

# Integrated Monitoring in Bird Conservation Regions (IMBCR):

Field Protocol for Spatially Balanced Sampling of Landbird Populations

2013



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## I. PROJECT OVERVIEW

Rocky Mountain Bird Observatory (RMBO) in cooperation with the US Forest Service, US Bureau of Land Management, US National Park Service, and other agencies, developed a program to monitor bird populations utilizing point counts as the primary sampling technique. The program was designed to be statistically rigorous, biologically accurate, and to produce data for analyses of population trends for most breeding diurnal landbird species. This document provides details of the design and of the operation of the Integrated Monitoring in Bird Conservation Regions (IMBCR) monitoring program. We intend this protocol to instruct field technicians on how to conduct point counts and to help others when establishing monitoring projects of their own, so that the methods can be comparable.

Survey points are arranged in a 4 x 4 grid of 16 points, with 250m spacing between points. Grids are selected using a spatially balanced 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 Field Offices, etc.).

## II. MATERIALS

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

- A. Timepiece** with a countdown timer and a chime;
- B. Binoculars** (you must provide these);
- C. Declination-adjustable compass** with sighting capability (e.g., a mirror);
- D. Clipboard** (with instruction sheets attached);
- E. Writing utensils** (pencil or indelible ink pen) (*3 pencils will be provided by your employer at the start of the field season; if you lose these you must provide additional writing utensils*);
- F. GPS unit** with point count 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. Maps and transect locations**;
- L. Protocol with master list of four-letter bird codes**;
- M. Master list of weather and habitat codes**, attached to the clipboard.

## III. NAVIGATING TO THE SURVEY LOCATION

Navigating to randomly selected survey locations can be challenging. Fortunately, there are a number of resources to assist you in finding your way to the most convenient access point for each survey site. You can utilize RMBO's online transect maps website, view the Google Earth file provided to you by your crew leader, review a previously existing transect description sheet, and consult Delorme, BLM, or USFS maps.

### **A. RMBO online maps website**

RMBO's online maps website is available at the following link:

<http://rmbo.org/v2/dataentry/monitoring/transectLocationMaps.aspx>

You will be required to login using the username and password provided to you at training. Once logged into the site, please select the appropriate project (e.g., state or park network you are working in) and transect from the drop down menus. Once the appropriate transect appears you can use the zoom and scroll features to follow existing roadways to the most convenient access point. You can also toggle between the terrain, satellite and maps options. The terrain feature shows topography, which is useful for navigating to the transect and between points. The maps feature only shows roads, but can be valuable when figuring out driving directions to a particular site. The satellite feature will display satellite photo imagery. We recommend that you take a careful look at steep transects using the satellite feature found in the upper left portion of the map. This will give you a better idea of whether steep slopes are vegetated or not.

### **B. Google Earth files**

Prior to training you will receive a Google Earth file with transects that you are expected to complete. To view this KML file you will need to download a free version of Google Earth from the internet. Once Google Earth is installed you can simply double click on the KML file sent to you and view the transect locations. This file will help you plan the order you would like to conduct your assigned surveys to minimize travel time and distance between survey locations. Additionally, you can zoom-in to get a better idea of existing roadways and the terrain at the survey locations.

### **C. Transect Description Sheet**

You will receive a printed transect description sheet (Figure 1) corresponding to each transect that has been assigned to you. If, for some reason, you are missing a transect description sheet you can print one by visiting RMBO's landowner website (<http://fc.rmbo.org/>), logging in with your landowner username and password (different from your data entry and transect description password), and entering the full transect name. If you would like to include the landowner information sheet (Figure 2) please check the box next to "show landowner information". Most transect description sheets will already have information recorded on them; however, it is possible that you will be assigned a transect that has not been completed before. Please take the time to record or verify all information on the transect description sheet. This is the best opportunity for information obtained "on the ground" to be passed on to crew leaders and future technicians. Be sure that each of the following fields is filled in before leaving the survey location:

#### **1. Observer Initials**

Record your data entry login here.

#### **2. Date Conducted (YYYY/MM/DD)**

Record the date you sampled the transect.

#### **3. 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 transects to field technicians with appropriate vehicles.

#### **4. DeLorme Page**

Don't forget to record the Delorme page and section that the transect is on. This allows future

field technicians to quickly locate the transect on the road map.

**5. Access Point UTM**

The UTM and projection zone for the closest spot to the transect where a surveyor can park their vehicle.

**6. Access and Transect Difficulty**

It is helpful to have an idea of what to expect before surveying 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. It is helpful for surveyors to know if they will be pressed for time to complete all 16 points, so they can ensure that they move quickly between points. Please record the access and transect difficulty using the rubric (Table 1) so future field technicians can plan accordingly.

**Table 1. Difficulty Rubric**

Rating Rubric	Transect Difficulty			
Access difficulty	1: Easy	2: Moderate	3: Difficult	4: Inaccessible Terrain
1: Easy	11	12	13	14
2: Moderate	21	22	23	24
3: Difficult	31	32	33	34
4: Inaccessible Terrain	4	4	4	4

**Explanation of codes**

**Access Difficulty (Measure of the hiking difficulty from the access point to the transect):**

- 1: ≤ 3 km and easy topography. Hike to transect requires less than 45 minutes.
- 2: 3 km - 6 km with relatively easy topography. Hike to transect requires less than 75 minutes.
- 3: ≥ 6 km and/or difficult terrain. Transect likely requires backpacking into transect the day before.
- 4: Transect is inaccessible due to river, cliffs, or other dangerous terrain.

**Transect Difficulty (Measure of the difficulty traveling between points on a transect):**

- 1: Relatively flat transect. 16 points are easily surveyed in approximately 4 hours.
- 2: Hilly terrain, areas with dense vegetation, and/or a few stream crossings. Technician might not be able to complete all 16 points during the sampling period.
- 3: Steep slopes, dense vegetation, or difficult stream crossings throughout the transect. Technician is unlikely to complete 12 or more points during the sampling period.
- 4: Transect has cliffs, rivers, or other dangerous terrain that do not permit 6 points to be finished.

**7. Directions to Access Point (VERY IMPORTANT!)**

You will want to 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 these directions. When recording directions to the Access Point provide explicit directions from a major intersection within a nearby town readily found on a map to the Access Point. It is extremely helpful to provide mileages from intersections or other landmarks using your odometer. For all sites, take GPS readings and record the UTM coordinates for each Access Point. It can be helpful to make the Access Point a recognizable feature on the landscape, like a cattle guard or sign post. You may encounter a situation where a road has been gated, washed out, etc. In these instances it is very important to record appropriate changes to the existing directions. Please don't inconvenience future surveyors by not making these changes.

If necessary, provide the distance and time to hike 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 to the transect will help future technicians immensely.

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

**DO NOT FORGET TO RECORD THE UTM'S OF THE ACCESS POINT ON THE TOP OF THE SHEET!**

### **8. Transect description**

In this section, please record the primary habitat types encountered on the transect. When necessary, please provide directions between points, describing paths future technicians may want to follow. You can also include useful information about terrain, barbed wire fences encountered, and any other information that would be helpful to know when surveying a transect.

### **9. Notes, Updates, and Camping Information**

Please provide directions and a description of camping options in the area in this section. Sometimes, camping is available right at the Access Point. If not, then record directions 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 (e.g., the transect is surrounded by private land) then record where you stayed. The nearest library or free internet location is often helpful information as well. Also, you can enter information relevant to the site, problems encountered during the transect, cool scenery, or other tidbits that either don't fit in other places or that future surveyors might find interesting. Please refrain from listing bird species that were found on the transect as this can bias future detection data.

### **D. Delorme, BLM, and USFS Maps**

Delorme maps are a particularly useful tool for driving around whatever study area you are working in. Surveys on BLM lands or National Forests may be greatly aided by maps produced by those agencies. In particular, we recommend having a USFS map for backcountry surveys as these will display trail systems and parking areas and can greatly simplify navigation to the transect. In most cases, your employer will provide you with these maps. If you do not have a map that you feel is necessary, contact your supervisor to see if you can be reimbursed for the expense of a purchased map.

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Transect Description Sheet <https://fc.rmbo.org/TransectDescriptionSheets.aspx>

**Transect: AZ-TONTO-TL10** Observer Initials: Date Conducted:  
 Transect Name: Deer Creek

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**Please verify all transect information. If the access point, county, map, or other information is inaccurate, please note the correct data!**

Transect is accessible to:  All Vehicles  High Clearance  4WD Only

DeLorme Page: County: Gila State: AZ

Access Point UTM: Management Unit: Tonto National Forest  
 12 465906 3766309

Elevation: Hiking time from AP to grid: 5 hours Difficulty: 2, 2  
 3270

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<p><b>Access Point Directions:</b>                  From the junction of HWY 87 and Bush HWY, drive N on HWY 87 for 35.1 miles. Exit at HWY 180 and go left into the parking lot for the Deer Creek Trailhead. Pt 13 is ~2km away. Follow Deer Creek trail until it goes down to the creek/wash. Cross fence and follow the creek to point 13 (~40 minutes).</p>	<p><b>Notes:</b>                  Camping - from trailhead, continue N on HWY 87 for 3.7 miles. Turn right on FR 417 (towards Gisela) and drive 3.2 miles. Turn left onto unmarked road. This turnoff leads back a short way to an OK campsite with some shade. Close to the road, but easily accessible.</p>
<p><b>Transect Description:</b>                  PJ and SH habitat. Point 13 is in RI habitat. Lots of ups and downs on this survey, but cattle trails are very helpful.</p>	

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<p><b>2012 Notes/Updates/Camping Information</b></p>	<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th>Point:</th> <th>Zone:</th> <th>Easting:</th> <th>Northing:</th> <th>TRS:</th> </tr> </thead> <tbody> <tr><td>1</td><td>12</td><td>465623</td><td>3768688</td><td>T8N R10E 7</td></tr> <tr><td>2</td><td>12</td><td>465373</td><td>3768688</td><td>T8N R10E 7</td></tr> <tr><td>3</td><td>12</td><td>465123</td><td>3768688</td><td>T8N R10E 7</td></tr> <tr><td>4</td><td>12</td><td>464873</td><td>3768688</td><td>T8N R10E 7</td></tr> <tr><td>5</td><td>12</td><td>465623</td><td>3768438</td><td>T8N R10E 7</td></tr> <tr><td>6</td><td>12</td><td>465373</td><td>3768438</td><td>T8N R10E 7</td></tr> <tr><td>7</td><td>12</td><td>465123</td><td>3768438</td><td>T8N R10E 7</td></tr> <tr><td>8</td><td>12</td><td>464873</td><td>3768438</td><td>T8N R10E 7</td></tr> <tr><td>9</td><td>12</td><td>465623</td><td>3768188</td><td>T8N R10E 7</td></tr> <tr><td>10</td><td>12</td><td>465373</td><td>3768188</td><td>T8N R10E 7</td></tr> <tr><td>11</td><td>12</td><td>465123</td><td>3768188</td><td>T8N R10E 7</td></tr> <tr><td>12</td><td>12</td><td>464873</td><td>3768188</td><td>T8N R10E 7</td></tr> <tr><td>13</td><td>12</td><td>465623</td><td>3767938</td><td>T8N R10E 7</td></tr> <tr><td>14</td><td>12</td><td>465373</td><td>3767938</td><td>T8N R10E 7</td></tr> <tr><td>15</td><td>12</td><td>465123</td><td>3767938</td><td>T8N R10E 7</td></tr> <tr><td>16</td><td>12</td><td>464873</td><td>3767938</td><td>T8N R10E 7</td></tr> </tbody> </table>	Point:	Zone:	Easting:	Northing:	TRS:	1	12	465623	3768688	T8N R10E 7	2	12	465373	3768688	T8N R10E 7	3	12	465123	3768688	T8N R10E 7	4	12	464873	3768688	T8N R10E 7	5	12	465623	3768438	T8N R10E 7	6	12	465373	3768438	T8N R10E 7	7	12	465123	3768438	T8N R10E 7	8	12	464873	3768438	T8N R10E 7	9	12	465623	3768188	T8N R10E 7	10	12	465373	3768188	T8N R10E 7	11	12	465123	3768188	T8N R10E 7	12	12	464873	3768188	T8N R10E 7	13	12	465623	3767938	T8N R10E 7	14	12	465373	3767938	T8N R10E 7	15	12	465123	3767938	T8N R10E 7	16	12	464873	3767938	T8N R10E 7
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4/4/2013 6:33 PM

Figure 1. Example Transect Description Sheet.

