



Breeding Bird Monitoring

Valley Forge National Historical Park 2014–2019 *Summary Report*

Natural Resource Data Series NPS/MIDN/NRDS—2020/1278



ON THE COVER

A common yellowthroat (*Geothlypis trichas*) at Valley Forge National Historical Park (©KITTY KONO)

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May 2020

U.S. Department of the Interior
National Park Service
Natural Resource Stewardship and Science
Fort Collins, Colorado

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Please cite this publication as:

Johnson, M. J. 2020. Breeding bird monitoring: Valley Forge National Historical Park 2014–2019 summary report. Natural Resource Data Series NPS/MIDN/NRDS—2020/1278. National Park Service, Fort Collins, Colorado.

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Executive Summary

The Mid-Atlantic Network (MIDN) of the National Park Service's Inventory and Monitoring Division (IMD) was established to serve 10 national parks in Pennsylvania and Virginia. The MIDN breeding bird protocol is administered by Mid-Atlantic Network staff in cooperation with the Natural Resource Management (NRM) staff of each participating park and utilizes citizen scientists to aid in data collection.

The primary objectives of this protocol are to determine the status and long-term trends in breeding bird species composition, relative abundance, and occupancy, and to evaluate changes in bird populations relative to park management regimes. Protocol procedures were developed to meet protocol objectives, address resource management needs, and provide opportunities for citizen scientists to contribute significantly to their local park and the Mid-Atlantic Network as a whole.

This report summarizes the data collected from 2009 through 2019, with a focus on 2014 through 2019, for Valley Forge National Historical Park. Detailed results for 2009 through 2013 can be found in previous publications by the MIDN. This report contains metrics on survey effort, species richness, abundance, occupancy, and the integrity of the forest bird community, as measured by a forest Bird Conservation Index (BCI).

Acknowledgments

We extend thanks to the Region 1 bird monitoring working group for helping with the development of reporting metrics for this report. Jim Comiskey, Matt Marshall, John Paul Schmit, Jeb Wofford, and Nathan Dammeyer provided valuable editorial comments. We would also like to thank our park resource managers and staff, including Kristen Allen, Tim Blumenschine, Amy Ruhe, Kate Jensen, Gregg Kneipp, and Timbo Sims for their continued support for the implementation of the Mid-Atlantic Network breeding bird monitoring program. Finally, the Mid-Atlantic Network's breeding bird monitoring program at Valley Forge National Historical Park would not be successful without the help of numerous volunteers. We sincerely thank our dedicated volunteers for performing the often difficult field work to gather the data summarized in this report:

- Jesse Attias
- Kayann Cassidy
- Tim Clemens
- Rich Conroy
- Andy Fayer
- Ron Grubb
- Pat Harrison
- Michael Harvell
- Mary Ellen Heisey
- Tom Heisey
- Stephanie Hudson
- Serina Ju
- Richard Keyser
- Les Murray
- Kristi Orcutt
- Sarah Pellecchia
- Bruce Piecukonis
- Kacy Reitnauer
- Hannah Rice
- Elizabeth Rico
- Geoffrey Rogalsky
- Yusuf Romaine
- Nicole Schwarz
- Vince Smith

- Carmen Solis
- Derek Stephan
- Dan Sullivan
- Wendy Sykora
- Jaime Thomas
- Lisa Tull
- Rick Wolf
- Eleanor Wolf

List of Acronyms

BCI: Bird Community Index

BCR: Bird Conservation Region

BOWA: Booker T. Washington National Monument

FRSP: Fredericksburg and Spotsylvania National Military Park

I&M: Inventory and Monitoring

MIDN: Mid-Atlantic Network

NABCI: North American Bird Conservation Initiative

NB: National Battlefield

NBP: National Battlefield Park

NER: NPS Northeast Region

NHP: National Historical Park

NM: National Monument

NMP: National Military Park

NP: National Park

NPS: National Park Service

PETE: Petersburg National Battlefield

PIF: Partners in Flight

RICH: Richmond National Battlefield Park

SE: Standard Error

VAFO: Valley Forge National Historical Park

Introduction

As part of the Natural Resource Challenge (NPS 1999), the Mid-Atlantic Network (MIDN) has been tasked with monitoring “vital signs,” a suite of physical, chemical, or biological elements or processes that represent the overall health or condition of the network parks’ natural resources. Breeding birds have been selected as one of the Mid-Atlantic Network’s vital signs because they are highly visible, are a reliable indicator of ecological integrity, and face numerous population threats in the region (Comiskey and Callahan 2008). The Mid-Atlantic Network consists of 10 park units across Pennsylvania and Virginia. In 2009, MIDN began pilot testing a volunteer breeding bird monitoring program at three network parks and now has five participating parks (Figure 1). In the future, the network hopes to expand monitoring efforts to the remaining parks within the network (Johnson and Wakamiya 2018).

The majority of participating parks, including Booker T. Washington National Monument (BOWA), Fredericksburg and Spotsylvania National Military Park (FRSP), and Valley Forge National Historical Park (VAFO) fall within the Piedmont Bird Conservation Region (BCR) (Figure 1). Richmond National Battlefield Park (RICH) falls in the far southwestern portion of the New England/Mid-Atlantic Coast BCR. Petersburg National Battlefield (PETE) is in the northern portion of the Southeastern Coastal plain BCR. Developed by the North American Bird Conservation Initiative (NABCI), BCRs are ecologically distinct units designed to help focus conservation efforts for specific bird communities (USNABCI Committee 2000).

The primary objectives for the monitoring protocol are to:

1. Estimate status and long-term trends in species composition, occupancy, and other indices of abundance for breeding bird populations within MIDN parks.
2. Estimate status and trends in measures of biotic integrity (Bird Community Indices) for breeding bird communities within MIDN parks.
3. Evaluate changes in bird populations in forest and grassland habitats relative to park management regimes.

This report summarizes monitoring data collected from 2009 through 2019 at Valley Forge National Historical Park, with a specific focus on the years 2014 through 2019. Detailed results for 2009 through 2013 can be found in the annual reports published for those years (Goodwin and Wakamiya 2011, Wakamiya 2012a, Wakamiya 2012b, Johnson 2014a, Johnson 2014b).

We provide park abundance and occurrence metrics for all species detected during breeding bird monitoring. We also provide a community-wide assessment of species composition (a “Bird Community Index” or BCI) in forested areas. The BCI informs on ecosystem integrity by evaluating the relative composition of different guilds in the overall bird community.

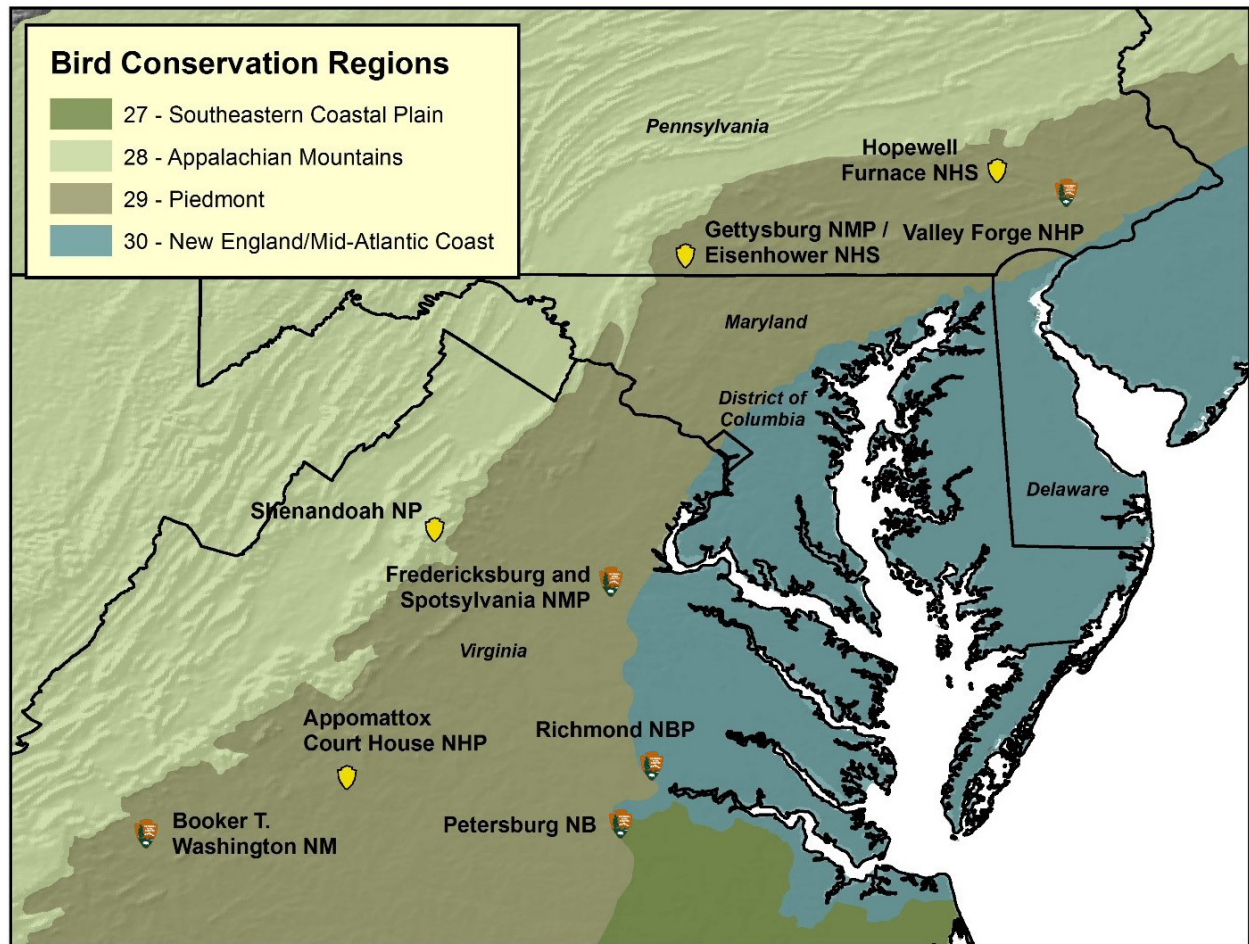


Figure 1. Mid-Atlantic Network parks and their associated Bird Conservation Region (BCR). Parks not yet participating in the breeding bird monitoring program are shown with a yellow icon.

Methods

Monitoring

Monitoring efforts following the procedures outlined by the MIDN breeding bird protocol were conducted at Valley Forge National Historical Park (VAFO) for the years 2009–2019. Skilled volunteers with approximately 3–5 years of experience in the region identifying birds visually and by ear were recruited by each participating park’s natural resource management staff. All volunteers attended a training session lead by the protocol lead to learn protocol and safety procedures prior to each field season. Point counts were conducted, when feasible, at 80 randomly distributed point count stations (38 forest, 42 grassland) between May 25 and July 15 for all years monitored. For a summary of survey effort see Table 2 below. During a point count, the distance from the observer to a bird of interest is estimated using two distance bands ($<50\text{m}$ and $\geq 50\text{m}$). For this report, we summarize all observations regardless of their distance band. For specific details regarding the point count procedures, please reference the MIDN breeding bird protocol narrative (Johnson and Wakamiya 2018) and standard operating procedures available on the MIDN website: <https://www.nps.gov/im/midn/breeding-birds.htm>.

Metrics

We present survey effort, population, and community metrics for Valley Forge National Historical Park (VAFO) for multiple years and for other participating parks within the network to allow for comparisons across years and within the network. A brief summary is provided above the results for each metric. For more detailed information regarding these metrics, please reference Standard Operating Procedure 10: Data Analysis and Reporting available at the link above.

Readers should treat results as preliminary, as metrics may be affected by variability in detection probability. A more comprehensive analysis that accounts for such variability and addresses long terms trends will be included as we acquire more data.

Results

Number of Species

This metric provides the total number of species observed, or species richness, and the mean number of species detected at each monitoring point. All detections, including flyovers (birds detected flying over the habitat within the point count radius) and incidentals (birds detected outside the time of survey), are included in these species counts. The species richness and mean number of individuals detected at each point are shown below (Figures 2 and 3).

