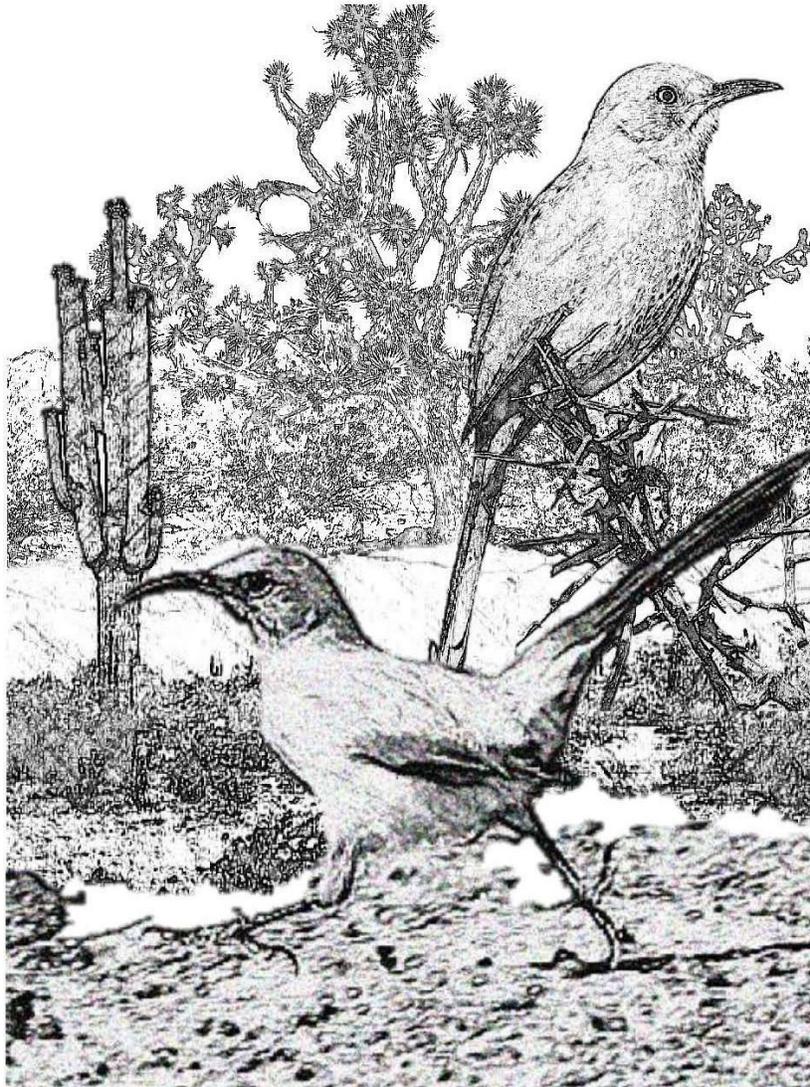


**Survey Protocol and Habitat Evaluation for
LeConte's (*Toxostoma lecontei*) and
Bendire's (*Toxostoma bendirei*) Thrasher**



Prepared by: The Desert Thrasher Working Group

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Objective

The objectives of these surveys are to estimate distribution, determine population trends over time, and to identify habitat preferences for Bendire's and LeConte's Thrashers.

Recommended Survey Times:

Consider local elevation and latitude when designing a survey schedule, as researchers will need to balance surveying early (which helps to minimize confusion of adults with juveniles, and which may maximize exposure to peak singing season) with surveying late (which can minimize the possibility of completely missing late-arriving, migratory Bendire's Thrashers). In general, earliest surveys should be focused at lower latitude and lower elevation. Surveys at higher latitude and higher elevation should be conducted later within the corresponding survey visit window.

Note: Precipitation can affect the timing and level of breeding activity throughout the region. This can manifest itself through differences in singing frequency, phenology of territory establishment, and phenology of nest initiation. Inter-annual differences in initiation of first clutches may span several weeks depending on winter precipitation (e.g. early phenology during wet winters, later during dry winters). Principal investigators should consider recent precipitation history when scheduling surveys, in order to strike a balance between likely phenology based on winter precipitation and the constraints of the survey period schedule described below.

Arizona:

Bendire's Thrasher. In Arizona, Bendire's Thrashers are found as migratory, wintering and resident populations throughout parts of the state on rural edges, desert scrubland (upper and lower) and semi-arid grasslands. Schedule surveys at lower desert elevations (30 to 549 m) and rural areas throughout the central part of the state from mid-February to the mid-April. Schedule surveys at higher Sonoran desert, semi-grassland desert or cold-temperate desertscrub habitat with elevations (366 m - 2134) from 1 April to the 30 May.

LeConte's Thrasher. In Arizona, schedule surveys mid-January to the end of March in suitable habitat at lower Sonoran Desert elevations (0 to 549 m).

Nevada:

Bendire's Thrasher. The Bendire's thrasher is a migratory species in Nevada, and does not typically arrive until late March. Begin surveying around this time within suitable habitat, with lower latitudes and elevations surveyed earlier in the season and higher latitudes and elevations surveyed later.

LeConte's Thrasher. Schedule surveys from late January to late May within suitable habitat.

California:

Bendire's Thrasher. Schedule surveys from February to mid-May within suitable habitat. When possible, schedule first survey visits in southeastern CA, moving north and west to higher

elevations. Bendire's Thrashers are migratory in California and their arrival has been correlated with winter rainfall.

LeConte's Thrasher. Schedule surveys from late January to late May within suitable habitat. When possible, schedule first survey visits in southeastern California, moving north and west and to higher elevations.

New Mexico:

Bendire's Thrasher. Surveys from mid-February to mid-May in elevations 850 m to 1097 m. Surveys from mid-April to mid-June in elevations above 1097 m in Pinon-Juniper habitat and grasslands.

Utah:

Bendire's Thrasher Currently the recommended survey time is the beginning of March to June. More study is needed.

Field Gear and Materials Checklist:

- Suitable vehicle
- Clipboard
- Several pencils and pens (black and red)
- Data forms (*extra copies), Maps and References:
 - Area map (aerial photo recommended)
 - Blank survey plot map
 - List of plot UTM's with vertices and vegetation point
 - Survey visit form*
 - Sighting forms*
 - Habitat evaluation forms*
 - Lists of species codes for birds and vegetation
 - Protocol
- Binoculars
- GPS with tracking function (unit set in advance to UTM NAD83)
- Extra batteries
- Watch
- Timer (e.g. timer on phone)
- Compass
- Laser rangefinder
- Thermometer
- Meter measuring tape
- Clinometer (recommended)
- Diameter tape (recommended for measuring nest substrate but a measuring tape can be used).
- SPOT finder (highly recommended)
- Camera (if available for photos of plot, birds, etc.)
- Small notebook
- Daypack
- First aid kit

- Lots of water and snacks
- sunscreen and hat (note: dress appropriate for changing weather)

Survey Plot Size. Each plot is 9 ha (300 x 300 m). All survey plots are oriented along a UTM northing and easting.

Survey Visits. Each plot will be visited three times. The time between visits vary depending on the length of your field season. However, you must have a minimum of 10 days betweenChanges to the recommended time are under discretion of the Project Lead.

It is ideal for each plot visit to be conducted by a different observer if logistics and crew size permit this.

If more than one person will be visiting the plot on all three visits, the following is suggested: To allow subsequent surveyors to revisit nests without biasing their survey results with prior knowledge of the presence of a nest on plot, please use the following technique for every plot you visit. After your survey, take a small piece of paper and pin or tape it to a clean survey map for that plot, folded to hide its contents. If there are any nests to check on subsequent visits, record UTM's and any information needed to find the nest(s). If not, leave the paper blank or just leave a note for the next surveyor.

When the same surveyor returns to a plot with an identified thrasher or shrike nest: the nest should be revisited and another sighting form should be completed. The follow-up information section can be completed for the previous visit's form.

Scouting. Surveyor and/or supervisor should pre-scout their surveys in Google Earth, <http://leware.net/geo/utmgoogle.htm> or other software before visiting the plots. This allows the surveyor to look for roads to use and record tentative directions and alternate routes (see above).

If a plot cannot be accessed, provide a detailed description of why on a Survey Form.

When to drop a plot (please use your best judgement and focus on safety as the most important objective):

- Any safety related issues (e.g. proximity to border if you are unable to team up with another surveyor, extremely steep or otherwise inaccessible terrain).
- If the plot contains any clearly marked private property, or if you must cross private land to access the plot and don't have the landowner's permission.
- If you must cross dangerous running water.
- Impassable or closed roads which don't allow surveyor to drive within 4 km of plot.

Preparation. It is highly recommended to prepare plot maps for all plots before they are surveyed in the field. This will help 1) the surveyor navigate to their plots, 2) the surveyor to orient themselves while within the plot, and 3) the surveyor map detections/ascertain whether the detected bird was within the plot.

For each plot, a geo-referenced aerial photograph of the plot and an Area Search map outlining the plot should be provided. Prior to departing from home or office, estimate the travel time to your plot, including time spent hiking from your vehicle and taking weather into consideration.

It is suggested to conduct a reconnaissance of the plot before conducting the first survey (e.g. the afternoon prior to the first survey). Without a prior visit to the plot, you may encounter one or more access issues such as poorer road conditions than expected, unforeseen locked gates, or steep topography. It is suggested to camp near your plot the night before. Do not camp within 500 m of a plot.

Be sure your GPS is in UTM's (NAD 83), not Lat/Long. Write the plot boundaries on your datasheet in UTM's. Before heading out to the field, enter the four corners of each plot as waypoints into your GPS. There is also the option to download the outline of the plots onto your GPS as tracks – this will depend on the software you are using and how your plot files are delivered and set up – see your GIS staff or field coordinator.

Conducting the Survey

Record the begin time and end time. The duration of the survey will be exactly **40 min** searching for and recording all birds seen, but focusing particularly on Bendire's Thrashers, LeConte's Thrashers, and Loggerhead Shrikes. The protocol is designed to allow the surveyor to survey up to 3 plots in one morning. Plots will be clustered at least 300 meters apart, with cluster sizes depending on the needs of each survey crew.

Survey Strategy and Time Management. Setting plot boundaries on UTM 100s will help the surveyor orient themselves within the plot by using their UTM position. We recommend north-south transect lines to avoid light interference and backlighting of perched birds in the distance. Transect lines should be spaced 50 m apart, on each UTM easting ending with 00 or 50, with the exception of the east and west boundary lines (Figure 1). With limited survey time, we recommend surveying the outer 50 meters of the plot from adjacent transect lines.

If difficult terrain, dense vegetation, or high bird abundance hampers your ability to survey a plot in the 40 minute window, you may skip a transect line to ensure complete plot coverage. However, you must walk within 50 meters of every point on your plot. Therefore, make sure you do walk the transect lines on either side of any line you choose to skip. If terrain or other plot characteristics are such that it makes more sense to survey in a different pattern, remember that this grid is a guideline.

