National Park Service
U.S. Department of the Interior

Inventory & Monitoring Division

Mid-Atlantic, Northeast Coastal and Barrier, and Northeast Temperate Network's Long-Term Breeding Landbird Monitoring Protocol Standard Operating Procedures

2024 Revision

For more information on MIDN/NCBN/NETN Breeding Landbird Monitoring Protocol, visit NETN's website at https://www.nps.gov/im/netn/breeding-landbirds.htm or MIDN's website at https://www.nps.gov/im/midn/breeding-birds.htm.

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Mid-Atlantic, Northeast Coastal and Barrier, and Northeast Temperate Network's Protocol Package Documents:

This is one of a series of documents that collectively describe the objectives, procedures, and data quality of the Mid-Atlantic Network (MIDN), Northeast Coastal and Barrier (NCBN), and Northeast Temperate Network (NETN) breeding landbird monitoring protocol. Please visit the NETN/MIDN Breeding Landbird Monitoring Program on the US NPS's Data Store (IRMA Reference Code #2190227) for links to all supporting protocol documents and products associated with this program, including but not limited to:

Protocol Narrative
Quality Assurance Plan (QAP)
Safety Plan
Summary of Major Protocol Changes

December 2024

ON THE COVER
A Common Yellowthroat singing.
Photograph by Andrew Reding

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SOP 1 - Site Selection and Point Count Site Establishment

Mid-Atlantic, Northeast Coastal and Barrier, and Northeast Temperate Network's Long-Term Breeding Landbird Monitoring Protocol

Version 1.00

Overview

This SOP explains the procedures for selecting and establishing landbird point count stations and collecting site information.

Point Count Site Selection

Point count stations are established with the goal to provide a representative sample of the bird community within a habitat of interest (grassland or forest) while balancing factors such as safety, accessibility, volunteer team size, and other landscape features within the park that may affect bird behavior and occupancy.

The number and location of point count stations within each park depends on the size of habitat to be sampled and proximity to other landscape features such as park roads and habitat edges. The exact locations of the points within each park may be determined by expert judgment, a systematic 250-m grid overlaid on the focal habitat, or using the Generalized Random Tessellation Stratified (GRTS) algorithm (Stevens and Olsen 2004) combined with grid overlay. At a minimum, final station locations must meet the following criteria:

1. Stations are greater than 15 m away from hiking trails to avoid visitor interruption of counts.
2. Stations are greater than 50 m away from primary roads (e.g. interstates and major highways) which may influence bird behavior and can reduce detection ability due to background noise.
3. Stations are greater than 15 m away from secondary and tertiary roads (e.g. local or park roads).
4. Stations are greater than 50 m from buildings which are frequented by visitors and may influence bird behavior.
5. Stations are greater than 50 m from the park boundary to restrict the study to habitats that are managed by the park.
6. Stations are greater than 250 m from the next nearest point count station to reduce double counting individual birds.

Furthermore, any potential sampling stations that could be hazardous to observers (e.g. steep slopes, extremely dense forests) or that are located in known archeological sites should be excluded.

Determining Potential Site Locations

Sample Size Considerations

To meet protocol objectives when establishing new point count stations, careful attention must be made to the size of focal habitat being monitored, the selection criteria above, and anticipated use of the monitoring data (e.g., location within park management units or in proximity to long term vegetation monitoring plots). Additional consideration needs to be made regarding the anticipated number of visits per station in each year and the number of volunteers available to survey birds. Fewer sampling stations may require more visits to each station per year to decrease uncertainty in park occupancy and abundance estimates.

In most parks, the number of point count stations are directly proportional to the area of the park habitat (forest or grassland) to be monitored to ensure that the data are representative (i.e., spatial coverage of area). In addition to the number of sites planned for monitoring, the number of times each site can be surveyed each year also needs consideration because contemporary analysis methods used to estimate bird occupancy or abundance require enough data to account for individuals that went undetected but were actually present (e.g., imperfect detection). In order to estimate imperfect detection point count surveys either should include multiple visits to a site in the same year or integrate count down methods and removal model analysis approaches (Doser et al. 2021). Thus, there may be tradeoffs between the total number of sites that can be monitored and the number of sites that are visited more than once due to the size of your volunteer team and intended analysis approaches.

Since confidence (or certainty) in the estimates describing the bird community derived from point count sampling tends to increase with sample size, ideally the number of sites and number of surveys at each site per year should be maximized based on the habitat area and number of volunteers available. However, since pools of volunteers change over time and parks vary in size there are a few considerations to keep in mind when establishing point count stations and developing a volunteer team.

1. All point count stations in the park should be surveyed at least once each year but ideally all sites would be surveyed twice depending on the number of available volunteers. When possible, a second survey should be conducted by the same observer as the first survey. For large parks with many sampling locations that cannot be surveyed each year, parks should consider dividing sites into a spatially balanced rotating panel design (see Tierney et al. 2019).

2. Parks with less than 10 point count stations should conduct no less than 2 surveys at each point count station per year. If possible, the second survey should be conducted by the same observer as the first survey.

3. For parks with many volunteers relative to the number of sites, parks should attempt to conduct up to 4 visits at each site each year.

The sampling guidelines above should work well to inform parks about their overall breeding bird community and should also provide reasonable population estimates for the commonly encountered species. However, these sampling guidelines may need further refinement for situations where there is need for higher confidence in information about less common species or from monitoring in very small parks (<10 sites). The only way to evaluate the influence of sample size (no. of sites and survey per site)

and relative abundance on the population estimates is to collect data for a few years and conduct preliminary analyses or to use simulations. Lastly, it is important to remember that our confidence in the community and population estimates from monitoring will improve with the repeated collection of data at each site over time.

Using a systematic 250-m grid

In most parks, GIS can be used as a first step for determining potential permanent sampling locations by overlaying a 250-m grid on park maps, vegetation layers or other GIS layers of interest (e.g., trails and roads). It is also possible to use this approach to co-locate forest bird point count stations with other monitoring plots. For instance, NETN's and MIDN's original bird protocol co-located point count stations with their long-term forest plots by adding their plot locations to the GIS to refine potential sampling locations. Currently in MIDN, forest bird point count stations are offset by 125m from their forest monitoring plots (Johnson and Wakamiya 2018). In NETN, forest bird point count stations are generally offset by 50 m to forest plots but in larger parks such as ACAD, forest plot locations are used as a central starting point for establishing a set ("route") of forest point count stations (Faccio et al. 2015).

Potential sampling stations are further reduced by excluding points failing the minimum selection criteria listed above. Using a GIS, create buffers for each scenario listed, and use them to exclude any points that fall within the buffers.

Once you have reduced the number of potential sampling stations using the GIS, categorize each potential sampling station, as either forest or grassland based on vegetation or land cover datasets available for each park. Overtime these broad habitat categories may change due to disturbance and succession and may require review, but during initial site establishment it is important to establish sites within consistent habitat categories so that your design provides an assessment of that habitat type at the park-scale. Note that ecotones should be avoided when possible because our interest is on the overall characterization of each habitat type rather than a comparison across types (Ralph et al. 1993).

Using the GRTS algorithm

After obtaining a list of stations meeting the minimum site selection criteria following the GIS steps above, the Generalized Random Tessellation Stratified (GRTS) algorithm (Stevens and Olsen 2004) is used to further reduce the number of points while maintaining a spatially balanced design. Using software like S-Draw or R, create an ordered list of points. Potential sampling points must be chosen in order from the resulting list. If a point is rejected for any of the reasons stated above, select the next point in the ordered list. The goal should be to establish as many sites as possible to provide a representative sample of the habitat of interest. However, consult the section on sampling size considerations above and work with your bird volunteer coordinator to determine the appropriate number of sites, anticipated number of surveys per site each year, and how to best layout sites to ensure accessibility and sampling.

If, after the establishment of sampling stations, new lands are acquired that Park NRM staff wish to monitor, follow the steps above using the same grid, and determine the number of potential additional points. These additional points are outside the established sampling design and will need to be analyzed separately from the points chosen the original GRTS draw.

Expert Judgment

In most cases, it is preferable to use a 250-m grid combined with GRTS to establish point count stations for monitoring (described below) but in some parks, point count stations may need to be established or their location adjusted using expert opinion. In these cases, it is helpful for the expert to use the GIS processes described below to first determine potential sampling locations and then, while at the park, make the final determination of station locations in a way that balances the selection criteria, anticipated visits per station per year, and proximity to other ongoing monitoring efforts.

Establishing Sampling Points

Using your ordered list of sampling points, examine park topographic maps to determine the best route to your selected locations. Using GPS and/or compass, travel to a proposed plot location to evaluate its suitability for sampling.

Upon arrival at the site, determine if the site should be rejected. Any of the reasons below can be used to justify rejecting or moving the site:

Accessibility
- Point over 1.5km from a road
- Slope more than 30% (too steep)
- River, creek between road and point that cannot be easily crossed
- Private land that must be crossed[1]

Safety
- Slope more than 30%
- Dangerous path (unstable bridges etc.)
- Rocky habitat that may increase risk of falls or may be habitat for venomous snakes
- Asbestos Release Sites (VAFO)

Frequency of visitors
- Heavily used recreational area that may result in noise or distractions
- On interpretive walk route

Vegetation/habitat
- Mowed lawn
- Dense and impenetrable vegetation

Sampling design
- Point too close to a road (not removed by 15/50m buffer)
- Point too close to building/ frequented area
- On private land

Cultural significance
- In a cemetery
- On an archeologically sensitive site (e.g. on a civil war earthworks)

If the initial location is not suitable (e.g., site is on an earthwork), the plot may be relocated using the following directions:
- Move point 5m in north direction
- If north is also unacceptable, return to original point and repeat relocation process this

[1] In some parks birders may have to briefly cross private lands to access sites (e.g., SAGA) but are permitted to do so under existing park-landowner agreements.

time east, then south, and finally west.

- If after checking each new location in all four cardinal directions it is determined that all points are unsuitable, then the site is discarded, and the next site on the ordered GRTS list is evaluated.

Safety is a priority of the landbird monitoring program and NPS staff need to ensure that all potential bird stations can be accessed safely and consistently. If following all criteria above places stations in areas that are too far and difficult to access or pose a safety hazard, NPS staff are allowed to make exceptions as needed and should also document those decisions justifying their deviation from the protocol.

Occassionally active, point count station locations may need to be altered or discontinued due to unforeseen circumstances. Any of the rejection criteria listed above may be used to discontinue monitoring or move a point to a more suitable location. Determination of whether a point can be moved and still maintain its unique point name will be based on the expert opinion of the protocol lead. Consideration should be given to whether the new location is still representative of the same habitat and sampling area of the original point. If it is not feasible to move the location, a new point count station may need to be established using the methods used previously at the park and outlined in the Determining Potential Site Locations section above.

Marking Point Count Stations

It is important to ensure that plot marking procedures have been approved by the natural resource manager at each park prior to plot establishment. These procedures may vary by park in response to individual park requirements.

Once a site is accepted, it is marked as follows, except at parks that prefer not to use permanent markings.

Choose a tree closest to the center of the site (if in a forested location). Tag the tree 6-7 inches above ground and on the north side of the tree. If the north side of the tree faces a trail or road frequented by visitors, place tag on opposite side of tree. Prior to the field season, tagged trees should be marked with flagging tape (check with park on preferred color), to provide a visual marker for volunteers.

After tagging and flagging the tree, set the GPS to average readings for a waypoint, and allow it to collect at least 100 readings. Label the waypoint as follows: PARK_RouteNumber_PointNumber (e.g., ACAD_31_01)

It is critical that observers be able to move quickly from one point to the next to complete their survey before breeding activity slows down at around 0900 hours. Therefore, where possible each point count station must be identified with both a permanent (aluminum tree tag) and visible marker (flagging tape) (Figure S1.1). In addition, a small amount of flagging spaced every 25 to 100 m (depending on density of habitat and therefore an observer's ability to maintain a compass bearing) in between stations may be necessary to help guide observers to the next point count station. This is especially important since GPS is not always reliable under the forest canopy in summer. Point count stations and flagging will be located at least 15 m away from hiking trails and interpretive signing, and at least 50 m from park roads, buildings, and other areas frequented by the public.

Beginning in 2008, point counts and associated routes in ACAD were permanently marked with metal trail signs and “fire tacks” (Figure S1.2). Fire tacks are small, but highly reflective, and should help volunteers navigate between point counts with a flashlight or headlamp in low light. Point counts were marked with metal signs and flagging, while routes between points were marked every 20-25 m with signs (no flagging). This marking method was expanded to the other NETN parks in 2012.

Figure S1.1. Example of point count markers using aluminum tree tag and flagging tape.

Figure S1.2. Example of metal signs used to mark point count stations. A reflective "fire tack" is visible at the left edge of the tree even with the top of the sign. Routes between point counts are marked similarly, but without flagging.

Site Data Collection

Fill out the Point Count Location Check Forms at each site, even if the site was rejected.

Point number: Record the plot identification number

Tag number: Record the tree tag number

Date: Record the date the site was established

Accepted, rejected, point moved: Check appropriate box to indicate if the site was accepted, rejected or moved

Coordinates:
E – Record GPS East Universal Transverse Mercator value at tagged tree
N – Record GPS North Universal Transverse Mercator value at tagged tree
Accuracy – Record the positional accuracy of the UTMN and UTME coordinates, as determined by GPS

Point movement: Provide description of why point was moved and in what direction

Reason for rejecting: Provide reason for why site was rejected if applicable

Point access directions: Record directions for driving and walking to the plot, including landmarks, distances, and bearings. Include parking recommendations where applicable.

Easy, moderate, difficult: Check appropriate box to indicate if navigation to site is likely to be easy, moderate, or difficult for a volunteer.

Comments: Record reason for choice of difficulty level if necessary or any other additional notes.

Point Count Location Check Forms

Point check [PARK] [YEAR]			**Checked By:**		
Point number:	Tag number:	Date:	Point number:	Tag number:	Date:
□ Accepted □ Rejected □ Point moved			□ Accepted □ Rejected □ Point moved		
If accepted or moved: ☐ Point tagged ☐ Point flagged ☐ No tagging/flagging			If accepted or moved: ☐ Point tagged ☐ Point flagged ☐ No tagging/flagging		
Coordinates: E _____ **Accuracy:** **N** _____ Point movement:			**Coordinates: E** _____ **Accuracy:** **N** _____ Point movement:		
Reason for rejecting:			Reason for rejecting:		
Point access directions:			Point access directions:		
☐ Easy ☐ Moderate ☐ Difficult			☐ Easy ☐ Moderate ☐ Difficult		
Comments:			Comments:		
Point number:	Tag number:	Date:	Point number:	Tag number:	Date:
□ Accepted □ Rejected □ Point moved			□ Accepted □ Rejected □ Point moved		
If accepted or moved: ☐ Point tagged ☐ Point flagged ☐ No tagging/flagging			If accepted or moved: ☐ Point tagged ☐ Point flagged ☐ No tagging/flagging		
Coordinates: E _____ **Accuracy:** **N** _____ Point movement:			**Coordinates: E** _____ **Accuracy:** **N** _____ Point movement:		
Reason for rejecting:			Reason for rejecting:		
Point access directions:			Point access directions:		
☐ Easy ☐ Moderate ☐ Difficult			☐ Easy ☐ Moderate ☐ Difficult		
Comments:			Comments:		

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Appendix A. Maps of sampling locations

This appendix contains maps for each park currently participating in the Mid-Atlantic, Northeast Coastal and Barrier, and Northeast Temperate Network's Long-Term Breeding Landbird Monitoring Protocol. Monitoring locations are colored coded to reflect the habitat type being monitored. Details regarding the number of sampling locations for each network are outlined in the tables S1.A1, S1.A2, S1.A3.

Table S1.A1. List of Mid-Atlantic Network parks currently participating in the Breeding Landbird Monitoring Program and the number of sampling locations for each park.

Park	Subunit	Park Code	Current Participation	Active sampling locations	Inactive sampling locations	Historical Total of sampled locations
Appomattox Court House National Historical Park (NHP)	–	APCO	No	0	33	33
Booker T. Washington National Monument (NM)	–	BOWA	Yes	10	6	16
Eisenhower National Historic Site (NHS)	–	EISE	No	Not Applicable	Not Applicable	Not Applicable
Fredericksburg & Spotsylvania National Military Park (NMP)	Spotsylvania Battlefield	FRSP	Yes	36	23	59
Gettysburg National Military Park (NMP)	–	GETT	Yes	12	0	12
Hopewell Furnace National Historic Site (NHS)	–	HOFU	Yes	28	0	28
Petersburg National Battlefield (NB)	Eastern Front	PETE	Yes	36	35	45
Richmond National Battlefield Park (NBP)	Malvern Hill	RICH	Yes	34	36	67
Shenandoah National Park	–	SHEN	No	Not Applicable	Not Applicable	Not Applicable
Valley Forge National Historical Park	–	VAFO	Yes	80	80	76

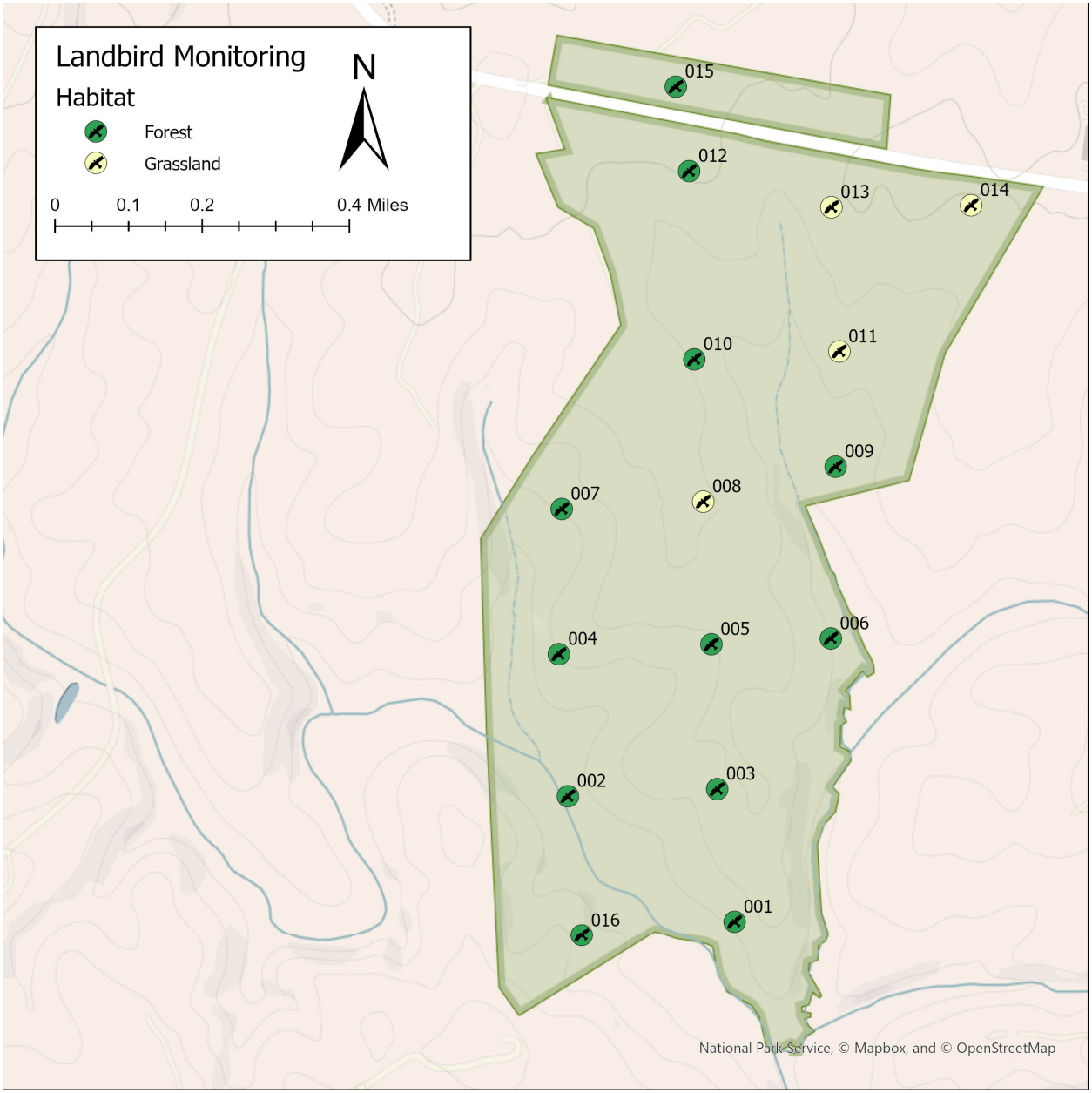

Figure S1.A1. Aerial image of Booker T. Washington National Monument (BOWA) showing active forest (green) and grassland (yellow) monitoring locations.

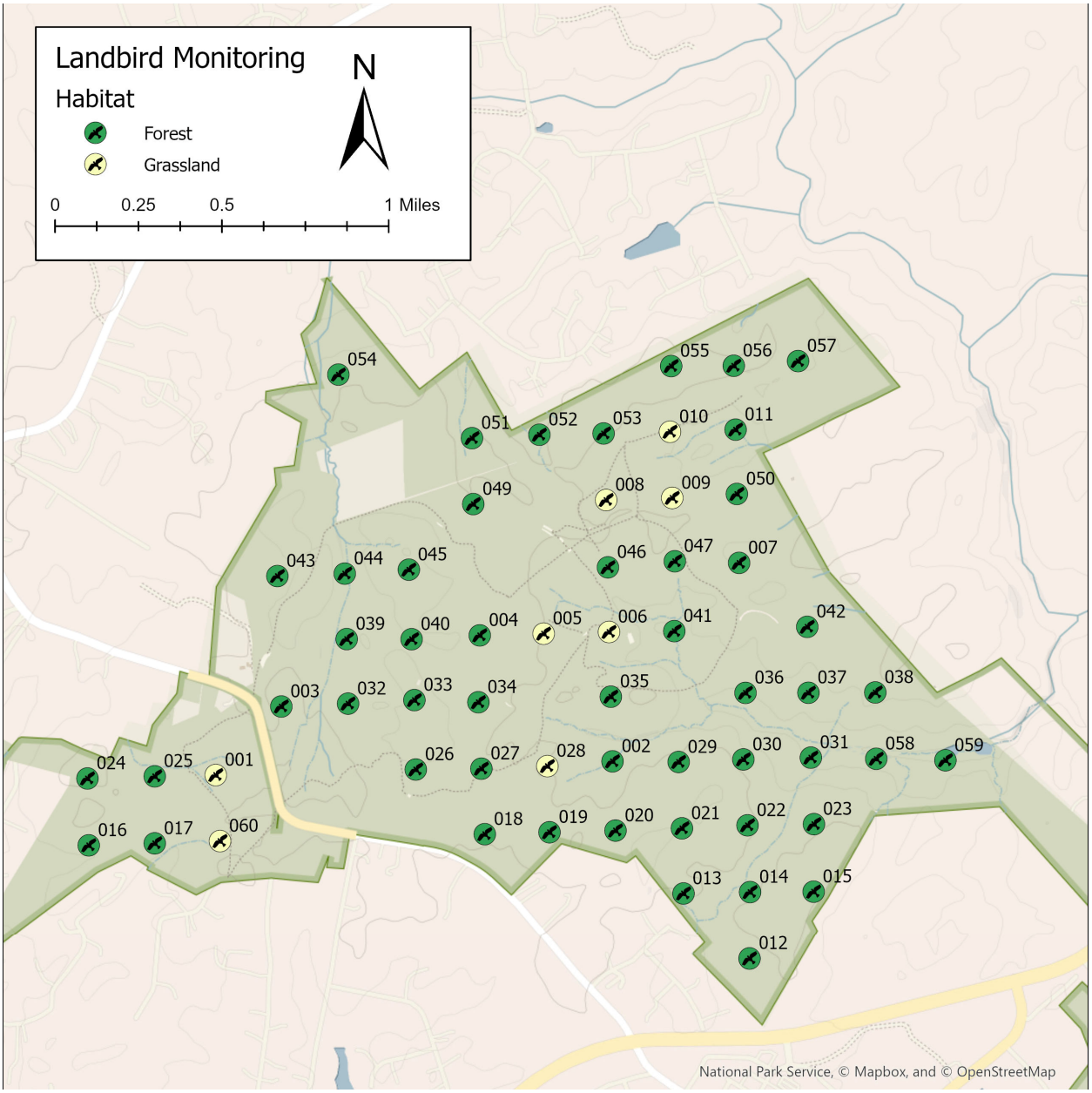

Figure S1.A2. Aerial image of the Spotsylvania Battlefield Unit of Fredericksburg and Spotsylvania National Military Park (FRSP) showing active forest (green) and grassland (yellow) monitoring locations.

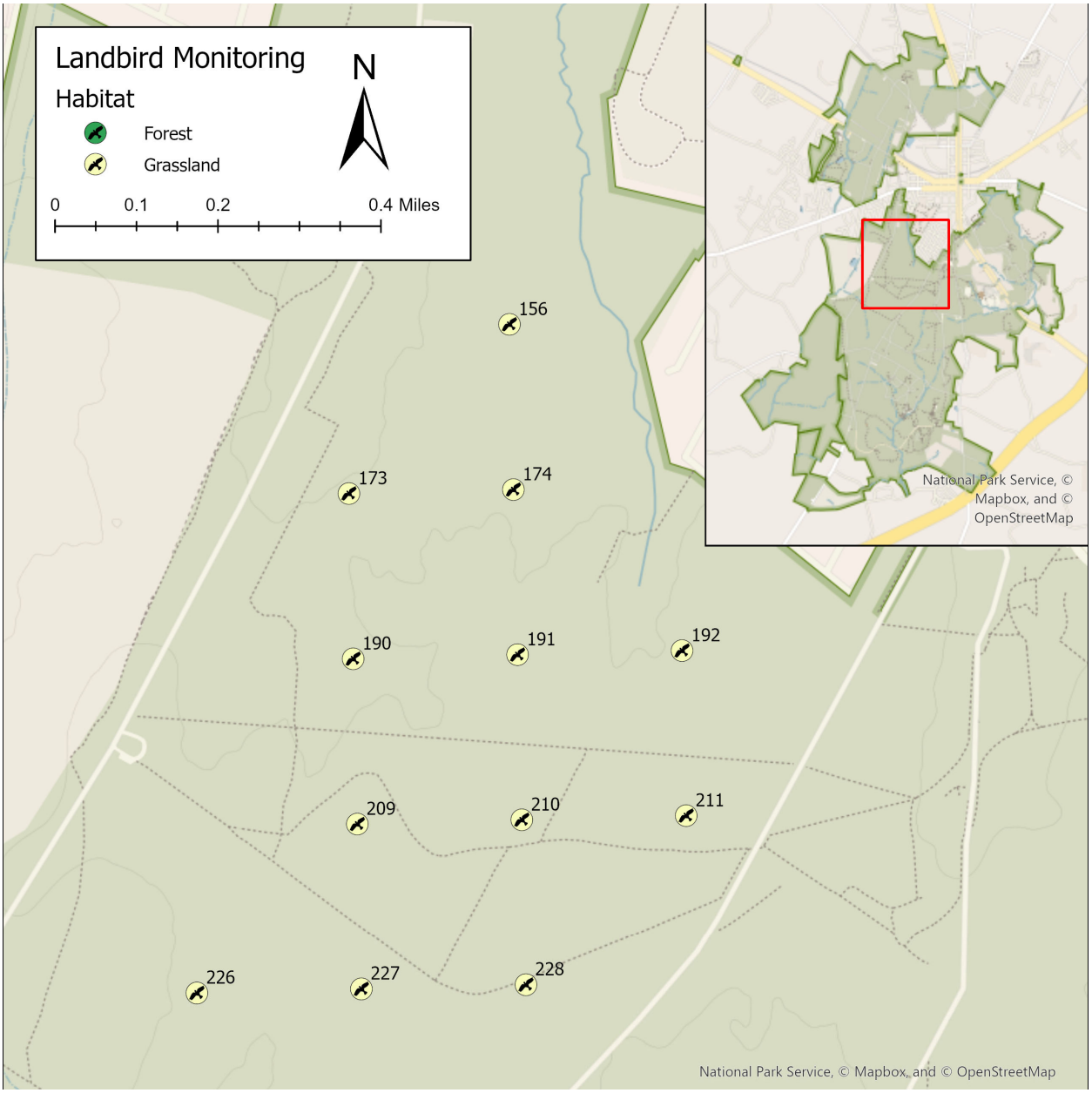

Figure S1.A3. Aerial image of the Gettysburg National Military Park (GETT) showing active forest (green) and grassland (yellow) monitoring locations.