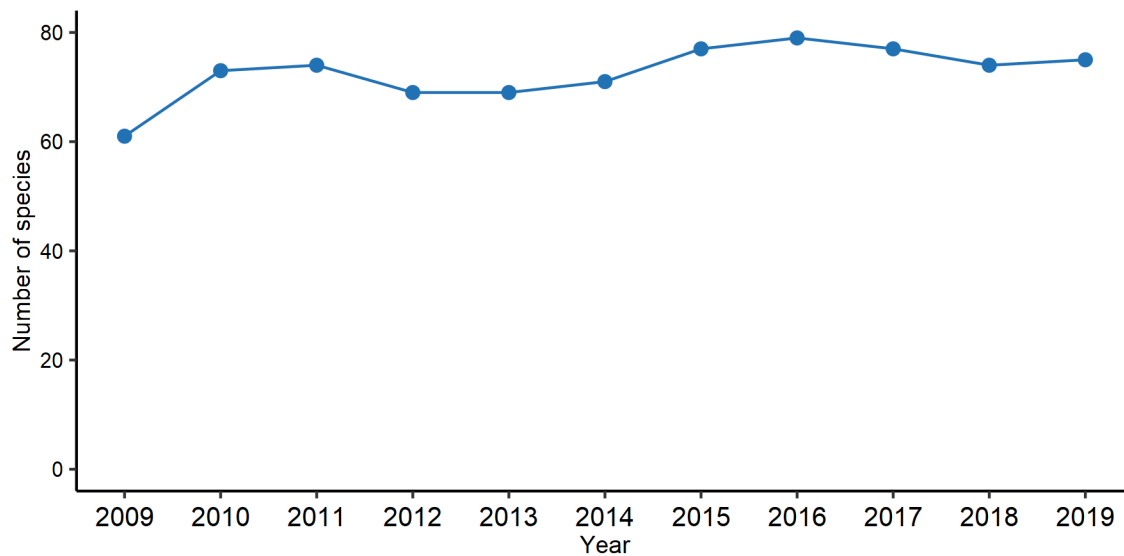


Figure 2. Species Richness detected at breeding bird monitoring points at Valley Forge National Historical Park for the years 2009–2019.

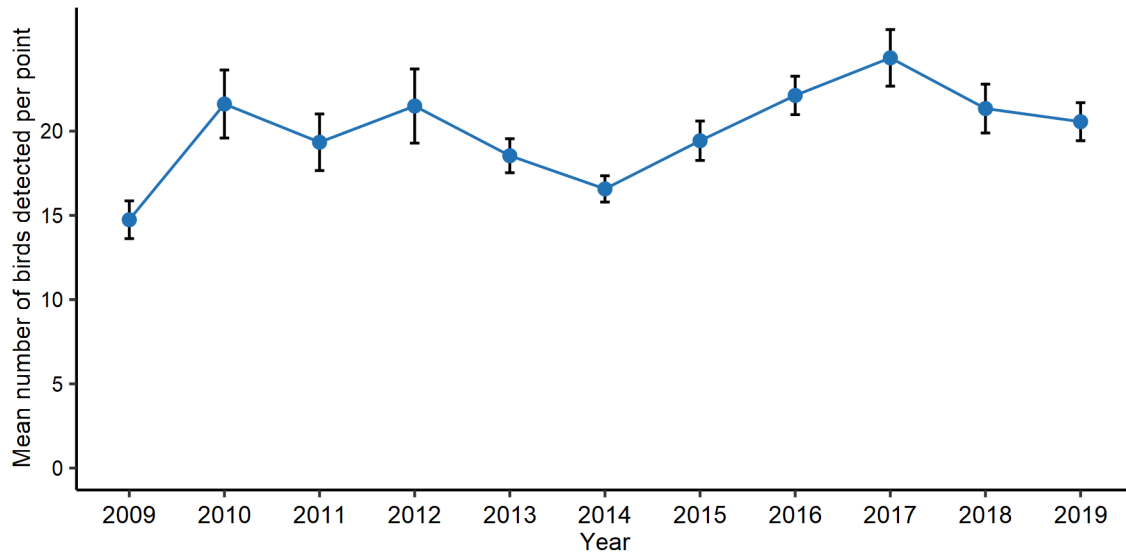


Figure 3. Mean $\pm$ SE number of individuals detected at breeding bird monitoring points at Valley Forge National Historical Park for the years 2009–2019. The mean was calculated based on the maximum number of detections at each point.

Relative Abundance

Relative abundance is calculated by dividing the total detections of a species by the number of monitoring points surveyed, not including flyovers and incidentals. The maximum number of detections per species across repeat visits are used in this calculation to avoid upward-biased results (e.g. inflating abundance estimates by double-counting the same individual bird across multiple visits). The ten most abundant species documented at all monitoring points, forest points, and grassland points are shown below (Figures 4–6). Relative abundance for all species observed during breeding bird monitoring at Valley Forge National Historical Park for the years 2014–2019 are provided in Appendix Table A1.

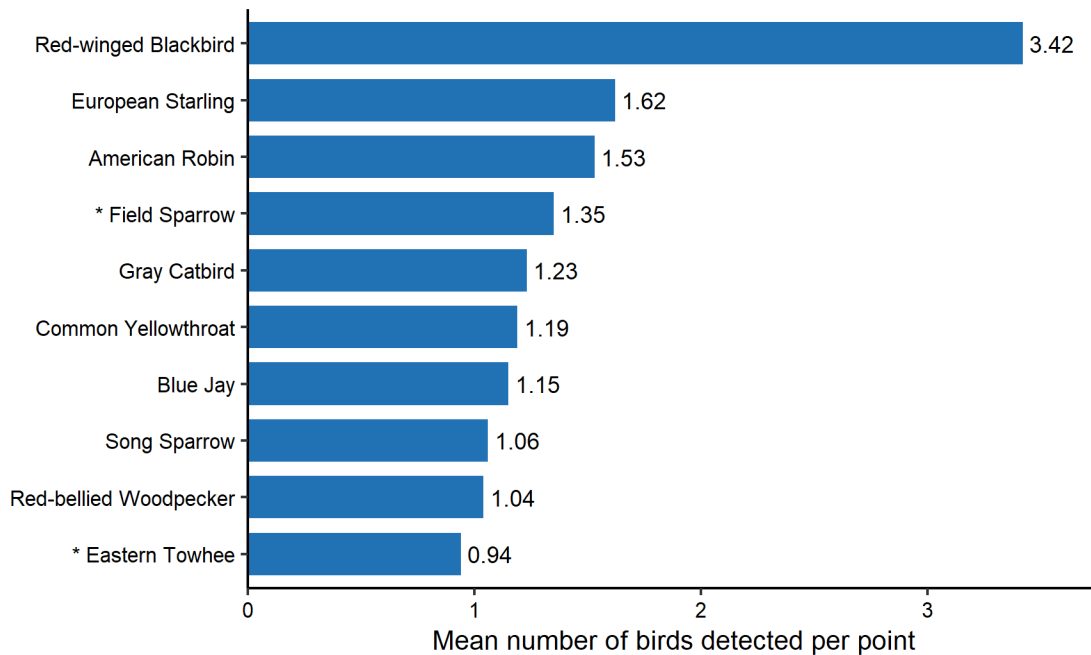


Figure 4. Ten most abundant species detected across all monitoring points during breeding bird monitoring at Valley Forge National Historical Park for the year 2019. The mean was calculated based on the maximum number of detections at each point. *Species of regional concern.

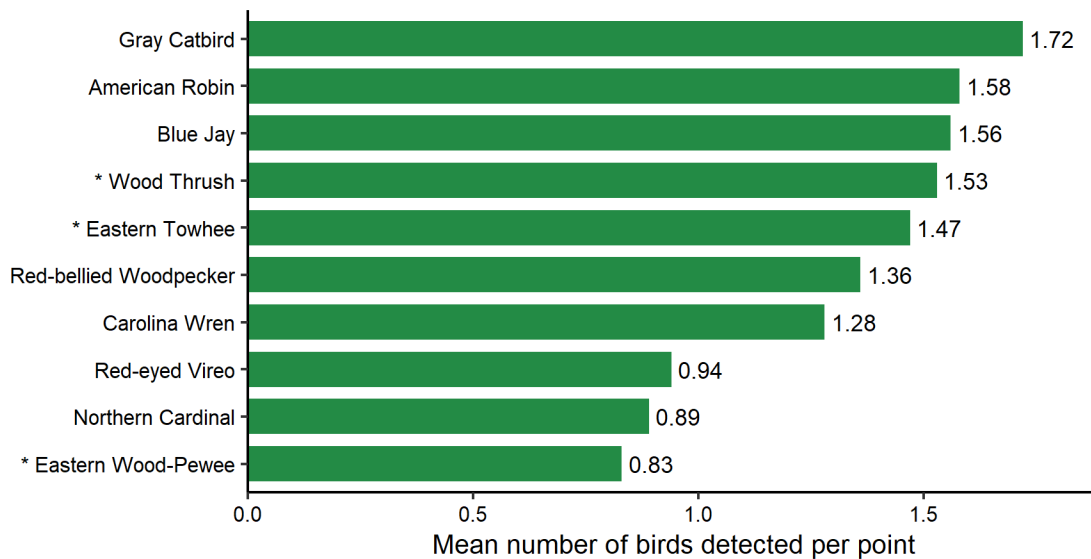


Figure 5. Ten most abundant species detected at forested points during breeding bird monitoring at Valley Forge National Historical Park for the year 2019. The mean was calculated based on the maximum number of detections at each point. *Species of regional concern.

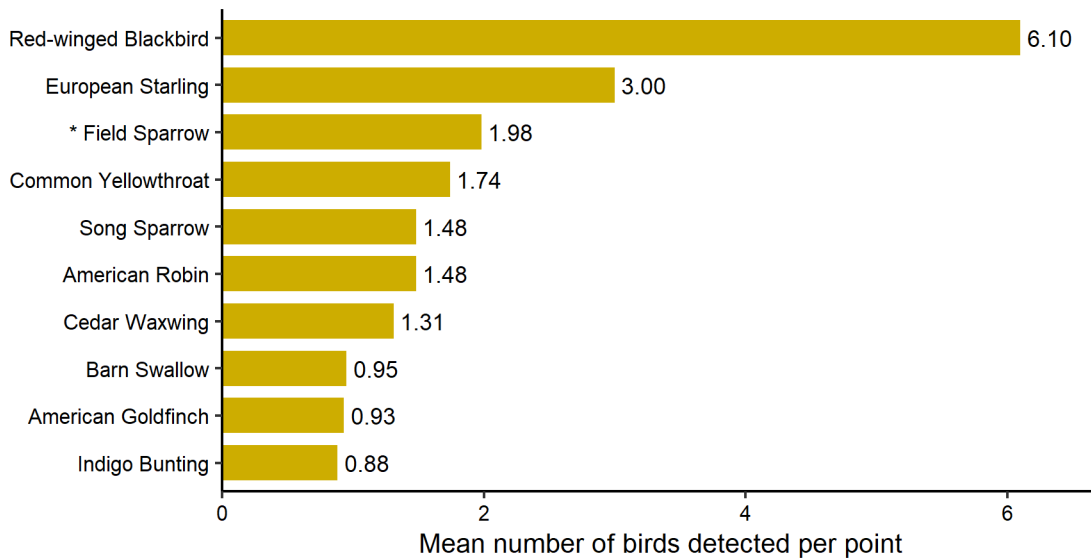


Figure 6. Ten most abundant species detected at grassland points during breeding bird monitoring at Valley Forge National Historical Park for the year 2019. The mean was calculated based on the maximum number of detections at each point. *Species of regional concern.

Percent Occurrence

To calculate percent occurrence, the total number of monitoring points at which a species is detected is divided by the total number of points surveyed. As with relative abundance, flyovers and incidentals are removed from the calculation. Percent occurrence across all points surveyed, forested points, and grassland points are shown below (Figures 7–9). Percent occurrence for all species observed at Valley Forge National Historical Park for the years 2014–2019 is provided in Appendix Table A2.

