Human Visitation Impacts on Montane Breeding Birds in the Catskills High Peaks

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Abstract

Off trail hiking has long been a popular recreational activity in the Catskill Mountains. With the resurgence of outdoor recreation during and after the COVID-19 pandemic, however, unsanctioned, informal hiking trails are proliferating in the Catskill High Peaks. Excessive human disturbance is known to decrease native biodiversity; however, the exact effects vary with the intensity of the disturbance and the sensitivity of the wildlife in a particular habitat. Due to impending threats to high elevation habitat, montane birds--such as the Bicknell's Thrush--are of particular concern. Hikers that travel off trail may disturb this species, as well as others that tend to nest on or near the ground. Long-term avian monitoring programs in North America typically occur along roads and rarely in montane forests. Mountain Birdwatch monitors birds along formal trail networks, but there is a lack of data for trailless montane areas in the northeastern U.S. Using the Mountain Birdwatch point count protocol, we measured avian richness and abundance across several trailless montane peaks that experience varying levels of hiker visitation. Our results suggest that montane species richness and abundance was negatively correlated with human visitor use across all trail types. The lowest rates of detection for both montane specialist bird species and generalist bird species occurred in the formally trailed areas with high levels of human visitation. A continuation of this project over several field seasons will inform NYSDEC land managers that are tasked with providing access to public lands while also protecting habitat and wildlife.

Introduction

Following the COVID-19 pandemic, there has been a world-wide increase in outdoor activity- including walking, biking, and hiking (Beery et al. 2021, Venter et al. 2021, Ferguson et al. 2022, Smith et al. 2023). Consequently, the popularity of fitness-tracking phone applications has skyrocketed. Apps such as AllTrails, Gaia, and Strava allow users to plan their routes and track their progress, all while incorporating game elements that motivate the user to maintain a fitness goal. These apps also provide detailed information about trails, including terrain, elevation, estimated completion time, scenic view spots, and more. As a result, hiking is more accessible than ever before.

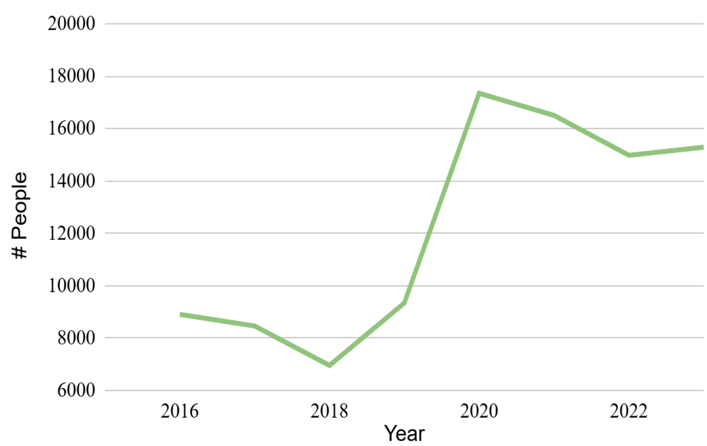


Figure 1. Canister tallies (solid line) of visitors in Region 3+4 Catskill High Peaks from 2016-2023. Data provided by Pine Roehrs [DEC], Formerly Trailless Catskill High Peaks Canister Sign in Analysis from 2009-2023.

The Catskill High Peaks of New York State is an open access, high elevation hiking destination located approximately 90 miles north of New York City. The peaks experience varying levels of human visitation, but have faced a substantial increase in hikers over the last few years (Figure 1). Following COVID-19 pandemic restrictions in 2020, peak visitation spiked by 86% in the Catskill High Peaks and has leveled off only slightly since.

Hiking groups such as the Catskill 3500 Club, Catskill Mountainkeeper and Hikers Anonymous offer badges for specific hiking accomplishments, therefore instilling a gamification of mountain hiking. Hikers are rewarded for hiking every peak- known as “peak bagging”- for hiking specific peaks during specific seasons, or for climbing peaks from several directions. Many of these mountains do not have official NYSDEC trails, thus causing hikers to “bushwhack”; a term coined for hiking off of an established trail. Repeated bushwhacking through the same areas eventually causes visitor-created herd paths to form, consequently encouraging more hikers to travel along those newly created paths. Smartphone hiking apps also promote the use of GPS tracks that concentrate hiker activity to a single corridor, leading to more informal trails (ITs) forming on the mountains.

The Catskill high peaks are home to a dwindling montane spruce-fir forest biome. This region also represents the southernmost extent of the breeding grounds of one of North America’s most rare and vulnerable songbirds—the Bicknell’s thrush (*Catharus bicknelli*; Rimmer et al. 2001a). This thrush, as well as other montane bird species, face ongoing threats as a result of climate change. Changing climate can reduce the extent of montane habitat on both the breeding and nonbreeding grounds due to the upslope movement of lower vegetation communities responding to the ever-increasing favorable conditions at higher elevations (Iverson 2007, Mata-Guel 2023). Such vegetation shifts have the potential to indirectly increase interspecific competition with montane bird species as lower elevation bird species also move upslope (Chen 2011). Elsewhere in the northeastern U.S., montane bird breeding habitats are fragmented by development, communication, and energy infrastructure, and now, as in the Catskills, IT networks (Hill 2019, Rimmer 2004). Several studies have shown that bird populations are susceptible to human disturbance caused by hikers using established trail networks. Impacts include reduced abundance and altered community composition (Miller et al. 1998, Gutzwiller and Anderson 1999), as well as reduced density, diversity, and species richness of bird populations in proximity to the trails (Thompson

2015, Bötsch et al. 2018, Grooms and Urbanek 2018). This disturbance is thought to be a greater concern during the breeding season, particularly for montane birds that have a narrower elevational range and more specialized habitat compared to their lower-land counterparts (Gutzwiller et al. 1998). Montane birds that nest on or near the ground have been shown to experience the impact of human intrusion at a greater intensity (Barton and Holmes 2007, Smith-Castro and Rodewald 2010, Thompson 2015). Recreational activity on trails can lead to intrusion-induced behaviors, such as nest abandonment (Barton and Holmes 2007) or increased alertness (Lima and Dill 1990, Fernandez et al. 2007), which can reduce foraging efficiency and attentiveness to young. Sites of human intrusion have a significantly lower rate of song occurrence and consistency (Gutzwiller et al. 1994) and singing behaviors can be delayed by human presence (Gutzwiller and Anderson 1997). Impacts of human disturbance are amplified with increased use of trails, trails that intersect through multiple habitat types (Rodriguez-Prieto et al. 2014), increased width of trail (Walters 2010), and trails that allow unrestricted recreationist movement or dogs (Bennet et al. 2009).

While IT networks may see less visitation than trail systems that are formally marked, the impact can reach a wider distribution. In areas without formal trails, human foot traffic is more erratic, and may result in a greater amount and broader area of trampled or disturbed vegetation. Because of trail difficulty, travel time can be more prolonged, creating a longer and more severe disturbance response in birds (Fernandez et al. 2007). Informal trail networks are also of concern because they tend to be less sustainable than formally marked trails. Oftentimes they occur as a result of visitors taking the shortest route between two points, sometimes across steep grades or through areas with sensitive vegetation (Roehrs and Rice 2020). In such cases, these actions can exacerbate the rates of soil erosion, compaction, or loss of organic litter (Marion, 2011). These difficult trail conditions often drive hikers to take new, less eroded routes, thus creating an ever-widening network of ITs.

We set out to monitor avian communities in the Catskill High Peaks on both trailed and trailless areas to better understand how hiking activity could affect montane bird populations. As part of an ongoing process of developing a Visitor Use Management (VUM) Plan for the formerly trail-less Catskill peaks, we partnered with the New York State Department of Environmental Conservation, the New York Natural Heritage Program, and the Vermont Center for Ecostudies under the Catskill Science Collaborative. Our research team consisted of field technicians Andres Barragan, Danielle Takacs, Samuel Mateo Jr., Kristyn Gessner, and Chris Gabelman, Sponsoring scientist Dr. Kara Belinsky (SUNY NP), Natural Resource Planner Pine Roehrs (DEC), Science Advisor Jason Hill (VCE), and Project Advisors Sara Hart (DEC), Max Henschell (NYNHP) and Tim Howard (NYNHP).