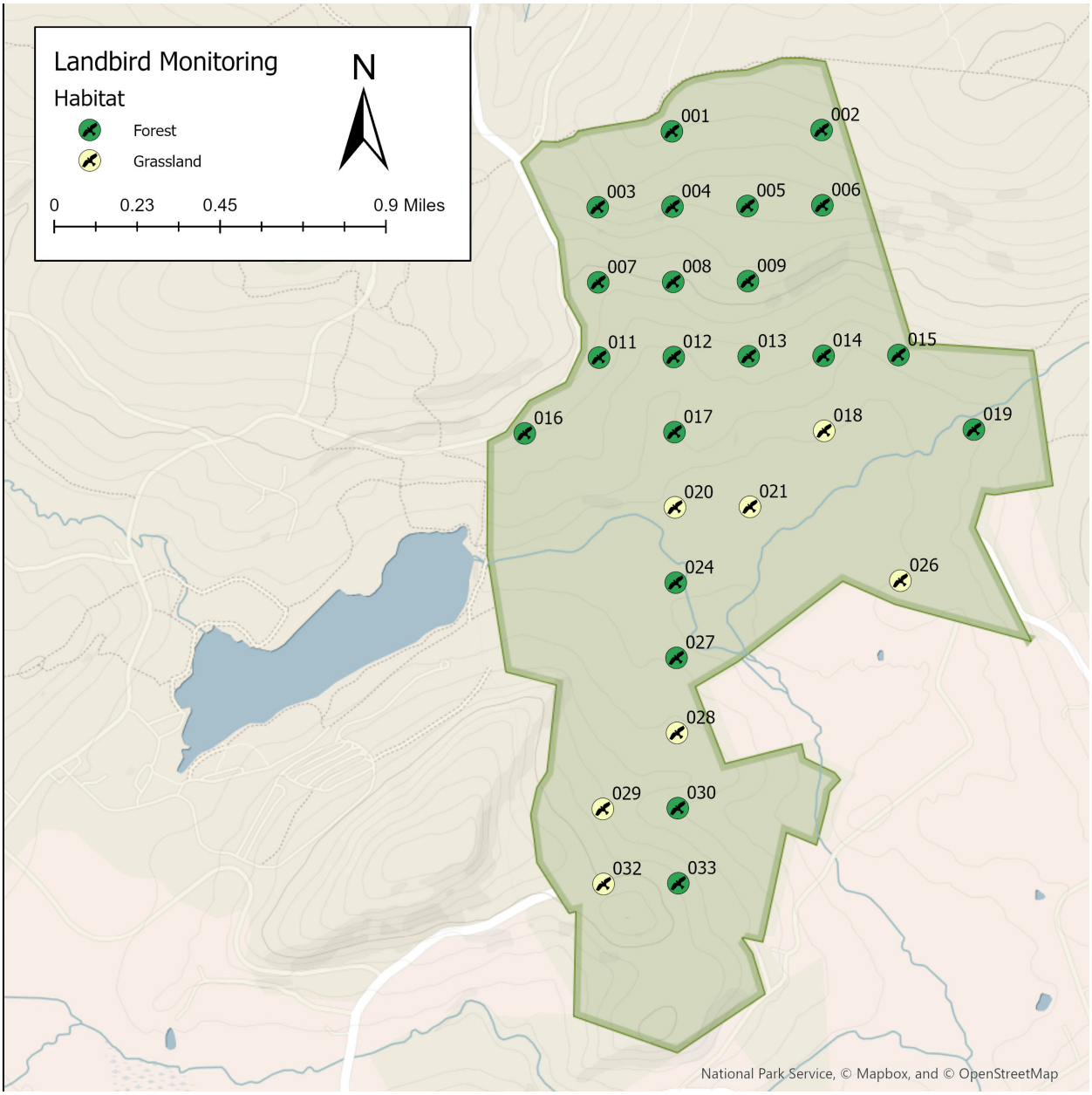

Figure S1.A4. Aerial image of the Hopewell Furnace National Historic Site (HOFU) showing active forest (green) and grassland (yellow) monitoring locations.

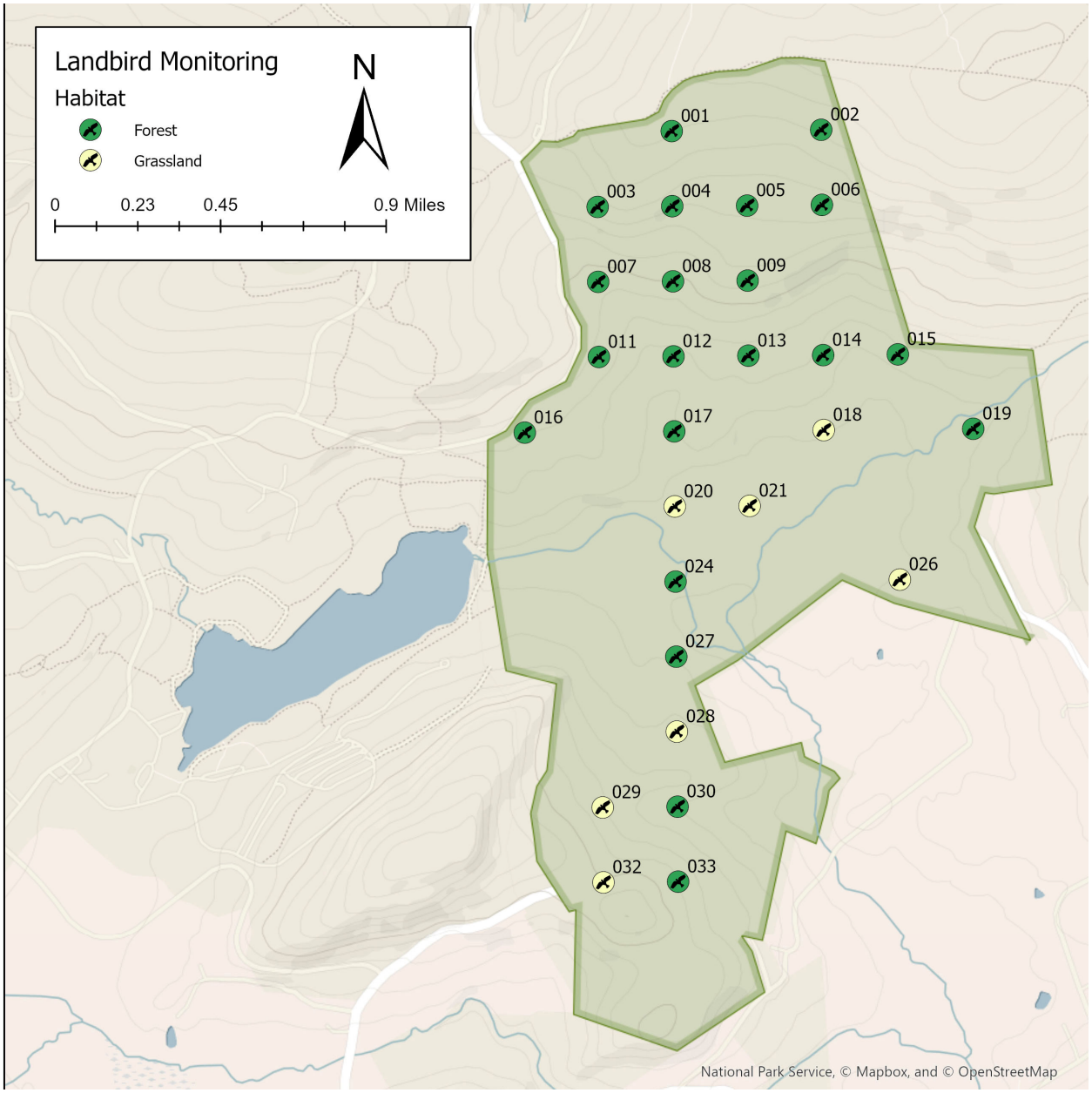

Figure S1.A5. Aerial image of the Eastern Front unit of Petersburg National Battlefield (PETE) showing active forest (green) and grassland (yellow) monitoring locations.

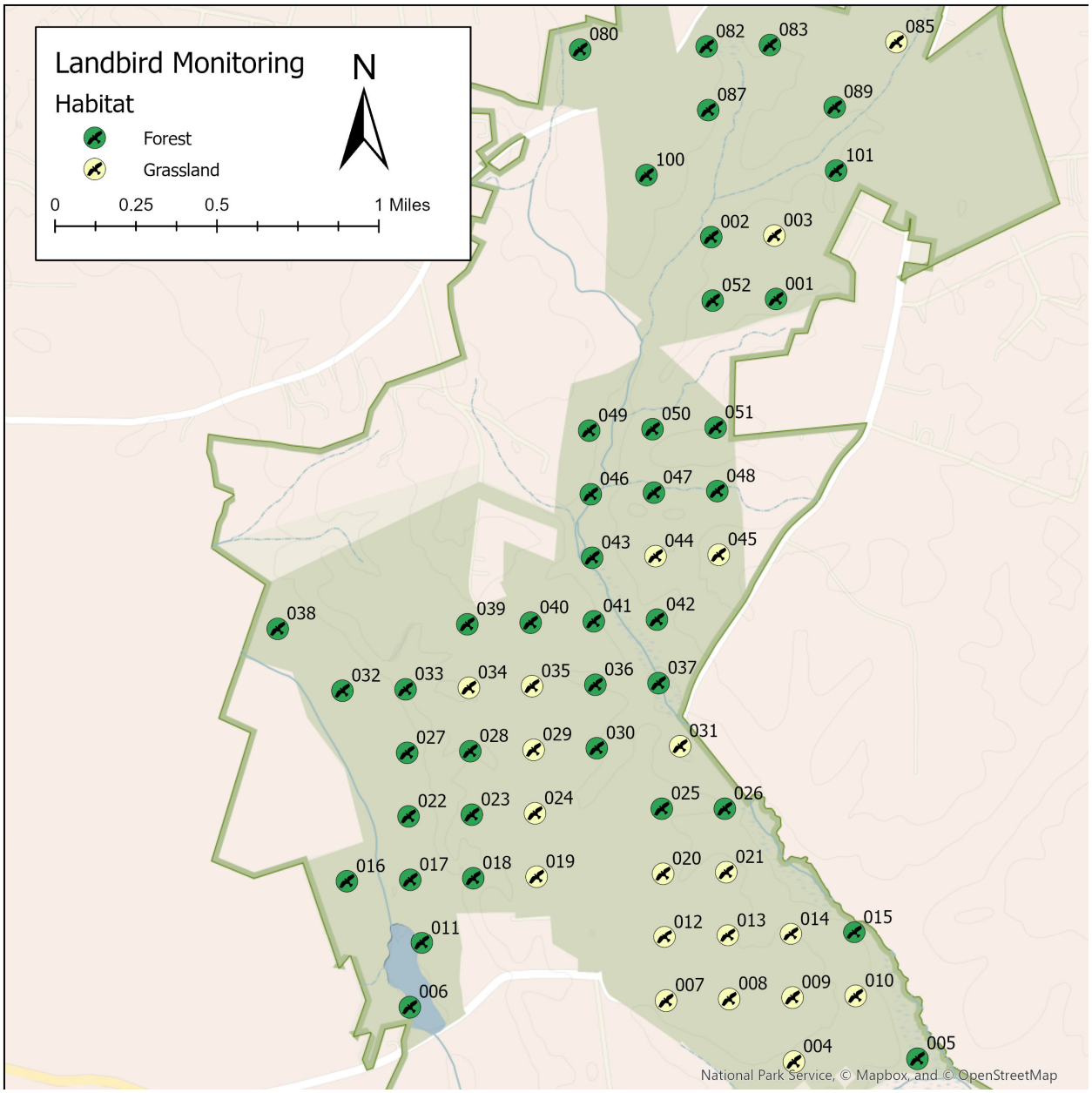

Figure S1.A6. Aerial image of the Malvern Hill unit of Richmond National Battlefield Park (RICH) showing active forest (green) and grassland (yellow) monitoring locations.

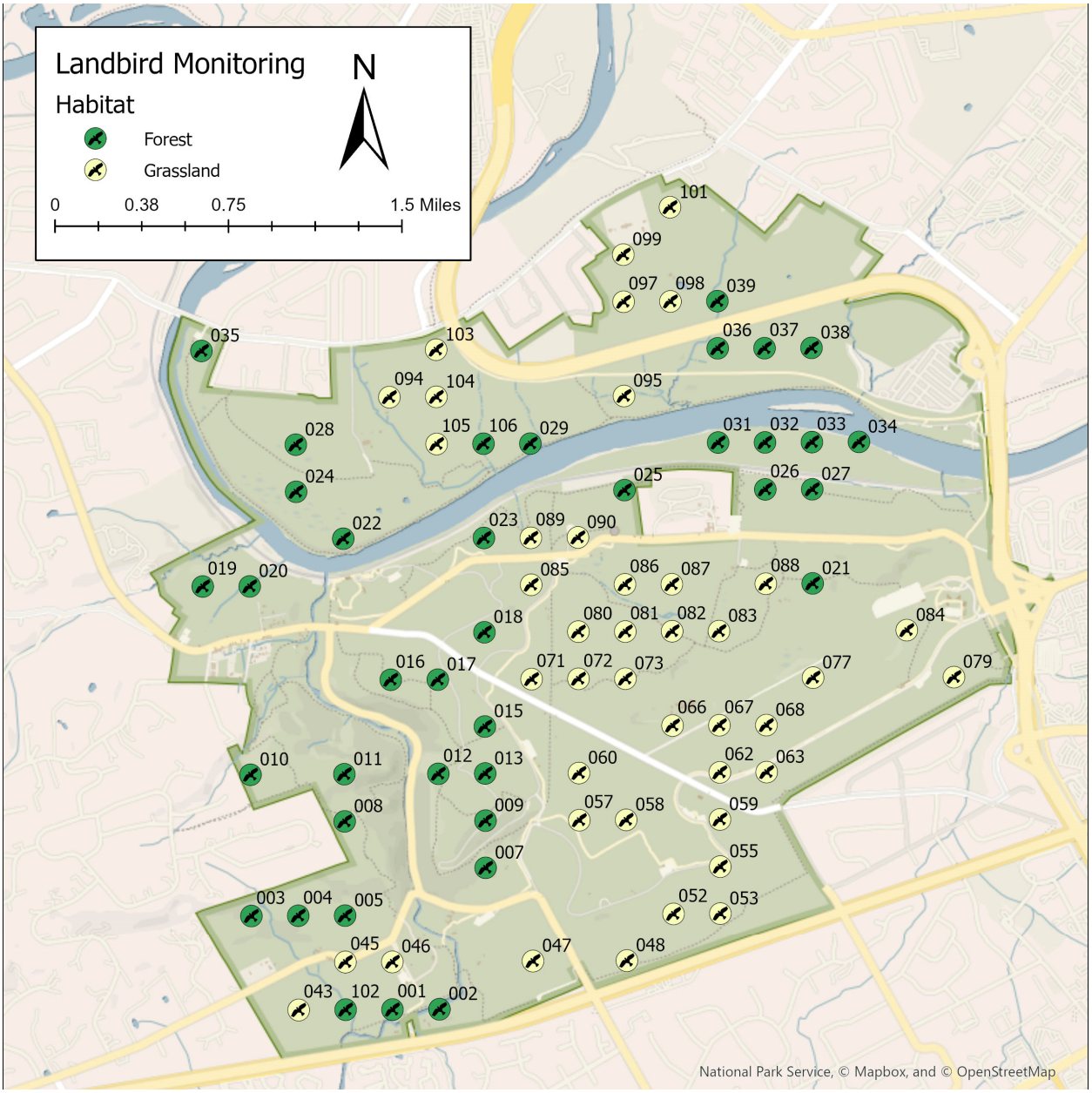

Figure S1.A7. Aerial image of Valley Forge National Historical Park (VAFO) showing active forest (green) and grassland (yellow) monitoring locations.

Table S1.A2. List of Northeast Coastal and Barrier parks currently participating in the Breeding Landbird Monitoring Program and the number of sampling locations for each park.

Park	Subunit	Park Code	Current Participation	Active sampling locations	Inactive sampling locations	Historical Total of sampled locations
Colonial National Historical Park (NHP)	–	COLO	Yes	50	0	50

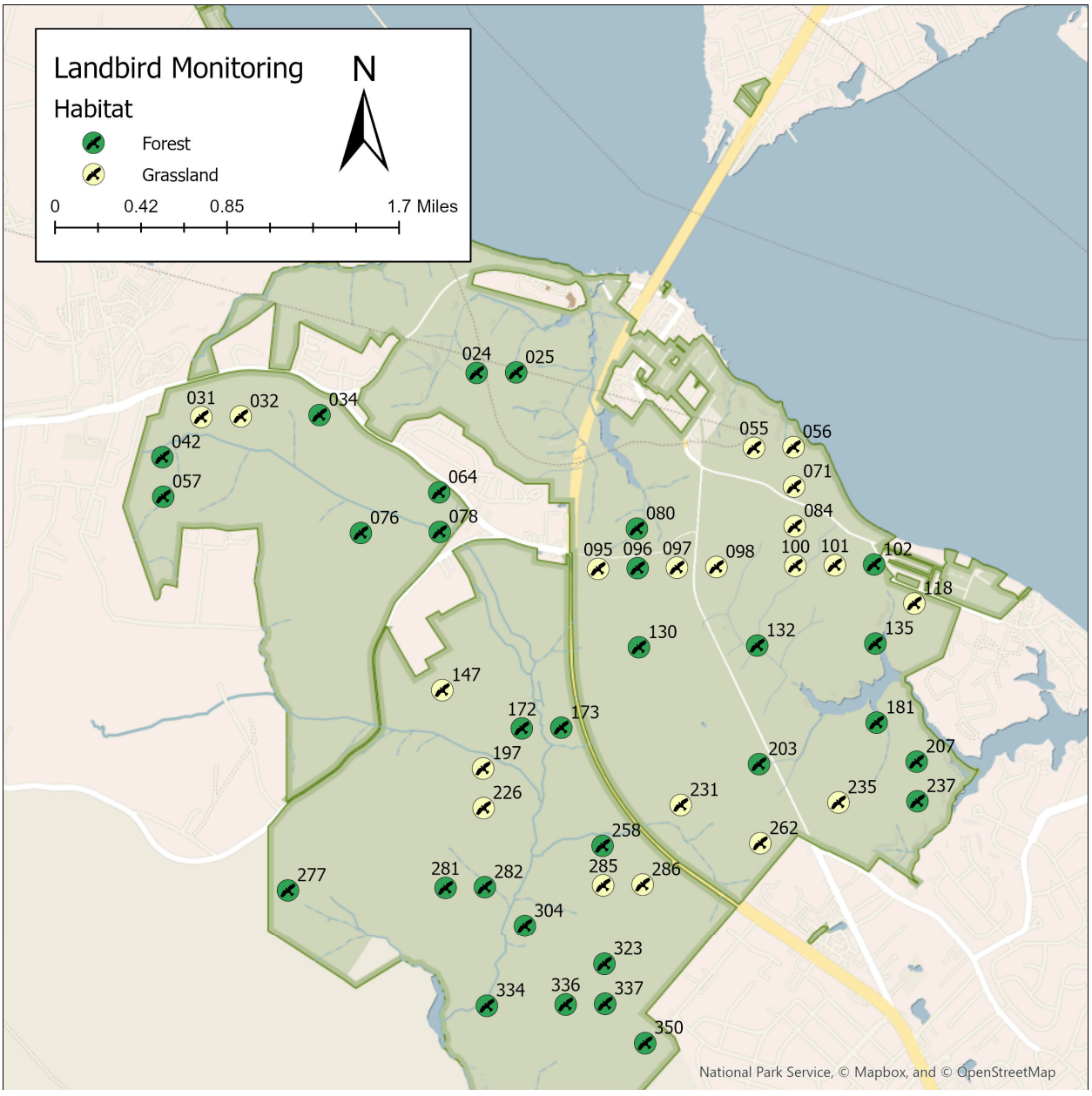

Figure S1.A8. Aerial image of Colonial National Historical Park (COLO) showing active forest breeding bird (green) and grassland (yellow) monitoring locations.

Table S1.A3. List of Northeast Temperate Network parks currently participating in the Breeding Landbird Monitoring Program and the number of sampling locations for each park.

Park	Subunit	Park Code	Current Participation	Active sampling locations	Inactive sampling locations	Historical Total of sampled locations
Acadia National Park (NP)	–	ACAD	Yes	51	0	51
Eleanor Roosevelt National Historic Site (NHS)	–	ELRO	Yes	11	0	11
Home of FDR National Historic Site (NHS)	–	HOFR	Yes	12	0	12
Marsh-Billings-Rockefeller National Historical Park (NHP)	_	MABI	Yes	25	0	25
Minute Man National Historical Park (NHP)	–	MIMA	Yes	29	0	29
Morristown National Historical Park (NHP)	–	MORR	Yes	29	0	29
Saint-Gaudens National Historical Park (NHP)	_	SAGA	Yes	8	0	8
Saugus Iron Works National Historic Site (NHS)	_	SAIR	Yes	3	0	3
Saratoga National Historical Park (NHP)	–	SARA	Yes	51	6	57
Vanderbilt Mansion National Historic Site (NHS)	–	VAMA	Yes	7	0	7
Weir Farm National Historic Site (NHS)		WEFA	Yes	5	0	5

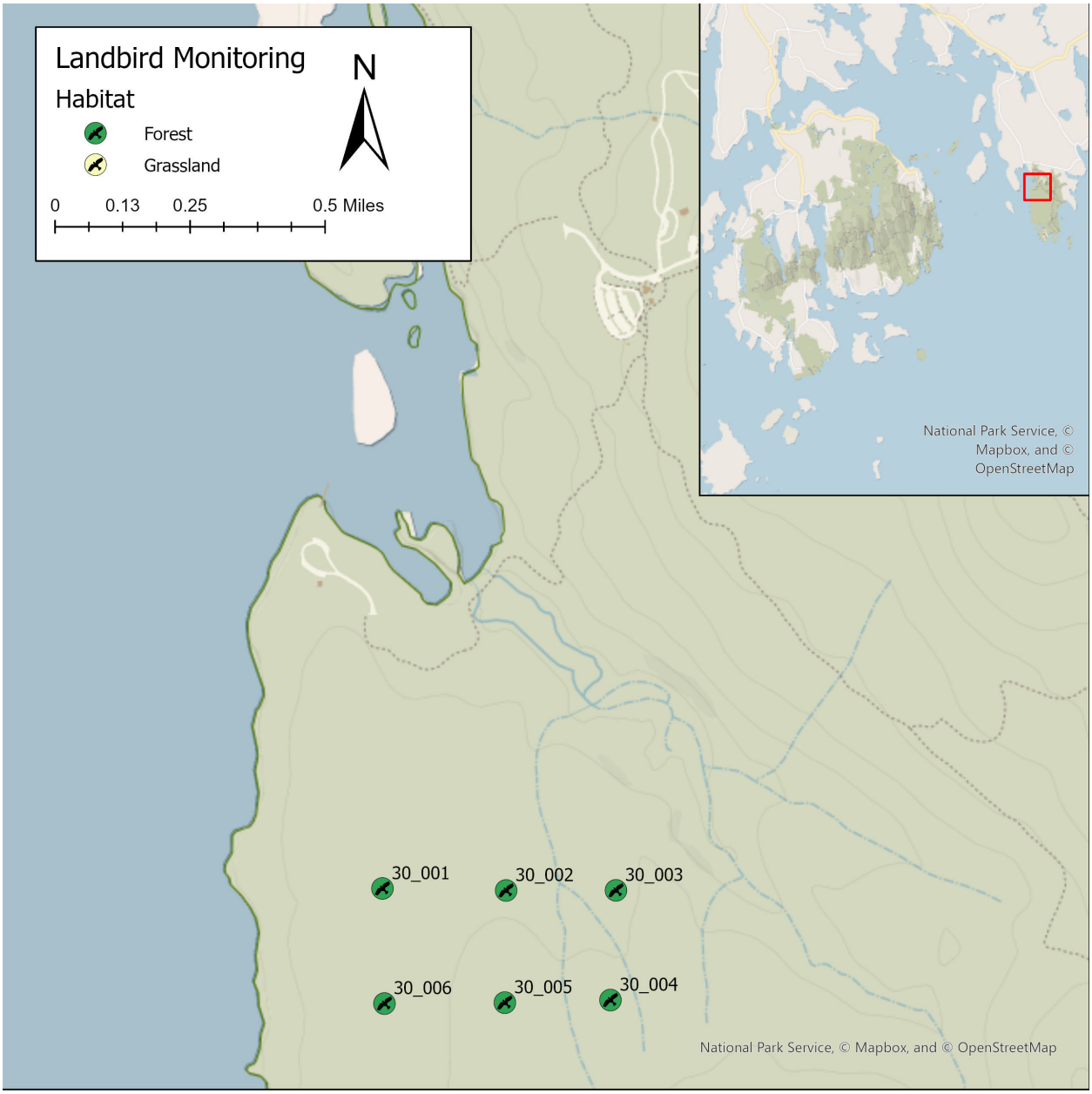

Figure S1.A9. Aerial image of eastern routes in Acadia National Park (ACAD) showing active forest breeding bird (green) monitoring locations.

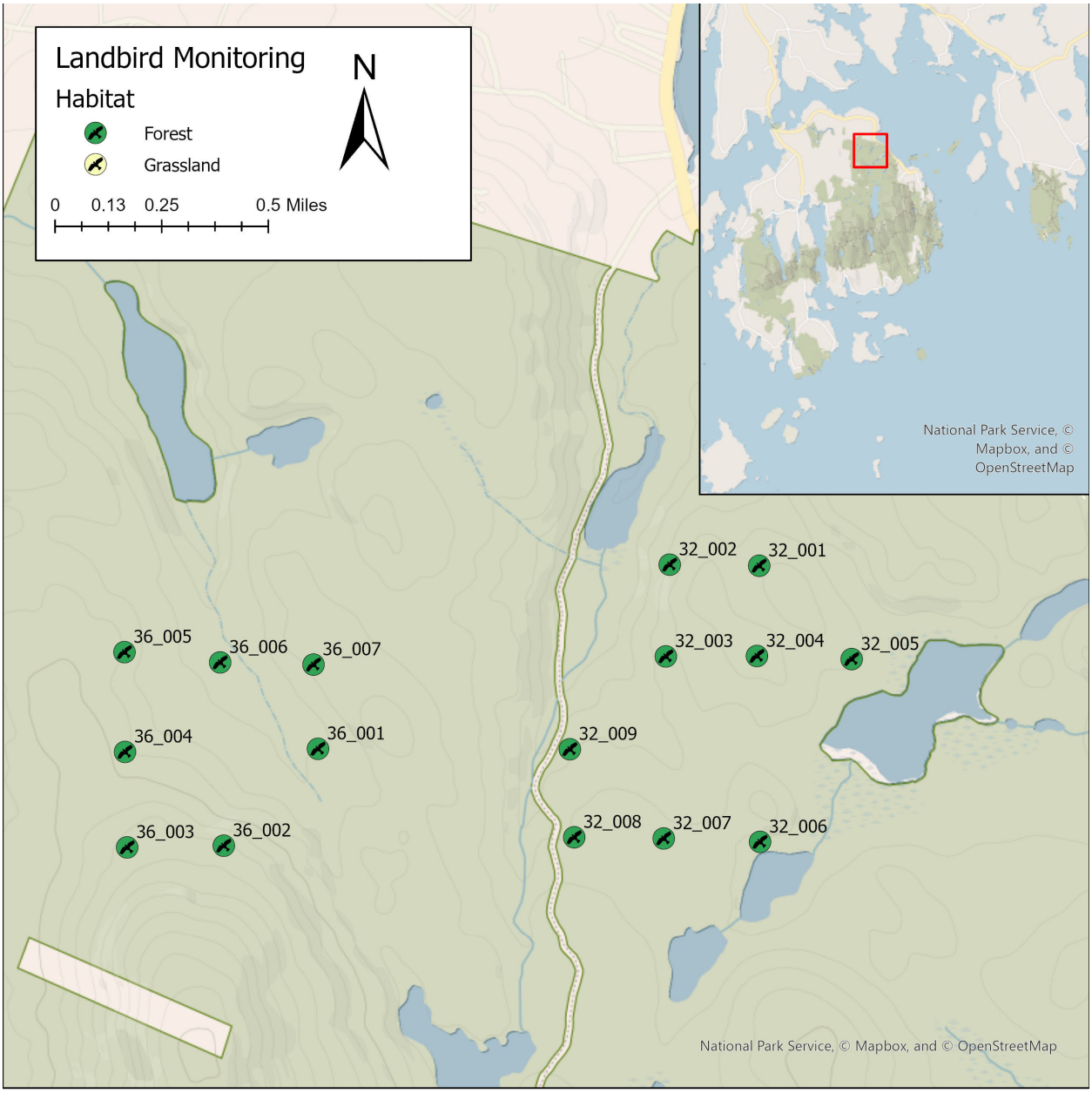

Figure S1.A10. Aerial image of northern routes in Acadia National Park (ACAD) showing active forest breeding bird (green) monitoring locations.