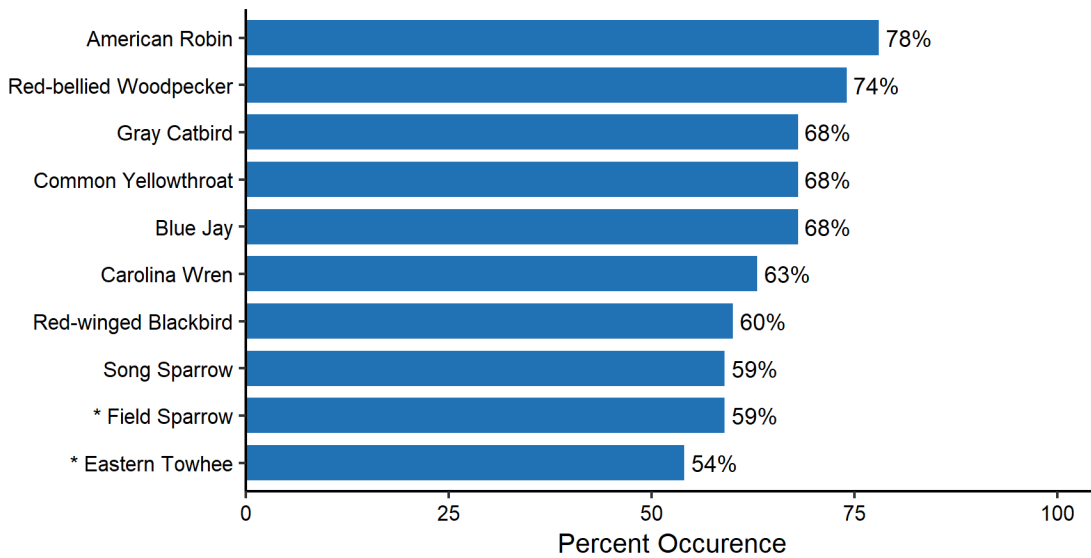


Figure 7. Ten species with the highest percent occurrence of monitoring points detected during breeding bird monitoring at Valley Forge National Historical Park for the year 2019. *Species of regional concern.

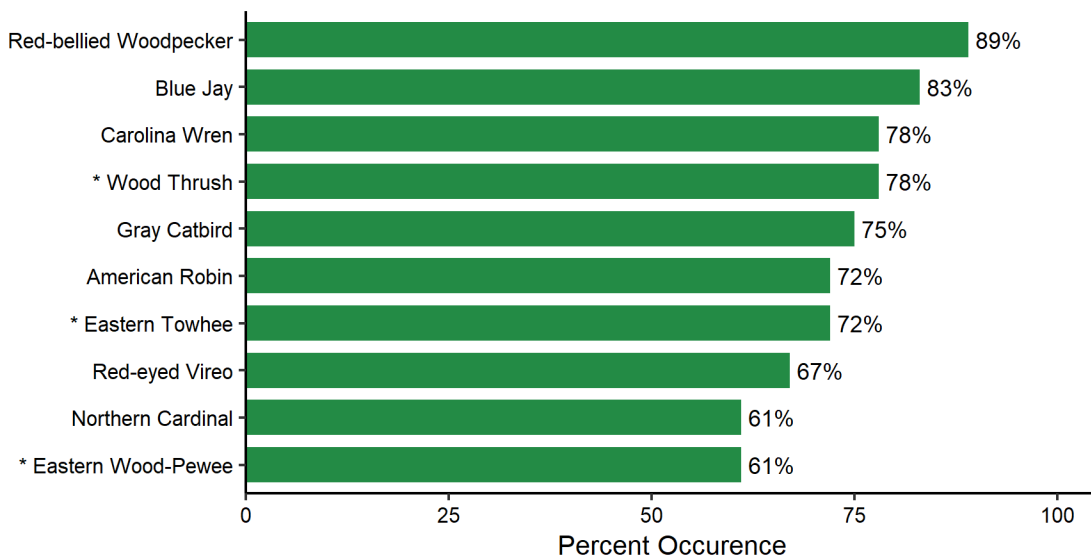


Figure 8. Ten species with the highest percent occurrence of forested monitoring points detected during breeding bird monitoring at Valley Forge National Historical Park for the year 2019. *Species of regional concern.

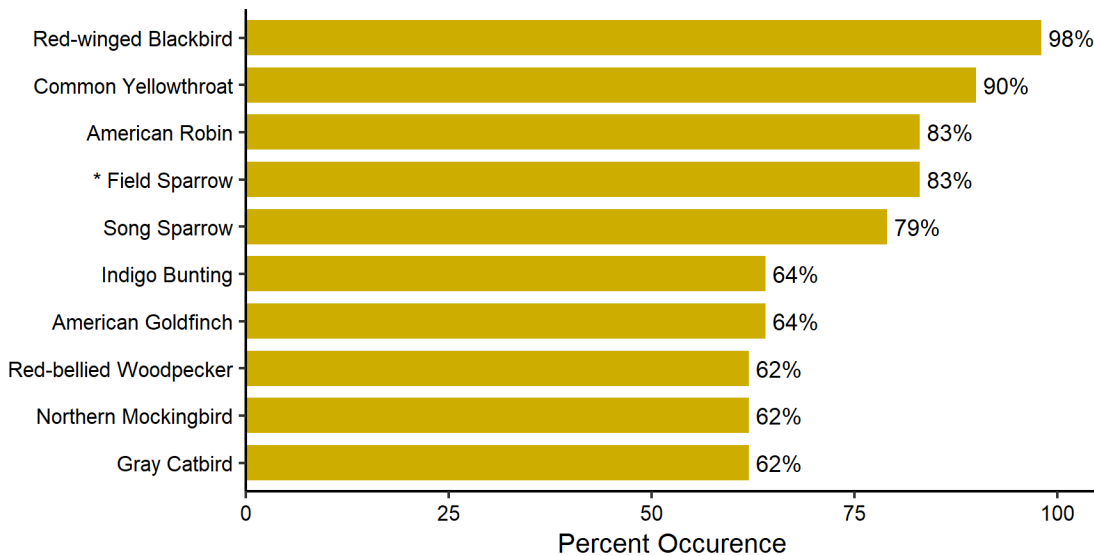


Figure 9. Ten species with the highest percent occurrence of grassland monitoring points detected during breeding bird monitoring at Valley Forge National Historical Park for the year 2019. *Species of regional concern.

Species of Concern

Partners in Flight (PIF), a multi-organizational effort to address the conservation of birds, produced a list of species considered important at the regional scale in the PIF North American Landbird Conservation Plan (Rosenberg et al. 2016). These species either face a high level of regional threats to their population or moderate regional threats combined with moderate or large regional population declines. The abundance and percent occurrence of regional species of concern documented at VAFO are shown below (Figures 10 and 11).

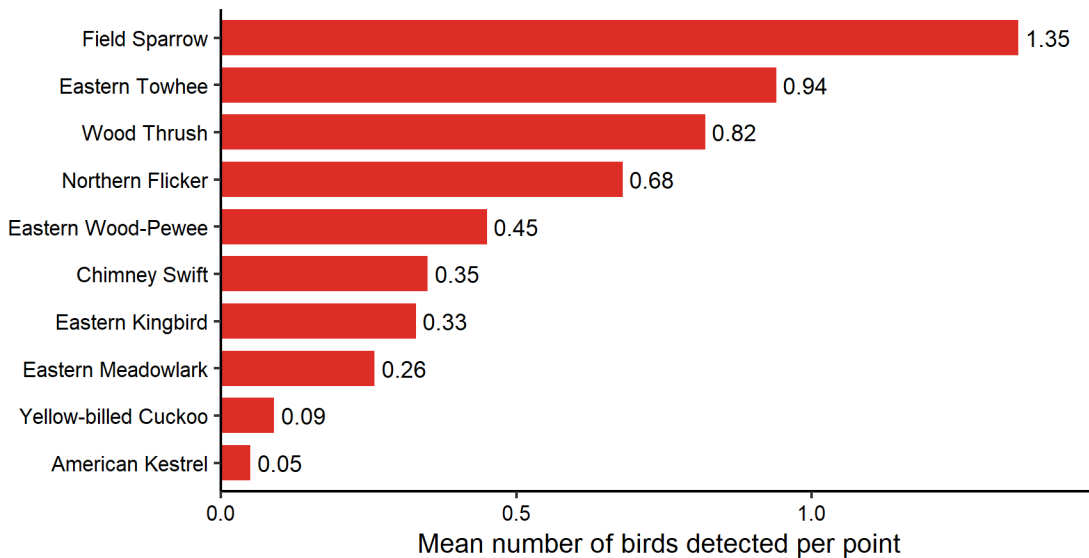


Figure 10. Ten most abundant species of regional concern detected during breeding bird monitoring at Valley Forge National Historical Park for the year 2019.

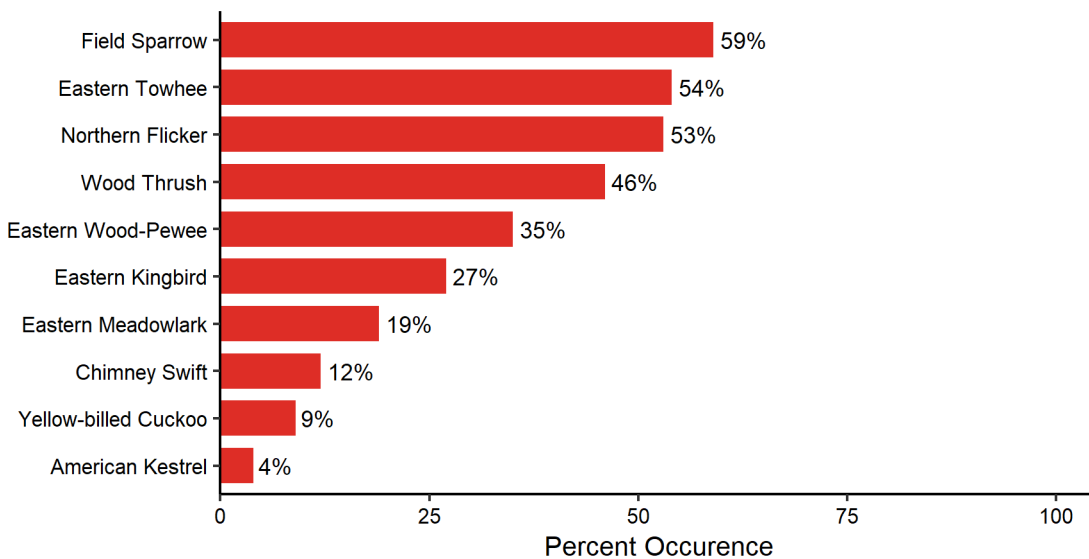


Figure 11. Ten species of regional concern with the highest percent occurrence during breeding bird monitoring at Valley Forge National Historical Park for the year 2019.

Ecological Integrity Metrics

Changes in ecological condition can variably impact avian guilds, resulting in alterations to the bird community as a whole (Severinghaus 1981, Verner 1984). Bird community indices (BCIs), yield a quantitative metric that can be used to define the ecological integrity of a sampled area based on the avian community present. Within the BCI presented below (Figure 12), avian guilds are ranked based on specialization, with specialist guilds receiving higher weight over generalist guilds. BCI scores

and ratings are based on ecological criteria. O’Connell et al. (1998, 2000) developed a combined forest integrity index that can be applied to the MIDN points located in forested areas.

For forest BCI analysis, data from grassland points, incidentals, flyovers, and unknown species are removed. Only members of the following taxonomic Orders are used in BCI analyses: Passeriformes, Columbiformes, Apodiformes, Piciformes, and Cuculiformes. Furthermore, only bird species that were included in the original development of these indices are considered (O’Connell et al. 1998, 2000). If a point is visited more than once, detections for that point are aggregated. Forest integrity estimates based on O’Connell et al. (1998, 2000) are built from percent guild representation rather than counts of individuals, so multiple visits provide a more complete picture of the community and not an upward biased BCI score (e.g. from double-counted individuals). For more detailed information regarding the calculation of the forest BCI, please reference Standard Operating Procedure 10: Data Analysis and Reporting.

