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Le Conte's Thrasher Monitoring in the Carrizo Plain National Monument

Report to the Bureau of Land Management

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Introduction

Le Conte's Thrasher (*Toxostoma lecontei;* LCTH) is an uncommon desert species associated with hot and dry climates throughout the southwestern United States. Its range is contiguous throughout the Mojave and Sonoran desert portions of Arizona, Nevada, Utah, and California except for a disjunct population found in California's San Joaquin Valley. This population, whose range partially overlaps with the Carrizo Plain National Monument (hereafter "Monument"), has been described as a sub-species (*T. l. macmillanorum*), but this distinction has not been widely recognized (Sheppard 1996). This population has, however, been recognized as a CA Bird Species of Special Concern (Shuford and Gardali 2008) due to greatly reduced range and population size, high endemism, and habitat loss and degradation (Fitton 2008).

Throughout its range Le Conte's Thrasher requires sparse to no ground cover with accumulated leaf litter under and around shrub vegetation for foraging (Sheppard 1996). Within the Monument, Le Conte's Thrasher is associated with moderately to sparsely vegetated arid shrubland habitats dominated by allscale saltbush (*Atriplex polycarpa*) and/or desert tea (*Ephedra californica*), which are important for nesting. Plant names are in conformity with the 2nd edition of the Jepson Manual (Baldwin et al. 2012) unless otherwise noted.

Due to its low population density, secretive nature, and preference for ambulatory locomotion, standard point count methods may not be effective at detecting this species in sufficient numbers for meaningful analysis. While this species has been regularly

detected at several locations over many years within the Monument, no systematic effort has specifically tracked this population, its habitat associations, and its population changes over time. Moreover, existing nationwide monitoring programs such as the Breeding Bird Survey rarely cover Le Conte's Thrasher habitat and are usually conducted after young have already fledged (Fitton 2008). Thus, our overall objectives in this study were to:

1. Collect baseline population data.
2. Describe and refine knowledge of spatial distribution of Le Conte's throughout the Monument.
3. Develop and test appropriate monitoring protocols for this species.
4. Collect information on habitat associations and key habitat features within the Monument.
5. Develop an online data-entry site to allow for the systematic collection, sharing, and analysis of population data over the long-term.

Summary of Recommendations

- Track population changes over time by conducting area searches during winter months (Dec – March) and visit plots at least twice each season.
- Enter data into the CA Avian Data Center (www.prbo.org/cadc) to provide access and automatic saving and backing up of survey data.
- Continue to collect and use plot relevé information (vegetation and geophysical measurements) to determine optimal shrub height, size, composition, cover and plot slope for Le Conte's Thrasher, establish conservation goals (e.g., birds per acre), and encourage implementation of management actions that are evaluated and adapted to meet conservation goals .
- Improve accuracy and detail of GIS-based vegetation maps to account for plant alliance, percent cover, and vegetation height of important vegetation alliances (e.g. allscale saltbush, desert tea) to better inform habitat management, restoration, and acquisition, and to improve habitat suitability or connectivity models.
- Investigate optimal livestock grazing strategies as they relate to impacts on habitat quality for Le Conte's Thrashers and other wildlife as well as to reduce the threat of stand-replacing fires. Investigate whether livestock grazing can be better managed to upgrade habitat quality for Le Conte's Thrasher (and perhaps, allow other native grazing animals such as pronghorn to benefit from more forage).
- Determine whether saltbush cover is decreasing in the SE part of Carrizo Plain, what the causes of saltbush decline may be, and whether the decline is impacting LCTH persistence in the region.
- Ascertain whether LCTH occur in the southwestern portion of the Monument (southwest of Soda Lake Road, below the east slopes of the Caliente Mountains and

around KCL Campground) as well as on the west side of the Caliente Mountains where they have been sighted in the past (Fitton 2008). Additional survey plots around suitable vegetation in these areas will help.

- Connect or expand the Carrizo Plain monitoring project to other sub-populations of the San Joaquin Le Conte's Thrasher through expansion of surveys (Fitton 2008) and/or sharing of monitoring protocols.

Methods

Habitat Suitability Model

To determine the spatial distribution of this species and to guide the placement of new survey sites, we used Maxent (Phillips and Dudik 2008), a program to develop a spatially explicit model of probability of occurrence in GIS, commonly known as a species distribution model (SDM). Maxent performs better than other distribution model algorithms (Elith et al 2006). Because Maxent was designed to use presence-only data, the presence locations obtained from the BLM made this an ideal model in this study. Occurrence data and several vegetation and landscape variables thought to influence the distribution of Le Conte's Thrasher in the Monument were inputs to the model (Table 1). Maxent then created a spatially explicit map of Le Conte's Thrasher probability of occurrence throughout the Monument.

We tested model performance using a receiver operating characteristic (ROC) plot (Fielding & Bell 1997). The ROC area under the curve (AUC) represents the ability of the model to discriminate between a known presence location and a random background location across the entire study area. In general AUC values of 0.6 – 0.7 indicate poor model performance, 0.7 – 0.8 is fair, 0.8 – 0.9 is good, and values greater than 0.9 represent excellent model discrimination (Swets 1988).

An initial model was run using historic Le Conte's Thrasher sightings provided by the BLM. This "Historic" model was tested using a 25% subset of the data points withheld from the model run.

We then used 2010 data to test the model's ability to discriminate between these new presence locations and a random location within the Monument. Newly collected data can differ in several ways from the data used to build the model (Vaughan & Ormerod 2005). Using this new data to test the model can provide insight into the model's ability to extrapolate outside those areas used to build the model as well as provide information that could improve its precision (Araújo et al. 2005; see Results).

We next developed a "Final" model using all presence locations collected by the BLM and PRBO through 2011. This final model was tested using a 10-fold cross-validation technique that divides the sample into replicate folds, each fold in turn being used to test the model's predictive performance. During the 2010-2011 surveys, we noted that some historic occurrence points were not located in suitable habitat and that thrashers were not subsequently detected at these points. Thus, to reduce the probability of using erroneous occurrence points, we removed any historic points that had a low spatial resolution (i.e., no associated GPS coordinates) from the final model.