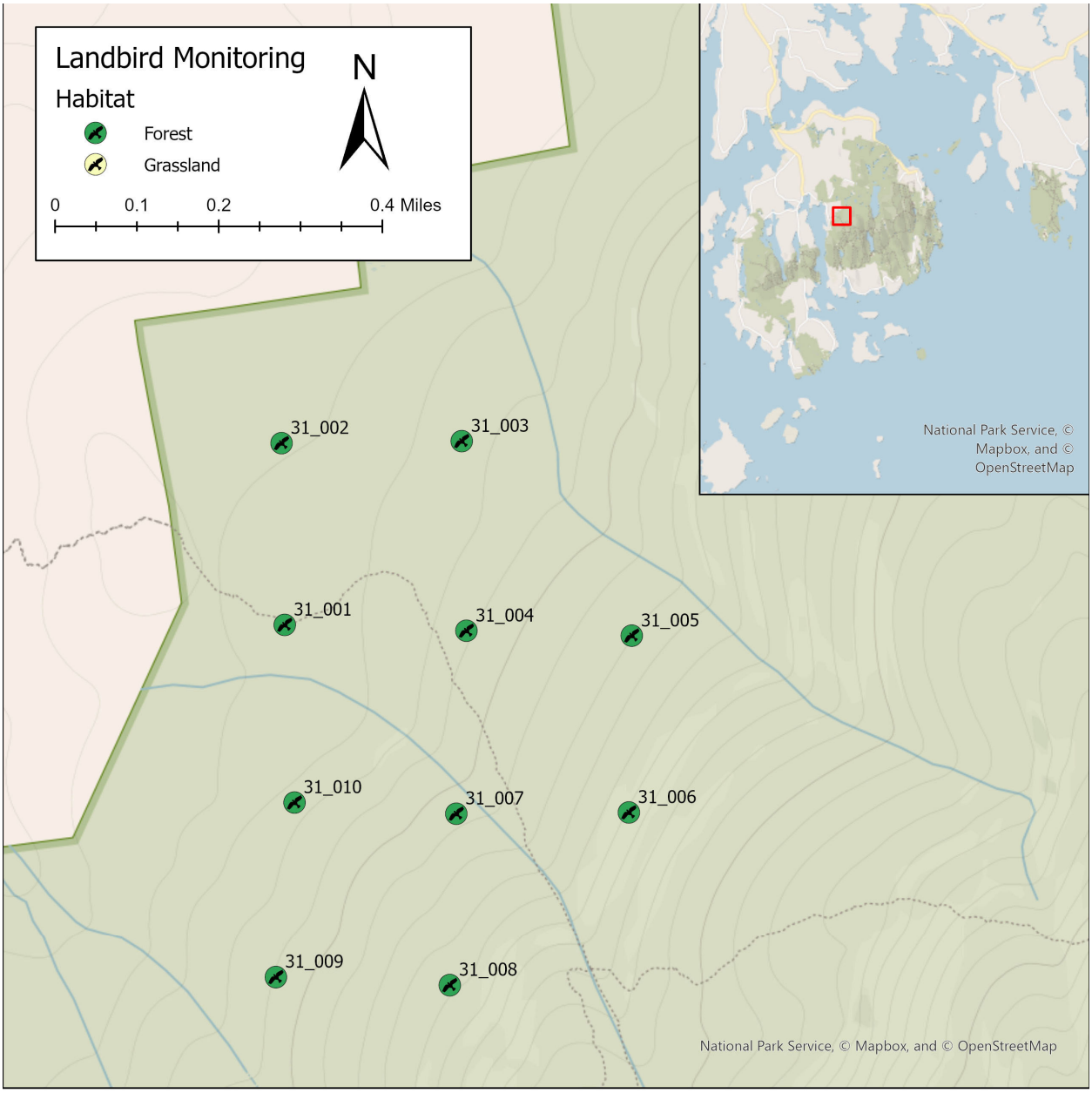

Figure S1.A11. Aerial image of central routes in Acadia National Park (ACAD) showing active forest breeding bird (green) monitoring locations.

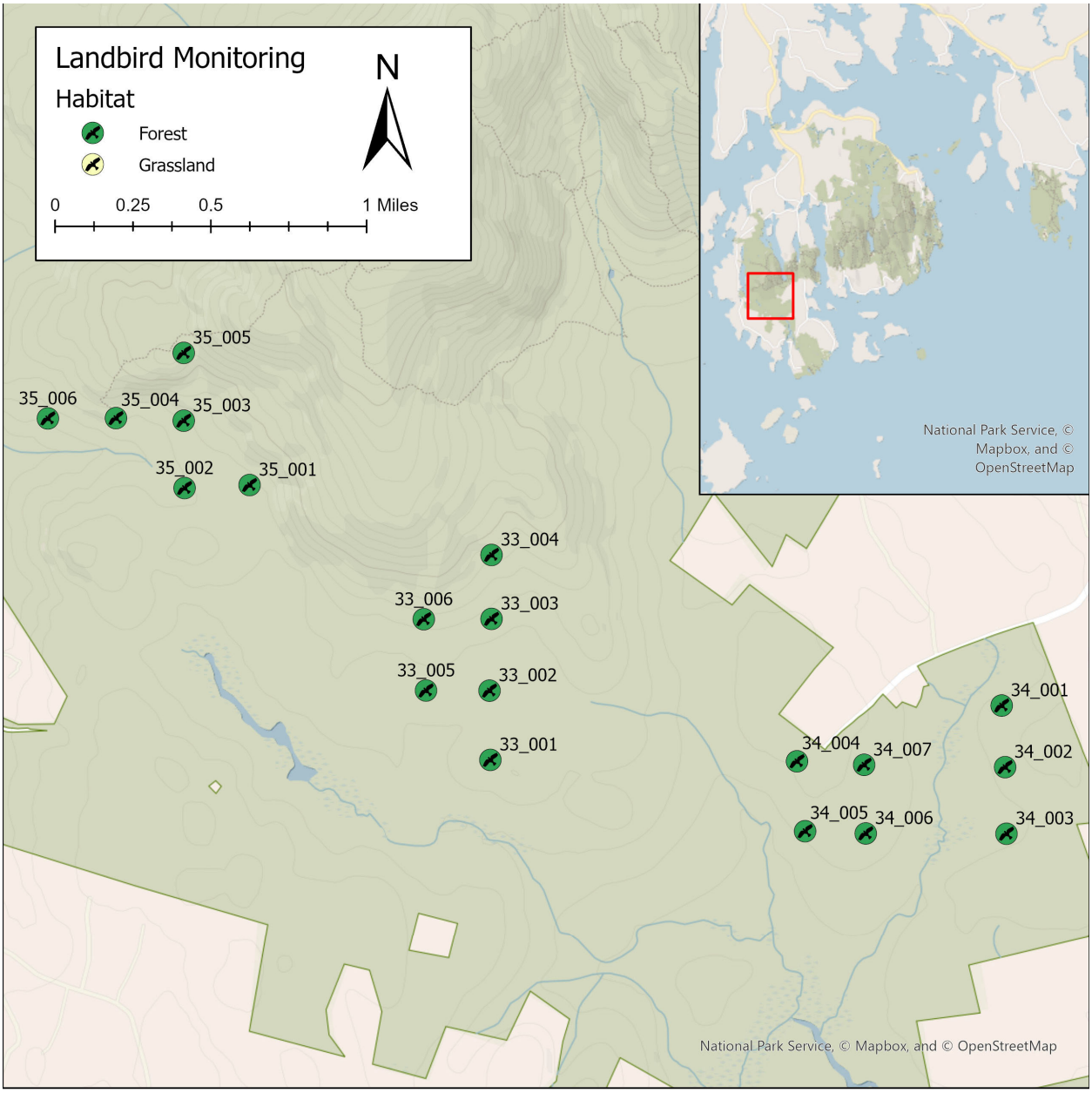

Figure S1.A12. Aerial image of southern routes in Acadia National Park (ACAD) showing active forest breeding bird (green) monitoring locations.

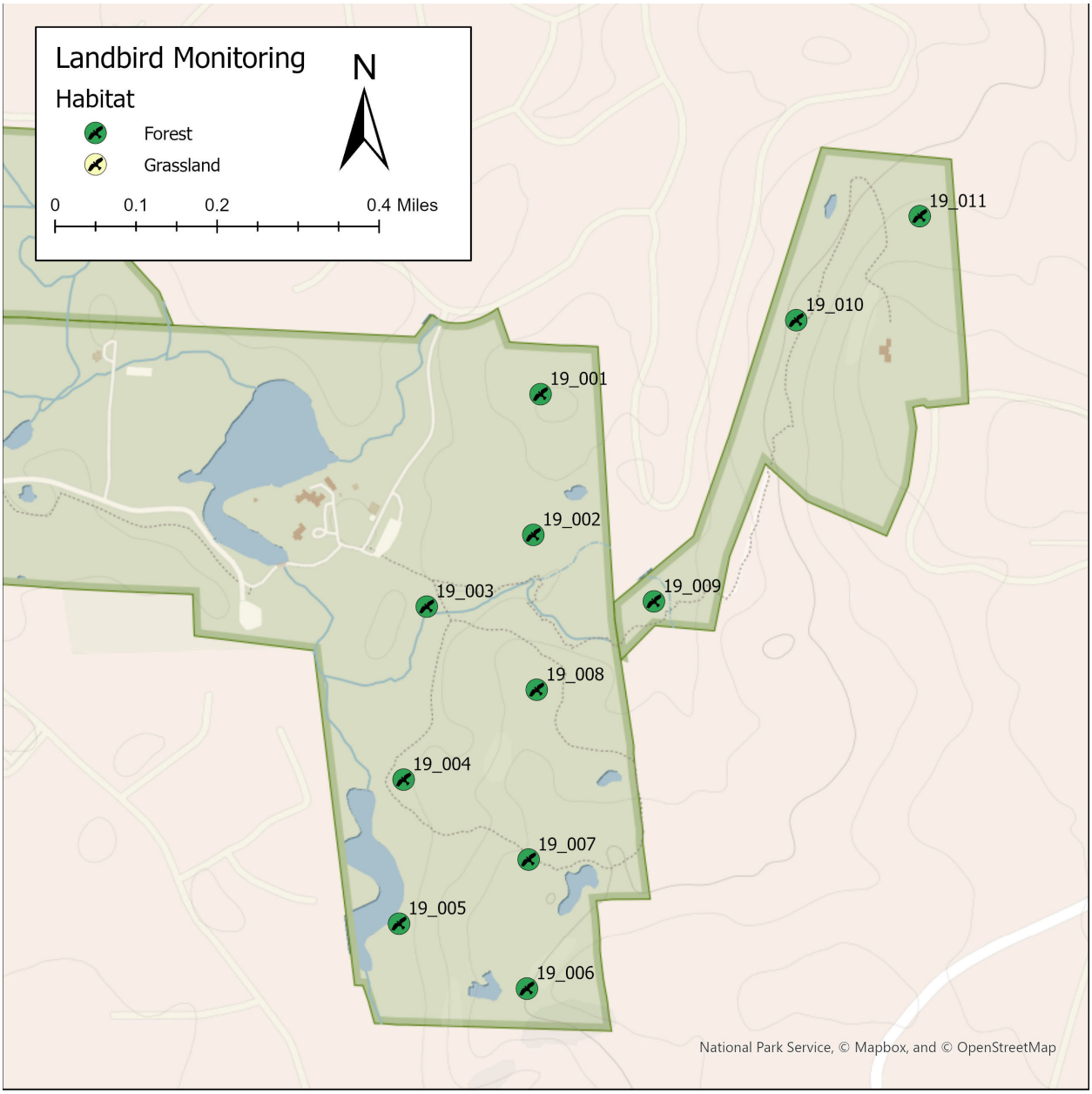

Figure S1.A13. Aerial image of routes in Eleanor Roosevelt National Historic Site (ELRO) showing active forest breeding bird (green) monitoring locations.

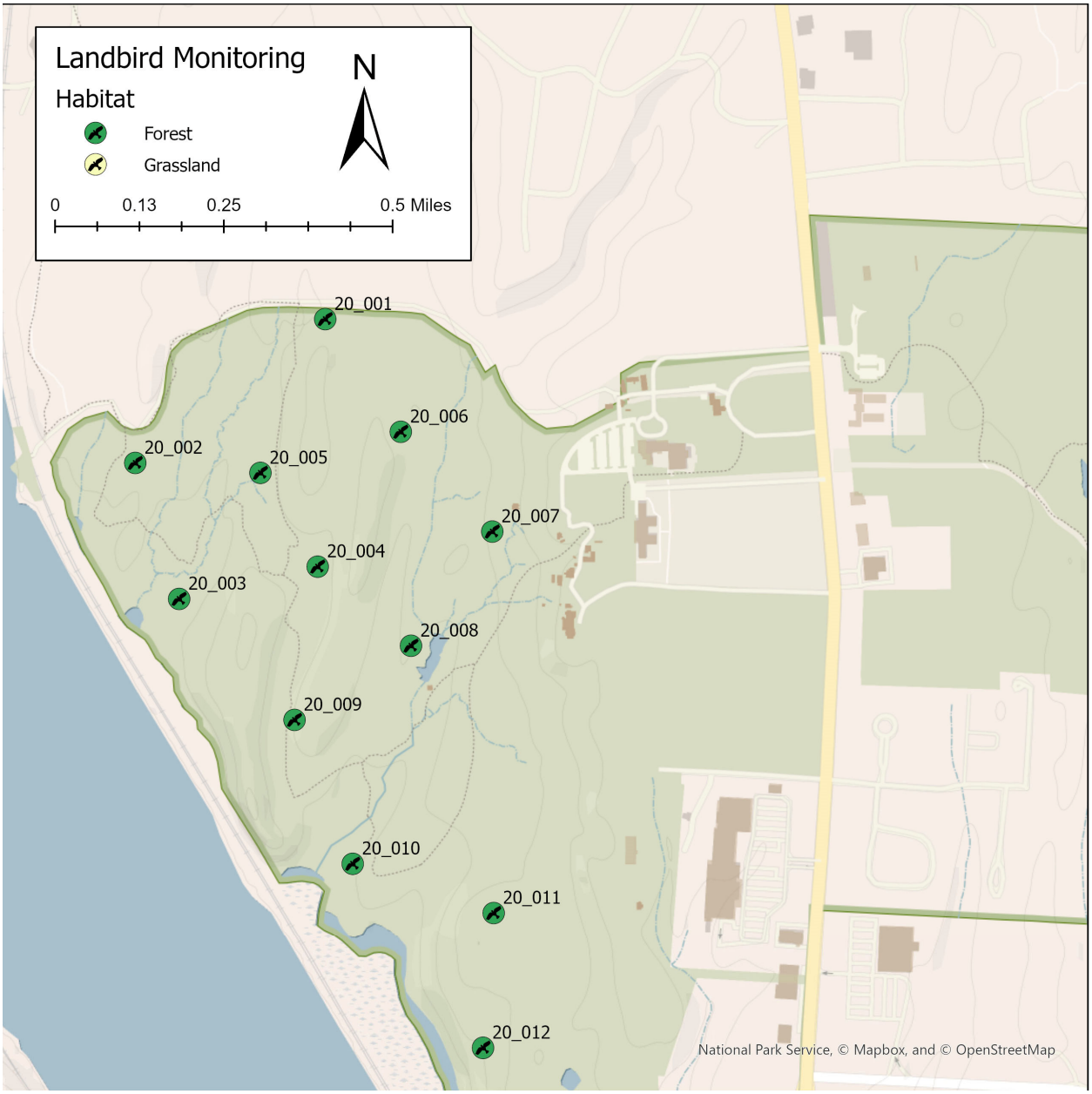

Figure S1.A14. Aerial image of routes in Home of FDR National Historic Site (HOFR) showing active forest breeding bird (green) monitoring locations.

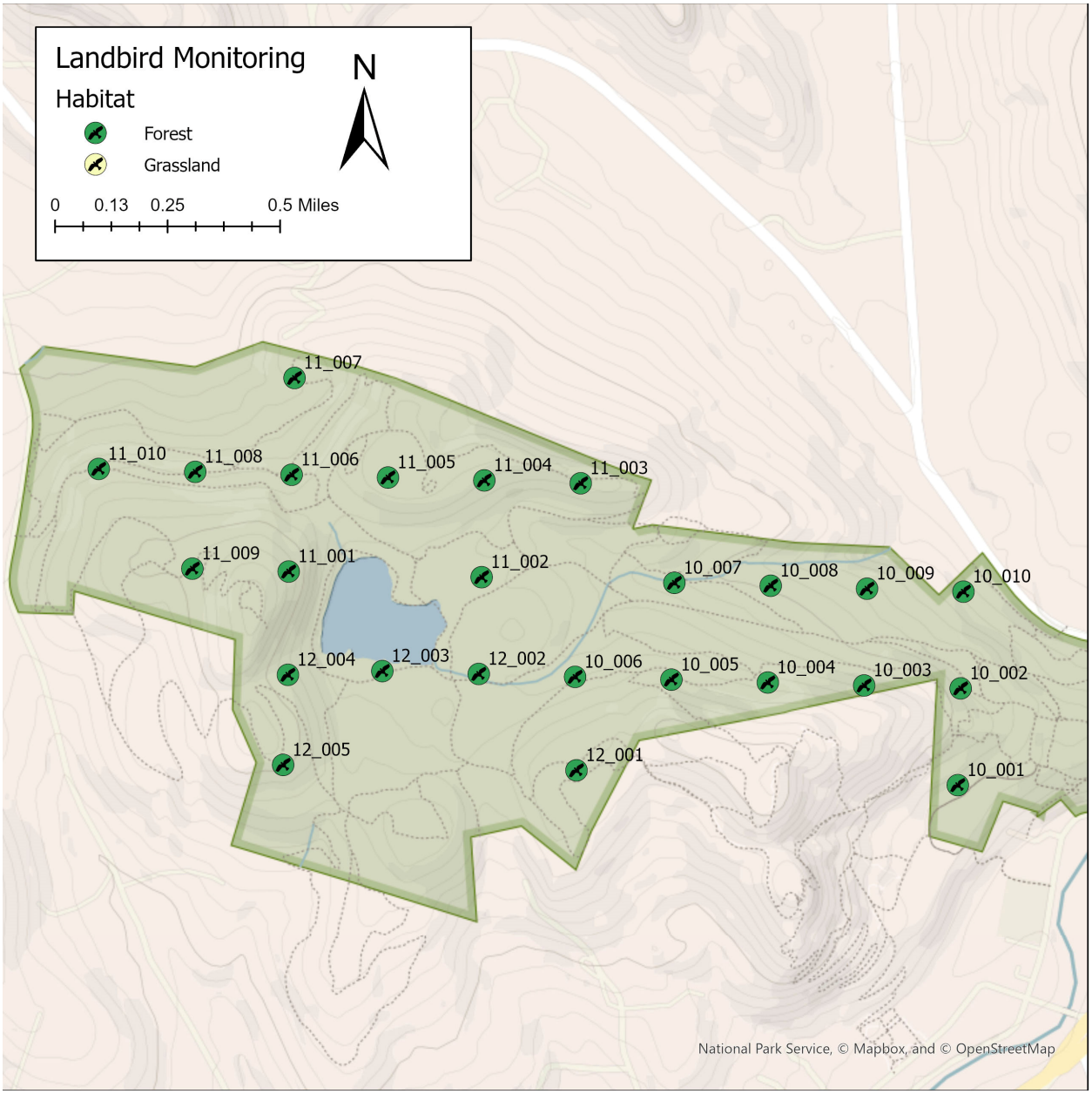

Figure S1.A15. Aerial image of routes in Marsh-Bilings-Rockefeller National Historical Park (MABI) showing active forest breeding bird (green) monitoring locations.

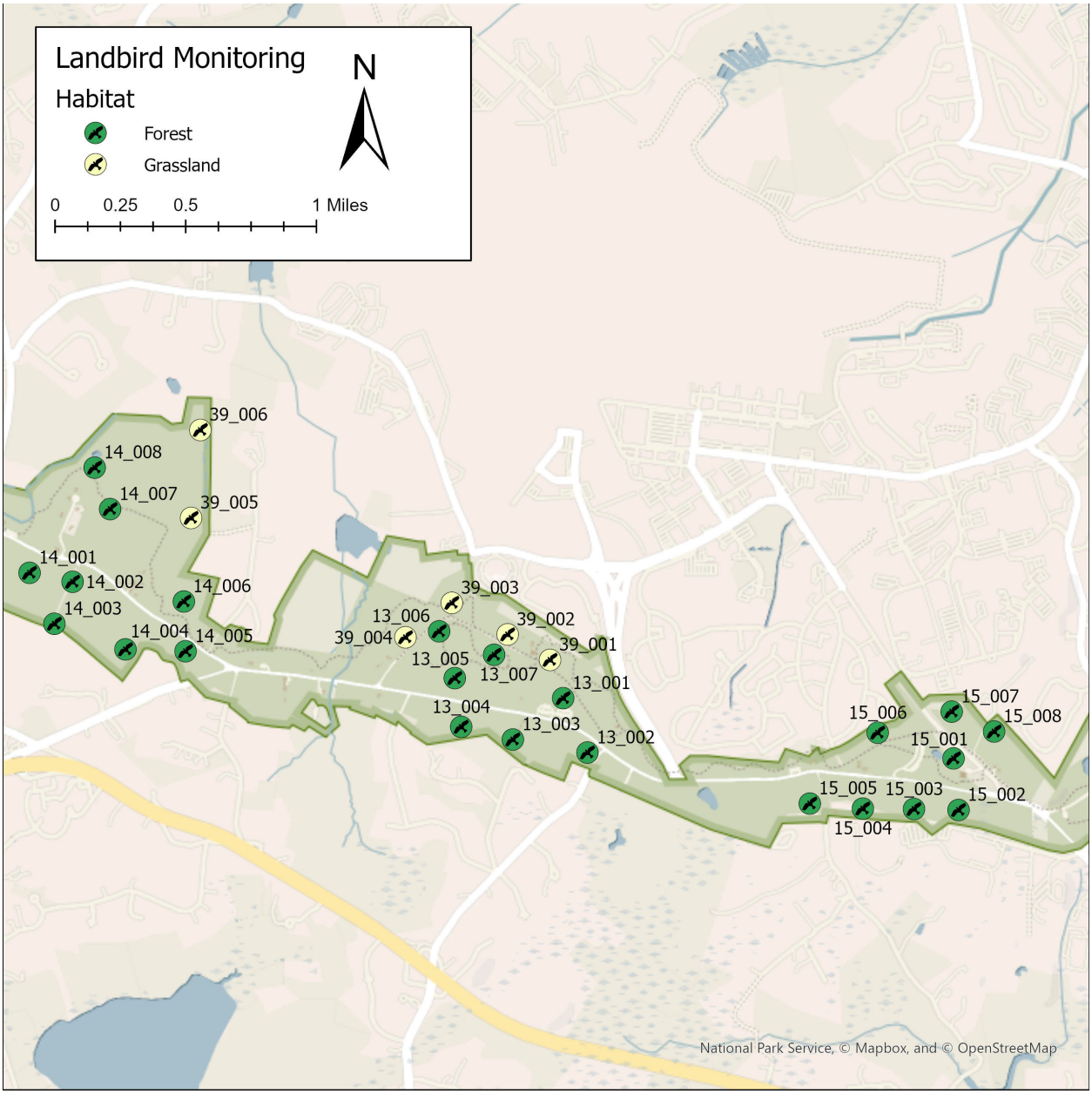

Figure S1.A16. Aerial image of routes in Minute Man National Historical Park (MIMA) showing active forest breeding bird (green) monitoring locations and grassland (yellow) monitoring locations.

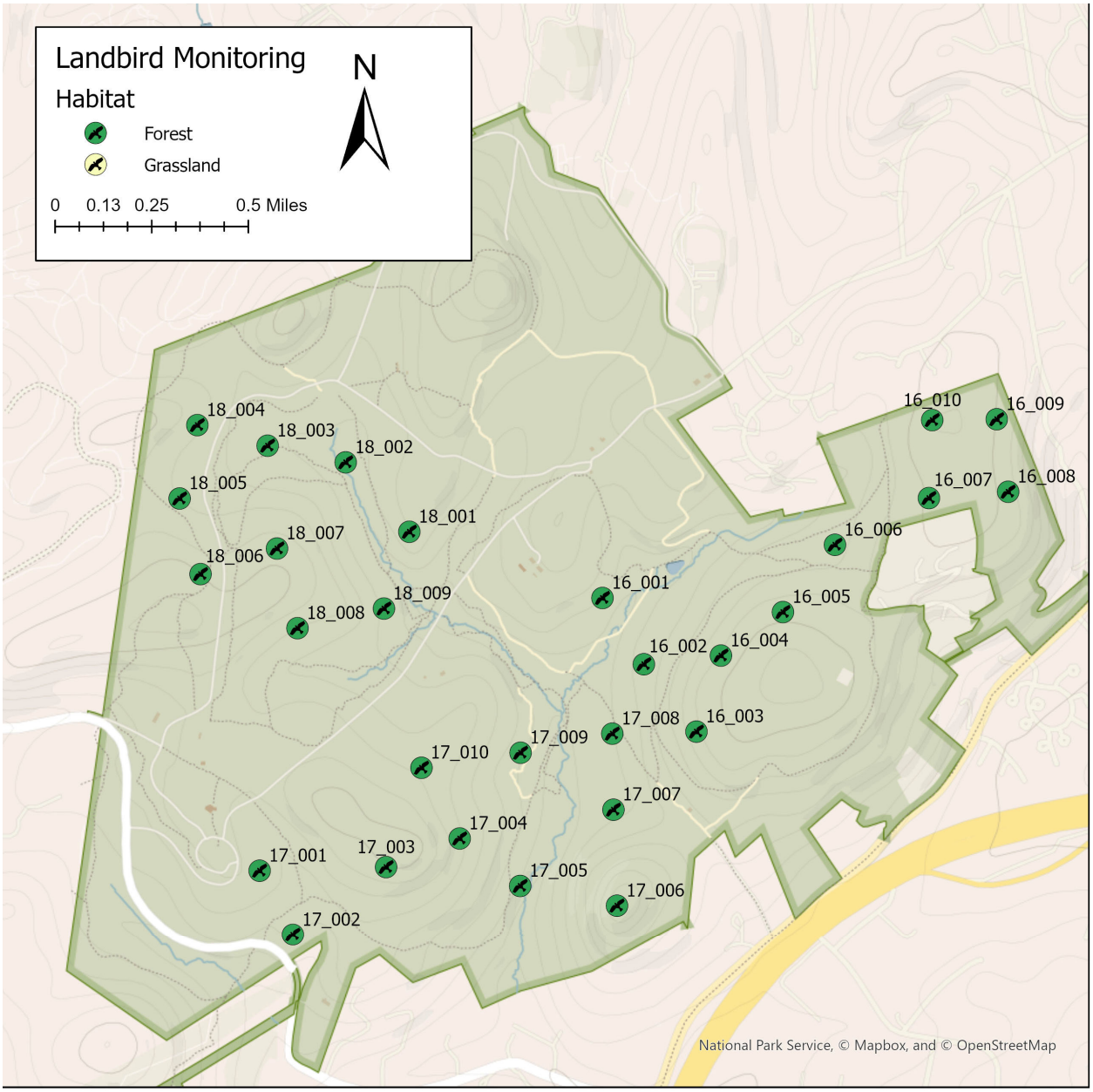

Figure S1.A17. Aerial image of routes in Morristown National Historical Park (MORR) showing active forest breeding bird (green) monitoring locations.

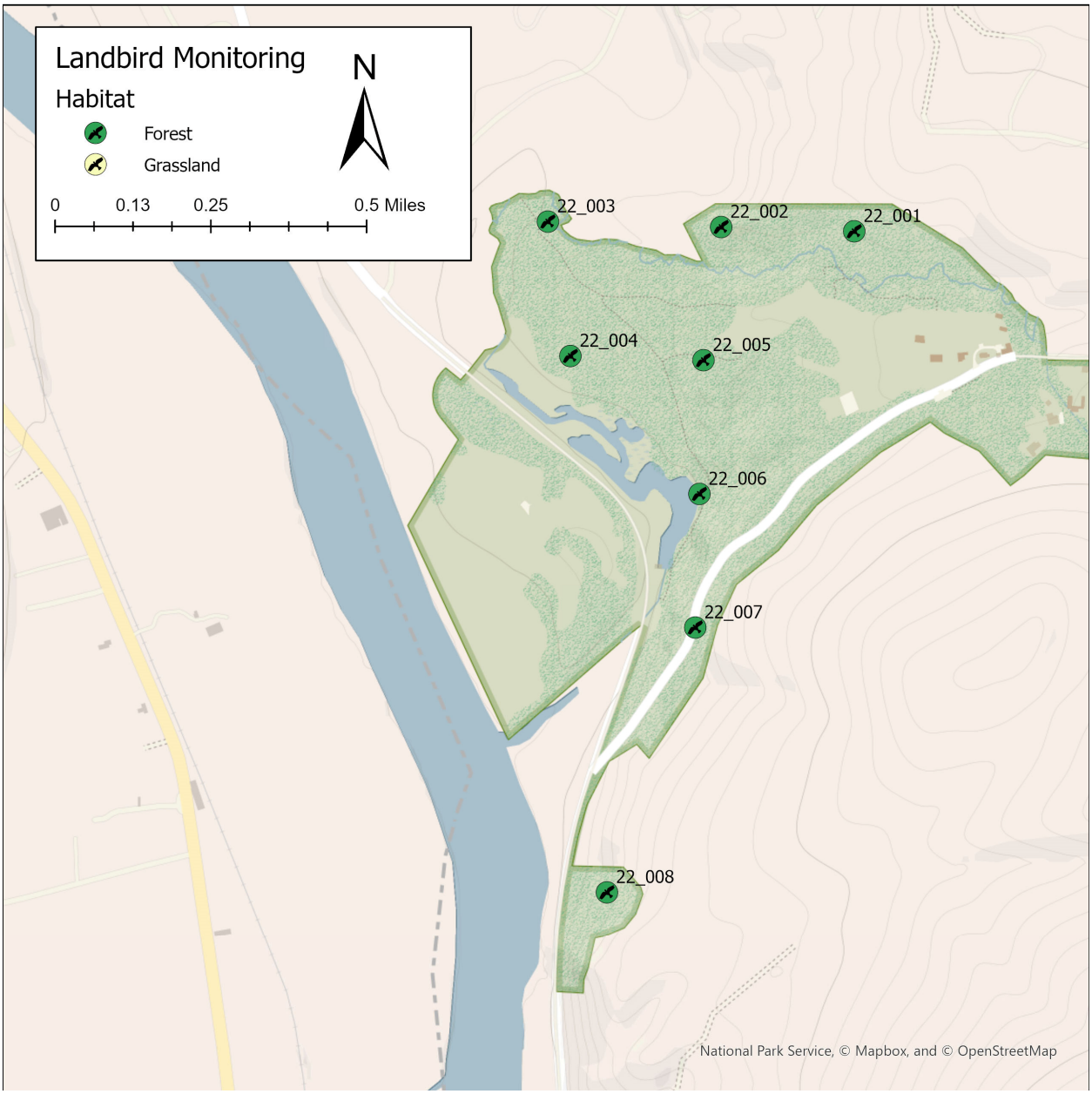

Figure S1.A18. Aerial image of routes in Saint-Gaudens National Historical Park (SAGA) showing active forest breeding bird (green) monitoring locations.