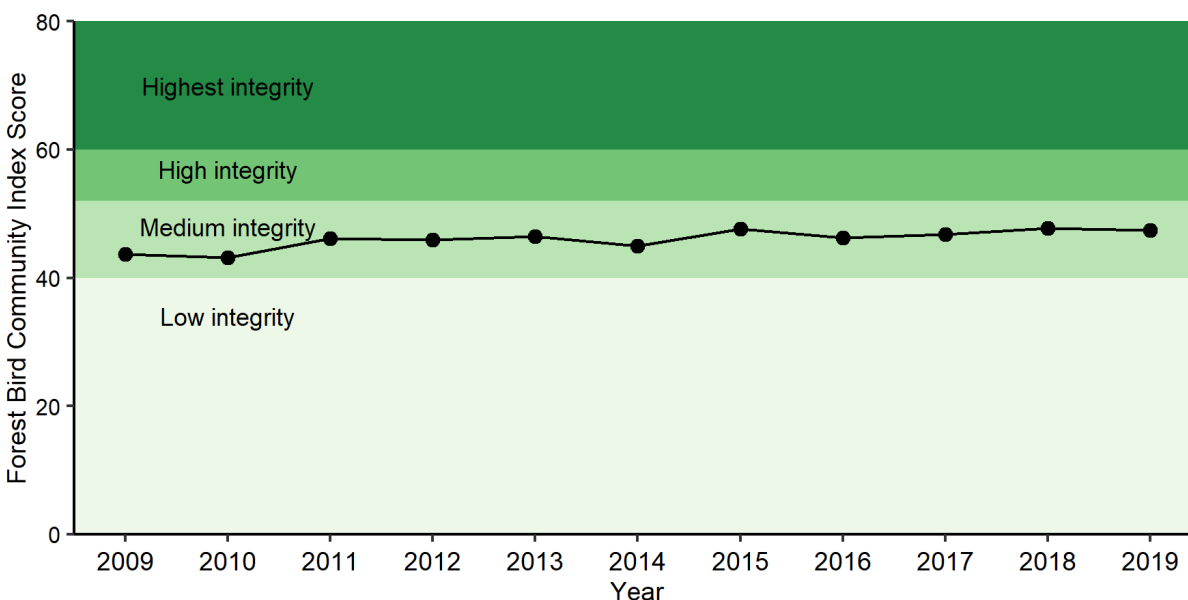


Figure 12. Bird Community Index (BCI) for forest points monitored at Valley Forge National Historical Park for the years 2009–2019. The points on the graph denote the mean BCI for points monitored during each year for the selected visits.

Survey Effort

The following tables and figures summarize the number of volunteers participating across the network (Table 1), the number of points surveyed (Table 2), and mean number of surveys per point (Tables 2). Maps are also included that display the locations of points surveyed each year and the number of surveys conducted at each point (Figures 13–18).

Table 1. Number of volunteer participants at all participating parks in the Mid-Atlantic Network Breeding Bird Monitoring Program for 2009–2019.

Year	BOWA	FRSP	PETE	RICH	VAFO	Total
2009	3	8	–	–	12	23
2010	4	9	–	5	14	40
2011	6	8	2	3	13	37
2012	4	8	1	6	11	36
2013	2	7	–	9	10	28
2014	1	7	–	7	12	27
2015	1	7	–	12	12	32
2016	1	6	2	11	14	34
2017	1	6	2	10	15	34
2018	2	5	1	8	11	27
2019	1	4	–	9	10	24

Table 2. Summary of breeding bird monitoring volunteer survey effort for Valley Forge National Historical Park for all years. SE refers to the standard error around the calculated mean.

Year	Points Surveyed	Number of Surveys	Mean visits per point	SE
2009	74	77	1.04	0.04
2010	75	137	1.83	0.09
2011	74	220	2.97	0.14
2012	75	205	2.73	0.12
2013	76	179	2.36	0.13
2014	76	176	2.32	0.14
2015	76	179	2.36	0.12
2016	65	127	1.95	0.06
2017	79	203	2.57	0.06
2018	79	213	2.70	0.08
2019	78	233	2.99	0.09

Survey Effort Maps

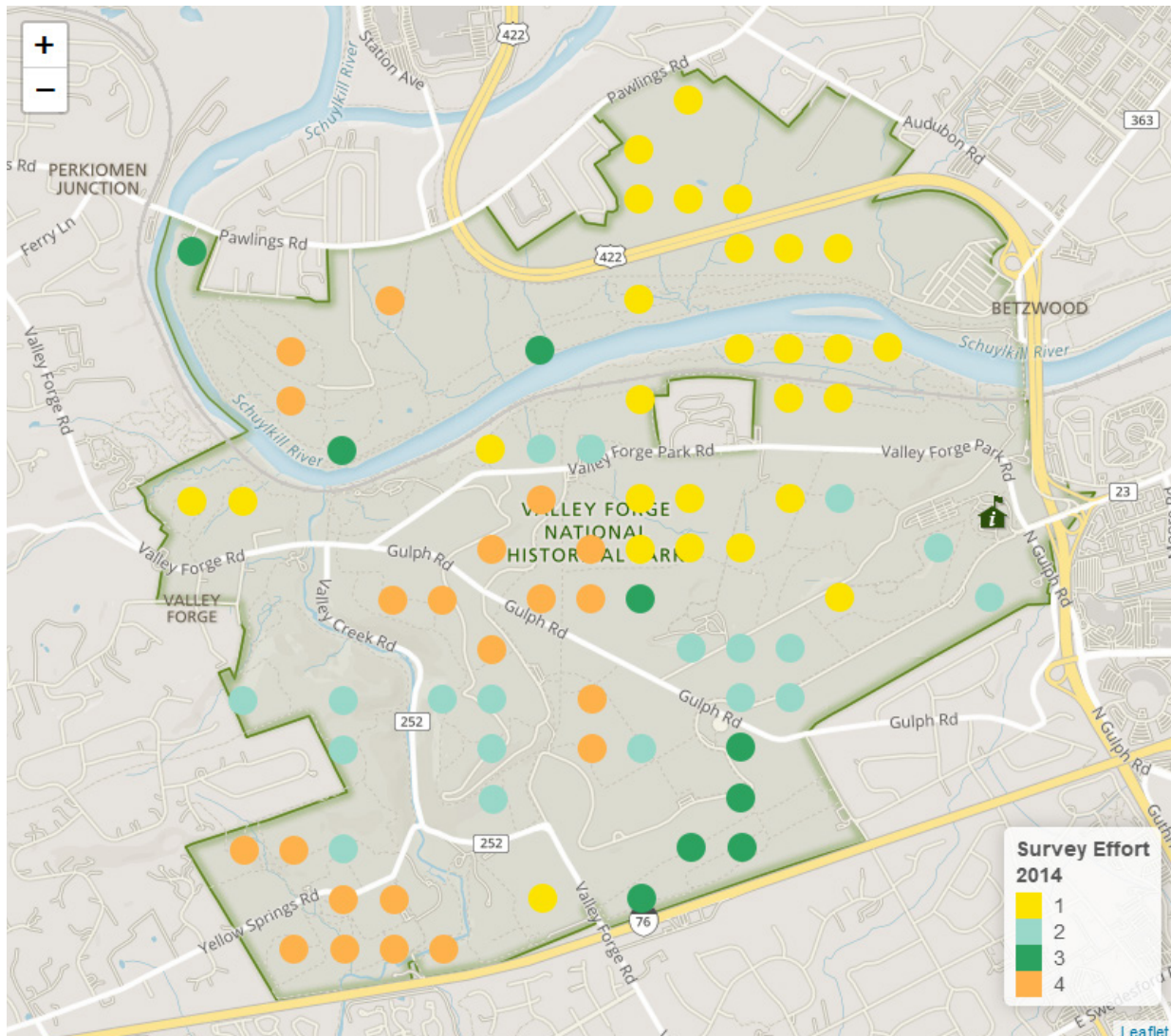


Figure 13. Map of breeding bird monitoring points and the number of visits to each point (Survey Effort) for Valley Forge National Historical Park for the year 2014.

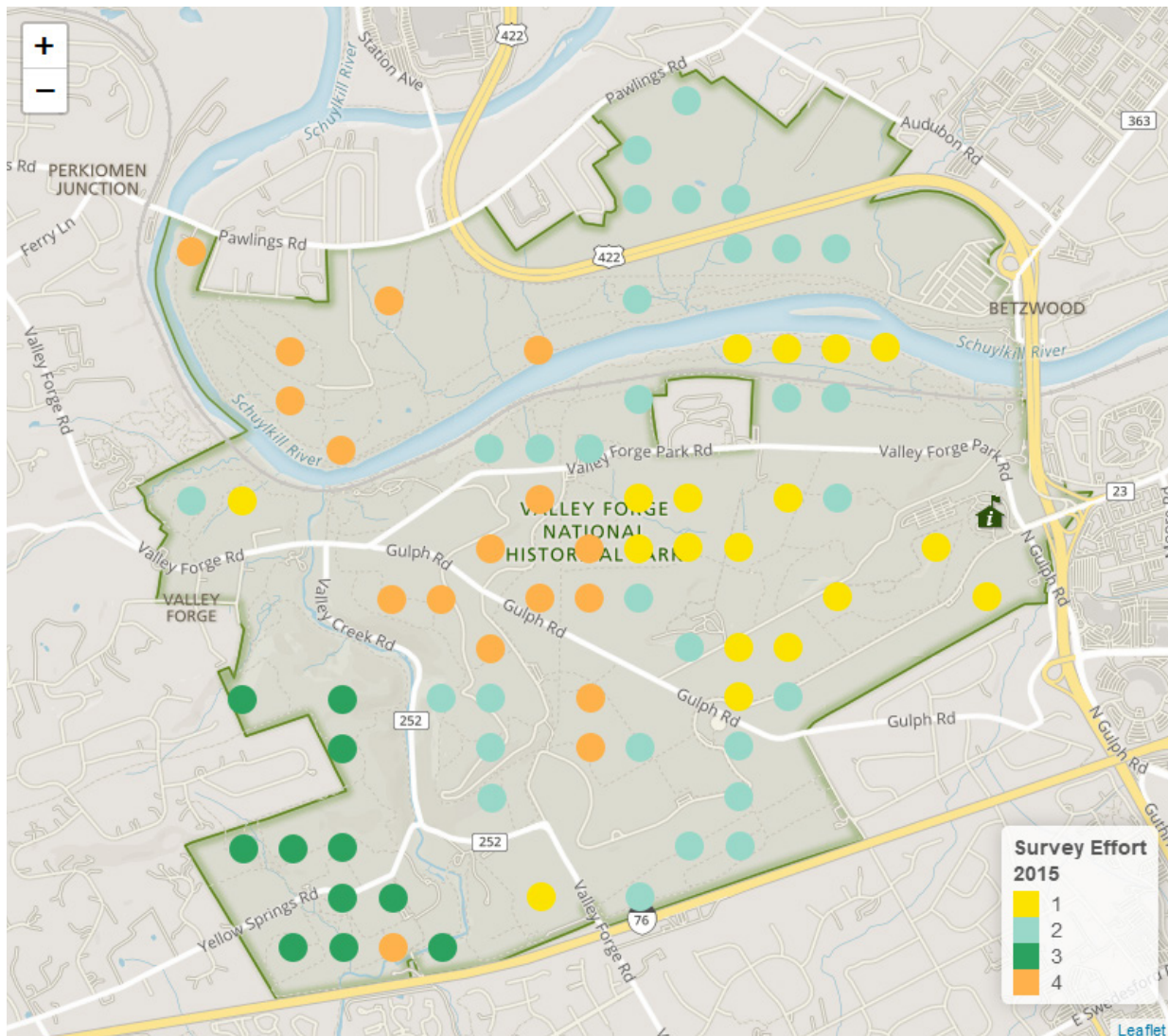


Figure 14. Map of breeding bird monitoring points and the number of visits to each point (Survey Effort) for Valley Forge National Historical Park for the year 2015.

