	Cottonwood	40	0 (0)	0 (0)	0 (0)	18 (6)	75 (7)	8 (4)
J_1401	Coyote willow	35	0 (0)	0 (0)	96 (3)	4 (3)	0 (0)	0 (0)
J_1401	Goodding's willow	4	0 (0)	0 (0)	75 (22)	25 (22)	0 (0)	0 (0)
J_1401	Honey mesquite	3	0 (0)	0 (0)	100 (0)	0 (0)	0 (0)	0 (0)
J_1401	Screwbean mesquite	19	0 (0)	23 (10)	64 (11)	13 (8)	0 (0)	0 (0)

[a] Number of individuals.

Table 20.—Tree height class distribution summary for polygons at the Palo Verde Ecological Reserve

Polygon	Species	N[a]	Percent (SE)					
			HC1	HC2	HC3	HC4	HC5	HC6
Phase 01_1401	Coyote willow	119	0 (0)	3 (1)	97 (1)	0 (0)	0 (0)	0 (0)
Phase 01_1401	Goodding's willow	2	0 (0)	0 (0)	0 (0)	50 (35)	50 (35)	0 (0)
Phase 02_1401	Cottonwood	44	0 (0)	0 (0)	0 (0)	9 (4)	68 (7)	23 (6)
Phase 02_1401	Coyote willow	17	0 (0)	0 (0)	76 (10)	24 (10)	0 (0)	0 (0)
Phase 02_1401	Goodding's willow	105	4 (2)	6 (2)	9 (3)	36 (5)	39 (5)	4 (2)
Phase 03_1401	Cottonwood	379	0 (0)	1 (1)	0 (0)	5 (1)	47 (3)	46 (3)
Phase 03_1401	Goodding's willow	10	0 (0)	0 (0)	40 (15)	60 (15)	0 (0)	0 (0)
Phase 04_1401	Cottonwood	153	0 (0)	4 (2)	4 (2)	29 (4)	42 (4)	21 (3)
Phase 04_1401	Coyote willow	3	0 (0)	0 (0)	67 (27)	33 (27)	0 (0)	0 (0)
Phase 04_1401	Goodding's willow	145	0 (0)	1 (1)	1 (1)	59 (4)	38 (4)	<1 (0)
Phase 04_1402	Cottonwood	219	0 (0)	0 (0)	0 (0)	13 (2)	73 (3)	15 (2)
Phase 04_1402	Coyote willow	4	0 (0)	0 (0)	75 (22)	25 (22)	0 (0)	0 (0)
Phase 04_1402	Goodding's willow	30	13 (6)	17 (7)	21 (7)	31 (8)	18 (7)	0 (0)
Phase 05_1401	Cottonwood	32	0 (0)	0 (0)	6 (4)	88 (6)	6 (4)	0 (0)
Phase 05_1401	Goodding's willow	35	0 (0)	13 (6)	39 (8)	45 (8)	3 (3)	0 (0)
Phase 05_1402	Cottonwood	77	0 (0)	0 (0)	3 (2)	78 (5)	19 (4)	0 (0)
Phase 05_1402	Goodding's willow	17	31 (11)	19 (9)	0 (0)	49 (12)	1 (3)	0 (0)
Phase 05_1403	Cottonwood	212	0 (0)	0 (0)	0 (0)	27 (3)	73 (3)	<1 (0)
Phase 05_1403	Coyote willow	1	0 (N/A)	0 (N/A)	100 (N/A)	0 (N/A)	0 (N/A)	0 (N/A)
Phase 05_1403	Goodding's willow	60	3 (2)	13 (4)	3 (2)	64 (6)	18 (5)	0 (0)
Phase 05_1403	Honey mesquite	5	0 (0)	0 (0)	100 (0)	0 (0)	0 (0)	0 (0)
Phase 05_1404	Cottonwood	121	0 (0)	0 (0)	5 (2)	10 (3)	84 (3)	0 (0)
Phase 05_1404	Coyote willow	2	0 (0)	0 (0)	50 (35)	50 (35)	0 (0)	0 (0)
Phase 05_1404	Goodding's willow	48	7 (4)	4 (3)	14 (5)	52 (7)	22 (6)	0 (0)
Phase 05_1405	Cottonwood	119	0 (0)	3 (1)	3 (1)	24 (4)	71 (4)	0 (0)

Table 20.—Tree height class distribution summary for polygons at the Palo Verde Ecological Reserve

Polygon	Species	N[a]	Percent (SE)					
			HC1	HC2	HC3	HC4	HC5	HC6
Phase 05_1405	Goodding's willow	62	10 (4)	7 (3)	8 (4)	70 (6)	5 (3)	0 (0)
Phase 05_1406	Cottonwood	147	0 (0)	0 (0)	2 (1)	34 (4)	64 (4)	0 (0)
Phase 05_1406	Goodding's willow	52	4 (3)	4 (3)	39 (7)	49 (7)	4 (3)	0 (0)
Phase 05_1407	Cottonwood	24	0 (0)	0 (0)	0 (0)	0 (0)	83 (8)	17 (8)
Phase 05_1407	Goodding's willow	69	0 (0)	5 (3)	8 (3)	88 (4)	0 (0)	0 (0)
Phase 06_1401	Cottonwood	37	0 (0)	0 (0)	0 (0)	3 (3)	97 (3)	0 (0)
Phase 06_1401	Coyote willow	7	0 (0)	0 (0)	86 (13)	14 (13)	0 (0)	0 (0)
Phase 06_1401	Goodding's willow	147	2 (1)	3 (2)	9 (2)	48 (4)	37 (4)	0 (0)
Phase 06_1402	Cottonwood	61	0 (0)	0 (0)	7 (3)	16 (5)	73 (6)	4 (3)
Phase 06_1402	Coyote willow	1	0 (N/A)	0 (N/A)	100 (N/A)	0 (N/A)	0 (N/A)	0 (N/A)
Phase 06_1402	Goodding's willow	118	1 (1)	0 (0)	1 (1)	79 (4)	19 (4)	0 (0)
Phase 06_1403	Cottonwood	119	0 (0)	0 (0)	3 (2)	4 (2)	81 (4)	11 (3)
Phase 06_1403	Goodding's willow	131	0 (0)	0 (0)	13 (3)	50 (4)	37 (4)	0 (0)
Phase 06_1404	Cottonwood	62	0 (0)	0 (0)	7 (3)	34 (6)	59 (6)	0 (0)
Phase 06_1404	Coyote willow	4	0 (0)	0 (0)	50 (25)	50 (25)	0 (0)	0 (0)
Phase 06_1404	Goodding's willow	85	0 (0)	0 (0)	7 (3)	68 (5)	25 (5)	0 (0)
Phase 06_1405	Cottonwood	8	0 (0)	0 (0)	0 (0)	0 (0)	100 (0)	0 (0)
Phase 06_1405	Coyote willow	2	0 (0)	0 (0)	0 (0)	100 (0)	0 (0)	0 (0)
Phase 06_1405	Goodding's willow	83	2 (2)	4 (2)	6 (3)	44 (5)	44 (5)	0 (0)

[a] Number of individuals.

Table 21.—Tree height class distribution summary for polygons at the Beal Lake Conservation Area

Polygon	Species	N[a]	Percent (SE)					
			HC1	HC2	HC3	HC4	HC5	HC6
K_1402	Cottonwood	8	0 (0)	0 (0)	0 (0)	75 (15)	25 (15)	0 (0)
K_1402	Coyote willow	15	0 (0)	0 (0)	67 (12)	33 (12)	0 (0)	0 (0)
K_1402	Goodding's willow	8	25 (15)	0 (0)	75 (15)	0 (0)	0 (0)	0 (0)
K_1402	Screwbean mesquite	62	0 (0)	21 (5)	76 (5)	3 (2)	0 (0)	0 (0)
L_1403	Cottonwood	84	0 (0)	0 (0)	10 (3)	17 (4)	47 (5)	26 (5)
L_1403	Goodding's willow	35	9 (5)	32 (8)	38 (8)	20 (7)	1 (1)	0 (0)
L_1403	Screwbean mesquite	19	0 (0)	0 (0)	95 (5)	5 (5)	0 (0)	0 (0)
P_1401	Cottonwood	102	0 (0)	0 (0)	0 (0)	48 (5)	40 (5)	12 (3)
P_1401	Goodding's willow	14	0 (0)	0 (0)	14 (9)	86 (9)	0 (0)	0 (0)
P_1401	Honey mesquite	4	0 (0)	0 (0)	100 (0)	0 (0)	0 (0)	0 (0)

[a] Number of individuals.

Table 22.—Tree height class distribution summary for polygons at the Cibola Valley Conservation Area

Polygon	Species	N[a]	Percent (SE)					
			HC1	HC2	HC3	HC4	HC5	HC6
Phase 01_1401	Coyote willow	123	0 (0)	0 (0)	43 (4)	58 (4)	0 (0)	0 (0)
Phase 01_1402	Coyote willow	51	0 (0)	0 (0)	18 (5)	82 (5)	0 (0)	0 (0)
Phase 01_1403	Cottonwood	93	4 (2)	0 (0)	8 (3)	4 (2)	79 (4)	5 (2)
Phase 01_1403	Coyote willow	5	0 (0)	0 (0)	80 (18)	20 (18)	0 (0)	0 (0)
Phase 01_1403	Goodding's willow	1	0 (N/A)	0 (N/A)	0 (N/A)	100 (N/A)	0 (N/A)	0 (N/A)
Phase 01_1404	Cottonwood	3	0 (0)	0 (0)	0 (0)	0 (0)	100 (0)	0 (0)
Phase 01_1404	Coyote willow	186	0 (0)	0 (0)	32 (3)	68 (3)	0 (0)	0 (0)
Phase 01_1404	Goodding's willow	5	0 (0)	0 (0)	0 (0)	20 (18)	80 (18)	0 (0)
Phase 01_1405	Cottonwood	79	0 (0)	0 (0)	8 (3)	66 (5)	26 (5)	0 (0)
Phase 01_1405	Coyote willow	4	0 (0)	25 (22)	75 (22)	0 (0)	0 (0)	0 (0)
Phase 01_1405	Goodding's willow	41	3 (3)	11 (5)	16 (6)	70 (7)	1 (1)	0 (0)
Phase 01_1405	Honey mesquite	2	0 (0)	0 (0)	100 (0)	0 (0)	0 (0)	0 (0)
Phase 01_1406	Cottonwood	125	0 (0)	2 (1)	29 (4)	34 (4)	35 (4)	0 (0)
Phase 01_1406	Coyote willow	24	0 (0)	4 (4)	67 (10)	29 (9)	0 (0)	0 (0)
Phase 01_1406	Goodding's willow	2	0 (0)	0 (0)	0 (0)	100 (0)	0 (0)	0 (0)
Phase 01_1407	Cottonwood	19	0 (0)	0 (0)	0 (0)	0 (0)	74 (10)	26 (10)
Phase 01_1407	Coyote willow	4	0 (0)	25 (22)	0 (0)	75 (22)	0 (0)	0 (0)
Phase 01_1407	Goodding's willow	60	3 (2)	3 (2)	13 (4)	73 (6)	8 (3)	0 (0)
Phase 01_1407	Honey mesquite	1	100 (N/A)	0 (N/A)	0 (N/A)	0 (N/A)	0 (N/A)	0 (N/A)
Phase 02_1401	Cottonwood	100	0 (0)	0 (0)	3 (2)	51 (5)	46 (5)	1 (1)
Phase 02_1401	Coyote willow	25	0 (0)	0 (0)	92 (5)	8 (5)	0 (0)	0 (0)
Phase 02_1401	Goodding's willow	76	0 (0)	16 (4)	9 (3)	64 (5)	11 (4)	0 (0)

Table 22.—Tree height class distribution summary for polygons at the Cibola Valley Conservation Area

Polygon	Species	N[a]	Percent (SE)					
			HC1	HC2	HC3	HC4	HC5	HC6
Phase 02_1401	Honey mesquite	2	84 (26)	0 (0)	16 (26)	0 (0)	0 (0)	0 (0)
Phase 02_1402	Cottonwood	184	1 (1)	2 (1)	3 (1)	45 (4)	49 (4)	0 (0)
Phase 02_1402	Coyote willow	73	0 (0)	0 (0)	30 (5)	56 (6)	14 (4)	0 (0)
Phase 02_1402	Goodding's willow	47	0 (0)	25 (6)	16 (5)	55 (7)	5 (3)	0 (0)
Phase 02_1402	Honey mesquite	3	73 (26)	0 (0)	27 (26)	0 (0)	0 (0)	0 (0)
Phase 03_1401	Cottonwood	81	0 (0)	0 (0)	3 (2)	66 (5)	30 (5)	1 (1)
Phase 03_1401	Coyote willow	6	0 (0)	0 (0)	100 (0)	0 (0)	0 (0)	0 (0)
Phase 03_1401	Goodding's willow	30	25 (8)	56 (9)	7 (5)	12 (6)	0 (0)	0 (0)
Phase 03_1401	Honey mesquite	4	100 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Phase 03_1401	Screwbean mesquite	1	0 (N/A)	0 (N/A)	100 (N/A)	0 (N/A)	0 (N/A)	0 (N/A)
Phase 03_1402	Cottonwood	115	0 (0)	2 (1)	30 (4)	59 (5)	10 (3)	0 (0)
Phase 03_1402	Coyote willow	46	0 (0)	0 (0)	93 (4)	7 (4)	0 (0)	0 (0)
Phase 03_1402	Goodding's willow	23	19 (8)	56 (10)	14 (7)	10 (6)	1 (2)	0 (0)
Phase 03_1402	Honey mesquite	2	84 (26)	0 (0)	16 (26)	0 (0)	0 (0)	0 (0)

[a] Number of individuals.

Table 23.—Tree height class distribution summary for polygons at the Cibola National Wildlife Refuge Unit 1 Conservation Area

Polygon	Species	N[a]	Percent (SE)					
			HC1	HC2	HC3	HC4	HC5	HC6
CR_1401	Cottonwood	83	0 (0)	7 (3)	41 (5)	45 (5)	6 (3)	2 (2)
CR_1401	Goodding's willow	41	6 (4)	8 (4)	51 (8)	35 (7)	0 (0)	0 (0)
CR_1401	Honey mesquite	52	9 (4)	9 (4)	31 (6)	51 (7)	0 (0)	0 (0)
CR_1401	Screwbean mesquite	1	0 (N/A)	0 (N/A)	100 (N/A)	0 (N/A)	0 (N/A)	0 (N/A)
HB-11_1401	Cottonwood	70	0 (0)	1 (1)	13 (4)	86 (4)	0 (0)	0 (0)
HB-11_1401	Coyote willow	1	0 (N/A)	0 (N/A)	100 (N/A)	0 (N/A)	0 (N/A)	0 (N/A)
HB-11_1401	Goodding's willow	113	1 (1)	1 (1)	25 (4)	73 (4)	0 (0)	0 (0)
HB-12_1401	Cottonwood	102	35 (5)	39 (5)	15 (4)	11 (3)	0 (0)	0 (0)
HB-12_1401	Coyote willow	1	0 (N/A)	0 (N/A)	100 (N/A)	0 (N/A)	0 (N/A)	0 (N/A)
HB-12_1401	Goodding's willow	58	2 (2)	41 (6)	31 (6)	26 (6)	0 (0)	0 (0)
NT_1401	Cottonwood	7	0 (0)	0 (0)	0 (0)	0 (0)	14 (13)	86 (13)
NT_1401	Goodding's willow	79	2 (2)	35 (5)	42 (6)	21 (5)	1 (1)	0 (0)
NT_1401	Honey mesquite	36	0 (0)	0 (0)	31 (8)	69 (8)	0 (0)	0 (0)
NT_1401	Screwbean mesquite	28	0 (0)	0 (0)	21 (8)	79 (8)	0 (0)	0 (0)

[a] Number of individuals.

Tree Size Class Distributions

Distribution of trees between SCs is summarized by conservation area, inference polygon, and species in tables 24 through 28. Cottonwood was generally in SC2 through SC5, with smaller or larger DBH uncommon. SC7 cottonwoods were only observed at older planting areas at CNU1. Goodding's willow DBH varied widely between inference polygons. SC1 through SC5 Goodding's willow were present, with the dominant SC varying between inference polygons. Due to current survey methodology, no SC1 coyote willow stems were documented. Coyote willow stems were mostly in SC2, with the remainder in SC3. Honey mesquite and screwbean mesquite were variably partitioned between SC1 and SC2.

Vegetation Volume

TVV is summarized by conservation area and inference polygon in tables 29 through 33. Mean TVV was between 1 and 2 for YEW. TVV at the PVER varied more widely, with a high of 2.4 in the coyote-willow dominated area of Phase 1, and a low of 0.36 in Phase 3 where vegetation is primarily tall cottonwoods. Similar results were observed for the CVCA and CNU1, where high TVV was present in coyote willow vegetation, and lower TVV was present in areas with primarily tall cottonwood and/or Goodding's willow. Mean TVV for all polygons at the BLCA was less than 1. Charts presenting vertical foliar density in attachment 8 show how the distribution of vegetation volume/foliage density corresponds to the height of observed species.

CONCLUSIONS AND RECOMMENDATIONS

Habitat creation areas were generally comprised of a dense overstory of native trees and shrubs, with a variably dense mix of primarily native understory vegetation (including quail bush, mule fat, willow baccharis, arrowweed, and desert broom). Saltcedar was present at CNU1 (Crane Roost) and approximately one-half of the inference polygons at the CVCA. Saltcedar was observed at 1 plot at YEW at 54 plants per acre. Tree density ranged from 64 trees per acre at 1 polygon at YEW up to nearly 4,000 per acre at the CVCA.

Table 24.—Tree size class distribution summary for polygons at Yuma East Wetlands

Polygon	Species	N[a]	Percent (SE)						
			SC1	SC2	SC3	SC4	SC5	SC6	SC7
C_1401	Cottonwood	31	0 (0)	0 (0)	15 (6)	85 (6)	0 (0)	0 (0)	0 (0)
C_1401	Screwbean mesquite	53	17 (5)	83 (5)	NS[b]	NS	NS	NS	NS
I_1401	Cottonwood	14	0 (0)	20 (11)	40 (13)	41 (13)	0 (0)	0 (0)	0 (0)
I_1401	Honey mesquite	1	0 (N/A)	100 (N/A)	NS	NS	NS	NS	NS
I_1401	Screwbean mesquite	36	0 (0)	100 (0)	NS	NS	NS	NS	NS
I_1402	Cottonwood	17	11 (8)	45 (12)	23 (10)	21 (10)	0 (0)	0 (0)	0 (0)
I_1402	Goodding's willow	1	0 (N/A)	100 (N/A)	0 (N/A)	0 (N/A)	0 (N/A)	0 (N/A)	0 (N/A)
I_1402	Honey mesquite	4	0 (0)	100 (0)	NS	NS	NS	NS	NS
I_1402	Screwbean mesquite	65	8 (3)	92 (3)	NS	NS	NS	NS	NS
I_1402	Velvet mesquite	3	100 (0)	0 (0)	NS	NS	NS	NS	NS
I_1403	Cottonwood	16	0 (0)	0 (0)	0 (0)	100 (0)	0 (0)	0 (0)	0 (0)
I_1403	Screwbean mesquite	3	0 (0)	100 (0)	NS	NS	NS	NS	NS
J_1401	Cottonwood	40	0 (0)	0 (0)	0 (0)	78 (7)	23 (7)	0 (0)	0 (0)
J_1401	Coyote willow	35	0 (0)	97 (3)	3 (3)	0 (0)	0 (0)	0 (0)	0 (0)
J_1401	Goodding's willow	4	50 (25)	25 (22)	25 (22)	0 (0)	0 (0)	0 (0)	0 (0)
J_1401	Honey mesquite	3	0 (0)	100 (0)	NS	NS	NS	NS	NS
J_1401	Screwbean mesquite	19	23 (10)	77 (10)	NS	NS	NS	NS	NS

[a] Number of individuals.
[b] Not surveyed.

Table 25.—Tree size class distribution summary for polygons at the Palo Verde Ecological Reserve

Polygon	Species	N[a]	Percent (SE)						
			SC1	SC2	SC3	SC4	SC5	SC6	SC7
Phase 01_1401	Coyote willow	119	0 (0)	100 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Phase 01_1401	Goodding's willow	2	0 (0)	0 (0)	0 (0)	50 (35)	50 (35)	0 (0)	0 (0)
Phase 02_1401	Cottonwood	44	0 (0)	0 (0)	0 (0)	43 (7)	55 (8)	2 (2)	0 (0)
Phase 02_1401	Coyote willow	17	0 (0)	100 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Phase 02_1401	Goodding's willow	105	8 (3)	32 (5)	32 (5)	25 (4)	3 (2)	0 (0)	0 (0)
Phase 03_1401	Cottonwood	379	1 (1)	7 (1)	22 (2)	50 (3)	19 (2)	0 (0)	0 (0)
Phase 03_1401	Goodding's willow	10	20 (13)	80 (13)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Phase 04_1401	Cottonwood	153	6 (2)	34 (4)	15 (3)	38 (4)	6 (2)	0 (0)	0 (0)
Phase 04_1401	Coyote willow	3	0 (0)	100 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Phase 04_1401	Goodding's willow	145	0 (0) 0-0	25 (4)	60 (4)	14 (3)	<1 (1)	0 (0)	0 (0)
Phase 04_1402	Cottonwood	219	0 (0)	6 (2)	16 (2)	46 (3)	32 (3)	0 (0)	0 (0)
Phase 04_1402	Coyote willow	4	0 (0)	100 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Phase 04_1402	Goodding's willow	30	34 (9)	47 (9)	13 (6)	6 (4)	1 (2)	0 (0)	0 (0)
Phase 05_1401	Cottonwood	32	0 (0)	24 (8)	54 (9)	22 (7)	0 (0)	0 (0)	0 (0)
Phase 05_1401	Goodding's willow	35	13 (6)	55 (8)	29 (8)	3 (3)	0 (0)	0 (0)	0 (0)
Phase 05_1402	Cottonwood	77	3 (2)	38 (6)	53 (6)	6 (3)	0 (0)	0 (0)	0 (0)
Phase 05_1402	Goodding's willow	17	31 (11)	56 (12)	12 (8)	1 (3)	0 (0)	0 (0)	0 (0)
Phase 05_1403	Cottonwood	212	0 (0)	13 (2)	20 (3)	62 (3)	4 (1)	0 (0)	0 (0)
Phase 05_1403	Coyote willow	1	0 (N/A)	100 (N/A)	0 (N/A)	0 (N/A)	0 (N/A)	0 (N/A)	0 (N/A)
Phase 05_1403	Goodding's willow	60	3 (2)	38 (6)	48 (6)	11 (4)	<1 (1)	0 (0)	0 (0)
Phase 05_1403	Honey mesquite	5	0 (0)	100 (0)	NS[b]	NS	NS	NS	NS
Phase 05_1404	Cottonwood	121	0 (0)	16 (3)	34 (4)	49 (5)	1 (1)	0 (0)	0 (0)
Phase 05_1404	Coyote willow	2	0 (0)	100 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)

Table 25.—Tree size class distribution summary for polygons at the Palo Verde Ecological Reserve

Polygon	Species	N[a]	Percent (SE)						
			SC1	SC2	SC3	SC4	SC5	SC6	SC7
Phase 05_1404	Goodding's willow	48	7 (4)	43 (7)	33 (7)	17 (5)	0 (0)	0 (0)	0 (0)
Phase 05_1405	Cottonwood	119	0 (0)	8 (2)	42 (5)	49 (5)	<1 (1)	0 (0)	0 (0)
Phase 05_1405	Goodding's willow	62	12 (4)	72 (6)	15 (5)	1 (1)	0 (0)	0 (0)	0 (0)
Phase 05_1406	Cottonwood	147	2 (1)	31 (4)	21 (3)	43 (4)	3 (2)	0 (0)	0 (0)
Phase 05_1406	Goodding's willow	52	8 (4)	84 (5)	8 (4)	<1 (1)	0 (0)	0 (0)	0 (0)
Phase 05_1407	Cottonwood	24	0 (0)	0 (0)	0 (0)	100 (0)	0 (0)	0 (0)	0 (0)
Phase 05_1407	Goodding's willow	69	3 (2)	85 (4)	11 (4)	1 (1)	0 (0)	0 (0)	0 (0)
Phase 06_1401	Cottonwood	37	0 (0)	0 (0)	0 (0)	84 (6)	16 (6)	0 (0)	0 (0)
Phase 06_1401	Coyote willow	7	0 (0)	100 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Phase 06_1401	Goodding's willow	147	13 (3)	38 (4)	33 (4)	16 (3)	<1 (0)	0 (0)	0 (0)
Phase 06_1402	Cottonwood	61	7 (3)	14 (4)	0 (0)	61 (6)	18 (5)	0 (0)	0 (0)
Phase 06_1402	Coyote willow	1	0 (N/A)	100 (N/A)	0 (N/A)	0 (N/A)	0 (N/A)	0 (N/A)	0 (N/A)
Phase 06_1402	Goodding's willow	118	1 (1)	34 (4)	54 (5)	11 (3)	0 (0)	0 (0)	0 (0)
Phase 06_1403	Cottonwood	119	3 (2)	3 (2)	24 (4)	67 (4)	3 (1)	0 (0)	0 (0)
Phase 06_1403	Goodding's willow	131	2 (1)	62 (4)	34 (4)	2 (1)	0 (0)	0 (0)	0 (0)
Phase 06_1404	Cottonwood	62	0 (0)	13 (4)	13 (4)	68 (6)	5 (3)	0 (0)	0 (0)
Phase 06_1404	Coyote willow	4	0 (0)	100 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Phase 06_1404	Goodding's willow	85	2 (1)	39 (5)	49 (5)	10 (3)	0 (0)	0 (0)	0 (0)
Phase 06_1405	Cottonwood	8	0 (0)	0 (0)	0 (0)	50 (18)	50 (18)	0 (0)	0 (0)
Phase 06_1405	Coyote willow	2	0 (0)	100 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Phase 06_1405	Goodding's willow	83	6 (3)	28 (5)	50 (5)	15 (4)	<1 (1)	0 (0)	0 (0)

[a] Number of individuals.
[b] Not surveyed.

Table 26.—Tree size class distribution summary for polygons at the Beal Lake Conservation Area

Polygon	Species	N[a]	Percent (SE)						
			SC1	SC2	SC3	SC4	SC5	SC6	SC7
K_1402	Cottonwood	8	0 (0)	0 (0)	0 (0)	75 (15)	25 (15)	0 (0)	0 (0)
K_1402	Coyote willow	15	0 (0)	100 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
K_1402	Goodding's willow	8	63 (17)	38 (17)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
K_1402	Screwbean mesquite	62	21 (5)	79 (5)	NS[b]	NS	NS	NS	NS
L_1403	Cottonwood	84	0 (0)	27 (5)	30 (5)	37 (5)	6 (3)	0 (0)	0 (0)
L_1403	Goodding's willow	35	50 (8)	47 (8)	3 (3)	1 (1)	0 (0)	0 (0)	0 (0)
L_1403	Screwbean mesquite	19	0 (0)	100 (0)	NS	NS	NS	NS	NS
P_1401	Cottonwood	102	0 (0)	34 (5)	44 (5)	21 (4)	1 (1)	0 (0)	0 (0)
P_1401	Goodding's willow	14	7 (7)	79 (11)	14 (9)	0 (0)	0 (0)	0 (0)	0 (0)
P_1401	Honey mesquite	4	0 (0)	100 (0)	NS	NS	NS	NS	NS

[a] Number of individuals.
[b] Not surveyed.

Table 27.—Tree size class distribution summary for polygons at the Cibola Valley Conservation Area

Polygon	Species	N[a]	Percent (SE)						
			SC1	SC2	SC3	SC4	SC5	SC6	SC7
Phase 01_1401	Coyote willow	123	0 (0)	98 (1)	3 (1)	0 (0)	0 (0)	0 (0)	0 (0)
Phase 01_1402	Coyote willow	51	0 (0)	97 (2)	3 (2)	0 (0)	0 (0)	0 (0)	0 (0)
Phase 01_1403	Cottonwood	93	0 (0)	8 (3)	28 (5)	39 (5)	24 (4)	0 (0)	0 (0)
Phase 01_1403	Coyote willow	5	0 (0)	100 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Phase 01_1403	Goodding's willow	1	0 (N/A)	0 (N/A)	0 (N/A)	100 (N/A)	0 (N/A)	0 (N/A)	0 (N/A)
Phase 01_1404	Cottonwood	3	0 (0)	0 (0)	0 (0)	33 (27)	67 (27)	0 (0)	0 (0)
Phase 01_1404	Coyote willow	186	0 (0)	99 (1)	1 (1)	0 (0)	0 (0)	0 (0)	0 (0)
Phase 01_1404	Goodding's willow	5	0 (0)	0 (0)	0 (0)	60 (22)	40 (22)	0 (0)	0 (0)
Phase 01_1405	Cottonwood	79	0 (0)	31 (5)	44 (6)	24 (5)	<1 (1)	0 (0)	0 (0)
Phase 01_1405	Coyote willow	4	0 (0)	100 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Phase 01_1405	Goodding's willow	41	11 (5)	68 (7)	19 (6)	3 (2)	0 (0)	0 (0)	0 (0)
Phase 01_1405	Honey mesquite	2	0 (0)	100 (0)	NS[b]	NS	NS	NS	NS
Phase 01_1406	Cottonwood	125	4 (2)	47 (4)	36 (4)	13 (3)	0 (0)	0 (0)	0 (0)
Phase 01_1406	Coyote willow	24	0 (0)	100 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Phase 01_1406	Goodding's willow	2	0 (0)	0 (0)	0 (0)	50 (35)	50 (35)	0 (0)	0 (0)
Phase 01_1407	Cottonwood	19	0 (0)	0 (0)	23 (10)	34 (11)	43 (11)	0 (0)	0 (0)
Phase 01_1407	Coyote willow	4	0 (0)	100 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Phase 01_1407	Goodding's willow	60	6 (3)	38 (6)	35 (6)	21 (5)	0 (0)	0 (0)	0 (0)
Phase 01_1407	Honey mesquite	1	100 (N/A)	0 (N/A)	NS	NS	NS	NS	NS
Phase 02_1401	Cottonwood	100	0 (0)	19 (4)	41 (5)	35 (5)	5 (2)	0 (0)	0 (0)

Table 27.—Tree size class distribution summary for polygons at the Cibola Valley Conservation Area

Polygon	Species	N[a]	Percent (SE)						
			SC1	SC2	SC3	SC4	SC5	SC6	SC7
Phase 02_1401	Coyote willow	25	0 (0)	100 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Phase 02_1401	Goodding's willow	76	16 (4)	63 (6)	19 (4)	2 (2)	0 (0)	0 (0)	0 (0)
Phase 02_1401	Honey mesquite	2	84 (26)	16 (26)	NS	NS	NS	NS	NS
Phase 02_1402	Cottonwood	184	2 (1) 0–4	37 (4)	47 (4)	14 (3)	<1 (0)	0 (0)	0 (0)
Phase 02_1402	Coyote willow	73	0 (0)	100 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Phase 02_1402	Goodding's willow	47	20 (6)	58 (7)	20 (6)	1 (2)	0 (0)	0 (0)	0 (0)
Phase 02_1402	Honey mesquite	3	73 (26)	27 (26)	NS	NS	NS	NS	NS
Phase 03_1401	Cottonwood	81	0 (0)	21 (5)	38 (5)	29 (5)	12 (4)	0 (0)	0 (0)
Phase 03_1401	Coyote willow	6	0 (0)	100 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Phase 03_1401	Goodding's willow	30	78 (8)	7 (5)	14 (6)	1 (2)	0 (0)	0 (0)	0 (0)
Phase 03_1401	Honey mesquite	4	100 (0)	0 (0)	NS	NS	NS	NS	NS
Phase 03_1401	Screwbean mesquite	1	0 (N/A)	100 (N/A)	NS	NS	NS	NS	NS
Phase 03_1402	Cottonwood	115	5 (2)	56 (5)	33 (4)	5 (2)	1 (1)	0 (0)	0 (0)
Phase 03_1402	Coyote willow	46	0 (0)	100 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Phase 03_1402	Goodding's willow	23	65 (10)	28 (9)	5 (4)	2 (3)	0 (0)	0 (0)	0 (0)
Phase 03_1402	Honey mesquite	2	84 (26)	16 (26)	NS	NS	NS	NS	NS

[a] Number of individuals.
[b] Not surveyed.

Table 28.—Tree size class distribution summary for polygons at the Cibola National Wildlife Refuge Unit 1 Conservation Area

Polygon	Species	N[a]	Percent (SE)						
			SC1	SC2	SC3	SC4	SC5	SC6	SC7
CR_1401	Cottonwood	83	13 (4)	67 (5)	11 (3)	5 (2)	2 (2)	1 (1)	<1 (1)
CR_1401	Goodding's willow	41	20 (6)	59 (8)	17 (6)	4 (3)	0 (0)	0 (0)	0 (0)
CR_1401	Honey mesquite	52	18 (5)	82 (5)	NS[b]	NS	NS	NS	NS
CR_1401	Screwbean mesquite	1	0 (N/A)	100 (N/A)	NS	NS	NS	NS	NS
HB-11_1401	Cottonwood	70	4 (2)	86 (4)	10 (4)	0 (0)	0 (0)	0 (0)	0 (0)
HB-11_1401	Coyote willow	1	0 (N/A)	100 (N/A)	0 (N/A)	0 (N/A)	0 (N/A)	0 (N/A)	0 (N/A)
HB-11_1401	Goodding's willow	113	8 (3)	92 (3)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
HB-12_1401	Cottonwood	102	76 (4)	22 (4)	2 (1)	0 (0)	0 (0)	0 (0)	0 (0)
HB-12_1401	Coyote willow	1	0 (N/A)	100 (N/A)	0 (N/A)	0 (N/A)	0 (N/A)	0 (N/A)	0 (N/A)
HB-12_1401	Goodding's willow	58	50 (7)	48 (7)	2 (2)	0 (0)	0 (0)	0 (0)	0 (0)
NT_1401	Cottonwood	7	0 (0)	0 (0)	0 (0)	0 (0)	43 (19)	29 (17)	29 (17)
NT_1401	Goodding's willow	79	19 (4)	32 (5)	39 (5)	10 (3)	<1 (1)	0 (0)	0 (0)
NT_1401	Honey mesquite	36	0 (0)	100 (0)	NS	NS	NS	NS	NS
NT_1401	Screwbean mesquite	28	0 (0)	100 (0)	NS	NS	NS	NS	NS

[a] Number of individuals.
[b] Not surveyed.

Table 29.—Total vegetation volume summary for polygons at Yuma East Wetlands

Polygon	Mean (SE) range	Median	SD[a]	N[b]	95% confidence interval
C_1401	1.11 (0.12) 0.88–1.28	1.19	0.21	3	0.59–1.64
I_1401	1.18 (0.11) 1.07–1.29	1.18	0.16	2	-0.23–2.59
I_1402	1.31 (0.15) 1.03–1.53	1.37	0.25	3	0.68–1.94
I_1403	1.85 (0.10) 1.71–2.06	1.79	0.18	3	1.4–2.3
J_1401	1.81 (0.56) 0.39–3.09	1.88	1.12	4	0.03–3.59

[a] Standard deviation.
[b] Number of plots in the polygon.

Table 30.—Total vegetation volume summary for polygons at the Palo Verde Ecological Reserve

Polygon	Mean (SE) range	Median	SD[a]	N[b]	95% confidence interval
Phase 01_1401	2.40 (0.38) 1.37–3.13	2.56	0.75	4	1.2–3.6
Phase 02_1401	0.98 (0.11) 0.54–1.51	0.98	0.31	8	0.72–1.24
Phase 03_1401	0.36 (0.10) 0.01–0.86	0.22	0.32	10	0.13–0.59
Phase 04_1401	0.68 (0.25) 0.18–2.41	0.47	0.72	8	0.08–1.28
Phase 04_1402	0.43 (0.15) 0.06–1.34	0.31	0.43	8	0.07–0.78
Phase 05_1401	1.37 (0.17) 0.46–1.98	1.36	0.48	8	0.97–1.76
Phase 05_1402	1.59 (0.17) 1.12–1.92	1.65	0.34	4	1.04–2.13
Phase 05_1403	0.76 (0.15) 0.14–1.42	0.86	0.45	9	0.42–1.11
Phase 05_1404	0.85 (0.19) 0.37–1.36	0.89	0.43	5	0.31–1.39
Phase 05_1405	0.89 (0.17) 0.48–1.29	0.94	0.37	5	0.43–1.35
Phase 05_1406	0.56 (0.18) 0.28–1.21	0.33	0.39	5	0.07–1.05
Phase 05_1407	0.99 (0.12) 0.69–1.26	1.00	0.23	4	0.62–1.36
Phase 06_1401	1.09 (0.19) 0.72–2.12	0.94	0.50	7	0.63–1.55
Phase 06_1402	0.95 (0.21) 0.37–1.91	0.89	0.59	8	0.46–1.45
Phase 06_1403	0.60 (0.08) 0.29–0.88	0.52	0.22	7	0.39–0.8
Phase 06_1404	0.83 (0.16) 0.29–1.58	0.79	0.42	7	0.43–1.22
Phase 06_1405	1.00 (0.23) 0.69–1.44	0.88	0.39	3	0.03–1.98

[a] Standard deviation.
[b] Number of plots in the polygon.

Table 31.—Total vegetation volume summary for polygons at the Beal Lake Conservation Area

Polygon	Mean (SE) range	Median	SD[a]	N[b]	95% confidence interval
K_1402	0.83 (0.29) 0.26–1.22	1.01	0.51	3	-0.43–2.09
L_1403	0.74 (0.25) 0.47–1.23	0.51	0.43	3	-0.33–1.81
P_1401	0.85 (0.07) 0.76–0.98	0.81	0.12	3	0.56–1.14

[a] Standard deviation.
[b] Number of plots in the polygon.

Table 32.—Total vegetation volume summary for polygons at the Cibola Valley Conservation Area

Polygon	Mean (SE) range	Median	SD[a]	N[b]	95% confidence interval
Phase 01_1401	1.76 (0.26) 1.41–2.52	1.54	0.51	4	0.94–2.57
Phase 01_1402	2.12 (0.01) 2.11–2.13	2.12	0.02	2	1.98–2.26
Phase 01_1403	0.57 (0.14) 0.29–0.91	0.54	0.28	4	0.13–1.01
Phase 01_1404	1.20 (0.16) 0.77–1.51	1.26	0.31	4	0.7–1.7
Phase 01_1405	0.68 (0.05) 0.60–0.81	0.66	0.10	4	0.53–0.84
Phase 01_1406	0.73 (0.16) 0.36–1.28	0.74	0.35	5	0.3–1.17
Phase 01_1407	0.54 (0.18) 0.14–0.91	0.54	0.37	4	-0.05–1.12
Phase 02_1401	0.86 (0.14) 0.42–1.52	0.67	0.41	8	0.51–1.2
Phase 02_1402	0.88 (0.15) 0.37–1.69	0.85	0.42	8	0.52–1.23
Phase 03_1401	0.70 (0.13) 0.21–1.24	0.60	0.38	8	0.38–1.02
Phase 03_1402	0.80 (0.12) 0.41–1.33	0.66	0.34	8	0.51–1.08

[a] Standard deviation.
[b] Number of plots in the polygon.

Table 33.—Total vegetation volume summary for polygons at the Cibola National Wildlife Refuge Unit 1 Conservation Area

Polygon	Mean (SE) range	Median	SD[a]	N[b]	95% confidence interval
CR_1401	1.05 (0.09) 0.72–1.54	0.98	0.26	8	0.83–1.27
HB-11_1401	1.74 (0.11) 1.27–2.24	1.73	0.32	8	1.47–2.01
HB-12_1401	0.81 (0.13) 0.40–1.39	0.78	0.36	8	0.51–1.11
NT_1401	1.17 (0.15) 0.37–1.98	1.08	0.47	10	0.83–1.51

[a] Standard deviation.
[b] Number of plots in the polygon.

Continued close observation or treatment and removal of non-native plant species observed at LCR MSCP conservation areas is recommended. Those detected for the 2014 field season were (excluding saltcedar):

- *Spanish false fleabane*: PVER
- *Morning glory*: PVER and CVCA

Non-native species of observed during the 2013, but not during the 2014, surveys were:

- *Buffelgrass*: PVER and CVCA
- *Sahara mustard*: PVER

Modified intensive survey methodology used for 2014 facilitated migration to MEFFs for 2014 and resulted in more efficient data collection compared to "enhanced" protocols from previous project years. To promote efficient and accurate data collection using MEFFs, we recommend continued use of the MEFF completion checklists and tally grids and having a designated field crew member for daily review and management of electronic data files.

Annual review of the data collection methods is recommended to make sure that priority data are effectively captured for LCR MSCP adaptive management. Changes from 2013 data protocols allowed increased data collection for TVV, which is a parameter of key interest for bird habitat quality. However, other monitoring components, such as foliar cover and density of SC1 coyote willow stems, were removed from survey protocols for 2014. If the 2014 data summaries are sufficient, the current field protocols, QA/QC methods, and data management process allow for efficient and consistent habitat documentation.

All vegetation data were collected prior to November 7, 2014, compared to mid-December for previous project years. This change allowed the Project Team to document vegetation characteristics closer to the avian nesting season and avoided fall leaf senescence. However, earlier survey periods required field staff to endure harsher field conditions. Warmer temperatures and increased mosquito activity were observed during the 2014 field season. Survey efficiency did not suffer significantly, however. We recommend continuing with the accelerated data collection timeline for future years.

Finally, updates to the LCR MSCP data queries allowed for much more efficient data analysis and summaries for 2014. We recommend continued collaboration with the LCR MSCP adaptive management staff and the LCR MSCP database developer to further refine the queries and allow more rapid development of tabular and graphical presentation of monitoring results from delivered data files.

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ATTACHMENTS

1 Plot Locations Sampled During 2014
2 2014 Plot Location Maps
3 2014 Field Instructions for Paper Data Sheets
4 2014 Field Data Sheets
5 2014 Field Instructions for Mobile Electronic Field Forms
6 2014 Site Reports
7 Vegetation Data Box Plots
8 Vertical Foliage Density Charts

ATTACHMENT 1

Plot Locations Sampled During 2014

Modified Intensive Plots (Sections) surveyed during the 2014 vegetation monitoring season

Conservation Area	Site	Section	Inference Polygon	Locat	Easting	Northing	Plot Bearing
Beal Lake	K	14005	K_1402	BLK14005	725860.6	3850906.3	315
	K	14009	K_1402	BLK14009	725869.8	3850871.4	315
	K	14015	K_1402	BLK14015	725855.5	3850804.7	315
	L	14008	L_1403	BLL14008	725781.5	3850887.2	315
	L	14010	L_1403	BLL14010	725813.3	3850868.3	315
	L	14011	L_1403	BLL14011	725766.2	3850862.7	315
	P	14001	P_1401	BLP14001	725741.4	3850932.9	315
	P	14002	P_1401	BLP14002	725778.4	3850932.7	315
	P	14004	P_1401	BLP14004	725731.8	3850911.4	315
Cibola NWR Unit 1	Crane Roost	14303	Crane Roost_1401	CNCR14303	714927.4	3694024.8	87
	Crane Roost	14304	Crane Roost_1401	CNCR14304	715032.2	3694015.8	87
	Crane Roost	14305	Crane Roost_1401	CNCR14305	714717.6	3694015.3	87
	Crane Roost	14306	Crane Roost_1401	CNCR14306	714874	3693968.7	87
	Crane Roost	14310	Crane Roost_1401	CNCR14310	715134	3693842.9	87
	Crane Roost	14311	Crane Roost_1401	CNCR14311	714744.7	3693820.2	87
	Crane Roost	14312	Crane Roost_1401	CNCR14312	714869.4	3693780.3	87
	Crane Roost	14313	Crane Roost_1401	CNCR14313	714790.6	3693759.1	87
	HB-11	14269	HB-11_1401	CNHB1114269	714224	3695237.9	0
	HB-11	14274	HB-11_1401	CNHB1114274	714148.8	3695208	0
	HB-11	14275	HB-11_1401	CNHB1114275	714015.9	3695205.2	0
	HB-11	14279	HB-11_1401	CNHB1114279	714111.9	3695163.4	0
	HB-11	14282	HB-11_1401	CNHB1114282	714219	3695150.8	0
	HB-11	14283	HB-11_1401	CNHB1114283	713959.8	3695149.3	0
	HB-11	14285	HB-11_1401	CNHB1114285	714043	3695108.7	0
	HB-11	14286	HB-11_1401	CNHB1114286	714185.6	3695107.2	0
	HB-12	14267	HB-12_1401	CNHB1214267	714451.4	3695246.4	0
	HB-12	14270	HB-12_1401	CNHB1214270	714628.6	3695236.7	0
	HB-12	14273	HB-12_1401	CNHB1214273	714382	3695208.7	0
	HB-12	14277	HB-12_1401	CNHB1214277	714573.2	3695183.6	0
	HB-12	14278	HB-12_1401	CNHB1214278	714462.4	3695164.8	0
	HB-12	14280	HB-12_1401	CNHB1214280	714641.9	3695158.9	0
	HB-12	14287	HB-12_1401	CNHB1214287	714591.6	3695103.3	0
	HB-12	14289	HB-12_1401	CNHB1214289	714393.1	3695091.1	0
	Nature Trail	14290	Nature Trail_1401	CNNT14290	716019.9	3694422.4	359
	Nature Trail	14291	Nature Trail_1401	CNNT14291	716116.1	3694405.2	359
	Nature Trail	14292	Nature Trail_1401	CNNT14292	715963.1	3694384.8	359
	Nature Trail	14293	Nature Trail_1401	CNNT14293	716102.8	3694373.9	359
	Nature Trail	14294	Nature Trail_1401	CNNT14294	715938	3694366.8	359
	Nature Trail	14297	Nature Trail_1401	CNNT14297	716067.9	3694316.2	359
	Nature Trail	14298	Nature Trail_1401	CNNT14298	716025.4	3694308.5	359
	Nature Trail	14299	Nature Trail_1401	CNNT14299	715897.5	3694298.5	359
	Nature Trail	14300	Nature Trail_1401	CNNT14300	716012.8	3694279.8	359
	Nature Trail	14301	Nature Trail_1401	CNNT14301	716115.8	3694270	359

Modified Intensive Plots (Sections) surveyed during the 2014 vegetation monitoring season

Conservation Area	Site	Section	Inference Polygon	Locat	Easting	Northing	Plot Bearing
Cibola Valley	Phase 01	14178	Phase 01_1406	CVP114178	717211.1	3699501.5	87
	Phase 01	14179	Phase 01_1404	CVP114179	717319.2	3699462.6	87
	Phase 01	14180	Phase 01_1406	CVP114180	717130.2	3699448.2	87
	Phase 01	14182	Phase 01_1406	CVP114182	717160.5	3699429.4	87
	Phase 01	14184	Phase 01_1403	CVP114184	717461.3	3699409.4	87
	Phase 01	14185	Phase 01_1401	CVP114185	717574.6	3699401.7	87
	Phase 01	14187	Phase 01_1403	CVP114187	717497.3	3699393	87
	Phase 01	14188	Phase 01_1404	CVP114188	717355.9	3699383.3	87
	Phase 01	14189	Phase 01_1406	CVP114189	717237.1	3699369.3	87
	Phase 01	14190	Phase 01_1404	CVP114190	717325.9	3699358.5	87
	Phase 01	14191	Phase 01_1401	CVP114191	717700.6	3699343.5	87
	Phase 01	14193	Phase 01_1403	CVP114193	717443.1	3699339.2	87
	Phase 01	14194	Phase 01_1401	CVP114194	717641.4	3699332.8	87
	Phase 01	14195	Phase 01_1406	CVP114195	717221.6	3699332.3	87
	Phase 01	14199	Phase 01_1401	CVP114199	717612.4	3699294.7	87
	Phase 01	14200	Phase 01_1403	CVP114200	717421.4	3699289.4	87
	Phase 01	14201	Phase 01_1404	CVP114201	717324.4	3699278	87
	Phase 01	14203	Phase 01_1402	CVP114203	717768.1	3699238.9	87
	Phase 01	14205	Phase 01_1402	CVP114205	717670.1	3699228.6	87
	Phase 01	14207	Phase 01_1407	CVP114207	717246.8	3699211.5	87
	Phase 01	14208	Phase 01_1407	CVP114208	717219.2	3699158.4	87
	Phase 01	14210	Phase 01_1405	CVP114210	717400.1	3699149.9	87
	Phase 01	14212	Phase 01_1405	CVP114212	717325.6	3699125.6	87
	Phase 01	14213	Phase 01_1405	CVP114213	717443.7	3699119.2	87
	Phase 01	14214	Phase 01_1405	CVP114214	717359.3	3699073.7	87
	Phase 01	14217	Phase 01_1407	CVP114217	717159.6	3699052.5	87
	Phase 01	14218	Phase 01_1407	CVP114218	717184.4	3699029.5	87
	Phase 02	14219	Phase 02_1402	CVP214219	717766.1	3698984.9	269
	Phase 02	14220	Phase 02_1402	CVP214220	717563.8	3698966.4	269
	Phase 02	14222	Phase 02_1401	CVP214222	717264	3698952.8	269
	Phase 02	14225	Phase 02_1401	CVP214225	717386.7	3698915.6	269
	Phase 02	14226	Phase 02_1401	CVP214226	717221.3	3698903.3	269
	Phase 02	14227	Phase 02_1401	CVP214227	717321.9	3698879.6	269
	Phase 02	14228	Phase 02_1402	CVP214228	717582.3	3698869.2	269
	Phase 02	14229	Phase 02_1402	CVP214229	717695.9	3698843.9	269
	Phase 02	14231	Phase 02_1401	CVP214231	717285.9	3698820.4	269
	Phase 02	14235	Phase 02_1402	CVP214235	717765.4	3698745.1	269
	Phase 02	14236	Phase 02_1401	CVP214236	717278.7	3698740.4	269
	Phase 02	14238	Phase 02_1401	CVP214238	717227.1	3698733.4	269
	Phase 02	14239	Phase 02_1402	CVP214239	717585.9	3698730.1	269
	Phase 02	14240	Phase 02_1402	CVP214240	717750.4	3698711	269
	Phase 02	14242	Phase 02_1402	CVP214242	717643.5	3698671.8	269
	Phase 02	14341	Phase 02_1401	CVP214341	724528.1	3623047.9	269
	Phase 03	14246	Phase 03_1402	CVP314246	714520.2	3698225.2	179
	Phase 03	14247	Phase 03_1402	CVP314247	714371.2	3698215.8	179
	Phase 03	14248	Phase 03_1402	CVP314248	714190.5	3698183.1	179
	Phase 03	14249	Phase 03_1402	CVP314249	714567.7	3698167.2	179
	Phase 03	14250	Phase 03_1402	CVP314250	714416.2	3698164.3	179
	Phase 03	14251	Phase 03_1402	CVP314251	714293.4	3698160.3	179
	Phase 03	14252	Phase 03_1402	CVP314252	714164.4	3698154	179
	Phase 03	14253	Phase 03_1402	CVP314253	714442.8	3698109.4	179
	Phase 03	14255	Phase 03_1401	CVP314255	714364.7	3697999.5	179
	Phase 03	14257	Phase 03_1401	CVP314257	714524	3697974.8	179
	Phase 03	14258	Phase 03_1401	CVP314258	714273.8	3697971.8	179
	Phase 03	14259	Phase 03_1401	CVP314259	714431.2	3697949.6	179
	Phase 03	14262	Phase 03_1401	CVP314262	714327.3	3697940.6	179
	Phase 03	14263	Phase 03_1401	CVP314263	714542.4	3697934.1	179
	Phase 03	14264	Phase 03_1401	CVP314264	714475.2	3697915.7	179
	Phase 03	14265	Phase 03_1401	CVP314265	714227.7	3697906.4	179

Modified Intensive Plots (Sections) surveyed during the 2014 vegetation monitoring season

Conservation Area	Site	Section	Inference Polygon	Locat	Easting	Northing	Plot Bearing
Palo Verde Ecological Reserve	Phase 01	14142	Phase 01_1401	PVP114142	729349.6	3730599.9	268
	Phase 01	14150	Phase 01_1401	PVP114150	729130.3	3730548.5	268
	Phase 01	14152	Phase 01_1401	PVP114152	729312.1	3730520.2	268
	Phase 01	14153	Phase 01_1401	PVP114153	729066.1	3730509.7	268
	Phase 02	14154	Phase 02_1401	PVP214154	728856	3730381.8	88
	Phase 02	14155	Phase 02_1401	PVP214155	728805.4	3730346.1	88
	Phase 02	14158	Phase 02_1401	PVP214158	728927.3	3730282.7	88
	Phase 02	14160	Phase 02_1401	PVP214160	728730.5	3730271.8	88
	Phase 02	14161	Phase 02_1401	PVP214161	728861.9	3730221.5	88
	Phase 02	14162	Phase 02_1401	PVP214162	728685.2	3730215.6	88
	Phase 02	14163	Phase 02_1401	PVP214163	728984.3	3730214.8	88
	Phase 02	14165	Phase 02_1401	PVP214165	728830.6	3730170.5	88
	Phase 03	14166	Phase 03_1401	PVP314166	728894.9	3729967.3	88
	Phase 03	14167	Phase 03_1401	PVP314167	728816.8	3729959.2	88
	Phase 03	14168	Phase 03_1401	PVP314168	728697.2	3729930.8	88
	Phase 03	14169	Phase 03_1401	PVP314169	728771.4	3729881.6	88
	Phase 03	14170	Phase 03_1401	PVP314170	728614.2	3729856.2	88
	Phase 03	14171	Phase 03_1401	PVP314171	728802.3	3729842.1	88
	Phase 03	14172	Phase 03_1401	PVP314172	728914	3729833.1	88
	Phase 03	14173	Phase 03_1401	PVP314173	728978.6	3729812.9	88
	Phase 03	14176	Phase 03_1401	PVP314176	728716	3729727.1	88
	Phase 03	14177	Phase 03_1401	PVP314177	728843.4	3729697.6	88
	Phase 04	14123	Phase 04_1402	PVP414123	730046.4	3731080.6	87
	Phase 04	14125	Phase 04_1402	PVP414125	730005.6	3731063.1	87
	Phase 04	14127	Phase 04_1402	PVP414127	729936.7	3731027	87
	Phase 04	14128	Phase 04_1402	PVP414128	730064.2	3731002.5	87
	Phase 04	14130	Phase 04_1402	PVP414130	729981	3730947.7	87
	Phase 04	14131	Phase 04_1402	PVP414131	729866.3	3730945	87
	Phase 04	14133	Phase 04_1402	PVP414133	729889.9	3730873.4	87
	Phase 04	14134	Phase 04_1402	PVP414134	730014.8	3730870	87
	Phase 04	14137	Phase 04_1401	PVP414137	729749	3730650.7	87
	Phase 04	14138	Phase 04_1401	PVP414138	729635.5	3730644.8	87
	Phase 04	14139	Phase 04_1401	PVP414139	729517.4	3730622.2	87
	Phase 04	14143	Phase 04_1401	PVP414143	729736.4	3730596.5	87
	Phase 04	14144	Phase 04_1401	PVP414144	729660.4	3730579.8	87
	Phase 04	14146	Phase 04_1401	PVP414146	729483.1	3730570.5	87
	Phase 04	14148	Phase 04_1401	PVP414148	729542.6	3730564	87
	Phase 04	14149	Phase 04_1401	PVP414149	729578	3730553.3	87
	Phase 05	14072	Phase 05_1407	PVP514072	731359.2	3731948.1	87
	Phase 05	14074	Phase 05_1405	PVP514074	731130.3	3731930.4	87
	Phase 05	14075	Phase 05_1407	PVP514075	731410.8	3731910	87
	Phase 05	14076	Phase 05_1407	PVP514076	731320.6	3731904	87
	Phase 05	14077	Phase 05_1407	PVP514077	731378.6	3731903.8	87
	Phase 05	14078	Phase 05_1405	PVP514078	731153.4	3731847.6	87
	Phase 05	14079	Phase 05_1406	PVP514079	731243.9	3731795.1	87
	Phase 05	14080	Phase 05_1405	PVP514080	731171.6	3731763.7	87
	Phase 05	14081	Phase 05_1405	PVP514081	731113.1	3731755	87
	Phase 05	14082	Phase 05_1406	PVP514082	731228.1	3731751.2	87
	Phase 05	14083	Phase 05_1406	PVP514083	731309.4	3731744.1	87
	Phase 05	14084	Phase 05_1406	PVP514084	731246.7	3731706.1	87
	Phase 05	14086	Phase 05_1406	PVP514086	731352.3	3731691.4	87
	Phase 05	14087	Phase 05_1405	PVP514087	731172.6	3731687.5	87
	Phase 05	14088	Phase 05_1402	PVP514088	731145.7	3731554.6	87
	Phase 05	14089	Phase 05_1401	PVP514089	730699.9	3731494.9	87
	Phase 05	14090	Phase 05_1401	PVP514090	730884.1	3731489.9	87
	Phase 05	14091	Phase 05_1402	PVP514091	731171.2	3731476.9	87
	Phase 05	14092	Phase 05_1402	PVP514092	731136.1	3731469.6	87
	Phase 05	14094	Phase 05_1404	PVP514094	731411	3731458.4	87
	Phase 05	14095	Phase 05_1402	PVP514095	731162.1	3731426.8	87