Figure S1.A19. Aerial image of routes in Saugus Iron Works National Historic Site (SAIR) showing active forest breeding bird (green) monitoring locations.

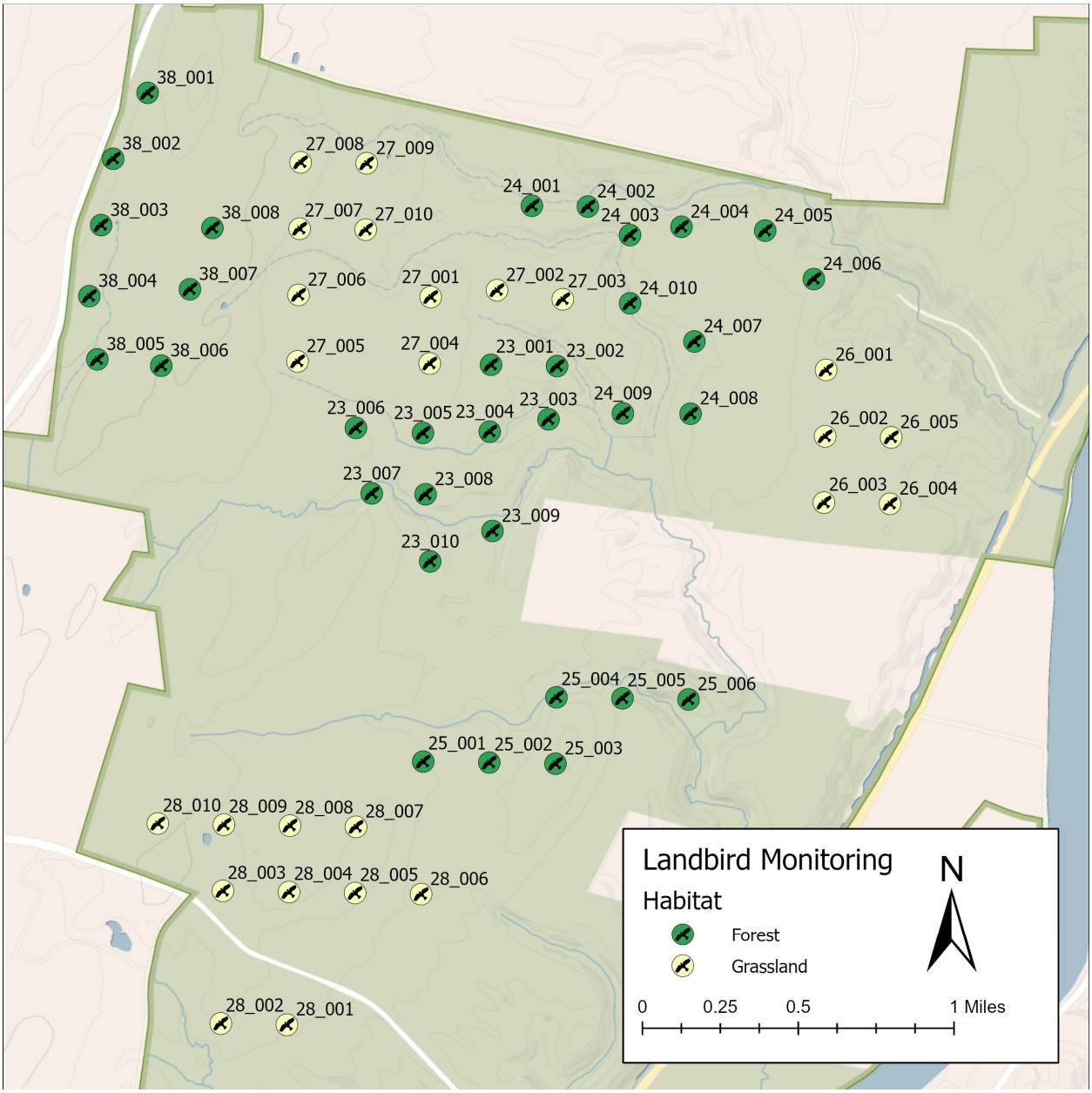

Figure S1.A20. Aerial image of routes in Saratoga National Historical Park (SARA) showing active forest breeding bird (green) monitoring locations and grassland (yellow) monitoring locations.

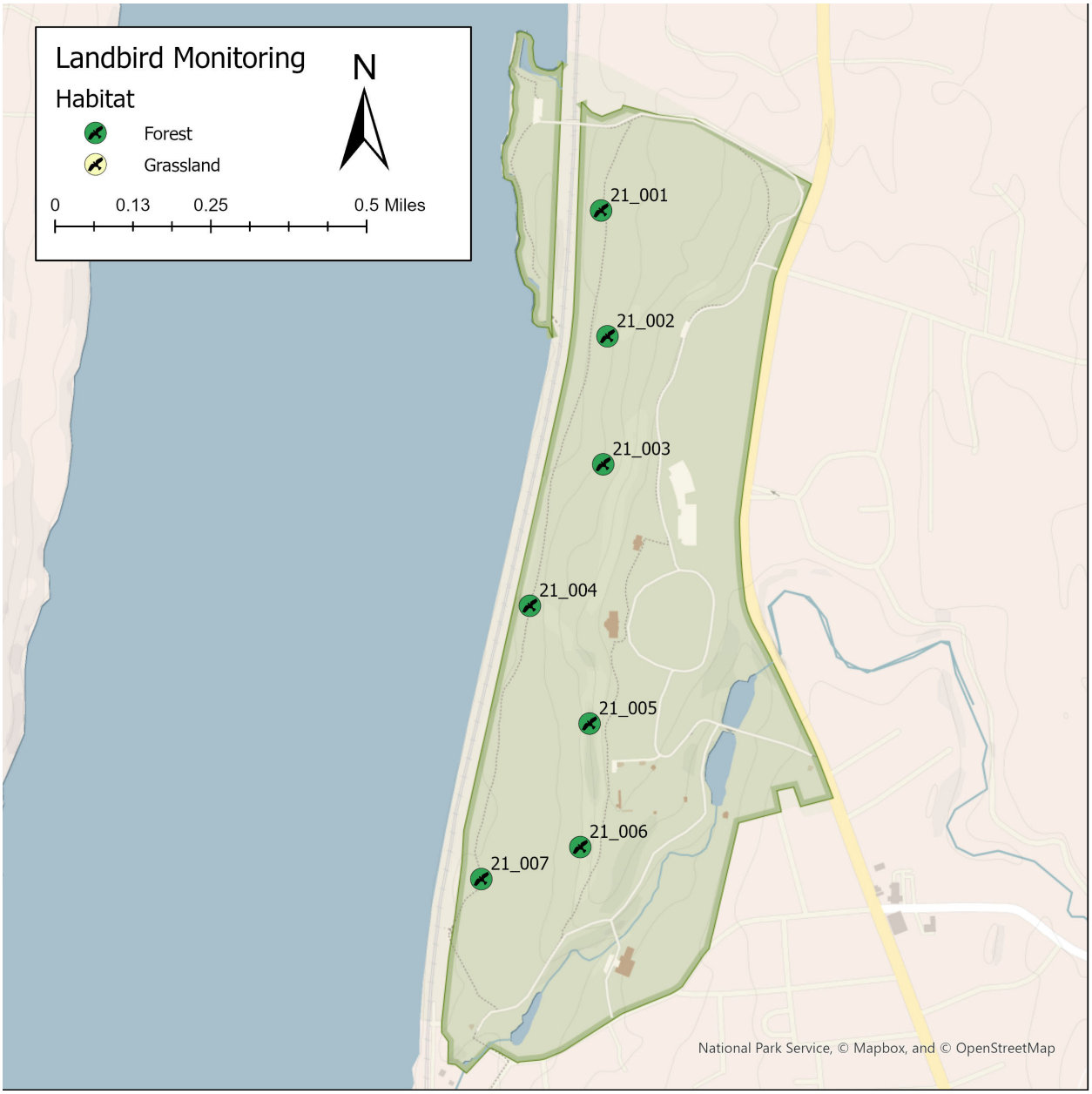

Figure S1.A21. Aerial image of routes in Vanderbilt Mansion National Historic Site (VAMA) showing active forest breeding bird (green) monitoring locations.

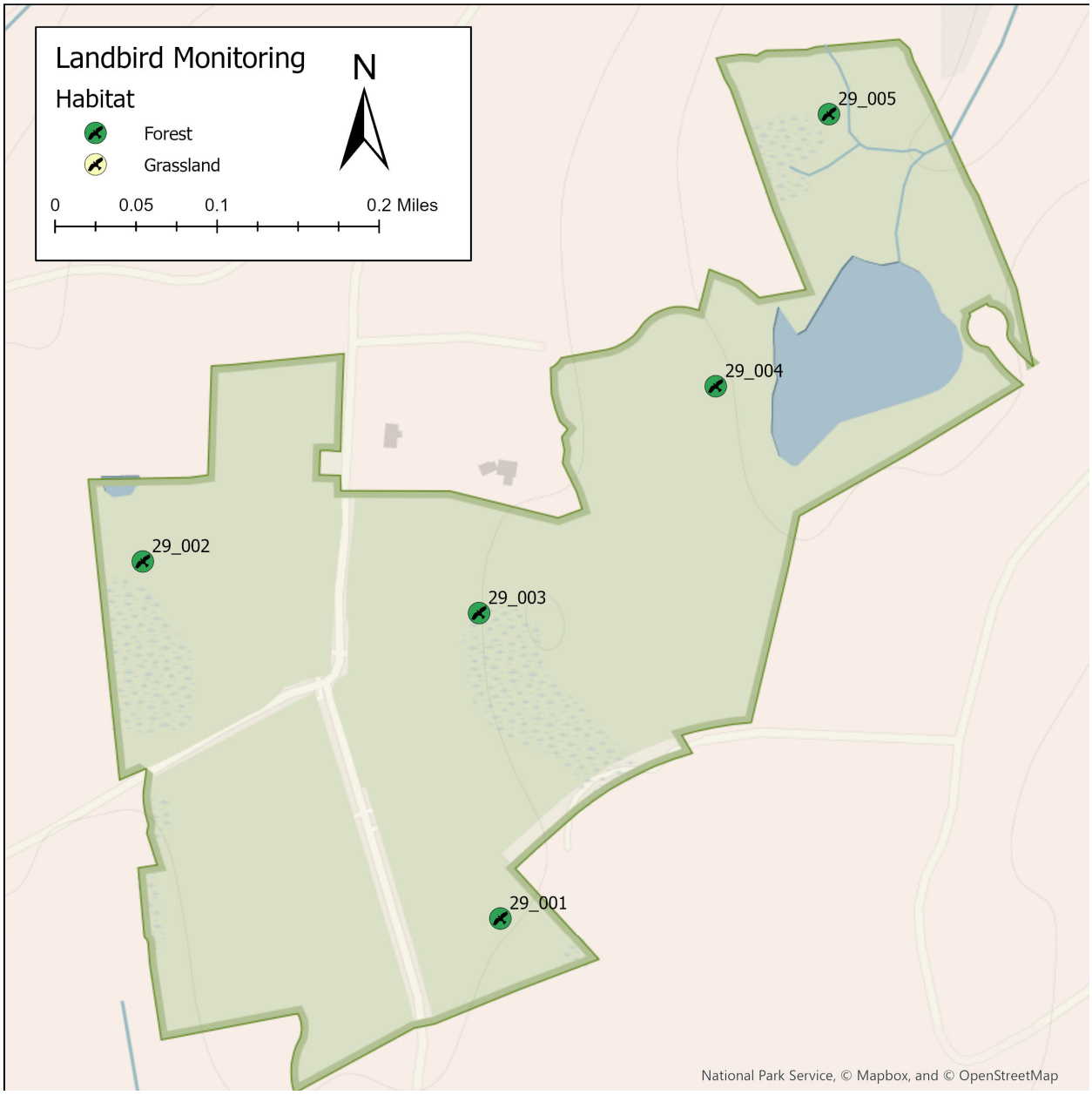

Figure S1.A22. Aerial image of routes in Weir Farm National Historic Site (WEFA) showing active forest breeding bird (green) monitoring locations.

Revision History

Version numbers will be incremented by a whole number (e.g., Version 1.30 to 2.00) when a change is made that significantly affects requirements or procedures. Version numbers will be incremented by decimals (e.g., Version 1.06 to Version 1.07) when there are minor modifications that do not affect requirements or procedures included in the protocol. Add rows as needed for each change or set of changes tied to an updated version number.

Revision History Log

Version #	Date	Revised by	Changes	Justification
1.00	September 2023	Aaron Weed, Adam Kozlowski, Mark Johnson, Ed Sharron	Updated SOP from the 2015 protocol.	

SOP 2 - Field Season Preparation and Annual Roles and Responsibilities

Mid-Atlantic, Northeast Coastal and Barrier, and Northeast Temperate Network's Long-Term Breeding Landbird Monitoring Protocol

Version 1.00

Overview

This document describes the planning, coordination, training, and equipment preparations to be completed prior to the field season (before mid-May each calendar year), as well as the year end annual review process.

Planning and Coordination Prior to Field Season

Preparations for the field season require a group effort shared amongst Inventory and Monitoring Division staff (IMD), Park Natural Resource Managers (NRM), and volunteers. Prior to the field season, typically in March or April, the IMD network's bird volunteer coordinator will contact Park NRM staff to coordinate volunteer observers, determine equipment needs, and set a date for volunteer training. The bird volunteer coordinator will cover coordination activities for Parks that lack capacity to do so. The table below outlines the roles and responsibilities for field season preparation and implementation.

Table S2.1. Annual roles and responsibilities for the preparation and implementation of point count surveys. referred browse regeneration species.

Role	Responsibilities
Bird volunteer coordinator	Coordinates returning volunteers and recruits new volunteers as needed with assistance from Park NRM
	Coordinates with Park NRM staff and volunteers on all protocol implementation activities
	Maintains updated versions of all printed field materials and provides these and equipment to volunteers (see Field Materials and Equipment below)
	Updates and distributes the Volunteer Training Manual to volunteers
	Provides annual training to volunteers prior to the beginning of the field season (see Volunteer Training below)
	Provides protocol guidance and addresses feedback during the field season to volunteers
	Contact volunteers to determine if volunteers have been able to monitor their assigned study site(s).
	Provides safety instructions and updated park contact information to volunteers
	Oversees the return of completed data forms
	Performs or coordinates 100% verification of volunteer data
	Visit survey points and determine if the points need to be retagged/reflagged (where applicable)

Role	Responsibilities
Park Natural Resource Staff	Coordinates and attends volunteer training at park with Bird Volunteer Coordinator
	Coordinates volunteer sampling effort at park as needed
	Coordinates surveys with volunteers including establishing check-in and check-out procedures
	Notifies Park Law Enforcement Rangers of volunteer activities as appropriate
	Returns equipment and completed data sheets to Bird Volunteer Coordinator in a timely fashion
Volunteers	Attends annual training or attests to having completed training in the past
	Reviews Volunteer Training Manual
	Acquires materials and equipment needed for survey
	Coordinates with Park NRM or Bird Volunteer Coordinator to setup surveys
	Conducts point count surveys during peak breeding season
	Transcribes field survey data from mapping sheets to the online database or the bird data coding sheets
	Returns equipment and completed data sheets to Bird Volunteer Coordinator
Data Manager	Provides site data (GPS data and map products, etc) on request
	Updates the database taxonomy list prior to field season
	Advises on data and information management activities
	Coordinates field data entry and verification in the database
	Applies changes to protocol materials based on yearly protocol review
	Checks data for completeness and manages post data collection quality control procedures
Protocol Lead	Purchases field equipment as needed
	Reviews taxonomic changes prior to field season and provides to data manager
	Coordinates Annual Operational Review
	Coordinates Field Season Review
	Reviews and reconciles changes to protocol materials based on Year-end Reviews

Volunteer Training

Within one month prior to the beginning of the field season, the bird volunteer coordinator conducts training sessions for new and returning volunteers on protocol implementation. If new volunteers are recruited, the bird volunteer coordinator will conduct a full in depth training session. Otherwise, the bird volunteer coordinator or resource manager may conduct a refresher course depending on volunteer needs. It is important to coordinate with park NRM staff to determine each park's individual needs and gather feedback from volunteers to continuously improve training and protocol implementation. Recruitment and training of volunteers is outlined in Standard Operating Procedure 3: Volunteer Recruitment and Training.

Update Taxonomy and Species Codes

The IMD networks in the Northeast Region have adopted the taxonomy of the American Ornithological Society referred to as the Birds of North and Middle America Checklist (Chesser et al. 2022). All data collection and reporting of information will use this taxonomy. Accepted changes to taxonomy are summarized in annual supplements to the checklist which are published in a scientific journal (Ornithology) in July of each year. Subsequent to this publication, the network will also make annual updates to the protocol taxonomy. Updated taxonomy is available for download (*.csv) at http://checklist.aou.org/. Bird species names are recorded in the field and stored in the database as unique four-letter acronyms of the common name. These species codes are maintained by the Institute for Bird Populations, follow the taxonomy of the NACC, and are also updated annually. The codes are available for download (*.dbf) at https://www.birdpop.org/pages/birdSpeciesCodes.php. The protocol lead works with the data manager to update the species lookup table in the database using the two files mentioned above on an annual basis at the time of field season closeout and ensures changes are in place prior to the field season.

Field Materials and Equipment

At least one month prior to the field season, the bird volunteer coordinator will update and distribute the following to volunteer birders:

- Volunteer manual
- Field mapping cards and bird data coding sheets
- Any recently published program resource briefs, data summaries, or reports

Table S2.2. Field equipment for conducting point count monitoring.

Item	Number required
AOU bird species list	1
Binder	1 per crew member
Binoculars	1 (Not provided)
Compass or phone with compass app	1
Emergency contact list	1
Bird Data Coding Sheet	4 per point count
Field Mapping Card	4 per point count
First Aid Kit	1 (Not provided)
GPS Unit or GPS enabled phone	1
Map of point locations	1
Park map	1
Parking permit	Where applicable
Pens or pencils	Many
Safety Plan and Volunteer Manual	1
Stopwatch or phone with countdown timer	1

Year-end Reviews

Field Season Review

Following the end of the field season, the Protocol Lead will confer with NRM staff at each participating park to identify lessons learned in terms of operational efficiencies, logistical or technical challenges, unexpected field conditions, and safety issues. Based on these discussions, the SOPs are clarified or updated as needed to provide better guidance.

Annual Operational Review

Following each field season network staff will coordinate a review to discuss protocol implementation, any potential issues encountered during the season, and to discuss the state of the science of the protocol. Based on these discussions, the team documents any lessons learned and any changes to procedures or equipment required for future monitoring. Protocol documents are clarified or updated as needed as a result of this review.

Literature Cited

Chesser, R. T., S. M. Billerman, K. J. Burns, C. Cicero, J. L. Dunn, B. E. Hernández-Baños, R. A. Jimenez, A. W. Kratter, N. A. Mason, P.C. Rasmussen, J.V. Remsen, Jr., D. F. Stotz, and K. Winker (2022). Sixty-third supplement to the American Ornithological Society's Check-list of North American Birds. Ornithology 139:ukac020

Revision History

Version numbers will be incremented by a whole number (e.g., Version 1.30 to 2.00) when a change is made that significantly affects requirements or procedures. Version numbers will be incremented by decimals (e.g., Version 1.06 to Version 1.07) when there are minor modifications that do not affect requirements or procedures included in the protocol. Add rows as needed for each change or set of changes tied to an updated version number.

Revision History Log

Version #	Date	Revised by	Changes	Justification
1.00	September 2023	Aaron Weed, Adam Kozlowski, Mark Johnson, Ed Sharron	Updated SOP from the 2015 protocol.	

SOP 3 - Volunteer Recruitment and Training

Mid-Atlantic, Northeast Coastal and Barrier, and Northeast Temperate Network's Long-Term Breeding Landbird Monitoring Protocol

Version 1.00

Overview

This Standard Operating Procedure (SOP) outlines the procedures necessary for recruiting and training volunteers to collect data for the Region 1 landbird monitoring program.

Recruiting volunteers

This monitoring program relies on the recruitment of experienced birders by park Natural Resource Management (NRM) staff and the landbird monitoring coordinators for each participating network. Volunteers may be recruited from local birding clubs, Audubon Chapters, birding listservs, or simply by word of mouth.

Participating volunteers and field staff must meet the following requirements:

1. Ability to identify most Mid-Atlantic or Northeastern breeding birds by sight and sound (~3-5 years of experience)
2. Capable of hiking on varied terrain
3. Ability to navigate with a GPS, or compass and map (Training will be provided)
4. Ability to follow protocol procedures and fill out field forms legibly
5. Willingness to attend the protocol training seminar
6. Fill out NPS volunteer form

Training Sessions

In order to capture meaningful data, it is imperative it is collected in a consistent manner by highly-trained volunteers. To participate in the program, volunteers must already be skilled in breeding bird identification for the Eastern United States. Therefore, training sessions will not cover species identification. However, a list of species found in the park is provided to each volunteer to help familiarize themselves with the local bird community. The training session should cover the following:

- Overview of I&M program and purpose of breeding bird monitoring
- Safety (see Safety Plan)
- Point count methodology (see SOP 4)
- Capturing environmental conditions during a point count (see SOP 4)
- Recording data on the field mapping cards (see SOP 4)
- Proper transcription of data onto field data forms (see SOP 4)
- How to access the Volunteer Resource Manual

- Distance estimation (see Appendix B of the Volunteer Resource Manual)

Prior to the field season, the project lead and park resource managers will discuss the need for a training session. First-time volunteers must attend a full training session and, if possible, partner with an experienced volunteer to better acclimate to protocol procedures. A shortened version of the full training session can be conducted for volunteers that have participated in the past but may need a refresher on particular topics.

All volunteers, regardless of the training schedule, must review the Volunteer Resource Manual prior to the beginning of the field season. The manual covers program objectives, assumptions, and sampling procedures, and will re-enforce the lessons learned in previous training. Volunteers are encouraged to practice point count procedures and use the equipment at home prior to conducting surveys in the field.

Revision History

Version numbers will be incremented by a whole number (e.g., Version 1.30 to 2.00) when a change is made that significantly affects requirements or procedures. Version numbers will be incremented by decimals (e.g., Version 1.06 to Version 1.07) when there are minor modifications that do not affect requirements or procedures included in the protocol. Add rows as needed for each change or set of changes tied to an updated version number.

Revision History Log

Version #	Date	Revised by	Changes	Justification
1.00	September 2023	Aaron Weed, Adam Kozlowski, Mark Johnson, Ed Sharron	Updated SOP from the 2015 protocol.	

SOP 4 - Conducting Variable Circular Plot Point Counts

Mid-Atlantic, Northeast Coastal and Barrier, and Northeast Temperate Network's Long-Term Breeding Landbird Monitoring Protocol

Version 1.00

Overview

This SOP provides step-by-step instructions for conducting 10-minute variable circular plot point counts. For each bird observed, the time (countdown minute of the count), distance band (0-50 m, and > 50 m), and type (**A**udio or **V**isual) is recorded. The methodology outlined below is largely based on songbird monitoring protocols developed for the Lower Mississippi Valley Joint Venture, available at www.lmvjv.org/monitoring. In addition, the procedures described below are compatible with methods used by the Great Lakes Network (GLKN) (Gostomski et al. 2010) and the United States Fish and Wildlife Service (USFWS) in the Northeast and Midwest (Knutson et al. 2016).

Each volunteer observer receives a Volunteer Training Manual (available for download on the NPS DataStore) outlining the point-count procedures in this SOP, as well as training methods for distance estimation.

The data collected during point counts (Table S4.1) is analyzed with two different methods (distance sampling and removal models), each of which is an independent approach to estimating abundance by correcting for the probability of detecting an individual. If this probability can accurately be estimated, (which can vary by habitat, observer, and other factors), the number of breeding landbirds that were NOT seen or heard during the point count can also be estimated, helping to derive a better estimate of abundance than would otherwise be possible. It is important for observers to understand the assumptions of these methods, and to work to meet these assumptions. Both approaches assume that breeding landbirds are correctly identified to species, and that each individual is recorded once. The distance sampling approach further assumes that all breeding landbirds at the center point are always detected, and that the correct distance band is recorded. The removal modeling approach assumes that the time recorded for the individual breeding landbird is the time it was first heard or seen, and works better with the simplifying assumption that observers are equally likely to hear a bird of a given species during every minute (in other words, the observer is just as likely to hear or see a Brown Creeper at minute one as they are at minute five).

Given these assumptions, all other data that are collected (e.g., type of detection, environmental variables) are secondary to the primary goals of getting accurate species identification, distance information, and time of first detection. If observers feel that they are unable to meet the assumptions of the distance sampling or the removal modeling approaches, they should provide a written comment with as much detail as possible when they submit their data forms. This is a tremendous help to the data analysis phase of the project.

Table S4.1. Description of variables recorded at point count stations during breeding landbird monitoring.

Variable	Description
Park	Name of park where point is located
Route	Name of route (if applicable)
Point	Number of point count station
Observer	Name of observer conducting the survey
Recorder	Name of recorder if different from primary observer
Date	MM/DD/YYYY
Air Temp ˚F	Temperature in degrees Fahrenheit
Sky	Sky condition code (see Table S4.3)
Wind	Wind speed code from Beaufort scale (see Table S4.2)
Noise	Noise condition code (See Table S4.4)
Start Time	Time of day; 2400 hour clock (e.g., 0732)
Species	Species of breeding landbirds[2] observed
Time Interval	Minute during which a species was observed
Detection Type	Type of observation (e.g., visual or auditory detection)
Distance Band	Distance category from observer that a species was detected within
Notes	Notes and specific remarks about the count or a specific observation

Survey Procedures

Count Conditions. Counts should be conducted between sunrise and 5 hours after which is when birds are most active and vocal, and during proper survey conditions. We recommend a 0500 hrs start time. Winds should be calm to light (< 12 mph; Code 3 or less on the Beaufort Scale, Table S4.2). Acceptable weather conditions for counting breeding landbirds include a sky condition of 0, 1, or 2; Table S4.3). Clear conditions or slightly damp is ideal. Counts should not be conducted in rain unless it is very light. The rule is to conduct surveys only in weather that is unlikely to reduce count numbers. Generally, the calmer and clearer the weather, the better the count. It is advisable to check the forecast the night before the survey and plan accordingly. Ambient noise levels should be at 2 or less during the survey period (Table S4.4). If noise levels of 3 or 4 occur during a count (e.g., a loud jet passes overhead, or loud vehicle noise) and more than 2 minutes of the count is affected, the count is invalidated, and the observer must start over after the noise level returns to an acceptable level.

Prior to the first point count, fill in the site name, date, and observer/recorder name on the field mapping card (Figure S4.1). Then, upon arriving at each point count station, record the station number, wind speed (Table S4.2), sky conditions (Table S4.3), and temperature (degrees Fahrenheit). Prior to beginning the count, orient the field mapping card (Figure S4.1) to a fixed direction and record the start time. At the conclusion of the count, fill in the Noise blank (Table S4.4) with the number that best reflects conditions experienced during the count.

[2] For NETN parks, chipmunks and squirrels are also recorded.

Use Count-down Timer. Begin the count by starting a count-down timer (device or phone app) to keep track of time. Do NOT use a stopwatch. Set the timer for 10-minutes and verify that it counts towards zero when you start it.

Note: Although the data may be transcribed to coding sheets later, the field mapping card is the only true record of what was detected during the survey. Even during the rush of a busy point count survey, remember to record data clearly and in a firm hand. When filling out the mapping cards, make notations in a consistent manner and use the standardized codes as defined on the field forms (Figures S4.1 and S4.2).

Table S4.2. Code, descriptions, and requirements for wind conditions.

WIND	MPH
0 = Calm, smoke rises vertically	<1
1 = Light Air; rising smoke drifts	1-3
2 = Light Breeze; leaves rustle, can feel wind on face	4-7
3 = Gentle Breeze; leaves & twigs move	8-12
4 = Moderate Breeze; moves thin branches, raises loose paper*	13-18
5 = Stiff Breeze; trees sway*	19-24

**Postpone survey until better conditions.*

Table S4.3. Code, descriptions, and requirements for sky conditions.

