



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**

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Great Basin Bird Observatory
1755 E. Plumb Lane #256A
Reno, NV 89502

www.gbbo.org

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1 Introduction

The Nevada Bird Count (NBC) uses intensive area searches primarily for two purposes, obtaining unbiased bird density estimates and inventorying and monitoring of high priority sites. An unbiased density estimate can be used to generate correction factors for density estimates obtained with rapid survey methods, such as the point count method, belt transect surveys, or rapid area searches (Bart and Earnst 2002). In contrast to intensive area searches, rapid survey methods are typically used for monitoring bird populations across large geographic areas and different habitat types. A disadvantage of many rapid methods is that they may provide only an index of bird abundance. Rapid surveys may also result in biased estimates of birds who are poorly detectable because they have a soft song, vocalize rarely, or behave secretively, who show strong seasonal changes in detectability, and who are temporarily undetectable because they are on a concealed nest or are foraging outside of their territory. To obtain an estimate of these biases, intensive area searches can be used in a double-sampling approach (Bart and Earnst 2002).

Intensive area searches can also give us excellent information of bird use of a particular area, such as a habitat restoration site or other high-priority site. For the surveyor, they are an unparalleled opportunity to enjoy and learn about the rich, secret life of birds. There is little time pressure during these surveys, and even the most common birds have an untold repertoire of behaviors, calls, and idiosyncrasies. An area search is the best chance to learn to “read” bird behaviors and acquire the skills for point-counting and similar rapid surveys.

2 Methods

2.1 *Field methods*

2.1.1 Plot setup

2.1.1.1 Materials

- Aerial photographs – for this account, we assume that you have geo-referenced aerial photographs printed out and surrounded with a UTM grid of known datum; if this is not the case, see Appendix G
- biodegradable flagging (e.g., wood fiber) – remember to pull the flagging at the end of the survey season!
- GPS unit
- Rangefinder for measuring distances
- Plot setup sheet
- Pen

2.1.1.2 Marking the Area Search Plot

The best method for setting up the plot will depend somewhat on the purpose of the area search, and on the habitat in which the plot is located. Some plots are randomly located within a habitat type to give an unbiased estimate of bird densities in that habitat type. Other plots are located in a high priority site to document the birds using that area.

The size of the plot will depend on habitat type and amount of bird activity. The survey plot should be large enough to include several breeding territories of landbirds. We are primarily concerned with mapping territories of breeding songbirds and species with similar breeding habits (e.g., sapsuckers, woodpeckers, American Kestrel). In areas that have high breeding bird densities, the plot can be comparatively small (about 10-20 acres [4-8 ha] in riparian or aspen), but it needs to be larger in areas with low bird densities (about 20-40 acres [8-16 ha], or more, in scrub habitats or pinyon-juniper). The final size and layout of a plot is determined by the area that can be thoroughly covered by one surveyor during a long morning. If a plot is established and later found to be too large, there are two options: (1) Where plot size is dictated by outside factors (e.g., a restoration area that needs to be covered in its entirety), one visit may be completed on successive days. (2) When that is not the case, plot size can be reduced for subsequent surveys (if this happens, however, remember to update the plot setup datasheet!). If in doubt of how large a plot can be surveyed, it is better to err slightly on the large side – if the plot is too small, it may be difficult to expand, because the extra area has not been previously surveyed.

The plot boundaries need to be sufficiently marked with flagging tape, so that the boundary can be seen from as many locations within the plot as possible. In addition, the surveyor must pass within 50m of every point within the plot during a survey, and for that, the 50m gridlines within the plot may also need to be flagged in monotypic stands. In open areas, the flagging may be at the intersections of the 50m gridlines; in thick vegetation, the lines connecting these points may also need to be flagged. GPS the boundary, and write the UTM coordinates on the plot setup sheet, along with the UTM coordinates of any important landmarks, such as free-standing trees, snags, fenceposts, or other permanent features that are not visible on the aerial photo. Even when using GPS units to locate paths and birds on the map/aerial, flagging is important to be able to correctly locate your own position and that of the birds you see. In thick vegetation, the flagging can help keep you on the path, and help reduce frustration levels! Note: while we typically use surveyor's flagging tape, permanent markers may be more appropriate for multi-year projects.

2.1.2 Collecting data

2.1.2.1 Gear

- Aerial photographs – we assume that you have geo-referenced aerial photographs printed out with a superimposed UTM grid of known datum; if this is not the case, see Appendix G
- Clipboard

- Binoculars
- Rangefinder
- Pencil/eraser
- GPS unit
- Scratch paper for taking notes
- Symbolology reference sheet (Appendix C)
- Notes from previous surveys
- Compass
- Lots and lots of water – whatever you think you might drink, bring some more – and snacks
- First Aid Kit

2.1.2.2 Time of Year and Number of Surveys per Season

Intensive area searches should be planned so they bracket the time period in which most landbird nesting activity takes place: early-mid April through mid-June in the lowlands of the Mojave Desert; mid-late May through early July in higher elevations and in the Great Basin. It is o.k. to miss the very earliest (e.g., some owls, raptors, and some songbirds) and the very latest breeders (e.g., cuckoos), because we are primarily focusing our efforts on the majority of nesting landbirds. Eight to 10 visits, spaced out by 4-7 days, need to be completed in each intensive area search plot per season.

2.1.2.3 Territories and Home Ranges

Birds can have different types of territories, but all territories share the common theme of an area containing a limited resource that is defended by an individual (or pair or group) against members of its own species and/or those of other species. Territories and home ranges differ in that a home range is usually a larger, undefended area where most of the bird's daily activity takes place, and which usually includes the smaller, defended territory (Welty and Baptista 1988).

Different bird species often have different types of territories, and the ones that we are most likely to encounter include those in which the following resources are defended: (1) mating, nesting, and feeding; (2) mating and nesting; and (3) nesting. Most of the territories we will encounter are mating/nesting/feeding territories maintained by many woodpeckers, shrikes, thrushes, icterids, warblers, sparrows, and more. Of the second type, mating and nesting will occur within the defended area, but foraging will occur elsewhere (e.g., Northern Harrier, Red-winged Blackbird, and some finches). In the last type, the defended area is limited to the nest, which is most common among waterbirds, waterfowl, and others (Welty and Baptista 1988).

In our area searches, the surveyor should be prepared to delineate territories and home ranges of a variety of species. The easiest birds are those that defend all, or most, areas of activity. Most songbirds fall into that category, and perhaps the most useful evidence for territory boundaries is a male songbird loudly patrolling its territory. As a general rule, defended areas are often vocally defended in the presence of intruders. Therefore, any alarm calling should be a reason to let the

birds settle down and spend more time in that spot to get evidence of breeding. However, not all birds are vocal, and the first priority should always be finding evidence of nesting, whether that is the nest or dependent young, “suspicious” behavior in an area that could contain a nest, or repeated flushing or other encounters of a female or a pair in the same spot.

2.1.2.4 Conducting an Area Search and Creating Maps

Write the plot name, date, and start and end times on the map and any other sheet of paper on which you may be writing notes on your intensive area search visit.