Modified Intensive Plots (Sections) surveyed during the 2014 vegetation monitoring season

Conservation Area	Site	Section	Inference Polygon	Locat	Easting	Northing	Plot Bearing
	Phase 05	14096	Phase 05_1401	PVP514096	730899.6	3731425.7	87
	Phase 05	14097	Phase 05_1401	PVP514097	730695.5	3731409.8	87
	Phase 05	14099	Phase 05_1404	PVP514099	731389.3	3731391	87
	Phase 05	14101	Phase 05_1404	PVP514101	731367.7	3731380	87
	Phase 05	14103	Phase 05_1404	PVP514103	731307.9	3731361.1	87
	Phase 05	14104	Phase 05_1404	PVP514104	731287.3	3731334.9	87
	Phase 05	14105	Phase 05_1401	PVP514105	730862.9	3731327.2	87
	Phase 05	14106	Phase 05_1403	PVP514106	731461.3	3731325.1	87
	Phase 05	14109	Phase 05_1401	PVP514109	730804.1	3731289.6	87
	Phase 05	14110	Phase 05_1401	PVP514110	730960.8	3731276.4	87
	Phase 05	14113	Phase 05_1403	PVP514113	731331.5	3731250.7	87
	Phase 05	14114	Phase 05_1403	PVP514114	731373.1	3731183.2	87
	Phase 05	14115	Phase 05_1403	PVP514115	731343.3	3731173.9	87
	Phase 05	14118	Phase 05_1403	PVP514118	731238.5	3731162	87
	Phase 05	14119	Phase 05_1401	PVP514119	730990	3731161.7	87
	Phase 05	14120	Phase 05_1403	PVP514120	731293.1	3731159.5	87
	Phase 05	14121	Phase 05_1403	PVP514121	731139.8	3731096.9	87
	Phase 05	14122	Phase 05_1403	PVP514122	731233.3	3731091.8	87
	Phase 05	14124	Phase 05_1403	PVP514124	731156.6	3731076.4	87
	Phase 06	14016	Phase 06_1402	PVP614016	731840.5	3732791.8	88
	Phase 06	14017	Phase 06_1403	PVP614017	731124.4	3732760.1	88
	Phase 06	14018	Phase 06_1403	PVP614018	731239.4	3732744.8	88
	Phase 06	14023	Phase 06_1402	PVP614023	731878.3	3732718.7	88
	Phase 06	14025	Phase 06_1403	PVP614025	731324.1	3732709.9	88
	Phase 06	14026	Phase 06_1402	PVP614026	731847.3	3732684.2	88
	Phase 06	14027	Phase 06_1403	PVP614027	731163	3732663.2	88
	Phase 06	14028	Phase 06_1403	PVP614028	731348	3732652.3	88
	Phase 06	14029	Phase 06_1403	PVP614029	731245.6	3732645.9	88
	Phase 06	14030	Phase 06_1403	PVP614030	731114.9	3732634.7	88
	Phase 06	14031	Phase 06_1402	PVP614031	731879.5	3732625.3	88
	Phase 06	14032	Phase 06_1402	PVP614032	731733.6	3732545.8	88
	Phase 06	14033	Phase 06_1402	PVP614033	731854.2	3732544.1	88
	Phase 06	14037	Phase 06_1402	PVP614037	731719.6	3732473.4	88
	Phase 06	14039	Phase 06_1402	PVP614039	731639.4	3732451.3	88
	Phase 06	14040	Phase 06_1401	PVP614040	731610.7	3732378.2	88
	Phase 06	14044	Phase 06_1404	PVP614044	731206.4	3732332.5	88
	Phase 06	14045	Phase 06_1401	PVP614045	731416.1	3732302	88
	Phase 06	14047	Phase 06_1401	PVP614047	731845.5	3732299.4	88
	Phase 06	14049	Phase 06_1404	PVP614049	731200.6	3732269.2	88
	Phase 06	14050	Phase 06_1401	PVP614050	731719.9	3732268.5	88
	Phase 06	14052	Phase 06_1401	PVP614052	731687.4	3732248.3	88
	Phase 06	14053	Phase 06_1404	PVP614053	731274.8	3732243.4	88
	Phase 06	14054	Phase 06_1401	PVP614054	731463.3	3732232.4	88
	Phase 06	14055	Phase 06_1404	PVP614055	731150.5	3732228.9	88
	Phase 06	14058	Phase 06_1401	PVP614058	731555	3732192.9	88
	Phase 06	14059	Phase 06_1404	PVP614059	731275.7	3732177.4	88
	Phase 06	14060	Phase 06_1405	PVP614060	731478	3732147.8	88
	Phase 06	14061	Phase 06_1404	PVP614061	731167.2	3732139.2	88
	Phase 06	14066	Phase 06_1405	PVP614066	731388.3	3732081.6	88
	Phase 06	14067	Phase 06_1405	PVP614067	731436.1	3732060.3	88
	Phase 06	14069	Phase 06_1404	PVP614069	731122.4	3732052.7	88

Modified Intensive Plots (Sections) surveyed during the 2014 vegetation monitoring season

Conservation Area	Site	Section	Inference Polygon	Locat	Easting	Northing	Plot Bearing
Yuma East Wetlands	C	14319	C_1401	YWC14319	724745.3	3623293.5	87
	C	14320	C_1401	YWC14320	724783.9	3623280.5	87
	C	14322	C_1401	YWC14322	724721.9	3623266.6	87
	I	14324	I_1403	YWI14324	724583.1	3623220.5	87
	I	14326	I_1403	YWI14326	724561	3623204.8	87
	I	14327	I_1401	YWI14327	724711.8	3623191.6	87
	I	14329	I_1401	YWI14329	724704	3623167.1	87
	I	14332	I_1403	YWI14332	724549.7	3623150.4	87
	I	14334	I_1402	YWI14334	724541.3	3623084.4	87
	I	14336	I_1402	YWI14336	724572.5	3623063.4	87
	I	14337	I_1402	YWI14337	724528.1	3623047.9	87
	J	14315	J_1401	YWJ14315	723992.2	3623866.9	87
	J	14316	J_1401	YWJ14316	723957.7	3623846.4	87
	J	14317	J_1401	YWJ14317	724064.2	3623815.8	87
	J	14318	J_1401	YWJ14318	724175	3623765.1	87

ATTACHMENT 2

2014 Plot Location Maps

Legend

Plot Centers

2014 Vegetation Plots

2014 Vegetation Monitoring Plots: Cibola National Wildlife Refuge - All Sites

AREA = CNU1
SITE = All

Map created by Chad McKenna of GeoSystems Analysis, Inc. on September 15, 2014. Grid projection = UTM, NAD 1983, Zone 11N, meters.

Legend

2014 Vegetation Plots

2014 Vegetation Monitoring Plots:
Cibola National Wildlife Refuge -
Crane Roost

AREA = CNU1
SITE = Crane Roost
BEARING = 87

0 125 250
Feet

GSA GeoSystems Analysis, Inc.

Parametrix

Map created by Chad McKenna of GeoSystems Analysis, Inc. on September 15, 2014. Grid projection = UTM, NAD 1983, Zone 11N, meters.

Legend

2014 Vegetation Plots

2014 Vegetation Monitoring Plots:
Cibola National Wildlife Refuge -
Hippie Burn 11

AREA = CNU1
SITE = HB-11
BEARING = 0

0 125 250 Feet

GSA GeoSystems Analysis, Inc.

Parametrix

Map created by Chad McKenna of GeoSystems Analysis, Inc. on September 15, 2014. Grid projection = UTM, NAD 1983, Zone 11N, meters.

Legend

2014 Vegetation Plots

2014 Vegetation Monitoring Plots:
Cibola National Wildlife Refuge -
Hippie Burn 12

AREA = CNU1
SITE = HB-12
BEARING = 0

0 125 250 Feet

GSA GeoSystems Analysis, Inc.

Parametrix

Map created by Chad McKenna of GeoSystems Analysis, Inc. on September 15, 2014. Grid projection = UTM, NAD 1983, Zone 11N, meters.

Legend

2014 Vegetation Plots

2014 Vegetation Monitoring Plots:
Cibola National Wildlife Refuge -
Nature Trail

AREA = CNU1
SITE = Nature Trail
BEARING = 359

0 125 250 Feet

GSA GeoSystems Analysis, Inc.

Parametrix

Map created by Chad McKenna of GeoSystems Analysis, Inc. on September 15, 2014. Grid projection = UTM, NAD 1983, Zone 11N, meters.

Legend

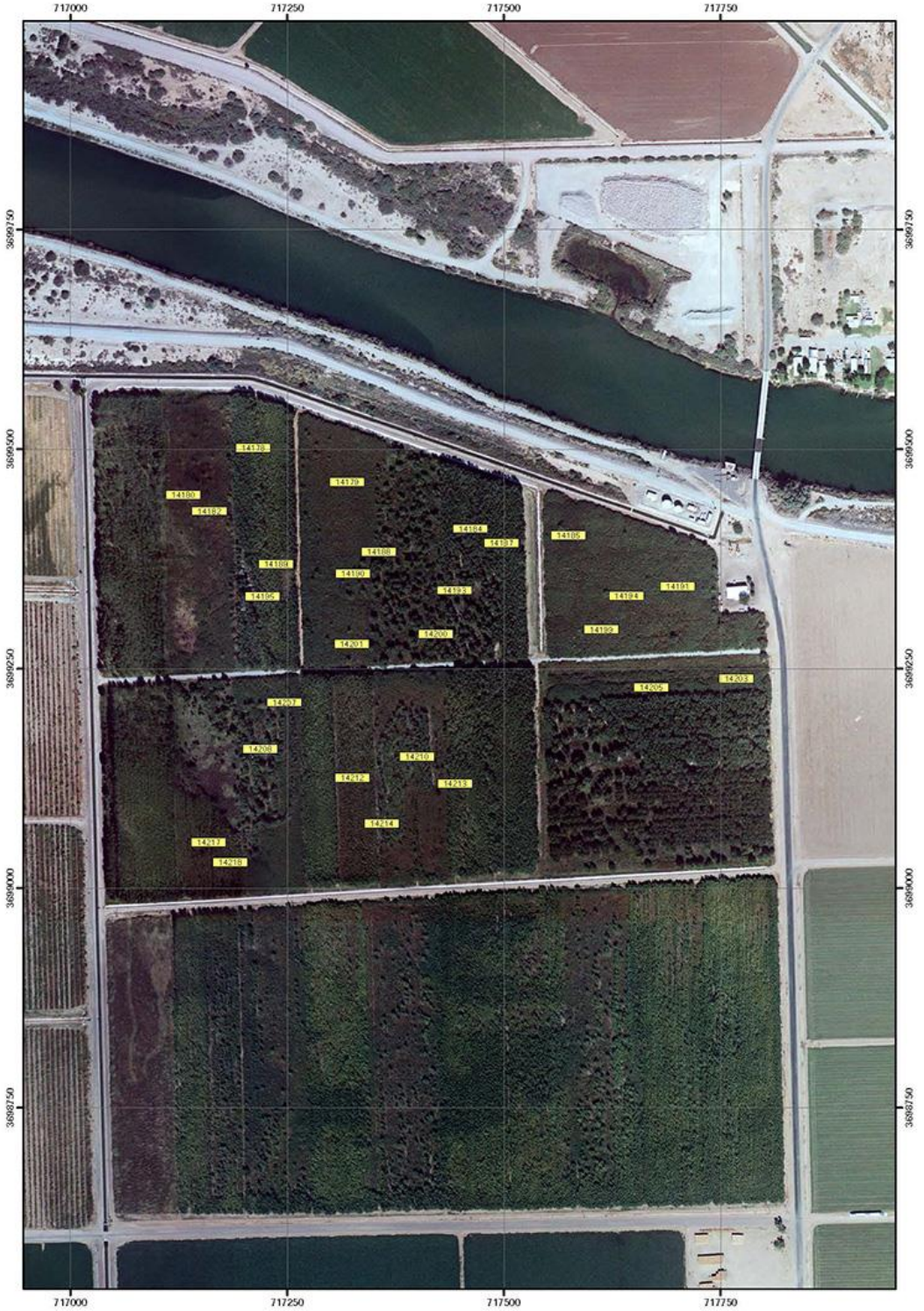
Plot Centers

2014 Vegetation Plots

2014 Vegetation Monitoring Plots: Cibola Valley Conservation Area - All Sites

AREA = CVCA
SITE = All

Map created by Chad McKenna of GeoSystems Analysis, Inc. on September 15, 2014. Grid projection = UTM, NAD 1983, Zone 11N, meters.



Legend

Plot Centers

2014 Vegetation Plots

2014 Vegetation Monitoring Plots:
Cibola Valley Conservation Area -
Phase 1

AREA = CVCA
SITE = Phase 1
BEARING = 87

0 250 500 Feet

GSA GeoSystems Analysis, Inc.

Parametrix

Map created by Chad McKenna of GeoSystems Analysis, Inc. on September 15, 2014. Grid projection = UTM, NAD 1983, Zone 11N, meters.

717000
717250
717500
717750
718000
3699500
3699250
3699000
3698750
3698500
3698250
3698000
Legend
Plot Centers
2014 Vegetation Plots
2014 Vegetation Monitoring Plots:
Cibola Valley Conservation Area -
Phase 2
AREA = CVCA
SITE = Phase 2
BEARING = 269
0 250 500
Feet
GSA
GeoSystems Analysis, Inc.
Parametrix
Map created by Chad McKenna of GeoSystems Analysis, Inc. on September 15, 2014. Grid projection = UTM, NAD 1983, Zone 11N, meters.

Legend

Plot Centers

2014 Vegetation Plots

2014 Vegetation Monitoring Plots:
Cibola Valley Conservation Area -
Phase 3

AREA = CVCA
SITE = Phase 3
BEARING = 179

0 250 500 Feet

GSA GeoSystems Analysis, Inc.

Parametrix

Map created by Chad McKenna of GeoSystems Analysis, Inc. on September 15, 2014. Grid projection = UTM, NAD 1983, Zone 11N, meters.

PHASE 1
PHASE 2
PHASE 3
PHASE 4
PHASE 5
PHASE 6
Legend
Plot Centers
2014 Vegetation Plots
2014 Vegetation Monitoring Plots:
Palo Verde Ecological Reserve -
All Phases
AREA = PVER
SITE = All Sites
BEARING = Varies by Site
0 1,000 2,000
Feet
GSA
GeoSystems Analysis, Inc.
Parametrix
Map created by Chad McKenna of GeoSystems Analysis, Inc. on September 15, 2014. Grid projection = UTM, NAD 1983, Zone 11N, meters.

Legend

Plot Centers

2014 Vegetation Plots

2014 Vegetation Monitoring Plots:
Palo Verde Ecological Reserve -
Phase 1

AREA = PVER
SITE = Phase 1
BEARING = 268

0 125 250
Feet

GSA GeoSystems Analysis, Inc.

Parametrix

Map created by Chad McKenna of GeoSystems Analysis, Inc. on September 15, 2014. Grid projection = UTM, NAD 1983, Zone 11N, meters.

Legend

Plot Centers

2014 Vegetation Plots

2014 Vegetation Monitoring Plots:
Palo Verde Ecological Reserve -
Phase 2

AREA = PVER
SITE = Phase 2
BEARING = 88

0 125 250
Feet

GSA GeoSystems Analysis, Inc.

Parametrix

Map created by Chad McKenna of GeoSystems Analysis, Inc. on September 15, 2014. Grid projection = UTM, NAD 1983, Zone 11N, meters.

Legend

Plot Centers

2014 Vegetation Plots

2014 Vegetation Monitoring Plots:
Palo Verde Ecological Reserve -
Phase 3

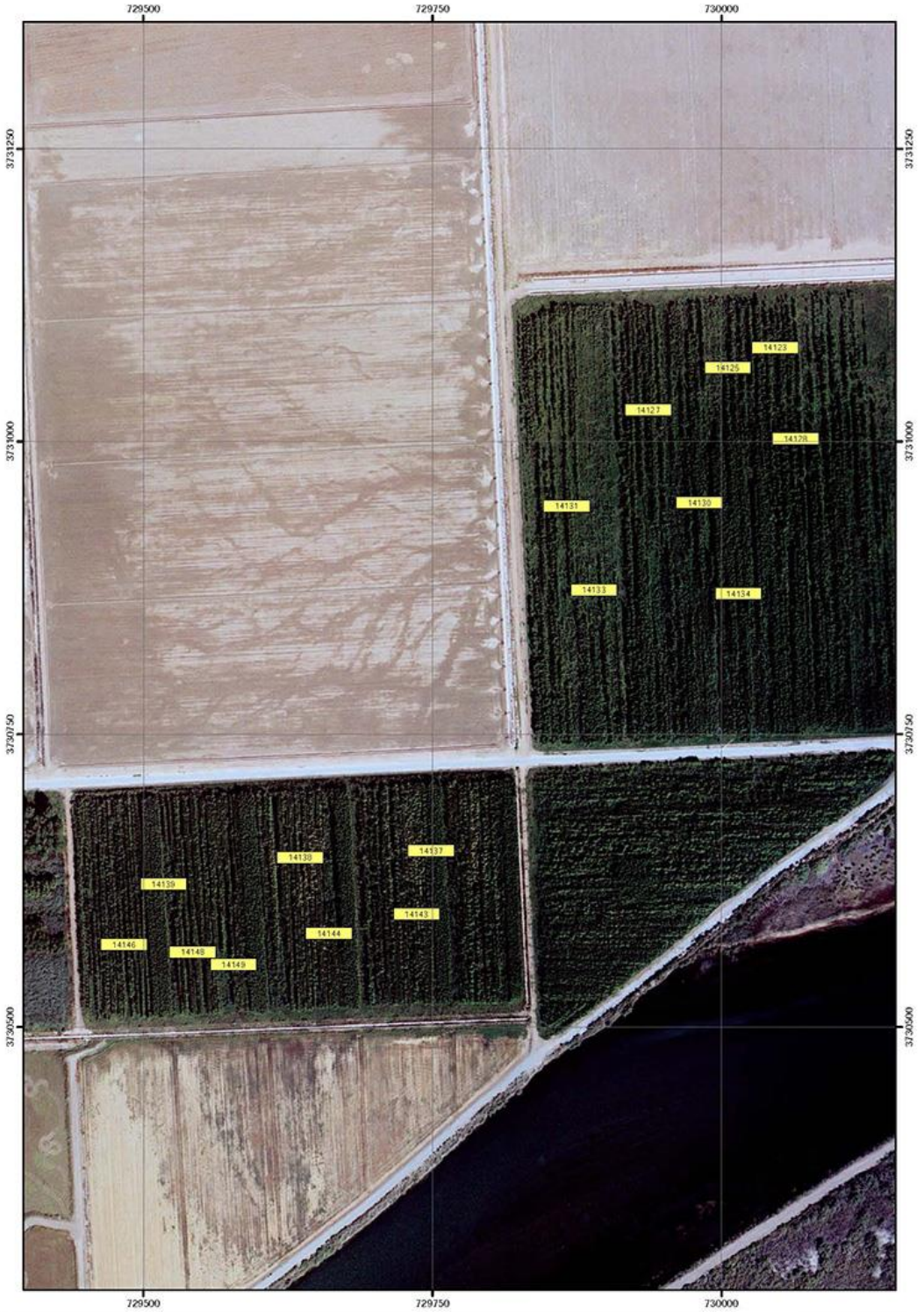
AREA = PVER
SITE =Phase 3
BEARING = 88

0 125 250
Feet

GSA GeoSystems Analysis, Inc.

Parametrix

Map created by Chad McKenna of GeoSystems Analysis, Inc. on September 15, 2014. Grid projection = UTM, NAD 1983, Zone 11N, meters.



Legend

Plot Centers

2014 Vegetation Plots

2014 Vegetation Monitoring Plots:
Palo Verde Ecological Reserve -
Phase 4

AREA = PVER
SITE = Phase 4
BEARING = 87

0 125 250 Feet

GSA GeoSystems Analysis, Inc.

Parametrix

Map created by Chad McKenna of GeoSystems Analysis, Inc. on September 15, 2014. Grid projection = UTM, NAD 1983, Zone 11N, meters.

Legend

Plot Centers

2014 Vegetation Plots

2014 Vegetation Monitoring Plots:
Palo Verde Ecological Reserve -
Phase 5

AREA = PVER
SITE =Phase 5
BEARING = 87

0 125 250 500 750 Foot

GSA GeoSystems Analysis, Inc.

Parametrix

Map created by Chad McKenna of GeoSystems Analysis, Inc. on September 15, 2014. Grid projection = UTM, NAD 1983, Zone 11N, meters.

Legend

Plot Centers

2014 Vegetation Plots

2014 Vegetation Monitoring Plots:
Palo Verde Ecological Reserve -
Phase 6

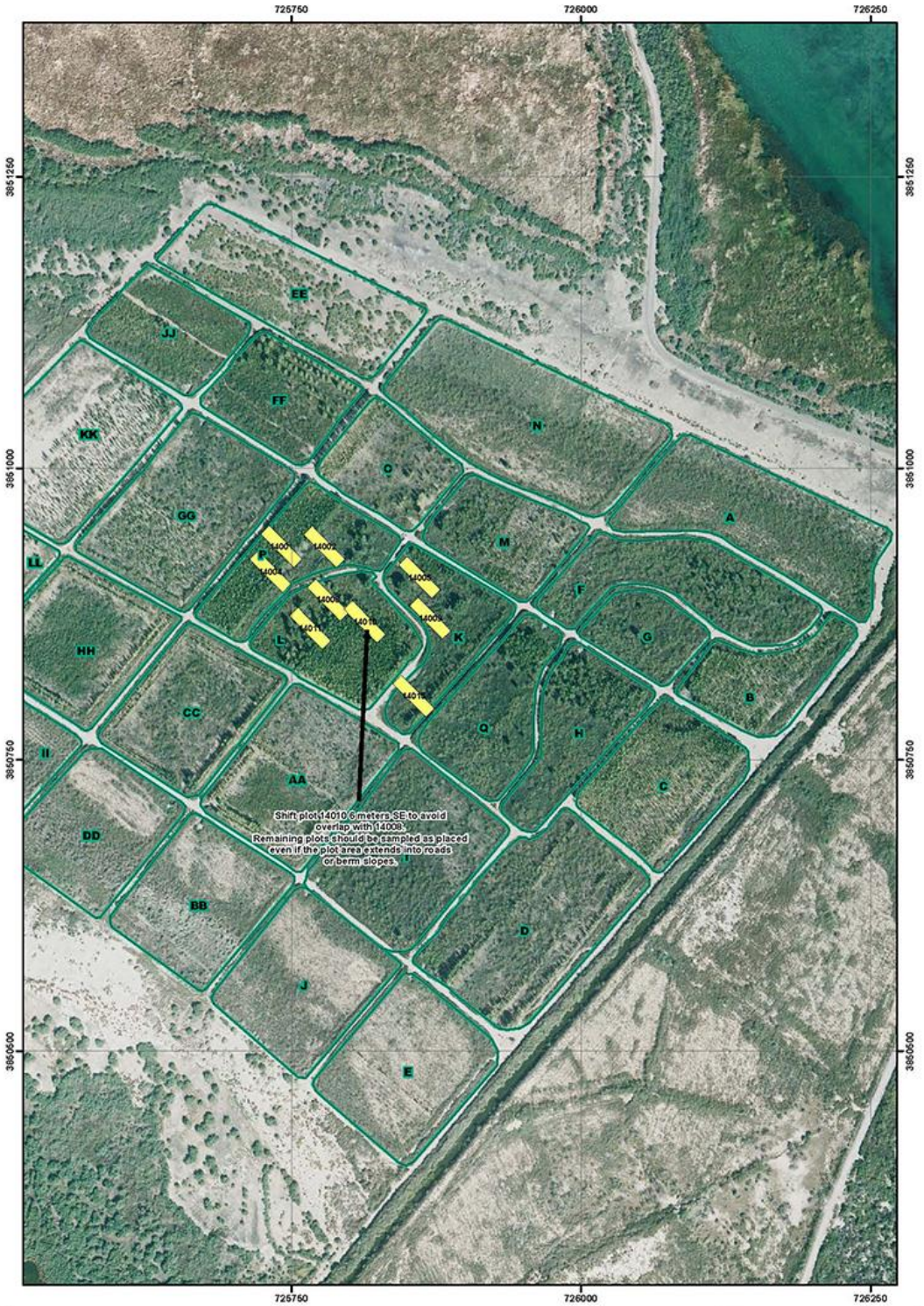
AREA = PVER
SITE = Phase 6
BEARING = 88

0 125 250 500 750 Foot

GSA GeoSystems Analysis, Inc.

Parametrix

Map created by Chad McKenna of GeoSystems Analysis, Inc. on September 15, 2014. Grid projection = UTM, NAD 1983, Zone 11N, meters.



Legend

Plot Centers

2014 Vegetation Plots

Beal Fields (Site Name Labeled)

2014 Vegetation Monitoring Plots: Beal Lake Conservation Area - Various Sites (Fields)

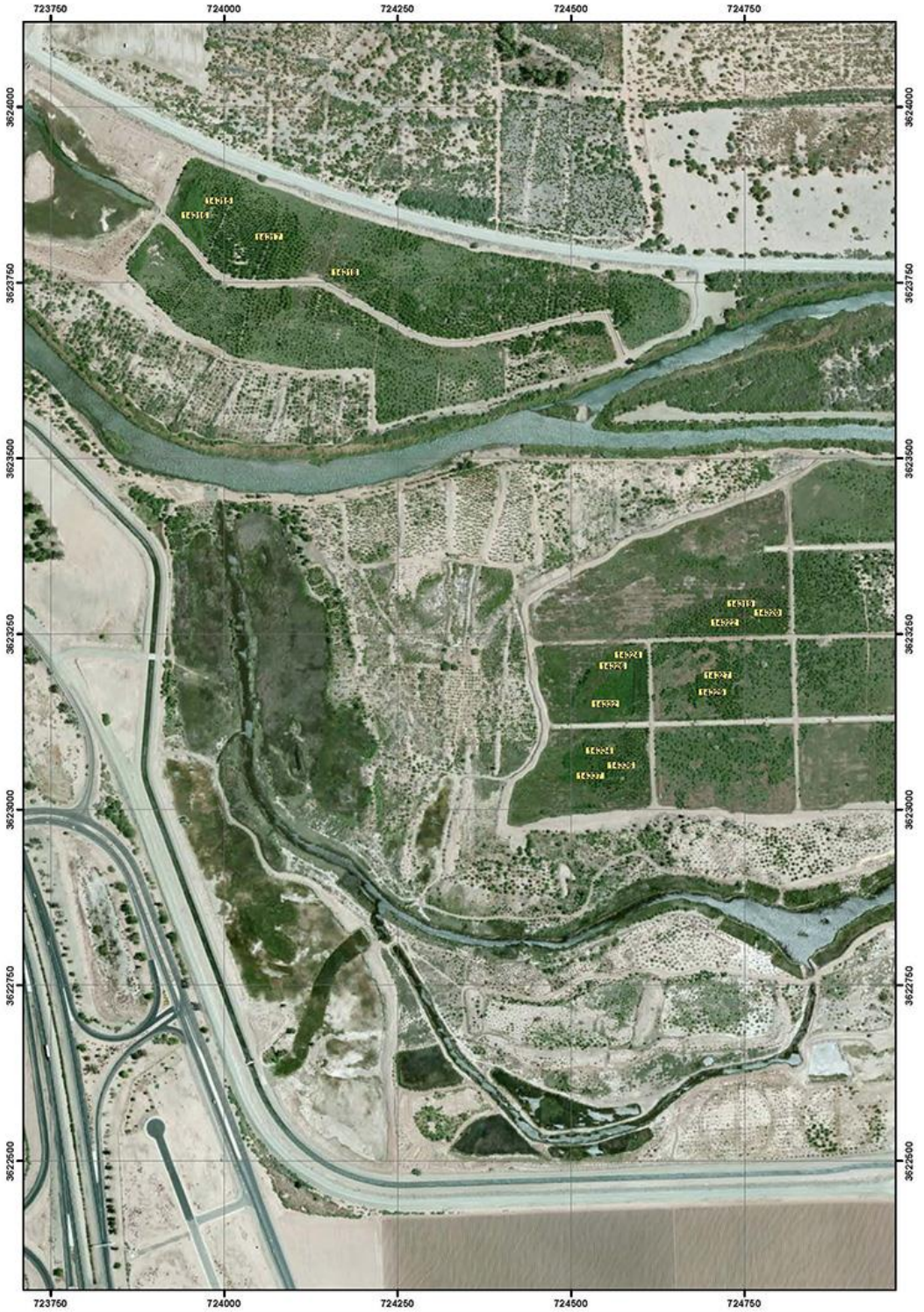
AREA = BLCA
SITE = Various
BEARING = 315

0 100 200 400 Feet

GSA GeoSystems Analysis, Inc.

Varametrix

Map created by Chad McKenna of GeoSystems Analysis, Inc. on September 26, 2014. Grid projection = UTM, NAD 1983, Zone 11N, meters.



Legend

2014 Vegetation Plots

2014 Vegetation Monitoring Plots:
Yuma East Wetlands

PLOT BEARING = 87

0 100 200 400 600 Feet

Map created by Chad McKenna of GeoSystems Analysis, Inc. on September 7, 2014. Grid projection = UTM, NAD 1983, Zone 11N, meters.

ATTACHMENT 3

2014 Field Instructions for Paper Data Sheets

2014 Modified Intensive Plot Method Field Instructions:
Vegetation Monitoring at Lower Colorado River Multi-species Conservation Program Habitat Creation and Existing Riparian Sites – Hardcopy Datasheet Version

Updated September 4, 2014

1.0 Plot Setup

1. Use GPS to navigate to plot center marker.
2. Determine the azimuth bearing ("Bearing 1") for the long plot edge (Borders 2 and 4). Note that the same bearing is used for all of the plots in a phase.
3. Subtract 90° to determine the azimuth bearing ("Bearing 2") for the short plot edge (Borders 1 and 3).
4. From the plot center, use a compass to line up the measuring tape with Bearing 2 between the plot center and A Plot Border 4.
5. With one person holding the coiled tape at the plot center, pull the 0 mark on the tape out 5 meters to the midpoint of A Plot Border 4. Check the bearing of this line with a compass. Place a pin flag at this location—the midpoint of A Plot Border 4.
6. With one person staying at the midpoint of A Plot Border 4, extend the tape to 10 m total (5 m from plot center) along the bearing line. Place a pin flag at the 10 m mark (the midpoint of A Plot Border 2).
7. Add pin flags at the: 1 m (point D5), 2.5 m (double flag, midpoint of B Plot Border 4), 5 m (plot center/D1), 7.5 m (double flag, midpoint of B Plot Border 2), 9 m (D3)and 10 m (midpoint of A Plot Border 2). Place two pin flags each at 0 m, 2.5 m, 7.5 m, and 10 m.
8. Reel in the tape and move to the midpoint of A Plot Border 2. Determine the direction of Bearing 1 from this location. Have one person stand at this location with the reeled tape and compass, and the second person extend the tape 20 m down A Plot Border 2 to Corner 1-2[1].
9. Once the tape has been extended to 20 m, backsight the tape at several locations to ensure that the azimuth remains at Bearing 1.
10. Anchor the 0 m mark of the tape at Corner 1-2[1]. Place double pin flags at the 12.5 m mark of Border 2.

11. Continue extending tape along Bearing 1 to the 40 m mark of Border 2 (Corner 2-3[1]). Place double pin flags at the 27.5 m mark of Border 2.
12. From Corner 2-3[1], extend the tape on Bearing 2 for 10 m along Border 3 to reach Corner 3-4[1]. Mark this plot corner.
13. From the 27.5 m mark of Border 2, extend the tape 10 m along Bearing 2. Place pin flags at 2.5 m, 5 m (double flag), 7.5 m, and 10 m (double flag). Reel in the tape.
14. Repeat 14 for the 12.5 mark of Border 2.
15. Fill in pin flags along A Plot and B Plot borders.
16. From Plot Center, extend the tape 4 m in each direction along Bearing 1 (this should direct you toward double flags on Border 1 and Border 3 of the B Plot) and place a pin flag at these two points (D2 and D4).

2.0 Survey Protocols

2.1 General Notes:

1. **Field and datasheet instructions are to be used to guide survey efforts. If inconsistencies or ambiguities are found, immediately notify the Field Supervisor, who will then notify the Project Supervisor. If crews are at a remote location where cell service is unavailable (i.e. Bill Williams River), crews shall refer to the MSCP Vegetation Monitoring Methods. At the end of the field day, the Field Supervisor will contact the Project Supervisor.**
2. If serious conditions such as patches of invasive species or vegetation mortality are encountered, notify the Field Supervisor, who will then notify the Project Supervisor. MSCP should be notified of mortality and/or invasive species presence.
3. Trees and shrubs will be considered IN a given plot for plant counts if any portion of the basal cover falls on Border 1 or Border 2 of the given survey area. They will be considered OUT of a given plot if any portion of the basal cover falls on Border 3 or Border 4 of the given survey area.
4. With the exception of SALEXI, plant counts will be conducted by individual. SALEXI is a clonal species for which individuals are not easily distinguished. These plants will be measured and/or tallied by stems which emerge separately from the ground. In order to be measured or tallied separately, stems must be entirely separated at the ground surface. NOTE: THIS IS DIFFERENT FROM STEM COUNT PROTOCOLS FOR TAMARIX AND MESQUITE.
5. Height of vegetation (trees/shrubs) is measured as the distance of the maximum live foliage above ground surface in a vertical direction. We are NOT measuring stem length, so do not straighten or extend branches for height measurements.
6. Mesquite, *Tamarix*, and willow baccharis stems are placed into diameter classes based on stem diameter at 10 cm above ground surface. Standard trees are measured at 1.4m above ground to determine diameter at breast height (DBH)
7. Size classes for standard trees are designated by DBH as follows: SC 1 is ≤2.5 cm DBH; SC2 is 2.51 – 8 cm DBH; SC3 is 8.01 – 12 cm DBH; SC 4 is 12.01 to 20 cm DBH; SC5 is 20.01 – 40 cm DBH; and SC6 is 40.1-50 cm DBH; SC7 is 50.1-80 cm DBH; and SC8 is >80 cm DBH. All DBH measurements will be ROUNDED UP to the next 0.5 cm interval. For example, a trunk measured as 2.01 cm would be recorded as 2.5, and would fall in SC 1; a trunk measured as 11.6 cm would be recorded as 12, and would fall in SC3; and a trunk measuring exactly 12.0 cm would be recorded as 12.
8. Follow DBH measurement specifications are provided in Section 3.0.
9. Size classes for mesquite and *Tamarix* are as follows: Size Class (SC)1 is ≤3 m tall; SC2 is >3 m tall.
10. Diameter classes (DC) for mesquite, *Tamarix* spp., and *Baccharis salicina* (willow baccharis, BACSAL1) and *Baccharis salicifolia* (mule's fat, BACSAL2) stems are as follows: DC 1 is ≤2.5 cm diameter; DC2 is 2.51 – 5.0 cm diameter; DC3 is 5.01 – 8.0 cm diameter; DC4 is 8.01 to 12 cm diameter; DC5 is 12.1 – 20 cm diameter; and DC6 is 20.01- 40 cm diameter. **Diameter class is determined at 10 cm above ground surface**. **No true measurements are recorded; it may be necessary to use the calipers on some stems to obtain a search image for stem size classes,**

but it is not anticipated that all stem diameters will be measured with calipers. NOTE: tree size classes and stem size classes are NOT identical.

11. Height classes for all trees are as follows:
    1. Height Class 1 – 0.1-1.5 meters
    2. Height Class 2 – 1.6-3.0 meters
    3. Height Class 3 – 3.1-6.0meters
    4. Height Class 4 – 6.1-12.0 meters
    5. Height Class 5 – 12.1-20.0 meters
    6. Height Class 6 – >20 meters

2.2 Datasheets 1-2 (Hits to Pole, Canopy Closure, Felled Trees, Snags, and Cavities)

1. On each sheet, enter the date, site location, section, and observers.
2. Measure the canopy closure using a convex densiometer. Proceed to points D1 through D9. Place the densiometer level on top of a post, 1.2 m directly above the D points. Count the number of hits for either vegetation (including both live and dead branches/trees) or open sky at each line intersection AND corners. Write the number of hits in the Canopy Closure Section. The total number of hits recorded sums to 37. The orientation of the densiometer measurements is as follows: D1) face "up" the plot; D2-D5) face out from plot center; D6-D9) face plot center.
3. Conduct hits to pole surveys at D1 through D9. At each location, extend the stadia rod vertically to a height slightly above the canopy, or to its full extent if required.
4. From 0 to 7 m, count the number of hits per meter by species and in one "All" category. A "hit" occurs when LIVE plant material (leaves or live stem, defined as a stem where green foliage is present above) is within 10 cm of the center of the rod for a given 10 cm interval.
5. For 7-8 m and each meter layer above, estimate if the number of hits per meter is 0, less than or equal to 5, or greater than 5.
6. When no more hits are encountered, place a "0" in the final blank, and line out spaces for subsequent meter layers.
7. A level should be rested against the side of the stadia rod to ensure it is vertical.
8. Note if any felled trees were observed in the plot, and if they are dead (no green stems or foliage) or alive.
    a. Felled trees are defined as trees where a main trunk is fallen or broken, thereby reducing the height of the tree, but the broken segment of the tree remains attached to the trunk.
    b. Felled trees, if alive, were already recorded in the standard trees datasheets based on DBH of the largest diameter remaining live shoot (for standard trees) or the tallest remaining live shoot (mesquite or Tamarix).
9. Determine the number of dead shrubs, including BACSAL, but excluding PLUSER in the B Plot Record the total number on datasheet 1.

10. Determine the presence of snags [dead trees in SC 4-6 (DBH> 12.0 cm)] regardless of species within the A Plot. Tally by SC on Datasheet 2.
11. If snags have cavities, count and record the number of cavities and record the SC and UTMs of those snags.

2.3 Datasheet 3 (Standard trees; excluding Salexi SC 1 and 2)

1. Survey the entire A Plot area for standard trees (including SALEXI with DBH>12.0cm) with a DBH greater than 12 cm (SC4 and above).
    a. Measure and record height and DBH (rounded up to the nearest 0.5 cm) for five trees of size class of each species that represent the size range observed in the plot for the given species/size class. If trees are shorter than the length of the stadia rod, use the rod to measure height to the nearest tenth of a meter. If trees are taller than the stadia rod, use a clinometer to estimate tree heights to the nearest ½-meter (refer to Section 4.0 for clinometer instructions).
        i. For each measured tree recorded in the A Plot, put a check mark in the adjacent column IF that tree is also within the B Plot area. If it is not within the B Plot area, record a zero in the cell.
        ii. Record the species AND SC in the column header.
    b. After five trees are recorded, dot tally all remaining trees in the appropriate grid by SC and Height Class. If a tallied tree from the A Plot also falls in the B Plot, make sure to record the dot tallies in the area designated "In B Plot" on each grid.
    c. After a tree is recorded, chalk and/or flag it to prevent re-measuring during A Plot OR B Plot surveys.

2. Survey the B Plot for standard trees with a DBH of <12 cm (SC1 through SC3), including SALEXI with a DBH between 8.1 cm and 12 cm (SC 3).
    a. Collect data as for the A Plot—DBH rounded up to the nearest 0.5 cm and height to the nearest 0.1 m for five representative individuals for each species-SC combination, Size Class/Height Class tally for additional individuals. Note that all trees in SC 4 (DBH >12 cm) have already been measured and a check mark was recorded if the tree occurred within the B Plot area.
    b. Trees shorter than 1.4 m (breast height) in the B Plot will be recorded with a DBH of "0". Trees ≥1.4 m tall with branching or non-woody stems at breast height will be recorded with a DBH of 0.5.
    c. As for the A Plot, Border 1 and 2 are "in" for the B Plot.

3. Survey the B plot for dead SC3 trees and write the count in the tally box. SC based on DBH, regardless of species.

2.4 Datasheet 4 [Mesquite species and Tamarix]

1. Survey the entire A Plot area for mesquite trees and *Tamarix* spp. that are >3 m tall (SC2).
    a. Measure and record heights of five trees per species that represent the size range observed in the plot. As for standard trees, tree height will be recorded to the nearest tenth of a meter if the tree is shorter than the stadia rod. If the tree is taller than the stadia rod, estimate height to the nearest half meter using a clinometer. Record the number of stems in each Diameter Class for each individual.
    b. After the 5 measured tree heights, record a height class for each tree. Record the number of stems in each Diameter Class for each individual.
2. After a tree is recorded, chalk and/or flag it to prevent re-measuring during A Plot OR B Plot surveys.
3. For each tree recorded in the A Plot, put a check mark in the adjacent column IF that tree is also within the B Plot area. If it is not within the B Plot area, record a zero in the cell.
4. Survey the entire B Plot area for mesquite trees or saltcedar that are less than 3.01 m tall.

a. Collect mesquite and saltcedar data as for the A Plot—height and number of stems in each diameter class for five representative individuals, Height Class and number of stems in each Diameter Class for additional individuals. Note that all SC2 mesquite and saltcedar plants (greater than 3 m tall) have already been measured.

5. As for the A Plot, Border 1 and 2 are "in" for the B Plot.

Record the required information for ALL TREES. Attach additional sheets as necessary.

2.4 Datasheet 5 [Willow baccharis (BACSAL1) and mule's fat (BACSAL2)]

1. Survey the B Plot area for *Baccharis salicina* and *B. salicifolia*.
    a. Determine whether the individual is *B. salicina* or *B. salicifolia* and denote BACSAL1 or BACSAL2 on the datasheet.
    b. For five representative individuals, record the shrub height to the nearest 0.1 m, and tally the number of stems in each DC.
    c. For all additional BACSAL, record the Shrub Class (height to nearest 0.5 m) and the number of stems in each DC.

2.6 Datasheet 6 (B Plot Shrubs, SC2 SALEXI, Incidental Species, Gaps)

1. Survey the entire B Plot area for shrub species, <u>NOT</u> including BACSAL, PLUSER or SALEXI (remember SALEXI is always considered a tree under this monitoring protocol not a shrub).
    a. Measure and record height (to the nearest tenth of a meter) for five individuals of each species that represent the size range observed in the plot for the given species. After five shrubs of each species are measured and recorded, dot tally all additional individuals of each species by shrub classes (height to the nearest 0.5m). As for the A Plot, Border 1 and 2 are "in" for the B Plot and each quadrant within.
2. B1 and B3 (SALEXI SC2 and Dead trees SC2)

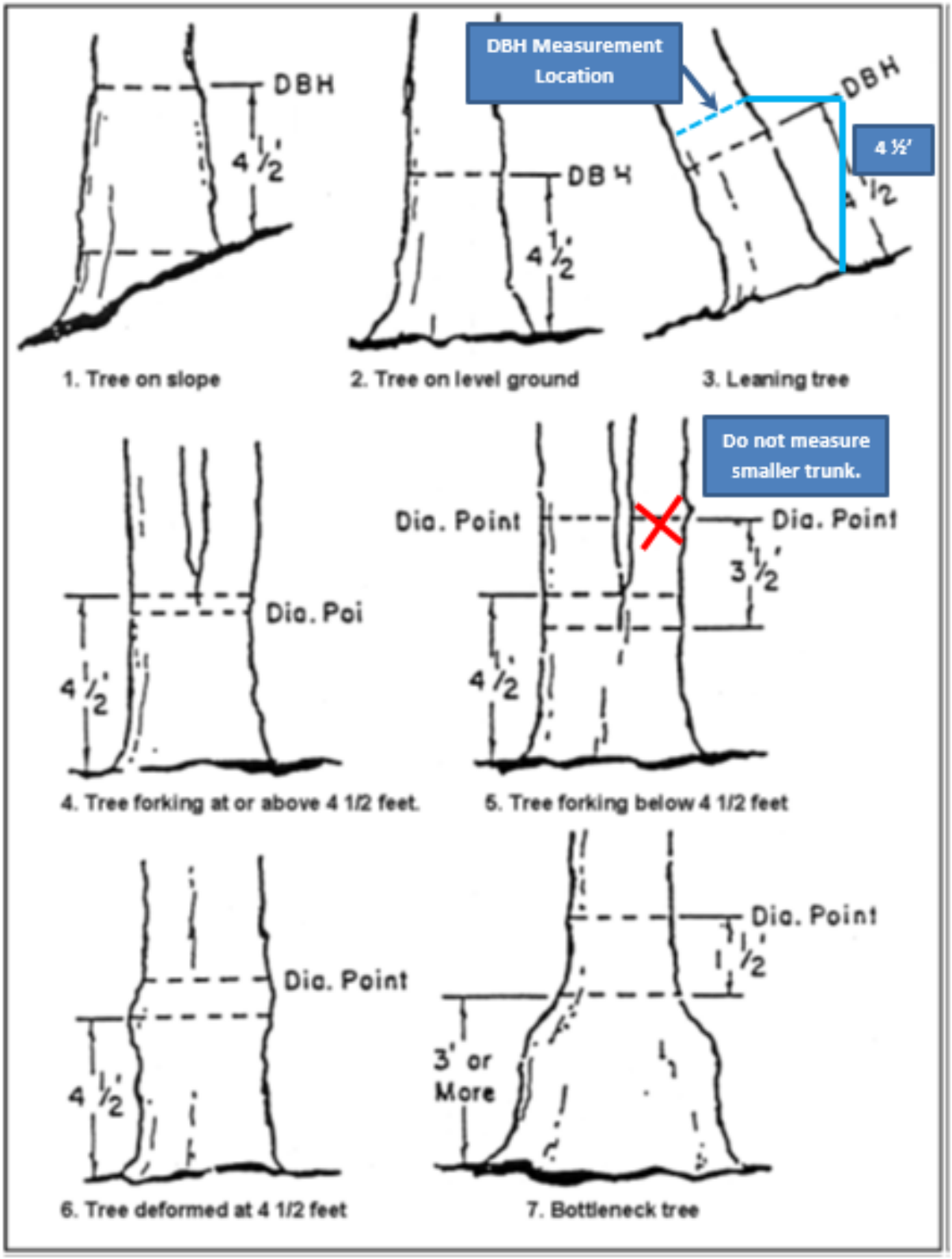
   a. Record measured heights for 5 representative SALEXI SC2 trees (i.e. stems separated where emerging from the ground surface) in B1 and B3 quadrants of the B Plot. For the remaining SALEXI SC2, dot tally by Height Class.
   b. Dot tally Dead SC2 trees (all species combined) in B1 and B3 (NOT by Height Class).
3. Record all "incidental" species. This list will include ALL species observed in the primary plot which are not recorded otherwise.
4. Determine the presence of or open canopy space (gaps) with an area of greater than or equal to 9 square meters (e.g. 3 m by 3 m) within 30 m of **Plot Center**. "Gap" is defined as without foliated vegetation greater than 3 m off the ground surface. Number each gap, place in distance category (using the distance to the edge of the canopy gap from plot center), denote whether it is a Canopy Gap (space within the planted area) or Edge Gap (open space outside of planted area, e.g. road, edge of field, stream edge), and record UTM coordinates of the center (Canopy Gap) or edge (Edge Gap). If no gaps exist within 30 m of Plot Center, write "None" and put a "0" in the distance category box.

3.0 DBH Measurement Specifications

DBH measurements will generally follow US Forest Service Standard Stand Exam guidelines, which are interpreted in the following figure (modified from http://www.nmsu.edu/~nmffa/Documents/CDEs/2010%20Foresty%20Materials/Measurement_of_Tree_Diameter.pdf). However, for the MSCP, we will be following different protocols for Cases 3 and 5.

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

- Case 1: Tree on a slope.
  - Tree DBH shall be recorded 1.4 m above the ground surface on the upslope side of the tree.
- Case 2: Tree on level ground.
  - Standard case. Record DBH for 1.4 m above ground surface.
- Case 3: Leaning tree (and felled, but re-growing tree; DIFFERENT FROM FIGURE).
  - **Record DBH at 1.4 m above ground surface.** Measure diameter perpendicular to the direction of tree growth at that level, as illustrated in the figure.
- Case 4: Tree forking at or above 1.4 m (the fork is incomplete at 1.4 m).
  - Measure DBH below the split as near as possible to 1.4 m, but beneath trunk irregularities occurring due to the split.
- Case 5: Tree fork completed below 1.4 m (DIFFERENT FROM FIGURE).
  - Measure the diameter of the **LARGEST TRUNK** at BH or as near BH as possible while avoiding trunk irregularities caused by the trunk split.
- Case 6: Tree irregularity at DBH.
  - Measure DBH away from irregularity, but as near to 1.4 m as possible (can be either immediately above or below).
- Case 7: Bottleneck tree.
  - Treat as you would a tree irregularity. Increase the height at which diameter is measured to be above the zone of irregularity.
- Oval tree trunks.
  - When oval trunks are present at DBH, use a DBH tape to measure DBH and/or place the tree into the appropriate size class.


DBH
4 ½'
1. Tree on slope
DBH Measurement Location
DBH
4 ½'
2. Tree on level ground
DBH
4 ½'
4 ½'
3. Leaning tree
Dia. Poi
4 ½'
4. Tree forking at or above 4 1/2 feet.
Do not measure smaller trunk.
Dia. Point
Dia. Point
3 ½'
4 ½'
5. Tree forking below 4 1/2 feet
Dia. Point
4 ½'
6. Tree deformed at 4 1/2 feet
Dia. Point
1 ½'
3' or More
7. Bottleneck tree

4.0 Clinometer Methods

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

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

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

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

4. Reference the clinometer table to estimate the height of the tree above eye height for the given distance from tree foliage column.

5. Correct for the observer's eye height:

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

Clinometer calculations (degrees)

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

ATTACHMENT 4

2014 Field Data Sheets

LCR-MSCP Vegetation Monitoring **Datasheet 1: Hits to Pole, Canopy Closure, Felled Trees, and Dead Shrubs**

Date _____ Area _____ Site _____ Section _____

Observers _____

Hits to Pole (D1-D4)

Record number of decimeter 'hits to pole' (within 10cm radius) for each meter layer, at collection points D1-D5 up to 7m . Meter layers above 7 meters will be estimated using 0, <5, or >5 hits per meter layer (not decimeter layer).

D1					D2					D3					D4				
Hits by Species					Hits by Species					Hits by Species					Hits by Species				
	ALL					ALL					ALL					ALL			
0_1					0_1					0_1					0_1				
1_2					1_2					1_2					1_2				
2_3					2_3					2_3					2_3				
3_4					3_4					3_4					3_4				
4_5					4_5					4_5					4_5				
5_6					5_6					5_6					5_6				
6_7					6_7					6_7					6_7				
Estimates					Estimates					Estimates					Estimates				
7_8					7_8					7_8					7_8				
8_9					8_9					8_9					8_9				
9_10					9_10					9_10					9_10				
10_11					10_11					10_11					10_11				
11_12					11_12					11_12					11_12				
12_13					12_13					12_13					12_13				
13_14					13_14					13_14					13_14				
14_15					14_15					14_15					14_15				
15_16					15_16					15_16					15_16				
16_17					16_17					16_17					16_17				
17_18					17_18					17_18					17_18				
18_19					18_19					18_19					18_19				
19_20					19_20					19_20					19_20				
20_21					20_21					20_21					20_21				
21_22					21_22					21_22					21_22				
22_23					22_23					22_23					22_23				
23_24					23_24					23_24					23_24				

Felled Trees

Are there felled trees in the plot? Choose only one.

Yes?		No?	

If so, how many, and are they dead or alive?

# alive	
# dead	

Dead Shrubs

Tally **Dead** shrubs (all together, NOT by species); **INCLUDING Bacsal.**
DO NOT include Pluser or Salexi stems.

Closure: Record number of cross hairs/corners covered with vegetation and/or sky (37 total). Record as live/total.

	D1	D2	D3	D4	D5	D6	D7	D8	D9
Canopy									
Sky									

LCR-MSCP Vegetation Monitoring **Datasheet 2: Hits To Pole, Snags, Cavities, Tallies**

Date _____ Area _____ Site _____ Section _____

Observers _____

Hits to Pole (D5-D9)

Record number of decimeter 'hits to pole' (within 10cm radius) for each meter layer, at collection points D1-D5 up to 7m . Meter layers above 7 meters will be estimated using 0, <5, or >5 hits per meter layer (not decimeter layer).

D5					D6					D7					D8					D9				
Hits by Species					Hits by Species					Hits by Species					Hits by Species					Hits by Species				
	ALL					**ALL**					**ALL**					**ALL**					**ALL**			
0_1					0_1					0_1					0_1					0_1				
1_2					1_2					1_2					1_2					1_2				
2_3					2_3					2_3					2_3					2_3				
3_4					3_4					3_4					3_4					3_4				
4_5					4_5					4_5					4_5					4_5				
5_6					5_6					5_6					5_6					5_6				
6_7					6_7					6_7					6_7					6_7				
Estimates					Estimates					Estimates					Estimates					Estimates				
7_8					7_8					7_8					7_8					7_8				
8_9					8_9					8_9					8_9					8_9				
9_10					9_10					9_10					9_10					9_10				
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23_24					23_24					23_24					23_24					23_24				

Snags	Cavities	Tallies			#	DBH	#Cavities	Easting	Northing
Dot tally snags (i.e. dead trees) by DBH SC's 4-6. SC4) 12.01-20cm SC5) 20.01-40cm SC6) ≥40.01cm	If a snag has a cavity, record # of cavities in each snag, the DBH, and GPS location of the snag.	SC4	SC5	SC6					

LCR-MSCP Vegetation Monitoring Date _____ Section _____ **Datasheet 3: Standard trees (Popfre, Salgoo, Salexi)**

Area _____ Site _____

Observers _____

Record 5 trees' heights and DBH (per species/SC); remaining trees are dot tallied by height class and size class. Measured tree heights should be representative of variation in habitat. Record Salexi SC3 and SC4 on this sheet. Tally **DEAD** in SC3 (all spp. comb. incl. Msq/Tam).

