

PROJECT BOBOLINK

Grassland Bird Conservation at Heaven Hill Farm
Prepared for the Henry Uihlein II & Mildred A. Uihlein Foundation
by the Paul Smith's College Adirondack Watershed Institute

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Project Bobolink

Grassland Bird Conservation at Heaven Hill Farm - 2021 Report to the Uihlein Foundation

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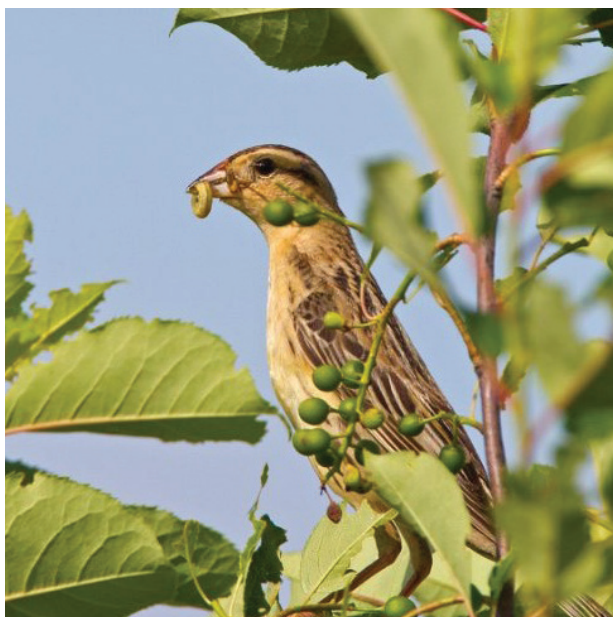
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Introduction

A recent report published by scientists across 7 institutions highlighted the alarming finding that, across the North American continent, 1 in 4 birds have been lost since 1970; a total of 2.9 billion (Rosenberg et al. 2019). Among them are 720 million grassland birds, a 53% population loss in this guild in the last 50 years. Native grasslands are one of the most endangered ecosystems in the Americas (Renfrew et al. 2019) and grassland birds such as bobolinks (*Dolichonyx oryzivorus*) rely on these habitats in both the breeding and wintering season. In the Northeast US, hay meadows often provide ideal habitat for grassland specialist species including the bobolink, as well as the savannah sparrow (*Passerculus sandwichensis*), and the northern harrier (*Circus hudsonius*). Natural grassland habitat is particularly rare in the context of the heavily forested Adirondack ecosystem. The Adirondacks are not considered to be a part of the core grassland habitat available at the state level, which is more prevalent in southern and western counties. Available grassland habitats in the Adirondacks may serve as important climate refugia, however. Refugia are areas that remain relatively buffered from contemporary climate change over time and enable persistence of valued physical, ecological, and sociocultural resources. Like many bird species, the bobolink is vulnerable to climate change and its range is expected to shift northwards as the climate warms. Grassland habitats located in higher elevation, northern regions like Heaven Hill and Uihlein Farm will become increasingly important for this and other grassland specialist species as these habitats decline more rapidly in areas to the south. The Paul Smith's College Adirondack Watershed Institute (AWI) has



Female bobolink, L. Master



worked with the Henry Uihlein II and Mildred A. Uihlein Foundation since 2019 to address concerns related to grassland birds breeding at Heaven Hill and Uihlein Farm. This report describes our activities and findings during the 2021 season and provides recommendations for future work.

Methods

In 2021, we used 3 methods to document birds and breeding activity at Heaven Hill Farm, continued informal observations and 2 additional data collection methods via smart phone. Bobolinks appeared in the area in approximately mid-May and we began observations on 3 June. We visited the site multiple times throughout the season to observe occurrence and breeding activity of bobolinks and savannah sparrows until all apparent breeding activity had ended.

Continued Informal and Behavioral Observations

As in prior seasons, informal, continuous bird counts were used throughout the breeding season by recording every bird species heard or seen while walking the fields and other areas of the property and observing both the savannah sparrows and bobolinks. These data help to describe the entire bird community present on the property and are an opportunity to document occurrence of species other than the target grassland birds.

Additionally, behavioral observation of bobolinks and

savannah sparrows were conducted multiple times/ week for a period of one to three hours each day throughout the breeding season and, as previously, we recorded all bobolinks detected, whether males or females, and documented behavior patterns and areas of the property where activity was concentrated. The purpose of this method is to document breeding behaviors and locations, as well as response to hay cutting and other management activities.