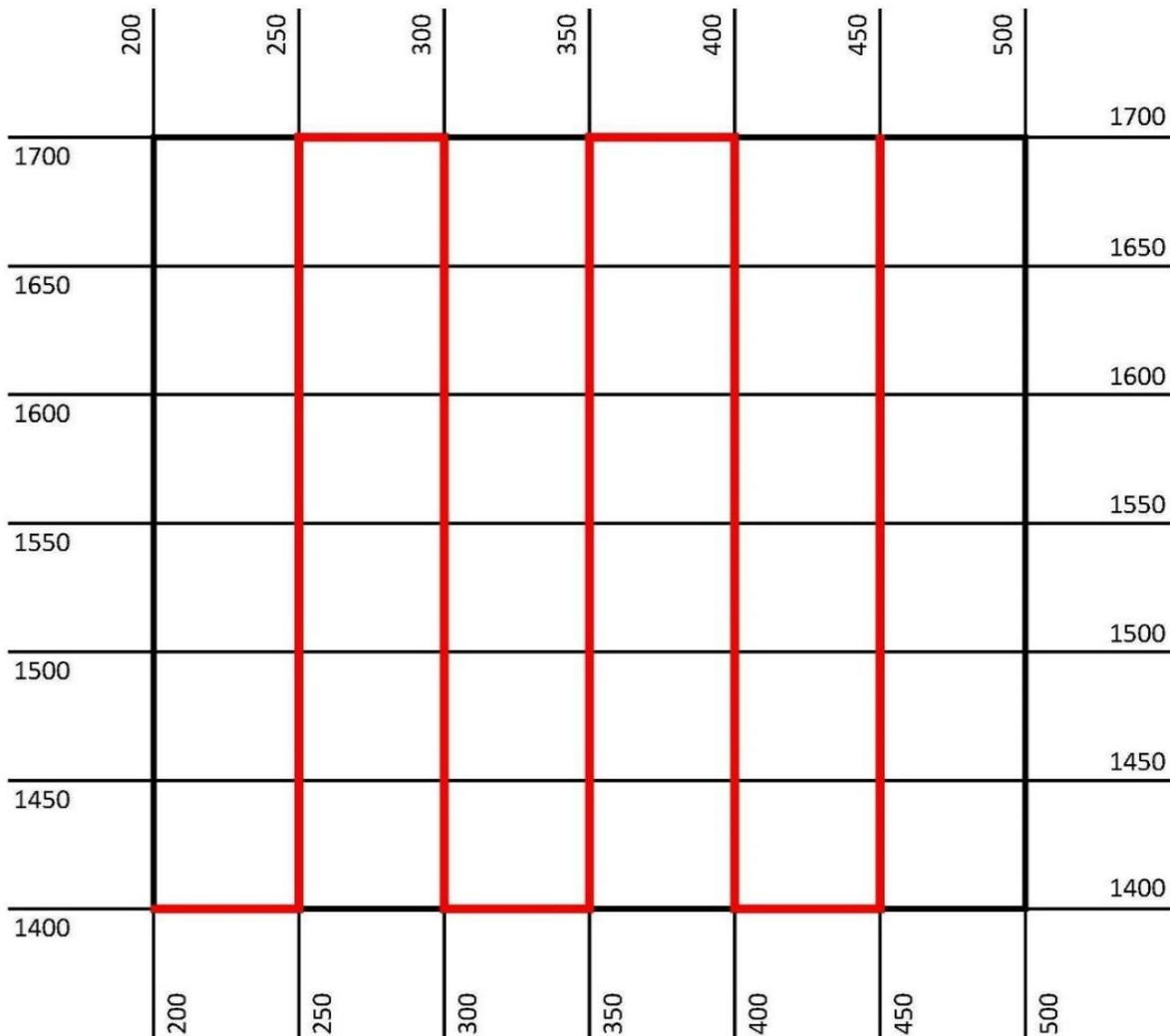
Begin from one corner of the plot. Figure 1 shows an example in which the southwest corner of the plot has coordinates ending with XXX200/XXX1400. The plot is 300x300 m, so the northwest corner coordinates are (displaying the last digits of easting and northing) 200/1700, the northeast corner coordinates are 500/1700, and the southeast corner's coordinates are 500/1400. From the southwest corner, walk 50 m due east along the southern edge of the plot to 250/1400. Beginning your survey here, walk due north across the plot. To maintain a straight line northward, it works to 1) use a compass and pick a landmark in the distance that is due north and aim for that landmark and 2) using the coordinates screen on your GPS, keep the easting as close to the original start coordinate as you can (in this case XXX250). Once you have reached the north edge of the plot (in this example, XXX250/XXX1700), walk due east along the northern edge of the plot to the next 50 m line (in this example, XXX300/XXX1700) and head due south, continuing in a serpentine pattern illustrated.

To ensure that the detection probability is as high as possible, the surveyor will walk through the plot in transects spaced 50 m apart. The surveyor may deviate from the transect line if it is felt that

suitable habitat will not be adequately searched from the prescribed route. Use a GPS to determine your position relative to the plot boundaries. **Only record birds in the main data section that were detected during the first 40 minutes of your survey and were within the survey plot.** If birds are detected before or after the 40 minute period, you may record them **in the Notes section only of the Survey Form**, but not with the other data that were recorded properly within the plot during the survey. **For detections before or after the 40 minute survey period, complete a Target Species** Thoroughly covering the plot in exactly 40 minutes will require that you manage your time as you survey; this is easier if you have a timer on your wrist watch set to 40 minutes or a timer on your clipboard. If the plot has little suitable habitat, and you are able to completely survey it in under 40 minutes, you must stay on the plot for the entire 40 minutes to complete the survey.

If for whatever reason you are unable to finish the plot in the allotted time, please indicate in the notes what proportion of the plot you were able to survey and why you were unable to completely cover the plot.

Figure 1. Example thrasher plot with survey route highlighted in red.



Datasheets

There are four data forms:

1. Thrasher Survey Form
2. Target Species Sighting Form
3. Survey Plot Map
4. Habitat Evaluation Form

Thrasher Survey Form

Before arriving at a site, record the following on the Thrasher Survey Form:

Observer's name

Date

Plot ID

Plot's UTM boundaries (north, east, south, and west)

Site Name (if you are provided with one)

Use the Navigation page (tracks option for some units) on your GPS unit to take you to one of the corners of your plot; when the distance to the corner equals zero, you are at the corner.

Before beginning your survey, record weather condition:

Wind = Beaufort scale or mph

Cloud cover = % cover

Precipitation = none or light

Temperature

Beaufort Scale Table

Beaufort	Average MPH	Knots	Surroundings
0 calm	0 - 1	0 - 1	Smoke rises vertically and the sea is mirror calm
1 light air	1.2 - 3	1 - 3	Smoke moves slightly with a breeze, and shows direction of the wind
2 light breeze	3.7 - 7.5	4 - 6	You can feel the breeze on your face and hear the leaves start to rustle
3 gentle breeze	8 - 12.5	7 - 10	Smoke will move horizontally and small branches start to sway. Wind extends a light flag
4 moderate	13 - 18.6	11 - 16	Loose dust or sand on the ground will move and larger branches will sway, loose paper blows
5 fresh breeze	19.3 - 25	17 - 21	Surface waves form on water and small trees sway
6 strong breeze	25.5 - 31	22 - 27	Trees begin to bend with force of wind and causes whistling in telephone wires. Some spray on the sea surface A

Survey conditions. Surveys can start within 30 minutes of sunrise and can end 30 min before sunset. Ideally, begin your surveys for that day as early as possible. However, safety, logistical considerations, and temperature may alter the start time. Do not conduct surveys when temperatures exceed 100 F. Check weather reports for the survey area and plan your day accordingly, monitoring both wind speeds and temperatures.

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 or temperatures over 100 F will cancel the survey. Consider your ability to hear and see birds clearly when deciding whether or not to survey.

Plan on spending roughly one to two hours per plot. Your day in the field may last up to seven hours, especially on the day you record the habitat measurements, so recognize that weather conditions may change during the day and plan accordingly. In general, surveyors can anticipate beginning surveys around sunrise and finishing up their final plot for that day by early afternoon.

Detection types. Record data for all bird species detected, including thrashers and shrikes. Write the species' 4-letter Alpha Code (or full name if uncertain of code) in the species column. Then record a letter to indicate how you detected the bird: J (juvenile), S (song), V (visual), C (call), F (flyover), H (wing whirr), or D (drum), H (wing whirr), or D (drum). Write one letter for each solitary individual seen. For groups of birds, write the number of individuals followed by the letter in parentheses, e.g. (20V). If V or C is recorded first, but the bird later sings, circle the code to indicate that it later sang. All singing individuals should receive an S or have a circled code. All juveniles should be recorded as J regardless of how they were detected. If a bird, or group of birds, flies directly over the plot without stopping and is in obvious transit to somewhere beyond the plot, record an F to indicate flyover.

For these surveys, record sightings of all birds on the **Survey Form**. But, we are particularly interested in sightings of Bendire's Thrasher, LeConte's Thrasher, and Loggerhead Shrike. In addition to the information you will record on the survey form, you will collect additional information on thrashers and shrikes on the **Target Species Sighting Form** (see below).

Be sure to note any breeding behavior in the appropriate data form column. Record any species of interest detected outside the plot *in the notes section*, especially thrashers, shrikes and raptors of any species, and estimate their distance to the plot. Later, please fill out a Target Species Sighting Form for thrashers and shrikes detected off-plot.

Following the survey and using the plot map you completed, you may (optionally) fill in the "Total" column. However, we can calculate this later, so it isn't necessary to count up longer strings of letters.

If you need to leave the plot momentarily or take a break, you may pause the survey and resume it once you re-enter. **Any birds detected while the survey is paused should NOT be recorded in on the Survey Form unless they are detected again once the survey timer is resumed.**

Target Species Sighting Form

The Target Species Sighting Form is completed when a LeConte's Thrasher, Bendire's Thrasher or Loggerhead Shrike has been detected. But we ask, any time you encounter one of these three species (even while walking to your survey, camping, driving, etc.), to complete this form.

Detecting Thrashers and Shrikes. In general, thrashers and shrikes tend to perch from a high vantage point within their territories to observe intruders (in this case, you). Scan frequently with your binoculars as you move through the plot, watching for perched thrashers at the top, side or middle of a tree or brush; or for shrikes that may be watching you from distances of several hundred meters at the highest vantage point. As you move through the plot, be cognizant that thrashers will often run/fly low to the ground both ahead of you or to your side, at the edge of your peripheral vision.

Be cautious, thrashers songs are highly variable and identification of singing thrashers can be difficult even for the most experienced surveyor. LeConte's Thrashers often deliver contact calls in response to the intrusion into their territory. These calls are often heard before birds (typically running ahead and to the sides of the observer) are seen. The call is a single, whistled *suuuweeep*. To some observers, the vocalization recalls a Phainopepla's call. Bendire's Thrashers will either sing quietly perched off to the side of a tree or tall brush, deliver a harsh trilled *raaaaah* call when defending a nest or call with a trilled *chulup* call when an intruder is in the area.

There are other species that will mimic LCTH or BETH. Northern Mockingbirds may sound almost identical to either birds. Black-throated Sparrows have been known to mimic the LCTH call. Even Loggerhead Shrikes have been observed luring a LCTH out of their nest mimicking their song. When in doubt, if possible, record the song or call on your smartphone or other recording device. *Remember, always try to visually confirm a target species!*

When you are in territory for both Curve-billed and Bendire's Thrasher be sure to carefully observe certain characteristics of the thrashers detected, as there can be similarities in these birds that occur dependent on age. For BETH look for the straight lower mandible and light patch at the base of the lower bill. The iris, spotting on the breast, body plumage overall color and outer rectrices patterns can be similar. Depending on both age and molt cycle (i.e., hatching year and early season second year CBTH are known to have identical bill lengths to that of an older adult BETH).

Recording sightings. When you detect a LeConte's Thrasher, Bendire's Thrasher or shrike, plot the bird's location and time on your aerial photo map and mark the point in your GPS. Observe the bird's activities. If you detect a singing thrasher, you must try to get a visual confirmation of the bird's identity. It's fine to deviate from the grid lines to track down a singing thrasher, but if you need to spend more than a few minutes to get a visual confirmation, pause your clock. Do not spend more than 15 minutes in "pause." Thrashers or shrikes detected during a pause should be given a sighting form, **but note that it was detected outside survey time**. If you later detect the same bird during the survey time, change the answer "Within survey time" to "Yes". If you are unsure of the identification, try to get a photo or recording. If the species can't be determined, record it as "XXTH" and return to the area after the survey if time permits for further observation

Return to the spot after the 40-minute survey to fill out the **Sighting Form Datasheet** for each individual bird. Fill in the basic plot information, initial detection time, and whether the bird/nest was within the plot boundaries and within the 40-minute survey time (**Please note this information is incredibly important towards determining population sizes**). Use your GPS to

record an exact waypoint of the bird or nest. If you are unable to reach the precise location, enter your coordinates from the point of observation, the estimated distance (in meters) and bearing in the space provided on the data form. Also, be sure to record the substrate that the bird was initially standing on and the bird's activity (singing, calling, foraging, flying, flushing, running, or perching).

Multiple birds seen together: The idea is to use one form for each individual bird. If multiple birds of a target species are seen together, i.e. a pair or family group, you may use one sighting form to record the information for multiple birds. Be sure to note how many adults, juveniles, and unknown are in the group (including lone birds). There is space on the data form to record multiple perch heights and substrates; please use this to record the perches of each bird. **Please fill out separate sighting forms for birds first detected > 25 meters apart, even if they are associated (i.e. family group or pair).**

Group Codes. In the space provided on the data form marked "Group Code", please give every *individual, pair or family group of each species* encountered each survey day a unique number. This is important for us to track how many breeding units of each species are found. Number Bendire's, LeConte's, and shrikes separately. Each day you will start over at "01" for each species. You won't always be 100% sure if birds you see are associated with each other; please use your best judgment and **always** record a group code representing your best guess. We can't decide after the fact! Note that group codes are by day and not by plot. This way, you can accurately track family groups even if they are off plot or spanning multiple plots. You will use the *Survey Form Datasheet* to track numbers of birds seen during each individual survey. See Appendix 6 for examples.

