Monitoring of High Priority Bird Species at Camp Grayling, Michigan

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Cover: Dry grassland at Camp Grayling in 2021. Photo by M. Monfils.

Table of Contents

List of Tables

List of Figures

List of Appendices

Executive Summary

Federal military facilities, such Camp Grayling Joint Maneuver Training Center (CGJMTC), are important in sustaining biodiversity, including threatened and endangered species and numerous migratory bird species. With many bird species continuing to decline, having current information on the status of bird species of conservation concern is vital to facilitating proactive management and minimizing possible conflicts between conservation measures and military training activities. The Michigan Natural Features Inventory (MNFI) partnered with the Michigan Department of Military and Veterans Affairs (DMVA) to design a bird survey program to gather information on bird species of high conservation concern using CGJMTC, such as listed, special concern, and declining species. The program will provide baseline data on these species and the overall bird communities using CGJMTC lands and a mechanism to monitor changes in relative abundance and distributions over time.

The MNFI worked with DMVA to develop a program that would meet their information needs and targeted the following bird species/groups: rare raptors, secretive marsh birds, golden-winged warbler (*Vermivora chrysoptera*, State special concern), red-headed woodpecker (*Melanerpes erythrocephalus*, State special concern), grassland birds, and pine barrens birds. For each target species/group, we created a three-year panel design of point-count stations to allow broad spatial coverage of CGJMTC on an annual, rotating basis. We used standardized point count methodologies for the target species/groups consistent with other monitoring efforts within the state and region. In 2021, staff from MNFI and DMVA implemented the first year of what was designed as a long-term monitoring program.

We conducted over 500 points counts for raptors, marsh birds, and at-risk bird species within CGJMTC in 2021. Across all surveys, 87 bird species were recorded, including endangered, threatened, and special concern species, species of greatest conservation need (SGCN), featured species of the Michigan Department of Natural Resources (Wildlife Division), and focal species of the Upper Mississippi / Great Lakes Joint Venture. Data gathered on several rare species will be incorporated into MNFI's Natural Heritage Database, including new element occurrences of northern goshawk (*Accipiter gentilis*, State special concern), golden-winged warbler, red-headed woodpecker, and common nighthawk (*Chordeiles minor*, State special concern. We also gathered information to update existing occurrences of American bittern (*Botaurus lentiginosus*, State special concern) and Kirtland's warbler (*Setophaga kirtlandii*, State endangered).

The sample design and survey protocols performed as expected, so we do not suggest major changes to the program moving forward. However, we do provide some recommendations to refine the sample design to better target the species of interest and slight modifications to the survey protocol to provide additional and more consistent data over time. The results of this first year of monitoring highlight the value of CGJMTC to a variety of breeding bird species and will provide valuable baseline information for evaluating trends in bird distributions and relative abundances as surveys are implemented in the future.

Introduction

Military installations serve as refuges for several at-risk wildlife species. For example, the intact wildlife habitats found on U.S. Department of Defense (DoD) lands support greater densities of threatened and endangered species than any other federal agency (Stein et al. 2008). Migratory bird species, even those once considered common and widespread, have been experiencing demonstrable population declines (Rosenberg et al. 2019), despite protection under the Migratory Bird Treaty Act. As more species become a conservation concern, it is increasingly important for land managers at military facilities to document the species that currently exist on their lands and, through proactive management, avoid potential conflicts between conservation measures and military training. Baseline surveys are a critical first step in making informed management decisions and, if repeated over time, can be used to document population changes. Surveys can also play an important part in helping installations to meet regulatory requirements.

Camp Grayling Joint Maneuver Training Center (CGJMTC) is an approximately 147,000-acre military installation used for military training that consists of a mosaic of lands owned by the Michigan Department of Military and Veterans Affairs (DMVA) and Michigan Department of Natural Resources (DNR). The facility provides a variety of habitats for migratory and resident breeding birds. The objective of this project was to develop and implement a bird monitoring program across CGJMTC to better document the species that occur on the installation and the distributions and relative abundances of at-risk and migratory species. Ultimately, these data will be incorporated into the CGJMTC Integrated Natural Resources Management Plan (INRMP) and used to provide guidelines for species management. The Michigan Natural Features Inventory (MNFI), a program of Michigan State University Extension (MSUE), worked with the DMVA to design a bird survey program to gather information on bird species of high conservation concern, such as state- and federally-listed, special concern, and declining species. The program will provide baseline data on these species and the broader bird communities using CGJMTC lands and a mechanism to monitor changes in relative abundance and distributions over time. In addition to designing the bird survey program, MNFI and DMVA staff implemented the first year of bird surveys of what was designed to be an annual, long-term program. In this report, we describe the monitoring program and methods used and summarize the results of the first year of surveys.

Methods

Sample Design

We developed bird surveys to evaluate the status (e.g., relative abundance, occupancy, trends) of the following rare or declining species with potential to occur at CGJMTC: 1) rare raptors; 2) secretive marsh birds; 3) golden-winged warbler (*Vermivora chrysoptera*, State special concern); 4) red-headed woodpecker (*Melanerpes erythrocephalus*, State special concern); 5) rare grassland birds; and 6) rare pine barrens species. Michigan Forest Inventory (MiFI) data were used to classify potential habitats for each bird species/group (Table 1). Based on cover type and size, we identified suitable stands and created spatial layers of potential habitat in ArcMap (ESRI 2017). Next, we created layers of potential survey points by overlaying point grids with appropriate spacing over the stands. We used a 250 m x 250 m point grid for late successional forest areas and a wider spaced, 400 m x 400 m point grid for early successional forest, shrub, and open cover types to reduce the likelihood of double counting (Ralph et al. 1995). Those points falling within the potential survey stands formed the sample frame for each species/group. Except for secretive marsh birds, there were more survey points than could be covered in one year, so we developed a panel sampling approach in which approximately one third of all points are covered in a year and all points are surveyed over three years. This approach could be applied on an ongoing, rotational basis, resulting in each point being surveyed every three years.

To develop our three survey panels while providing a spatially balanced and logistically efficient sample, we created a layer of 100-hectare hexagons to serve as our primary sample units (PSU) for CGJMTC. We used 100 hectares as our PSU size because it represents the approximate maximum area an individual can survey in a day under the various protocols used in this project. Each PSU was assigned a random number and after putting them in numerical order, we created the three survey panels for each bird species/group as follows: Panel 1 – first third of PSUs, Panel 2 – second third of PSUs, and Panel 3 – last third of PSUs. In this sample design, survey points are our secondary sample units, so when a PSU is selected for survey, all secondary sample units, or point count stations, falling within the PSU are to be surveyed (Figure 1).

Table 1. Michigan Forest Inventory (MiFI) stand descriptors used to identify potential habitats for the bird species or groups targeted in the Camp Grayling monitoring program.

Habitat Descriptor	Rare Raptors	Secretive Marsh Birds	Golden-winged Warbler	Red-headed Woodpecker	Grassland Birds
Cover type and code					
Aspen (A)	X		X		
Treed bog (D)			X		
Lowland deciduous (E)	X				
Herbaceous openland (G)					X
Hemlock (H)	X				
Lowland shrub (L)			X		
Lowland mixed forest (LM)	X			X	
Northern hardwood (M)	X			X	
Natural mixed pines (MC)	X				
Mixed upland deciduous (MD)	X			X	
Marsh (N)		X			
Oak (O)				X	
Lowland aspen/ balsam popular (P)	X		X	X	
Red pine (R)	X				
Upland mixed forest (UM)	X			X	
Low-density trees (U)				X	
Bog (V)		X			
Urban (X)				X	
White pine (W)	X				
Size density class	9	NA	All	All	NA
Minimum patch area (hectares)	4.0	4.0	2.0	NA	10.0

Figure 1. Examples of primary sample units (green hexagons) and secondary sample units (point count stations, yellow points) used in designing Camp Grayling bird surveys.

Rare Raptors

Raptor surveys were designed to target red-shouldered hawk (*Buteo lineatus*, State threatened) and northern goshawk (*Accipiter gentilis*, State special concern). Deciduous, mixed, and coniferous forest stands (except for pine plantations) of size-density class 9 and at least 4 hectares (10 acres) were considered potential habitat for these species. We surveyed raptors using a three-minute point count (Mosher et al. 1990, Anderson 2007, Bruggeman et al. 2011) consisting of two, one-minute broadcast periods (one for red-shouldered hawk, one for northern goshawk) and a final one-minute silent listening period. Calls were broadcasted using a FoxPro NX4 at a volume that produced a sound pressure of approximately 95 dB at one meter from the unit. The broadcast unit was rotated about 120 degrees for each series of calls to ensure 360-degree coverage.

We conducted surveys from 20 April to 5 May 2021 during daylight hours (sunrise to sunset). Weather conditions that can reduce the detectability of raptors were avoided (e.g., strong winds, moderate to heavy precipitation). Although red-shouldered hawk and northern goshawk were the focus of surveys, we recorded all raptor observations. For each raptor observation, we recorded the species, approximate distance when first detected (using distance bins of 0-50 m, 51-100 m, 101-250 m, 251-500 m, and > 500 m), and direction (i.e., N, NW, NE, S, SW, SE). When red-shouldered hawks or northern goshawks were observed, we searched the vicinity surrounding the survey point and location of the detection for potential nests. Trees were also visually inspected for stick nests while walking and driving between survey stations. We documented nest locations using tablet computers along with information on the species detected, activity observed (e.g., territorial behavior, incubation), nest status (e.g., decorated, feathers, whitewash), tree species, and approximate nest height. When an active nest was

confirmed (e.g., bird seen incubating or flushed from nest), we discontinued surveys at nearby points (i.e., within the same contiguous forest stand or nearest on the 250-meter point grid) to minimize disturbance to the nesting pair.