New Applications

In 2021, we made the decision to discontinue the use of point counts on the Heaven Hill property because of site limitations. The open habitat character of the property and small size of the area sampled means that we are generally detecting the same individual birds from one established point to the next. Point counts are more frequently used in forested habitats and, although appropriate for grasslands, require broader spacing so that the same individuals are not heard from all points. We do not feel that this method was adding appreciably to our knowledge of the birds present at Heaven Hill. In retrospect, we believe a set of points established and monitored annually at Uihlein Farm, because of the larger size of the parcel, would be valuable.

Though we discontinued point counts at Heaven Hill, we did establish new methods for data collection in summer 2021. To make information collection faster and more standardized, we developed a Survey123 application for use at both Heaven Hill and Uihlein Farm. Survey123 is a form-centric data gathering tool that allows users to create, share, and analyze surveys and is associated with ArcGIS. Among the advantages of Survey123 are its ability to share surveys with anyone, whether they have an ArcGIS license or not. Data can be collected via the freely downloadable Survey123 smartphone app or via a web interface. Paul Smith’s College ArcGIS license allows us to create surveys and have immediate access to the data from any internet-connected computer. We created a survey called BOBO SAVS and used it primarily ourselves but also shared it with a number of birders who frequent Heaven Hill to observe bobolinks. Ellen Jones, in particular, provided us with a significant amount of data throughout the breeding season. The BOBO SAVS survey allows for collection of a variety of basic information for each survey (observer, date, time, temperature, weather conditions, location), detailed breeding and nesting data for bobolink and savannah sparrow, and additional information on occurrence of any other bird species detected on site. It also allows for uploading of photos and/or audio files associated with each survey. This was a valuable addition to our methods in 2021 and we anticipate using the application again in subsequent seasons; we will continue to share it with potential volunteer observers who may wish to contribute data.

In addition to the Survey123 app, we also field tested an existing phone app for the collection of location information for bobolink and savannah sparrow observations. We used a free smartphone app called Map Marker which allows the user to drop a pin on any location in a Google Earth image and associate it with a name and notes. We used this app to field test the collection of fine scale habitat use information by noting the locations of individual birds in order to document their spatial use of all areas of the property.

Findings

Overall Bird Species Richness and Relative Abundance

Informal observations of birds were made approximately every other day throughout the breeding season by AWI and additional visits by Ellen Jones. We detected a total of 44 species through the course of the season, representing all birds that were detectable by ear or sight from our location on the property (Table 1). The diversity of species was similar to 2019 and 2020, with a handful of species undetected since 2019 and 1 species – black-and-white warbler – entirely new to our records at the site. It is important to note that the use of the smartphone app for data collection has most likely increased our observations for some species due to both ease of use and to observations provided by outside observers; numbers for some species may therefore appear significantly higher than years past.

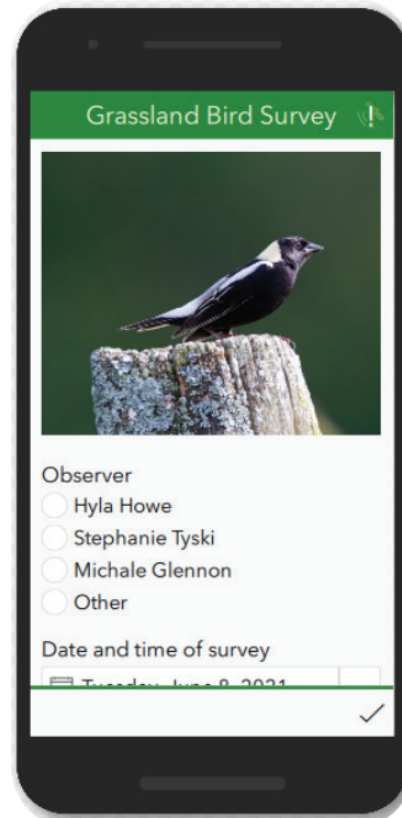


Table 1. Bird species detected at Heaven Hill Farm during May – August, 2021.