Table 1. Habitat variables used to model habitat suitability for Le Conte's Thrasher

Variable	**Description**
Vegetation type	Vegetation type at point
Percent spiny saltbush (*Atriplex spinifera*)	Percent spiny saltbush vegetation type within a 1-km radius
Percent allscale saltbush	Percent allscale saltbush vegetation type within a 1-km radius
Stream index	Inverse-weighted distance to nearest stream
Slope mean	Mean slope within a 500-m radius
Elevation	Elevation at point
Elevation mean	Mean elevation within a 500-m radius
Vegetation types (Holland 1986)	
Interior coast range saltbush scrub	
Valley sink scrub	
Upper Sonoran sub shrub scrub	
Spiny saltbush	
Valley saltbush scrub	
Valley sink scrub	
Juniper woodland	
Juniper oak woodland	
Diablan sage association	
Non-native grasses	
Lake	
Tilled	

Site Selection and Surveys

We used Area Search Censuses (Ralph et al. 1993) for systematic and thorough searches not afforded by point count surveys. They allow bird-to-habitat relationships to be determined and land management techniques assessed. The area search protocol is effective for surveying Le Conte's Thrasher because it allows surveyors to flush hiding birds and locate birds not singing or calling. The protocol allows for more than one observer. Observers are able to communicate with each other, compare notes, and chase down unfamiliar species or sounds, thereby allowing non-birders to participate by serving as recorders or tallying species (see the Protocol section for a full description of the protocols used).

We conducted vegetation relevés to measure vegetation characteristics within the entire plot as well as within a 50-m radius around each thrasher sighting and active thrasher nest. Vegetation measurements are useful for determining bird habitat needs, for tracking changes to the habitat over time, and for providing habitat management recommendations. Our measurements focused on dominant plant types thought to be important for Le Conte's Thrashers (e.g., percent cover of allscale saltbush, desert tea, spiny saltbush). We recommend that future surveys also conduct vegetation relevés at the plot level and that protocol information be included as part of the Area Search Protocol section below.

2010 Field Work

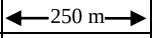
In 2010, the entire Monument was gridded into 250 m^2 plots – the approximate size of a Le Conte's Thrasher territory (Sheppard 1996). We then prioritized survey plots based on several habitat criteria. One main objective was to locate and survey suitable Le Conte's Thrasher habitat. As a starting point, one-third of the plots were located in areas that had at least some habitat considered to be of high suitability by the model (probability occupied > 50%). Another third of the plots were located where the species had been seen historically. This partitioning allowed us to determine whether individuals were still located in these sites and to attain vegetation data within known occurrence points. The final one-third of plots were located along the southwestern slopes of the Temblor Mountains where vegetation seemed suitable according to vegetation maps, but were not considered high suitability by the model, likely due to their higher slope and elevation. This subset would improve our understanding of the relationship between Le Conte's Thrasher and saltbush (*Atriplex* spp.). Although we did not specifically target areas that were considered to be completely unsuitable, based on published literature and our personal experience with the species (Sheppard, 1996; e.g., habitat without shrub cover, cultivated land, barren, or lake bed), plots had a wide variety of shrub cover ranging from 0-80% total shrub cover. Surveys were conducted between March 2nd, 2010 and March 8th, 2010

Because Le Conte's Thrasher individuals or pairs may cluster together, we grouped plots into blocks of 25 adjacent plots (5x5) and then sampled a subset (13) of these plots (Figure 1). This design allowed us to determine the degree of territorial clustering and whether it could be influenced by conspecific attraction or habitat. The configuration of

plots surveyed was chosen to maximize the number of different inter-block distances while allowing the surveyor to visit adjacent plots and minimize time spent navigating between survey plots.

Figure 1. Survey grid with plot configuration used in 2010.
Numbers represent the order in which the cells were visited.

	8		6	
9		7		5
10		3	4	
11			2	
	12	13		1



2011 Field Work

During the 2010 season, the detection of Le Conte's Thrasher individuals was low. In 2011 we focused our efforts in plots with a high probability of occupancy, i.e., plots that had historic sightings and/or sightings from surveys in 2010. In addition, we also surveyed plots visited in 2010 that did not have detections but had similar vegetation parameters as measured in plots with detections. Surveys were conducted between February 24th, 2011 and February 28th, 2011.

To increase our chances of detecting thrashers that were present and to obtain a rigorous detection probability, we surveyed individual plots two to three times during the season. We define detection probability as the likelihood of detecting a Le Conte's Thrasher during a survey given that individuals of that species were present in the survey area (MacKenzie et al 2002). It is not possible to detect birds with 100% certainty whenever one is present (i.e., detection probability of 1). Thus, our goal was to estimate the proportion of sites that were occupied (occupancy), given that the species was not always detected when present. Detection probability and occupancy rate estimates were derived with the software program R using the package 'unmarked'.

Results

Habitat Suitability Model

Model test results were good to excellent (Table 2) with a final AUC score of 0.893 using presence data across all years. Figure 2 shows the projected model using Historic sighting locations only. Figure 3 shows the final projected model using all BLM and PRBO sighting locations. Both models show high habitat suitability in the southwestern portion of the Monument (Figs. 1-2; north and south of KCL Campground). However, we did not have location data for historic sightings there, and a survey there in 2010 did not detect any individuals. However, in the past, individuals have been detected south of KCL Campground in desert tea vegetation (S. Fitton, pers. comm.). The area around the southeastern portion of the Monument also shows high habitat suitability. We did have historic sightings in this area and one individual was detected in 2010. However, no individuals were detected here in 2011. The allscale saltbush in this area appeared dry

and unhealthy. Further investigation of why thrashers may or may not occur in these areas may prove informative.

Figure 2. Species distribution model for Le Conte's Thrasher modeled using historic location data collected before 2010. Darker colors represent an increasing probability of occurrence.