SKY	
0 = clear or a few clouds	4 = fog, if deters detection*
1 = scattered to partly cloudy	5 = drizzle or light rain*
2 = broken clouds/overcast	6 = rain*
	7 = snow*

**Postpone survey until better conditions.*

Table S4.4. Code, descriptions, and requirements for noise conditions

NOISE	dB
0 = No background noise for majority of survey	<40
1 = Faint background noise for majority of survey	40-45
2 = Moderate background noise; difficulty hearing birds >100m away for majority of survey	45-50
3 = Loud background noise; difficulty hearing birds >50m away for >2 minutes*	50-60
4 = Intense background noise; difficulty hearing birds >25m away for >2 minutes*	>60

**Count is invalidated. Wait to see if you can restart the survey or return when conditions are more favorable.*

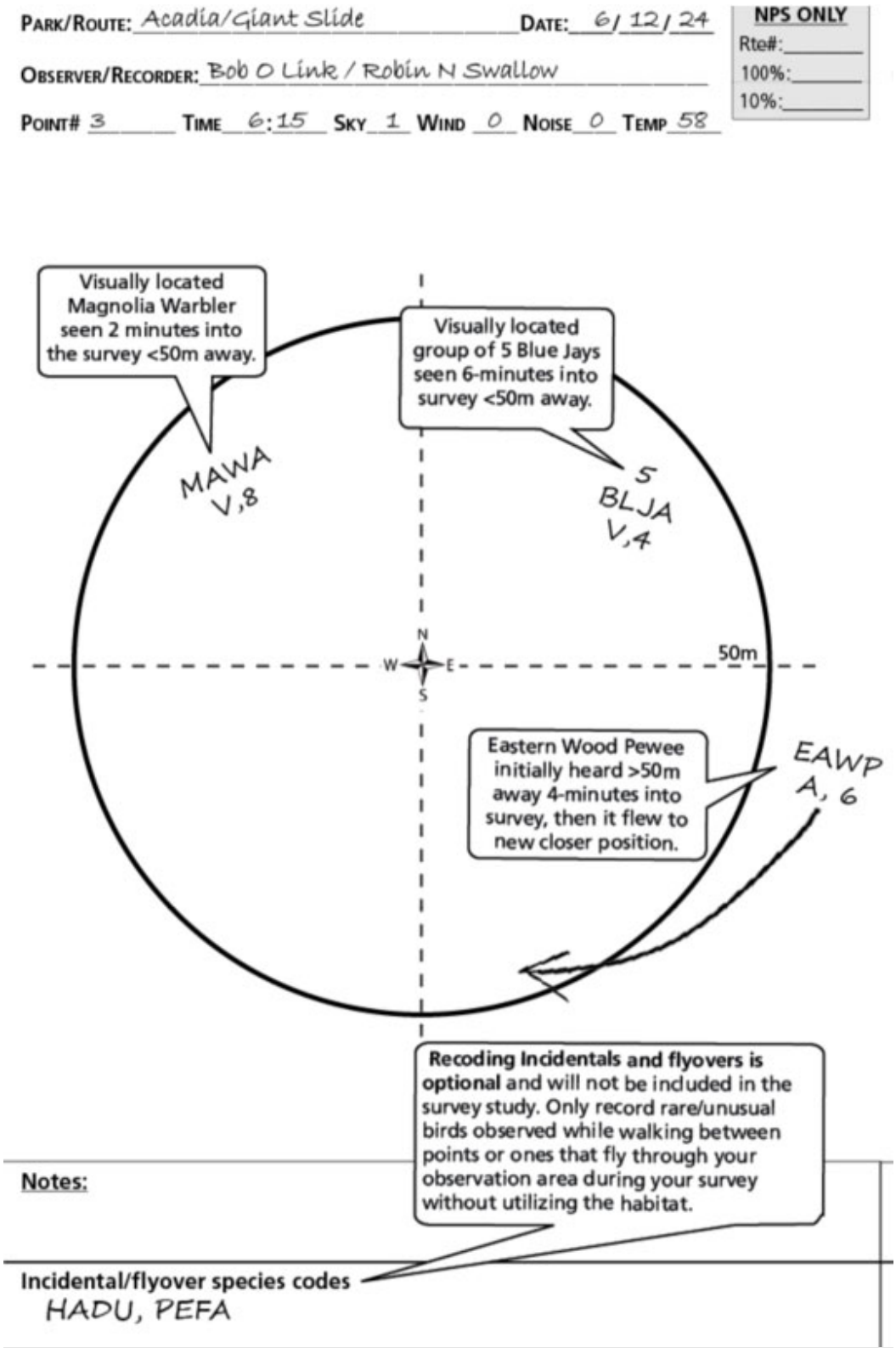

Figure S4.1. Example field mapping card, including standardized symbols used to record observations made while conducting point counts.

	=	Count of 1 (no need to note the "1" in this scenario)
CARW	=	Carolina Wren
A, 8	=	Aural detection at minute 8
2	=	Group of 2
AMGO	=	American Goldfinch
V, 4	=	Visual detection at minute 4
⟶	=	Perceived change in location

Figure S4.2. Notation instructions for the field mapping card.

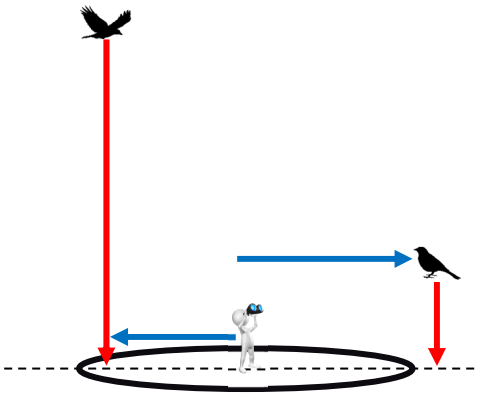

Figure S4.3. Measuring horizontal distances to birds.

Navigating to Point. Use Avenza maps or other app, a GPS, or paper map and compass to navigate to your points. If your Park marks your routes and points, please notify your Park contact or the volunteer coordinator if any of the markers are damaged or missing.

Count (record) All Birds. All birds of breeding age (excluding young of the the year), squirrels, and chipmunks (see box below) seen or heard during the 10-minute sampling period are counted and mapped (excepting "incidental" observations) on the NPS-issued field mapping card. Birds that fly

NETN Parks Only: Red squirrels, gray squirrels, and eastern chipmunks are effective nest predators. We monitor their populations with forest breeding birds. Follow the same recording procedures for these mammals as you would for birds, using the following four-letter codes:

RDSQ—red squirrel
EGSQ—Eastern gray squirrel
CHIP—Eastern chipmunk

through or over the point count station and that do not interact with the habitat in any way do not meet the assumptions of distance or removal models. For these birds, only record their species code in the bottom of the mapping card under Incidental Observations and Flyovers if the species have not been previously observed on the day of survey. These observations could be valuable for park species lists. For each individual detected, record on the field mapping card its four-letter species code. Below the code, record detection type (A or V) followed by the minute in which it was first encountered (i.e., 9 for birds encountered during the first minute counting down to 0 for encounters during the last minute of the 10-minute survey period). See Figure S4.1 for a sample field mapping card. Species codes follow the list published yearly by the Institute for Bird Populations (https://www.birdpop.org/). This list will be provided to volunteer observers by the monitoring coordinator. Remember that the crucial information is species identification, distance band, and time of first detection (in that order). If multiple individuals of the same species are detected at the same time and distance, use the notation in Figure S4.2.

Map Observations. Counting is done by mapping all observations (both visual and auditory) on the field mapping cards, keeping track of movements as best you can. Mapping (marking the location and noting movements) is the best way to reduce duplicate records. Mark individuals on the field mapping card in the appropriate distance band and approximate spatial location. The recorded distance should be the horizontal distance between the location a bird was first detected and the point count station center (See figure 3). Imagine dropping a plumb-bob down from a bird's location and estimating its distance from the point count station center. Use standard species codes to identify species observed.

- ***Orientation.*** Holding the field mapping card in a fixed position, spend part of the time facing in each of the cardinal directions to better detect birds.
- ***Count Individuals Once.*** Do not record any individual birds believed to have been counted earlier in the count or at previous stations. All individual birds should only be counted once.
- ***When to Stop.*** At the end of 10 minutes, stop mapping observations. Before leaving the point, check over the field mapping card thoroughly to make sure it is complete and legible. Remember, this is the only record of what happened during the survey. Take the time to clarify anything illegible or out of the ordinary.
- ***Incidental Observations.*** If the volunteer encounters bird species that may be of interest to the park after the official 10-minute survey or in between points, they can be recorded at the bottom of the mapping card under Incidental Observations and Flyovers.

Sampling Frequency. Each site should be sampled at least once during the breeding season, but one or two follow-up surveys within 2-weeks of the initial visit is encouraged. The exception to this is at NETN's three smallest parks (Saint-Gaudens NHP, Saugus Iron Works NHS, and Weir Farm NHS), which due to their small sizes can only accommodate a few point count stations.To reduce

between-year variability at these three parks, study sites are surveyed twice annually, with replicates occurring about 7-14 days apart. In order to reduce within-or between-site bias due to time of day, each study site is surveyed in the same order each time (e.g., the order in which point counts are surveyed is not altered).

Data Transcription.

a. **Preferred Option: Online Data Entry**. Volunteers who are willing to enter their data into an online database may do so upon completion of the required online security training. Upon request, volunteer coordinators will provide more information on the security training; SOP 5 Landbird Monitoring Database - User Guide also provides more detailed instructions.

b. **Alternative Option: Transcribe Field Mapping Cards to Bird Data Coding Sheet**. Data from the field mapping cards should be transcribed to data coding sheets if the data is going to be entered into the database by someone other than the person who collected the data. Field mapping cards should be transcribed in the order outlined in Figures S4.4 and S4.5). Data should be transcribed one section at a time working clockwise around the mapping card. Remember to only transcribe one record of an individual at the first time you saw or heard it. After completing each coding sheet, conduct a 100% check to look for transcription errors. If you need to correct information on the mapping card or data coding sheet (for example, you used the wrong bird code), draw a single line through the incorrect data and then enter the correct data next to the original data, along with your initials.

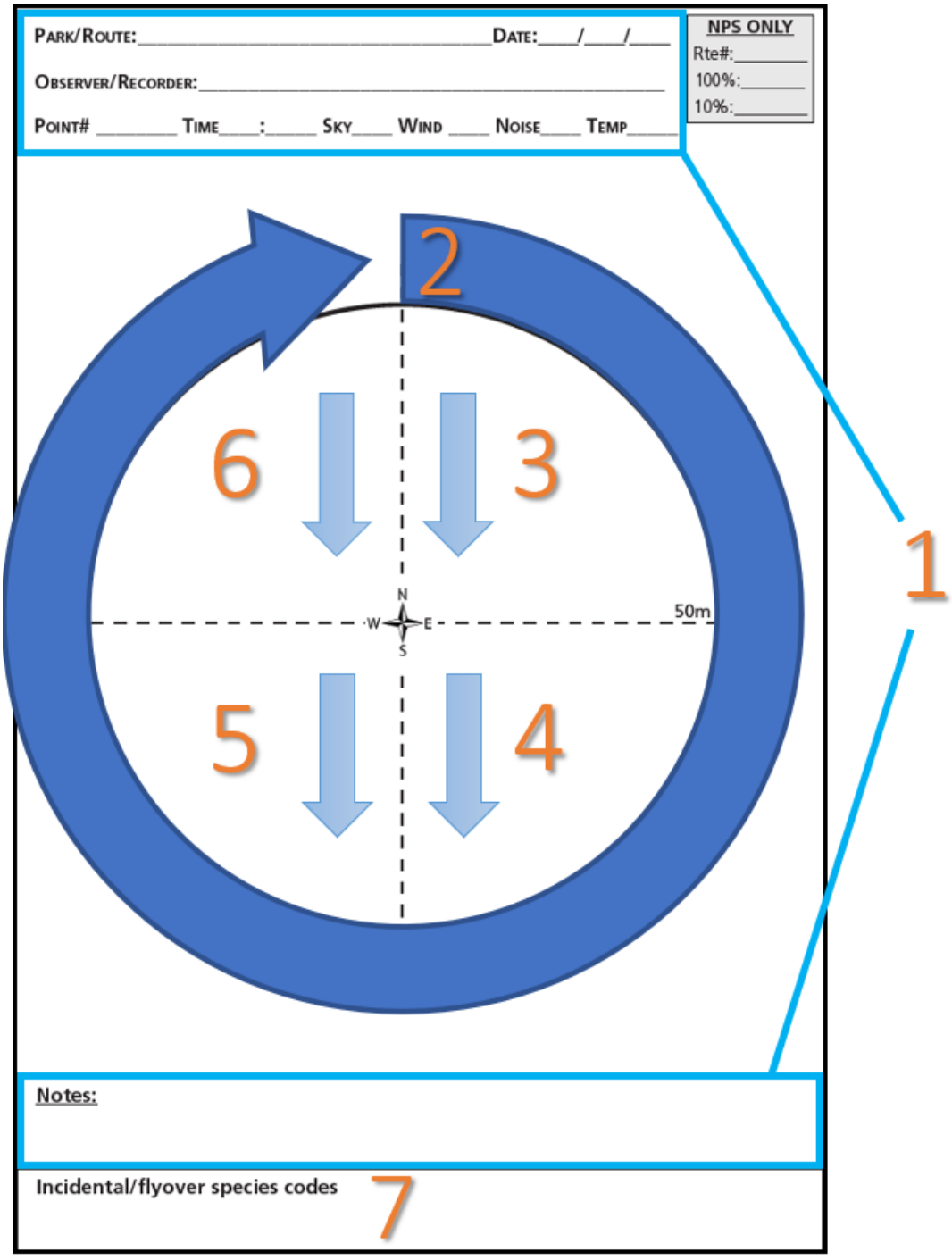

Figure S4.4. Order that bird data are transcribed from field mapping cards to the landbird database or bird data coding sheets. The event information and event comments are transcribed first (1). Next, all birds in the >50m distance band are transcribed in clockwise order (2, dark blue arrow). Birds within 0-50m distance band are transcribed by quadrant, starting with the upper right quadrant (3). Birds within each quadrant are transcribed top to bottom (light blue arrows). Incidental and flyover observations are transcribed last.

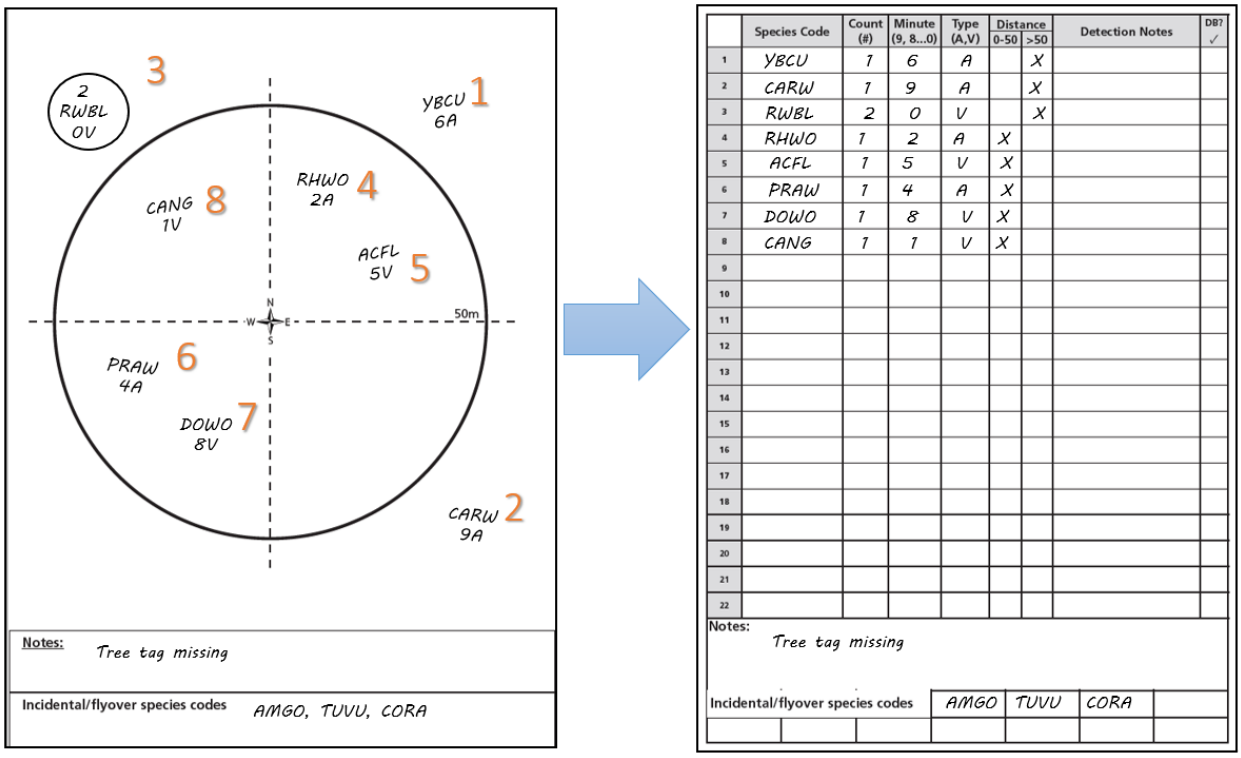

Figure S4.5. Example data transcription from field mapping card to bird data coding sheet.

2. ***Mail or Email Data.*** After data have been proofed, the original field mapping cards and the data coding sheets should be mailed to your bird volunteer coordinator. Data forms should be received by the local coordinator by August 15th.

Literature Cited

Gostomski, T., M. Knutson, N. P. Danz, B. Route, and T. W. Sutherland. 2010. Landbird monitoring protocol, Great Lakes Inventory and Monitoring Network. Natural Resource Report NPS/GLKN/NRR—2010/225. National Park Service, Fort Collins, Colorado

Knutson MG, O'Brien L, Sutherland TW, Carlyle KL, Herner-Thogmartin J., Carter L. 2016. National protocol framework for the inventory and monitoring of breeding landbirds using point counts. Version 2.0. Natural Resources Program Center, Fort Collins, CO.

Revision History

Version numbers will be incremented by a whole number (e.g., Version 1.30 to 2.00) when a change is made that significantly affects requirements or procedures. Version numbers will be incremented by decimals (e.g., Version 1.06 to Version 1.07) when there are minor modifications that do not affect requirements or procedures included in the protocol. Add rows as needed for each change or set of changes tied to an updated version number.

Revision History Log

Version #	Date	Revised by	Changes	Justification
1.00	September 2023	Aaron Weed, Adam Kozlowski, Mark Johnson, Ed Sharron	Updated SOP from the 2015 protocol.	

SOP 5 – Landbird Monitoring Database User Guide

Mid-Atlantic, Northeast Coastal and Barrier, and Northeast Temperate Network's Long-Term Breeding Landbird Monitoring Protocol
Version 1.00

Introduction and Background

Data collected under the Mid-Atlantic, Northeast Coastal and Barrier, and Northeast Temperate Network's Landbird Monitoring protocol must be entered, quality-checked, documented, managed, and made available to others for a variety of purposes, such as management decision-making, research, and education. To assit with these requirements, all landbird data collected under this protocol are stored and managed in a single, data management application managed and maintained by the National Park Service (NPS).

The landbird monitoring database is made of two components, a Microsoft .Net web-based front-end user interface and a SQL Server back-end database. The user-interface is accessed through the National Park Service's Integrated Resource Management Application (IRMA) by authorized users both inside and outside the NPS. The user interface consists of various standardized forms to help the user enter and validate data and reporting tools to help with QA/QC and data summarization. The back-end database consists of numerous lookup and data storage tables, which are linked to the front-end database.

This user guide was written to provide instruction on how to obtain access to and navigate within the database's online user-interface, properly enter bird observations, and review and edit existing observation records. Additional instruction is provided on database roles and responsibilities, data processing levels, and change tracking.

Accessing the Landbird Monitoring Database

The landbird monitoring database is accessed using a web-browser (currently supported are Microsoft Edge and Google Chrome) at the following address: https://irma.nps.gov/Region1/Landbirds/

NPS staff with access to the DOI network can be granted database access permision without any additional training. Non NPS users do not have access to the DOI network and are considered external users. These users must complete the steps outlined below to be granted database access. Once authorized and connected to the DOI network, upon entering the database you will see the Survey Event List allowing you to review existing bird monitoring events or add a new one.

If you are not an authorized user, attempts to enter the database will result in the user being redirected to the IRMA partner access registry and authorization service webpage. The following steps must be completed to provide unauthorized external users with login access to the landbird monitoring database.

Steps to be completed by the unauthorized external user:

1. Complete the required DOI Information Management and Technology (IMT) Awareness Training available at the following address: https://www.doi.gov/doitalent/training-download. Users must create an eDOIU account to access the training course above by going to this link: https://edoiu.doi.gov/login/index.php. Upon completion of the training, you will be prompted to print a completion certificate. This printed certificate must be provided to your volunteer bird coordinator who will send it to one of the database administrators (e.g., participating I&M network Data Managers) who then will grant you access to the database.

2. Upon completion of IMT training, users need to create a new external account using the IRMA Partner Access site at the following address: https://irma.nps.gov/PartnerSTS/Account/LogOn. NPS Partner Access requires the use of Login.gov. Users can use an existing Login.gov account, or create a new account by following the link on the page.

Steps to be completed by NPS staff with a database role of 'Administrator':

3. File the IMT training certificate in the NPS_IMD_Region1_Landbirds Team → Database channel → IMT Training Certificates folder.

4. Add the new user's account using the Landbird Monitoring database user interface.
    a. While connected to the DOI network, access the landbird monitoring database.
    b. Administration tab → Manage Users.
    c. Click the 'Add' button.
    d. In the 'Add New User' pop-up window, begin typing the new user's name into the 'User' field and use autocorrect to provide likely matches to select from.
    e. Complete the rest of the 'Add New User' form.
        i. Take special care to select the 'User Role' appropriate for the new user (see User Roles section below).

    Note: Most users outside the DOI (partners) should be enrolled as 'Park Data Entry' users. However, only the 'Protocol Lead' and 'Data Reader' user roles are enabled when a new user is created. 'Park Data Entry' user rolls can only be assigned to established users. In these cases, choose 'Data Reader' as a temporary user roll and proceed with steps below to edit it after saving.
    f. Save the new user entries.
    g. If you need to change the user roll to 'Park Data Entry':
        i. Locate the user you wish to edit under Administration tab → Manage Users.
        ii. Click the pencil icon ('Edit') to the left of the user's UserName.
        iii. In the 'Edit user' box toggle the 'User Role' to 'Park Data Entry'.
        iv. A 'Parks' dialog will appear. Proceed to sequentially add the parks the user will have permission to add data to.
        v. Click 'Save' to save changes and close the 'Edit User' box.

If access to the database is still denied after following the above instructions, please contact a database Administrator or Data Manager from a participating Inventory and Monitoring Network.

Database User Roles

Each database user is assigned a role. The role assigned to a user determines the extent to which that user can add, modify, delete, or validate data in the database. The user roles that can be assigned are (in order of increasing abilities):

- Data Reader: User who has access to view database records and run reports. Data readers are not able to add or edit database records.
- Park Data Entry: User who has access to add and edit database records for their assigned park(s). Non-assigned park records can be viewed, but not edited.
- Protocol Lead: User who can add, edit, and delete database records for all parks, as well as mark individual records' Data Processing Level (DPL) flags as 'Raw' or 'Provisional'.
- Administrator: Primarily for use by the backend database administrators to provide a user with full database access: add, edit, and delete database records for all parks; bulk update all DPL flags; add and remove users and edit their roles.

A full list of user abilities for each user role can be found in Appendix S5.1.

Database Navigation

A menu bar is located at the top of all pages in the database (Figure S5.1 and Figure S5.2). From the menu bar, users can add and edit data, as well as access QA checks, data summaries, and reports. For those with the roles of Data Reader, Park Data Entry, and Protocol Lead, the only items visible are the Home tab and the Reports tab (Figure S5.1). The roles of Administrator also have access to 'Survey Events Processing' and 'Administration' tabs (as seen in Figure S5.2).

Figure S5.1. Limited menu-bar available to Data Reader, Park Data Entry, and Protocol Lead user roles.

Figure S5.2. Full menu-bar available to the Administrator user role.

Home Tab

When the user clicks on the word/tab "Home", no matter what screen the user is on, it will take them back to the database's homepage and the Survey Event List. If the user hovers over the "Home" tab, a sub-tab appears that says "IRMA Portal" which will take the user back to main IRMA Portal page.

Reports Tab

The Reports page is used to access any available reports designed to summarize the contents of the database.

Survey Event Processing Tab (visible for Administrator user roll only)

The Survey Event Processing screen (Figure S5.3) is used by database administrators to update the Data Processing Level (DPL) flags on multiple records at once (i.e. bulk update). It can also be used to determine which survey locations for a particular time frame are still in the 'Raw' or 'Provisional' data state and need to be quality-checked and corrected.

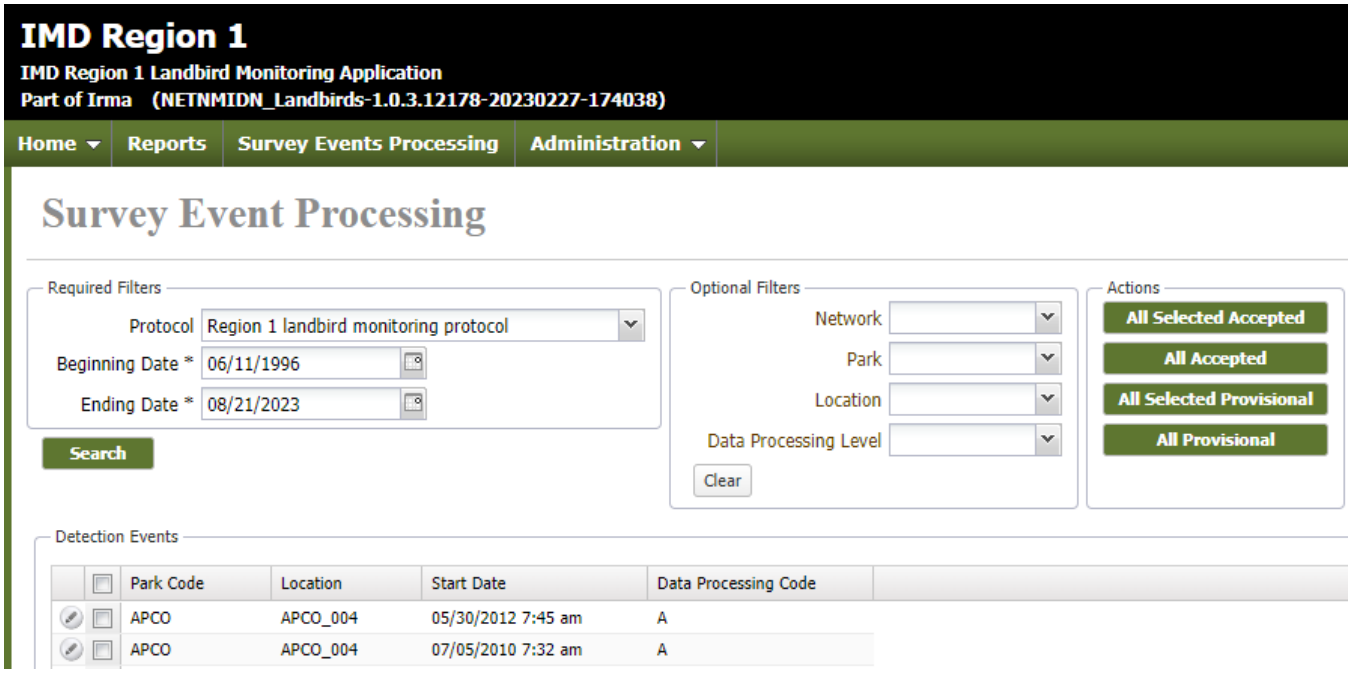

Figure S5.3. Survey Event Processing screen for reviewing and updating Data Processing Level (DPL) flags in bulk.

Administration Tab (visible for Administrator user roll only)

The Administration tab is used by database administrators to manage lookup lists, stored protocols, sites and locations, and database user roles and permissions.

Viewing / Entering / Editing Landbird Monitoring Data

To enter data from field datasheets, to continue editing existing records, or to view existing data, start on the 'homepage' of the database, which is the Survey Event List.

Parts of the Survey Event List Screen

Search Filters

The Search Filters section (Figure S5.4) of the Survey Event List screen is in the upper left-hand corner. No matter if you are doing data entry, data edits, or just looking at data, the Filters section is your greatest tool.

When the Survey Event List screen opens, it will automatically be filtered to show the "Region 1 Landbird Monitoring Protocol" data, as it is the default protocol of the database. If you are using a different protocol,

choose from the Protocol list for the correct choice. Currently, the two protocols in use are the "Region 1 Landbird Monitoring Protocol" and the "Region 1 QC Landbird Monitoring Protocol".

NOTE: Use the QC Landbird Monitoring Protocol when entering any surveys conducted for the purpose of testing the quality of the bird data (e.g. 2 observer/side-by-side surveys).

The filters available are:

- Protocol [mandatory; picklist] – Limits the events listed to the chosen protocol.
- Network [optional; picklist] – Limits the events listed to the chosen Inventory and Monitoring Network of choice and limits the Park Unit picklist to only Parks in the chosen network.
- Park Unit [optional; picklist] – Limits the events listed to the chosen Park Unit.
- Location [optional; picklist] – Limits the events listed to the Location chosen.
- DPL [optional; picklist] – Limits the events listed to the chosen Data Processing Level flag.
- Location (partial) [optional; textbox]– Type in any part of a bird survey location or transect that you are interested in looking at. For example, GETT_0" for all GETT survey points 001 to 099.
- Event year [optional; textbox]– Limits the events listed to the year enter.

To have the Survey Event List show items that match your filter selections, click on the "Search" button.

To remove an individual filter, just delete the contents in the specific filter box then click on the "Search" button to refresh.