Secretive Marsh Birds

Open wetlands (e.g., marshes, wet meadows) of at least 4 hectares (10 acres) were surveyed for a suite of rare, declining, and secretive marsh bird species. We followed the North American Marsh Bird Monitoring Protocols (Conway 2011), which were further described for the Michigan Marsh Bird Survey (Michigan Bird Conservation Initiative [MiBCI] 2015). The survey methods target 10 primary species (e.g., rails, bitterns, grebes) and 8 secondary species (e.g., selected songbirds, marsh-nesting terns) that occur in marshes and other wetlands dominated by emergent vegetation.

We conducted three visits during the breeding season (mid-May to late June) at points separated by at least 400 m (Conway 2011). Surveys were done in the morning between 30 minutes before to 3 hours after sunrise. During each visit, we completed a 10-minute point count consisting of a five-minute passive listening period followed by one-minute broadcast periods for the following five species: Least bittern (*Ixobrychus exilis*, State threatened), yellow rail (*Coturnicops noveboracensis*, State threatened), sora (*Porzana carolina*), Virginia rail (*Rallus limicola*), and American bittern (*Botaurus lentiginosus*, State special concern). Calls were broadcasted using an MP3 player (Oakton MP100) and portable wireless speaker (Ultimate Ears Wonderboom 2) at the recommended sound pressure of 80-90 dB at one meter from the speaker. Observations of primary target species were recorded by individual bird across each minute of the 10-min survey and the distance at first detection was estimated to the nearest 5 meters with aid of a laser rangefinder. Secondary species were tracked at the species level, with only the period of first observation of the species noted and the total number of individuals were recorded within three distance bins (0-50 m, 51-100 m, and > 100 m). Please refer to the Michigan Marsh Bird Survey Protocol (MiBCI 2015) for detailed survey methods.

At-risk Bird Surveys

We used the same point-count methodology for surveys targeting golden-winged warbler, red-headed woodpecker, grassland birds, and pine barrens birds. Areas of early successional aspen and balsam poplar, shrub wetlands, and treed bogs at least 2 hectares (5 acres) in size were the focus of golden-winged warbler surveys. Stands of deciduous, mixed, and oak-dominated forests, and areas with low tree densities within the Hanson Forest and Cantonment were surveyed for red-headed woodpeckers. We identified grasslands (herbaceous openlands in MiFI) of at least 10 hectares (25 acres) as potential grassland bird habitats where surveys were conducted.

Surveys occurred during late May through early July and from sunrise to 4 hours after sunrise (Ralph et al. 1995). We avoided conducting surveys during weather conditions that can reduce bird detectability (e.g., winds ≥ 20 km/hr [13 mph], moderate to heavy precipitation). All birds seen or heard were recorded during 10-minute point counts. The 10-minute point count consisted of three periods: 2 minutes, 3 minutes, and 5 minutes (Ralph et al. 1995). Use of the three survey periods provides flexibility in making comparisons with other surveys and studies of varying time lengths (e.g., North American Breeding Bird Survey). During each time period, we assigned each bird observation to one of four distance categories at the time of first observation (0-25 m, 26-50 m, 51-100 m, and >100 m) based on the estimated distance of the bird from the observer. Having observations assigned to distance bins facilitates analyses to estimate density and population size.

Results

Below we provide a summary of our 2021 survey results according to the target bird species or group. A complete list of the bird species detected with scientific names is provided in Table A1 (Appendix A).

Rare Raptors

Of the 161 potential points in our Year 1 survey panel for CGJMTC, we conducted surveys for northern goshawk and red-shouldered hawk at 134 points (83%) (Figure 2). Nine points were not surveyed because they were close to active nests found during surveys and we wanted to avoid disturbing incubating birds. The remaining 18 points were not surveyed because we were unable to gain access to specific training areas or due to poor weather conditions.

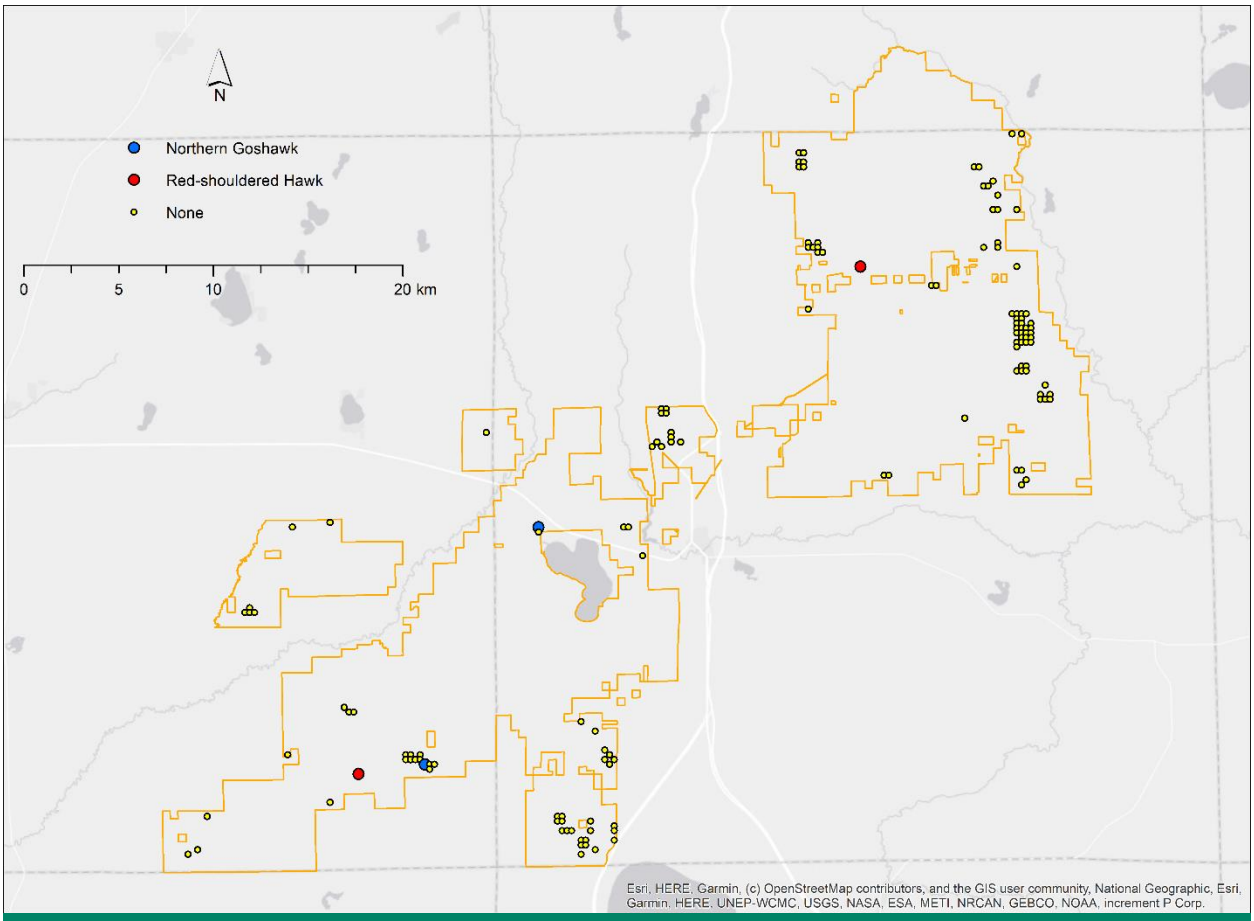

Figure 2. Rare raptor point-count stations where surveys were conducted within Camp Grayling in 2021. Locations are indicated where observations of northern goshawk (blue points) and red-shouldered hawk (red points) occurred.

We detected northern goshawks at two points and red-shouldered hawks at two additional points (Figure 2). Active northern goshawk nests were found near the two points, but we did not find any active red-shouldered hawk nests. While conducting red-headed woodpecker surveys, we observed a pair of northern goshawks at another location just north of King Road and west of Oak Road. The goshawks were calling and exhibiting territorial behavior, but we were unable to find any nests despite searching the area. Red-shouldered hawks were also heard calling at six point-count stations during golden-winged warbler and red-headed woodpecker surveys.

One of the two active northern goshawk nests was located to the northwest of Lake Margrethe near McIntyre Landing (Figure 3). The nest occurred about 15 meters (50 feet) above the ground in a white pine (*Pinus strobus*) having a dbh of approximately 45 cm (18 inches). The nest was located near the edge of a natural red pine stand adjacent to lowland coniferous forest. We observed both adults at the nest site and the female was incubating at the time.

The second active northern goshawk nest was found in a planted red pine (*Pinus resinosa*) stand located north of Six Point Road and west of Pine Road. Adjacent stands consisted of aspen, oak, pine, and mixed forest. The nest was built about 12 meters (40 feet) above the ground in a red pine with an estimated dbh of 33 cm (13 inches). We only observed one of the adults, but it was incubating when the nest was found (Figure 4).

Figure 3. Northern goshawk nest found within the South Camp of Camp Grayling in 2021 to the northwest of Lake Margrethe. Photo by A. Cole-Wick.

Figure 4. Habitat at a northern goshawk nest found within the South Camp of Camp Grayling in 2021. Photo by A. Cole-Wick.

Secretive Marsh Birds

Based on GIS assessment of MiFI data and aerial photography, we identified 17 potential marsh bird survey points for CGJMTC. After reviewing these points in the field for potential habitat and accessibility, we narrowed the 17 points down to 8 survey points. Four points were surveyed three times according to Conway (2011), whereas the four points located just south of Chub Creek/North Branch Au Sable River were only visited once. After the first survey, we determined the habitat was not suitable for secretive marsh birds due to the sparse emergent vegetation and lack of standing water.

