

**Rocky Mountain Bird Observatory**  
**Point Transect Protocol,**  
**Modified for Surveys in Tamarisk**



**April 2010**





# ROCKY MOUNTAIN BIRD OBSERVATORY

**Mission:** *To conserve birds and their habitats*

**Vision:** *Native bird populations are sustained in healthy ecosystems*

**Core Values:** *(Our goals for achieving our mission)*

1. **Science** *provides the foundation for effective bird conservation.*
2. **Education** *is critical to the success of bird conservation.*
3. **Stewardship** *of birds and their habitats is a shared responsibility.*

**RMBO accomplishes its mission by:**

**Partnering** *with state and federal natural resource agencies, private landowners, schools, and other nonprofits for conservation.*

**Studying** *bird responses to habitat conditions, ecological processes, and management actions to provide scientific information that guides bird conservation efforts.*

**Monitoring** *long-term trends in bird populations for our region.*

**Providing** *active, experiential, education programs that create an awareness and appreciation for birds.*

**Sharing** *the latest information in land management and bird conservation practices.*

**Developing** *voluntary, working partnerships with landowners to engage them in conservation.*

**Working** *across political and jurisdictional boundaries including, counties, states, regions, and national boundaries. Our conservation work emphasizes the Western United States, including the Great Plains, as well as Latin America.*

**Creating** *informed publics and building consensus for bird conservation needs.*

**Suggested Citation:**

Blakesley, J. A., D. J. Hanni, C. M. White, G. J. Levandoski, and J. J. Birek. 2010. Rocky Mountain Bird Observatory Point Transect Protocol, Modified for surveys in Tamarisk. Unpublished report. Rocky Mountain Bird Observatory, Brighton, CO. 37 pp.

**Cover Photos:**

Spotted Towhee by Bill Schmoker. Used with permission.

**Contact Information:**

Jennifer Blakesley    [jennifer.blakesley@rmbo.org](mailto:jennifer.blakesley@rmbo.org)  
RMBO Fort Collins Office  
230 Cherry Street  
Fort Collins, CO 80521  
970.482.1707

## **ACKNOWLEDGEMENTS**

We sincerely thank the authors of Rocky Mountain Bird Observatory's original point transect protocol (Leukering et. al. 2005): Tony Leukering, Michael Carter, Arvind Panjabi, Douglas Faulkner, and Rich Levad.

# TABLE OF CONTENTS

<b>ACKNOWLEDGEMENTS</b> .....	<b>I</b>
<b>TABLE OF CONTENTS</b> .....	<b>II</b>
<b>I. PROJECT OVERVIEW</b> .....	<b>3</b>
<b>II. TRANSECT DESIGN AND OVERVIEW</b> .....	<b>3</b>
<b>III. MATERIALS</b> .....	<b>4</b>
<b>IV. CONDUCTING THE SURVEYS</b> .....	<b>4</b>
A. POINT COUNTS.....	4
<b>IV. POTENTIAL PROBLEMS WHEN CONDUCTING POINT COUNTS</b> .....	<b>6</b>
<b>V. LITERATURE CITED</b> .....	<b>7</b>
<b>APPENDIX A. EXPLANATION OF FIELD FORMS AND DATA CODES</b> .....	<b>8</b>
I. TRANSECT DESCRIPTION SHEET .....	8
II. VEGETATION DATA SHEET .....	9
III. TAMARISK SUPPLEMENTAL VEGETATION AND BEETLE DATA .....	13
IV. BIRD DATA .....	14
IV. OTHER IMPORTANT REMINDERS .....	19
<b>APPENDIX B: LOW-DENSITY TARGET SPECIES (“88” BIRDS)</b> .....	<b>20</b>
UPPER COLORADO RIVER BASIN .....	20
<b>APPENDIX C. KEY OF 2-LETTER CODES FOR SHRUBS &amp; TREES</b> .....	<b>21</b>
<b>APPENDIX D. FOUR-LETTER BIRD CODES FOR ALL PROGRAMS</b> .....	<b>23</b>
<b>APPENDIX E. SAMPLE TRANSECT DESCRIPTION SHEET</b> .....	<b>25</b>
<b>APPENDIX F. SAMPLE VEGETATION DATA SHEET</b> .....	<b>26</b>
<b>APPENDIX G. SUPPLEMENTAL VEGETATION AND BEETLE DATA SHEET FOR SURVEYS IN TAMARISK</b> .....	<b>27</b>
<b>APPENDIX H. SAMPLE BIRD DATA SHEET</b> .....	<b>28</b>

## I. PROJECT OVERVIEW

This document is a modification of the point transect protocol used by Rocky Mountain Bird Observatory for landbird surveys conducted under a habitat-stratified sampling design. Most of the text is identical to the document: “Rocky Mountain Bird Observatory Point Transect Protocol” (Hanni et al. 2009). Where the text has been modified from Hanni et al. (2009), the font is blue, as it is here.

Rocky Mountain Bird Observatory (RMBO) in cooperation with Colorado Division of Wildlife, U.S. Forest Service, Bureau of Land Management, National Park Service, and other agencies, developed a program to monitor bird populations that utilizes point-counts along habitat-stratified transects (i.e., point transects) as the primary sampling technique. We originally designed this program for the state of Colorado, but have since employed it in Wyoming, Black Hills National Forest in South Dakota, Kaibab National Forest in Arizona, and elsewhere. The point transect portion of this program has been designed to be statistically rigorous and biologically sound, and should produce data for analyses of population trends for most diurnal, regular-breeding landbird species. This document delineates the design and operation of our point transect program. We intend this protocol to instruct our field workers on how to conduct point counts and for others to follow when establishing monitoring projects of their own, so that the design and methods are comparable.

## II. TRANSECT DESIGN AND OVERVIEW

We confined our study to the portion of the Upper Colorado River Basin that lies in Utah and Colorado. Our study area consisted of riparian vegetation along the Colorado River and its major tributaries. We defined our sampling unit as a 5-km<sup>2</sup> block.

We used ArcMap (ESRI 2005) and Google Earth (Google, Inc. 2009) software, and a digital map of vegetation cover from the Southwest Regional Gap Analysis Project (SWREGAP; Lowry et al. 2005) to characterize the study area. Landcover types we used were Invasive Southwest Riparian Woodland and Shrubland, and Rocky Mountain Lower Montane Riparian Woodland and Shrubland (Ecological System codes D04 and S093, respectively; Lowry et al. 2005). We selected 44 sampling units by the following process:

1. Using ArcMap, overlaid a 5-km<sup>2</sup> grid on the Utah and Colorado portion of the Upper Colorado River Basin.
2. Retained only grid cells that contained at least 3.5 km of the Colorado River and/or one of its major tributaries.
3. Overlaid digital maps of native and invasive woody riparian vegetation from SWREGAP.
4. Retained only grid cells that contained native and/or invasive woody riparian vegetation.
5. Categorized each grid cell with respect to whether it was inside or outside of the range of the Tamarisk Beetle in 2008.
6. Randomly selected cells within and outside of the beetle range.
7. Overlaid a grid of potential sampling points (250 m spacing) within each grid cell.
8. Overlaid randomly selected cells and their associated points on satellite imagery in Google Earth.
9. Rejected any cell that contained < 8 points in woody riparian vegetation.
10. Rejected any cell that was inaccessible by automobile and foot.
11. For retained cells, rejected sampling points not occurring in woody riparian vegetation, or, sometimes, moved sampling points  $\leq$  150 m to place them in riparian vegetation.
12. Selected the most contiguous 8-16 points within each cell for sampling.

We selected sampling locations regardless of land ownership or administration. We contacted private and tribal landowners for permission to survey on their properties and obtained necessary permits and permission to survey in National Parks and National Wildlife Refuges.

Because points within a given transect are not independent of each other, the entire transect, rather than the individual point, is the sampling unit. Observers record all avian species detected at each point. In addition, observers also record certain species of concern along the line transect in between points. We estimate detection probability using Distance sampling (Buckland et al 2001), Removal sampling (Farnsworth et al 2002) and [Occupancy modeling \(MacKenzie et al. 2002\)](#). We then use the detection probability to calculate estimate densities and [site occupancy rates](#) of species with large enough sample sizes.

### III. MATERIALS

Before heading out into the field, each technician should be sure s/he has the following (unless otherwise indicated below, RMBO will supply all materials):

- A. **Timepiece** with a countdown timer and a chime;
- B. **Binoculars** (*you must provide this*);
- C. **Declination-adjustable compass** with sighting capability (i.e., a mirror);
- D. **Clipboard** (with instruction sheets/lists attached);
- E. **Writing utensils** in case you lose one (pencil or indelible ink pen) (*3 pencils will be provided by RMBO at the start of the field season; if you lose these you must provide additional writing utensils*);
- F. **GPS unit** with point locations loaded onto it;
- G. **Rangefinder**;
- H. **Extra batteries**;
- I. **Data forms** sufficient for all the points planned that morning;
- J. **Plant ID guide**;
- K. **Master list of four-letter bird species codes**;
- L. **Master list of weather and habitat codes**, taped to the clipboard; and
- M. **Insect net** for sampling beetles.