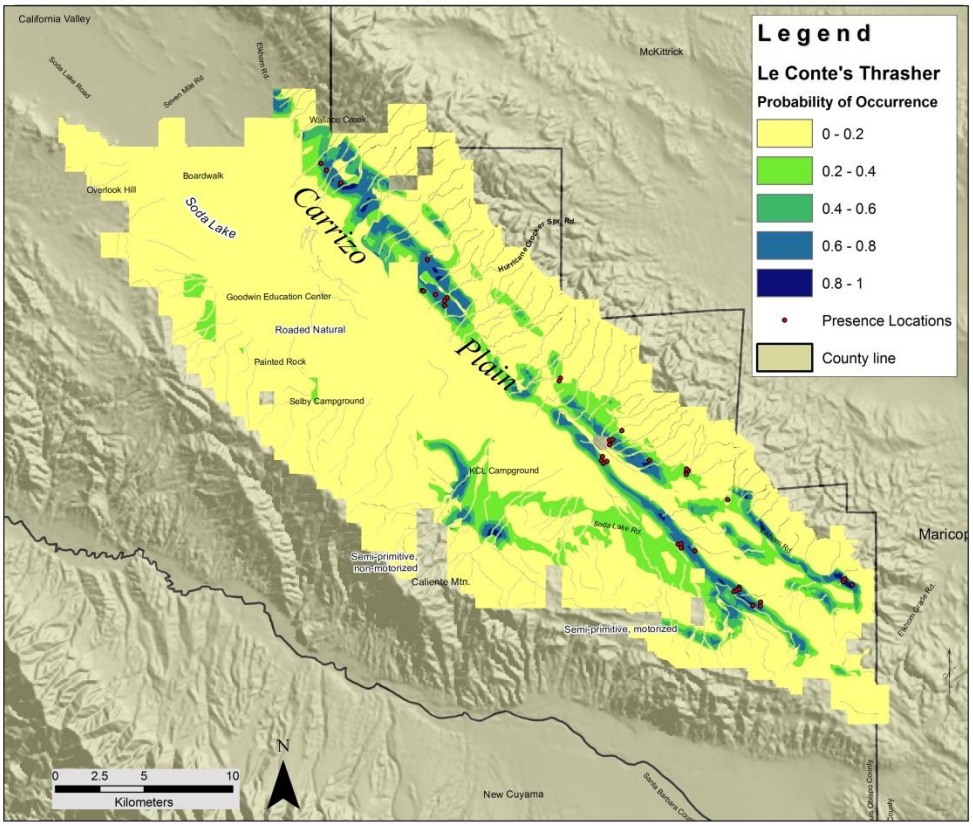


Figure 3. Species distribution model for Le Conte's Thrasher using location data across all years. Darker colors represent an increasing probability of occurrence.

Image represents the average across a 10-fold cross-validation.

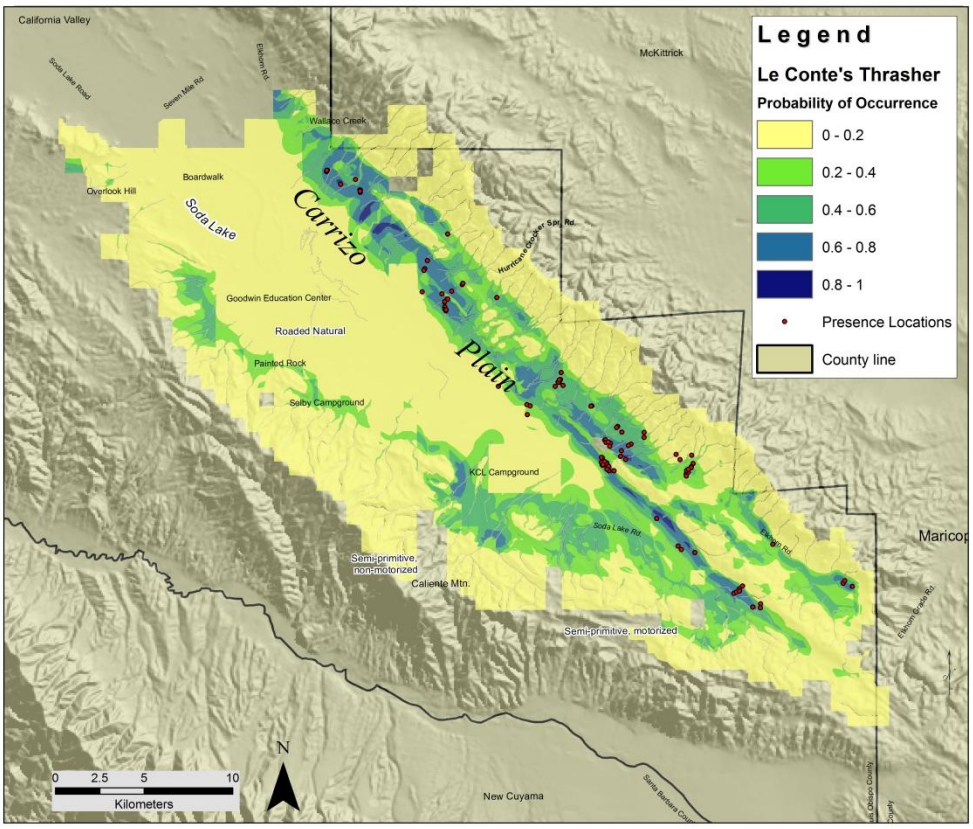


Table 2. Predictive performance results of SDM models run using occurrence data provided by the BLM (Historic), this same model tested with newly collected occurrence data in 2010 (Historic Test), and a model run with all data points including new surveys conducted in 2011 (Final 2011).

Table 2

Model	**AUC Test Score (Standard Deviation)**	**# Presence points**
Historic	0.922 (0.026)	42
Historic Test	0.823 (0.050)	59
Final 2011	0.893 (0.050)	81

Sightings and Occupancy

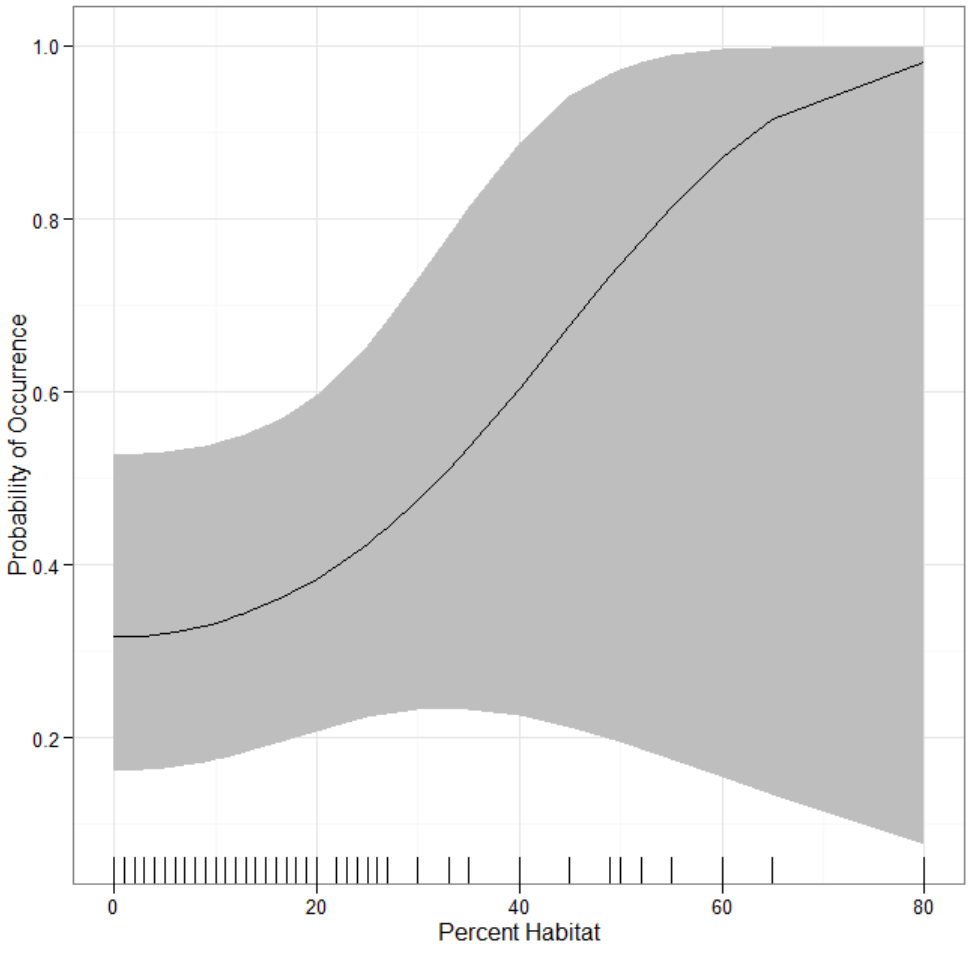
In total 234 plots were surveyed during the seven 2010 survey days. Of the 18 total thrasher sightings, 8 were located during a survey within a plot and 10 were found outside of an official survey. In total we detected 48 bird species during the surveys (Appendix 1).