The goal of our area searches is to record location of each bird detected in order to eventually map their territory. Start the surveys promptly at daybreak, within the half hour before sunrise. Your survey route must take you within 50m of every point within the plot. On each survey, walk a different route through the plot, making sure to walk the boundaries. While there is technically no time limitation on this survey, the surveyor should be able to cover the entire plot during the prime time for bird activity, early to late morning. You do not need to walk an even pace, and you can deviate from your gridlines as often as you like – just make sure that you are keeping to the 50m rule! Feel free to stay in a particular area for awhile to try to answer a question about your territories. However, the time spent at a particular spot must be balanced with the need to finish the plot by 10-11 a.m., before bird activity declines. At some point, you may need to move on without having answered your question, in order to finish the plot – however, feel free to return to that spot after the survey to clarify territory locations. A technique you may want to use is to divide your plot into sections, and decide how much time you can spend in each section; then if you decide to stay to observe in a particular area, you know when it is time to move on.

Recording Locations on the Map. For each sighting location, the number of individuals in the group needs to be recorded, including sex and age, if possible. The best evidence for nesting should also be recorded. Priority should be given to any evidence that is used to confirm breeding (e.g., carrying nest material or food to a nest, eggs, nestlings, dependent young). As a second choice, evidence of probable breeding should be recorded, but if positive nesting evidence is observed, other behaviors do not need to be recorded.

In any case, all information that may be useful in determining territory boundaries should be recorded – so, a male singing next to the nest does not need to be recorded, but a male singing at a potential territory boundary needs to be recorded. However, when in doubt, write it down!

Nests. When you find a nest, please take a GPS location nearby. Do not record the exact location unless you believe you can do so without disturbing the nest. Also, turning your back on the nest while GPSing will help reduce disturbance. Wait to write down any nest information until you are further away from the nest and are no longer inhibiting parental care. **Do not approach a known nest when nest predators or parasites are nearby, e.g., corvids or Brown-headed Cowbirds. Do not stop at the nest and do not touch the vegetation to get a better look. If you accidentally come upon a nest, continue walking in the same direction if possible rather than back-tracking, to avoid creating a dead-end scent trail at the nest.**

Simultaneous Detections. Birds often respond to other territorial birds of the same species. Sometimes they may only become active, if other territorial birds are active. Therefore, it is an important tool in area searches to listen and watch for other territorial birds while delineating one territory. For example, if you hear a singing Vermilion Flycatcher, stop, look, listen, and determine whether you can detect any other male Vermilion Flycatchers in the area, marking all locations on the map. When in the field, you will have to decide such questions as “Is that singing Vermilion Flycatcher the same as the one seen an hour ago, 70m away?” If they are, link the two observations with a solid line; if you suspect, but don’t know, that they are, link with a solid line and a question mark; if you suspect that they are two different birds, link with a dashed line and a question mark (for an exhaustive display of the symbology of territory mapping, see Appendix C).

Migrants and Flyovers. Migrants. Please do record the locations of suspected migrants on your maps. Often, you will not know for sure that they are migrants until the end of the season, when you realize that they were only on the plot briefly and didn’t show any sustained territorial behaviors. Since they do not have territories, they are not transferred over to the end-of-season territory summary datasheet. Their presence provides us with useful information about migration chronology and about important habitats and spots for migrants. Flyovers. Birds flying over the plot that are not actively using the plot do not need to be recorded on the map, but should be recorded in the notes. A typical flyover in many plots of Nevada may be a Turkey Vulture, or a Common Raven. However, if you have a nest or loafing in the plot, they are of course recorded as in the same manner as all other active users of the plot. Some “flyover” species cause some confusion with our surveyors. For instance, hummingbirds, swallows, and swifts are most commonly detected in flight, but whether they are true “flyovers” depends on whether you suspect that they actively use the plot’s resources. A good rule-of-thumb for making that decision is to call only those birds flyovers who come over the plot flying and do not land until they are again outside the plot. Birds that are doing foraging or mating flights (e.g., hummingbirds, swallows) over the plot should not be recorded as flyovers, but as active users of the plot instead. **For symbols and methods of recording behavior, see Appendix C.**

Partial Territories. Territories that are only partially inside the area search plot need special attention, since they can significantly influence our breeding density estimate. If a territorial bird spends part of its time inside and part of it outside the area search plot, the surveyor needs to delineate the territory **both inside and outside** of the area search plot boundary. This is the only way we can determine what proportion of the territory needs to be included in the final density estimate. Therefore, a buffer area around the area search plot needs to be available on your map, so you can accurately delineate territories that are partially outside the plot boundaries.

Difficult Species. Territory mapping is best-suited for territorial species that defend all areas of their activities, particularly those whose territories are with the scale of the plot. Most species you will encounter will be easily surveyed this way. Other species, such as Gambel’s and California Quail, various ducks, Mourning Dove, and various woodpeckers do not cleanly fit into these categories as they only defend a small territory around the nest site and move around their home range without necessarily indicating its boundaries to you. These are discussed in more detail in Appendix B.

2.1.3 Behavioral summary

The following is a summary of behaviors that indicate breeding that should be recorded when territory-mapping. For more information, including species-specific information, see also Appendix A.

Nest Material. Adults carrying nest material can be assumed to be building a nest in the area. It is often possible to follow the bird to the appropriate nest location. At this stage, it is important not to approach the nest itself or spend much time near it, because nest-building birds are extremely likely to abandon their effort when they are even slightly disturbed.

Carrying Food. Adults carrying food during the nesting season are usually going to a nest with nestlings, to dependent young, or to a nest with an incubating adult. It is possible to follow the bird to the nest and confirm its location this way, but regardless of the exact nest location, carrying food generally serves as positive breeding evidence. If the bird carrying food disappears into a thicket and re-appears without food, the location of that thicket will be sufficiently accurate as a nest site for our purposes. Additionally, it should be recorded if nestlings or dependent young are present, if it can be determined. It helps to listen for begging calls near the suspected nest site, as both nestlings and recently-fledged songbird young often vocalize when the adult approaches (typically, these are plaintive, high-pitch calls that resemble a Cedar Waxwing call, or at least variations thereof).

Nests. Nests can often be found by carefully examining likely locations. For instance, tree cavities should be observed to determine if the young are out and disturbance to the nest may cause the parents to abandon their young. Open cup nests can also often be found while carefully examining the vegetation and ground cover. Only those nests that can be examined quickly and without disruption of the vegetation should be approached to determine stage and content of the nest. However, for the purposes of our intensive area searches, the approximate location and estimated status of the nest without nest visitation will be perfectly sufficient. Once you have located a nest, make a point of visiting the area of the nest site at your next plot visit to see if you can determine the stage in the breeding cycle, if that was not possible before. Recently fledged young are usually easier to find than the nest, and disturbance is less of an issue at that stage in parental care.