### IV. CONDUCTING THE SURVEYS

#### A. Seasonal Timing

Point counts should be performed after all migratory species have returned to the area and after Tamarisk has leafed out. In 2010 we plan to survey each transect three times, beginning at lower elevations and latitudes. Complete one survey at each transect before beginning the second round of surveys; complete two surveys at each transect before beginning the third round of surveys.

Points must be surveyed during the time of day that songbirds are most detectable. Surveys should begin approximately ½ hour before sunrise (once there is enough light to identify birds by sight) and finished before 11am (preferably before 10am).

#### B. Point Counts

You will receive a GPS unit with all of the points for your transects pre-loaded onto it. Follow

the GPS unit to each point count station (we will practice this during training). We do not have waypoint data for some transects, so you may need to follow the bearings given on the transect description sheet to find each point. If this is the case, please record your UTM coordinates so that we will have this information for next year. Upon reaching a point, fill out the GPS accuracy and habitat data on the field forms **first**. **DO NOT begin counting until after this is done** Upon reaching a point, record and label the waypoint in the GPS unit, and fill out the GPS accuracy and habitat data on the field forms **first** (including directions to point). **Do NOT begin counting until after you have done this** (however, do identify and make a mental note of the identification and locations of any birds flushed from around the count station upon your approach). Doing this first is important for two reasons: 1) it will ensure that you do not forget to write it down, and 2) it will allow the local birds to “settle down” somewhat after the disturbance you created when approaching the point. Please see “**Appendix A: Explanation of field forms and data codes**” for more instructions on how to record habitat and bird data.

### 1. Habitat Data

Pay particular attention to filling in the squares in the habitat blocks of the data form for each of the 15 points per transect **while at each point**. We will use the habitat data to relate bird use with vegetation features and habitat type, so please be as accurate as possible in providing these data. [For surveys in Tamarisk, you will have a supplemental data sheet to record information on Tamarisk defoliation, beetle density, and plant phenology.](#)

### 2. Bird Data

After recording the general habitat data at the point count station activate your timepiece and begin counting and recording the birds you see and/or hear. **The count duration is 6 minutes**. Place a mark (draw a line between detections) on the bird datasheet between birds recorded in each one-minute interval during the 6-minute count (see “Appendix I: Sample Bird Data Sheet”). To do this, simply initiate the timer, and when you hear the first beep (at one minute), draw a line under the last bird recorded and keep recording new birds until you hear the second beep (at two minutes). Then, draw another line under the last bird recorded and continue to draw lines under the last bird detected in each one-minute interval until the 6<sup>th</sup> beep when the count at this point is over. Do NOT record any other birds after the 6 minutes are over, even if it is an “interesting” bird (you could record this bird in the notes field if you so desire). If you do not detect any birds during an interval, record **NOBI** (No Birds) in that interval. We are providing a time piece that beeps every minute and you must learn how to use it properly (we will go over this at training). Please make certain that the time piece’s beeper is on and is functioning as it is impossible to pay attention to the birds and to note how much time (by looking at your time piece) has passed at the same time. All birds detected during the 6-minute count period should be recorded using the **correct 4-letter codes** (See Appendix F for bird species codes; most are obvious, but please commit to memory those codes that are unusual and do not follow the general rules). You should also record birds flushed from the count station upon arrival (and measure their distance from the point), because we assume that these birds would have remained at their original locations were it not for the disturbance created by the observer.

For each independently detected bird, you will record:

- 1) the **species**, using the appropriate 4-letter code,
- 2) the **distance** from you to the bird,
- 3) **how** the bird was detected (by song, call, drumming, flying over the habitat, other aural cues, or visually),
- 4) the **sex** of the bird if known (if the bird is a juvenile, put in J for sex),
- 5) the **cluster size** and **cluster ID** code for any birds that observed as part of a

cluster (i.e., non-independent detections). Please see Appendix A for further instructions on how to distinguish and record clusters.

While conducting counts, be sure to focus primarily on birds that are close to the point. While we do ask you to record all birds detected, distant birds have little effect on density estimates. However, missing close birds can have a significant effect on density estimates. Also, be sure to look and listen in all directions, including up. It is best to slowly rotate in place while you are counting; making three complete turns in the five minutes is probably adequate. **Don't forget to look up!** It is very important to stay in one place while counting. It is acceptable to take a step or two away from the point in order to identify a bird that you have detected from a point, but cannot identify from the point, but **ALWAYS** return ASAP to the point. Do NOT chase birds during the count. After the five minutes are up, you may chase down a bird that you couldn't identify on the point in order to get an identification for the point, but do not leave the point during the five minutes and do NOT record birds on the point count that were only found while chasing another bird. **Remember: Consistency of methods and coverage is the key to useful data!**

Be aware of what is going on around you and realize that you may hear or see individual birds on multiple points. It is okay to record the same bird on multiple points only if the bird has not moved from the location where you originally detected it. For example, if you see a Western Meadowlark on a powerline, and that same Western Meadowlark is visible from the next two points in the same location, you would record it on all three point counts. However, if you see a Redtailed Hawk soaring above you, and still see the hawk soaring on another point, only record this bird once.

## IV. POTENTIAL PROBLEMS WHEN CONDUCTING POINT COUNTS

### A. Window species

This is "listening through" (not detecting) a particular common species because you are habituated to it (Mourning Dove is a common window species).

### B. Look and Listen everywhere

Be sure to look up regularly, particularly in taller forest types and, particularly if you are wearing a hat. **Do not wear sunglasses or hats that can affect your hearing while counting birds!** This includes caps that pull down over your ears as well as full-brimmed hats that can deflect sound away from your ears. Be sure to look and listen in all directions (try to look and listen in all directions equally).

### C. Stand at Points

**Do not sit or kneel** as this can reduce the number of individuals recorded, by decreasing visibility, audibility and dexterity. If you are tired, take a short break after the point count. As long as you start early, you should have plenty of time to rest along the way.

### D. NO Pishing

Do not attract birds to you. Pishing is permissible after the count in order to attempt to identify an individual that was not identifiable on the count, but do not add other individuals after the count that were not first detected during the count period.

### E. Airplane (and other) Noise

If audibility of birds is reduced by mechanical noise, interrupt the count (i.e., stop your timer), and restart when the noise abates so that the total time still equals a five-minute count.

### F. Guessing

Never guess on the identity of a bird. Instead, use an unknown code (e.g. unidentified sparrow - UNSP) for those individuals about which you're not sure. However, recording a lot of unidentified birds is an indication that you need to learn/practice more before performing point counts.

### **G. Know the Area**

The day before conducting a point count transect, check out your survey area and familiarize with it so you know what to expect. Plan out an access route during the daylight the day before, that way you will be able to find your way easier if you have to hike in the dark the next morning.

### **H. Practice**

Practice in the habitat before counting for real. Be familiar with the songs and calls of all species found in a habitat before conducting point counts in that habitat. Use habitat-specific bird data queried from the RMBO Avian Data Center website ([www.rmbo.org/public/monitoring/countseffort.aspx](http://www.rmbo.org/public/monitoring/countseffort.aspx)) along with audio recordings to practice before (and during) the field season.

### **I. Weather**

Weather can always be a factor when conducting point counts. Never conduct a point count when it is raining, as birds will not be very active and visibility may be poor. Also, do not conduct a point count if the wind is strong enough to hinder your ability to hear bird calls and songs, as this will affect the number of birds you are able to detect.

## **V. LITERATURE CITED**

- Buckland, S. T., D. R. Anderson, K. P. Burnham, J. L. Laake, D. L. Borchers, and L. Thomas. 2001. Introduction to distance sampling. Oxford University Press, London, UK.
- Farnsworth, G.L., K.H. Pollock, J.D. Nichols, T.R. Simons, J.E. Hines, and J.R. Sauer. 2002. A removal model for estimating detection probabilities from point count surveys. *Auk* 119: 414-425.
- Leukering, T., M. Carter, A. Panjabi, D. Faulkner, and R. Leivad. Revised 2005. Rocky Mountain Bird Observatory Point Transect Protocol. Unpubl. document. Rocky Mountain Bird Observatory, Brighton, CO. 29 pp.
- MacKenzie, D. I., J. D. Nichols, G. B. Lachman, S. Droege, J. A. Royle, and C. A. Langtimm. 2002. Estimating site occupancy rates when detection probabilities are less than one. *Ecology* 83:2248-2255.

## APPENDIX A. EXPLANATION OF FIELD FORMS AND DATA CODES

Please refer to Appendices E, F, G, and H to view example data sheets while reading the information below.

### I. Transect Description Sheet

#### A. Observer Initials

Record your first, middle, and last initials here.

#### B. Date Conducted

Record the date the transect was conducted

#### C. Transect Accessible to

Please record how accessible the transect is (all vehicles, high-clearance, or 4WD). It is important for us to know the accessibility of each transect so that we can assign them to field technicians according to the type of vehicle they drive.

#### D. DeLorme Page

Don't forget to record the DeLorme page and coordinates the transect is on. This allows future field technicians to quickly locate the transect on the road map.

#### E. Access Point UTM's

See "H. Directions to Access Point" below.