American bittern and swamp sparrow were on the only target species detected during surveys. We observed two American bitterns while conducting the first survey of the three points located near Black Creek. One American bittern was also detected in the same area during the second visit. An American bittern element occurrence is known for this area based on observations occurring in 2004, which will be updated with the information we collected in 2021.

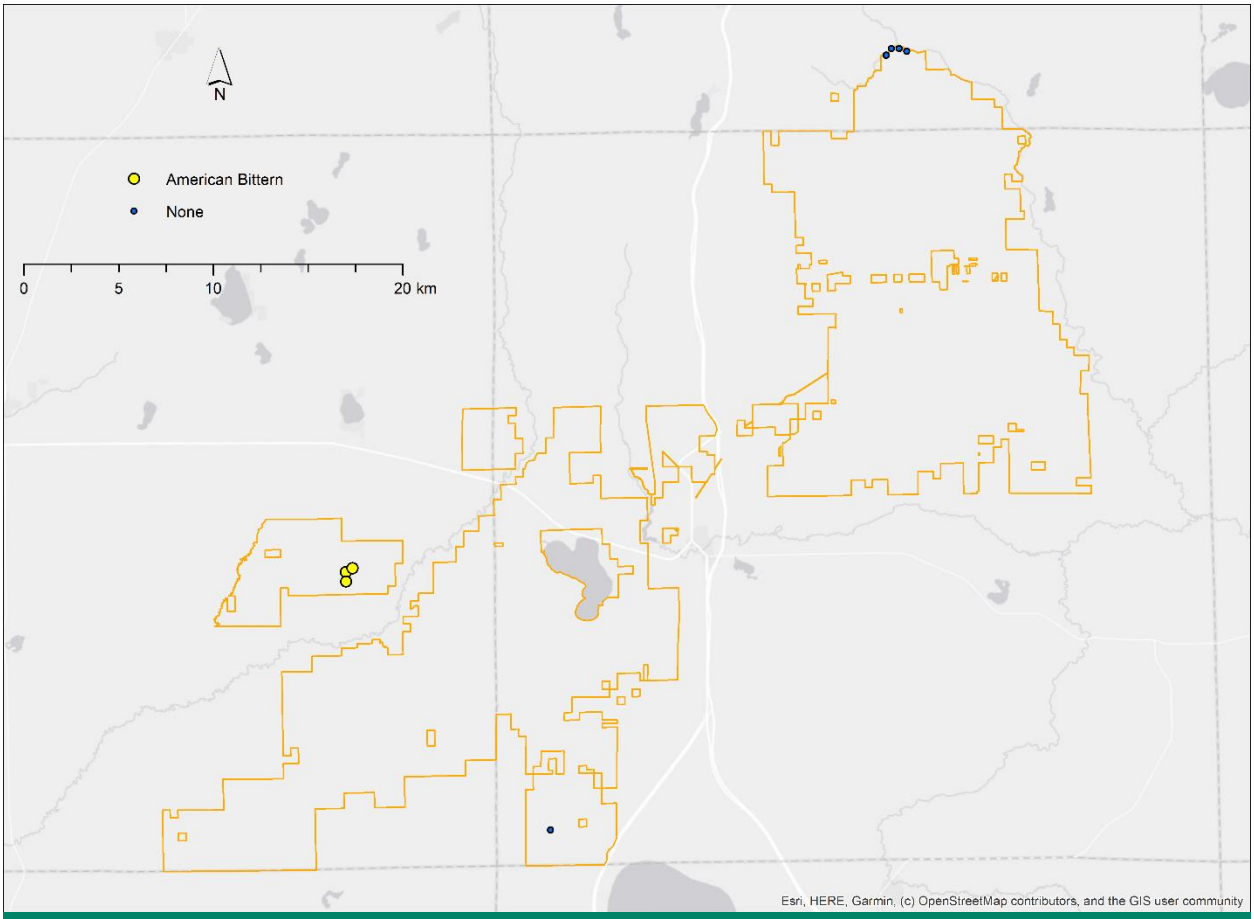

Figure 5. Secretive marsh bird point-count stations where surveys were conducted within Camp Grayling in 2021. Points with American bittern observations are shaded yellow.

At-risk Bird Species

We completed 417 point counts for all targeted at-risk bird species or groups in 2021, consisting of 214 golden-winged warbler points, 158 red-headed woodpecker points, 30 grassland bird points, and 15 pine barrens points. Surveys were conducted between 25 May and 9 July 2021. We recorded 85 bird species across all 410 points surveyed (Table 2). While conducting surveys in 2021, we documented new occurrences of golden-winged warbler, red-headed woodpecker, and common nighthawk (State special concern), and gathered information to update existing Kirtland's warbler (State endangered) occurrences. These Kirtland's warbler observations do not represent all occurrences for CGJMTC as additional targeted surveys are conducted annually by DMVA across the installation. In addition, we recorded several featured species of the DNR, Wildlife Division, and focal species of the Upper Mississippi / Great Lakes Joint Venture (JV; Table 2).

Table 2. Proportion of points having bird species detected during 2021 at Camp Grayling by target species or group.

Species	Special Status[1]	Golden-winged Warbler	Red-headed Woodpecker	Grassland Birds	Pine Barrens Birds
Alder Flycatcher	---	0.005	---	---	---
American Crow	---	0.098	0.095	0.233	0.133
American Goldfinch	---	0.009	0.013	0.100	---
American Redstart	---	0.201	0.076	0.033	0.133
American Robin	---	0.168	0.475	0.433	0.133
Baltimore Oriole	---	0.047	0.013	---	---
Barred Owl	---	0.009	---	---	---
Black-and-white Warbler	---	0.079	0.019	---	0.067
Black-billed Cuckoo	---	0.051	0.057	0.300	0.267
Black-capped Chickadee	---	0.173	0.259	0.300	0.200
Blue Jay	---	0.556	0.886	0.833	0.800
Brewer's Blackbird	---	---	---	0.067	---
Broad-winged Hawk	---	0.005	---	---	---
Brown Creeper	---	0.005	---	---	---
Brown Thrasher	---	0.093	0.133	0.367	0.400
Brown-headed Cowbird	---	0.014	0.025	0.267	0.467
Canada Goose	DNR	0.065	---	---	---
Cedar Waxwing	---	0.042	0.108	0.200	0.200
Chestnut-sided Warbler	---	0.009	---	---	---
Chipping Sparrow	---	0.093	0.095	0.533	0.533
Clay-colored Sparrow	---	---	---	0.133	---
Common Grackle	---	0.079	0.095	0.200	0.200
Common Nighthawk	SC, SGCN	---	0.006	0.100	---
Common Raven	---	0.509	0.234	0.500	0.267
Common Yellowthroat	---	0.093	---	---	---
Dark-eyed Junco	---	0.019	0.025	0.267	0.267
Downy Woodpecker	---	0.019	0.025	---	---
Eastern Bluebird	DNR	---	---	0.133	0.067
Eastern Kingbird	---	---	0.013	0.167	0.067
Eastern Phoebe	---	0.014	---	---	---
Eastern Towhee	---	0.206	0.323	0.533	0.333
Eastern Wood-Pewee	---	0.308	0.475	0.033	0.133
European Starling	---	---	---	0.033	---
Field Sparrow	---	0.206	0.285	0.867	0.600
Golden-winged Warbler	SC, SGCN, DNR, DoD, JV	0.023	---	---	---
Gray Catbird	---	0.131	---	---	---
Great Crested Flycatcher	---	0.023	0.089	0.033	0.133
Hairy Woodpecker	---	0.009	0.070	---	---
Hermit Thrush	---	0.313	0.475	0.633	0.533
House Wren	---	0.009	---	0.033	---
Indigo Bunting	---	0.047	0.101	0.200	0.067
Kirtland's Warbler	E, SGCN, DNR, JV	---	---	0.100	0.067
Least Flycatcher	---	0.005	0.006	---	---
Lincoln's Sparrow	---	---	---	0.267	0.267
Magnolia Warbler	---	0.009	---	---	---
Mourning Dove	---	0.047	0.114	0.567	0.267

Table 2. Continued.

Species	Special Status[1]	Golden-winged Warbler	Red-headed Woodpecker	Grassland Birds	Pine Barrens Birds
Nashville Warbler	---	0.131	0.215	0.600	0.800
Northern Cardinal	---	0.047	---	---	---
Northern Flicker	---	0.154	0.367	0.633	0.267
Ovenbird	---	0.874	0.563	0.400	0.200
Pied-billed Grebe	---	0.005	---	---	---
Pileated Woodpecker	DNR	0.009	0.025	0.067	---
Pine Warbler	---	0.005	0.171	0.100	---
Purple Finch	---	---	---	0.033	---
Red-bellied Woodpecker	---	0.019	0.082	0.000	0.133
Red-breasted Nuthatch	---	0.009	0.006	0.000	0.067
Red-eyed Vireo	---	0.551	0.665	0.200	0.200
Red-headed Woodpecker	SC, SGCN, DNR, JV	0.005	0.241	---	---
Red-shouldered Hawk	T, SGCN, DNR	0.023	0.006	---	---
Red-tailed Hawk	---	0.019	0.044	---	0.067
Red-winged Blackbird	---	0.065	0.019	0.133	0.267
Ring-billed Gull	---	0.005	---	---	---
Rose-breasted Grosbeak	---	0.439	0.468	0.333	0.400
Ruffed Grouse	DNR	0.107	0.006	---	---
Sandhill Crane	---	0.061	---	0.133	---
Savannah Sparrow	---	---	---	0.033	---
Scarlet Tanager	---	0.131	0.468	0.367	0.533
Song Sparrow	---	0.056	0.038	0.067	---
Swainson's Thrush	---	0.009	---	---	---
Swamp Sparrow	---	0.009	---	0.033	---
Tufted Titmouse	---	0.047	0.006	0.033	---
Turkey Vulture	---	---	0.038	0.067	---
Upland Sandpiper	DNR, JV	---	---	0.333	0.133
Veery	---	0.154	0.006	0.033	---
Vesper Sparrow	---	---	0.051	0.567	---
White-breasted Nuthatch	---	0.023	0.430	0.067	0.133
White-throated Sparrow	---	0.033	0.006	0.067	---
Wild Turkey	DNR	0.009	---	---	---
Wilson's Snipe	JV	---	---	---	0.067
Wood Thrush	DNR, JV	0.014	---	---	---
Yellow Warbler	---	0.093	---	---	---
Yellow-bellied Sapsucker	---	0.028	0.032	0.133	0.067
Yellow-billed Cuckoo	---	0.051	0.241	0.067	0.133
Yellow-rumped Warbler	---	---	0.006	0.100	---
Yellow-throated Vireo	---	0.009	0.051	---	---

[1]Special status:

SC = State special concern; T = State threatened; E = State endangered; SGCN = species of greatest conservation need (Derosier et al. 2015); DNR = Department of Natural Resources, Wildlife Division feature species for habitat management; DoD = Department of Defense mission-sensitive species; and JV = focal species of the Upper Mississippi / Great Lakes Joint Venture.