Thrashers or shrikes detected outside the survey plot or survey time should also be given a sighting form, **but note that it was detected outside survey time and/or outside the survey plot.**

Nests. When a nest is found and confirmed occupied, complete the second half of the Target Species Sighting Form. Occupied nests are those with eggs or nestlings, and with the target species visually confirmed visiting it.

If an active nest is found, be careful not to disturb the nest by eliciting distress calls from the parents or alerting predators to its presence. Take a GPS reading as close to the nest as possible. Record the location from where you are standing, the distance and orientation to the nest. If the situation allows (without disturbing the vegetation or adults) take a photo of the nest. Then step away to record the estimated orientation and height (~0.1 m from the ground to the bottom of the nest), substrate supporting the nest, the stage of the nest (building, egg, or nestling), and number of eggs or chicks. Remember, only do this if this can be determined without disturbing the nest.

If possible, later in the season or on a later visit, someone can revisit the nest and take the measurements when the nesting is complete.

Photographs and Recordings. If you do wish to submit photographs and/or recordings of the birds you survey and monitor, please title the file with the species, date (year month day), transect ID and initials (e.g. BETH 20160430_AZBETH11_KM). Clearly labeled photographs of the habitat around nest sites are also very useful. Email the file or mail to your coordinator.

Habitat Evaluation Form

The dominant plant species, diversity of plant species, density and abundance of vegetation, plus the structure (age/height) of the vegetation often dictate the diversity and density of the breeding birds within an area. In an effort to begin to address this important relationship, each plot includes UTM coordinates at the plot center designating a location at which we need basic information on the vegetation.

The point used to complete the habitat evaluation form will be the center UTM coordinates (NAD83) on the plot. Also include the average elevation (in meters) within 100 m of plot center, and the dominant habitat type on the plot.

States may also, at their discretion, ask surveyors to complete additional vegetation points for areas with incidental Bendire's Thrashers (i.e. never detected during survey time or on plot). To maintain consistency with plot-wide vegetation sampling, these habitat evaluation points will be completed at the center of the 300 m x 300 m plot grid containing the bird. Ask your supervisor for assistance in determining that point. Conduct the habitat evaluation like any other, recording Plot ID as "Incidental".

Note: If you are unable to reach the UTM point designated due to safety issues, you may randomly choose a point within 50m of the center point. Please note, if this is necessary it is also important to evaluate if you are able to completely survey birds within that quadrant.

When to start. Vegetation surveys only need to be conducted once on each plot per season. Vegetation surveys should be done at the end of your area search survey. You should conduct one vegetation survey per survey day if possible.

Survey Protocol and Habitat Evaluation

Habitat Categories. Habitat categories derived from the Arizona Breeding Bird Atlas, Landfire, and Heaton et al. 2011, Report to Clark County MSHCP 2005-UNR-578:D27.

Habitat Type	Elevation	Characteristics
Alkali Sink (ALS)	Below 600 m (2000 ft)	Saltgrass, iodine bush, Suaeda, saltcedar. Also includes barren playas.
Saltbush scrub (ATR)	600-2400 m (2000-8000 ft)	Dominated by <i>Atriplex</i> species
Blackbrush (BLB)	760-1400m (2500-4500 ft)	Higher elevation, usually dominated by blackbrush but can also include communities with species such as Joshua tree or banana yucca without white bursage as a dominant.
Barren (BRN)	Throughout range	Areas of bedrock, desert pavement, scarps, sandstone, etc. where vegetation accounts for <15% cover but is not a playa (see ALS).
Chihuahuan Desertscrub (DCH)	975-1463 m (3200-4800 ft)	Most commonly creosote, tarbush, acacia, yucca, graythorn, ocotillo, and mesquite.
Great Basin Desertscrub (DGB)	1219-2130 m (4000-7000 ft)	Vegetation is low and homogeneous; salt shrub, sagebrush, prickly pear and snakeweed are often common.
Mojave Desert Scrub (DMO)	Below 1400 m (4500 ft)	Mojave Desert areas dominated by creosote, and typically white bursage, without co-dominant blackbrush or saltbush.
Desert riparian (DRI)	Up to 1800 m (6000 ft)	Stream habitats forming a roughly linear greenbelt through desert communities. Typical plants include cottonwood, willow, <i>Baccharis</i> , arrowweed, saltcedar.
Sonoran Desert scrub, lower (DSL)	30-549 m (100-1800ft)	Low brush such as creosote and bursage, palo verde, mesquite
Sonoran Desert scrub, upper (DSU)	366-1097 m (1200-3600ft)	Saguaro, ironwood, catclaw, cholla sp.
Pinyon-juniper (FPJ)	1219 -2286m (4000-7500 ft)	Pinyon and/or juniper dominated woodland.
Greasewood Flat (GRF)	1219-2130 m (4000-7000 ft)	Open to moderately dense shrublands dominated or co-dominated by greasewood.
Grassland (GRS)	914-1679 m (3000-5500 ft)	Dominated by grasses with or without some tree/shrubs and succulents.
Rural/Livestock Yards (RUR)	30-2896 m (100-9500 ft)	Edges and greenbelts in between rural sprawl and livestock yards.
Interior Chaparral (SIC)	1067-2286 m (3500-7500 ft)	Dominated by dense shrubs, especially manzanita, ceanothus, and live oak.

The Point-Center Quarter Section. See the top portion of the Thrasher Habitat Evaluation Form. The vegetation point is located in the center of the measurement area. From the center point, use a compass to define the four quadrants or QUARTERS (NORTHEAST, SOUTHEAST, SOUTHWEST and NORTHWEST). In this section, you will be measuring the distance from the center point for each of the following: Cholla, Yucca, Shrubs ($\leq 0.5\text{m}$), shrub/trees ($>0.5\text{m}$ to 2m), and trees ($>2\text{m}$) for each quadrant. In each of these quarters, identify and measure the distance (in 1 meter increments) to the closest woody plant from the center point. Please measure to the main trunk (for single-stemmed trees) or to the center of a multi-stemmed tree or shrub as far out as you can see. Use your rangefinder when possible; if the vegetation is within 10 meters, you may need to use your measuring tape. If the plant is beyond the range of your rangefinder, you will need to estimate. You will also record the species with the appropriate designated code.

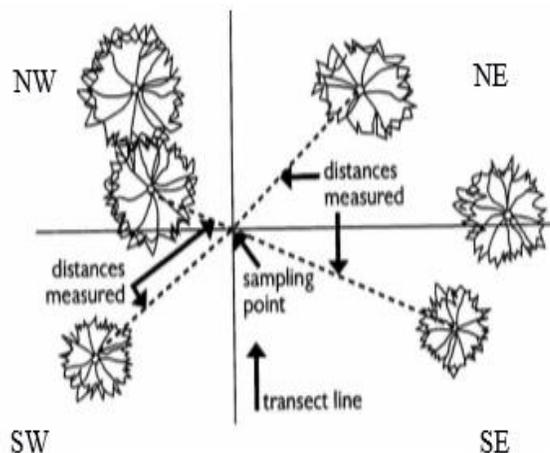
It is critical to obtain accurate distance measurements to plants because accurate plant density estimates are dependent upon it. This manual includes a list of common Sonoran and Mojave Desert plants and their 4-letter code to use when completing the Habitat Evaluation Form (Appendix 3).

Woody Desert Plant (Shrubs and Trees) describes the density, diversity and vertical complexity of the vegetation. This category includes all woody plants including typical trees and shrubs, cactus, and ocotillo. DO NOT include cholla and yucca (except Joshua Tree) which are measured separately (see above). For each QUARTER within an unlimited radius, record distance to nearest woody shrub or tree in the following three vertical structure categories: $<0.5\text{ m}$, $0.5\text{-}2\text{ m}$, and $>2\text{ m}$. Note the species of each plant recorded.

Cholla Density estimate density of cholla cacti. For each QUARTER within an unlimited radius, record distance to nearest individual cholla plant that is $>0.5\text{ m}$ in height. Note the species.

Yucca Density estimate density of yucca *other than Joshua Tree*. For each QUARTER within an unlimited radius, record distance to nearest individual yucca plant that is $>0.5\text{ m}$ in height (not including inflorescence). Note the species.

See diagram:



Vegetation Estimates. See the portion on the data form below the point-center quarter measurements. Estimates are taken for the number of fruit-bearing shrubs and yucca species.

Fruit-bearing Shrub Density estimate density of fruit-bearing shrubs (see list below) within **50 m** and identify to species. List each species and density estimates separately. Include all fruit-bearing shrub species whether they are actively fruiting or dormant. Count the number of individual shrubs when possible, or estimate to the nearest 10, e.g. 20, 30, 40, etc. when in large numbers (>20). When identifying mistletoe numbers, use estimated counts by the number of clumps.

Yucca Density estimate density and height class of all yuccas over 2 meters tall, including all yucca species such as Joshua tree, Mojave yucca, and soap tree yucca. From the sampling point, use binoculars and laser rangefinder (if necessary) to count the number of yuccas within a **100m** radius (360°). Please obtain as exact a count as possible; do not estimate. Record species and count each species separately.

Ground Cover describes the ground cover of potentially important habitat variables. Along a 50-m line in the North direction only from the vegetation point, estimate the coverage along this line of ground cover (bunchgrass, invasive grasses and annuals [see list below], and bare ground) in 1-meter increments.

Note: Depending on the need of each state, variables can be adjusted.

Disturbance Evaluation describes the natural and human ground disturbances in and around the overall plot area. Ground Disturbance is recorded for the following variables:

- OHV (2-track) use-evidence (non-designated roads; i.e. roads not on the maps),
- Burned habitat (controlled or natural),
- Livestock evidence (Cattle, horse, burro, or other livestock evidence, e.g. any grazed trees, brush and grasses; manure piles; pens; tracks),
- Mechanical disturbance (brush clearing, e.g. chainsaw, masticator, or bulldozer),
- And other (describe in space provided).

Code Description:

- 1 - High; Majority (>50%) of plot has recent evidence.
- 2 - Medium; Some (<50%) of plot has recent evidence or within (2-10 years).
- 3 - Low; No sign on plot but some evidence (<10 years) within (~1km) area around plot.
- 4 - None; No sign on plot or within (~1 km) area around plot.
- 6 - Other; explain in notes.

Ground Composition describes the top layer of the ground cover within a *50m radius* of plot center (360°). Terms used for this section are defined:

- Boulders (greater than 250mm; e.g. basketball to car diameter),
- Cobbles (greater than 64 mm; e.g. tennis ball to basketball diameter),
- Pebbles (greater than 2mm; e.g. pea to tennis ball diameter),
- Sand (less than 2mm; small grainy feel),
- Clay/silt (very fine smooth feel, would dissolve in water), or
- Other (Not all ground cover types are listed. Only the most common found during the pilot year of thrasher surveys. If unsure of the type or it's not listed, describe in notes; e.g. woody debris, soil, bedrock, scoria, etc.,).

Physical Attributes and Invasive Plants documents various physical attributes of the plot, plus the distribution of several invasive plant species which potentially threaten Sonoran and Mojave Desert habitats. For the **entire 300x300 m plot**, please place an “X” on the line to the right of any of the listed physical attributes noted and invasive plant species you detected.

Physical attributes to be measured include:

- **Tank w/ standing water;**
- **Rural sprawl within 5km** (Any occupied residence or a property of at least one acre, with or without livestock. Residences are found edged with natural habitat/open spaces; no presence of modified green belts or parks. Typically on the edges of towns, isolated small towns with a population under 2,000 people, and agricultural edged areas);
- **Fruit-bearing shrubs** (any species of shrub which bears fruit - see list below; list species.)
 - Serviceberry (*Amelanchier spp.*),
 - Manzanita (*Arctostaphylos spp.*),
 - Barberry (*Berberis spp.*),
 - Russian olive (*Eleagnus angustifolia*),
 - Juniper (*Juniperus spp.*),
 - Wolfberry (*Lycium spp.*),
 - Mistletoe (*Phoradendrom spp.*),
 - Sumac (*Rhus spp.*);
- **Invasive plants**
 - Cheatgrass (*Bromus tectorum*),
 - Sahara mustard (*Brassica tournefortii*),
 - Red brome (*Bromus rubens var. madritensis*),
 - Buffelgrass (*Cenchrus ciliaris* or *Pennisetum ciliare*),
 - Arabian or Mediterranean grass (*Schismus arabicus*),
 - Bermuda grass (*Cynodon dactylon*),
 - Fountain grass (*Pennisetum setaceum*),
 - Russian thistle (*Salsola iberica*).

