TOS PROTOCOL AND PROCEDURE: BREEDING LANDBIRD ABUNDANCE AND DIVERSITY

PREPARED BY	ORGANIZATION	DATE
Katherine M. Thibault	FSU	12/31/2013

APPROVALS	ORGANIZATION	APPROVAL DATE
Mike Stewart	SE	04/04/2014
Dave Tazik	SCI	04/04/2014
Andrea Thorpe	FSU	04/04/2014

RELEASED BY	ORGANIZATION	RELEASE DATE
Stephen Craft	SE	04/10/2014

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Change Record

REVISION	DATE	ECO #	DESCRIPTION OF CHANGE
A_DRAFT	10/03/2011	ECO-00280	Initial Draft Release
B_DRAFT	01/13/2014	ECO-01140	Draft release. Will be finalized in next rev.
C	03/17/2014	ECO-01667	Production release, template change, and other changes as detailed in Appendix C
D	04/10/2014	ECO-01792	Updated Appendix F with site-specific information

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1 DESCRIPTION

1.1 Purpose

The primary purpose of this document is to provide a change-controlled version of Observatory protocols and procedures for Plot Establishment. This document provides the content for training and field-based materials for NEON staff and contractors. Content changes (i.e. changes in particular tasks or safety practices) occur via this change controlled document, not through field manuals or training materials.

This document is a detailed description of the field establishment process, relevant pre- and post-field tasks, and safety issues as they relate to this procedure and protocol.

1.2 Scope

This document relates the tasks for a specific field sampling and directly associated activities and safety practices. This document does not describe:

- General safety practices
- Site-specific safety practices
- General equipment maintenance

It does identify procedure-specific safety hazards and associated safety requirements such as safe handling of small mammals or safe use of required chemicals and reagents.

1.3 Acknowledgements

My thanks to Richard Podolsky, Courtney Meier, and Dave Schimel who wrote the first versions of this protocol. The method is heavily adapted from the Rocky Mountain Bird Observatory 2010 field protocol for spatially balanced sampling of landbird populations (Hanni et al. 2010), in combination with the Integrated Monitoring for Bird Conservation Regions (IMBCR) program (White et al. 2012). The protocol was also informed by the breeding landbird abundance and diversity working group (Jennifer Blakesley, Richard Chandler, Tom Gardali, Allen Hurlbert, Douglas Johnson, Ken Pollock, Kathryn Purcell, Ted Simons, Susan Skagen).

2 RELATED DOCUMENTS AND ACRONYMS

2.1 Applicable Documents

Applicable documents contain information that shall be applied in the current document. Examples are higher level requirements documents, standards, rules and regulations.

AD [01]	NEON.DOC.004300	EHS Safety Policy and Program Manual
AD [02]	NEON.DOC.004316	Operations Field Safety and Security Plan
AD [03]	NEON.DOC.000724	Domain Chemical Hygiene Plan and Biosafety Manual
AD [04]	NEON.DOC.001155	NEON Training Plan
AD [05]	NEON.DOC.050005	Field Operations Job Instruction Training Plan

2.2 Reference Documents

Reference documents contain information complementing, explaining, detailing, or otherwise supporting the information included in the current document.

RD [01]	NEON.DOC.000008	NEON Acronym List
RD [02]	NEON.DOC.000243	NEON Glossary of Terms
RD [03]	NEON.DOC.000916	TOS Science Design Breeding Landbird Abundance and Diversity
RD [04]	NEON.DOC.005003	NEON Scientific Data Products Catalog
RD [05]	NEON.DOC.014051	Field Audit Plan
RD [06]	NEON.DOC.000824	Data and Data Product Quality Assurance and Control Plan
RD [07]	NEON.DOC.001584	Datasheets for TOS Protocol and Procedure: Breeding Landbird Abundance & Diversity
RD [08]	NEON.DOC.001407	Raw Data Ingest Workbook for Breeding Landbird Abundance & Diversity
RD [09]	NEON.DOC.001271	TOS Protocol: Manual Data Transcription

2.3 Definitions

A **protocol** is a formal summary description of a procedure and its related rationale, and includes information on knowledge and resources needed to implement the procedure. A **procedure** is a set of prescribed actions that must take place to achieve a certain result, and can also be called a method. It differs from a science design in that science designs provide a more complete description of the rationale for selecting specific protocols. It differs from a training manual in that training manuals provide materials in support of skills acquisition in the topic areas including information on how to best train staff rather than detailing only the steps of the procedure.

According to Ralph et al. 1993, a **landbird** is "the general term used for the generally smaller birds (usually exclusive of raptors and upland game birds) not usually associated with aquatic habitats." Landbirds are typically censused during the first half of the breeding season, when birds are "most

active, paired, on territories, and vocal" (Ralph et al. 1993). For the purposes of this document, 'bird' and 'breeding landbird' are used interchangeably.

3 BACKGROUND AND OBJECTIVES

3.1 Background

Breeding landbirds were chosen to be a component of NEON's suite of biodiversity measurements (Kao et al. 2012), because breeding birds (a) have proven useful in large-scale modeling of climate change impacts (Stralberg et al. 2009, Tingley et al. 2012); (b) are consumers of other NEON taxa (i.e., insects, plants); (c) serve as reservoirs for mosquito-borne diseases of interest to NEON (e.g., West Nile Virus; LaDeau et al. 2007, McKenzie and Goulet 2010); (d) can be impacted by nest predation by small mammals (also a NEON target taxon; Schmidt et al. 2008); (e) are vulnerable to climate change (Gardali et al. 2012); and (f) respond strongly to land-use change (Luther et al. 2008, Newbold et al. 2012, Jongsomjit et al. 2012). Moreover, the long history of data collection at the regional and national scales allows for the integration of NEON sampling into larger datasets to examine regional and continental-scale and decadal-scale trends (e.g., Bart et al. 1995, Saracco et al. 2008).

In North America, there are over 650 species of breeding birds, and many approaches have been developed to sample them, given their diversity of habits and habitats (Bibby et al. 2000, Fancy and Sauer 2000). As a result of this diversity, no single sampling method can be used with equal efficacy on songbirds, seabirds, waterfowl, and raptors (e.g., Ralph et al. 1993, Fancy and Sauer 2000). The breeding bird component of the NEON TOS is designed to sample songbirds and other birds that are diurnal and resident in or migrating through terrestrial habitats, commonly referred to as landbirds. The most common methods for sampling breeding birds are spot mapping of territories, area searches of specific sites, strip transects along predetermined routes, nest searches, and point counts (Ralph et al. 1993, Nur et al. 1999), as well as mist-netting for marking and recapture.

Of these, point counts are the most commonly used method of sampling birds (Bibby et al. 2000, Rosenstock et al. 2002), and they have been described as 'the most efficient and data rich method of counting birds' (Ralph et al. 1993). Point counts involve an observer standing at a point for a predetermined amount of time (typically 3-20 minutes), typically during the peak of singing activity that occurs in the early morning, and recording all of the individuals seen or heard (Ralph et al. 1995; Figure 1). The original design for NEON bird sampling formulated by the group of experts known as the Tiger team included point counts as the method of choice (Hansen 2008). Acoustic monitoring is being considered as a complementary method to collect data on bird diversity and phenology (e.g., Celis-Murillo et al. 2009, Blumstein et al. 2011), but is contingent on additional funding and advances in machine learning algorithms to automate species identification of bird songs and calls.

The advantages of point counts include (1) minimal disturbance to the birds; (2) provides data on a diversity of species (Hutto and Young 2002); and (3) provides comparability with many other datasets. The major disadvantages of point counts are (1) the need for highly skilled observers for only a limited

portion of the year; (2) the challenges associated with even highly skilled observers to process all of the necessary data in a 3 – 20 minute count; and (3) the fact that the detectability of birds is not constant across space, time, and species (Rosenstock et al. 2002). Detectability is significantly affected by (1) observers who significantly vary in visual and auditory acuity and experience (Sauer et al. 1994); (2) environmental variables such as weather, light conditions, vegetation, and topography; and (3) the physical and behavioral variation within and among species (Rosenstock et al. 2002). Variation in detectability is ameliorated by the use of statistical methods that have been developed to account for this issue (e.g., distance sampling - Box 1).

The objective of the NEON breeding landbird sampling is to provide robust estimates of species diversity, abundance and density. To that end, point counts that are randomly distributed in the areas of interest (i.e., not along roadsides) and that use techniques that account for variation in detectability are the recommended sampling methods (e.g., Nur et al. 1999, Bibby et al. 2000, Fancy and Sauer 2000, Rosenstock et al. 2002). Distance sampling is one such technique, and it involves recording distance from the observer to the bird. Distance data are then used in statistical analyses designed to adjust the count of birds that were present but undetected (Box 1).

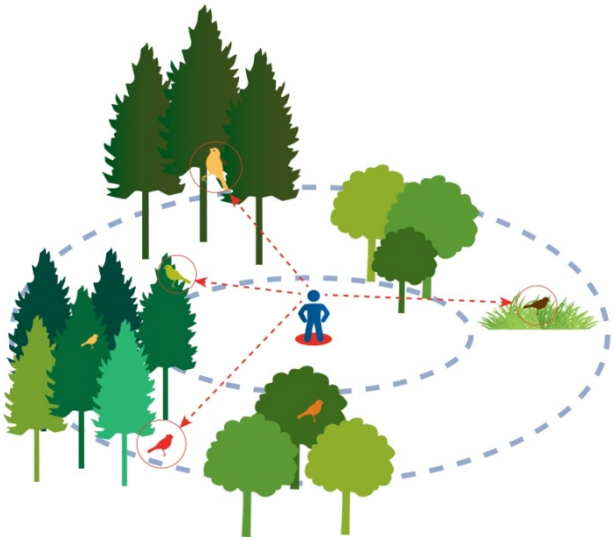

Figure 1. Schematic depicting the point count method of sampling birds.

In distance sampling, the distances from the observer to each bird (represented by dashed red lines in Figure 1), as well as the species, sex, and age, are recorded.

Box 1. Overview of Distance Sampling (Excerpted from White et al. 2012)

Distance sampling theory was developed to account for the decreasing probability of detecting an object of interest (e.g., a bird) with increasing distance from the observer to the object (Buckland et al. 2001). The detection probability is used to adjust the count of birds to account for birds that were present but undetected. Application of distance theory requires that three critical assumptions be met: 1) all birds at and near the sampling location (distance = 0) are detected; 2) distances of birds are measured accurately; and 3) birds do not move in response to the observer's presence (Buckland et al. 2001, Thomas et al. 2010).

3.2 NEON Science Requirements

This protocol fulfills Observatory science requirements that reside in NEON's Dynamic Object-Oriented Requirements System (DOORS). Copies of approved science requirements have been exported from DOORS and are available in NEON's document repository, or upon request.

3.3 NEON Data Products

Execution of this protocol procures samples and/or generates raw data satisfying NEON Observatory scientific requirements. These data and samples are used to create NEON data products, and are documented in the NEON Scientific Data Products Catalog (RD [04]).

4 PROTOCOL

Point count method

Breeding landbirds will be sampled using the point count method. Point counting entails one or more observers going to pre-established points and recording all the birds heard and/or seen during a set period of time (Figure 1). The NEON point count method is adapted from the Rocky Mountain Bird Observatory 2010 field protocol for spatially balanced sampling of landbird populations (Hanni et al. 2010; http://bit.ly/17ekDNB). Point counts are six minutes long, with each minute tracked by the observer, following a two-minute settling-in period. All birds shall be recorded to species and sex, whenever possible, and the distance to each individual or flock shall be measured with a laser rangefinder, except in the case of flyovers.

Spatial distribution of point counts

As a guiding principle, bird sampling is stratified such that grid positions achieve representative coverage of important bird breeding vegetation types. The grids will be collocated with a subset of the TOS Distributed Plots (see RD[03] for additional details). To increase efficiency, point counts will be distributed in 9 point 0.56 km^2 grids, in a 3 x 3 array, with 250m spacing between points (Figure 2). This

differs from the grid size used in the IMBCR protocol (4 x 4, 1 km^2 grids), in order to accommodate sample sizes of 5 – 15 grids at most NEON sites. At sites that cannot accommodate a minimum of 5 grids, points will be distributed randomly throughout the site (collocated with Distributed plots; minimum distance of 250m between points) to achieve these sample sizes. These sample sizes are minimum requirements to characterize spatial variability across the site. These deviations from the IMBCR design will still allow for comparable estimates of density across all sites.

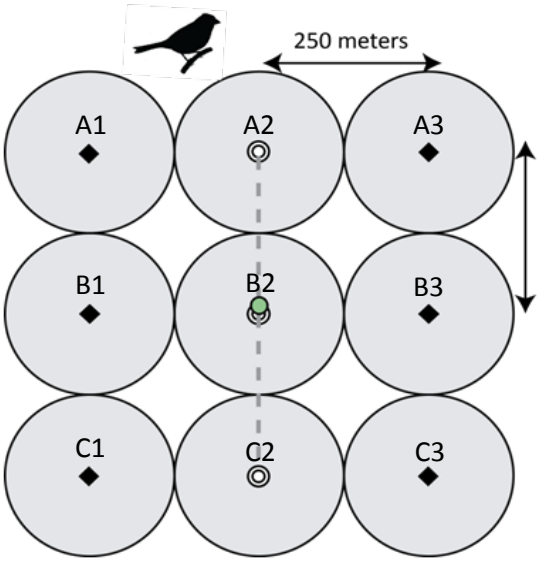

Figure 2. Design of the point count grid, consisting of 9 points separated by a minimum of 250 m. The center of the grid is just offset from a Distributed plot (green circle), where plants, soils, microbes, and insects will also be sampled.

Timing of point counts

Point counts will be conducted only during the early morning, from 30 minutes before sunrise to 3-4 hours after sunrise, depending on the weather and other ambient conditions (see site-specific appendices for daily sampling guidelines). Audible detection of birds can be limited because of vegetation, as well as high ambient noise from such sources as the wind or from other species such as insects or frogs. Similarly, visual detection of birds can be hampered from dust, low clouds, flying snow, fog, or rain. Handheld weather stations should be used at every point by technicians to keep track of weather conditions that can inhibit detection, particularly wind speed. When ambient conditions significantly inhibit detectability, sampling should not be conducted.

The sampling window for breeding birds for each site corresponds to when most of the birds encountered will likely be resident, breeding birds, rather than species that either over-winter or migrate through during the spring or fall. Timing is therefore critical and varies across environmental gradients. The initiation of breeding activity also varies among species, so it is best to spread the sampling effort out evenly over the sampling window. Points will be counted only one to two times per

breeding season, depending on the size of the site (i.e., sites with grids will be sampled once; small sites will be sampled twice; see site-specific appendices for guidelines; Table 1). This approach allows for greater spatial replication; repeat sampling will be used primarily at small sites in order to increase the number of detections at that site, in order to fit detection functions.

Table 1. Summary of temporal and spatial sampling design.

Relative site area	Point arrays	Number of arrays	Repeated sampling	Sampling Window
Large	9-pt grids	5 - 15	No	≥ 5 days, ≤ 14 days
Small	Single points	5 - 25	Yes – 2x per season	≥ 7 days, ≤ 21 days

Breeding season dates will be informed by local experts and by eBird data (ebird.org), which is known to provide large amounts of data pertaining to the arrival of spring migrants, particularly in well-populated regions of the U.S. (Hurlbert and Liang 2012). For example, RMBO recommends that breeding bird sampling in Colorado should occur between May 10 and June 15 for sites below 7,500 feet in elevation, and from June 5 to June 30 for 7,500 – 9,300 feet (N. Van Lanen, pers. comm.). The approximate timelines that have been provided in historical NEON documentation are listed in Table 2, with a modification for Domain 17 (Kathryn Purcell, pers. comm). More refined windows of 2-3 weeks for all sites can be found in the site-specific appendices.

Table 2. Domain specific schedules for breeding bird observations, to be refined.

Schedule for bird observations	Domains	Domain regions
March 21 - April 30	17	Pacific Southwest
April 8th – June 16th	3, 4, 14, 20	Puerto Rico, HI, FL, Desert Southwest
April 23rd – June 28th	2, 6, 7, 8, 10, 11, 13, 15, 17	Mid-Atlantic, Ozarks, Appalachians, Prairie, Southern plains, Southern Rockies, Great Basin, Pacific Southwest
May 1st – July 5th	1, 5, 9, 12, 16	Northeast, Great Lakes, Northern Plains, Pacific Northwest
May 15th – July 20th	18, 19	Alaska

5 QUALITY ASSURANCE AND CONTROL

The procedures associated with this protocol will be audited according to the Field Audit Plan (RD[05]). Additional quality assurance will be performed on data collected via these procedures according to the NEON Data and Data Product Quality Assurance and Control Plan (RD[06]).

The QA/QC plan for Breeding Landbird Abundance and Diversity Sampling is in development, and all details will ultimately be found in the associated document (see Birek et al. 2011 for a good example) .

The plan includes:

- Double-review of at least 10% of the entered data, if data are transcribed from paper datasheets, with error rates reported to the FSU Staff Scientist.
- Cold checks of field data collection (sensu USFS Forest Inventory Analysis; http://1.usa.gov/HTBWK2), if funding is made available.

- Regular bird identification quizzes for field technicians, with the expectation that technicians will consistently successfully identify more than 90% of the tested species. Bird identification quizzes will be administered and scored throughout the season to assess and confirm the skills of each observer, with a minimum of 3 quizzes per observer (i.e., beginning, middle, and end of breeding season). The individual quiz scores for each observer may be published as metadata, using anonymized IDs for the observers, rather than names.
- Scanned copies of the paper datasheets will be provided to the Avian Ecologist within 7 days after the first week of sampling per breeding season. The datasheets will be checked for errors and missing data. This cold check shall be repeated throughout the sampling season, if necessary, providing an iterative process to improve error detection and assess error resolution.
- Equipment and task checklists are provided in Appendix A and B.

Audible detection of birds can be limited because of vegetation, as well as high ambient noise from such sources as the wind or from other species such as insects or frogs. Similarly, visual detection of birds can be hampered from dust, low clouds, flying snow, fog, or rain. When ambient conditions significantly inhibit detectability, sampling should not be conducted.

- No landbird sampling shall occur during precipitation events or in dense fog.
- No landbird sampling shall occur in winds greater than 25 mph (40 kph), as determined with a handheld anemometer.

Sampling can be resumed as soon as conditions allow for effective detections, as long as sampling occurs within the morning sampling window within the specified breeding season window. All points on a grid do not have to be sampled on the same day, but it is preferable to complete sampling for a single grid within a window of 7 days.