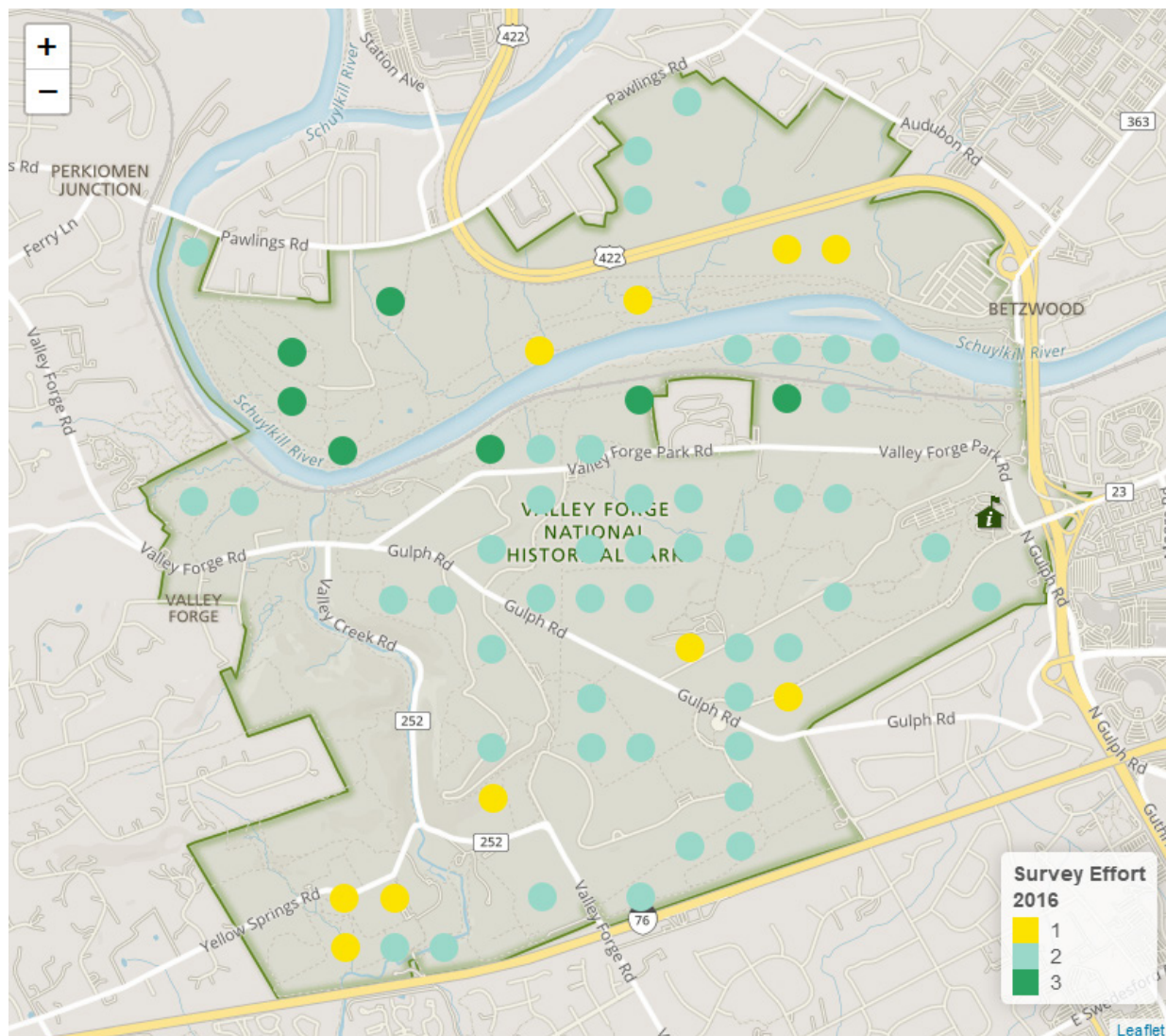


Figure 15. Map of breeding bird monitoring points and the number of visits to each point (Survey Effort) for Valley Forge National Historical Park for the year 2016.

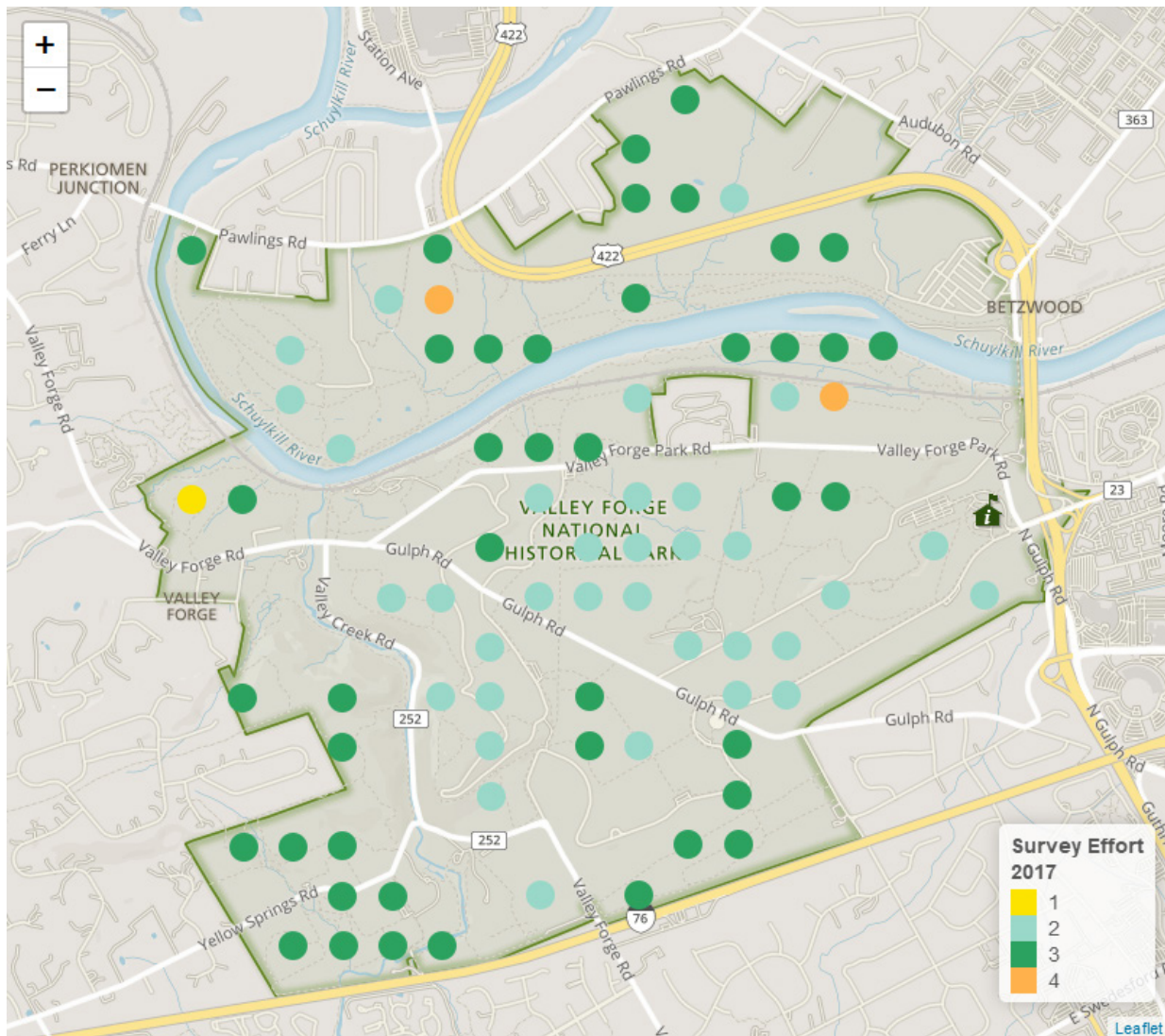


Figure 16. Map of breeding bird monitoring points and the number of visits to each point (Survey Effort) for Valley Forge National Historical Park for the year 2017.

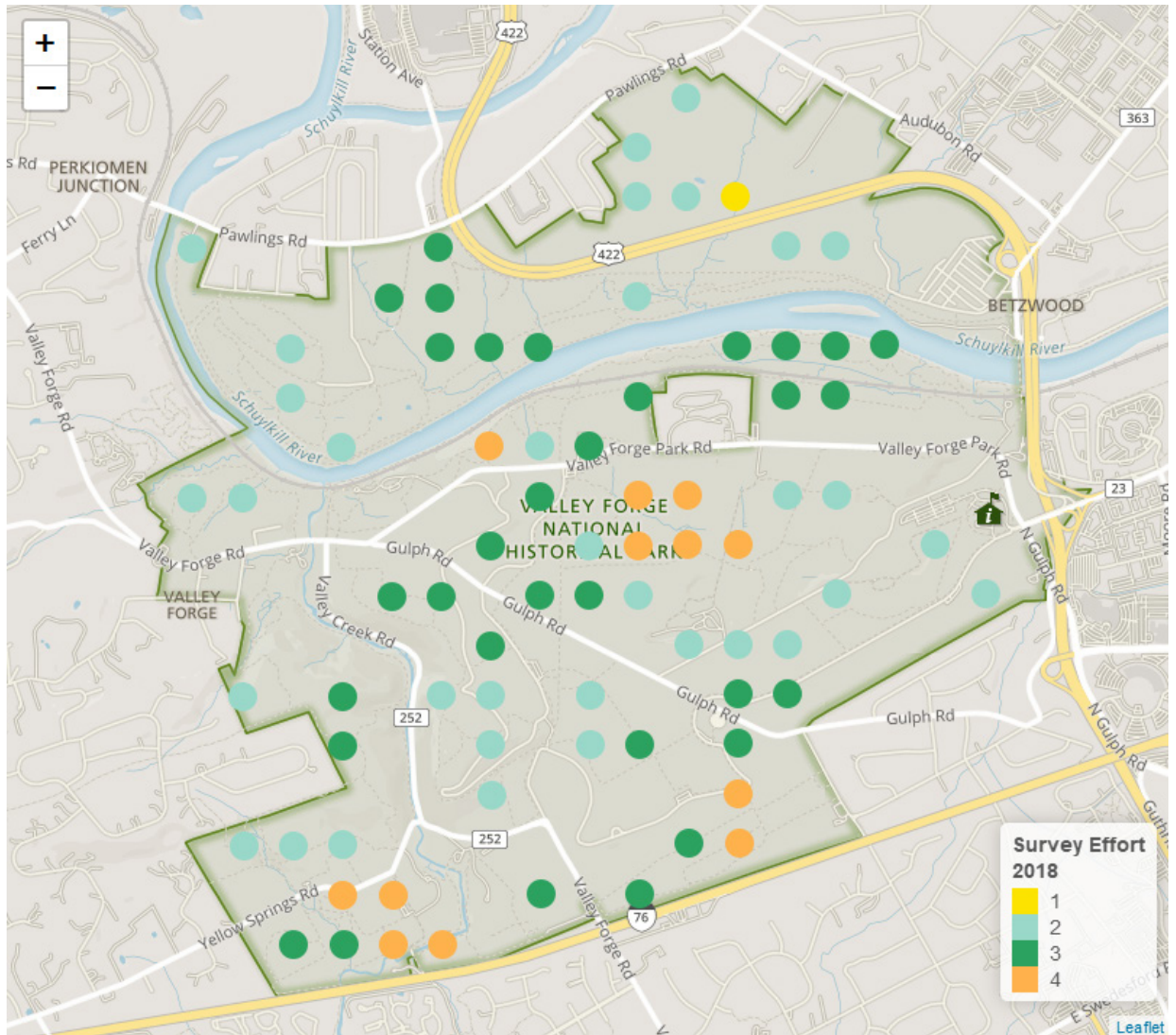


Figure 17. Map of breeding bird monitoring points and the number of visits to each point (Survey Effort) for Valley Forge National Historical Park for the year 2018.