In total 76 plots were surveyed over six days in 2011, with 39 of these visited three times, 16 visited twice, and 21 visited once for a total of 170 plot visits. Of the 47 total thrasher sightings, 25 were located during a survey within a plot and 22 were found outside an official survey. In total we detected 38 bird species during the 2011 surveys (Appendix 1).

Without correction for detection probability, the naive occupancy rate of sites we surveyed in 2011 was 19%. We calculated detection probability to be 0.33 (0.09 SE) giving us a revised overall occupancy rate of 57%, more than doubling the occupancy rate for sites visited in 2011. Our occupancy rate was modeled using the total percent cover of allscale saltbush and desert tea (i.e. "habitat") chosen as an *a priori* covariate. Occupancy model results are shown in Figure 4. Model results indicate that Le Conte's Thrasher occurrence decreases with less shrub cover within a plot. Although the modeled probability of occurrence continues increasing with more shrub cover, sample sizes of plots with high proportions of shrub cover were low. This is reflected in the large error values associated with shrub cover values above 40%. Thus, we would interpret these results with caution. Moreover, as indicated previously, several studies have shown that Le Conte's Thrashers require open ground for foraging. Because our plots did not cover

entire territories, the habitat cover percentages do not reflect the actual needs of an individual or pair.

Figure 4. Occupancy model for Le Conte's Thrashers for sites surveyed in 2010 and 2011 in the Monument. Percent habitat is defined as the total percent cover of allscale saltbush and desert tea. Gray bar indicates upper and lower standard error values. Sampling values of percent habitat are indicated along the X-axis.



Habitat Associations

Only two species of shrub were commonly associated with locations where we encountered Le Conte's Thrashers: allscale saltbush and desert tea. Thrashers were also encountered on the ground foraging or travelling. The highest densities of thrashers were in areas with large shrubs (> 1.5 m). The largest shrubs tended to be on flat ground and had much open space around them, whereas the shrubs on steeper slopes tended to be shorter and were more tightly packed together. Additionally, other species of shrubs, such as goldenbush (*Ericameria sp*.), tended to be mixed with the saltbush on the steeper slopes, which further decreased the open space. As shown in previous research (Sheppard 1996, Fletcher 2009), most of the Le Conte's Thrashers that we encountered were on flat or gently sloping ground and not on steep slopes. Shepperd (1996) stated that suitable Le Conte's Thrasher habitat typically consists of one or more species of *Atriplex*, but we did not find thrashers in areas with high proportions of spiny saltbush when we surveyed these habitats in 2010. Although spiny saltbush occurred on the flat, low-lying areas of the Carrizo Plain, we found this species to be shorter than allscale saltbush and more tightly packed together. Whether Le Conte's Thrashers prefer flat ground, large shrubs, or require both was not explicitly studied, but these two factors seem to be important for territory occupation (Fletcher 2009). Plant height and percent cover characteristics were not available in a GIS format for modeling. In lieu of saltbush percent cover we used a derived landscape variable (percent habitat classified as saltbush within a 1-km radius). While this successfully located some areas with intermediate levels of shrub cover we would encourage the development of GIS vegetation layers for

the Monument that explicitly measure percent cover for various vegetation types. GIS layers that identify vegetation type and height at a finer scale would also be useful. These would greatly increase our ability to identify existing and potentially suitable thrasher habitat.

We found four Le Conte's Thrasher nests in 2011, all of which were within allscale saltbush and were in the incubation stage. Vegetation characteristics were measured in a 50-m radius around the nests and are summarized in table 3.

Table 3. Nest data and vegetation characteristics in a 50-m plot around four nests. Height values are in meters

Nest stage	**# eggs or nestlings**	**Nest height**	**Avg nest shrub height (range)**	**% allscale saltbush cover**	**% other shrub cover**	**% grass/forb cover**	**% bare ground cover**
Egg	2	0.4	1.7 (2.1 – 0.1)	16	4	76	4
Egg	3	0.7	1.5 (1.5 – 0.1)	15	0	80	5
Egg	3	0.6	1.3 (1.5 – 0.2)	7	0	15	78
Egg	3	0.4	1.5 1.5 – 0.1)	19	8	53	20
Mean		**0.525**	**1.5**	**14.25**	**3**	**56**	**26.75**

We summarized vegetation measurements for plots where Le Conte's Thrashers were detected in 2010 and 2011 (Table 4). The dominant shrub cover was allscale saltbush with an average percent cover of 15.5% and an average maximum height of 1.3 m. The average percent cover of desert tea was only 1.8%. However, in plots where thrashers were present and allscale saltbush was absent, ephedra was 6.7 times more extensive (12% cover).

Table 4. Mean percent cover and mean maximum height (standard deviation) for shrub cover and mean percent ground cover in plots with Le Conte's Thrasher detections in 2010 and 2011 .

allscale saltbush		desert tea		Other shrub		Grass/forb	Bare ground
% cover	Max ht	% cover	Max ht	% cover	Max ht	% cover	% cover
15.5 (12.58)	1.3 (0.3)	1.8 (4.4)	1.1 (0.4)	2.1 (4.1)	0.6 (0.2)	66.9 (16.2)	13.7 (8.5)