## IV. VERIFYING ACCESS PERMISSION

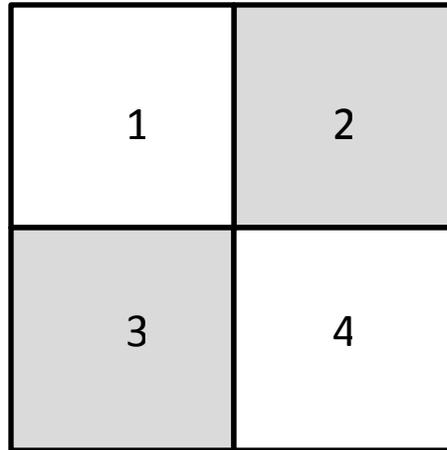
Landownership is determined by the Landowner Liaison prior to the beginning of the field season. Technicians are responsible for determining public or granted access routes to the survey location. Do not attempt to cross or survey property if you have any question regarding ownership. Trespassing is a serious offense and may be cause for immediate termination. The following descriptions explain the most common types of landownership encountered while conducting bird surveys:

- **Public Right-of-Way:** Public right-of-ways are federal, state or local governmental passageways through any type of landownership. The most common form of a public right of way is a road. **This does not mean that all roads are public.** Interstates, state highways, county, USFS and BLM roads are public right of ways. Therefore, if a road is labeled as such, you can travel on the road without trespassing. Legally, landowners cannot gate public right of ways even if they own adjacent property; however, you may see instances where this occurs. If you come to a gate or other indicator (e.g. No Trespassing sign), assume you have reached the end of the public right-of-way.
- **Federal Lands:** USFS and BLM lands are generally accessible to the public without the need for permits or passes. However, local restrictions may apply (i.e. due to safety precautions or sensitive wildlife areas) – you can check on closures by contacting the district or field offices. U.S. Fish and Wildlife Service, Department of Defense and U.S. National Park Service lands are more restricted and typically require passes and/or permits. Bureau of Indian Affairs lands are treated as Private Lands and may require a letter granting permission.
- **State Lands:** Generally, there are two major types of state lands; state trust lands and state resource (i.e. wildlife, parks or forest) lands. Each state has varying regulations outlining how lands are used and accessed. For example, in Colorado you must have permission from the Colorado State Land Board before accessing state lands, whereas in North Dakota, the public may access school trust lands without prior consent. State resource lands almost always require passes or permits. Be sure to ask your field crew leader about the regulations for your study area.
- **Local Government Lands:** The most commonly encountered local government lands are county and city lands. Because local government policy varies significantly between entities, be sure to check with your field crew leader to determine if passes and/or permits are required.
- **Private Lands:** Private lands are owned by individuals or businesses. Private landowners have the right to prevent access to the land they own. Furthermore, they have the right to prevent access to adjacent public land if no public right of way exists. Trespassing laws vary state to state; for simplicity's sake, if you are on private land without landowner consent – you are trespassing.

### **Additional Factors:**

If passes or permits are required, Crew Leaders will obtain permits before the transect is surveyed. Your employer will reimburse you for any pass fees incurred while conducting surveys.

You may find yourself working in an area where there is a mixture of public and private parcels in a configuration resembling a checkerboard. This is most commonly found in BLM lands; however, may also occur in other areas. In these instances, it is not legal to “jump corners” from one public parcel to the next. For instance, in the figure below, it would not be legal to pass from parcel one to parcel four without permission from the landowner of parcel two or three.



**Figure 2. Representation of “checkerboard” landscape. Shaded squares represent private parcels and un-shaded squares represent public parcels.**

### **Determining and Recording Access Permission**

It is your supervisor’s goal to obtain permission to access private or restricted property prior to the beginning of the field season. Under most circumstances permission to survey at least 4 of the 16 point count locations (the minimum required for a transect to be considered “complete” due to private land issues) on a transect will have already been obtained before the transect is assigned to you. On occasion, technicians may be asked to contact assessor offices, resource managers, and/or private landowners to obtain additional contact information and permission. **It is each technician’s responsibility to verify which points your employer has obtained permission to survey prior to navigating to the survey site.** Please go to: <http://fc.rmbo.org> and click on the link for the landowner database. Once you log in using the username and password provided to you at training, you can navigate to the appropriate transect and review the access status for each point. Please make sure to circle each point where access has been “granted” and cross out any points where access has been “denied” on your landowner information sheet (Figure 3). Points where the access status is listed as “no contact” or “unknown” should not be marked. This will help you understand and remember which points are ready to survey, which points should be avoided, and which points could use some more information in the event that you encounter a landowner near the transect or if you see a nearby house. Technicians are responsible for reviewing the notes associated with each landowner whose land they intend to survey to make certain there are no instructions regarding driving on roads, disturbing cattle, etc. Please record these notes on your landowner information sheet as a reminder to yourself. Finally, **technicians are responsible for calling landowners that have granted access to their property two or three days prior to surveying the property.** It is extremely important that technicians do this because your employer has promised each landowner that they will receive notification prior to the survey, as a courtesy to them. When calling please tell the landowner your name, the organization you are working for, provide an expected date that you will be on their property, and describe the vehicle that you will be driving. In the event that a landowner who has already granted permission doesn’t answer the phone, a voicemail message will suffice. If the landowner doesn’t answer and you are unable to leave a message you should not survey the property until you establish some contact with the landowner. If you are unable to establish contact after four attempts please contact your crew leader.

Please record notes on all your attempts to contact landowners and the result of those attempts on the “contact log” datasheet on the back of the landowner information sheet. You will use this form to

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record any additional landowner information you may collect in the field. If you find that the landowner information we provided is different from what you encounter in the field (such as landowner names, phone numbers, addresses, etc.) or if you obtain new landowner information please record that information on the appropriate line. Also, if a point is listed as private, and you discover it is actually public (or vice versa), you will record that information here as well. Be sure to record all information on this sheet in the landowner database (see data entry protocol).

<b>Name:</b> Jennifer Blakesley <b>Address:</b> 1230 Mountain Vista St., Green River, WY 82935 <b>Phone:</b> (307) 332-0835	5, 9 13
<b>Name:</b> Jeff Birek (owner) <b>Business:</b> Birek Cattle Co. LLC <b>Address:</b> PO Box 247 Green River, WY 82935 <b>Phone:</b> (307) 331-4251 <b>Alternate Phone:</b> (307) 328-4455	1
<b>Name:</b> Green Grass Country Club (Owner), Nick Van Lanen (Contact) <b>Business:</b> Green Grass Country Club <b>Address:</b> PO Box 21 Green River, WY 82935 <b>Phone:</b> Phone: (307) 882-1459 <b>Notes:</b> 2/2011: Contact Nick before entering.	10, 11 14
<b>Name:</b> Chris White (owner) <b>Address:</b> PO Box 844 Green River, WY 82935 <b>Physical Address:</b> 2716 Tulane Dr. <b>Phone:</b> (307) 452-9845	2, 4
<b>Name:</b> Jora Rehm-Lorber (owner) <b>Address:</b> 589 Comanche Cir Green River, WY 82935 <b>Phone:</b> (307) 362-3854	6, 7, 8
<b>Name:</b> Matthew & Cassidy McLaren (owner) <b>Address:</b> 1100 Mountain Vista St. Green River, WY 82935 <b>Phone:</b> (307) 462-8985	12, 15, 16
<b>Name:</b> David Hanni (owner) <b>Address:</b> PO Box 1441 Green River, WY 82935 <b>Phone:</b> (307) 433-9957	3

Figure 3. Example Landowner Information Sheet.

## V. PREPARATION

### A. Stay Organized

Organize equipment and materials for the following morning's survey. Prepare food and personal gear to facilitate a timely departure from camp or trailhead. Bring appropriate gear, including extra water and a first aid kit every day. Before heading out into the field, be sure to have all the gear and equipment necessary to complete your survey.

### B. Familiarize yourself with the survey site

The day before conducting a point count survey, check out your survey area and familiarize yourself with the habitat. You should plan out an access route during the daylight. This will make it easier to find your way to the first point if you have to hike in in the dark the next morning. Determine the point to point route you will take to conduct the survey. If the survey is in a remote area, be sure to make arrangements to camp the previous night near the survey area.

### C. Check Weather Reports

Unless there are extreme conditions predicted for the morning surveys (i.e., strong winds and/or heavy rain), we recommend that observers attempt to conduct a survey. Counts should not be conducted if wind strength on the Beaufort scale is a sustained 5 or greater, or if it is raining (anything greater than a drizzle). If you encounter these conditions, wait until the weather improves or cancel the sampling for that day and try again on another day. Consider data entry on days when surveys are canceled or locating other nearby transects that you will be surveying in the future.

### D. Daily Timing

Sampling will occur in the morning, beginning approximately ½ hour before sunrise (once there is enough light to identify birds by sight) and ending no later than 5 hours after official sunrise. There is considerable variation among sunrise times, and it is advisable to use a table localized for the area being sampled. Attempt to arrive at the first point while it is still dark so that the count can begin as soon as it is light enough to see. Singing rates for most species is usually highest before or near official sunrise and then decline slowly over the next few hours.

### E. Safety

Please review the Safety Protocol provided to you before conducting your first survey. It is important to make sure 1) you are aware of the dangers you may encounter in the field, 2) you know how to minimize the likelihood of encountering those dangers, and 3) you know what to do in the event you encounter a dangerous situation.