To remove all filter selections, click the "Clear" button.

Survey Event List

The survey events list is the bottom portion of the homepage. Choices made in the Search Filters section will re-query the list to make it easier to find out if your survey is in the database or not. Figure S5.4 shows an example of how the filters modify what is in the listing.

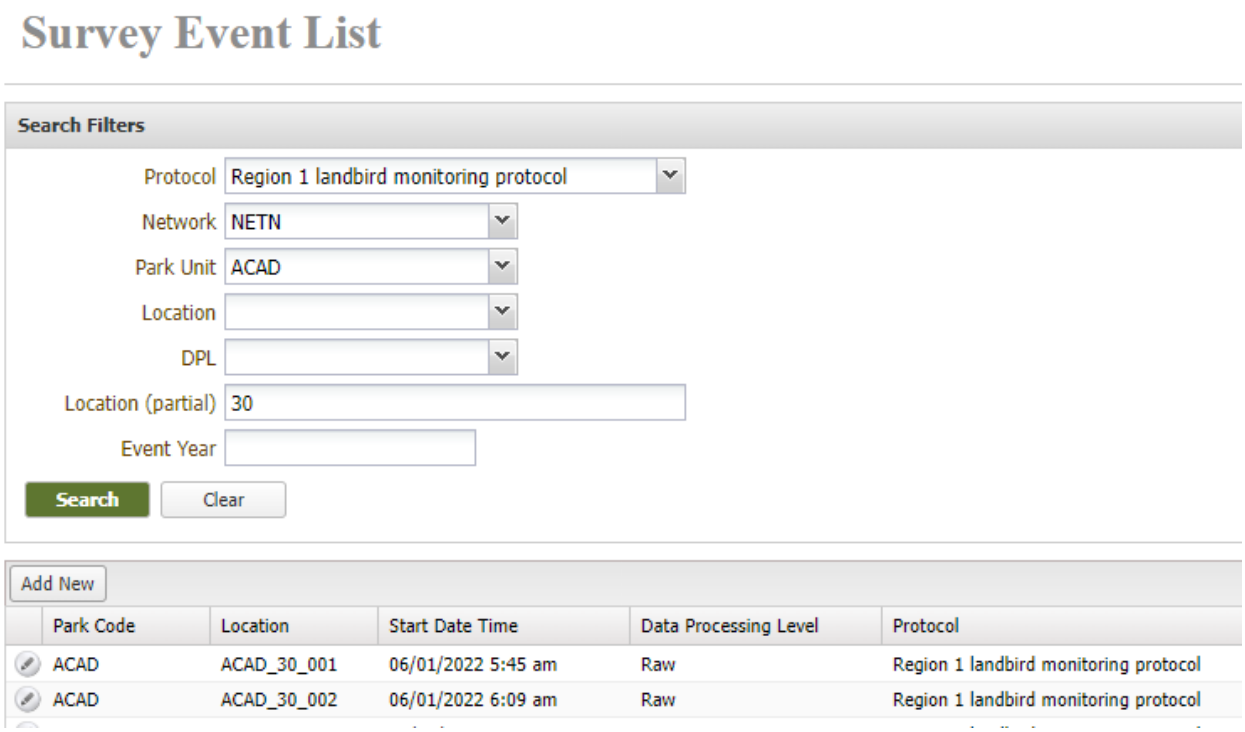

Figure S5.4. Example of the Survey Event List filtered by specific Network, Park, and Location (partial) values.

Viewing an Existing Event Record

To open an existing event, select the icon to the left of the event of interest's row. Figure S5.5 shows the 2 icon types available that will open records. The icon that looks like a "link" are records that can be open in read-only mode, while the icon that looks like a pencil are records that can be viewed and/or edited. Icon appearance is based on the user role.

Figure S5.5. Icons to open database records

To get back to the Survey Event List once done viewing, adding, or editing a record, the user can use the browser's back button or click on the "Home" tab.

Parts of a Survey Event Record

When a survey event record is open for viewing or editing, the Survey Event Details screen is displayed (Figure S5.6). Some parts of the user interface will be hidden based on the user role. The parts of the screen are:

- **Save Button** – to save changes made to the record.
- **Delete Button** – Only active for administrators.

- **Survey Event Details** – the top portion of the screen, which contains the point location and survey condition information.

- "**Mark Provisional**" and "**Mark Raw**" buttons – are for used to track the level of QAQC that has occurred for each survey event. These buttons are not used during initial data entry sessions. More information on DPL flags can be found in the 'Updating Data Processing Levels' section later in this manual and in SOP 6 Data Quality Control and Publication.

- **Bird Detection Tab** – first tab in the bottom portion of the screen. Lists out the specific bird detections that are associated with the event.

- **Audit Information Tab**– second tab in the bottom portion of the screen. Tracks revision history of the record.

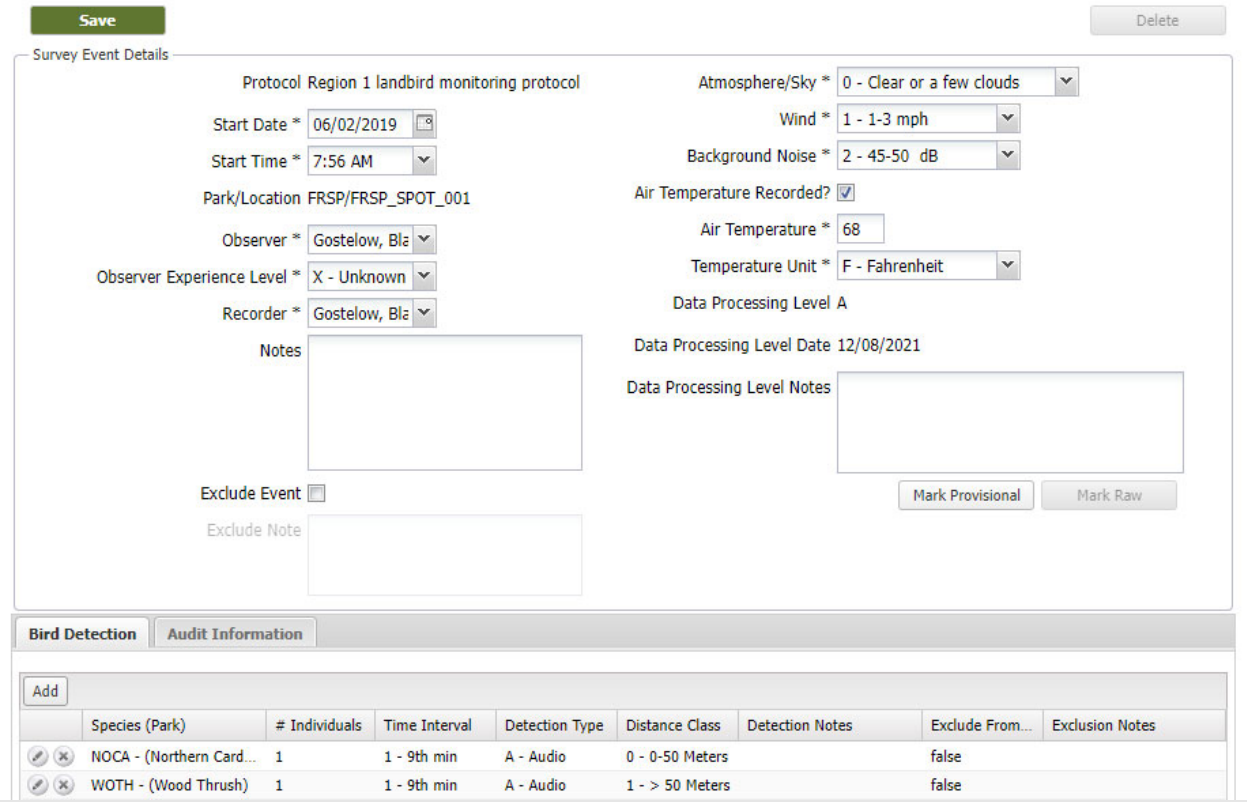

Figure S5. 6. Survey Event Details screen

Adding a New Survey Event Record

Instructions below walk through the steps of first entering the survey event details and then the bird detections associated with that survey.

Step 1: Preparing the data for transcription to the database

Observers entering their own observations will transcribe the data directly from their Field Mapping Cards into the database. NPS staff transcribing data to the database on behalf of an observer will enter their data from Bird Data Coding Sheets. If only Field Mapping Cards were turned in by the observer, NPS staff will

transcribe the data from the mapping card to the Bird Data Coding Sheet in the order described in Figure S5.7. For more information on paper field forms and required transcription steps, see SOP 4 Conducting Variable Circular Plot Point Counts.

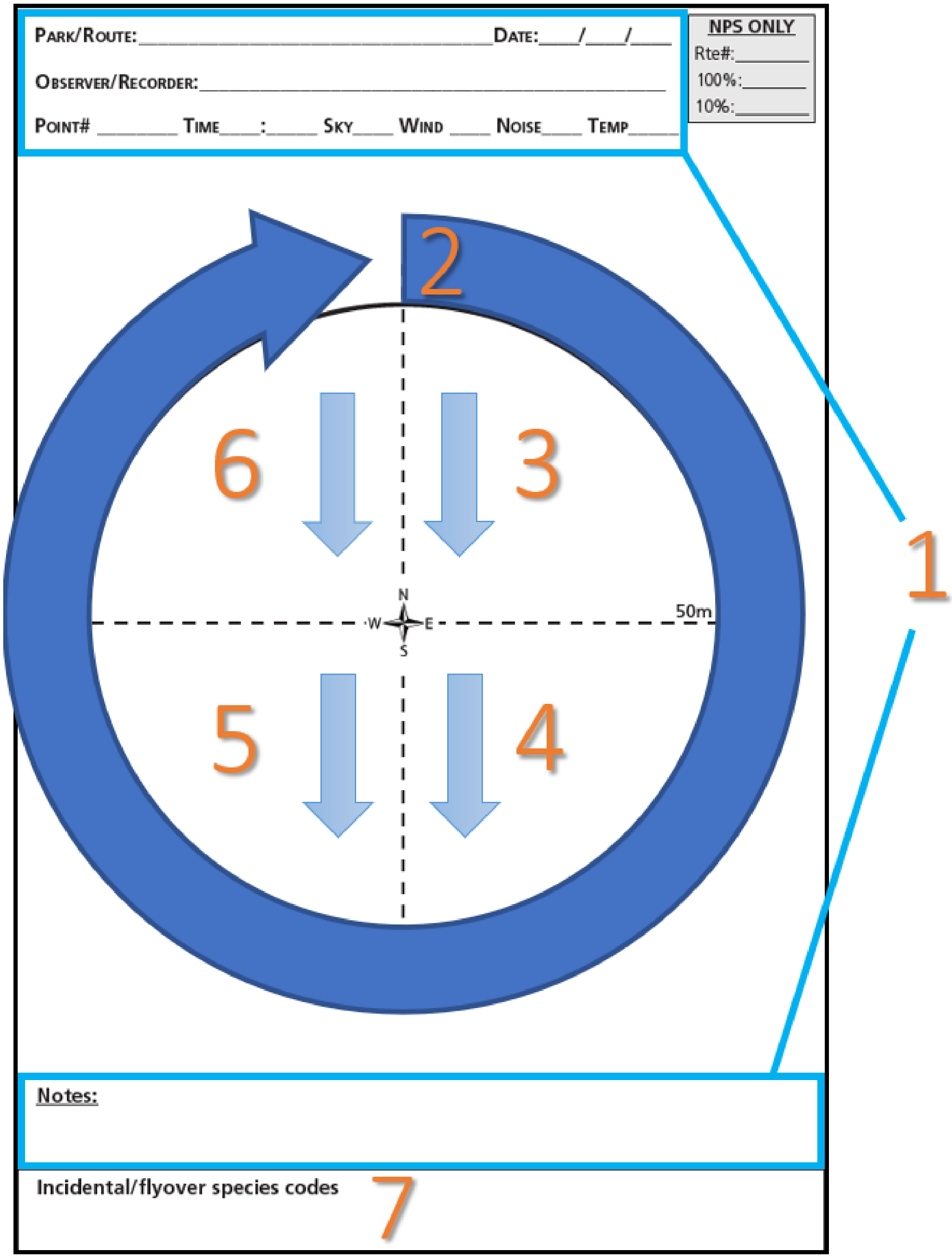

Figure S5.7. Order that bird data are transcribed from Field Mapping Cards to the landbird database or Bird Data Coding Sheets. The event information and event comments are transcribed first (1). Next, all birds in the >50m distance band are transcribed in clockwise order (2, dark blue arrow). Birds within 0-50m distance band are transcribed by quadrant, starting with the upper right quadrant (3). Birds within each quadrant are transcribed top to bottom (light blue arrows). Incidental and flyover observations are transcribed last.

Step 2: Starting a new event record

From the homepage, click on the "Add New" button between the search filters section and the survey events listing (Figure S5.4). Clicking 'Add New' will bring the user to the 'Survey Event Details' pop-up form (Figure S5.8).

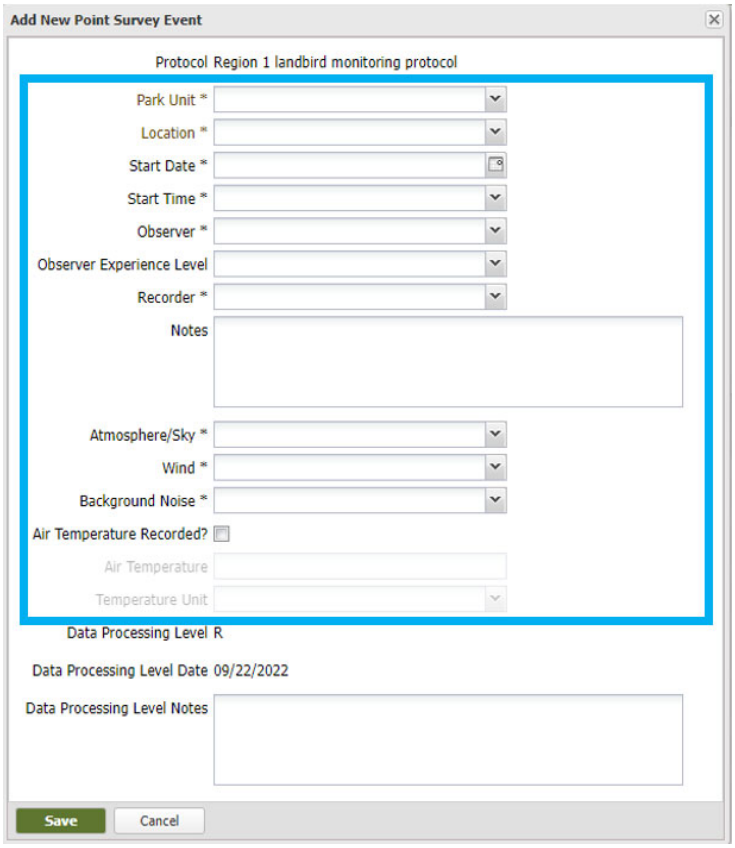

Figure S5.8. Screen for adding a new point survey event.

Step 3: Entering Survey Events

Use the "Add New Point Survey Event" pop-up screen to enter the survey event details from the paper datasheets. Figure S5.9 shows an example of a Field Mapping Card and corresponding Bird Data Coding Sheet for this protocol. Items outlined in blue in Figure S5.8 (Database - Survey Events) and Figure S5.9 (Datasheet – Survey Events) indicate corresponding sections data will be transcribed from the paper datasheets to the database.

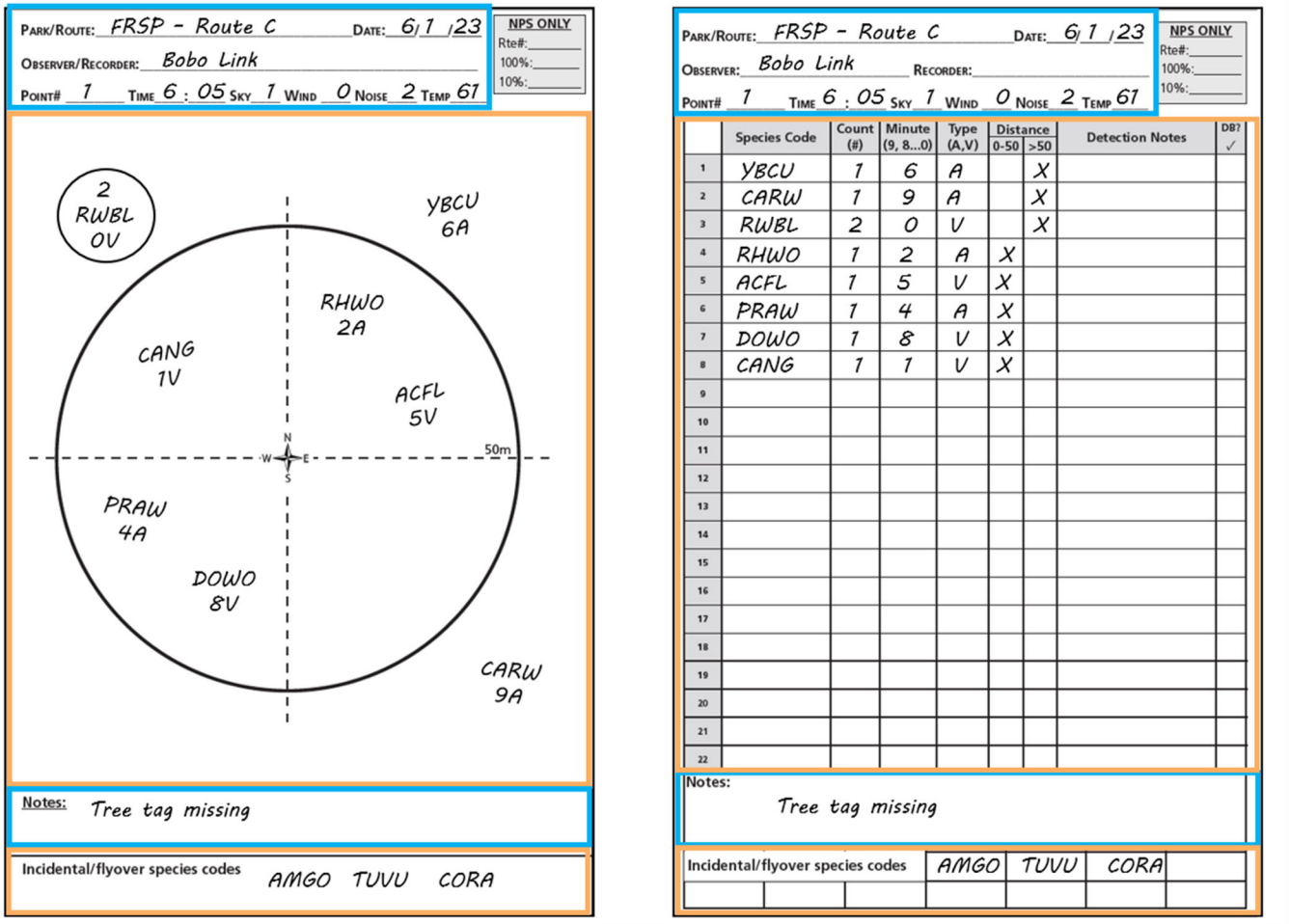

Figure S5.9. Landbird datasheet examples: Field Mapping Card (left) and Bird Data Coding Sheet (right). Fields outlined in blue indicate event level details. Fields outlined in orange indicate bird observation details.

Explanation of Survey Event level fields in the database:

a. **Park Unit**: What is the Park where the sampling occurred?

b. **Location**: What is the survey point / location? The location selection drop-list will just show locations within the selected park. If a location is not on the drop-list, see the *Troubleshooting* section of this manual for information on what to do.

c. **Start Date**: The date of the field survey. Type in the date, or choose the correct date from the calendar button, that corresponds to the date on the datasheet.

d. **Start Time**: The time of the field survey. Type in, or select from the drop-list, the correct start time that is indicated on the datasheet.

e. **Observer**: Who did the observations? This should be indicated on the datasheet. If the person is not on the drop-list, select "UNKNOWN" and see the *Troubleshooting* portion of this manual for information on what to do.

f. **Observer Experience Level**: Select default value of 'X-Unknown' from drop down.

g. **Recorder**: If not indicated on the datasheet, the recorder should be the same as the observer. If the person is not on the drop-list, select "UNKNOWN" and see the *Troubleshooting* portion of this manual for information on what to do.

h. **Notes:** Use this field to put down any notes the observer/recorder notated on the datasheet. This could be about noise, birds seen before or after the survey, etc. If there are notes regarding specific birds noted during the survey, place those notes in the bird detections (explained further down in the manual).

i. **Atmosphere/Sky**: Choose from the list the correct condition indicated on the datasheet. If it was not indicated, select "Y – NULL value".

j. **Wind**: Choose from the list the correct condition indicated on the datasheet. If it was not indicated, select "Y – NULL value".

k. **Background Noise**: Choose from the list the correct condition indicated on the datasheet. If it was not indicated, select "Y – NULL value".

l. **Air Temperature Recorded**: Was the temperature listed on the datasheet? If so, check the box. If not, leave the box empty.

m. **Air Temperature**: If you checked the box for 'Air Temperature Recorded' (as noted above), then this field will be available to fill in with the temperature recorded on the datasheet.

n. **Temperature Unit**: Defaults to Fahrenheit. If the temperature was recorded in Celsius, change this field to reflect the correct units.

o. **Data Processing Level**: All new data are Raw. Provisional (P) and Certified (C) data are those having undergone QA/QC, corrections, and finalization. This is a non-editable field in this form.

p. **Data Processing Level Date**: The date the Processing Level was given. This is a non-editable field in this form.

q. **Data Processing Note**: This field is used for any notes during the various processing steps for tracking and informational purposes. Primarily used during QAQC processes and data acceptance finalization.

r. **Exclude Event**: A checkbox flags records in the very rare case that a record is missing data or in some other way causes it to not be used in analytical capacity. Only visible and editable by database users with 'Administrator' rights.

s. **Exclude Note**: This field would capture any notes related to an excluded event. Only visible and editable by database users with 'Administrator' rights.

Once the fields have been filled in, click "Save" to move on to the bird detections. This will then open the "Survey Event Details" form (Figure S5.10).

If for some reason the data you entered is in error, click "Cancel" or use the ESC key on your keyboard.

Step 4. Entering Bird Detections

With the Survey Event Details screen open, edits can be made to the point location and survey condition information in the top section (see Figure S5.10, blue outline). The fields are the same that were described in Step 3. If changes are made, click on the "Save" button in the upper left corner of the screen.

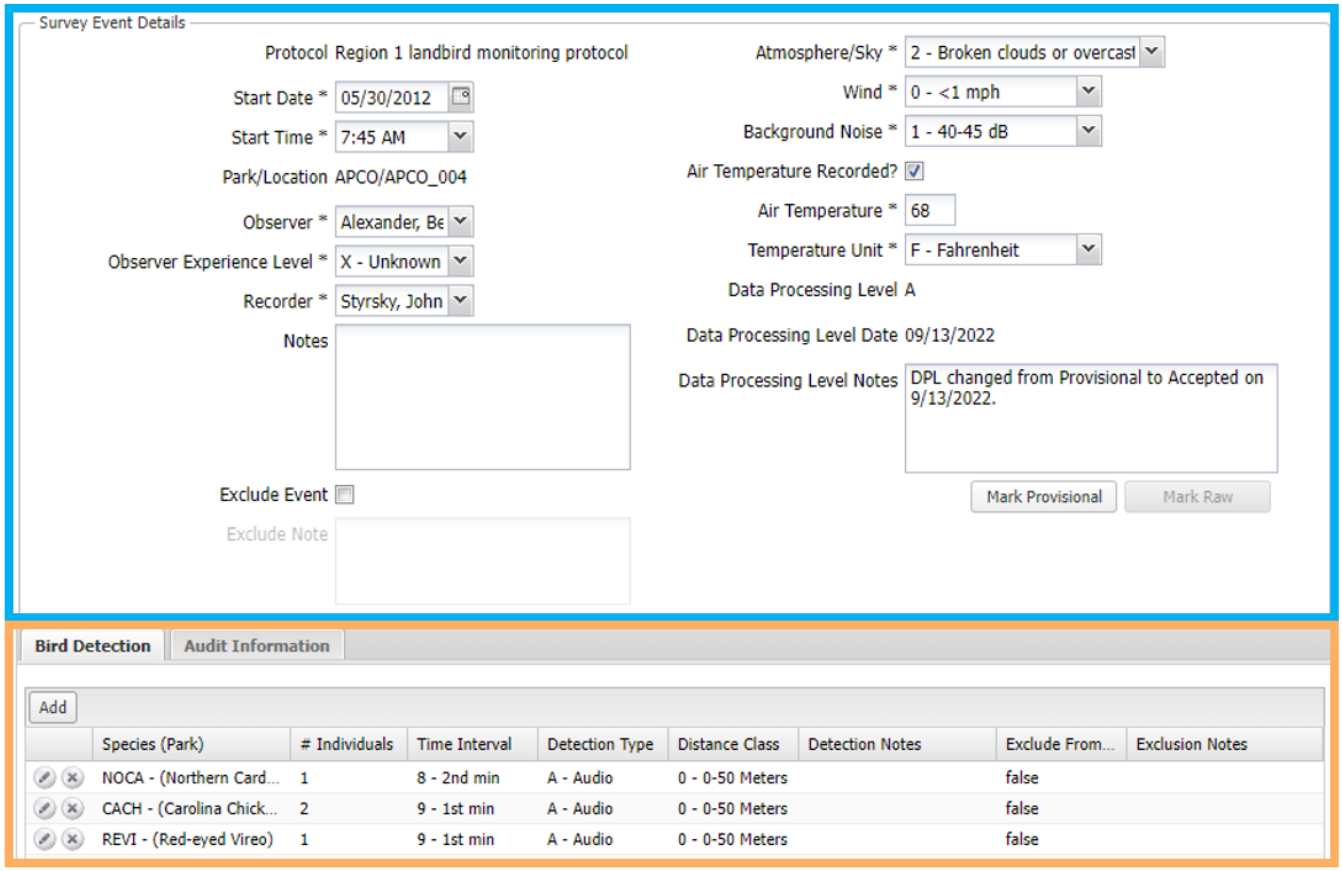

Figure S5.10. Survey Event Details screen

To start on the bird detections, add the species noted on the datasheet to the "Bird Detection" tab at the bottom of the screen (see Figure S5.10, orange outline). Create a new bird detection by clicking on the "Add" button under the "Bird Detections" header (Figure S5.11). Then fill-out the detection information (see Figure S5.12).

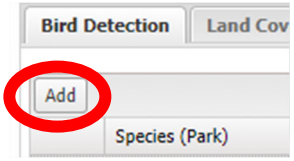

Figure S5.11. Bird Detections – Add Record Button

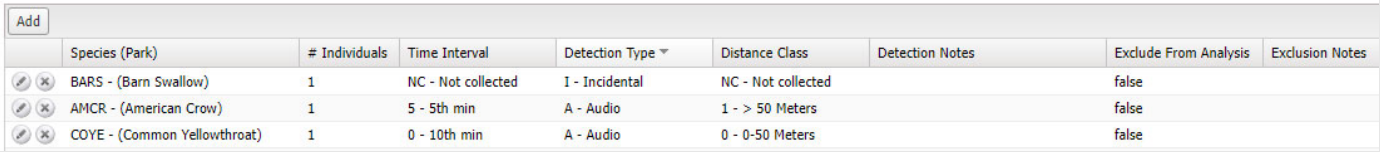

Figure S5.12. Bird Detections – Add / Edit Species Record

a. **Species**: Choose the species detected using the four-letter AOU code from the drop-list.

b. **Number of Individuals**: Enter the number of individuals of the bird species detected.

c. **Time Interval**: Select the correct time interval for the detection.

d. **Detection Type**: Select the correct detection type for the detection.

e. **Distance Class**: What distance range the detection was in.

f. **Detection Notes**: Enter any notes about the observation.

g. **Exclude From Analysis**: A checkbox that flags in the very rare case that it case that a record is missing data or in some other way causes it to not be used in analytical capacity. Only visible and editable by the Administrator role.

h. **Exclusion Notes**: This field would capture any notes related to an excluded observation. Only visible and editable by the Administrator role.

Incidental observations and flyovers require special attention during data entry because they are recorded in the field as simply a 4-letter species code (i.e. no time or distance collected). The following values should be used when recording Incidental observations and flyovers in the database:

- Number of Individuals: '1' (incidental observations are only used for species lists)
- Time Interval: 'NC' (not collected by protocol)
- Detection Type: 'I' (indicates incidental observation)
- Distance Class: 'NC' (not collected by protocol)
- Detection Notes: Can be populated or left empty.
- Exclude checkbox/notes: 'False'

To assist with data entry, you can use the tab key to move between fields. The down arrow key will open the picklist, pressing the arrows keys will navigate up and down the picklist. Tab or Enter will commit your choice. When data entry for the observation is complete, you can use the Enter key on the keyboard to save or use the 'Update' button on the bird detection data entry screen. Additionally, using Ctrl+SHIFT+N key combination will open a new bird observation row for editing.

If any required fields are not filled in, they will be outlined in red and the "Update" button will not be available.

If for some reason the data you entered is in error, click "Cancel" or use the ESC key on your keyboard to undo your work.

Step 5. Saving your work

Now that data have been entered, they should be saved. To save the record, click on the "Save" button in the upper left corner of the Survey Event Details screen . A record can be saved at any time during data entry, not just when you have completed the entire record. Try to save often to avoid losing any of your work.