A Plot - **SC4, SC5, SC6** Standard Trees - **Incl. Salexi SC4**

	Spp/SC															
	Tree #	DBH	HT(m)	In B	DBH	HT(m)	In B	DBH	HT(m)	In B	DBH	HT(m)	In B	DBH	HT(m)	In B
Measured	1															
	2															
	3															
	4															
	5															

SC4) 12.1-20.0cm **SC5)** 20.1-40.0cm **SC6)** 40.1-50.0cm

B Plot - **SC3** Standard Trees - **Incl. Salexi SC3**

	Spp/SC										
	Tree #	DBH	HT(m)	DBH	HT(m)	DBH	HT(m)	DBH	HT(m)	DBH	HT(m)
Measured	1										
	2										
	3										
	4										
	5										

SC3) 8.1-12.0cm

B Plot - **SC1, SC2** Standard Trees - **DO NOT incl. Salexi SC1 or SC2**

	Spp/SC										
	Tree #	DBH	HT(m)	DBH	HT(m)	DBH	HT(m)	DBH	HT(m)	DBH	HT(m)
Measured	1										
	2										
	3										
	4										
	5										

SC1) ≤2.5cm **SC2)** 2.51-8.0cm **HC1** 0.1-1.5m; **HC2** 1.6-3.0m **HC3** 3.1-6.0m; **HC4** 6.1-12.0m **HC5** 12.1-20.0m; **HC6** 20.1-35.0m

Popfre

Tally	SC1	SC2	SC3	SC4	SC5	SC6
HC1 (0.1-1.5m)				In B Plot	In B Plot	In B Plot
HC2 (1.6-3.0m)				In B Plot	In B Plot	In B Plot
HC3 (3.1-6.0m)				In B Plot	In B Plot	In B Plot
HC4 (6.1-12.0m)				In B Plot	In B Plot	In B Plot
HC5				B	B	B
HC6				B	B	B

Salgoo

Tally	SC1	SC2	SC3	SC4	SC5	SC6
HC1 (0.1-1.5m)				In B Plot	In B Plot	In B Plot
HC2 (1.6-3.0m)				In B Plot	In B Plot	In B Plot
HC3 (3.1-6.0m)				In B Plot	In B Plot	In B Plot
HC4 (6.1-12.0m)				In B Plot	In B Plot	In B Plot
HC5				B	B	B
HC6				B	B	B

Salexi

Tally	SC3	SC4
HC1		In B Plot
HC2		In B Plot
HC3		In B Plot
HC4		

Dead

SC3
Tally all **Dead** trees in SC3; smaller SC's tallied elsewhere.

LCR-MSCP Vegetation Monitoring **Datasheet 4: Mesquite and Tamarix**

Date __________ Area ____________________ Site ____________________ Section ______________

Observers ____________________

	Mesq/Tam Plot A - SC2 (>3.0m Ht)																								Mesq/Tam Plot B - SC1 (≤3.0m Ht)																				
Spp																																													
		Tally								Tally								Tally								Tally							Tally							Tally					
Tree #	HT(m)	DC1	DC2	DC3	DC4	DC5	DC6	In B	HT(m)	DC1	DC2	DC3	DC4	DC5	DC6	In B	HT(m)	DC1	DC2	DC3	DC4	DC5	DC6	In B	HT(m)	DC1	DC2	DC3	DC4	DC5	DC6	HT(m)	DC1	DC2	DC3	DC4	DC5	DC6	HT(m)	DC1	DC2	DC3	DC4	DC5	DC6
Measured 1																																													
2																																													
3																																													
4																																													
5																																													
#	HC	DC1	DC2	DC3	DC4	DC5	DC6	In B	HC	DC1	DC2	DC3	DC4	DC5	DC6	In B	HC	DC1	DC2	DC3	DC4	DC5	DC6	In B	HC	DC1	DC2	DC3	DC4	DC5	DC6	HC	DC1	DC2	DC3	DC4	DC5	DC6	HC	DC1	DC2	DC3	DC4	DC5	DC6
6																																													
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30																																													
31																																													

Record measured height for 5 trees of each mesquite species and saltcedar in each size class. For all remaining trees record the height class. Mesquite and saltcedar stems are dot tallied by diameter class; no measured stems. Only count the stems of mesquite and saltcedar when the split is complete by 10 cm and only when it is a true split. Check the 'In B' box if an A Plot tree is also in B Plot; put

HC1 = 0.1-1.5m; **HC2** = 1.6-3.0m; **HC3** = 3.1-6.0m; **HC4** = 6.1-12.0m; **HC5** = 12.1-20.0; **HC6** = 20.1-35.0m

DC1 = ≤2.5cm; **DC2** = 2.51-5.0cm; **DC3** = 5.1-8.0cm; **DC4** = 8.1-12.0cm; **DC5** = 12.1-20.0cm; **DC6** = 20.1-40.0 **NOTE: DC VALUES AREN'T THE SAME AS SC VALUES.**

LCR-MSCP Vegetation Monitoring **Datasheet 5: BACSAL**

Date _____ Area _____ Site _____

Observers _____ Section _____

	#	HT(m)	Tally DC1	Tally DC2	Tally DC3
Measured	1				
	2				
	3				
	4				
	5				
	#	Shrub Class	DC1	DC2	DC3
	6				
	7				
	8				
	9				
	10				
	11				
	12				
	13				
	14				
	15				
	16				
	17				
	18				
	19				
	20				
	21				
	22				
	23				
	24				
	25				
	26				
	27				
	28				
	29				
	30				
	31				

BACSAL (Cont.)

#	Shrub Class	Tally DC1	Tally DC2	Tally DC3
32				
33				
34				
35				
36				
37				
38				
39				
40				
41				
42				
43				
44				
45				
46				
47				
48				
49				
50				
51				
52				
53				
54				
55				
56				
57				
58				
59				
60				
61				
62				
63				

BACSAL (Cont.)

#	Shrub Class	Tally DC1	Tally DC2	Tally DC3
64				
65				
66				
67				
68				
69				
70				
71				
72				
73				
74				
75				
76				
77				
78				
79				
80				
81				
82				
83				
84				
85				
86				
87				
88				
89				
90				
91				
92				
93				
94				
95				

Record measured height for 5 Bacsal shrubs. For all remaining individuals record the shrub height class. Bacsal stems are dot tallied by diameter class; no measured stems. Only count the stems of Bacsal when the split is complete by 10 cm and only when it is a true split.

For shrub class, enter one of the following: **0.5m, 1.0m, 1.5m, 2.0m, 2.5m, 3.0m, 3.5m, 4.0m, 4.5m, 5.0m, 5.5m**

DC1 = ≤2.5cm; **DC2** = 2.51-5.0cm **DC3** = 5.1-8.0cm **NOTE: DC VALUES AREN'T THE SAME AS SC VALUES.**

LCR-MSCP Vegetation Monitoring **Datasheet 6 - Shrubs, SC2 Salexi, Dead SC2 Trees, and Incidentals**

Date _____ Area _____ Site _____ Section _____

Observers _____

Record the **measured** height for 5 individuals of each species to the nearest **0.1 m**. Dot tally additional individuals to the nearest **0.5 m.**

DO NOT RECORD PLUSER or BACSAL HERE

Plot B - Shrub Species

	Species					
	Shrub #	HT(m)	HT(m)	HT(m)	HT (m)	HT(m)
Measured	1					
	2					
	3					
	4					
	5					

Dot Tallies

Species					
0.5					
1.0					
1.5					
2.0					
2.5					
3.0					
3.5					
4.0					
4.5					

B1 and B3 - Salexi SC2 trees and all SC2 Dead trees

Measure height and DBH for **SALEXI** in **SC2**.

Dot tally dead trees in SC2 (all species combined); NOT by HC.

Salexi	Quadrant	DBH (cm)	HT (m)	Tally
SC2 2.51-8.0cm	B1			B1
	B3			B3

Dot tally remaining Salexi **SC2** trees by height class.

		Tally **Salexi SC2** (2.51-8.0cm)
HC1 0.1-1.5m	B1	
	B3	
HC2 1.6-3.0m	B1	
	B3	
HC3 3.1-6.0m	B1	
	B3	
HC4 6.1-12.0m	B1	
	B3	

Incidental species

Record all species that are within Plot A that were NOT recorded anywhere else within the plot. No additional data need to be collected on the species listed in this box.

Distance to Gap

Estimate distance to all gaps ≥9 square meters (e.g.3x3m) that are within 30 meters of plot center; gap defined as no foliated vegetation greater than 3m from the ground. Next, estimate gap size, and take GPS point at gap center.

Distance from center categories: 1= <3m, 2= 3-6m, 3= 6.1-9m, 4= 9.1-12m, 5= 12.1-30m.

Gap Size estimate: write in an estimated size, for example, 2x5m or 3X3m; if edge put road, field, river, or other. C or E: Record if gap is canopy or edge; UTM pt at gap center or if edge, then at edge of habitat.

Gap Num	Dist Catg	Size Est	C or E	Easting	Northing

ATTACHMENT 5

2014 Field Instructions for Mobile Electronic Field Forms

2014 Modified Intensive Plot Method Field Instructions:

Vegetation Monitoring at Lower Colorado River Multi-species Conservation Program Habitat Creation and Existing Riparian Sites – Mobile Electronic Field Form Version

Updated September 2014

Plot Setup

Setup Instructions—PLOTS NOT PREVIOUSLY MARKED:

1. Use GPS to navigate to plot center marker.
2. Determine the azimuth bearing ("Bearing 1") for the long plot edge (Borders 2 and 4). Note that the same bearing is used for all of the plots in a phase.
3. Subtract 90° to determine the azimuth bearing ("Bearing 2") for the short plot edge (Borders 1 and 3).
4. From the plot center, use a compass to line up the measuring tape with Bearing 2 between the plot center and A Plot Border 4.
5. With one person holding the coiled tape at the plot center, pull the 0 mark on the tape out 5 meters to the midpoint of A Plot Border 4. Check the bearing of this line with a compass. Place a pin flag at this location—the midpoint of A Plot Border 4.
6. With one person staying at the midpoint of A Plot Border 4, extend the tape to 10 m total (5 m from plot center) along the bearing line. Place a pin flag at the 10 m mark (the midpoint of A Plot Border 2).
7. Add pin flags at the: 1 m (point D5), 2.5 m (double flag, midpoint of B Plot Border 4), 5 m (plot center/D1), 7.5 m (double flag, midpoint of B Plot Border 2), 9 m (D3)and 10 m (midpoint of A Plot Border 2). Place two pin flags each at 0 m, 2.5 m, 7.5 m, and 10 m.
8. Reel in the tape and move to the midpoint of A Plot Border 2. Determine the direction of Bearing 1 from this location. Have one person stand at this location with the reeled tape and compass, and the second person extend the tape 20 m down A Plot Border 2 to Corner 1-2[1].
9. Once the tape has been extended to 20 m, backsight the tape at several locations to ensure that the azimuth remains at Bearing 1.
10. Anchor the 0 m mark of the tape at Corner 1-2[1]. Place double pin flags at the 12.5 m mark of Border 2.
11. Continue extending tape along Bearing 1 to the 40 m mark of Border 2 (Corner 2-3[1]). Place double pin flags at the 27.5 m mark of Border 2.
12. From Corner 2-3[1], extend the tape on Bearing 2 for 10 m along Border 3 to reach Corner 3-4[1]. Mark this plot corner.
13. From the 27.5 m mark of Border 2, extend the tape 10 m along Bearing 2. Place pin flags at 2.5 m, 5 m (double flag), 7.5 m, and 10 m (double flag). Reel in the tape.
14. Repeat 14 for the 12.5 mark of Border 2.
15. Fill in pin flags along A Plot and B Plot borders.
16. Mark D6-D9 on the corners of the A Plot.
17. From Plot Center, extend the tape 4 m in each direction along Bearing 1 (this should direct you toward double flags on Border 1 and Border 3 of the B Plot) and place a pin flag at these two points (D2 and D4).

Mobile Electronic Field Form (MEFF) Background

1. The Lower Colorado River Multi-Species Conservation Program (LCR MSCP) Data Management Group has developed a series of mobile electronic field forms (MEFFs) to capture the LCR MSCP vegetation protocol in Trimble® TerraSync™ software. Under the Trimble® file structure model, a series of individual features are grouped into a single rover (or data) file (typically .ssf or .cor depending on whether or not the data were post-processed using differential correction). A Trimble® "data dictionary" file (.ddf) establishes the data format, the type of features logged, etc. for a particular data (rover) file. Data dictionaries can be developed as templates with certain parameters and filters to ensure that quality and consistent data are collected across users in the field. As this document explains, you'll save a rover file and select the appropriate data dictionary reference depending on the particular survey intensity employed and the collection point.
2. The LCR MSCP Data Management Group has also developed a user manual titled, "LCR MSCP Mobile Electronic Field Form Guidebook – Vegetation" (or "MEFF Guidebook" hereafter). Use that source as a guide to manage and transfer Trimble data dictionaries received from the Data Management group, as well as, using specific forms, QA/QC, and managing data after you return to the office.
3. Two data dictionaries are required for capturing the mandatory field data for an Enhanced plot, as shown in the following list of data dictionaries:
    - Enhanced – Hits to Pole (HTP): Data dictionary that is used to enter data from D Collection Points at an Enhanced Plot. Only canopy closure (densiometer) and vertical foliage volume (hits to pole) measurements are recorded in this data dictionary.
    - Enhanced – Other (OTH): Data dictionary that is used for entering data collected at the A, B, C, and E collection points. This dictionary establishes the format for capturing all of the data required at an Enhanced Plot at each of the Collection Points besides D1-D9.
4. In addition to completed MEFF forms, **two hardcopy pages are required for every field plot – the hardcopy checklist/tally sheet (hardcopy Page 1) and the Hits To Pole 'All' sheet (Page 2).** Directions for how to use these hardcopy pages are discussed later in this document.
5. A **hardcopy checklist** has been developed to prevent gross oversights (e.g. skipping an entire collection point or a mandatory component within a collection point) during electronic field data acquisition. The checklist serves as a paper trail to verify that fieldwork and post-field QA/QC were completed for the specific data collection component. During fieldwork, ensure that the checklist datasheet is entirely filled out prior to moving on to the next collection point or next plot. Clean, complete, and legible hardcopy checklists need to be maintained for each measured plot. These will be delivered to MSCP at the end of the field season.
6. **•Place a minus (-) on the hardcopy checklist to denote absence of a feature in the plot (triggering a NONE feature on the GPS). If the feature is present in the plot, record a check mark (√).**

7. Each plot measured needs to have a **COMPLETE** Trimble® data file associated with the plot. The hardcopy checklist is meant to be used as a guide to ensure that a full series of forms was captured for the plot. Even if certain mandatory components are not present in the monitoring plot, a feature should still be created to acknowledge that the collection point or mandatory plot component wasn't skipped altogether in the field (similar to crossing something off a hardcopy datasheet). The pre-established protocol for logging a blank feature is specifically listed for each GPS form later in this document.
8. The hardcopy checklist sheet also includes a space for tallying trees/shrubs/stems and other plot components that are tallied or dot counted through the plot data collection process and then only entered into the GPS unit once, after all of the tallying is completed.
9. Page 2 of the hardcopy sheets include a section for determining 'All' hits to pole intercepts for each meter layer measured at the D collection points. **Using the ALL HTP hardcopy datasheet is mandatory**. Regardless of whether or not you need it in the field, it's important for QA/QC on the back end.
10. A "**cheat sheet**" has also been developed to serve as a quick reference for the specific value ranges that define various diameter, height, distance, cover, or size classes. The cheat sheet also includes a table referencing tree heights determined via the clinometer.

Survey Protocols

General Notes

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

2. If serious management issues are observed, like the presence of noxious weeds or frequent planting stress and/or mortality for example, notify the Field Supervisor, who will then notify the Project Supervisor. MSCP will be notified of these observations ASAP.

3. Record a photograph on the GPS for species recorded as Unknown in the field.

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

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

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

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

8. Size classes for standard trees are designated by DBH as follows: SC 1 is ≤2.5 cm DBH; SC2 is 2.5 – 8 cm DBH; SC3 is 8.1 – 12 cm DBH; SC 4 is 12.1 to 20 cm DBH; SC5 is 2.1 – 40 cm DBH, SC6 is 40.1 – 50 cm DBH, SC7 is 50.1 – 80 cm; and SC 8 is >80 cm DBH. All DBH measurements will be ROUNDED UP to the next 0.5 cm interval. For example, a trunk that measures 2.1 cm would be recorded as 2.5, and would fall in SC 1; a trunk measured 11.6 cm would be recorded as 12, and would fall in SC3; and a trunk measuring exactly 12.0 cm would be recorded as 12.

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

10. Size classes for mesquite and *Tamarix* are as follows: Size Class (SC) 1 is ≤3 m tall; SC2 is >3 m tall.

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

12. *Baccharis salicina* is considered BACSAL1 while *Baccharis salicifolia* is considered BACSAL 2.

13. Height classes for all trees are as follows:

1. Height Class 1 – 0.1-1.5 meters
2. Height Class 2 – 1.6-3.0 meters
3. Height Class 3 – 3.1-6.0 meters
4. Height Class 4 – 6.1-12.0 meters
5. Height Class 5 – 12.1-20.0 meters
6. Height Class 6 – > 20 meters

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

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

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

17. **Many of the Species dropdowns throughout the data dictionaries create "New", "Unknown" and/or "Other" as potential selections. If these are selected, a space for recording additional species information (in the case of unknowns), or a six digit species acronym when is not available on the dropdown for a known species (in the case of Other or New) . It is mandatory that you enter the species Acronym or notes in the case of Unknowns to later determine which species the measurements correspond with.**

D COLLECTION POINTS – HTP Data Dictionary

1. Create a new data file, **name the file according to file naming standards from the MEFF Guidebook**, and make sure to select the HTP data dictionary from the Dictionary Name dropdown. **A list of the plot names has also been provided to each crew. Please conform to these conventions when naming files on the GPS.**
2. There are two primary measurement components at the D collection points – Canopy Closure and Hits to Pole. Individual forms have been developed for each of the primary measurement components that are specific to the nine D Collection Points (D1-D9). Navigate to each collection point and enter both measurement components into the appropriate feature (form) on the Trimble®.
3. Measure the canopy closure using a convex densiometer. Proceed to points D1 through D9. Place the densiometer level on top of a post, 1.2 m directly above the D points. Count the number of hits for either vegetation (<u>including both live and dead branches/trees</u>) or open sky at each line intersection AND corners. Note that the total number of "crosshairs" plus corners assessed sums to 37. Always enter the total number of **open sky** hits into Trimble® form. The orientation of the densiometer measurements is as follows: D1) face "up" the plot; (D2-D5) face out from plot center, (D6-D9) face "in" towards the center of the plot.
4. Conduct hits to pole surveys at D1 through D9. At each location, extend the stadia rod vertically to a height slightly above the canopy, or to its full extent if required. A level should be rested against the side of the stadia rod to ensure it is vertical.
5. From 0 to 7 m, count the number of hits per meter <u>by species.</u> When more than one species is present within a meter, tally the total hits into the <u>"All"</u> category. When more than one species is present, we recommend recording hits for the "All" category on a hardcopy datasheet initially. After the hits to pole measurements are complete for each species at the collection point, enter the tallied values for "All" into the Trimble®.
6. An individual feature should be developed for every meter layer that contains foliage that is intercepted during the hits to pole measurements. There are dropdowns available for up to 6 species within the meter layer. So in practice - create a new feature, select the meter layer that is being measured from the dropdown, select the first species, enter the number of hits for that species within the meter layer, and then follow that same procedure for each additional species in the meter layer. After all individual species are recorded for the meter layer, enter the information for "All" species, which represents the total number of decimeter sections that contained a hit, regardless of species. After all hits are recorded for the meter layer, close that feature, and create a new feature for the next meter layer.

7. The "All" category measures the total number of hits within the meter layer. Note that this is not the sum of all species combined but rather the total number of decimeter intervals that contain a hit, regardless of species.
8. A "hit" occurs when LIVE plant material (leaves or live stem) is within 10 cm of the center of the rod for a given 10 cm interval.
9. For 7-8 m and each meter layer above above, estimate if the number of hits per meter is 0, less than or equal to 5, or greater than 5.
10. **If no hits are present at the CP, select NONE and ML 0_1 from the dropdowns and save the feature.**
11. Update the hardcopy checklist as data are captured at each collection point by checking the box as the collection point is completed.
12. Use the hardcopy checklist to double-check that canopy closure and hits to pole measurements were completed at each of the D Collection Points (D1-D9) and double-check that a feature was created and attributed for each collection point on the GPS. Close the data file and move on to the next series of Collection Points.

OTH Data Dictionary

1. Create a new rover (data) file and name the file **per the MEFF Guidebook** instructions. Use the OTH data dictionary this time when selecting the Dictionary Name. **A list of the plot names has also been provided to each crew. Please conform to these conventions when naming files on the GPS.**
2. A Trimble® data file established with the OTH data dictionary contains a feature for each of the remaining data collection components captured in the plot.

Collection Point A

'Trees – Measure A' Form

1. Survey the entire A Plot area for standard trees (including SALEXI with DBH>12.0cm) with a DBH greater than 12 cm (SC4 and above).
    a. Measure and record height (to the nearest tenth of a meter) and DBH for five trees of size class of each species that represent the size range observed in the plot for the given species/size class. If trees are shorter than the length of the stadia rod, use the rod to measure height to the nearest tenth of a meter. If trees are taller than the stadia rod, use a clinometer to estimate tree heights to the nearest ½-meter (per clinometer instructions presented later in this document).
        i. For each measured tree recorded in the A Plot, record if tree is also within the B Plot area.
        ii. To enter this information on the Trimble®, create a new 'Trees – Measure' feature, select the appropriate species and size class from the dropdown, and enter the height and dbh**.** The form allows the dbh and height to be entered for five individuals of each species/size class combination. Five measured trees is the threshold number of measurements after which tallying begins.
        iii. **Each time a new species/size class combination is encountered, create a new feature specific to that combination on the GPS and also circle the species-SC from the list on the hardcopy checklist.** For example, SC4 Popfre individuals are entered into a separate 'Trees – Measure' form than SC5 Popfre individuals. It is **NOT necessary,** however, to enter all of the measured individuals for the size class at the same time. It's relatively easy to close the form, and relocate the form for a particular species/SC. Use the *Update Features* menu to enter additional individuals for the species/SC if a different feature is currently open.
        iv. **Cross off all Species/SC class combinations not encountered in the A plot from the Hardcopy Checklist. Check the box on the Hardcopy Checklist when all measurements are completed for standard trees SC 4 and greater.**
        v. **If no tree measurements are required (no SC4 standard trees or SALEXI observed in the plot), create a new feature, select 'None' as the species, and leave -98 for specific measurements. Record a (-) in the checklist box if the Trees – Measure form was created on the GPS but measured trees were absent from the plot.**

'Trees – Tally A' Form

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

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

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

d. Zeros should be entered into each HC/B cell without any tallied individuals. Please DO NOT Leave -98 in these cells.

e. If no tallied trees need to be recorded at the plot (l5 or fewer individuals for all species/SC combination), create a new feature, select 'None' as the species, and leave the -98 values in measurement cells. In this case, record a minus on the hardcopy checklist.

f. Reminder: Update hardcopy checklist as data collection components are completed by checking/circling/slashing datasheet components as appropriate.

'Mesq-Tam – Measure A' Form

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

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

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

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

   d. If no Mesq or Tam individuals are encountered for SC 2, select 'None' from the species list and leave -98 for measurement values.

   e. Circle each species-SC combination observed on the hardcopy checklist. As with all mandatory plot components, check the box alongside the data collection component on the hardcopy checklist after it's encountered in the plot and recorded on the GPS. Record a minus on the checklist for features absent from the plot.

'Mesq-Tam – Tally A' Form

1. After the 5 measured tree heights are completed, record a HC for each tree. Record the number of stems in each Diameter Class (DC) for remaining individuals in the SC.

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

3. **Each "tallied" tree is recorded as a separate feature in the Trimble®.** As each new tallied Mesq-Tam tree is encountered, create a new feature, enter the HC, record the number of stems in each DC category, and record whether that tree is also within the B Plot area. **Zeros are entered for all diameter classes absent on the individual. If no Mesq-Tam tallying is not required because the plot area only contains five or fewer trees, create a new feature, select 'None', and leave the -98 values in measurement cells. In this case, record a minus on the hardcopy checklist.**

4. **Put a check in the hardcopy checklist box if this feature was present in the plot.**

Collection Point B

'Trees – Measure B' Form

1. Survey the B Plot for standard trees with a DBH of <12 cm (SC1 through SC3), including SALEXI with a DBH between 8.1 cm and 12 cm (SC 3). Standard trees in SC1-3 are documented in the 'Trees – Measure B' form.
    a. Collect data per the A Plot but this time for smaller SC's —DBH and height for five representative individuals for each species-SC combination, SC/HC tally for additional individuals (in the 'Trees – Tally B' Form). Note that all trees in SC 4 (DBH >12 cm) have already been measured and we recorded whether or not the tree occurred within the B Plot area.
    b. Trees shorter than 1.4 m (breast height) in the B Plot will be recorded with a DBH of "0". Trees >1.4 m with branching or non-woody stems at breast height will be recorded with a DBH of 0.5.
2. Record the measured individuals in the "Trees – Measure B" form on the Trimble® following the same protocol as the A Plot. Each species-SC combination is entered into its own GPS feature but that feature stores the attributes for all five measured trees.
3. Similar to the A Plot, Border 1 and 2 are "in" for the B Plot.
4. The B Plot is divided into four quadrants, SALEXI SC2 trees are only tallied in Quads B1 and B3. The 'Trees – Measure' form includes "Salexi SC2 B1" and "Salexi SC2 B3" in the species dropdown. Enter measured dbh and height for SC2 SALEXI encountered in either B1 or B3.
5. If no standard trees in SC3 or lower or SALEXI SC2 or SC3 are located in the B plot, create a new feature, select 'None' as the species, and leave -98 as the measured values.

'Trees – Tally B' Form

1. Follow same general concept utilized for tallied trees in the A Plot but in this case for individuals in the smaller SC's (1-3).
2. After five measured trees are recorded for the species-SC combination, use the hardcopy tally sheet to dot tally all remaining trees in the appropriate grid by SC and HC.
3. Enter the data into the 'Trees – Tally B' form on the GPS after the dot tallying is completed in the collection point.
4. Tally SALEXI SC2 in Quad B1 and B3 by Height Class.
5. As with the 'Trees- Tally – A' form, enter a zero for all height classes that did not contain an individual, and record a feature with 'None' as a species if the 'Trees – Tally B' form is not required for the plot.

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

1. Survey the entire B Plot area for mesquite trees or saltcedar that are less than 3.01 m tall.

    a. Collect mesquite and saltcedar data as for the A Plot—height and number of stems in each diameter class for five representative individuals, Measured individuals are entered in the 'Mesq-Tam – Measure B' form. Then Height Class and number of stems in each Diameter Class are recorded for additional individuals and entered into the 'Mesq-Tam – Tally' form. Note that all SC2 mesquite and saltcedar plants (greater than or equal to 3.01 m tall) have already been measured.

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

'Bacsal – Measure' Form and 'Bacsal – Tally' Form

1. Survey the B Plot area for Baccharis (BACSAL). Determine and record whether the species is *Baccharis salicina* (BACSAL1) or *B. salicifolia* (BACSAL 2).
    a. For five representative individuals, record the shrub height to the nearest 0.1 m, and tally the number of stems in each DC. Enter these measurements in the 'Bacsal – Measure' form on the Trimble®. **Zeros are entered for each DC that does not contain stems if an individual was measured. All five measured** individuals are entered into one feature.

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

c. 'None' is documented as follows:

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

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

'Shrubs B – Measure' Form and 'Shrubs B – Tally' Form

1. Survey the entire B Plot area for shrub species, NOT including BACSAL, PLUSER or SALEXI (remember SALEXI is always considered a tree rather than a shrub under this monitoring protocol).
   a. Measure and record height (to the nearest tenth of a meter) for five individuals of each species that represent the size range observed in the plot for the given species. A separate feature is created for each species and the form includes all five true measurements for the species.
   b. Dot tally all additional individuals of each species by shrub classes (height to the nearest 0.5m) on a hardcopy tally grid. After the dot tallies are completed, use the 'Shrubs B – Tally' form on the Trimble® to enter the total number of shrubs that fell in each HC. Enter a '0' for each HC without an individual (do not leave the -98).
   c. As for the A Plot, Border 1 and 2 are "in" for the B Plot and each quadrant within.
   d. **If no measured and/or tallied shrub features are required, utilize a similar approach for documenting 'None' as discussed in the Bacsal section above.**
   e. **As always, record a minus on the hardcopy checklist if the feature was absent from the plot or a check mark if the feature was present.**

'Shrubs B - Dead' Form

1. Dot count all dead shrubs, including BACSAL, but excluding PLUSER. Dead shrubs do not need to be tallied by species. After the Dead tallies are completed, enter the total count into the '*Shrubs B –Dead' form.*
2. **If no dead shrubs occur in the B Plot, create a new feature and ENTER ZERO for the Dead count. In this case, mark a minus sign on the hardcopy checklist.**

A COLLECTION POINT/GENERAL PLOT INFORMATION

'Trees – Dead/Felled' Form

1. Depending on SC, dead trees are tallied at different locations throughout the plot. **Dead trees are always placed into Size Classes based on DBH, regardless of species**. Large dead trees (SC 4 and greater) are considered snags and discussed later ('Snags' form). Dead SC3 trees are measured through the entire B Plot while Dead SC2 trees are only measured in B1 and B3. The 'Trees – Dead/Felled' feature captures each of these dead size classes; thus, the feature is used for multiple collection points.
2. If Dead SC3 trees are encountered in the B Plot, or Dead SC 2 Trees are present in either B1 or B3, enter the tally by size class into the 'Trees – Dead/Felled' form. The total number of dead individuals for each dead SC/CP is entered in the Dead Tally box. To do this, select the SC/CP combination from the dropdown and enter the total dead tally but leave -98 in both Felled Tree-related attributes. A new form needs to be created for each dead SC/CP group that is present within the plot. Only one feature should be created for each Dead SC/CP.
3. Felled trees are tallied throughout the entire A collection point according to whether they are live or dead. A tally of live or dead felled trees is also captured in the 'Trees – Dead/Felled' form. In most cases, it's recommended that you tally Live and Dead Felled on the paper tallysheet and then enter the total for each class on the GPS when plot measurements are finished. When documenting Felled trees, select 'Felled' from the *Species* dropdown and enter the total number of live

and or dead trees. Enter zero if either attribute (Live and Felled/Dead and Felled) is absent (do not leave -98 in *Felled Alive* or *Felled Dead* in this case) but leave -98 as the *Dead Tally*. Only one Felled feature should be recorded at each plot.

4. Dead versus Felled attributes should not be recorded within the same feature.
5. Protocols for documenting absence of Dead and/or Felled trees are listed below:
    a. Every plot requires a Trees - Dead/Felled feature with "Felled" selected from the dropdown, regardless of whether Felled trees or Dead trees are present. If Felled trees are not present in the plot, record a feature, select "Felled", leave -98 as the Dead Count, and record 0 Live Felled and 0 Dead Felled.
    b. When Dead SC2 or SC3 trees are not present, select "None" as the species, enter zero for Dead Tally, and leave Felled Alive and Felled Dead as -98.
    c. Thus, every plot requires at least 2 Trees - Dead/Felled features regardless of presence/absence of either Dead or Felled trees.

'Snag' Form

1. Determine the presence of snags [dead trees in SC 4-6 (DBH> 12.0 cm)] regardless of species within the A Plot. Record the total number of snags within each SC on the Trimble® unit. If no snags are found in the plot, create a new 'Snag' feature and select 'No' alongside *Snags Found?*.

'Cavities' Form

1. If snags have cavities, GPS the location by creating a new 'Cavities' feature on the Trimble®. Count and record the number of cavities present on the snag and record the snag DBH on the GPS while the location is being logged.
    a. **The recorder should stand stationary at the snag with the cavity while marking this feature so an accurate geographic location can be obtained.**
    b. **Each cavity is marked as an independent feature. If no cavities are present, create a new feature and select 'No' for *Cavities Found*.**

'Gaps' Form

1. Determine the presence of open canopy space (gaps) with an area of greater than or equal to 9 square meters (e.g. 3 m by 3 m) within 30 m of **Plot Center**. A 30 meter radius ("buffer") around the plot center has been loaded onto the GPS unit as a background file. Use the Map page on the Trimble to determine whether you are currently within that 30 meter radius.
2. Like cavities, gaps require an accurate GPS location so the recorder should stand still while the GPS is recording positions.
3. "Gap" is defined as an area without foliated vegetation greater than 3 m off the ground surface. As gaps are located, denote whether it is a Canopy Gap (space within the planted area) or Edge Gap (open space outside of planted area, e.g. road, edge of field, stream edge), select the most representative distance category (using the distance to the edge of the canopy gap from plot center), and stand at the center (Canopy Gap) or edge (Edge Gap) of the gap while recording attributes on the GPS unit **so an accurate location is captured**. Each gap will be marked as its own GPS feature on the Trimble®. If no Gaps occur, create a new feature and select 'None' for the Edge Gap type designation.

'Incidentals' Form

1. Record a list of all "incidental" species on the 'Incidentals' form. This list will include ALL species observed in the primary plot which are not recorded otherwise.
2. It is not necessary to record species already captured in the D plots as incidentals.
3. General plot notes are also recorded in the notes section of the 'Incidentals' feature.
4. The 'Incidentals' form can also be used to note any major problems with the site, which might include prevalence of invasive species or patches of vegetation mortality. If serious conditions such as these are encountered, notify the Field Supervisor, who will then notify the Project Supervisor.

HARDCOPY CHECKLISTS AND QA/QC

1. The hardcopy checklist plus tally sheet (Sheet 1) and HTP All (Sheet 2) are required documentation for every plot. Please provide those hardcopy sheets to the Field Supervisor at the end of each field day.
2. Before leaving the plot location, make sure that each of the mandatory elements are checked, circled, or crossed-off (as appropriate) from the hardcopy checklist.

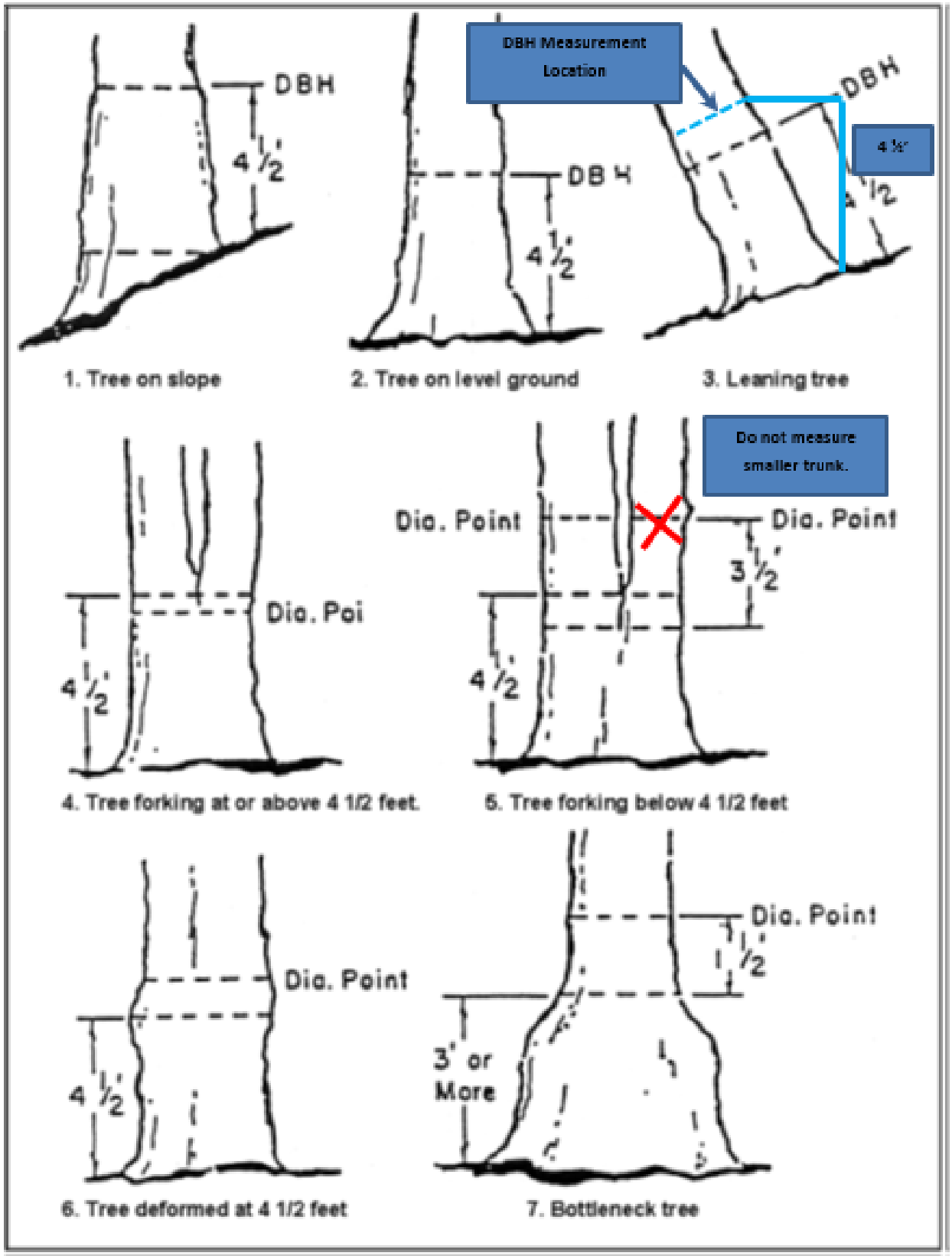
3. Ensure that a feature is also created for every feature/collection point following instructions in this document and as guided by the hardcopy checklist.

DBH Measurement Specifications

DBH measurements will generally follow US Forest Service Standard Stand Exam guidelines, which are interpreted in the following figure (modified from http://www.nmsu.edu/~nmffa/Documents/CDEs/2010%20Foresty%20Materials/Measurement_of_Tree_Diameter.pdf). However, for the MSCP, we will be following different protocols for Cases 3 and 5.

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

- Case 1: Tree on a slope.
  - Tree DBH shall be recorded 1.4 m above the ground surface on the upslope side of the tree.
- Case 2: Tree on level ground.
  - Standard case. Record DBH for 1.4 m above ground surface.
- Case 3: Leaning tree (and felled, but re-growing tree; DIFFERENT FROM FIGURE).
  - **Record DBH at 1.4 m above ground surface.** Measure diameter perpendicular to the direction of tree growth at that level, as illustrated in the figure.
- Case 4: Tree forking at or above 1.4 m (the fork is incomplete at 1.4 m).
  - Measure DBH below the split as near as possible to 1.4 m, but beneath trunk irregularities occurring due to the split.
- Case 5: Tree fork completed below 1.4 m (DIFFERENT FROM FIGURE).
  - Measure the diameter of the **LARGEST TRUNK** at BH or as near BH as possible while avoiding trunk irregularities caused by the trunk split.
- Case 6: Tree irregularity at DBH.
  - Measure DBH away from irregularity, but as near to 1.4 m as possible (can be either immediately above or below).
- Case 7: Bottleneck tree.
  - Treat as you would a tree irregularity. Increase the height at which diameter is measured to be above the zone of irregularity.
- Oval tree trunks.
  - When oval trunks are present at DBH, use a DBH tape to measure DBH and/or place the tree into the appropriate size class.


DBH
4 1/2'
1. Tree on slope
DBH Measurement Location
DBH
4 1/2'
2. Tree on level ground
DBH
4 ½'
4 1/2
3. Leaning tree
Dia. Poi
4 1/2'
4. Tree forking at or above 4 1/2 feet.
Do not measure smaller trunk.
Dia. Point
Dia. Point
3 1/2'
4 1/2
5. Tree forking below 4 1/2 feet
Dia. Point
4 1/2'
6. Tree deformed at 4 1/2 feet
Dia. Point
1 1/2'
3' or More
7. Bottleneck tree

Clinometer Methods

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

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

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

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

4. Reference the clinometer table to estimate the height of the tree above eye height for the given distance from tree foliage column.

5. Correct for the observer's eye height:

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

Clinometer calculations (degrees)

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

Plot: **Date:**

HTP Rover File Name: **OTH Rover File Name:**

Field Observers: **QC By:**

LCR MSCP VEG MEFF FORM COMPLETION CHECKLIST - MODIFIED ENHANCED PLOT

Mark boxes below as forms are completed in field. Enter (-) if not present in field but feature was saved. Enter check mark if feature was present in plot. Check boxes as features are observed during post field QA/QC

Completed in Field	QA/QC complete	NOTES:

HITS TO POLE Data Dictionary File

D COLLECTION POINTS

Completed in Field	QA/QC complete		Completed in Field	QA/QC complete	
		D1 Cnpy Clsr			D1 Hits to Pole
		D2 Cnpy Clsr			D2 Hits to Pole
		D3 Cnpy Clsr			D3 Hits to Pole
		D4 Cnpy Clsr			D4 Hits to Pole
		D5 Cnpy Clsr			D5 Hits to Pole
		D6 Cnpy Clsr			D6 Hits to Pole
		D7 Cnpy Clsr			D7 Hits to Pole
		D8 Cnpy Clsr			D8 Hits to Pole
		D9 Cnpy Clsr			D9 Hits to Pole

OTHER Data Dictionary File

A COLLECTION POINTS

Completed in Field	QA/QC complete	Feature	
		Trees - Measure A (standard trees SC 4 and greater)	Circle if present/Cross if not: Popfre SC4 SC5 SC6 SC7 SC8 Salgoo SC4 SC5 SC6 SC7 SC8 OTHER SPP (Note)
		Trees - Tally A (SC 4 and greater)	
		Mesq-Tam - Measure A (SC2)	Circle if present/Cross if not: SC2 Propub Progla Tamspp OTHER
		Mesq-Tam - Tally A (SC 2)	
		Trees - Dead/Felled (includes various Collection Point's)	Circle if present/Cross if not: Dead Felled
		Snag	
		Cavities	
		Gaps	
		Incidentals	

B COLLECTION POINTS

Completed in Field	QA/QC complete	Feature	
		Trees - Measure B (SC3 and lower)	Circle if present/Cross if not: Popfre SC1 SC2 SC3 Salgoo SC1 SC2 SC3 OTHER SPP (Note)
		Trees - Tally B (SC3 and lower)	
		Mesq-Tam - Measure B (SC1)	Circle if present/Cross if not: SC1 Propub Progla Tamspp OTHER
		Mesq-Tam - Tally B (SC1)	
		BACSAL - Measure	
		BACSAL - Tally	
		Shrubs B - Measure	
		Shrubs B - Dead	
		Shrubs B - Tally	

Misc Tally Grid

LCR-MSCP Vegetation Monitoring **MEFF HTP Tally Sheet**

Date: **Plot:** **Observers:**

HTP 'ALL' Tallies

HITS TO POLE									
	ALL D1	ALL D2	ALL D3	ALL D4	ALL D5	ALL D6	ALL D7	ALL D8	ALL D9
0_1									
1_2									
2_3									
3_4									
4_5									
5_6									
6_7									
Estimates									
7_8									
8_9									
9_10									
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ATTACHMENT 6

2014 Site Reports

LONG TERM VEGETATION MONITORING OF MSCP RESTORATION SITES
Individual Site Reports
Beal Lake Conservation Area
10/10/14

Project: Lower Colorado River Multi-Species Conservation Program Vegetation Monitoring
Site: Beal Lake Conservation Area
Dates of Survey: October 1, 2014
Observers: Will Widener (Field Supervisor), Cyrus Bullock, Chris Sanderson, Jesse Perry, Jessyka Wengreen, Michelle Ferman

I Introduction

For Option Year 3 (2014 field season) of Contract No. R11PD30179: *Vegetation Monitoring at Lower Colorado River Multi-Species Conservation Program Habitat Creation and Existing Riparian Sites*, Parametrix and GeoSystems Analysis, Inc. are completing vegetation surveys at five Multi-Species Conservation Program (MSCP) conservation areas: Yuma East Wetlands, Beal Lake Conservation Area, Palo Verde Ecological Reserve, Cibola Valley Conservation Area, and Cibola National Wildlife Refuge Unit 1 Conservation Area.

During the 2014 field season, field personnel are conducting surveys according to the "Modified Intensive" MSCP methods (following version 6 of the MSCP post-development vegetation monitoring protocols). Data are being collected using Global Positioning System (GPS) units equipped with Mobile Electronic Field Forms (MEFFs).

With accompanying delivery of the electronic data package, this Site Report summarizing the survey effort and site conditions at Beal Lake Conservation Area (BLCA) comprises project Deliverable 2.

II Summary of Field Activities

During a one day field session (October 1, 2014) at BLCA, field personnel performed vegetation data collection using MEFFs. Below is a day by day summary of field activities that occurred at BLCA during the 2014 field session:

<u>Wednesday 10/1/2014</u>

- Three teams of two field personnel completed 3 plots per team (9 plots total) using the MEFF data dictionaries. Plot survey efficiency for the day was approximately 2 hours per plot.
- Data were transferred off the GPS units and backed up that night.

<u>Thursday 10/2/2014</u>

- Michelle Ferman completed QA/QC on the 10/1 data.

All 9 plots within the BLCA site were surveyed during the 1-day field session. The 9 plots were completed approximately 1-day ahead of what was anticipated (scheduled) due to the placement of plot locations in areas with fewer mesquite than in previous years. Overall, the process with Trimble data collection went smoothly during the survey.

Weather conditions consisted of abundant sunshine and temperatures in the mid 90's (degrees Fahrenheit) on the day of the survey. No major obstacles or unusual observations occurred during the survey.

III Minor Obstacles

Minor obstacles encountered at the site which may have affected the project schedule and/or should be considered for future survey efforts include:

- None

Obstacles associated with MEFF data management and processing include:

- None

IV Habitat

Habitat types encountered and surveyed at the site include:

- Plots with a dominant cottonwood (*Populus fremontii*) overstory with mixed screwbean mesquite (*Prosopis pubescens*) and/or honey mesquite (*P. glandulosa*) understory as well as scattered coyote willow (*Salix exigua*) and/or Gooding's willow (*S. gooddingii*).
- Plots dominated by arrowweed with scattered mesquite and willow.
- Very few plots within the survey area contain herbaceous species.
- Plots 14008 and 14015 contained scattered tamarix (*Tamarix* sp.).
- No water features within the plots.
- Plots did not contain noxious weeds or other non-native invasive plant species.
- All vegetation species within the survey area were identified.

V Other Considerations

Other considerations for the field site which may require swift management action include:

- Plots 14008 and 14015 intersect access roads. The plots were surveyed as placed (not moved), as directed the Bureau of Reclamation.
- Plot 14010 was shifted to the southeast approximately 6 meters as to not overlap with Plot 14008. The shift of the plot to the southeast occurred on bearing and maintained similar vegetation type and structure compared to the original plot location.
- Buffelgrass (*Pennisetum ciliare*), observed in plot BLCA_N_0091 during 2011, was not observed during 2012, 2013, or 2014 surveys.

LONG TERM VEGETATION MONITORING OF MSCP RESTORATION SITES
Individual Site Reports
Cibola National Wildlife Refuge Unit 1 Conservation Area
1/13/14

Project: Lower Colorado River Multi-Species Conservation Program Vegetation Monitoring
Site: Cibola National Wildlife Refuge Unit 1 Conservation Area
Dates of Survey: October 20; October 29 – November 1, 2014
Observers: Will Widener (Field Supervisor), Cyrus Bullock, Amanda Smith, Michelle Ferman, Chris Sanderson, Eric Hough, Jenny Lisignoli, Jason Harris

I Introduction

For Option Year 3 (2014 field season) of Contract No. R11PD30179: *Vegetation Monitoring at Lower Colorado River Multi-Species Conservation Program Habitat Creation and Existing Riparian Sites*, Parametrix and GeoSystems Analysis, Inc. are completing vegetation surveys at five Multi-Species Conservation Program (MSCP) conservation areas: Yuma East Wetlands, Beal Lake Conservation Area, Palo Verde Ecological Reserve, Cibola Valley Conservation Area, and Cibola National Wildlife Refuge Unit 1 Conservation Area.

During the 2014 field season, field personnel are conducting surveys according to the "Modified Intensive" MSCP methods (following version 6 of the MSCP post-development vegetation monitoring protocols). Data are being collected using Global Positioning System (GPS) units equipped with Mobile Electronic Field Forms (MEFFs).

II Summary of Field Activities

During a four and a half day field session (October 20 and October 29 through November 1, 2014), field personnel completed vegetation data collection at CNU1 using the MEFFs. During the 2014 field season, the 3 sites were surveyed in this Conservation Area:

- Nature Trail (NT)
- Crane Roost (CR)
- Hippie Burn 11 (HB-11)
- Hippie Burn 12 (HB-12)

Three additional sites within CNU1 surveyed during previous project years were not included in the 2014 field season:

- Cottonwood Genetics Study
- Mass Transplanting
- CW North
- Hippie Burn 13 (HB-13)
- Hippie Burn 14 (HB-14)

Below is a day by day summary of field activities that occurred at CNU1 during the 2014 field session:

<u>10/20/14</u>

- Three teams of two field personnel mobilized from Cibola Valley Conservation Area and completed one plot per team within CNU1.
- Data were transferred off the GPS units and backed up that night.

10/29/14

- Two teams of two field personnel completed two plots per team. Plot survey efficiency for the day was approximately 3.5 hours per plot.
- Will Widener trained two field personnel who may join the team during the 2015 field season. During the training, the team of three completed two plots.
- Data were transferred off the GPS units and backed up that night.

10/30/14

- Four teams of two field personnel completed approximately 3 plots per team. Plot survey efficiency for the day was approximately 2.5 hours per plot. **Nature Trail completed.**
- Data were transferred off the GPS units and backed up that night.

10/31/14

- Two teams of two field personnel and one team of three field personnel completed approximately three plots per team. Plot survey efficiency for the day was approximately 2.5 hours per plot. **Crane Roost completed.**
- Data were transferred off the GPS units and backed up that night.
- Michelle Ferman completed QA/QC on the 10/29 and 10/30 data from the hotel.

11/1/14

- Two teams of two field personnel and one team of three field personnel completed Hippie Burn – **CNU1 Completed.**
- Data were transferred off the GPS units and backed up that night.
- Michelle Ferman completed QA/QC on the 10/31 data from the hotel.

11/2/14

- Michelle Ferman completed QA/QC on the 11/1 data.

All 34 plots selected by Reclamation at CNU1 were surveyed during the field sessions and average data collection efficiency was slightly higher than anticipated (scheduled). Overall, the process with Trimble data collection went smoothly.

During the surveys, weather consisted of sunny conditions with temperatures in the upper 80's and lower 90's (degrees Fahrenheit) with periods of high wind during the last day of the survey. No major obstacles or unusual observations occurred during the surveys.

III Obstacles

Minor obstacles encountered at the site which may have affected the project schedule and/or should be considered for future survey efforts include:

- Plots dominated by thick seep willow (*Baccharis salicina*) and/or screwbean and honey mesquite (*Prosopis pubescens* and *Prosopis glandulosa*) within the Nature Trail and portions of Crane Roost.
- Windy conditions during the last day of survey rendered vegetation volume and densitometer readings difficult.

Obstacles associated with MEFF data management and processing include:

- None

IV Habitat

Habitat types encountered and surveyed at the site included:

- Dominant species in plots at the Nature Trail were cottonwood, Goodding's willow (*Salix gooddingii*), and/or seep willow with scattered mesquite (honey and screwbean) and Johnson grass (*Sorghum halepense*).
- Dominant species in plots at the Crane Roost were cottonwood, Goodding's willow, and/or mesquite (honey and screwbean). As noted during previous project years, vegetation stress was apparent in some areas of the Crane Roost.
- The recently planted Hippie Burn is dominated by Gooding's willow and cottonwood.
- No noxious weeds or Spanish false fleabane (*Pulicaria paludosa*) were identified within any of the plots.
- Tamarix (*Tamarix* sp.) was identified within a few plots (especially Crane Roost), but was not prevalent within the site.
- The one unknown vegetation species observed within the site include:

Area	Site	Section	Name Given in Field	Identified to…..
CNU1	Hippie Burn11	14283	Unknown (Thinopyrum sp.)	*Pascopyrum smithii**

* *Pascopyrum smithii* has never been collected in the area before, but the collected sample keyed to this species and resembled herbarium collections examined at the University of New Mexico. The sample will be sent to an agronomist for a second opinion.

V Other Considerations

Other considerations for the field site which may require swift management action include:

- None

LONG TERM VEGETATION MONITORING OF MSCP RESTORATION SITES
Individual Site Reports
Cibola Valley Conservation Area
11/7/2014

Project: Lower Colorado River Multi-Species Conservation Program Vegetation Monitoring
Site: Cibola Valley Conservation Area
Dates of Survey: October 6, 2014 and October 15, 2014 - October 20, 2014
Observers: Will Widener (Field Supervisor), Cyrus Bullock, Chris Sanderson, Amanda Smith, Michelle Ferman, Lindsay Martindale, Eric Hough

I Introduction

For Option Year 3 (2014 field season) of Contract No. R11PD30179: *Vegetation Monitoring at Lower Colorado River Multi-Species Conservation Program Habitat Creation and Existing Riparian Sites*, Parametrix and GeoSystems Analysis, Inc. are completing vegetation surveys at five Multi-Species Conservation Program (MSCP) conservation areas: Yuma East Wetlands, Beal Lake Conservation Area, Palo Verde Ecological Reserve, Cibola Valley Conservation Area, and Cibola National Wildlife Refuge Unit 1 Conservation Area.

During the 2014 field season, field personnel are conducting surveys according to the "Modified Intensive" MSCP methods (following version 6 of the MSCP post-development vegetation monitoring protocols). Data are being collected using Global Positioning System (GPS) units equipped with Mobile Electronic Field Forms (MEFFs).

With accompanying delivery of the electronic data package, this Site Report summarizing the survey effort and site conditions at Cibola Valley Conservation Area (CVCA) comprises project Deliverable 5.

II Summary of Field Activities

During a 5-1/2 day field session (October 6, 2014 and October 15 - October 20, 2014) at CVCA, field personnel completed vegetation data collection using the MEFFs.

Below is a day by day summary of field activities that occurred at CVCA during the 2014 field session:

<u>10/6/14</u>
- Three teams of two field personnel completed approximately 3.5 plots per team. Plot survey efficiency for the day was approximately 2 hours per plot.
- Data were transferred off the GPS units and backed up that night.

<u>10/7/14</u>
- Michelle Ferman completed QA/QC on the 10/6 data from the hotel.

<u>10/15/14</u>
- Two teams of two and one team of three field personnel completed 3 plots per team. Plot survey efficiency for the day was approximately 1.5 to 2 hours per plot.
- Data were transferred off the GPS units and backed up that night.