Methods

Preliminary Studies:

As part of a long-term monitoring program of the Catskill high peaks, the NYSDEC has been collecting several years of baseline data in order to inform potential future management strategies.

Over a 12-week period in the summer of 2019, DEC's Natural Resource Planner, Pine Roehrs, surveyed nearly 40 miles of ITs on 17 trailless peaks over 3,500 ft in the wilderness, wild forest, private land and state forest areas in the Catskills and the results were documented in a 2020 report (Roehrs and Rice 2020). Strava heatmaps and smartphone hiking app information were used to identify areas where monitoring needed to take place. Strava is a fitness app that aggregates user data and creates heat maps that show areas with the highest concentration of visitation. Strava heatmap information was collected again in 2020 during the COVID-19 pandemic. The heat maps indicated that hundreds of new informal visitor-created trails were forming as a result of significant increases in visitation. In 2021, an addendum to the 2019 report called for increased monitoring and evaluation of the natural resources and ecological communities within the study area (Roehrs and Rice 2022).

During the summer and fall of 2022, New York Natural Heritage Program (NYNHP) Ecologists Max Henschell and Elizabeth Spencer surveyed the trailless peaks to determine the effects that ITs have on natural communities in the Catskills. NYNHP staff found the most damage to occur across steep slopes where there is an increase in soil erosion, and on the summits where hiker presence is sustained and concentrated. They also found the conditions surrounding ITs to be poor, with increased occurrence of invasive species, disturbance of wildlife, and excessive erosion.

Simultaneously, in 2022, the NYSDEC announced a VUM planning process to identify solutions that address impacts to natural resources caused by the proliferation and expansion of user-created ITs on formerly trailless Catskill high peaks. Some of the goals of this planning process include 1) documentation and categorization of the condition of ITs using an informal trail monitoring protocol 2) consolidation of visitor traffic to a single corridor to reduce impacts to natural resources caused by informal trails 3) identification of exclusion areas where development of formal trail systems would not be appropriate given sensitive natural resources, and 4) designation of a preferred path to the summit of the formerly trailless peaks.

Study Site:

To elucidate the relationship between IT networks and montane bird species, we assessed avian abundance and richness, as well as human impacts, across montane areas that we assigned to one of three categories. The first category included established, formal trails on the mountains of Big Slide, Hunter, and Plateau that experience high levels of visitor use in the summer months. The second category included informal (i.e., bushwhacked) trails on the mountains of Southwest Hunter, Balsam Cap, Dink, Friday, and Rusk that also experience regular hiker use. The third category included informal trails on the mountains of Little Slide, the South Shoulder of Slide, the North Shoulder of Sugarloaf, Rusk, West Hunter, and Southwest Hunter that have low rates of visitation (Table 1). Pine Roehrs (NYSDEC) and staff from the NYNHP visited many of the trailless peaks to perform vegetation assessments and identify areas of interest where hiker presence intersected with rare or vulnerable species (Henschell 2022). Jason Hill (VCE) used topo maps, Strava data, and aerial footage to identify stands of montane spruce-fir forest on these mountains that hikers likely passed through to reach the summits. The research team designated avian sampling locations along these likely hiking paths (typically ridgelines), separated by 250 m (straight-line distance) to reduce the chance that an individual bird could be detected from adjacent sampling stations (i.e., double-counted).

The project was carried out along the peaks and ridgelines of the Region 3 and Region 4 Catskill Mountains (Figure 2), and the sample points ranged in elevation from 3300 to 4200 ft. The habitat varied from high-elevation, spruce-fir zones with stunted trees and high-density old growth regions, to more open mesic areas dominated by deciduous maple-beech stands.

Table 1. Tally of sample point locations where bird counts and site impact data were measured. For High Visitation/Formal trail points, breeding bird data was obtained from community scientists through Mountain BirdWatch. For all other points, breeding bird data and site impact data was collected by CSC field technicians.
*Weather conditions in summer of 2023 prevented some bird point counts at this location and are therefore not represented in the data.

Location	Trail type	Visitor use	# of sampling points	
West Hunter	Informal	Low	5	
Little Slide	Informal	Low	7*	
Rusk	Informal	Low	1	
Slide South Shoulder	Informal	Low	3	
Southwest Hunter	Informal	Low	4	
Sugarloaf North Shoulder	Informal	Low	4	
Low Visitation/Informal Trail TOTAL				24
Rusk	Informal	High	6	
Southwest Hunter	Informal	High	5	
Balsam Cap	Informal	High	1*	
Dink	Informal	High	4	
Friday	Informal	High	5	
High Visitation/Informal Trail TOTAL				21
North Hunter	Formal	High	6	
West Hunter	Formal	High	5	
North Plateau	Formal	High	6	
South Plateau	Formal	High	6	
High Visitation/Formal Trail TOTAL				23
GRAND TOTAL				**68**