| Common name | Scientific name | AOU** code | Total 2019 | Total 2020 | Total 2021 |
|------------------------------|--------------------------------|---------------|---------------|---------------|---------------|
| American crow | <i>Corvus brachyrhynchos</i> | AMCR | 34 | 24 | 63 |
| American goldfinch | <i>Spinus tristis</i> | AMGO | 10 | 14 | 59 |
| American kestrel | <i>Falco sparverius</i> | AMKE | 2 | 0 | 1 |
| American robin | <i>Turdus migratorius</i> | AMRO | 9 | 15 | 20 |
| Barn swallow | <i>Hirundo rustica</i> | BARS | 2 | 9 | 15 |
| Barred owl | <i>Strix varia</i> | BADO | 1 | 1 | 0 |
| Belted kingfisher | <i>Megaceryle alcyon</i> | BEKI | 3 | 3 | 0 |
| Black-and-white warbler | <i>Mniotilta varia</i> | BAWW | 0 | 0 | 1 |
| Blackburnian warbler | <i>Setophaga fusca</i> | BLBW | 0 | 1 | 0 |
| Black-capped chickadee | <i>Poecile atricapillus</i> | BCCH | 8 | 6 | 26 |
| Black-throated blue warbler* | <i>Setophaga caeruleascens</i> | BTBW | 2 | 2 | 1 |
| Black-throated green warbler | <i>Setophaga virens</i> | BTNW | 5 | 1 | 1 |
| Blue jay | <i>Cyanocitta cristata</i> | BLJA | 13 | 5 | 18 |
| Blue-headed vireo | <i>Vireo solitarius</i> | BHVI | 22 | 11 | 22 |
| Bobolink* | <i>Dolichonyx oryzivorus</i> | BOBO | 40+ | 40+ | 40+ |
| Canada goose | <i>Branta canadensis</i> | CAGO | 2 | 1 | 10 |
| Cedar waxwing | <i>Bombycilla cedrorum</i> | CEDW | 2 | 5 | 30 |
| Chestnut-sided warbler | <i>Setophaga pensylvanica</i> | CSWA | 5 | 4 | 0 |
| Chipping sparrow | <i>Spizella passerina</i> | CHSP | 6 | 13 | 21 |
| Common loon* | <i>Gavia immer</i> | COLO | 1 | 1 | 0 |
| Common raven | <i>Corvus corax</i> | CORA | 2 | 1 | 0 |
| Common yellowthroat | <i>Geothlypis trichas</i> | COYE | 2 | 1 | 3 |
| Eastern bluebird | <i>Sialia sialis</i> | EABL | 17 | 15 | 39 |
| Eastern kingbird | <i>Tyrannus tyrannus</i> | EAKI | 0 | 1 | 0 |
| Eastern phoebe | <i>Sayornis phoebe</i> | EAPH | 2 | 4 | 7 |
| Eastern wood pewee | <i>Contopus virens</i> | EWPE | 0 | 2 | 0 |
| Great blue heron | <i>Ardea herodias</i> | GBHE | 0 | 1 | 1 |
| Hermit thrush | <i>Catharus guttatus</i> | HETH | 4 | 16 | 28 |
| House finch | <i>Haemorhous mexicanus</i> | HOFI | 0 | 1 | 0 |
| Indigo bunting | <i>Passerina cyanea</i> | INBU | 0 | 8 | 9 |
| Least flycatcher | <i>Empidonax minimus</i> | LEFL | 1 | 2 | 1 |
| Mourning dove | <i>Zenaida macroura</i> | MODO | 0 | 1 | 0 |
| Northern flicker | <i>Colaptes auratus</i> | NOFL | 10 | 12 | 3 |
| Northern harrier* | <i>Circus hudsonius</i> | NOHA | 2 | 2 | 0 |
| Northern parula | <i>Setophaga americana</i> | NOPA | 0 | 1 | 2 |
| Ovenbird | <i>Seiurus aurocapilla</i> | OVEN | 26 | 17 | 15 |
| Pileated woodpecker | <i>Dryocopus pileatus</i> | PIWO | 0 | 1 | 1 |
| Purple finch | <i>Haemorhous purpureus</i> | PUFI | 3 | 0 | 3 |
| Red-breasted nuthatch | <i>Sitta Canadensis</i> | RBNU | 7 | 1 | 3 |
| Red-eyed vireo | <i>Vireo olivaceus</i> | REVI | 4 | 14 | 38 |
| Red-tailed hawk | <i>Buteo jamaicensis</i> | RTHA | 1 | 0 | 0 |