Dependent Young. In this protocol, we often refer to dependent young and/or recently fledged young. The two terms are technically not synonymous, although in many cases during area searches, the difference doesn't matter much. What we are after for area searches is the notion of dependent young, because dependent young are still found close to their nest site and still depend on their parents for being fed, or to have food pointed out to them. At about 10 days after fledging, most songbird young can feed on their own, and the family groups break down their territory and start moving around a much larger area than where they nested. At this time, the surveyor will find family groups with pretty independent young that suddenly appear in the area search plot, even though they didn't nest there. Therefore, make sure to determine based on behavior of the young whether these are still fully dependent in a sense that they are not mobile

enough to forage on their own, nor have likely wandered far from the nest site. If they are more independent than that, they should be designated as a “family group” in the records, not as evidence of a territory. Note also that most family groups stay together for a long time after the young become independent in a sense that, if left to their own devices, the young would survive on their own, but they still like to hang around their siblings while wandering around. The reason we make that distinction is that dependent young typically stay within the vicinity of the nest sites, while the “older” family groups start to wander into other areas. With ducks, quail, grouse, and waterbirds, the brood consists of dependent young when they cannot yet fly and still fully depend on the hen to lead them to foraging areas. For these, the brood locations are as important to us as are nest locations.

Paired Adults. Paired adults often indicate a breeding territory if they persist as a pair in the same location for multiple visits, so nesting (or a nesting attempt) must be confirmed during subsequent visits. Some species pair up and even set up temporary territories during migration, so having a “mated pair” along during a single visit is not sufficient to confirm local nesting. Regardless, copulations and mate guarding (see below) are strong suggestions that nesting is about to happen and should therefore be noted.

Nest Guarding, Mate Guarding, and Territorial Displays. Nest guarding consists of repeated calling and reluctance of a bird to leave, particularly in the presence of the observer. Birds usually only do that when the observer is standing near their nest, nestlings, or recently-fledged young. Mate guarding is a little harder to discern, but becomes obvious to the trained observer after careful observation: during the egg laying period, the male continuously follows the foraging female in very close proximity (usually less than 10 ft) and appears entirely pre-occupied with this activity for long periods of time, rather than foraging himself. Territorial displays are usually carried out by males of the same species who occupy adjacent territories. The display involves an aggressive dispute at the respective territory boundaries, including furious vocalizations toward each other (calls, repeated singing) and sometimes physical aggression between the two birds. This is a particularly useful behavior for delineating territory boundaries of two neighbors. Specific agonistic behaviors can range from excited alarm calling, chases, wing-spread displays, to physical disputes (e.g., grabbing each other with their feet). After the dispute, the two males usually retreat into their respective territories and observe each other for awhile before resuming other activities.

Singing Males. Singing does not by itself indicate the presence of a territory, but it is used to advertise territories, and must be recorded on the map. Please make sure to differentiate between territorial singing (or equivalent noise-making, such as drumming in woodpeckers, trilling flight displays of hummingbirds, or winnowing by snipes), and calling. “Singing” refers to the long-distance advertisement for mates and routine patrolling of territories. In songbirds, it’s usually easy, because they tend to have the long melodic (e.g., Yellow Warbler, Bell’s Vireo) song when they patrol territories, and reserve their chip calls for everything else.

Singing Females. Note that while most singing in songbirds is done by males, there are exceptions, for example grosbeaks, the “Solitary” Vireos, and some finches. The Blue Grosbeak female is well known for its song, so you may have a male and female both singing in the same territory (usually, it’s only one of them, though). With practice, it is possible to distinguish

between the male and female song, but be prepared to check out the Blue Grosbeak songs, to determine which sex is singing.

Calling. Calling, which we distinguish from singing, can be used in conjunction with other evidence to locate breeding activity. In most songbirds, and in variations in other birds, calling involves sharp, aggressive, often loud vocalizations that are in contrast to the soft, melodic, and complex songs that are used for mate attraction and territory display. In many songbirds, alarm calls involve “chip” notes or other short, barking commands to the mate or the intruder. As a general rule, birds are reluctant to leave when they are alarmed about their nest and young, so with any alarm calls you detect, immediately look around for other evidence of nesting, perhaps suitable nesting habitat being right there, the mate of the calling bird getting agitated, or the calling bird not leaving and getting more agitated as you stay. If this behavior is directed at you, back away then and observe from a distance, because the bird will want to check on the nest or fledglings after an intrusion.

2.2 *Post-survey data summaries*

2.2.1 Creating species maps

2.2.1.1 Transferring data

Immediately after each survey, transfer all locations and symbols for each species to a species-specific map; each visit will also have its own symbol to replace the species code, e.g., the first visit would be denoted by A, the second visit by B (see Appendix for examples). As the surveys continue, a clearer picture will form about their territories. Take great care when transferring data, that the data are transferred correctly, and that no data are missed. Marking the transferred data on the original map is recommended, either by using a highlighter, or writing over the original penciled location in pen. The purpose of transferring data is to allow you to focus on areas of the plot where you are uncertain about territory boundaries, the number of territories, or whether or not there may be other species present. Over the period of the 8-10 visits, we aim to use the cumulative knowledge from all previous visits to ferret out all nesting and home range activity that is taking place on the plot, so use the previous visits to determine where in the plot you need more time to get count of all birds present.

2.2.1.2 Determining where future attention needs to be paid

It is crucial that we know how many territories, and partial territories, are within the area search plot. Estimating that there are 2-3 territories of Phainopeplas, for example, is not acceptable. If you don't know how many territories there are, more time needs to be spent on the plot to find out whether it's 2 or 3, or 2 and a partial one. Before each survey, examine your species-specific maps, and determine where you need to spend more effort.

2.2.2 Filling in survey datasheet

On each datasheet, fill in the plot name, the UTM (and datum) of one of the corners, the year, and the surveyor's name. After each survey, fill in the date and the data in the appropriate column for that visit on the survey datasheet. In the first column, write out the full name of the species. In the second, assign a number to the territory or individual of that species (e.g., the first Yellow Warbler male would be assigned YWAR1, the second Yellow Warbler pair detected would be assigned YWAR2). Each territory has its own row. For common species, it is recommended that each species be given its own page, to avoid having to flip between pages trying to find all your Yellow Warbler territories. In the subsequent 10 columns (arranged and labeled by survey date), describe in a word or two the most critical information you observed for each territory on that visit (see Section 2.1.3 Behavioral Summary, and the prompts at the bottom of the datasheet). Feel free to write more detailed notes on territories on a separate sheet of paper, and attach to datasheet. In the second to last column, estimate the proportion of the territory located within the area search plot (i.e., 0.1-1.0). In the final column, note whether the nest or territory center is located inside or outside the area search plot. Often, territories are asymmetrical, with nests located away from the geometric center of the territory; however, if the nest is not found, use the center of the territory as the basis for calling it inside or outside of the plot.

2.3 End-of-season analysis

2.3.1 Finalizing the territory map

At the end of the field season, it is time to go through each species map and draw the final polygon that will represent each territory you found for that species. Note that territories may shift somewhat over the course of your surveys, particularly if the territory-holders reneest. In this case, consider it to be the same territory for the purposes of the summary, though on the map, if it is possible to draw polygons for the early and later territories, please do so – this will give us more accurate territory size information for some of our analyses. If it is not possible to distinguish between early and late territories for that pair, then simply drawing boundaries for one territory is fine.