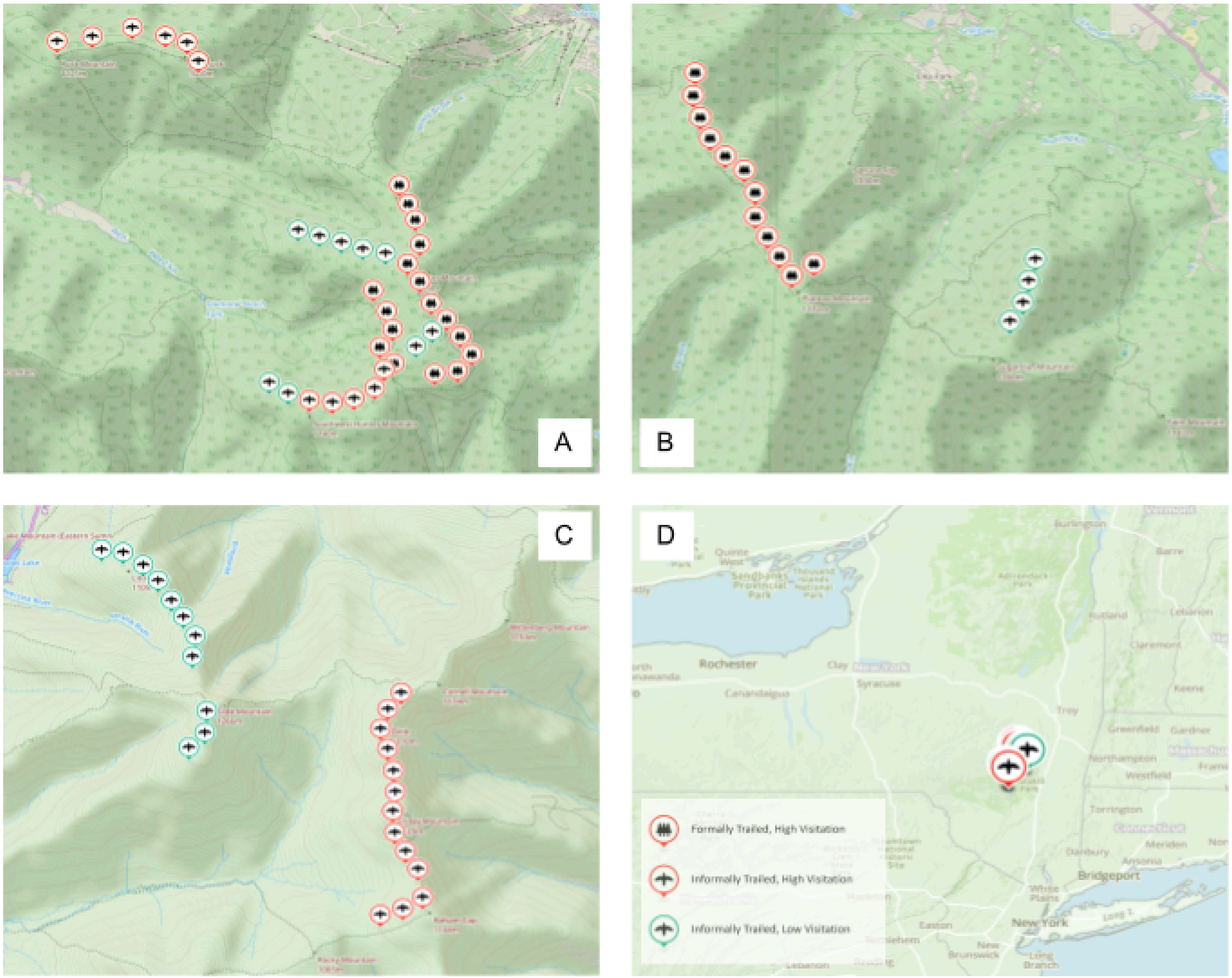
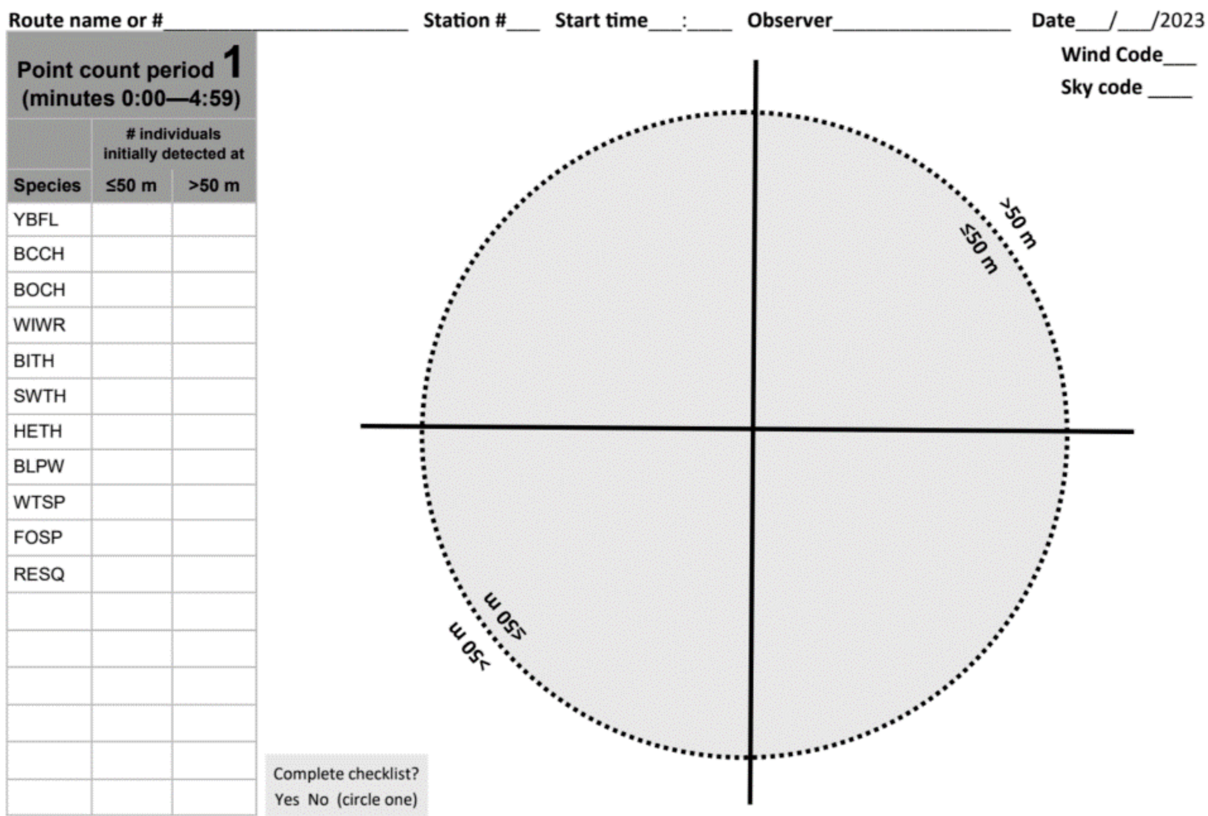


Figure 2. Overhead Gaia imagery of sampling points in Region 3 (A, B) and Region 4 (C) of the Catskill Mountains in NY, as well as a zoomed-out view of the survey location (D).

Data Collection: Montane Birds

Since 2000, community scientists have been monitoring populations of montane bird species in the high-elevation forests of the northeastern US through Mountain Birdwatch (MBW), a program administered by the Vermont Center for Ecostudies. Mountain Birdwatch provides region-wide monitoring for 10 species of birds such as the iconic Bicknell's Thrush *(Catharus bicknelli)*, Blackpoll Warbler *(Setophaga striata)*, Yellow-bellied Flycatcher *(Empidonax flaviventris),* and others that are rarely detected during traditional roadside monitoring schemes like the North American Breeding Bird Survey. The results provide powerful insight into the health of our montane bird populations in the northeastern U.S. However, MBW monitoring only occurs on formal trail networks, and more information is needed about montane areas with informal trail networks.


Route name or #____________ Station #___ Start time___:____ Observer____________ Date___/___/2023

Wind Code___
Sky code ____

Point count period 1 (minutes 0:00—4:59)	# individuals initially detected at	
Species	≤50 m	>50 m
YBFL		
BCCH		
BOCH		
WIWR		
BITH		
SWTH		
HETH		
BLPW		
WTSP		
FOSP		
RESQ		

Complete checklist?
Yes No (circle one)

Figure 3. Blank datasheet for Mountain BirdWatch protocol. Species alpha codes (unique 4-digit acronyms) are provided in the table on the left and represent the 10 avian and 1 mammal species that MBW members are required to count. Alpha codes were written at their estimated position on the circle (centered at observer location), then tallied in the table. Sky and wind conditions are recorded due to their impact on an observers ability to detect birds.

The MBW protocol consists of four consecutive, independent 5-minute point counts at each sampling station, for a total sampling period of 20 minutes per station. The observer stands in one spot and records any birds they can detect visually or aurally—and assigns each bird into one of two initial distance detection categories: <50m or >50m (Figure 3). Observers are required to monitor 10 focal avian species and one mammal—red squirrel. There are 8 focal avian species that breed in the Catskills region (Table 2).

For our project, we followed this protocol, with some minor adjustments to improve safety and data quality standards. In MBW, a lone observer conducts the avian monitoring while our project relied on two data observers. During each point count, two observers conducted simultaneous independent counts, standing at least 10 m apart. When possible, observers stood with a tree or brush between them to reduce the chances that one observer's behavior or detection of a bird could influence the other observer's count. Point counts typically began 45 minutes before sunrise and were concluded before 10 am. During periods of rain (which was often the case), point counts were paused and resumed 20 minutes after the rain stopped. Depending on timing, we conducted 4-8 point counts across different sampling locations during a morning on a given mountain.

For this project, the field technicians carried out point counts on the informal trail networks in June and early July 2023 and 2024. Due to scheduling and weather, we were able to complete 45 of the 49 selected stations in 2023 (Table 1). All stations were completed in 2024, however, only the 45 stations that we surveyed the year prior were used in the data analysis. MBW community scientists conducted point counts at 47 stations on formal trail networks, 23 of which were used in our data analysis (Table 1).

Table 2. Common names, Latin names, and 4-letter alpha codes of species that were detected at least twice by fellows during point counts in the Catskills. The black box indicates focal species, and the color scale represents average nesting height from the ground (varies significantly- information gathered from allaboutbirds.org). **Neo-tropical migrants

White-throated Sparrow *Zonotrichia albicollis* WTSP	Black-capped Chickadee *Poecile atricopilla* BCCH	American Goldfinch *Spinus tristis* AMGO	Hairy Woodpecker *Leuconotopicus villosus* HAWO
Hermit Thrush** *Catharus guttatus* HETH	Bicknell's Thrush** *Catharus bicknelli* BITH	Blue Jay *Cyanocitta cristata* BLJA	Red-breasted Nuthatch** *Sitta canadensis* RBNU
Winter Wren** *Troglodytes troglodytes* WIWR	Blackpoll Warbler** *Setophaga striata* BLPW	American Robin *Turdus migratorius* AMRO	Golden-crowned Kinglet** *Regulus satrapa* GCKI
Yellow-bellied Flycatcher** *Empidonax flaviventris* YBFL	Swainson's Thrush** *Catharus ustulatus* SWTH	Black-throated Green Warbler** *Setophaga virens* BTNW	Blackburnian Warbler** *Setophaga fusca* BLBW
Dark-eyed Junco *Junco hyemalis* DEJU	Magnolia Warbler** *Setophaga magnolia* MAWA	Black-throated Blue Warbler** *Setophaga caerulescens* BTBW	Red Crossbill** *Loxia curvirostra* RECR
Mourning Warbler** *Geothlypis philadelphia* MOWA	Black-and-White Warbler** *Mniotilta varia* BWWA	Purple Finch** *Haemorhous purpureus* PUFI	Yellow-rumped Warbler** *Setophaga coronata* YRWA

0-5 ft
5-15 ft
15-25 ft
25-60+ ft

Analysis

To determine the effect of trail type on species abundance and richness, we ran five analyses of variance (ANOVA). We tested the variance for focal species abundance and richness, all species abundance and richness, and abundance of Bicknell's Thrush. The groups for this test represented the three trail categories: Low Visitation/Informal Trail, High Visitation/Informal Trail, and High Visitation/Formal Trail. We also ran a Tukey Test for significance between those categories.