As an added safety measure for RMBO field technicians, SPOT (Satellite Personal Tracker) Units are provided for each individual. SPOT units are a way for technicians to regularly check in with their field crew leaders to maintain contact when both parties have irregular access to internet and phone service. Additionally, SPOT units allow technicians to send a "help" message in the event of an emergency. RMBO requires field technicians to send their crew leader an "ok" message prior to, and following, the completion of each survey. This assures the field crew leader that technicians are able to safely get into, and out of, their transects on a daily basis. The nature of this form of contact requires the regular and consistent use of the units; otherwise, the field crew leader is left wondering if the technician forgot to check in or if they are in need of assistance. The use of SPOT units will be covered in detail during training, and more information is available in the Safety

Protocol.

## VI. CONDUCTING POINT COUNT SURVEYS

### A. Seasonal Timing

Point counts should be performed after all migratory species have returned to their breeding areas and as early in the season as possible without counting transient birds that are still migrating through. Counts performed in grasslands in late May are not comparable to counts performed in the same habitat in early July. Most local breeding birds complete nesting before the middle of July and are much less vocal than they are in May. We will provide you with optimal survey dates, based on primary habitat and elevation, for your study area at training. Below is an example of the optimal survey dates used in Colorado in 2008.

#### Colorado Optimal Survey Dates:

<7,500ft (<2,286m) - 12 May - 15 June  
7,500ft - 9,300ft (2,286m - 2,835m) - 5 June - 30 June  
>9,300ft (>2,835m) - 25 June - 15 July

### B. Point Counts – Getting Started

You will receive a GPS unit with all of the point locations for your transects loaded onto it. Follow the GPS unit to each point count station (we will practice this during training). Please see Appendix A for a description of how points 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 note on your datasheet 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” after the disturbance you created while approaching the point.

### C. Approaching the Point

There may be instances where you should not or cannot conduct the survey from the exact point locations. In these instances, observers may conduct a point count from anywhere within a 25m radius of the exact point count location. Common reasons why an observer might survey up to 25 meters from a point count station include: 1) permission was not granted from a private landowner; however, the observer can count from a public right of way road that is within 25m 2) the point count station does not afford good visibility (a boulder, rock or other obstruction is blocking your view) or 3) it is difficult to hear (often times running water can make hearing birds difficult but moving a few steps away greatly improves your aural detection ability). You should make every effort to conduct the count from the exact point location and only survey up to 25m from a point if it is absolutely necessary. If you are unable to get within 25m of the exact point location, most likely because of a physical barrier, then do not survey the point.

### D. Collecting Habitat Data

Fill in the habitat data for each of the 16 points while at the point. Unlike the bird data, which we record to an unlimited distance from each point, **we only record habitat data within a 50m radius of each point**. We 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. Because it is very important to finish as many point counts as

possible in a morning, we ask that you do not spend more than a couple minutes filling in habitat data at each point. Collect samples of unknown plant species (place in a numbered zip lock bag) so you can identify them after completing the survey. Below is a description of the fields found on the vegetation datasheet and brief instructions on filling in these fields. Please refer to Figure 5 at the end of this section for an example of a completed vegetation datasheet.

### 1. Site Data

- a. **Observer:** Enter the unique login that was provided to you
- b. **Date:** Enter the date using the following format: YYYY-MM-DD
- c. **GPS Unit #:** Your unit has a silver property tag on the back of it; please enter that number here.
- d. **Transect ID:** Enter the full character code identifying the state, stratum and transect number (e.g., CO-BCR16-AR8) as it appears on the transect description page. It is important to fill out the FULL name of the transect.
- e. **Access Point:** Mark the access point using your GPS unit and record the zone and coordinates on the datasheet. If a transect is located far from any road it is still useful to record UTM's of a logical place to leave your vehicle.
- f. **Time:** (start and end) Enter start and stop times in military time for the entire transect using **Mountain Daylight Time.**
- g. **Sky:** (start and end) Enter one-digit codes at beginning and end of the point count grid (not for each point)

0=0-15% cloud cover	1=16-50% cloud cover	2=51-75% cloud cover
3=76-100% cloud cover	5=fog	6=drizzle
8=Light snow		

***You should not survey in any other conditions!***

- h. **Wind:** (start and end): Enter one-digit codes at beginning and end of the point count grid:

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 should not survey in any other conditions!***

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

### 2. Point Info

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

### 3. Other (Y/N)

- a. **Mid-story:** Record either Y or N to indicate the presence of several distinct layers of overstory vegetation.
- b. **Cliff/rock:** Record either Y or N to indicate the presence of cliffs or large rocky outcrops within a **50m** 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 should 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 (trees that are *completely* dead) that are  $\geq 3\text{m}$  high and  $\geq 6$  inches dbh) within a **50m** radius of the count station.

#### 4. Primary Habitat

Enter a two-letter code corresponding to the primary habitat type that best describes the 50m radius surrounding the point. Please use the descriptions below as a guide:

- a. **Agricultural /Rural (AR):** vegetation has been planted by humans for food production or ornamental purposes in sparsely developed areas. Examples include a farmed field with wheat, corn, millet, etc., a fallow field, or a rural home site with planted non-native species. Please make note of crop spp., if fallow, etc.
- b. **Aspen (AS):** overstory dominated by aspen although scattered ponderosa pine or Douglas-fir may be present. The overstory cover should be  $\geq 10\%$  and consist of  $\geq 50\%$  Aspen. Aspen stands often have an abundant and diverse shrub layer. Typical shrub species in aspen habitats include snowberry, willow, sagebrush, mountain mahogany and oak. On occasion there may be no shrub layer. Typically the ground under aspen stands is covered by grasses and forbs.
- c. **Alpine Tundra (AT):** high-elevation, open landscapes that occur above tree line. These areas should have no overstory and often lack a significant shrub component. Ground cover consists of short grasses (generally  $\leq 10\text{cm}$  in height), wild flowers, mosses, lichens and succulents.
- d. **Burned (BU):** forest habitat with  $>5\%$  overstory cover where  $>50\%$  of canopy is dead and shows evidence of severe fire scars or where  $>50\%$  of trees have burned and fallen.
- e. **Cliff/Rock (CR):** area is dominated by rock and/or generally lacking vegetative cover (e.g., talus slopes, boulder fields, and rocky outcroppings). Areas described as Cliff/Rock should have  $\leq 20\%$  shrub and vegetated ground cover.
- f. **Desert/Semi desert Shrubland (DS):** dry landscape containing shrubs, but lacking a co-dominant grass component. % shrub cover should be  $\geq 20$ . Shrubs often include sagebrush, greasewood, fremont mahonia and saltbush. Sagebrush must comprise  $\leq 30\%$  of the shrub composition (see Sage Shrubland). Ground cover layer is typically dominated by bare ground and rock with limited forbs and grasses present. Grass and forbs make up  $\leq 20\%$  of ground cover.

- g. Grassland (GR):** landscape lacking an overstory and significant shrub component. Ground cover is dominated by grasses and perhaps some forbs. Shrub component must be  $\leq 20\%$ . The sum of live and dead standing grass must be  $\geq 20\%$
- h. Insect Infested (II):** forested habitat with  $\geq 10\%$  of the overstory dead or sickly - typically referring to pine bark beetle affecting lodgepole and ponderosa pine. Canopy cover must be  $\geq 10\%$ .
- i. Lodgepole Pine (LP):** habitat consisting of  $\geq 10\%$  canopy cover that is dominated by lodgepole pine. Canopy may have other conifer species or some aspen but lodgepole pine must be dominant. Shrub layer can be conspicuous or nearly absent.
- j. Mixed Conifer (MC):** forested habitat consisting of several species of conifers, such as ponderosa pine, lodgepole pine, Douglas-fir or spruce/fir spp. If the area is dominated by Douglas-fir, use Mixed Conifer as the primary habitat type. Canopy cover should be  $\geq 10\%$ . Overstory may range from very dense to relatively open. Undergrowth is complex and typically contains deciduous shrubs and/or conifer saplings. Stands with dense overstory may have little or no shrub and ground cover layers.
- k. Montane Meadow (MM):** areas with little to no overstory that are surrounded by forests. Elevations should be  $\geq 7,000'$ . Soils should be moist to wet with forbs or grass as the dominant ground cover. Canopy cover should be  $\leq 10\%$ . Shrub layer should be  $\leq 10\%$ .
- l. Open Water (OW):** habitat consisting of  $\geq 50\%$  open water, bank, and shoreline. Any other habitat type may be present, but must be  $< 50\%$ .
- m. Pinyon-Juniper/Juniper (PJ):** vegetative communities largely influenced by pinyon pine, juniper or a combination of the two species. The overstory and shrub cover must sum to  $\geq 10\%$ . Semi-arid conditions often produce a relatively short overstory. Juniper tends to dominate at lower elevations while pinyon dominates at higher elevations. Typically, shrub layer includes sagebrush, rabbit brush, oak or mahogany. Ground cover is usually dominated by grasses with fewer forbs.
- n. Ponderosa Pine (PP):** areas with  $\geq 10\%$  overstory cover that is made up primarily of Ponderosa Pine. This habitat often includes other tree types such as fir, pine and aspen. Shrub layer relatively open and often includes common juniper, oak, cliffrose and currents. Ground cover typically dominated by grass species.
- o. Riparian (RI):** stands or strips of trees or shrubs near a permanent or seasonal water source. Typical tree and shrub species include cottonwood, box elder, maple, aspen, alder and willows. Typically isolated areas surrounded by coniferous forest, grassland, shrubland or sagebrush habitat. If riparian habitat is present within the 50m radius, this should be the primary habitat type.
- p. Sage Shrubland (SA):** habitat where grasses and shrubs are co-dominant and the shrub cover is  $\geq 20\%$ . Shrub species must consist of  $\geq 30\%$  sagebrush. Typical ground cover is dominated by grasses with limited forbs and bare ground.
- q. Spruce-Fir (SF):** coniferous forest that is dominated by spruce and fir species (typically occurring at elevations  $\geq 7000'$ ). Note that Douglas-fir is not a true fir species (see Mixed

Conifer). Overstory cover should be  $\geq 10\%$  with spruce and fir species dominating the overstory cover. Variable understory typically includes shrubs and forbs with few grasses.

- r. **Shrubland (SH):** landscape co-dominated by grass and shrub species. Shrub cover must be  $\geq 20\%$ . Sagebrush must be  $< 30\%$  of shrub layer (see Sage Shrubland). Typical shrub species include ceonothus, manzanita, sage, rabbitbrush, currant, skunkbrush, serviceberry and plum. Ground cover dominated by grasses.
- s. **Urban/Residential (UR):** areas highly impacted by human development in which  $\geq 20\%$  of the ground is covered by impermeable surfaces. Typically describing relatively dense development including houses, lawns, sidewalks and streets.
- t. **Wetland (WE):** habitat influenced by permanent or seasonal flooding resulting in tall reeds, grasses, and/or cattails with little to no overstory. This habitat is defined by the presence of some emergent vegetation that is adapted to wet soils or inundation. Typical species include cattails, sedges, rushes and sphagnum mosses. Overstories are limited to drier areas around the wetland and overstory cover must be  $\leq 20\%$ .