<u>10/16/14</u>
- Three teams of two field personnel completed approximately 3.5 plots per team. Plot survey efficiency for the day was approximately 1.5 to 2 hours per plot.
- Data were transferred off the GPS units and backed up that night.
- Michelle Ferman completed QA/QC on the 10/15 and 10/16 data from the hotel.

<u>10/17/14</u>
- Two teams of two and one team of three field personnel completed approximately 3.5 plots per team. Plot survey efficiency for the day was approximately 1.5 to 2 hours per plot - **Phase 3 completed**.

- Data were transferred off the GPS units and backed up that night.
- After receiving and downloading new data dictionary files from the BOR, Michelle Ferman also updated the data dictionaries on the GPS units.

10/18/14

- Two teams of two field personnel completed approximately 3.5 plots per team. Plot survey efficiency for the day was approximately 1.5 to 2 hours per plot.
- As a result of a malfunction during the data dictionary update on one of the GPS units, one team of two could not fully survey assigned plots. The team proceeded to set up 2 plots and collected D collection point data on paper datasheets. This data was entered onto the functioning GPS unit the following day, when the remainder of data was read, after the data dictionary was retransferred to the GPS unit.
- Data were transferred off the GPS units and backed up that night.
- Michelle Ferman completed QA/QC on the 10/17 data from the hotel.

10/19/14

- Two teams of two and one team of three field personnel completed approximately 3.5 plots per team. Plot survey efficiency for the day was approximately 1.5 to 2 hours per plot **- Phase 1 completed**.
- Data were transferred off the GPS units and backed up that night.

10/20/14

- Three teams of two field personnel completed 1 plot per team completing Phase 2 – **CVCA completed**.
- Three teams of two field personnel mobilized to Cibola National Wildlife Refuge Unit 1 Conservation Area and completed one plot per team.
- Data were transferred off the GPS units and backed up that night.
- Michelle Ferman completed QA/QC on the 10/19 data from the hotel.

All 59 plots selected by Reclamation at CVCA were surveyed during the field session, and average data collection efficiency was slightly higher than anticipated (scheduled). An unknown grass was encountered by 3 crews. It was later identified as tapertip cupgrass (*Eriochloa acuminata*). This included CPV214241, CVP114214, and CVP114212. No other unknown species were encountered.

Weather consisted of mostly sunny conditions and temperatures in the 90's (degrees Fahrenheit) during the survey. No major obstacles or unusual observations occurred during the surveys.

III Obstacles

Minor obstacles encountered at the site which may have affected the project schedule and/or should be considered for future survey efforts include:

- Flood irrigation management within the southern portion of Phase 01 on 10/15 and 10/16 and within Phase 02 on 10/17 was occurring during the vegetation monitoring effort.
- Maintenance crews were observed spraying herbicide on the periphery of plantings. It didn't appear that the herbicide was dyed and there was no visible signage. Crews were warned and should be notified if they are working near herbicide application to avoid unintended exposure.
- When an unknown incidental grass from Phase 03 was brought to field crew supervisor, it was initially thought to have been alkali sacaton (*Sporobolus airoides*), and was entered into the GPS Unit. The crew continued to record the species as alkali sacaton. The grass was later identified as fall panicgrass (*Panicum dichotomiflorum*), which superficially resembles alkali sacaton. The data for plots CVP314247 and CVP314255, were adjusted by the field data manager to correct this error.

Obstacles associated with MEFF data management and processing include:

- It is unclear what caused the malfunction in the data dictionary update. Test files were present on the unit, indicating that the data dictionary had successfully updated in order to be present on the test file. But on the following day, no data dictionaries were present on the GPS unit. The following evening, the data dictionaries were re-uploaded to the GPS unit, and no further issues occurred. It is expected that some errors like this will occur, and crews should be prepared to adapt their approach and make good use in their time, to avoid sacrificing too much plot efficiency.

IV Habitat

Habitat types encountered and surveyed at the site included:

- Dominant species within Phase 01 and 02 consisted of cottonwood (*Populus fremontii*), Goodding's willow (*Salix gooddingii*), and/or coyote willow *(Salix exigua*).
- Dominant species within Phase 03 consisted of cottonwood with a mix of Goodding's and/or coyote willow.
- Chilean hybrid of mesquite was identified within Phases 02 and 03.
- No Spanish false fleabane (*Pulicaria paludosa*) was identified within any of the plots.
- Tamarix (*Tamarix* sp.) and arrowweed (*Pluchea sericea)* were identified within a few plots, but were not prevalent within the site.

V Other Considerations

Other considerations for the field site which may require swift management action include:

- A large amount of dead and stressed Goodding's and coyote willow within Phase 03.

- Carelessweed (*Amaranthus palmeri*) and desert horse purslane (*Trianthema portulacastrum*) were both observed being sprayed with what was presumably an herbicide by maintenance crews. Unless these native species are being treated for management purposes, it is recommended that these species not be treated with herbicide, as it can lead to herbicide exposure to birds and other wildlife that may utilize these species as forage. If these species must be treated, it is recommended that they be treated earlier in the season, before seed-set, to prevent persistence into the next growing season and wildlife ingestion of herbicide-treated seeds.

- Purple morning glory (*Ipomoea purpurea*), a noxious weed species with the potential to spread rapidly if not managed was identified throughout the site and was especially abundant within Phases 01 and 02. This species is a prohibited noxious weed in Arizona.

- Sahara mustard (*Brassica tournefortii*), a very fast growing and drought tolerant non-native invasive weed was identified within Phase 05 (Section 22) and Phase 06 (Section 23) during the 2013 site survey. Phases 05 and 06 were not surveyed during the 2014 field session as directed by the Bureau of Reclamation. *Brassica tournefortii* smothers native herbaceous plants and competes with shrubs for light and soil moisture.

- Buffelgrass (*Pennisetum ciliare*), a shrubby grass that grows densely and crowds out native plants, was identified within Phase 04E (Section 117) during the 2013 site survey. Phase 04E was not surveyed during the 2014 field session.

- It appears that many of the mesquite, especially in Phases 02 and 03, may be Chilean mesquites (*Prosopis chilensis*), or honey mesquite-Chilean mesquite hybrids. If Chilean mesquite is unwanted by MSCP, a program of replacing these trees may be considered. It is recommended that source materials for future plantings be thoroughly vetted.

LONG TERM VEGETATION MONITORING OF MSCP RESTORATION SITES
Individual Site Reports
Palo Verde Ecological Reserve
10/22/14

Project: Lower Colorado River Multi-Species Conservation Program Vegetation Monitoring
Site: Palo Verde Ecological Reserve
Dates of Survey:
Field Session #1 - September 17 – September 22, 2014
Field Session #2 - October 2 - October 5, 2014
Observers:
Field Session #1 - Will Widener (Field Supervisor), Cyrus Bullock, Jesse Perry, Jessyka Wengreen, Amanda Smith, Michelle Ferman, Lindsay Martindale, Chris Sanderson, Eric Hough
Field Session #2 - Will Widener (Field Supervisor), Cyrus Bullock, Jesse Perry, Jessyka Wengreen, Michelle Ferman, Chris Sanderson

I Introduction

For Option Year 3 (2014 field season) of Contract No. R11PD30179: *Vegetation Monitoring at Lower Colorado River Multi-Species Conservation Program Habitat Creation and Existing Riparian Sites*, Parametrix and GeoSystems Analysis, Inc. are completing vegetation surveys at five Multi-Species Conservation Program (MSCP) conservation areas: Yuma East Wetlands, Beal Lake Conservation Area, Palo Verde Ecological Reserve, Cibola Valley Conservation Area, and Cibola National Wildlife Refuge Unit 1 Conservation Area.

During the 2014 field season, field personnel are conducting surveys according to the "Modified Intensive" MSCP methods (following version 6 of the MSCP post-development vegetation monitoring protocols). Data are being collected using Global Positioning System (GPS) units equipped with Mobile Electronic Field Forms (MEFFs).

With accompanying delivery of the electronic data package, this Site Report summarizing the survey effort and site conditions at Palo Verde Ecological Reserve (PVER) comprises project Deliverable 4.

II Summary of Field Activities

During two field sessions totaling 10 days (September 17 – 22, 2014 and October 2 - 5, 2014) at PVER, field personnel completed vegetation data collection using the MEFFs.

Below is a day by day summary of activities that occurred at PVER during the 2014 field sessions:

Field Session #1:

<u>9/17/14</u>
- Two teams of two field personnel set up plots within Phases 2 and 3.
- Will Widener held a training session for two field personnel. During the training session approximately three plots were surveyed.
- Data were transferred off the GPS units and backed up that night.

<u>9/18/14</u>
- Two teams of two and one team of three field personnel completed approximately 15 plots (these plots were set up the previous day) - **Phase 2 completed**.
- Data were transferred off the GPS units and backed up that night.
- Michelle Ferman completed QA/QC on the 9/17 data from the hotel.

<u>9/19/14</u>
- Four teams of two field personnel completed 2 to 3 plots per team within Phase 1 and Phase 3 (Phase 3 plots were set up 9/17) - **Phase 1 and Phase 3 completed**.

- Data were transferred off the GPS units and backed up that night.
- Michelle Ferman completed QA/QC on the 9/18 data from the hotel.

9/20/14

- Four teams of two field personnel completed 3 plots per team. Plot survey efficiency for the day was approximately 2 hours per plot - **Phase 4 completed**.
- Data were transferred off the GPS units and backed up that night.
- Michelle Ferman completed QA/QC on the 9/19 data from the hotel.

9/21/14

- Four teams of two field personnel completed 3.5 plots per team. Plot survey efficiency for the day was approximately 1.5 to 2 hours per plot.
- Data were transferred off the GPS units and backed up that night.
- Michelle Ferman completed QA/QC on the 9/20 data from the hotel.

9/22/14

- Four teams of two field personnel completed 3.5 plots per team. Plot survey efficiency for the day was approximately 1.5 to 2 hours per plot - Field Session #1 complete.
- Data were transferred off the GPS units and backed up that night.
- Michelle Ferman completed QA/QC on the 9/21 data from the hotel.

9/23/14

- Michelle Ferman completed QA/QC on the 9/22 data, as the other crews mobilized home.

Field Session #2:

10/2/14

- Field personnel traveled from Beal Lake Conservation Area to PVER. Field surveys at PVER began at approximately 9:45 am.
- Three teams of two field personnel completed 3 to 3.5 plots per team. Plot survey efficiency for the day was approximately 1.5 to 2 hours per plot.
- Data were transferred off the GPS units and backed up that night.

10/3/14

- One team of two and one team of three field personnel completed 4 plots per team. Plot survey efficiency for the day was approximately 1.5 to 2 hours per plot - **Phase 5 completed**.
- Data were transferred off the GPS units and backed up that night.
- Michelle Ferman completed QA/QC on the 10/2 data.

10/4/14

- Three teams of two field personnel completed 4 plots per team. Plot survey efficiency for the day was approximately 1.5 hours per plot.
- Data were transferred off the GPS units and backed up that night.

10/5/14

- One team of two and one team of three field personnel completed 4 plots finishing Phase 6. **PVER completed.**
- Data were transferred off the GPS units and backed up that night.
- Michelle Ferman completed QA/QC on the 10/4 data.

10/6/14

- Michelle Ferman completed QA/QC on the 10/5 data.

All 109 plots selected by Reclamation at PVER were surveyed during the field sessions, and average data collection efficiency was as anticipated (scheduled). Overall, the process with Trimble data collection went smoothly. All vegetation species within the survey area were identified.

Weather consisted of mostly sunny conditions and temperatures in the 101 to 104 degree Fahrenheit range during the first field session. During the second field session, weather conditions consisted of abundant sunshine and temperatures in the upper 90's (degrees Fahrenheit). No major obstacles or unusual observations occurred during the surveys.

III Minor Obstacles

Minor obstacles encountered at the site which may have affected the project schedule and/or should be considered for future survey efforts include:

- Flood irrigation management within Phases 05 and 06 on 09/21/14 and 9/22/14 was occurring during the vegetation monitoring effort.
- Although the field session was scheduled to avoid rifle deer season, archery deer hunters were observed at the site during Field Session #2. When hunters are present, crews must take additional safety precautions.
- Afternoon windy conditions on 10/2/14 rendered vegetation by volume and densitometer readings difficult.

Obstacles associated with MEFF data management and processing include:

- None

IV Habitat

Habitat types encountered and surveyed at the site included:

- Dominant cottonwood (*Populous fremontii*) overstory with scattered coyote and Goodding's willow (*Salix exigua* and *S. gooddingii*, respectively).
- Codominant cottonwood and willows (Goodding's and coyote willow).
- Dominant cottonwood.
- Dominant willows (both species).
- Variable cover of Bermuda grass (*Cynodon dactylon*) in the understory of plots dominated by Goodding's willow.
- Mesquite (*Prosopis glandulosa*) and arrowweed (*Pluchea sericea)* were identified within a few plots, but were not prevalent within the site.

V Other Considerations

Other considerations for the field site which may require swift management action include:

- Spanish false fleabane (*Pulicaria palidosa*), a non-native plant of interest which may spread throughout the site if not managed, was observed throughout Phase 01 and within the lower section of Phase 06.

- Morning glory (*Ipomoea purpurea*), a noxious weed species with the potential to spread rapidly if not managed, was identified within Phase 04, within the lower section of Phase 06, and just outside of plot PVP614044. *Ipomoea purpurea* is a prohibited noxious weed in Arizona.

LONG TERM VEGETATION MONITORING OF MSCP RESTORATION SITES
Individual Site Reports
Yuma East Wetlands
9/26/14

Project: Lower Colorado River Multi-Species Conservation Program Vegetation Monitoring
Site: Yuma East Wetlands
Dates of Survey: September 7, 2014 – September 10, 2014
Observers: Chad McKenna (Data Manager), Will Widener (Field Supervisor), Cyrus Bullock, Chris Sanderson, Amanda Smith, Michelle Ferman, Lindsay Martindale, Eric Hough

I Introduction

During the 2014 field season, field personnel will conduct Multi-Species Conservation Program (MSCP) surveys according to the "Modified Intensive" methods (following version 6 of the MSCP post-development vegetation monitoring protocols). Based on these protocols, the primary changes for the 2014 field season, as opposed to surveys conducted during the 2011 through 2013 field seasons, are as follows:

- Elimination of "C" plots (herbaceous and ground cover data)
- Elimination of "E" plots (size class 1 coyote willow [*Salix exigua*] and arrowweed [*Pluchea sericea*] data)
- Addition of four "D" data collection points (vegetation volume and canopy closure data) for a total of nine per plot
- All plots sampled will be established in new locations and sample plots will not be permanently marked
- No "rotational" or "reduced effort" surveys will be conducted

Also, during field surveys, data collection will occur using Global Positioning System (GPS) units equipped with Mobile Electronic Field Forms (MEFFs). With the use of MEFFs, the data collection process will be shifted from hardcopy field forms to electronic forms for the first time during the 2014 field season.

II Summary of Field Activities

During a 3-day session (September 7 - 10, 2014) at YEW, field personnel performed MEFF protocol training (1-day) and vegetation data collection using the MEFFs (2-days).

Below is a day by day summary of activities that occurred at YEW during the 2014 field session:

<u>Monday 9/8/2014</u>
- Chad McKenna led MEFF training in a conference room setting (approximately 2.5 hours).
- Chad McKenna and Will Widener led MEFF field training (on-site) with the GPS units.
- One plot was surveyed during field training using the MEFF data dictionaries.

<u>Tuesday 9/9/2014</u>
- Four teams of two field personnel completed 2 plots per team using the MEFF data dictionaries (8 plots total). Plot survey efficiency for the day was 3 to 3.5 hours per plot.
- Data were transferred off the GPS units and backed up that night.

<u>Wednesday 9/10/2014</u>
- Three teams of two field personnel completed 2 plots per team using the MEFF data dictionaries (6 plots total). Plot survey efficiency for the day was 2 to 2.5 hours per plot. As field personnel became more familiar with the MEFF data dictionaries, survey efficiency increased from the previous day.
- Chad McKenna and Michelle Ferman completed QA/QC on data collected on 9/8 and 9/9 from the hotel.

All 15 plots within the YEW site were surveyed during the field session. Excluding the 1-day training session, all 15 plots would have been completed within a two day period, as anticipated (scheduled). Overall, the process with

Trimble data collection went smooth. Crews grasped the MEFF protocol quickly. Data gaps and anomalies were relatively easy to clarify with crews and correct in the electronic data. Crews requested changes to the species list in the hits to pole data dictionary. We also adjusted the process for capturing Dead and Felled trees in the MEFFs and documenting null features on the hardcopy checklist. Those changes were incorporated into revised field instructions.

Weather conditions consisted of mostly sunny conditions and temperatures in the high 90's (degrees Fahrenheit) with high humidity. No major obstacles or unusual observations occurred during the survey.

III Minor Obstacles

Minor obstacles encountered at the site which may have affected the project schedule and/or should be considered for future survey efforts include:

- Portions of site and main access route inundated due to monsoonal storms
- High temperatures in conjunction with high humidity
- Dense mosquito populations throughout survey areas

Obstacles associated with MEFF data management and processing include:

- The Pathfinder Office (PFO) Differential Correction Utility yielded grossly inaccurate positional errors. We suspect this error was resolved via a software update. Grossly repositioned features were no longer a problem after updating to PFO 5.60.

IV Habitat

Habitat types encountered and surveyed at the site include:

- A majority of the plots consisted of a mix of Fremont's cottonwood (*Populus fremontii*), mule fat (*Baccharis salicifolia*) – denoted bacsal1 for these surveys, and screwbean mesquite (*Prosopis pubescens*), with an understory of alkali sacaton (*Sporobolus airoides*) and Bermuda grass (*Cynodon dactylon*). Species with variable cover included honey mesquite (*Prosopis glandulosa*), velvet mesquite (*Prosopis velutina*), willow baccharis (*Baccharis salicina*) – denoted bacsal2, and saltgrass (*Distichilis spicata*).
- Plot YWI14332 was dominated by coyote willow with subdominant bacsal1.
- Plots did not contain tamarix (*Tamarix* sp.) or arrowweed.
- Plots did not contain noxious weeds or other non-native invasive plant species.
- No water features were present within the plots.
- Unknown vegetation species observed within the site included:

Area	**Site**	**Section**	**Name Given in Field**	**Identified to…..**
YEW	I	14326	Unknown 1	*Phragmites australis*
YEW	J	14317	Will Widener Unk.	PENDING

V Other Considerations

Other considerations for the field site which may require swift management action include:

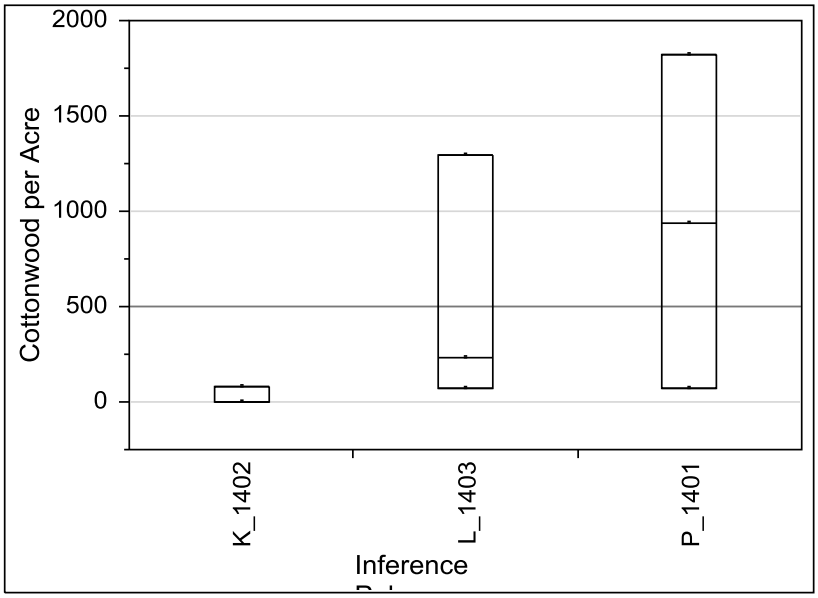
- None

ATTACHMENT 7

Vegetation Data Box Plots

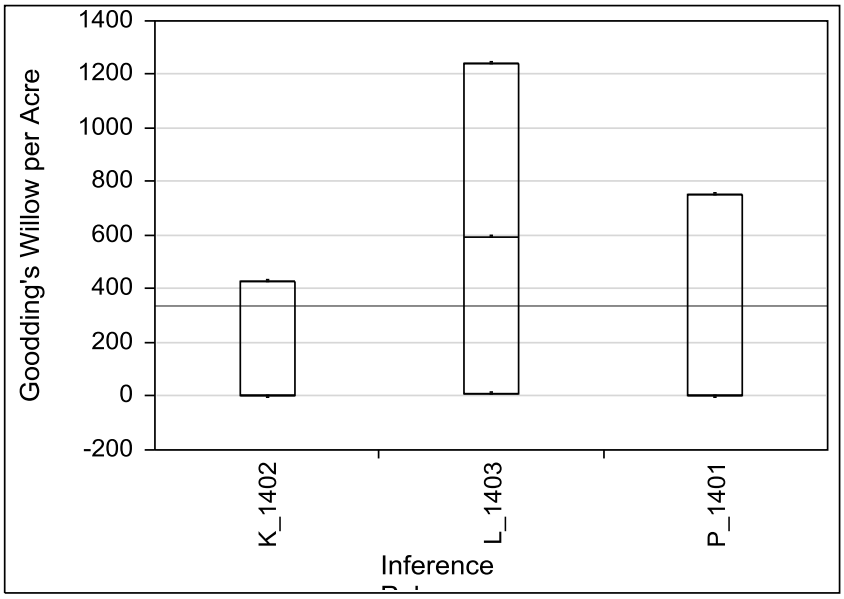
VII 1 TREE DENSITY BY SPECIES AND INFERENCE POLYGON

VII 1.1 Beal Lake Conservation Area



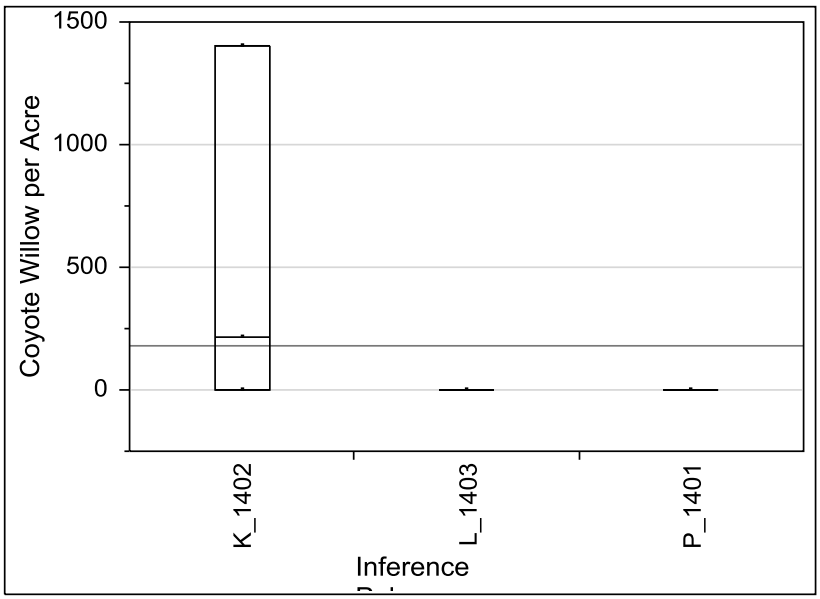
Quantiles

Level	Minimum	10%	25%	Median	75%	90%	Maximum
K_1402	0	0	0	0	80.93725	80.93725	80.93725
L_1403	70.8201	70.8201	70.8201	232.6946	1291.624	1291.624	1291.624
P_1401	70.8201	70.8201	70.8201	934.1508	1824.461	1824.461	1824.461



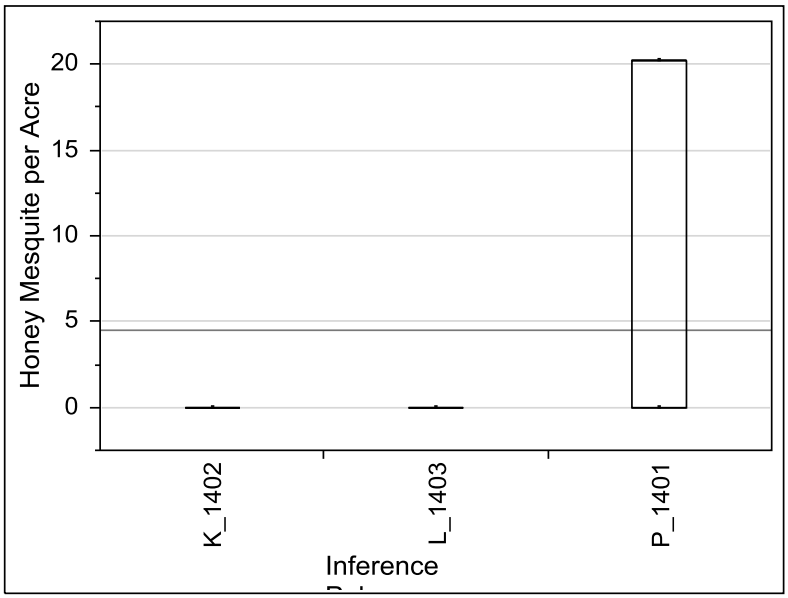
Quantiles

Level	Minimum	10%	25%	Median	75%	90%	Maximum
K_1402	0	0	0	0	431.6654	431.6654	431.6654
L_1403	10.11716	10.11716	10.11716	593.5399	1241.038	1241.038	1241.038
P_1401	0	0	0	0	755.4144	755.4144	755.4144



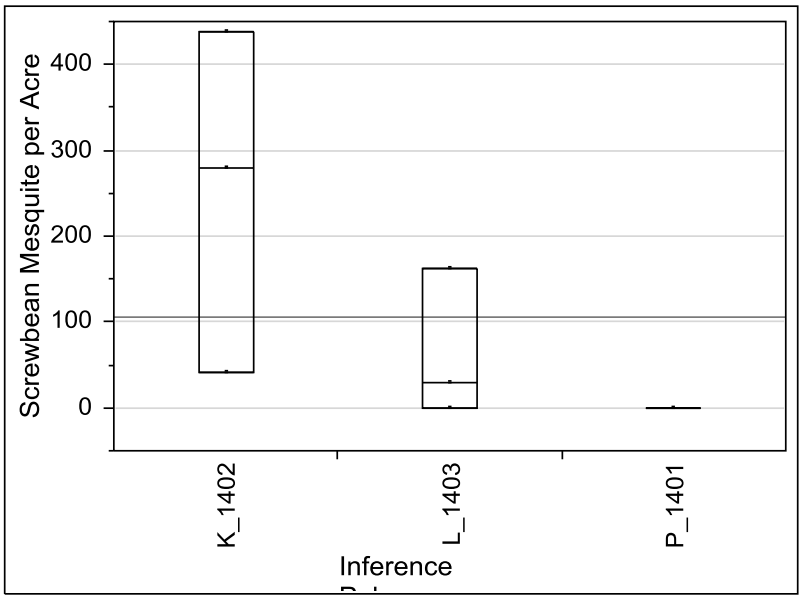
Quantiles

Level	Minimum	10%	25%	Median	75%	90%	Maximum
K_1402	0	0	0	215.8327	1402.912	1402.912	1402.912
L_1403	0	0	0	0	0	0	0
P_1401	0	0	0	0	0	0	0



Quantiles

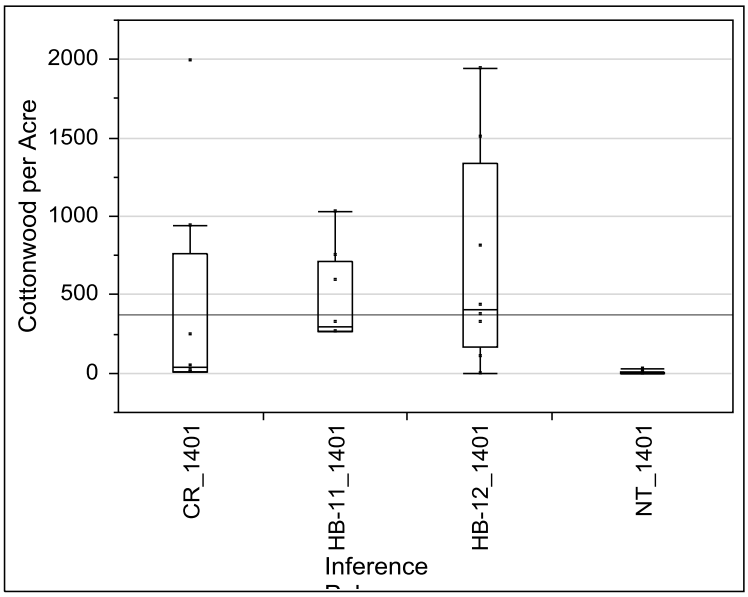
Level	Minimum	10%	25%	Median	75%	90%	Maximum
K_1402	0	0	0	0	0	0	0
L_1403	0	0	0	0	0	0	0
P_1401	0	0	0	20.23431	20.23431	20.23431	20.23431



Quantiles

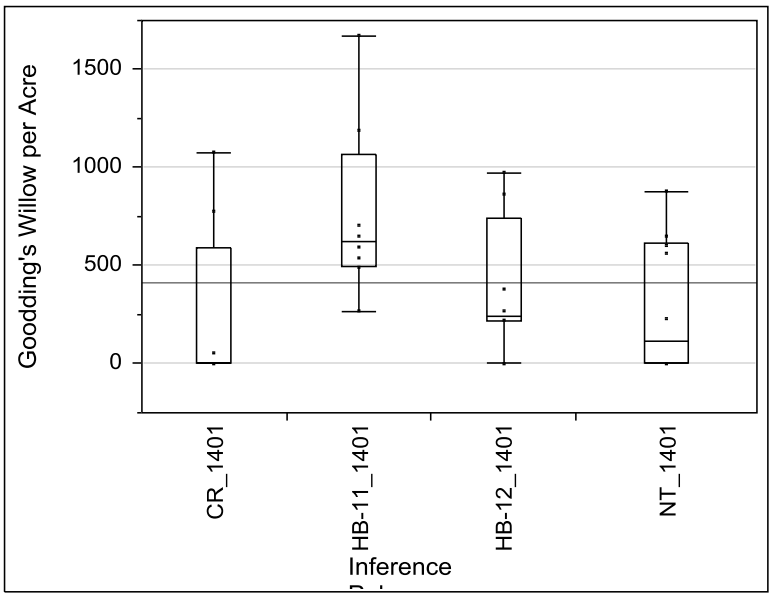
Level	Minimum	10%	25%	Median	75%	90%	Maximum
K_1402	40.46863	40.46863	40.46863	279.908	438.4101	438.4101	438.4101
L_1403	0	0	0	30.35147	161.8745	161.8745	161.8745
P_1401	0	0	0	0	0	0	0

VII 1.2 Cibola National Wildlife Refuge Unit 1 Conservation Area



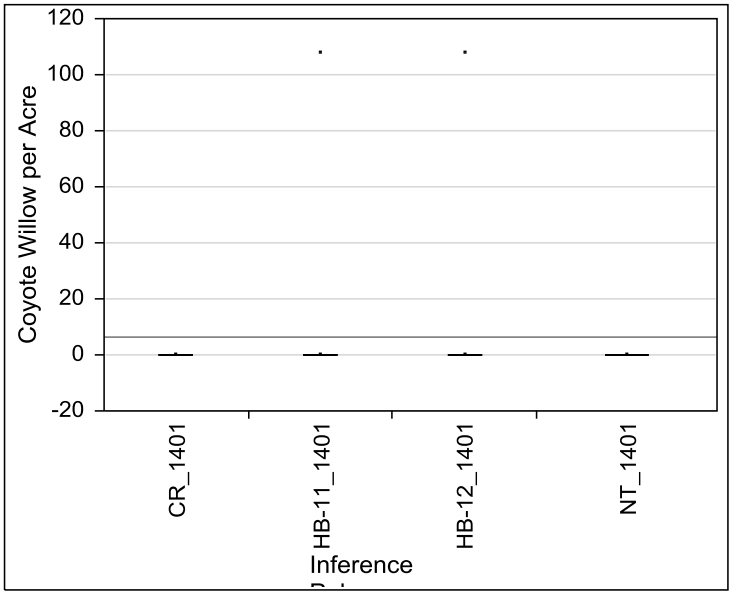
Quantiles

Level	Minimum	10%	25%	Median	75%	90%	Maximum
CR_1401	10.11716	10.11716	12.64645	35.41005	765.5315	1996.452	1996.452
HB-11_1401	269.7908	269.7908	269.7908	296.7699	714.9457	1025.205	1025.205
HB-12_1401	0	0	161.8745	404.6863	1335.465	1942.494	1942.494
NT_1401	0	0	0	0	12.64645	29.33975	30.35147



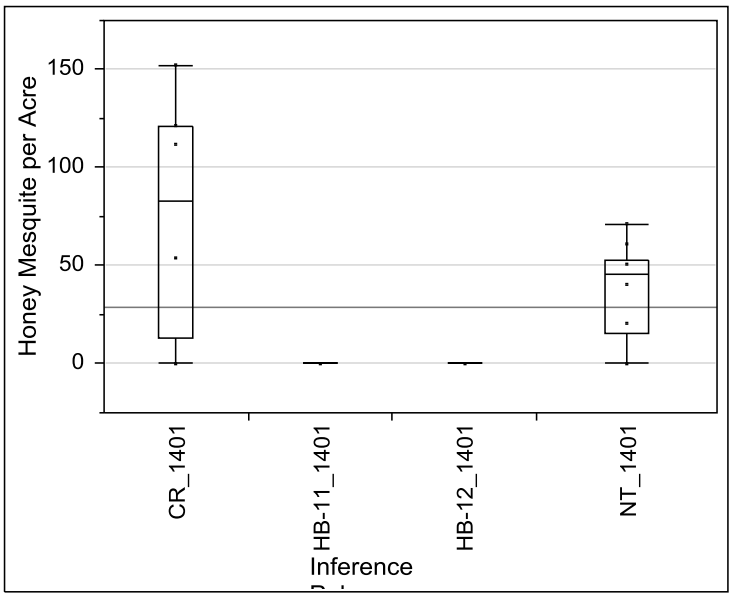
Quantiles

Level	Minimum	10%	25%	Median	75%	90%	Maximum
CR_1401	0	0	0	0	592.6968	1079.163	1079.163
HB-11_1401	269.7908	269.7908	499.1131	620.5189	1065.674	1672.703	1672.703
HB-12_1401	0	0	215.8327	242.8118	741.9248	971.247	971.247
NT_1401	0	0	0	111.2887	612.088	850.8529	873.4479



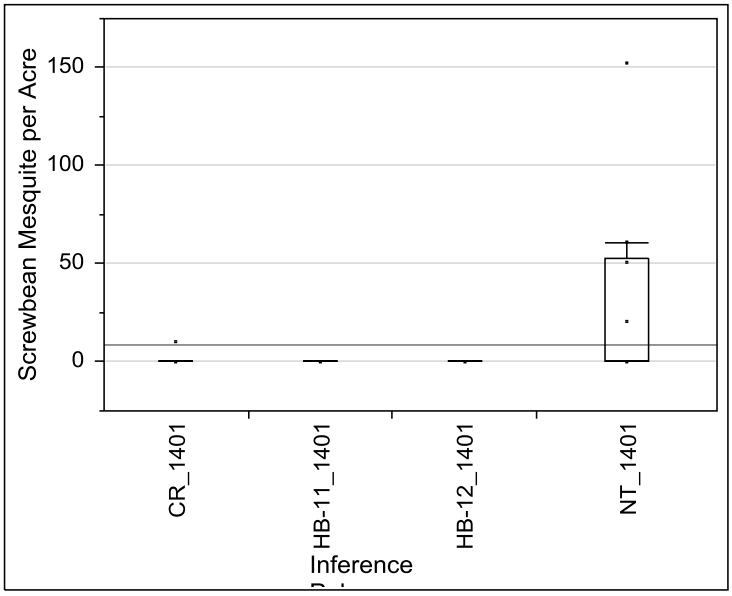
Quantiles

Level	Minimum	10%	25%	Median	75%	90%	Maximum
CR_1401	0	0	0	0	0	0	0
HB-11_1401	0	0	0	0	0	107.9163	107.9163
HB-12_1401	0	0	0	0	0	107.9163	107.9163
NT_1401	0	0	0	0	0	0	0



Quantiles

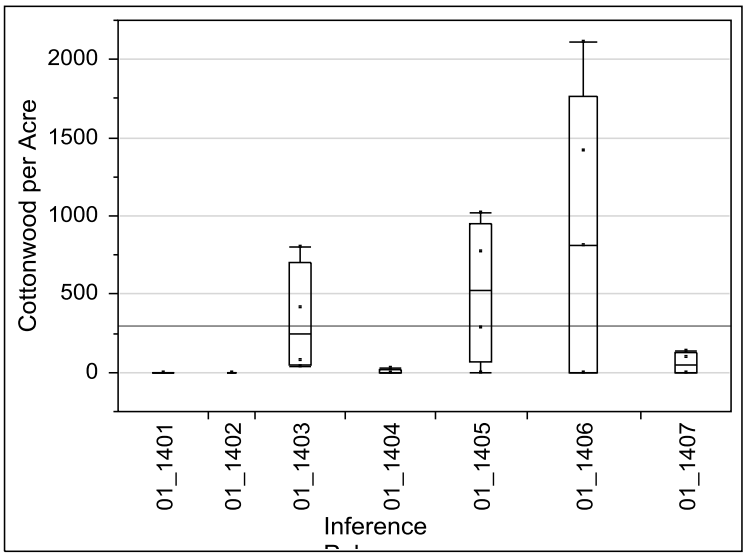
Level	Minimum	10%	25%	Median	75%	90%	Maximum
CR_1401	0	0	13.48954	82.62345	121.4059	151.7574	151.7574
HB-11_1401	0	0	0	0	0	0	0
HB-12_1401	0	0	0	0	0	0	0
NT_1401	0	0	15.17574	45.52721	53.11507	69.80838	70.8201



Quantiles

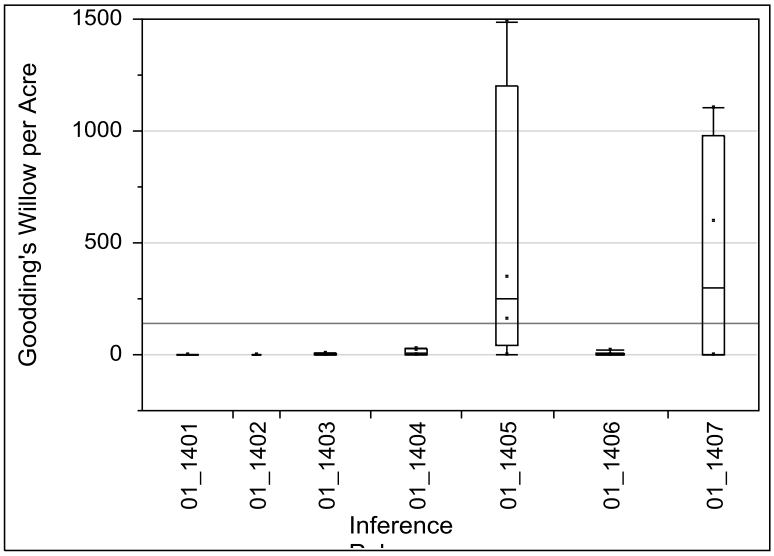
Level	Minimum	10%	25%	Median	75%	90%	Maximum
CR_1401	0	0	0	0	0	10.11716	10.11716
HB-11_1401	0	0	0	0	0	0	0
HB-12_1401	0	0	0	0	0	0	0
NT_1401	0	0	0	0	53.11507	142.6519	151.7574

VII 1.3 Cibola Valley Conservation Area Phase 01



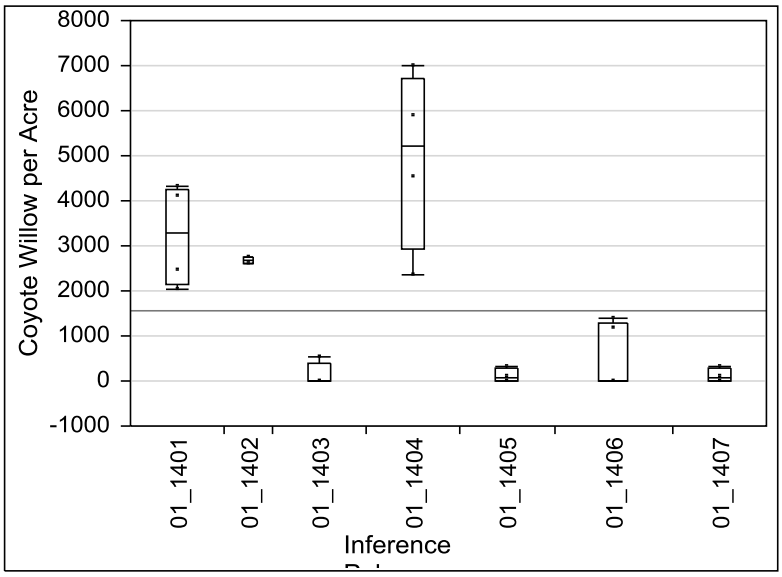
Quantiles

Level	Minimum	10%	25%	Median	75%	90%	Maximum
01_1401	0	0	0	0	0	0	0
01_1402	0	0	0	0	0	0	0
01_1403	40.46863	40.46863	50.58578	247.8703	703.1424	799.2554	799.2554
01_1404	0	0	0	0	22.7636	30.35147	30.35147
01_1405	0	0	71.66319	527.7783	953.542	1015.088	1015.088
01_1406	0	0	0	809.3725	1762.071	2107.741	2107.741
01_1407	0	0	0	50.58578	126.4645	134.8954	134.8954



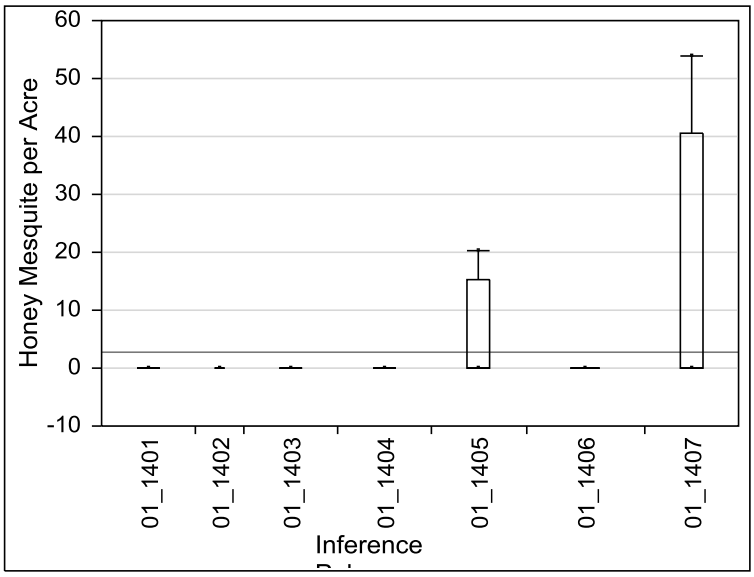
Quantiles

Level	Minimum	10%	25%	Median	75%	90%	Maximum
01_1401	0	0	0	0	0	0	0
01_1402	0	0	0	0	0	0	0
01_1403	0	0	0	0	7.587868	10.11716	10.11716
01_1404	0	0	0	10.11716	27.82218	30.35147	30.35147
01_1405	0	0	40.46863	252.9289	1201.412	1487.222	1487.222
01_1406	0	0	0	0	10.11716	20.23431	20.23431
01_1407	0	0	0	298.4561	978.8349	1106.142	1106.142



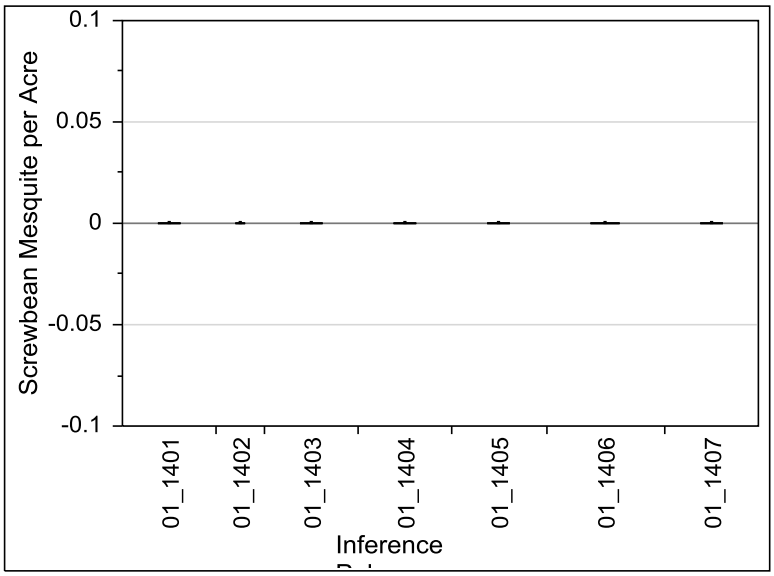
Quantiles

Level	Minimum	10%	25%	Median	75%	90%	Maximum
01_1401	2050.41	2050.41	2158.327	3291.448	4262.695	4316.654	4316.654
01_1402	2589.992	2589.992	2589.992	2670.929	2751.867	2751.867	2751.867
01_1403	0	0	0	0	404.6863	539.5817	539.5817
01_1404	2374.159	2374.159	2913.741	5206.963	6731.282	7014.562	7014.562
01_1405	0	0	0	53.95817	269.7908	323.749	323.749
01_1406	0	0	0	0	1294.996	1402.912	1402.912
01_1407	0	0	0	53.95817	269.7908	323.749	323.749



Quantiles

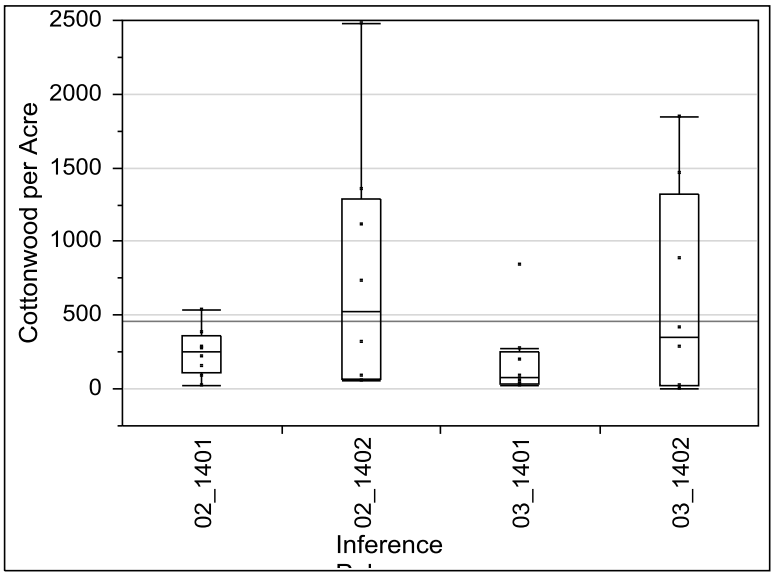
Level	Minimum	10%	25%	Median	75%	90%	Maximum
01_1401	0	0	0	0	0	0	0
01_1402	0	0	0	0	0	0	0
01_1403	0	0	0	0	0	0	0
01_1404	0	0	0	0	0	0	0
01_1405	0	0	0	0	15.17574	20.23431	20.23431
01_1406	0	0	0	0	0	0	0
01_1407	0	0	0	0	40.46863	53.95817	53.95817



Quantiles

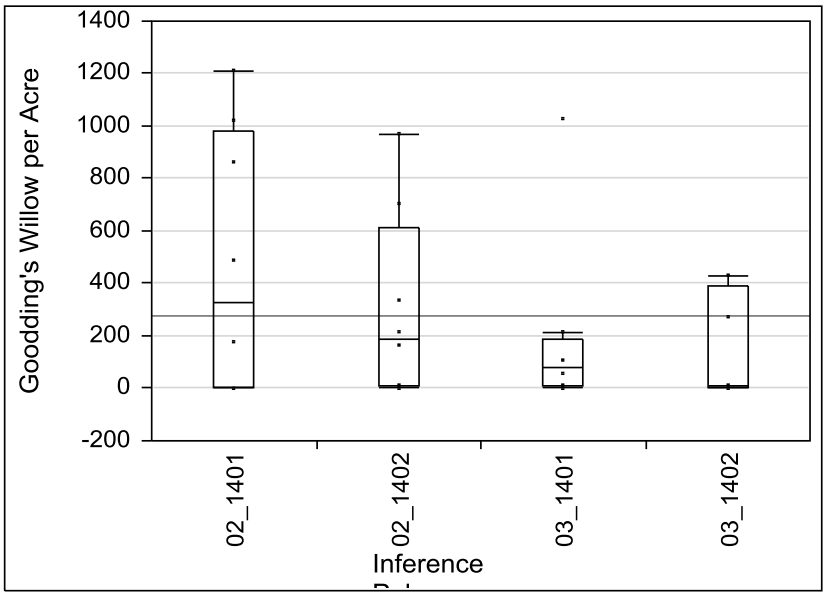
Level	Minimum	10%	25%	Median	75%	90%	Maximum
01_1401	0	0	0	0	0	0	0
01_1402	0	0	0	0	0	0	0
01_1403	0	0	0	0	0	0	0
01_1404	0	0	0	0	0	0	0
01_1405	0	0	0	0	0	0	0
01_1406	0	0	0	0	0	0	0
01_1407	0	0	0	0	0	0	0

VII 1.4 Cibola Valley Conservation Area Phase 02-03



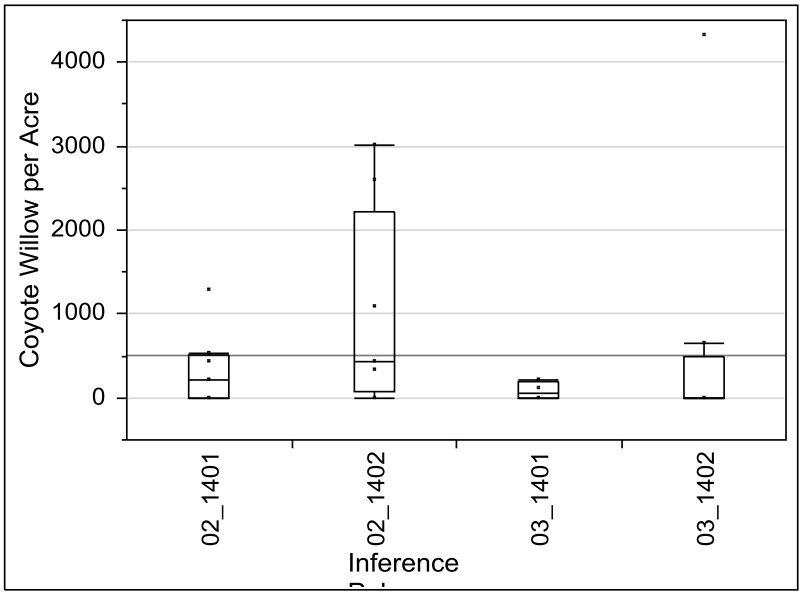
Quantiles

Level	Minimum	10%	25%	Median	75%	90%	Maximum
02_1401	20.23431	20.23431	107.0732	249.5565	358.316	539.5817	539.5817
02_1402	60.70294	60.70294	68.29081	524.406	1289.937	2478.703	2478.703
03_1401	20.23431	20.23431	32.88076	80.93725	255.4582	836.3516	836.3516
03_1402	0	0	20.23431	354.1005	1317.76	1841.323	1841.323



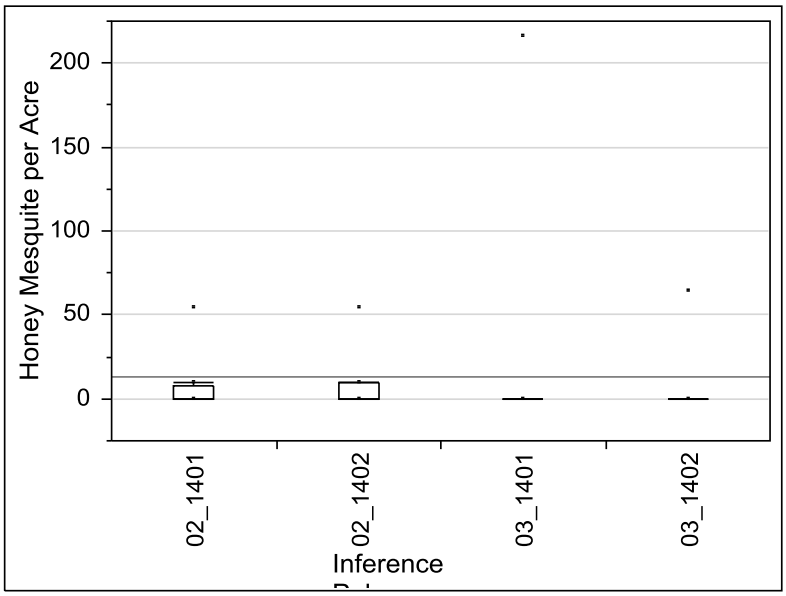
Quantiles

Level	Minimum	10%	25%	Median	75%	90%	Maximum
02_1401	0	0	0	328.8076	982.2073	1207.314	1207.314
02_1402	0	0	10.11716	188.8536	609.5587	971.247	971.247
03_1401	0	0	10.11716	80.93725	188.8536	1025.205	1025.205
03_1402	0	0	0	10.11716	391.1967	431.6654	431.6654



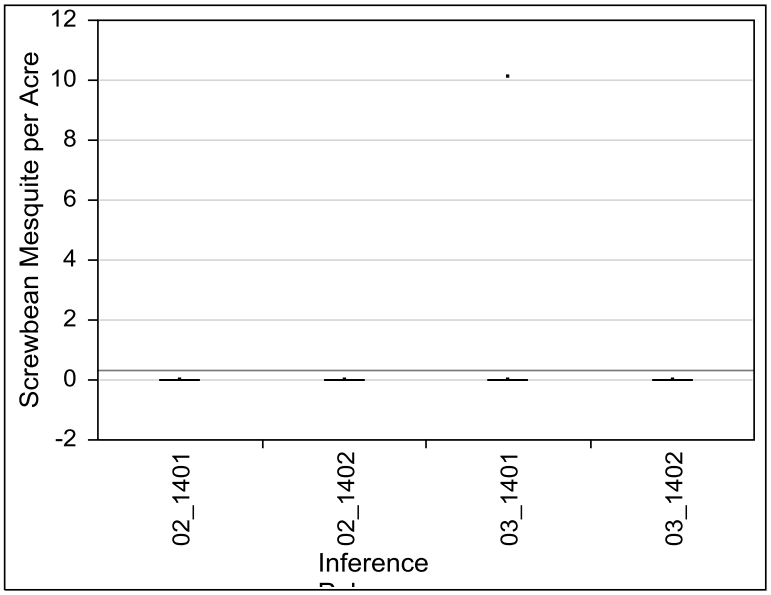
Quantiles

Level	Minimum	10%	25%	Median	75%	90%	Maximum
02_1401	0	0	0	215.8327	512.6026	1294.996	1294.996
02_1402	0	0	80.93725	431.6654	2212.285	3021.657	3021.657
03_1401	0	0	0	53.95817	188.8536	215.8327	215.8327
03_1402	0	0	0	0	485.6235	4316.654	4316.654