#### F. Time Required to Survey the Transect

It is helpful to have an idea of what to expect before conducting a transect. Some transects are located on easy terrain and can be conducted relatively quickly, while others are on very difficult terrain and take a long time. Please record the amount of time it took you to conduct this transect so future field technicians can plan accordingly. If the transect required an hour hike to access it, include that time as well. **Note: If the transect is located far from a road and requires you to backpack in the day before, record how many days the transect took you to complete.** This will help future technicians to allow time for these transects.

#### G. Directions to Access Point (VERY IMPORTANT!)

We will provide you with a transect description sheet and topographic map for each transect assigned to you, as well as a road atlas for your study area. The transect description sheet will contain road-based directions on how to find each transect. If the directions are incomplete or inaccurate, please record updated directions on this sheet and enter these directions into the database later. Provide explicit directions from some nearby town, major intersection, or geographical feature readily found on a map to the access point in the space provided for directions on the transect description sheet. Provide mileages from intersections or other landmarks using your odometer. Try to locate the most logical and efficient location to access each transect. This location will become the Access Point. This point is the end goal for the directions you provide. For all sites, take GPS readings and record **UTM coordinates** for each access point. Also, **be explicit in your description about the exact location of the access point** (e.g. "the right post of the green metal gate" or "the NE corner of the cattle guard").

Be as clear and accurate as possible when recording directions. Remember, someone will use your directions next year to find these transects.

**Example:** CO-PP17 - From intersection of US 160 & US 84 E of Pagosa Springs, follow US 84 S for about 5 mi. and turn right onto FR 651 (8 Mile Mesa Road). Continue on FR 651 for 4.7 miles to a fork. Take the right fork to a lookout tower in 0.6 mile. The access point is the outhouse near the fire tower. DeLorme page 88 C2.

## H. Transect description

Provide the **distance** and **bearing** *from the access point to the first point* (do not provide bearing from first point back to the access point). Then, provide the bearing you follow to each of the remaining points along the transect. You should have bearings provided to you from previous years. If no bearings are given and you have GPS coordinates provided in your unit, please record the bearings as you go. To do this, use the “go to” function on the GPS to determine your bearing from the last point. It is important to understand that this bearing will be the inverse of the bearing you followed to reach the current point (e.g. if you traveled on a bearing of 264 degrees to reach the point, the GPS unit will tell you that the bearing to the point is 84 degrees). Try to adhere to the bearings as much as possible. In some situations, such as when you are conducting a transect in a linear habitat, it becomes more important to stay within the target habitat than it is to follow the bearings exactly. Use your best judgment in this situation, but try to follow the directions as much as possible. Always be sure to record your bearing from one point to the next, as this information is crucial to the transect aspect of the point-count transect. Feel free to provide *between-point accounts*, when necessary, describing the topography, habitat, landmarks and/or other features that you pass prior to arriving at the next count station. ***It is especially important that you record any turns, changes in bearings, or other deviations that you make from the original transect bearing.*** *As this is a long-term monitoring program, the importance of providing detailed directions/descriptions for each transect cannot be overstated!* GPS locations alone are not always sufficiently reliable as the accuracy of GPS locations can vary significantly.

## I. Notes, Updates, and Camping Information

Provide directions and a description of camping options in the area. Sometimes, camping is available right at the Access Point. If not, then record direction to where you camped and provide UTMs for that location. It is important for future field technicians to know what their camping options are before arriving at the transect. If camping is unavailable (i.e. transect is surrounded by private land) then record where you stayed.

Enter information relevant to the site, problems encountered during the transect, interesting birds seen, cool scenery, or other tidbits that either don't really fit in other places or that future surveyors might find interesting.

## II. Vegetation Data Sheet

### A. SITE DATA

1. **Observer:** Enter your first two initials *and your full last name*
2. **Date:** Enter the date in the format: MM-DD-YY
3. **GPS Unit #:** Enter the number from the RMBO silver property tag on the back of your GPS unit
4. **Transect ID:** Enter the full character code identifying the strata and number (e.g. TA-DOLI3)
5. **Access Point:** You should enter the access point in the same manner as the point

UTMs, using 00 as the point number. Mark this point in your GPS unit as well.

**6. Time:** Enter start and stop times for entire transect (not individual points) using 24-hour clock

**7. Sky:** (start and end): Enter one-digit codes at beginning and end of transect (not at points)

0=0-15% cloud cover      1=16-50% cloud cover      2=51-75% cloud cover

3=76-100% cloud cover      4=fog      6=drizzle

**You shouldn't survey in any other conditions!**

**8. Wind:** (start and end): Enter one-digit codes at beginning and end of transect

0=Less than 1 mph; smoke rises vertically

1=1-3 mph; smoke drift shows wind direction

2=4-7 mph; leaves rustle, wind is felt on face

3=8-12 mph; leaves, small twigs in constant motion; light flag extended

4=13-18 mph; raises dust, leaves, loose paper; small branches in motion

**YOU SHOULDN'T SURVEY IN ANY OTHER CONDITIONS!**

**9. Temperature:** (start and end): Use °F (if you do not have a thermometer estimate to nearest 5°)

## B. Habitat Data

Unlike the bird data, which we record to an unlimited distance from each point, we only record habitat data within a 50-m radius of each point.

### 1. Point Info

**a. Distance to road:** Enter the distance in meters for **EACH** point based on your best knowledge of the site. **You should ignore roads beyond 100m.** *For our purposes, a "road" must be substantial enough so that it either causes a significant disruption of the understory vegetation OR a break in the canopy.* For example, a grassy 2-track running through an open meadow should not be considered a road, whereas a gravel or dirt road that forms a 3 to 4-m wide break in the grass cover would be considered a road. Similarly, an old, pine needle-covered logging track in an open forest situation is not a road, whereas a logging road that causes a clear and wide break in the woody understory vegetation or in the forest canopy is a road. We will cover this topic thoroughly during the training session.

**b. Private Property:** Enter "Y" for yes and "N" for no for **EACH** point.

**c. Level of accuracy:** enter the level of accuracy that is displayed on your GPS screen (+/- X meters) when you arrive at each point. You must do this in the field at each point.

### 2. Overstory (forested habitats only)

**a. Structural stage:** At each point-count station, identify and record *the structural stage that best describes the overstory trees* within a 50-m radius of the point-count station. Please use the following scale (see Appendix C for detailed habitat specific information on structural stages):

- 1) grass-forb (i.e., no or very few overstory trees present);
- 2) shrub-seedling (i.e., generally trees below head height);
- 3) sapling-pole;
- 4) mature;
- 5) old-growth.

**b. Canopy Cover:** Estimate closure of the combined canopy trees to the nearest 10 percent within a 50-m radius of the point-count.

**c. Mean Canopy Height:** At each point-count station, estimate the *average height to the top of the canopy trees* (in meters) within a 50-m radius circle to the nearest meter. Use a rangefinder to help gauge estimates.

**d. Species Composition:** Identify the dominant tree species in the overstory and record the ***relative abundance (%)*** of the total overstory occupied by each species within a 50-m radius of each point-count station; you can list up to five species. Note that if only one tree species is present in the overstory, the relative percent should be 100%, regardless of how much of the circle the tree species occupies. Record tree species on the data form using the correct 2-letter vegetation code (see Appendix D for plant species codes). Note that Snags (SN), dead trees (DC or DD), and dead burned trees (BU) should be considered here. Estimates in increments of 10% are adequate in most situations. However, if there are only a few individuals of a certain species, use smaller percentages to accurately reflect that while being sure that the total of all species sums to 100% (i.e. DF 98%, SN 2%).

### 3. Mid-story (forested habitats only)

**Sub-canopy species:** You should only fill out this section if, ***and only if***, there is a *distinct* sub-canopy comprised of individual trees different from those making up the overstory. Enter up to three species' two-letter codes in the spaces provided (see Appendix D for plant species codes) in descending order of abundance. If there is no distinct sub-canopy, leave the provided spaces blank. This evaluation should not include foliage on mid-story branches from overstory trees, only those distinct trees that form a canopy (even if it is only one tree) below the overstory canopy.

### 4. Shrub layer

Use this category to estimate the amount and species makeup of any woody shrub layer (*including* seedling trees) present. Generally, shrubs are >0.5 meter high and <5.0 meters high. Anything taller than 5.0 meters should be considered part of the sub-canopy (e.g. very tall oaks or aspens that are of greater height); anything shorter than 0.5 meter should be considered in the ground cover category (except for the rare instances where there is a distinct shrub layer that are all less than 0.5 meter (sage transects) – in this case, record all shrubs species as a shrub layer and estimate cover as usual).

**a. Shrub Cover:** Estimate the *total* percent coverage of all woody shrub species AND seedling trees present within 50-m of the count station to the nearest 10%.

**b. Mean height:** Estimate the average height to the nearest 0.5 meter of the shrub layer.

**c. Species composition:** Identify the shrub species (including seedling trees) present and record the *relative* percent of the total shrub layer occupied by each

species within a 50-m radius of each point-count station; you can list up to five species. Note that if only one shrub species is present, the relative percent should be 100%, regardless of how much of the circle the species occupies. Record shrub species on the data forms using the correct two-letter vegetation code (see Appendix D for plant species codes).