Discussion

The effect of cattle grazing (and its relationship to fire) on Le Conte's Thrashers was not studied in detail with these surveys and is a complex issue. However, a few of our plots did have an obvious grazing history and the saltbush in these plots tended to have a shorter stature due to the heavy pruning they received from the cattle. If saltbush size is positively correlated with Le Conte's Thrasher habitat suitability, then overgrazing by cattle may be incompatible with the persistence of Le Conte's Thrasher in the Carrizo Plain. Others have also found that livestock grazing can destroy or denude saltbush vegetation (Sheppard 1996). Fitton (2008) reviewed these factors in more detail and we summarize many of his findings and recommendations here: High density livestock grazing throughout the summer can help convert established native vegetation suitable for Le Conte's Thrasher foraging and nesting to unsuitable habitat by destroying leaf litter, promoting the introduction of non-native annual grasses, and severely damaging shrubs. Invasion of non-native annuals is problematic because of their tendency to replace open ground and litter used by thrashers. Resulting heavy cover by non-native annuals can promote future frequency and higher intensity of fires, which in turn can kill

saltbush and their seeds, effectively converting shrubland habitat needed for nesting into grassland. Thus, protecting and maintaining established native and perennial grass populations is important for Le Conte's Thrashers. A concerted habitat restoration program to propagate more favored shrubs and native perennial grass in lost or degraded sites may help increase suitable Le Conte's Thrasher habitat. However, managed livestock grazing in areas with established non-native grass cover may help reduce fuel loads and thereby prevent catastrophic stand-replacing fires. Managed livestock grazing includes restricting it in the late summer when shrubs are heavily damaged because they are the only green vegetation available and restricting it during periods of drought or after a year following a significant recruitment of seedlings. Managed livestock grazing also includes restricting it so that shrubs are able to maintain a hemispherical shape more suitable for nesting. We recommend further investigation of an optimal grazing regime in habitat currently occupied by Le Conte's Thrasher and of testing whether grazing should cease altogether in habitat of Le Conte's Thrasher.

Online Data Entry and Access

The California Avian Data Center (CADC; data.prbo.org/cadc; Ballard et al. 2010) is a regional node of the Avian Knowledge Network (AKN; www.aviankowledge.net) hosted by PRBO. It is an in-use, secure, and well-tested platform providing a powerful, cost-effective solution to the data management, analysis, and consolidation needs of the region's bird monitoring community. CADC is currently curating > 94 million bird observations spanning 4 decades.

By using CADC for this project, we will provide a safe repository for controlled data entry and access to all avian observation data for the study area, with the goal of providing project managers as complete access to data as possible while limiting access to people outside the project, if needed to protect nest location or other sensitive data. Monument staff will control the access rights, from restricted (no access outside of project) to full public availability with the ability to download a complete copy of all the project observation data at any time, in several standard formats. All system hosting and administration tasks (e.g., data backup and recovery) will be performed by PRBO.

Through a Le Conte's Thrasher project page hosted by CADC - http://data.prbo.org/apps/cplcth/ - users will be able to login and enter their bird observations, download data forms, download maps and coordinates to locate targeted survey areas, and view summary information and online maps. PRBO can train Monument staff in the use of the data entry system and will be available to answer future questions that may come up by users.

Area Search Protocol and Instructions to Observers for Conducting Le Conte's Thrasher Surveys

Introduction

Le Conte's Thrasher (*Toxostoma lecontei*) is an uncommon desert species associated with hot and dry climates throughout the southwestern United States. Its range is contiguous throughout the Mojave and Sonoran desert portions of Arizona, Nevada, Utah, and California except for a disjunct population found in California's San Joaquin Valley. This population, which occurs within the Carrizo Plain National Monument (hereafter "Monument"), has been described as a sub-species (*T. l. macmillanorum*), but this distinction has not been widely recognized (Sheppard 1996). This population has, however, been recognized as a CA Bird Species of Special Concern (Shuford and Gardali 2008) due to greatly reduced range and population size, high endemism, and habitat loss and degradation (Fitton 2008).

Within the Monument, Le Conte's thrashers are associated with moderately to sparsely vegetated habitats predominated by allscale saltbush (*Atriplex polycarpa*) and/or desert tea (*Ephedra californica*), which are important shrubs for nesting. Throughout their range Le Conte's thrashers require sparse to no ground cover with accumulated leaf litter under and around vegetation for foraging (Sheppard 1996).

Surveys consist of searching for birds within a specific 250 x 250 m square plot (6.25 ha). Each plot is searched thoroughly for a 20-minute period. The goal is to locate and identify all bird individuals within the plot, paying particular attention to Le Conte's Thrasher individuals. If possible, we encourage you to cover more than one plot in a morning (2-3 plots). Additionally, plots should be visited multiple times within a season (2-3 times). This will provide information on the probability that an individual will be detected during a survey.

Equipment and Training Needed

What you will need:

- ✓ Binoculars
- ✓ Data sheets, clipboard, and extra pens
- ✓ GPS unit loaded with plot coordinates (see "Using the GPS Unit" below)
- ✓ Compass
- ✓ A watch/clock with a secondhand
- ✓ Bird identification guide (optional)

Prior to the Start of the Survey

-Observers are encouraged to participate in scheduled orientation before conducting surveys to ensure that protocols are understood and being followed in a consistent manner by all.

-In general, it is a good idea to familiarize oneself with the location of and access routes to the survey plot before the day of the survey.

-Before the day of the survey, it is a good idea to test out the GPS unit and use the plot coordinates to explore the plot - it helps to have a good sense of how to use the gps unit to explore the borders and habitat of the plot so it can be thoroughly covered. Before heading out to the field, enter the four corners of each plot as waypoints. Be sure your GPS is in UTMs, not Lat/Long. See the section "Using the GPS Unit" below for more details

-Observers should familiarize themselves with the range of vocalizations of Le Conte's Thrasher. The MacCauley Sound Library at Cornell University is a good starting to learn and refresh familiarity with the calls of LETH.

-Observers should learn the 4-letter codes.

When to Survey

Survey Timing: Peak singing time for Le Conte's Thrashers is between December and February. During the remainder of the nesting season, males may sing as little as 0-10 minutes a day but may sing more when a new nest is being constructed or eggs are being laid. Vocalizations are heard more frequently at dawn or mid-morning AND dusk. Thus, surveyors should focus their survey visits during the winter months (Dec-Mar) and the early morning or dusk.

Survey Conditions/Weather: Moderate to heavy precipitation will cancel a survey. Light precipitation may be fine for surveys. If precipitation is showery, then wait for showers to end before resuming the area search. Heavy winds > Beaufort 5 will cancel the survey. The main criteria for cancelling a survey should be your ability to hear birds calling or singing. If wind and/or precipitation are affecting your ability to hear birds you should cancel your survey or wait until conditions improve. If you want to continue with your survey regardless (NOT ADVISED), make note of the conditions within your data sheet.

Conducting the Survey

The surveyor will spend exactly 20 min in the plot searching for and recording all birds seen, but focusing on Le Conte's Thrasher. Record the begin time and end time at the top of the datasheet, but record the times of any pauses in the **Notes** section. Do not be distracted or spend too much time looking for rare birds other than Le Conte's Thrasher.

Review the survey protocol, form, and codes used within. Before arriving at a site, record the following on your datasheets in the appropriate areas: observer's name, date, the plot ID, and its UTM boundaries (north, east, south, and west).

Just before starting a survey, record the weather condition (Temperature, wind = Beaufort scale, Cloud cover = % cover, Precipitation = none or light).

