

**Rocky Mountain Bird Observatory**  
**Field Protocol for Migration Phenology Project**  
**2010**





# ROCKY MOUNTAIN BIRD OBSERVATORY

*Mission: To conserve birds and their habitats*

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

## **Core Values:**

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:**

- **Monitoring** long-term bird population trends to provide a scientific foundation for conservation action.
- **Researching** bird ecology and population response to anthropogenic and natural processes to evaluate and adjust management and conservation strategies using the best available science.
- **Educating** people of all ages through active, experiential programs that create an awareness and appreciation for birds.
- **Fostering** good stewardship on private and public lands through voluntary, cooperative partnerships that create win-win situations for wildlife and people.
- **Partnering** with state and federal natural resource agencies, private citizens, schools, universities, and other non-governmental organizations to build synergy and consensus for bird conservation.
- **Sharing** the latest information on bird populations, land management and conservation practices to create informed publics.
- **Delivering** bird conservation at biologically relevant scales by working across political and jurisdictional boundaries in western North America.

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## I. PROJECT OVERVIEW

Rocky Mountain Bird Observatory (RMBO) in cooperation with the National Park Service developed a program to determine if migratory bird species are arriving earlier on their breeding grounds in the central flyway utilizing point counts and recording equipment to gather data. This document provides details of the design and of the operation of this project. We intend this protocol to instruct our field workers on how to conduct point counts and for others to follow when establishing projects of their own, so that the design and methods are comparable.

Survey points for the most RMBO monitoring projects are arranged in a 4 x 4 grid of 16 points, with 250 m spacing between points. Grids are selected using a spatially balance sampling algorithm (Blakesley and Hanni 2009). Grids are generally selected without regard to habitat type, except for some grids placed within riparian corridors. In most instances, grids are stratified by land ownership (National Forests, National Grasslands, National Parks, BLM land, etc.).

For this project, points will be established in grassland habitat only and arranged in a 3 x 3 grid pattern with the center point (in most cases) being the location of the songmeter recording unit. All points are still 250 m apart.

## II. MATERIALS

Before heading out into the field, each technician should be sure to have the following equipment (RMBO will supply all materials unless otherwise indicated below):

- 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** (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 grid locations loaded onto it;
- G. **Rangefinder**;
- H. **Extra batteries** for GPS unit and for recording units;
- I. **Data forms** sufficient for all the points planned that morning;
- J. **Plant ID guide**;
- K. **Maps and transect locations**;
- L. **Master list of four-letter codes** and;
- M. **Master list of weather and habitat codes**, taped to the clipboard.
- N. **Extra scandisk cards to exchanging with those in recording units**

## III. CONDUCTING POINT COUNTS

### A. Seasonal Timing

Point counts should be performed before, during, and after migratory species arrive at their breeding sites and especially before they return since the goal of this project is to determine when

breeding species are returning (this is very different from other projects aimed to sample only breeding birds). Observers should survey each individual point-count grid during the time of day that songbirds are most detectable. Observers should start conducting point counts approximately ½ hour before sunrise (or once there is enough light to ID birds by sight) and finished before 11am (preferably before 10am). In some cases, such as more southern locations, counts should be completed before 9am.

## **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). Please see Appendix G for a description of how transects are labeled within the GPS unit. 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** (however, do identify and make a mental note of the locations of any birds flushed from around the count station upon your approach). Filling out the habitat data 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. [Note: in 2012, we will be recording vegetation information during the last visit to each point. This is because the bushes/trees, if present, will be leafed out by then which will make it easier to identify them.]

### **1. Habitat Data**

Fill in the habitat data for each of the 9 points **while at the point**. We will use the habitat data to relate bird density to vegetation features and habitat types. This information will have real applications for managing habitats for birds, so please be as accurate as possible with these data. However, it is very important to finish the bird surveys, so do not spend more than a couple minutes filling in habitat data at each point. You will become faster at this with time.

### **2. Bird Data**

After recording the general habitat data at the point count station activate your timepiece and begin recording the birds you see or hear. **The count duration is 6 minutes. Record which minute each bird is detected in on the bird datasheet between birds recorded in each one-minute interval** (there is a column for this). To do this, simply start the timer, and when you hear the first beep (at one minute), record a “1” in the proper and keep recording new birds until you hear the second beep (at two minutes). Then, record a “2” in the proper column and continue in this fashion for 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 if you so desire). However, if the species is an “88” bird, then you can record it as such on the data sheet after the point data (see “88” bird info below). **If you do not detect any birds during a minute interval, record NOBI (No Birds) in that interval and continue to record the minute in appropriate column when no birds were detected.** 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 correctly 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. If, before your 6 minute survey, you notice a bird that was flushed from the survey point upon your arrival, record the bird’s original distance from the survey 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 four-letter code,
- 2) the **distance** (determined with a rangefinder if possible) from you to the bird,
- 3) **how** the bird was detected (by song, call, drumming, 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 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 six 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 before or 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 six minutes and do NOT record birds that were only found while chasing another bird after the count. **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 Red-tailed Hawk soaring above you, and still see the hawk soaring on another point, only record this bird once.

## IV. POTENTIAL ISSUES 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 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. **Never pish or attract birds toward you when you are near a point that has not been completed!**

### **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 six-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. If you are unsure of the correct unknown code, make a note in the comments section so you can write the correct code in later.

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

We will be visiting each survey site during training, so this is not pertinent for this position like the other positions where you visit each site only once during the season.

### **H. Practice**

Practice identifying birds in a habitat or elevation range before counting in that area. Be familiar with the songs and calls of all species found in an area before conducting point counts there. Use BCR- or 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.

Cornell has recordings for each species on their All About Birds website (e.g. [http://www.allaboutbirds.org/guide/grasshopper\\_sparrow/lifehistory/ac](http://www.allaboutbirds.org/guide/grasshopper_sparrow/lifehistory/ac)).

Xeno Canto (<http://www.xeno-canto.org/>) is another great on-line and free resource for bird sounds.

### **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**

- Blakesley, J.A. and D. J. Hanni. 2009. Monitoring Colorado's Birds, 2008. Tech. Rep. M-MCB08-01. Rocky Mountain Bird Observatory, Brighton, CO. 39 pp.
- 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.

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

Please refer to Appendices H, I, and J 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 you sampled the transect.