## 5. Ground Cover

### a. We classify ground cover into five categories:

- 1) woody vegetation below 0.5 m (roughly knee height) including cacti;
- 2) dead and downed trees (also of a minimum of 6" dbh);
- 3) broad-leaved herbaceous plants and forbs;
- 4) bare ground (including rocks) and/or leaf litter; and
- 5) grass.

**b. Cover:** For each of these categories, estimate the *total* percent of ground cover within 50 meters of the count station that qualifies for each. In most all cases, the categories in this section will add up to 100%. The only time this won't happen is if you have some ground cover type that is not on the data sheet (i.e. water). If water is present at a point, make a note of it at the bottom of the vegetation data sheet

Note: Please put a "0" in the box for any ground cover category that is absent from the 50-m circle, rather than leaving it blank.

**c. Grass height:** Estimate in centimeters the average height of the grass within the 50-m radius. Learn where 10cm, 20cm, 30cm, etc. are on your leg as a guide. You can also use your data sheet.  $8\frac{1}{2} \times 11 = 21.5\text{cm} \times 28\text{cm}$ .

## 6. Croplands

If the point you are surveying is in cropland, please specify whether it is **bare (plowed), fallow, or active (and indicate crop species if known)**. Write these data in across the applicable row for the point in the section **Shrub Layer**.

## 7. Other (Y/N)

**a. Human structures:** Record either Y or N to indicate the presence or absence of human-created structures (e.g. cabins, bridges, mine shafts, etc) within a **50-m** radius of the count station. This includes any human structure that would influence (positively or negatively) the detection or the behavior of birds in the area, such as something that a bird could use for perching or nesting (e.g. windmill, gas well, mine shaft, building, or power pole). For example, you would not need to record a stop sign in a forested area because there are already plenty of places for a bird to perch. However, you would record a stop sign in grassland, as it provides a perch for singing that is higher than the surrounding vegetation.

**b. Cliff/rock:** Record either Y or N to indicate the presence of cliffs or large rocky outcrops within a **50-m** radius of the count station.

**c. Prairie dog town:** Record either Y or N to indicate the presence of a prairie dog town. Abandoned towns will be marked as Y.

**d. Prairie dog presence:** Record either Y or N to indicate the presence of prairie

dogs. If you have reason to believe a colony is active, but they are all inside (excessive heat or cold), mark Y. Look for fresh sign such as scat or diggings.

**e. # of Snags:** Count the numbers of snags (>3 meters high, >6 in. dbh) within a **50-m** radius of the count station.

### III. Tamarisk Supplemental Vegetation and Beetle Data

Fill out the sheet at all points. Perform the sweeps for beetles at three of your points. If you are in a plot with tamarisk at every point, sweep points 1, 5, and 10. If you are in a plot that has tamarisk at only some points, sweep 3 points of your choice that have tamarisk – space these out if you have a choice. Whereas the general vegetation data sheet should be filled out before the avian point count, this sheet should be filled out **AFTER the point count**.

#### A. Distance from you singing bird can be heard

The purpose of recording this information is to determine whether the data need to be truncated because of river or highway noise.

#### B. Distance to the edge of woody riparian vegetation

Again, this is to determine whether or not the data will be truncated during analyses.

#### C. Tamarisk defoliation by beetles and refoliation

Be sure to distinguish between tamarisk plants that have not yet leafed out for the year from plants that are defoliated due to tamarisk beetles. Defoliation will be categorized for each sampling location as the average level of defoliation within 50 m of the sampling point and will be recorded as “None, Low, Medium, or High”. Low refers to mostly green trees, with a “frosted” appearance or having a slight haze of brown; or very minute patches of defoliation. Low can be easily overlooked as un-defoliated. High covers the range from 100% defoliated trees that look dry, brown and completely dead, to the trees that are roughly 80% brown and lacking much green foliage. Medium describes trees bearing a substantial amount of green foliage, but also showing distinguishable signs of defoliation.

Refoliation is best noticed by the “fireworks puffs” or “poodle puffs” that are the signature of tamarisk re-sprouting. Leaves will re-sprout out of the sides of branches and trunks. Low refoliation indicates the presence of these puffs with only a slight recovery over the plant. Medium roughly 30-70% of the tree holding newly sprouted vegetation. High indicates roughly 80% or more of the tree refoliated.

#### D. Evidence of Tamarisk Removal

By humans. Codes are self-explanatory.

#### E. Tamarisk Beetle sweep count

The goal is to determine if beetles are present in the survey area on the day bird surveying is conducted. This protocol is designed to be fast and efficient.

Perform the sweeps for beetles at three of your points. If you are in a plot with tamarisk at every point, sweep points 1, 5, and 10. If you are in a plot that has tamarisk at only some points, sweep 3 points of your choice that have tamarisk – space these out if you have a choice. Technician may sweep multiple tamarisk plants close to the point (i.e. if the point is surrounded by tamarisk) or a single tamarisk shrub.

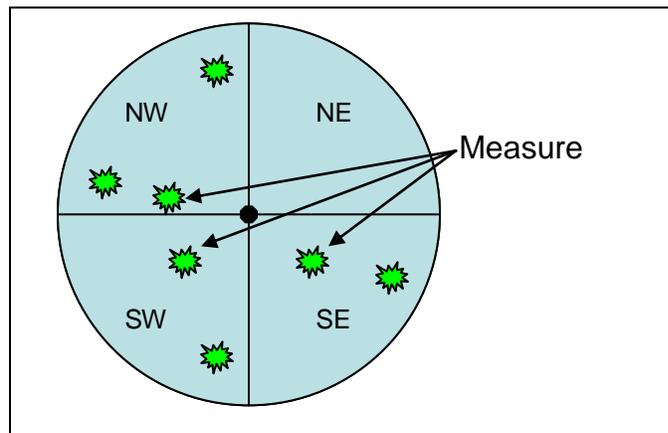
**How to Sweep:** Sweep net should be dragged or swept roughly *upwards* through tamarisk vegetation for a distance of about 1 meter, five times at each point. Take care not to let beetles escape or fly out of the net before counting. Shaking the net vigorously and tapping sides of net may knock beetles into the bottom of the net and aid in counting.

**Counting beetles:** An exact count of adult beetles and larvae is not necessary. A quick estimate is sufficient. Please estimate numbers of adult beetles and larvae **separately**. Please estimate if NO adults/larvae are present, 1-10 adults/larvae are present, 10-50 adults/larvae, >50 adults/larvae are present in the net.

## F. Phenology Data

The data on plant phenology will help us to understand the correspondence between the timing of plant green-up, flowering and fruiting, the timing of tamarisk beetle presence, and the densities of bird species. We will be recording plant phenology data for 4 species: Cottonwood, Russian Olive, Tamarisk and Willow.

Visualize a 50 m radius circle around the point, cut into quarters by a line running north-south and a line running east-west (use your compass). In the NW quarter, find the cottonwood nearest the point and record the percent of the plant's canopy that is leafed out, the percent in flower, and the percent in fruit (or seed). In the same quarter, record the same information for the other 3 species. Repeat the process for the other quarters. If all species are present within 50 m of the point at each quarter, you will be recording this information for 16 plants. If a particular plant is not in a quarter, draw a line through the data fields for that plant species in that quarter (do NOT enter zero).



## IV. Bird Data

### A. General Info

It is extremely important to fill in this data at the bottom of each and every bird form. If a bird form does not have this information and it becomes separated from the vegetation data sheet, then there is no way for us to know what transect the data came from. This data would become useless and an entire day's worth of data collection would be lost. Before starting your first point count, be sure to fill out this information:

1. **Observer:** Fill in your first, middle and last initials on all pages of the bird form.
2. **Project:** Fill in the 2-letter project code on all pages of the bird form (i.e. Colorado=CO, Black Hills National Forest=BH).
3. **Transect Name:** Fill in the 4-character transect ID code (habitat and number) on all pages of the bird form (i.e. AS14).

### B. Point Data

1. **Point #:** Enter the number of the point (1-15) on the transect. **NOTE:** for entries for low density species *between points* enter "88" (see below for more information on "88" birds).
2. **Species:** All birds detected during the 6-minute count period should be recorded using the correct 4-letter codes (See Appendix F for bird species codes; most are

obvious, but please commit to memory those codes that are unusual and do not follow the general rules). If you ever record a bird and are unsure of the four-letter code, make a note of it in the notes section at the bottom of the page to avoid confusion later.

Never record the same bird twice. If you already recorded a bird on an earlier point and detect it again at the next point, do not record the bird again. We do not want to double count any birds.

PLEASE, PLEASE use correct codes, as it makes data entry and analysis easier. Species that cause particular problems for observers include: **Northern Shoveler** (NSHO, not NOSH), Ring-necked Pheasant (RINP, not RNPH), **Western Wood-Pewee** (WEWP, not WWPE), **Gray Jay** (GRAJ, not GRJA), **Tree Swallow** (TRES, not TRSW), **Bank Swallow** (BANS, not BASW), **Barn Swallow** (BARS, not BASW), **MacGillivray's Warbler** (MGWA, not MAWA), **Yellow Warbler** (YWAR, not YEWA), **Yellow-rumped Warbler** (AUWA - for Audubon's Warbler, MYWA for Myrtle's Warbler, not YRWA), **Lark Bunting** (LARB, not LABU), **Savannah Sparrow** (SAVS, not SASP), **Lazuli Bunting** (LAZB, not LABU) and **Red-winged Blackbird** (RWBL, not RWBB).