Golden-winged Warbler

We surveyed 214 (83%) of the 259 survey points identified in the Year 1 panel of point count stations for golden-winged warbler. Most of the points not visited in 2021 were due to our inability to get access to training areas because of scheduled CGJMTC training activities. Eight golden-winged warblers were recorded at five (2%) of the 214 points surveyed. An additional five warblers were detected while moving between survey points or during surveys for other target species/groups (Figure 6). Most of our observations occurred in young aspen (Figure 7) or shrubby wetlands. Given a 5-km separation distance for Passerine element occurrences, these records represent three new element occurrences for CGJMTC, with two being in the North Camp and one in the South Camp. Being a relatively new addition to the special concern list, the MNFI only recently began tracking golden-winged warbler in the Natural Heritage Database. In addition to being a SGCN and JV focal species, golden-winged warbler is a Department of Defense (DoD) mission-sensitive species, meaning it is a species with high potential to impact DoD missions if federally listed under the Endangered Species Act.

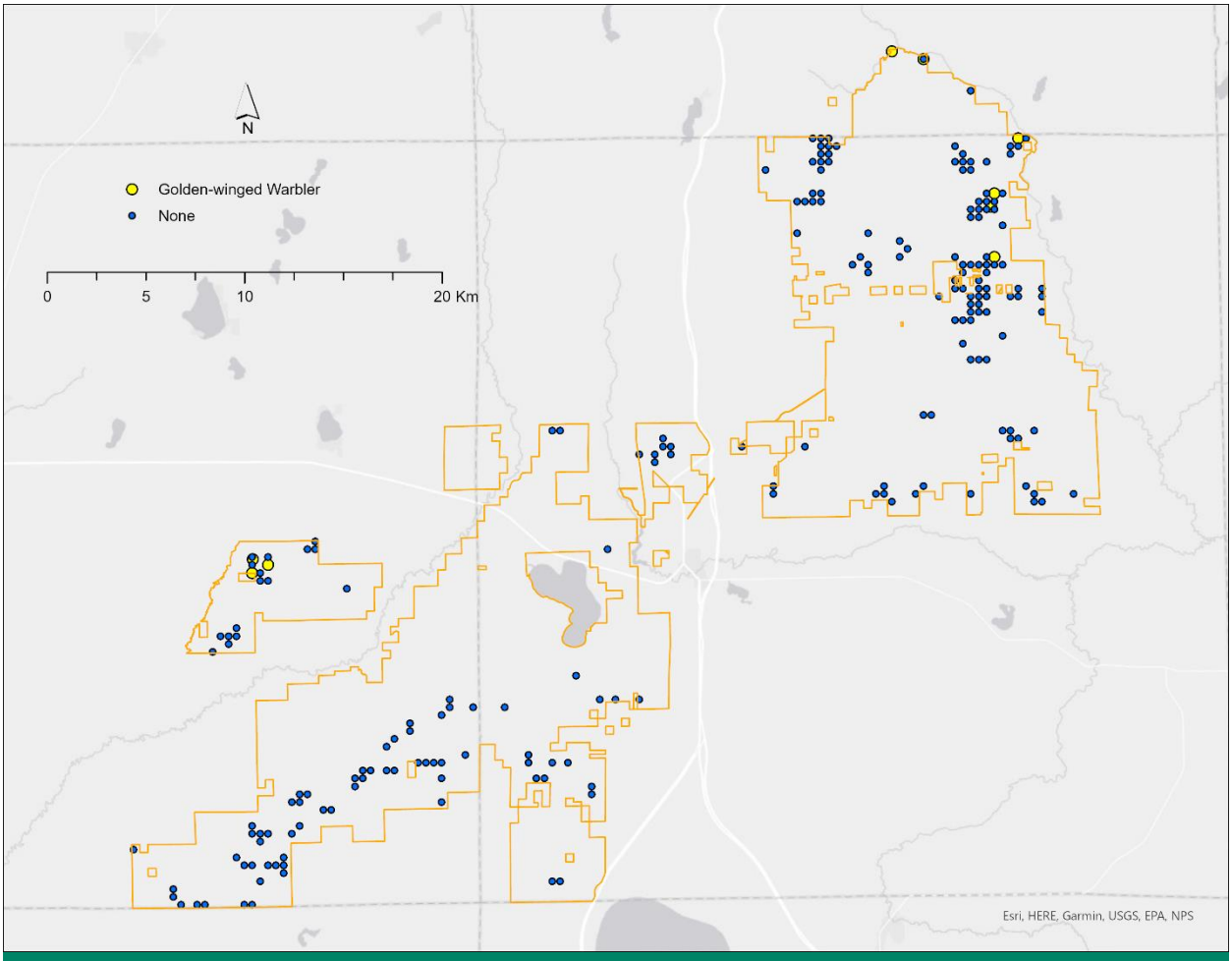

Figure 6. Golden-winged warbler point-count stations where surveys were conducted within Camp Grayling in 2021. Points with golden-winged warbler observations are shaded yellow.

Figure 7. Young aspen at a point-count station within Camp Grayling having a golden-winged warbler observation in 2021. Photo by A. Cole-Wick.

We detected 70 bird species while conducting surveys at points targeting golden-winged warbler. Ovenbird, blue jay, red-eyed vireo, and common raven were the most common species observed in these habitats, with all being recorded at more than half the point count stations. We also regularly observed rose-breasted grosbeak, eastern wood-pewee, and hermit thrush, which were detected at about 30-40% of the points visited. In addition to golden-winged warbler, we observed two other species of greatest conservation need (SGCN), red-shouldered hawk and red-headed woodpecker. Wood thrush was recorded at three survey points, which along with red-headed woodpecker, is a focal species for conservation planning and implementation within the JV region due to declining populations (Soulliere et al. 2020). Wood thrush is also a DNR featured species, as are Canada goose, pileated woodpecker, ruffed grouse, and wild turkey, which were also recorded. DNR Wildlife Division selected 41 featured species to focus their habitat management planning and implementation.

Red-headed Woodpecker

We surveyed 158 (98%) of the 162 survey points identified in the Year 1 panel of point count stations for red-headed woodpecker (Figure 8), all of which were in the South Camp. Red-headed woodpeckers were detected at 25% of the points surveyed in 2021, with a total of 54 individuals recorded. An additional red-headed woodpecker was observed during a point count station surveyed for golden-winged warblers in the western portion of South Camp. Most of our observations occurred in mature oak forests (Figure 9). Given a 5-km separation distance for woodpecker element occurrences, these records represent two new and the first documented element occurrences for CGJMTC. The main element occurrence consists of the observations recorded within the Cantonment, STA06, STA10, STA11, and STA15 (Figure 8). The second occurrence is represented by a single detection within STA08. Red-headed woodpecker is a relatively new addition to special concern list, so MNFI only recently began tracking the species in the Natural Heritage Database.