To ensure that the detection probability is as high as possible, the surveyor should walk through the plot in ≥ 3 transects that will ensure that the maximum possible distance

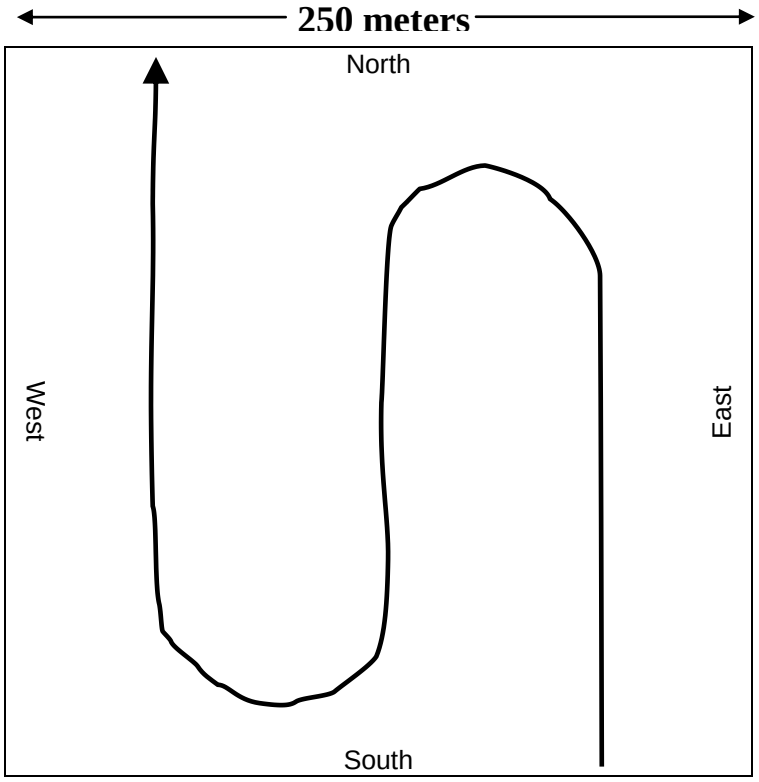
between a surveyor and a thrasher is only 50 m (Figure 5). The surveyor may deviate from the transect line if he or she feels that suitable habitat will not be adequately searched from the prescribed route. If the plot has too much suitable habitat (or the terrain is too difficult) to thoroughly survey within the 20 minute period, the surveyor will need to prioritize the search so that the best habitat (flat areas with large saltbush or ephedra) is surveyed first. After the best habitat is surveyed, move on to areas with less suitable habitat. Survey these areas in transects spaced 20-50 meters apart. If the plot has little suitable habitat, and the survey is complete in under 20 minutes, the surveyor must stay on the plot for the entire 20 minutes before leaving the site.

During the census, record the name of each species seen or heard on the plot in the **Species** column of the survey form (Appendix 2). If you know the American Ornithologists' Union 4-letter code for the bird (e.g. WIWA for Wilson's Warbler; see Appendix 3), please use that; if not, record the full individual name of the bird species. Unidentified birds should be indicated as XXXX, but surveyors should note what type of bird was seen – e.g., hummingbird species, thrasher species. Record data as described on the PRBO Area Search Code Key section below. For each individual of each species, record a single letter (S=song, V=visual, C=call), in the order of priority explained in the key within the **Tally** column. You should change the data from a call to a song, if a higher priority observation later occurs for that individual. Recording any special behaviors (such as food carries, flocking, displaying), is strongly recommended but not required; there are respective **Behavior** columns on the form for these observations as listed in the key. Fill in the **Total** column for each species after the census is complete. Other species not recorded in the 20 minutes, observed off the plot, or exhibiting interesting behaviors, may be recorded under **Additional Notes**.

The "time constraint" nature of area search censuses is an important feature; never extend your time to include "just a few good birds", or to cover the area more thoroughly. Carefully record your starting time when you begin, stay aware of the time throughout the census to ensure both good coverage and correct timing. Observers are free to pause the area search (and the clock) to investigate songs, calls, or breeding activity. This may be necessary for identifying species you are not familiar with. Keep close track of any pauses you take in the 20 minutes, and record the beginning and end times of these pauses in the notes. With groups it may be helpful to designate one observer as

timekeeper. Additionally, please try to **be sensitive to the subjects of your census and in particular do not stay too long near a nest or anywhere where birds are distress calling**.

Figure 5. Survey example route through a plot. Route should deviate from this if suitable habitat lies off transect. UTM values increase from west to east (left to right) and from south to north (bottom to top).



Area Search Form Codes Key

Name and Email Address: Contact information for primary person conducting the area search.
Date and Visit #: Day in which census is done, and corresponding visit number (1, 2, 3, 4 etc. if known)
Plot ID: Name of plot and consecutive number given to the specific area search plot within the site. For example, "Priority 1 – 10" or "Priority 2 – 8"
Weather (Censuses should not be conducted in bad weather, which includes high winds):

Temperature: Celsius or Fahrenheit (specify) of temperature at time of census
Cloud Cover: Percent of sky covered by clouds
Wind Speed: Use the Beaufort scale table below.
Precipitation = none, light, drizzle.

Start Time: Time the 20 minute census was begun.

End Time: Time the census was completed. Is not always 20 minutes after start time as interruptions may occur. Indicate in Notes why it is not 20 minutes (e.g., spent 5 minutes tracking down a bird, etc.)

Species: Use current 4-letter code from the AOU checklist as well as subspecies if discernible. If you do not know the 4-letter code please write name in full.

Tally of Individuals: Put an S (song), V (visual), or C (call) for each individual encountered in the following priority:

Priority is S, V, C. For example, if you first see an individual (V) then later during the census hear it call (C), and after a few minutes hear it sing (S), the only code recorded on the form in the end for this individual would be an S. If you hear a bird sing (S) then see it (V), the only code recorded would be an S.

Total: After each area search is complete, tally the total number of individuals of each species encountered.

Behavior: Check each column if any individual of the species is observed doing the following:

Forag: Foraging observed
Flock: Bird observed in a flock
Copul: Copulation observed
Displ: Breeding display observed
Pair: 2 birds believed to be a mated pair observed; courtship behavior observed
Mater. Carry: Individual observed carrying nest material
Food Carry: Individual observed carrying food
Nest: Active nest found.
Fledg: Dependent fledgling observed (being fed by adults, begging, with fledgling-length tail)

Additional notes/obs: Flyovers (birds flying above and not through the plot) are recorded here, as can be birds detected outside of the boundaries of the plot, and any other information deemed pertinent, including nest predators. Give the names of the observers whose personal information is not filled out above.