When unexpected field conditions require deviations from this protocol, the following field implementation guidance must be followed to ensure quality standards are met:

Table 3. Contingency matrix of sampling actions and outcomes

Delay	Action	Adverse Outcome	Outcome for Data Products
Hours	Continue with sampling if there is still time in the sampling window around dawn. Otherwise, skip sampling for the day. An additional sampling day should be added within 7 days.	If additional time is not available, fewer samples will be collected.	Fewer sampling points could result in less precise estimation of breeding bird species richness, diversity, or density.
1-7 days	Add additional days of sampling as soon as possible to sample all points.	If additional time is not available, fewer samples will be collected.	Fewer sampling points could result in less precise estimation of breeding bird species richness, diversity, or density
8 or more days	Contact appropriate scientific lead(s) on the FSU team for guidance.	May miss target sampling window.	1. Species richness due to changes in seasonal phenology could be influenced by significant changes in temporal sampling window. 2. Not completing all plots impacts diversity metrics and target sample size.

6 SAFETY

Personnel working at a NEON site must be compliant with safe field work practices as outlined in the Operations Field Safety and Security Plan (AD[02]) and EHS Safety Policy and Program Manual (AD[01]). The Field Operations Manager and the Lead Field Technician have primary authority to stop work activities based on unsafe field conditions; however, all employees have the responsibility and right to stop their work in unsafe conditions.

As the bird sampling protocol involves no extraordinary procedures, safe field work practices should suffice. These include the use of insect repellent in areas with ticks and fleas, ready availability of a field first aid kit, and working within sight of another person.

7 PERSONNEL REQUIREMENTS

All field ornithologists should have the following expertise:

- Demonstrated knowledge and experience identifying the species of birds that occur at a particular site both visually and aurally.
- Prior experience conducting avian field surveys, with preference given for technicians with experience conducting breeding bird surveys, particularly in a similar region.

8 TRAINING REQUIREMENTS

All technicians must complete required safety training as defined in the NEON Training Plan (RD[04]). Additionally technicians complete protocol specific training for safety and implementation of protocol as required in Field Operations Job Instruction Training Plan (RD[05]).

Training should minimally include the following components:

1) Technicians who have been identified to conduct bird sampling will be provided with study materials, including field guides and song recordings, as soon as possible after hiring.
2) A workshop including lectures and field work will be conducted for 1-5 days (depending on the experience of the technicians) prior to the onset of field sampling to provide an overview of the procedures and the goals of the sampling. Hands-on work with the sampling equipment and review of common bird species for a domain will be included. A quiz of the technicians' knowledge of birds by sight and song will be administered and scored at the end of the workshop. Only technicians that score >90% on the final test will be deemed sampling-ready.
3) During the field-based training, technicians that need additional training will shadow experienced ornithologists, followed by the experienced ornithologists performing hot checks on the technicians.
4) All technicians will practice measuring known distances to objects with the laser rangefinders until they can reliably measure distances up to 150 meters to an accuracy of ±5 meters.

9 SAMPLE FREQUENCY AND TIMING

9.1 Sampling Frequency

Sampling will occur once or twice per breeding season at each point at a site, depending on the size of the site (i.e., sites with grids will be sampled once; small sites will be sampled twice; see site-specific appendices for guidelines).

9.2 Sampling Timing Parameters

At sites that can accommodate the minimum of five 9-point grids, points within each grid are sampled once per season. At these sites, the sampling window must span a minimum of 5 days (i.e., all grids at a site should not be sampled on the same day) and a maximum of 14 days. For example, at a site with 15

grids,three grids could be sampled on each of 5 consecutive days or eight grids could be sampled on day 1 and the remaining seven on day 5 or day 14, etc. . At sites that cannot accommodate the minimum of five 9-point grids, points are sampled twice within a season. At these smaller sites, points should be sampled with a minimum of 7 days between sampling bouts and no longer than 21 days (see Table 1 above). Breeding season dates will be informed by local experts and by eBird data (ebird.org), which can provide large amounts of data pertaining to the arrival of spring migrants, particularly in well-populated regions of the U.S. (Hurlbert and Liang 2012). Sampling timing will be provided by Science Operations in the site-specific appendices to this protocol. All sampling must occur within the window provided.

10 STANDARD OPERATING PROCEDURES

SOP A: Preparing for Sampling

See Appendix A and B for handy equipment and task checklists.

1) Familiarize yourself with the species codes *before going into the field*.

Species that often cause problems include: **Cackling Goose** (CACG not CAGO), **Canada Goose** (CANG not CAGO), **Northern Shoveler** (NSHO, not NOSH), Ring-necked Pheasant (RINP, not RNPH), **Barn Owl** (BNOW not BAOW), **Barred Owl** (BDOW not BAOW), **Broad-tailed Hummingbird** (BTLH not BTHU), **Western Wood-Pewee** (WEWP, not WWPE), **Gray Jay** (GRAJ, not GRJA), **Tree Swallow** (TRES, not TRSW), **Bank Swallow** (BANS, not BASW), **Barn Swallow** (BARS, not BASW), **Cactus Wren** (CACW not CAWR), **Canyon Wren** (CANW not CAWR), **Cedar Waxwing** (CEDW not CEWA), **Black-throated Gray Warbler** (BTYW not BTGW), **MacGillivray's Warbler** (MGWA, not MAWA), **Yellow Warbler** (YWAR, not YEWA), **Canyon Towhee** (CANT not CATO), **Lark Bunting** (LARB, not LABU), **Sage Sparrow** (SAGS not SASP), **Savannah Sparrow** (SAVS, not SASP), **Lazuli Bunting** (LAZB, not LABU), **Red-winged Blackbird** (RWBL, not RWBB).

2) Clean and check binoculars to make sure they are in good working condition.
3) Check, charge, or replace batteries for the laser rangefinder, camera, handheld weather station, stopwatch, and GPS unit.
4) Upload background images, layers, and waypoints associated with bird grids to the GPS unit.
5) Print and organize data sheets.
6) Set appropriate declination on the compasses.

Field Equipment and Materials

Table 4. Field equipment list

Maximo Item No.	Item Description	Purpose	Quantity per technician	Habitat-Specific	Special Handling
Required	Handheld Weather Station that measures maximum, average, and current temperature with an accuracy of +- 1 degree F, humidity +- 3%, and wind speed +- 3%	Measuring temperature, RH, and wind speed	1	No	No
Required	Binoculars, Full Size, Magnification 10 x 42, Field of View 264 ft. @ 1000 yd, Water Proof, with Case, Strap, Lens Cover, & Cloth	Visual identification of birds	1	No	No
Required	Stopwatch / timer; must have notification chime every minute	Tracking minutes of point count	1	No	No
Required	Laser rangefinder, Minimum specs: 6X multicoated monocular, waterproof, fogproof, 18mm of eye relief, Accurate to 1/2-yd. increments to 99.5 yds. and 1-yd. increments to 550 yds	Measuring distances	1	No	No

Required	The Sibley Guide to Birds	Visual identification of birds	1	No	No
Required	Camera, digital – minimum specifications: 10 megapixel, compact, 5x optical zoom	Photographing rare or unknown birds	1	No	No
Required	GPS Receiver, Handheld, Recreational Accuracy	Navigating to points	1	No	No
Suggested	Magnetic Compass, Handheld, Mirror-sighting, Floating	Navigating between points	1	No	No

SOP B: Field Sampling

The method is heavily adapted from the Rocky Mountain Bird Observatory 2010 field protocol for spatially balanced sampling of landbird populations (Hanni et al. 2010). The bird point count datasheet is provided separately (RD[07]), but a key to the datasheet can be found in Appendix A.

1) Record the date, plot ID, start cloud cover, and start relative humidity on the Bird point count datasheet (RD[07]).
   - Date (YYYY-MM-DD) and plot ID (SITE_XXX) should be filled out on every datasheet.
   - Start and ending cloud cover (%) and relative humidity (%) need to be completed only once per plot ID per date.
   - Cloud cover is estimated visually, while relative humidity should be measured with handheld weather station.
2) Upon reaching each point on the grid, wait 2 minutes in order to allow the local birds to become accustomed to your presence (the 'settling in period'). While waiting, fill in the required metadata (i.e., point ID (XX), start-time (XX:XX), habitat code, temperature (degrees Celcius), and average wind speed (kilometers per hour) on the Bird point count datasheet (RD[07]). These metadata are filled out once for each point at all sites.
   - DO NOT begin counting until the 2 minutes have passed.
   - DO identify and note the locations of any birds flushed from around the point upon approach. These data should be recorded when the counting period begins.
3) Set the timer for the point count duration (i.e., 6 minutes), with a chime to indicate the passing of each minute within the counting period. Begin the count-down, and begin recording the birds you see and/or hear onto the Bird point count datasheet (RD[07]).
4) For each independently detected bird, record the following information:
   - The **species**, using the appropriate 4-letter code (Pyle and DeSante 2012).
     i) If there is any uncertainty in the species identification, please note this in the **idQ** (i.e., identification qualifier) column on the datasheet – using one of the codes below (Table 5). Leave blank if there is not uncertainty.

Table 5. Codes for identification qualifier entries

idQ	Identification Qualifier Description*
CS	cf. species
AS	aff. species
CG	cf. genus
AG	aff. genus
CF	cf. family
AF	aff. family

* cf. roughly equals "not sure"; aff. roughly equals "similar to, but is not"

ii) Use the digital camera to take pictures of (a) species for which the identification is uncertain (except in very common cases), (b) species that are very rare or has state or federal status, or (c) if there is something unusual or noteworthy about a particular individual.

- The horizontal **distance** to the bird (measured with the rangefinder).

  i) Distance to birds is recorded radially in 2-dimensions from the observer; only the horizontal distance is recorded. That is, a bird 10 meters up in a tree directly overhead is recorded as zero meters from the observer.

  ii) If you cannot get a direct line of sight to a bird, estimate the distance the bird is from a visible point and use the rangefinder to measure to that point. Then add or subtract the estimated distance between that point and the bird to obtain the best possible distance estimate. **Estimate the distance from the visible point to the bird BEFORE using the rangefinder.** Distance-sampling assumes that you measure all distances accurately, so be sure to use your rangefinders as much as possible.

  iii) 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 determine their locations relative to a landmark, such as a tree or shrub, then measure the distance to that landmark. If you are unable to pin-point its location, then estimate the distance *to the nearest meter*. **Do not round distances to 5 or 10 m intervals**, as this causes heaping at particular values and complicates data analysis.

  iv) Flyovers do not require distance measurements.

  This method uses distance-sampling techniques and analyses; bird data recorded without associated distances (with the exception of flyovers) can NOT be used in the analysis.

- **How** the bird was detected:

  i) V=visual, C=calling, S=singing, D=drumming, F=Flyover, or O=other aural (e.g., wing beats).

  ii) Enter the code for how you **first** detected each individual (only one entry per field). Remember that how you detect a bird is different from how you identify it.

- The **sex** of the bird (F = Female; M = Male; U = Unknown).The **cluster size** and **cluster ID code** for **any birds** observed as part of a cluster (i.e. non-independent detections). See Appendix C for more information on how to distinguish and record clusters.

5) **Record the passing of each minute** in the appropriate column of the datasheet (RD[07]).

6) Before moving to the next sample point, **review the datasheet** to ensure that all required data have been recorded.

7) **Skip a line** on the datasheet between sampling points within a grid.

Tips and Tricks (from Hanni et al. 2010)

1) The following are a few **general guidelines** for collecting high-quality data :
   - If you do not detect any birds, record "NOBI" (No Birds).
   - If you see a rare or unexpected bird after the count period has elapsed, you may record this species on the datasheet, entering '88' as the point ID.
   - If you detect a bird that was flushed from the survey point upon your arrival, record the bird's original distance from the survey point. We assume that these birds would have remained at their original locations were it not for the disturbance created by the observer.
   - Focus primarily on birds that are close to the observation point. This is because missing distant birds has only a small effect on density estimates, but missing birds that are close by has a much larger effect on density estimates.
   - Look and listen in all directions – **including UP**.
     i) Note that distance to birds is recorded radially in 2-dimensions from the observer. That is, a bird 10 meters up in a tree directly overhead is recorded as zero meters from the observer.
   - Do not move from the observation point. That said, it is acceptable to take a step or two away from the point to identify a bird spotted from the point, but **ALWAYS** return ASAP to the point to continue observations.
   - Do NOT chase birds before or during the count. After the observation period has elapsed, you may chase down a bird to identify it, if you couldn't identify it from the point.
2) There are **several potential issues** that can lead to problems in the data:
   - Window species – these are species that you see or listen through, because they are common. For example, Mourning Dove is a common window species. This can result in the observer failing to count individuals of these species. The goal is to get an accurate count of all species, so be aware of this issue and strive to count all individuals seen and heard. Look and listen everywhere – Look up regularly, and do not wear hats that obscure hearing (including wide-brimmed hats that deflect sound), or sunglasses that obscure vision.
   - Stand at observation points – do not sit or kneel. Altering your position will affect your ability to consistently and repeatably see and hear birds.
   - No "pishing" – do not make noises that can attract birds to you and alter the density estimation.
   - Airplanes and other external noises – If audibility of birds is reduced by mechanical noise, then interrupt the count and resume when the noise abates. The total time spent counting should still equal 6 minutes.
   - Never guess the identity of a bird – If the bird species is unknown, use the table of unknown species codes in Appendix B.

SOP C: Equipment Maintenance: Cleaning and Storage

Conducting the same list of equipment-related activities after a sampling event as done prior to a sampling event is also recommended (see Appendix A for checklist), and so they are reproduced here.

1) Clean and check binoculars to make sure they are in good working condition.
2) Check, and charge or replace batteries for the laser rangefinder, camera, handheld weather station, stopwatch, and GPS unit.
3) Check that the appropriate declination is set on the compasses.

SOP D: Data Entry and Verification

1) Transcribe information from datasheet into the provided spreadsheet (RD[08]). This should be done at the end of the sampling day. If not possible, then as soon as possible, but no more than 14 days after the end of the sampling bout.
    a. Enter data in format provided in Excel file (RD[08]).
    b. Follow QA/QC procedures for ensuring accurate transcription of data (RD[09]).
    c. Include notes on all deviations from procedures. Indicate what was done and why.
2) Scan and then file hard copy of datasheet, as described in RD[09].
3) Another technician shall review the transcribed data to reveal transcription errors. Double-review of at least 10% of the entered data is required, if data are transcribed from paper datasheets, with transcription error rates reported to the Avian Ecologist.
4) The transcribed data can then be further checked for errors in usage of species codes by comparison to a master spreadsheet of species codes.

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Appendix A QUICK REFERENCE: BREEDING BIRD POINT SAMPLING DATASHEET

Data Field	Description/What to Enter
eventDate	Date that sampling was conducted (YYYYMMDD)
plotID	Plot identifier (4-character site code _XXX)
recordedBy	Full name of personnel conducting the point count(s) (First name Last name)
cloudsStart	Estimate of % cloud cover, at the start of sampling of the plotID
cloudsEnd	Estimate of % cloud cover, at the end of sampling of the plotID
rhStart	Relative humidity (%), as measured by handheld weather station, at the start of sampling of the plotID on a given eventDate
rhEnd	Relative humidity (%) at the end of sampling of the plotID
pointID	Relative coordinate of the point within the given plotID (A1 – C3)
habitatCode	The dominant habitat surrounding the point
startTime	24-hr format (hhmm; e.g., 0812 or 1432)
temperature	The air temperature measured at beginning of each point count with a handheld weather station, in degrees Celsius
wind	The average wind speed measured at beginning of each point count with a handheld weather station, in kilometers per hour
minute	The minute of sampling within the 6-minute point count sampling period
taxonID	Unique 4 character species code, following AOU conventions
idqCode	Code expressing the determiner's doubts about the Identification
radial distance	Radial distance between the observer and the bird(s), in meters
how	How the bird(s) is (are) **first** detected by the observer
visual	Whether the bird(s) was (were) seen after the initial detection (Y or N)
sex	M = male; F = Female; U = Unknown
clusterSize	Clusters consist of either flocks or paired birds of the same species observed together; the size of the cluster is simply the count of individuals.
clusterCode	Clusters consist of either flocks or paired birds of the same species observed together; alphabetic codes (A:Z) are used to link clusters that span multiple records.
remarks	Technician notes; free-form

NEON BIRD POINT COUNT DATASHEET (VER. 11/30/2013) — Page: of:

EventDate (YYYYMMDD): 20110618 — PlotID: CPER_005 — START: — CLOUDS (%): 80 — RH (%): 23

RecordedBy: Josephine A. Schmoe — END: — CLOUDS (%): 0 — RH (%): 12

HOW : V = Visual | S = Singing | C = Calling | D = Drumming | O = Other | F = Flyover | SEX: M = Male | F = Female | U = Unk

idQ: CS = cf. species; AS = aff. species; CB = cf. subspecies; AB = aff. subspecies [cf. ≈ not sure about; aff. ≈ Similar to, but is not]

HABITATS: MX = mixed; CE = Closed Evergreen; OE = Open Evgr; GR = grassland; SH = shrubland; MD = meadow; RP = riparian

	PointID	Habitat Code	Start Time (24 Hr)	Temp (°C)	Wind (kph)	Minute	TaxonID	idQ	Radial Distance (m)	How	Visual	Sex	CLUSTER Size	CLUSTER Code	
1	1	GR	5:00	63	1.6	1	HOLA		07 1	S		M			1
2							LISP		12 2	S		M			2
3						2	STJA		03 6	C		U			3
4						3	MOCH		18 4	C		U	2		4
5						4	AMPI		04 6	C		U			5
6						5	NOBI								6
7						6	CORA		17 7	V		U			7
8															8
9	2		0.2	65	1.2	1	DEJU		04 0	S		M	1	A	9
10							DEJU		04 1	V		U	1	A	10
11							YRWA		13 3	C, S		M			11
12						2	NOBI								12
13						3	AMRO			F		U	3		13
14						4	HAWO		02 8	O		M			14
15							MOCH		10 8	C		U			15
16							MOCH		12 2	C		U			16
17						5	NOBI								17
18						6	RWBL		07 6	V		U	34		18
19							DEJU		10 1	S		M	1	B	19
20							DEJU		10 2	V		U	1	B	20
21															21
22	88		0.2				BRCR			S		U			22