If you detect a bird that you are unable to identify, use the code **UNBI**. Never guess on the identity of a bird, because this amounts to falsifying data. If you are unsure, we would prefer you to record UNBI rather than incorrectly identify a bird. However, recording a lot of unidentified birds is an indication that you need to study up and practice more before performing more point counts. Following is a table of unidentified bird codes you should use:

<b>Unknown Bird</b>	<b>Code</b>
Unknown Accipiter	UNAC
Unknown Bird	UNBI
Unknown Blackbird	UNBL
Unknown Buteo	UNBU
Unknown Chickadee	UNCH
Unknown Duck	UNDU
Unknown Empidonax	UNEM
Unknown Falcon	UNFA
Unknown Finch	UNFI
Unknown Flycatcher	UNFL
Unknown Grouse	UNGR
Unknown Gull	UNGU
Unknown Hawk	UNHA
Unknown Hummingbird	UNHU
Unknown Jay	UNJA
Unknown Oriole	UNOR
Unknown Owl	UNOW
Unknown Raptor	UNRA
Unknown Sandpiper	UNSA
Unknown Sparrow	UNSP
Unknown Swallow	UNSW
Unknown Vireo	UNVI
Unknown Warbler	UNWA

Unknown Woodpecker	UNWO
Unknown Wren	UNWR

**3. Measuring Distances:** Using your Rangefinder, measure the distance from the point to each and every individual bird detected during the count and record the distance in meters on the data sheet under “Radial Distance”. If you detect a bird beyond one kilometer (1000m), fit number in the three spaces provided as best you can. **Please note that we record radial distance (horizontal distance), not actual distance.** If you detect a bird singing in a tree directly above you, the distance would be 0, not how far the bird is above you. We will review this during training.

You should measure all distances to birds using your Rangefinder whenever possible. If you cannot get a direct line of sight to the location of a bird, use the Rangefinder to measure to a point close to that bird, and then add or subtract the additional estimated distance between that point and the bird to obtain the best possible distance estimate from the point to the bird. Distance-sampling relies upon the assumption that you measure all distances accurately, so always use your rangefinders as much as possible!

Always measure distances to where you first detected the bird, not to where you first identified it. For birds that are vocalizing but not seen, try to pin-point their locations to a specific tree/bush, then measure the distance to that tree. If you are unable to pin-point its location to a specific tree/bush, then estimate the distance, but do not round distances to the nearest 5 or 10 meter interval. Rounding distances causes heaping at popular values and makes analysis more problematic! If you see or hear a bird that is beyond the range of the Rangefinder, measure to the furthest object in the direction of the bird that the Rangefinder can measure to, and estimate the distance beyond that object to the bird. Add your estimate plus the measured distance and record the sum as the total distance.

Every bird recorded on point counts must have a radial distance measurement associated with it! This is imperative! Because our monitoring programs rely on Distance-sampling techniques and analyses, birds recorded without associated distances are essentially useless data that we cannot use in analysis! We will further explain the premises behind Distance-sampling during the training session. But please, please, PLEASE do not forget to measure and record radial distances for EACH bird recorded on point counts.

**4. How:** In the “How” column, record **how each bird was detected**, i.e., whether the bird was detected by ear (V=visual, C=calling, S=singing, D=drumming, F=Flyover, or O=other aural, e.g. wing beats). Enter the code for how you **first** detected each individual. Remember that how you detect a bird is different from how you identify it.

When birds sing, this is important information for us to know, as it is a strong indicator that the species is holding a breeding territory (and thus a potentially breeding species in the study area). **If you first detect a bird by means other than it singing and that same individual later sings, neatly write an ‘S’ in the ‘How’ box next to the first code entered.**

**5. Sex:** In the “Sex” column, record the sex of the bird, if known (F=female, M=male, U=unknown). Change a U to an M or F if you later see or otherwise identify the same individual as male or female. Assume that singing birds are males only if: 1) you can see that the singing bird is a male, 2) it is a warbler, or 3) it is singing emphatically and repeatedly. Females of many species will vocalize, although generally their

vocalizations are less emphatic and extensive. You should not record sex for birds giving only sex-unspecific calls.

Example 1:

On a point count, you detect six birds. You see a male RNSA, you hear a drumming RNSA, a calling WBNU, a singing WETA, and a singing CHSP, and you see a brown-plumaged CAFI. You should record the radial distances for all six individuals. In order, the "How" column should be filled in with V, D, C, S, S, and V. Fill in the "Sex" column: M, U, U, M, M, and U respectively (male CAFI require two years to achieve adult plumage, thus a brown-plumaged bird cannot be sexed in the field).

**6. Transect notes:** Enter information relevant to the site or individual points in the notes section at the bottom of the data sheet. It is very important to make notes about rare or unusual birds here. After the field season, RMBO staff review the data and look for any detections that seem odd or out of place. If you positively identify a species that you believe we may question later, it is helpful to write notes to affirm your detection.

Here you will record the reasons why you did not survey certain points within the grid (if applicable). The choices and their codes are:

T:Ran out of Time

U:Terrain **U**nsafe (could not safely approach to within 25 m of point)

R:Can't cross **R**iver

P:Private Property - no **P**ermission

W:**W**eather (rain or wind)

S:**S**now pack impassible

O:**O**ther - explain

This is also the location to record problems encountered during the survey, cool scenery, or other tidbits that either don't really fit in other places or that future surveyors might find interesting. If you are unable to complete a point, record the reason why here.

When entering data into the database, don't forget to look through the notes sections on your data sheets. Notes that are useful to someone surveying next year should be entered on the transect description page.

**7. Clusters:** "A cluster is a relatively tight aggregation of objects of interest..." (Buckland et al. 2001). In our point count sampling, clusters are actually our unit of observation, with most cluster sizes = 1. There are generally two cases in which cluster sizes are > 1: flocks, and paired birds. In either case, we define a cluster as birds of the same species that you observed TOGETHER (foraging, flying, perching, or obviously interacting with each other). Two males of the same species singing 20 meters apart do NOT constitute a cluster. Distances between members of a cluster should be very short.

How to record clusters:

Flocks: When individuals of the same species are obviously in a flock and cannot be readily sexed (e.g. Cliff Swallow or Pine Siskin), record the distance to the center of the flock and record the number of individuals in the "Cluster Size" column of your data form. You do not need to enter a Cluster Code. When you can determine sex, enter the number of males on one line, and the number of females on the next line, with the appropriate number of each sex in the corresponding "Cluster Size" boxes. Then

enter the same letter on both lines for the “Cluster Code” (a, b, c ...).

**Pairs:** Often you may hear a bird singing or calling, look up, and see that it is a male bird with a female perched or foraging nearby. Or you may see one individual moving about, raise your binoculars to identify it, and observe that there are actually two individuals of the same species but opposite sex in that location. In these cases, enter the male and female on separate lines of your data form, with the appropriate codes for “HOW” detected. In the first scenario, the male “HOW” = S(inging) and the female “HOW” = V(isual). In the second scenario, “HOW” = V(isual) for both the male and female. In both cases enter the same letter for the “Cluster Code” of each member of the pair (a, b, c ...).

**Example 2:**

After recording a Western Tanager (WETA) and an American Robin (AMRO) on a point count, the observer hears a Black-headed Grosbeak (BHGR) give its distinctive squeaky call note. The observer turns to see the bird and notes that the calling bird is a male BHGR 27 meters away AND also notes that there is a female BHGR in the same tree, but about 29 meters away. Next, the observer hears 5 Pine Siskins (PISI), looks up, and measures that they are 36-38 meters away. Finally, the observer hears a Mountain Chickadee (MOCH) calling, looks up and sees that MOCH as well as a second MOCH in the same tree, both at 17 meters away. The sex of both individuals is unknown, but the method of detection differs, so record them on separate lines with a common Cluster Code. See table below.

The observer’s data looks like this (with a dash indicating no entry):

Point #	Species	Radial Distance	HOW	SEX	CLUSTER SIZE CODE	
03	WETA	46	S	M	1	-
-	AMRO	103	S	M	1	-
-	BHGR	27	C	M	1	a
-	BHGR	29	V	F	1	a
-	PISI	37	V	U	5	-
-	MOCH	17	C	U	1	b
-	MOCH	17	V	U	1	b

**8. Flyovers:** Flyovers are birds that are not using the habitat in the vicinity of the point count and are only observed traveling high above the area, and not landing within sight. For true flyovers that are not using the surrounding habitat, enter the species code, enter an “F” in the “How” column, and draw a short line through the distance column – i.e. you do not need to estimate distance for flyovers. However, individuals of species that habitually hunt on the wing (e.g. raptors, swallows, swifts) and that appear to be foraging or hunting in the vicinity around the point, should NOT be treated as flyovers, and instead should be recorded as any other bird recorded on the point count. Additionally, individuals that you first detect in flight that are simply flying from perch to perch within the habitat should NOT be recorded as flyovers. Provide distance estimates to these flying individuals where you first detected them and record the best how-detected variable.