Percentage of Wash Cover on Plot. Using your plot overview map as needed, estimate the percentage of plot with wash cover. For the purpose of this estimate, a wash is defined as an area where occasional or seasonal flowing water affects the vegetation in a way that noticeably differentiates wash vegetation from the surrounding non-wash vegetation.

Adjacent Land Use describes the land use around of the plot (e.g. agriculture, ranching, rural, etc.).

Data entry

See the Data Entry Protocol.

The Desert Thrasher Working Group Background

The DTWG consists of partners from throughout the Southwest, such as Fish and Wildlife Service, Department of Defense, New Mexico Game and Fish, Arizona Game and Fish, New Mexico State

University, Tucson Audubon, Sonoran Audubon, Point Blue, Great Basin Bird Observatory and Atwell. A recent task of the DTWG was to establish a standardized protocol for detecting Bendire's and LeConte's thrashers. Together, the DTWG designed a standardized protocol for detecting Bendire's and LeConte's Thrashers, primarily based on protocol used by Point Blue for work performed on the Carrizo Plains that utilized the area search method. The habitat evaluation was incorporated from the Arizona Game and Fish Department's breeding bird survey protocol.

The Desert Thrasher Working Group (DTWG) was originally established in January 2010 under John Arnett, Dave Krueper and Carol Beardmore. The goal was to gain insights on the desert thrasher species, since large-scale monitoring programs such as the BBS may not adequately cover these early-breeding and/or scarce species. The idea spawned after the LeConte's Thrasher Survey Workshop held at the BMGR-East in Southwest AZ. LeConte's Thrasher, Bendire's Thrasher and Loggerhead Shrikes are considered a species of conservation concern by the USFWS and Partners in Flight. Similarly, a listing status the state agencies have identified several of these desert dwelling species as a Species of Greatest Conservation Need. LeConte's Thrasher and Bendire's Thrasher have been identified as species at risk across their range in the Southwest. A need was identified to better understand these and other understudied birds, with the goal of and to developing management recommendations to actions addressing the long-term declines of desert birds.

The group took a short hiatus, but was reactivated by Dave Krueper in 2015. The group facilitated the design and implementation of a research project on breeding Bendire's Thrashers in New Mexico. In 2016, with the help of volunteers from the Tucson Audubon and AGFD, surveys were extended into AZ to assist the NMU student efforts. In 2017, the group collaborated on designing and implementing (with BLM funding) a pilot year effort to survey for BETH and LCTH. Agencies within the region were granted funding from BLM to conduct statewide surveys in Arizona, California and Nevada. The protocol used in 2016 was evaluated and redesigned by a DTWG subgroup for surveys in the 2017 season. The subgroup produced a search method protocol which included a habitat evaluation component. With additional BLM funding, the group will be conducting range-wide surveys for BETH (and LCTH in some states) As of 2018, BLM has continued financial support to conduct surveys region-wide, which currently includes Arizona, California, Nevada, New Mexico and Utah.

Analysis of Area Search Data: Site-Level Models

This protocol was designed for the following analysis:

Our goal was to create a site-level abundance model that could then be used to inform a landscape-level abundance model across the region. In order to create the site-level abundance model we first had to take into account that some individuals would go undetected during our surveys due to low detection probabilities (imperfect detection) which in turn could lead to biased models of abundance.

The site-level models are the imperfect detection models. We fit a model to estimate the occupancy of thrashers in our data, and a model to estimate the abundance. Both include correction for imperfect detection, which is possible to estimate if there are repeated surveys at the same location. For example, in repeated visits to a site BETH detection may be 0 in some visits and 1 in others. If we assume the population is closed (i.e., no immigrations or emigrations, births or deaths), we must assume the site is clearly occupied and the survey events when a bird was not recorded must be solely due to imperfect detection. That is, the

variation in detection events throughout the repeated visits to the site informs a probability of detection.

The same logic applies to the abundance models, except that now probability of detection is inferred from the variation in the total number of birds detected throughout the visits. Notably, a site with 0 detections may be occupied, because birds there may be difficult to detect. Further, a site that has a detection of one individual may indeed host more than one individual, such that the count of one bird is the result of the true abundance with imperfect detection.

The imperfect detection models thus include two functions. One function fits the best estimate of the probability of detection, and the other fits the abundance or occupancy. These are fit simultaneously and each has its own set of covariates, which can be further discussed. The statistical procedure seeks to find the set of covariate coefficients such that the predicted abundance/occupancy, corrected for imperfect detection, fits the observed data as best as possible.

Because the functions are fit simultaneously, there may be several competing top models, all fitting the data approximately equally.

Models were fit using package “unmarked” (Fiske et al. 2014) in the programming language “R” (R Core Team 2014).

Appendix 1. Species Descriptions

LeConte's Thrasher

The LeConte's Thrasher (*Toxostoma lecontei*) is a gray-brown, medium-sized (24-28 cm in length, 55-76 g in weight) songbird with a long tail and black curved bill. Adult thrashers have an unspotted breast, dark eyes, and pale under-tail feathers that are buffy orange in color. LeConte's Thrashers are unique in that they occupy especially sparse environments, exhibit a preference for running over flying, and are extremely reclusive. Song is a long series of warbled, variable phrases with many slurred notes. Call is two-noted, with second note higher in pitch.

Habitat Requirements and Life History. The LeConte's thrasher is a secretive species, despite inhabiting sparsely vegetated areas usually comprised of creosote bush (*Larrea tridentata*) and/or saltbush (*Atriplex* spp.) on flat or gently undulating hills with shallow braided washes. The LeConte's thrasher is most vocal prior to and early in the breeding season which extends from January through May. This seasonal window also corresponds to the period when most individuals are observed. Consequently, general breeding bird surveys conducted May through August for most species may not be adequate to monitor the LeConte's thrasher. In previous studies, creosote bush was the predominant plant species where this species was found, along with lower growing shrubs such as littleleaf saltbush (*Atriplex polycarpa*), bursage (*Ambrosia* spp.), graythorn (*Ziziphus obtusifolia*), and wolfberry (*Lycium* spp.) (Corman 2005). Trees and larger shrubs are typically sparingly distributed, but can include catclaw acacia (*Senegalia greggii*), paloverde (*Parkinsonia* spp.), ocotillo (*Fouquieria splendens*), smoketree (*Dalea spinosa*), mesquite (*Prosopis* spp.), ironwood (*Olneya tesota*) and saguaro (*Carnegiea gigantea*). The birds forage on the ground by digging into the substrate in search of arthropods including scorpions, spiders, beetles, grasshoppers, seeds, and even small vertebrates such as lizards. The LeConte's thrasher nests in robust and often thorny shrubs or small trees that can support a nest approximately 0.5-2 m (1.8-6.3 ft) above the ground (Corman 2005). Their breeding season begins in late January and can extend through early June; however, pairs remain together year-round. During the breeding season a female thrasher may have up to 3 broods each with 2-4 eggs. The eggs are incubated for 14-20 days by both parents, and the young fledge 14-18 days after hatching. These thrashers average 2-3 nest attempts each year often successfully producing young from all three broods (Sheppard 1996, Corman 2005).

Distribution and Abundance. The LeConte's thrasher is a locally uncommon to rare permanent resident in the western and southern San Joaquin Valley, upper Kern River basin, Owens Valley, Mojave Desert, and the Lower Colorado River Valley subdivision of the Sonoran Desert biotic community in the southwestern United States. California serves as the main population center for this species where density estimates range from 0.2-7.3 pairs/km² (CalPIF 2006). Populations have declined in California, however, especially in the San Joaquin Valley. Numbers are also declining in Arizona where this thrasher's range overlaps with agriculture and urban development. In Arizona, the densest concentrations of LeConte's thrashers occur on the Cabeza Prieta National Wildlife Refuge and the Barry M. Goldwater Range (BMGR) (Corman 2005). YPG is also noted to contain numerous individuals (DeVos and Ough 1986, Ough and DeVos 1986). This species was historically documented farther to the southeast (Avra Valley, west of Tucson) than its known current distribution across the Lower Colorado River Valley subdivision to Florence, Arizona; however, none have been detected since the 1980's (Corman 2005) (Figures 1 and 2).

Species Status. The LeConte's thrasher is recognized as a Bird of Conservation Concern by USFWS, and as a Wildlife Species of Concern by Arizona and California (Latta et al., 1999, CalPIF 2006) (Table 1, Appendix B). This species has a global (G) ranking of G3 indicating that populations are vulnerable throughout its range. A state (S) ranking of S3 indicates that populations in Arizona are apparently secure. The LeConte's thrasher was identified as Species of Greatest Conservation Need (SGCN) (rated "1" in the Vulnerability category) in Arizona's Comprehensive Wildlife Conservation Strategy (AGFD 2006) (Table 2, Appendix C). Compared to the subset of SGCN in need of immediate attention (tier 1a), conservation priority is intermediate for the LeConte's thrasher in Arizona (tier 1b). This species is also featured by both the Arizona and California Partners in flight as a priority species and has also been modeled in the Coachella Multi-species Habitat Conservation Plan (2007).

Threats. Despite the existence of vast stretches of apparently suitable LeConte's thrasher habitat (especially in Arizona), this species remains rare, local and declining in many areas due to a low tolerance of expanding agriculture and urban development (Corman 2005). A large amount of LeConte's thrasher habitat occurs in areas with limited or no public access such as the BMGR and YPG. These large and undisturbed tracts of LeConte's habitat undoubtedly benefit from extreme limitation or complete closure to the public, thus minimizing the principle threats to this species such as OHV disturbance and human development (e.g., residential, agricultural, etc.). LeConte's thrasher habitat is also threatened by invasive species including Sahara mustard (*Brassica tournefortii*), black mustard (*Brassica nigra*), Mediterranean grass (*Schismus barbatus*), and Arabian schismus (*Schismus arabicus*). These species grow very fast, smothering native herbaceous plants and competing with shrubs for light and soil moisture. Dead plant material from these species adds to the fine fuel load in desert areas increasing wildfire potential and intensity. Wildfires have the potential for long-term impacts to community composition and structure (Brown and Minnich 1986) because most Sonoran Desert plants are poorly adapted to fire (Rogers and Steele 1980).

Bendire's Thrasher

The Bendire's Thrasher (*Toxostoma bendirei*) is a medium sized pale brown song bird (60g), with small triangle patterns on the breast, a pale lower mandible and base, yellow to orange iris, and a short slightly curved bill (bill to nare 19-21 mm). The call is a quick "tirup" and the song is a continuous mumbled melody - in comparison to the Curve-billed Thrasher (*Toxostoma curvirostre*) which has a crisp continuous song. The Bendire's Thrasher can be seen doing short flights in between vegetation - unlike some other thrashers such as the LeConte's Thrasher (*Tomostoma lecontei*) which typically travels running on the ground between vegetation. Bendire's Thrasher nests can be found in a variety of vegetation types in their natural habitat with a range height of 1.9 to 9.8 ft (0.6-3 m) (2005). In the urban areas, nesting habits can be similar as these birds place their nests in the average known range of 1.9 to 9.8 ft (0.6-3 m) in vegetation along fence lines - nests have also been observed in a patio awning at 4 m high - nests have also been observed in rural neighborhoods in structures such as a patio awning at 4 m high.

Habitat. The Bendire's Thrasher occurs within a variety of lowland to upland deserts across northwestern Mexico and in the U.S. - Arizona, California, Nevada, New Mexico and Utah. The Bendire's Thrasher (BETH) is listed as a USFWS Species of Conservation Concern (2002), an IUCN red list category VU, National Audubon red list (2002), and already a third priority as a species of special concern by the California Department of Fish and Game (2008). Threats to the BETH persist with habitat loss, invasive vegetation, and possible displacement due to the Curve-billed Thrasher. Populations are common to locally uncommon at elevations that range from 500 ft (151 m) in

southern Arizona to 6100 ft (2000 m) on the Colorado Plateau in northwest Arizona. The species' natural habitat includes a range of different habitat types: semi-desert and desert areas scattered with large shrubs and open ground; on the edges of mesquite patches found in grasslands; and pinyon-juniper. Among these desert areas these birds have established residential (non-migratory) populations within human modified habitats around urban edges such as small ranches, stock yards and acreage properties in rural neighborhoods.