The following criteria can be used to delineate territories:

- (1) locations of confirmed active nest sites, nestlings, or dependent young need to be recorded as part of a territory, if their location can be determined. If territorial behavior has not been observed sufficiently to delineate clear territory boundaries beyond the nest site, then the locations of 90% of sightings of attending adults provides the approximate area of the territory/home range for that pair.
- (2) in the absence of direct breeding evidence, at least three detections of the birds on the same territory on separate visits (eight visits total) are necessary to determine probable breeding in the delineated area, OR at least four detections of the birds on the same territory on separate visits (nine or more visits total)

- (3) in the absence of direct breeding evidence, the first and last records in a cluster must be at least 10 days apart (to avoid including migrants that might stay to refuel for more than a few days)

Note that there may occasionally be the detection of another individual in a cluster that clearly does not belong to that pair. Be careful to indicate it as such, rather than trying to subdivide a territory into two, or otherwise changing the observed territory boundaries. It does happen occasionally that migrants or neighbors transgress territory boundaries. If you have evidence that that has happened during a visit, then treat it as the exception to the rule rather than re-delineating territories. If two clusters of sighting locations are close together, it is important that you spent enough time during the area searches to determine whether one or two territories are represented in the cluster of detections.

2.3.1.1 How to deal with partial territories.

Some territories will be located at the plot boundary, with part of the territory located outside of the plot. To the best of your ability, indicate what proportion of the territory is located within the area search plot, and also where the nest or geometric center of the territory is located.

2.3.2 Filling in end-of-season summary

At the end of the field season, complete the intensive area search summary sheet. Fill in the plot name, the year, the UTMS of the plot corner, and the surveyor name. Each species detected on the plot (including migrants) is recorded. If the species had territories on the plot, indicate how many territories, including partial territories (e.g., if there was 1 complete territory, 0.3 of a second territory, and 0.7 of a third territory, enter 2.0 territories); if breeding information was detected, then calculate incubation peak to the best of your ability (see Appendix D). For migrants coming through the plot, record the species, and the peak date on which they were seen. You may find that you had migrant individuals of a species that also breeds in the plot, in which case, please indicate the peak date for these “extra” individuals. Please note that more than one date for incubation peak is possible, particularly for species that readily re-nest or double-brood.

3 Where do the data go from here?

Now that these area search data are collected, they will be used in several ways.

Double-sampling to estimate population densities. These intensive area search data form the best approximation we can generate to the true density of the birds breeding on the plot. By comparing this information to the results of our rapid surveys on the same area, whether those be point counts or rapid area searches, we can begin to estimate detection probabilities for the bird species located on that plot, and apply those probabilities to those same species in similar habitats. With these population density estimates in hand, we can compare them to density estimates generated by other means (e.g., removal modeling, DISTANCE sampling, double

observer surveys), thereby gaining a clearer picture of that species in the habitats surveyed, and greater confidence in our estimates.

Natural history information. The area search data provide breeding information for Nevada's birds, including nesting/incubation/hatching/fledging dates, parasitism rates, territory sizes, incidences of re-nesting and double-brooding, among other variables. Moreover, with habitat assessments completed on these sites, we are able to better understand the habitat features important to these species, and improve our ability to manage for them.

Assessing project goals. Many of our area search data are collected on specific sites of conservation interest, such as The Nature Conservancy's McCarran Ranch and the Southern Nevada Water Authority's Warm Springs Preserve. Data collection on these type of sites is geared towards specific management goals, and only secondarily is for the derivation of detection probabilities. For example, McCarran Ranch is undergoing habitat restoration, including raising the river bed and restoring a meandering channel pattern, active plantings of native trees and shrubs, and the construction or enhancement of floodplain wetlands. In combination, these activities should result in greater riparian woodland cover, more diverse tree and shrub stands, increased availability of wetlands, and therefore increased resources for both breeding birds and migrant bird populations. By mapping territories on the restoration site before and after restoration, we are able to document whether these habitat changes do truly lead to an increase in bird use of the site, and tie that use to specific habitat features. Both of these results will then aid the land managers in designing and implementing future habitat restoration projects.

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Appendix A: Behavioral Cues

Locating Nests

- Follow flights of individuals carrying nesting material or food to the nest, or fecal sacs from the nest
- Hang out in open areas with good view of territory
- Use different paths across the plot on each visit
- DO NOT APPROACH NEST TOO CLOSELY
- If an egg-laying female detects a predator in the area (such as an observer), she will sometimes check the nest by looking down at it repeatedly – so watch for females staying in an area without actively feeding (Martin and Geupel 1993)
- Watch for copulations, which often occur near the nest.
- During incubation, females start moving very fast when they are foraging; if you see this, then you will be able to follow the female back to the nest; on average, females are off the nest 6-10 min. Often the female will give a chip note on the nest, or just after leaving it (Martin and Geupel 1993).

Species-Specific Behaviors & Life History Information

The following species-specific behaviors and life history information are from multiple sources, particularly from the Birds of North American species accounts. For more information, see <http://bna.birds.cornell.edu/BNA>.

Abert's Towhee

- Territory (0.9) 1.5-2 ha (in optimum habitat) occupied year-round by permanent monogamous pairs (Tweit and Finch 1994)
- Female builds nest ~1 week (Tweit and Finch 1994)
- Nest primarily April – July (Tweit and Finch 1994)
- Nest in shrubs and trees, usually 1.5-2.2m high, particularly preferring to nest in mistletoe clumps (Tweit and Finch 1994)
- 1 egg laid/day; incubation by female starts after lay first egg; 14d; asynchronous hatching
- young can walk at 10d, leave nest at 12-13d – leave on foot, don't fly until ~1 week post-fledging (Tweit and Finch 1994)
- frequent fights with other pairs/individuals at territory boundaries (Tweit and Finch 1994)
- threat display: body feathers ruffled, head retracted, scapulars raised, tail spread (Tweit and Finch 1994)
- male marks boundaries with territory calls, males are visibly aggressive defending snags and areas around them (Tweit and Finch 1994)

Bell's Vireo

- Nest building 4-5d, (Brown 1993)
- Egg-laying 4d, begins 1-2d after nest completion, 1 egg/day (April/May) (Brown 1993)
- Incubation 14d, fledge 10-12d post-hatch (Brown 1993)
- Nests suspended from small lateral/terminal forks of low hanging branches, 0.5-1.5m above ground (0.2-8.0m) (Brown 1993)
- Both sexes incubate, F more than M; when exchange incubation duty (Brown 1993)
 - When F incubates, M sings several times as approach nest, F responds with several calls; M lands in nest tree, sings several times, F calls, then flies from nest; M moves to nest, inspects, and begins incubating. Incubating males sing from nest. (Brown 1993)
- Nestling eyes open 5d, feathers emerge rapidly after 7d, hopping to nest rim begins 9d, (Brown 1993)
- Fecal sacs eaten for first 5d, then carried away (Brown 1993)
- Adults feed fledglings 20d (and perhaps up to 30d) post-fledge (Brown 1993)
- 4 (3-5) eggs/clutch (Brown 1993)