Appendix B **CHECKLISTS**

REQUIRED TASK CHECKLIST BEFORE AND AFTER CONDUCTING BIRD SURVEYS

Complete this checklist before and after EACH field sampling event

Binoculars cleaned and checked to make sure they are in good working condition	☐
Batteries for the laser rangefinder checked and charged if necessary	☐
Batteries for the GPS unit checked and charged if necessary	☐
Appropriate declination is set on the compasses	☐
Print datasheets for next sampling event	☐
Double-check completed datasheets to ensure thoroughness	☐
File completed datasheets in designated safe place for subsequent scanning and data entry	☐

EQUIPMENT FOR CONDUCTING BIRD SURVEYS

Complete this checklist for each team member prior to EACH field sampling event

Item Description	Crew #1	Crew #2	Crew #3	Crew #4
10 × 40 binoculars	☐	☐	☐	☐
GPS	☐	☐	☐	☐
Laser rangefinder	☐	☐	☐	☐
Sibley Field Guide to Birds	☐	☐	☐	☐
Datasheets	☐	☐	☐	☐
Declination adjustable compass w/ mirror sight	☐	☐	☐	☐
Countdown timer w/ chime	☐	☐	☐	☐
Master list of 4-letter species codes	☐	☐	☐	☐
Kestrel (temp & wind measurements)	☐	☐	☐	☐

Appendix C PROTOCOL CHANGE SUMMARY

The following changes to SOPs have been made between Rev B and Rev C protocols:

- Specification that sites that can accommodate grids are sampled only once per season, while sites that are too small to accommodate grids will have points that are to be sampled twice a season
- Changed sampling window specifications (see section 9.2):
- At sites that can accommodate the minimum of five 9-point grids, points within each grid are sampled once per season. At these sites, the sampling window must span a minimum of 5 days (i.e., all grids at a site should not be sampled on the same day) and a maximum of 14 days. For example, at a site with 15 grids,three grids could be sampled on each of 5 consecutive days or eight grids could be sampled on day 1 and the remaining seven on day 5 or day 14, etc. . At sites that cannot accommodate the minimum of five 9-point grids, points are sampled twice within a season. At these smaller sites, points should be sampled with a minimum of 7 days between sampling bouts and no longer than 21 days (see Table 1 above). Moved datasheet to separate change-controlled document
- SOP B: Modified datasheet to reflect the changes made to metadata recording:
  - Date (YYYY-MM-DD) and plot ID (SITE_XXX) should be filled out on every datasheet.
  - Start and ending cloud cover (%) and relative humidity (%) need to be completed only once per plot ID per date.
- SOP B: Removed '88' bird list and relaxed recording requirements for rare species. Protocol changed to:
  - If you see a rare or unexpected bird after the count period has elapsed, you may record this species on the datasheet, entering '88' as the point ID.
- SOP B: added identification qualifier to recorded data fields
- SOP B: added explicit instructions on when to take photographs
- Lumped site-specific information into one appendix

Appendix D **UNKNOWN BIRD CODES**

If you detect a bird that you are unable to identify, use the appropriate unknown bird code (below). Never guess on the identity of a bird. This is falsifying data. If you are unsure, record UNBI rather than incorrectly identifying a bird. However, recording a lot of unidentified birds is an indication that you need to study up and practice before performing more point counts.

Bird Type	Code
Unknown Accipiter	UNAC
Unknown Bird	UNBI
Unknown Blackbird	UNBL
Unknown Buteo	UNBU
Unknown Chickadee	UNCH
Unknown Corvid	UNCO
Unknown Dove	UNDO
Unknown Duck	UNDU
Unknown Empidonax	UNEM
Unknown Falcon	UNFA
Unknown Finch	UNFI
Unknown Flycatcher	UNFL
Unknown Gnatcatcher	UNGN
Unknown Grouse	UNGR
Unknown Gull	UNGU
Unknown Hawk	UNHA
Unknown Hummingbird	UNHU
Unknown Jay	UNJA
Unknown Nuthatch	UNNU
Unknown Oriole	UNOR
Unknown Owl	UNOW
Unknown Pipit	UNPI
Unknown Raptor	UNRA
Unknown Sparrow	UNSP
Unknown Swallow	UNSW
Unknown Swift	UNSI
Unknown Tanager	UNTA
Unknown Thrush	UNTH
Unknown Thrasher	UNTR
Unknown Vireo	UNVI
Unknown Warbler	UNWA
Unknown Woodpecker	UNWO
Unknown Wren	UNWR

Appendix E CLUSTER INFORMATION

Clusters consist of either flocks or paired birds – i.e., birds of the same species observed together (foraging, flying, perching, or obviously interacting with each other). Two males of the same species singing 20 meters apart do NOT constitute a cluster.

How to record clusters:

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

Then enter the same letter on both lines for the "Cluster Code" (a, b, c …). The Cluster Code is only used to link clusters that take up multiple lines on the data sheet.

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

Appendix F **SITE-SPECIFIC INFORMATION**

D01 – CORE - HARV (Harvard Forest)

Recommended Sampling Window: June 1 - June 30

Recommended Daily Sampling Period: 20 minutes after official sunrise - 10:30 AM

Source: Rocky Mountain Bird Observatory

Species Lists:

Mean relative abundances (species abundance/total community abundance) of bird species observed during the Breeding Bird Survey on the route that passes east of Petersham, MA (Route 900 – Ware River) – in descending order. Source: (Sauer et al. 2011).

commonName	scientificName	meanRA	minYear	maxYear	landbird
Ovenbird	*Seiurus aurocapilla*	0.105	1993	2011	TRUE
Red-eyed Vireo	*Vireo olivaceus*	0.073	1993	2011	TRUE
American Robin	*Turdus migratorius*	0.051	1993	2011	TRUE
Veery	*Catharus fuscescens*	0.042	1993	2011	TRUE
Blue Jay	*Cyanocitta cristata*	0.041	1993	2011	TRUE
Mourning Dove	*Zenaida macroura*	0.036	1993	2011	TRUE
American Crow	*Corvus brachyrhynchos*	0.035	1993	2011	TRUE
Blue-headed Vireo	*Vireo solitarius*	0.031	1993	2011	TRUE
Scarlet Tanager	*Piranga olivacea*	0.03	1993	2011	TRUE
Cedar Waxwing	*Bombycilla cedrorum*	0.028	1993	2011	TRUE
Tree Swallow	*Tachycineta bicolor*	0.027	1993	2011	TRUE
Red-winged Blackbird	*Agelaius phoeniceus*	0.026	1993	2011	TRUE
Common Yellowthroat	*Geothlypis trichas*	0.024	1993	2011	TRUE
Chestnut-sided Warbler	*Setophaga pensylvanica*	0.024	1993	2011	TRUE
Black-capped Chickadee	*Poecile atricapillus*	0.021	1993	2011	TRUE
Gray Catbird	*Dumetella carolinensis*	0.02	1993	2011	TRUE
Tufted Titmouse	*Baeolophus bicolor*	0.019	1993	2011	TRUE
Chipping Sparrow	*Spizella passerina*	0.019	1993	2011	TRUE
Brown-headed Cowbird	*Molothrus ater*	0.017	1993	2011	TRUE
Rose-breasted Grosbeak	*Pheucticus ludovicianus*	0.016	1993	2011	TRUE
Northern Rough-winged Swallow	*Stelgidopteryx serripennis*	0.016	1994	2005	TRUE
European Starling	*Sturnus vulgaris*	0.016	1993	2008	TRUE
Common Grackle	*Quiscalus quiscula*	0.015	1993	2011	TRUE
Hermit Thrush	*Catharus guttatus*	0.014	1993	2011	TRUE

Barn Swallow	*Hirundo rustica*	0.014	1993	2011	TRUE
Least Flycatcher	*Empidonax minimus*	0.013	1993	2010	TRUE
American Goldfinch	*Spinus tristis*	0.013	1993	2010	TRUE
Wood Thrush	*Hylocichla mustelina*	0.012	1993	2011	TRUE
Baltimore Oriole	*Icterus galbula*	0.012	1993	2011	TRUE
Black-throated Green Warbler	*Setophaga virens*	0.012	1993	2011	TRUE
Black-and-white Warbler	*Mniotilta varia*	0.011	1993	2011	TRUE
Eastern Towhee	*Pipilo erythrophthalmus*	0.011	1993	2011	TRUE
Yellow Warbler	*Setophaga petechia*	0.011	1993	2011	TRUE
Pine Warbler	*Setophaga pinus*	0.01	1993	2011	TRUE
American Redstart	*Setophaga ruticilla*	0.01	1993	2011	TRUE
White-breasted Nuthatch	*Sitta carolinensis*	0.01	1993	2011	TRUE
Song Sparrow	*Melospiza melodia*	0.009	1993	2011	TRUE
Great Crested Flycatcher	*Myiarchus crinitus*	0.008	1993	2011	TRUE
Bank Swallow	*Riparia riparia*	0.008	1993	1999	TRUE
Eastern Phoebe	*Sayornis phoebe*	0.008	1993	2011	TRUE
Yellow-rumped Warbler	*Setophaga coronata*	0.008	1993	2011	TRUE
Eastern Kingbird	*Tyrannus tyrannus*	0.008	1993	2010	TRUE
Chimney Swift	*Chaetura pelagica*	0.007	1994	2005	TRUE
Eastern Wood-Pewee	*Contopus virens*	0.007	1993	2011	TRUE
Hairy Woodpecker	*Picoides villosus*	0.007	1993	2011	TRUE
Red-breasted Nuthatch	*Sitta canadensis*	0.007	1993	2011	TRUE
Northern Cardinal	*Cardinalis cardinalis*	0.006	1993	2011	TRUE
Common Raven	*Corvus corax*	0.006	1994	2011	TRUE
Bobolink	*Dolichonyx oryzivorus*	0.006	1993	2011	TRUE
Black-throated Blue Warbler	*Setophaga caerulescens*	0.006	1993	2010	TRUE
Winter Wren	*Troglodytes hiemalis*	0.006	1993	2005	TRUE
Black-billed Cuckoo	*Coccyzus erythropthalmus*	0.005	1995	2009	TRUE
Pileated Woodpecker	*Dryocopus pileatus*	0.005	1993	2011	TRUE
Downy Woodpecker	*Picoides pubescens*	0.005	1993	2011	TRUE
House Wren	*Troglodytes aedon*	0.005	1993	2011	TRUE
Blue-winged Warbler	*Vermivora cyanoptera*	0.005	1993	2011	TRUE
Ruby-throated Hummingbird	*Archilochus colubris*	0.004	1993	2011	TRUE
Evening Grosbeak	*Coccothraustes vespertinus*	0.004	1995	2002	TRUE
Northern Flicker	*Colaptes auratus*	0.004	1993	2005	TRUE
Northern Mockingbird	*Mimus polyglottos*	0.004	1993	1993	TRUE
House Sparrow	*Passer domesticus*	0.004	1993	2008	TRUE
Blue-gray Gnatcatcher	*Polioptila caerulea*	0.004	1997	2002	TRUE
Prairie Warbler	*Setophaga discolor*	0.004	1993	2010	TRUE

Blackburnian Warbler	*Setophaga fusca*	0.004	1994	2011	TRUE
Eastern Bluebird	*Sialia sialis*	0.004	1993	2011	TRUE
White-throated Sparrow	*Zonotrichia albicollis*	0.004	1993	2010	TRUE
Canada Warbler	*Cardellina canadensis*	0.003	1996	2009	TRUE
Brown Creeper	*Certhia americana*	0.003	1993	2008	TRUE
Rock Pigeon	*Columba livia*	0.003	1997	1997	TRUE
Alder Flycatcher	*Empidonax alnorum*	0.003	1993	2006	TRUE
Belted Kingfisher	*Megaceryle alcyon*	0.003	1998	1998	TRUE
Northern Waterthrush	*Parkesia noveboracensis*	0.003	1993	2006	TRUE
Indigo Bunting	*Passerina cyanea*	0.003	1993	2011	TRUE
Magnolia Warbler	*Setophaga magnolia*	0.003	1994	2004	TRUE
Yellow-bellied Sapsucker	*Sphyrapicus varius*	0.003	2003	2011	TRUE
Field Sparrow	*Spizella pusilla*	0.003	1993	2008	TRUE
Yellow-throated Vireo	*Vireo flavifrons*	0.003	1995	2004	TRUE
Willow Flycatcher	*Empidonax traillii*	0.002	1993	1993	TRUE
Dark-eyed Junco	*Junco hyemalis*	0.002	1995	1995	TRUE
Swamp Sparrow	*Melospiza georgiana*	0.002	1993	2009	TRUE
Nashville Warbler	*Oreothlypis ruficapilla*	0.002	1993	1993	TRUE
Canada Goose	*Branta canadensis*	0.027	1994	2011	FALSE
Turkey Vulture	*Cathartes aura*	0.008	1995	2011	FALSE
Mallard	*Anas platyrhynchos*	0.006	1993	2010	FALSE
Killdeer	*Charadrius vociferus*	0.004	1994	2011	FALSE
Wild Turkey	*Meleagris gallopavo*	0.004	1996	2011	FALSE
Barred Owl	*Strix varia*	0.004	1993	2010	FALSE
Wood Duck	*Aix sponsa*	0.003	1999	2003	FALSE
Great Blue Heron	*Ardea herodias*	0.003	1994	2010	FALSE
Ruffed Grouse	*Bonasa umbellus*	0.003	1994	2010	FALSE
Broad-winged Hawk	*Buteo platypterus*	0.003	1993	2009	FALSE
American Woodcock	*Scolopax minor*	0.003	2003	2003	FALSE
Cooper's Hawk	*Accipiter cooperii*	0.002	1995	2003	FALSE
American Bittern	*Botaurus lentiginosus*	0.002	1994	1994	FALSE
Red-shouldered Hawk	*Buteo lineatus*	0.002	1993	1998	FALSE
American Kestrel	*Falco sparverius*	0.002	1995	1995	FALSE
Herring Gull	*Larus argentatus*	0.002	1995	1995	FALSE

D01 – RELOCATABLE - BART (Barlett Experimental Forest)

Recommended Sampling Window: TBD

Recommended Daily Sampling Period: TBD

Source: TBD

Species Lists:

Mean relative abundances (species abundance/total community abundance) of bird species observed during the Breeding Bird Survey on the JEFFERS NTCH route (Route 116) – in descending order. Source: (Sauer et al. 2011).

commonName	scientificName	meanRA	minYear	maxYear	landbird
Red-eyed Vireo	*Vireo olivaceus*	0.135	1993	2011	TRUE
Black-throated Green Warbler	*Setophaga virens*	0.071	1993	2011	TRUE
American Robin	*Turdus migratorius*	0.071	1993	2011	TRUE
Ovenbird	*Seiurus aurocapilla*	0.051	1993	2011	TRUE
Winter Wren	*Troglodytes hiemalis*	0.045	1993	2011	TRUE
Hermit Thrush	*Catharus guttatus*	0.042	1993	2011	TRUE
White-throated Sparrow	*Zonotrichia albicollis*	0.04	1993	2011	TRUE
Swainson's Thrush	*Catharus ustulatus*	0.039	1993	2011	TRUE
American Redstart	*Setophaga ruticilla*	0.038	1993	2011	TRUE
Blue-headed Vireo	*Vireo solitarius*	0.036	1993	2011	TRUE
Common Yellowthroat	*Geothlypis trichas*	0.032	1993	2011	TRUE
Black-throated Blue Warbler	*Setophaga caerulescens*	0.028	1993	2011	TRUE
Black-capped Chickadee	*Poecile atricapillus*	0.027	1993	2011	TRUE
Cedar Waxwing	*Bombycilla cedrorum*	0.026	1993	2011	TRUE
Dark-eyed Junco	*Junco hyemalis*	0.025	1993	2011	TRUE
Yellow-rumped Warbler	*Setophaga coronata*	0.025	1993	2011	TRUE
American Crow	*Corvus brachyrhynchos*	0.024	1993	2011	TRUE
Song Sparrow	*Melospiza melodia*	0.021	1993	2011	TRUE
European Starling	*Sturnus vulgaris*	0.019	1994	2003	TRUE
Chestnut-sided Warbler	*Setophaga pensylvanica*	0.018	1993	2011	TRUE
Veery	*Catharus fuscescens*	0.017	1993	2011	TRUE
Least Flycatcher	*Empidonax minimus*	0.016	1993	2011	TRUE
Magnolia Warbler	*Setophaga magnolia*	0.016	1993	2011	TRUE
Chipping Sparrow	*Spizella passerina*	0.015	1994	2011	TRUE
Blackburnian Warbler	*Setophaga fusca*	0.014	1993	2011	TRUE
Tree Swallow	*Tachycineta bicolor*	0.014	1993	2011	TRUE

Yellow-bellied Sapsucker	*Sphyrapicus varius*	0.011	1993	2011	TRUE
Eastern Phoebe	*Sayornis phoebe*	0.01	1993	2011	TRUE
American Goldfinch	*Spinus tristis*	0.009	1993	2011	TRUE
Common Raven	*Corvus corax*	0.008	1993	2011	TRUE
Nashville Warbler	*Oreothlypis ruficapilla*	0.008	1993	2011	TRUE
Common Grackle	*Quiscalus quiscula*	0.008	1993	2011	TRUE
Blue Jay	*Cyanocitta cristata*	0.007	1994	2011	TRUE
Downy Woodpecker	*Picoides pubescens*	0.007	1993	2011	TRUE
Northern Parula	*Setophaga americana*	0.007	1993	2011	TRUE
Eastern Wood-Pewee	*Contopus virens*	0.006	1993	2006	TRUE
Alder Flycatcher	*Empidonax alnorum*	0.006	1993	2011	TRUE
Yellow-bellied Flycatcher	*Empidonax flaviventris*	0.006	1993	2011	TRUE
Wood Thrush	*Hylocichla mustelina*	0.006	1993	2010	TRUE
Scarlet Tanager	*Piranga olivacea*	0.006	1993	2009	TRUE
Golden-crowned Kinglet	*Regulus satrapa*	0.006	1993	2009	TRUE
Blackpoll Warbler	*Setophaga striata*	0.006	1994	2011	TRUE
Red-winged Blackbird	*Agelaius phoeniceus*	0.005	1993	1999	TRUE
Gray Catbird	*Dumetella carolinensis*	0.005	1993	2009	TRUE
Baltimore Oriole	*Icterus galbula*	0.005	2000	2000	TRUE
Swamp Sparrow	*Melospiza georgiana*	0.005	1998	2011	TRUE
Indigo Bunting	*Passerina cyanea*	0.005	1994	2011	TRUE
Hairy Woodpecker	*Picoides villosus*	0.005	1995	2009	TRUE
Ruby-crowned Kinglet	*Regulus calendula*	0.005	1993	2010	TRUE
Yellow Warbler	*Setophaga petechia*	0.005	1993	2006	TRUE
Red-breasted Nuthatch	*Sitta canadensis*	0.005	1993	2011	TRUE
Mourning Dove	*Zenaida macroura*	0.005	1993	2010	TRUE
Ruby-throated Hummingbird	*Archilochus colubris*	0.004	1994	2010	TRUE
Canada Warbler	*Cardellina canadensis*	0.004	1993	2005	TRUE
Brown Creeper	*Certhia americana*	0.004	1993	2009	TRUE
Chimney Swift	*Chaetura pelagica*	0.004	1995	2010	TRUE
Evening Grosbeak	*Coccothraustes vespertinus*	0.004	1993	2003	TRUE
Northern Flicker	*Colaptes auratus*	0.004	1993	2011	TRUE
Mourning Warbler	*Geothlypis philadelphia*	0.004	1996	2010	TRUE
Barn Swallow	*Hirundo rustica*	0.004	1996	2005	TRUE
Belted Kingfisher	*Megaceryle alcyon*	0.004	1994	2003	TRUE
Black-and-white Warbler	*Mniotilta varia*	0.004	1993	2011	TRUE
Pine Siskin	*Spinus pinus*	0.004	1998	2007	TRUE
House Wren	*Troglodytes aedon*	0.004	1993	2009	TRUE
Tufted Titmouse	*Baeolophus bicolor*	0.003	2003	2005	TRUE