You may exit an editing session by clicking on the "HOME" tab, using the back arrow on the browser, or closing your browser window. If you have unsaved changes, you will see a database warning prompt. Hit the Cancel button and save your work before exiting (Figure S5.13).

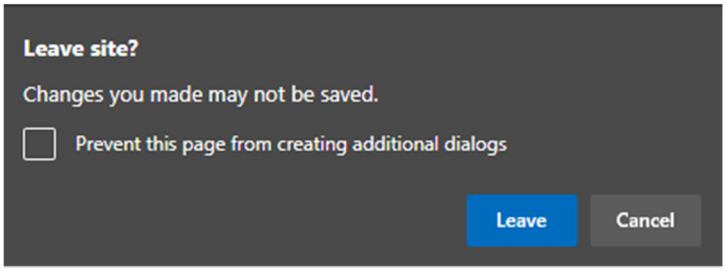

Figure S5.13. Unsaved Changes Message when leaving page

Editing a Record

Ability to edit survey event data is governed by a combination of a record's Data Processing Level (DPL) flag and the database role assigned to the user as outlind in Table S5.1. Note: DPL flags of 'Certified' records must be downgraded to 'Provisional' prior to allowing data edits by any user role. A list of full user permissions are covered in Appendix S5.1.

Table S5.1: Editability of a survey event based on its Data Processing Level (DPL) flag and the user's assigned database permissions role.

DPL Flag	Data Reader	Park Data Entry	Protocol Lead	Administrator
Raw	No edits	Can edit	Can edit	Can edit
Provisional	No edits	No edits	Can edit	Can edit
Certified	No edits	No edits	No edits	No edits

To edit a survey, it is recommended to first use the Filters section to help reduce the list of point surveys to choose from. Then select the desired record from the Survey Events List and click on the pencil icon to begin editing (see Figure S5.14). Reference Step 2 for section and field specifics.

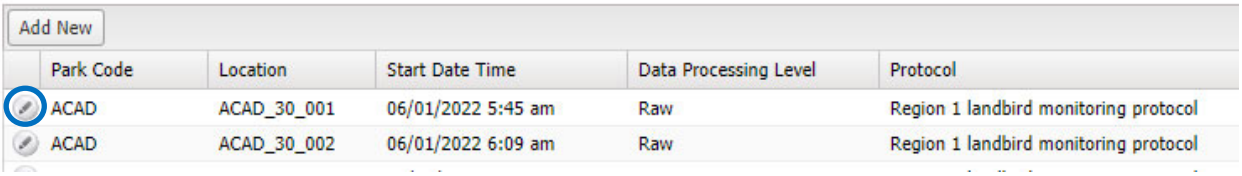

Figure S5.14. Survey event list. Edit Icon circled in blue.

To edit a specific bird observation in a survey record, the process is the same. Click the pencil icon on the row that needs to be revised (see Figure S5.15, blue circle). Reference Step 3 for section and field specifics.

Once changes have been made, make sure to save your changes.

Deleting a Record

Deleting Bird Detections within a Survey

Users with permissions other than Data Reader can remove specific bird detections in a survey if the Data Processing Level (DPL) is set to Raw. To do this, the user would click on the "Y" button (see Figure S5.15, red circle). For other DPL levels, editing capabilities vary by user role and DPL level and follow the matrix in Appendix S5.1.

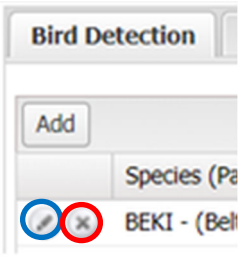

Figure S5.15. Icon placement within Bird Detection screen

Deleting Full Survey Records

Users with the roles of Protocol Lead or Administrator can delete a complete survey event record that is marked Raw or Provisional. Any survey events marked Certified must be downgraded to Provisional before any edits or deletions can occur. The role of Administrator is the only role who can downgrade the DPL level from Certified to Provisional.

Tracking Changes on a Record

Users with Protocol Lead or Administrator roles can view information regarding a record's creation and subsequent edits via the Audit Information tab in the bottom section of the "Survey Event Details" screen of a specific record.

Updating Data Processing Levels

Data Processing Level (DPL) flags are used in the database to identify the extent to which the QA/QC procedures, as defined in the protocol's Quality Assurance Plan (QAP), have been completed for each survey event. Upon data entry (record creation), each survey event is automatically assigned an initial DPL of

"Raw". As subsequent, designated QA/QC steps are completed for a survey event, NPS staff are required to upgrade the DPL flag for a survey event as follows:

- The DPL flag for a survey event is manually upgraded to "Provisional" upon successful completion of the corresponding data verification steps detailed in SOP 6 Data Quality Control and Publication.
- The DPL flag for a survey event is manually updated to "Certified" upon successful completion of the corresponding data validation steps detailed in SOP 6 Data Quality Control and Publication.

Updating DPL flags is the responsibility of protocol staff with database roles of either 'Protocol Lead' or 'Adminstrator'. Depending on the user's role, DPL flags can either be edited one event at a time by following instructions in the 'Editing a Record' section above – or- managed as bulk updates via the landbird database's 'Survey Event Processing' tab. Only database 'Administrator' roles have access to the bulk update tool.

Troubleshooting

Missing Survey Location

If a survey location is not present on the drop-down list, inform the network's landbird monitoring coordinator or database administrators. They will enter the information after confirming that the item is not on the list.

Missing Observer or Recorder Name

If an observer or recorder name is not present on the drop-down list, inform the network's landbird monitoring coordinator or database administrators. They will enter the information after confirming that the item is not on the list. It is possible that a person is on the list, but the datasheet might be misspelled, a nickname, or the person has changed their name.

In the meantime, use the name "UNKNOWN" for the unlisted person, write the name in that record's Notes section for later correction.

Species Missing on Park List

If a species is not present on the drop-down list, inform the network's landbird monitoring coordinator or database administrators. They will enter the information after confirming that the item is not on the list or does not have an updated name.

In the meantime, use the code "UNBI" for the unlisted species, write the species name or species code in that record's Notes section for later correction.

Data Errors

Incomplete Save

When doing data entry or edits, saving is a key component to getting the entered data committed into the database. An incomplete save happens when the commit cannot happen due to validation rules in the database. If an incomplete save occurs, the user will be notified by a pop-up messages and the fields that need to be completed will be marked in a red outline

Data entered into a field not matching pick-list options

There is a potential that data is entered into a field that does not have compatibility with the pick-list selections available. If this happens, the field will revert to a blank state. To fix, pick a selection in the picklist that applies. If none match what is on your datasheet, then inform the network's landbird monitoring coordinator or database administrators to address the issue.

Other Errors

There might be other errors besides those mentioned here. If an error occurs, please contact the database administrators. Try to include screen captures of error messages, information on what was being done (what was entered, clicked, etc.), and other relevant information.

Exiting the Database

Before exiting the database, please make sure you save your work! To exit the database, just close the web-browser tab or close the web-browser completely.

Database Contacts

This information is current as of the date of this document.

- MIDN, NCBN, NETN Landbird Monitoring Coordinators:
  Mark J. Johnson: mark_johnson@nps.gov
  Edmund Sharron: ed_sharron@nps.gov

- MIDN, NCBN, NETN Landbird Database Administrators:
  Mark J. Johnson: mark_johnson@nps.gov
  Adam Kozlowski: adam_kozlowski@nps.gov

Revision History

The following table lists the edits and amendments to this document. Version numbers will be incremented by a whole number (e.g., Version 1.30 to 2.00) when a change is made that significantly affects requirements or procedures. Version numbers will be incremented by decimals (e.g., Version 1.06 to Version 1.07) when there are minor modifications that do not affect requirements or procedures included in the protocol. Rows are added as needed for each change or set of changes tied to an updated version number.

Revision History Log

Version Number	Revision Date	Revised by	Description
1.0	10/01/2022	M. Johnson A. Kozlowski	Initial document on the instructions on the database – access, data entry, troubleshooting.

Appendix S5.1

Table S5.A1: List of user activities allowed by database role (data reader, park data entry, protocol lead, administrator). A'Y' indicates activity permitted, "N' indicates activity not allowed, other values define limits to permissions.

Functional Area	Activity	Data Reader	Park Data Entry	Protocol Lead	Administrator	Notes
Survey Event Details	View Survey Event Detail	Y	Y	Y	Y	i.e. ability to view a survey
Survey Event Details	Add Survey Event Detail	N	For assigned parks	Y	Y	i.e. ability to add a survey
Survey Event Details	Edit Survey Event Detail	N	Raw (for assigned parks)	Raw Provisional	Raw Provisional	i.e. ability to edit a survey; Admins can edit 'Certified' records only by downgrading them to 'Provisional' first.
Survey Event Details	Delete Survey Event Detail	N	Raw (for assigned parks)	Raw Provisional	Raw Provisional	i.e. ability to delete a survey; Admins can delete 'Certified' records only by downgrading them to 'Provisional' first.
Survey Event Details	View Survey Event Detail - DPL	Y	Y	Y	Y	i.e. ability to view survey DPL
Survey Event Details	Edit Survey Event Detail - DPL	N	N	Raw Provisional	Raw Provisional	i.e. ability to edit survey DPL; Admins can edit 'Certified' records only by downgrading them to 'Provisional' first.
Survey Event Details	View Survey Event Detail- DPL Notes	N	N	Y	Y	i.e. ability to view survey DPL notes
Survey Event Details	Edit Survey Event Detail- DPL Notes	N	N	Raw Provisional	Raw Provisional	i.e. ability to edit survey DPL notes; Admins can edit 'Certified' records only by downgrading them to 'Provisional' first.
Survey Event Details	View Event Exclusion fields Survey Event Detail	N	N	Raw Provisional Certified	Raw Provisional Certified	i.e. ability to view survey level exclusions
Survey Event Details	Edit Event Exclusion fields	N	N	Raw Provisional	Raw Provisional	i.e. ability to edit survey level exclusions; Admins can edit 'Certified' records only by downgrading them to 'Provisional' first.

Survey Event Details	Delete Event Exclusion fields	N	N	Raw Provisional	Raw Provisional	i.e. ability to delete survey level exclusions; Admins can delete 'Certified' records only by downgrading them to 'Provisional' first.
Bird Detection	View Bird Detection	Y	Y	Y	Y	
Bird Detection	Add Bird Detection	N	Raw (for assigned parks)	Raw Provisional	Raw Provisional	i.e. ability to add new bird detections; Admins can add detections to 'Certified' records only by downgrading them to 'Provisional' first.
Bird Detection	Edit Bird Detection	N	Raw (for assigned parks)	Raw Provisional	Raw Provisional	i.e. ability to edit existing bird detections; Admins can edit detections of 'Certified' records only by downgrading them to 'Provisional' first.
Bird Detection	Delete Bird Detection	N	Raw (for assigned parks)	Raw Provisional	Raw Provisional	i.e. ability to delete exisiting bird detections; Admins can delete detections in 'Certified' records only by downgrading them to 'Provisional' first.
Bird Detection	View Exclude Detection & Exclude reason fields	N	N	Y	Y	
Bird Detection	Edit Exclude Detection & Exclude reason fields	N	N	Raw Provisional	Raw Provisional	i.e. ability to edit dection level exclusions; Admins need to downgrade 'Certified' records to 'Provisional to change this field.
Bird Detection	Delete Exclude Detection & Exclude reason fields	N	N	Raw Provisional	Raw Provisional	i.e. ability to delete dection level exclusions; Admins need to downgrade 'Certified' records to 'Provisional to change this field.
Survey Event Details	Mark Raw Button	N	N	Provisional	Provisional	
Survey Event Details	Mark Provisional Button	N	N	Raw	Raw Certified	Note: Records can only be marked as 'Certified' by Admin role using Data Processing Tab (bulk updates)
Audit	View Audit Information	N	N	Y	Y	i.e. ledger of changes made to survey event invcluding detections
Survey Event Processing	Mark Selected Provisional	N	N	N	Raw Certified	i.e. bulk updates to DPL is allowed for Admin role only
Survey Event Processing	Mark All Provisional	N	N	N	Raw Certified	i.e. bulk updates to DPL is allowed for Admin role only

Survey Event Processing	Mark Selected Certified	N	N	N	Provisional	i.e. bulk updates to DPL is allowed for Admin role only
Survey Event Processing	Mark All Certified	N	N	N	Provisional	i.e. bulk updates to DPL is allowed for Admin role only

SOP 6 – Data Quality Control and Publication

Mid-Atlantic, Northeast Coastal and Barrier, and Northeast Temperate Network's Long-Term Breeding Landbird Monitoring Protocol
Version 1.00

Overview

This Standard Operating Procedure (SOP) describes the steps taken to ensure the quality, consistency, and security of the data managed by the Mid-Atlantic, Northeast Coastal and Barrier, and Northeast Temperate Network's Long-Term Breeding Landbird Monitoring Protocol. Data processing stages covered in this SOP include: collection, transcription, submission, verification, validation, certification, preservation, and publication. Data management responsibilities for completing these stages are divided between volunteer observers, the protocol's volunteer coordinator, and the network data manager. The roles and responsibilities detailed here are also presented in graphical form in Figures 1 through 3 at the end of this SOP. More information on data quality standards as they relate to protocol specific activities can be found in the Quality Assurance Plan (QAP) for this protocol.

Data Collection

Landbird point count data are collected on paper Field Mapping Cards by trained volunteers according to procedures described in SOP 4 - Conducting Variable Circular Plot Point Counts.

Data Transcription

As soon as feasible, data collected on paper datasheets are transcribed to a single, data management application (landbird monitoring database) managed and maintained by the National Park Service (NPS). The user-interface is accessed through the National Park Service's Integrated Resource Management Application (IRMA) by authorized users both inside and outside the NPS. The user interface consists of various standardized forms to help the user enter and validate data. Detailed instructions for accessing and using the database can be found in SOP 5 – Landbird Monitoring Database Users Guide. Methods of data transcription for this protocol are as follows:

a. **Preferred Option: Online Data Entry**. Volunteers bypass transcription of their data to paper Bird Data Coding Sheets and enter their data directly from their Field Mapping Cards into an online database. Detailed instructions for using the online database are provided in SOP 5 – Landbird Monitoring Database User Guide.

b. **Alternative Option: Transcribe Field Mapping Cards to Bird Data Coding Sheets**. Survey data from the Field Mapping Cards are transcribed to Bird Data Coding Sheets if the data is going to be entered into the database by someone other than the person who

collected the data. Detailed instructions for accurately transcribing data are provided in SOP 4 – Conducting Variable Circular Plot Point Counts.

After transcription (paper-to-database or paper-to-paper) is complete, the transcriber conducts a 100% review of their work. Any errors found will be corrected. To correct errors on paper datasheets (e.g., the wrong bird code), a single line is drawn through the incorrect data and the correct data entered next to it. All corrections will be signed with the corrector's initials.

Data Submission

Once the volunteer observer has completed transcription (paper-to-database or paper-to-paper) and completed their 100% review of their work, the original Field Mapping Cards and any Bird Data Coding Sheets are mailed to the Volunteer Coordinator within one month of field data collection.

Data Verification

After receiving the Field Mapping Cards and Bird Data Coding Sheets from the observer, the Volunteer Coordinator will initiate a 100% and a 10% verification of all transcribed data (paper-to-database and paper-to-paper). Data verification is a difficult but necessary task that may require close communication with the observers to resolve discrepancies.

Data verification requirements:

- 100% checks are defined as a full review of all site-level (e.g. route number, observer, time, weather, noise) and observation-level (e.g. species, count, detection type) data fields to verify accurate transcription between the original and all copies (paper-to-database and paper-to-paper).
- 10% checks are conducted after 100% checks have been completed and are defined as verification of a random selection of 10% of each observer's completed point counts (e.g. 2 point counts of 20); include the site- and observation-level data. This sampling strategy ensures at least some data from each observer is reviewed.
- 100% and 10% data checks are completed by different reviewers. In situations where this is not feasible, there should be at least a 24-hour separation between 100% and 10% checks conducted by the same person.
- Any corrections made to the datasheets are completed using the same correction methods described in the minimum data transcription requirements above (i.e. single cross-out and sign with initials). Corrections made in the database should be accompanied with notes where allowed. Note: The NPS Landbird database automatically maintains a change log. Database users with 'Protocol Lead' or 'Administrator' roles can view information regarding a record's creation and subsequent edits via the 'Audit Information' tab in the bottom section of the 'Survey Event Details' screen of a specific record.

- If an error is discovered at any point during the 10% check, an additional point count from the same observer will be randomly selected and reviewed. If an additional error is detected, another full 100% check of all the observer's data will be required.
- The Volunteer Coordinator will work with the observer to resolve any data conflicts identified during the 100% or 10% checks and provide additional guidance to prevent those errors from occurring in future surveys.
- If there is an unresolvable problem with the data that renders it unsuitable for use, either the observation or the entire survey will be flagged as 'Excluded' and the reason for exclusion recorded in the database. For example, this may occur when an observer is clearly inexperienced.
- Similar errors repeated across many observers may signify a problem with the protocol or datasheet and should be addressed as soon as possible in consultation with all Volunteer Coordinator's and Data Manager's participating in this protocol.
- Upon completing data verification, staff will sign the datasheet corresponding with the verification level they completed. A space is provided in the upper right corner of the Field Mapping Cards and Bird Data Coding Sheets for this purpose.

Data Validation

Upon completion of data verification, a cumulative, draft dataset is exported from the database as a .csv file and a series of scripted quality checks are run to check the completeness and logical consistency of the data. Table S6.1 outlines the standardized checks currently being run on the data. The Volunteer Coordinator compiles any questions or concerns discovered during data validation and works with the Volunteer Observers and network Data Manager to correct or annotate the data as needed. Survey data are considered certified when all data verification and validation steps have been completed (see below).

Data Certification

Data processing level (DPL) flags are used in the Landbird Monitoring Database to identify the extent to which the QA/QC procedures, as defined in the protocol's Quality Assurance Plan (QAP), have been completed for each survey event.

Data processing level flags and their meaning:

- **Raw:** Data collection for this point occurred following the Quality Assurance steps detailed in the QAP with variations being noted in the database. Initial data entry into the online database was completed for this event, but the transcription accuracy has not been verified (i.e. no 100% or 10% check).

- **Provisional:** Data collection for this point occurred following the Quality Assurance steps detailed in the QAP with variations being noted in the database. Online data entry was completed and fully verified as having been transcribed accurately (i.e. 100% and 10% transcription check).

- **Certified:** Data collection for this point occurred following the Quality Assurance steps detailed in the QAP with variations being noted in the database. Online data entry, data verification, and data validation steps were all completed as defined in this SOP.

Applying DPL's in the landbird database:
Data Processing flags are assigned at the survey event level (not individual bird observation level) in the landbird database. Upon data entry (record creation), each survey event is automatically assigned an initial DPL of "Raw". Upon successful completion of the data verification steps detailed in this SOP, each event's DPL is manually upgraded to "Provisional". Upon successful completion of the data validation steps detailed in this SOP, each event's DPL is manually updated to "Certified". Data Processing Levels can be edited one event at a time or as bulk updates via the landbird database's 'Survey Event Processing' tab. For more detailed instructions on updating DPL's please see SOP 5 – Landbirds Monitoring Database User Guide.

Data Preservation

Steps taken to protect physical and digital data assets for this protocol:

- Paper data forms: Original Field Mapping Cards and Bird Data Coding Sheets are scanned to PDF annually and filed on NPS DataStore upon completion of annual data certification activities (https://irma.nps.gov/DataStore/Reference/Profile/2190227). Following scanning, hardcopy datasheets are retained onsite by each network participating in this monitoring protocol.

- Landbird database: The transactional, NPS Landbird database used to store data for this protocol is maintained on a SQL server residing in a U.S. government accredited data center and is backed up daily.

- Landbird data package: Data packages containing machine readable datasets and XML metadata are generated and published from the database annually on NPS DataStore (see Data Publication section below). These data packages serve as the authoritative, public-facing version of the data.

Data Publication

Publishing breeding landbird data is a multi-step process consisting of exporting data in a standard format from the database, generating metadata, and publishing the final data package on DataStore.

Breeding landbird data package format, scope, and schedule:

- Data will be published using the approved IMD data package format (.csv file dataset and .xml file metadata).
- A single data package will be published annually containing data for all networks and parks contained in the database at the time of publication.
- Datasets included in the data package will contain cumulative data (vs. annual) – i.e. each year's data will be added to and include corrections to previous years data [as opposed to

an incremental solution which publishes each year's data as a separate data package; 2019, 2020, 2021...]. The breeding landbird data package will be published to the NPS DataStore no later than December 15th of each calendar year that the protocol is active in any one network.

- All breeding landbird data packages published on NPS DataStore will be made publicly accessible unless they contain controlled unclassified information (CUI). For data packages with CUI, a full dataset will be published internally and a version with CUI redacted published publicly.

Data Requests

Requests for Mid-Atlantic, Northeast Coastal and Barrier, and Northeast Temperate Network's breeding landbird monitoring data should be directed to the latest data package published in NPS DataStore. Requests that cannot be satisfied with the publicly available data package should be directed to either the Volunteer Coordinator or Data Manager of the network or networks that are contained in the request.

Table S6.1: List of standard validation tests run on landbird data to check for completeness and logical consistency.

Data Level	Validation Check	Action Taken
Event	Summary of all points run during a field season (i.e. missing surveys).	Survey information is confirmed or corrected and Park staff and volunteers are notified that points were not sampled properly for the year
Event	Find same day surveys.	The later event is flagged as excluded
Event	Check for survey dates outside expected survey season (day/month).	Survey event date is confirmed and events too far outside of the survey season will be flagged as excluded. If confirmed an event level note is added: "Verified Event Date"
Event	Check for survey dates outside expected year (< 2006 for NETN; < 2009 for MIDN)	Survey event date is confirmed and events too far outside of the survey season will be flagged as excluded
Event	Check NETN routes that all points expected have been entered.	Survey information is confirmed or corrected and Park staff and volunteers are notified that points were not sampled properly for the year
Event	Check NETN routes for date and Observer/Recorder discrepancies.	Survey information is confirmed or corrected and Park staff and volunteers are notified that points were not sampled properly for the year
Event	Any point visited more than 4 times in a year.	Event details are confirmed and any events flagged as excluded
Event	Environmental variables out of ideal range (Sky, Wind, Noise).	Out of range variables are confirmed against data sheet and any events deemed effected by adverse conditions are flagged as excluded. If confirmed an event level note is added: "Verified environmental range"
Event	Temperature out of ideal range	Out of range variables are confirmed against data sheet and any events deemed effected by adverse conditions are flagged as excluded. If confirmed an event level note is added: "Temperatures confirmed as accurate"
Event	Excluded events or observations checkbox where notes are NULL.	Appropriate notes are added to the 'reason for exclusion' note fields where necessary

Event	Event time is out of range	Event details are confirmed and any corrections made. Any events that occurred outside the required sampling time frame are flagged for exclusion. If a time is confirmed insert a note that reads: “Verified survey start time”
Observation	Surveys without any birds	Event details are confirmed and an event note is added confirming that there were no birds observed
Observation	New species for park.	New species are reviewed for accuracy. Species observations deemed unlikely to be accurate are flagged for exclusion. If observation details are confirmed to be accurate, a note for the observation is added: “Species code verified”
Observation	Detection Type 'A' or 'V' and has NC in any field	Observation details are confirmed and any values that are missing are marked Permanently Missing
Observation	Detection Type 'I' and has any of the fields that should be NC as something else	Observation details are confirmed and values that should be recorded as NC are updated to NC
Observation	Single bird counts > 9.	Observation details are confirmed and any typos corrected. If confirmed add an observation level note: “Verified bird count”
Both	Check event and observation level notes for the words "juvenile, young, fledgling" birds.	Observation details are confirmed and if it is clear from the notes that their were observations of juvenile young of the year birds, observation records are flagged for exclusion, or the bird count is updated to only include breeding age individuals. Once the bird count is finalized, add a note for the observation: “Verified bird count by age”.
Observation	Birds with species code of UNBI	Observation details are confirmed and if correct, a note for the observation is added: “Species code verified”
Both	Proper use of 'Permanently missing' and 'Not collected' flags.	Event and observation details are confirmed and any typos corrected. Distance band can only be Permanently missing if the paper mapping cards are permanently missing. If this is the case an event

		level note is added: “Verified mapping cards are permanently missing”. Only Incidental observations can use the Not collected flag.

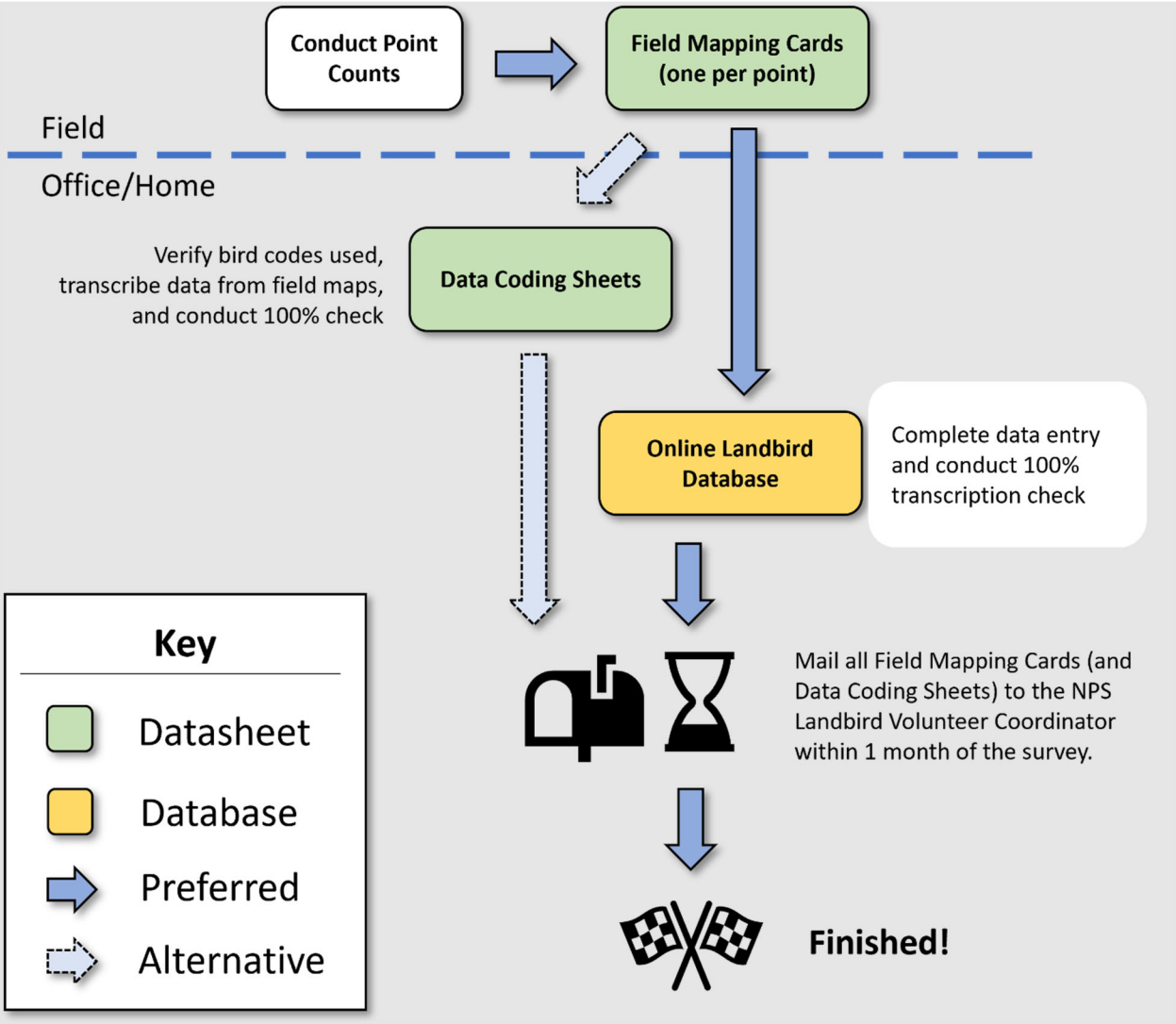

Figure S6.1. Flow diagram for breeding landbird monitoring protocol data management responsibilities of Volunteer Observers.