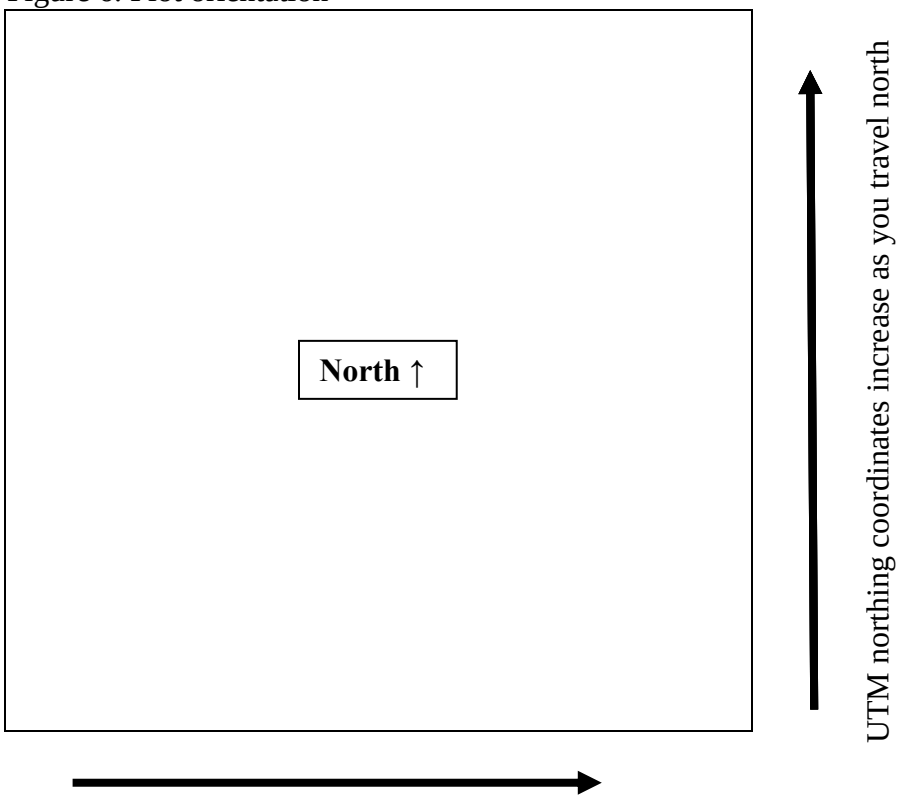
Wind scale:

Beaufort Scale			
Force	**Wind (Mph)**	**WMO Classification**	**On Land**
0	Less than 1	Calm	Calm, smoke rises vertically
1	1-3	Light Air	Smoke drift indicates wind direction, still wind vanes
2	4-7	Light Breeze	Wind felt on face, leaves rustle, vanes begin to move
3	8-12	Gentle Breeze	Leaves and small twigs constantly moving, light flags extended
4	13-17	Moderate Breeze	Dust, leaves, and loose paper lifted, small tree branches move
5	18-24	Fresh Breeze	Small trees in leaf begin to sway. Branches of a moderate size move.
6	25-30	Strong Breeze	Larger tree branches moving, whistling in wires
7	31-38	Near Gale	Whole trees moving, resistance felt walking against wind
8	39-46	Gale	Whole trees in motion, resistance felt walking against wind
9	47-54	Strong Gale	Slight structural damage occurs, slate blows off roofs

Using the GPS Unit

All survey plots are oriented along a UTM northing and easting. UTM values increase from west to east and from south to north. For example, if you are at your western plot boundary, your UTM coordinates will increase as you head east into your plot, but they will decrease if you head west and away from your plot (Figure 6).

Figure 6. Plot orientation



Before heading out to the field, enter the four corners of each plot as waypoints. Be sure your GPS is in UTMs, not Lat/Long. To get to the edge of your plot, use the Navigation page to take you to one of the corners; when the distance to the corner equals zero, you are at the corner. Be sure the plot boundaries are written on your datasheet in UTMs. To figure out the plot boundaries in the field, select the SW corner waypoint and then the NE corner waypoint. The Northing is a 7-digit number, while the Easting is a 6-digit number. The plot boundaries should be in multiples of 250 meters, but occasionally Garmin GPSs change the numbers by a meter, so please round the boundary to the nearest 250 meter. If you are rounding by more than 1-2 meters, then you are probably

looking at the wrong waypoint. As you begin a survey, keep your GPS on the Map page so that you can see the four corners of the plot. Your GPS should be set up so that it leaves a trail to show where you have surveyed. This is very helpful to ensure that you cover the plot as thoroughly as possible. If you see a bird near the edge of the plot, you will need to determine whether the bird is in or out of the plot by comparing the bird's position to the plot boundary. With your GPS, walk up to where you saw the bird and look at your position on the Satellite page. If the bird was not within the plot boundaries, record the bird in the notes section.

Optional Vegetation Data

Information about the vegetation within the plot will help determine the habitat needs of birds and will inform habitat management. Although optional, we encourage you to get to know the plants in the study area and provide information about them in the survey form. As a plot is surveyed, visually estimate the percent cover of allscale saltbush, spiny saltbush, ephedra, other shrubs, grass, barren ground, and trees (oak, juniper, etc). The sum of the coverage should equal 100%. In addition, record the maximum and minimum heights (~0.1 m) of each species observed. A lightweight tape measure should be used for this. **High**: Estimate to the nearest 0.1 meter the *average* height of the upper bounds of the vegetation. This is not usually the height of the tallest plant: if a single shrub, which takes up a very small area, is much higher than the average high layer, this is NOT the height that is recorded. Another way to think of this is the height above which only 10% of individuals reach. **Low**: Estimate to the nearest 0.1 meter the average height of the lower bounds of the tree and shrub species. This should be the average height of the

low living *branches* for each species. If a plot has 0% of any veg type, record a 0 for % cover and dashes for Max ht and Min ht. Do not leave any blanks.

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Appendices

Appendix 1. Common and scientific names for species detected during surveys in 2010 and 2011. Names are listed in alphabetical order. * indicates a BLM listed sensitive species.