Black-billed Cuckoo	*Coccyzus erythropthalmus*	0.003	1997	1997	TRUE
Pileated Woodpecker	*Dryocopus pileatus*	0.003	1994	2009	TRUE
Northern Mockingbird	*Mimus polyglottos*	0.003	2006	2006	TRUE
Brown-headed Cowbird	*Molothrus ater*	0.003	1998	1998	TRUE
Great Crested Flycatcher	*Myiarchus crinitus*	0.003	2006	2006	TRUE
Savannah Sparrow	*Passerculus sandwichensis*	0.003	2001	2007	TRUE
Black-backed Woodpecker	*Picoides arcticus*	0.003	1993	2009	TRUE
Boreal Chickadee	*Poecile hudsonicus*	0.003	2007	2007	TRUE
Eastern Bluebird	*Sialia sialis*	0.003	1994	2002	TRUE
White-breasted Nuthatch	*Sitta carolinensis*	0.003	1999	2008	TRUE
Brown Thrasher	*Toxostoma rufum*	0.003	1999	1999	TRUE
Eastern Kingbird	*Tyrannus tyrannus*	0.003	1995	2010	TRUE
Yellow-throated Vireo	*Vireo flavifrons*	0.003	2010	2010	TRUE
Warbling Vireo	*Vireo gilvus*	0.003	1994	2002	TRUE
Philadelphia Vireo	*Vireo philadelphicus*	0.003	1994	2004	TRUE
Grasshopper Sparrow	*Ammodramus savannarum*	0.002	1993	2000	TRUE
Olive-sided Flycatcher	*Contopus cooperi*	0.002	1995	1995	TRUE
Northern Waterthrush	*Parkesia noveboracensis*	0.002	1994	1995	TRUE
Rose-breasted Grosbeak	*Pheucticus ludovicianus*	0.002	1993	2009	TRUE
Pine Warbler	*Setophaga pinus*	0.002	1993	1993	TRUE
Mallard	*Anas platyrhynchos*	0.017	2001	2011	FALSE
Barred Owl	*Strix varia*	0.005	2002	2009	FALSE
Canada Goose	*Branta canadensis*	0.004	2011	2011	FALSE
American Kestrel	*Falco sparverius*	0.004	1994	2002	FALSE
Sharp-shinned Hawk	*Accipiter striatus*	0.003	2004	2004	FALSE
American Black Duck	*Anas rubripes*	0.003	2010	2010	FALSE
Great Blue Heron	*Ardea herodias*	0.003	2003	2003	FALSE
Broad-winged Hawk	*Buteo platypterus*	0.003	1996	2010	FALSE
Killdeer	*Charadrius vociferus*	0.003	1998	1998	FALSE
Wild Turkey	*Meleagris gallopavo*	0.003	2007	2007	FALSE
American Woodcock	*Scolopax minor*	0.003	2009	2009	FALSE

D02 – CORE – SCBI (Smithsonian Conservation Biology Institute)

Recommended Sampling Window: TBD

Recommended Daily Sampling Period: TBD

Source: TBD

Species Lists:

Mean relative abundances (species abundance/total community abundance) of bird species observed during the Breeding Bird Survey on the FRONT ROYAL route (Route 923) – in descending order. Source: (Sauer et al. 2011).

commonName	scientificName	meanRA	minYear	maxYear	landbird
Eastern Towhee	*Pipilo erythrophthalmus*	0.114	1993	2011	TRUE
Indigo Bunting	*Passerina cyanea*	0.113	1993	2011	TRUE
Red-eyed Vireo	*Vireo olivaceus*	0.102	1993	2011	TRUE
Wood Thrush	*Hylocichla mustelina*	0.101	1993	2011	TRUE
American Redstart	*Setophaga ruticilla*	0.079	1993	2011	TRUE
Eastern Wood-Pewee	*Contopus virens*	0.056	1993	2011	TRUE
Ovenbird	*Seiurus aurocapilla*	0.056	1993	2011	TRUE
Scarlet Tanager	*Piranga olivacea*	0.05	1993	2011	TRUE
Northern Cardinal	*Cardinalis cardinalis*	0.036	1993	2011	TRUE
American Crow	*Corvus brachyrhynchos*	0.032	1993	2011	TRUE
Tufted Titmouse	*Baeolophus bicolor*	0.028	1993	2011	TRUE
Acadian Flycatcher	*Empidonax virescens*	0.024	1993	2011	TRUE
Brown-headed Cowbird	*Molothrus ater*	0.024	1993	2011	TRUE
American Goldfinch	*Spinus tristis*	0.021	1993	2011	TRUE
Cerulean Warbler	*Setophaga cerulea*	0.02	1993	2011	TRUE
Chipping Sparrow	*Spizella passerina*	0.019	1993	2011	TRUE
Cedar Waxwing	*Bombycilla cedrorum*	0.018	1993	2011	TRUE
Veery	*Catharus fuscescens*	0.018	1993	2011	TRUE
Gray Catbird	*Dumetella carolinensis*	0.017	1993	2011	TRUE
Common Raven	*Corvus corax*	0.014	1993	2011	TRUE
Great Crested Flycatcher	*Myiarchus crinitus*	0.014	1993	2011	TRUE
American Robin	*Turdus migratorius*	0.014	1993	2011	TRUE
Yellow-billed Cuckoo	*Coccyzus americanus*	0.013	1993	2011	TRUE
Worm-eating Warbler	*Helmitheros vermivorum*	0.013	1993	2011	TRUE
Mourning Dove	*Zenaida macroura*	0.013	1993	2011	TRUE
Rose-breasted Grosbeak	*Pheucticus ludovicianus*	0.012	1993	2011	TRUE

Red-bellied Woodpecker	*Melanerpes carolinus*	0.011	1993	2010	TRUE
White-breasted Nuthatch	*Sitta carolinensis*	0.011	1993	2011	TRUE
Pileated Woodpecker	*Dryocopus pileatus*	0.01	1993	2011	TRUE
Carolina Wren	*Thryothorus ludovicianus*	0.01	1993	2010	TRUE
Northern Flicker	*Colaptes auratus*	0.009	1994	2011	TRUE
Common Grackle	*Quiscalus quiscula*	0.009	1993	2010	TRUE
Hooded Warbler	*Setophaga citrina*	0.009	1994	2011	TRUE
Blue-headed Vireo	*Vireo solitarius*	0.009	1993	2010	TRUE
Black-billed Cuckoo	*Coccyzus erythropthalmus*	0.008	1995	2011	TRUE
Dark-eyed Junco	*Junco hyemalis*	0.008	1993	2011	TRUE
Black-and-white Warbler	*Mniotilta varia*	0.008	1993	2010	TRUE
Blue-gray Gnatcatcher	*Polioptila caerulea*	0.008	1993	2011	TRUE
Downy Woodpecker	*Picoides pubescens*	0.007	1993	2011	TRUE
Carolina Chickadee	*Poecile carolinensis*	0.007	1993	2011	TRUE
Chimney Swift	*Chaetura pelagica*	0.006	1993	2009	TRUE
Least Flycatcher	*Empidonax minimus*	0.006	1994	1998	TRUE
Barn Swallow	*Hirundo rustica*	0.006	1995	1998	TRUE
Yellow-throated Vireo	*Vireo flavifrons*	0.006	1994	2011	TRUE
Kentucky Warbler	*Geothlypis formosa*	0.005	1994	2005	TRUE
Hairy Woodpecker	*Picoides villosus*	0.005	1994	2007	TRUE
Chestnut-sided Warbler	*Setophaga pensylvanica*	0.005	1993	2008	TRUE
Ruby-throated Hummingbird	*Archilochus colubris*	0.004	2006	2011	TRUE
Blue Jay	*Cyanocitta cristata*	0.004	1993	2010	TRUE
Baltimore Oriole	*Icterus galbula*	0.004	1998	2009	TRUE
Eastern Phoebe	*Sayornis phoebe*	0.004	1993	2008	TRUE
Canada Warbler	*Cardellina canadensis*	0.003	2000	2002	TRUE
Common Yellowthroat	*Geothlypis trichas*	0.003	1998	2011	TRUE
Yellow-breasted Chat	*Icteria virens*	0.003	2007	2011	TRUE
Louisiana Waterthrush	*Parkesia motacilla*	0.003	1994	2009	TRUE
Black-throated Blue Warbler	*Setophaga caerulescens*	0.003	2002	2002	TRUE
Black-throated Green Warbler	*Setophaga virens*	0.003	1997	1997	TRUE
Eastern Bluebird	*Sialia sialis*	0.003	1996	2000	TRUE
Brown Thrasher	*Toxostoma rufum*	0.003	2005	2011	TRUE
Tree Swallow	*Tachycineta bicolor*	0.002	1995	2009	TRUE
Eastern Screech-Owl	*Megascops asio*	0.009	2007	2007	FALSE
Red-tailed Hawk	*Buteo jamaicensis*	0.005	2006	2008	FALSE
Barred Owl	*Strix varia*	0.005	1993	2006	FALSE
Broad-winged Hawk	*Buteo platypterus*	0.004	1998	2010	FALSE
Wood Duck	*Aix sponsa*	0.003	2007	2007	FALSE

Ruffed Grouse	*Bonasa umbellus*	0.003	1994	2011	FALSE
Great Horned Owl	*Bubo virginianus*	0.003	2004	2008	FALSE
Northern Bobwhite	*Colinus virginianus*	0.003	2000	2000	FALSE
Wild Turkey	*Meleagris gallopavo*	0.003	1993	2004	FALSE

D03 – CORE – OSBS (Ordway-Swisher Biological Station)

Recommended Sampling Window: TBD

Recommended Daily Sampling Period: TBD

Source: TBD

Species Lists:

Mean relative abundances (species abundance/total community abundance) of bird species observed during the Breeding Bird Survey on the BELMORE route (Route 21) – in descending order. Source: (Sauer et al. 2011).

commonName	scientificName	meanRA	minYear	maxYear	landbird
Northern Cardinal	*Cardinalis cardinalis*	0.137	1993	2011	TRUE
American Crow	*Corvus brachyrhynchos*	0.112	1993	2011	TRUE
Carolina Wren	*Thryothorus ludovicianus*	0.102	1993	2011	TRUE
Mourning Dove	*Zenaida macroura*	0.08	1993	2011	TRUE
Great Crested Flycatcher	*Myiarchus crinitus*	0.076	1993	2011	TRUE
Eastern Towhee	*Pipilo erythrophthalmus*	0.063	1993	2011	TRUE
Northern Mockingbird	*Mimus polyglottos*	0.06	1993	2011	TRUE
Tufted Titmouse	*Baeolophus bicolor*	0.056	1993	2011	TRUE
Red-bellied Woodpecker	*Melanerpes carolinus*	0.051	1993	2011	TRUE
Pine Warbler	*Setophaga pinus*	0.048	1993	2011	TRUE
Common Yellowthroat	*Geothlypis trichas*	0.043	1993	2011	TRUE
Blue Jay	*Cyanocitta cristata*	0.037	1993	2011	TRUE
White-eyed Vireo	*Vireo griseus*	0.037	1993	2011	TRUE
Blue-gray Gnatcatcher	*Polioptila caerulea*	0.028	1993	2011	TRUE
Northern Parula	*Setophaga americana*	0.024	1993	2011	TRUE
Chimney Swift	*Chaetura pelagica*	0.017	1993	2011	TRUE
Bachman's Sparrow	*Peucaea aestivalis*	0.015	1993	2008	TRUE
Downy Woodpecker	*Picoides pubescens*	0.014	1993	2011	TRUE
Purple Martin	*Progne subis*	0.013	1993	2005	TRUE
Common Grackle	*Quiscalus quiscula*	0.012	1993	2011	TRUE
Rock Pigeon	*Columba livia*	0.011	1996	2005	TRUE
Yellow-billed Cuckoo	*Coccyzus americanus*	0.01	1995	2011	TRUE
European Starling	*Sturnus vulgaris*	0.01	1993	2009	TRUE
Brown Thrasher	*Toxostoma rufum*	0.01	1993	2011	TRUE
Boat-tailed Grackle	*Quiscalus major*	0.009	1993	2009	TRUE
Fish Crow	*Corvus ossifragus*	0.008	1993	2011	TRUE

Pileated Woodpecker	*Dryocopus pileatus*	0.008	1993	2011	TRUE
Carolina Chickadee	*Poecile carolinensis*	0.008	1995	2011	TRUE
Red-eyed Vireo	*Vireo olivaceus*	0.008	1993	2011	TRUE
Red-headed Woodpecker	*Melanerpes erythrocephalus*	0.007	1993	2009	TRUE
Summer Tanager	*Piranga rubra*	0.007	1993	2010	TRUE
Eastern Bluebird	*Sialia sialis*	0.007	1993	2010	TRUE
Red-winged Blackbird	*Agelaius phoeniceus*	0.006	1993	2009	TRUE
Brown-headed Cowbird	*Molothrus ater*	0.006	1993	2011	TRUE
Yellow-throated Warbler	*Setophaga dominica*	0.006	1993	1998	TRUE
Common Ground-Dove	*Columbina passerina*	0.005	1995	2009	TRUE
Loggerhead Shrike	*Lanius ludovicianus*	0.005	1993	2011	TRUE
Blue Grosbeak	*Passerina caerulea*	0.005	1998	2009	TRUE
Eastern Meadowlark	*Sturnella magna*	0.005	1995	2009	TRUE
Yellow-throated Vireo	*Vireo flavifrons*	0.005	1995	2011	TRUE
Acadian Flycatcher	*Empidonax virescens*	0.004	1993	1993	TRUE
Indigo Bunting	*Passerina cyanea*	0.004	2003	2008	TRUE
Eurasian Collared-Dove	*Streptopelia decaocto*	0.004	2001	2003	TRUE
Eastern Wood-Pewee	*Contopus virens*	0.003	1998	2004	TRUE
Orchard Oriole	*Icterus spurius*	0.003	1996	1996	TRUE
Prothonotary Warbler	*Protonotaria citrea*	0.003	1993	1995	TRUE
Eastern Kingbird	*Tyrannus tyrannus*	0.003	2000	2003	TRUE
Ruby-throated Hummingbird	*Archilochus colubris*	0.002	1994	2001	TRUE
Northern Flicker	*Colaptes auratus*	0.002	1995	1995	TRUE
Gray Catbird	*Dumetella carolinensis*	0.002	1993	1996	TRUE
Brown-headed Nuthatch	*Sitta pusilla*	0.002	1994	2002	TRUE
Cattle Egret	*Bubulcus ibis*	0.048	1993	2011	FALSE
Northern Bobwhite	*Colinus virginianus*	0.022	1993	2011	FALSE
Black Vulture	*Coragyps atratus*	0.014	1993	2010	FALSE
Turkey Vulture	*Cathartes aura*	0.013	1993	2011	FALSE
Red-shouldered Hawk	*Buteo lineatus*	0.01	1993	2011	FALSE
White Ibis	*Eudocimus albus*	0.009	1999	2007	FALSE
Killdeer	*Charadrius vociferus*	0.008	1993	2011	FALSE
Common Nighthawk	*Chordeiles minor*	0.008	1993	2011	FALSE
Sandhill Crane	*Grus canadensis*	0.007	1996	2007	FALSE
Wild Turkey	*Meleagris gallopavo*	0.007	1993	2008	FALSE
Wood Stork	*Mycteria americana*	0.006	2003	2003	FALSE
Osprey	*Pandion haliaetus*	0.005	2001	2009	FALSE
Barred Owl	*Strix varia*	0.005	1993	2009	FALSE
Wood Duck	*Aix sponsa*	0.004	1995	2011	FALSE

Swallow-tailed Kite	*Elanoides forficatus*	0.004	1995	2009	FALSE
Great Egret	*Ardea alba*	0.003	1994	2011	FALSE
Great Blue Heron	*Ardea herodias*	0.003	2001	2008	FALSE
Red-tailed Hawk	*Buteo jamaicensis*	0.003	1994	2008	FALSE
Little Blue Heron	*Egretta caerulea*	0.003	2005	2005	FALSE
Cooper's Hawk	*Accipiter cooperii*	0.002	1994	1994	FALSE
Limpkin	*Aramus guarauna*	0.002	2001	2001	FALSE

D03 – RELOCATABLE – DISN (Disney Wilderness Preserve)

Recommended Sampling Window: TBD

Recommended Daily Sampling Period: TBD

Source: TBD

Species Lists:

Mean relative abundances (species abundance/total community abundance) of bird species observed during the Breeding Bird Survey on the KISSIMMEE route (Route 69) – in descending order. Source: (Sauer et al. 2011).