## 5. Overstory Data

Anything 3.0m or taller should be considered part of the overstory.

- a. **Canopy Cover:** Estimate closure of the combined canopy trees within a 50m radius of the point-count. Use 1%, 5%, or multiples of 10% when estimating % overstory cover.
- b. **Mean Canopy Height:** At each point-count station, estimate the *average height to the top of the canopy trees* within a 50m radius circle to the nearest 1m. Use a rangefinder to help gauge estimates.
- c. **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 50m 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 datasheet using the correct two-letter vegetation code (see Appendix B for plant species codes). Note that Insect Infested (II), Snags (SN), dead trees (DC or DD), and burned trees (BU) should be considered part of the overstory species composition. Use 1%, 5%, or multiples of 10% when estimating overstory composition. It is acceptable for the largest value to be something other than 1%, 5%, or a multiple 10% so that the overall species composition total equals 100%.

## 6. Shrub Layer Data

Use this category to estimate the percent cover and species makeup of any woody vegetation (*including* seedling trees) that is  $\geq 0.25\text{m}$  high and  $< 3.0\text{m}$  high. Anything shorter than 0.25m should be considered part of the ground cover category.

- a. **Shrub Cover:** Estimate the *total* percent coverage of all woody shrub species AND seedling trees present within 50m of the count station. Use 1%, 5%, or a multiple of 10% to estimate the % shrub cover.
- b. **Mean height:** Estimate the average height to the nearest 0.25m 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 50m 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 B for plant species codes). Use 1%, 5%, or multiples of 10% when estimating shrub layer composition. It is acceptable for the largest value to be something other than 1%, 5%, or a multiple 10% in order for the sum of the species composition to equal 100%.

Note: 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 Shrub Layer section.

## 7. Ground Cover Data

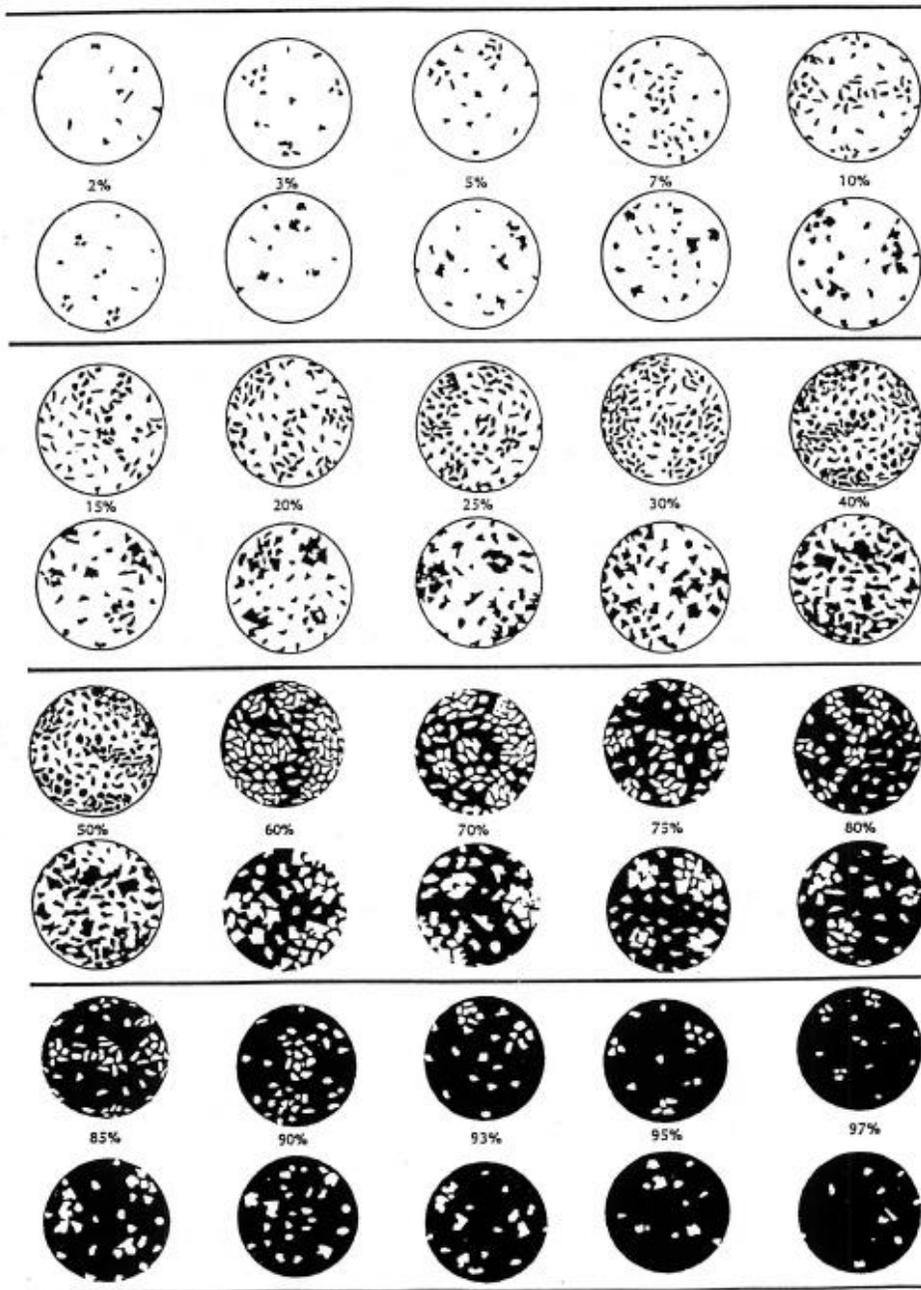
We classify ground cover into eight categories. For each of these categories, estimate the *total* percent of ground cover within 50m of the count station. Use 1%, 5%, or multiples of 10% when estimating % ground cover. It is acceptable for the largest ground cover value to be something other than 1%, 5%, or a multiple 10% in order for the sum of the ground cover to equal 100%. We also record the average height for dead standing grass, and for live grass **and** herbaceous plant height (combined).

The ground cover data collected are:

- a. snow;
- b. water;
- c. woody vegetation below 0.25m (roughly mid-calf height) including cacti;
- d. dead and down trees (with a minimum dbh of 6");
- e. broad-leaved herbaceous plants and forbs;
- f. bare ground (including rocks) and/or leaf litter (including all woody debris with a dbh < 6");
- g. dead standing grass (including rushes, reeds, and sedges) that is no longer alive and is clearly from the previous year's growing season;
- h. live grass (including rushes, reeds, and sedges) that is still green or is clearly from this year's growing season;
- i. Dead standing grass height: Estimate the average height of all dead grass (including rushes, reeds, and sedges) that is no longer alive and is from the previous year's growing season. Estimates should be to the nearest centimeter and include all dead grass within the 50m radius.
- j. Grass and herbaceous height: Estimate the average height of the living grass species and all herbaceous plants to the nearest centimeter within the 50m radius. You should use your datasheet (8 ½ " x 11" = 21.5cm x 28cm) or pencil (15cm) to help you estimate.

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

### COVER ESTIMATOR (PERCENTAGE OF DARK AREA)



Barry, Sheila. 1994. Monitoring Vegetation Cover. Alameda County Resource Conservation District, 1996  
Holmes St., Livermore, CA 94550

**Figure 4. Examples of percentage cover.**



**E. Point Information Datasheet**

There is a simple datasheet on the back of the vegetation datasheet with 16 lines on it; one line for each point on the survey (Figure 6). If you are unable to survey a point on a transect, record the reason why you were unable to survey on this datasheet (Figure 6). Possible reasons points were not conducted are as follows:

P:	Private Property - Denied <u>P</u> ermission
N:	Private Property - <u>N</u> o contact with landowner
U:	Terrain <u>U</u> nsafe (could not safely approach to within 25 m of point)
R:	Can't cross <u>R</u> iver
S:	<u>S</u> now pack impassible
H:	Running water near point - unable to <u>H</u> ear
W:	<u>W</u> eather (rain or wind)
G:	No <u>G</u> PS reception, cannot find point
T:	Ran out of <u>T</u> ime (5 hours past sunrise or noticeably decreased bird activity)
O:	<u>O</u> ther - explain

These are just a few reasons; you may run into other unexpected issues in the field. For these instances record “O” for “Other” and 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.

Field Protocol for Spatially Balanced Sampling of Landbird Populations: 2013 Field Season

Point	Landowner Info/Reasons points were not conducted
1	
2	
3	O: Pt. on public property, but denied access by USFWS b/c of active wolf den.
4	
5	
6	
7	
8	
9	U Scree Slope (steep)
10	
11	
12	
13	
14	
15	P Mr. Johnson denied access
16	P " " " "

Observer Initials (all three)

N	V	L
---	---	---

Year

2	0	1	0
---	---	---	---

State

WY
----

BCR

10
----

Transect Name (e.g. RM99)

SR09
------

Order of Importance	Please record the reasons why you did not survey certain points within the grid (if applicable). If more than one of the codes below apply, please record ONLY the code of highest importance.
<div style="text-align: center;">  <p>Most</p> <p>Least</p> </div>	<p>P: Private Property - Denied <u>P</u>ermission</p> <p>N: Private Property - <u>N</u>o contact with landowner</p> <p>U: Terrain <u>U</u>nsafe (could not safely approach to within 25 m of point)</p> <p>R: Can't cross <u>R</u>iver</p> <p>S: <u>S</u>now pack impassible</p> <p>H: Running water near point - unable to <u>H</u>ear</p> <p>W: <u>W</u>eather (rain or wind)</p> <p>G: No <u>G</u>PS reception, cannot find point</p> <p>T: Ran out of <u>T</u>ime (Past 11am or noticeably decreased bird activity)</p> <p>O: <u>O</u>ther - explain</p>

**Figure 6. Example of a completed Point Information Datasheet.**

## F. Collecting Bird Data

### 1. General Info

**It is extremely important to fill in the blanks at the bottom of both sides of each and every bird form.** If a bird form does not have this information and it becomes separated from the vegetation datasheet, then there is no way for us to know what transect the data are associated with. These data would become useless and an entire day of data collection would be lost. Also, we scan copies of all of our data, so the general info needs to be on **both** sides of the datasheet. **Before starting your first point count, be sure to fill out this information:**

- 1. Observer:** Fill in your unique login code on all pages of the bird form.
- 2. Date:** Record the date you are conducting the survey (MM/DD/YY).
- 3. Project/State:** Fill in the two-letter project code on all pages of the bird form (i.e. Colorado=CO).
- 4. BCR:** Fill in the BCR you are working in.
- 5. Transect Name:** Fill in the four-character grid ID code (strata and number) on all pages of the bird form.
- 6. Page number:** Fill in the page number associated with the bird data. Please count each side of a datasheet as a page.