9. **“88” Birds:** While walking between points, record all low-density birds species on the list of “88” birds (see Appendix B). Record the same data you would during a point count (species, distance, how, sex, cluster). Also record the **bearing** to the bird from the line transect. **It is very important to make sure you are on the bearing between points when you record this information.** If you need to leave the bearing in order to avoid an obstacle and detect a 88 bird, note where you detected the bird, return to the between point bearing, and then collect your data.

10. **VERY IMPORTANT:** *Check over your point-count data before leaving each count station* to make sure you have recorded all the required information (e.g. distances, how/sex info, etc.). Skip a line between entries for individual points. On the data sheet, you should group together all birds recorded on a particular point; then leave a blank line before starting entries for the next point.

#### **IV. OTHER IMPORTANT REMINDERS**

Once you finish your transect and before leaving your sites, don't forget to:

- 1) Check to make sure you entered your observer initials, transect#, and sheet #'s at the bottom of EACH page!
- 2) Record the end of transect data (time, temp, sky, wind, transect notes) **IMMEDIATELY UPON COMPLETING THE TRANSECT!**
- 3) Go through your data sheets carefully to make sure you have not forgotten to record any data. You are not done working until you've reviewed your data from the morning!
- 4) Provide clear and explicit directions to the access point, if you have not already done so!

## **APPENDIX B: LOW-DENSITY TARGET SPECIES (“88” BIRDS)**

### **Upper Colorado River Basin**

Record these species whenever they are encountered anywhere between points along a transect:

- ALL galliforms
- Turkey Vulture
- ALL raptors
- ALL owls
- Common Nighthawk
- Common Poorwill
- ALL woodpeckers (except NOFL)
- Black Phoebe
- American Crow
- Black-capped Chickadee
- Mountain Chickadee
- Red-breasted Nuthatch
- White-breasted Nuthatch
- Western Bluebird
- Townsend’s Solitaire
- Northern Mockingbird
- Lucy’s Warbler
- Yellow-rumped Warbler
- Common Yellowthroat
- Blue Grosbeak
- American Goldfinch

## APPENDIX C. KEY OF 2-LETTER CODES FOR SHRUBS & TREES

### Code Shrubs/Small Trees

- AL Alder sp. (*Alnus spp.*)
- AB Alder-leaved buckthorn (*Rhamnus alnifolia*)
- AP American plum (*Prunus americana*)
- AC Arizona Cypress (*Cupressus arizonica*)
- BE Beaked hazelnut
- BG Beargrass (*Nolina spp.*)
- BI Birch spp. (*Betula spp.*)
- BB Blackberry/Raspberry (*Rubus spp.*)
- BL Blackbrush (*Coleogyne ramosissima*)
- BF Buffaloberry (*Sheperdia canadensis*)
- BH Bush honeysuckle (*Lonicera spp.*)
- CC Choke cherry (*Prunus virginiana*)
- CH Cholla (*Opuntia spp.*)
- CR Cliffrose or bitterbrush (*Purshia spp.*)
- CJ Common juniper (*Juniperus communis*) – low growing shrub in high elev. (NOT the tree)
- CB Corkbark Fir
- DH Desert Holly (*Berberis fremontii*)
- DO Desert Olive (*Forestiera neomexicana*)
- EB Elderberry (*Sambucus spp.*)
- FB Fendlerbush (*Fendlera rupicola*)
- GO Gambel oak (*Quercus gambelii*)
- GB Gooseberry/Currant (*Ribes spp.*)
- GW Greasewood (*Sarcobatus spp*)
- HA Hawthorn (*Crataegus spp.*)
- HB Huckleberry (*Vaccinium spp.*)
- IB Indigo bush or Leadplant (*Amorpha spp.*)
- JU Juniper (bush-size) – all *Juniperus* species (Utah, Rocky Mountain, and One-seed)
- MZ Manzanita (*Artocostaphalis spp.*)
- MT Mormon Tea (*Ephedra spp.*)
- MO Mountain ash (*Sorbus scopulina*)
- MM Mountain mahogany (*Cercocarpus spp.*)
- MS Mountain/Ocean spray
- LC New Mexico Locust (*Robinia neomexicana*)
- NB Ninebark (*Physocarpus spp*)
- OB Oak bush – not Gambel oak
- OG Oregon grape (*Berberis aquifolium*)
- OT Other shrub – unknown species or not on list
- RA Rabbitbrush (*Chrysothamnus spp.*)
- RD Red-osier dogwood (*Cornus sericea*)
- RB River (water) birch (*Betula occidentalis*)
- MA Rocky mountain maple (*Acer spp.*)
- RO Russian olive (*Elaeagnus angustifolia*)
- SA Sage spp. (*Artemisia spp.*)
- SL Saltbush (*Atriplex spp.*)
- SB Serviceberry (*Amelanchier spp.*)

LO Shrub Live Oak (*Quercus turbinella*)  
 SC Shrubby cinquefoil (*Pentaphylloides floribunda*)  
 SE Single-leaf Ash (*Fraxinus anoala*)  
 SK Skunkbrush (*Rhus trilobata*)  
 SW Snakeweed (*Gutierrezia sarothrae*)  
 SY Snowberry (*Symphoricarpos spp.*)  
 TA Tamarisk/Saltcedar (*Tamarix pentandra*)  
 TB Thimbleberry (*Rubus spp.*)  
 VI Viburnum (*Viburnum spp.*)  
 WR Wild rose (*Rosa spp.*)  
 WI Willow spp. (*Salix spp.* - primarily for all shrubby willows)  
 WO Wolfberry (*Lycium pallidum*)  
 YU Yucca (*Yucca spp.*)

**Code Large trees**

HH American hophornbeam (*Ostrya virginiana*)  
 AH Ash (*Fraxinus spp.*)  
 BP Balsam poplar (*Populus balsamifera*)  
 BS Blue spruce (*Picea pungens*)  
 BX Box elder (*Acer negundo*)  
 BR Bristlecone pine (*Pinus aristata*)  
 BO Bur oak (*Quercus macrocarpa*)  
 BC **Burned** conifer  
 BD **Burned** deciduous  
 CW Crack willow (*Salix fragilis*)  
 DC **Dead** coniferous - recently dead (still has bark)  
 DD **Dead** deciduous - recently dead (still has bark)  
 DJ **Dead** Juniper – recently dead (still has bark)  
 DY **Dead** pinyon pine – recently dead (still has bark)  
 DF Douglas fir (*Psuedotsuga menziesii*)  
 FC Fremont cottonwood (*Populus fremontii*)  
 JU Juniper spp. (*Juniperus spp.*)  
 LP Lodgepole pine (*Pinus contorta*)  
 NC Narrow-leaf cottonwood (*Populus angustifolia*)  
 PB Paper birch (*Betula papyrifera*)  
 PW Peachleaf willow (*Salix amigdaloides*)  
 PY Pinyon pine (*Pinus edulis*)  
 PC Plains cottonwood (*Populus deltoides*)  
 PP Ponderosa pine (*Pinus ponderosa*)  
 AS Quaking aspen (*Populus tremuloides*)  
 RO Russian olive (*Elaeagnus angustifolia*)  
 SN Unidentifiable snag – no bark  
 UC Unknown coniferous tree or not on list  
 UD Unknown deciduous tree or not on list  
 WF White fir (*Abies concolor*)  
 WS White spruce (*Picea glauca*)  
 WP Whitebark pine (*Pinus albicaulis*)  
 WI Willow species (*Salix spp.*)