| | | | | | |
|---------------------------|----------------------------------|------|-----|-----|-----|
| Red-winged blackbird | <i>Agelaius phoeniceus</i> | RWBL | 2 | 1 | 0 |
| Rose-breasted grosbeak | <i>Pheucticus ludovicianus</i> | RBGR | 0 | 2 | 0 |
| Ruby-throated hummingbird | <i>Archilochus colubris</i> | RTHU | 0 | 2 | 8 |
| Savannah sparrow | <i>Passerculus sandwichensis</i> | SAVS | 40+ | 40+ | 40+ |
| Scarlet tanager* | <i>Piranga olivacea</i> | SCTA | 1 | 0 | 1 |
| Song sparrow | <i>Melospiza melodia</i> | SOSP | 15 | 19 | 48 |
| Tree swallow | <i>Tachycineta bicolor</i> | TRSW | 8 | 13 | 34 |
| Turkey vulture | <i>Cathartes aura</i> | TUVU | 0 | 1 | 0 |
| Veery | <i>Catharus fuscescens</i> | VEER | 0 | 1 | 1 |
| White-breasted nuthatch | <i>Sitta carolinensis</i> | WBNU | 3 | 0 | 0 |
| White-throated sparrow | <i>Zonotrichia albicollis</i> | WTSP | 0 | 1 | 0 |
| Wild turkey | <i>Meleagris gallopavo</i> | WITU | 2 | 2 | 0 |
| Winter wren | <i>Troglodytes hiemalis</i> | WIWR | 0 | 4 | 0 |
| Wood thrush* | <i>Hylocichla mustelina</i> | WOTH | 0 | 1 | 0 |
| Yellow-bellied sapsucker | <i>Sphyrapicus varius</i> | YBSA | 10 | 2 | 11 |
| Yellow-rumped warbler | <i>Setophaga coronata</i> | YRWA | 0 | 1 | 1 |

* Considered Species of Greatest Conservation Need in New York State by NYS Department of Environmental Conservation. ** American Ornithological Union 4 letter codes.

Heaven Hill remains a haven for grassland specialists like bobolink and savannah sparrow, as well as other birds favoring farmlands and open habitats such as American goldfinch, American robin, Eastern bluebird, chipping sparrow, and tree swallow. The surrounding woods also support numerous woodland species like hermit thrush, ovenbird, and red-eyed vireo. Our new activity focused on the proposed recreation trail means we are making additional observations in the forested habitats and likely to see increasing numbers of forest associated birds in these totals over time.

Bobolink and Savannah Sparrow

Visits were made to the site on 47 different dates between June 3rd and August 21st with the bulk of visits during the height of the season in June (15 days) and July (23 days) and the remainder in late May and early August. One of our primary aims in the 2021 season was to again determine the extent to which our findings from 2019 and 2020 were indicative of breeding activity in other years. The early part of 2019 was unusually cold and rainy while 2020 was both warmer and drier and our findings were very different indicating that bobolinks, in particular, may be influenced strongly by temperature and precipitation in the early part of the season. In 2020 we believed there may have been as many as 8-10 male and 6-8 female bobolinks on the site and they used nearly all areas of the property. Likewise, in 2021 we believe



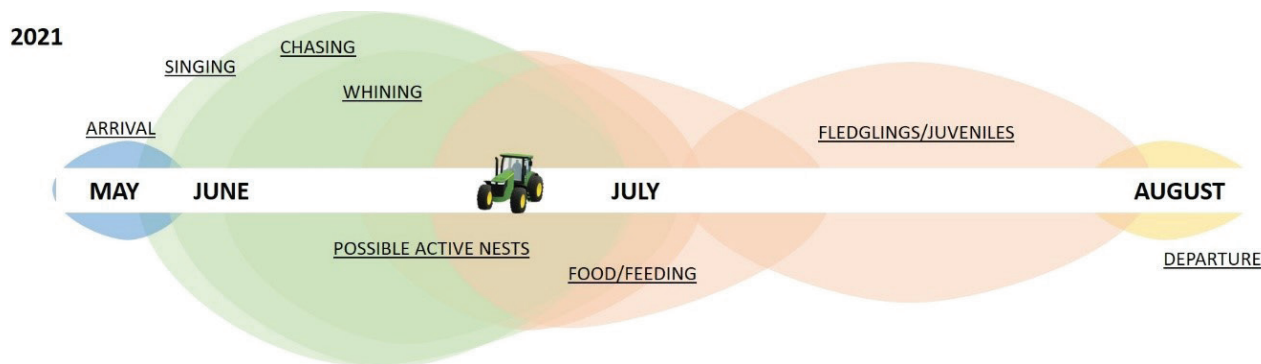


Figure 1. Chronology of bobolink breeding behavior observed at Heaven Hill Farm in Lake Placid, NY, 2021. Size of polygons indicates relatively frequency with which each behavior was observed. Mowing began on or around 24 June.

similar or slightly higher numbers of individuals were present on the site. Bobolink was observed on 79% of our visits to Heaven Hill and savannah sparrow on 69%; counts of bobolinks in groups ranged from 1-2 individuals to more than 20 at the end of the breeding season when fledglings were also present.