2010				2011			
Common Name	**Scientific Name**	**Common Name**	**Scientific Name**	**Common Name**	**Scientific Name**	**Common Name**	**Scientific Name**
American Goldfinch	Carduelis tristis	Le Conte's Thrasher*	Toxostoma lecontei	American Kestrel	Falco sparverius	Northern Harrier	Circus cyaneus
American Kestrel	Falco sparverius	Loggerhead Shrike	Lanius ludovicianus	American Pipit	Anthus rubescens	Northern Mockingbird	Mimus polyglottos
American Pipit	Anthus rubescens	Merlin	Falco columbarius	Anna's Hummingbird	Calypte anna	Prairie Falcon	Falco mexicanus
Anna's Hummingbird -	Calypte anna	Mountain Bluebird	Sialia currucoides	Barn Owl	Tyto alba	Ruby-crowned Kinglet	Regulus calendula
Barn Swallow	Hirundo rustica	Northern Harrier	Circus cyaneus	Bewick's Wren	Thryomanes bewickii	Rock Wren	Salpinctes obsoletus
Bewick's Wren	Thryomanes bewickii	Northern Mockingbird -	Mimus polyglottos	Brown-headed Cowbird	Molothrus ater	Red-tailed Hawk	Buteo jamaicensis
Brewer's Blackbird	Euphagus cyanocephalus	Prairie Falcon	Falco mexicanus	Brewer's Blackbird	Euphagus cyanocephalus	Sage Sparrow	Amphispiza belli
Burrowing Owl*	Athene cunicularia	Ruby-crowned Kinglet	Regulus calendula	Brewer's Sparrow	Spizella breweri	Say's Phoebe	Sayornis saya
California Towhee	Pipilo crissalis	Rock Wren	Salpinctes obsoletus	Burrowing Owl	Athene cunicularia	Sage Thrasher	Oreoscoptes montanus
California Quail	Callipepla californica	Red-tailed Hawk	Buteo jamaicensis	California Towhee	Pipilo crissalis	Savannah Sparrow	Passerculus sandwichensis
California Thrasher	Toxostoma redivivum	Red-winged Blackbird	Agelaius phoeniceus	California Quail	Callipepla californica	Short-eared Owl	Asio flammeus
Cliff Swallow	Petrochelidon pyrrhonota	Sage Sparrow	Amphispiza belli	Common Raven	Corvus corax	Vesper Sparrow	Pooecetes gramineus
Cooper's Hawk	Accipiter cooperii	Say's Phoebe	Sayornis saya	European Starling	Sturnus vulgaris	White-crowned Sparrow	Zonotrichia leucophrys
Common Raven	Corvus corax	Sage Thrasher	Oreoscoptes montanus	Ferruginous Hawk*	Buteo regalis	Western Meadowlark	Sturnella neglecta
European Starling	Sturnus vulgaris	Savannah Sparrow	Passerculus sandwichensis	Golden Eagle*	Aquila chrysaetos		
Ferruginous Hawk*	Buteo regalis	Short-eared Owl	Asio flammeus	House Finch	Carpodacus mexicanus		
Golden Eagle*	Aquila chrysaetos	Spotted Towhee	Pipilo maculatus	Horned Lark	Eremophila alpestris		
White-crowned Sparrow	Zonotrichia leucophrys	Tree Swallow	Tachycineta bicolor	Lawrence's Goldfinch	Carduelis lawrencei		
Hermit Thrush	Catharus guttatus	Turkey Vulture	Cathartes aura	Lark Sparrow	Chondestes grammacus		
House Finch	Carpodacus mexicanus	Vesper Sparrow	Pooecetes gramineus	Le Conte's Thrasher*	Toxostoma lecontei		
Horned Lark	Eremophila alpestris	Violet-green Swallow	Tachycineta thalassina	Loggerhead Shrike	Lanius ludovicianus		
Lawrence's Goldfinch	Carduelis lawrencei	Western Meadowlark	Sturnella neglecta	Merlin	Falco columbarius		
Lark Sparrow	Chondestes	White-	Aeronautes	Mountain	Sialia		

	grammacus	throated Swift	saxatalis	Bluebird	currucoides
Long-billed Curlew	Numenius americanus	Hummingbird species	Trochilidae	Mourning Dove	Zenaida macroura

Appendix 2. Example area search survey form. Available via http://data.prbo.org/apps/cplcth/

Le Conte's Thrasher Survey Form - Carrizo Plain

Observer Information		Survey Information	
First name	Last name	Date	Visit # (if known)
Email address		Start time	End time
Phone #		Plot ID	

Temp _____ F or C (circle one) Cloud Cover ____ % Wind speed _____ Wind direction _____ Rain _____

Plot Boundaries East _____ North _____ West _____ South _____

Vegetation (entire plot)	% Cover	High ht (0.1 m)	Low ht (0.1 m)
Common Saltbush			
Spiny Saltbush			
Ephedra			
Other shrubs			
Trees			
Grass			
Barren Ground			

Bird & Mammal Species Within Plot

Species	Tally of Individuals (Song, Visual, Call, one letter per individual)	TOTAL	Behavior (check if applicable)*								
			forag	flock	copul	displ	pair	carry mater	carry food	nest	fledg

Additional notes/obs _____

Appendix 3. AOU codes for birds and common mammals seen in the Carrizo Plain. Unknown birds should be indicated as XXX, but surveyors should note what type of bird was seen – e.g., unidentified hummingbird species as XXHU, unidentified thrasher species as XXTH.

Common name – AOU code	**Common name – AOU code**	**Mammal Common Name – 4-letter code**
American Goldfinch -AMGO	Loggerhead Shrike - LOSH	Black-tailed jackrabbit – BTJR
American Kestrel - AMKE	Merlin - MERL	California ground squirrel – CAGS
American Pipit - AMPI	Mountain Bluebird - MOBL	Coyote – COYO
Anna's Hummingbird - ANHU	Mourning Dove - MODO	Desert cottontail – DECO
Barn Swallow - BARS	Northern Harrier - NOHA	Kangaroo rat (sp) – KRAT
Bewick's Wren - BEWR	Northern Mockingbird - NOMO	Long-tailed weasel - LTWE
Brewer's Blackbird - BRBL	Prairie Falcon - PRFA	Pronghorn – PRON
Brown-headed Cowbird - BHCO	Ruby-crowned Kinglet - RCKI	San Joaquin antelope squirrel – SJAS
Burrowing Owl - BUOW	Rock Wren - ROWR	San Joaquin kit fox – SJKF
California Towhee - CALT	Red-tailed Hawk - RTHA	
California Quail – CAQU	Red-winged Blackbird - RWBL	
California Thrasher - CATH	Sage Sparrow - SAGS	
Cliff Swallow - CLSW	Say's Phoebe - SAPH	
Cooper's Hawk - COHA	Sage Thrasher - SATH	
Common Raven - CORA	Savannah Sparrow - SAVE	
European Starling - EUST	Short-eared Owl -SEOW	
Ferruginous Hawk - FEHA	Spotted Towhee - SPTO	
Golden Eagle - GOEA	Tree Swallow - TRES	
Hermit Thrush - HETH	Turkey Vulture - TUVU	
House Finch - HOFI	Vesper Sparrow - VESP	
Horned Lark - HOLA	Violet-green Swallow - VGSW	
Lawrence's Goldfinch - LAGO	Western Meadowlark - WEME	
Lark Sparrow - LASP	White-crowned Sparrow - WCSP	
Long-billed Curlew - LBCU	White-throated Swift - WTSW	
Le Conte's Thrasher - LCTH or SJTH		