We considered a species present at a sampling location if it was detected at least once during the 4 five-minute point counts periods. The same individual bird could be detected in multiple point counts periods, so we used the largest count for each species during any five-minute point count periods at a sampling location as our metric for the number of individuals detected. For example: if we detected nothing in the 1^{st} period, one Bicknell's Thrush in the 2^{nd} period, three Bicknell's Thrush in the 3^{rd} period, and nothing in the 4^{th} period, the number of Bicknell's Thrush detected at that point count station was (n=3) in our data analysis.

Results-Discussion

Over the course of two survey seasons, the field technicians detected a grand total of 1,583 individual birds during point counts on IT networks. Comparing the number of individuals, the most commonly detected species were Yellow-rumped Warbler (n = 241), Swainson's Thrush (n = 174), and Magnolia Warbler (n = 152). In 2023, we detected a total of 997 birds and 26 species, and in 2024 we detected 586 birds and 27 species. Community scientists through Mountain Birdwatch contributed an additional 434 detections to our data, with the most common species being Swainson's Thrush (n = 64), Yellow-rumped Warbler (n = 46), and Winter Wren (n = 42). They detected a total of 170 birds and 24 species in 2023, and 264 birds, 23 species in 2024. Some species were omitted from the results if they were detected only once by a single technician (see Table A3 and A4 in Appendix A).

Our findings support that all species abundance and focal species abundance decreases on trails with higher visitation (Figure 5). According to the results of the ANOVA, there was a significant effect of trail type on the focal species abundance [$F(2, 65) = 15.21$, $p < 0.001$], and all species abundance [$F(2, 65) = 46.06$, $p < 0.001$]. Post hoc comparisons using the Tukey HSD indicated significance at nearly all levels, but results were insignificant only when comparing focal species abundance at informal and formal trails with high visitation (see Table A5 Appendix B). The ANOVA also showed that trail type had a significant effect on focal species richness [$F(2, 65) = 3.72$, $p < 0.05$], however, post hoc comparisons only showed significance between informally trailed, low visitation points and informally trailed, high visitation points (see Table A6 Appendix B).

The ANOVA also revealed that there was no significant effect of trail type on all species richness [$F(2, 65) = 1.31$, $p = 0.28$] or the abundance of Bicknell's Thrush [$F(2, 65) = 1.43$, $p = 0.247$]. A total of 23 Bicknell's Thrush were detected at informal trails with low visitation, 5 with high visitation , and 17 at formally established trails with high visitation (Figure 6). Although the results are not statistically significant, we can see that the lowest number of detections were in informally trailed, high visitation (Figure 6) points. While we expect less bird detections in higher visitation areas, these results suggest the formality of the trail may have had an impact on Bicknell Thrush abundance. Informal trails are less sustainable than sanctioned trails and alter vegetative/soil composition at a greater rate, therefore creating a less suitable breeding habitat. They are also generally difficult to traverse, therefore, hikers spend more time on the path, increasing the time spent in proximity to the birds and disturbing them. In addition, as ITs erode, hikers may seek different, more suitable routes, thus continuously expanding the disturbed area. Bicknell's Thrush have an average nesting height of 5-15 ft (Table 2) and are more susceptible to human disturbances. These ideas may suggest that there would be more detections in formal trails when compared to high visitation ITs, especially for focal bird species that nest on or near the ground.

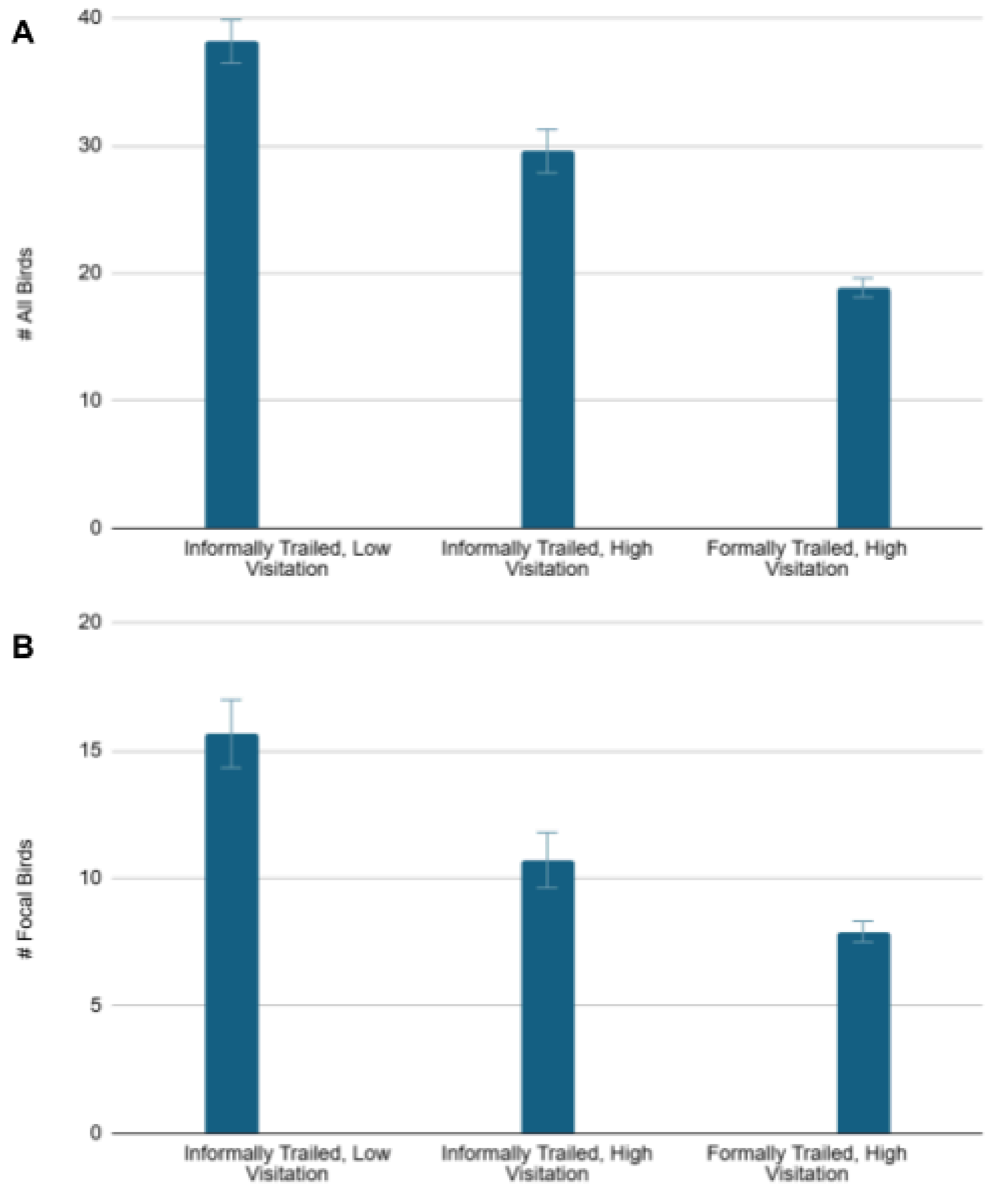


Figure 5. Bar plot of the # of focal birds (A) and the # of all birds (B) detected across trail types. The Y axis represents # of individuals detected, the error bars show calculated standard error.