Breeding Evidence and Chronology

We used behavioral observations to record breeding behaviors indicative of possible nesting. Though pinpointing the location of nests remains a challenge in grassland habitats with limited numbers of observers, we observed a number of behaviors that indicate probable breeding and which we documented in our field survey application including singing, chasing, territorial defense, whining, carrying food, visiting probable nest sites, and presence of fledgling birds.

The observed chronology of breeding again followed what is generally known for both bobolinks and savannah sparrows, with young from first nests present in mid to late June for bobolinks and mid-May to mid-June for savannah sparrows (Figure 1). Past researchers have documented mean fledging dates for bobolinks of 23 June, 24 June, and 22 June for Ontario, Quebec, and upstate NY respectively (MacDonald 2017). We found a generally similar pattern in 2021 as we had in 2020, with the exception that some activities and behaviors were observed at slightly earlier dates. For example, we observed birds carrying food as early as June 15 and fledglings were observed as early as July 19. In all, conditions appear to have been similar or slightly better than 2020, and we observed significant numbers of fledglings on site, especially at the end of the season when the territories break down and birds gather in groups in preparation for migration. Some of this may, again, be attributable to increased observation power both because we have more

experience with documenting these behaviors, and because we were able to share our survey and collect information from additional observers. However, it appears that 2021 was a very good year and we can say unequivocally that both species nested successfully at Heaven Hill.

Space Use

In contrast to 2019 but similar to 2020, we observed bobolinks regularly throughout nearly all areas of the open fields at Heaven Hill in 2021. The area of the most intense use remains similar to past years, and that is partially located within the set aside where there are numerous perches in the form of rocks, shrubs, and a handful of small trees from which these birds prefer to sing and observe their surroundings. In particular, the expansion of the unmowed area and reduced encroachment into the set aside area in 2021 appears to have benefitted both species and will continue to do so.



Indigo bunting male, L. Master

Response to Mowing

Mowing of the first cut appears to have begun on or around 24 June and was nearly complete by 12 July, a timing which coincides with the presence of active nests. Immediately following mowing, multiple female bobolinks were observed exhibiting agitated behavior in the cut areas. Additional species were also noted in the cut grass including savannah sparrow, eastern bluebird, and American robin. The agitated behavior of female birds and the reluctance on the part of both species to leave the area even as it was being cut likely indicates that nests were present in the field. The most commonly observed reactions to mowing we documented were agitated birds, birds feeding in the recently mowed areas, and the presence of crows or other scavengers. After the hay was baled, we also observed birds of several species, including both grassland species, perching on the baled hay and one

Eastern bluebird apparently pulling nesting material from the bales.

Expansion and Use of Set Aside

Heaven Hill maintains a set aside area for nesting birds in the western end of the field, and also retains strips of unmown vegetation along the sides of the driveway. In 2021, the installation of bluebird boxes (next section) around the perimeter of the set aside in the area of high activity created an expansion of of the unmowed area, a great opportunity to expand the protected space for these birds. The expanded area of unmowed grass closely matches what we had suggested in past reports as a limit to the cutting and documented locations of birds throughout the season demonstrates the conservation gain that has accompanied this action (Figure 2).



Figure 2. Heaven Hill with mapped boundary of set aside area and observed locations of bobolink and savannah sparrow during 2021 breeding season. Observations are not exhaustive but demonstrate high use of this area, as in prior years, and benefit of reduced mowing encroachment on the set aside area.

New Activities: Nest Box Installation

Though not a planned activity for 2021, we had discussed in prior years the value of adding bird boxes at Heaven Hill and did so this season through a successful event in partnership with Northern New York Audubon (NNYA). A visit from a colleague and tree swallow expert to Heaven Hill in June prompted a renewed discussion of nest boxes and, organized and led entirely by Hyla Howe, we invited a group of NNYA volunteers to the site in July and constructed approximately 50 bluebird boxes. The success of this event prompted a subset of these volunteers to return on their own at a later date to finish additional boxes. We installed approximately 15 boxes at Heaven Hill around the perimeter of the set aside area and an additional 12 boxes at Uihlein Farm. Though it was too late in the season for these to be used for nesting by bluebirds and swallows, they will be ready upon their arrival in spring 2022 and we expect every box to be occupied. They were also utilized immediately upon installation as perches by bobolink, savannah sparrow, and other species at Heaven Hill.