#### 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 "G. Directions to Access Point" below.

#### F. Time Required to do 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. You may be required to figure out directions to your transects using Google Earth™ (we will also provide you with Google Earth™ files containing the locations of all transects within your study area). If you do not already have Google Earth™ on your computer, we recommend you download it (it is a free program that can be found on the internet) and familiarize yourself with it. Once you figure out directions to your transect, record this information on the transect description sheet. Later, when entering your transect data into the database, you will enter this information as well.

Provide explicit directions from a 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 location 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”). We will provide you with a *DeLorme Atlas and Gazetteer*.

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

**Example:**

SD-BCR17-BH30

From Hot Springs, drive west on HWY 18 to HWY 89.

Turn right on HWY 89 and drive 0.8 miles.

Turn left on CR 317 (Pilger Mountain Rd) and drive 7.3 miles.

Turn left on CR 318 (Elbow Canyon Rd) and drive 1.9 miles.

Turn right on FR 319 and drive 2.5 miles.

Turn left on FR 312 and drive 3.8 miles.

Pt. 13is AP (right next to the road).

**H. Transect description**

Provide the **distance** and **bearing** from the access point to the grid, or more specifically, to the first point if it becomes apparent that there is a logical order in which to survey the points. Record recommendations of a survey route through the grid for the subsequent year, if necessary. As some of these grids are miles from the nearest road, explicit details of a good route in will help future technicians greatly. Feel free to provide *between-point accounts* as well, when necessary, describing the topography, habitat, landmarks and/or other features that you pass prior to arriving at the next count station.

**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 UTM's 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 (e.g., the 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. Point Information Data Sheet**

**A. Points not conducted**

If you are unable to survey a point on a transect, record the reason you were unable to survey on this data sheet. Common reasons for not surveying a point are:

- 1) Inaccessible due to terrain

- 2) Ran out of time
- 3) Weather (rain or wind)

These are just a few reasons; you may run into other unexpected issues in the field. Just be sure to take detailed notes on why points were not conducted. We need to report this information to our funders after the field season, so the more information you provide us, the less we will have to contact you with questions after the field season.

### III. Vegetation Data Sheet

#### A. Site Data

1. **Observer:** Enter your first and middle 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. CO-BCR16-AR8)
5. **Access Point:** Mark the access point using your GPS unit and record the coordinates on the data sheet. If a transect is located far from any road, it is still useful to pick a logical place to leave your vehicle and record that location.
6. **Time:** Enter start and stop times for entire point count grid (not individual points) using 24-hour clock
7. **Sky:** (start and end): Enter one-digit codes at beginning and end of the point count grid (not at points)  

<i>0=0-15% cloud cover</i>	<i>1=16-50% cloud cover</i>	<i>2=51-75% cloud cover</i>
<i>3=76-100% cloud cover</i>	<i>5=fog</i>	<i>6=drizzle</i>
<i>8=Light snow</i>	<i>9=T'storm, precipitation or not</i>	

***You shouldn't survey in any other conditions!***
8. **Wind:** (start and end): Enter one-digit codes at beginning and end of the point count grid:  

<i>0=Less than 1 mph; smoke rises vertically</i>
<i>1=1-3 mph; smoke drift shows wind direction</i>
<i>2=4-7 mph; leaves rustle, wind is felt on face</i>
<i>3=8-12 mph; leaves, small twigs in constant motion; light flag extended</i>
<i>4=13-18 mph; raises dust, leaves, loose paper; small branches in motion</i>

***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. 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% 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 down 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 the average height of the grass in centimeters 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 ½ " x 11" = 21.5cm x 28cm.

## **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.

## **IV. Bird Data**

### **A. General Info**

It is extremely important to fill in this data at the bottom of the front and back of each and every bird form. If a bird form does not have this information and it becomes separated from the

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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. We are beginning to scan copies of all of our data, so the general info needs to be on both sides of the datasheet. For this project, we will want to record the date on each sheet and both sides of each sheet since we will be revisiting each transect multiple times. 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).
3. **BCR:** Fill in the number of the BCR you are working in.
4. **Transect Name:** Fill in the grid ID code (strata and number) on all pages of the bird form.

### B. Point Data

1. **Point #:** Enter the number of the point (01-16) on the transect you are about to survey. **NOTE:** for entries for low density species *between points* enter "88" (see below for more information on "88" birds).
2. **Time:** Please record the time when the point count began in the Species column next to the Point #.
3. **Species:** All birds detected during the 6-minute count period will 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.

PLEASE, PLEASE use correct codes, as it makes data entry and analysis easier. Species that cause particular problems for observers include: **Cackling Goose** (CACG not CAGO), **Canada Goose** (CANG not CAGO), **Northern Shoveler** (NSHO, not NOSH), Ring-necked Pheasant (RINP, not RNPH), **Barn Owl** (BNOW not BAOW), **Barred Owl** (BDOW not BAOW), **Broad-tailed Hummingbird** (BTLH not BTHU), **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), **Cactus Wren** (CACW not CAWR), **Canyon Wren** (CANW not CAWR), **Cedar Waxwing** (CEDW not CEWA), **Black-throated Gray Warbler** (BTYW not BTGW), **MacGillivray's Warbler** (MGWA, not MAWA), **Yellow Warbler** (YWAR, not YEWA), , **Canyon Towhee** (CANT not CATO), **Lark Bunting** (LARB, not LABU), **Sage Sparrow** (SAGS not SASP), **Savannah Sparrow** (SAVS, not SASP), **Lazuli Bunting** (LAZB, not LABU) and **Red-winged Blackbird** (RWBL, not RWBB).

Some individuals can be identified to subspecies. If you can identify one of the below subspecies, please use the four-letter codes below:

Subspecies	Code
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Northern Flicker (Red-shafted)	RSFL
Northern Flicker (Yellow-shafted)	YSFL
Northern Flicker (Intergrade)	FLIN
Yellow-rumped Warbler (Audubon's)	AUWA
Yellow-rumped Warbler (Myrtle's)	MYWA
Dark-eyed Junco (Gray-headed)	GHJU
Dark-eyed Junco (Oregon)	ORJU
Dark-eyed Junco (Pink-sided)	PSJU
Dark-eyed Junco (Red-backed)	RBJU
Dark-eyed Junco (Slate-colored)	SCJU
Dark-eyed Junco (White-winged)	WWJU
White-crowned Sparrow (Gambel's)	GWCS
White-crowned Sparrow (Mountain)	MWCS

If you detect a bird that you are unable to identify, use the appropriate unknown bird code. Never guess on the identity of a bird. This is 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. Below is a table of unidentified bird codes you can use:

<b>Unknown Bird</b>	<b>Code</b>
Unknown Accipiter	UNAC
Unknown Bird	UNBI
Unknown Blackbird	UNBL
Unknown Buteo	UNBU
Unknown Chickadee	UNCH
Unknown Corvid	UNCO
Unknown Dove	UNDO
Unknown Duck	UNDU
Unknown Empidonax	UNEM
Unknown Falcon	UNFA
Unknown Finch	UNFI
Unknown Flycatcher	UNFL
Unknown Gnatcatcher	UNGN
Unknown Grouse	UNGR
Unknown Gull	UNGU
Unknown Hawk	UNHA
Unknown Hummingbird	UNHU
Unknown Jay	UNJA
Unknown Nuthatch	UNNU
Unknown Oriole	UNOR
Unknown Owl	UNOW
Unknown Pipit	UNPI

Unknown Bird	Code
Unknown Raptor	UNRA
Unknown Sparrow	UNSP
Unknown Swallow	UNSW
Unknown Swift	UNSI
Unknown Tanager	UNTA
Unknown Thrush	UNTH
Unknown Thrasher	UNTR
Unknown Vireo	UNVI
Unknown Warbler	UNWA
Unknown Woodpecker	UNWO
Unknown Wren	UNWR

**3. Measuring Distances:** Using your Rangefinder as often as possible, 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), enter the distance as “999”. **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, estimate the distance that bird is from a visible point and use the Rangefinder to measure to that point. 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. **Please estimate the distance from the visible point to the bird BEFORE using the Rangefinder to get the distance from you to that point.** Distance-sampling relies upon the assumption that you measure all distances accurately, so 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, estimate the distance the bird is past a point-within-range and add that distance to what the Rangefinder displays. **Once again, estimate the distance between the bird and point-within-range BEFORE using the Rangefinder to get the distance from you to that point.** 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, bird data recorded without associated distances CANNOT be used 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 sparrow, or 3) it is singing emphatically and repeatedly. Females of many species will sing, although generally their songs are less emphatic and extensive. You should not record sex for birds giving only sex-unspecific calls.

Example:

On a point count, you detect six birds. You see a male RNSA, you hear a drumming RNSA, a calling WBNU, a singing AUWA, 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.

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.

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.

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How to record clusters:

Flocks: When two or more 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 ...). The Cluster Code is only used to link clusters that take up multiple lines on the data sheet.

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(usual). In the second scenario, “HOW” = V(usual) 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:

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. Squirrels:** Yes, squirrels. In an effort to incorporate other information into our bird

monitoring programs, we are also collecting data on red squirrels (RESQ) and Abert's squirrels (ABSQ) during point counts. *Treat both squirrels as you would a bird on point counts and treat Abert's squirrels as an "88" species as well.* That is, fill in the How and Sex boxes (generally a "U") for each Abert's squirrel detected between points. Please do not forget to record these squirrels **and** their associated data at all point counts, as the utility of these data depend on everyone collecting them throughout the study areas.

**9. Flyovers:** Some birds observed flying over a point without showing any signs of landing should be recorded as a flyover. 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. You should record these as if they were a perched bird. Additionally, individuals that you first detect in flight that are simply flying from perch to perch nearby 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. For true flyovers, 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.

**10. "88" Birds:** While walking between points, record all low-density birds species on the list of "88" birds. You do not need to record distance *but do record HOW and CLUSTER SIZE.* **Also record any you think might be rare for the area in which you are surveying.** (See Appendix B for a list of 88 bird species.)

**11. 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. All individual birds on a particular point should be bunched together on the form; then you should leave a blank line before starting entries for the next point.

## V. Other Important Information

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

- 1) Check to make sure you entered **The DATE**, your observer initials, point count grid #, 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. Your work is not done 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)

Record these species as 88 birds when you encounter them between points. You do not need to record distances, but please do record How, Sex, and Cluster information.

### I. Texas

- All cuckoos (including GRRO)
- All diurnal raptors
- All galliforms (chicken-like birds)
- All nightjars
- All owls
- All phoebes
- All rosy-finches
- All swifts
- All woodpeckers (incl. sapsuckers but not NOFL)
- Bell’s Vireo
- Lark Bunting
- Long-billed Curlew
- Mountain Plover
- Snowy Plover
- Upland Sandpiper

## II. South Dakota

All cuckoos (including GRRO)	Dickcissel
All diurnal raptors	Evening Grosbeak
All galliforms	Golden-crowned Kinglet
All nightjars	Gray Catbird
All owls	Hammond's Flycatcher
All phoebes	Indigo Bunting
All rosy-finches	Lark Bunting
All swifts	Lazuli Bunting
All woodpeckers (except NOFL and HAWO)	Least Flycatcher
American Dipper	Lesser Goldfinch
Baltimore Oriole	Loggerhead Shrike
Bank Swallow	Long-billed Curlew
Black-and-white Warbler	N. Rough-winged Swallow
Black-billed Magpie	Pinyon Jay
Blue Grosbeak	Pygmy Nuthatch
Bobolink	Red-eyed Vireo
Brown Creeper	Say's Phoebe
Canyon Wren	Turkey Vulture
Cassin's Finch	Upland Sandpiper
Cassin's Kingbird	Veery
Cedar Waxwing	White-throated Swift
Chestnut-collared Longspur	White-winged Crossbill
Clark's Nutcracker	Wilson's Snipe
Common Yellowthroat	Yellow-breasted Chat

## APPENDIX C. GUIDELINES FOR CLASSIFYING STRUCTURAL STAGE BY HABITAT

The following characteristics can generally define the various structural stages of the habitats listed below. Use this information as a guide to help you better understand what we mean by “structural stage”. Expect variability among sites depending on geographic location, elevation, aspect, slope, soil quality and other site characteristics. Therefore, you must use your head when judging structural stage. The important thing is to roughly assess the size (structural stage) and density (canopy coverage) of the trees at each point.

Record all data regarding habitat on the vegetation data sheet *prior to beginning each point count*.