## APPENDIX D. FOUR-LETTER BIRD CODES FOR ALL PROGRAMS

Code	Species	Code	Species	Code	Species	Code	Species
ABSQ	Abert's Squirrel	BCNH	Black-crowned Night-Heron	CHSP	Chipping Sparrow	FOTE	Forster's Tern
ACWO	Acorn Woodpecker	BHGR	Black-headed Grosbeak	CHUK	Chukar	FOSP	Fox Sparrow
AMAV	American Avocet	BTYW	Black-throated Gray Warbler	CITE	Cinnamon Teal	FRGU	Franklin's Gull
AMBI	American Bittern	BTSP	Black-throated Sparrow	CLNU	Clark's Nutcracker	GADW	Gadwall
AMCO	American Coot	BLGR	Blue Grosbeak	CCSP	Clay-colored Sparrow	GAQU	Gambel's Quail
AMCR	American Crow	BLJA	Blue Jay	CLSW	Cliff Swallow	GOEA	Golden Eagle
AMDI	American Dipper	BGGN	Blue-gray Gnatcatcher	COGR	Common Grackle	GCKI	Golden-crowned Kinglet
AMGO	American Goldfinch	BWTE	Blue-winged Teal	COME	Common Merganser	GRWA	Grace's Warbler
AMKE	American Kestrel	BOBO	Bobolink	CONI	Common Nighthawk	GRSP	Grasshopper Sparrow
AMPI	American Pipit	BRBL	Brewer's Blackbird	COPO	Common Poorwill	GRCA	Gray Catbird
AMRE	American Redstart	BRSP	Brewer's Sparrow	CORA	Common Raven	GRFL	Gray Flycatcher
AMRO	American Robin	BTLH	Broad-tailed Hummingbird	COYE	Common Yellowthroat	GRAJ	Gray Jay
ATTW	American Three-toed Woodpecker	BWHA	Broad-winged Hawk	COHA	Cooper's Hawk	GRPA	Gray Partridge
AWPE	American White Pelican	BRCR	Brown Creeper	COFL	Cordilleran Flycatcher	GRVI	Gray Vireo
AMWI	American Wigeon	BRTH	Brown Thrasher	CBTH	Curve-billed Thrasher	GBHE	Great Blue Heron
ATFL	Ash-throated Flycatcher	BCRF	Brown-capped Rosy-Finch	DEJU	Dark-eyed Junco	GCFL	Great Crested Flycatcher
BAIS	Baird's Sparrow	BHCO	Brown-headed Cowbird	GHJU	Dark-eyed Junco (Gray-headed)	GREG	Great Egret
BAEA	Bald Eagle	BUFF	Bufflehead	ORJU	Dark-eyed Junco (Oregon)	GHOW	Great Horned Owl
BAOR	Baltimore Oriole	BUOR	Bullock's Oriole	PSJU	Dark-eyed Junco (Pink-sided)	GRPC	Greater Prairie-Chicken
BTPI	Band-tailed Pigeon	BUOW	Burrowing Owl	WWJU	Dark-eyed Junco (White-winged)	GRRO	Greater Roadrunner
BANS	Bank Swallow	BUSH	Bushtit	DICK	Dickcissel	GRSG	Greater Sage-Grouse
BARS	Barn Swallow	CAGU	California Gull	DCCO	Double-crested Cormorant	GTGR	Great-tailed Grackle
BAGO	Barrow's Goldeneye	CAHU	Calliope Hummingbird	DOWO	Downy Woodpecker	GRHE	Green Heron
BEVI	Bell's Vireo	CAGO	Canada Goose	DUFL	Dusky Flycatcher	GTTO	Green-tailed Towhee
BEKI	Belted Kingfisher	CANV	Canvasback	DUGR	Dusky Grouse	AGWT	Green-winged Teal
BEWR	Bewick's Wren	CANT	Canyon Towhee	EAGR	Eared Grebe	GUSG	Gunnison Sage-Grouse
BLPH	Black Phoebe	CANW	Canyon Wren	EABL	Eastern Bluebird	HAWO	Hairy Woodpecker
BLRA	Black Rail	CAFI	Cassin's Finch	EAKI	Eastern Kingbird	HAFL	Hammond's Flycatcher
BLSW	Black Swift	CAKI	Cassin's Kingbird	EAME	Eastern Meadowlark	HETH	Hermit Thrush
BLTE	Black Tern	CASP	Cassin's Sparrow	EAPH	Eastern Phoebe	HEWA	Hermit Warbler
BAWW	Black-and-white Warbler	CAEG	Cattle Egret	EAWP	Eastern Wood-Pewee	HOLA	Horned Lark
BBWO	Black-backed Woodpecker	CEDW	Cedar Waxwing	EUCD	Eurasian Collared-Dove	HOFI	House Finch
BBMA	Black-billed Magpie	CCLO	Chestnut-collared Longspur	EUST	European Starling	HOSP	House Sparrow
BCCH	Black-capped Chickadee	CSWA	Chestnut-sided Warbler	EVGR	Evening Grosbeak	HOWR	House Wren
BCHU	Black-chinned Hummingbird	CHRA	Chihuahuan Raven	FEHA	Ferruginous Hawk	INBU	Indigo Bunting
BCSP	Black-chinned Sparrow	CHSW	Chimney Swift	FISP	Field Sparrow	ILBH	Indigo x Lazuli Bunting Hybrid
JUTI	Juniper Titmouse	NOPI	Northern Pintail	RBGR	Rose-breasted Grosbeak	VGSW	Violet-green Swallow
KILL	Killdeer	NOPO	Northern Pygmy-Owl	RCKI	Ruby-crowned Kinglet	VIRA	Virginia Rail

Code	Species	Code	Species	Code	Species	Code	Species
LARB	Lark Bunting	NRWS	Northern Rough-winged Swallow	RUDU	Ruddy Duck	VIWA	Virginia's Warbler
LASP	Lark Sparrow	NSHO	Northern Shoveler	RUGR	Ruffed Grouse	WAVI	Warbling Vireo
LAZB	Lazuli Bunting	NOWA	Northern Waterthrush	RUHU	Rufous Hummingbird	WEBL	Western Bluebird
LCSP	Le Conte's Sparrow	OLWA	Olive Warbler	RCSP	Rufous-crowned Sparrow	WEGR	Western Grebe
LEFL	Least Flycatcher	OSFL	Olive-sided Flycatcher	SAGS	Sage Sparrow	WEKI	Western Kingbird
LEGO	Lesser Goldfinch	OCWA	Orange-crowned Warbler	SATH	Sage Thrasher	WEME	Western Meadowlark
LESC	Lesser Scaup	OROR	Orchard Oriole	SACR	Sandhill Crane	WESJ	Western Scrub-Jay
LEYE	Lesser Yellowlegs	OSPR	Osprey	SAVS	Savannah Sparrow	WETA	Western Tanager
LEWO	Lewis's Woodpecker	OVEN	Ovenbird	SAPH	Say's Phoebe	WEWP	Western Wood-Pewee
LISP	Lincoln's Sparrow	PESA	Pectoral Sandpiper	SCQU	Scaled Quail	WBNU	White-breasted Nuthatch
LOSH	Loggerhead Shrike	PEFA	Peregrine Falcon	SCOR	Scott's Oriole	WCSP	White-crowned Sparrow
LBCU	Long-billed Curlew	PBGR	Pied-billed Grebe	SEWR	Sedge Wren	MWCS	White-crowned Sparrow (Mountain)
LEOW	Long-eared Owl	PIGR	Pine Grosbeak	SSHA	Sharp-shinned Hawk	WFIB	White-faced Ibis
LUWA	Lucy's Warbler	PISI	Pine Siskin	STGR	Sharp-tailed Grouse	WTPT	White-tailed Ptarmigan
MGWA	MacGillivray's Warbler	PIJA	Pinyon Jay	SEOW	Short-eared Owl	WTSW	White-throated Swift
MAWA	Magnolia Warbler	PLVI	Plumbeous Vireo	SNEG	Snowy Egret	WWCR	White-winged Crossbill
MALL	Mallard	PRFA	Prairie Falcon	SOSP	Song Sparrow	WITU	Wild Turkey
MAGO	Marbled Godwit	PUMA	Purple Martin	SORA	Sora	WILL	Willet
MAWR	Marsh Wren	PYNU	Pygmy Nuthatch	SPSA	Spotted Sandpiper	WISA	Williamson's Sapsucker
MCLO	McCown's Longspur	RECR	Red Crossbill	SPTO	Spotted Towhee	WIFL	Willow Flycatcher
MERL	Merlin	RESQ	Red Squirrel	SPPI	Sprague's Pipit	WIPH	Wilson's Phalarope
MOBL	Mountain Bluebird	RBWO	Red-bellied Woodpecker	STJA	Steller's Jay	WISN	Wilson's Snipe
MOCH	Mountain Chickadee	RBNU	Red-breasted Nuthatch	SWHA	Swainson's Hawk	WIWA	Wilson's Warbler
MOUP	Mountain Plover	REVI	Red-eyed Vireo	SWTH	Swainson's Thrush	WIWR	Winter Wren
MODO	Mourning Dove	REDH	Redhead	TEWA	Tennessee Warbler	WODU	Wood Duck
MIKI	Mississippi Kite	RHWO	Red-headed Woodpecker	SWHA	Swainson's Hawk	YWAR	Yellow Warbler
NOBI	NO BIRDS	RNSA	Red-naped Sapsucker	SWTH	Swainson's Thrush	YBSA	Yellow-bellied Sapsucker
NOBO	Northern Bobwhite	RNPH	Red-necked Phalarope	TEWA	Tennessee Warbler	YBCU	Yellow-billed Cuckoo
NOFL	Northern Flicker	RTHA	Red-tailed Hawk	TOSO	Townsend's Solitaire	YHBL	Yellow-headed Blackbird
FLIN	Northern Flicker (Intergrade)	RWBL	Red-winged Blackbird	TRES	Tree Swallow	YRWA	Yellow-rumped Warbler
RSFL	Northern Flicker (Red-shafted)	RBGU	Ring-billed Gull	TRUS	Trumpeter Swan	AUWA	Yellow-rumped Warbler (Audubon's)
YSFL	Northern Flicker (Yellow-shafted)	RNDU	Ring-necked Duck	TUVU	Turkey Vulture		
NOGO	Northern Goshawk	RINP	Ring-necked Pheasant	UPSA	Upland Sandpiper		
NOHA	Northern Harrier	ROPI	Rock Pigeon	VEER	Veery		
NOMO	Northern Mockingbird	ROWR	Rock Wren	VESP	Vesper Sparrow		

Recently Changed Common Names  
Tricky Codes

# APPENDIX E. SAMPLE TRANSECT DESCRIPTION SHEET

Transect: **WY-MC48**

Observer Initials: **JST**

Date Conducted: **6/29/2008**

Transect Name:

**Please verify all Transect Information. If AP, County, Map, etc. is inaccurate please note the correct data!**

Map Accurate?  
 Yes:  If no, please describe at bottom of page  
 No:

Transect is accessible to:  All Vehicle  
 High Clearance  
 4WD only

Roads of Colorado Page: (if applicable) DeLorme Page: 59 B5 County: Park State: WY

Access Point UTM: 12 587659 4924771 Management Unit: Shoshone NF

Elevation: Time required to do the transect:

## Transect Descriptions

### Directions to Access Point:

From Cody, go W on Highway 14-16 towards Yellowstone. 40 miles from the rodeo grounds in Cody you'll pass the Wayfarer's Chapel. Continue another 1.5 miles and look for a gated dirt road on right leading to buildings. Park here and walk a couple hundred meters to the Mormon Creek bridge. Access point is the concrete bridge abutment on the NE side of the creek.