New Activities: Proposed Recreation Trail

An additional activity in 2021 focused on collecting data to inform the construction of a proposed recreation trail that would connect Heaven Hill to the Henry's Woods trails and possibly to the Northville-Placid trail in the future. Most of our efforts were focused on collecting occurrence information for mammals in the area of the proposed trail in part because we spent a majority of our time earlier in the season focused on bird observations during the critical months of June and July. We made several traverses of the proposed trail route, and assume that the eventual location of the trail will generally follow the route previously flagged by Steve Langdon. The flagged route was chosen based solely on physical limitations and is sited to avoid steep slopes and wet or rocky soils, as well as to minimize stream crossings.

Using equipment available to us from prior projects, we deployed 8 Bushnell trail cameras along the proposed route to collect information on mammals present in the area. These are high quality trail cameras which are triggered by animals crossing an infrared beam and can be programmed to a variety of settings. We deployed them on August 2 and made 2 subsequent visits, once on 12 August to make adjustments in placement, and once on 8 November to retrieve data. The cameras remain deployed on site to capture winter season mammal observations and behavior.



To date, the cameras had taken more than 9,000 photos and documented an impressive diversity of both birds and mammals. We have not made any formal analyses of these data because the cameras are still deployed, but as of 8 November we had detected a total of 9 bird species and 16 mammals (Table 2).

Stephanie Tyski, in association with coursework for her Master's degree program at Paul Smith's College, conducted an independent analysis of the proposed trail utilizing GIS data and information on slope from 1m digital elevation models and ecological integrity from McGarigal et al. (2018). McGarigal et al. (2018) mapped a landscape index of ecological integrity for all terrestrial and aquatic ecosystem types in the Northeast, defining ecological integrity as the ability of an area to support native biodiversity and the ecosystem processes necessary to sustain it over the long term. This comprehensive index combined multiple intactness (i.e. stressor) and resilience metrics and has demonstrated utility and been partially validated in terrestrial and aquatic settings (McGarigal et al. 2013, McGarigal et al. 2018). Though this analysis was conducted for the purpose of her coursework, her work does reveal that the proposed trail traverses an area of high ecological integrity within the context of the broader landscape (Figure 3). Intactness and connectivity are among the characteristics that the ecological integrity index captures and the high mammal diversity we detected on the site may be a reflection of the size and quality of this forest block.

Table 2. Bird and mammal species detected on proposed recreation trail route at Heaven Hill Farm during August – November, 2021.

| Order | Common name | Scientific name |
|---------|-----------------------------|--|
| Birds | American robin | <i>Turdus migratorius</i> |
| | American woodcock | <i>Scolopax minor</i> |
| | Barred owl | <i>Strix varia</i> |
| | Blue jay | <i>Cyanocitta cristata</i> |
| | Dark-eyed junco | <i>Junco hyemalis</i> |
| | Hermit thrush | <i>Catharus guttatus</i> |
| | Ruffed grouse | <i>Bonasa umbellus</i> |
| | White-breasted nuthatch | <i>Sitta carolinensis</i> |
| | Wild turkey | <i>Meleagris gallopavo</i> |
| Mammals | American black bear | <i>Ursus americanus</i> |
| | American marten | <i>Martes americana</i> |
| | Bobcat | <i>Lynx rufus</i> |
| | Coyote | <i>Canis latrans</i> |
| | Deermouse | <i>Peromyscus spp</i> – N. American (<i>maniculatus</i>) or white-footed (<i>leucopus</i>) |
| | Eastern chipmunk | <i>Tamias striatus</i> |
| | Eastern gray squirrel | <i>Sciurus carolinensis</i> |
| | Fisher | <i>Pekania pennanti</i> |
| | Flying squirrel | <i>Glaucomys spp</i> – Northern (<i>sabrinus</i>) or Southern (<i>volans</i>) |
| | Gray fox | <i>Urocyon cinereoargenteus</i> |
| | North American porcupine | <i>Erethizon dorsatum</i> |
| | North American red squirrel | <i>Tamiasciurus hudsonicus</i> |
| | Raccoon | <i>Procyon lotor</i> |
| | Red fox | <i>Vulpes vulpes</i> |
| | Snowshoe hare | <i>Lepus americanus</i> |
| | White-tailed deer | <i>Odocoileus virginianus</i> |