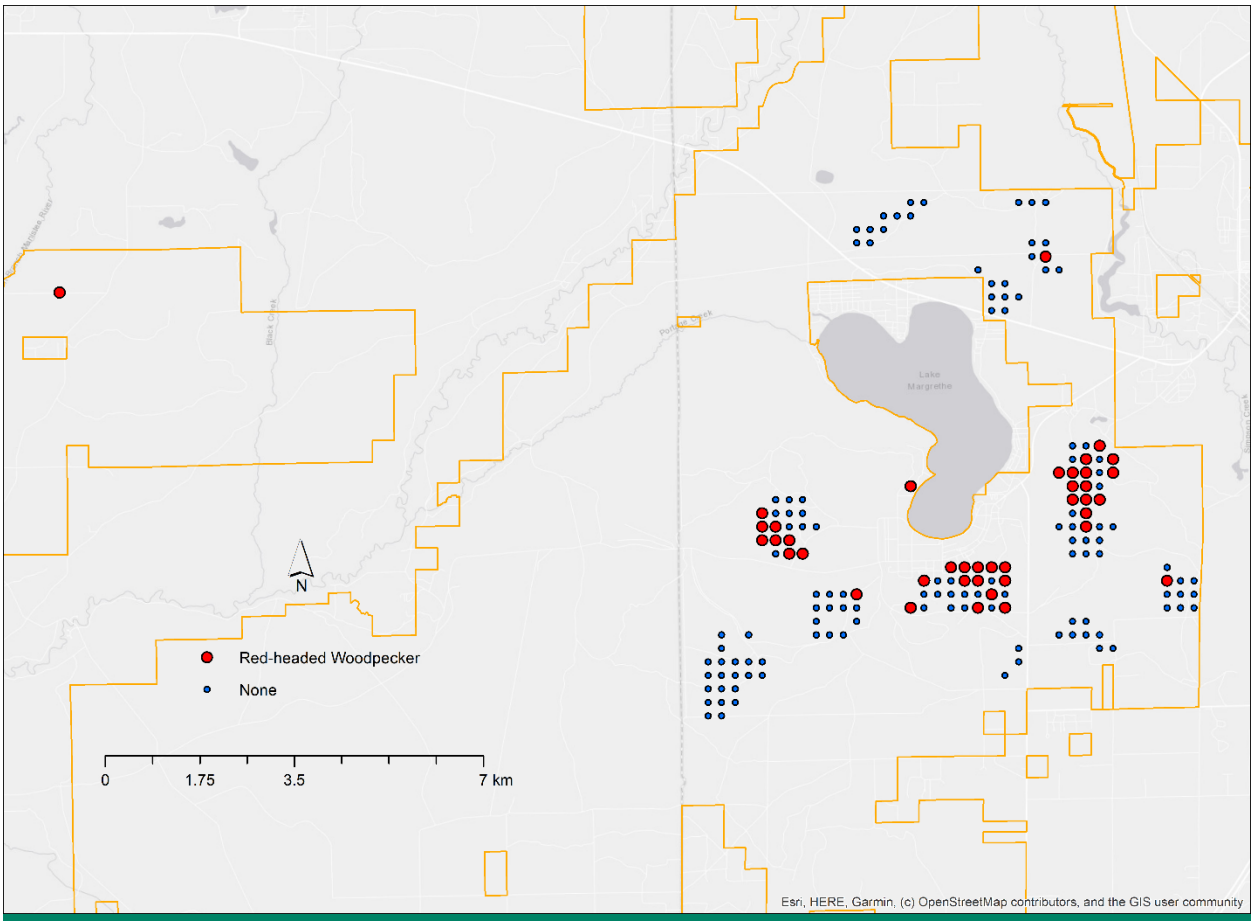

Figure 8. Red-headed woodpecker point-count stations where surveys were conducted within Camp Grayling in 2021. Points with red-headed woodpecker observations are shaded red.

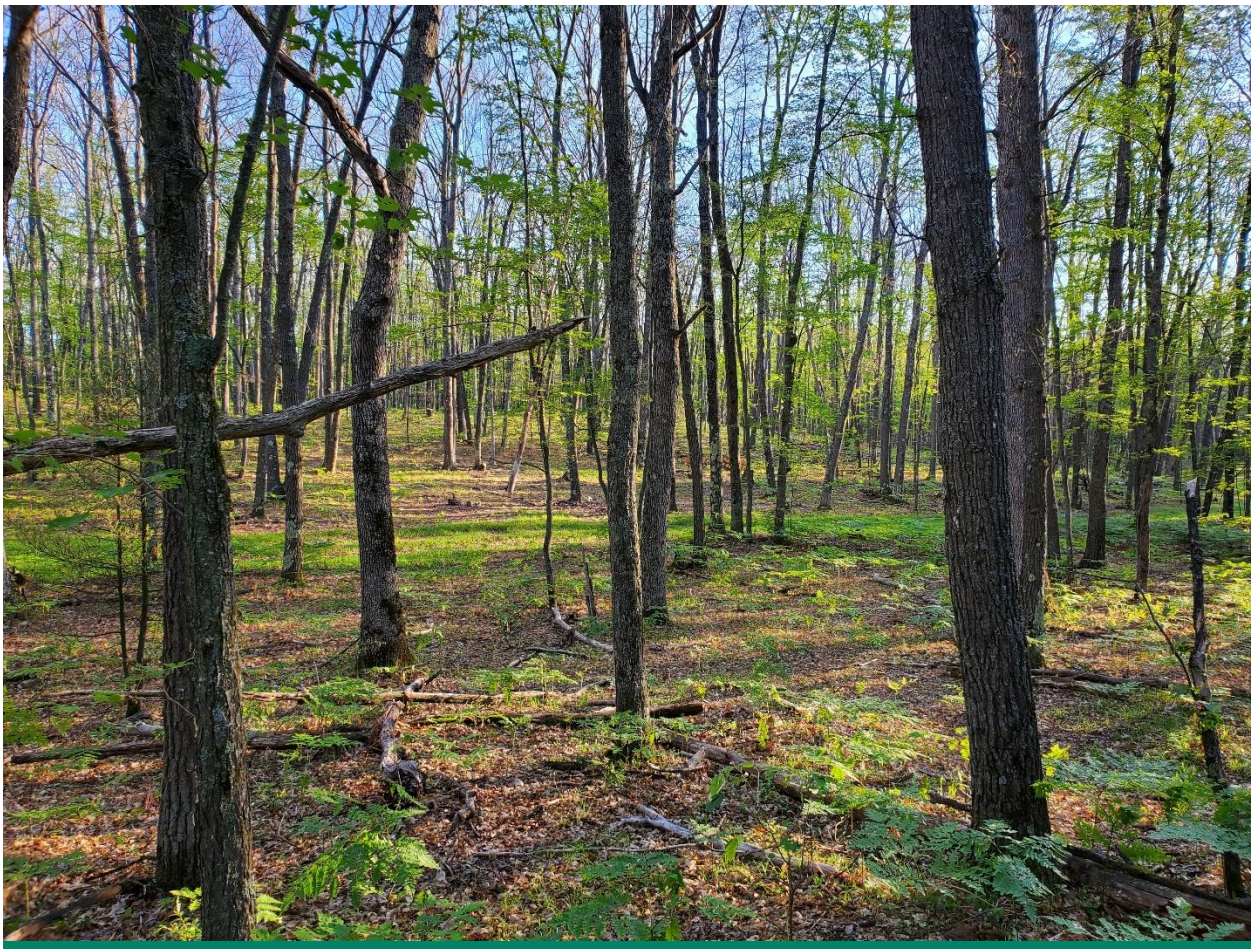

Figure 9. Mature oak forest at a point-count station within Camp Grayling having a red-headed woodpecker observation in 2021. Photo by M. Monfils.

We recorded 54 bird species while conducting points counts for red-headed woodpeckers (Table 2). Blue jay, red-eyed vireo, and ovenbird were the most common species observed during surveys targeting red-headed woodpecker; all three species were detected at more than half of the survey points. We also commonly observed American robin, eastern wood-pewee, hermit thrush, rose-breasted grosbeak, scarlet tanager, and white-breasted nuthatch, with these species being recorded at 40-50% of the points surveyed.

Several bird species of conservation concern were documented during red-headed woodpecker surveys. Along with being a SGCN, red-headed woodpecker is considered a focal species for conservation by the JV because of long-term declining populations within the upper Midwest and Great Lakes regions (Soulliere et al. 2020). We recorded two additional SGCN, red-shouldered hawk and common nighthawk, while conducting surveys for red-headed woodpecker. Two DNR featured species, pileated woodpecker and ruffed grouse, were also recorded during red-headed woodpecker surveys.

Grassland Birds

We surveyed 30 (91%) of the 33 survey points identified in the Year 1 panel of point-count stations targeting rare grassland bird species (Figure 10). No rare grassland bird species were detected, but we did record several other species of conservation interest. We observed five Kirtland's warblers across three survey stations; we will use this information to update two existing element occurrences. We recorded five common nighthawks at three survey points and documented an adult female (injury-feigning) with two nestlings while walking between survey points (Figure 11). This latter observation constitutes a new element occurrence for the species and the first for Camp Grayling.

We recorded 56 species while conducting surveys targeting rare grassland bird species (Table 2). Field sparrow, blue jay, northern flicker, and hermit thrush were the most common species detected, with field sparrow and blue jay observed at more than 80% of the points, and hermit thrush and northern flicker at just over 60% of the point-count stations. Eight species were also regularly observed (40-60% of points): American robin, chipping sparrow, common raven, eastern towhee, mourning dove, Nashville warbler, ovenbird, and vesper sparrow. We observed upland sandpiper at a third of the survey stations. Upland sandpiper is a JV focal species under its Shorebird Habitat Conservation Strategy due to declining population trends and threats to habitat (Potter et al. 2007). We also observed two DNR featured species, eastern bluebird and pileated woodpecker, while conducting grassland bird surveys.