### TransectDescription:

From AP - 148m @ 54 deg to pt. 1.

- Pt. 1 - 12 deg to pts. 2-5.
- Pt. 5 - 301 deg to pts. 6-9.
- Pt. 9 - 211 deg to pts. 10-12.
- Pt. 12 - 121 deg to pts. 13-14.
- Pt. 14 - 107 deg to pt. 15.
- Pt. 7 - Instead of crossing large gully, go above and at 250m go into gully. Point is by tall slender rock on cliff edge. Weather station is visible to W. Use this description if it is helpful, but be sure to follow the given bearing (301 deg) in any case.
- Pt. 8 - Travel past weather station down steep, grassy slope into forest.
- Pt. 9 - Go upstream to cross drainage
- Pt. 10 - Have to go downstream. Point is 50m from west side of stream.
- Pt. 12 - USFS cabin is visible at bottom of hill as you approach point.
- Pt. 13 - Near cabin/corrals.

### Notes:

Point 15 formerly ended up on/near highway, so it was moved in 2005.

Most of the Douglas Firs on this transect are dying.

2007 - I changed 1st bearing from 60 deg to 54 deg, because original bearing would put me in the middle of the of the creek. I could not hear any birds at pt 1 due to loud creek noise.

Camping: I camped @ Eagle Creek campground, ~ 1/2 mile before AP. Hard shell campers only, no tents allowed. You might be able to sleep in your car if you ask the campground host. Otherwise, try camping at any of the other campgrounds along the way.

**\* Please remember to record bearings for all low density species!**

### 2008 Notes or Updates and camping information

UTMs:	zone	easting	northing
1:	12	587798	4924818
2:	12	587903	4925045
3:	12	588004	4925272
4:	12	588108	4925500
5:	12	588210	4925727
6:	12	588029	4925900
7:	12	587844	4926078
8:	12	587657	4926248
9:	12	587481	4926423
10:	12	587308	4926243
11:	12	587138	4926060
12:	12	586966	4925878
13:	12	587149	4925712
14:	12	587332	4925541
15:	12	587551	4925420
16:			

# APPENDIX F. SAMPLE VEGETATION DATA SHEET

Note: The back side of this datasheet will contain the same form for points 9-15.

Observer (FI, MI, Last name)	Date (mm/dd/yy)	GPS Unit # :	Program	Transect ID	start
J.S. Trimarco	07 17 08	239	W1	MC26	Time 6:10
Access Point UTM	ZONE: 12	UTMs: 5172644664525			Sky 0
					Wind 0
					Temp 45°

6-char Pt-ID	Easting	Northing	Accuracy	6-char Pt-ID	Easting	Northing	Acc.
01	5171864664577	12		05	5171584665415	7	
02	5170834664804	12		06	5172654665639	15	
03	5171614665034	8		07	5173694665865	6	
04	5169954665227	6		08	5175684666015	6	

Rocky Mountain Bird Observ. - atory Point-Transsect Form

Point info			Overstory - all spp. total to 100%															
Point	Dist. to road (m)	Private property?	Bearing to Point	Point	Struct stage(1-5)	Canopy Cover %	Mean Canopy Height	Species #1	Sp 1 abund %	Species #2	Sp 2 abund %	Species #3	Sp 3 abund %	Species #4	Sp 4 abund %	Species #5	Sp 5 abund %	Point
1	1	N	323	1	4	80	20	LP	50	SU	10	AS	20	DC	10			1
2	2		320	2	4	40	15	LP	35	SU	15	DD	10	AS	30	DD	5	2
3	3		6	3	4	70	15	LP	25	SU	10	AS	50	DC	5	DD	10	3
4	4		206	4	4	50	15	LP	45	AS	35	SU	10	DD	5	DC	5	4
5	5		28	5	3	40	9	SU	65	DC	5	LD	10	AS	20			5
6	6		13	6	4	80	80	SU	50	LP	40	DC	5	AS	5			6
7	7		12	7	4	20	15	SU	30	DC	10							7
8	8		40	8	4	50	15	LP	55	AS	25	SU	10	DD	5	DC	5	8

Midstory				Shrub layer - all spp. total to 100%													
Point	Distinct SUBCANOPY - If Present			Point	Percent Cover	Mean height (m)	Species #1	Sp 1 abund %	Species #2	Sp 2 abund %	Species #3	Sp 3 abund %	Species #4	Sp 4 abund %	Species #5	Sp 5 abund %	Point
	#1	#2	#3														
1				1	20	1	JU	80	SN	20							1
2				2	20	1	SA	50	SN	40	JU	10					2
3				3	15	1	JU	90	RE	10							3
4				4	20	1	MM	60	SN	30	JU	10					4
5				5	15	1	MM	50	RE	20	SA	20	SN	10			5
6				6	10	1	JU	100									6
7				7	15	1	MM	40	JU	40	SA	10	SN	10			7
8				8	10	1	JU	95	SA	5							8

Ground Cover - usually totals to 100%						Other (Y/N)						
Point	Woody %	Dead and Down %	Herbaceous %	Bare / litter %	Grass %	Grass & Herb. Height (cm)	Human structures?	Cliffrock?	P-dog town?	P-dogs present?	# of Snags	Point
1	10	10	75	5	35		N	N	N	N	2	1
2	10	10	70	10	30		N	N	N	N	1	2
3	10	10	70	10	30		N	N	N	N	0	3
4	5	15	75	5	30		N	N	N	N	0	4
5	10	15	65	10	35		N	N	N	N	4	5
6	10	13	65	10	35		N	N	N	N	0	6
7	5	15	70	10	30		N	N	N	N	2	7
8	5	20	65	10	30		N	N	N	N	0	8

If found, please mail to:  
Rocky Mountain Bird Observatory (www.rmbo.org)  
14500 Lark Bunting Lane, Brighton, CO 80603

**APPENDIX G. SUPPLEMENTAL VEGETATION AND BEETLE DATA  
SHEET FOR SURVEYS IN TAMARISK**

# APPENDIX H. SAMPLE BIRD DATA SHEET

How: V=visual; S=singing; C=calling; D=drumming; O=other aural detection. Sex: M=male; F=female; U=unknown.  
 Between points, point # = 99. Rocky Mountain Bird Observatory, PO Box 1232, Brighton CO 80601

Rocky Mountain Bird Observatory Point Transect Bird Form

Point #	Species	Radial Distance	HOW	SEX	Bearing	Cluster		Point #	Species	Radial Distance	HOW	SEX	Bearing	Cluster	
						Size	Code							Size	Code
01	RCKI	86	S	M					RBNW	103	C	U			
	WEWP	68	C	U					NOFL	309	C	U			
	MWCS	117	C/S	M					SAVS	84	S	M			
	NOFL	50	C	U					NOBI						
	AMRO	123	S	M											
	RESQ	32	C	U				04	AMRO	76	S	M			
	PISI	71	C	U					CEOW	51	C	U	23	4	
	WAVI	123	S	M					DEJU	58	S	M			
	WEWP	90	C	U					NOFL	207	C	U			
99	RNSA	37	C	U	121				LISP	82	S	M			
02	LISP	97	S	M					RESQ	12	C	U			
	CAGO		F	U			2		RESQ	47	C	U			
	LISP	125	S	M					DEJU	65	S	M			
	RECR	31	C	U			6		MWCS	79	S	M			
	AUWA	33	S	M			1A		AMRO	45	C	U			
	AUWA	27	V	F			1A		AUWA	39	S	M			
	UNRA	700	V	U					LISP	99	S	M			
	WETA	63	S	M					RBNW	103	C	U			
	MWCS	101	S	M					NOBI						
	RCKI	116	S	M				99	HAWD	26	C	U	34		
	*NOGO	63	V	U	273				HAWD	104	O	M	165		
	DEJU	42	C/S	U											
03	LISP	72	S	M				05	RBNW	99	C	U			
	MWCS	105	S	M					AMRO	67	S	M			
	LISP	206	S	M					HETH	176	S	M			
	AMRO	96	S	M					RCKI	121	S	M			
	LISP	47	C/S	M					RESQ	28	C	U			
	MWCS	108	S	M					AMRO	84	C	U			
	BTLH	49	O	U					TOSO	54	C/S	M			
	MWCS	6	C	U					NOBI						
	LISP	107	S	M					NOBI						
	MWCS	55	S	M											

Notes: \*NOGO detected at pt 3- observed perched in tree

Observer Initials-all three: JST      Year: 2008      Program (BH, AZ, etc.): WY      Transect number, i.e., AS04: MC26