### Habitat-Specific Information for Assessing Habitat and Structural Stage:

#### Aspen

- 1: Grass-Forb stage: Grasses and forbs dominate; aspen suckers/saplings are absent.
- 2: Shrub-Seedling stage: Suckers/saplings are present, up to 2 inches dbh and 4 m in height. Stem density can vary from 5,000 to 40,000 stems per acre.
- 3: Sapling-Pole stage: Saplings between 2 and 8 inches dbh and up to 6-13 m in height on good sites; on poorer sites trees may never reach 8 inches dbh and may be shorter than 6 m, with crooked and twisted boles.
- 4: Mature stage: On better sites, trees between 16-24 inches dbh and 28-33 m in height. Typically, there is a high density of grass, forbs and shrubs in the understory. Snags are also generally common in this stage.
- 5: Old-Growth stage: Large diameter trees and many snags are present, as are diseased trees and downed material. Snags often occur in large groups.

#### High-elevation Riparian

- 1: Grass-Forb stage: Grasses and forbs dominate; no woody growth occurs.
- 2: Shrub-Seedling stage: Willows up to 1.3 m in height occur.
- 3: Sapling-Pole stage: Willows up to 6.6 m in height dominate; alders may also occur. Mortality among willows may be substantial during this stage, resulting in thinning of the stand.
- 4: Mature stage: Alder and willow co-dominate; blue spruce is also often present.
- 5: Old-Growth stage: Blue-spruce dominates, along with willows and alders; heavy amounts of litter and downed material, and randomly distributed snags.

#### Mixed Conifer

- 1: Grass-Forb stage: Grasses and forbs dominate; no trees or saplings.
- 2: Shrub-Seedling stage: Saplings up to 1 inch dbh or 3 m in height; stand can be quite dense.
- 3: Sapling-Pole stage: Dominant trees > 1 inch dbh, but most trees <15 inch dbh; generally only very open stands have significant cone production in this stage.
- 4: Mature stage: Average dbh of dominant trees 15 - 25 inches; large dbh snags are relatively sparse.
- 5: Old-Growth stage: Similar to mature stage but with a greater proportion of large dbh trees; large snags and downfall are more common; forest can be single or multi-layered.

#### Montane Riparian

- 1: Grass-Forb stage: Grasses and forbs dominate; no woody growth occurs.
- 2: Shrub-Seedling stage: Willows up to 1.3 m in height occur.

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- 3: Sapling-Pole stage: Willows up to 6.6 m in height dominate; alders may also occur. Mortality among willows may be substantial during this stage, resulting in thinning of the stand.
- 4: Mature stage: Alder and willow co-dominate, canopy trees also often present.
- 5: Old-Growth stage: larger trees common, along with willows and alders; heavy amounts of litter, downed material, and snags.

### Pinyon-Juniper

- 1: Grass-Forb stage: Grasses and forbs dominate; saplings and small trees are absent.
- 2: Shrub-Seedling stage: Juniper and/or woody shrubs are present; pinyon seedlings are generally absent or sparse.
- 3: Sapling-Pole stage: Junipers average ~2 m in height; pinyons 2-5 m in height. Few if any snags are present.
- 4: Mature stage: Wide range of tree sizes may be present; pinyons are generally between 6-18 inches dbh and 3-10 m in height; junipers are typically 6-12 inches dbh and average 6 m in height. Snags 6-20 inches dbh are typically present.
- 5: Old-Growth stage: Virtually indistinguishable from Mature stage, but incidence of snags, litter and downed material is generally higher.

### Ponderosa Pine

- 1: Grass-Forb stage: Bunchgrasses and bluegrass dominate; pine seedlings absent. This stage usually results from fire and/or logging.
- 2: Shrub-Seedling stage: Small pine saplings ( $\leq 1$  inch dbh) and a variety of woody shrubs are likely to be present, as well as grasses. Litter and downed material may also exist.
- 3: Sapling-Pole stage: Trees 1-7 inches dbh, 3-17 m in height; age of stand 6-50 yrs old. Stands in this stage can be quite dense, normally exceeding 70% canopy closure, and are typically even aged. Some small dbh snags may be present.
- 4: Mature stage: Average dbh of trees between 16 to 24 inches. Stand can be multi-layered, and snags suitable in size for most cavity-nesting birds should be present.
- 5: Old-Growth stage: Average dbh of dominant trees between 30 to 60 inches; stand uneven in age and generally open; numerous snags of a wide variety of sizes are present.

### Spruce-Fir

- 1: Grass-Forb stage: Primarily herbaceous plants; no trees or saplings; near complete absence of downed litter or snags.
- 2: Shrub-Seedling stage: Saplings up to 1 inch in diameter at breast height (dbh) are dominant.
- 3: Sapling-Pole stage: Stems 1-7 inches dbh, and 2-15 m in height are dominant.
- 4: Mature stage: Average dbh 16-22 inches.
- 5: Old-Growth stage: Average dbh of dominant trees  $> 22$  inches; forest is typically multi-layered, with trees of varying age/size, significant amounts of accumulated downfall and numerous, randomly distributed snags. Grasses and forbs are relatively scarce, but epiphytic vegetation (mosses & lichens) is prevalent.

## APPENDIX D. KEY OF TWO-LETTER CODES FOR SHRUBS AND TREES

Code	Shrubs/Small Trees
AA	Acacia spp.
AL	Alder sp. ( <i>Alnus spp.</i> )
AB	Alder-leaved buckthorn ( <i>Rhamnus alnifolia</i> )
AP	American plum ( <i>Prunus americana</i> )
AC	Arizona Cypress ( <i>Cupressus arizonica</i> )
BE	Beaked hazelnut
BG	Beargrass ( <i>Nolina spp.</i> )
BI	Birch spp. ( <i>Betula spp.</i> )
BB	Blackberry/Raspberry ( <i>Rubus spp.</i> )
BL	Blackbrush ( <i>Coleogyne ramosissima</i> )
BF	Buffaloberry ( <i>Sheperdia canadensis</i> )
BH	Bush honeysuckle ( <i>Lonicera spp.</i> )
CC	Choke cherry ( <i>Prunus virginiana</i> )
CH	Cholla ( <i>Cylindropuntia spp.</i> )
CR	Cliffrose or bitterbrush ( <i>Purshia spp.</i> )
CJ	Common juniper ( <i>Juniperus communis</i> ) – low growing shrub in high elev. (NOT the tree)
CB	Corkbark Fir
CT	Creosote ( <i>Larrea tridentata</i> )
DH	Desert Holly ( <i>Berberis fremontii</i> )
DO	Desert Olive ( <i>Forestiera neomexicana</i> )
EB	Elderberry ( <i>Sambucus spp.</i> )
FB	Fendlerbush ( <i>Fendlera rupicola</i> )
GO	Gambel oak ( <i>Quercus gambelii</i> )
GB	Gooseberry/Currant ( <i>Ribes spp.</i> )
GW	Greasewood ( <i>Sarcobatus spp</i> )
HA	Hawthorn ( <i>Crataegus spp.</i> )
HB	Huckleberry ( <i>Vaccinium spp.</i> )
IB	Indigo bush or Leadplant ( <i>Amorpha spp.</i> )
JU	Juniper (bush-size) – all <i>Juniperus</i> species (Utah, Rocky Mountain, and One-seed)
MZ	Manzanita ( <i>Artocostaphalis spp.</i> )
MT	Mormon Tea ( <i>Ephedra spp.</i> )
MO	Mountain ash ( <i>Sorbus scopulina</i> )
MM	Mountain mahogany ( <i>Cercocarpus spp.</i> )
MS	Mountain/Ocean spray
LC	New Mexico Locust ( <i>Robinia neomexicana</i> )
NB	Ninebark ( <i>Physocarpus spp</i> )
OB	Oak bush – not Gambel oak
OG	Oregon grape ( <i>Berberis aquifolium</i> )
OP	Prickly Pear ( <i>Opuntia spp.</i> )
OT	Other shrub – unknown species or not on list