### 2. Point Data

Enter the number of the point (01-16) on the transect you are about to survey. **NOTE:** for entries of low density species *between points* leave a blank row on the datasheet and enter “88” as the minute (see below for more information on “88” birds). After recording the general habitat data at the point count station and denoting the point you are at on the bird datasheet, record the time next to the point number in military format, using Mountain Daylight Time (MDT) regardless of the time zone you are in. At training, you will be instructed on how to set the clock on your stopwatch to MDT, and you will refer to that clock when recording time.

Once you have recorded the time and the point you are about to survey, activate your timepiece and begin recording the birds you see and hear. **The count duration is six minutes. It is extremely important to document the minute of the count that an individual bird was first detected.** To do this, simply write the number of the minute under the “minutes” column each time the beeper goes off. **DO NOT** record any other birds after the six minutes are over, even if it is an interesting bird (you should record this bird as an “88” bird if you have not yet detected that species on the transect). If you do not detect any birds during a minute interval, record **NOBI** (No Birds) for 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 correctly as it is impossible to pay attention to the birds and note how much time (by looking at your time piece) has passed simultaneously. If, during your six minute survey, you detect a bird that was flushed from the survey point upon your arrival (before you began the six minute survey), 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.

While conducting counts, be sure to focus primarily on birds that are close to the point. Although 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. **Note: Do not use a**

**scope when conducting point counts. It is more important to focus on and accurately record birds that are close to you rather than those that are far away. Binoculars will be sufficient for visual bird identification.**

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 where you are conducting the point in order to identify a bird that you have detected from the point but **ALWAYS** return ASAP to the point. Do NOT chase birds before or during the count. After the six 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 power line, 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. Additionally, you should mentally track birds that may move around you during a point so as not to double count them during a single six-minute count.

For each independently detected bird, you will record:

1. **Point Number**
2. **Time**
3. **Each minute during the count**
4. **Species, using 4-letter codes**
5. **Radial Distance (m) to each bird**
6. **How**
7. **Sex of the bird**
8. **If the bird was visually observed**
9. **If you believe the bird is a migrant**
10. **The cluster size and cluster ID code.**

Please refer to Figure 7 at the end of this section for an example of a completed bird datasheet.

### **3. Point Number**

Enter the number of point on the transect-you are about to survey. Indicate the start of a new point by leaving a blank line on the data form and recording the next point number. If observations from one point span multiple pages, be sure to include ("cont.") next to the point number at the top of the next page. NOTE: for birds detected between points that are not currently on the species list for the park being surveyed enter "88" for the point number (see below for more information).

### **4. Time**

Record the start time (in military time) for the point count at each point. Record the time in

Mountain Daylight Time regardless of the time zone you are in.

**5. Minute (1 – 6)**

Record the minute you are in during the six minute count. Minute 1 is from 0-60 seconds. Your timer will beep once a minute to let you know when to start the next minute.

**6. Species**

All birds detected during the six-minute count period will be recorded using the correct four-letter codes (See Appendix C 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, proofing and analyses 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), **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 are able to visually identify an individual to subspecies please use the four-letter codes below. Please do not make assumptions regarding which subspecies you detected (i.e., you need to visually identify individuals to subspecies).

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

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:

Unknown Bird	Code	Unknown Bird	Code
Unknown Accipiter	UNAC	Unknown Kingbird	UNKI
Unknown Bird	UNBI	Unknown Meadowlark	UNME
Unknown Blackbird	UNBL	Unknown Myiarchus	UNMY
Unknown Buteo	UNBU	Unknown Nuthatch	UNNU
Unknown Cardinal	UNCA	Unknown Oriole	UNOR
Unknown Chickadee	UNCH	Unknown Owl	UNOW
Unknown Cormorant	UNCT	Unknown Pipit	UNPI
Unknown Corvid	UNCO	Unknown Raptor	UNRA
Unknown Dove	UNDO	Unknown Raven	UNRV
Unknown Duck	UNDU	Unknown Sandpiper	UNSA
Unknown Empidonax	UNEM	Unknown Sparrow	UNSP
Unknown Falcon	UNFA	Unknown Swallow	UNSW
Unknown Finch	UNFI	Unknown Swift	UNSI
Unknown Flicker	UNFR	Unknown Tanager	UNTA
Unknown Flycatcher	UNFL	Unknown Thrasher	UNTR
Unknown Gnatcatcher	UNGN	Unknown Thrush	UNTH
Unknown Grouse	UNGR	Unknown Towhee	UNTO
Unknown Gull	UNGU	Unknown Vireo	UNVI
Unknown Hawk	UNHA	Unknown Warbler	UNWA
Unknown Hummingbird	UNHU	Unknown Woodpecker	UNWO
Unknown Jay	UNJA	Unknown Wren	UNWR

If no birds are detected during a one-minute period, enter NOBI (No Birds) in the space for four-letter bird codes. If no birds are detected during a six minute count, you should have six time periods recorded, each with NOBI written next to it. This will help you keep track of your minute intervals, and the data will reflect that you did conduct a six minute count.

## 7. Distance

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 datasheet 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. 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 rangefinder to determine a distance for every bird detection!

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 object. 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 10m interval. Rounding distances causes heaping at popular values and makes analyses 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 that is within-range of your rangefinder 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 analyses! 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.

## 8. How

In the “How” column, record **how each bird was detected** (i.e., 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 in the upper left portion of the box. Remember that how you detect a bird may be different from how you identify it.

It is difficult to identify woodpeckers by their drumming patterns; therefore, we do not want species identified in this manner. If you first detect a woodpecker species by its drumming and later identify the woodpecker by another means please record a note on how the individual was identified in the notes section of the datasheet.

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, potentially a 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 lower right portion of the ‘How’ box.**

Flyovers: A bird observed flying over a point without showing any signs of using the surrounding habitat should be recorded as a “flyover”. However, individuals of species that habitually hunt on the wing (e.g. raptors, swallows, swifts) or appear to be foraging (e.g. crossbills, goldfinches, waxwings) or hunting in the vicinity around the point, should NOT be treated as flyovers. Additionally, individuals that you first detect in flight that are simply flying from perch to perch nearby should NOT be recorded as flyovers. For true flyovers, enter an “F” in the “How” column.

## 9. Sex

In the “Sex” column, record the sex of the bird only if you visually observe a sexually dimorphic species and can identify the sex of the individual (M, F). If you are unable to visually observe the bird or if the bird is of a species that does not exhibit sexual dimorphism, record the sex as “U” for

unknown. Change the U to an M or F if you later identify the same individual as male or female. Females of many bird species sing at least occasionally, and female singing behavior of many species is poorly understood, so please do not assume that singing birds are males.

If you record a bird and visually identify it as a juvenile, record “J” in the Sex column. The surveys we conduct are for breeding birds and juveniles do not fall into this category. Marking juvenile birds as such will allow us to factor these birds out of analysis while retaining proof of breeding behavior for the location.

*Example:* On a point count, you detect six birds. You see a male RNSA, you hear a RNSA calling, you hear a calling WBNU, you see a male AUWA that later sings, you hear 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, C, C, V/S, S, and V. Fill in the “Sex” column: M, U, U, M, U, and U respectively (male CAFI require two years to achieve adult plumage, thus a brown-plumaged bird cannot be sexed in the field).

#### **10. Visual**

In the “Visual” column enter a checkmark if you were able to **visually identify** the individual at any time during the survey. Check this box even if you recorded “V” for the detection type. This column is meant to further assure us of proper identification. You may also check this box if you visually identify the individual before or after the point count. Note: If a bird was detected visually but identified by another means AND you were never able to positively identify the individual by sight then do NOT check the visual checkbox.

#### **11. Migrating?**

In the “Migrating?” column enter a checkmark if you have reason to believe the detected individual is not on its breeding territory. Clues that a bird may be migrating through are 1) the bird is in a large flock 2) the bird is in unusual habitat that differs substantially from where it is typically found during the breeding season (e.g., a Brewer’s Sparrow that is detected in a desert environment with no sagebrush 3) the bird is outside of its typical breeding range.

#### **12. Cluster Count/Cluster ID**

“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: single species flocks and paired birds. In either case, we define a cluster as birds of the same species that are observed TOGETHER (foraging, flying, perching, or obviously interacting with each other). Distances between members of a cluster should be very short (within 20m). Two males of the same species singing within 20m do NOT constitute a cluster. Please record the two types of clusters as follows.

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 datasheet.

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 datasheet, with the appropriate codes for “HOW” detected and “Sex”. 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 27m away AND also notes that there is a female BHGR in the same tree, but about 29m away. Next, the observer hears 5 Pine Siskins (PISI), looks up, and measures that they are 36-38m 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 17m 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. The observer’s data looks like this:

Time	Point #	Minute	Species	Radial Distance	How	Sex	Visual	Migrant?	Cluster	
									Size	Code
0552	03	1	WETA	46	S	M	X		1	
			AMRO	103	S	U			1	
		2	BHGR	27	C	M	X		1	A
			BHGR	29	V	F	X		1	A
		3	PISI	37	C	U	X		5	
		4	NOBI							
		5	MOCH	17	C	U	X		1	B
			MOCH	17	V	U	X		1	B
		6	NOBI							

## 12. 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 squirrel species as you would a bird on point counts (fill in the radial distance, how, sex, and visual boxes). 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.

## 13. “88” Birds:

It is important to track occurrences of all species at each transect. To do this we document detections of species that we have not detected while actively conducting point counts (these are detections that occur while collecting vegetation data, walking between points, etc.) on the transect. In order to ensure that the detection occurred on the transect grid, you should only record “88 Birds” after completing the first point count and before beginning the last point count of the morning. Please do not record “88” birds that you detect while approaching the transect in

the morning or after finishing your last point count. To record an “88” bird, leave a single blank row between your last point count detection and record the species, How, Visual, Migrant? and cluster size for the “88” detection. You do not need to record distance for these detections. If you record an “88” bird and then subsequently detect that individual on a point count, please cross out the “88” detection.

#### **14. Transect notes**

Enter information relevant to the site or individual points in the notes section at the bottom of the datasheet. This is a good place to record problems encountered during the survey, or anything that may have affected your point counts (loud noises, cows, etc.)

This is also the location to record notes regarding rare or unusual birds and alternate methods of identification for woodpeckers which were first detected drumming. It is very important to make notes about rare or unusual birds because 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. Useful notes regarding a rare species should include information regarding key field marks (both visual and/or auditory), what was the age and sex of the bird, how you differentiated the rare species from other, similar, species and any relevant information regarding behavior and/or weather conditions. Also, if you were able to obtain a photo or audio recording of the species please bring this to the attention of your supervisor.

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

#### **15. 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, 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.

#### **16. Final Note**

Please do not enter bird detections that you record during surveys into eBird. IMBCR data are already shared with eBird so if you enter detection data those records will be added to eBird twice. This causes data management issues and complicates the collaboration process.



## VI. OTHER IMPORTANT INFORMATION

Once you finish surveying the transect, and before leaving your site, don't forget to:

- 1) Check to make sure you entered your observer initials, point count grid #, and sheet #'s on EACH page!
- 2) Record the end of transect data (time, temp, sky, wind, transect notes) IMMEDIATELY UPON COMPLETING THE TRANSECT!
- 3) Go through your datasheets 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!