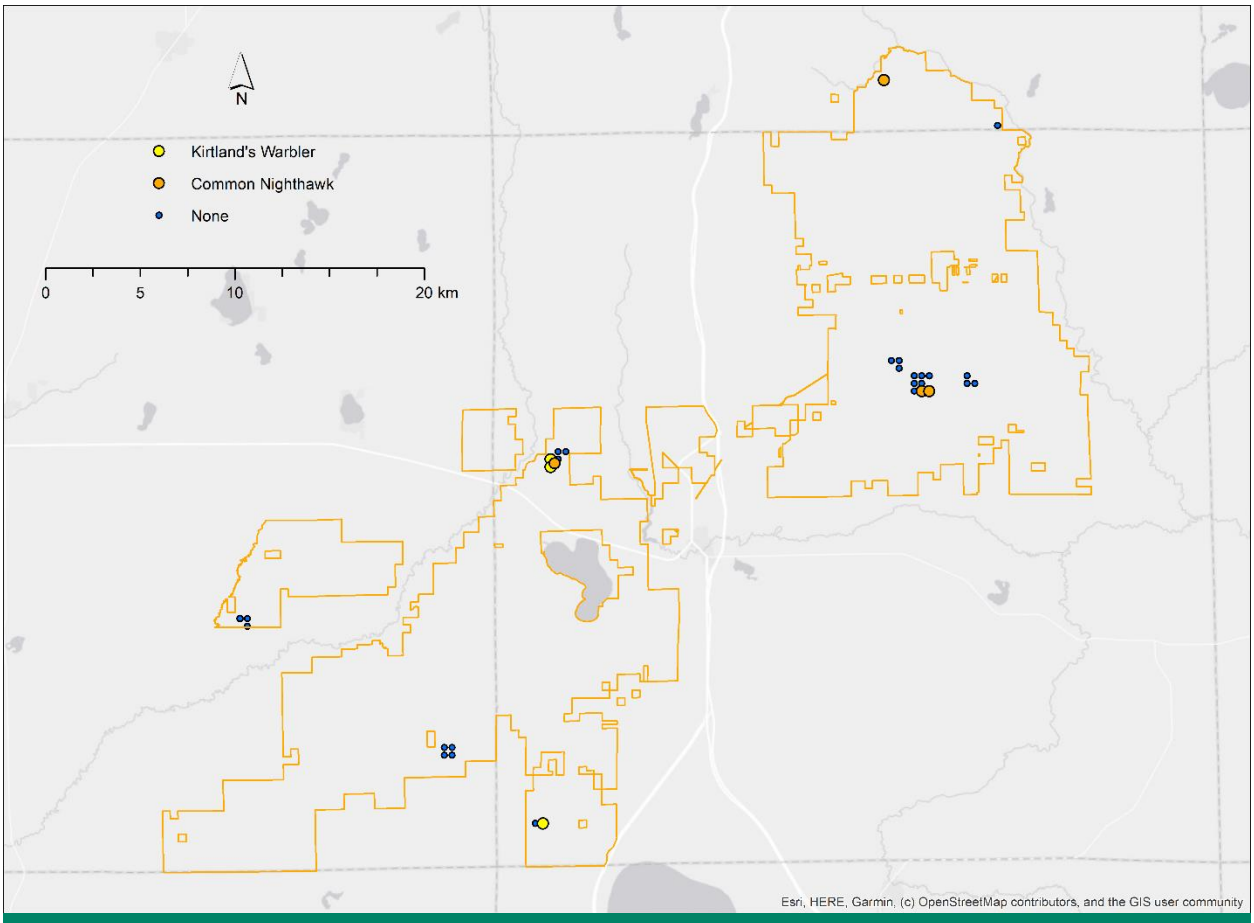

Figure 10. Grassland bird point-count stations where surveys were conducted within Camp Grayling in 2021. Points with rare species detected are indicated.

Figure 11. Common nighthawk nestlings observed while conducting grassland bird surveys. Photo by M. Monfils.

Pine Barrens Birds

Fifteen points were surveyed by DMVA staff within the 5,000-acre Pine Barrens Management Unit of CGJMTC in 2021 (Figure 12). Although pine barrens are targeted for management within this unit, the area contains several other cover types, including grasslands and forests dominated by jack pine (*Pinus banksiana*), aspen (*Populus* spp.), and oak (*Quercus* spp.). No rare species were detected but 40 bird species were recorded (Table 2). Nashville warbler, blue jay, field sparrow, and chipping sparrow were the species most commonly encountered, being recorded at about 50-80% of the point count stations. Brown-headed cowbird, brown thrasher, and rose-breasted grosbeak were also common and observed at 40-50% of the survey points. Kirtland's warbler was recorded at one survey point and upland sandpiper, a JV focal species, was detected at two points. Wilson's snipe, a JV focal species for shorebird habitat conservation (Potter et al. 2007) was observed at one survey point. One DNR featured species, eastern bluebird, was recorded at one pine barrens survey point.

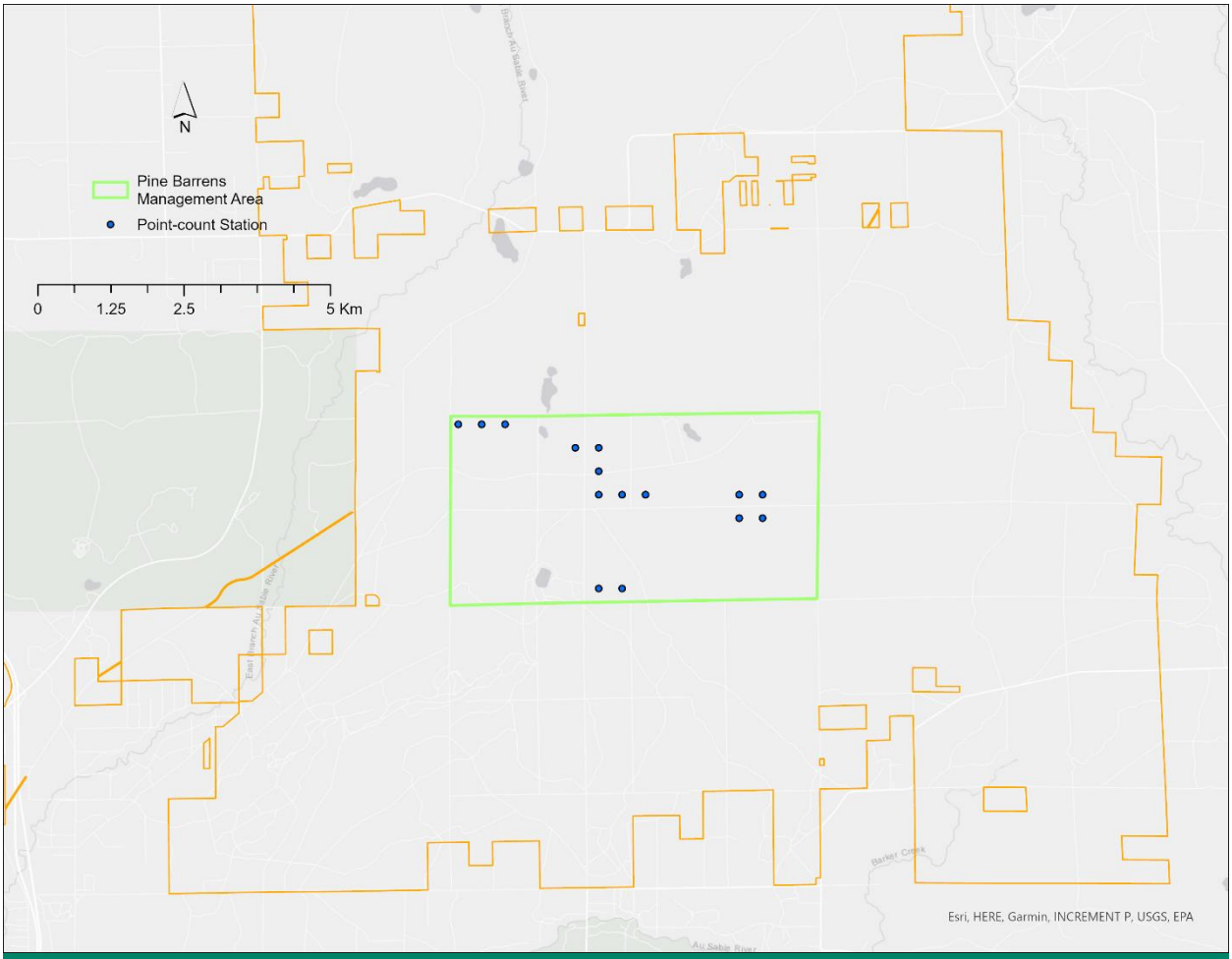

Figure 12. Pine barrens bird point-count stations where surveys were conducted within Camp Grayling in 2021.

Discussion

Working in partnership with the DMVA, MNFI implemented a successful first year of what is hoped to be a long-term monitoring program. With the help of DMVA staff, we conducted over 500 point counts for rare raptors, secretive marsh birds, and other birds of conservation concern. These surveys provided data resulting in new element occurrences for northern goshawk, golden-winged warbler, red-headed woodpecker, and common nighthawk, as well as updates to existing American bittern and Kirtland's warbler occurrences. Across all surveys, 87 bird species were recorded within CGJMTC, which highlights the value of the facility to the breeding bird community. This assemblage of bird species included endangered, threatened, and special concern species, SGCN, multiple DNR featured species, and several JV focal species.

We recommend continuing with the same sample design and survey protocols that were used in 2021. Using a panel sample design will provide good spatial coverage of the large facility, while providing a reasonable level of survey effort annually. The survey effort can also be scaled based on the level of funding available. For future rare raptor surveys, we could refine our survey points by dropping those that fall within or near the edge of recent forest treatments to focus effort in those stands most likely to support the target species. Given the minimal amount of marsh bird habitat in the CGJMTC, we think future surveys can be limited to the four points visited in 2021. Three of these points are within the area where American bittern was detected in 2004 and again in 2021, so continuing to survey these points would allow for regular monitoring of that occurrence. Areas surveyed for grassland birds could also be further refined over time by dropping points that occurred within habitats unsuitable for these species. We conducted grassland bird surveys in areas classified as herbaceous openland, but many of these sites were recently harvested forests or openings within pine barrens. The most promising grassland bird habitats were the large herbaceous areas within the Pine Barrens Management Area. These sites are not likely to support rare grassland bird species, such as Henslow's sparrow (*Centronyx henslowii*) or grasshopper sparrow (*Ammodramus savannarum*), but they were frequently used by upland sandpiper, another species of conservation concern.

The survey protocols worked well and we recommend their continued use during future surveys; however, there are some small changes that could improve some surveys. Two additions to the raptor survey protocol could produce valuable information over time: 1) checking the status of nests that were active during previous seasons; and 2) conducting productivity checks of nests found during a given breeding season (i.e., estimate number of fledged young). The first addition would produce a growing spatial data set of known nest sites that could inform management. Over time, we may be able to delineate individual breeding territories. We suggest conducting follow-up productivity checks in June of active nests found during the April point counts. These second visits allow an assessment of nest productivity, which over time will provide information about the overall status of northern goshawk and red-shouldered hawk populations within Camp Grayling. Based on our experience in 2021, we suggest shortening the morning survey window used for the at-risk bird surveys from 5 hours after sunrise to 4 hours after sunrise. We noticed bird activity often declined after about 10:00, so we believe this change will produce more consistent data over time. The protocol document (Appendix B) was updated to reflect this change.