Quantiles

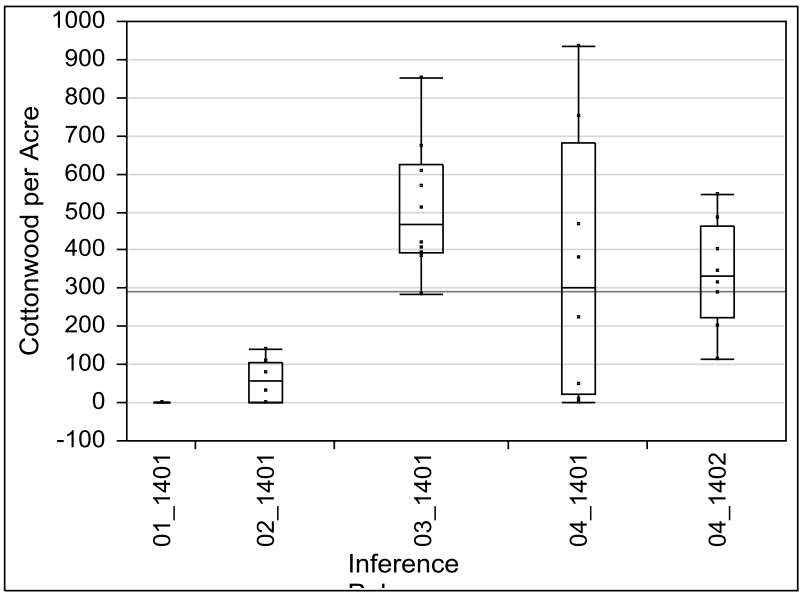
Level	Minimum	10%	25%	Median	75%	90%	Maximum
02_1401	0	0	0	0	7.587868	53.95817	53.95817
02_1402	0	0	0	0	10.11716	53.95817	53.95817
03_1401	0	0	0	0	0	215.8327	215.8327
03_1402	0	0	0	0	0	64.07533	64.07533



Quantiles

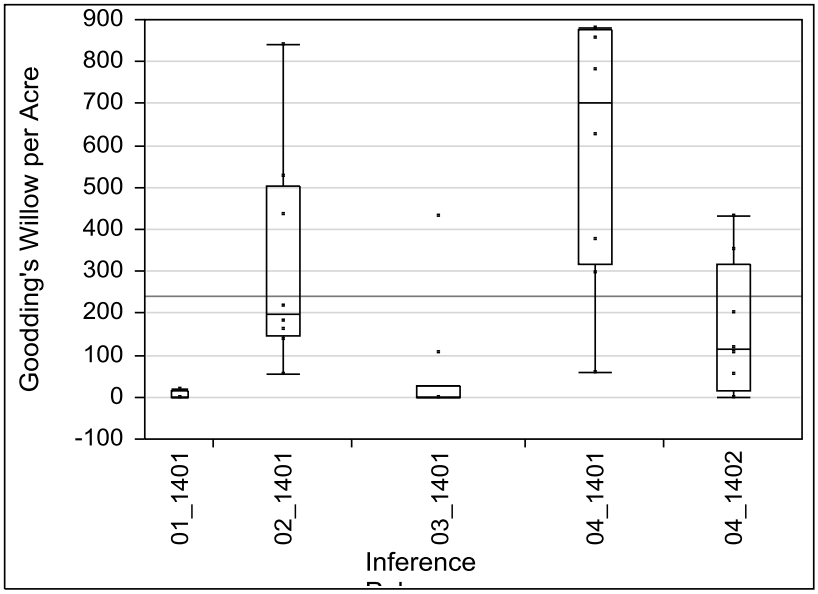
Level	Minimum	10%	25%	Median	75%	90%	Maximum
02_1401	0	0	0	0	0	0	0
02_1402	0	0	0	0	0	0	0
03_1401	0	0	0	0	0	10.11716	10.11716
03_1402	0	0	0	0	0	0	0

VII 1.5 Palo Verde Ecological Reserve Phase 01-04



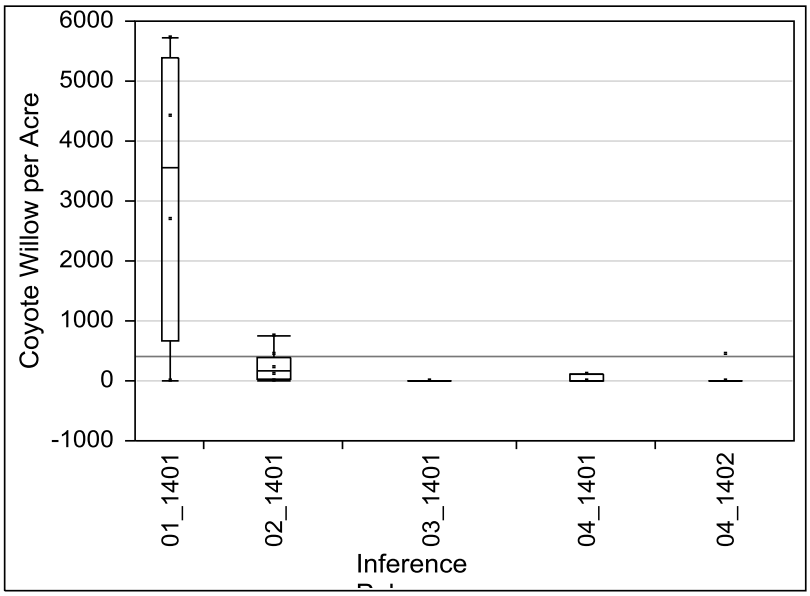
Quantiles

Level	Minimum	10%	25%	Median	75%	90%	Maximum
01_1401	0	0	0	0	0	0	0
02_1401	0	0	0	55.64436	103.7009	141.6402	141.6402
03_1401	283.2804	293.3975	392.0398	465.3892	623.8913	835.3399	853.2135
04_1401	0	0	20.23431	301.8285	681.2219	934.1508	934.1508
04_1402	114.6611	114.6611	223.4205	330.4938	464.5461	546.3265	546.3265



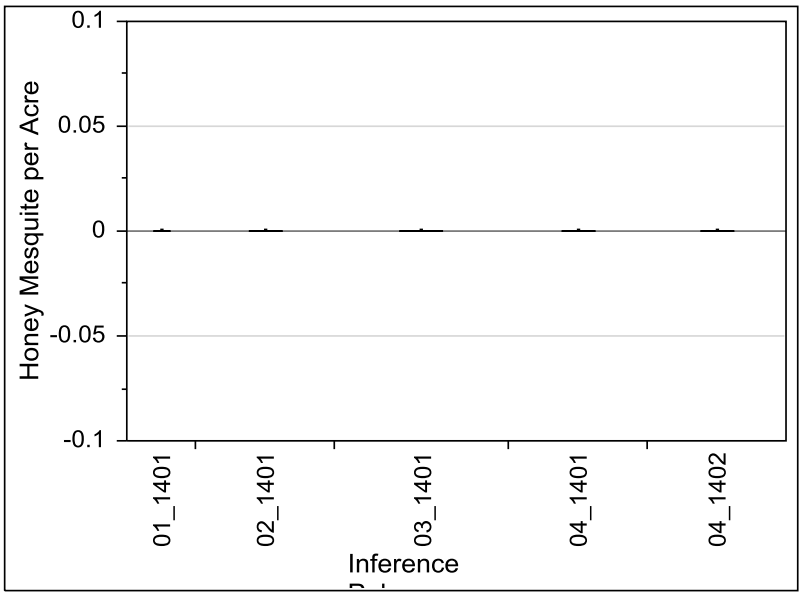
Quantiles

Level	Minimum	10%	25%	Median	75%	90%	Maximum
01_1401	0	0	0	0	15.17574	20.23431	20.23431
02_1401	53.95817	53.95817	144.1695	198.9707	503.3285	839.724	839.724
03_1401	0	0	0	0	26.97908	399.2905	431.6654
04_1401	60.70294	60.70294	316.1611	703.1424	874.291	880.1926	880.1926
04_1402	0	0	13.48954	112.9749	316.1611	431.6654	431.6654



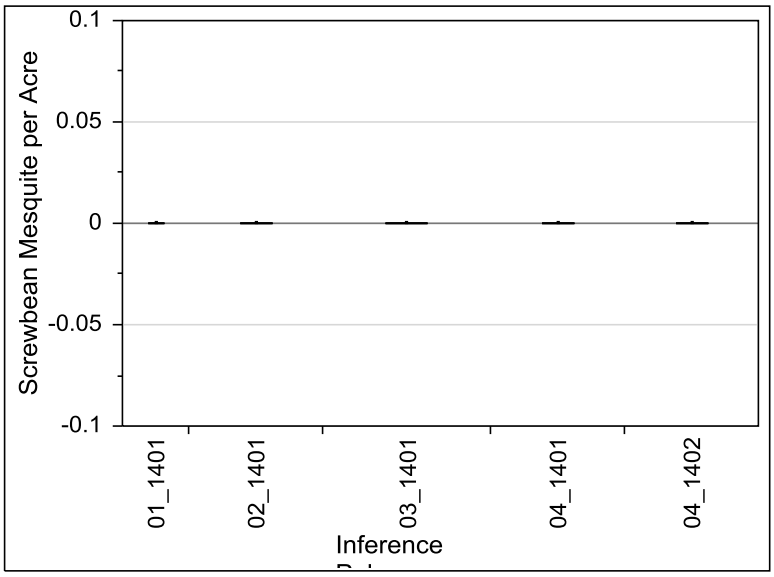
Quantiles

Level	Minimum	10%	25%	Median	75%	90%	Maximum
01_1401	0	0	674.4771	3561.239	5395.817	5719.566	5719.566
02_1401	0	0	26.97908	161.8745	377.7072	755.4144	755.4144
03_1401	0	0	0	0	0	0	0
04_1401	0	0	0	0	107.9163	107.9163	107.9163
04_1402	0	0	0	0	0	431.6654	431.6654



Quantiles

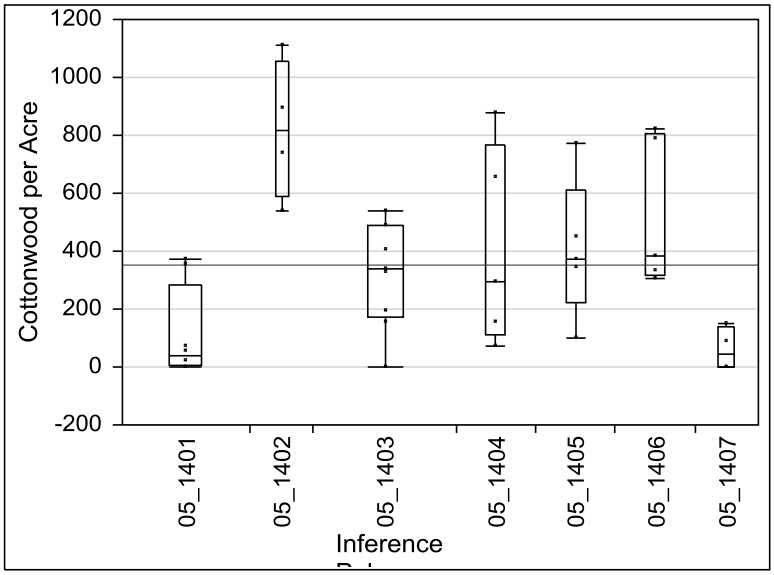
Level	Minimum	10%	25%	Median	75%	90%	Maximum
01_1401	0	0	0	0	0	0	0
02_1401	0	0	0	0	0	0	0
03_1401	0	0	0	0	0	0	0
04_1401	0	0	0	0	0	0	0
04_1402	0	0	0	0	0	0	0



Quantiles

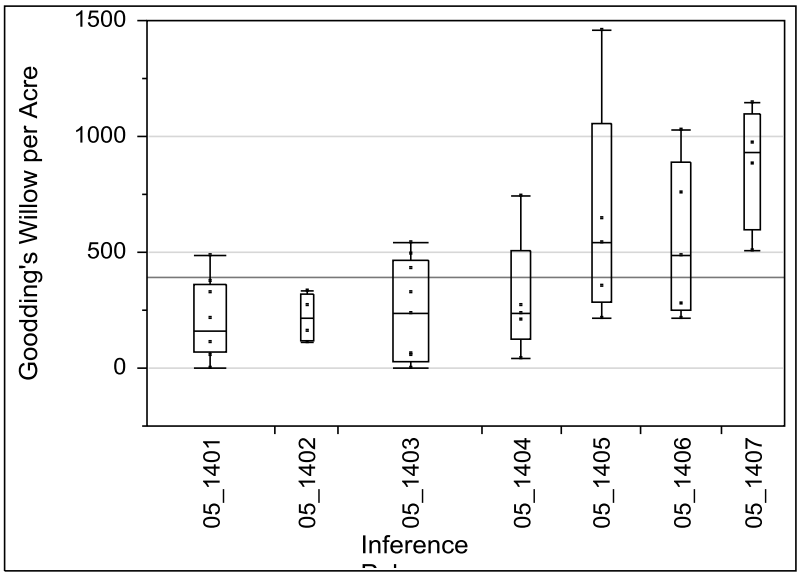
Level	Minimum	10%	25%	Median	75%	90%	Maximum
01_1401	0	0	0	0	0	0	0
02_1401	0	0	0	0	0	0	0
03_1401	0	0	0	0	0	0	0
04_1401	0	0	0	0	0	0	0
04_1402	0	0	0	0	0	0	0

VII 1.6 Palo Verde Ecological Reserve Phase 05



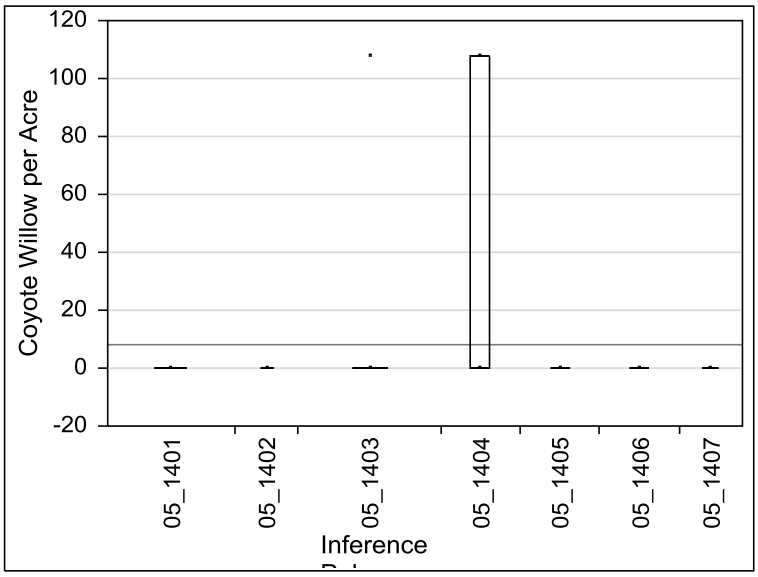
Quantiles

Level	Minimum	10%	25%	Median	75%	90%	Maximum
05_1401	0	0	5.058578	37.09624	283.2804	374.3348	374.3348
05_1402	536.2093	536.2093	586.7951	816.1173	1055.557	1109.515	1109.515
05_1403	0	0	173.6779	340.6109	488.9959	536.2093	536.2093
05_1404	70.8201	70.8201	112.9749	296.7699	767.2177	876.8202	876.8202
05_1405	101.1716	101.1716	222.5774	370.9624	610.4018	772.2763	772.2763
05_1406	303.5147	303.5147	318.6904	381.0796	804.314	819.4897	819.4897
05_1407	0	0	0	45.52721	136.5816	151.7574	151.7574



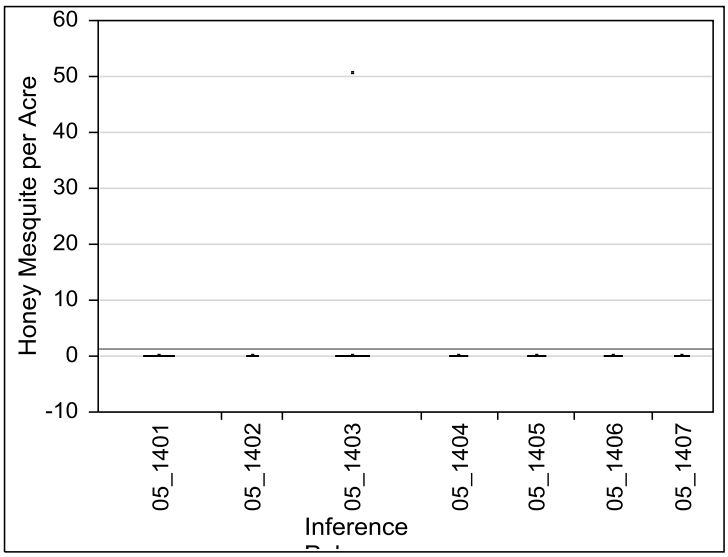
Quantiles

Level	Minimum	10%	25%	Median	75%	90%	Maximum
05_1401	0	0	67.44771	161.8745	361.6884	485.6235	485.6235
05_1402	107.9163	107.9163	121.4059	215.8327	317.8473	333.8662	333.8662
05_1403	0	0	26.97908	232.6946	462.0168	542.9541	542.9541
05_1404	40.46863	40.46863	124.7783	232.6946	505.8578	741.9248	741.9248
05_1405	215.8327	215.8327	284.9666	539.5817	1052.184	1456.871	1456.871
05_1406	215.8327	215.8327	247.8703	485.6235	890.3098	1025.205	1025.205
05_1407	505.8578	505.8578	600.2846	927.406	1100.241	1143.239	1143.239



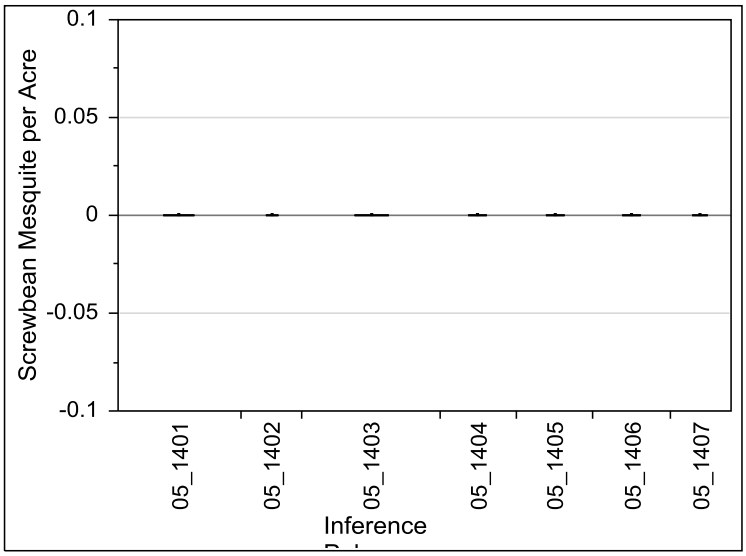
Quantiles

Level	Minimum	10%	25%	Median	75%	90%	Maximum
05_1401	0	0	0	0	0	0	0
05_1402	0	0	0	0	0	0	0
05_1403	0	0	0	0	0	107.9163	107.9163
05_1404	0	0	0	0	107.9163	107.9163	107.9163
05_1405	0	0	0	0	0	0	0
05_1406	0	0	0	0	0	0	0
05_1407	0	0	0	0	0	0	0



Quantiles

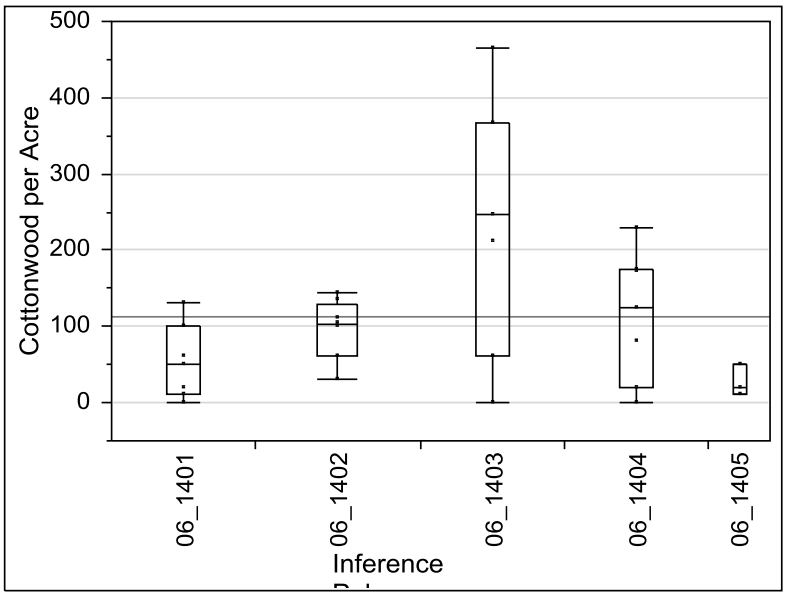
Level	Minimum	10%	25%	Median	75%	90%	Maximum
05_1401	0	0	0	0	0	0	0
05_1402	0	0	0	0	0	0	0
05_1403	0	0	0	0	0	50.58578	50.58578
05_1404	0	0	0	0	0	0	0
05_1405	0	0	0	0	0	0	0
05_1406	0	0	0	0	0	0	0
05_1407	0	0	0	0	0	0	0



Quantiles

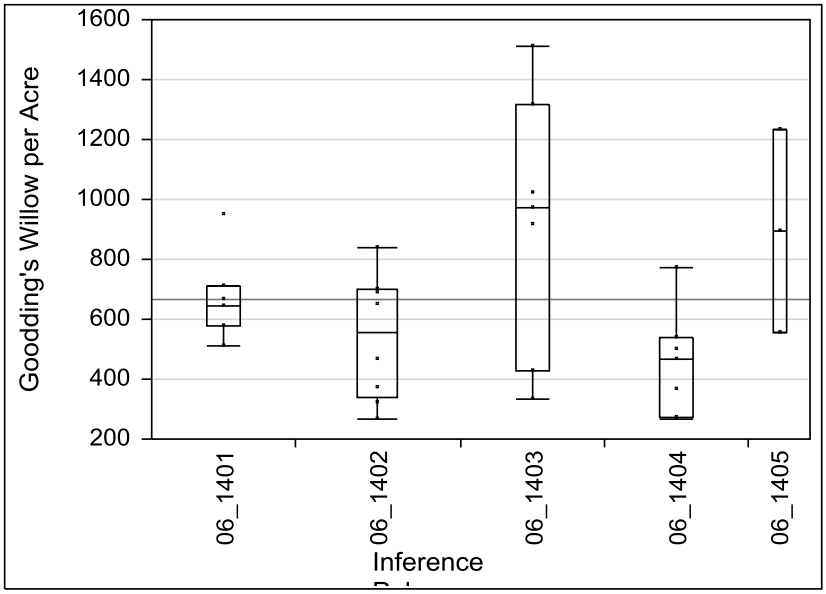
Level	Minimum	10%	25%	Median	75%	90%	Maximum
05_1401	0	0	0	0	0	0	0
05_1402	0	0	0	0	0	0	0
05_1403	0	0	0	0	0	0	0
05_1404	0	0	0	0	0	0	0
05_1405	0	0	0	0	0	0	0
05_1406	0	0	0	0	0	0	0
05_1407	0	0	0	0	0	0	0

VII 1.7 Palo Verde Ecological Reserve Phase 06



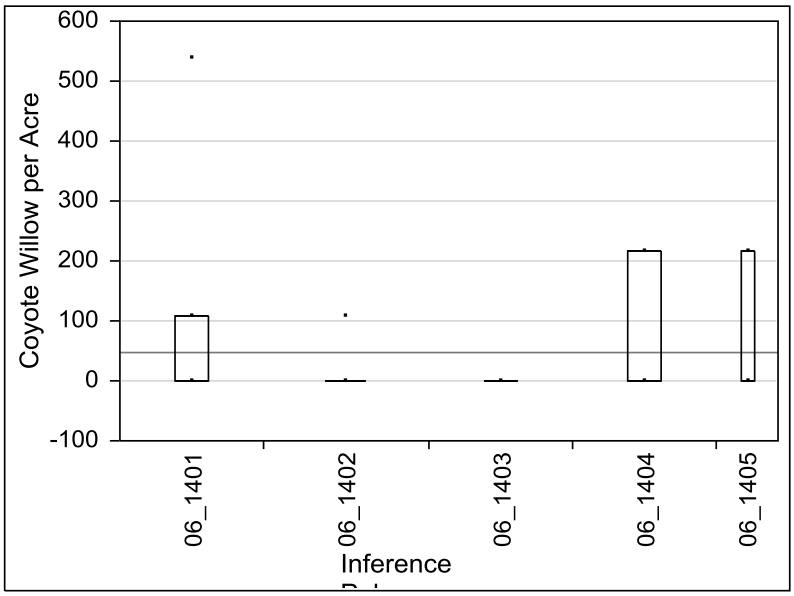
Quantiles

Level	Minimum	10%	25%	Median	75%	90%	Maximum
06_1401	0	0	10.11716	50.58578	101.1716	131.523	131.523
06_1402	30.35147	30.35147	60.70294	102.8578	128.9937	145.0126	145.0126
06_1403	0	0	60.70294	246.1841	367.59	465.3892	465.3892
06_1404	0	0	20.23431	124.7783	175.364	229.3222	229.3222
06_1405	10.11716	10.11716	10.11716	20.23431	50.58578	50.58578	50.58578



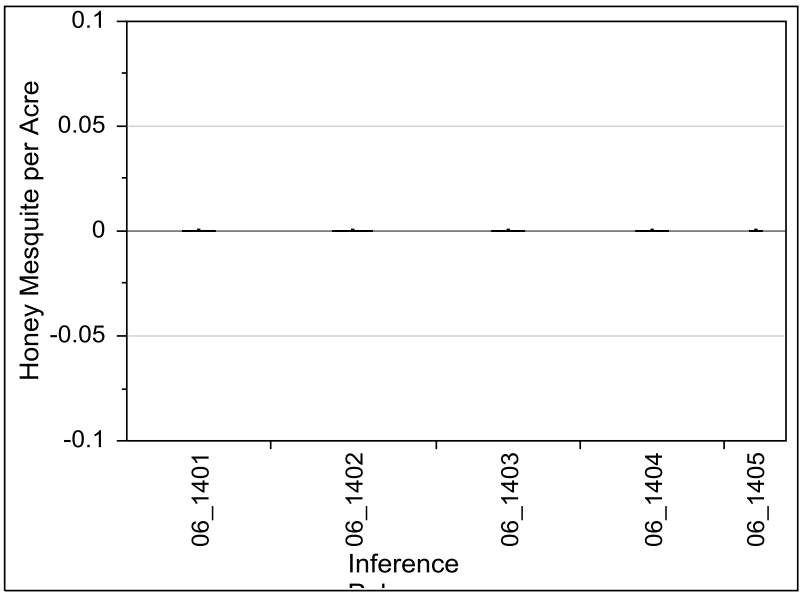
Quantiles

Level	Minimum	10%	25%	Median	75%	90%	Maximum
06_1401	512.6026	512.6026	580.0503	644.1256	711.5734	951.0127	951.0127
06_1402	266.4185	266.4185	336.3955	558.1298	698.0838	836.3516	836.3516
06_1403	333.8662	333.8662	428.293	971.247	1315.23	1510.829	1510.829
06_1404	266.4185	266.4185	269.7908	468.7616	539.5817	772.2763	772.2763
06_1405	553.0712	553.0712	553.0712	893.6822	1234.293	1234.293	1234.293



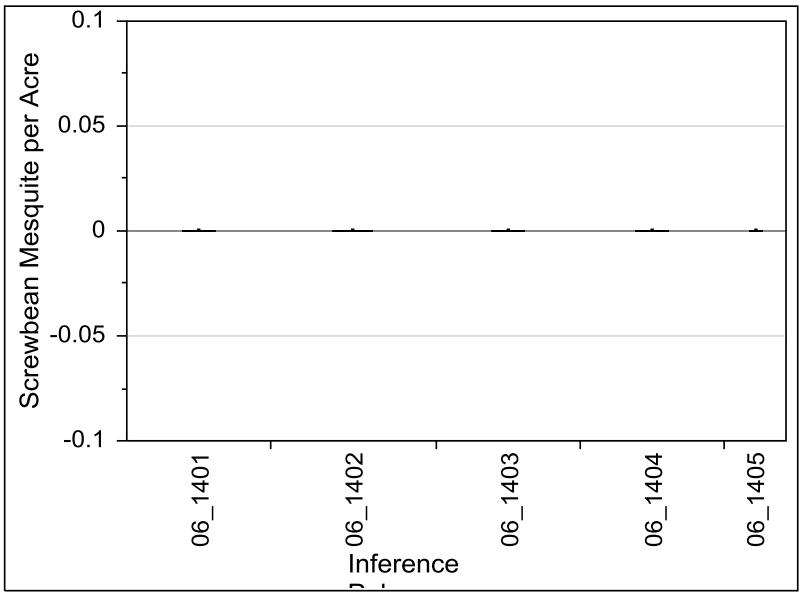
Quantiles

Level	Minimum	10%	25%	Median	75%	90%	Maximum
06_1401	0	0	0	0	107.9163	539.5817	539.5817
06_1402	0	0	0	0	0	107.9163	107.9163
06_1403	0	0	0	0	0	0	0
06_1404	0	0	0	0	215.8327	215.8327	215.8327
06_1405	0	0	0	0	215.8327	215.8327	215.8327



Quantiles

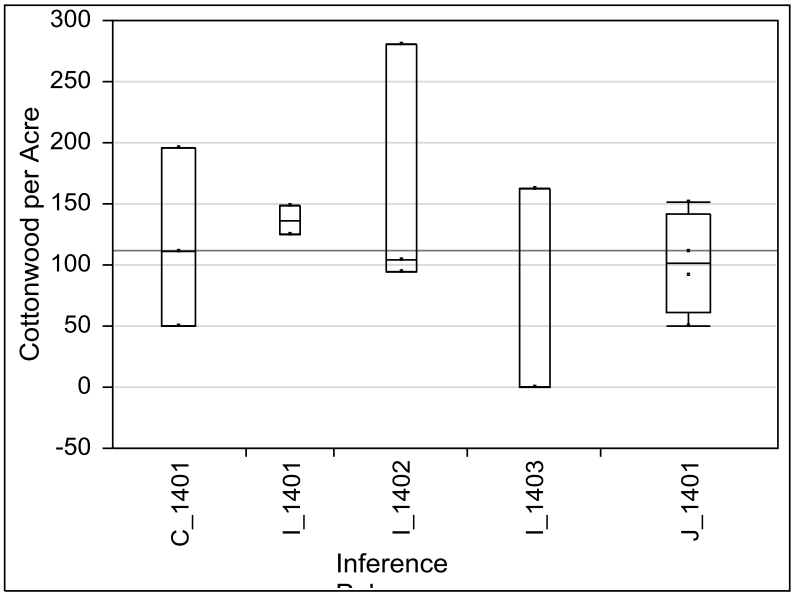
Level	Minimum	10%	25%	Median	75%	90%	Maximum
06_1401	0	0	0	0	0	0	0
06_1402	0	0	0	0	0	0	0
06_1403	0	0	0	0	0	0	0
06_1404	0	0	0	0	0	0	0
06_1405	0	0	0	0	0	0	0



Quantiles

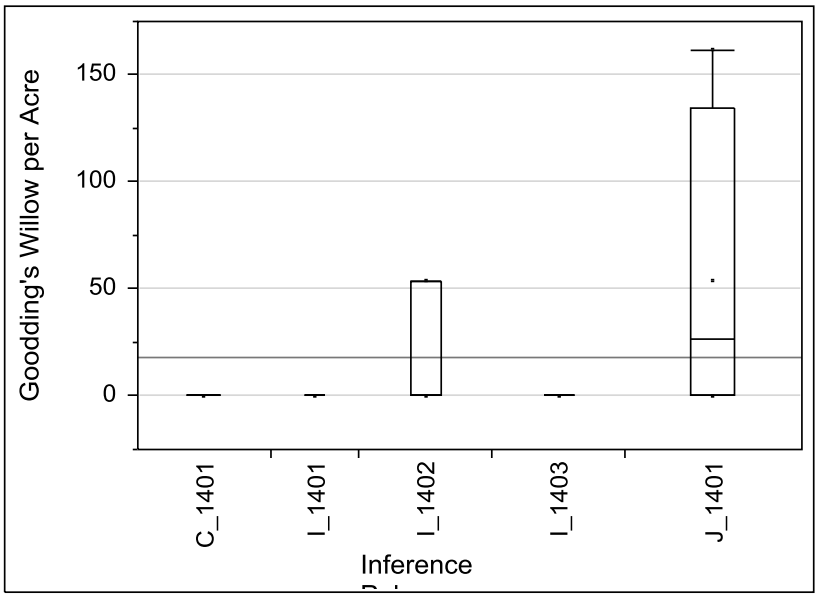
Level	Minimum	10%	25%	Median	75%	90%	Maximum
06_1401	0	0	0	0	0	0	0
06_1402	0	0	0	0	0	0	0
06_1403	0	0	0	0	0	0	0
06_1404	0	0	0	0	0	0	0
06_1405	0	0	0	0	0	0	0

VII 1.8 Yuma East Wetlands



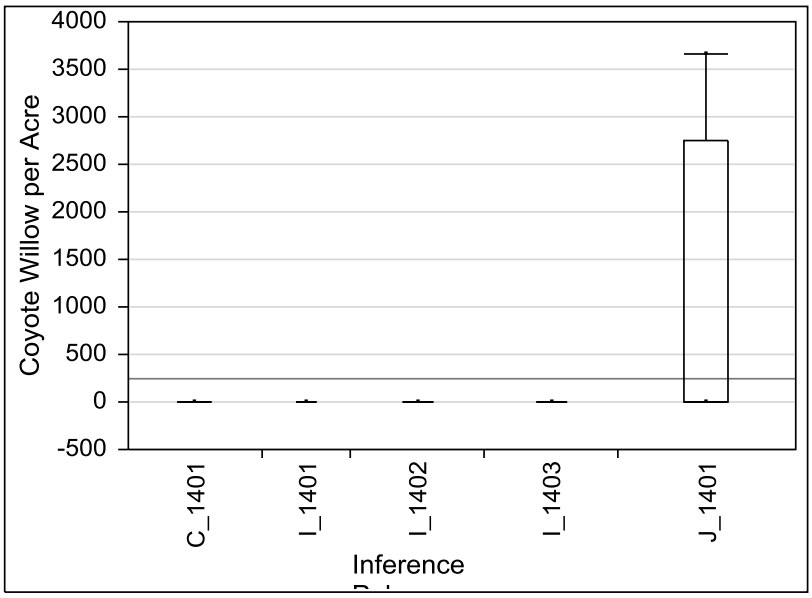
Quantiles

Level	Minimum	10%	25%	Median	75%	90%	Maximum
C_1401	50.58578	50.58578	50.58578	111.2887	195.5984	195.5984	195.5984
I_1401	124.7783	124.7783	124.7783	136.5816	148.385	148.385	148.385
I_1402	94.4268	94.4268	94.4268	104.544	279.908	279.908	279.908
I_1403	0	0	0	0	161.8745	161.8745	161.8745
J_1401	50.58578	50.58578	60.70294	101.1716	141.6402	151.7574	151.7574



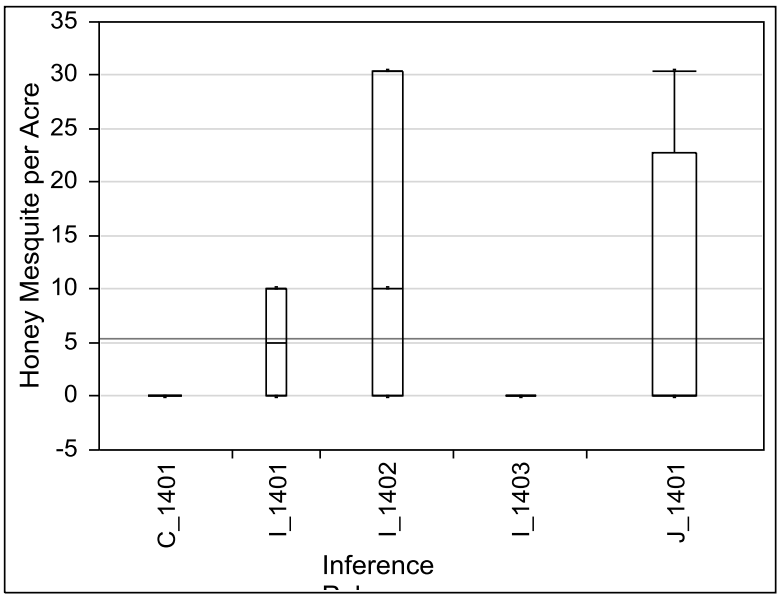
Quantiles

Level	Minimum	10%	25%	Median	75%	90%	Maximum
C_1401	0	0	0	0	0	0	0
I_1401	0	0	0	0	0	0	0
I_1402	0	0	0	0	53.95817	53.95817	53.95817
I_1403	0	0	0	0	0	0	0
J_1401	0	0	0	26.97908	134.8954	161.8745	161.8745



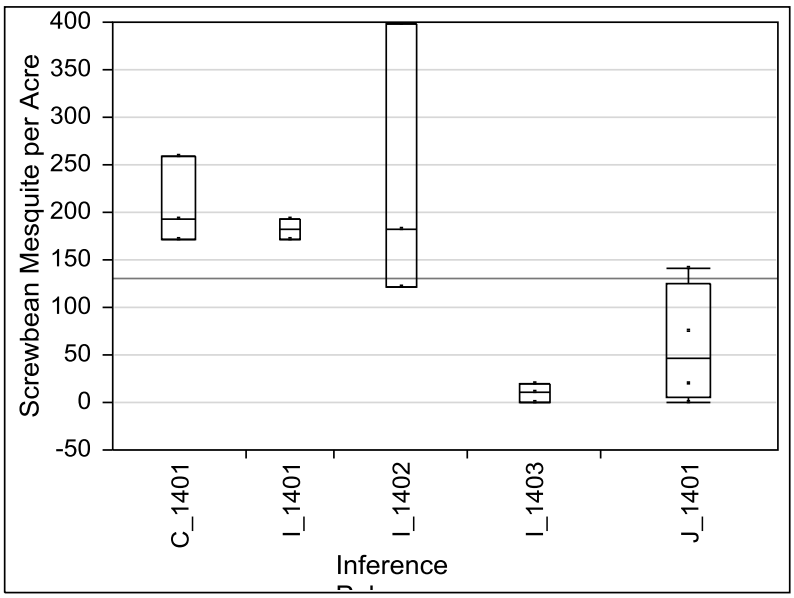
Quantiles

Level	Minimum	10%	25%	Median	75%	90%	Maximum
C_1401	0	0	0	0	0	0	0
I_1401	0	0	0	0	0	0	0
I_1402	0	0	0	0	0	0	0
I_1403	0	0	0	0	0	0	0
J_1401	0	0	0	0	2751.867	3669.155	3669.155



Quantiles

Level	Minimum	10%	25%	Median	75%	90%	Maximum
C_1401	0	0	0	0	0	0	0
I_1401	0	0	0	5.058578	10.11716	10.11716	10.11716
I_1402	0	0	0	10.11716	30.35147	30.35147	30.35147
I_1403	0	0	0	0	0	0	0
J_1401	0	0	0	0	22.7636	30.35147	30.35147

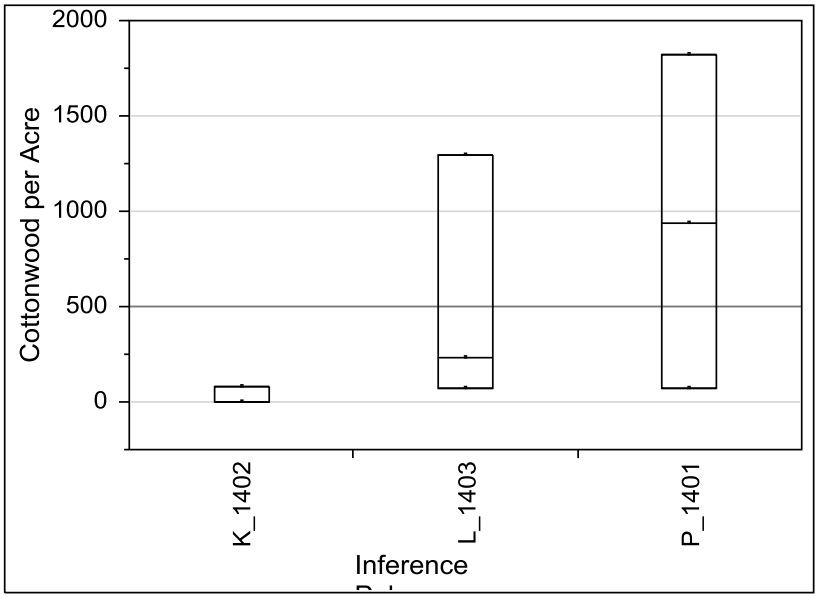


Quantiles

Level	Minimum	10%	25%	Median	75%	90%	Maximum
C_1401	171.9917	171.9917	171.9917	192.226	259.6737	259.6737	259.6737
I_1401	171.9917	171.9917	171.9917	182.1088	192.226	192.226	192.226
I_1402	121.4059	121.4059	121.4059	182.1088	397.9415	397.9415	397.9415
I_1403	0	0	0	10.11716	20.23431	20.23431	20.23431
J_1401	0	0	5.058578	47.2134	124.7783	141.6402	141.6402

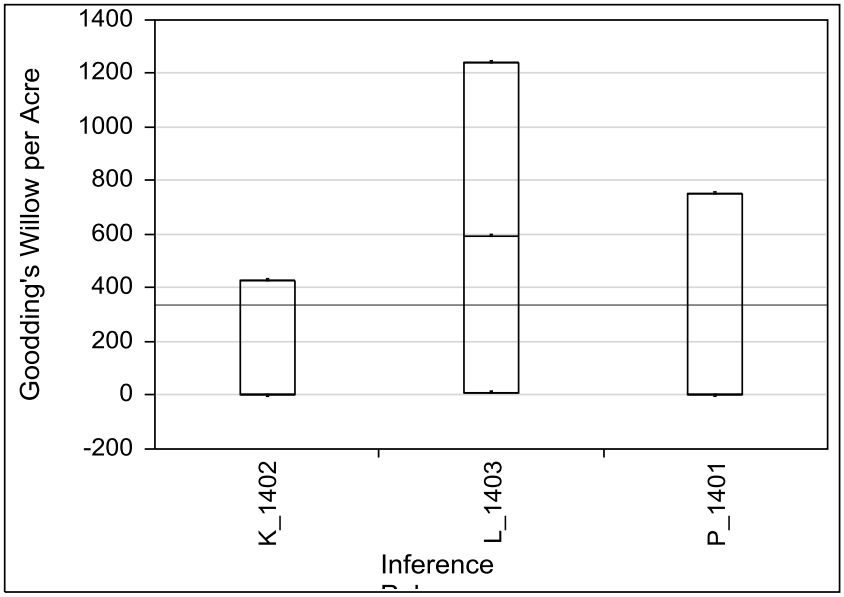
VII 2 SHRUB DENSITY BY SPECIES AND INFERENCE POLYGON

VII 2.1 Beal Lake Conservation Area



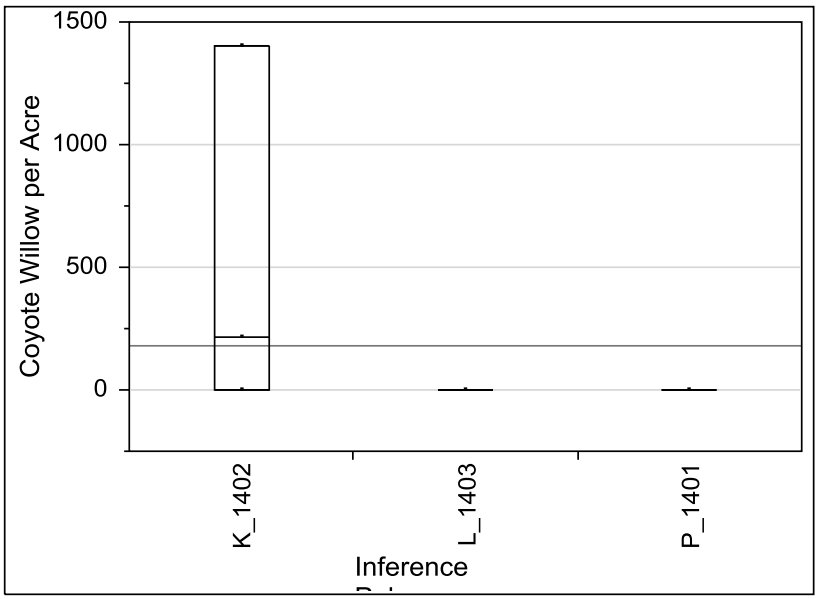
Quantiles

Level	Minimum	10%	25%	Median	75%	90%	Maximum
K_1402	0	0	0	0	80.93725	80.93725	80.93725
L_1403	70.8201	70.8201	70.8201	232.6946	1291.624	1291.624	1291.624
P_1401	70.8201	70.8201	70.8201	934.1508	1824.461	1824.461	1824.461



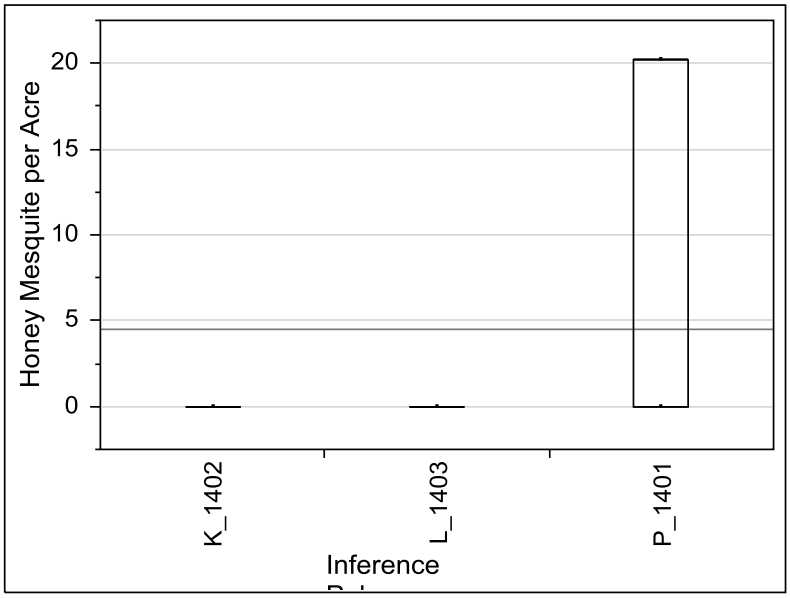
Quantiles

Level	Minimum	10%	25%	Median	75%	90%	Maximum
K_1402	0	0	0	0	431.6654	431.6654	431.6654
L_1403	10.11716	10.11716	10.11716	593.5399	1241.038	1241.038	1241.038
P_1401	0	0	0	0	755.4144	755.4144	755.4144



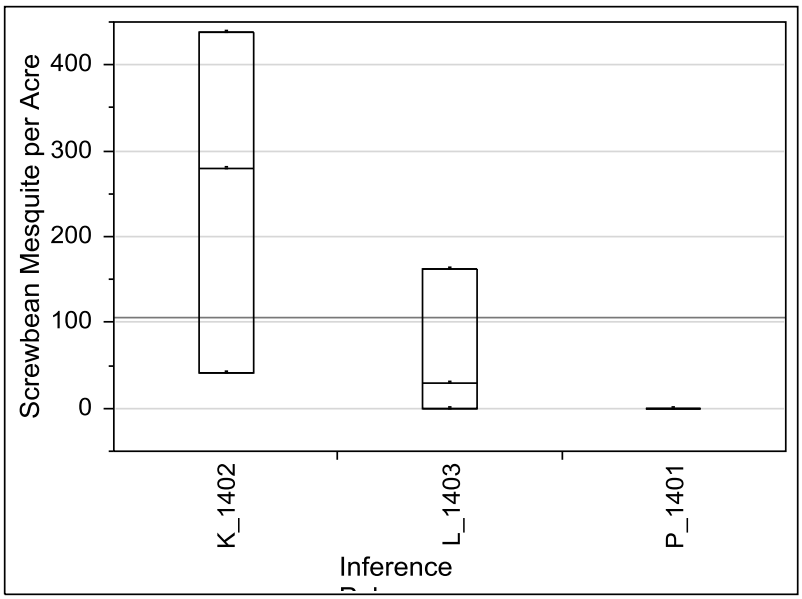
Quantiles

Level	Minimum	10%	25%	Median	75%	90%	Maximum
K_1402	0	0	0	215.8327	1402.912	1402.912	1402.912
L_1403	0	0	0	0	0	0	0
P_1401	0	0	0	0	0	0	0



Quantiles

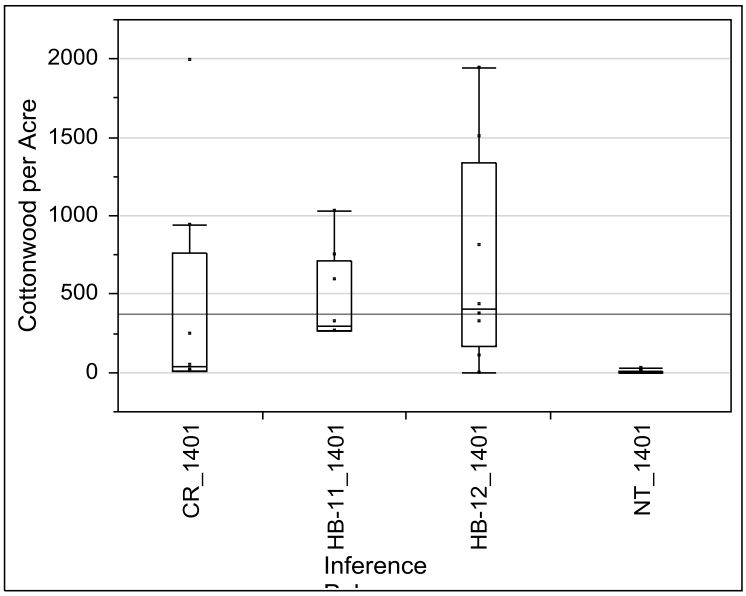
Level	Minimum	10%	25%	Median	75%	90%	Maximum
K_1402	0	0	0	0	0	0	0
L_1403	0	0	0	0	0	0	0
P_1401	0	0	0	20.23431	20.23431	20.23431	20.23431



Quantiles

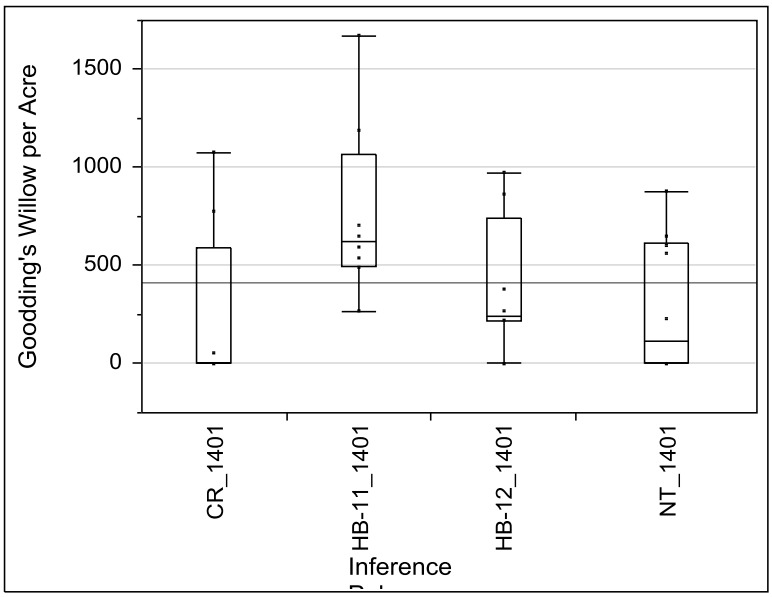
Level	Minimum	10%	25%	Median	75%	90%	Maximum
K_1402	40.46863	40.46863	40.46863	279.908	438.4101	438.4101	438.4101
L_1403	0	0	0	30.35147	161.8745	161.8745	161.8745
P_1401	0	0	0	0	0	0	0

VII 2.2 Cibola National Wildlife Refuge Unit 1 Conservation Area



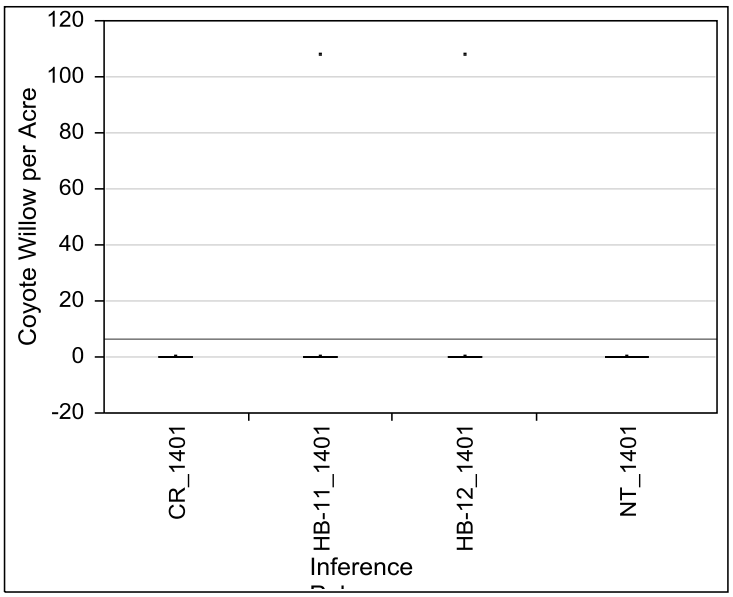
Quantiles

Level	Minimum	10%	25%	Median	75%	90%	Maximum
CR_1401	10.11716	10.11716	12.64645	35.41005	765.5315	1996.452	1996.452
HB-11_1401	269.7908	269.7908	269.7908	296.7699	714.9457	1025.205	1025.205
HB-12_1401	0	0	161.8745	404.6863	1335.465	1942.494	1942.494
NT_1401	0	0	0	0	12.64645	29.33975	30.35147



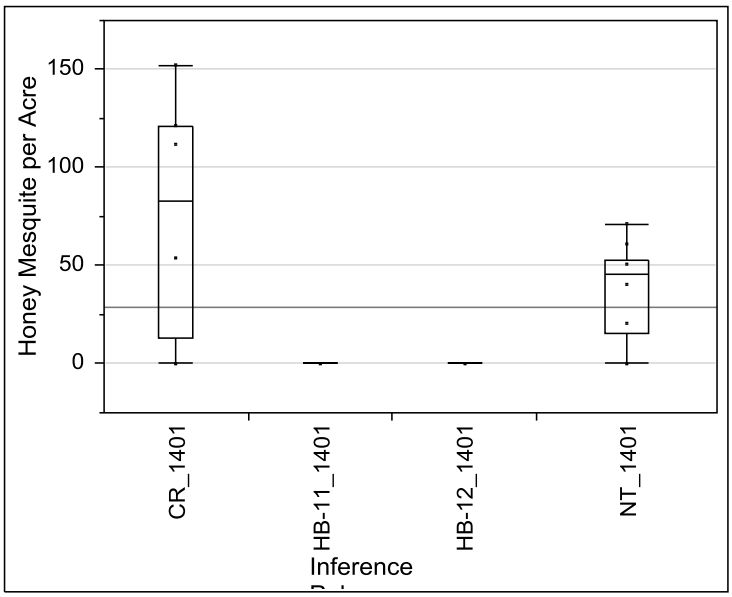
Quantiles

Level	Minimum	10%	25%	Median	75%	90%	Maximum
CR_1401	0	0	0	0	592.6968	1079.163	1079.163
HB-11_1401	269.7908	269.7908	499.1131	620.5189	1065.674	1672.703	1672.703
HB-12_1401	0	0	215.8327	242.8118	741.9248	971.247	971.247
NT_1401	0	0	0	111.2887	612.088	850.8529	873.4479