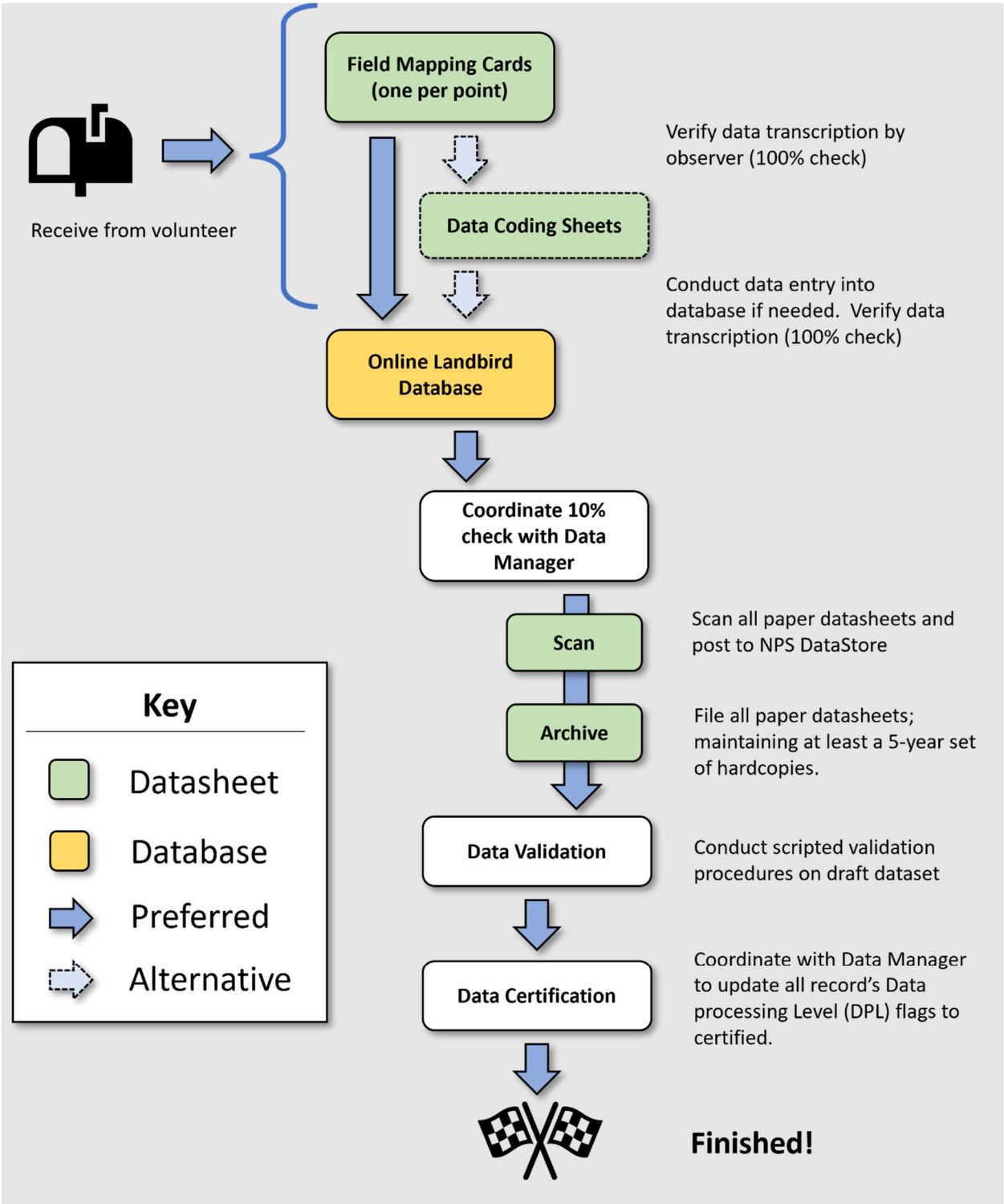

Figure S6.2. Flow diagram for breeding landbird monitoring protocol data management responsibilities: Volunteer Coordinator.

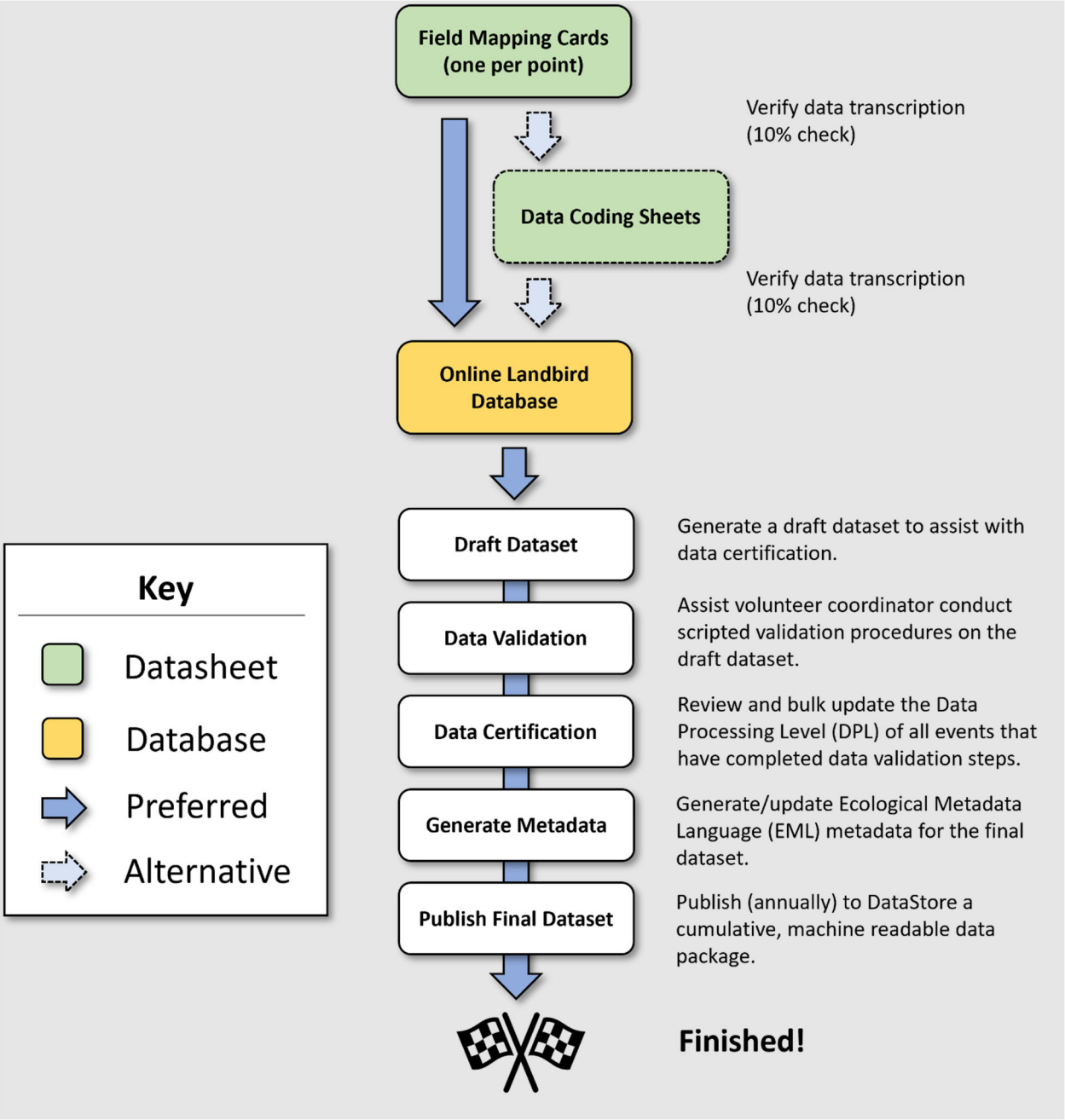

Figure S6.3. Flow diagram for breeding landbird monitoring protocol data management responsibilities: Network Data Manager.

Revision History

The following table lists the edits and amendments to this document. Version numbers will be incremented by a whole number (e.g., Version 1.30 to 2.00) when a change is made that significantly affects requirements or procedures. Version numbers will be incremented by decimals (e.g., Version 1.06 to Version 1.07) when there are minor modifications that do not affect requirements or procedures included in the protocol. Rows are added as needed for each change or set of changes tied to an updated version number.

Revision History Log

Version Number	Revision Date	Revised by	Description
1.0	10/01/2022	M. Johnson A. Kozlowski	Initial document on the instructions on the quality control and publication.

SOP 7: Data Analysis and Reporting

Mid-Atlantic, Northeast Coastal and Barrier, and Northeast Temperate Network's Long-Term Breeding Landbird Monitoring Protocol

Version 1.00

Overview

This document provides details of planned analysis and reporting of data collected for the Mid-Atlantic, Northeast Coastal and Barrier, and Northeast Temperate Networks' Long-Term Breeding Landbird Monitoring Protocol.

Analyses of point count monitoring will range from summaries that consist of relatively simple tabulations of annual monitoring effort, species richness, Bird Community Index (BCI; O'Connell et al. 2000) and relative abundance, to more complex analyses that are completed periodically to estimate trends in site- or park-level occupancy and abundance that account for imperfect detection (MacKenzie et al. 2002; Kelner and Swihart 2014). Additional analyses that examine species-habitat associations may be conducted. The assistance of a professional biostatistician is recommended for analyses involving models that account for imperfect detection (e.g., occupancy, N-mixture models, and removal models) of population and community metrics.

Analyses will be completed and reported at time periods that are relevant to meet the needs and objectives of parks managers and to support scientific review of the monitoring program. Simple summaries and QAQC analyses will be conducted on an annual basis to meet program requirements related to data certification and to inform parks of annual outcomes. Trend analysis and other complex analyses will be completed when appropriate to meet programmatic requirements while considering the effects of relative abundance, sample size and detection probability on the certainty of modeled estimates. Given the amount of point count data required to reliably estimate population and community metrics, the timing of these analyses may range from 10 to 20 years depending on the approach and need. It is also important to note that the frequency of trend analyses will depend on whether the objectives are to model trends in a population of uncommon vs common species, or an entire community. In general, our point count monitoring may never reliably estimate trends of rare or relatively uncommon species, unless done so in the context of a community model (see Doser et al. 2021). Programmatic capacity (funding and staffing) will dictate the timing and complexity of the analyses performed.

Analysis results will be provided to parks in a variety of reporting approaches ranging from resource briefs, data visualizers, to scientific journal articles and reports. Only certified data will be used as the basis for the analyses unless reporting is justified from provisional data and approved by the network program manager. The following sections below summarize the main analyses to be conducted and reported on from the monitoring program.

Survey Effort

The total number of points surveyed, the average number of surveys conducted, and the number of volunteers participating across each network and within each park will be summarized from the annual data. A map may also be provided for each park showing the locations of points surveyed each year and the number of surveys conducted at each point (Figure S7.1). This map will provide feedback to park coordinators regarding how well they were able to balance their volunteer effort across their point count locations.

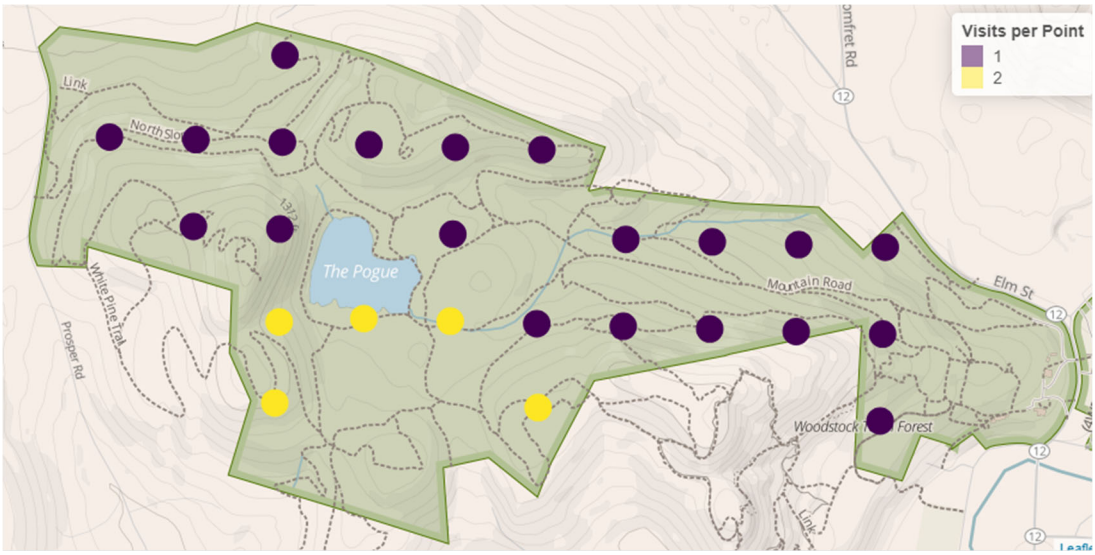

Figure S7.1. Map of monitoring sampling effort (no. surveys) at MABI's permanent sites in 2018.

Community Metrics

Species Richness

The number of detected species (or species richness) is a key metric from our monitoring because it provides a straight-forward indication of the bird diversity using parks as breeding habitat during the summer (Figure S7.2). Analyses that account for imperfect detection (e.g., Doser et al. 2021) and sampling effort (e.g., rarefaction) may be conducted periodically to provide modeled estimates of richness in comparison to observed richness. Reporting of incidentals and flyovers encountered will be available in the published dataset and associated data visualizers.

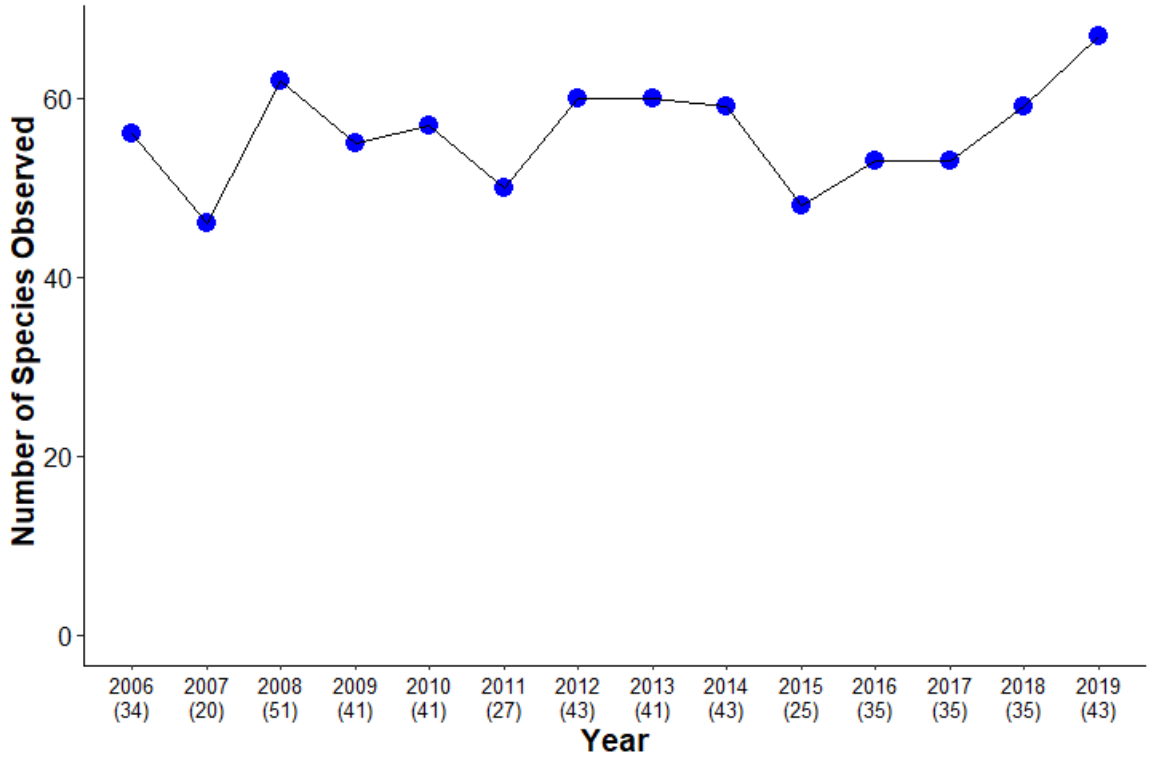

Figure S7.2. Number of bird species detected during monitoring at SARA within 0-50 meters from the observer. The horizontal axis indicates the year, with the number of points monitored in parenthesis. The vertical axis indicates the number of birds species detected during monitoring. Additional bird species were likely present at the points, but not detected.

Bird Community Integrity

Forested Sites

The Bird Community Index (BCI; O'Connell et al. 1998; 2000) is an index designed to indicate the conservation status (or "health") of the bird community in forested areas such as those in our parks. It was developed for conservation of forest birds common within the Central Appalachian region and our analyses indicate that it is also applicable to and helpful for characterizing breeding birds in MIDN, NCBN, and NETN parks because of the similarity of species. To calculate the BCI, the list of bird species from each site is considered separately. If a site has many bird species that are dependent upon intact forest areas during breeding ("forest obligates") the site gets a high score, whereas birds that live in a variety of areas ("generalists") give a site a low score. Based on these assessments each survey site is assigned a BCI score. The scores are then averaged for the entire park in each year. This average score is used to categorize the bird community of the park as either Low, Medium, High, or Highest Integrity (Figure S7.3).

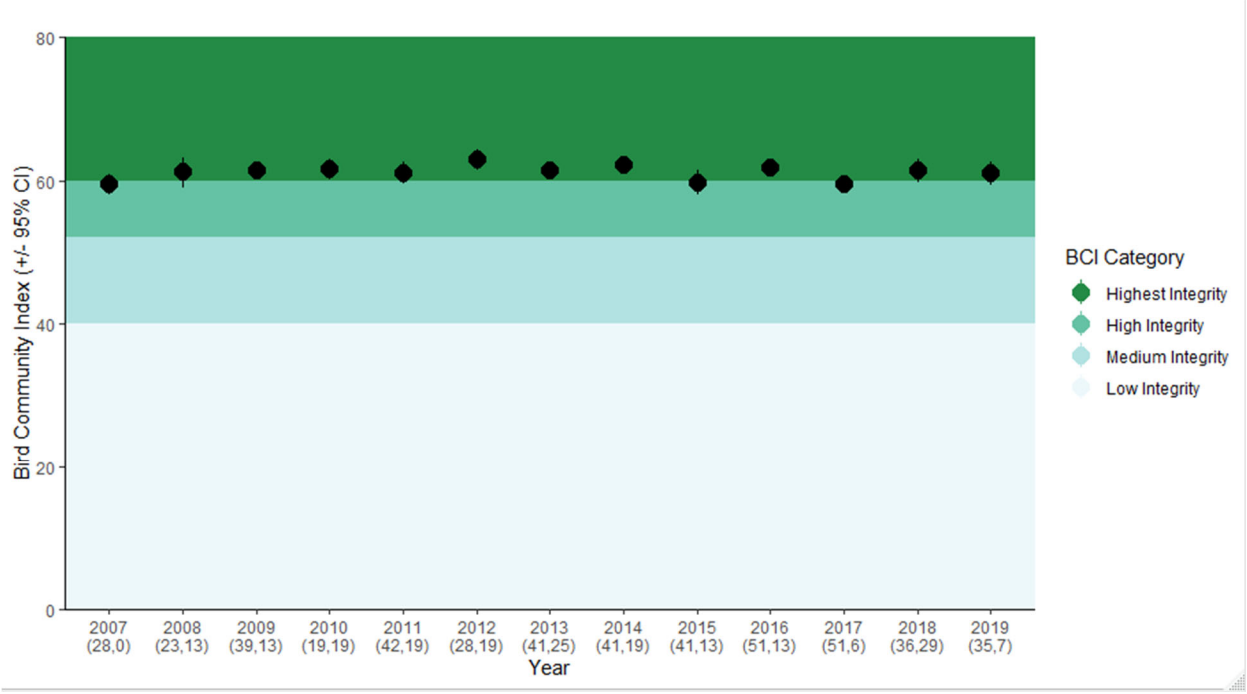

Figure S7.3. Annual Bird Community Index values averaged across the park forest at ACAD. Data summaries exclude species not suspected to be breeding in the forest (e.g., flyovers). The annual BCI value shown is the average (+/-95% C.I.) BCI rating across all monitoring sites. The horizontal axis indicates the year, with the number of points monitored by visit in parenthesis.

Population metrics

Occurrence (Occupancy)

The presence of a species detected during point count monitoring at a site or across sites is a basic measure of whether and how widespread a species is breeding in a park. The total number of monitoring points at which a species is detected divided by the total number of points surveyed provides an estimate of annual park occurrence. The total number of monitoring points at which a species is detected divided by the total number of points surveyed over time at the site estimates site occurrence over the monitoring period. Flyovers and incidentals are removed in calculations of percent occurrence.

Relative Abundance

Relative abundance, expressed as the average of the maximum number of birds detected per site per year, provides an indication of how often a particular species is observed during monitoring and reflects its population status in the park (Figure S7.4).

Special note is taken for species of conservation concern. Partners in Flight (PIF), a cooperative effort to address the conservation of birds, produced a list of species of conservation concern in their North American Landbird Conservation Plan (Rosenberg et al. 2016). They define two sets of species of concern, “Watchlist” species that face immediate threats due to habitat alteration, declining populations, small population size, and limited distributions, and “Stewardship” species that are representative species of avifaunal biomes that may or may not be in immediate danger.

These lists have been developed at the continental and regional scale. Counts of both continental and regional (e.g. Piedmont and Southeastern Coastal Plain BCRs) Watchlist and Stewardship species detected during the year are emphasized in reports (Figure S7.4).

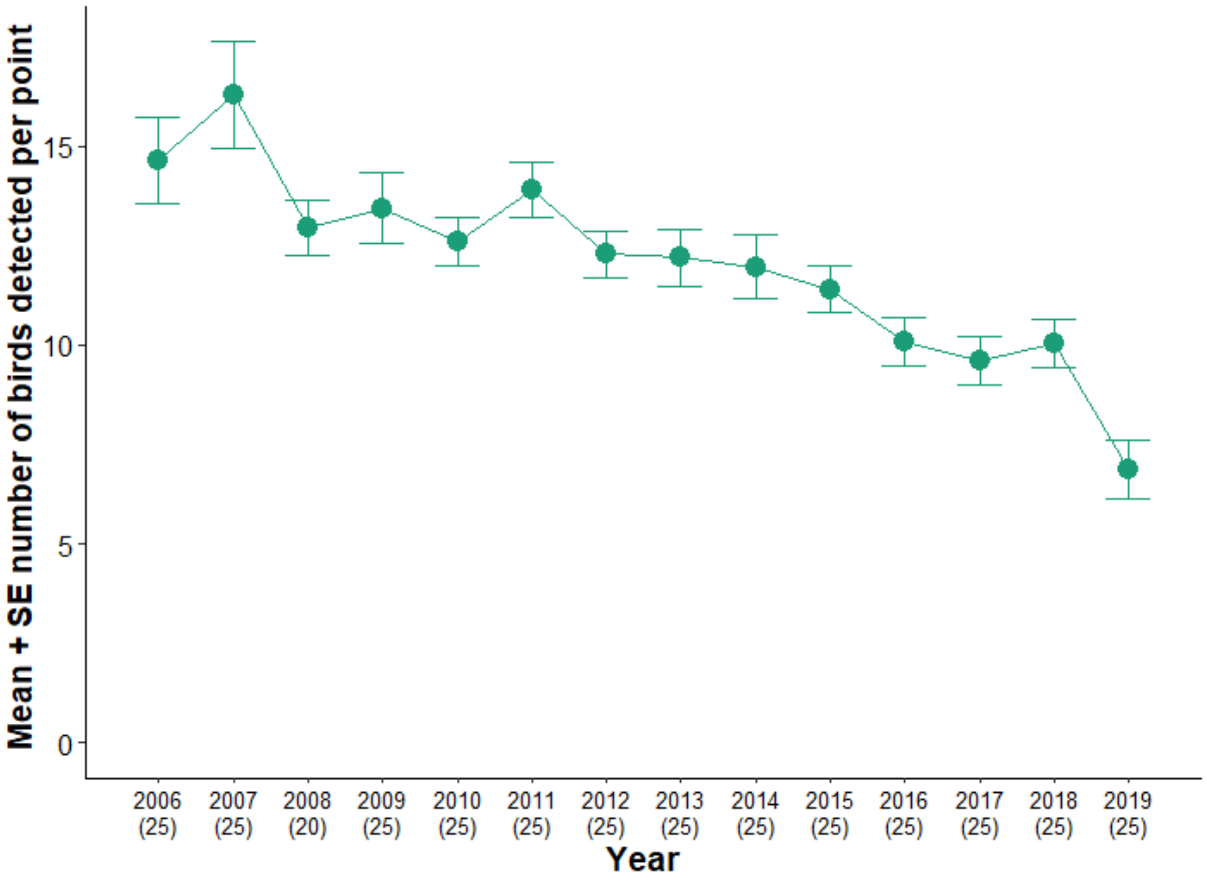

Figure S7.4. Relative abundance (mean ± SE) of all birds detected per site at MABI from 2006 to 2019 with the number of points monitored in parenthesis.

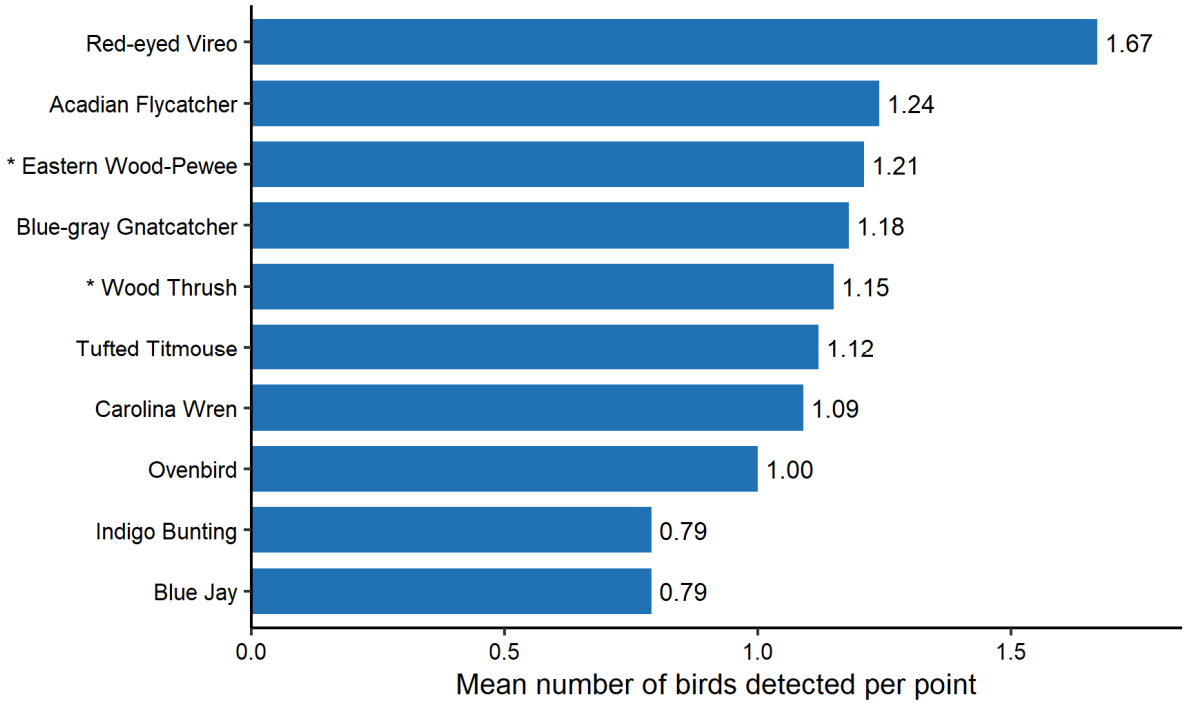

Figure S7.5. The most abundant species detected at FRSP in 2019 (average number observed per site). *Species of regional concern.

Effects of Detectability on Population and Community Metric Estimation

While relative abundance can be derived for all species detected, its use as an accurate measure of population size and as an index of population change has been criticized (Rosenstock et al. 2002, Thompson 2002, Farnsworth et al. 2005) because it does not account for imperfect detection. Not surprisingly, community metrics derived from point count monitoring also suffer from the same issue. When an observer fails to detect a bird, the bird may have been absent, or the observer may not have detected the bird (MacKenzie et al. 2002). A failure to detect a bird that is present can result from many environmental or survey-related factors (i.e. wind, distance, weather, observer error) and not accounting for a probability of detection can underestimate species presence and abundance.

Various statistical methods and software packages have been developed to estimate population densities while accounting for detection probability including program DISTANCE (distance sampling) (Thomas et al. 2010), program MARK (removal modeling) (White and Burnham 1999), and the "unmarked" package in program R (hierarchical modeling) (Fiske and Chandler 2011). In general, because a minimum of 80-100 detections of each species per observer are needed to calculate detection probabilities (and observer effects on detection probability) with sufficient precision, several years of data collection will be needed for all but the most common species (Bibby et al. 1998). When enough data has been collected, an analysis of factors influencing detection rates will be conducted and population densities will be estimated using the best available statistical methods and software packages.

Trend Analysis

Trend analysis will be conducted to provide a quantitative measure of whether there has been a statistical change of a particular population or community metric over time and space. There are a variety of models that can be used to estimate trends in landbird community and population metrics of varying complexity. When and how to conduct a trend analysis should be determined by a qualified statistician based on the targeted objective of the analysis and the structure and statistical properties of the data. There are a variety of available models ranging in complexity to estimate trends of individual species to entire communities that incorporate detection probability and environmental covariates (Farnsworth et al. 2005; Doser et al. 2021).

Evaluating Park Management effects

Analysis results generated by this protocol may be evaluated in the context of park management needs, such as grassland management. Park management actions can have impacts both positive and negative on breeding birds and it is important to interpret the results of any analysis in the light of past changes, both natural and human influenced. As appropriate the protocol lead will use park management data to evaluate whether changes to the bird populations or community are seen in treatment areas.

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Revision History

The following table lists the edits and amendments to this document. Version numbers will be incremented by a whole number (e.g., Version 1.30 to 2.00) when a change is made that significantly affects requirements or procedures. Version numbers will be incremented by decimals (e.g., Version 1.06 to Version 1.07) when there are minor modifications that do not affect requirements or procedures included in the protocol. Rows are added as needed for each change or set of changes tied to an updated version number.

Revision History Log

Version #	Date	Revised by	Changes	Justification
1.00	October 2024	Aaron Weed, Mark Johnson		