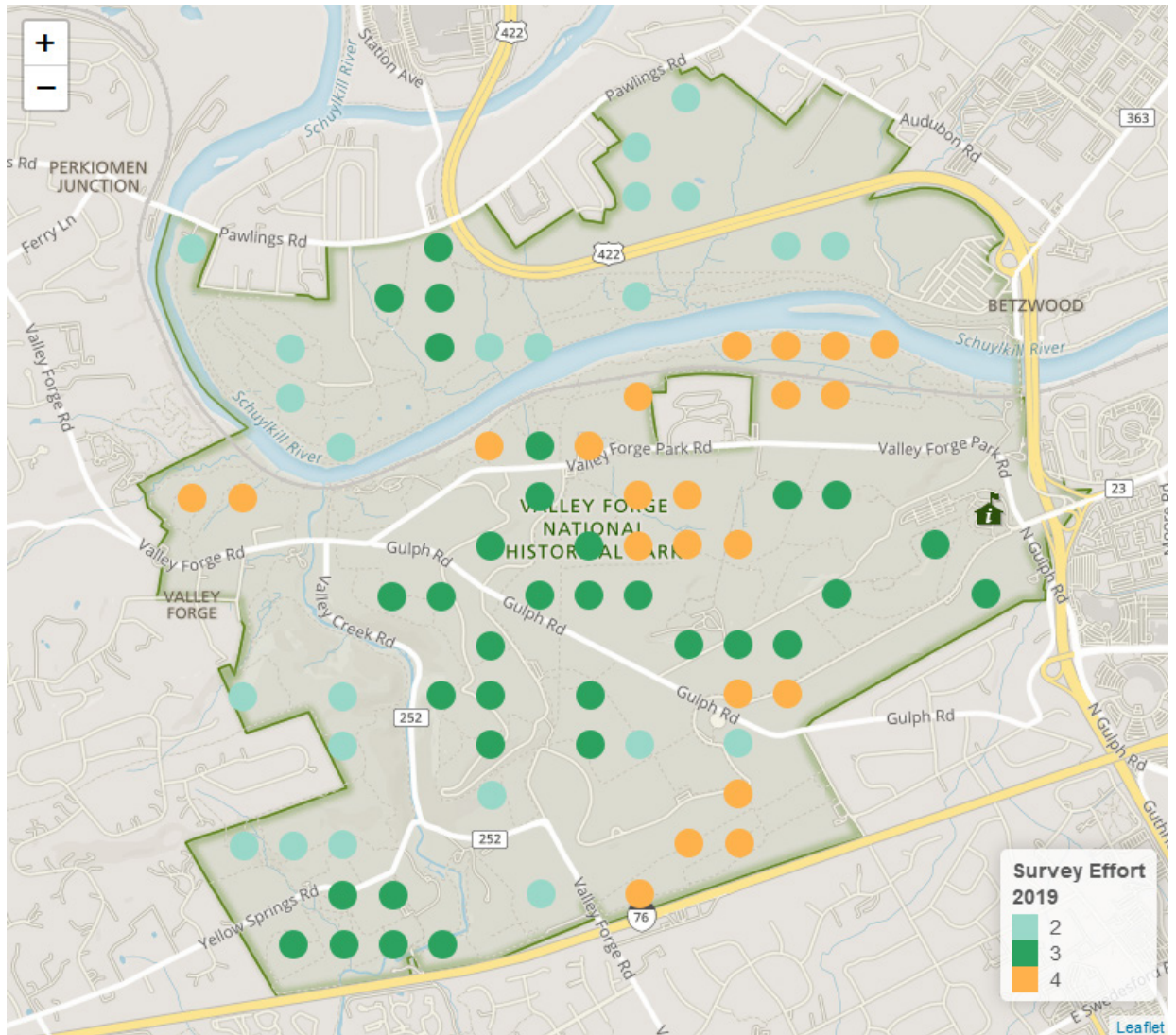


Figure 18. Map of breeding bird monitoring points and the number of visits to each point (Survey Effort) for Valley Forge National Historical Park for the year 2019.

Literature Cited

- Comiskey, J. A. and K. K. Callahan. 2008. Mid-Atlantic Network vital signs monitoring plan. Natural Resource Report NPS/MIDN/NRR—2008/071. National Park Service, Fort Collins, Colorado.
- Johnson, M. J. 2014a. Breeding bird monitoring: Mid-Atlantic Network 2012 summary report. Natural Resource Data Series. NPS/MIDN/NRDS—2014/650. National Park Service. Fort Collins, Colorado
- Johnson, M. J. 2014b. Breeding bird monitoring: Mid-Atlantic Network 2013 summary report. Natural Resource Data Series. NPS/MIDN/NRDS—2014/736. National Park Service. Fort Collins, Colorado
- Johnson, M. J. and S. M. Wakamiya. 2018. Breeding bird monitoring protocol for the Mid-Atlantic Network. Natural Resource Report NPS/MIDN/NRR—2018/1769. National Park Service, Fort Collins, Colorado.
- Goodwin, S. E. and Wakamiya, S. M. 2011. Breeding bird monitoring: Mid-Atlantic Network 2009 annual report. Natural Resource Data Series. NPS/MIDN/NRDS—2011/142. National Park Service, Natural Resource Program Center. Fort Collins, Colorado.
- NPS. 1999. Natural Resource Challenge: The National Park Service's Action Plan for Preserving Natural Resources. U.S. Department of Interior, National Park Service, Washington, DC.
- O'Connell, T.J., L.E. Jackson and R.P. Brooks. 1998. The Bird Community Index: A Tool for Assessing Biotic Integrity in the Mid-Atlantic Highlands. Final Report prepared for U. S. Environmental Protection Agency, Region III.
- O'Connell T.J., L.E. Jackson and R.P. Brooks. 2000. Bird guilds as indicators of ecological condition in the central Appalachians. *Ecological Applications* 10:1706–1721.
- Rosenberg, K. V., J. A. Kennedy, R. Dettmers, R. P. Ford, D. Reynolds, J. D. Alexander, C. J. Beardmore, P. J. Blancher, R. E. Bogart, G. S. Butcher, A. F. Camfield, A. Couturier, D. W. Demarest, W. E. Easton, J. J. Giocomo, R. H. Keller, A. E. Mini, A. O. Panjabi, D. N. Pashley, T. D. Rich, J. M. Ruth, H. Stabins, J. Stanton, and T. Will. 2016. Partners in Flight Landbird Conservation Plan: 2016 Revision for Canada and Continental United States. Partners in Flight Science Committee. Partners in Flight Science Committee.
- Severinghaus, W. D. 1981. Guild theory development as a mechanism for assessing environmental impact. *Environmental Management* 5(3):187–190.
- USNABCI Committee. 2000. The North American Bird Conservation Initiative in the United States: a vision of American bird conservation. U.S. Fish and Wildlife Service, Arlington, Virginia.

- Verner, J. 1984. The guild concept applied to management of bird populations. *Environmental Management* 8(1):1–13.
- Wakamiya, S. 2012a. Breeding bird monitoring: Mid-Atlantic Network 2010 summary report. Natural Resource Data Series. NPS/MIDN/NRDS—2012/279. National Park Service. Fort Collins, Colorado.
- Wakamiya, S. 2012b. Breeding bird monitoring: Mid-Atlantic Network 2011 summary report. Natural Resource Data Series. NPS/MIDN/NRDS—2012/331. National Park Service. Fort Collins, Colorado.

Appendix A

Relative Abundance

Table A1. Relative abundance for all species observed during breeding bird monitoring at Valley Forge National Historical Park (2014–2019). The means presented were calculated based on the maximum number of detections at each point. *Species of regional concern.

Common Name	Scientific Name	2014	2015	2016	2017	2018	2019
Acadian Flycatcher	<i>Empidonax virescens</i>	0	0.01±0.01	0	0	0	0
Alder Flycatcher	<i>Empidonax alnorum</i>	0	0	0	0.01±0.01	0.01±0.01	0
American Coot	<i>Fulica americana</i>	0.03±0.02	0	0.03±0.03	0.03±0.02	0.08±0.03	0.06±0.03
American Crow	<i>Corvus brachyrhynchos</i>	0.43±0.08	0.54±0.10	0.35±0.09	0.28±0.06	0.35±0.08	0.28±0.07
American Goldfinch	<i>Spinus tristis</i>	0.64±0.12	0.50±0.11	0.77±0.16	0.78±0.13	0.92±0.14	0.63±0.10
* American Kestrel	<i>Falco sparverius</i>	0	0.04±0.03	0.06±0.04	0.05±0.02	0.10±0.04	0.05±0.03
American Redstart	<i>Setophaga ruticilla</i>	0	0	0	0.01±0.01	0	0
American Robin	<i>Turdus migratorius</i>	1.47±0.17	1.72±0.16	1.48±0.16	1.38±0.14	1.58±0.17	1.53±0.14
Bald Eagle	<i>Haliaeetus leucocephalus</i>	0.03±0.03	0	0	0	0	0
Baltimore Oriole	<i>Icterus galbula</i>	0.50±0.08	0.33±0.06	0.62±0.11	0.37±0.06	0.41±0.06	0.49±0.08
Bank Swallow	<i>Riparia</i>	0.01±0.01	0	0	0	0	0
Barn Swallow	<i>Hirundo rustica</i>	0.36±0.10	0.13±0.05	0.17±0.08	0.35±0.12	0.20±0.09	0.51±0.19
* Belted Kingfisher	<i>Megasceryle alcyon</i>	0.01±0.01	0	0.02±0.02	0.01±0.01	0.01±0.01	0.01±0.01
Black-and-white Warbler	<i>Mniotilta varia</i>	0	0	0.02±0.02	0	0	0
* Black-billed Cuckoo	<i>Coccyzus erythrophthalmus</i>	0.01±0.01	0	0.02±0.02	0	0	0.01±0.01
Black Vulture	<i>Coragyps atratus</i>	0	0.03±0.02	0.03±0.03	0.01±0.01	0	0.03±0.02
Blackpoll Warbler	<i>Setophaga striata</i>	0	0.01±0.01	0.03±0.02	0.01±0.01	0	0.01±0.01

Table A1 (continued). Relative abundance for all species observed during breeding bird monitoring at Valley Forge National Historical Park (2014–2019). The means presented were calculated based on the maximum number of detections at each point. *Species of regional concern.