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<b>Code</b>	<b>Shrubs/Small Trees</b>
RA	Rabbitbrush ( <i>Chrysothamnus spp.</i> )
RD	Red-osier dogwood ( <i>Cornus sericea</i> )
RB	River (water) birch ( <i>Betula occidentalis</i> )
MA	Rocky mountain maple ( <i>Acer spp.</i> )
RO	Russian olive ( <i>Elaeagnus angustifolia</i> )
SA	Sage spp. ( <i>Artemisia spp.</i> )
SL	Saltbush ( <i>Atriplex spp.</i> )
SB	Serviceberry ( <i>Amelanchier spp.</i> )
LO	Shrub Live Oak ( <i>Quercus turbinella</i> )
SC	Shrubby cinquefoil ( <i>Pentaphylloides floribunda</i> )
SE	Single-leaf Ash ( <i>Fraxinus anoala</i> )
SK	Skunkbrush ( <i>Rhus trilobata</i> )
SW	Snakeweed ( <i>Gutierrezia sarothrae</i> )
SY	Snowberry ( <i>Symphoricarpos spp.</i> )
TA	Tamarisk/Saltcedar ( <i>Tamarix pentandra</i> )
TB	Thimbleberry ( <i>Rubus spp.</i> )
VI	Viburnum ( <i>Viburnum spp.</i> )
WR	Wild rose ( <i>Rosa spp.</i> )
WI	Willow spp. ( <i>Salix spp.</i> - primarily for all shrubby willows)
WO	Wolfberry ( <i>Lycium pallidum</i> )
YU	Yucca ( <i>Yucca spp.</i> )

<b>Code</b>	<b>Large trees</b>
HH	American hophornbeam ( <i>Ostrya Virginian</i> )
AE	American Elm
AH	Ash ( <i>Fraxinus spp.</i> )
BP	Balsam poplar ( <i>Populus balsamifera</i> )
BS	Blue spruce ( <i>Picea pungens</i> )
BX	Box elder ( <i>Acer negundo</i> )
BR	Bristlecone pine ( <i>Pinus aristata</i> )
BO	Bur oak ( <i>Quercus macrocarpa</i> )
BC	<b>Burned</b> conifer
BD	<b>Burned</b> deciduous
CW	Crack willow ( <i>Salix fragilis</i> )
DC	<b>Dead</b> coniferous - recently dead (still has bark)
DD	<b>Dead</b> deciduous - recently dead (still has bark)
DJ	<b>Dead</b> Juniper – recently dead (still has bark)
DY	<b>Dead</b> pinyon pine – recently dead (still has bark)
DF	Douglas fir ( <i>Psuedotsuga menziesii</i> )
ES	Engelmann spruce ( <i>Picea engelmannii</i> )
FC	Fremont cottonwood ( <i>Populus fremontii</i> )

## Field Protocol for Spatially Balanced Sampling of Landbird Populations: 2010 Field Season

Code	Large trees
JU	Juniper spp. ( <i>Juniperus</i> spp.)
LM	Limber pine ( <i>Pinus flexilis</i> )
LP	Lodgepole pine ( <i>Pinus contorta</i> )
NC	Narrow-leaf cottonwood ( <i>Populus angustifolia</i> )
PB	Paper birch ( <i>Betula papyrifera</i> )
PW	Peachleaf willow ( <i>Salix amigdaloides</i> )
PY	Pinyon pine ( <i>Pinus edulis</i> )
PC	Plains cottonwood ( <i>Populus deltoides</i> )
PP	Ponderosa pine ( <i>Pinus ponderosa</i> )
AS	Quaking aspen ( <i>Populus tremuloides</i> )
RO	Russian olive ( <i>Elaeagnus angustifolia</i> )
SU	Subalpine fir ( <i>Abies lasiocarpa</i> )
SN	Unidentifiable snag – no bark
UC	Unknown coniferous tree or not on list
UD	Unknown deciduous tree or not on list
WF	White fir ( <i>Abies concolor</i> )
WS	White spruce ( <i>Picea glauca</i> )
WP	Whitebark pine ( <i>Pinus albicaulis</i> )
WI	Willow species ( <i>Salix</i> spp.)