## VII. 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 in taller forest types and, particularly if you are wearing a hat. **Do not wear sunglasses or hats that can affect your hearing or visual field 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 (equally). Avoid wearing bright colors that may attract species to you (hummingbirds, etc.) or frighten birds away from you.

### 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 time for short rests along the way.

### D. NO Pishing

Do not attract birds to you during the counts by pishing or playing bird calls. Pishing is permissible after the count in an 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 otherwise attract birds toward you when you are near a point that has not been completed!**

### E. Vehicle (and other) Noise

Occasionally aircraft or other mechanical noise can be loud and reduce your ability to hear birds. In these instances, stop your stopwatch and wait for the noise to subside. Once the noise is gone, start your stopwatch again and continue the count where you left off. If excessive noise interrupts the count for more than 1 minute, start the survey again after the disturbance has passed. Include notes about disturbance in the notes on the datasheet.

### 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**

The day before you survey a transect, check out your survey area and familiarize yourself with the habitats found within the grid so you know what to expect. Plan out an access route the day before. You will be able to find your way in the dark more easily if you have already done the hike during daylight hours.

### **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. Birding on-site the evening before is often helpful when camping at or near the transect. Study the list of bird species you are likely to come across in your study area (provided by your crew leader) 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 (light mist or drizzle is fine as long as it is not impacting the bird activity). 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. If you are unsure that the weather is impacting your ability to detect birds or resulting in decreased bird activity, conduct the count and review the data afterwards. If you detected very few birds or almost all of your detections were visual it is likely that your ability to hear and/or bird activity is impacted by the weather. In these instances make a note that the data should not be used for analyses.

## VIII. LITERATURE CITED

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- Buckland, S. T., D. R. Anderson, K. P. Burnham, J. L. Laake, D. L. Borchers, and L. Thomas. 2001. Introduction to distance sampling: estimating abundance of biological populations. Oxford University Press, Oxford, UK.
- Leukering, T., M. Carter, A. Panjabi, D. Faulkner, and R. Levad. Revised 2005. Point Transect Protocol. Unpubl. document. Rocky Mountain Bird Observatory Brighton, Colorado, USA.

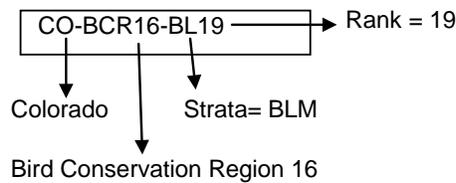
## APPENDIX A. GPS NAMING SYSTEM

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:

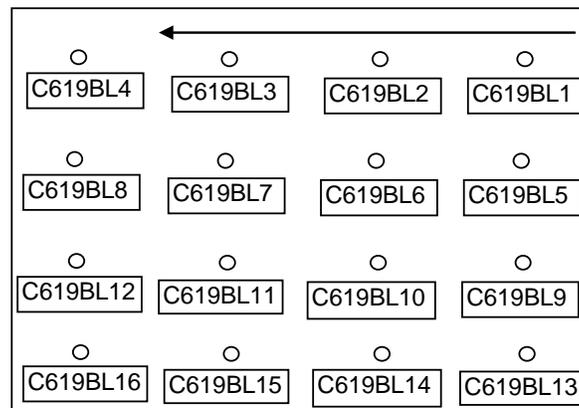
CO-BCR16-BL19

Point 1 GPS label; C 6 19 BL 1

C = first character of the Transect (Grid) Label  
 6 = last digit of the BCR (16 or 18) number  
 19 = The next 1 or 2 digits is the Rank  
 BL = The strata code  
 1 = the point number

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 B. KEY OF TWO-LETTER CODES FOR SHRUBS AND TREES**

Code	Common Name	Scientific Name	States
AA	Acacia	<i>Acacia spp.</i>	UT, AZ, NM, TX, OK, KS
AG	Agave	<i>Agave spp.</i>	TX, NM, AZ, UT
AL	Alder	<i>Alnus spp.</i>	AZ, CO, KS, MT, ID, NM, ND, OK, TX, UT, WY
AE	American Elm	<i>Ulmus americana</i>	MT, WY, CO, ND, SD, NE, KS, OK, TX
HH	American Hophornbeam	<i>Ostrya virginiana</i>	WY, SD, ND, NE, KS, OK, TX
AP	American Plum	<i>Prunus americana</i>	CO, KS, MT, UT
AM	Apache Plume	<i>Fallugia paradoxa</i>	AZ, CO, NM, OK, TX, UT
AC	Arizona Cypress	<i>Cupressus arizonica</i>	AZ, NM, TX, UT
AH	Ash	<i>Fraxinus spp.</i>	All
BP	Balsam Poplar	<i>Populus balsamifera</i>	MT, WY, CO, UT, SD, ND, ID
BE	Beaked Hazelnut	<i>Corylus cornuta</i>	CO, MT, ND, SD, WY, ID
BG	Beargrass	<i>Nolina spp.</i>	AZ, CO, NM, OK, TX, UT
BI	Birch	<i>Betula spp.</i>	All
BY	Bitter Cherry	<i>Prunus emarginata</i>	MT, ID, WY, UT, AZ, NM
PT	Black Cottonwood	<i>Populus trichocarpa</i>	ND, MT, ID, WY, UT
BB	Blackberry / Raspberry / Thimbleberry	<i>Rubus spp.</i>	All
BL	Blackbrush	<i>Coleogyne ramosissima</i>	AZ, CO, UT
BS	Blue Spruce	<i>Picea pungens</i>	UT, AZ, NM, CO, WY, ID
BX	Box Elder	<i>Acer negundo</i>	All
BR	Bristlecone Pine	<i>Pinus aristata</i>	AZ, NM, CO
AB	Buckthorn	<i>Rhamnus spp.</i>	All
BF	Buffaloberry	<i>Shepherdia canadensis</i>	AZ, CO, MT, ND, NM, SD, UT, WY, ID
BO	Bur Oak	<i>Quercus macrocarpa</i>	MT, WY, NM, TX, OK, KS, NE, ND, SD
BC	burnt conifer		All
BD	burnt deciduous		All
CA	Ceanothus	<i>Ceanothus spp.</i>	All
CP	Chihuahuan Pine	<i>Pinus leiophylla</i>	AZ, NM
CC	Choke Cherry	<i>Prunus virginiana</i>	All
CH	Cholla	<i>Cylindropuntia spp.</i>	AZ
CR	Cliffrose or Bitterbrush	<i>Purshia spp.</i>	AZ, CO, MT, NE, NM, TX, UT, WY, ID
CJ	Common Juniper	<i>Juniperus communis</i>	AZ, CO, MT, ND, NE, NM, SD, UT, WY, ID
CW	Crack Willow	<i>Salix fragilis</i>	MT, WY, UT, CO, NM, SD, ND, KS, NE, ID
CE	Creosote	<i>Larrea tridentata</i>	AZ
CT	Crucifixion Thorn	<i>Canotia holacantha</i>	AZ
DA	dead Aspen		All
DC	dead conifer		All
DD	dead deciduous		All
DJ	dead Juniper		All
DY	dead Pinyon Pine		All

Field Protocol for Spatially Balanced Sampling of Landbird Populations: 2012 Field Season

Code	Common Name	Scientific Name	States
DO	Desert Olive	<i>Forestiera neomexicana</i>	AZ, NM
DF	Douglas Fir	<i>Pseudotsuga menziesii</i>	MT, WY, CO, UT, AZ, NM, TX, ID
EB	Elderberry	<i>Sambucus spp.</i>	All
ES	Engelmann Spruce	<i>Picea engelmannii</i>	MT, WY, ID, CO, UT, NM, AZ
FB	Fendlerbush	<i>Fendlera rupicola</i>	AZ, CO, NM, TX, UT
FE	Fernbush	<i>Chamaebatiaria millefolium</i>	AZ, CO, NM, TX, UT
FH	Fool's Huckleberry	<i>Menziesia ferruginea</i>	MT, ID, WY
FC	Fremont Cottonwood	<i>Populus fremontii</i>	UT, CO, NM, AZ, TX
FM	Fremont Mahonia / Barberry / Desert Holly	<i>Berberis spp.</i>	ID, MT, ND, SD, NE, CO, AZ, NM, KS, UT
GO	Gambel Oak	<i>Quercus gambelii</i>	AZ, CO, NM, OK, SD, TX, UT, WY
GB	Gooseberry / Currant / Ribes spp.	<i>Ribes spp.</i>	All
GF	Grand Fir	<i>Abies grandis</i>	MT, ID
GW	Greasewood	<i>Sarcobatus spp.</i>	AZ, CO, MT, ND, NE, NM, SD, TX, UT, ID, WY
GA	Green Ash	<i>Fraxinus pennsylvanica</i>	MT, WY, UT, CO, NM, ND, SD, NE, KS, OK, TX
HK	Hackberry	<i>Celtis spp.</i>	All
HA	Hawthorn	<i>Crataegus spp.</i>	All
HB	Huckleberry	<i>Vaccinium spp.</i>	AZ, CO, KS, MT, NM, ND, SD, TX, UT, WY, ID
IB	Indigo bush or Leadplant	<i>Amorpha spp.</i>	All
JU	Juniper	<i>Juniperus spp.</i>	All
LM	Limber Pine	<i>Pinus flexilis</i>	UT, AZ, ID, CO, NM, WY, MT, SD, ND, NE
LP	Lodgepole Pine	<i>Pinus contorta</i>	UT, ID, CO, WY, MT, SD
MZ	Manzanita	<i>Arctostaphylos spp.</i>	AZ, CO, MT, NM, ND, SD, TX, UT, WY
ME	Mesquite	<i>Prosopis spp.</i>	AZ
MK	Mock Orange	<i>Philadelphus spp.</i>	MT, ID, WY, UT, CO, AZ, NM, TX, OK
MT	Mormon Tea	<i>Ephedra spp.</i>	AZ, CO, NM, TX, UT, OK, WY
MO	Mountain Ash	<i>Sorbus scopulina</i>	AZ, CO, MT, ND, NM, SD, UT, WY
MM	Mountain Mahogany	<i>Cercocarpus spp.</i>	AZ, CO, KS, MT, NE, NM, OK, SD, TX, UT, WY, ID
MS	Mountain Spray or Oceanspray	<i>Holodiscus spp.</i>	AZ, CO, MT, UT, ID, WY, NM, TX
NC	Narrow-leaf Cottonwood	<i>Populus angustifolia</i>	AZ, NM, UT, CO, WY, ID, MT, SD, NE, TX
LC	New Mexico Locust	<i>Robinia neomexicana</i>	AZ, CO, NM, TX, UT, WY
NB	Ninebark	<i>Physocarpus spp.</i>	All
XX	Identified But Not Listed		All
OB	Oak bush	<i>Quercus spp.</i>	All
OL	Ocotillo	<i>Fouquieria splendens</i>	TX, NM, AZ
OG	Oregon-grape	<i>Mahonia aquifolium</i>	AZ, CO, MT, ID, ND, SD, NM, NE, TX, UT, WY
YE	Pacific Yew	<i>Taxus brevifolia</i>	MT, ID
PV	Palo Verde	<i>Cercidium floridum</i>	AZ
PB	Paper Birch	<i>Betula papyrifera</i>	MT, ID, WY, CO, SD, ND, NE
PW	Peachleaf Willow	<i>Salix amigdaloides</i>	All
PY	Pinyon Pine	<i>Pinus edulis</i>	UT, AZ, WY, CO, NM, TX, OK
PC	Plains Cottonwood	<i>Populus deltoides</i>	MT, WY, CO, UT, NM, AZ, TX, OK, KS, NE, SD, NE
PP	Ponderosa Pine	<i>Pinus ponderosa</i>	UT, AZ, CO, NM, WY, MT, ID, SD, ND, NE, OK, TX