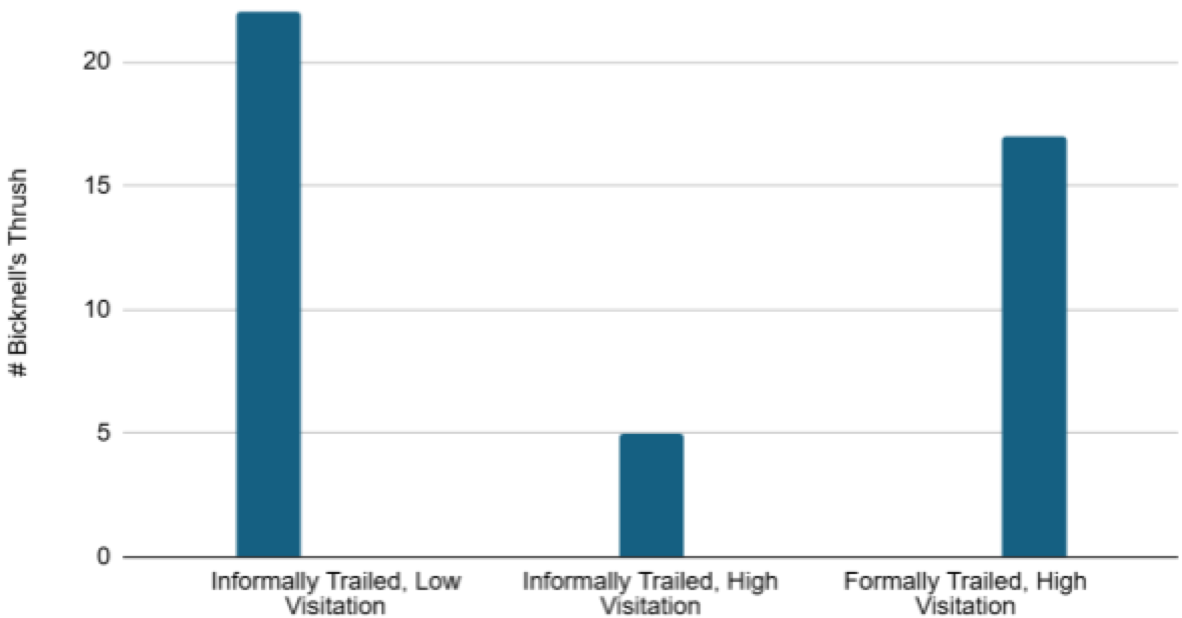


Figure 6. Bar plot of the total # of Bicknell's Thrush detected across trail type. No significant difference was calculated between categories, as determined by ANOVA and Tukey HSD (α=0.05).

This data represents only two seasons of data collection. It is possible that other patterns will arise as sampling continues, however, from these results, we can see some smaller trends that may be valuable to expand upon. Because levels of visitor use had the greatest influence on bird detections, that should be a focal point. Visitors could also be encouraged to track their hike on Gaia or Strava so that more specific measures of trail activity could be obtained. It would be interesting to see if there is a correlation between trail difficulty or the time it takes people to complete a certain length of trail and the species abundance and richness on that trail. This additional data could be useful when further exploring the relationship between trail formality and bird detections.

In 2023, there was excessive rain throughout the breeding/singing season, and we believed the point count data may not have been an accurate depiction of the birds breeding at or near each sample point. Singing behaviors and detection abilities are impacted heavily by weather conditions (Robbins 1981), and several point counts were conducted on mornings after or during inconsistent downpour. Despite there being much less rain in 2024, there were 411 fewer bird detections at the informal trails compared to the year prior. Mountain Birdwatch community scientists also contributed 94 more detections in 2024 than the year prior, including 14 Bicknell's Thrush. This greatly affected the results for Bicknell abundance across the trail types as only 3 Bicknell's Thrush were detected in 2023 at formally trailed, high visitation points; 19 Bicknell's were detected at informally trailed low visitation points in 2023 and only 3 in 2024. Bird populations fluctuate annually, while that may explain the disparity in the two years, a dataset of several years will be key in getting solid data to properly inform trail management decisions.

Another factor to note is the different observers for the point count data. All informally trailed mountains were sampled by fellows that recorded all identifiable species detected, whereas Mountain BirdWatch community scientists are instructed to focus on the target species and only include non-focal species if they are able. This factor could have skewed the data towards formally trailed mountains for all species abundance and richness. However, within the trails that we analyzed, all MBW community scientists uploaded data for both focal and non-focal species, so we may assume that the differences are negligible.

For future continuations of this project, we should consider having field technicians record point counts across both formally trailed and informally trailed peaks for consistency in the data. Despite field conditions, these data provide a solid foundation for future sampling and support some key findings in other studies.

Implementation

Based on the results, as well as my experience gathering data and conversing with people that have been intimately involved with the Catskills and its trails, there are a few suggestions I would have for the DEC when implementing management that protects vulnerable montane species. When hiking on Rusk, as well as the ridgelines of Friday-Dink and Slide, herd trails faded in and out, and it was apparent that there were several paths being used simultaneously (Fig 9). In cases such as this—in areas of high visitation—I would suggest a single trail be designated for use and any additional paths be covered up with logs or other obstacles. This may encourage hikers to stick to one path and therefore decrease the area of forest impacted. Many of these paths are not in sustainable locations, and establishing formal trails may attract a higher volume of hikers to the area, which could have detrimental results. Rather than focusing on informal vs. formal trail networks, it may be valuable to create future research efforts that address levels of visitor use, or to mitigate "overuse". My final suggestion would be to create more awareness for the wildlife that live in the mountains. Many hikers that love to spend outdoors are not informed about their impact on nature. I think visual depictions of vulnerable species at trailheads and along trails will send a powerful message that we share outdoor spaces with wildlife and must be respectful of that. These suggestions are largely a reflection of management solutions that are already being considered by the DEC (Roehrs and Rice 2020).

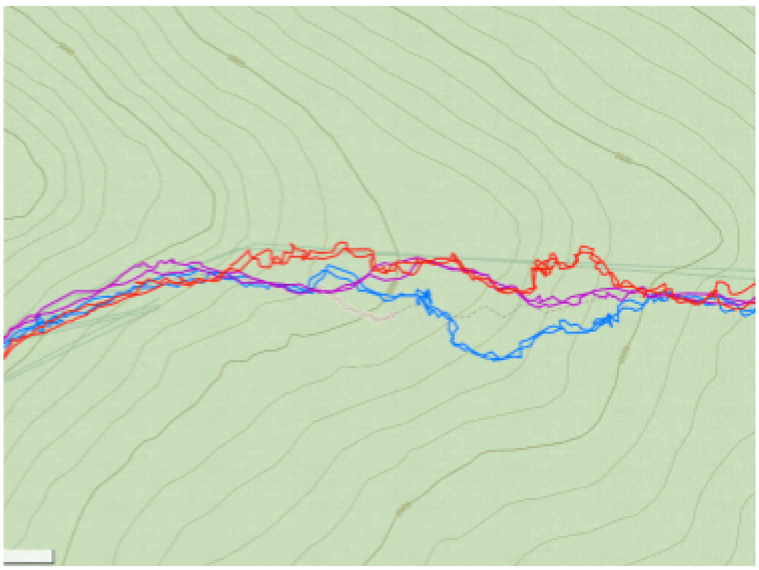


Figure 9. Snippet of tracks uploaded publicly to Gaia showing the path of three different users on the herd path up Friday Mountain. The tracks follow the herd path, then branch off, then join back together.

Conclusion

The results of this study provide evidence to show that high levels of visitor-use have a negative impact on breeding montane birds. Using data from this project, as well as vegetation and informal trail surveys completed by Pine Roehrs and Max Henschell, visitor data from canister sign-ins and from smartphone hiking apps, and several years of data from Mountain Birdwatch, the NYSDEC are more equipped to make informed management decisions that maintain human recreation while protecting local wildlife.

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Appendix A—Raw Data

Table A1. Raw data from 2023 bird point counts.