## APPENDIX F. FOUR-LETTER BIRD CODES

Common Name	Code	Common Name	Code	Common Name	Code	Common Name	Code
Abert's Towhee	ABTO	Barrow's Goldeneye	BAGO	Blue-gray Gnatcatcher	BGGN	Canyon Wren	CANW
Acorn Woodpecker	ACWO	Bell's Vireo	BEVI	Blue-winged Teal	BWTE	Cassin's Finch	CAFI
Alder Flycatcher	ALFL	Belted Kingfisher	BEKI	Bobolink	BOBO	Cassin's Kingbird	CAKI
Am. Three-toed Woodpecker	ATTW	Bewick's Wren	BEWR	Bohemian Waxwing	BOWA	Cassin's Sparrow	CASP
American Avocet	AMAV	Black Phoebe	BLPH	Boreal Chickadee	BOCH	Cassin's Vireo	CAVI
American Bittern	AMBI	Black Rail	BLRA	Boreal Owl	BOOW	Cattle Egret	CAEG
American Coot	AMCO	Black Rosy-Finch	BLRF	Brewer's Blackbird	BRBL	Cave Swallow	CASW
American Crow	AMCR	Black Swift	BLSW	Brewer's Sparrow	BRSP	Cedar Waxwing	CEDW
American Dipper	AMDI	Black Tern	BLTE	Bridled Titmouse	BRTI	Chestnut-backed Chickadee	CBCH
American Goldfinch	AMGO	Black Vulture	BLVU	Broad-tailed Hummingbird	BTLH	Chestnut-collared Longspur	CCLO
American Kestrel	AMKE	Black-and-white Warbler	BAWW	Broad-winged Hawk	BWHA	Chestnut-sided Warbler	CSWA
American Pipit	AMPI	Black-backed Woodpecker	BBWO	Brown Creeper	BRCR	Chihuahuan Raven	CHRA
American Redstart	AMRE	Black-billed Cuckoo	BBCU	Brown Thrasher	BRTH	Chimney Swift	CHSW
American Robin	AMRO	Black-billed Magpie	BBMA	Brown-capped Rosy-Finch	BCRF	Chipping Sparrow	CHSP
American Tree Sparrow	ATSP	Black-capped Chickadee	BCCH	Brown-crested Flycatcher	BCFL	Chukar	CHUK
American White Pelican	AWPE	Black-capped Vireo	BCVI	Brown-headed Cowbird	BHCO	Cinnamon Teal	CITE
American Wigeon	AMWI	Black-chinned Hummingbird	BCHU	Bufflehead	BUFF	Clark's Grebe	CLGR
Anna's Hummingbird	ANHU	Black-chinned Sparrow	BCSP	Bullock's Oriole	BUOR	Clark's Nutcracker	CLNU
Ash-throated Flycatcher	ATFL	Black-crowned Night-Heron	BCNH	Burrowing Owl	BUOW	Clay-colored Sparrow	CCSP
Baird's Sandpiper	BASA	Black-headed Grosbeak	BHGR	Bushtit	BUSH	Cliff Swallow	CLSW
Baird's Sparrow	BAIS	Black-necked Stilt	BNST	Cackling Goose	CACG	Colima Warbler	COLW
Bald Eagle	BAEA	Black-tailed Gnatcatcher	BTGN	Cactus Wren	CACW	Common Black-Hawk	CBHA
Baltimore Oriole	BAOR	Black-throated Gray Warbler	BTYW	California Gull	CAGU	Common Goldeneye	COGO
Band-tailed Pigeon	BTPI	Black-throated Sparrow	BTSP	California Quail	CAQU	Common Grackle	COGR
Bank Swallow	BANS	Blue Grosbeak	BLGR	Calliope Hummingbird	CAHU	Common Loon	COLO
Barn Owl	BNOW	Blue Jay	BLJA	Canada Goose	CANG	Common Merganser	COME
Barn Swallow	BARS			Canvasback	CANV	Common Moorhen	COMO
Barred Owl	BDOW			Canyon Towhee	CANT		

ROCKY MOUNTAIN BIRD OBSERVATORY

*Conserving birds and their habitats*

**Field Protocol for Spatially Balanced Sampling of Landbird Populations: 2010 Field Season**

<b>Common Name</b>	<b>Code</b>	<b>Common Name</b>	<b>Code</b>	<b>Common Name</b>	<b>Code</b>	<b>Common Name</b>	<b>Code</b>
Common Nighthawk	CONI	Gambel's Quail	GAQU	Harris's Hawk	HRSH	Loggerhead Shrike	LOSH
Common Poorwill	COPO	Golden Eagle	GOEA	Henslow's Sparrow	HESP	Long-billed Curlew	LBCU
Common Raven	CORA	Golden-cheeked Warbler	GCWA	Hepatic Tanager	HETA	Long-billed Dowitcher	LBDO
Common Yellowthroat	COYE	Golden-crowned Kinglet	GCKI	Hermit Thrush	HETH	Long-eared Owl	LEOW
Cooper's Hawk	COHA	Golden-winged Warbler	GWWA	Hooded Merganser	HOME	Lucy's Warbler	LUWA
Cordilleran Flycatcher	COFL	Grace's Warbler	GRWA	Hooded Oriole	HOOR	MacGillivray's Warbler	MGWA
Crissal Thrasher	CRTH	Grasshopper Sparrow	GRSP	Hooded Warbler	HOWA	Mallard	MALL
Curve-billed Thrasher	CBTH	Gray Catbird	GRCA	Horned Grebe	HOGR	Marbled Godwit	MAGO
Dark-eyed Junco	DEJU	Gray Flycatcher	GRFL	Horned Lark	HOLA	Marsh Wren	MAWR
Dickcissel	DICK	Gray Jay	GRAJ	House Finch	HOFI	McCown's Longspur	MCLO
Double-crested Cormorant	DCCO	Gray Partridge	GRPA	House Sparrow	HOSP	Merlin	MERL
Downy Woodpecker	DOWO	Gray Vireo	GRVI	House Wren	HOWR	Mississippi Kite	MIKI
Dusky Flycatcher	DUFL	Gray-crowned Rosy-Finch	GCRF	Hutton's Vireo	HUVI	Montezuma Quail	MONQ
Dusky Grouse	DUGR	Great Blue Heron	GBHE	Indigo Bunting	INBU	Mountain Bluebird	MOBL
Eared Grebe	EAGR	Great Crested Flycatcher	GCFL	Juniper Titmouse	JUTI	Mountain Chickadee	MOCH
Eastern Bluebird	EABL	Great Egret	GREG	Killdeer	KILL	Mountain Plover	MOUP
Eastern Kingbird	EAKI	Great Gray Owl	GGOW	Ladder-backed Woodpecker	LBWO	Mountain Quail	MOUQ
Eastern Meadowlark	EAME	Great Horned Owl	GHOW	Lapland Longspur	LALO	Mourning Dove	MODO
Eastern Phoebe	EAPH	Greater Pewee	GRPE	Lark Bunting	LARB	N. Rough-winged Swallow	NRWS
Eastern Screech-Owl	EASO	Greater Prairie-Chicken	GRPC	Lark Sparrow	LASP	Nashville Warbler	NAWA
Eastern Wood-Pewee	EAWP	Greater Roadrunner	GRRO	Lazuli Bunting	LAZB	Northern Bobwhite	NOBO
Eurasian Collared-Dove	EUCD	Greater Sage-Grouse	GRSG	Le Conte's Sparrow	LCSP	Northern Cardinal	NOCA
European Starling	EUST	Greater Scaup	GRSC	Least Flycatcher	LEFL	Northern Flicker	NOFL
Evening Grosbeak	EVGR	Greater Yellowlegs	GRYE	Lesser Goldfinch	LEGO	Northern Goshawk	NOGO
Ferruginous Hawk	FEHA	Great-tailed Grackle	GTGR	Lesser Nighthawk	LENI	Northern Harrier	NOHA
Field Sparrow	FISP	Green Heron	GRHE	Lesser Prairie-Chicken	LEPC	Northern Mockingbird	NOMO
Flammulated Owl	FLOW	Green-tailed Towhee	GTTO	Lesser Scaup	LESC	Northern Parula	NOPA
Forster's Tern	FOTE	Green-winged Teal	AGWT	Lesser Yellowlegs	LEYE	Northern Pintail	NOPI
Fox Sparrow	FOSP	Gunnison Sage-Grouse	GUSG	Lewis's Woodpecker	LEWO	Northern Pygmy-Owl	NOPO
Franklin's Gull	FRGU	Hairy Woodpecker	HAWO	Lincoln's Sparrow	LISP	Northern Saw-whet Owl	NSWO
Gadwall	GADW	Hammond's Flycatcher	HAFL			Northern Shoveler	NSHO