Status and Distribution. The Bendire's Thrasher (*Toxostoma Bendirei*) is a Species of Conservation Concern with the USFWS (2002), a 1c SGCN species by the Arizona Game and Fish Department, and a third priority as a species of special concern by the California Department of Fish and Game (2008).

The Bendire's Thrasher range extends into southern Nevada, Utah, on the south-central edge of Colorado, through to southeastern California, Arizona, New Mexico to Sonora, north-ern Sinaloa, and extreme northern Chihuahua, Mexico. The winter range encompasses south-ern Arizona, southwestern New Mexico, Sonora and northern Chihuahua (England and Laudenslayer 1993).

Threats. The Bendire's Thrasher can be found in various habitats from, lower Sonoran desert to pinyon-juniper. Threats to this species persist with habitat loss due to overgrazing, excessive off-highway vehicle use, invasive vegetation, and possible displacement due to competition of resources by other avian fauna (Curve-billed Thrasher).

Appendix 2. Training Materials

THRASHER IDENTIFICATION CHART

<p>Bendire's Thrasher BETH</p>		
<p>Curve-billed Thrasher CBTH</p>		
<p>Crissal Thrasher CRTH</p>		
<p>LeConte's Thrasher LCTH</p>		

THRASHER IDENTIFICATION COMPARISON PHOTOGRAPHS

Bendire's Thrasher	Curve-billed Thrasher
	



Survey Protocol and Habitat Evaluation

Thrasher Identification Chart

Species	Call	Bill	Iris	Plumage	Behaviors
Bendire's Thrasher BETH	Song is a mixed warbled mumbled; quietly sung at the beginning of the season, nesting, moving through, or the presence of a CBTH. Call is short repeated Tir-up. When with young, the female will give a quick chur-up calling them in.	Slight decurved bill; straight lower mandible; pale base on lower mandible < 5mm from head; length is up to 21 mm nare to tip; length varies 6-11 mm shorter than CBTH (has been found to vary).	The adult iris has a yellow-orange (yellow-light orange as they age). Juvi has a medium to light grey iris as the bird ages, before turning pale-yellow to yellow-dark orange.	Overall plumage tends to be lighter beige grey than an adult CBTH; triangle spotting on breast (can be indistinct and diffused); flanks washed buffy/brown. Recently observed and noted that rural residents most often darker and spots tend to be more diffused than migratory birds.	When singing, tends to perch off to the side of the tree or structure; during vocalization playback will often pop up a minimum of 30-50 meters away; when moving flies down into the center of the tree and flies low going from bush to bush. Note: There are migrating populations and residential that stick to rural areas. Rural will most often breed earlier than migrating.
Curve-billed Thrasher CBTH	Song is a strong and loud melodic mix of warbled calls and trills. Call is a Whit-wheat.	Long, thick and dark decurved bill (upper and lower mandible); up to 27mm nare to tip. Note: Be cautious with first year birds as the bill length can be the same length of an adult BETH.	Adult has an orange-yellow iris (with an outer red ring). Juvi has a dark purple-grey iris the first eight weeks then lighter grey up to 8-10 months before turning yellow to yellow-orange.	Overall plumage is gray-brown; larger than BETH by 10 to 18 grams variance and 4-7 inches bigger in length); round spotting on the breast (can be diffuse and indistinct). NOTE: Be cautious with first year birds as the spotting can be minimal and more diffused.	This bird has been observed most often calling from structures and most often tops of trees; swift and direct in movement; more aggressive than the other thrashers found in Arizona; has adapted well in residential areas; appears to prefer nesting in cholla cactus in its natural habitat or around residential areas.
Crissal Thrasher CRTH	The song is a warbling and melodic (chidery and cheeoo-ree-weep); primarily in calls of 2 and 3 notes. Note: NOMO will attempt to mimic but often doesn't follow through repeating of 3 notes.	Long, curved and thin bill; thinner in width and longer curve and length than CBTH.	Adult has a brown to yellow-brown iris.	Overall plumage medium to dark gray brown (often more brown); white throat; broad and distinct malar stripes; deep chestnut on the undertail coverts; lower belly is pale gray.	Short glide and rapid wing beats. Prefers to dense scrub and found in deep washes and riparian edges. Prefers to breed in bushes and shrubs (e.g. jojoba, wolfberry).
LeConte's Thrasher LCTH	The song long loud warbling that is infrequent with repetition of phrases. The call is a higher pitch "suuu-weep"	Long decurved bill; most often shorter than the CBTH.	Adult and juvi have a dark iris.	Overall plumage is pale faded grayish-brown; lacking of the supercilium; narrow malar strip; and the lower belly is pale gray.	Tend to perch at the top of brush when singing; runs along the ground more often than flying from bush to bush; seems to prefer sandier habitats than other thrashers.
Sage Thrasher SATH	Song is a long ramble of varied notes; call is a short "chuck"	Shortest bill of all the thrashers (10 to 11 mm).	Adult iris ranges from lemon yellow to amber.	A gray and white bird; usually a streaked and white throat; distinct streaks on breast; white wing bar; and square tail.	Swift and direct in flight; closer related to mockingbirds but does tend to run rather than fly bush to bush; elusive in behavior if pressured.

Training videos to view behaviors:

- https://youtu.be/E_mZa203sxl
- <https://youtu.be/CUWALFyIMs>
- <https://youtu.be/jNY-KOKAz-4>
- <https://youtu.be/3j2Fbjzwpoe>
- <https://youtu.be/fscLQSKNZwY>
- <https://youtu.be/WoAnS771SOI>

Note: To obtain a word version of the training materials or questions, contact Chrissy Kondrat at ckondrat-smith@azgfd.gov.

Appendix 3. Bird and Plant Abbreviations and Codes

Four-letter codes for birds:

This appendix includes a master list of all species recorded on past thrasher surveys for each region.

In most cases, the code consists of the first two letters of the first and last names (e.g., BETH = Bendire’s Thrasher). When the first name is hyphenated, the first letter of each word is used (e.g., BCFL = Brown-crested Flycatcher). When the last name is hyphenated, the first two letters of the first word are used (e.g., WESO = Western Screech-Owl). When two species would have the same code, adjustments are made (e.g., CANW = Canyon Wren; CACW = Cactus Wren).

Vegetation codes have the same format as bird codes, but using the scientific name. E.g., catclaw acacia, the common name for *Senegalia greggii*. The code is SEGR.

If the surveyor is unsure of the correct code during their survey time, the surveyor should put in comments the name of the bird and the code they used.

Unknown species should be coded as described below, with a description in comment, photo or sample plant specimen.

Code	Species
UNBI	Unknown bird
UNCH	unknown cholla
UNFB	Unknown fruit-bearing
UNSH	unknown shrub
UNTR	unknown tree
UNTR2	Add a number when there is more than one unknown species.

Currently there are bird lists available on the following pages for AZ, CA and NV; plant lists for AZ and NV. Lists will be updated in this appendix after each survey season and when further data is available.

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Arizona Bird Species detected during area-search surveys in 2017					
Abert's Towhee	ABTO	Elf Owl	ELOW	Pyrrhuloxia	PYRR
American Kestrel	AMKE	European Starling	EUST	Phainopepla	PHAI
Ash-throated Flycatcher	ATFL	Ferruginous Pygmy-Owl	FEPO	Prairie Falcon	PRFA
Barn Owl	BANO	Gambel's Quail	GAQU	Purple Martin	PUMA
Bell's Vireo	BEVI	Gila Woodpecker	GIWO	Red-tailed Hawk	RTHA
Bendire's Thrasher	BETH	Gilded Flicker	GIFL	Rock Wren	ROWR
Black-tailed Gnatcatcher	BTGN	Golden Eagle	GOEA	Rufous-crowned Sparrow	RCSP
Black-throated Sparrow	BTSP	Greater Roadrunner	GRRO	Rufous-winged Sparrow	RWSP
Black Vulture	BLVU	Great Horned Owl	GHOW	Say's Phoebe	SAPH
Bronzed Cowbird	BRCO	Harris's Hawk	HASH	Scott's Oriole	SCOR
Brown-crested Flycatcher	BCFL	Hooded Oriole	HOOR	Turkey Vulture	TUVU
Brown-headed Cowbird	BHCO	Horned Lark	HOLA	Varied Bunting	VABU
Cactus Wren	CACW	House Finch	HOFI	Verdin	VERD
Canyon Towhee	CANT	Ladder-backed Woodpecker	LBWO	Vermilion Flycatcher	VEFL
Canyon Wren	CANW	Le Conte's Thrasher	LCTH	Violet-green Swallow	VGSW
Chihuahuan Raven	CHRA	Lesser Nighthawk	LENI	Western Kingbird	WEKI
Common Poorwill	COPO	Loggerhead Shrike	LOSH	Western Meadowlark	WEME
Common Raven	CORA	Long-eared Owl	LEOW	Western Screech-Owl	WESO
Costa's Hummingbird	COHU	Lucy's Warbler	LUWA	White-throated Swift	WTSW
Crested Caracara	CRCA	Mourning Dove	MODO	White-winged Dove	WWDO
Crissal Thrasher	CRTH	Northern Cardinal	NOCA	Zone-tailed Hawk	ZTHA
Curve-billed Thrasher	CBTH	Northern Mockingbird	NOMO		

Survey Protocol and Habitat Evaluation

Arizona Plant Codes		
Scientific Name	Common Name	Species Code
Ambrosia ambrosioides	canyon ragweed	AMAM
Ambrosia deltoidea	bursage, triangle-leaf	MADE
Ambrosia dumosa	bursage, white	AMDU
Atriplex canescens	saltbush, four-winged	ATCA
Atriplex polycarpa	saltbush, littleleaf	ATPO
Baccharis sarothroides	desert broom	BASA
Berberis, spp.	barberry, spp.	BERB
Bursera microphylla	elephant tree	BUMI
Calliandria eriophylla	fairyduster	CAER
Canotia holacantha	crucifixion thorn	CAHO
Carnegiea gigantea	saguaro	CAGI
Celtis laevigata var. reticulata	hackberry, netleaf	CELA
Celtis pallida	hackberry, desert	CEPA
Chilopsis linearis	desert willow	CHLI
Cylindropuntia leptocaulis	cholla, Christmas	CYLE
Cylindropuntia acanthocarpa	cholla, buckhorn	CYAC
Cylindropuntia arbuscula	cholla, pencil	CYVE
Cylindropuntia bigelovii	cholla, teddybear	CYBI
Cylindropuntia fulgida	cholla, chain-fruit	CYFU
Cylindropuntia spinosior	cholla, cane	CYSP
Cylindropuntia spinosior	cholla, walkingstick	CYSP
Cylindropuntia versicolor	cholla, staghorn	CYVE
Cylindropuntia whipplei	cholla, whipple	CYWH
Dodonaea viscosa	hopbush	DOVI
Encelia farinosa	brittlebush	ENFA
Ephedra spp.	Ephedra (Mormon tea)	EPHE

Ericameria laricifolia	turpentine brush	ERLA
Eriogonum fasciculatum	buckwheat, flattop	ERFA
Ferocactus spp.	barrel cactus, spp.	FERO
Fouquieria splendens	ocotillo	FOSP
Hymenoclea salsola	burrobrush	HYSA
Hyptis emoryi	desert lavender	HYEM
Juniperus spp.	juniper, spp.	JUNI
Justicia californica	chuparosa	JUCA
Krameria erecta	ratany, range (littleleaf)	KRAM
Krameria grayi	ratany, white	KRAM
Krameria spp	ratany spp.	KRAM
Larrea tridentata	creosotebush	LATR
Lycium spp.	wolfberry, spp.	LYCI
Mimosa spp.	mimosa, spp.	MIMO
Olneya tesota	ironwood	OLTE
Opuntia spp.	prickly pear, spp.	OPUN
Parkinsonia florida	paloverde, blue	PAFL
Parkinsonia microphylla	paloverde, foothill	PAMI
Poliomntha incana	desert rosemary	POIN
Prosopis glandulosa	mesquite, honey	PRGL
Prosopis velutina	mesquite, velvet	PRVE
Quercus turbinella	oak, scrub live	OUTU
Rhus ovata	sugar sumac (sugar bush)	RHOV
Senegalia greggii	acacia, catclaw	SEGR
Senna covesii	desert senna	SECO
Simmondsia chinensis	jojoba	SICH
Sphaeralcea spp.	globemallow, spp.	SPHA
Tamarix spp.	tamarisk spp. (salt cedar)	TAMA
Trixis californica	Trixis	TRCA
Vachellia constricta	acacia, whitethorn	VACO
Yucca brevifolia	joshua tree	YUBR
Ziziphus obtusifolia	graythorn	ZIOB