Common Name	Scientific Name	2014	2015	2016	2017	2018	2019
Blue-gray Gnatcatcher	<i>Polioptila caerulea</i>	0.04±0.02	0.09±0.04	0.14±0.04	0.06±0.03	0.03±0.02	0.09±0.04
* Blue-winged Warbler	<i>Vermivora cyanoptera</i>	0	0	0	0	0	0
Blue Grosbeak	<i>Passerina caerulea</i>	0	0	0.02±0.02	0.01±0.01	0.05±0.02	0.03±0.02
Blue Jay	<i>Cyanocitta cristata</i>	1.55±0.15	1.47±0.13	1.35±0.13	1.39±0.12	1.66±0.14	1.15±0.12
Bobolink	<i>Dolichonyx oryzivorus</i>	0	0	0	0	0	0
Brown-headed Cowbird	<i>Molothrus ater</i>	0.11±0.05	0.18±0.05	0.12±0.05	0.09±0.03	0.13±0.04	0.12±0.04
Brown Thrasher	<i>Toxostoma rufum</i>	0.01±0.01	0.01±0.01	0.03±0.02	0.01±0.01	0.04±0.02	0.03±0.02
Canada Goose	<i>Branta canadensis</i>	0.11±0.07	0.03±0.03	0.05±0.03	0.38±0.38	0.10±0.05	0.05±0.03
Carolina Chickadee	<i>Poecile carolinensis</i>	0.41±0.08	0.45±0.09	0.62±0.11	0.39±0.08	0.32±0.07	0.15±0.05
Carolina Wren	<i>Thryothorus ludovicianus</i>	0.17±0.05	0.30±0.06	0.48±0.10	0.53±0.08	0.59±0.08	0.86±0.12
Cedar Waxwing	<i>Bombycilla cedrorum</i>	0.03±0.02	0.09±0.04	0.12±0.06	0.16±0.09	0.08±0.04	0.76±0.38
Chestnut-sided Warbler	<i>Setophaga pensylvanica</i>	0	0.03±0.02	0	0	0	0
* Chimney Swift	<i>Chaetura pelagica</i>	0.24±0.10	0.12±0.05	0.31±0.09	0.24±0.11	0.39±0.12	0.35±0.14
Chipping Sparrow	<i>Spizella passerina</i>	0.24±0.07	0.13±0.04	0.20±0.06	0.11±0.04	0.13±0.05	0.15±0.06
Common Grackle	<i>Quiscalus quiscula</i>	0.13±0.04	0.09±0.04	0.25±0.10	0.10±0.04	0.08±0.03	0.08±0.04
Common Merganser	<i>Mergus merganser</i>	0	0	0	0.03±0.02	0	0
Common Raven	<i>Corvus corax</i>	0	0	0	0.01±0.01	0.06±0.03	0
Common Yellowthroat	<i>Geothlypis trichas</i>	0.53±0.10	0.80±0.14	0.65±0.12	1.00±0.12	1.19±0.13	1.19±0.13
Cooper's Hawk	<i>Accipiter cooperii</i>	0	0	0.03±0.02	0	0	0
Double-crested Cormorant	<i>Phalacrocorax auritus</i>	0	0	0	0	0.01±0.01	0
Downy Woodpecker	<i>Dryobates pubescens</i>	0.25±0.06	0.26±0.06	0.20±0.06	0.32±0.06	0.27±0.06	0.33±0.07

Table A1 (continued). Relative abundance for all species observed during breeding bird monitoring at Valley Forge National Historical Park (2014–2019). The means presented were calculated based on the maximum number of detections at each point. *Species of regional concern.

Common Name	Scientific Name	2014	2015	2016	2017	2018	2019
Eastern Bluebird	<i>Sialia sialis</i>	0.04±0.02	0.05±0.03	0.06±0.04	0.06±0.03	0.06±0.03	0
* Eastern Kingbird	<i>Tyrannus</i>	0.32±0.08	0.17±0.06	0.18±0.06	0.25±0.06	0.18±0.05	0.33±0.07
* Eastern Meadowlark	<i>Sturnella magna</i>	0.50±0.11	0.49±0.09	0.68±0.13	0.29±0.09	0.15±0.05	0.26±0.07
Eastern Phoebe	<i>Sayornis phoebe</i>	0.04±0.02	0.08±0.03	0.03±0.02	0	0.05±0.02	0.01±0.01
Eastern Screech-Owl	<i>Megascops asio</i>	0	0	0	0	0	0
* Eastern Towhee	<i>Pipilo erythrophthalmus</i>	0.45±0.10	0.79±0.13	0.63±0.11	0.73±0.10	0.84±0.11	0.94±0.13
* Eastern Wood-Pewee	<i>Contopus virens</i>	0.47±0.08	0.43±0.08	0.38±0.08	0.46±0.08	0.46±0.07	0.45±0.08
European Starling	<i>Sturnus vulgaris</i>	1.16±0.38	0.68±0.17	2.14±0.89	4.67±1.33	2.77±1.11	1.62±0.47
* Field Sparrow	<i>Spizella pusilla</i>	0.79±0.16	0.96±0.17	1.09±0.19	1.19±0.15	1.42±0.16	1.35±0.16
Fish Crow	<i>Corvus ossifragus</i>	0.01±0.01	0.03±0.02	0.09±0.05	0	0.03±0.02	0.01±0.01
* Grasshopper Sparrow	<i>Ammodramus savannarum</i>	0	0	0	0.03±0.03	0	0
Gray Catbird	<i>Dumetella carolinensis</i>	0.68±0.11	0.76±0.12	0.63±0.10	0.61±0.10	0.89±0.12	1.23±0.17
Great Blue Heron	<i>Ardea herodias</i>	0.01±0.01	0	0	0	0	0
Great Crested Flycatcher	<i>Myiarchus crinitus</i>	0.43±0.07	0.34±0.06	0.40±0.08	0.47±0.11	0.42±0.08	0.4±0.08
* Green Heron	<i>Butorides virescens</i>	0	0	0	0	0.01±0.01	0
Hairy Woodpecker	<i>Dryobates villosus</i>	0.11±0.04	0.18±0.05	0.14±0.06	0.14±0.04	0.13±0.04	0.08±0.03
House Finch	<i>Haemorhous mexicanus</i>	0.11±0.05	0.12±0.08	0.03±0.02	0.03±0.02	0.04±0.03	0.05±0.04
House Sparrow	<i>Passer domesticus</i>	0	0.04±0.04	0	0	0	0
House Wren	<i>Troglodytes aedon</i>	0.30±0.07	0.28±0.06	0.20±0.06	0.27±0.06	0.28±0.07	0.27±0.06
Indigo Bunting	<i>Passerina cyanea</i>	0.47±0.09	0.61±0.12	0.75±0.12	0.81±0.11	0.68±0.11	0.59±0.10
Killdeer	<i>Charadrius vociferus</i>	0	0	0.02±0.02	0	0	0

Table A1 (continued). Relative abundance for all species observed during breeding bird monitoring at Valley Forge National Historical Park (2014–2019). The means presented were calculated based on the maximum number of detections at each point. *Species of regional concern.

Common Name	Scientific Name	2014	2015	2016	2017	2018	2019
Louisiana Waterthrush	<i>Parkesia motacilla</i>	0.01±0.01	0	0	0	0	0
Mallard	<i>Anas platyrhynchos</i>	0.04±0.04	0.07±0.07	0.03±0.02	0.01±0.01	0.09±0.06	0
Mourning Dove	<i>Zenaida macroura</i>	0.33±0.07	0.46±0.09	0.37±0.08	0.53±0.10	0.48±0.08	0.46±0.08
Northern Cardinal	<i>Cardinalis</i>	0.59±0.08	0.54±0.07	0.63±0.09	0.71±0.09	0.48±0.07	0.65±0.10
* Northern Flicker	<i>Colaptes auratus</i>	0.29±0.07	0.53±0.08	0.48±0.08	0.57±0.07	0.56±0.09	0.68±0.08
Northern Mockingbird	<i>Mimus polyglottos</i>	0.51±0.10	0.51±0.11	0.51±0.09	0.51±0.07	0.32±0.07	0.46±0.08
Northern Parula	<i>Setophaga americana</i>	0.01±0.01	0	0	0	0	0
Northern Rough-winged Swallow	<i>Stelgidopteryx serripennis</i>	0.03±0.02	0	0.02±0.02	0.03±0.02	0.35±0.32	0.14±0.09
Orchard Oriole	<i>Icterus spurius</i>	0.29±0.08	0.18±0.06	0.23±0.09	0.35±0.08	0.42±0.09	0.50±0.09
Ovenbird	<i>Seiurus aurocapilla</i>	0.05±0.03	0.07±0.03	0.05±0.03	0.06±0.03	0.14±0.05	0.13±0.05
Palm Warbler	<i>Setophaga palmarum</i>	0.01±0.01	0	0	0	0	0
Pileated Woodpecker	<i>Dryocopus pileatus</i>	0.05±0.03	0.09±0.03	0.06±0.03	0.03±0.02	0.11±0.04	0.09±0.04
Pine Warbler	<i>Setophaga pinus</i>	0	0	0.02±0.02	0	0	0.01±0.01
* Prairie Warbler	<i>Setophaga discolor</i>	0.01±0.01	0.01±0.01	0.02±0.02	0	0	0
Prothonotary Warbler	<i>Protonotaria citrea</i>	0	0	0	0	0	0.01±0.01
Purple Martin	<i>Progne subis</i>	0	0.01±0.01	0	0	0	0
Red-bellied Woodpecker	<i>Melanerpes carolinus</i>	0.76±0.10	1.13±0.11	0.82±0.10	1.03±0.09	0.99±0.10	1.04±0.09
Red-eyed Vireo	<i>Vireo olivaceus</i>	0.58±0.09	0.47±0.08	0.34±0.07	0.39±0.07	0.39±0.08	0.54±0.09
Red-shouldered Hawk	<i>Buteo lineatus</i>	0.01±0.01	0	0.02±0.02	0.01±0.01	0	0
Red-tailed Hawk	<i>Buteo jamaicensis</i>	0.12±0.05	0.07±0.04	0.06±0.03	0.13±0.04	0.16±0.05	0.15±0.05
Red-winged Blackbird	<i>Agelaius phoeniceus</i>	1.66±0.25	1.61±0.27	2.52±0.43	2.03±0.28	2.91±0.49	3.42±0.48

Table A1 (continued). Relative abundance for all species observed during breeding bird monitoring at Valley Forge National Historical Park (2014–2019). The means presented were calculated based on the maximum number of detections at each point. *Species of regional concern.

Common Name	Scientific Name	2014	2015	2016	2017	2018	2019
Rock Pigeon	<i>Columba livia</i>	0	0	0	0.06±0.06	0.03±0.03	0.12±0.08
Rose-breasted Grosbeak	<i>Pheucticus ludovicianus</i>	0	0	0.06±0.03	0	0	0
Ruby-throated Hummingbird	<i>Archilochus colubris</i>	0	0	0	0	0	0.01±0.01
Savannah Sparrow	<i>Passerculus sandwichensis</i>	0	0.04±0.02	0	0	0	0
Scarlet Tanager	<i>Piranga olivacea</i>	0.12±0.04	0.26±0.06	0.09±0.04	0.23±0.05	0.19±0.04	0.14±0.04
Solitary Sandpiper	<i>Tringa solitaria</i>	0	0	0	0.03±0.02	0	0
Song Sparrow	<i>Melospiza melodia</i>	0.67±0.1	0.76±0.12	0.89±0.11	0.86±0.11	1.00±0.12	1.06±0.13
Swainson's Thrush	<i>Catharus ustulatus</i>	0	0.01±0.01	0	0	0	0
Tree Swallow	<i>Tachycineta bicolor</i>	0.13±0.05	0.01±0.01	0.02±0.02	0.23±0.09	0.13±0.05	0.26±0.09
Tufted Titmouse	<i>Baeolophus bicolor</i>	0.72±0.09	0.75±0.10	0.52±0.08	0.91±0.13	0.58±0.08	0.14±0.04
Turkey Vulture	<i>Cathartes aura</i>	0.08±0.05	0.09±0.07	0.03±0.02	0	0.06±0.04	0.09±0.04
Veery	<i>Catharus fuscescens</i>	0	0.03±0.02	0.03±0.02	0	0.01±0.01	0
Vesper Sparrow	<i>Poocetes gramineus</i>	0	0	0	0	0.01±0.01	0
Warbling Vireo	<i>Vireo gilvus</i>	0.09±0.04	0.13±0.06	0.28±0.07	0.1±0.04	0.25±0.06	0.26±0.06
White-breasted Nuthatch	<i>Sitta carolinensis</i>	0.24±0.05	0.38±0.07	0.28±0.06	0.39±0.07	0.49±0.07	0.38±0.06
White-eyed Vireo	<i>Vireo griseus</i>	0	0	0	0	0	0
Wild Turkey	<i>Meleagris gallopavo</i>	0	0	0	0	0	0.01±0.01
Willow Flycatcher	<i>Empidonax traillii</i>	0.01±0.01	0.07±0.04	0.08±0.05	0.03±0.02	0.08±0.03	0.13±0.05
Wood Duck	<i>Aix sponsa</i>	0.03±0.03	0	0	0.01±0.01	0.01±0.01	0
* Wood Thrush	<i>Hylocichla mustelina</i>	0.43±0.09	0.78±0.14	0.62±0.14	0.75±0.12	0.68±0.11	0.82±0.12
Worm-eating Warbler	<i>Helminthos vermivorum</i>	0	0.01±0.01	0	0	0	0

Table A1 (continued). Relative abundance for all species observed during breeding bird monitoring at Valley Forge National Historical Park (2014–2019). The means presented were calculated based on the maximum number of detections at each point. *Species of regional concern.