Blue Grosbeak

- territory size during nest building and incubation larger (~6ha) than during nestling stage (~5ha) (White 1998)
- First eggs in CA mid Apr to mid July; double-brooding common in southern portion of range (White 1998)
- Nest
 - Usually low in small trees/shrubs/vines, 15 cm-7.8m (Ingold 1993)
 - Incubation by female, ~11-12d (Ingold 1993)
 - 1 egg laid/day, clutch ~4d (3-5) (Ingold 1993)
 - Hatching over 2d
 - Female provides most food for young (Ingold 1993)
 - Young fledge 9-13d after hatch (White 1998)

Gila Woodpecker

- General habitats include saguaro desert, riparian woodland, and residential areas; prefers cottonwood-dominated habitat along lower Colorado River (Edwards and Schnell 2000)
- Some nests in honey and screwbean mesquites in LCR; also in saguaros (nest holes in saguaros frequently near top of cactus; can cause eventual death of saguaros) (Edwards and Schnell 2000)
- Territory sizes in washes approximately 4.5 ha; in open desert area, approximately 10ha; during pre-nesting period will defend area 40-50m from nest from Gilded Flickers, other Gilas, and European Starlings (Edwards and Schnell 2000)

Gilded Flicker

- Excavates nests primarily in cactus, especially saguaro, but also in cottonwoods and willows in riparian woodlands. (Moore 1995)
- Arizona, 19 of 27 occupied nests were found in Apr, 11 with eggs, 8 with young; 11 Apr earliest complete clutch (Moore 1995)
- breeding pair defends its nest tree and immediate surroundings with Long-calling, drumming, displays, and Wicka dances, but once incubation begins, other pairs can establish nests within previously defended boundaries (Moore 1995)

Gray Vireo

- Nest building 1-2d after pair formation; 5-6 d to complete nest (Barlow et al 1999)
- 4 eggs/clutch; eggs laid 1/day; incubation 12-14d, nestlings fledge 13-14d post-hatch; young may move as much as 15m from nest on 2nd day post-fledge; parents usu care for fledglings within 15-20m of nest for 5-10d postfledge; after 10d postfledge, tail and primaries nearly adult-length (Barlow et al 1999)
- nests often in W or N-facing tree forks, hangs from terminal or lateral fork of small branch, 2m (1.3-3.4m) high (Barlow et al 1999)
- both parents incubate; M sings occasionally on nest; F sings 1-3 syllable songs from nest (Barlow et al 1999)
- 5-6d post-hatch eyes start to open, nestlings show feather emergence (Barlow et al 1999)
- both parents feed young (Barlow et al 1999)

Phainopepla

- Nest records Feb through early June (Chu and Walsberg 1999)
- Nest 2-5 (14)m above ground on 5-10cm wide branch of tree usu in fork, on horizontal branch, or within mistletoe clump (Chu and Walsberg 1999)
- Nest building 4d-3weeks
- Clutch 2 (2-4) eggs, 1 egg laid/day (Chu and Walsberg 1999)
- Incubation 14d (Chu and Walsberg 1999)
- Eggs incubated almost continuously; incoming parent may give Kuk-kuk call as it returns to nest to replace current other parent on nest (Chu and Walsberg 1999)
- Eggs hatch over 2-3d
- Brooding continuous until 4d post-hatch, when declines (Chu and Walsberg 1999)
- At 14-19d young may leave nest briefly, but leave for good ~20d; fledglings move in family group with parents for at least 1 week (Chu and Walsberg 1999)

Summer Tanager

- Courtship usually accompanied by males singing and calling and frequently chasing females
- Nest
 - Nest-building 2-4 weeks after arrival in spring (Robinson 1996)
 - Egg-laying immediately after nest built; 1 egg/day (mid-May – mid-July),
 - Incubation 12 d; nestling period 8-10d; fledglings attended by adults 2-4 weeks post-fledge (Robinson 1996)
 - Nest height variable (1.3 – 22+) (Robinson 1996)
 - Female builds nest (Robinson 1996)
 - (2) 3-4 (5) eggs/clutch; 1 egg/d laid (Robinson 1996)
 - In some pairs, F fed by M at/near nest during incubation; M approaches nest with food, gives pi-tuk call; female may leave nest to beg for food (Robinson 1996)
 - By day 3, nestlings can raise heads to rim of nest, by day 6 quick-developers may be able to move to edge of nest, by day 10, young capable of short fluttery flights (Robinson 1996)
 - Fed by parents at least 3 wks post-fledge (Robinson 1996)

Vermilion Flycatcher

- Males typically arrive a few days to a week prior to females (Wolf and Jones 2000)
- Nest-site selection begins just after pair formation; nest building early April through late May (Wolf and Jones 2000)
- Displays
 - Nest-Site-Showing Display
 - Male flies to potential nest site, crouches in horizontal fork, makes slight nest-forming movements while giving Chatter Call and fluttering wings close above back in small-amplitude movements. Display in several potential sites, repeated displays in preferred site. Female often ignores displaying male, but may join him at potential nest sites and crouch next to him. Female replaces male at nest site, and both birds crouch next to one another, displaying. (Wolf and Jones 2000)
- Nests usually in trees, including willow, mesquite and cottonwood; usually placed into horizontal fork of branch, where free of leaves (Wolf and Jones 2000)
 - Nest heights usually 2.4-6 (18)m, with height varying by tree species
 - Generally built by female (Wolf and Jones 2000)
 - Incubation period 13-15 days, by female, who stayed on nest 1-43 min, leave nest for 1-13 min (male feeds female; occasional copulation on nest) (Wolf and Jones 2000)
 - Nestlings' eyes start to open at 4d
 - Female broods young; male feeds female. Attentive periods 0.3-39min, off nest 1-26min
 - Both sexes remove fecal sacs (Wolf and Jones 2000)
 - Young fledged 14-16 d after hatching (Wolf and Jones 2000)

Willow Flycatcher

- NOTE: in southern Nevada and the Lower Colorado River, the Willow Flycatchers breeding there will be southwestern Willow Flycatchers, which are listed under the Endangered Species Act. Do NOT disturb them or their nests!
- Territory sizes vary; most within 0.3-1.8ha (Sedgwick 2000)
- Vigorous chases during courtship and territorial establishment (Sedgwick 2000)
- Nest-building in soCal mid-late May – s. Sierra Nevada, earliest eggs 25 May, latest 29 July, earliest fledge 26 June latest 27 August (Sedgwick 2000)
- Female builds nest, often low in shrubs/small trees, near water (Sedgwick 2000)
- Nest construction 36h to 5-7d (Sedgwick 2000)
- Clutch size 3-4 (5) eggs (Sedgwick 2000)
- 1 egg laid/day; often 1 day skipped, so 4-egg clutch in 5 days (Sedgwick 2000)
- Incubation 13-15 d (Sedgwick 2000)
- Nestling stage 13-16 d (Sedgwick 2000)

Yellow Warbler

- Wet, deciduous thickets (especially willow), and in disturbed/early successional habitats (Lowther et al 1999)
- Nest built in upright fork of shrub or tree, at variable heights (Lowther et al 1999)
- Territories dynamic, overlapping and boundary shifts do occur (Lowther et al 1999)
- Utah: territory size 0.14 ha (range 0.05–0.29) (Lowther et al 1999)

Appendix B: Dealing with Difficult Species

Colonial Nesters (for example, **Red-winged and Yellow-headed Blackbirds, Cliff Swallows, Bank Swallows, White-throated Swifts**). If there is a large colony on the plot, it may be too hard to keep track of and map individuals. If so, map the colony boundary, then count the number of individuals/males/nests within that boundary as accurately as possible. If the plot is clearly part of the home range of a colony, e.g., a river with dozens of Cliff Swallows foraging on the plot, then try to obtain the best one-time estimate of the colony that is using the plot. To avoid double-counting, always conduct such flock size estimates only once during each visit.