Acknowledgements

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Appendix A: List of Bird Species Detected

Table A1. Common and scientific names of bird species detected in Camp Grayling in 2021.

Common Name	Scientific Name
Alder Flycatcher	*Empidonax alnorum*
American Bittern	*Botaurus lentiginosus*
American Crow	*Corvus brachyrhynchos*
American Goldfinch	*Spinus tristis*
American Redstart	*Setophaga ruticilla*
American Robin	*Turdus migratorius*
Baltimore Oriole	*Icterus galbula*
Barred Owl	*Strix varia*
Black-and-white Warbler	*Mniotilta varia*
Black-billed Cuckoo	*Coccyzus erythropthalmus*
Black-capped Chickadee	*Aphanotriccus audax*
Blue Jay	*Cyanocitta cristata*
Brewer's Blackbird	*Euphagus cyanocephalus*
Broad-winged Hawk	*Buteo platypterus*
Brown Creeper	*Spermestes cucullata*
Brown Thrasher	*Toxostoma rufum*
Brown-headed Cowbird	*Cinclocerthia ruficauda*
Canada Goose	*Branta canadensis*
Cedar Waxwing	*Bombycilla cedrorum*
Chestnut-sided Warbler	*Setophaga pensylvanica*
Chipping Sparrow	*Spizella passerina*
Clay-colored Sparrow	*Spizella pallida*
Common Grackle	*Quiscalus quiscula*
Common Nighthawk	*Chordeiles minor*
Common Raven	*Corvus corax*
Common Yellowthroat	*Geothlypis trichas*
Dark-eyed Junco	*Junco hyemalis*
Downy Woodpecker	*Dryobates pubescens*
Eastern Bluebird	*Sialia sialis*
Eastern Kingbird	*Tyrannus tyrannus*
Eastern Phoebe	*Sayornis phoebe*
Eastern Towhee	*Pipilo erythrophthalmus*
Eastern Wood-Pewee	*Contopus virens*
European Starling	*Sturnus vulgaris*
Field Sparrow	*Spizella pusilla*
Golden-winged Warbler	*Vermivora chrysoptera*
Gray Catbird	*Dumetella carolinensis*
Great Crested Flycatcher	*Myiarchus crinitus*
Hairy Woodpecker	*Dryobates villosus*
Hermit Thrush	*Catharus guttatus*
House Wren	*Troglodytes aedon*
Indigo Bunting	*Passerina cyanea*

Table A1. Continued.	
Common Name	**Scientific Name**
Kirtland's Warbler	*Setophaga kirtlandii*
Least Flycatcher	*Empidonax minimus*
Lincoln's Sparrow	*Melospiza lincolnii*
Magnolia Warbler	*Setophaga magnolia*
Mourning Dove	*Zenaida macroura*
Nashville Warbler	*Leiothlypis ruficapilla*
Northern Cardinal	*Cardinalis cardinalis*
Northern Flicker	*Colaptes auratus*
Northern Goshawk	*Accipiter gentilis*
Ovenbird	*Seiurus aurocapilla*
Pied-billed Grebe	*Podilymbus podiceps*
Pileated Woodpecker	*Dryocopus pileatus*
Pine Warbler	*Setophaga pinus*
Purple Finch	*Haemorhous purpureus*
Red-bellied Woodpecker	*Melanerpes carolinus*
Red-breasted Nuthatch	*Sitta canadensis*
Red-eyed Vireo	*Vireo olivaceus*
Red-headed Woodpecker	*Melanerpes erythrocephalus*
Red-shouldered Hawk	*Buteo lineatus*
Red-tailed Hawk	*Buteo jamaicensis*
Red-winged Blackbird	*Agelaius phoeniceus*
Ring-billed Gull	*Larus delawarensis*
Rose-breasted Grosbeak	*Pheucticus ludovicianus*
Ruffed Grouse	*Bonasa umbellus*
Sandhill Crane	*Antigone canadensis*
Savannah Sparrow	*Passerculus sandwichensis*
Scarlet Tanager	*Piranga olivacea*
Song Sparrow	*Melospiza melodia*
Swainson's Thrush	*Catharus ustulatus*
Swamp Sparrow	*Melospiza georgiana*
Tufted Titmouse	*Baeolophus bicolor*
Turkey Vulture	*Cathartes aura*
Upland Sandpiper	*Bartramia longicauda*
Veery	*Catharus fuscescens*
Vesper Sparrow	*Pooecetes gramineus*
White-breasted Nuthatch	*Sitta carolinensis*
White-throated Sparrow	*Zonotrichia albicollis*
Wild Turkey	*Meleagris gallopavo*
Wilson's Snipe	*Gallinago delicata*
Wood Thrush	*Hylocichla mustelina*
Yellow Warbler	*Setophaga petechia*
Yellow-bellied Sapsucker	*Sphyrapicus varius*
Yellow-billed Cuckoo	*Coccyzus americanus*
Yellow-rumped Warbler	*Setophaga coronata*
Yellow-throated Vireo	*Vireo flavifrons*

Appendix B: Camp Grayling Bird Survey Protocols

MNFI BIRD SURVEY PROTOCOLS

CAMP GRAYLING BIRD MONITORING PROGRAM

General Sample Design

We designed bird surveys to evaluate the status (e.g., relative abundance, trends) of several rare or declining species with potential to occur on Camp Grayling Joint Maneuver Training Center (CGJMTC):

1. rare raptors (red-shouldered hawk [*Buteo lineatus*, state threatened], northern goshawk [*Accipiter gentilis*, state special concern]);

2. red-headed woodpecker (*Melanerpes erythrocephalus*, state special concern);

3. golden-winged warbler (*Vermivora chrysoptera*, state special concern);

4. grassland birds (e.g., Henslow's sparrow [*Centronyx henslowii*], grasshopper sparrow [*Ammodramus savannarum*]); and

5. secretive marsh birds (e.g., American bittern [*Botaurus lentiginosus*]).

Michigan Forest Inventory (MiFI) data were used to classify potential habitats for each bird species/group. Based on cover type and size, we identified suitable stands and created spatial layers of potential habitat in ArcMap. Next, we created layers of potential survey points by overlaying point grids with appropriate spacing over the stands. We used a 250 m x 250 m point grid for late successional forest areas and a wider spaced, 400 m x 400 m point grid for early successional forest, shrub, and open cover types to reduce the likelihood of double counting (Ralph et al. 1995). Those points falling within the potential survey stands formed the sample frame for each species/group. For most target species/groups, there were more survey points than could be covered in one year, so we developed a panel sampling approach in which approximately one third of all points are covered in a year and all points are surveyed over three years. This approach could be applied on an ongoing, rotational basis, resulting in each point being surveyed every three years.

To develop our three survey panels while providing a spatially balanced and logistically efficient sample, we created a layer of 100-hectare hexagons to serve as our primary sample units for CGJMTC. We used 100 hectares as our PSU size because it represents the approximate area an individual can survey in a day. Each PSU was assigned a random number and after putting them in numerical order, we created the three survey panels for each bird species/group as follows: Panel 1 – first third of PSUs, Panel 2 – second third of PSUs, and Panel 3 – last third of PSUs. In this sample design, survey points are our secondary sample units, so when a PSU is selected for survey, all secondary sample units, or points, falling within the PSU are to be surveyed (Figure 1).

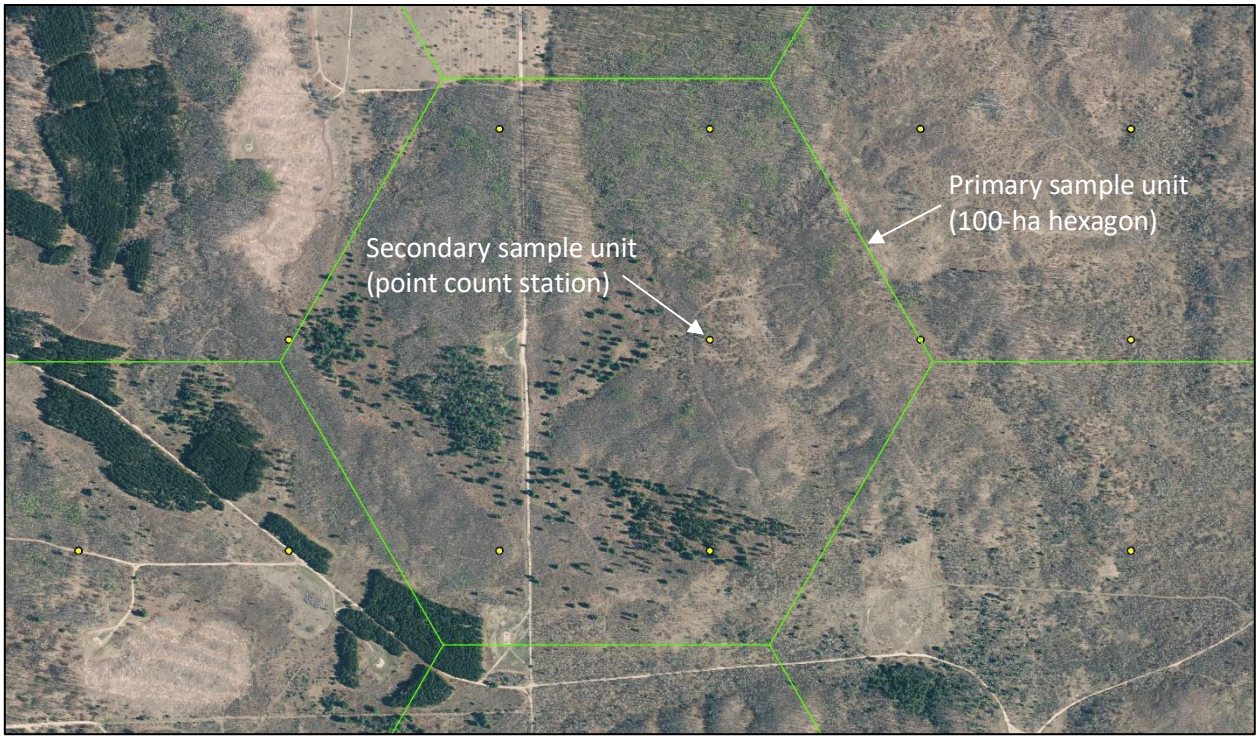

Figure 1. Examples of primary sample units (green hexagons) and secondary sample units (yellow points) used in designing Camp Grayling bird surveys.