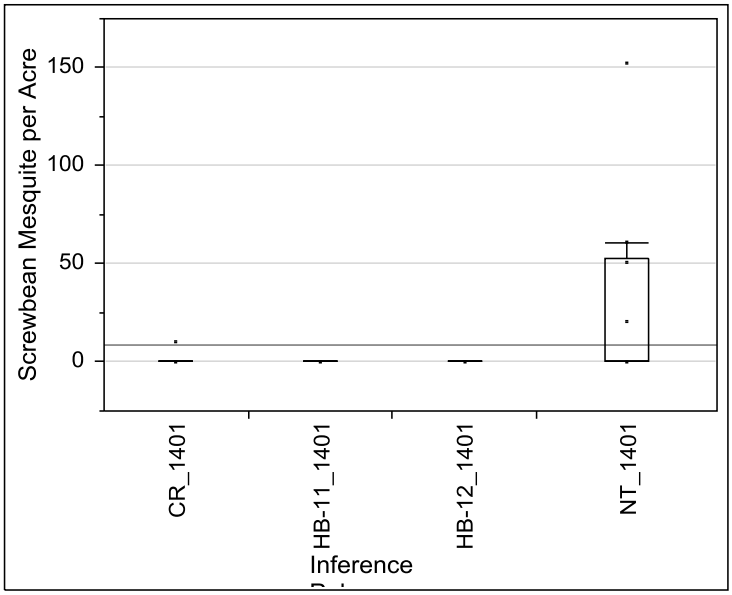
Quantiles

Level	Minimum	10%	25%	Median	75%	90%	Maximum
CR_1401	0	0	0	0	0	0	0
HB-11_1401	0	0	0	0	0	107.9163	107.9163
HB-12_1401	0	0	0	0	0	107.9163	107.9163
NT_1401	0	0	0	0	0	0	0



Quantiles

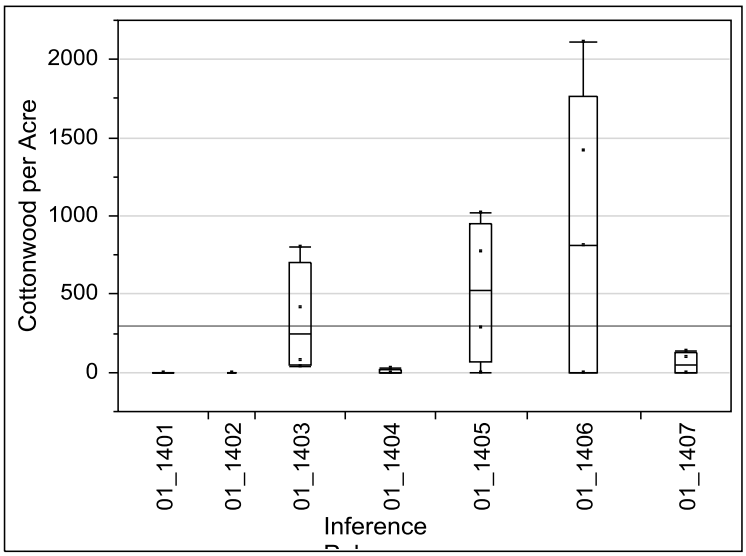
Level	Minimum	10%	25%	Median	75%	90%	Maximum
CR_1401	0	0	13.48954	82.62345	121.4059	151.7574	151.7574
HB-11_1401	0	0	0	0	0	0	0
HB-12_1401	0	0	0	0	0	0	0
NT_1401	0	0	15.17574	45.52721	53.11507	69.80838	70.8201



Quantiles

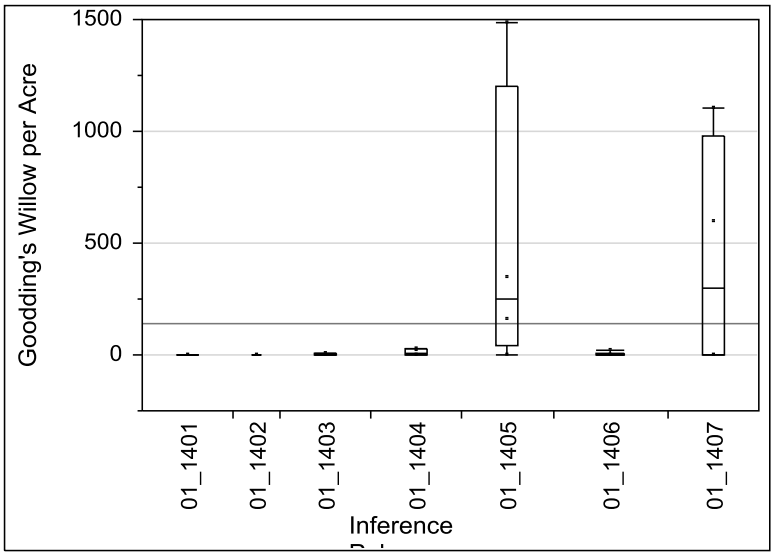
Level	Minimum	10%	25%	Median	75%	90%	Maximum
CR_1401	0	0	0	0	0	10.11716	10.11716
HB-11_1401	0	0	0	0	0	0	0
HB-12_1401	0	0	0	0	0	0	0
NT_1401	0	0	0	0	53.11507	142.6519	151.7574

VII 2.3 Cibola Valley Conservation Area Phase 01



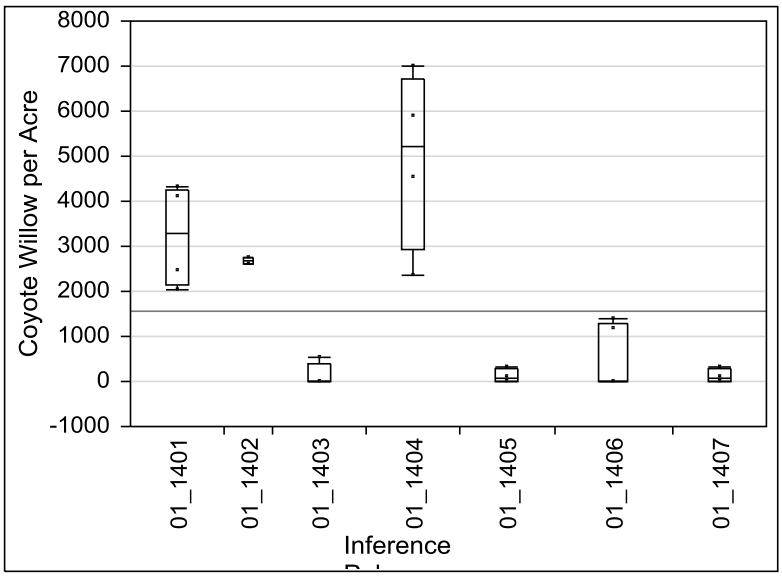
Quantiles

Level	Minimum	10%	25%	Median	75%	90%	Maximum
01_1401	0	0	0	0	0	0	0
01_1402	0	0	0	0	0	0	0
01_1403	40.46863	40.46863	50.58578	247.8703	703.1424	799.2554	799.2554
01_1404	0	0	0	0	22.7636	30.35147	30.35147
01_1405	0	0	71.66319	527.7783	953.542	1015.088	1015.088
01_1406	0	0	0	809.3725	1762.071	2107.741	2107.741
01_1407	0	0	0	50.58578	126.4645	134.8954	134.8954



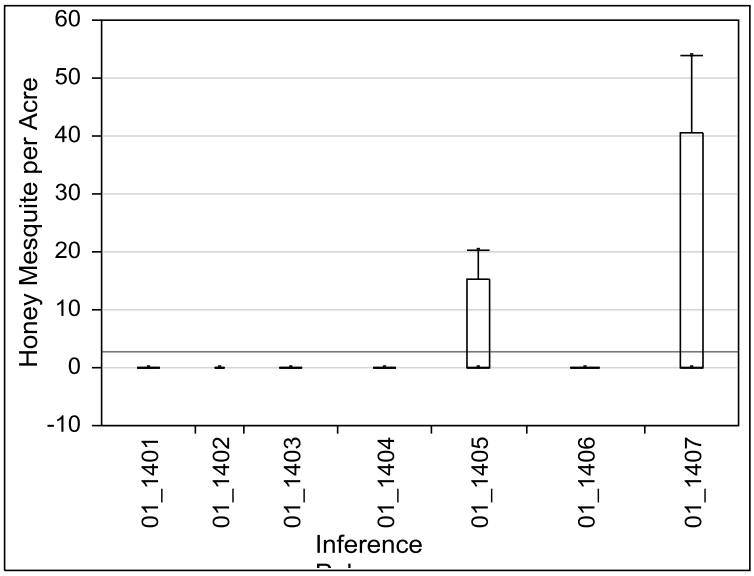
Quantiles

Level	Minimum	10%	25%	Median	75%	90%	Maximum
01_1401	0	0	0	0	0	0	0
01_1402	0	0	0	0	0	0	0
01_1403	0	0	0	0	7.587868	10.11716	10.11716
01_1404	0	0	0	10.11716	27.82218	30.35147	30.35147
01_1405	0	0	40.46863	252.9289	1201.412	1487.222	1487.222
01_1406	0	0	0	0	10.11716	20.23431	20.23431
01_1407	0	0	0	298.4561	978.8349	1106.142	1106.142



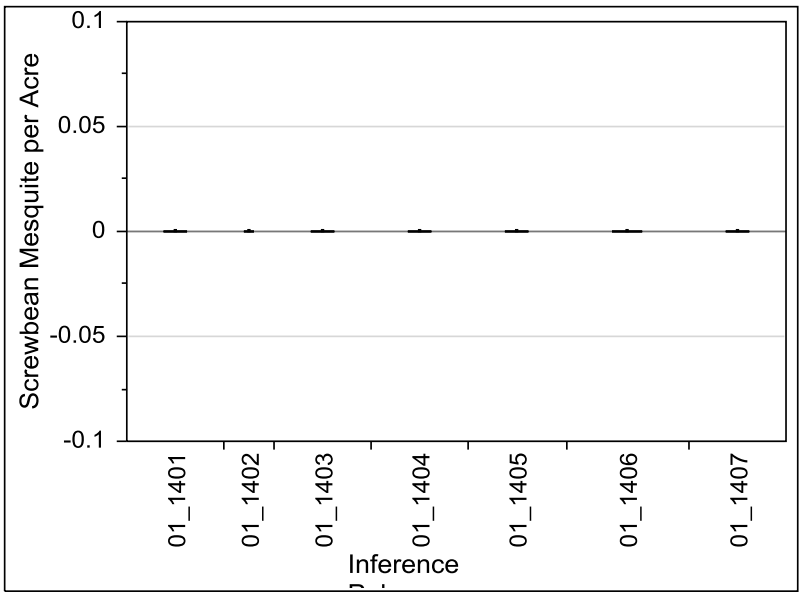
Quantiles

Level	Minimum	10%	25%	Median	75%	90%	Maximum
01_1401	2050.41	2050.41	2158.327	3291.448	4262.695	4316.654	4316.654
01_1402	2589.992	2589.992	2589.992	2670.929	2751.867	2751.867	2751.867
01_1403	0	0	0	0	404.6863	539.5817	539.5817
01_1404	2374.159	2374.159	2913.741	5206.963	6731.282	7014.562	7014.562
01_1405	0	0	0	53.95817	269.7908	323.749	323.749
01_1406	0	0	0	0	1294.996	1402.912	1402.912
01_1407	0	0	0	53.95817	269.7908	323.749	323.749



Quantiles

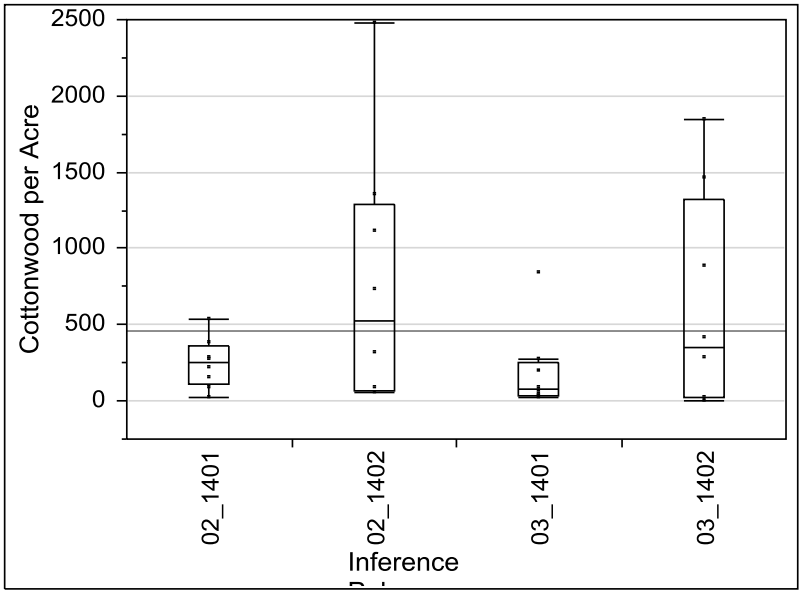
Level	Minimum	10%	25%	Median	75%	90%	Maximum
01_1401	0	0	0	0	0	0	0
01_1402	0	0	0	0	0	0	0
01_1403	0	0	0	0	0	0	0
01_1404	0	0	0	0	0	0	0
01_1405	0	0	0	0	15.17574	20.23431	20.23431
01_1406	0	0	0	0	0	0	0
01_1407	0	0	0	0	40.46863	53.95817	53.95817



Quantiles

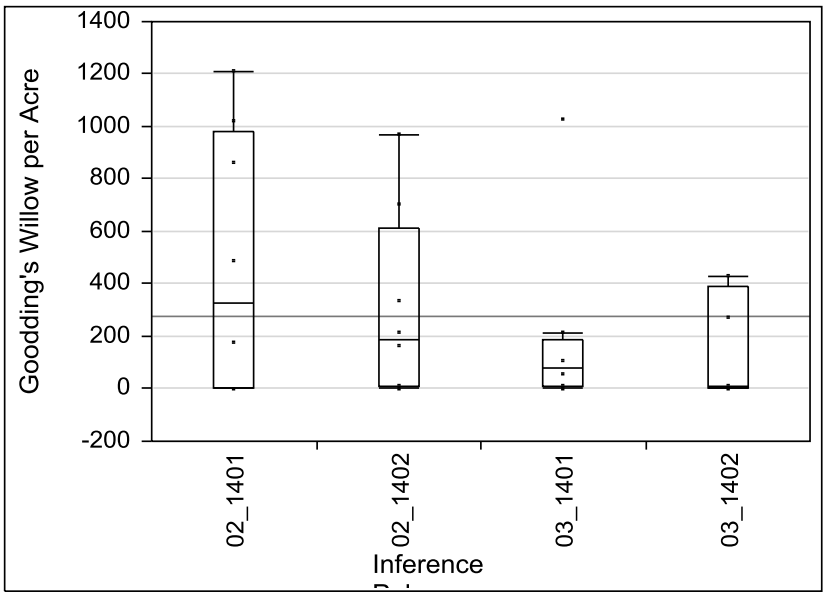
Level	Minimum	10%	25%	Median	75%	90%	Maximum
01_1401	0	0	0	0	0	0	0
01_1402	0	0	0	0	0	0	0
01_1403	0	0	0	0	0	0	0
01_1404	0	0	0	0	0	0	0
01_1405	0	0	0	0	0	0	0
01_1406	0	0	0	0	0	0	0
01_1407	0	0	0	0	0	0	0

VII 2.4 Cibola Valley Conservation Area Phase 02-03



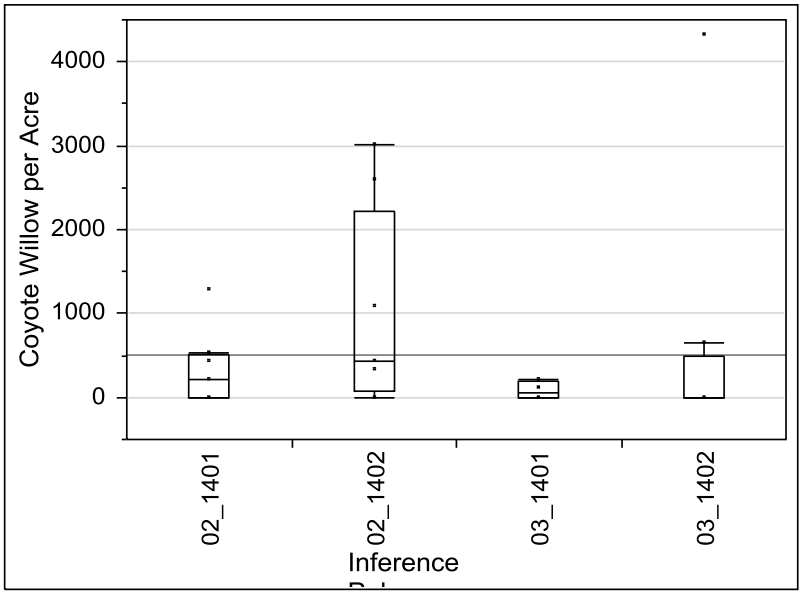
Quantiles

Level	Minimum	10%	25%	Median	75%	90%	Maximum
02_1401	20.23431	20.23431	107.0732	249.5565	358.316	539.5817	539.5817
02_1402	60.70294	60.70294	68.29081	524.406	1289.937	2478.703	2478.703
03_1401	20.23431	20.23431	32.88076	80.93725	255.4582	836.3516	836.3516
03_1402	0	0	20.23431	354.1005	1317.76	1841.323	1841.323



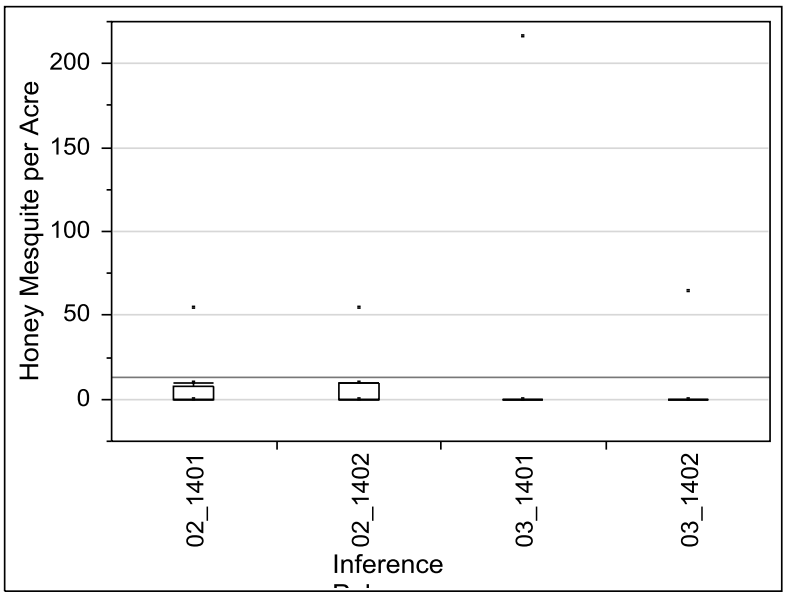
Quantiles

Level	Minimum	10%	25%	Median	75%	90%	Maximum
02_1401	0	0	0	328.8076	982.2073	1207.314	1207.314
02_1402	0	0	10.11716	188.8536	609.5587	971.247	971.247
03_1401	0	0	10.11716	80.93725	188.8536	1025.205	1025.205
03_1402	0	0	0	10.11716	391.1967	431.6654	431.6654



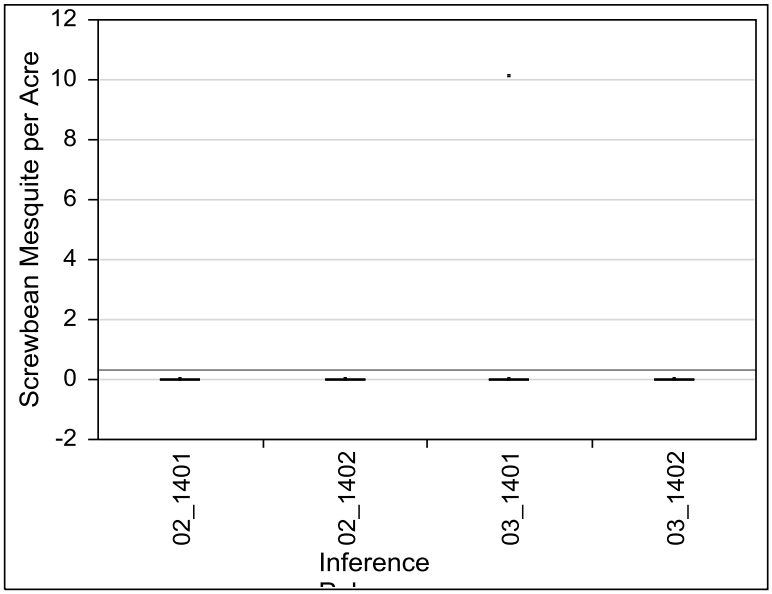
Quantiles

Level	Minimum	10%	25%	Median	75%	90%	Maximum
02_1401	0	0	0	215.8327	512.6026	1294.996	1294.996
02_1402	0	0	80.93725	431.6654	2212.285	3021.657	3021.657
03_1401	0	0	0	53.95817	188.8536	215.8327	215.8327
03_1402	0	0	0	0	485.6235	4316.654	4316.654



Quantiles

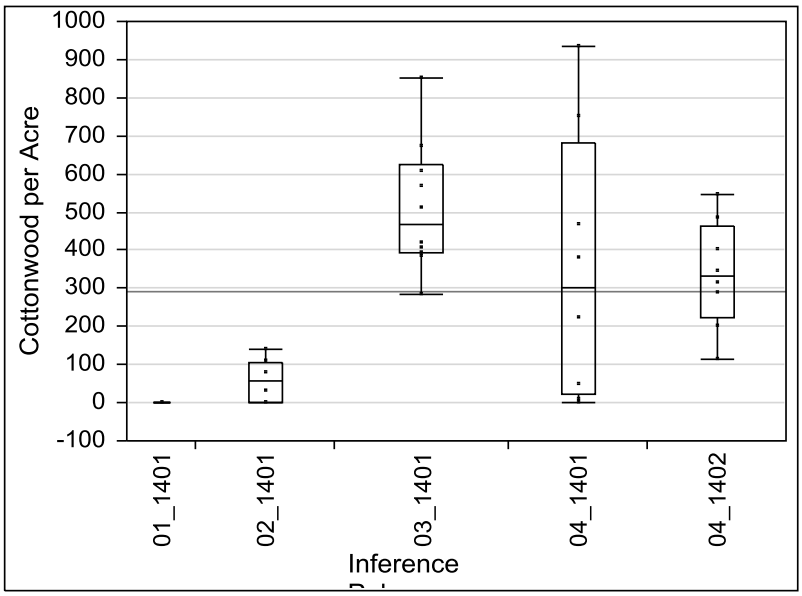
Level	Minimum	10%	25%	Median	75%	90%	Maximum
02_1401	0	0	0	0	7.587868	53.95817	53.95817
02_1402	0	0	0	0	10.11716	53.95817	53.95817
03_1401	0	0	0	0	0	215.8327	215.8327
03_1402	0	0	0	0	0	64.07533	64.07533



Quantiles

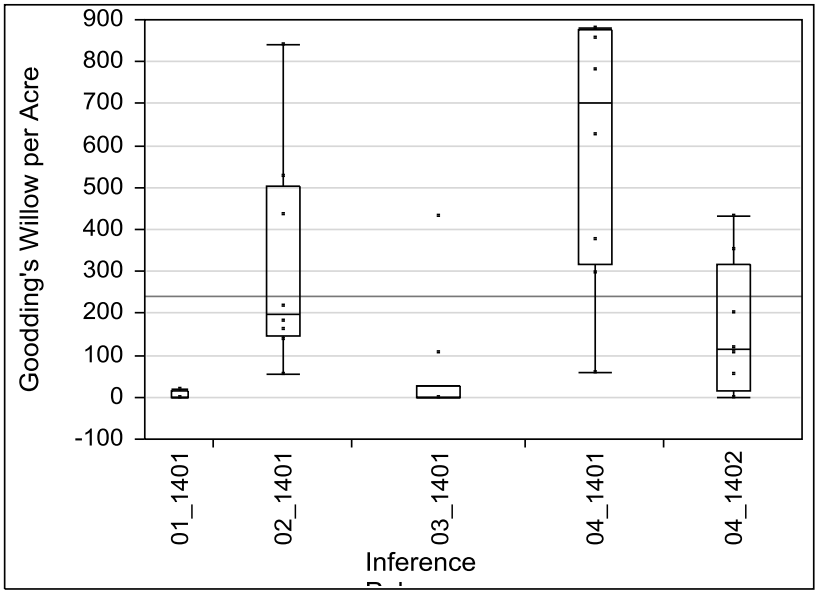
Level	Minimum	10%	25%	Median	75%	90%	Maximum
02_1401	0	0	0	0	0	0	0
02_1402	0	0	0	0	0	0	0
03_1401	0	0	0	0	0	10.11716	10.11716
03_1402	0	0	0	0	0	0	0

VII 2.5 Palo Verde Ecological Reserve Phase 01-04



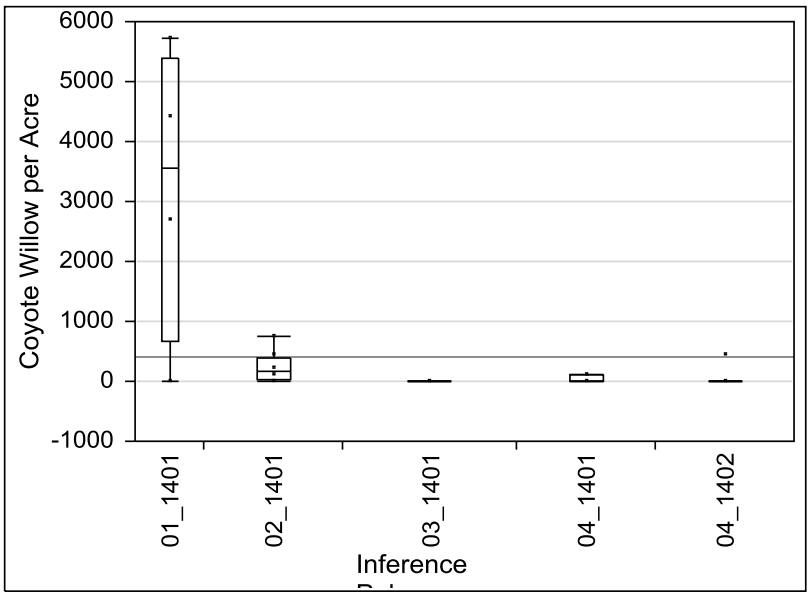
Quantiles

Level	Minimum	10%	25%	Median	75%	90%	Maximum
01_1401	0	0	0	0	0	0	0
02_1401	0	0	0	55.64436	103.7009	141.6402	141.6402
03_1401	283.2804	293.3975	392.0398	465.3892	623.8913	835.3399	853.2135
04_1401	0	0	20.23431	301.8285	681.2219	934.1508	934.1508
04_1402	114.6611	114.6611	223.4205	330.4938	464.5461	546.3265	546.3265



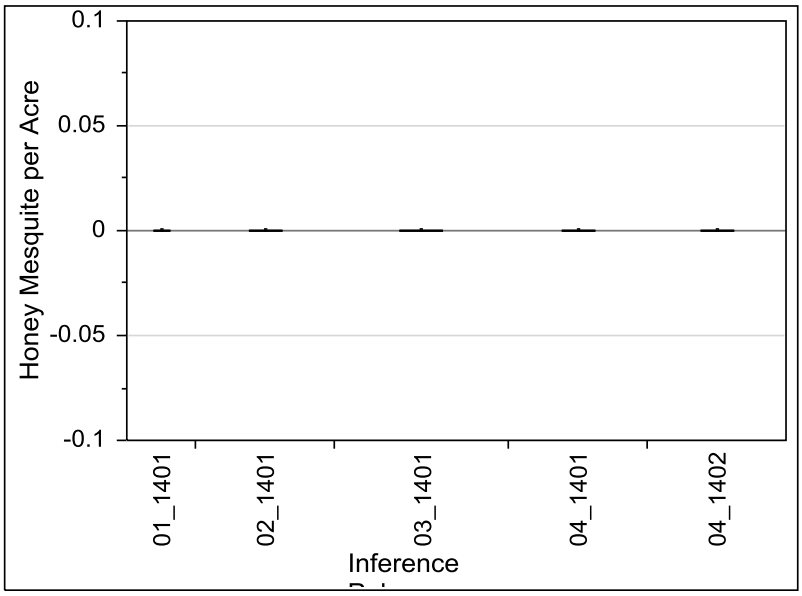
Quantiles

Level	Minimum	10%	25%	Median	75%	90%	Maximum
01_1401	0	0	0	0	15.17574	20.23431	20.23431
02_1401	53.95817	53.95817	144.1695	198.9707	503.3285	839.724	839.724
03_1401	0	0	0	0	26.97908	399.2905	431.6654
04_1401	60.70294	60.70294	316.1611	703.1424	874.291	880.1926	880.1926
04_1402	0	0	13.48954	112.9749	316.1611	431.6654	431.6654



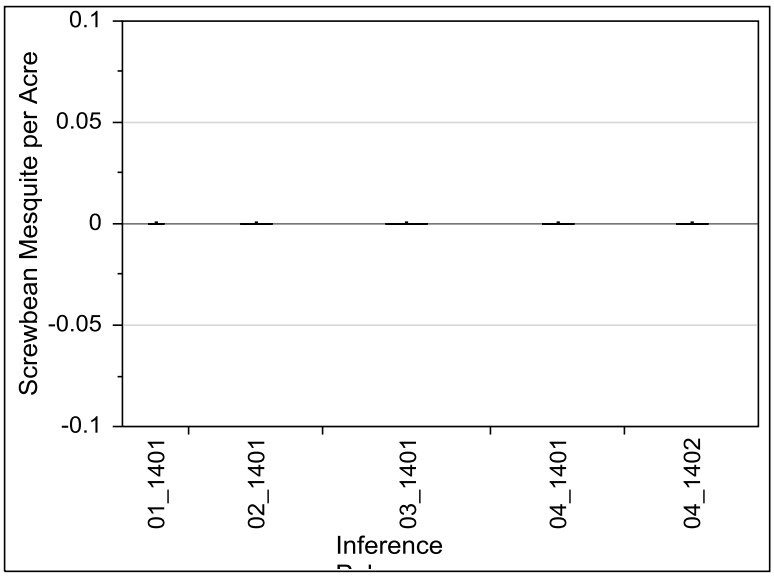
Quantiles

Level	Minimum	10%	25%	Median	75%	90%	Maximum
01_1401	0	0	674.4771	3561.239	5395.817	5719.566	5719.566
02_1401	0	0	26.97908	161.8745	377.7072	755.4144	755.4144
03_1401	0	0	0	0	0	0	0
04_1401	0	0	0	0	107.9163	107.9163	107.9163
04_1402	0	0	0	0	0	431.6654	431.6654



Quantiles

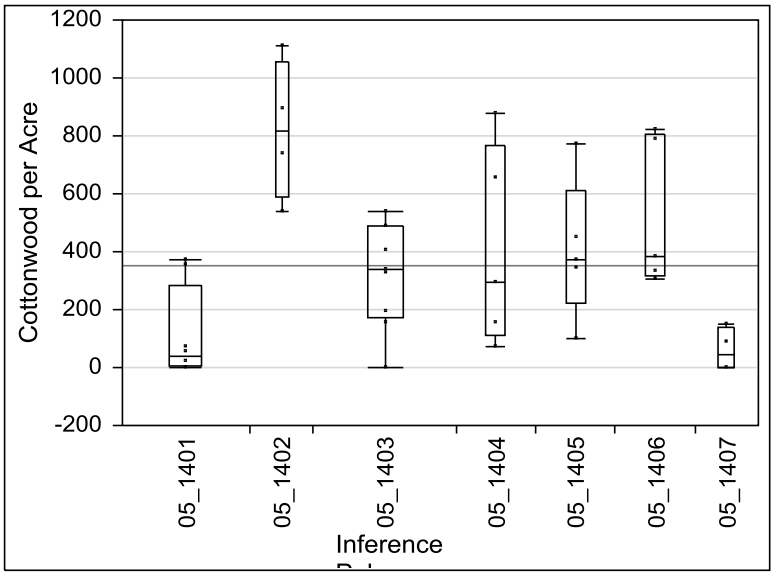
Level	Minimum	10%	25%	Median	75%	90%	Maximum
01_1401	0	0	0	0	0	0	0
02_1401	0	0	0	0	0	0	0
03_1401	0	0	0	0	0	0	0
04_1401	0	0	0	0	0	0	0
04_1402	0	0	0	0	0	0	0



Quantiles

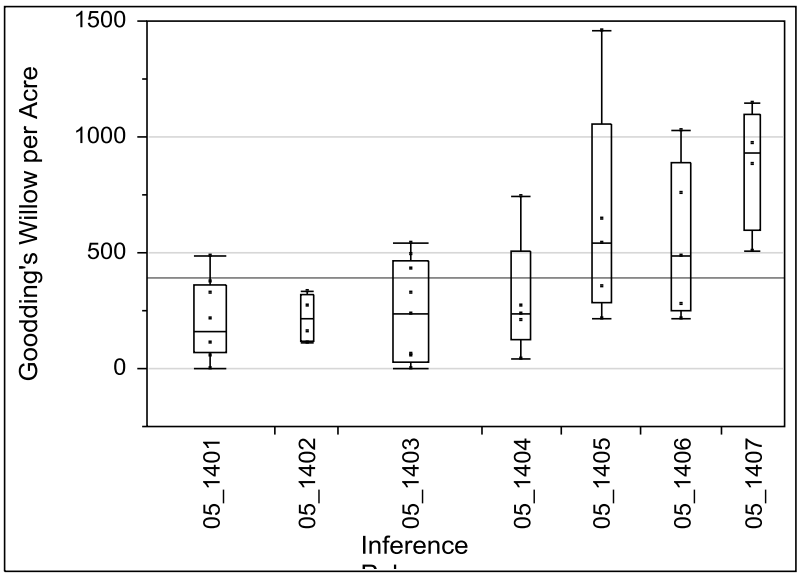
Level	Minimum	10%	25%	Median	75%	90%	Maximum
01_1401	0	0	0	0	0	0	0
02_1401	0	0	0	0	0	0	0
03_1401	0	0	0	0	0	0	0
04_1401	0	0	0	0	0	0	0
04_1402	0	0	0	0	0	0	0

VII 2.6 Palo Verde Ecological Reserve Phase 05



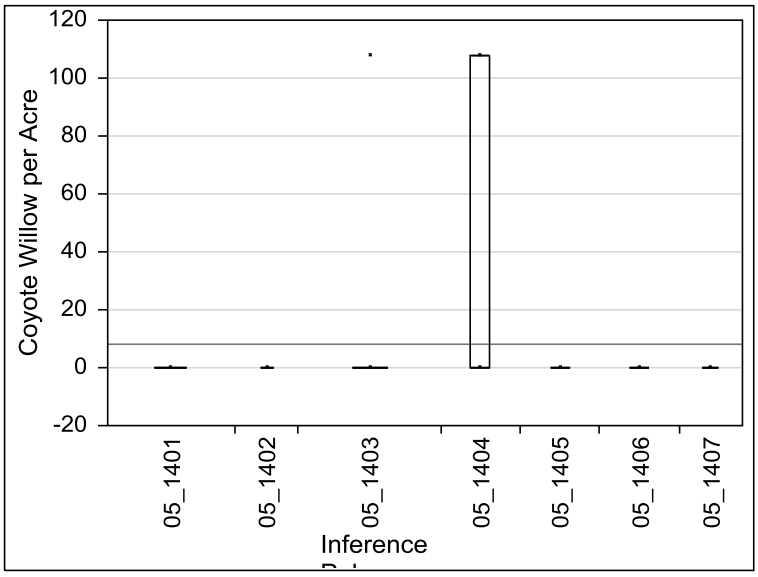
Quantiles

Level	Minimum	10%	25%	Median	75%	90%	Maximum
05_1401	0	0	5.058578	37.09624	283.2804	374.3348	374.3348
05_1402	536.2093	536.2093	586.7951	816.1173	1055.557	1109.515	1109.515
05_1403	0	0	173.6779	340.6109	488.9959	536.2093	536.2093
05_1404	70.8201	70.8201	112.9749	296.7699	767.2177	876.8202	876.8202
05_1405	101.1716	101.1716	222.5774	370.9624	610.4018	772.2763	772.2763
05_1406	303.5147	303.5147	318.6904	381.0796	804.314	819.4897	819.4897
05_1407	0	0	0	45.52721	136.5816	151.7574	151.7574



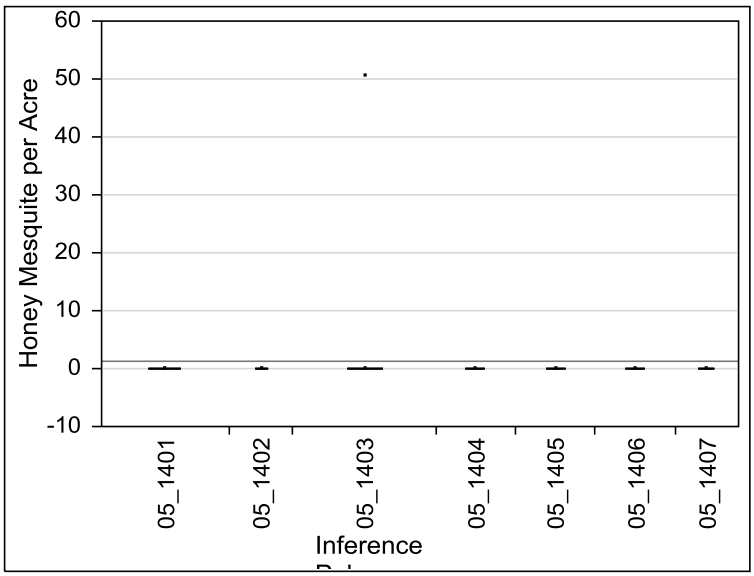
Quantiles

Level	Minimum	10%	25%	Median	75%	90%	Maximum
05_1401	0	0	67.44771	161.8745	361.6884	485.6235	485.6235
05_1402	107.9163	107.9163	121.4059	215.8327	317.8473	333.8662	333.8662
05_1403	0	0	26.97908	232.6946	462.0168	542.9541	542.9541
05_1404	40.46863	40.46863	124.7783	232.6946	505.8578	741.9248	741.9248
05_1405	215.8327	215.8327	284.9666	539.5817	1052.184	1456.871	1456.871
05_1406	215.8327	215.8327	247.8703	485.6235	890.3098	1025.205	1025.205
05_1407	505.8578	505.8578	600.2846	927.406	1100.241	1143.239	1143.239



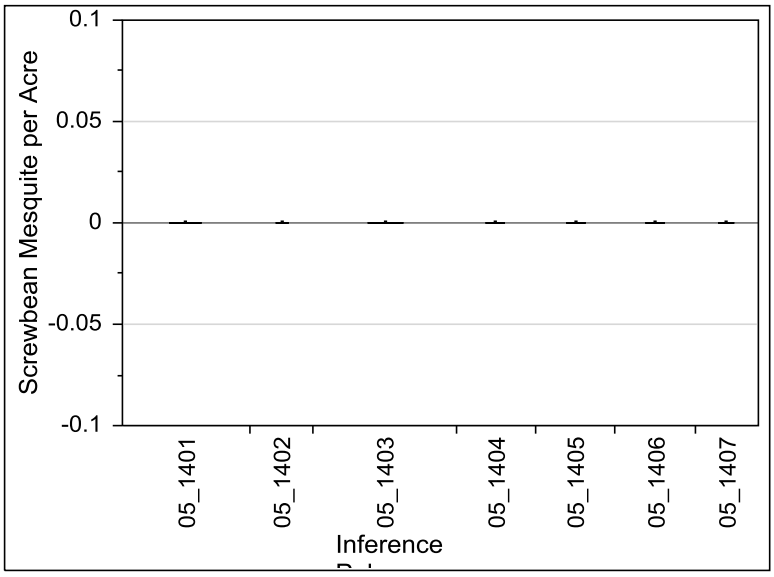
Quantiles

Level	Minimum	10%	25%	Median	75%	90%	Maximum
05_1401	0	0	0	0	0	0	0
05_1402	0	0	0	0	0	0	0
05_1403	0	0	0	0	0	107.9163	107.9163
05_1404	0	0	0	0	107.9163	107.9163	107.9163
05_1405	0	0	0	0	0	0	0
05_1406	0	0	0	0	0	0	0
05_1407	0	0	0	0	0	0	0



Quantiles

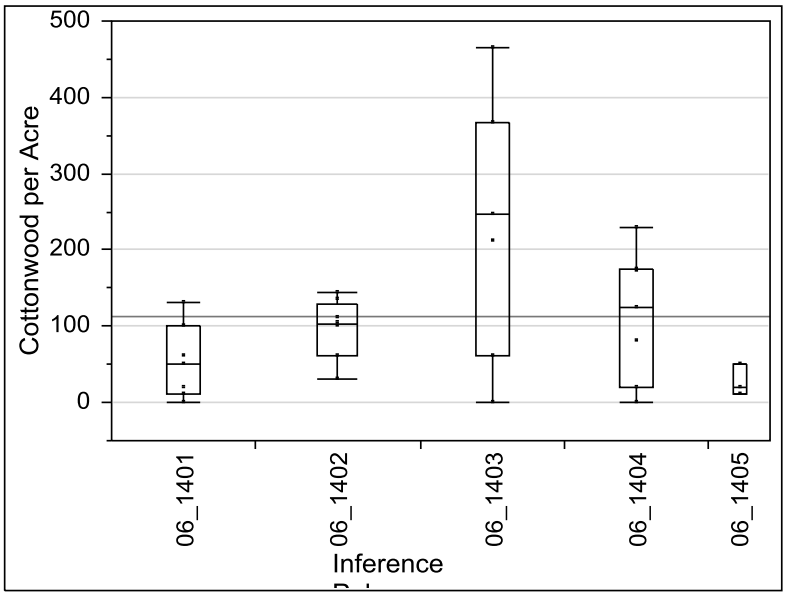
Level	Minimum	10%	25%	Median	75%	90%	Maximum
05_1401	0	0	0	0	0	0	0
05_1402	0	0	0	0	0	0	0
05_1403	0	0	0	0	0	50.58578	50.58578
05_1404	0	0	0	0	0	0	0
05_1405	0	0	0	0	0	0	0
05_1406	0	0	0	0	0	0	0
05_1407	0	0	0	0	0	0	0



Quantiles

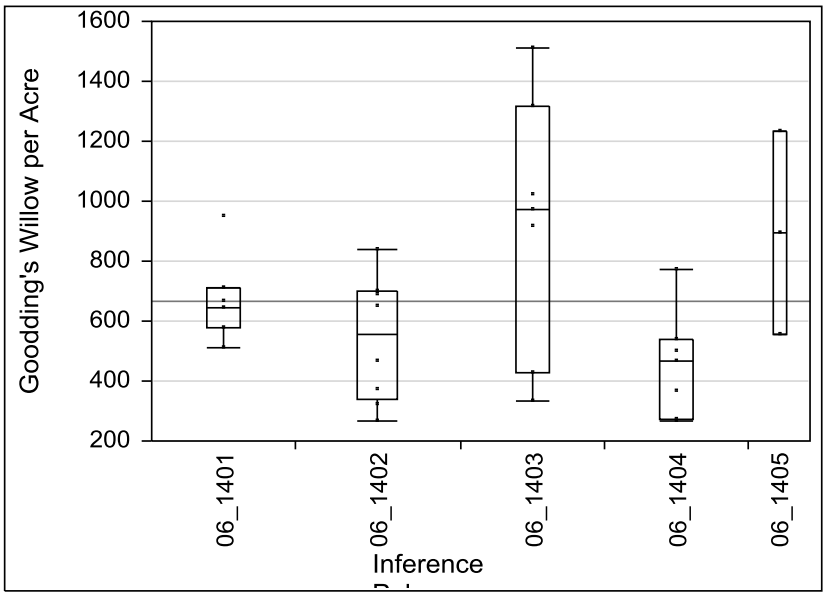
Level	Minimum	10%	25%	Median	75%	90%	Maximum
05_1401	0	0	0	0	0	0	0
05_1402	0	0	0	0	0	0	0
05_1403	0	0	0	0	0	0	0
05_1404	0	0	0	0	0	0	0
05_1405	0	0	0	0	0	0	0
05_1406	0	0	0	0	0	0	0
05_1407	0	0	0	0	0	0	0

VII 2.7 Palo Verde Ecological Reserve Phase 06



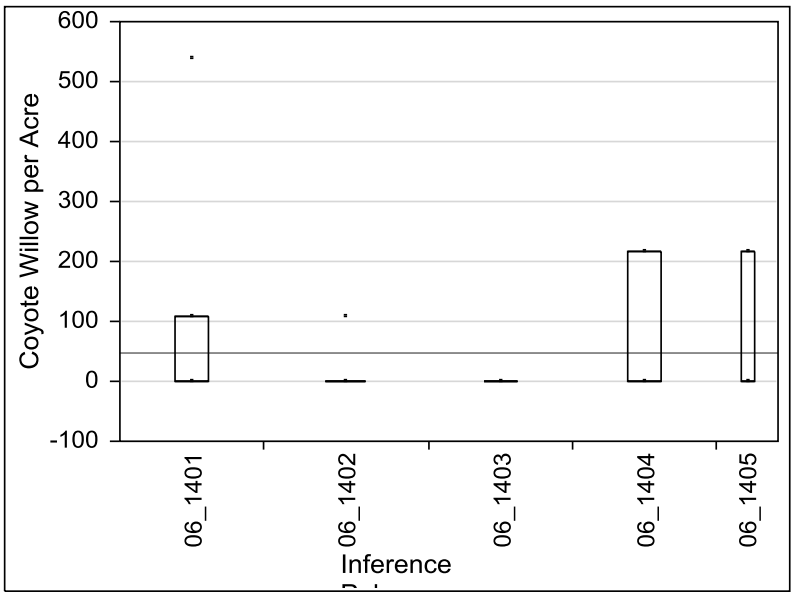
Quantiles

Level	Minimum	10%	25%	Median	75%	90%	Maximum
06_1401	0	0	10.11716	50.58578	101.1716	131.523	131.523
06_1402	30.35147	30.35147	60.70294	102.8578	128.9937	145.0126	145.0126
06_1403	0	0	60.70294	246.1841	367.59	465.3892	465.3892
06_1404	0	0	20.23431	124.7783	175.364	229.3222	229.3222
06_1405	10.11716	10.11716	10.11716	20.23431	50.58578	50.58578	50.58578



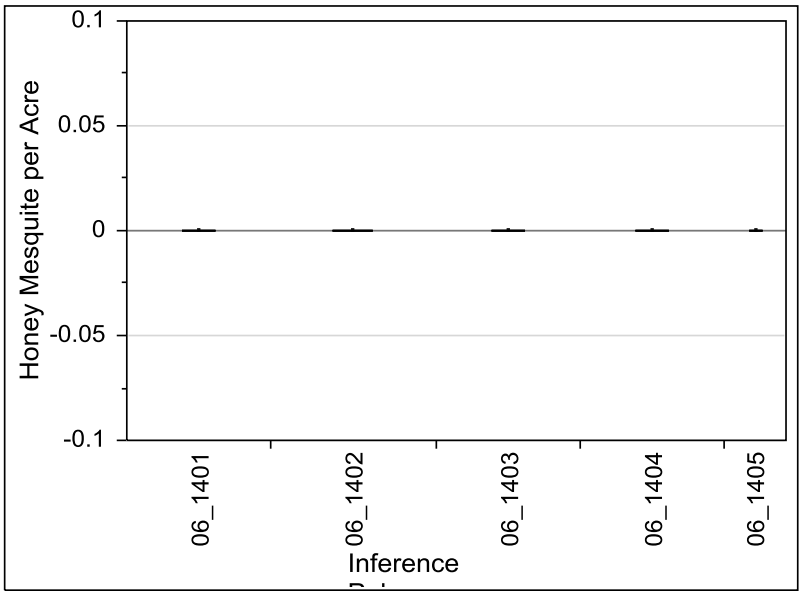
Quantiles

Level	Minimum	10%	25%	Median	75%	90%	Maximum
06_1401	512.6026	512.6026	580.0503	644.1256	711.5734	951.0127	951.0127
06_1402	266.4185	266.4185	336.3955	558.1298	698.0838	836.3516	836.3516
06_1403	333.8662	333.8662	428.293	971.247	1315.23	1510.829	1510.829
06_1404	266.4185	266.4185	269.7908	468.7616	539.5817	772.2763	772.2763
06_1405	553.0712	553.0712	553.0712	893.6822	1234.293	1234.293	1234.293



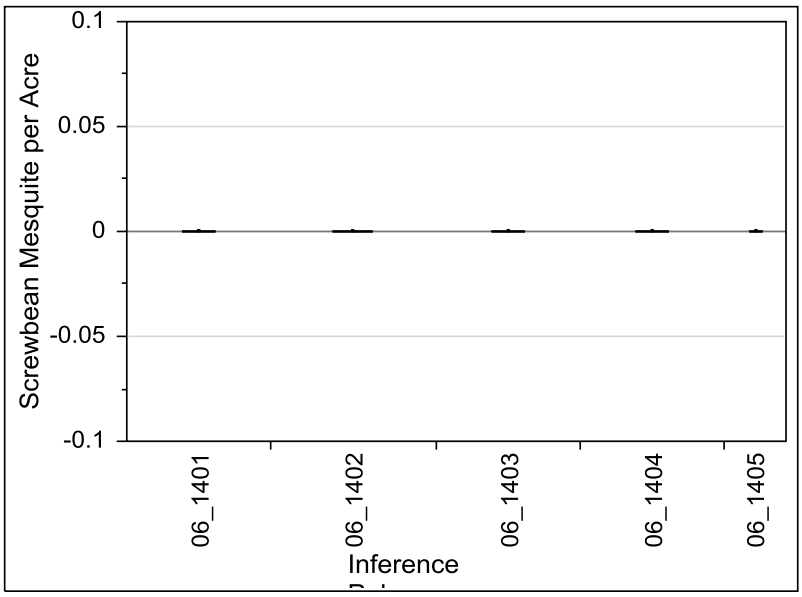
Quantiles

Level	Minimum	10%	25%	Median	75%	90%	Maximum
06_1401	0	0	0	0	107.9163	539.5817	539.5817
06_1402	0	0	0	0	0	107.9163	107.9163
06_1403	0	0	0	0	0	0	0
06_1404	0	0	0	0	215.8327	215.8327	215.8327
06_1405	0	0	0	0	215.8327	215.8327	215.8327



Quantiles

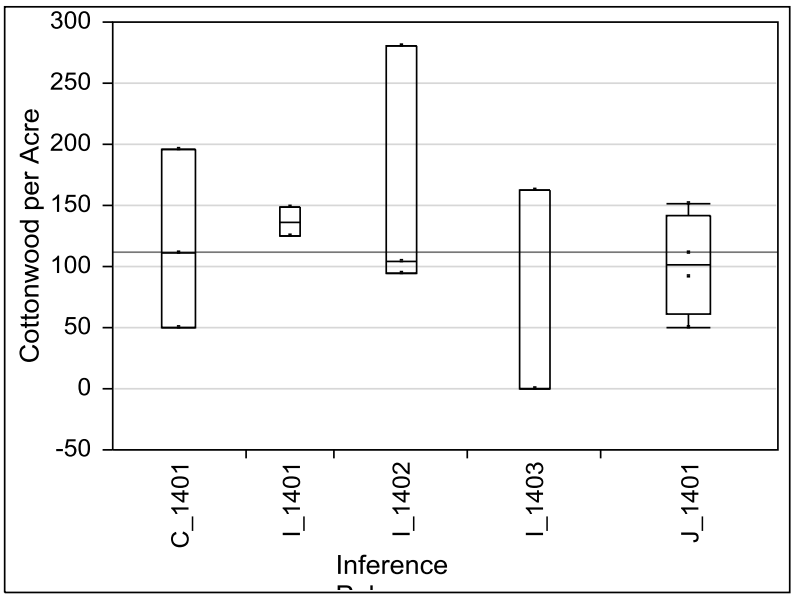
Level	Minimum	10%	25%	Median	75%	90%	Maximum
06_1401	0	0	0	0	0	0	0
06_1402	0	0	0	0	0	0	0
06_1403	0	0	0	0	0	0	0
06_1404	0	0	0	0	0	0	0
06_1405	0	0	0	0	0	0	0



Quantiles

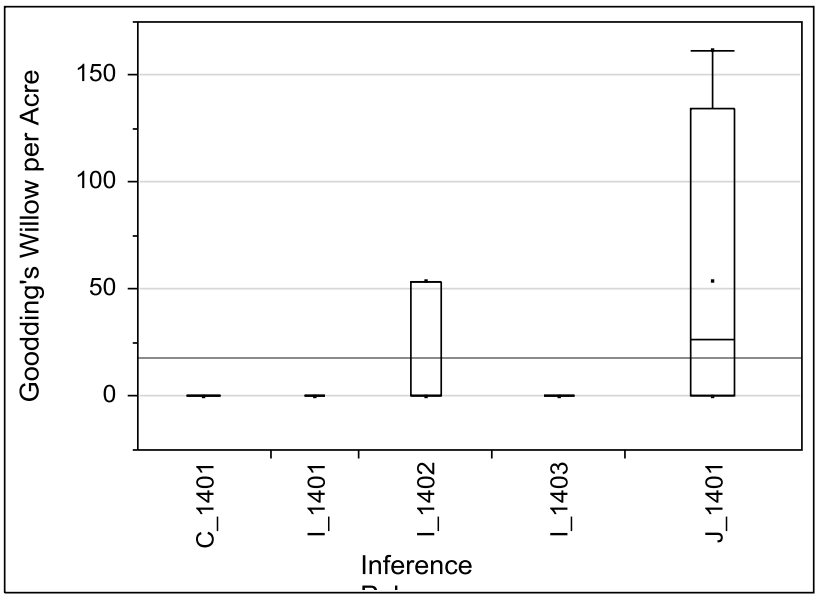
Level	Minimum	10%	25%	Median	75%	90%	Maximum
06_1401	0	0	0	0	0	0	0
06_1402	0	0	0	0	0	0	0
06_1403	0	0	0	0	0	0	0
06_1404	0	0	0	0	0	0	0
06_1405	0	0	0	0	0	0	0