Gambel's and California Quail. We want both accurate locations and an accurate count of individuals. You will probably hear the male vocalizing before you see the quail themselves. Mark the location of the males on your map as accurately as possible. As you make your way over to their area of the plot, take the time to try to find the cover and count the individuals. Don't worry about multiple locations for the quail – they are not really territorial – just record the first location you find/hear them and get an accurate count. Note that you may have multiple coveys in your plot. While it will be difficult, do your best to record all of the coveys, without double-counting! Remember, however, that both sexes of (for example) Gambel's Quail vocalize -- The Location (or Assembly) Call, probably the most common call, is a 3- or 4-note *ka-KAA-ka-ka*, with emphasis on the second syllable, used by birds separated from their mate or other covey members, and may be heard throughout the day, particularly in the morning and late afternoon. The *kaa* or *cow* call, given only by the male, is given during the breeding season, advertising his availability (usually) from an elevated perch, such as shrub, tree, or fencepost (Brown et al 1998).

House Finch. House Finches are not territorial, but the males will mate-guard, and male singing (particularly the songs including the buzz syllable, usually at the end of the song) is advertising to females, not to other males. They also range widely. Mapping House Finch locations is straightforward, but drawing a territory at the end of the field season, may require finding a potential nest site, so for species such as this, keeping an eye out for a nest is worthwhile.

Colonial swallows. See Colonial Nesters and House Finch accounts, above. Note that (for example) Cliff Swallows are foraging over your plot, and examine potential nesting habitat (e.g., cliffs, buildings, bridges, culverts) for active nests. If there are no active nests on your plot, do not worry about mapping anything, just record the one-time foraging flock size estimate, if there is a foraging flock on the plot. Tree Swallows, on the other hand, are not colonial (though several pairs may nest close together if available cavities are clustered), and will frequently perch near their nest cavity, and mapping them is much more simple.

Appendix C: Symbology

(VEFL) singing Vermilion Flycatcher

2VEFL 2 male Vermilion Flycatchers in territorial dispute

ABTO calling Abert's Towhee

ABTO Abert's Towhee vocalizing (not song) w likely territorial/reproductive significance

* YWAR Yellow Warbler Nest

* BTHU_{on} Broad-tailed Hummingbird Female on nest

— BUOR_fmat —> Bullock's Oriole female flying with nest material

— BUOR_ofd —> Bullock's Oriole male flying with food

(YWAR) —> YWAR_f Yellow Warbler male (singing) flies to female

(SOSP) — SOSP singing song sparrow — same individual detected in 2 locations

(SOSP) — pair? — SOSP singing Song Sparrow & 2nd Song Sparrow — possible pair

SOSP — ? — SOSP possibly same Song Sparrow in 2 locations

(SOSP) - - - - - (SOSP) 2 separate singing ♂ Song Sparrows

(YWAR) - - - ? - - - YWAR_o 2 Yellow Warbler male detections, 1 singing, suspect different individuals

VEFL_f 2 juv Vermilion Flycatcher female with 2 juveniles

2 VEFL_f 2 Vermilion Flycatcher pairs

Symbology based on Bibby et al. 1992.

Appendix D: Incubation peak

Incubation peak is the period when the majority of territories have females and/or males on the nest incubating eggs. There may be more than one peak, when observing species that readily re-nest and/or double-brood. If nests are located and eggs are being incubated, that date can be used. If nestlings or fledglings are found, then calculate the estimated incubation period by working backwards with the average incubation period and fledging period. E.g., if you find 3 newly-fledged (within a day or two) juveniles on June 22, and the time between hatch and fledging is 20 days, and the incubation period is 12 days, to calculate the date you would use for this nest you would work backwards from June 22, using 2 days fledged, 20 day nestling period, and 6 days of incubation, resulting in May 25. If for this species you had incubation dates of May 20, May 25, May 27, June 20, June 22, then the incubation peaks that you would record on your form would be May 24 and June 21, to correspond with the 2 peaks.

The following table contains information on incubation, nestling, and fledgling periods for use in calculating incubation peaks for some of our more common and/or focal species.

Species	Nest Construction (days)	Egg-laying (1d/egg)	Incubation (days)	Nestling Stage (days)	Comments
Abert's Towhee	7	1 (1d/egg)	14d	12-13	Incubation starts after lay first egg. Asynchronous hatch. Young can walk at 10d; leave nest on foot 12-13d post-hatch; don't usually fly until ~1 week after leave nest.
Bell's Vireo	4-5	4d (1d/egg)	14d	10-12	Adults feed fledglings 20 (-30?) d post-fledging
Blue Grosbeak		~4 (1d/egg)	11-12	9-13	
Gila Woodpecker			~13d	~28d	
Gilded Flicker	15 (11-20d)	3-13 (1d/egg)	11d	~24 (21-27)	Fledglings nearly independent ~2wks post-fledging
Gray Vireo	5-6	4 (1d/egg)	12-14	13-14	Parents usually care for fledglings within 15-20m of nest for 5-10d post-fledging 5-6d post-hatch, eyes start to open, nestlings show feather emergence
Phainopepla	4 days – 3 weeks	2 (2-4) (1d/egg)	14	~20d	At 14-19d young may leave nest briefly, but leave for good ~20d; fledglings move in family group with parents for at least 1 week Hatch over 2-3d

Species	Nest Construction (days)	Egg-laying	Incubation (days)	Nestling Stage (days)	Comments
Summer Tanager		3-4 (1d/egg)	12	8-10	By day 3, nestlings can raise heads to rim of nest, by day 6 quick-developers may be able to move to edge of nest, by day 10, young capable of short fluttery flights Fledglings fed at least 3 weeks after leaving nest
Vermilion Flycatcher			13-15	14-16	Nestlings' eyes open at ~4 days
Willow Flycatcher	2-7d	~5d	13-15d	13-16d	1 egg/day, often 1 day skipped so 4 eggs in 5 days (clutch 3-4(5))
Yellow Warbler	~4d	3-4?	11d	8-10d	Clutch size varies by latitude; hatching spread over 36-50h; young still with adults 17 (21?) d after leave nest