Rare Raptor Surveys

Deciduous, mixed, and coniferous forest stands (except for pine plantations) of size-density class 9 and at least 4 hectares (10 acres) in area were considered potential habitat for red-shouldered hawk and northern goshawk. Raptors will be surveyed using a three-minute point count conducted at each point count station (Mosher et al. 1990, Anderson 2007, Bruggeman et al. 2011). Each three-minute point count will consist of two, one-minute broadcast periods (one for red-shouldered hawk, one for northern goshawk) and a final one-minute silent listening period. Observers should use an electronic broadcast unit capable of playing calls at a sound pressure of 95 dB at one meter from the unit (e.g., FoxPro NX4). While conducting a point count, the broadcast unit should be rotated about 120 degrees for each series of calls to ensure 360-degree coverage.

Surveys should occur between early-April and early May during daylight hours (sunrise to sunset). Weather conditions that can reduce the detectability of raptors (e.g., strong winds, moderate to heavy precipitation) should be avoided. Although red-shouldered hawk and northern goshawk are the focus of surveys, all raptor observations should be recorded. For each raptor observation, record the species, approximate distance when first observed (using distance bins of 0-50 m, 51-100 m, 101-250 m, 251-500 m, and > 500 m), and direction (i.e., N, NW, NE, S, SW, SE). If a red-shouldered hawk or northern goshawk is observed, the vicinity surrounding the survey point and location of the detection should be searched for potential nests. Trees should also be visually inspected for stick nests while walking and driving between survey stations. Nest locations should be recorded using a GPS unit/tablet computer along with the following information: species, bird activity (e.g., territorial behavior, incubation, young), nest status (e.g., decorated, feathers, whitewash), tree species, and approximate nest height. In cases when an active nest is confirmed (e.g., bird seen incubated or flushed from nest), we recommend not

conducting surveys at nearby points to minimize disturbance to the nesting pair. Generally, we recommend not surveying other points within the same contiguous forest stand and at minimum avoid surveying adjacent points (i.e., those nearest on the 250-meter point grid). Be sure to note on Survey123 or hard copy forms which points were not surveyed and the reason why.

Summary of rare raptor survey guidelines.	
TARGET BIRD SPECIES	Red-shouldered hawk and northern goshawk.
BIRD SPECIES RECORDED	All raptors.
TIME OF YEAR	Approximately early-April to early May.
TIME OF DAY	All daylight hours (sunrise to sunset).
SUITABLE CONDITIONS	Winds < 20 km/hr (13 mph) and avoid precipitation and heavy fog that inhibits bird detection.
TYPE OF SURVEY	Point count.
LENGTH OF SURVEY	Three minutes.
VISITS PER SEASON	One.
BROADCASTS	One-minute period for red-shouldered hawk and one-minute period for northern goshawk, followed by one-minute silent listening period.
POINT DATA RECORDED	Unique point ID, observer, date, time of survey, temperature, wind speed (km/hr or Beaufort Index), cloud cover (% of sky), precipitation, and presence/absence of potential habitat for red-shouldered hawk and northern goshawk.
BIRD DATA RECORDED	For each raptor detection, record species, whether it responded to the broadcast, distance of first observation (0-50 m, 51-100 m, 101-250 m, 251-500 m, and > 500 m), and direction of first observation (N, NW, NE, S, SW, SE).
NEST DATA RECORDED	For each nest found, record geographic location using GPS, nesting species (if known), bird activity, nest status, tree species, and approximate nest height

At-risk Bird Surveys

The same point count methodology will be used for surveys targeting red-headed woodpecker, golden-winged warbler, and grassland birds. Red-headed woodpecker points fall within stands of deciduous, mixed, and oak-dominated forests, and areas with low tree densities within the Hanson Forest and cantonment. Areas of early successional aspen and balsam poplar, shrub wetlands, and treed bogs at least 2 hectares (5 acres) in size will be the focus of golden-winged warbler surveys. We identified grasslands of at least 10 hectares (25 acres) as potential grassland bird habitats where surveys should be conducted.

Surveys can occur during approximately late May through early July and from sunrise to 4 hours after sunrise (Ralph et al. 1995). Avoid conducting surveys during weather conditions that can reduce bird detectability (e.g., strong winds, moderate to heavy precipitation). All birds seen or heard should be recorded during a 10-minute point count. The 10-minute point count consists of three periods: 2 minutes, 3 minutes, and 5 minutes (Ralph et al. 1995). Use of the three survey periods provides flexibility in making comparisons with other surveys and studies of varying time lengths (e.g., North American Breeding Bird Survey).

During each time period, each bird observation should be assigned to one of four distance categories at the time of first observation (0-25 m, 26-50 m, 51-100 m, and >100 m) based on the estimated distance of the bird from the observer. We recommend surveyors use laser rangefinders to assist with distance

estimation. Having observations assigned to distance bins facilitates analyses to estimate density and population size. See Appendix A for a bird survey form developed for this survey methodology.

Summary of at-risk bird survey guidelines.	
TARGET BIRD SPECIES	Red-headed woodpecker, golden-winged warbler, and grassland birds.
BIRD SPECIES RECORDED	All birds.
TIME OF YEAR	Approximately late May to early July.
TIME OF DAY	Sunrise to 4 hours after sunrise.
SUITABLE CONDITIONS	Winds < 20 km/hr (13 mph) and avoid precipitation and heavy fog that inhibits bird detection.
TYPE OF SURVEY	Point count.
LENGTH OF SURVEY	10 minutes.
VISITS PER SEASON	One.
BROADCASTS	None.
POINT DATA RECORDED	Unique point ID, observer, date, time of survey, temperature, wind speed (km/hr or Beaufort Index), cloud cover (% of sky), precipitation, and noise level (0-4 scale).
BIRD DATA RECORDED	For each bird detection, record species, number detected, distance of first observation (0-25 m, 26-50 m, 51-100 m, > 100 m).

Secretive Marsh Bird Surveys

Open wetlands (e.g., marshes, wet meadows) of at least 4 hectares (10 acres) in area will be surveyed for a suite of rare, declining, and secretive marsh bird species. We will follow the North American Marsh Bird Monitoring Protocols (Conway 2011), which were further described for the Michigan Marsh Bird Survey (Michigan Bird Conservation Initiative [MiBCI] 2015). The survey methods target 10 primary species (e.g., rails, bitterns, grebes) and 8 secondary species (e.g., selected songbirds, marsh-nesting terns).

Conway (2011) recommends three visits be conducted during the breeding season (mid-May to late June) at points separated by at least 400 m. Surveys can be done in the morning (30 minutes before to 3 hours after sunrise) or evening (2 hours before to 30 minutes after sunset). During each visit, a 10-minute point count is conducted consisting of a five-minute passive listening period followed by one-minute broadcast periods for each of five species (Least Bittern [*Ixobrychus exilis*], Yellow Rail [*Coturnicops noveboracensis*], Sora [*Porzana carolina*], Virginia Rail [*Rallus limicola*], and American Bittern). Broadcast equipment should be capable of reaching the required sound pressure of 80-90 dB at one meter from the speaker. Observations of primary target species are recorded by individual across each minute of the 10-min survey and the distance at first detection is estimated to the nearest 5 meters. Secondary species are tracked at the species level, with the only the period of first observation of the species noted and the total number of individuals are recorded within three distance bins (0-50 m, 51-100 m, and > 100 m). We recommend surveyors use laser rangefinders to assist with distance estimation. Please refer to the Michigan Marsh Bird Survey Protocol (MiBCI 2015; Appendix B) for detailed survey instructions.

Summary of secretive marsh bird survey guidelines.	
TARGET BIRD SPECIES	Secretive marsh birds.
BIRD SPECIES RECORDED	Primary target species: yellow rail, sora, Virginia rail, king rail, least bittern, American bittern, American coot, common gallinule, pied-billed grebe, and Wilson's snipe. Secondary target species: black tern, Forster's tern, marsh wren, sedge wren, swamp sparrow, Le Conte's sparrow, yellow-headed blackbird, and sandhill crane.
TIME OF YEAR	May 15 to June 30.
TIME OF DAY	Morning (30 min before to 3 hours after sunrise) or evening (2 hours before to 30 min after sunset).
SUITABLE CONDITIONS	Winds < 20 km/hr (13 mph) and avoid precipitation and heavy fog that inhibits bird detection.
TYPE OF SURVEY	Point count.
LENGTH OF SURVEY	10 minutes.
VISITS PER SEASON	Three: one visit during each period (May 15-31, June 1-15, and June 16-30).
BROADCASTS	Five-min passive period followed by one-min broadcast periods for least bittern, yellow rail, sora, Virginia rail, and American bittern.
POINT DATA RECORDED	Unique point ID, observer, date, time of survey, temperature, wind speed (km/hr or Beaufort Index), cloud cover (% of sky), precipitation, and noise level (0-4 scale).
BIRD DATA RECORDED	Primary target species: record detections by individual across each one-minute period, estimate distance to nearest 5 meters, and note repeat detections. Secondary target species: record observation by species, note one-minute period of first detection only, and total the number of individuals detected by distance bin (0-50 m, 51-100 m, > 100 m).

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