commonName	scientificName	meanRA	minYear	maxYear	landbird
Northern Mockingbird	*Mimus polyglottos*	0.186	1993	2011	TRUE
Mourning Dove	*Zenaida macroura*	0.144	1993	2011	TRUE
Boat-tailed Grackle	*Quiscalus major*	0.121	1993	2011	TRUE
Fish Crow	*Corvus ossifragus*	0.092	1993	2011	TRUE
Common Grackle	*Quiscalus quiscula*	0.088	1993	2011	TRUE
European Starling	*Sturnus vulgaris*	0.086	1993	2011	TRUE
Eastern Meadowlark	*Sturnella magna*	0.067	1993	2011	TRUE
Rock Pigeon	*Columba livia*	0.052	1994	2011	TRUE
Eurasian Collared-Dove	*Streptopelia decaocto*	0.047	1999	2011	TRUE
American Crow	*Corvus brachyrhynchos*	0.043	1993	2011	TRUE
Blue Jay	*Cyanocitta cristata*	0.04	1993	2011	TRUE
Eastern Towhee	*Pipilo erythrophthalmus*	0.039	1993	2011	TRUE
Northern Cardinal	*Cardinalis cardinalis*	0.037	1993	2011	TRUE
Purple Martin	*Progne subis*	0.029	1993	2011	TRUE
Loggerhead Shrike	*Lanius ludovicianus*	0.022	1993	2011	TRUE
Carolina Wren	*Thryothorus ludovicianus*	0.021	1993	2011	TRUE
Red-winged Blackbird	*Agelaius phoeniceus*	0.019	1993	2010	TRUE
Red-bellied Woodpecker	*Melanerpes carolinus*	0.019	1993	2011	TRUE
Northern Rough-winged Swallow	*Stelgidopteryx serripennis*	0.017	2001	2001	TRUE
House Sparrow	*Passer domesticus*	0.015	1993	2011	TRUE
Chimney Swift	*Chaetura pelagica*	0.013	1993	2011	TRUE
Great Crested Flycatcher	*Myiarchus crinitus*	0.013	1993	2011	TRUE
Tufted Titmouse	*Baeolophus bicolor*	0.011	1993	2010	TRUE
White-eyed Vireo	*Vireo griseus*	0.01	1993	2011	TRUE
Common Yellowthroat	*Geothlypis trichas*	0.009	1993	2011	TRUE
Bachman's Sparrow	*Peucaea aestivalis*	0.009	1993	2008	TRUE

Brown-headed Cowbird	*Molothrus ater*	0.008	2002	2003	TRUE
Eastern Bluebird	*Sialia sialis*	0.008	1994	2011	TRUE
Northern Parula	*Setophaga americana*	0.007	1993	2011	TRUE
White-winged Dove	*Zenaida asiatica*	0.007	2001	2007	TRUE
Pileated Woodpecker	*Dryocopus pileatus*	0.006	1994	2009	TRUE
Pine Warbler	*Setophaga pinus*	0.006	1993	2009	TRUE
Brown Thrasher	*Toxostoma rufum*	0.006	1993	2003	TRUE
Eastern Kingbird	*Tyrannus tyrannus*	0.006	1993	1999	TRUE
Common Ground-Dove	*Columbina passerina*	0.005	1993	2011	TRUE
Downy Woodpecker	*Picoides pubescens*	0.005	1993	2011	TRUE
Northern Flicker	*Colaptes auratus*	0.004	1993	2009	TRUE
Red-headed Woodpecker	*Melanerpes erythrocephalus*	0.004	1993	2009	TRUE
Blue-gray Gnatcatcher	*Polioptila caerulea*	0.004	1993	2008	TRUE
Yellow-throated Warbler	*Setophaga dominica*	0.004	1993	2010	TRUE
Yellow-billed Cuckoo	*Coccyzus americanus*	0.003	1994	2006	TRUE
Summer Tanager	*Piranga rubra*	0.003	1994	2010	TRUE
Brown-headed Nuthatch	*Sitta pusilla*	0.003	1993	2002	TRUE
Hairy Woodpecker	*Picoides villosus*	0.002	1994	1994	TRUE
Cattle Egret	*Bubulcus ibis*	0.223	1993	2011	FALSE
White Ibis	*Eudocimus albus*	0.123	1993	2011	FALSE
Black Vulture	*Coragyps atratus*	0.081	1993	2011	FALSE
Turkey Vulture	*Cathartes aura*	0.064	1993	2011	FALSE
Sandhill Crane	*Grus canadensis*	0.027	1993	2011	FALSE
Great Egret	*Ardea alba*	0.026	1993	2011	FALSE
Wild Turkey	*Meleagris gallopavo*	0.018	1993	2006	FALSE
Great Blue Heron	*Ardea herodias*	0.016	1993	2011	FALSE
Mallard	*Anas platyrhynchos*	0.015	2001	2010	FALSE
Mottled Duck	*Anas fulvigula*	0.014	1999	2011	FALSE
Glossy Ibis	*Plegadis falcinellus*	0.013	1999	2009	FALSE
Northern Bobwhite	*Colinus virginianus*	0.012	1993	2011	FALSE
Osprey	*Pandion haliaetus*	0.011	1995	2011	FALSE
Red-shouldered Hawk	*Buteo lineatus*	0.01	1993	2011	FALSE
Killdeer	*Charadrius vociferus*	0.009	1993	2011	FALSE
Common Nighthawk	*Chordeiles minor*	0.009	1993	2005	FALSE
Wood Stork	*Mycteria americana*	0.009	1993	2011	FALSE
Snowy Egret	*Egretta thula*	0.008	1999	2010	FALSE
Crested Caracara	*Caracara cheriway*	0.007	1999	2011	FALSE
Swallow-tailed Kite	*Elanoides forficatus*	0.007	1999	2010	FALSE
Double-crested Cormorant	*Phalacrocorax auritus*	0.007	1993	2011	FALSE

Cooper's Hawk	*Accipiter cooperii*	0.005	2001	2011	FALSE
Wood Duck	*Aix sponsa*	0.005	1993	2010	FALSE
Green Heron	*Butorides virescens*	0.005	1993	2011	FALSE
Little Blue Heron	*Egretta caerulea*	0.005	1994	2011	FALSE
Tricolored Heron	*Egretta tricolor*	0.005	1999	2007	FALSE
Anhinga	*Anhinga anhinga*	0.004	1993	2011	FALSE
Limpkin	*Aramus guarauna*	0.004	2007	2011	FALSE
Red-tailed Hawk	*Buteo jamaicensis*	0.004	1994	2010	FALSE
Bald Eagle	*Haliaeetus leucocephalus*	0.004	1993	2009	FALSE
Roseate Spoonbill	*Platalea ajaja*	0.004	2011	2011	FALSE
Common Gallinule	*Gallinula galeata*	0.003	1993	2008	FALSE
Black-necked Stilt	*Himantopus mexicanus*	0.003	2009	2009	FALSE

D03 – RELOCATABLE – JERC (Jones Ecological Research Center)

Recommended Sampling Window: TBD

Recommended Daily Sampling Period: TBD

Source: TBD

Species Lists:

Mean relative abundances (species abundance/total community abundance) of bird species observed during the Breeding Bird Survey on the route that passes east of Petersham, MA (Route 900 – Ware River) – in descending order. Source: (Sauer et al. 2011).

commonName	scientificName	meanRA	minYear	maxYear	landbird
Northern Cardinal	*Cardinalis cardinalis*	0.182	1993	2011	TRUE
Mourning Dove	*Zenaida macroura*	0.131	1993	2011	TRUE
American Crow	*Corvus brachyrhynchos*	0.121	1993	2011	TRUE
Blue Jay	*Cyanocitta cristata*	0.107	1993	2011	TRUE
Carolina Wren	*Thryothorus ludovicianus*	0.101	1993	2011	TRUE
Red-winged Blackbird	*Agelaius phoeniceus*	0.082	1993	2011	TRUE
Northern Mockingbird	*Mimus polyglottos*	0.078	1993	2011	TRUE
Red-bellied Woodpecker	*Melanerpes carolinus*	0.058	1993	2011	TRUE
Common Grackle	*Quiscalus quiscula*	0.057	1993	2011	TRUE
Great Crested Flycatcher	*Myiarchus crinitus*	0.049	1993	2011	TRUE
Purple Martin	*Progne subis*	0.042	1995	2010	TRUE
Tufted Titmouse	*Baeolophus bicolor*	0.039	1993	2011	TRUE
Indigo Bunting	*Passerina cyanea*	0.034	1993	2011	TRUE
Eastern Towhee	*Pipilo erythrophthalmus*	0.034	1993	2011	TRUE
Blue Grosbeak	*Passerina caerulea*	0.032	1993	2011	TRUE
Barn Swallow	*Hirundo rustica*	0.029	1993	2011	TRUE
Pine Warbler	*Setophaga pinus*	0.029	1993	2011	TRUE
Fish Crow	*Corvus ossifragus*	0.028	1994	2010	TRUE
Common Ground-Dove	*Columbina passerina*	0.027	1993	2011	TRUE
Carolina Chickadee	*Poecile carolinensis*	0.026	1993	2011	TRUE
Brown-headed Cowbird	*Molothrus ater*	0.024	1993	2011	TRUE
Northern Parula	*Setophaga americana*	0.021	1993	2011	TRUE
Eurasian Collared-Dove	*Streptopelia decaocto*	0.019	2000	2011	TRUE
White-eyed Vireo	*Vireo griseus*	0.018	1993	2011	TRUE
Eastern Bluebird	*Sialia sialis*	0.017	1993	2011	TRUE
House Sparrow	*Passer domesticus*	0.016	1993	2008	TRUE

Field Sparrow	*Spizella pusilla*	0.014	1993	2011	TRUE
Brown Thrasher	*Toxostoma rufum*	0.014	1993	2011	TRUE
Red-headed Woodpecker	*Melanerpes erythrocephalus*	0.013	1993	2010	TRUE
Common Yellowthroat	*Geothlypis trichas*	0.011	1993	2011	TRUE
Eastern Meadowlark	*Sturnella magna*	0.011	1993	2010	TRUE
Yellow-billed Cuckoo	*Coccyzus americanus*	0.009	1993	2011	TRUE
Brown-headed Nuthatch	*Sitta pusilla*	0.009	1993	2011	TRUE
Chimney Swift	*Chaetura pelagica*	0.008	1993	2010	TRUE
Wood Thrush	*Hylocichla mustelina*	0.008	1993	2009	TRUE
Yellow-breasted Chat	*Icteria virens*	0.008	1993	2011	TRUE
White-breasted Nuthatch	*Sitta carolinensis*	0.008	1994	2011	TRUE
Eastern Wood-Pewee	*Contopus virens*	0.007	1993	2011	TRUE
Summer Tanager	*Piranga rubra*	0.007	1993	2011	TRUE
European Starling	*Sturnus vulgaris*	0.007	1993	2006	TRUE
Eastern Kingbird	*Tyrannus tyrannus*	0.007	1993	2011	TRUE
Pileated Woodpecker	*Dryocopus pileatus*	0.006	1994	2011	TRUE
Loggerhead Shrike	*Lanius ludovicianus*	0.006	1993	2008	TRUE
Bachman's Sparrow	*Peucaea aestivalis*	0.006	1994	2011	TRUE
Blue-gray Gnatcatcher	*Polioptila caerulea*	0.006	1993	2011	TRUE
Northern Rough-winged Swallow	*Stelgidopteryx serripennis*	0.006	2004	2007	TRUE
Rock Pigeon	*Columba livia*	0.005	1993	2000	TRUE
Acadian Flycatcher	*Empidonax virescens*	0.005	1993	2011	TRUE
Orchard Oriole	*Icterus spurius*	0.005	1993	2011	TRUE
Downy Woodpecker	*Picoides pubescens*	0.005	1995	2011	TRUE
Gray Catbird	*Dumetella carolinensis*	0.004	1993	2004	TRUE
Red-eyed Vireo	*Vireo olivaceus*	0.004	1995	2011	TRUE
Ruby-throated Hummingbird	*Archilochus colubris*	0.003	1998	2009	TRUE
Northern Flicker	*Colaptes auratus*	0.003	1999	2002	TRUE
Belted Kingfisher	*Megaceryle alcyon*	0.003	2006	2006	TRUE
Yellow-throated Vireo	*Vireo flavifrons*	0.003	1993	2010	TRUE
Kentucky Warbler	*Geothlypis formosa*	0.002	1993	1993	TRUE
Prothonotary Warbler	*Protonotaria citrea*	0.002	1993	2001	TRUE
Prairie Warbler	*Setophaga discolor*	0.002	1993	1993	TRUE
Yellow-throated Warbler	*Setophaga dominica*	0.002	1995	1995	TRUE
Northern Bobwhite	*Colinus virginianus*	0.08	1993	2011	FALSE
Wood Stork	*Mycteria americana*	0.08	2001	2011	FALSE
Cattle Egret	*Bubulcus ibis*	0.055	1993	2011	FALSE
White Ibis	*Eudocimus albus*	0.05	1993	2011	FALSE
Great Egret	*Ardea alba*	0.031	1993	2011	FALSE

Little Blue Heron	*Egretta caerulea*	0.022	1993	2011	FALSE
Black Vulture	*Coragyps atratus*	0.021	1994	2011	FALSE
Turkey Vulture	*Cathartes aura*	0.011	1994	2011	FALSE
Wood Duck	*Aix sponsa*	0.009	1995	2011	FALSE
Great Blue Heron	*Ardea herodias*	0.007	1993	2010	FALSE
Canada Goose	*Branta canadensis*	0.007	2006	2006	FALSE
Common Gallinule	*Gallinula galeata*	0.007	1994	2010	FALSE
Mississippi Kite	*Ictinia mississippiensis*	0.007	2010	2010	FALSE
Red-shouldered Hawk	*Buteo lineatus*	0.006	1994	2010	FALSE
Pied-billed Grebe	*Podilymbus podiceps*	0.006	1993	2009	FALSE
Barred Owl	*Strix varia*	0.006	2004	2004	FALSE
Great Horned Owl	*Bubo virginianus*	0.005	1996	2011	FALSE
Killdeer	*Charadrius vociferus*	0.005	1993	2011	FALSE
Osprey	*Pandion haliaetus*	0.005	2008	2010	FALSE
Snowy Egret	*Egretta thula*	0.004	1996	2011	FALSE
Cooper's Hawk	*Accipiter cooperii*	0.003	2006	2006	FALSE
Anhinga	*Anhinga anhinga*	0.003	1996	2007	FALSE
Red-tailed Hawk	*Buteo jamaicensis*	0.003	1993	2004	FALSE
Green Heron	*Butorides virescens*	0.003	1993	2010	FALSE
Eastern Screech-Owl	*Megascops asio*	0.003	2009	2009	FALSE
Wild Turkey	*Meleagris gallopavo*	0.002	1993	1993	FALSE

D05 – CORE – UNDE (University of Notre Dame Environmental Research Center)

Recommended Sampling Window: TBD

Recommended Daily Sampling Period: TBD

Source: TBD

Species Lists:

Mean relative abundances (species abundance/total community abundance) of bird species observed during the Breeding Bird Survey on the Irma route (Route 22) – in descending order. Source: (Sauer et al. 2011).

commonName	scientificName	meanRA	minYear	maxYear	landbird
American Robin	*Turdus migratorius*	0.187	1993	2011	TRUE
Red-eyed Vireo	*Vireo olivaceus*	0.165	1993	2011	TRUE
Song Sparrow	*Melospiza melodia*	0.144	1993	2011	TRUE
Ovenbird	*Seiurus aurocapilla*	0.134	1993	2011	TRUE
Chipping Sparrow	*Spizella passerina*	0.131	1993	2011	TRUE
American Crow	*Corvus brachyrhynchos*	0.129	1993	2011	TRUE
Red-winged Blackbird	*Agelaius phoeniceus*	0.112	1993	2011	TRUE
Chestnut-sided Warbler	*Setophaga pensylvanica*	0.105	1993	2011	TRUE
Black-capped Chickadee	*Poecile atricapillus*	0.101	1993	2011	TRUE
European Starling	*Sturnus vulgaris*	0.091	1993	2011	TRUE
American Goldfinch	*Spinus tristis*	0.084	1993	2011	TRUE
Common Yellowthroat	*Geothlypis trichas*	0.079	1993	2011	TRUE
Cedar Waxwing	*Bombycilla cedrorum*	0.061	1993	2011	TRUE
Red Crossbill	*Loxia curvirostra*	0.057	1997	1997	TRUE
Tree Swallow	*Tachycineta bicolor*	0.056	1993	2011	TRUE
White-throated Sparrow	*Zonotrichia albicollis*	0.053	1993	2011	TRUE
Mourning Dove	*Zenaida macroura*	0.051	1993	2011	TRUE
Indigo Bunting	*Passerina cyanea*	0.048	1993	2011	TRUE
Bobolink	*Dolichonyx oryzivorus*	0.045	1993	2011	TRUE
Mourning Warbler	*Geothlypis philadelphia*	0.045	1993	2011	TRUE
Cliff Swallow	*Petrochelidon pyrrhonota*	0.045	1993	2011	TRUE
Blue Jay	*Cyanocitta cristata*	0.04	1993	2011	TRUE
Savannah Sparrow	*Passerculus sandwichensis*	0.04	1993	2011	TRUE
Yellow-rumped Warbler	*Setophaga coronata*	0.037	1993	2011	TRUE
Least Flycatcher	*Empidonax minimus*	0.035	1993	2011	TRUE
Brown-headed Cowbird	*Molothrus ater*	0.035	1993	2011	TRUE