Appendix E: Area Search Point Counts (Nevada Bird Count)

A surveyor other than the person doing the area searches is needed to do the double-sampling that allows us to estimate how much is missed during a typical point count. For this, the second surveyor visits the area search plot without receiving any previous information about the birds on the plot. He/she then conducts a point count according to the GBBO protocol with the following small modifications:

- Only birds inside the area search plot are of real interest to us. Therefore, the point count data need to **clearly indicate which birds were seen inside the plot versus outside.** Point count methods are otherwise exactly the same as described in the GBBO point count protocol.
- **In this case (and only in this case!), it is o.k. to have overlapping point count plots.** In other words, after completing the first point count, the surveyor moves on to another spot within the area search plot, regardless of how far from the previous point count it is. This new point is simply another sample of the area search plot, so the surveyor should go ahead and count all the birds, even if some of them have already been counted at the previous point.
- The surveyor should conduct at least **5 or 6 point counts** this way within the boundaries of the area search plot.
- To further check how well point counts represent the true density of birds, this point count exercise within the area search plot may be done 2-3 times over the season and by different point count surveyors.

Appendix F: Rapid Area Searches (Lower Colorado River Project surveys, 2009)

The goal in a rapid area search is to record all birds in the plot during the survey time, to record approximate territory locations of high-priority species, but to otherwise focus entirely on obtaining an accurate count of all birds present on the plot. Flyovers (i.e., birds that are not observed landing in the plot) are recorded separately from birds using the plot (for breeding, foraging, and loafing). All surveys are done in fair weather conditions from sunrise until the entire plot has been surveyed (not to extend past 12 noon). Surveyors will spend each visit scouring the plot (passing within 50 m of every point within the plot) to record all birds. Generally, the methods for recording birds during a visit are the same as they are for the intensive area searches, with the following exceptions.

There are two main differences between intensive and rapid area searches:

1. Rapid area searches are done only twice per season- once in the first half and once in the second half (intensive area searches are done once a week for 8 weeks throughout the season).
2. In rapid area searches, we do not generate territory maps for all the species in the plot, only for the six covered species of the Lower Colorado River project. For all other species, we determine the number of breeding pairs in the plot. We still record all individuals' locations on the grid map or aerial photo, and we determine during each visit, whether their territories should be counted as being in or out of the plot.
3. We *will* map the territories of the covered species (Yellow Warbler, Bell's Vireo, Summer Tanager, Gila Woodpecker, Gilded Flicker, Vermilion Flycatcher) as best we can in two visits. This information will be used in collecting habitat data for the covered species.

So, the basic data that are collected in a rapid area search include the following:

- We need to determine during each visit, to the best of our abilities, if birds are using the plot for breeding or if they are just passing through (e.g. migrants, fly-overs, independent young, etc.)
- When recording data, it is critical to indicate on the data sheets presumed breeders as opposed to presumed non-breeders. The counts of breeders will later be compared to the counts on the intensively surveyed plots to create our detection ratios in the analysis.
- Therefore, it is very important to distinguish males, females, and juveniles to the extent possible, and to record this information thoroughly. We want to avoid "unknown" birds as much as possible since it is unclear if these are breeders or not.
- It will be challenging in some cases to determine during rapid area searches, whether birds are breeding. Early in the season we expect birds to be singing and to be mated. If a bird is not exhibiting any clear breeding behavior, but it is a known breeder in the area, spend a little more time to see if breeding behaviors become evident.
- Many migrants will be present the first half of the season. Know which species are known breeders and which are only known as migrants. Don't spend time with known

migrants, just record their presence and move on to the next bird. Similarly, record fly-overs quickly and move on.

- One of the trickiest birds for this is the Yellow Warbler. YWARs breed on the LCR and as far north as the arctic, so birds we see may be migrants or they may be local breeders. Spend extra time with these birds if they are not exhibiting breeding behavior to try to determine if they are staying or migrating. If they are eating non-stop and with a flock of migrants, then they are likely migrant individuals that will move on rather than nest. Take lots of notes on the individuals that you are unsure about, and after the survey discuss the details with your crew leader.

If LCR MSCP covered species are found, surveyors will map their locations and make a rough estimate of their territories and nest locations based on their visit. Any breeding activity will be recorded using the codes established for LCR, which allow us to distinguish breeding evidence by phase of the breeding cycle and reliability. In addition, males, females, juveniles, and group sizes will be explicitly recorded.

Territories on the edge:

As with intensive area searches, locations of the birds using the edge of the plot or moving between the outside and inside of the plot need to be mapped to prevent double-counting and to provide accurate density estimates. **These partial territories near the plot boundary need special attention, since they can significantly influence our breeding density estimate.** If an individual is using the plot edge or moving on and off the plot, two methods will be used to determine if the bird should be counted “in” the plot on the rapid survey summary sheet. If the individual has a nest on the plot (that you can find or pinpoint the general location, like “in this mesquite or that tamarisk thicket), then it is “in”. Second, the surveyor will mark on the map the locations where the bird is observed by plotting all the singing and other locations where the individual is seen on that morning. Next, the surveyor will connect the dots to form a loose territory and determine the centroid. Finally, if the centroid of the individual’s established territory is in the plot, and then the bird is counted as “in.”

Many species have territories smaller than a few hectares. So, with our current plot sizes (~9ha), many territories will clearly be within the plot. Remember, it is important to spend more time with the edge birds since counting these birds in or out of the plot can significantly influence our estimates to be too high or too low.

Appendix G: Territory mapping when GIS & aerial photos are unavailable

Ease of obtaining reliable density data with an area search/spot-mapping effort is largely determined by the availability of adequate maps of the plot. In our experience, it is most practical to use high-quality aerial photography, preferably geo-referenced, for the area search plot. If possible, printouts of aerial photographs of the plot surrounded by a superimposed UTM grid frame, are ideal. However, other maps, such as detailed vegetation or wetland maps can also be used. Therefore, the protocol can be divided into two scenarios:

Area searches using high-quality aerial photography or other maps, or
Area searches when high-quality aerial photography is not available.

If high-quality aerial photography is available, the section of aerial photography for the intensive site should be printed out and overlaid with a transparency or tracing paper, so the surveyor can delineate a survey plot on the photo and in the field (we typically use surveyor's flagging tape, but permanent markers may be more appropriate for multi-year projects). The layout of the survey plot needs to be simple to avoid confusion about plot boundaries during surveys. It is critical that a surveyor can be completely certain where the plot boundaries are at all times during a survey, so enough markers should be used that at least two of them can be seen in the field from the surveyor's vantage point. The plot boundaries and prominent landmarks, such as free-standing trees, snags, fenceposts, or boulders, also need to be recorded with a handheld GPS unit, if they are not visible on the aerial photo (see plot summary sheet).