**ROCKY MOUNTAIN BIRD OBSERVATORY**

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**Field Protocol for Spatially Balanced Sampling of Landbird Populations: 2010 Field Season**

<b>Common Name</b>	<b>Code</b>	<b>Common Name</b>	<b>Code</b>	<b>Common Name</b>	<b>Code</b>	<b>Common Name</b>	<b>Code</b>
Northern Shrike	NSHR	Red-headed Woodpecker	RHWO	Snow Bunting	SNBU	Vesper Sparrow	VESP
Northern Waterthrush	NOWA	Red-naped Sapsucker	RNSA	Snow Goose	SNGO	Violet-green Swallow	VGSW
Olive Warbler	OLWA	Red-necked Grebe	RNGR	Snowy Egret	SNEG	Virginia Rail	VIRA
Olive-sided Flycatcher	OSFL	Red-tailed Hawk	RTHA	Snowy Plover	SNPL	Virginia's Warbler	VIWA
Orange-crowned Warbler	OCWA	Red-winged Blackbird	RWBL	Solitary Sandpiper	SOSA	Warbling Vireo	WAVI
Orchard Oriole	OROR	Ring-billed Gull	RBGU	Song Sparrow	SOSP	Western Bluebird	WEBL
Osprey	OSPR	Ring-necked Duck	RNDU	Sora	SORA	Western Grebe	WEGR
Ovenbird	OVEN	Ring-necked Pheasant	RINP	Spotted Owl	SPOW	Western Kingbird	WEKI
Painted Bunting	PABU	Rock Pigeon	ROPI	Spotted Sandpiper	SPSA	Western Meadowlark	WEME
Painted Redstart	PARE	Rock Wren	ROWR	Spotted Towhee	SPTO	Western Screech-Owl	WESO
Pectoral Sandpiper	PESA	Rose-breasted Grosbeak	RBGR	Sprague's Pipit	SPPI	Western Scrub-Jay	WESJ
Peregrine Falcon	PEFA	Rough-legged Hawk	RLHA	Spruce Grouse	SPGR	Western Tanager	WETA
Phainopepla	PHAI	Ruby-crowned Kinglet	RCKI	Steller's Jay	STJA	Western Wood-Pewee	WEWP
Pied-billed Grebe	PBGR	Ruddy Duck	RUDU	Stilt Sandpiper	STSA	White-breasted Nuthatch	WBNU
Pileated Woodpecker	PIWO	Ruffed Grouse	RUGR	Summer Tanager	SUTA	White-crowned Sparrow	WCSP
Pine Grosbeak	PIGR	Rufous Hummingbird	RUHU	Swainson's Hawk	SWHA	White-eyed Vireo	WEVI
Pine Siskin	PISI	Rufous-crowned Sparrow	RCSP	Swainson's Thrush	SWTH	White-faced Ibis	WFIB
Pinyon Jay	PIJA	Rusty Blackbird	RUBL	Tennessee Warbler	TEWA	White-tailed Ptarmigan	WTPT
Piping Plover	PIPL	Sage Sparrow	SAGS	Townsend's Solitaire	TOSO	White-throated Sparrow	WTSP
Plumbeous Vireo	PLVI	Sage Thrasher	SATH	Townsend's Warbler	TOWA	White-throated Swift	WTSW
Prairie Falcon	PRFA	Sandhill Crane	SACR	Tree Swallow	TRES	White-winged Crossbill	WWCR
Purple Finch	PUFI	Savannah Sparrow	SAVS	Trumpeter Swan	TRUS	White-winged Dove	O
Purple Martin	PUMA	Say's Phoebe	SAPH	Tundra Swan	TUSW	Whooping Crane	WHCR
Pygmy Nuthatch	PYNU	Scaled Quail	SCQU	Turkey Vulture	TUVU	Wild Turkey	WITU
Pyrrhuloxia	PYRR	Scissor-tailed Flycatcher	STFL	Upland Sandpiper	UPSA	Willet	WILL
Red Crossbill	RECR	Scott's Oriole	SCOR	Varied Bunting	VABU	Williamson's Sapsucker	WISA
Red-bellied Woodpecker	RBWO	Sedge Wren	SEWR	Varied Thrush	VATH	Willow Flycatcher	WIFL
Red-breasted Nuthatch	RBNU	Sharp-shinned Hawk	SSHA	Vaux's Swift	VASW	Wilson's Phalarope	WIPH
Red-eyed Vireo	REVI	Sharp-tailed Grouse	STGR	Veery	VEER	Wilson's Plover	WIPL
Red-faced Warbler	RFWA	Short-eared Owl	SEOW	Verdin	VERD	Wilson's Snipe	WISN
Redhead	REDH	Smith's Longspur	SMLO	Vermilion Flycatcher	VEFL		

**ROCKY MOUNTAIN BIRD OBSERVATORY**

*Conserving birds and their habitats*

**Field Protocol for Spatially Balanced Sampling of Landbird Populations: 2010 Field Season**

<b>Common Name</b>	<b>Code</b>
Wilson's Warbler	WIWA
Winter Wren	WIWR
Wood Duck	WODU
Yellow Warbler	YWAR
Yellow-bellied Sapsucker	YBSA
Yellow-billed Cuckoo	YBCU
Yellow-breasted Chat	YBCH
Yellow-headed Blackbird	YHBL
Yellow-rumped Warbler	YRWA
Yellow-throated Vireo	YTVI
Zone-tailed Hawk	ZTHA