	BCCH	BITH	BLPW	HETH	SWTH	WIWR	WTSP	YBFL	YRWA	MAWA	GCKI	DEJU	RBNU	AMGO	AMRO	BLJA	BLBW	BTBW	BTNW	BWWA	HAWO	MOWA	PUFI	RECR	BHVI	RCKI
Hunter W Low 1	1	4	2	0	5	3	0	0	7	1	4	4	1	0	4	0	0	0	0	0	0	0	0	0	0	0
Hunter W Low 2	0	0	4	0	4	0	0	0	0	3	1	2	0	0	0	0	0	0	4	0	0	0	0	0	0	0
Hunter W Low 3	0	0	3	2	0	1	0	0	0	0	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hunter W Low 4	0	0	0	0	2	2	0	0	3	0	4	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0
Hunter W Low 5	0	0	0	0	2	0	0	0	5	1	3	3	0	0	3	0	0	0	4	2	0	0	0	0	0	0
Little Slide Low 1	4	0	1	3	0	4	0	3	5	2	0	0	3	0	0	0	4	0	3	0	0	0	0	0	0	0
Little Slide Low 2	3	1	3	0	0	3	0	4	3	4	5	3	1	2	0	0	0	0	1	0	0	0	0	0	0	0
Little Slide Low 4	0	0	7	0	4	0	0	2	7	4	3	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Little Slide Low 5	2	0	2	0	4	3	0	0	3	2	2	6	0	0	0	0	0	0	0	1	0	0	0	0	0	0
Little Slide Low 6	1	0	3	3	1	0	0	0	0	2	2	4	0	0	0	0	0	0	1	0	0	0	0	0	0	0
Little Slide Low 7	5	0	1	0	4	0	0	2	7	2	3	2	0	0	0	0	2	0	0	0	0	0	1	0	0	0
Little Slide Low 8	0	0	1	4	4	0	0	0	7	0	2	5	0	0	0	0	0	0	0	0	0	0	2	0	0	0
Rusk Low 1	0	0	4	0	0	1	0	0	2	4	2	2	0	0	0	2	3	0	1	0	2	2	3	0	0	0
SW Hunter Low 1	2	0	3	0	3	0	0	0	4	4	3	2	0	0	0	0	1	0	1	0	0	0	0	0	0	0
SW Hunter Low 2	1	0	3	0	6	0	0	0	4	4	1	3	0	0	0	0	0	0	2	0	0	0	2	0	0	0
SW Hunter Low 3	3	1	4	7	3	4	2	0	2	0	2	3	0	0	2	0	0	0	0	0	0	0	0	0	0	0
SW Hunter Low 4	0	0	2	1	6	3	0	0	5	2	3	0	0	0	1	0	0	0	2	0	0	0	0	4	0	0
Sugarloaf N Shoulder Low 1	0	0	3	2	5	4	0	0	5	1	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sugarloaf N Shoulder Low 2	1	0	1	0	4	3	0	0	4	8	3	1	3	0	0	0	1	0	0	0	0	0	0	0	0	0

Sugarloaf N Shoulder Low 3	3	0	0	1	3	3	0	0	5	1	5	4	2	0	0	0	2	0	0	0	0	0	0	0	0	0
Sugarloaf N Shoulder Low 4	1	2	2	0	0	2	0	0	3	2	5	3	0	0	0	1	1	0	0	0	0	0	0	0	0	0
Slide S Shoulder Low 1	0	8	4	0	0	4	6	0	4	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Slide S Shoulder Low 2	4	2	5	1	0	1	0	0	5	8	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Slide S Shoulder Low 3	0	1	5	0	0	0	0	0	5	2	6	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Balsam Cap High 1	0	0	0	0	0	0	0	0	0	0	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Dink High 1	1	0	3	0	1	2	0	0	6	0	3	1	2	0	0	0	1	0	0	0	0	0	0	0	0	0
Dink High 2	2	0	5	0	4	1	0	0	6	2	0	3	0	0	0	0	0	0	0	2	0	0	0	0	0	0
Dink High 3	0	0	3	0	3	2	0	1	4	4	0	0	0	0	2	2	0	0	0	0	0	0	0	0	0	0
Dink High 4	1	0	4	0	0	2	0	0	2	0	1	0	0	0	0	4	0	0	2	0	0	0	0	0	0	0
Friday High 1	2	0	2	0	3	3	0	0	5	2	1	0	0	0	0	2	2	0	4	2	0	0	0	0	0	0
Friday High 2	2	0	4	0	1	3	0	0	3	2	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Friday High 3	0	0	0	0	4	2	0	0	0	0	1	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Friday High 4	1	0	2	0	3	4	0	0	0	0	3	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
Friday High 5	0	0	0	0	2	3	0	2	0	2	4	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0
Rusk High 1	0	0	0	0	0	2	0	0	4	2	1	4	0	0	0	0	2	2	0	0	0	0	0	0	0	0
Rusk High 2	0	0	0	0	0	4	0	0	4	4	0	4	0	0	0	2	3	0	2	0	0	0	0	0	0	0
Rusk High 3	0	0	0	0	0	0	0	0	3	2	4	0	0	1	0	3	4	0	1	0	0	0	0	0	0	0
Rusk High 4	0	0	0	0	0	0	0	0	6	0	2	0	1	0	0	0	3	0	3	0	0	0	0	0	0	0
Rusk High 5	0	0	1	0	3	2	0	0	4	6	2	0	3	3	0	0	2	3	1	0	0	0	0	0	0	0
Rusk High 6	0	3	0	4	1	2	0	0	4	0	2	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SW Hunter High 1	0	0	0	0	2	1	0	0	3	0	2	1	0	0	0	0	0	1	4	0	0	0	0	0	0	0

SW Hunter High 2	0	0	2	0	3	3	0	0	2	2	3	2	1	0	0	0	0	0	0	0	0	0	0	0	0	0
SW Hunter High 3	1	0	4	0	2	2	0	0	1	0	2	0	2	0	0	4	0	0	3	0	0	0	0	0	0	0
SW Hunter High 4	1	0	3	0	4	2	0	0	0	2	1	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SW Hunter High 5	0	0	0	1	4	5	0	0	5	5	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hunter N High 1	0	0	1	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1
Hunter N High 2	0	2	0	0	0	1	0	0	2	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	1
Hunter N High 3	0	0	1	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1
Hunter N High 4	0	0	0	0	2	0	0	0	1	0	0	2	1	0	0	0	0	0	1	0	0	0	0	0	0	1
Hunter N High 5	0	0	0	0	1	1	0	0	1	0	0	0	2	0	0	0	0	0	1	0	0	0	0	0	1	1
Hunter N High 6	1	0	2	0	1	0	0	0	1	0	0	1	1	0	0	0	0	0	2	0	0	0	0	0	0	0
Hunter W High 1	0	0	0	0	3	1	0	0	0	0	0	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0
Hunter W High 2	0	0	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hunter W High 3	0	0	0	1	2	0	0	0	1	1	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0
Hunter W High 4	0	0	1	0	2	1	0	0	0	1	2	1	0	0	0	1	0	0	1	0	0	0	0	0	0	0
Hunter W High 5	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1	1	0	1	1	0	0	0	0	1	0
Plateau N High 1	0	0	1	0	1	0	0	0	2	1	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0
Plateau N High 2	0	0	1	0	0	0	0	0	1	1	1	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0
Plateau N High 3	0	0	0	0	1	1	0	0	0	2	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
Plateau N High 4	0	0	0	0	1	1	0	0	2	1	1	0	1	0	0	0	1	0	0	0	0	0	1	0	0	0
Plateau N High 5	0	0	0	0	0	1	0	0	2	0	2	1	1	0	0	1	0	0	1	0	0	0	0	0	0	0
Plateau N High 6	0	0	1	0	0	0	0	0	2	0	1	0	0	0	0	0	1	0	0	0	0	0	1	0	0	0
Plateau S High 1	0	0	1	0	0	1	0	0	2	1	2	1	0	0	0	1	1	0	0	0	0	0	0	0	0	0
Plateau S High 2	0	1	1	0	0	2	0	0	0	2	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0

Plateau S High 3	0	0	1	0	0	0	0	0	1	3	1	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0
Plateau S High 4	0	0	1	0	2	0	0	0	1	1	1	0	1	0	0	1	1	0	0	0	0	0	0	0	0	0
Plateau S High 5	0	0	1	0	0	2	0	0	1	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Plateau S High 6	0	0	1	0	2	0	0	0	1	1	1	1	1	0	0	1	1	0	0	0	0	0	0	0	0	0
TOTAL	**43**	**25**	**111**	**30**	**120**	**98**	**8**	**14**	**181**	**110**	**123**	**90**	**30**	**6**	**14**	**28**	**41**	**6**	**53**	**10**	**2**	**2**	**11**	**4**	**2**	**5**

Table A2. Raw data from 2024 bird point counts.