Appendix H: Examples of filled-in datasheets

1. Plot setup sheet
2. Survey map
3. Species map
4. Survey datasheet
5. End-of-season summary

Area Search Plot Set-Up Sheet (remit to GBBO, 1755 E. Plumb Ln #256, Reno, NV 89502)

Plot Name: LR-Example

Surveyor Name: J. Ballard Set-up Date: 5/10/09

Primary Habitat Type: Lowland Riparian Ownership: PRIVATE

Plot Boundary (record UTMx around the entire plot; use NAD27 as a map datum):

UTMx <u>555800</u>	UTMy <u>4555450</u>
UTMx <u>555500</u>	UTMy <u>4555450</u>
UTMx <u>555800</u>	UTMy <u>4555150</u>
UTMx <u>555500</u>	UTMy <u>4555150</u>
UTMx <u>555767</u>	UTMy <u>4555272</u>
UTMx <u>555745</u>	UTMy <u>4555295</u>
UTMx <u>555771</u>	UTMy <u>4555306</u>
UTMx <u>555800</u>	UTMy <u>4555321</u>
UTMx _____	UTMy _____
UTMx _____	UTMy _____
UTMx _____	UTMy _____
UTMx _____	UTMy _____
UTMx _____	UTMy _____
UTMx _____	UTMy _____
UTMx _____	UTMy _____
UTMx _____	UTMy _____
UTMx _____	UTMy _____
UTMx _____	UTMy _____
UTMx _____	UTMy _____

Locations of convenient landmarks inside the plot and in its immediate vicinity (e.g., prominent trees, snags, fence posts, cattle guards, nest boxes, boulders, etc.)¹

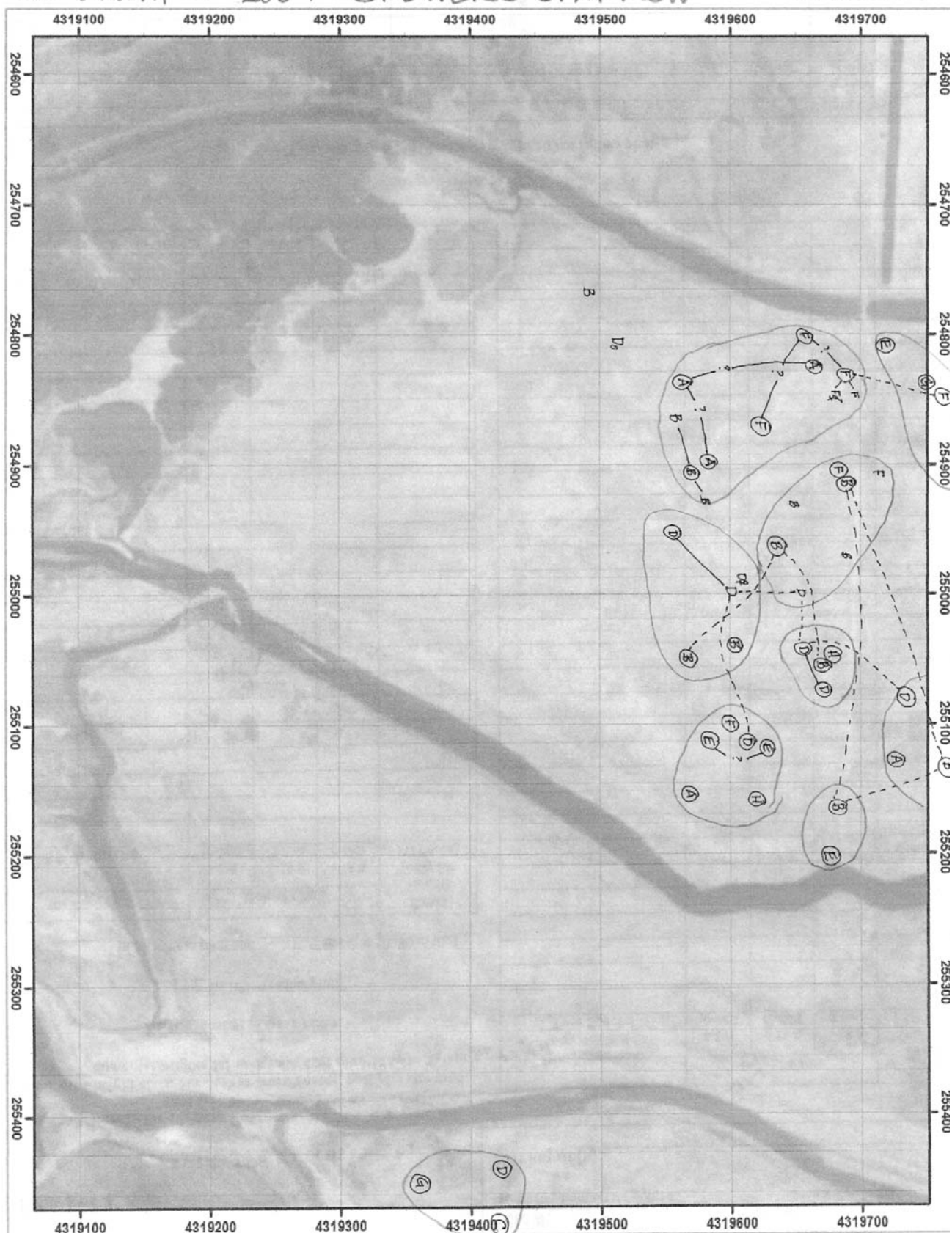
Landmark Name <u>lightning-struck cottonwood</u>	UTMx <u>555624</u>	UTMy <u>4555292</u>
Landmark Name _____	UTMx _____	UTMy _____
Landmark Name _____	UTMx _____	UTMy _____
Landmark Name _____	UTMx _____	UTMy _____
Landmark Name _____	UTMx _____	UTMy _____
Landmark Name _____	UTMx _____	UTMy _____

Flags at 50m intervals throught plot.

¹ Use back of the sheet for additional GPS locations or comments about plot set-up.

LR-Example 2009 BREWER'S SPARROW

J. Ballard



Enter number of individuals detected on each date and best evidence for nesting (remit to GBBO, 1755 E. Plumb Lane #256A, Reno, NV 89502

Datum: NAD21 Year: 2009

J. Ballard

[illegible]

construction: nest being constructed (evidence: nest material carried or construction observed)
eggs: nest being incubated (evidence: adult observed incubating eggs, or nest with eggs found)
nestings: young present in nest (evidence: food carried to nest, fecal sacs carried away from nest, begging calls, young seen in nest)
Nidlings: dependent young present outside a nest (evidence: young begging from adults, downy plumage, short tail, difficulty flying)
singing/silent: individual bird singing or observed silent, no other signs of nesting
pair: mated pair observed, no other signs of nesting

copulation/mate guarding: see protocol
nest guarding: see protocol
territorial displays: boundary disputes of males (usually), consisting of aggressive calling, singing, physical interactions between owners of adjacent territories -- excellent evidence for territory boundaries
Prrter in plot: proportion of territory within area search plot (0,1-1,0)
in/out: Is the nest or center of territory inside or outside of area search plot

[insert end-of-season summary]

Appendix I: Blank Datasheets

1. Plot setup sheet
2. Survey Datasheet
3. End-of-Season Summary