Common Name	Scientific Name	2014	2015	2016	2017	2018	2019
* Yellow-billed Cuckoo	<i>Coccyzus americanus</i>	0.07±0.03	0.05±0.03	0.06±0.03	0.03±0.02	0.01±0.01	0.09±0.03
Yellow-throated Vireo	<i>Vireo flavifrons</i>	0.03±0.02	0.07±0.03	0.08±0.03	0.08±0.03	0.10±0.03	0.06±0.03
Yellow-throated Warbler	<i>Setophaga dominica</i>	0	0	0	0.01±0.01	0	0
Yellow Warbler	<i>Setophaga petechia</i>	0.09±0.03	0.20±0.06	0.17±0.07	0.06±0.03	0.09±0.04	0.12±0.04

Percent Occurrence

Table A2. Percent occurrence for all species observed during breeding bird monitoring at Valley Forge National Historical Park (2014–2019).

*Species of regional concern.

Common Name	Scientific Name	2014	2015	2016	2017	2018	2019
Acadian Flycatcher	<i>Empidonax virescens</i>	0	1	0	0	0	0
Alder Flycatcher	<i>Empidonax alnorum</i>	0	0	0	1	1	0
American Coot	<i>Fulica americana</i>	3	0	2	3	8	6
American Crow	<i>Corvus brachyrhynchos</i>	30	36	25	22	27	19
American Goldfinch	<i>Spinus tristis</i>	37	30	35	46	52	44
* American Kestrel	<i>Falco sparverius</i>	0	3	5	5	9	4
American Redstart	<i>Setophaga ruticilla</i>	0	0	0	1	0	0
American Robin	<i>Turdus migratorius</i>	71	79	80	80	84	78
Bald Eagle	<i>Haliaeetus leucocephalus</i>	1	0	0	0	0	0
Baltimore Oriole	<i>Icterus galbula</i>	41	29	45	34	37	38
Bank Swallow	<i>Riparia</i>	1	0	0	0	0	0
Barn Swallow	<i>Hirundo rustica</i>	20	11	9	16	9	21
* Belted Kingfisher	<i>Megasceryle alcyon</i>	1	0	2	1	1	1
Black-and-white Warbler	<i>Mniotilta varia</i>	0	0	2	0	0	0
* Black-billed Cuckoo	<i>Coccyzus erythrophthalmus</i>	1	0	2	0	0	1
Black Vulture	<i>Coragyps atratus</i>	0	3	2	1	0	3
Blackpoll Warbler	<i>Setophaga striata</i>	0	1	3	1	0	1
Blue-gray Gnatcatcher	<i>Poliophtila caerulea</i>	4	8	14	6	3	8
* Blue-winged Warbler	<i>Vermivora cyanoptera</i>	0	0	0	0	0	0

Table A2 (continued). Percent occurrence for all species observed during breeding bird monitoring at Valley Forge National Historical Park (2014–2019). *Species of regional concern.

Common Name	Scientific Name	2014	2015	2016	2017	2018	2019
Blue Grosbeak	<i>Passerina caerulea</i>	0	0	2	1	5	3
Blue Jay	<i>Cyanocitta cristata</i>	72	78	78	82	82	68
Bobolink	<i>Dolichonyx oryzivorus</i>	0	0	0	0	0	0
Brown-headed Cowbird	<i>Molothrus ater</i>	8	16	11	9	11	10
Brown Thrasher	<i>Toxostoma rufum</i>	1	1	3	1	4	3
Canada Goose	<i>Branta canadensis</i>	4	1	3	1	5	4
Carolina Chickadee	<i>Poecile carolinensis</i>	30	32	42	29	25	13
Carolina Wren	<i>Thryothorus ludovicianus</i>	16	28	34	42	49	63
Cedar Waxwing	<i>Bombycilla cedrorum</i>	3	8	6	8	5	19
Chestnut-sided Warbler	<i>Setophaga pensylvanica</i>	0	3	0	0	0	0
* Chimney Swift	<i>Chaetura pelagica</i>	9	9	20	11	19	12
Chipping Sparrow	<i>Spizella passerina</i>	18	13	17	11	10	10
Common Grackle	<i>Quiscalus quiscula</i>	12	8	12	8	8	6
Common Merganser	<i>Mergus merganser</i>	0	0	0	3	0	0
Common Raven	<i>Corvus corax</i>	0	0	0	1	5	0
Common Yellowthroat	<i>Geothlypis trichas</i>	36	42	43	58	66	68
Cooper's Hawk	<i>Accipiter cooperii</i>	0	0	3	0	0	0
Double-crested Cormorant	<i>Phalacrocorax auritus</i>	0	0	0	0	1	0
Downy Woodpecker	<i>Dryobates pubescens</i>	22	21	17	29	23	27
Eastern Bluebird	<i>Sialia sialis</i>	4	4	5	6	5	0
* Eastern Kingbird	<i>Tyrannus tyrannus</i>	22	12	15	22	15	27

Table A2 (continued). Percent occurrence for all species observed during breeding bird monitoring at Valley Forge National Historical Park (2014–2019). *Species of regional concern.

Common Name	Scientific Name	2014	2015	2016	2017	2018	2019
* Eastern Meadowlark	<i>Sturnella magna</i>	29	32	40	14	11	19
Eastern Phoebe	<i>Sayornis phoebe</i>	4	8	3	0	5	1
Eastern Screech-Owl	<i>Megascops asio</i>	0	0	0	0	0	0
* Eastern Towhee	<i>Pipilo erythrophthalmus</i>	28	45	48	51	51	54
* Eastern Wood-Pewee	<i>Contopus virens</i>	38	32	32	35	38	35
European Starling	<i>Sturnus vulgaris</i>	32	21	31	34	29	27
* Field Sparrow	<i>Spizella pusilla</i>	34	39	55	59	66	59
Fish Crow	<i>Corvus ossifragus</i>	1	3	6	0	3	1
* Grasshopper Sparrow	<i>Ammodramus savannarum</i>	0	0	0	1	0	0
Gray Catbird	<i>Dumetella carolinensis</i>	43	43	45	41	57	68
Great Blue Heron	<i>Ardea herodias</i>	1	0	0	0	0	0
Great Crested Flycatcher	<i>Myiarchus crinitus</i>	36	30	31	34	32	31
* Green Heron	<i>Butorides virescens</i>	0	0	0	0	1	0
Hairy Woodpecker	<i>Dryobates villosus</i>	11	16	11	14	11	8
House Finch	<i>Haemorhous mexicanus</i>	7	4	3	3	3	3
House Sparrow	<i>Passer domesticus</i>	0	1	0	0	0	0
House Wren	<i>Troglodytes aedon</i>	21	24	17	24	23	22
Indigo Bunting	<i>Passerina cyanea</i>	33	34	49	54	43	41
Killdeer	<i>Charadrius vociferus</i>	0	0	2	0	0	0
Louisiana Waterthrush	<i>Parkesia motacilla</i>	1	0	0	0	0	0
Mallard	<i>Anas platyrhynchos</i>	1	1	3	1	4	0

Table A2 (continued). Percent occurrence for all species observed during breeding bird monitoring at Valley Forge National Historical Park (2014–2019). *Species of regional concern.

Common Name	Scientific Name	2014	2015	2016	2017	2018	2019
Mourning Dove	<i>Zenaida macroura</i>	28	32	28	39	35	36
Northern Cardinal	<i>Cardinalis cardinalis</i>	49	47	49	53	41	46
* Northern Flicker	<i>Colaptes auratus</i>	24	41	40	48	43	53
Northern Mockingbird	<i>Mimus polyglottos</i>	30	29	38	43	25	36
Northern Parula	<i>Setophaga americana</i>	1	0	0	0	0	0
Northern Rough-winged Swallow	<i>Stelgidopteryx serripennis</i>	3	0	2	3	4	4
Orchard Oriole	<i>Icterus spurius</i>	20	14	12	25	25	35
Ovenbird	<i>Seiurus aurocapilla</i>	4	5	5	5	11	10
Palm Warbler	<i>Setophaga palmarum</i>	1	0	0	0	0	0
Pileated Woodpecker	<i>Dryocopus pileatus</i>	5	9	6	3	11	8
Pine Warbler	<i>Setophaga pinus</i>	0	0	2	0	0	1
* Prairie Warbler	<i>Setophaga discolor</i>	1	1	2	0	0	0
Prothonotary Warbler	<i>Protonotaria citrea</i>	0	0	0	0	0	1
Purple Martin	<i>Progne subis</i>	0	1	0	0	0	0
Red-bellied Woodpecker	<i>Melanerpes carolinus</i>	55	71	58	76	66	74
Red-eyed Vireo	<i>Vireo olivaceus</i>	42	36	28	32	30	40
Red-shouldered Hawk	<i>Buteo lineatus</i>	1	0	2	1	0	0
Red-tailed Hawk	<i>Buteo jamaicensis</i>	9	4	6	11	13	12
Red-winged Blackbird	<i>Agelaius phoeniceus</i>	62	53	55	58	58	60
Rock Pigeon	<i>Columba livia</i>	0	0	0	1	1	3
Rose-breasted Grosbeak	<i>Pheucticus ludovicianus</i>	0	0	6	0	0	0

Table A2 (continued). Percent occurrence for all species observed during breeding bird monitoring at Valley Forge National Historical Park (2014–2019). *Species of regional concern.

Common Name	Scientific Name	2014	2015	2016	2017	2018	2019
Ruby-throated Hummingbird	<i>Archilochus colubris</i>	0	0	0	0	0	1
Savannah Sparrow	<i>Passerculus sandwichensis</i>	0	4	0	0	0	0
Scarlet Tanager	<i>Piranga olivacea</i>	12	24	9	22	19	14
Solitary Sandpiper	<i>Tringa solitaria</i>	0	0	0	3	0	0
Song Sparrow	<i>Melospiza melodia</i>	46	46	58	53	58	59
Swainson's Thrush	<i>Catharus ustulatus</i>	0	1	0	0	0	0
Tree Swallow	<i>Tachycineta bicolor</i>	9	1	2	11	9	12
Tufted Titmouse	<i>Baeolophus bicolor</i>	55	50	43	58	47	14
Turkey Vulture	<i>Cathartes aura</i>	4	4	3	0	4	6
Veery	<i>Catharus fuscescens</i>	0	3	3	0	1	0
Vesper Sparrow	<i>Pooecetes gramineus</i>	0	0	0	0	1	0
Warbling Vireo	<i>Vireo gilvus</i>	8	8	22	9	20	23
White-breasted Nuthatch	<i>Sitta carolinensis</i>	22	30	26	30	46	37
White-eyed Vireo	<i>Vireo griseus</i>	0	0	0	0	0	0
Wild Turkey	<i>Meleagris gallopavo</i>	0	0	0	0	0	1
Willow Flycatcher	<i>Empidonax traillii</i>	1	4	5	3	8	10
Wood Duck	<i>Aix sponsa</i>	1	0	0	1	1	0
* Wood Thrush	<i>Hylocichla mustelina</i>	28	45	31	43	41	46
Worm-eating Warbler	<i>Helmitheros vermivorum</i>	0	1	0	0	0	0
* Yellow-billed Cuckoo	<i>Coccyzus americanus</i>	7	4	6	3	1	9

Table A2 (continued). Percent occurrence for all species observed during breeding bird monitoring at Valley Forge National Historical Park (2014–2019). *Species of regional concern.

Common Name	Scientific Name	2014	2015	2016	2017	2018	2019
Yellow-throated Vireo	<i>Vireo flavifrons</i>	3	5	8	8	10	6
Yellow-throated Warbler	<i>Setophaga dominica</i>	0	0	0	1	0	0
Yellow Warbler	<i>Setophaga petechia</i>	9	14	11	6	8	12

The Department of the Interior protects and manages the nation's natural resources and cultural heritage; provides scientific and other information about those resources; and honors its special responsibilities to American Indians, Alaska Natives, and affiliated Island Communities.

NPS 464/170204, May 2020

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