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California Bird species detected during area search surveys in 2017					
American Kestrel	AMKE	Common Raven	CORA	Orange-crowned Warbler	OCWA
American Robin	AMRO	Cooper's Hawk	COHA	Phainopepla	PHAI
Ash-throated Flycatcher	ATFL	Costa's Hummingbird	COHU	Red-tailed Hawk	RTHA
Barn Swallow	BARS	Crissal Thrasher	CRTH	Rock Wren	ROWR
Bell's Sparrow	BESP	Dark-eyed "Oregon" Junco	ORJU	Ruby-crowned Kinglet	RCKI
Bendire's Thrasher	BETH	Eurasian Collared-Dove	EUCD	Sage Thrasher	SATH
Bewick's Wren	BEWR	Gambel's Quail	GAQU	Say's Phoebe	SAPH
Black-chinned Hummingbird	BCHU	Horned Lark	HOLA	Scott's Oriole	SCOR
Black-throated Sparrow	BTSP	House Finch	HOFI	Tree Swallow	TRES
Blue-gray Gnatcatcher	BGGN	House Wren	HOWR	Turkey Vulture	TUVU
Brewer's Blackbird	BRBL	Ladder-backed Woodpecker	LBWO	Verdin	VERD
Brewer's Sparrow	BRSP	Lark Sparrow	LASP	Warbling Vireo	WAVI
Bullock's Oriole	BUOR	LeConte's Thrasher	LCTH	Western Kingbird	WEKI
Cactus Wren	CACW	Lesser Goldfinch	LEGO	Western Meadowlark	WEME
California Quail	CAQU	Lincoln's Sparrow	LISP	White-crowned Sparrow	WCSP
Cassin's Kingbird	CAKI	Loggerhead Shrike	LOSH	Yellow-rumped "Audubon's" Warbler	AUWA
Chipping Sparrow	CHSP	Lucy's Warbler	LUWA		
Common Poorwill	COPO	Mountain Bluebird	MOBL		

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Nevada Bird species detected during area-search surveys in 2017					
American Kestrel	AMKE	Gambel's Quail	GAQU	Prairie Falcon	PRFA
American Pipit	AMPI	Great Horned Owl	GHOW	Ruby-crowned Kinglet	RCKI
American Wigeon	AMWI	Gilded Flicker	GIFL	Rock Wren	ROWR
Anna's Hummingbird	ANHU	Gila Woodpecker	GIWO	Red-shafted Flicker	RSFL
Ash-throated Flycatcher	ATFL	Golden Eagle	GOEA	Red-tailed Hawk	RTHA
Audubon's Warbler	AUWA	Gray Flycatcher	GRFL	Sage Sparrow	SAGS
Barn Swallow	BARS	Greater Roadrunner	GRRO	Say's Phoebe	SAPH
Black-chinned Hummingbird	BCHU	Greater Yellowlegs	GRYE	Sage Thrasher	SATH
Bell's Sparrow	BESP	Green-tailed Towhee	GTTO	Savannah Sparrow	SAVS
Bendire's Thrasher	BETH	Gambel's White-crowned Sparrow	GWCS	Scott's Oriole	SCOR
Bewick's Wren	BEWR	House Finch	HOFI	Solitary Vireo	SOVI
Blue-gray Gnatcatcher	BGGN	Horned Lark	HOLA	Swainson's Hawk	SWHA
Brown-headed Cowbird	BHCO	Hooded Oriole	HOOR	Townsend's Warbler	TOWA
Black-headed Grosbeak	BHGR	House Wren	HOWR	Tree Swallow	TRES
Black Phoebe	BLPH	Killdeer	KILL	Turkey Vulture	TUVU
Brewer's Sparrow	BRSP	Lark Sparrow	LASP	Unid. Empidonax Flycatcher	UEFL
Broad-tailed Hummingbird	BTAH	Ladder-backed Woodpecker	LBWO	Unid. Hummingbird	UNHU
Black-tailed Gnatcatcher	BTGN	Lazuli Bunting	LAZB	Unknown sp.	UNKN
Black-throated Sparrow	BTSP	LeConte's Thrasher	LCTH	Unid. Sparrow	UNSP
Bullock's Oriole	BUOR	Lesser Goldfinch	LEGO	Verdin	VERD
Burrowing Owl	BUOW	Lesser Nighthawk	LENI	Vesper Sparrow	VESP
Cactus Wren	CACW	Lincoln's Sparrow	LISP	Violet-green Swallow	VGSW
California Gull	CAGU	Loggerhead Shrike	LOSH	Virginia's Warbler	VIWA

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Canyon Wren	CANW	Lucy's Warbler	LUWA	Warbling Vireo	WAVI
Cassin's Vireo	CAVI	MacGillivray's Warbler	MGWA	White-crowned Sparrow	WCSP
Curve-billed Thrasher	CBTH	Mountain Bluebird	MOBL	Western Kingbird	WEKI
Chipping Sparrow	CHSP	Mourning Dove	MODO	Western Meadowlark	WEME
Cliff Swallow	CLSW	Mountain White-crowned Sparrow	MWCS	Western Tanager	WETA
Cooper's Hawk	COHA	Myrtle Warbler	MYWA	Western Wood-Pewee	WEWP
Costa's Hummingbird	COHU	Northern Flicker	NOFL	Wilson's Warbler	WIWA
Common Poorwill	COPO	Northern Harrier	NOHA	White-throated Swift	WTSW
Common Raven	CORA	Northern Mockingbird	NOMO	White-winged Dove	WWDO
Crissal Thrasher	CRTH	Northern Rough-winged Swallow	NRWS	Yellow Warbler	YEWA
Dusky Flycatcher	DUFL	Peregrine Falcon	PEFA	Yellow-rumped Warbler	YRWA
Eurasian Collared-Dove	EUCD	Phainopepla	PHAI		

Nevada Plant Codes		
Scientific Name	Common Name	Species Code
<i>Acamptopappus sphaerocephalus</i>	Rayless goldenhead	ACSP
<i>Adenophyllum cooperi</i>	Cooper's dyssodia	ADCO
<i>Ambrosia dumosa</i>	White bursage	AMDU
<i>Ambrosia eriocentra</i>	Wooly bursage	AMER
<i>Atriplex canescens</i>	Fourwing saltbush	ATCA
<i>Atriplex confertifolia</i>	Shadscale saltbush	ATCO
<i>Atriplex polycarpa</i>	Cattle saltbush	ATPO
<i>Atriplex torreyi</i>	Torrey's saltbush	ATTO
<i>Bahiopsis parishii</i>	Parish's goldeneye	BAPA
<i>Bassia americana</i>	Green-molly	BAAM
<i>Bebbia juncea</i>	Sweetbush	BEJU
<i>Chilopsis linearis</i>	Desert willow	CHLI
<i>Coleogyne ramosissima</i>	Blackbrush	CORA
<i>Cylindropuntia acanthocarpa</i>	Buckhorn cholla	CYAC
<i>Cylindropuntia bigelovii</i>	Teddybear cholla	CYBI
<i>Cylindropuntia echinocarpa</i>	Silver cholla	CYEC
<i>Cylindropuntia ramosissima</i>	Branched pencil cholla	CYRA

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<i>Echinocactus polycephalus</i>	Cottontop cactus	ECPO
<i>Echinocereus engelmannii</i>	Strawberry hedgehog cactus	ECEN
<i>Eleagnus angustifolia</i>	Russian olive	ELAN
<i>Encelia actoni</i>	Acton's brittlebush	ENAC
<i>Encelia farinosa</i>	Brittlebush	ENFA
<i>Encelia virginensis</i>	Virgin River brittlebush	ENVI
<i>Ephedra nevadensis</i>	Nevada Mormon tea	EPNE
<i>Ephedra viridis</i>	Green Mormon tea	EPVI
<i>Ericameria linearifolia</i>	Narrowleaf goldenbush	ERLI
<i>Ericameria paniculata</i>	Mojave rabbitbrush	ERPA
<i>Eriogonum fasciculatum</i>	California buckwheat	ERFA
<i>Escobaria vivipara</i>	Common beehive cactus	ESVI
<i>Fallugia paradoxa</i>	Apache plume	FAPA
<i>Ferocactus cylindraceus</i>	California barrel cactus	FECY
<i>Grayia spinosa</i>	Spiny hopsage	GRSP
<i>Grusonia parishii</i>	Parish's club-cholla	GRPA
<i>Gutierrezia sarothrae</i>	Broom snakeweed	GUSA
<i>Hymenoclea salsola</i>	Cheesebush	HYSA
<i>Juniperus osteosperma</i>	Oneseed juniper	JUOS
<i>Krameria erecta</i>	Littleleaf ratany	KRER
<i>Krameria grayi</i>	White ratany	KRGR
<i>Krascheninnikovia lanata</i>	Winterfat	KRLA
<i>Larrea tridentata</i>	Creosote	LATR
<i>Lepidium fremontii</i>	Desert pepperweed	LEFR
<i>Lycium andersonii</i>	Anderson wolfberry	LYAN
<i>Lycium cooperi</i>	Peach thorn	LYCO
<i>Mammillaria tetrancistra</i>	Common fishhook cactus	MATE
<i>Menodora spinescens</i>	Spiny menodora	MESP
<i>Opuntia basilaris</i>	Beavertail pricklypear	OPBA
<i>Opuntia chlorotica</i>	Dollarjoint pricklypear	OPCH
<i>Opuntia erinacea</i>	Mojave pricklypear	OPER
<i>Opuntia phaeacantha</i>	Tulip pricklypear	OPPH
<i>Peucephyllum schottii</i>	Pygmy cedar	PESC
<i>Phoradendrom californicum</i>	Desert mistletoe	PHCA
<i>Pinus monophylla</i>	Singleleaf pinyon	PIMO
<i>Porophyllum gracile</i>	Odora	POGR
<i>Prosopis glandulosa</i>	Honey mesquite	PRGL
<i>Prosopis pubescens</i>	Screwbean mesquite	PRPU
<i>Prunus fasciculata</i>	Desert almond	PRFA
<i>Psilostrophe cooperi</i>	Whitestem paperflower	PSCO
<i>Psorothamnus fremontii</i>	Fremont's dalea	PSFR
<i>Quercus turbinella</i>	Sonoran scrub oak	QUTU
<i>Rhus trilobata</i>	Skunkbush sumac	RHTR
<i>Salazaria mexicana</i>	Mexican bladdersage	SAME

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Salvia dorrii	Purple sage	SADO
Senegalia greggii	Catclaw acacia	SEGR
Senna armata	Desert senna	SEAR
Senna covesii	Desert senna	SECO
Sphaeralcea ambigua	Globemallow	SPAM
Stanleya pinnata	Prince's plume	STPI
Suaeda nigra	Mojave seablite	SUNI
Tetradymia stenolepis	Mojave cottonthorn	TEST
Thamnosma montana	Turpentine broom	THMO
Xylorhiza tortifolia	Mojave woodyaster	XYTO
Yucca baccata	Banana yucca	YUBA
Yucca brevifolia	Joshua tree	YUBR
Yucca schidigera	Mojave yucca	YUSC
Yucca utahensis	Utah yucca	YUUT

Survey Protocol and Habitat Evaluation

Appendix 4. Sample Survey Form

Thrasher Survey Form									
Observer(s) Name and Contact Info: <i>Lauren Harter</i>					Plot ID: <i>NV-BETH235</i>				
					Date: <i>4/8/2018</i>				
Site Name: <i>Walking Box 2</i>					Visit #: <i>1</i>				
Start time: <i>0721</i>	Temperature: <i>60 F</i>	Cloud Cover: <i>0</i> %	Wind: <i>0 1 2 3 4 5 6</i> beaufort		use one or the other				
End time: <i>0806</i>	Precipitation (circle one): <i>None</i> or Light		Wind: <i>4</i> mph						
Plot Boundaries		NW Corner	E	<i>679500</i>	NE Corner	E	<i>679800</i>		
			N	<i>3917800</i>		N	<i>3917800</i>		
Zone: <i>11</i>	SW Corner		E	<i>679500</i>	SE Corner	E	<i>679800</i>		
			N	<i>3917500</i>		N	<i>3917500</i>		
Record details on LCTH, BETH and LOSH and complete the Sighting Form									
Species Observed	CODE: Visual (V), Song (S), Call (C), Juvenile (J), Flyover (F); one code per individual; groups in parenthesis e.g. (20V) ****Note that Juveniles should be always be recorded as J						Total #	Highest breeding code	
LCTH	<i>(V) C</i>						<i>2</i>	<i>NB</i>	
BETH									
LOSH									
Record details on all other species detected (Use the Notes section if more space is needed)									
Species Observed	CODE: Visual (V), Song (S), Call (C), Juvenile (J), Flyover (F); one code per individual; groups in parenthesis e.g. (20V) ****Note that Juveniles should be always be recorded as J						Total #	Highest breeding code	
<i>ATFL</i>	<i>CC</i>						<i>2</i>	<i>P</i>	
<i>BRSP</i>	<i>(6V)CCV</i>						<i>9</i>		
<i>BTSP</i>	<i>SSCVSVSS</i>						<i>8</i>	<i>NE</i>	
<i>PHAI</i>	<i>V</i>						<i>1</i>		
<i>HOFI</i>	<i>S(2F)</i>						<i>3</i>		
**Breeding Codes (listed highest to lowest)									
NY Nest with young			FL Recently fledged young			C Courtship or copulation			
NE Nest with eggs			ON Occupied nest			P Pair			
FY Feeding young			DD Distraction display						
CF Carrying food			NB Nest building						

Comments:

Saw a LOSH during survey ~200m off plot. Returned after survey to fill out sighting form.