Brewer's Blackbird	*Euphagus cyanocephalus*	0.032	1993	2010	TRUE
Nashville Warbler	*Oreothlypis ruficapilla*	0.029	1993	2011	TRUE
Eastern Phoebe	*Sayornis phoebe*	0.024	1993	2011	TRUE
House Wren	*Troglodytes aedon*	0.024	1993	2011	TRUE
Bank Swallow	*Riparia riparia*	0.023	1998	2000	TRUE
Alder Flycatcher	*Empidonax alnorum*	0.021	1993	2011	TRUE
Rose-breasted Grosbeak	*Pheucticus ludovicianus*	0.021	1993	2011	TRUE
Common Grackle	*Quiscalus quiscula*	0.02	1993	2011	TRUE
Clay-colored Sparrow	*Spizella pallida*	0.02	1993	2011	TRUE
Rock Pigeon	*Columba livia*	0.017	1993	2011	TRUE
Hermit Thrush	*Catharus guttatus*	0.016	1993	2011	TRUE
Pine Warbler	*Setophaga pinus*	0.016	1993	2011	TRUE
Eastern Bluebird	*Sialia sialis*	0.016	1993	2011	TRUE
Eastern Meadowlark	*Sturnella magna*	0.016	1993	2010	TRUE
Eastern Kingbird	*Tyrannus tyrannus*	0.016	1993	2011	TRUE
Eastern Wood-Pewee	*Contopus virens*	0.014	1993	2011	TRUE
Black-and-white Warbler	*Mniotilta varia*	0.014	1993	2011	TRUE
Barn Swallow	*Hirundo rustica*	0.013	1993	2011	TRUE
Black-throated Green Warbler	*Setophaga virens*	0.013	1993	2010	TRUE
Veery	*Catharus fuscescens*	0.012	1993	2011	TRUE
Common Raven	*Corvus corax*	0.012	1993	2011	TRUE
Red-breasted Nuthatch	*Sitta canadensis*	0.012	1993	2011	TRUE
Northern Flicker	*Colaptes auratus*	0.011	1993	2011	TRUE
Gray Catbird	*Dumetella carolinensis*	0.01	1993	2011	TRUE
Great Crested Flycatcher	*Myiarchus crinitus*	0.01	1993	2011	TRUE
House Sparrow	*Passer domesticus*	0.01	1994	2011	TRUE
Sedge Wren	*Cistothorus platensis*	0.009	1993	2009	TRUE
Chimney Swift	*Chaetura pelagica*	0.008	1993	2011	TRUE
Baltimore Oriole	*Icterus galbula*	0.008	1993	2011	TRUE
Yellow Warbler	*Setophaga petechia*	0.008	1993	2011	TRUE
Yellow-bellied Sapsucker	*Sphyrapicus varius*	0.008	1993	2011	TRUE
Swamp Sparrow	*Melospiza georgiana*	0.007	1993	2011	TRUE
American Redstart	*Setophaga ruticilla*	0.007	1993	2011	TRUE
Pine Siskin	*Spinus pinus*	0.007	2000	2009	TRUE
Ruby-throated Hummingbird	*Archilochus colubris*	0.006	1994	2011	TRUE
Northern Cardinal	*Cardinalis cardinalis*	0.006	2002	2011	TRUE
Black-billed Cuckoo	*Coccyzus erythropthalmus*	0.005	1999	2011	TRUE
Downy Woodpecker	*Picoides pubescens*	0.005	1993	2011	TRUE
Hairy Woodpecker	*Picoides villosus*	0.005	1997	2010	TRUE

White-breasted Nuthatch	*Sitta carolinensis*	0.005	1993	2009	TRUE
Field Sparrow	*Spizella pusilla*	0.005	1993	2011	TRUE
Brown Thrasher	*Toxostoma rufum*	0.005	1993	2011	TRUE
Golden-winged Warbler	*Vermivora chrysoptera*	0.005	1993	2010	TRUE
Warbling Vireo	*Vireo gilvus*	0.005	1993	2011	TRUE
Blue-headed Vireo	*Vireo solitarius*	0.005	1993	2004	TRUE
Canada Warbler	*Cardellina canadensis*	0.004	1993	2010	TRUE
Evening Grosbeak	*Coccothraustes vespertinus*	0.004	1995	2007	TRUE
Pileated Woodpecker	*Dryocopus pileatus*	0.004	1993	2011	TRUE
Horned Lark	*Eremophila alpestris*	0.004	1997	2000	TRUE
Scarlet Tanager	*Piranga olivacea*	0.004	1993	2011	TRUE
Vesper Sparrow	*Pooecetes gramineus*	0.004	1996	1998	TRUE
Golden-crowned Kinglet	*Regulus satrapa*	0.004	1993	2009	TRUE
Blackburnian Warbler	*Setophaga fusca*	0.004	2002	2005	TRUE
Winter Wren	*Troglodytes hiemalis*	0.004	1993	2010	TRUE
Olive-sided Flycatcher	*Contopus cooperi*	0.003	2009	2009	TRUE
Yellow-bellied Flycatcher	*Empidonax flaviventris*	0.003	2004	2006	TRUE
Wood Thrush	*Hylocichla mustelina*	0.003	2002	2011	TRUE
Belted Kingfisher	*Megaceryle alcyon*	0.003	1993	2010	TRUE
Red-bellied Woodpecker	*Melanerpes carolinus*	0.003	2006	2006	TRUE
Lincoln's Sparrow	*Melospiza lincolnii*	0.003	1993	2006	TRUE
Eastern Towhee	*Pipilo erythrophthalmus*	0.003	1994	2000	TRUE
Northern Parula	*Setophaga americana*	0.003	1994	2008	TRUE
Magnolia Warbler	*Setophaga magnolia*	0.003	1993	2011	TRUE
Northern Rough-winged Swallow	*Stelgidopteryx serripennis*	0.003	2006	2006	TRUE
Western Meadowlark	*Sturnella neglecta*	0.003	2007	2007	TRUE
Le Conte's Sparrow	*Ammodramus leconteii*	0.002	1994	1994	TRUE
Northern Waterthrush	*Parkesia noveboracensis*	0.002	1994	2005	TRUE
Canada Goose	*Branta canadensis*	0.043	2000	2011	FALSE
Mallard	*Anas platyrhynchos*	0.018	1993	2011	FALSE
Ruffed Grouse	*Bonasa umbellus*	0.015	1996	2011	FALSE
Wild Turkey	*Meleagris gallopavo*	0.011	2000	2010	FALSE
Merlin	*Falco columbarius*	0.01	2010	2010	FALSE
Sandhill Crane	*Grus canadensis*	0.008	1994	2011	FALSE
Common Loon	*Gavia immer*	0.007	1997	2010	FALSE
Blue-winged Teal	*Anas discors*	0.006	2003	2003	FALSE
Wood Duck	*Aix sponsa*	0.005	1993	2011	FALSE
Killdeer	*Charadrius vociferus*	0.005	1994	2011	FALSE
American Kestrel	*Falco sparverius*	0.005	1993	2010	FALSE

Great Blue Heron	*Ardea herodias*	0.004	1993	2011	FALSE
Red-tailed Hawk	*Buteo jamaicensis*	0.004	1995	2010	FALSE
Broad-winged Hawk	*Buteo platypterus*	0.004	1993	2011	FALSE
Green Heron	*Butorides virescens*	0.004	1995	2008	FALSE
Northern Harrier	*Circus cyaneus*	0.004	1993	2010	FALSE
Bald Eagle	*Haliaeetus leucocephalus*	0.004	1994	2010	FALSE
Osprey	*Pandion haliaetus*	0.004	1996	2011	FALSE
American Woodcock	*Scolopax minor*	0.004	1994	1994	FALSE
Sharp-shinned Hawk	*Accipiter striatus*	0.003	2009	2011	FALSE
Upland Sandpiper	*Bartramia longicauda*	0.003	2000	2000	FALSE
Turkey Vulture	*Cathartes aura*	0.003	2001	2007	FALSE
Wilson's Snipe	*Gallinago delicata*	0.003	2002	2004	FALSE
Hooded Merganser	*Lophodytes cucullatus*	0.003	1994	2008	FALSE
Cooper's Hawk	*Accipiter cooperii*	0.002	1995	1999	FALSE

D07 – CORE – ORNL (Oak Ridge National Laboratory)

Recommended Sampling Window: TBD

Recommended Daily Sampling Period: TBD

Source: TBD

Species Lists:

Mean relative abundances (species abundance/total community abundance) of bird species observed during the Breeding Bird Survey on the LOVELL route (Route 33) – in descending order. Source: (Sauer et al. 2011).

commonName	scientificName	meanRA	minYear	maxYear	landbird
European Starling	*Sturnus vulgaris*	0.414	1993	2011	TRUE
Common Grackle	*Quiscalus quiscula*	0.305	1993	2011	TRUE
American Robin	*Turdus migratorius*	0.183	1993	2011	TRUE
Mourning Dove	*Zenaida macroura*	0.179	1993	2011	TRUE
Northern Mockingbird	*Mimus polyglottos*	0.174	1993	2011	TRUE
Northern Cardinal	*Cardinalis cardinalis*	0.163	1993	2011	TRUE
Song Sparrow	*Melospiza melodia*	0.148	1993	2011	TRUE
American Crow	*Corvus brachyrhynchos*	0.147	1993	2011	TRUE
Carolina Wren	*Thryothorus ludovicianus*	0.081	1993	2011	TRUE
Chimney Swift	*Chaetura pelagica*	0.076	1993	2011	TRUE
Blue Jay	*Cyanocitta cristata*	0.075	1993	2011	TRUE
Carolina Chickadee	*Poecile carolinensis*	0.068	1993	2011	TRUE
Barn Swallow	*Hirundo rustica*	0.066	1993	2011	TRUE
Red-winged Blackbird	*Agelaius phoeniceus*	0.065	1993	2011	TRUE
Eastern Towhee	*Pipilo erythrophthalmus*	0.064	1993	2011	TRUE
American Goldfinch	*Spinus tristis*	0.062	1993	2011	TRUE
Brown-headed Cowbird	*Molothrus ater*	0.051	1993	2011	TRUE
Eastern Meadowlark	*Sturnella magna*	0.047	1993	2011	TRUE
Indigo Bunting	*Passerina cyanea*	0.045	1993	2011	TRUE
Tufted Titmouse	*Baeolophus bicolor*	0.04	1993	2011	TRUE
Purple Martin	*Progne subis*	0.039	1993	2011	TRUE
Eastern Bluebird	*Sialia sialis*	0.033	1993	2011	TRUE
House Sparrow	*Passer domesticus*	0.032	1993	2011	TRUE
Rock Pigeon	*Columba livia*	0.031	1993	2008	TRUE
Field Sparrow	*Spizella pusilla*	0.028	1993	2011	TRUE
Red-bellied Woodpecker	*Melanerpes carolinus*	0.027	1993	2011	TRUE

Downy Woodpecker	*Picoides pubescens*	0.016	1993	2011	TRUE
Brown Thrasher	*Toxostoma rufum*	0.015	1993	2011	TRUE
Tree Swallow	*Tachycineta bicolor*	0.014	2007	2011	TRUE
Cedar Waxwing	*Bombycilla cedrorum*	0.011	1993	2007	TRUE
Eastern Kingbird	*Tyrannus tyrannus*	0.011	1994	2011	TRUE
White-breasted Nuthatch	*Sitta carolinensis*	0.01	1993	2011	TRUE
House Wren	*Troglodytes aedon*	0.01	1996	2011	TRUE
Red-eyed Vireo	*Vireo olivaceus*	0.01	1993	2011	TRUE
Common Yellowthroat	*Geothlypis trichas*	0.009	1993	2011	TRUE
Blue Grosbeak	*Passerina caerulea*	0.009	1993	2011	TRUE
Wood Thrush	*Hylocichla mustelina*	0.008	1993	2011	TRUE
Eastern Phoebe	*Sayornis phoebe*	0.008	1993	2011	TRUE
Northern Rough-winged Swallow	*Stelgidopteryx serripennis*	0.008	1993	2011	TRUE
Yellow-billed Cuckoo	*Coccyzus americanus*	0.007	1993	2007	TRUE
Northern Flicker	*Colaptes auratus*	0.007	1993	2011	TRUE
Great Crested Flycatcher	*Myiarchus crinitus*	0.007	1993	2007	TRUE
Blue-gray Gnatcatcher	*Polioptila caerulea*	0.007	1993	2011	TRUE
Yellow-breasted Chat	*Icteria virens*	0.006	1993	2011	TRUE
Orchard Oriole	*Icterus spurius*	0.005	1993	2011	TRUE
Summer Tanager	*Piranga rubra*	0.005	1995	2008	TRUE
Eastern Wood-Pewee	*Contopus virens*	0.004	1993	2004	TRUE
Gray Catbird	*Dumetella carolinensis*	0.004	1993	2008	TRUE
Chipping Sparrow	*Spizella passerina*	0.004	1993	2011	TRUE
Yellow-throated Vireo	*Vireo flavifrons*	0.004	1997	2003	TRUE
White-eyed Vireo	*Vireo griseus*	0.004	1993	2008	TRUE
Ruby-throated Hummingbird	*Archilochus colubris*	0.003	1995	2004	TRUE
Pileated Woodpecker	*Dryocopus pileatus*	0.003	2001	2011	TRUE
Willow Flycatcher	*Empidonax traillii*	0.003	2007	2007	TRUE
Hairy Woodpecker	*Picoides villosus*	0.003	1995	2006	TRUE
Scarlet Tanager	*Piranga olivacea*	0.003	1993	2011	TRUE
Hooded Warbler	*Setophaga citrina*	0.003	2000	2000	TRUE
Pine Warbler	*Setophaga pinus*	0.003	1994	2008	TRUE
Loggerhead Shrike	*Lanius ludovicianus*	0.002	1993	1993	TRUE
Belted Kingfisher	*Megaceryle alcyon*	0.002	2001	2001	TRUE
Canada Goose	*Branta canadensis*	0.018	1993	2008	FALSE
Killdeer	*Charadrius vociferus*	0.014	1993	2011	FALSE
Common Nighthawk	*Chordeiles minor*	0.006	2002	2002	FALSE
Northern Bobwhite	*Colinus virginianus*	0.005	1993	2003	FALSE
Cooper's Hawk	*Accipiter cooperii*	0.004	1994	2003	FALSE

Wood Duck	*Aix sponsa*	0.004	1995	2004	FALSE
Mallard	*Anas platyrhynchos*	0.004	1993	1995	FALSE
Red-tailed Hawk	*Buteo jamaicensis*	0.004	1996	2011	FALSE
Green Heron	*Butorides virescens*	0.004	1995	2008	FALSE
Great Blue Heron	*Ardea herodias*	0.003	1996	2005	FALSE
Red-shouldered Hawk	*Buteo lineatus*	0.003	1993	2011	FALSE
Broad-winged Hawk	*Buteo platypterus*	0.003	1999	1999	FALSE
Turkey Vulture	*Cathartes aura*	0.003	2000	2008	FALSE
American Kestrel	*Falco sparverius*	0.003	2006	2006	FALSE
Yellow-crowned Night-Heron	*Nyctanassa violacea*	0.003	2008	2008	FALSE
Double-crested Cormorant	*Phalacrocorax auritus*	0.003	1998	1998	FALSE
Great Horned Owl	*Bubo virginianus*	0.002	1993	1993	FALSE

D08 – CORE – TALL (Talladega National Forest)

Recommended Sampling Window: TBD

Recommended Daily Sampling Period: TBD

Source: TBD

Species Lists:

Mean relative abundances (species abundance/total community abundance) of bird species observed during the Breeding Bird Survey on the route that passes east of Petersham, MA (Route 900 – Ware River) – in descending order. Source: (Sauer et al. 2011).

commonName	scientificName	meanRA	minYear	maxYear	landbird
Northern Cardinal	*Cardinalis cardinalis*	0.129	1993	2011	TRUE
Yellow-breasted Chat	*Icteria virens*	0.117	1993	2011	TRUE
American Crow	*Corvus brachyrhynchos*	0.081	1993	2011	TRUE
Eastern Towhee	*Pipilo erythrophthalmus*	0.078	1993	2011	TRUE
Indigo Bunting	*Passerina cyanea*	0.075	1993	2011	TRUE
White-eyed Vireo	*Vireo griseus*	0.066	1993	2011	TRUE
Mourning Dove	*Zenaida macroura*	0.061	1993	2011	TRUE
Barn Swallow	*Hirundo rustica*	0.06	1993	2011	TRUE
Red-eyed Vireo	*Vireo olivaceus*	0.058	1993	2011	TRUE
Wood Thrush	*Hylocichla mustelina*	0.055	1993	2011	TRUE
Northern Mockingbird	*Mimus polyglottos*	0.05	1993	2011	TRUE
Carolina Wren	*Thryothorus ludovicianus*	0.046	1993	2011	TRUE
Purple Martin	*Progne subis*	0.043	1993	2011	TRUE
Blue Jay	*Cyanocitta cristata*	0.039	1993	2011	TRUE
Blue-gray Gnatcatcher	*Polioptila caerulea*	0.038	1993	2011	TRUE
Tufted Titmouse	*Baeolophus bicolor*	0.033	1993	2011	TRUE
Red-winged Blackbird	*Agelaius phoeniceus*	0.031	1993	2011	TRUE
Hooded Warbler	*Setophaga citrina*	0.029	1993	2011	TRUE
Red-bellied Woodpecker	*Melanerpes carolinus*	0.028	1993	2011	TRUE
Brown-headed Cowbird	*Molothrus ater*	0.028	1993	2011	TRUE
Pine Warbler	*Setophaga pinus*	0.027	1993	2011	TRUE
Cliff Swallow	*Petrochelidon pyrrhonota*	0.025	2005	2011	TRUE
Carolina Chickadee	*Poecile carolinensis*	0.023	1993	2011	TRUE
Common Yellowthroat	*Geothlypis trichas*	0.021	1993	2011	TRUE
Eastern Kingbird	*Tyrannus tyrannus*	0.02	1993	2011	TRUE
Prairie Warbler	*Setophaga discolor*	0.019	1993	2011	TRUE

Orchard Oriole	*Icterus spurius*	0.018	1993	2011	TRUE
Summer Tanager	*Piranga rubra*	0.018	1993	2011	TRUE
Common Grackle	*Quiscalus quiscula*	0.018	1993	2005	TRUE
Chimney Swift	*Chaetura pelagica*	0.017	1993	2005	TRUE
Yellow-billed Cuckoo	*Coccyzus americanus*	0.017	1993	2011	TRUE
Acadian Flycatcher	*Empidonax virescens*	0.017	1993	2011	TRUE
Great Crested Flycatcher	*Myiarchus crinitus*	0.017	1993	2011	TRUE
Blue Grosbeak	*Passerina caerulea*	0.016	1993	2011	TRUE
Eastern Wood-Pewee	*Contopus virens*	0.015	1993	2011	TRUE
Northern Parula	*Setophaga americana*	0.013	1993	2011	TRUE
Kentucky Warbler	*Geothlypis formosa*	0.012	1993	2011	TRUE
Eastern Phoebe	*Sayornis phoebe*	0.012	1993	2011	TRUE
Brown Thrasher	*Toxostoma rufum*	0.012	1993	2011	TRUE
Fish Crow	*Corvus ossifragus*	0.01	1993	2011	TRUE
Yellow-throated Warbler	*Setophaga dominica*	0.01	1993	2011	TRUE
Eastern Bluebird	*Sialia sialis*	0.01	1993	2011	TRUE
Downy Woodpecker	*Picoides pubescens*	0.008	1994	2011	TRUE
Prothonotary Warbler	*Protonotaria citrea*	0.008	1993	2011	TRUE
American Redstart	*Setophaga ruticilla*	0.008	1993	2011	TRUE
Gray Catbird	*Dumetella carolinensis*	0.007	1994	2005	TRUE
Northern Rough-winged Swallow	*Stelgidopteryx serripennis*	0.007	1993	2005	TRUE
Swainson's Warbler	*Limnothlypis swainsonii*	0.006	1993	2011	TRUE
Chipping Sparrow	*Spizella passerina*	0.006	1993	2009	TRUE
Field Sparrow	*Spizella pusilla*	0.006	1994	2011	TRUE
Yellow-throated Vireo	*Vireo flavifrons*	0.006	1993	2011	TRUE
Pileated Woodpecker	*Dryocopus pileatus*	0.005	1995	2011	TRUE
Belted Kingfisher	*Megaceryle alcyon*	0.005	1993	2011	TRUE
Louisiana Waterthrush	*Parkesia motacilla*	0.005	1993	2011	TRUE
Northern Flicker	*Colaptes auratus*	0.004	1994	2011	TRUE
Worm-eating Warbler	*Helmitheros vermivorum*	0.004	1995	2011	TRUE
Black-and-white Warbler	*Mniotilta varia*	0.004	1993	2004	TRUE
House Sparrow	*Passer domesticus*	0.004	1993	1993	TRUE
Hairy Woodpecker	*Picoides villosus*	0.004	2001	2011	TRUE
Brown-headed Nuthatch	*Sitta pusilla*	0.004	1994	2011	TRUE
American Goldfinch	*Spinus tristis*	0.004	1995	2011	TRUE
Eastern Meadowlark	*Sturnella magna*	0.004	1995	2004	TRUE
American Robin	*Turdus migratorius*	0.004	1993	2011	TRUE
Ruby-throated Hummingbird	*Archilochus colubris*	0.003	1993	2011	TRUE
Red-headed Woodpecker	*Melanerpes erythrocephalus*	0.003	1997	2011	TRUE