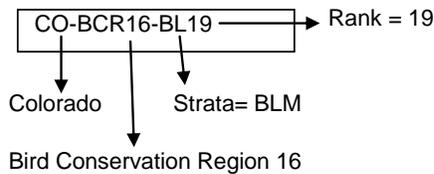
## APPENDIX G. GPS NAMING SYSTEM

At the beginning of the field season, you will receive a GPS unit containing waypoints for each point on each transect assigned to you. The following is an example of how transects and points will be labeled in your GPS unit:

### Monitoring Colorado Birds Grid Label & Point Label Explanation

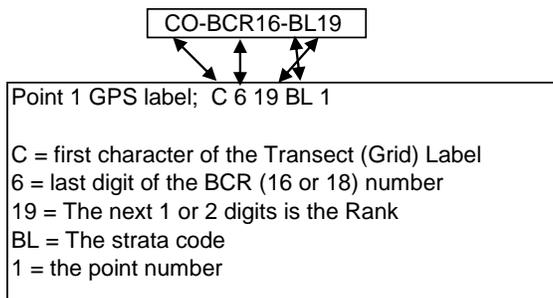
The Grid (Transect) labels are based on the State, Bird Conservation Region (BCR), Strata Code (ie. BLM = BL) and the Rank (This number corresponds with the order of the sample)

Grid Label Example



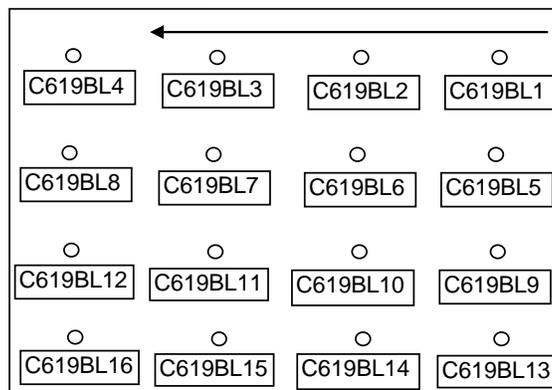
Point Label Example (16 points per Grid)

The point GPS label is related to the Transect (Grid) label by the following;



Grid with GPS labels Number order is from upper right to left

Point Number	GPS label
1	C619BL1
2	C619BL2
3	C619BL3
4	C619BL4
5	C619BL5
6	C619BL6
7	C619BL7
8	C619BL8
9	C619BL9
10	C619BL10
11	C619BL11
12	C619BL12
13	C619BL13
14	C619BL14
15	C619BL15
16	C619BL16



## APPENDIX H. SAMPLE TRANSECT DESCRIPTION SHEET

**Transect:** CO-BCR16-RO25      Observer Initials: CW      Date Conducted: 7/2/2008

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: \_\_\_\_\_ DeLorme Page: **27 D4** County: Routt State: CO  
 (if applicable)  
 Access Point UTM: \_\_\_\_\_ Management Unit: ROUTT  
 Elevation: **2306357445, n4439716** Time required to do the transect: **5 hours**

**Transect Descriptions**

Directions to Access Point:

**From Toponas, go south on Hwy 131. Turn left onto Hwy 134 and drive, 5.7 miles. Turn left on FR270. Follow road 1.5 miles to transect. There is a turnout on the left where you can park, and this is the AP. This transect straddles FR270.**

TransectDescription:

**Relatively easy transect in mixed conifer with some aspen, with many points in open, high mountain meadows.**

**Suggested order of points:**

Notes:

**2, 3, 4, 8, 7, 6, 10, 11, 12, 16, 15, 14, 13, 9, 5, 1**  
 Please remember to record bearings for all low density species!

**2008 Notes or Updates and camping information**

**Camping - Continue along FR270 to Lynx Pass Campground on the left. It is a small campground with just a few spots, about \$8/night. Nice spot.**

UTMs:	zone	easting	northing
1:	13	357525	4439728
2:	13	357275	4439728
3:	13	357025	4439728
4:	13	356775	4439728
5:	13	357525	4439478
6:	13	357275	4439478
7:	13	357025	4439478
8:	13	356775	4439478
9:	13	357525	4439228
10:	13	357275	4439228
11:	13	357025	4439228
12:	13	356775	4439228
13:	13	357525	4438978
14:	13	357275	4438978
15:	13	357025	4438978
16:	13	356775	4438978



v

### APPENDIX J. 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 # = 88. Rocky Mountain Bird Observatory, PO Box 1232, Brighton, CO 80601

Rocky Mountain Bird Observatory Point Transect Bird Form

Point #	Species	Radial Distance	HOW	SEX	Cluster		Point #	Species	Radial Distance	HOW	SEX	Cluster	
					Size	Code						Size	Code
02	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			08	AMRO	76	S	M		
	PISI	71	C	U				DEJU	58	S	M		
	WAVI	123	S	M				NOFL	207	C	U		
	WEWP	90	C	U				LISP	82	S	M		
								RESQ	12	C	U		
88	RNSA		C	U				RESQ	47	C	U		
								DEJU	65	S	M		
03	LISP	97	S	M				MWCS	79	S	M		
	CAGO		F	U	2			AMRO	45	C	U		
	LISP	125	S	M				AUWA	39	S	M		
	RECR	31	C	U	6			LISP	99	S	M		
	AUWA	33	S	M	1	A		RBNW	103	C	U		
	AUWA	27	V	F	1	A		NOBI					
	UNRA	700	V	U									
	WETA	63	S	M			12	RBNW	99	C	U		
	MWCS	101	S	M				AMRO	67	S	M		
	RCKI	116	S	M				HETH	176	S	M		
	NOGO	63	V	U				RCKI	121	S	M		
	DEJU	42	C	U				RESQ	28	C	U		
								AMRO	84	C	U		
04	LISP	72	S	M				TOSO	54	C/S	M		
	MWCS	105	S	M				NOBI					
	LISP	206	S	M				NOBI					
	AMRO	96	S	M									
	LISP	47	C/S	M									
	MWCS	108	S	M									
	BTLH	49	O	U									
	MWCS	6	C	U									
	LISP	107	S	M									
	MWCS	55	S	M									

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

Observer 1 Initials-all three: C M W | Year: 2008 | State: CO | BCR: 11 | Transect Name (e.g. RM99): B D 2 E