Paused survey when loud OHV drove by near the plot.

Survey Protocol and Habitat Evaluation

Appendix 5. Sample Sighting Form

Target Species Sighting Form

Fill out *entire* top half of data sheet. If nest found, also fill out bottom half.

Record sightings of Bendire's Thrasher, LeConte's Thrasher, and Loggerhead Shrike				Plot ID: <u>NV-BETH235</u>		
Observer: <u>Lauren Harter</u>		Contact email: <u>-</u>		Date: <u>4/8/2018</u>		
Species: <u>LCTH</u>		Time: <u>0732</u>		Visit #: <u>1</u>		
UTM E (NAD83): <u>679620</u>		UTM N (NAD83): <u>3917565</u>		Site Name: <u>Walking Box 2</u>		
# Adults: <u>2</u>		# Juveniles: <u>0</u>		# Unknown age: <u>0</u>		
Within Plot: <input checked="" type="radio"/> N (circle one)		Location Information (owner, contact info, etc):				
Within Survey Time: <input checked="" type="radio"/> N (circle one)		<u>BLM</u>				
Activity (circle all that apply): <input checked="" type="radio"/> Sing <input checked="" type="radio"/> Call <input type="radio"/> Forage <input checked="" type="radio"/> Fly <input type="radio"/> Flush <input type="radio"/> Run <input checked="" type="radio"/> Perch <input type="radio"/> Incubate						
Record perch substrate and height for all birds in a group. If >3, record in notes below.			Bird 1	Bird 2	Bird 3	Habitat description: <u>Diverse BLB veg near large wash, lot of YUBR, YUSC, CYAC, LYAN</u>
Perch Substrate (species):			<u>LATR</u>	<u>CYAC</u>		Highest Breeding Code: <u>NB</u>
Perch Height (0.1 m):			<u>1.8</u>	<u>1.2</u>		Photo/Recording taken: <input checked="" type="radio"/> Yes <input type="radio"/> No
Photo number(s): <u>047-063</u>			Nest found (circle one): <input checked="" type="radio"/> Yes <input type="radio"/> No			Occupied Nest (circle one): Yes <input type="radio"/> No <input checked="" type="radio"/>
If NEST FOUND, complete section below with nest information: see codes below						
UTM E (NAD83): <u>679631</u>			Nest Stage		<u>NB</u>	
UTM N (NAD83): <u>3917569</u>			# of Eggs		<u>0</u>	
Elevation (m): <u>1104</u>			# of Nestlings		<u>0</u>	
<i>*Estimates ONLY, unless nest is no longer occupied.</i>			# of Adults Present		<u>2</u>	
Habitat: <u>BLB</u>		See protocol for list of habitat codes				
Substrate: <u>CYAC</u>		species of substrate and nursing plants (if applicable)				
*Plant Height: <u>1.6</u> <u>1.5</u> m		measure or estimate to highest point				
*DBH: <u>N/A</u> cm		diameter of main trunk, if present, at 1.3 m off ground				
*Plant Width: <u>0.5</u> <u>0.6</u> m		width of substrate plant at widest point				
*Distance to Center/Trunk: <u>0</u> cm		measure interior outer edge of nest to the center or trunk of substrate				
*Nest Height: <u>0.2</u> <u>1.2</u> m		measure ground to top of nest				
*Nest Orientation (dgrs): <u>48</u>		° measure degree out with lining up center and nest out				
Follow-up Date: <u>5/2/18</u>		Nest Contents: <u>4 nestlings</u>		# of Fledglings (if known): <u>N/A</u>		
Comments/Diagram of Nest Site:						
<p>Saw then heard singing adult, while watching 1st bird I heard a second call nearby - turned out to be another adult perched at a nest w/ material in its bill. 2nd bird went to nest and added material. Nest measurements are estimated.</p>						
Breeding Codes						
NY	Nest with young	FL	Recently fledged young	C	Courtship or copulation	
NE	Nest with eggs	ON	Occupied nest	P	Pair	
FY	Feeding young	DD	Distraction display			
CF	Carrying food	NB	Nest building			

Additional Comments:

5/2 - Nest contains 4 large nestlings. Photo #126

5/28 - Nest empty, no LCTH around. Took nest measurements.

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Appendix 6. Group Code Examples

Examples: Let's go through an example of a "mock" survey day and how you would fill out group codes with multiple thrasher sightings. On your first plot, you have a singing lone Bendire's Thrasher. Since it is your first Bendire's Thrasher of the day, you give it a code of "01". See below for a partially filled in example datasheet.

Target Species Sighting Form

Fill out *entire* top half of data sheet. If nest found, also fill out bottom half.

Record sightings of Bendire's Thrasher, LeConte's Thrasher, and Loggerhead Shrike				Plot ID:	NV-BETH-05
Observer:		Contact email:		Date:	5 Apr 2018
Species: BETH		Time:		Visit #:	
UTM E (NAD83):		UTM N (NAD83):		Site Name:	
# Adults: 1	# Juveniles: 0	# Unknown age: 0	Group Code: 01		
Within Plot:		<input checked="" type="radio"/> Y <input type="radio"/> N (circle one)		Location Information (owner, contact info, etc):	
Within Survey Time:		<input checked="" type="radio"/> Y <input type="radio"/> N (circle one)			
Activity (circle all that apply): <input checked="" type="radio"/> Sing <input type="radio"/> Call <input type="radio"/> Forage <input type="radio"/> Fly <input type="radio"/> Flush <input type="radio"/> Run <input type="radio"/> Perch <input type="radio"/> Incubate					
Record perch substrate and height for all birds in a group. If >3, record in notes below.			Bird 1	Bird 2	Bird 3
Perch Substrate (species):			Habitat description:		
Perch Height (0.1 m):			Highest Breeding Code:		
Nest found (circle one): Yes No			Photo/Recording taken: Yes No		Photo number(s):
			Occupied Nest (circle one): Yes No		

On your second plot, you find two groups of Bendire's Thrashers - one adult with two fledglings and one adult with one fledgling. They are over 25 meters apart, so you fill out two Target Species Sighting Forms, but you believe they are a single family unit. You would record a group code of "02" on both forms. (If you believed they were not a single family unit, you would instead number them "02" and "03"). See below for partially filled in example datasheets.

Target Species Sighting Form

Fill out *entire* top half of data sheet. If nest found, also fill out bottom half.

Record sightings of Bendire's Thrasher, LeConte's Thrasher, and Loggerhead Shrike				Plot ID:	NV-BETH-06
Observer:		Contact email:		Date:	5 Apr 2018
Species: BETH		Time:		Visit #:	
UTM E (NAD83):		UTM N (NAD83):		Site Name:	
# Adults: 1	# Juveniles: 2	# Unknown age: 0	Group Code: 02		
Within Plot:		<input checked="" type="radio"/> Y <input type="radio"/> N (circle one)		Location Information (owner, contact info, etc):	
Within Survey Time:		<input checked="" type="radio"/> Y <input type="radio"/> N (circle one)			
Activity (circle all that apply): Sing <input checked="" type="radio"/> Call <input checked="" type="radio"/> Forage <input type="radio"/> Fly <input type="radio"/> Flush <input type="radio"/> Run <input checked="" type="radio"/> Perch <input type="radio"/> Incubate					
Record perch substrate and height for all birds in a group. If >3, record in notes below.			Bird 1	Bird 2	Bird 3
Perch Substrate (species):			Habitat description:		
Perch Height (0.1 m):			Highest Breeding Code:		FL
Nest found (circle one): Yes <input checked="" type="radio"/> No			Photo/Recording taken: Yes No		Photo number(s):
			Occupied Nest (circle one): Yes No		

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Target Species Sighting Form

Fill out *entire* top half of data sheet. If nest found, also fill out bottom half.

Record sightings of Bendire's Thrasher, LeConte's Thrasher, and Loggerhead Shrike				Plot ID:	NV-BETH-06
Observer:		Contact email:		Date:	5 Apr 2018
Species: BETH		Time:		Visit #:	
UTM E (NAD83):		UTM N (NAD83):		Site Name:	
# Adults: 1	# Juveniles: 1	# Unknown age: 0	Group Code: 02		
Within Plot: Y <input checked="" type="radio"/> N (circle one)			Location Information (owner, contact info, etc):		
Within Survey Time: Y <input checked="" type="radio"/> N (circle one)					
Activity (circle all that apply): Sing <input type="radio"/> Call <input checked="" type="radio"/> Forage <input type="radio"/> Fly <input type="radio"/> Flush <input checked="" type="radio"/> Run <input type="radio"/> Perch <input checked="" type="radio"/> Incubate <input type="radio"/>					
Record perch substrate and height for all birds in a group. If >3, record in notes below.			Habitat description:		
	Bird 1	Bird 2	Bird 3		
Perch Substrate (species):			Highest Breeding Code:		FL
Perch Height (0.1 m):			Photo/Recording taken: Yes No		Photo number(s):
Nest found (circle one): Yes <input checked="" type="radio"/> No			Occupied Nest (circle one): Yes No		

On your hike back to the car at the end of the day, you walk near your first plot and find a pair of Bendire's Thrashers with a nest. After comparing to your earlier sighting, you realize that one of these birds is the singing individual from your first plot. You would fill out a sighting form for the new member of the pair and the nest, and give it a group code of "01" to link it with the bird detected earlier. You wouldn't record the first adult again, since you already have a sighting form for that bird from that day. See below for a partially filled in example datasheet.

Target Species Sighting Form

Fill out *entire* top half of data sheet. If nest found, also fill out bottom half.