VII 2.8 Yuma East Wetlands



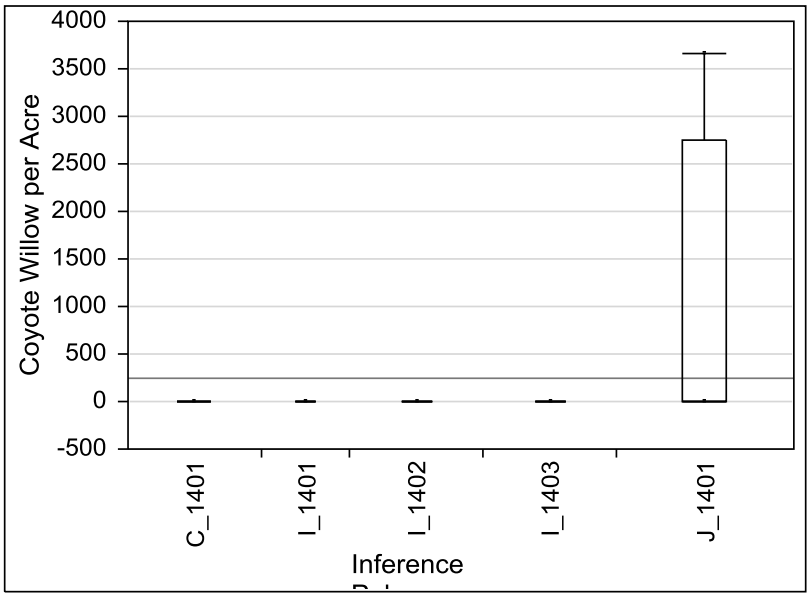
Quantiles

Level	Minimum	10%	25%	Median	75%	90%	Maximum
C_1401	50.58578	50.58578	50.58578	111.2887	195.5984	195.5984	195.5984
I_1401	124.7783	124.7783	124.7783	136.5816	148.385	148.385	148.385
I_1402	94.4268	94.4268	94.4268	104.544	279.908	279.908	279.908
I_1403	0	0	0	0	161.8745	161.8745	161.8745
J_1401	50.58578	50.58578	60.70294	101.1716	141.6402	151.7574	151.7574



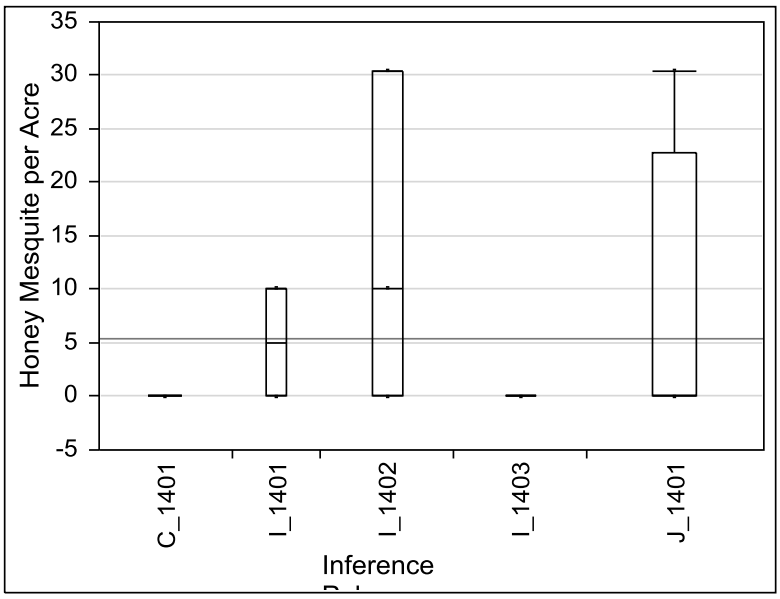
Quantiles

Level	Minimum	10%	25%	Median	75%	90%	Maximum
C_1401	0	0	0	0	0	0	0
I_1401	0	0	0	0	0	0	0
I_1402	0	0	0	0	53.95817	53.95817	53.95817
I_1403	0	0	0	0	0	0	0
J_1401	0	0	0	26.97908	134.8954	161.8745	161.8745



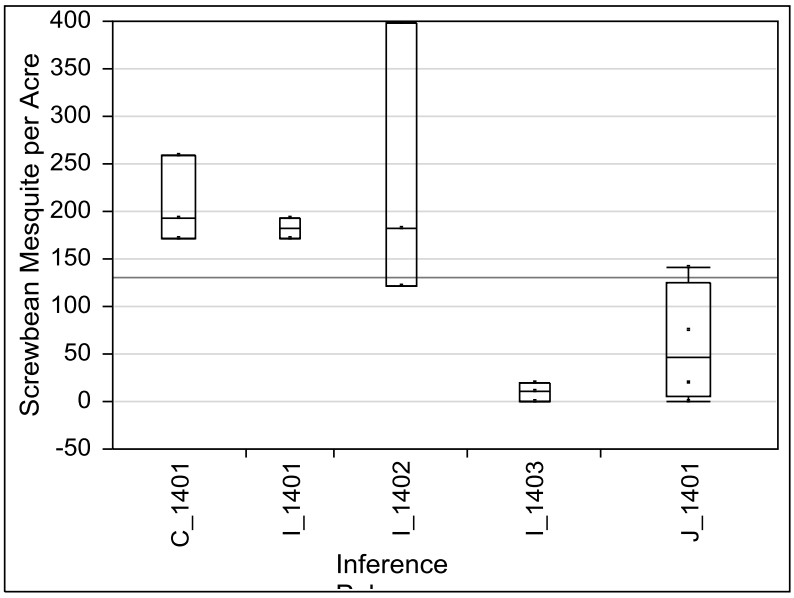
Quantiles

Level	Minimum	10%	25%	Median	75%	90%	Maximum
C_1401	0	0	0	0	0	0	0
I_1401	0	0	0	0	0	0	0
I_1402	0	0	0	0	0	0	0
I_1403	0	0	0	0	0	0	0
J_1401	0	0	0	0	2751.867	3669.155	3669.155



Quantiles

Level	Minimum	10%	25%	Median	75%	90%	Maximum
C_1401	0	0	0	0	0	0	0
I_1401	0	0	0	5.058578	10.11716	10.11716	10.11716
I_1402	0	0	0	10.11716	30.35147	30.35147	30.35147
I_1403	0	0	0	0	0	0	0
J_1401	0	0	0	0	22.7636	30.35147	30.35147



Quantiles

Level	Minimum	10%	25%	Median	75%	90%	Maximum
C_1401	171.9917	171.9917	171.9917	192.226	259.6737	259.6737	259.6737
I_1401	171.9917	171.9917	171.9917	182.1088	192.226	192.226	192.226
I_1402	121.4059	121.4059	121.4059	182.1088	397.9415	397.9415	397.9415
I_1403	0	0	0	10.11716	20.23431	20.23431	20.23431
J_1401	0	0	5.058578	47.2134	124.7783	141.6402	141.6402

ATTACHMENT 8

Vertical Foliage Density Charts

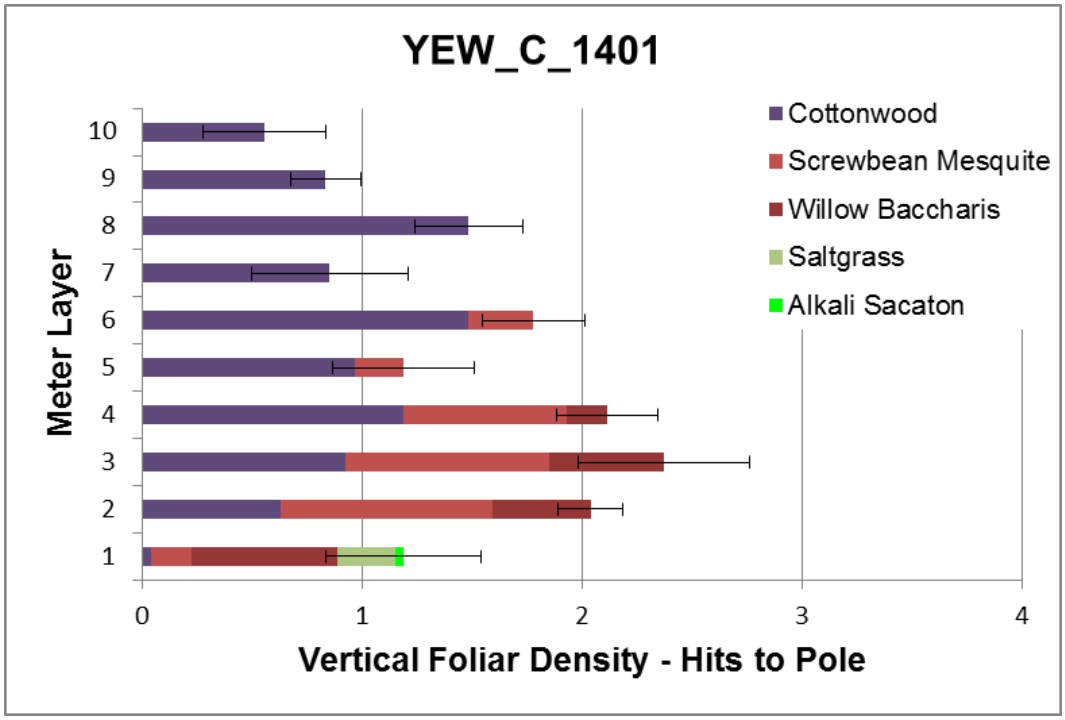


Figure VIII-1. Vertical foliar density for Yuma East Wetlands Inference Polygon C_1401 presented as the mean number of hits by species and meter layer. Error bars indicate one standard error of the total number of hits per meter layer.

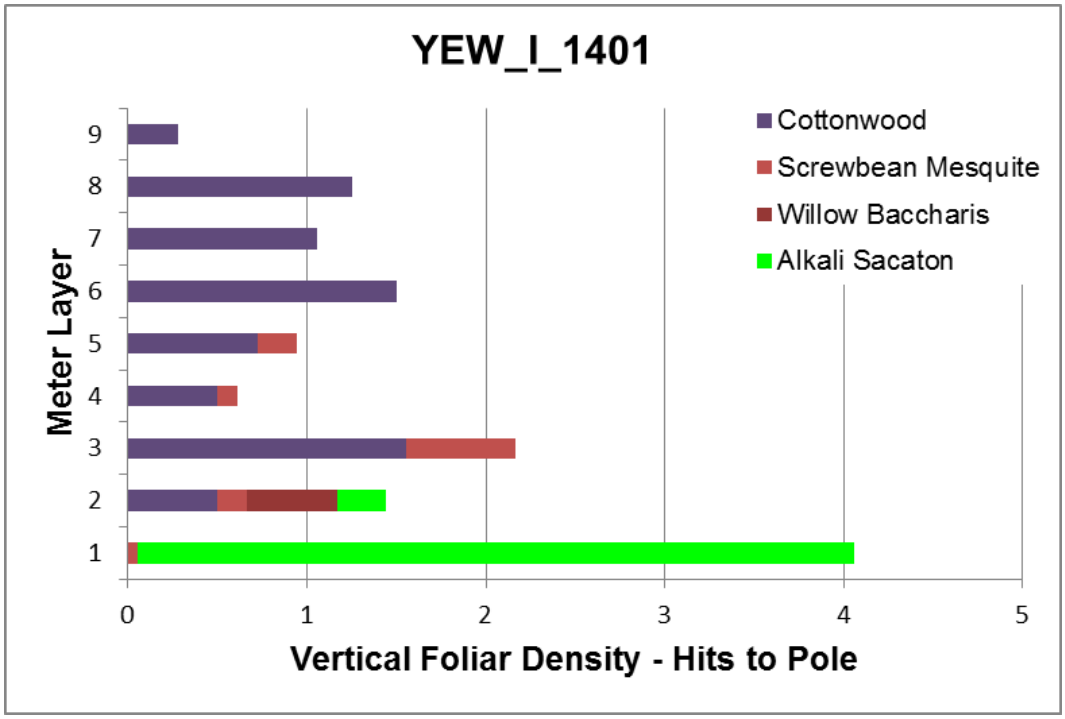


Figure VIII-2. Vertical foliar density for Yuma East Wetlands Inference Polygon I_1401 presented as the mean number of hits by species and meter layer.

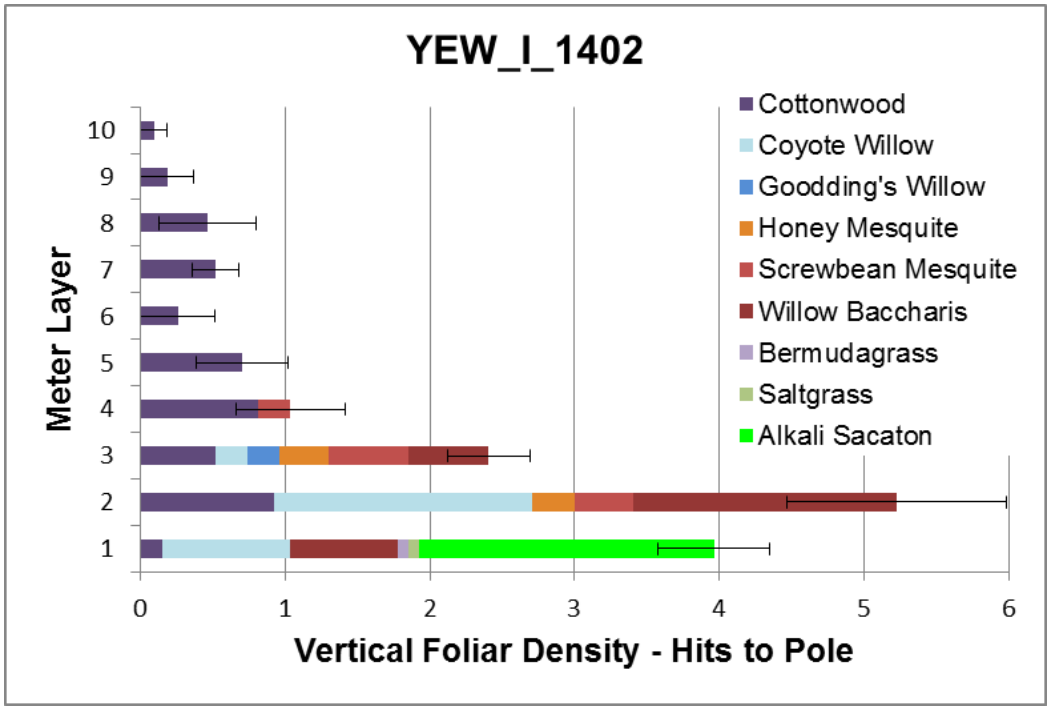


Figure VIII-3. Vertical foliar density for Yuma East Wetlands Inference Polygon I_1402 presented as the mean number of hits by species and meter layer. Error bars indicate one standard error of the total number of hits per meter layer.

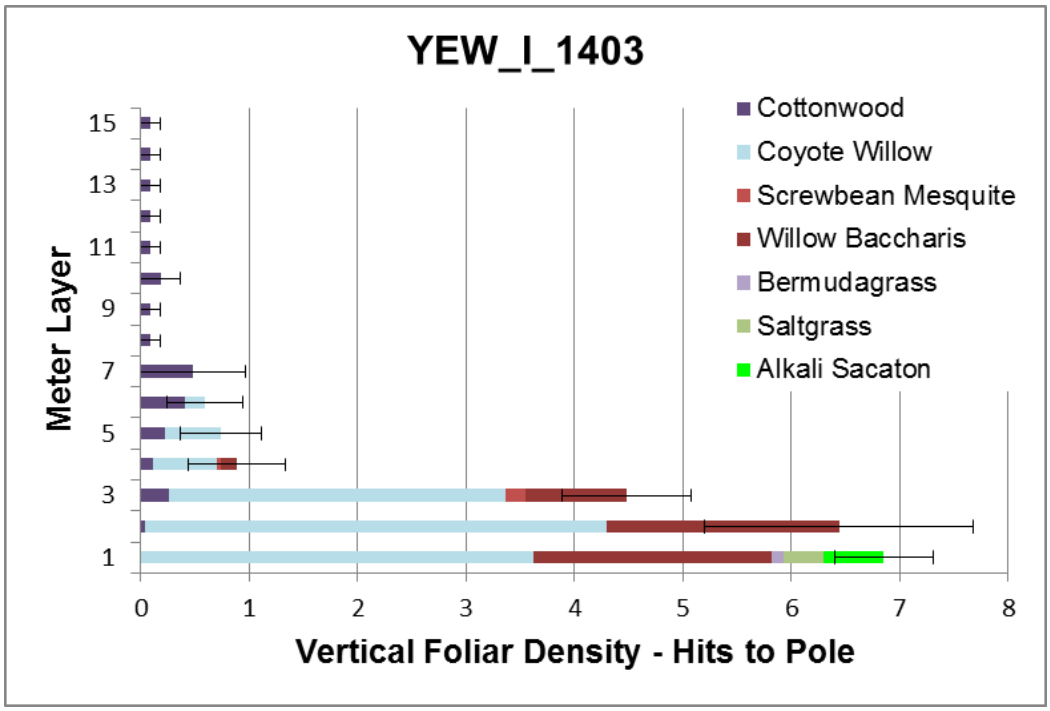


Figure VIII-4. Vertical foliar density for Yuma East Wetlands Inference Polygon I_1403 presented as the mean number of hits by species and meter layer. Error bars indicate one standard error of the total number of hits per meter layer.

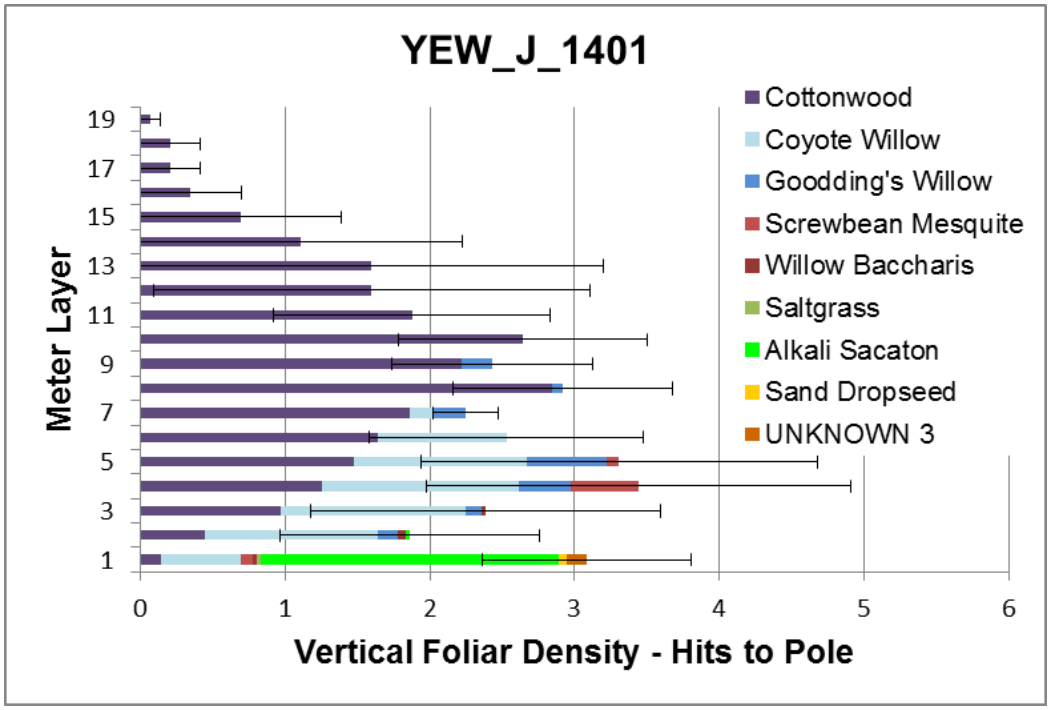


Figure VIII-5. Vertical foliar density for Yuma East Wetlands Inference Polygon J_1401 presented as the mean number of hits by species and meter layer. Error bars indicate one standard error of the total number of hits per meter layer.

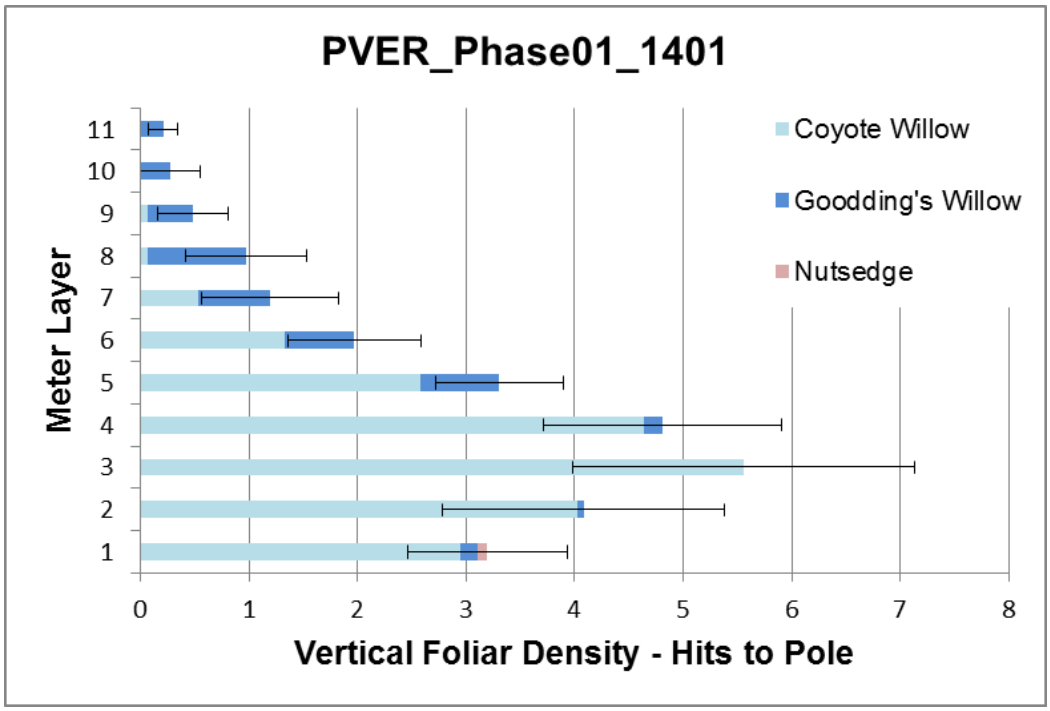


Figure VIII-6. Vertical foliar density for Palo Verde Ecological Reserve Inference Polygon Phase 01_1401 presented as the mean number of hits by species and meter layer. Error bars indicate one standard error of the total number of hits per meter layer.

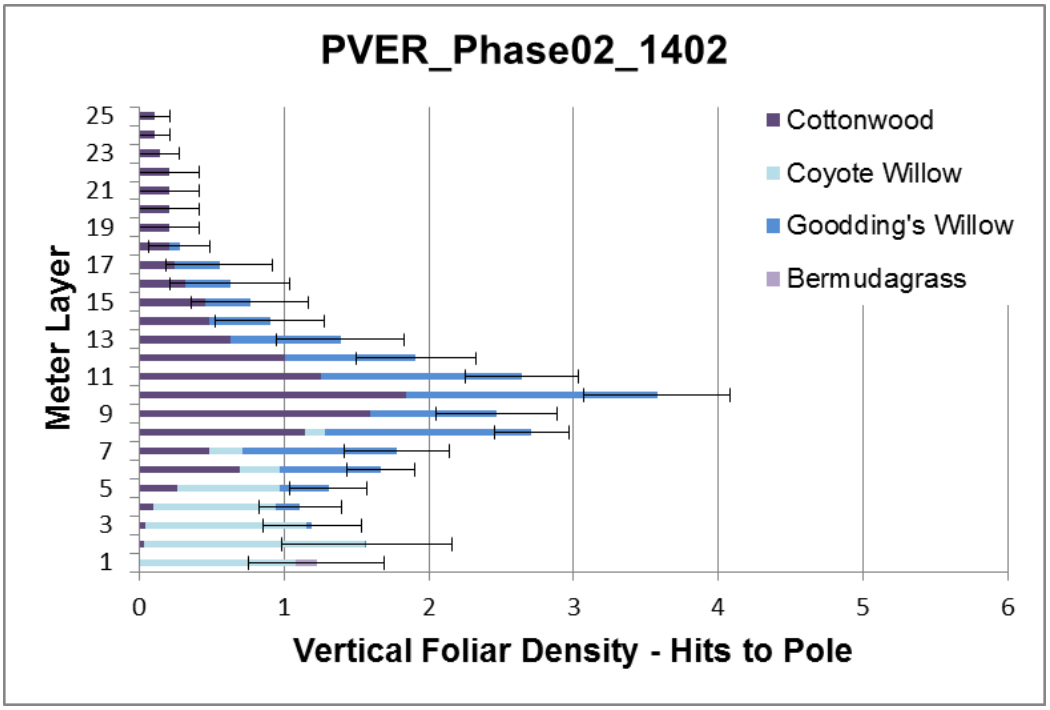


Figure VIII-7. Vertical foliar density for Palo Verde Ecological Reserve Inference Polygon Phase 02_1402 presented as the mean number of hits by species and meter layer. Error bars indicate one standard error of the total number of hits per meter layer.

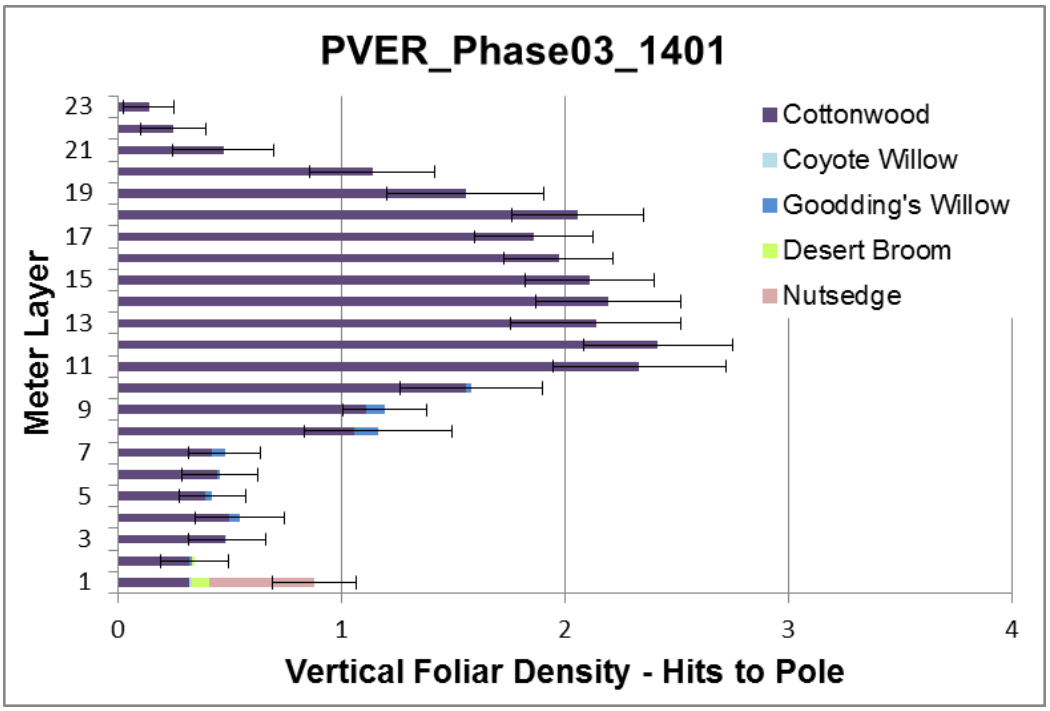


Figure VIII-8. Vertical foliar density for Palo Verde Ecological Reserve Inference Polygon Phase 03_1401 presented as the mean number of hits by species and meter layer. Error bars indicate one standard error of the total number of hits per meter layer.

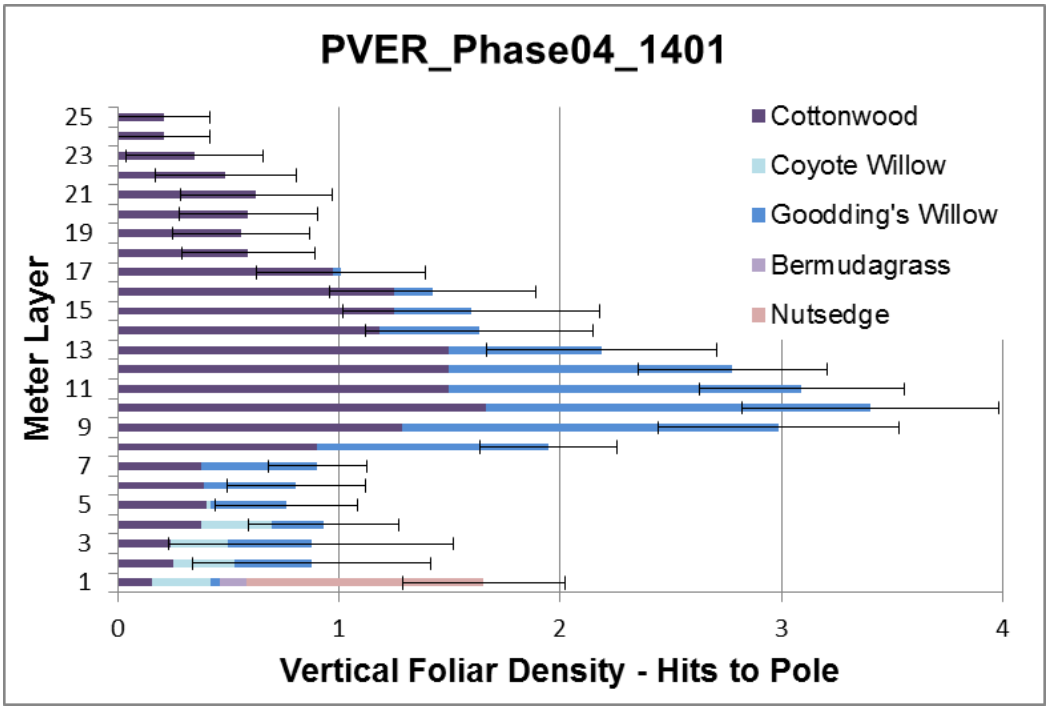


Figure VIII-9. Vertical foliar density for Palo Verde Ecological Reserve Inference Polygon Phase 04_1401 presented as the mean number of hits by species and meter layer. Error bars indicate one standard error of the total number of hits per meter layer.

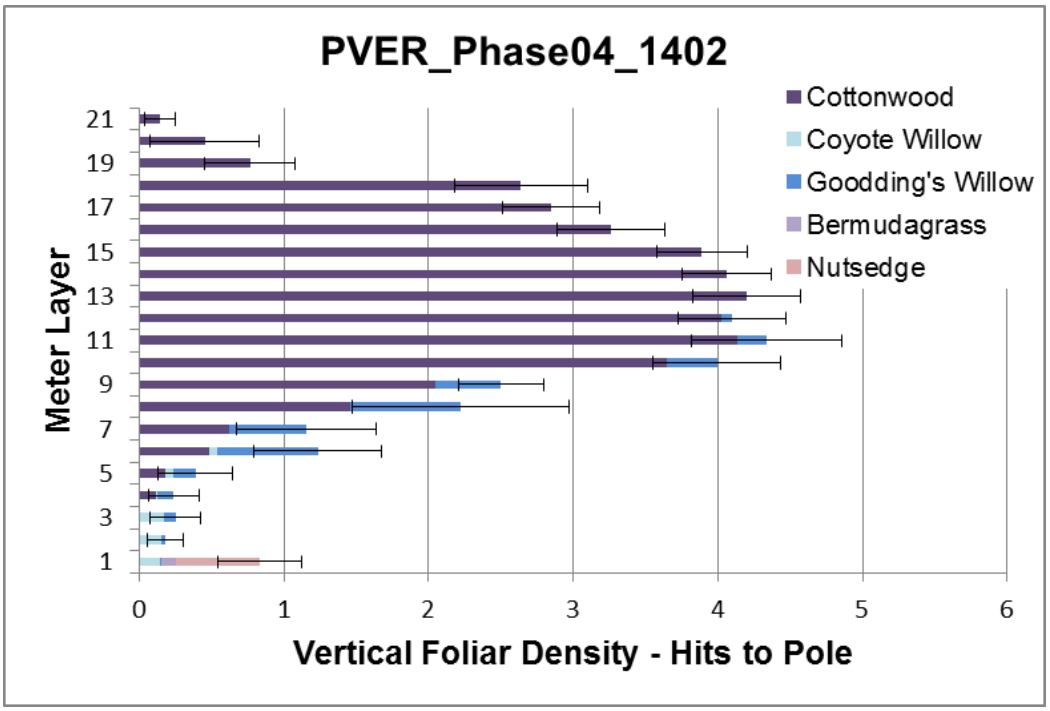


Figure VIII-10. Vertical foliar density for Palo Verde Ecological Reserve Inference Polygon Phase 04_1402 presented as the mean number of hits by species and meter layer. Error bars indicate one standard error of the total number of hits per meter layer.

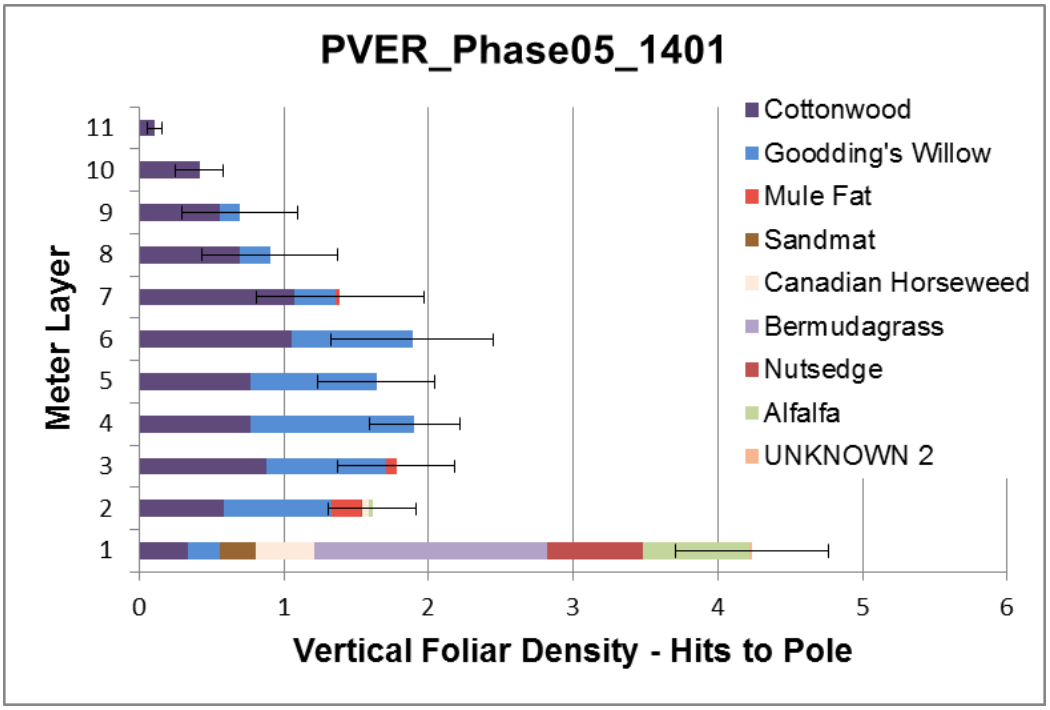


Figure VIII-11. Vertical foliar density for Palo Verde Ecological Reserve Inference Polygon Phase 05_1401 presented as the mean number of hits by species and meter layer. Error bars indicate one standard error of the total number of hits per meter layer.

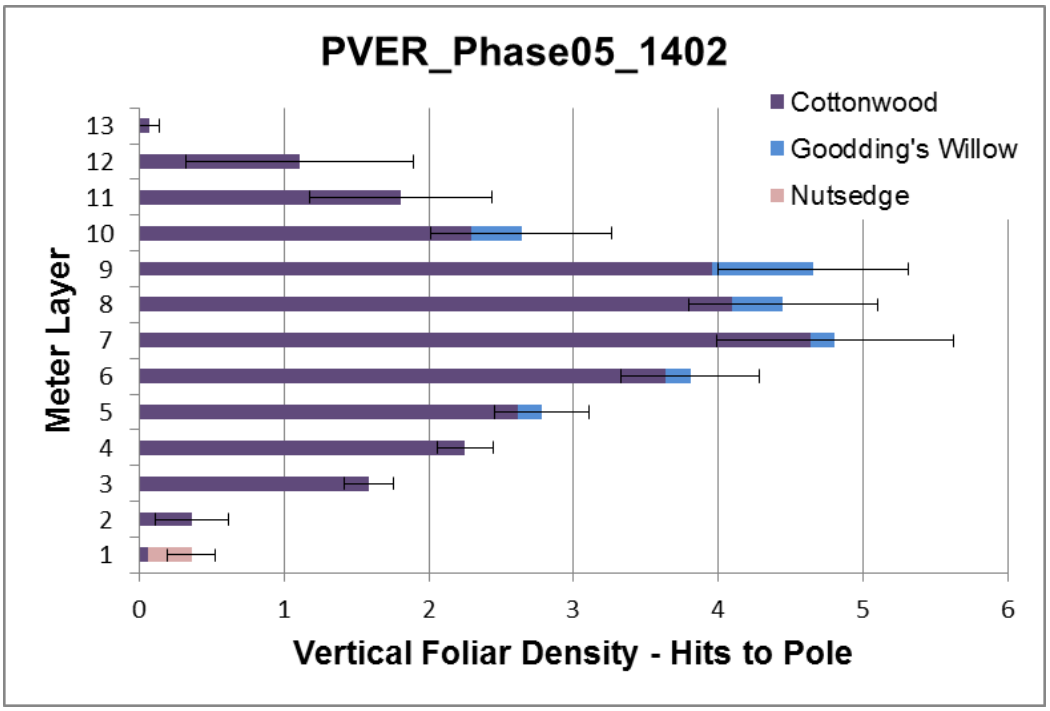


Figure VIII-12. Vertical foliar density for Palo Verde Ecological Reserve Inference Polygon Phase 05_1402 presented as the mean number of hits by species and meter layer. Error bars indicate one standard error of the total number of hits per meter layer.

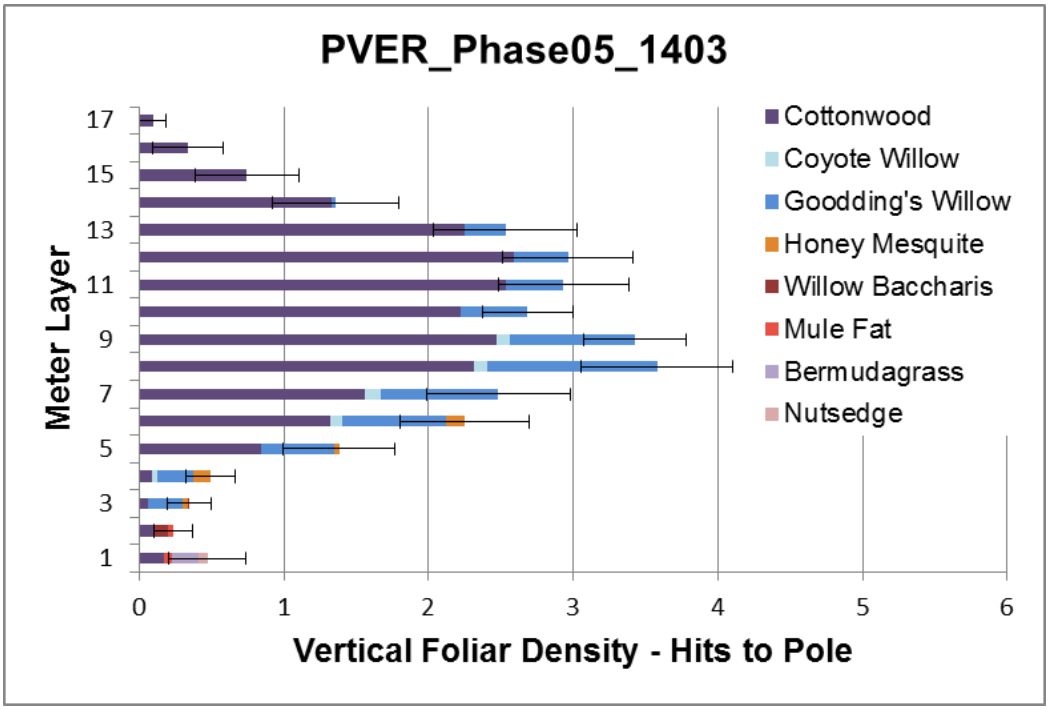


Figure VIII-13. Vertical foliar density for Palo Verde Ecological Reserve Inference Polygon Phase 05_1403 presented as the mean number of hits by species and meter layer. Error bars indicate one standard error of the total number of hits per meter layer.

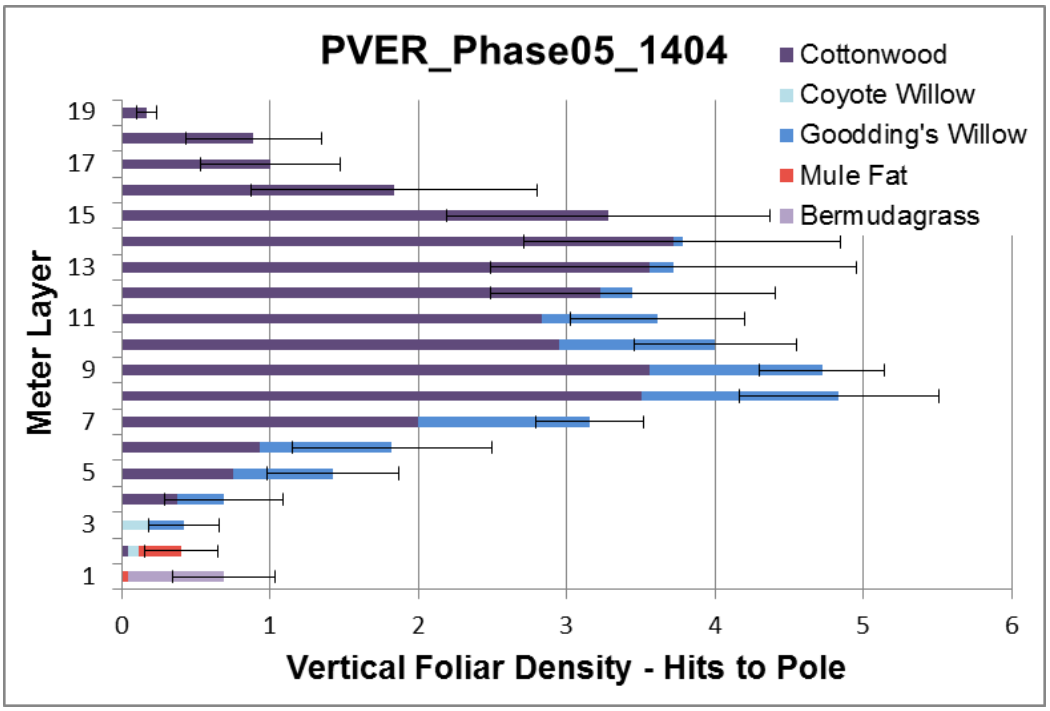


Figure VIII-14. Vertical foliar density for Palo Verde Ecological Reserve Inference Polygon Phase 05_1404 presented as the mean number of hits by species and meter layer. Error bars indicate one standard error of the total number of hits per meter layer.

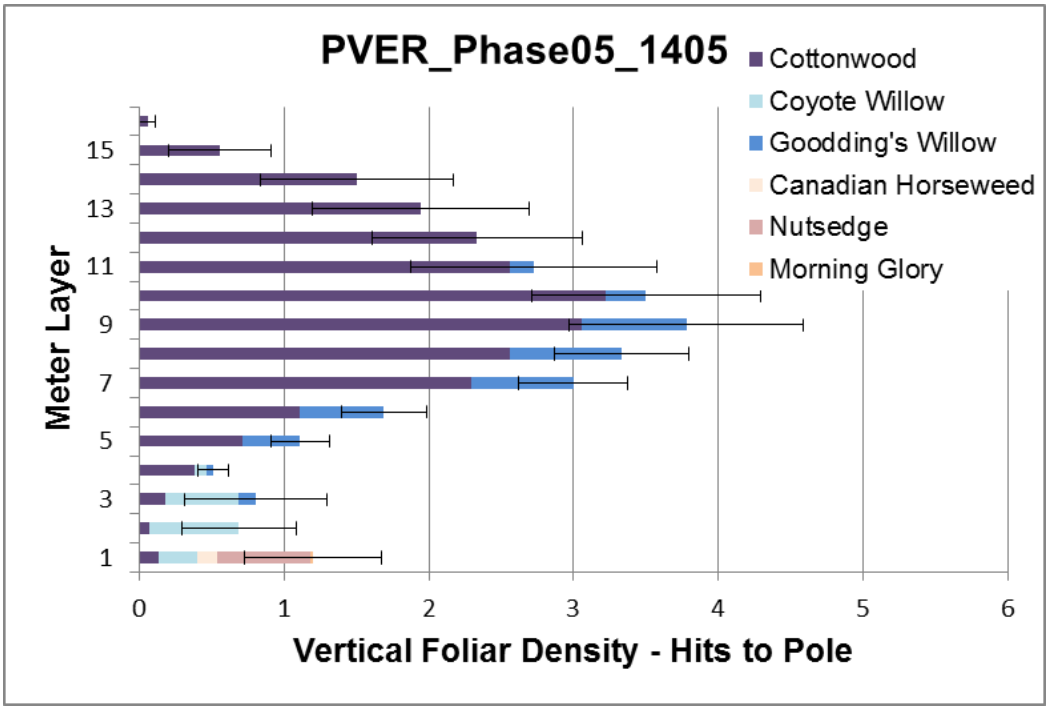


Figure VIII-15. Vertical foliar density for Palo Verde Ecological Reserve Inference Polygon Phase 05_1405 presented as the mean number of hits by species and meter layer. Error bars indicate one standard error of the total number of hits per meter layer.

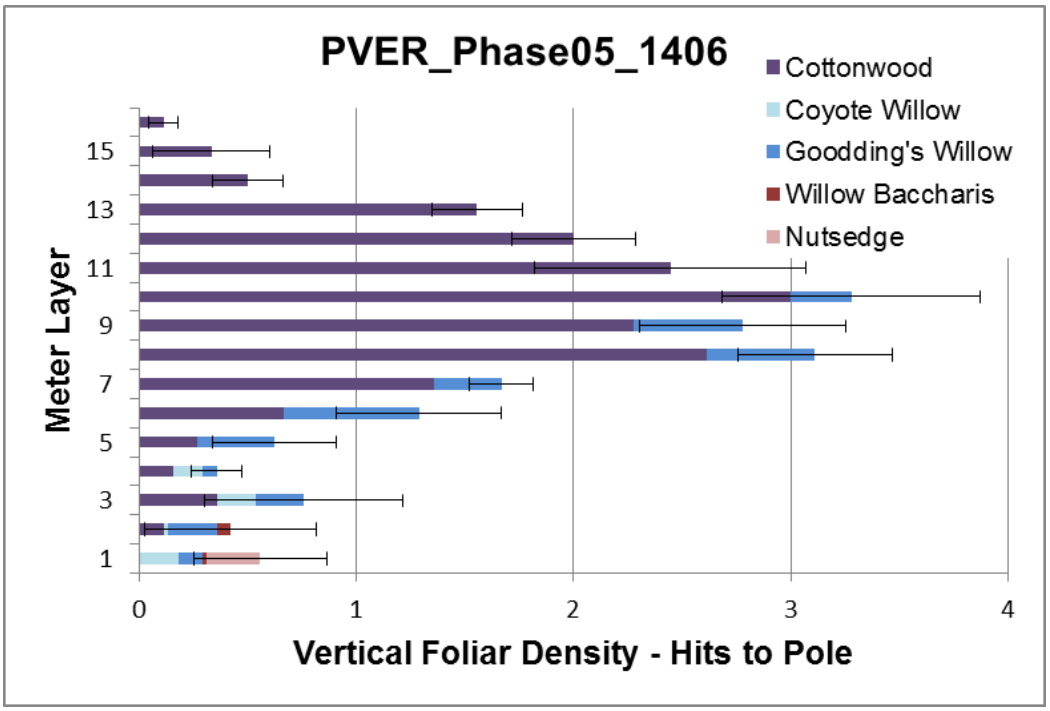


Figure VIII-16. Vertical foliar density for Palo Verde Ecological Reserve Inference Polygon Phase 05_1406 presented as the mean number of hits by species and meter layer. Error bars indicate one standard error of the total number of hits per meter layer.

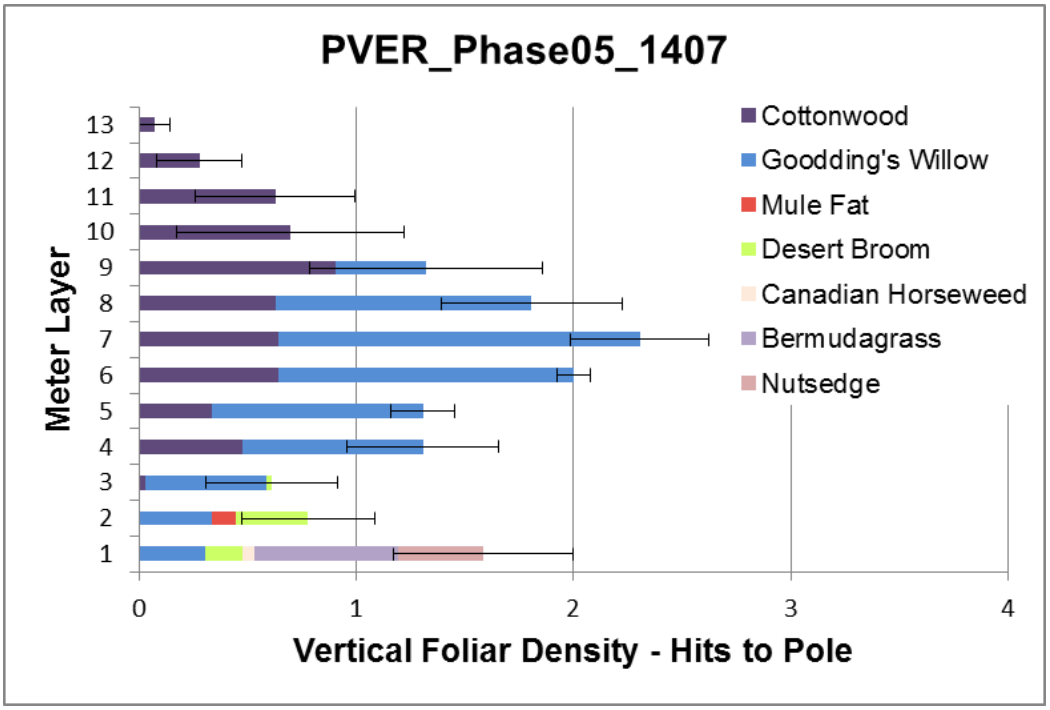


Figure VIII-17. Vertical foliar density for Palo Verde Ecological Reserve Inference Polygon Phase 05_1407 presented as the mean number of hits by species and meter layer. Error bars indicate one standard error of the total number of hits per meter layer.

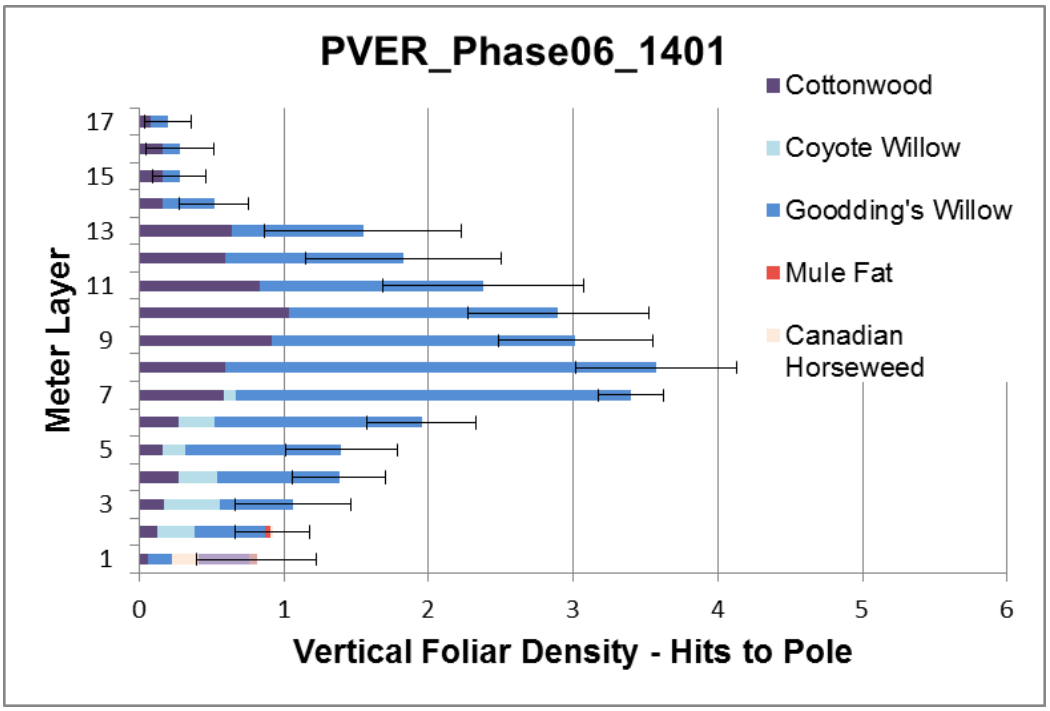


Figure VIII-18. Vertical foliar density for Palo Verde Ecological Reserve Inference Polygon Phase 06_1401 presented as the mean number of hits by species and meter layer. Error bars indicate one standard error of the total number of hits per meter layer.

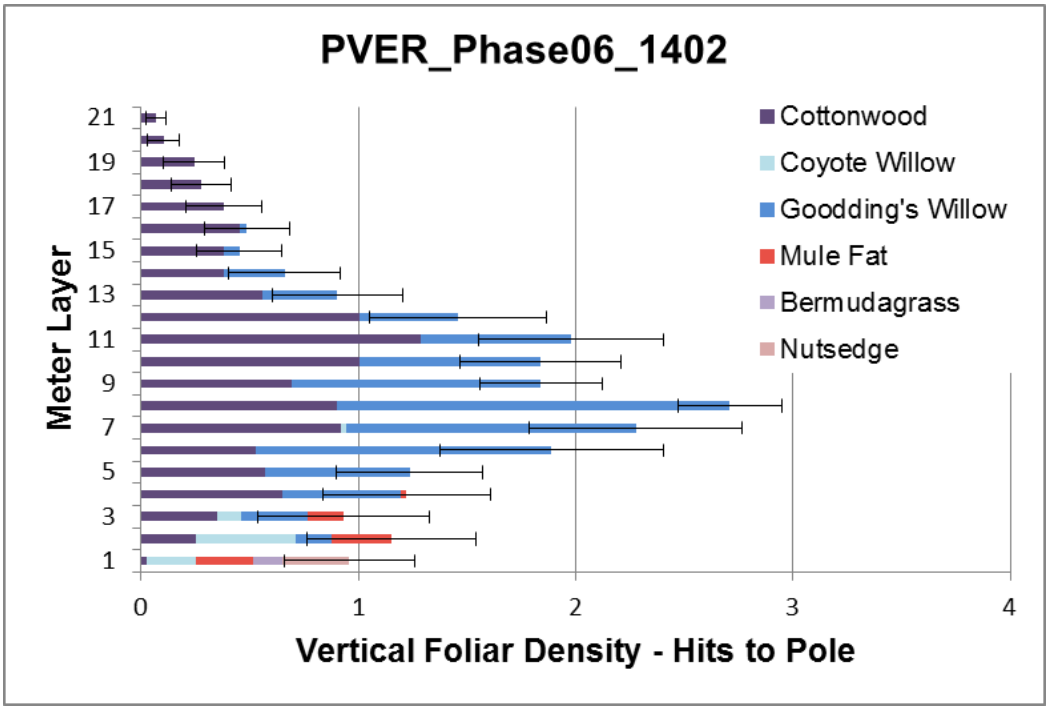


Figure VIII-19. Vertical foliar density for Palo Verde Ecological Reserve Inference Polygon Phase 06_1402 presented as the mean number of hits by species and meter layer. Error bars indicate one standard error of the total number of hits per meter layer.