Rock Pigeon	*Columba livia*	0.002	1993	1993	TRUE
Northern Bobwhite	*Colinus virginianus*	0.029	1993	2011	FALSE
Canada Goose	*Branta canadensis*	0.026	1993	2005	FALSE
Cattle Egret	*Bubulcus ibis*	0.017	2003	2003	FALSE
Turkey Vulture	*Cathartes aura*	0.011	1993	2009	FALSE
American Coot	*Fulica americana*	0.01	1996	1996	FALSE
Black Vulture	*Coragyps atratus*	0.008	1993	2009	FALSE
Great Egret	*Ardea alba*	0.007	1994	2011	FALSE
Great Blue Heron	*Ardea herodias*	0.007	1993	2011	FALSE
Cooper's Hawk	*Accipiter cooperii*	0.006	2003	2003	FALSE
Wood Duck	*Aix sponsa*	0.006	1994	2005	FALSE
Snowy Egret	*Egretta thula*	0.006	2005	2005	FALSE
Green Heron	*Butorides virescens*	0.005	1993	2004	FALSE
Little Blue Heron	*Egretta caerulea*	0.005	1994	2002	FALSE
Red-shouldered Hawk	*Buteo lineatus*	0.004	1993	2011	FALSE
Anhinga	*Anhinga anhinga*	0.003	2000	2000	FALSE
Red-tailed Hawk	*Buteo jamaicensis*	0.003	1995	2011	FALSE
Broad-winged Hawk	*Buteo platypterus*	0.003	1997	2005	FALSE
Killdeer	*Charadrius vociferus*	0.003	1996	2005	FALSE
Wild Turkey	*Meleagris gallopavo*	0.003	1995	2005	FALSE
Yellow-crowned Night-Heron	*Nyctanassa violacea*	0.003	1996	1996	FALSE
Pied-billed Grebe	*Podilymbus podiceps*	0.003	1997	1997	FALSE
Barred Owl	*Strix varia*	0.003	1994	2002	FALSE

D09 – CORE – WOOD (Woodworth Field Station)

Recommended Sampling Window: TBD

Recommended Daily Sampling Period: TBD

Source: TBD

Species Lists:

Mean relative abundances (species abundance/total community abundance) of bird species observed during the Breeding Bird Survey on the BUCHANAN route (Route 12) – in descending order. Source: (Sauer et al. 2011).

commonName	scientificName	meanRA	minYear	maxYear	landbird
Cliff Swallow	*Petrochelidon pyrrhonota*	0.768	1996	2011	TRUE
Red-winged Blackbird	*Agelaius phoeniceus*	0.717	1996	2011	TRUE
Brown-headed Cowbird	*Molothrus ater*	0.405	1996	2011	TRUE
Yellow-headed Blackbird	*Xanthocephalus xanthocephalus*	0.4	1996	2011	TRUE
Common Grackle	*Quiscalus quiscula*	0.263	1996	2011	TRUE
Horned Lark	*Eremophila alpestris*	0.128	1996	2011	TRUE
Savannah Sparrow	*Passerculus sandwichensis*	0.119	1996	2011	TRUE
Western Meadowlark	*Sturnella neglecta*	0.114	1996	2011	TRUE
Vesper Sparrow	*Pooecetes gramineus*	0.108	1996	2011	TRUE
Clay-colored Sparrow	*Spizella pallida*	0.106	1996	2011	TRUE
Mourning Dove	*Zenaida macroura*	0.094	1996	2011	TRUE
Song Sparrow	*Melospiza melodia*	0.089	1996	2011	TRUE
Bobolink	*Dolichonyx oryzivorus*	0.082	1996	2011	TRUE
Common Yellowthroat	*Geothlypis trichas*	0.079	1996	2011	TRUE
Yellow Warbler	*Setophaga petechia*	0.075	1996	2011	TRUE
Barn Swallow	*Hirundo rustica*	0.068	1996	2011	TRUE
Dickcissel	*Spiza americana*	0.067	2006	2006	TRUE
Eastern Kingbird	*Tyrannus tyrannus*	0.065	1996	2011	TRUE
Marsh Wren	*Cistothorus palustris*	0.058	1996	2011	TRUE
American Goldfinch	*Spinus tristis*	0.058	1996	2011	TRUE
Western Kingbird	*Tyrannus verticalis*	0.056	1996	2011	TRUE
European Starling	*Sturnus vulgaris*	0.048	1996	2011	TRUE
Bank Swallow	*Riparia riparia*	0.041	1997	2010	TRUE
House Wren	*Troglodytes aedon*	0.041	1996	2011	TRUE
American Robin	*Turdus migratorius*	0.039	1996	2011	TRUE
Brewer's Blackbird	*Euphagus cyanocephalus*	0.036	1998	2011	TRUE

Willow Flycatcher	*Empidonax traillii*	0.035	1996	2011	TRUE
Tree Swallow	*Tachycineta bicolor*	0.03	1996	2011	TRUE
Grasshopper Sparrow	*Ammodramus savannarum*	0.028	1996	2011	TRUE
Sedge Wren	*Cistothorus platensis*	0.028	1996	2011	TRUE
Le Conte's Sparrow	*Ammodramus leconteii*	0.021	1996	2009	TRUE
Orchard Oriole	*Icterus spurius*	0.02	1996	2011	TRUE
American Crow	*Corvus brachyrhynchos*	0.018	1996	2011	TRUE
Warbling Vireo	*Vireo gilvus*	0.017	1996	2011	TRUE
House Sparrow	*Passer domesticus*	0.016	1996	2011	TRUE
Chestnut-collared Longspur	*Calcarius ornatus*	0.015	1996	2011	TRUE
Cedar Waxwing	*Bombycilla cedrorum*	0.012	1996	2009	TRUE
Northern Rough-winged Swallow	*Stelgidopteryx serripennis*	0.012	2005	2005	TRUE
Least Flycatcher	*Empidonax minimus*	0.011	1996	2011	TRUE
Brown Thrasher	*Toxostoma rufum*	0.011	1996	2011	TRUE
Gray Catbird	*Dumetella carolinensis*	0.01	1996	2011	TRUE
Rock Pigeon	*Columba livia*	0.008	1996	2009	TRUE
Baltimore Oriole	*Icterus galbula*	0.008	1997	2011	TRUE
Nelson's Sparrow	*Ammodramus nelsoni*	0.007	1997	2010	TRUE
Black-billed Cuckoo	*Coccyzus erythropthalmus*	0.007	1997	2009	TRUE
Northern Flicker	*Colaptes auratus*	0.007	1996	2011	TRUE
Blue Jay	*Cyanocitta cristata*	0.007	1996	2010	TRUE
Hairy Woodpecker	*Picoides villosus*	0.006	2003	2003	TRUE
Chipping Sparrow	*Spizella passerina*	0.006	2000	2010	TRUE
Ovenbird	*Seiurus aurocapilla*	0.005	2002	2006	TRUE
Baird's Sparrow	*Ammodramus bairdii*	0.004	1998	2005	TRUE
Say's Phoebe	*Sayornis saya*	0.004	1996	2011	TRUE
Chimney Swift	*Chaetura pelagica*	0.003	2000	2000	TRUE
Eastern Wood-Pewee	*Contopus virens*	0.003	1998	1998	TRUE
Rose-breasted Grosbeak	*Pheucticus ludovicianus*	0.003	1998	2010	TRUE
Downy Woodpecker	*Picoides pubescens*	0.003	2000	2007	TRUE
Black-capped Chickadee	*Poecile atricapillus*	0.003	1997	2006	TRUE
Eastern Phoebe	*Sayornis phoebe*	0.003	2005	2005	TRUE
Eastern Bluebird	*Sialia sialis*	0.003	2010	2010	TRUE
Red-eyed Vireo	*Vireo olivaceus*	0.003	2008	2010	TRUE
Lark Sparrow	*Chondestes grammacus*	0.002	2001	2001	TRUE
Mallard	*Anas platyrhynchos*	0.255	1996	2011	FALSE
Canada Goose	*Branta canadensis*	0.202	1996	2011	FALSE
Gadwall	*Anas strepera*	0.137	1996	2011	FALSE
Blue-winged Teal	*Anas discors*	0.097	1996	2011	FALSE

Ring-billed Gull	*Larus delawarensis*	0.086	1996	2011	FALSE
Double-crested Cormorant	*Phalacrocorax auritus*	0.079	1996	2011	FALSE
Killdeer	*Charadrius vociferus*	0.068	1996	2011	FALSE
American White Pelican	*Pelecanus erythrorhynchos*	0.068	1996	2011	FALSE
Lesser Scaup	*Aythya affinis*	0.065	1996	2011	FALSE
American Coot	*Fulica americana*	0.063	1996	2011	FALSE
Franklin's Gull	*Leucophaeus pipixcan*	0.054	1998	2010	FALSE
Black Tern	*Chlidonias niger*	0.045	1996	2011	FALSE
Wilson's Snipe	*Gallinago delicata*	0.035	1996	2011	FALSE
Northern Shoveler	*Anas clypeata*	0.033	1996	2011	FALSE
Ring-necked Pheasant	*Phasianus colchicus*	0.027	1996	2011	FALSE
Redhead	*Aythya americana*	0.026	1996	2011	FALSE
California Gull	*Larus californicus*	0.026	2002	2002	FALSE
Northern Pintail	*Anas acuta*	0.025	1996	2011	FALSE
Upland Sandpiper	*Bartramia longicauda*	0.024	1996	2011	FALSE
Pied-billed Grebe	*Podilymbus podiceps*	0.023	1996	2011	FALSE
Marbled Godwit	*Limosa fedoa*	0.022	1996	2011	FALSE
Sora	*Porzana carolina*	0.018	1996	2011	FALSE
Ruddy Duck	*Oxyura jamaicensis*	0.016	1996	2011	FALSE
Red-tailed Hawk	*Buteo jamaicensis*	0.015	1996	2011	FALSE
Wilson's Phalarope	*Phalaropus tricolor*	0.015	1996	2011	FALSE
Forster's Tern	*Sterna forsteri*	0.014	2003	2003	FALSE
Sharp-tailed Grouse	*Tympanuchus phasianellus*	0.014	1996	2011	FALSE
Wood Duck	*Aix sponsa*	0.012	1997	2011	FALSE
American Wigeon	*Anas americana*	0.012	1996	2011	FALSE
Ring-necked Duck	*Aythya collaris*	0.012	2007	2010	FALSE
Common Tern	*Sterna hirundo*	0.01	2004	2004	FALSE
Willet	*Tringa semipalmata*	0.01	1996	2011	FALSE
American Bittern	*Botaurus lentiginosus*	0.009	1996	2011	FALSE
American Avocet	*Recurvirostra americana*	0.009	1996	2011	FALSE
Canvasback	*Aythya valisineria*	0.008	1997	2011	FALSE
Northern Harrier	*Circus cyaneus*	0.008	1999	2011	FALSE
Horned Grebe	*Podiceps auritus*	0.007	2010	2010	FALSE
Green-winged Teal	*Anas crecca*	0.006	1996	2010	FALSE
Cattle Egret	*Bubulcus ibis*	0.006	2005	2005	FALSE
Black-crowned Night-Heron	*Nycticorax nycticorax*	0.006	1997	2011	FALSE
Gray Partridge	*Perdix perdix*	0.006	2009	2009	FALSE
Swainson's Hawk	*Buteo swainsoni*	0.005	1996	2011	FALSE
Eared Grebe	*Podiceps nigricollis*	0.005	1997	2000	FALSE

Virginia Rail	*Rallus limicola*	0.005	1999	2010	FALSE
Spotted Sandpiper	*Actitis macularius*	0.004	1998	2008	FALSE
Western Grebe	*Aechmophorus occidentalis*	0.004	2011	2011	FALSE
Great Horned Owl	*Bubo virginianus*	0.004	1999	2009	FALSE
Ferruginous Hawk	*Buteo regalis*	0.004	1996	2010	FALSE
Great Blue Heron	*Ardea herodias*	0.003	1998	2000	FALSE
Common Nighthawk	*Chordeiles minor*	0.003	2009	2009	FALSE
American Kestrel	*Falco sparverius*	0.003	1998	2007	FALSE
Caspian Tern	*Hydroprogne caspia*	0.003	2008	2008	FALSE
Least Bittern	*Ixobrychus exilis*	0.003	2006	2007	FALSE
Hooded Merganser	*Lophodytes cucullatus*	0.003	2003	2003	FALSE

D10 – CORE – CPER (Central Plains Experimental Range)

Recommended Sampling Window: May 10 - June 15

Recommended Daily Sampling Period: official sunrise - 10:30 AM

Source: Rocky Mountain Bird Observatory

Species Lists:

Mean relative abundances (species abundance/total community abundance) of bird species observed during the Breeding Bird Survey on the route that passes through CPER (Route 901 – Rockport) – in descending order. Source: (Sauer et al. 2011).

commonName	scientificName	meanRA	minYear	maxYear	landbird
Lark Bunting	*Calamospiza melanocorys*	0.621	1994	2010	TRUE
Horned Lark	*Eremophila alpestris*	0.299	1994	2010	TRUE
Western Meadowlark	*Sturnella neglecta*	0.273	1994	2010	TRUE
McCown's Longspur	*Rhynchophanes mccownii*	0.158	1994	2010	TRUE
Mourning Dove	*Zenaida macroura*	0.08	1994	2010	TRUE
Brewer's Sparrow	*Spizella breweri*	0.037	1994	2010	TRUE
Western Kingbird	*Tyrannus verticalis*	0.031	1994	2010	TRUE
Cassin's Sparrow	*Peucaea cassinii*	0.03	1996	2010	TRUE
European Starling	*Sturnus vulgaris*	0.03	1994	2010	TRUE
Loggerhead Shrike	*Lanius ludovicianus*	0.019	1995	2010	TRUE
Cliff Swallow	*Petrochelidon pyrrhonota*	0.016	1999	2010	TRUE
Barn Swallow	*Hirundo rustica*	0.013	1994	2010	TRUE
Rock Pigeon	*Columba livia*	0.012	2009	2009	TRUE
Chestnut-collared Longspur	*Calcarius ornatus*	0.009	1994	2010	TRUE
Say's Phoebe	*Sayornis saya*	0.008	1994	2010	TRUE
Grasshopper Sparrow	*Ammodramus savannarum*	0.007	1996	2010	TRUE
Lark Sparrow	*Chondestes grammacus*	0.006	2008	2008	TRUE
Northern Mockingbird	*Mimus polyglottos*	0.006	1994	2010	TRUE
Common Grackle	*Quiscalus quiscula*	0.006	1995	2010	TRUE
American Robin	*Turdus migratorius*	0.006	1996	2010	TRUE
Red-winged Blackbird	*Agelaius phoeniceus*	0.005	1994	2004	TRUE
House Sparrow	*Passer domesticus*	0.005	1994	2008	TRUE
Northern Rough-winged Swallow	*Stelgidopteryx serripennis*	0.005	2000	2008	TRUE
Eastern Kingbird	*Tyrannus tyrannus*	0.004	1998	2009	TRUE
Western Wood-Pewee	*Contopus sordidulus*	0.003	1998	2007	TRUE
Brewer's Blackbird	*Euphagus cyanocephalus*	0.003	2009	2009	TRUE

Bullock's Oriole	*Icterus bullockii*	0.003	2001	2010	TRUE
Brown-headed Cowbird	*Molothrus ater*	0.003	1994	2009	TRUE
Sage Thrasher	*Oreoscoptes montanus*	0.003	1994	2004	TRUE
Eurasian Collared-Dove	*Streptopelia decaocto*	0.003	2009	2009	TRUE
Swainson's Hawk	*Buteo swainsoni*	0.017	1994	2010	FALSE
Common Nighthawk	*Chordeiles minor*	0.012	1994	2010	FALSE
American Kestrel	*Falco sparverius*	0.009	2004	2005	FALSE
Red-tailed Hawk	*Buteo jamaicensis*	0.007	1994	2009	FALSE
Ferruginous Hawk	*Buteo regalis*	0.007	1994	2010	FALSE
Killdeer	*Charadrius vociferus*	0.005	1994	2009	FALSE
Golden Eagle	*Aquila chrysaetos*	0.004	1996	2010	FALSE
Burrowing Owl	*Athene cunicularia*	0.004	1994	2010	FALSE
Northern Shoveler	*Anas clypeata*	0.003	2000	2000	FALSE
Mountain Plover	*Charadrius montanus*	0.003	2002	2005	FALSE
Northern Harrier	*Circus cyaneus*	0.003	1996	2007	FALSE
Prairie Falcon	*Falco mexicanus*	0.003	2000	2010	FALSE
American Avocet	*Recurvirostra americana*	0.003	2003	2005	FALSE

D10 – RELOCATABLE – STER (Sterling)

Recommended Sampling Window: May 10 - June 15

Recommended Daily Sampling Period: official sunrise - 10:30 AM

Source: Rocky Mountain Bird Observatory

Species Lists:

Mean relative abundances (species abundance/total community abundance) of bird species observed during the Breeding Bird Survey on the route that passes approximately 15 miles north of the site (Route 7 – Fleming) – in descending order. Source: (Sauer et al. 2011).

commonName	scientificName	meanRA	minYear	maxYear	landbird
Horned Lark	*Eremophila alpestris*	0.494	1993	2011	TRUE
Mourning Dove	*Zenaida macroura*	0.458	1993	2011	TRUE
Western Meadowlark	*Sturnella neglecta*	0.354	1993	2011	TRUE
Lark Bunting	*Calamospiza melanocorys*	0.345	1993	2011	TRUE
Red-winged Blackbird	*Agelaius phoeniceus*	0.264	1993	2011	TRUE
House Sparrow	*Passer domesticus*	0.24	1993	2011	TRUE
Common Grackle	*Quiscalus quiscula*	0.179	1993	2011	TRUE
European Starling	*Sturnus vulgaris*	0.172	1993	2011	TRUE
Western Kingbird	*Tyrannus verticalis*	0.104	1993	2011	TRUE
Grasshopper Sparrow	*Ammodramus savannarum*	0.064	1993	2011	TRUE
Rock Pigeon	*Columba livia*	0.062	1993	2006	TRUE
American Robin	*Turdus migratorius*	0.062	1993	2011	TRUE
Barn Swallow	*Hirundo rustica*	0.05	1993	2011	TRUE
Loggerhead Shrike	*Lanius ludovicianus*	0.047	1993	2011	TRUE
Black-billed Magpie	*Pica hudsonia*	0.032	1993	2006	TRUE
Brown-headed Cowbird	*Molothrus ater*	0.031	2004	2011	TRUE
Great-tailed Grackle	*Quiscalus mexicanus*	0.029	2005	2011	TRUE
American Crow	*Corvus brachyrhynchos*	0.024	1993	1999	TRUE
Eastern Kingbird	*Tyrannus tyrannus*	0.024	1993	2006	TRUE
Lazuli Bunting	*Passerina amoena*	0.021	2006	2011	TRUE
Eurasian Collared-Dove	*Streptopelia decaocto*	0.013	2005	2011	TRUE
Chimney Swift	*Chaetura pelagica*	0.012	1993	2011	TRUE
Northern Flicker	*Colaptes auratus*	0.012	1999	2006	TRUE
Eastern Bluebird	*Sialia sialis*	0.011	2003	2003	TRUE
Downy Woodpecker	*Picoides pubescens*	0.007	2006	2006	TRUE
Dickcissel	*Spiza americana*	0.007	2011	2011	TRUE

Lark Sparrow	*Chondestes grammacus*	0.006	1999	2005	TRUE
Brown Thrasher	*Toxostoma rufum*	0.006	1993	2005	TRUE
Bullock's Oriole	*Icterus bullockii*	0.005	1993	2006	TRUE
Northern Mockingbird	*Mimus polyglottos*	0.005	2004	2005	TRUE
Blue Jay	*Cyanocitta cristata*	0.004	1993	2011	TRUE
Orchard Oriole	*Icterus spurius*	0.003	2005	2005	TRUE
Red-headed Woodpecker	*Melanerpes erythrocephalus*	0.003	2006	2006	TRUE
Warbling Vireo	*Vireo gilvus*	0.003	2006	2006	TRUE
Ring-necked Pheasant	*Phasianus colchicus*	0.13	1993	2011	FALSE
Northern Bobwhite	*Colinus virginianus*	0.113	1993	2003	FALSE
Killdeer	*Charadrius vociferus*	0.042	1993	2011	FALSE
Mallard	*Anas platyrhynchos*	0.028	1993	2011	FALSE
Canada Goose	*Branta canadensis*	0.027	2003	2005	FALSE
Great Blue Heron	*Ardea herodias*	0.025	2003	2003	FALSE
Green-winged Teal	*Anas crecca*	0.023	2003	2003	FALSE
Swainson's Hawk	*Buteo swainsoni*	0.021	1993	2006	FALSE
Upland Sandpiper	*Bartramia longicauda*	0.02	2006	2006	FALSE
Northern Harrier	*Circus cyaneus*	0.02	1993	2006	FALSE
American Kestrel	*Falco sparverius*	0.018	2003	2011	FALSE
Burrowing Owl	*Athene cunicularia*	0.015	1999	2006	FALSE
Wood Duck	*Aix sponsa*	0.012	2005	2005	FALSE
Northern Pintail	*Anas acuta*	0.011	2003	2003	FALSE
Prairie Falcon	*Falco mexicanus*	0.011	1999	2003	FALSE
Spotted Sandpiper	*Actitis macularius*	0.01	2006	2006	FALSE
Red-tailed Hawk	*Buteo jamaicensis*	0.01	2003	2011	FALSE
Short-eared Owl	*Asio flammeus*	0.008	2005	2006	FALSE
Ferruginous Hawk	*Buteo regalis*	0.008	1999	2004	FALSE
Blue-winged Teal	*Anas discors*	0.006	2003	2003	FALSE
Great Horned Owl	*Bubo virginianus*	0.004	1993	2005	FALSE

D10 – RELOCATABLE – RMNP (Rocky Mountain National Park)

Recommended Sampling Window: June 5 - June 30

Recommended Daily Sampling Period: official sunrise - 10:30 AM

Source: Rocky Mountain Bird Observatory

Species Lists:

Mean relative abundances (species abundance/total community abundance) of bird species observed during the Breeding Bird Survey on the route that passes through RMNP (Route 904 – Trail Ridge Road) – in descending order. Source: (Sauer et al. 2011).

commonName	scientificName	meanRA	minYear	maxYear	landbird
Ruby-crowned Kinglet	*Regulus calendula*	0.053	2003	2011	TRUE
American Pipit	*Anthus rubescens*	0.046	2003	2011	TRUE
Horned Lark	*Eremophila alpestris*	0.043	2003	2011	TRUE
Broad-tailed Hummingbird	*Selasphorus platycercus*	0.043	2003	2011	TRUE
American Robin	*Turdus migratorius*	0.038	2003	2011	TRUE
Hermit Thrush	*Catharus guttatus*	0.033	2003	2011	TRUE
Violet-green Swallow	*Tachycineta thalassina*	0.032	2003	2011	TRUE
Common Raven	*Corvus corax*	0.024	2003	2011	TRUE
Yellow-rumped Warbler	*Setophaga coronata*	0.023	2003	2011	TRUE
White-crowned Sparrow	*Zonotrichia leucophrys*	0.023	2003	2011	TRUE
Dark-eyed Junco	*Junco hyemalis*	0.018	2003	2011	TRUE
Clark's Nutcracker	*Nucifraga columbiana*	0.018	2003	2011	TRUE
Green-tailed Towhee	*Pipilo chlorurus*	0.018	2005	2011	TRUE
Black-billed Magpie	*Pica hudsonia*	0.016	2003	2011	TRUE
Tree Swallow	*Tachycineta bicolor*	0.016	2003	2011	TRUE
American Crow	*Corvus brachyrhynchos*	0.014	2004	2011	TRUE
Barn Swallow	*Hirundo rustica*	0.012	2004	2011	TRUE
Brown-capped Rosy-Finch	*Leucosticte australis*	0.011	2011	2011	TRUE
Red Crossbill	*Loxia curvirostra*	0.011	2004	2011	TRUE
Lincoln's Sparrow	*Melospiza lincolnii*	0.011	2003	2011	TRUE
Pine Grosbeak	*Pinicola enucleator*	0.011	2004	2011	TRUE
Pine Siskin	*Spinus pinus*	0.011	2006	2007	TRUE
Steller's Jay	*Cyanocitta stelleri*	0.01	2003	2011	TRUE
Mountain Chickadee	*Poecile gambeli*	0.01	2003	2011	TRUE
Mourning Dove	*Zenaida macroura*	0.01	2004	2006	TRUE
Townsend's Solitaire	*Myadestes townsendi*	0.009	2003	2007	TRUE

White-breasted Nuthatch	*Sitta carolinensis*	0.009	2007	2007	TRUE
Chipping Sparrow	*Spizella passerina*	0.009	2003	2007	TRUE
Brown-headed Cowbird	*Molothrus ater*	0.008	2003	2004	TRUE
Northern Rough-winged Swallow	*Stelgidopteryx serripennis*	0.008	2003	2003	TRUE
Warbling Vireo	*Vireo gilvus*	0.008	2003	2011	TRUE
Vesper Sparrow	*Pooecetes gramineus*	0.007	2011	2011	TRUE
Red-breasted Nuthatch	*Sitta canadensis*	0.007	2003	2007	TRUE
Red-winged Blackbird	*Agelaius phoeniceus*	0.006	2004	2004	TRUE
Northern Flicker	*Colaptes auratus*	0.006	2004	2007	TRUE
Cordilleran Flycatcher	*Empidonax occidentalis*	0.006	2003	2011	TRUE
Brewer's Blackbird	*Euphagus cyanocephalus*	0.006	2007	2007	TRUE
Orange-crowned Warbler	*Oreothlypis celata*	0.006	2003	2004	TRUE
Cliff Swallow	*Petrochelidon pyrrhonota*	0.006	2005	2007	TRUE
Mountain Bluebird	*Sialia currucoides*	0.006	2003	2007	TRUE
House Wren	*Troglodytes aedon*	0.006	2003	2007	TRUE
Rock Pigeon	*Columba livia*	0.005	2006	2011	TRUE
Gray Jay	*Perisoreus canadensis*	0.005	2004	2007	TRUE
Wilson's Warbler	*Cardellina pusilla*	0.004	2003	2007	TRUE
Song Sparrow	*Melospiza melodia*	0.004	2003	2007	TRUE
Band-tailed Pigeon	*Patagioenas fasciata*	0.004	2004	2005	TRUE
Black-headed Grosbeak	*Pheucticus melanocephalus*	0.004	2003	2007	TRUE
Rock Wren	*Salpinctes obsoletus*	0.004	2005	2007	TRUE
sapsucker sp.	*Sphyrapicus sp.*	0.004	2011	2011	TRUE
American Dipper	*Cinclus mexicanus*	0.003	2003	2006	TRUE
Western Wood-Pewee	*Contopus sordidulus*	0.003	2003	2007	TRUE
Hammond's Flycatcher	*Empidonax hammondii*	0.003	2003	2004	TRUE
Dusky Flycatcher	*Empidonax oberholseri*	0.003	2003	2004	TRUE
MacGillivray's Warbler	*Geothlypis tolmiei*	0.003	2004	2005	TRUE
Loggerhead Shrike	*Lanius ludovicianus*	0.003	2004	2004	TRUE
Belted Kingfisher	*Megaceryle alcyon*	0.003	2004	2004	TRUE
Western Tanager	*Piranga ludoviciana*	0.003	2003	2011	TRUE
Yellow Warbler	*Setophaga petechia*	0.003	2005	2005	TRUE
European Starling	*Sturnus vulgaris*	0.003	2007	2007	TRUE
Plumbeous Vireo	*Vireo plumbeus*	0.003	2003	2011	TRUE
Mallard	*Anas platyrhynchos*	0.008	2003	2006	FALSE
White-tailed Ptarmigan	*Lagopus leucura*	0.006	2003	2011	FALSE
Spotted Sandpiper	*Actitis macularius*	0.003	2003	2005	FALSE
Green-winged Teal	*Anas crecca*	0.003	2006	2006	FALSE

Red-tailed Hawk	*Buteo jamaicensis*	0.003	2005	2007	FALSE
Turkey Vulture	*Cathartes aura*	0.003	2005	2005	FALSE
Northern Pygmy-Owl	*Glaucidium gnoma*	0.003	2006	2007	FALSE

D15 – CORE – ONAQ (Onaqui-Benmore)

Recommended Sampling Window: TBD

Recommended Daily Sampling Period: TBD

Source: TBD

Species Lists:

Mean relative abundances (species abundance/total community abundance) of bird species observed during the Breeding Bird Survey on the VERNON route (Route 155) – in descending order. Source: (Sauer et al. 2011).

commonName	scientificName	meanRA	minYear	maxYear	landbird
Western Meadowlark	*Sturnella neglecta*	0.385	1993	2011	TRUE
Horned Lark	*Eremophila alpestris*	0.25	1993	2011	TRUE
Common Raven	*Corvus corax*	0.14	1993	2011	TRUE
Brewer's Blackbird	*Euphagus cyanocephalus*	0.109	1993	2011	TRUE
Brewer's Sparrow	*Spizella breweri*	0.095	1993	2011	TRUE
Red-winged Blackbird	*Agelaius phoeniceus*	0.066	1993	2011	TRUE
Mourning Dove	*Zenaida macroura*	0.057	1993	2011	TRUE
Lark Sparrow	*Chondestes grammacus*	0.052	1993	2011	TRUE
European Starling	*Sturnus vulgaris*	0.041	1993	2011	TRUE
Sage Thrasher	*Oreoscoptes montanus*	0.04	1993	2011	TRUE
House Sparrow	*Passer domesticus*	0.035	1993	2011	TRUE
Vesper Sparrow	*Pooecetes gramineus*	0.034	1995	2011	TRUE
Spotted Towhee	*Pipilo maculatus*	0.03	1993	2011	TRUE
Black-throated Sparrow	*Amphispiza bilineata*	0.028	1993	2008	TRUE
Barn Swallow	*Hirundo rustica*	0.026	1993	2010	TRUE
Pinyon Jay	*Gymnorhinus cyanocephalus*	0.023	1993	2007	TRUE
Blue-gray Gnatcatcher	*Polioptila caerulea*	0.018	1993	2011	TRUE
Brown-headed Cowbird	*Molothrus ater*	0.017	1993	2011	TRUE
Western Kingbird	*Tyrannus verticalis*	0.015	1993	2011	TRUE
Chipping Sparrow	*Spizella passerina*	0.014	1993	2011	TRUE
Western Scrub-Jay	*Aphelocoma californica*	0.013	1996	2011	TRUE
Loggerhead Shrike	*Lanius ludovicianus*	0.012	1993	2010	TRUE
American Robin	*Turdus migratorius*	0.012	1993	2011	TRUE
Rock Pigeon	*Columba livia*	0.011	1994	2004	TRUE
Yellow-headed Blackbird	*Xanthocephalus xanthocephalus*	0.011	1993	2011	TRUE

Black-billed Magpie	*Pica hudsonia*	0.01	1993	2011	TRUE
Bushtit	*Psaltriparus minimus*	0.009	1997	2009	TRUE
Northern Flicker	*Colaptes auratus*	0.008	1996	1996	TRUE
Northern Mockingbird	*Mimus polyglottos*	0.008	1993	2009	TRUE
Savannah Sparrow	*Passerculus sandwichensis*	0.008	1996	2011	TRUE
American Goldfinch	*Spinus tristis*	0.008	1993	2002	TRUE
Eurasian Collared-Dove	*Streptopelia decaocto*	0.008	2007	2011	TRUE
Gray Flycatcher	*Empidonax wrightii*	0.007	1997	2010	TRUE
Bullock's Oriole	*Icterus bullockii*	0.007	2010	2011	TRUE
Western Tanager	*Piranga ludoviciana*	0.007	2010	2010	TRUE
Mountain Bluebird	*Sialia currucoides*	0.006	1993	2011	TRUE
Northern Rough-winged Swallow	*Stelgidopteryx serripennis*	0.006	1993	2007	TRUE
Common Yellowthroat	*Geothlypis trichas*	0.005	2009	2011	TRUE
Song Sparrow	*Melospiza melodia*	0.005	1995	2011	TRUE
Ash-throated Flycatcher	*Myiarchus cinerascens*	0.005	1994	2011	TRUE
Tree Swallow	*Tachycineta bicolor*	0.005	2005	2006	TRUE
Plumbeous Vireo	*Vireo plumbeus*	0.005	1997	2011	TRUE
Yellow Warbler	*Setophaga petechia*	0.004	2001	2010	TRUE
Warbling Vireo	*Vireo gilvus*	0.004	1994	2004	TRUE
Juniper Titmouse	*Baeolophus ridgwayi*	0.003	2007	2007	TRUE
Western Wood-Pewee	*Contopus sordidulus*	0.003	1994	2010	TRUE
Lazuli Bunting	*Passerina amoena*	0.003	2001	2007	TRUE
Say's Phoebe	*Sayornis saya*	0.003	1994	2011	TRUE
Broad-tailed Hummingbird	*Selasphorus platycercus*	0.003	2003	2006	TRUE
Scott's Oriole	*Icterus parisorum*	0.002	1995	2001	TRUE
California Gull	*Larus californicus*	0.297	1999	2006	FALSE
Ring-necked Pheasant	*Phasianus colchicus*	0.04	1993	2011	FALSE
Long-billed Curlew	*Numenius americanus*	0.026	1993	2011	FALSE
Common Nighthawk	*Chordeiles minor*	0.018	1993	2010	FALSE
Short-eared Owl	*Asio flammeus*	0.017	1995	2009	FALSE
Swainson's Hawk	*Buteo swainsoni*	0.012	1993	2009	FALSE
Killdeer	*Charadrius vociferus*	0.012	1993	2011	FALSE
Northern Harrier	*Circus cyaneus*	0.011	1993	2011	FALSE
Red-tailed Hawk	*Buteo jamaicensis*	0.01	1993	2011	FALSE
Greater Sage-Grouse	*Centrocercus urophasianus*	0.01	2000	2009	FALSE
Wilson's Snipe	*Gallinago delicata*	0.01	1993	2011	FALSE
Ferruginous Hawk	*Buteo regalis*	0.008	1993	2006	FALSE
Chukar	*Alectoris chukar*	0.007	2006	2006	FALSE
Burrowing Owl	*Athene cunicularia*	0.007	1996	2010	FALSE

Sandhill Crane	*Grus canadensis*	0.007	2010	2010	FALSE
Turkey Vulture	*Cathartes aura*	0.006	1996	2009	FALSE
Mallard	*Anas platyrhynchos*	0.005	1993	2008	FALSE
American Kestrel	*Falco sparverius*	0.005	1993	2011	FALSE
Golden Eagle	*Aquila chrysaetos*	0.004	1993	2007	FALSE
Great Horned Owl	*Bubo virginianus*	0.004	1995	2006	FALSE
Prairie Falcon	*Falco mexicanus*	0.004	1994	2006	FALSE
Sharp-shinned Hawk	*Accipiter striatus*	0.003	2000	2000	FALSE
Sora	*Porzana carolina*	0.003	1996	2001	FALSE