Record sightings of Bendire's Thrasher, LeConte's Thrasher, and Loggerhead Shrike				Plot ID:	N/A
Observer:		Contact email:		Date:	5 Apr 2018
Species: BETH		Time:		Visit #:	
UTM E (NAD83):		UTM N (NAD83):		Site Name:	
# Adults: 1	# Juveniles: 0	# Unknown age: 0	Group Code: 01		
Within Plot: Y <input checked="" type="radio"/> N (circle one)			Location Information (owner, contact info, etc):		
Within Survey Time: Y <input checked="" type="radio"/> N (circle one)					
Activity (circle all that apply): Sing <input type="radio"/> Call <input type="radio"/> Forage <input type="radio"/> Fly <input type="radio"/> Flush <input type="radio"/> Run <input type="radio"/> Perch <input checked="" type="radio"/> Incubate <input type="radio"/>					
Record perch substrate and height for all birds in a group. If >3, record in notes below.			Habitat description:		
	Bird 1	Bird 2	Bird 3		
Perch Substrate (species):			Highest Breeding Code:		NB
Perch Height (0.1 m):			Photo/Recording taken: Yes No		Photo number(s):
Nest found (circle one): <input checked="" type="radio"/> Yes No			Occupied Nest (circle one): Yes No		

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Appendix 7. Sample Habitat Evaluation Form

Thrasher Habitat Evaluation Form			
Surveyor: <i>Lauren</i>	mE(NAD83): <i>679650</i>	Plot ID: <i>NV-BETH 235</i>	
<i>Harter</i>	mN(NAD83): <i>3917650</i>	Date: <i>4/8/2018</i>	
Habitat Type: <i>BLB</i>	Elevation (m): <i>1110</i>	Zone: <i>115</i>	Site Name: <i>Walking Box 2</i>
Point-Center Quarter: Measure distance to the first visible vegetation.			
Northwest	Distance	Species	
Cholla (>0.5m)	<i>32</i>	<i>CYAC</i>	
Yucca (>0.5m)	<i>14</i>	<i>YUSC</i>	
Shrub sp. (≤0.5m)	<i>1</i>	<i>ERFA</i>	
Shrub/tree(>0.5 to 2m)	<i>3</i>	<i>TEST</i>	
Tree (>2 m)	<i>21</i>	<i>LATR</i>	
Northeast			
Cholla (>0.5m)	<i>17</i>	<i>CYAC</i>	
Yucca (>0.5m)	<i>12</i>	<i>YUSC</i>	
Shrub sp. (≤0.5m)	<i>3</i>	<i>PESC</i>	
Shrub/tree(>0.5 to 2m)	<i>5</i>	<i>LATR</i>	
Tree (>2 m)	<i>38</i>	<i>YU3R</i>	
Southeast			
Cholla (>0.5m)	<i>18</i>	<i>CYAC</i>	
Yucca (>0.5m)	<i>16</i>	<i>YUSC</i>	
Shrub sp. (≤0.5m)	<i>2</i>	<i>KRGR</i>	
Shrub/tree(>0.5 to 2m)	<i>2</i>	<i>LATR</i>	
Tree (>2 m)	<i>26</i>	<i>LATR</i>	
Southwest			
Cholla (>0.5m)	<i>50</i>	<i>CYAC</i>	
Yucca (>0.5m)	<i>44</i>	<i>YUSC</i>	
Shrub sp. (≤0.5m)	<i>2</i>	<i>ERFA</i>	
Shrub/tree(>0.5 to 2m)	<i>8</i>	<i>SEGR</i>	
Tree (>2 m)	<i>8</i>	<i>LATR</i>	
Fruit-bearing shrub (estimate # of fruiting shrubs within 50 m radius) Exact count or estimate by 10: 0, 10, 20, 30, etc.			
Count/Estimate:	<i>3</i>	Species:	<i>LYCO</i>
Count/Estimate:	<i>11</i>	Species:	<i>LYAN</i>
Count/Estimate:	<i>8</i>	Species:	<i>PHCA</i>
Yucca Species (Count all yucca >2 m height, by species, within 100 m radius)			
Species:	<i>YU3R</i>	Count:	<i>73</i>
Species:	<i>YUSC</i>	Count:	<i>2</i>
Species:		Count:	
Ground Cover (at veg. pt. along 50 m line N) Estimate to the nearest meter			
# of meters bunchgrass:	<i>5</i>		
# of meters invasive:	<i>1</i>		
# of meters bare ground:	<i>25</i>		
Adjacent Land Use: <i>Shooting range ~500 m from plot</i>			
Comments:			
			Disturbance Codes
			1 = >50% of plot has recent evidence
			2 = Some recent or old >10 yrs evidence
			3 = Some evidence within ~1km of plot
			4 = No sign in site or within 1km of plot
			6 = Other, explain in comments
Disturbance Evaluation:			CODE
OHV use evidence			<i>3</i>
Burned habitat			<i>4</i>
Livestock evidence			<i>2</i>
Mechanical			<i>4</i>
Soil Composition w/in 50m			%
silt/clay			<i>0</i>
sand			<i>20</i>
rock			<i>80</i>
other (list):			
Presence on entire plot			X
Tank w/ standing water			<i>-</i>
Rural sprawl w/in 5km			<i>-</i>
Fruit-bearing Shrubs			<i>X</i>
Cheatgrass			<i>-</i>
Sahara mustard			<i>-</i>
Red brome			<i>X</i>
Buffleggrass			<i>-</i>
Arab. Mediterranean grass			<i>-</i>
Bermuda grass			<i>-</i>
Fountain grass			<i>-</i>
Russian thistle			<i>-</i>
% of Wash Cover			<i>30</i>

LYAN, LYCO

Appendix 8. Invasive Plant Identification Resources.

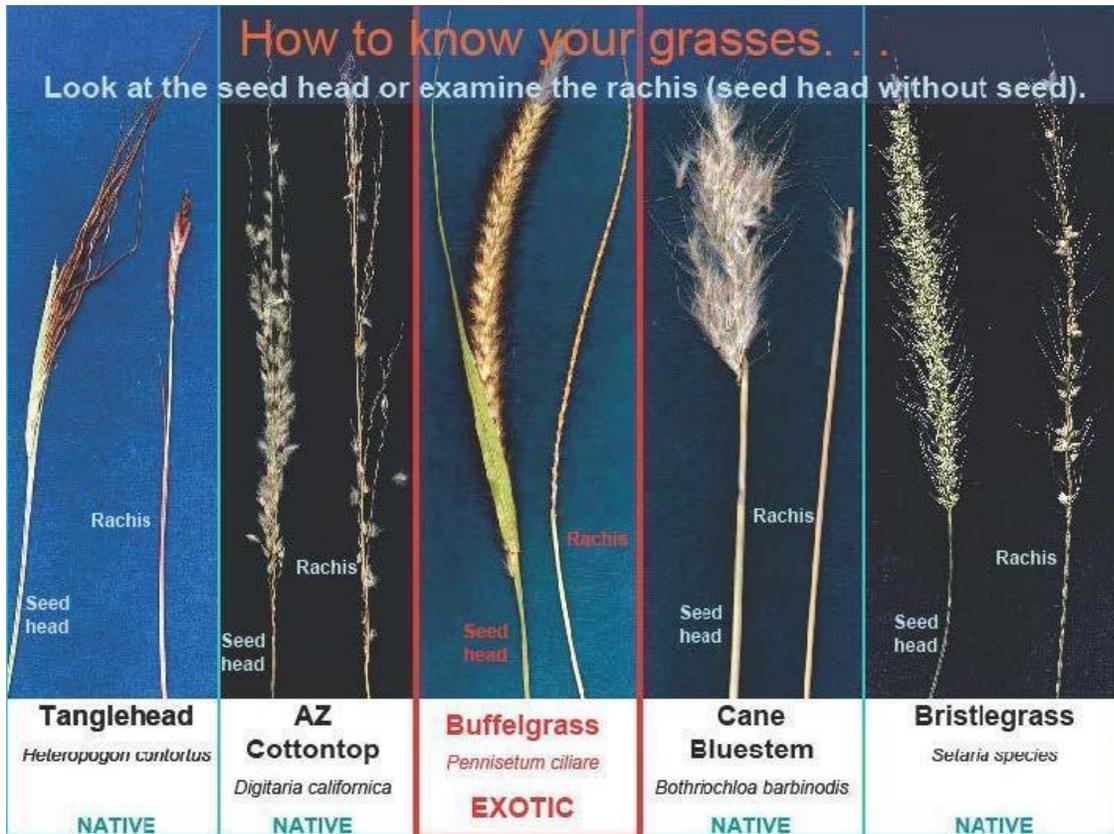
Available Online Resources:

http://www.arizonensis.org/sonoran/fieldguide/plantae/sonoran_desert_flora.html

<http://cabezaprieta.org/plants.php>

<https://www.fireflyforest.com/flowers/>

Grass Classification Guide



<http://www.buffelgrass.org/sites/default/files/grasscomparison.pdf>; Prepared by Bethany Hontz/Saguaro National Park

Sahara Mustard *Brassica tournefortii*



All above: <http://cabezaprieta.org> by Hank Jorgensen

Buffelgrass *Pennisetum ciliare* or *Cenchrus ciliaris*



<http://www.buffelgrass.org> by Christine Hannum



© Larry Allain



Photo: Chris Gardiner ©

www.tropicalforages.info/key/Forages/Media/Html/ by Chris Gardiner

Larry Allain @ USDA-NRCS PLANTS Database

Fountain grass *Pennisetum setaceum*



Both above: <http://cabezaprieta.org> By Hank Jorgensen

Red Brome *Bromus rubens* var. *madritensis*



© Patrick J. Alexander

Patrick J. Alexander @ USDA-NRCS PLANTS Database



www.blm.gov/pgdata Stephen Laymon



www.arizonensis.org Michael J. Plagens 2008

Arabian or Mediterranean Grass *Schismus arabicus*



Dale A. Zimmerman Herbarium, Western New Mexico University



CalPhotos.berkeley.edu © Steve Matson 2011



CalPhotos.berkeley.edu © Joe DiTomaso 2001

Bermuda Grass *Cynodon dactylon*



Both above: http://www.saguaro-juniper.com/i_and_i/invasive_spp/bermuda_grass.html

Russian thistle (tumbleweed) *Salsola tragus* or *iberica*



Both above: www.delange.org/ThistleRussian
Images Copyright [George & Audrey DeLange](#)

References

- Arnett, J. and J. McFarland. 2013. *Field Manual for Bird Surveys in Southern Mohave County, AZ*. Arizona Field Ornithologists & Arizona Important Bird Area Program. April 26-28.
- Ashton, I., E. William Schweiger, J. Burke, D. Shorrock, D. Pillmore, and M. Britten. 2010. *Alpine vegetation composition structure and soils monitoring protocol: 2010 version*. Natural Resource Report NPS/ROMN/NRR—2010/277. National Park Service, Fort Collins, Colorado.
- Corman, T., E. Juarez, J. Arnett, and C. Beardmore. 2015. *Arizona Bird Conservation Initiative Arizona Coordinated Bird Monitoring Program*.
- Corman, Troy and Catherine Wise-Gervais. 2005. [Arizona Breeding Bird Atlas](#). University of New Mexico Press, Albuquerque.
- Elzinga Ph.D., Daniel W. Salzer, and John W. Willoughy. 2015. *Measuring & Monitoring Plant Populations*. <https://www.blm.gov/nstc/library/pdf/MeasAndMon.pdf>.
- Great Basin Bird Observatory. 2010. *Nevada Bird Count: Intensive Area Searches and Spot-Mapping: Great Basin Bird Observatory's Protocol for Conducting Bird Surveys Using Intensive Area Search and Spot-Mapping Methods*.
- Heaton, J. S., X. Miao, K. Von Seckendorff Hoff, D. Charlet, P. Cashman, J. Trexler, A. Grimmer, and R. Patil. 2011. Final Report 2005-UNR-578. Report to Clark County MSHCP 2005-UNR-578:D27.
- Jongsomjit, D., Tietz, J.R., Michaile, S., Fonseca, T., and Geupel, G.R. 2012. *Le Conte's Thrasher Monitoring in the Carrizo Plain National Monument. Report to the Bureau of Land Management*. PRBO contribution. #1886.
- Landfire: Landfire Vegetation Dynamics Models. (2013, June - last update). [Homepage of the LANDFIRE Project, U.S. Department of Agriculture, Forest Service; U.S. Department of Interior], [Online]. Available: <https://www.landfire.gov/index.php> [2013, May 8].
- National Park Service and U.S. Department of the Interior. 2010. *Alpine Vegetation Composition Structure and Soils Monitoring Protocol*; Natural Resource Report NPS/ROMN/NRR—2010/277.
- Pardieck, K. and R. B. Waide. 1992. Avinet. (http://www.avinet.com/avi_faq.html#abstract).
- Point Blue Conservation Science. 2014. *Carrizo Plains; LeConte's Thrasher Abundance Modeling: 2014 Summary Report to the Bureau of Land Management*.
- Pyle, P. 1997. *Identification Guide to North American Birds, Part I*. Slate Creek Press, California.
- Sterling, J. 2008. *Bendire's Thrasher (Toxostoma bendirei)*. In: Shuford, W.D. and T. Gardali, editors. *California Bird Species of Special Concern: A ranked assessment of species, subspecies, and distinct populations of birds of immediate conservation concern in California*. Studies of Western Birds 1. Western Field Ornithologists, Camarillo, California, and California Department of Fish and Game, Sacramento.
- UCLS – LaMMNA. 2007. (<http://environment.ucla.edu/ctr/research/Inf-Diseases/UCLA-LaMMNA-Protocol-Spring-2007.pdf>).