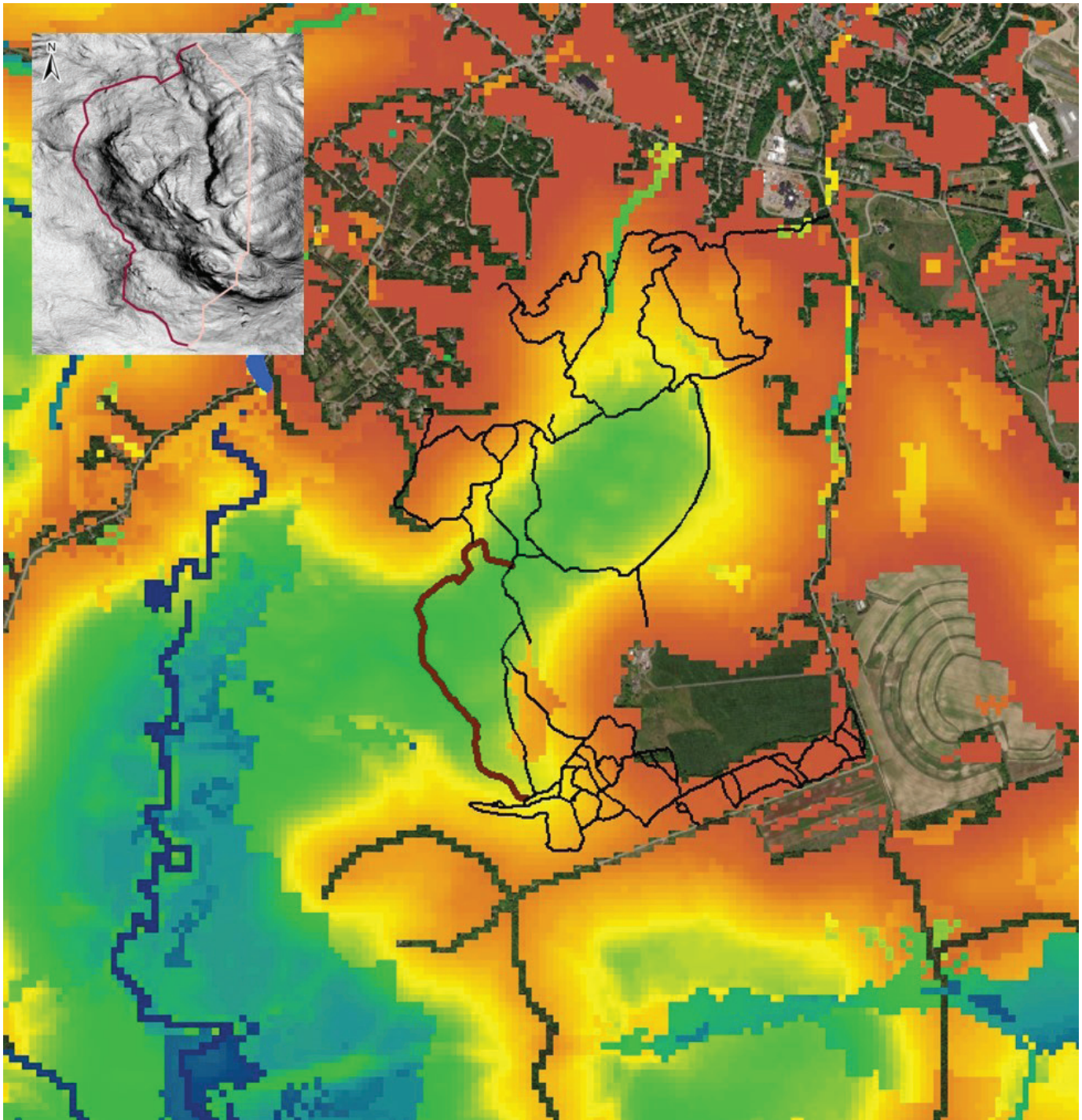


Figure 3. Proposed trail (thick brown) and existing trails (black) superimposed on ecological integrity map of McGarigal et al. (2018); ecological integrity ranges from red (lowest) to blue (highest). Inset depicts slope from 1 m digital elevation model of area of proposed trail on Heaven Hill.

Recommendations

Grassland Birds

The future of grassland bird nesting and population growth depends on open grassland and the majority of grassland habitat in the Adirondack Park is privately owned, providing opportunities for management but also challenges in the form of achieving economic returns on harvested hay while still allowing for breeding to occur in these fields. We have provided a set of recommended best management practices for grassland birds compiled from the scientific literature (Atwood et al. 2017, Dechant et al. 1999, NRCS 1999, Ochterski 2006) and our own observations and conversations with a number of birders, bird researchers, farmers, and conservation organizations. These remain highly relevant to Heaven Hill and include abstaining from mowing between May 15 and August 15, collecting the cut hay in the set aside area at least every 3 years, discouraging growth of forbs and woody vegetation, reclaiming field edges and enlarging fields where possible, avoiding disturbance to birds during the breeding season, and making use of mowing patterns that reduce mortality.