	BCCH	BITH	BLPW	HETH	SWTH	WIWR	WTSP	YBFL	YRWA	MAWA	GCKI	DEJU	RBNU	AMGO	AMRO	BLJA	BLBW	BTNW	BWWA	PUFI	BHVI	RCKI	OVEN	BRCR	YBSA	BDOW	RBGR	NSWO	REVI
Hunter W Low 1	2	0	2	0	3	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hunter W Low 2	0	0	2	0	1	1	0	0	1	1	0	2	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0
Hunter W Low 3	0	0	1	0	1	1	0	0	1	2	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
Hunter W Low 4	0	0	0	0	1	0	0	0	1	2	1	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0
Hunter W Low 5	0	0	0	0	0	0	0	0	1	0	1	0	1	0	0	1	1	1	0	0	0	0	0	0	0	0	0	0	0
Little Slide Low 1	0	0	0	0	2	1	0	0	2	0	3	0	1	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0
Little Slide Low 2	0	0	1	0	1	1	0	0	1	2	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Little Slide Low 3	2	0	0	0	2	2	0	0	4	1	0	1	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
Little Slide Low 4	2	0	2	2	3	0	0	0	2	2	2	1	1	0	0	0	0	1	0	0	0	0	0	0	0	0	1	0	0
Little Slide Low 5	3	0	0	1	2	1	0	1	2	4	1	2	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Little Slide Low 6	0	0	1	0	1	0	0	0	3	2	1	3	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0
Little Slide Low 7	1	0	1	2	3	0	0	0	3	1	2	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Little Slide Low 8	2	0	0	2	1	0	0	0	4	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
Rusk Low 1	0	0	1	3	1	1	0	0	2	3	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SW Hunter Low 1	0	0	2	0	1	2	0	0	2	2	2	1	1	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0
SW Hunter Low 2	1	0	3	0	0	1	0	0	1	0	0	2	2	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
SW Hunter Low 3	1	0	3	0	1	1	0	0	2	0	0	2	0	0	0	0	0	2	0	1	2	0	0	0	0	0	0	0	0

SW Hunter Low 4	0	0	2	0	3	1	0	0	2	2	0	2	1	0	0	0	1	3	0	0	1	0	0	0	0	0	0	0	0
Sugarloaf N Shoulder Low 1	0	2	2	2	2	0	0	0	2	2	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sugarloaf N Shoulder Low 2	0	0	1	2	2	0	0	0	2	1	2	2	0	0	0	1	2	0	0	0	0	0	1	0	0	0	0	0	0
Sugarloaf N Shoulder Low 3	4	0	1	1	1	0	0	0	2	2	3	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
Sugarloaf N Shoulder Low 4	0	0	1	0	2	2	0	0	2	3	2	2	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Slide S Shoulder Low 1	0	1	1	0	1	2	2	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Slide S Shoulder Low 2	0	0	1	0	2	1	1	0	2	2	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Slide S Shoulder Low 3	0	0	2	0	0	2	1	0	2	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Balsam Cap High 1	0	0	0	0	0	1	0	0	1	1	0	1	2	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0
Balsam Cap High 2	1	0	0	0	0	0	0	0	3	0	0	2	1	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0
Balsam Cap High 3	0	0	1	1	2	0	0	1	1	1	1	2	2	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
Balsam Cap High 4	2	0	1	0	2	1	0	1	2	2	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
Dink High 1	2	0	1	0	1	1	0	0	2	0	0	2	1	0	0	0	1	1	0	1	0	0	0	0	0	0	0	0	0
Dink High 2	0	0	1	0	2	0	0	0	1	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Dink High 3	2	0	1	0	2	1	0	0	3	1	0	2	1	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0
Dink High 4	0	0	1	1	2	1	0	0	2	1	1	1	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
Friday High 1	0	0	1	0	0	2	0	0	0	0	1	2	1	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0
Friday High 2	0	1	1	0	1	0	0	0	2	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Friday High 3	2	0	0	0	3	1	0	0	0	0	2	2	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
Friday High 4	0	0	2	0	2	1	0	0	0	2	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
Friday High 5	1	0	0	0	0	0	0	0	3	1	0	0	0	0	0	0	2	0	0	0	1	0	0	0	0	0	0	0	0
Rusk High 1	2	0	0	0	1	1	0	0	3	1	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
Rusk High 2	1	0	1	0	2	0	0	0	2	1	2	2	1	0	0	0	2	2	0	0	0	0	0	0	0	0	0	0	1
Rusk High 3	0	0	0	0	2	0	0	0	1	1	2	0	0	0	0	0	1	0	0	0	0	0	2	0	0	0	0	0	0
Rusk High 4	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Rusk High 5	0	0	0	0	0	1	0	0	2	3	2	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Rusk High 6	0	0	0	0	2	0	0	0	3	2	0	2	0	0	0	0	0	1	0	0	0	0	2	0	0	0	0	0	0
SW Hunter High 1	0	0	2	0	2	2	0	0	2	1	0	0	2	0	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0
SW Hunter High 2	1	1	0	0	3	1	0	0	0	1	1	1	2	0	0	1	1	1	0	0	0	0	0	0	1	0	0	0	0
SW Hunter High 3	0	0	1	0	3	2	0	0	1	2	0	2	2	0	0	1	1	2	0	0	0	0	0	0	0	0	0	0	0
SW Hunter High 4	2	0	0	0	2	1	0	0	1	0	1	0	1	0	0	0	1	2	0	0	0	0	0	0	1	0	0	0	0
SW Hunter High 5	0	0	2	2	3	2	0	0	2	0	1	2	2	0	0	1	0	0	0	0	0	0	0	0	0	1	0	0	0
Hunter N 1	0	2	1	0	1	0	2	0	0	2	0	1	0	0	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0
Hunter N 2	0	2	0	0	3	1	0	0	2	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hunter N 3	0	1	1	0	0	2	0	1	1	1	0	0	0	0	0	0	0	2	0	0	0	1	0	0	0	0	0	0	0

Hunter N 4	0	0	1	0	2	0	0	0	0	1	0	0	1	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0
Hunter N 5	0	0	1	0	3	1	0	1	1	0	0	1	1	0	0	0	0	1	0	0	0	1	0	1	0	0	0	0	0
Hunter N 6	0	0	1	0	1	1	1	0	1	0	0	0	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
Hunter W 1	0	0	0	1	4	0	0	0	0	0	0	1	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
Hunter W 2	2	0	0	0	3	1	0	1	0	0	0	1	0	0	0	0	0	1	0	1	0	0	1	0	0	0	0	0	0
Hunter W 3	1	0	0	0	2	2	1	1	1	1	1	1	0	0	0	0	1	1	1	0	0	0	0	0	0	0	0	0	0
Hunter W 4	0	1	1	1	2	2	0	2	0	1	1	1	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0
Hunter W 5	0	0	0	1	1	2	0	2	1	1	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0
Plateau N 1	0	0	1	0	2	1	0	2	1	1	2	1	1	0	0	0	1	0	0	1	0	0	1	0	0	0	0	0	0
Plateau N 2	0	1	0	0	3	1	0	0	1	0	1	1	1	0	0	0	1	0	0	1	0	1	1	0	0	0	0	0	0
Plateau N 3	1	0	0	0	1	1	0	1	0	1	2	1	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
Plateau N 4	1	1	2	0	1	2	0	0	2	1	0	1	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
Plateau N 5	0	1	0	0	2	2	0	0	2	2	0	0	0	0	0	1	1	1	0	0	0	0	0	0	0	0	0	0	0
Plateau N 6	0	0	1	0	2	1	0	1	1	2	1	0	1	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0
Plateau S 1	0	0	1	0	2	2	0	0	1	1	3	1	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
Plateau S 2	0	1	0	0	2	2	0	0	1	1	0	1	1	0	0	0	1	0	0	0	1	0	0	1	0	0	0	0	0
Plateau S 3	0	0	1	0	2	2	0	0	2	1	0	0	1	0	0	0	0	1	0	1	0	0	0	1	0	0	0	0	0
Plateau S 4	0	1	1	0	3	1	0	0	1	1	0	1	1	0	0	0	1	0	0	1	0	0	0	1	0	0	0	0	0
Plateau S 5	0	1	1	0	0	2	0	0	2	1	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
Plateau S 6	2	2	1	1	2	1	0	0	1	2	0	1	0	0	0	1	1	0	0	1	0	0	0	0	0	1	0	0	0
TOTAL	41	19	62	23	118	70	8	15	106	80	53	72	47	1	1	13	43	35	1	11	5	6	8	5	2	2	1	1	1