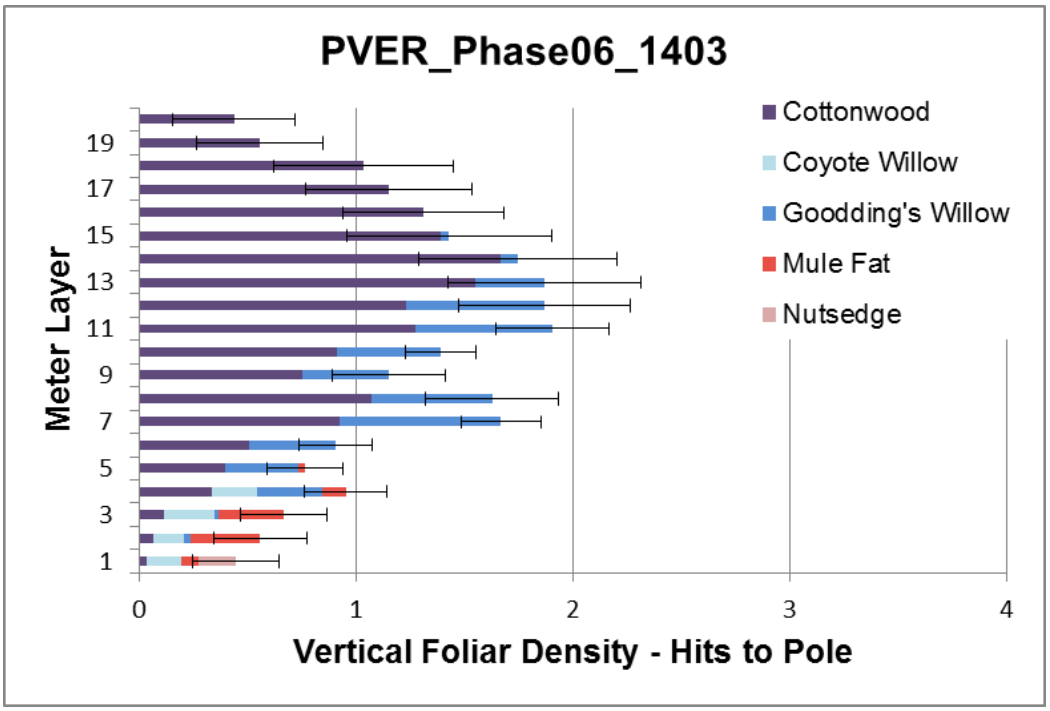


Figure VIII-20. Vertical foliar density for Palo Verde Ecological Reserve Inference Polygon Phase 06_1403 presented as the mean number of hits by species and meter layer. Error bars indicate one standard error of the total number of hits per meter layer.

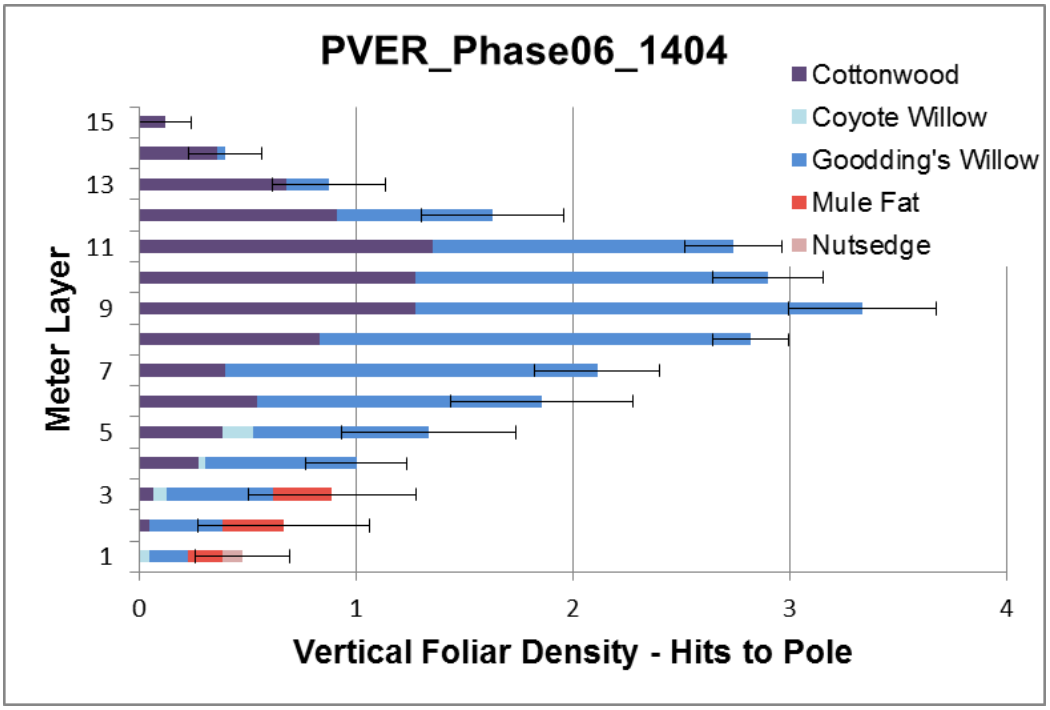


Figure VIII-21. Vertical foliar density for Palo Verde Ecological Reserve Inference Polygon Phase 06_1404 presented as the mean number of hits by species and meter layer. Error bars indicate one standard error of the total number of hits per meter layer.

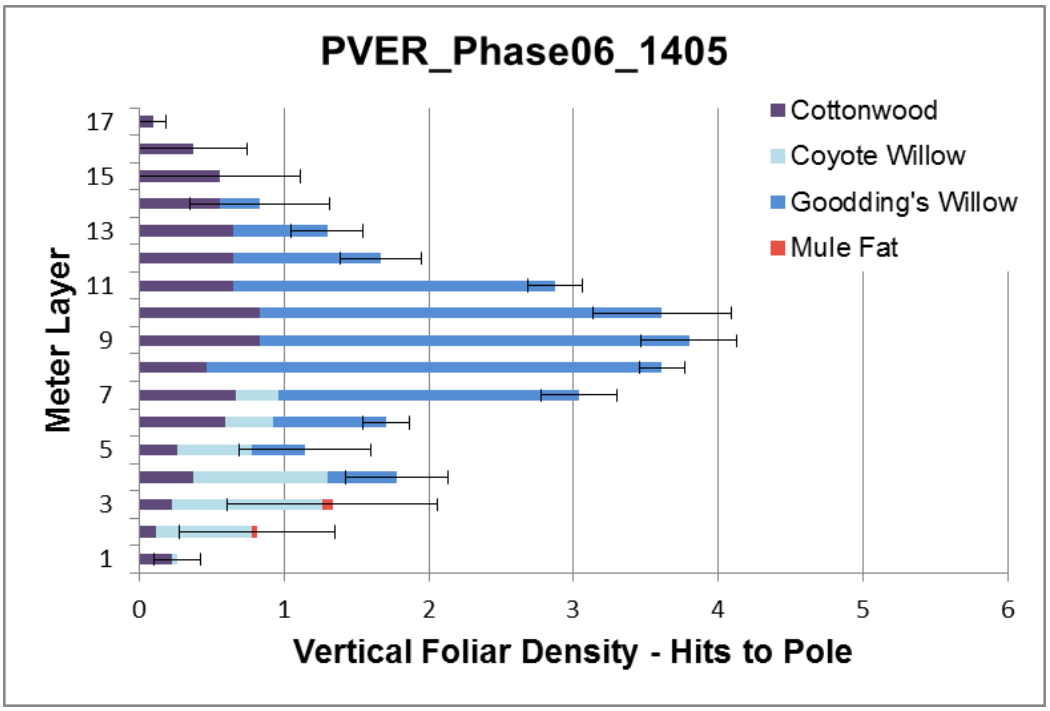


Figure VIII-22. Vertical foliar density for Palo Verde Ecological Reserve Inference Polygon Phase 06_1405 presented as the mean number of hits by species and meter layer. Error bars indicate one standard error of the total number of hits per meter layer.

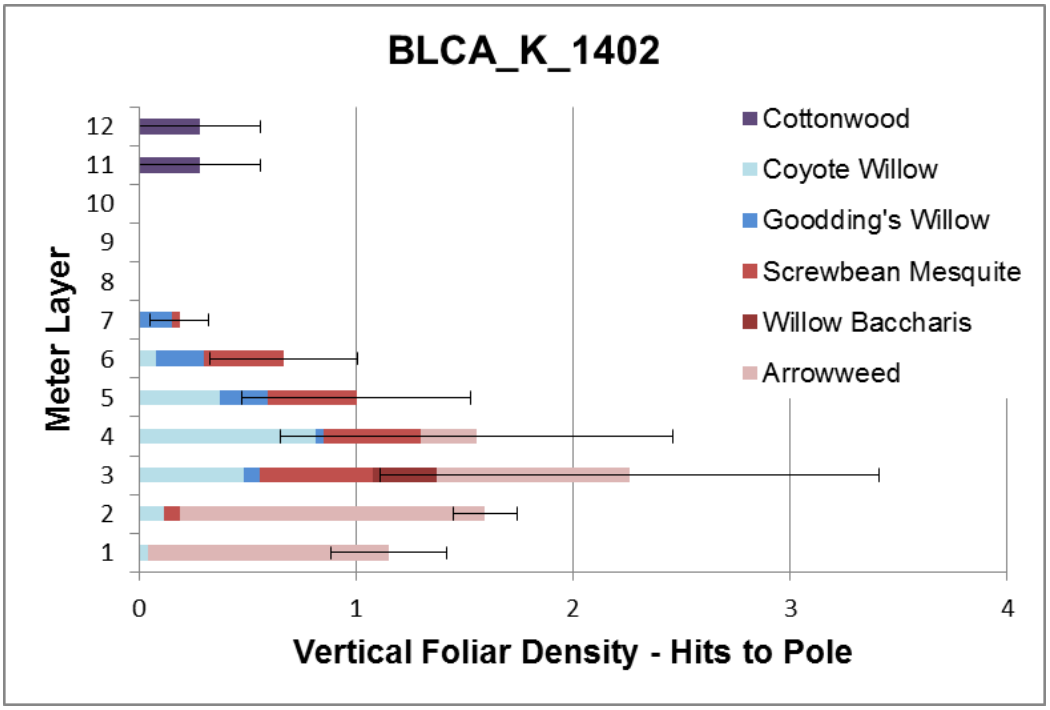


Figure VIII-23. Vertical foliar density for Beal Lake Conservation Area Inference Polygon K_1402 presented as the mean number of hits by species and meter layer. Error bars indicate one standard error of the total number of hits per meter layer.

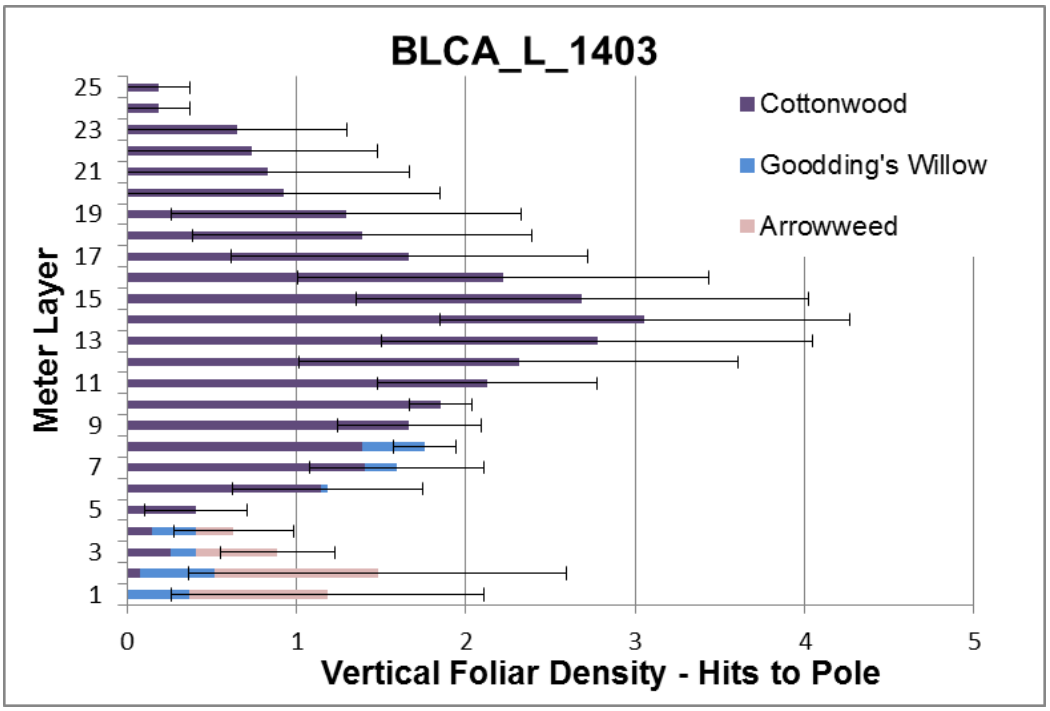


Figure VIII-24. Vertical foliar density for Beal Lake Conservation Area Inference Polygon L_1403 presented as the mean number of hits by species and meter layer. Error bars indicate one standard error of the total number of hits per meter layer.

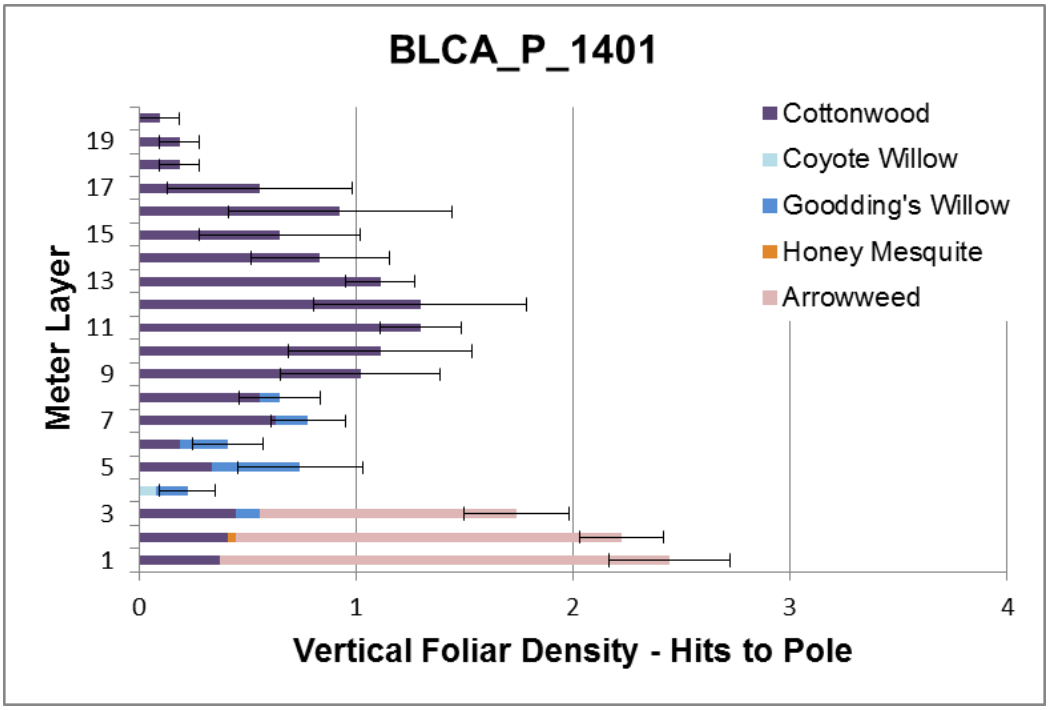


Figure VIII-25. Vertical foliar density for Beal Lake Conservation Area Inference Polygon P_1401 presented as the mean number of hits by species and meter layer. Error bars indicate one standard error of the total number of hits per meter layer.

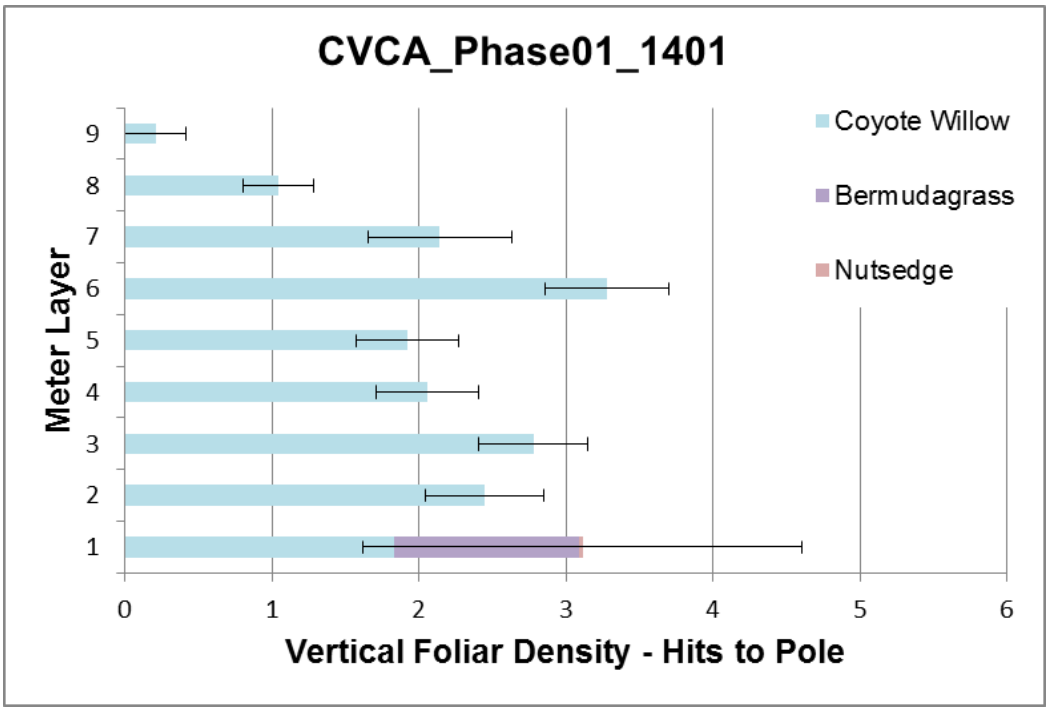


Figure VIII-26. Vertical foliar density for Cibola Valley Conservation Area Inference Polygon Phase 01_1401 presented as the mean number of hits by species and meter layer. Error bars indicate one standard error of the total number of hits per meter layer.

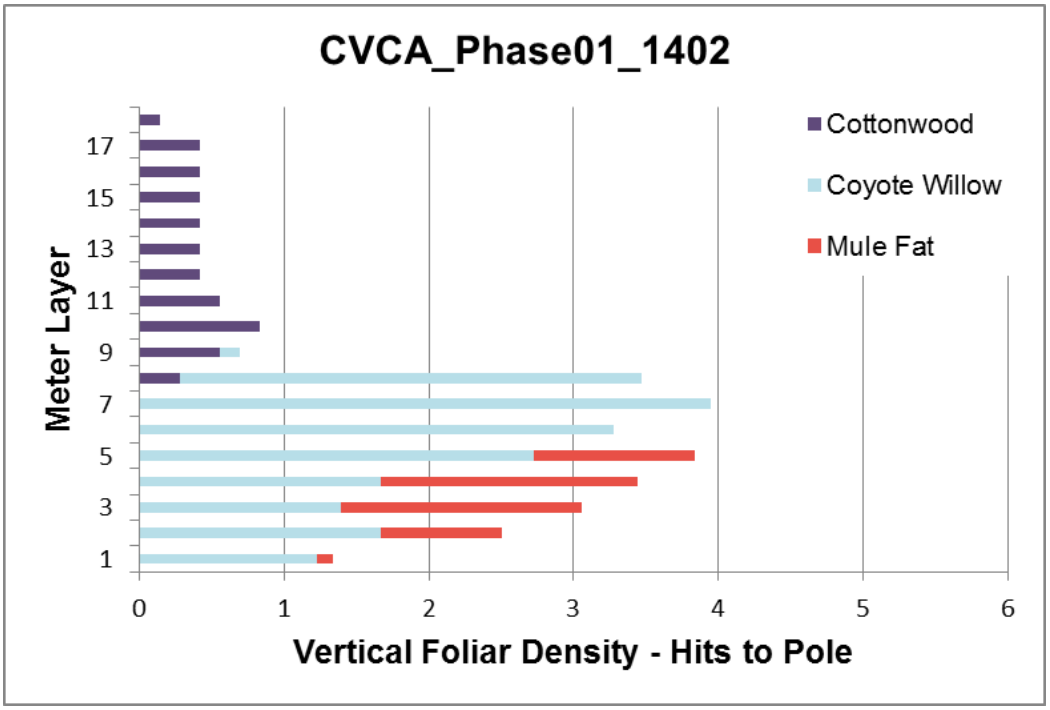


Figure VIII-27. Vertical foliar density for Cibola Valley Conservation Area Inference Polygon Phase 01_1402 presented as the mean number of hits by species and meter layer.

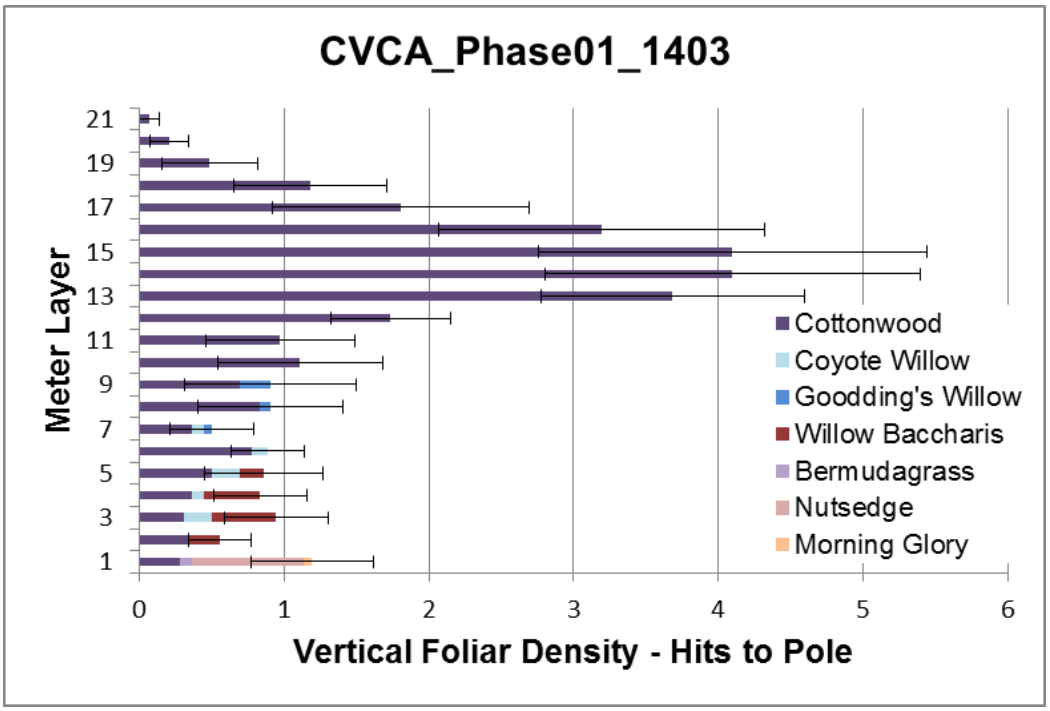


Figure VIII-28. Vertical foliar density for Cibola Valley Conservation Area Inference Polygon Phase 01_1403 presented as the mean number of hits by species and meter layer. Error bars indicate one standard error of the total number of hits per meter layer.

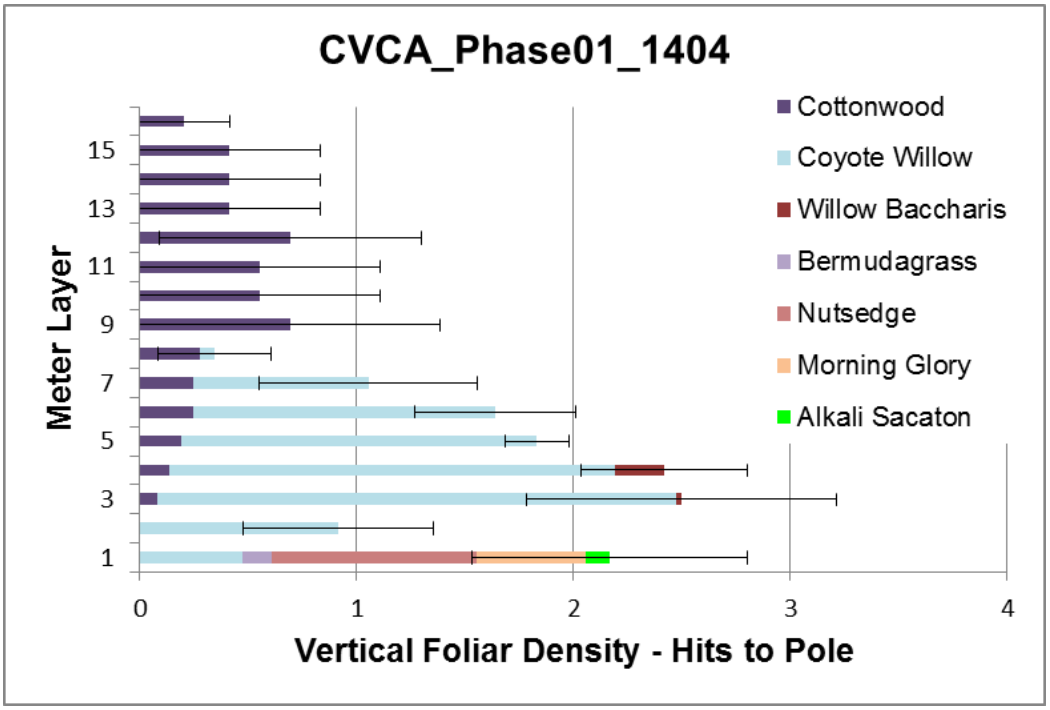


Figure VIII-29. Vertical foliar density for Cibola Valley Conservation Area Inference Polygon Phase 01_1404 presented as the mean number of hits by species and meter layer. Error bars indicate one standard error of the total number of hits per meter layer.

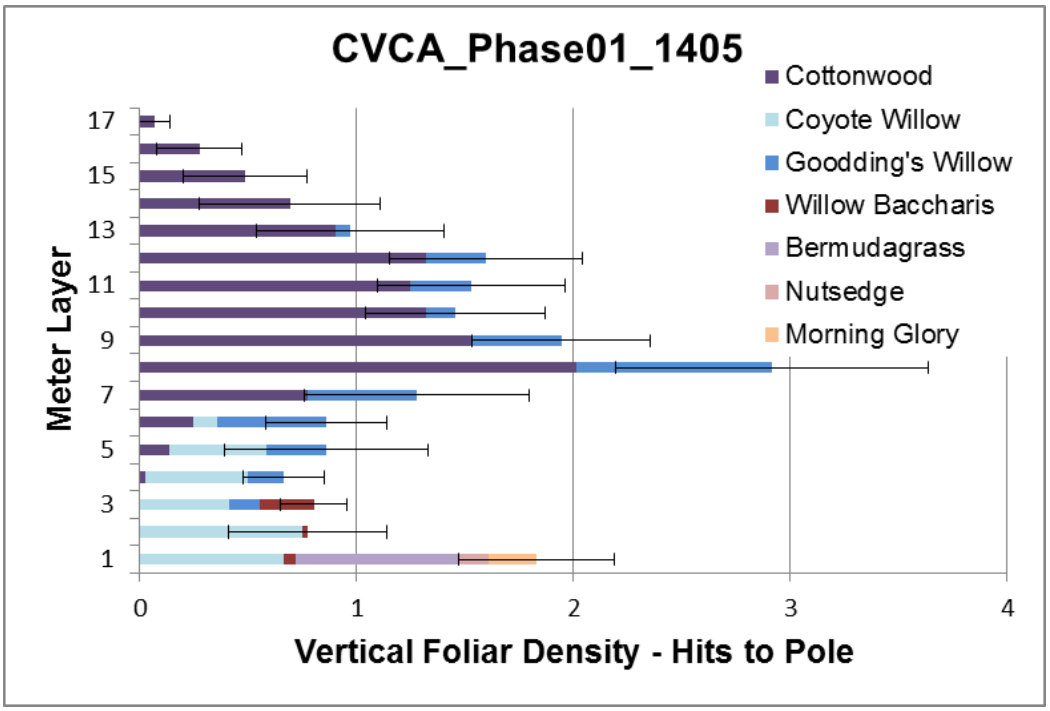


Figure VIII-30. Vertical foliar density for Cibola Valley Conservation Area Inference Polygon Phase 01_1405 presented as the mean number of hits by species and meter layer. Error bars indicate one standard error of the total number of hits per meter layer.

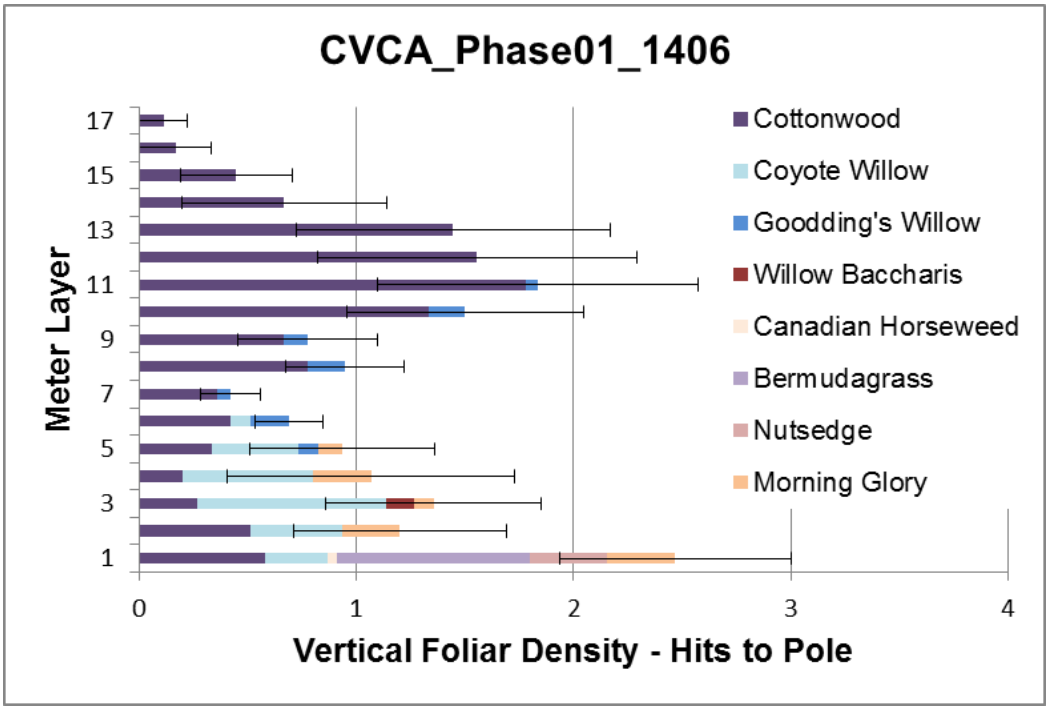


Figure VIII-31. Vertical foliar density for Cibola Valley Conservation Area Inference Polygon Phase 01_1406 presented as the mean number of hits by species and meter layer. Error bars indicate one standard error of the total number of hits per meter layer.

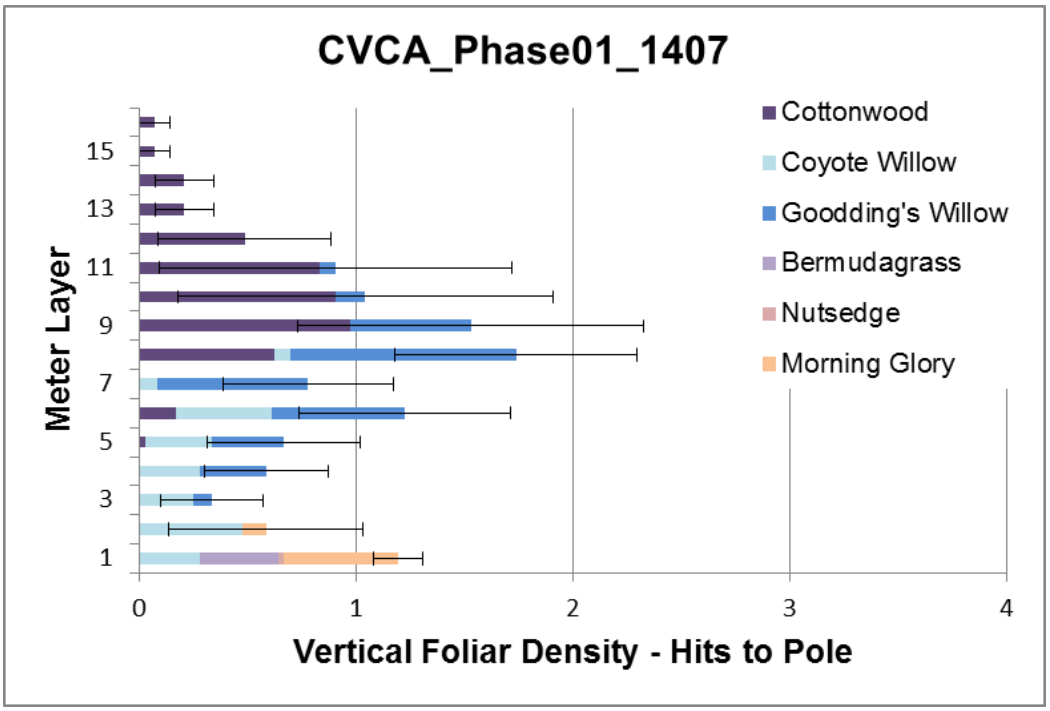


Figure VIII-32. Vertical foliar density for Cibola Valley Conservation Area Inference Polygon Phase 01_1407 presented as the mean number of hits by species and meter layer. Error bars indicate one standard error of the total number of hits per meter layer.

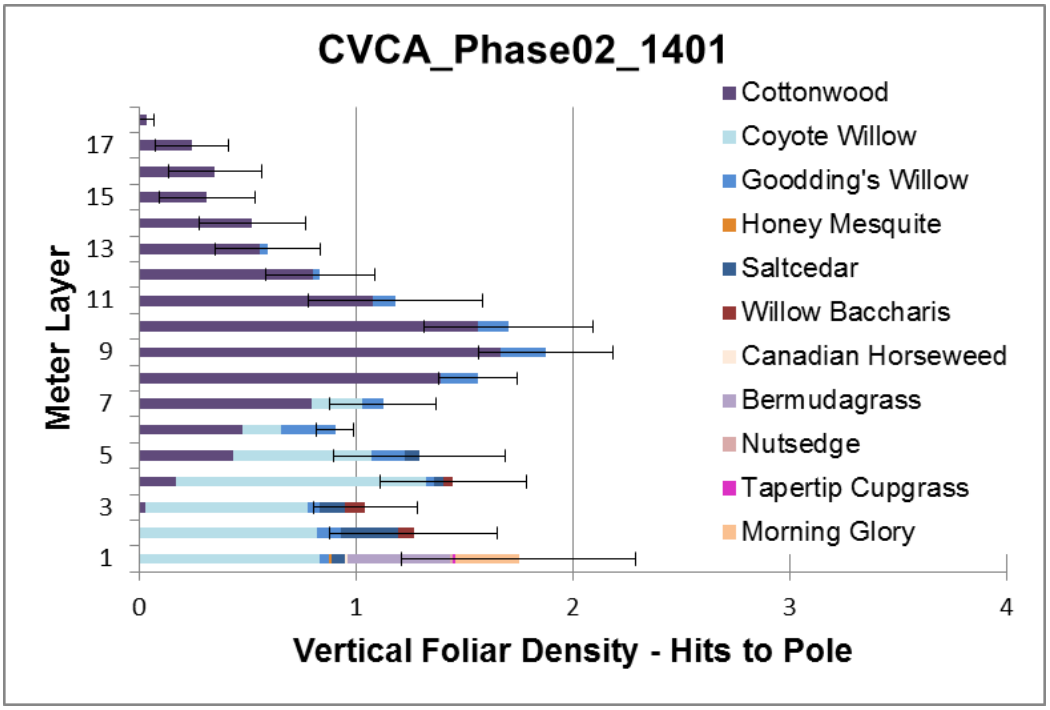


Figure VIII-33. Vertical foliar density for Cibola Valley Conservation Area Inference Polygon Phase 02_1401 presented as the mean number of hits by species and meter layer. Error bars indicate one standard error of the total number of hits per meter layer.

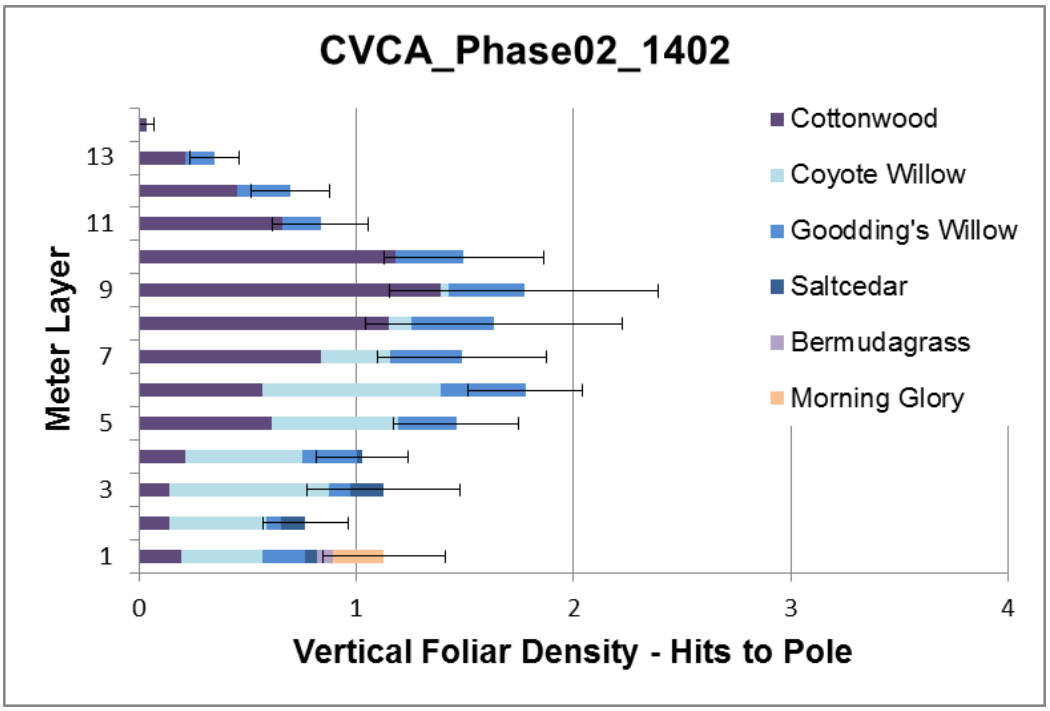


Figure VIII-34. Vertical foliar density for Cibola Valley Conservation Area Inference Polygon Phase 02_1402 presented as the mean number of hits by species and meter layer. Error bars indicate one standard error of the total number of hits per meter layer.

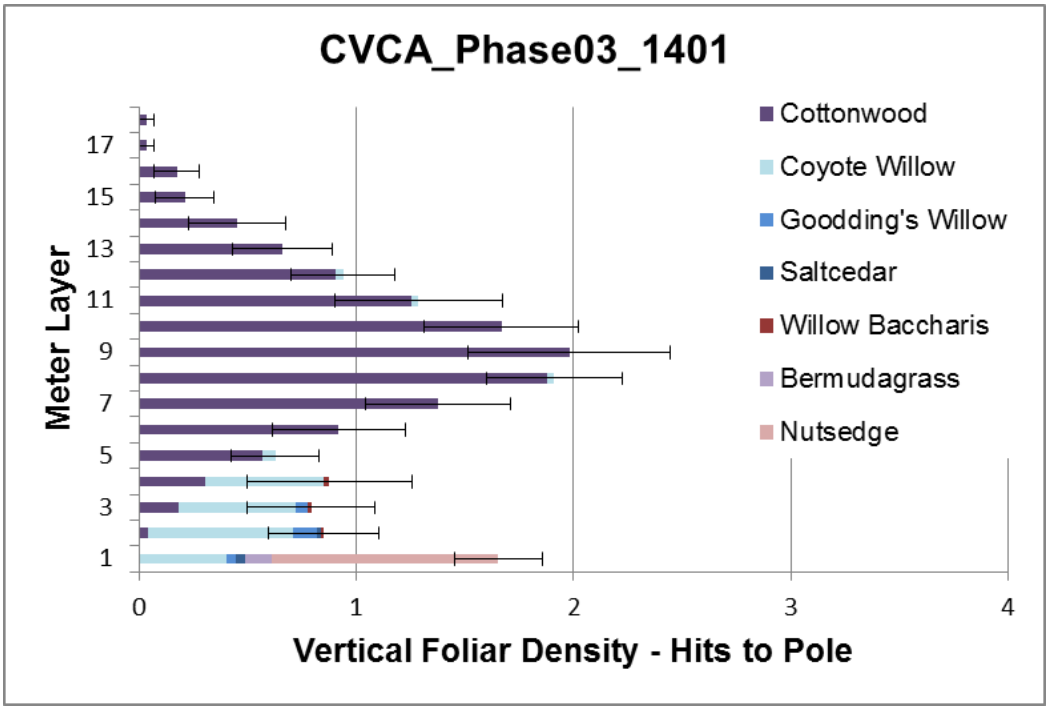


Figure VIII-35. Vertical foliar density for Cibola Valley Conservation Area Inference Polygon Phase 03_1401 presented as the mean number of hits by species and meter layer. Error bars indicate one standard error of the total number of hits per meter layer.

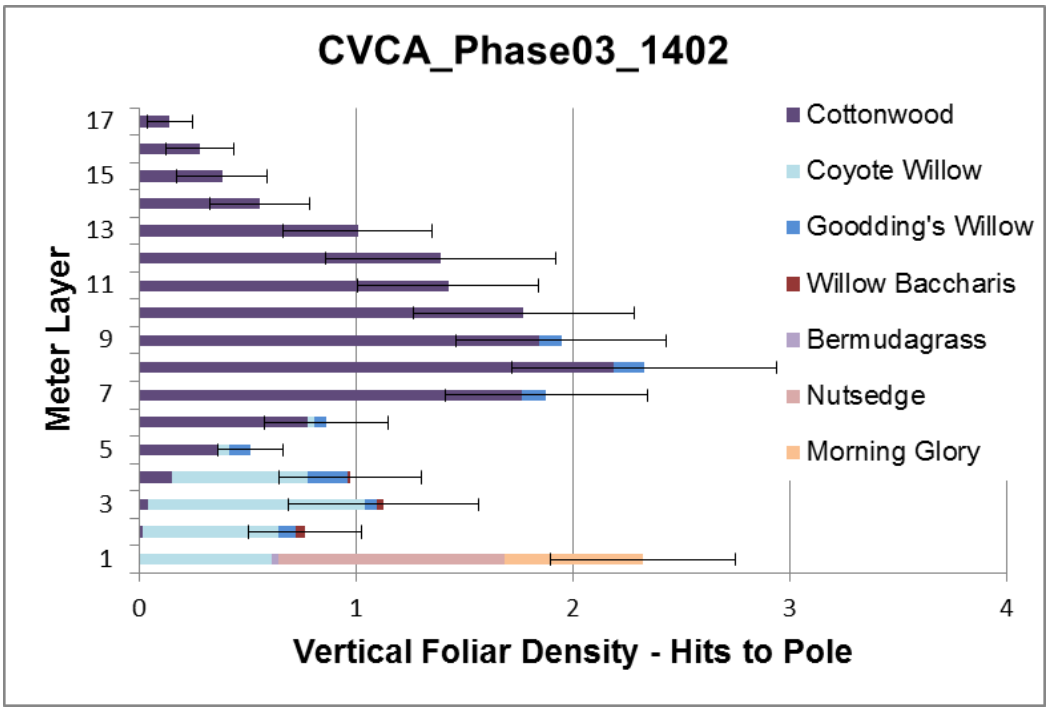


Figure VIII-36. Vertical foliar density for Cibola Valley Conservation Area Inference Polygon Phase 03_1402 presented as the mean number of hits by species and meter layer. Error bars indicate one standard error of the total number of hits per meter layer.

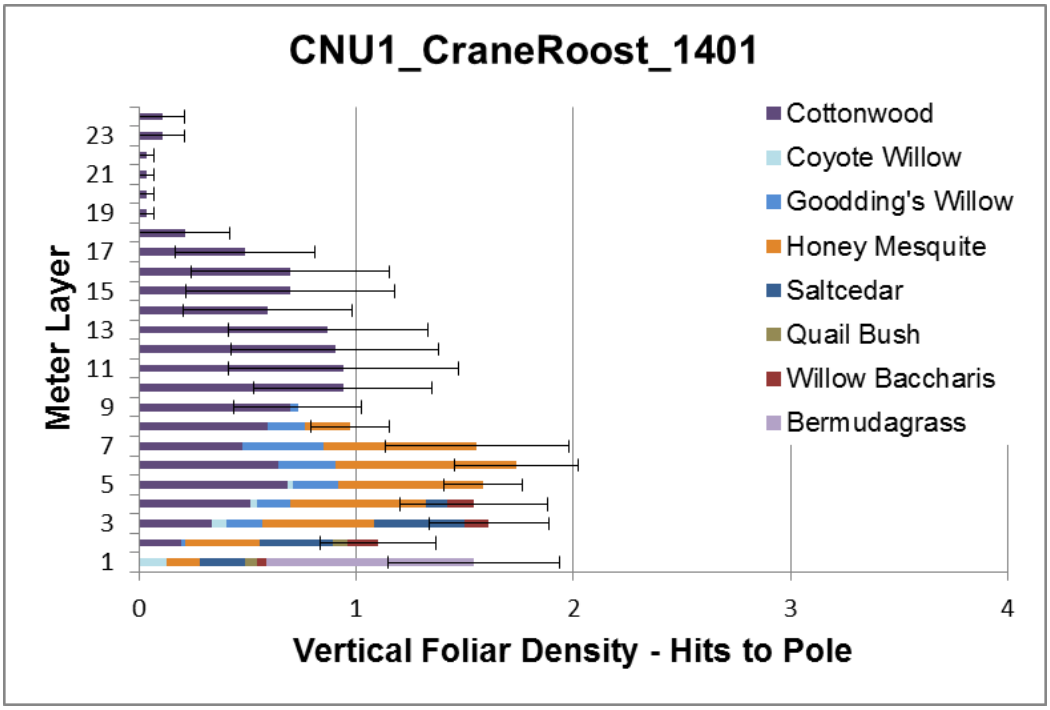


Figure VIII-37. Vertical foliar density for Cibola National Wildlife Refuge Unit 1 Conservation Area Inference Polygon CraneRoost_1401 presented as the mean number of hits by species and meter layer. Error bars indicate one standard error of the total number of hits per meter layer.

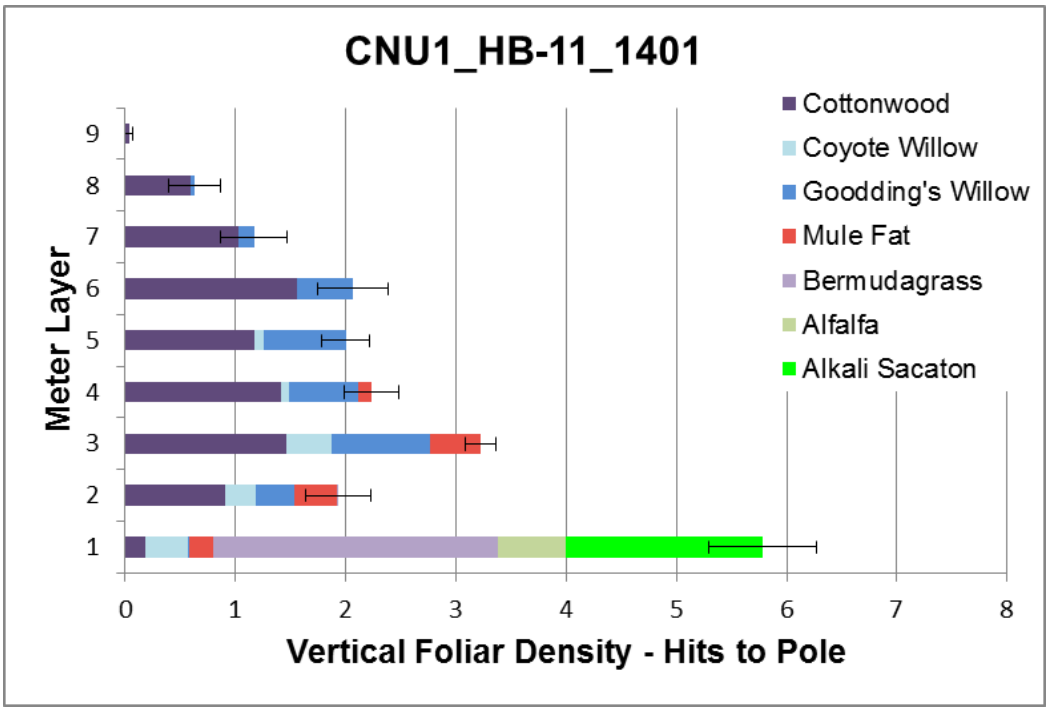


Figure VIII-38. Vertical foliar density for Cibola National Wildlife Refuge Unit 1 Conservation Area Inference Polygon HB-11_1401 presented as the mean number of hits by species and meter layer. Error bars indicate one standard error of the total number of hits per meter layer.

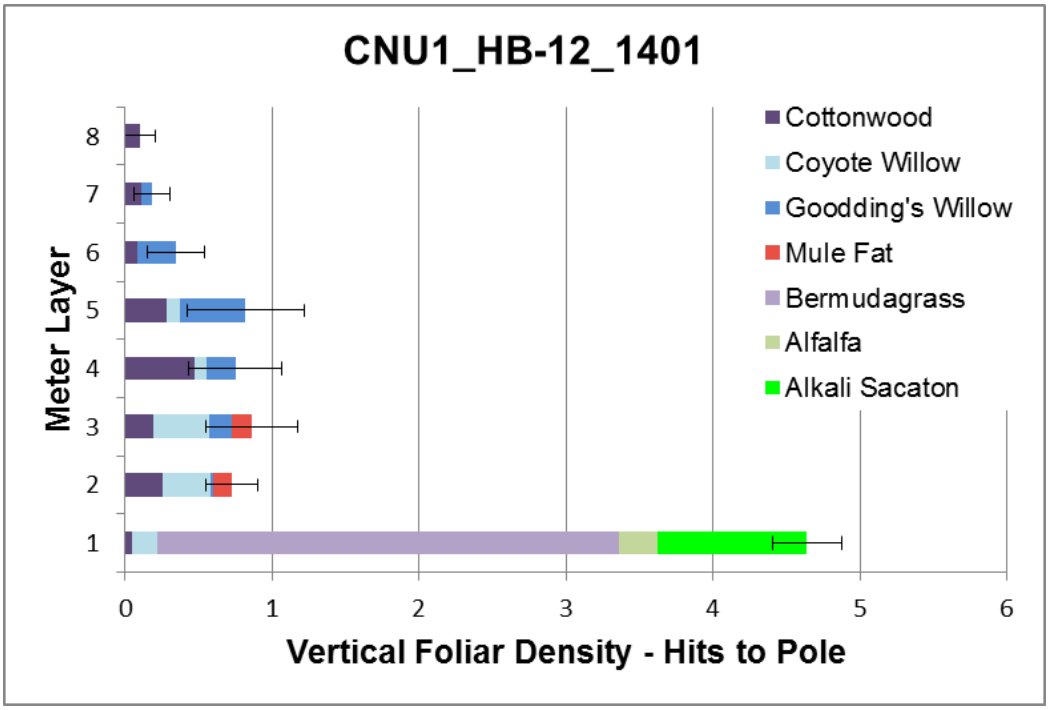


Figure VIII-39. Vertical foliar density for Cibola National Wildlife Refuge Unit 1 Conservation Area Inference Polygon HB-12_1401 presented as the mean number of hits by species and meter layer. Error bars indicate one standard error of the total number of hits per meter layer.

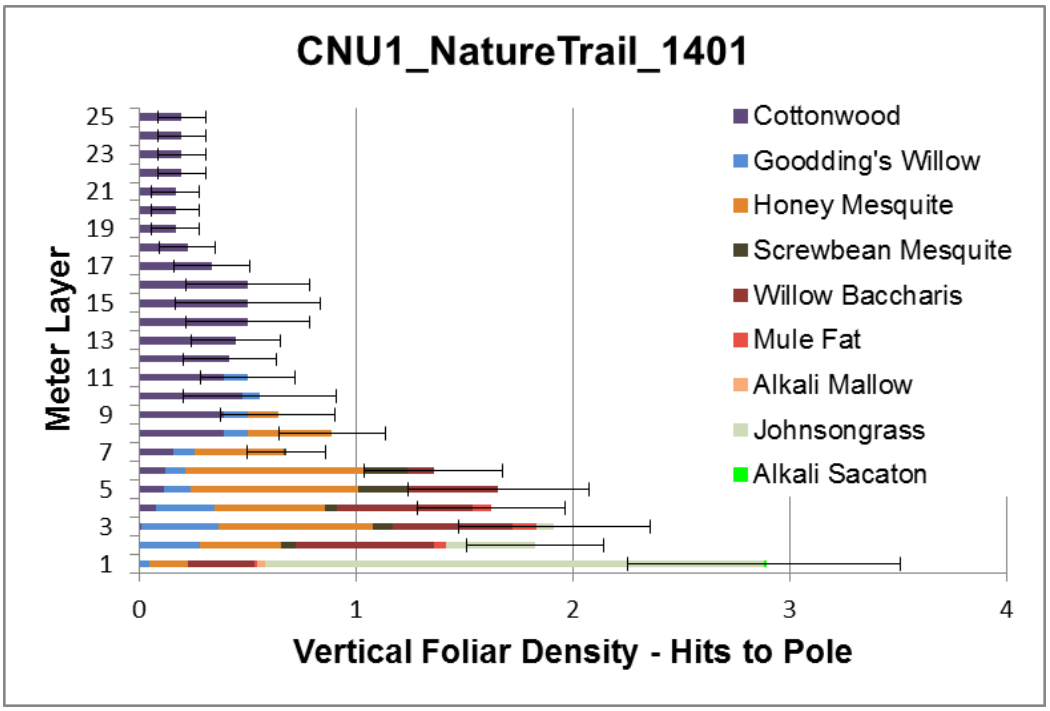


Figure VIII-40. Vertical foliar density for Cibola National Wildlife Refuge Unit 1 Conservation Area Inference Polygon NatureTrail_1401 presented as the mean number of hits by species and meter layer. Error bars indicate one standard error of the total number of hits per meter layer.