Field Protocol for Spatially Balanced Sampling of Landbird Populations: 2012 Field Season

Code	Common Name	Scientific Name	States
OP	Prickly Pear	<i>Opuntia spp.</i>	All
AS	Quaking Aspen	<i>Populus tremuloides</i>	UT, ID, AZ, CO, NM, WY, MT, SD, ND, NE, TX
RA	Rabbitbrush	<i>Chrysothamnus spp.</i>	AZ, CO, KS, MT, NE, NM, OK, TX, ID, UT, WY
BU	Ragweed/Bursage	<i>Ambrosia spp.</i>	All
RD	Red-osier Dogwood	<i>Cornus sericea</i>	AZ, CO, KS, MT, ND, NE, NM, SD, UT, ID, WY
RH	Rhododendron	<i>Rhododendron spp.</i>	MT, ID, CO, OK, TX
MA	Rocky Mountain Maple	<i>Acer spp.</i>	All
RO	Russian Olive	<i>Elaeagnus angustifolia</i>	All
SA	Sagebrush	<i>Artemisia sp.</i>	All
CG	Saguaro	<i>Carnegiea gigantea</i>	AZ
SL	Saltbush	<i>Atriplex spp.</i>	All
SB	Serviceberry	<i>Amelanchier spp.</i>	All
LO	Shrub Live Oak	<i>Quercus turbinella</i>	UT, CO, NM, AZ, TX
SC	Shrubby Cinquefoil	<i>Pentaphylloides floribunda</i>	UT, AZ, NM, CO, ID, WY, MT, ND, SD
EL	Siberian Elm	<i>Ulmus pumila</i>	All
SE	Single-leaf Ash	<i>Fraxinus anomala</i>	UT, AZ, NM, WY, CO
SK	Skunkbrush	<i>Rhus trilobata</i>	All
SS	Smooth Sumac	<i>Rhus glabra</i>	All
SN	Snag		All
SW	Snakeweed	<i>Gutierrezia sarothrae</i>	All
SY	Snowberry	<i>Symphoricarpos spp.</i>	All
SP	Spiraea	<i>Spiraea betulifolia</i>	ND, SD, MT, WY, ID
SU	Subapline Fir	<i>Abies lasiocarpa</i>	AZ, CO, NM, UT, WY, ID, MT
SZ	Sugar Sumac	<i>Rhus ovata</i>	AZ
PL	Sycamore	<i>Platanus spp.</i>	NE, KS, OK, TX, NM, AZ
TA	Tamarisk or Saltcedar	<i>Tamarix pentandra</i>	All
TW	Twinberry / Bush Honeysuckle	<i>Lonicera spp.</i>	All
UC	Unknown coniferous species		All
UD	Unknown deciduous species		All
VI	Viburnum	<i>Viburnum spp.</i>	NM, CO, WY, MT, ID, ND, SD, OK, NE, KS, TX
WB	Water Birch	<i>Betula occidentalis</i>	ID, MT, ND, SD, NE, WY, CO, UT, NM, AZ
WX	Waxflower	<i>Jamesia americana</i>	WY, CO, UT, AZ, NM
HE	Western Hemlock	<i>Tsuga heterophylla</i>	MT, ID
LA	Western Larch	<i>Larix occidentalis</i>	MT, ID, WY, UT
WC	Western Red Cedar	<i>Thuja plicata</i>	MT, ID
WW	Western White Pine	<i>Pinus monticola</i>	MT, ID, UT
WF	White Fir	<i>Abies concolor</i>	WY, ID, CO, UT, NM, AZ
WS	White Spruce	<i>Picea glauca</i>	MT, WY, ID, SD
WP	Whitebark Pine	<i>Pinus albicaulis</i>	MT, ID, WY
WR	Wild Rose	<i>Rosa acicularis</i>	MT, WY, ID, CO, NM, KS, SD, ND
WI	Willow	<i>Salix spp.</i>	All
WN	Winterfat	<i>Krascheninnikovia lanata</i>	All

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Code	Common Name	Scientific Name	States
WO	Wolfberry	<i>Lycium pallidum</i>	UT, NM, AZ, CO, TX, OK
YU	Yucca	<i>Yucca spp.</i>	MT, ND, SD, WY, NE, CO, UT, KS, OK, TX, AZ, NM

### APPENDIX C. FOUR-LETTER BIRD CODES

Common Name	Code
Abert's Towhee	ABTO
Acorn Woodpecker	ACWO
Alder Flycatcher	ALFL
American Avocet	AMAV
American Bittern	AMBI
American Coot	AMCO
American Crow	AMCR
American Dipper	AMDI
American Goldfinch	AMGO
American Kestrel	AMKE
American Pipit	AMPI
American Redstart	AMRE
American Robin	AMRO
American Three-toed Woodpecker	ATTW
American White Pelican	AWPE
American Wigeon	AMWI
Anna's Hummingbird	ANHU
Aplomado Falcon	APFA
Arizona Woodpecker	AZWO
Ash-throated Flycatcher	ATFL
Baird's Sparrow	BAIS
Bald Eagle	BAEA
Baltimore Oriole	BAOR
Band-tailed Pigeon	BTPI
Bank Swallow	BANS
Barn Owl	BNOW
Barn Swallow	BARS

Common Name	Code
Barred Owl	BDOW
Barrow's Goldeneye	BAGO
Bell's Vireo	BEVI
Belted Kingfisher	BEKI
Bendire's Thrasher	BETH
Bewick's Wren	BEWR
Black Phoebe	BLPH
Black Rail	BLRA
Black Rosy-Finch	BLRF
Black Swift	BLSW
Black Tern	BLTE
Black Vulture	BLVU
Black-and-white Warbler	BAWW
Black-backed Woodpecker	BBWO
Black-billed Cuckoo	BBCU
Black-billed Magpie	BBMA
Black-capped Chickadee	BCCH
Black-capped Gnatcatcher	BCGN
Black-capped Vireo	BCVI
Black-chinned Hummingbird	BCHU
Black-chinned Sparrow	BCSP
Black-crested Titmouse	BCTI
Black-crowned Night-Heron	BCNH
Black-headed Grosbeak	BHGR
Black-necked Stilt	BNST
Blackpoll Warbler	BLPW
Black-tailed Gnatcatcher	BTGN

Common Name	Code
Black-throated Gray Warbler	BTYW
Black-throated Sparrow	BTSP
Blue Grosbeak	BLGR
Blue Jay	BLJA
Blue-gray Gnatcatcher	BGGN
Blue-throated Hummingbird	BLUH
Blue-winged Teal	BWTE
Bobolink	BOBO
Bohemian Waxwing	BOWA
Boreal Chickadee	BOCH
Boreal Owl	BOOW
Botteri's Sparrow	BOSP
Brewer's Blackbird	BRBL
Brewer's Sparrow	BRSP
Bridled Titmouse	BRTI
Broad-billed Hummingbird	BBLH
Broad-tailed Hummingbird	BTLH
Broad-winged Hawk	BWHA
Bronzed Cowbird	BROC
Brown Creeper	BRCR
Brown Pelican	BRPE
Brown Thrasher	BRTH
Brown-capped Rosy-Finch	BCRF
Brown-crested Flycatcher	BCFL
Brown-headed Cowbird	BHCO
Bufflehead	BUFF
Bullock's Oriole	BUOR

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Common Name	Code
Burrowing Owl	BUOW
Bushtit	BUSH
Cackling Goose	CACG
Cactus Wren	CACW
California Gull	CAGU
California Quail	CAQU
Calliope Hummingbird	CAHU
Canada Goose	CANG
Canvasback	CANV
Canyon Towhee	CANT
Canyon Wren	CANW
Carolina Wren	CARW
Caspian Tern	CATE
Cassin's Finch	CAFI
Cassin's Kingbird	CAKI
Cassin's Sparrow	CASP
Cassin's Vireo	CAVI
Cattle Egret	CAEG
Cave Swallow	CASW
Cedar Waxwing	CEDW
Chestnut-backed Chickadee	CBCH
Chestnut-collared Longspur	CCLO
Chestnut-sided Warbler	CSWA
Chihuahuan Raven	CHRA
Chimney Swift	CHSW
Chipping Sparrow	CHSP
Chuck-will's-widow	CWWI
Chukar	CHUK
Cinnamon Teal	CITE

Common Name	Code
Clapper Rail	CLRA
Clark's Grebe	CLGR
Clark's Nutcracker	CLNU
Clay-colored Sparrow	CCSP
Cliff Swallow	CLSW
Colima Warbler	COLW
Common Black-Hawk	CBHA
Common Gallinule	COGA
Common Goldeneye	COGO
Common Grackle	COGR
Common Ground-Dove	COGD
Common Loon	COLO
Common Merganser	COME
Common Nighthawk	CONI
Common Peafowl	CPEA
Common Poorwill	COPO
Common Raven	CORA
Common Tern	COTE
Common Yellowthroat	COYE
Cooper's Hawk	COHA
Cordilleran Flycatcher	COFL
Costa's Hummingbird	COHU
Crested Caracara	CRCA
Crissal Thrasher	CRTH
Curve-billed Thrasher	CBTH
Dark-eyed Junco	DEJU
Dark-eyed Junco (Gray-headed)	GHJU
Dark-eyed Junco (Oregon)	ORJU
Dark-eyed Junco (Pink-sided)	PSJU

Common Name	Code
Dark-eyed Junco (Red-backed)	RBJU
Dark-eyed Junco (Slate-colored)	SCJU
Dark-eyed Junco (White-winged)	WWJU
Dickcissel	DICK
Double-crested Cormorant	DCCO
Downy Woodpecker	DOWO
Dusky Flycatcher	DUFL
Dusky Grouse	DUGR
Dusky-capped Flycatcher	DCFL
Eared Grebe	EAGR
Eastern Bluebird	EABL
Eastern Kingbird	EAKI
Eastern Meadowlark	EAME
Eastern Phoebe	EAPH
Eastern Screech-Owl	EASO
Eastern Whip-poor-will	EWPW
Eastern Wood-Pewee	EAWP
Elegant Trogon	ELTR
Elf Owl	ELOW
Eurasian Collared-Dove	EUCD
European Starling	EUST
Evening Grosbeak	EVGR
Ferruginous Hawk	FEHA
Ferruginous Pygmy-Owl	FEPO
Field Sparrow	FISP
Five-striped Sparrow	FSSP
Flammulated Owl	FLOW
Forster's Tern	FOTE
Fox Sparrow	FOSP