We recognize that some of these recommendations cannot be implemented at Heaven Hill given the restrictions of weather and a short growing season and our next highest recommendations have been to enlarge the area of the set aside, restrict the cutting to previously identified zones, and restrict to the extent possible any use of the open field by people, dogs, or unauthorized vehicles between May 15 and August 15. We are very pleased that all 3 of these recommendations were addressed in 2021. The construction of bird nest boxes and their subsequent installation to mark the boundary of the set aside area has provided great benefit to the birds at Heaven Hill. In addition, the use of signage to request that hikers stay out of the open grassland during the breeding season has also likely resulted in less disturbance to birds during this period. We recommend the continued use of either temporary or permanent signage, both to restrict use of the open meadow during the breeding season but also to highlight the important work the Uihlein Foundation is doing to benefit grassland birds.

Recreation Trail

Our recommendations to date are limited to potential future research on the proposed recreation trail. As we have highlighted in prior presentations, the opportunity for before-and-after ecological research in the context of any habitat alteration is rare and underrepresented in the scientific literature; the majority of recreation ecology studies are associated with trails and other infrastructure that already exists. We have already documented a tremendous diversity of mammal species in the area of the proposed

trail but have available equipment and expertise to expand significantly beyond mammals. If the Uihlein Foundation remains interested in the potential construction of a trail connecting Henry's Woods to Heaven Hill, we recommend continuing to examine the pre-construction ecological context and, specifically to:

- Begin work earlier in the season, possibly in late April or early May to survey vernal pools
- Continue with the camera monitoring and collect 4-season data on mammal use of the area
- Consider use of track tubes for smaller mammals that are not often detected via cameras
- Establish a set of point counts locations along the proposed route for forest bird surveys
- Utilize autonomous recording units for detection of additional species including owls, and possibly frogs
- Consider placement of cover boards along the proposed route for additional detection of amphibians
- Consider monitoring of additional locations including a control area that will not have a trail in the foreseeable future, or on existing trails at Heaven Hill or Henry's Woods for the purpose of comparison

We also recommend that the Foundation consider the possible benefits and costs of not building the trail. Our explorations of the site on foot suggest that the hill is particularly fertile with an underlying calcareous substrate and several species of vegetation that are regionally important, as well as cliff and cave features that provide denning habitat. At broader scales, the area in which Heaven Hill is located is characterized by high ecological integrity and is a component of a larger block identified by the Nature Conservancy as important for resilience, climate flow, and recognized biodiversity (Anderson et al. 2016). We suggest that the characteristics of the broader landscape surrounding the site may provide important context in your planning process.

Conclusions

We appreciate the opportunity to work with the Uihlein Foundation again this season to document the use of Heaven Hill by grassland birds and other species. Conditions during this breeding season were warmer and drier throughout than they were in 2019 and similar to 2020. We documented large numbers of birds and we observed them using nearly all areas of the property. While this presents a challenge for recommendations with respect to management, at the same time we were able to document numerous breeding behaviors and observe multiple fledglings at the end of the season and we believe both species produced several successful nests in 2021.

Worthy of note for the 2021 season is the inspiration that the grassland bird work at Heaven Hill has had upon Hyla Howe and her subsequent efforts to develop this work into the basis for a Master's project. She has pursued relationships with grassland bird experts

at the University of Vermont and also reached out to faculty at Cornell University and other institutions and is in the process of developing a project to begin in 2022. She hopes to use Heaven Hill as a reference and demonstration site and then to promote these and other management techniques throughout Essex County with interested individuals who have potential grassland bird habitat on their lands. In combination with her creative funding ideas including agrotourism and road biking, there is an opportunity to leverage the efforts of the Uihlein Foundation to influence grassland bird habitat conservation on much larger scales. This activity would be challenging for AWI to take on given our range of existing projects, but will undoubtedly flourish given the attention of a dedicated and enthusiastic student. We appreciate the opportunity and inspiration that your efforts have provided and hope you are as excited as we are that your actions to help these birds both at Heaven Hill and Uihlein Farm can be a model for other interested landowners in the Adirondacks.



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