Field Protocol for Spatially Balanced Sampling of Landbird Populations: 2012 Field Season

Common Name	Code
Franklin's Gull	FRGU
Gadwall	GADW
Gambel's Quail	GAQU
Gila Woodpecker	GIWO
Gilded Flicker	GIFL
Golden Eagle	GOEA
Golden Vireo	GOVI
Golden-crowned Kinglet	GCKI
Golden-crowned Warbler	GCRW
Golden-fronted Woodpecker	GFWO
Golden-winged Warbler	GWWA
Grace's Warbler	GRWA
Grasshopper Sparrow	GRSP
Gray Catbird	GRCA
Gray Flycatcher	GRFL
Gray Hawk	GRHA
Gray Jay	GRAJ
Gray Partridge	GRPA
Gray Vireo	GRVI
Gray-crowned Rosy-Finch	GCRF
Great Blue Heron	GBHE
Great Egret	GREG
Great Gray Owl	GGOW
Great Horned Owl	GHOW
Great Kiskadee	GKIS
Greater Pewee	GRPE
Greater Prairie-Chicken	GRPC
Greater Roadrunner	GRRO
Greater Sage-Grouse	GRSG

Common Name	Code
Greater Scaup	GRSC
Greater Yellowlegs	GRYE
Great-tailed Grackle	GTGR
Green Heron	GRHE
Green Kingfisher	GKIN
Green-tailed Towhee	GTTO
Green-winged Teal	AGWT
Groove-billed Ani	GBAN
Gunnison Sage-Grouse	GUSG
Hairy Woodpecker	HAWO
Hammond's Flycatcher	HAFL
Harlequin Duck	HARD
Harris's Hawk	HRSH
Harris's Sparrow	HASP
Hepatic Tanager	HETA
Hermit Thrush	HETH
Hermit Warbler	HEWA
Hooded Merganser	HOME
Hooded Oriole	HOOR
Hooded Warbler	HOWA
Horned Grebe	HOGR
Horned Lark	HOLA
House Finch	HOFI
House Sparrow	HOSP
House Wren	HOWR
Hutton's Vireo	HUVI
Inca Dove	INDO
Indigo Bunting	INBU
Indigo x Lazuli Bunting Hybrid	ILBH

Common Name	Code
Juniper Titmouse	JUTI
Killdeer	KILL
Ladder-backed Woodpecker	LBWO
Lark Bunting	LARB
Lark Sparrow	LASP
Lawrence's Goldfinch	LAGO
Lazuli Bunting	LAZB
Le Conte's Sparrow	LCSP
Le Conte's Thrasher	LCTH
Least Bittern	LEBI
Least Flycatcher	LEFL
Least Grebe	LEGR
Least Sandpiper	LESA
Least Tern	LETE
Lesser Goldfinch	LEGO
Lesser Nighthawk	LENI
Lesser Prairie-Chicken	LEPC
Lesser Roadrunner	LERO
Lesser Scaup	LESC
Lesser Yellowlegs	LEYE
Lewis's Woodpecker	LEWO
Lincoln's Sparrow	LISP
Little Blue Heron	LBHE
Loggerhead Shrike	LOSH
Long-billed Curlew	LBCU
Long-eared Owl	LEOW
Louisiana Waterthrush	LOWA
Lucifer Hummingbird	LUHU
Lucy's Warbler	LUWA

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Common Name	Code
MacGillivray's Warbler	MGWA
Magnificent Hummingbird	MAHU
Magnolia Warbler	MAWA
Mallard	MALL
Marbled Godwit	MAGO
Marsh Wren	MAWR
McCown's Longspur	MCLO
Merlin	MERL
Mexican Chickadee	MECH
Mexican Jay	MEJA
Mexican Whip-poor-will	MWPW
Mississippi Kite	MIKI
Montezuma Quail	MONQ
Mountain Bluebird	MOBL
Mountain Chickadee	MOCH
Mountain Plover	MOPL
Mourning Dove	MODO
Mourning Warbler	MOWA
Nashville Warbler	NAWA
Nelson's Sparrow	NESP
No Birds	NOBI
Northern Beardless-Tyrannulet	NBTY
Northern Bobwhite	NOBO
Northern Cardinal	NOCA
Northern Flicker	NOFL
Northern Flicker (Integrate)	FLIN
Northern Flicker (Red-shafted)	RSFL
Northern Flicker (Yellow-shafted)	YSFL
Northern Goshawk	NOGO

Common Name	Code
Northern Harrier	NOHA
Northern Hawk Owl	NOHO
Northern Mockingbird	NOMO
Northern Parula	NOPA
Northern Pintail	NOPI
Northern Pygmy-Owl	NOPO
Northern Rough-winged Swallow	NRWS
Northern Saw-whet Owl	NSWO
Northern Shoveler	NSHO
Northern Waterthrush	NOWA
Olive Sparrow	OLSP
Olive Warbler	OLWA
Olive-sided Flycatcher	OSFL
Orange-crowned Warbler	OCWA
Orchard Oriole	OROR
Osprey	OSPR
Ovenbird	OVEN
Pacific Wren	PAWR
Pacific-slope Flycatcher	PSFL
Painted Bunting	PABU
Painted Redstart	PARE
Palm Warbler	PAWA
Pectoral Sandpiper	PESA
Peregrine Falcon	PEFA
Phainopepla	PHAI
Pied-billed Grebe	PBGR
Pileated Woodpecker	PIWO
Pine Grosbeak	PIGR
Pine Siskin	PISI

Common Name	Code
Pinyon Jay	PIJA
Plumbeous Vireo	PLVI
Prairie Falcon	PRFA
Prothonotary Warbler	PROW
Purple Martin	PUMA
Pygmy Nuthatch	PYNU
Pyrrhuloxia	PYRR
Red Crossbill	RECR
Red Phalarope	REPH
Red-bellied Woodpecker	RBWO
Red-breasted Nuthatch	RBNU
Red-breasted Sapsucker	RBSA
Red-eyed Vireo	REVI
Red-faced Warbler	RFWA
Redhead	REDH
Red-headed Woodpecker	RHWO
Red-naped Sapsucker	RNSA
Red-necked Grebe	RNGR
Red-necked Phalarope	RNPH
Red-shouldered Hawk	RSHA
Red-tailed Hawk	RTHA
Red-winged Blackbird	RWBL
Ring-billed Gull	RBGU
Ring-necked Duck	RNDU
Ring-necked Pheasant	RINP
Rock Pigeon	ROPI
Rock Wren	ROWR
Rose-breasted Grosbeak	RBGR
Ross's Goose	ROGO

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Common Name	Code
Ruby-crowned Kinglet	RCKI
Ruby-throated Hummingbird	RTHU
Ruddy Duck	RUDU
Ruffed Grouse	RUGR
Rufous Hummingbird	RUHU
Rufous-crowned Sparrow	RCSP
Rufous-winged Sparrow	RWSP
Rusty Blackbird	RUBL
Sage Sparrow	SAGS
Sage Thrasher	SATH
Sandhill Crane	SACR
Savannah Sparrow	SAVS
Say's Phoebe	SAPH
Scaled Quail	SCQU
Scarlet Tanager	SCTA
Scissor-tailed Flycatcher	STFL
Scott's Oriole	SCOR
Sedge Wren	SEWR
Semipalmated Plover	SEPL
Sharp-shinned Hawk	SSHA
Sharp-tailed Grouse	STGR
Short-eared Owl	SEOW
Short-tailed Hawk	STHA
Snowy Egret	SNEG
Snowy Plover	SNPL
Solitary Sandpiper	SOSA
Song Sparrow	SOSP
Sooty Grouse	SOGR
Sora	SORA

Common Name	Code
Spotted Owl	SPOW
Spotted Sandpiper	SPSA
Spotted Towhee	SPTO
Sprague's Pipit	SPPI
Spruce Grouse	SPGR
Squirrel, Abert's	ABSQ
Squirrel, Red	RESQ
Steller's Jay	STJA
Sulphur-bellied Flycatcher	SBFL
Summer Tanager	SUTA
Swainson's Hawk	SWHA
Swainson's Thrush	SWTH
Swamp Sparrow	SWSP
Tennessee Warbler	TEWA
Townsend's Solitaire	TOSO
Townsend's Warbler	TOWA
Tree Swallow	TRES
Trumpeter Swan	TRUS
Tufted Titmouse	TUTI
Turkey Vulture	TUVU
Upland Sandpiper	UPSA
Varied Bunting	VABU
Varied Thrush	VATH
Vaux's Swift	VASW
Veery	VEER
Verdin	VERD
Vermilion Flycatcher	VEFL
Vesper Sparrow	VESP
Violet-green Swallow	VGSW

Common Name	Code
Virginia Rail	VIRA
Virginia's Warbler	VIWA
Warbling Vireo	WAVI
Western Bluebird	WEBL
Western Flycatcher	WEFL
Western Grebe	WEGR
Western Kingbird	WEKI
Western Meadowlark	WEME
Western Sandpiper	WESA
Western Screech-Owl	WESO
Western Scrub-Jay	WESJ
Western Tanager	WETA
Western Wood-Pewee	WEWP
Whiskered Screech-Owl	WHSO
White-breasted Nuthatch	WBNU
White-crowned Sparrow	WCSP
White-crowned Sparrow (Gambel's)	GWCS
White-crowned Sparrow (Mountain)	MWCS
White-eared Hummingbird	WEHU
White-eyed Vireo	WEVI
White-faced Ibis	WFIB
White-tailed Ptarmigan	WTPT
White-throated Sparrow	WTSP
White-throated Swift	WTSW
White-winged Crossbill	WWCR
White-winged Dove	WWDO
Whooping Crane	WHCR
Wild Turkey	WITU
Willet	WILL

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Common Name	Code
Williamson's Sapsucker	WISA
Willow Flycatcher	WIFL
Wilson's Phalarope	WIPH
Wilson's Snipe	WISN
Wilson's Warbler	WIWA
Winter Wren	WIWR
Wood Duck	WODU

Common Name	Code
Wood Stork	WOST
Worm-eating Warbler	WEWA
Yellow Warbler	YEWA
Yellow-billed Cuckoo	YBCU
Yellow-billed Magpie	YBMA
Yellow-breasted Chat	YBCH
Yellow-eyed Junco	YEJU

Common Name	Code
Yellow-headed Blackbird	YHBL
Yellow-rumped Warbler	YRWA
Yellow-rumped Warbler (Audubon's)	AUWA
Yellow-rumped Warbler (Myrtle)	MYWA
Yellow-throated Vireo	YTVI
Yellow-throated Warbler	YTWA
Zone-tailed Hawk	ZTHA