American Goldfinch *Spinus tristis* AMGO	American Robin *Turdus migratorius* AMRO	Bicknell's Thrush *Catharus bicknelli* BITH	Black-and-white Warbler *Mniotilta varia* BWWA
Blackburnian Warbler *Setophaga fusca* BLBW	Black-capped Chickadee *Poecile atricopilla* BCCH	Blackpoll Warbler *Setophaga striata* BLPW	Black-throated Blue Warbler *Setophaga caerulescens* BTBW
Black-throated Green Warbler *Setophaga virens* BTNW	Blue-headed Vireo *Vireo solitarius* BHVI	Blue Jay *Cyanocitta cristata* BLJA	Brown Creeper *Certhia americana* BRCR
Canada Warbler *Cardellina canadensis* CAWA	Dark-eyed Junco *Junco hyemalis* DEJU	Fox Sparrow *Passerella iliaca* FOSP	Golden-crowned Kinglet *Regulus satrapa* GCKI
Hairy Woodpecker *Leuconotopicus villosus* HAWO	Hermit Thrush *Catharus guttatus* HETH	Magnolia Warbler *Setophaga magnolia* MAWA	Mourning Warbler *Geothlypis philadelphia* MOWA
Ovenbird *Seiurus aurocapilla* OVEN	Purple Finch *Haemorhous purpureus* PUFI	Red Crossbill *Loxia curvirostra* RECR	Red-breasted Nuthatch *Sitta canadensis* RBNU
Red-eyed Vireo *Vireo olivaceus* REVI	Ruby-crowned Kinglet *Regulus calendula* RCKI	Swainson's Thrush *Catharus ustulatus* SWTH	White-throated Sparrow *Zonotrichia albicollis* WTSP
Winter Wren *Troglodytes troglodytes* WIWR	Yellow-bellied Flycatcher *Empidonax flaviventris* YBFL	Yellow-rumped Warbler *Setophaga coronata* YRWA	

Table A3. Common names, Latin names, and 4-letter alpha codes of all species that were detected during 2023 point counts in the Catskills. Red shading indicates species that were detected only once by a single field technician and were excluded from the informal trail data analysis. Orange shading indicates species that were detected only once by a single MBW community scientist and were therefore excluded from formal trail data analysis

American Goldfinch *Spinus tristis* AMGO	American Robin *Turdus migratorius* AMRO	Bicknell's Thrush *Catharus bicknelli* BITH	Black-and-white Warbler *Mniotilta varia* BWWA
Blackburnian Warbler *Setophaga fusca* BLBW	Black-capped Chickadee *Poecile atricopilla* BCCH	Blackpoll Warbler *Setophaga striata* BLPW	Black-throated Green Warbler *Setophaga virens* BTNW
Black-Billed Cuckoo *Coccyzus erythropthalmus* BBCU	Blue-headed Vireo *Vireo solitarius* BHVI	Blue Jay *Cyanocitta cristata* BLJA	Brown Creeper *Certhia americana* BRCR
Barred Owl *Strix varia* BDOW	Cedar Waxwing *Bombycilla cedrorum* CEWA	Dark-eyed Junco *Junco hyemalis* DEJU	Fox Sparrow *Passerella iliaca* FOSP
Golden-crowned Kinglet *Regulus satrapa* GCKI	Hermit Thrush *Catharus guttatus* HETH	Magnolia Warbler *Setophaga magnolia* MAWA	Northern Saw-whet Owl *Aegolius acadicus* NSWO
Ovenbird *Seiurus aurocapilla* OVEN	Purple Finch *Haemorhous purpureus* PUFI	Red Crossbill *Loxia curvirostra* RECR	Rose-breasted Grosbeak *Pheucticus ludovicianus* RBGR
Red-breasted Nuthatch *Sitta canadensis* RBNU	Red-eyed Vireo *Vireo olivaceus* REVI	Ruby-crowned Kinglet *Regulus calendula* RCKI	Swainson's Thrush *Catharus ustulatus* SWTH
Scarlet Tanager *Piranga olivacea* SCTA	White-throated Sparrow *Zonotrichia albicollis* WTSP	Winter Wren *Troglodytes troglodytes* WIWR	Yellow-bellied Flycatcher *Empidonax flaviventris* YBFL
Yellow-rumped Warbler *Setophaga coronata* YRWA	Yellow-bellied Sapsucker *Sphyrapicus varius* YBSA		

Table A4. Common names, Latin names, and 4-letter alpha codes of all species that were detected during 2024 point counts in the Catskills. Red shading indicates species that were detected only once by a single field technician and were excluded from the informal trail data analysis. Orange shading indicates species that were detected only once by a single MBW community scientist and were therefore excluded from formal trail data analysis

Appendix B—ANOVA

SUMMARY						
Groups	Count	Sum	Average	Variance	pooled variance:	23.57243867
Informally Trailed, Low Visitation	24	376	15.6666666	42.49275362	Q:	3.4
Informally Trailed, High Visitation	21	225	10.7142857	24.41428571		
Formally Trailed, High Visitation	23	182	7.91304347	3.81027668		

ANOVA						
Source of Variation	SS	df	MS	F	P-value	F crit
Between Groups	725.5401595	2	362.770079	15.21838667	0.000003792471195	3.13814193
Within Groups	1549.445135	65	23.8376174			
Total	2274.985294	67				

Comparison	Abs. Mean Diff	n (Group 1)	n (Group 2)	SE	Q Critical Value	Significant?	P
A vs. B	4.952380952	24	21	1.03159069	4.800722809	yes	6.89E-03
B vs. C	2.801242236	21	23	1.042003549	2.688323125	no	1.58E-02
A vs. C	7.753623188	24	23	1.007385778	7.696776507	yes	1.88E-06

Table A5. ANOVA single factor and Tukey test for focal species abundance

SUMMARY						
Groups	Count	Sum	Average	Variance	pooled variance:	0.9000109794
Informally Trailed, Low Visitation	24	81	3.375	1.070652174	Q:	3.4
Informally Trailed, High Visitation	21	56	2.66666666	1.133333333		
Formally Trailed, High Visitation	23	64	2.78260869	0.4960474308		

ANOVA						
Source of Variation	SS	df	MS	F	P-value	F crit
Between Groups	6.662936914	2	3.33146845	3.7204111	0.02952735441	3.13814193
Within Groups	58.20471014	65	0.89545707			
Total	64.86764706	67				

Comparison	Abs. Mean Diff	n (Group 1)	n (Group 2)	SE	Q Critical Value	Significant?	P
A vs. B	0.7083333333	24	21	0.199939397	3.542740171	yes	0.03
B vs. C	0.115942029	21	23	0.2019575819	0.5740909942	no	0.67
A vs. C	0.5923913043	24	23	0.1952480834	3.034044146	no	0.03

Table A6. ANOVA single factor and Tukey test for focal species richness

SUMMARY						
Groups	*Count*	*Sum*	*Average*	*Variance*	pooled variance:	47.64943848
Informally Trailed, Low Visitation	24	916	38.1666666	69.53623188	Q:	3.4
Informally Trailed, High Visitation	21	621	29.5714285	60.65714286		
Formally Trailed, High Visitation	23	434	18.8695652	12.75494071		

ANOVA						
Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Between Groups	4383.900408	2	2191.95020	46.06299811	3.48E-13	3.13814193
Within Groups	3093.084886	65	47.5859213			
Total	7476.985294	67				

Comparison	Abs. Mean Diff	n (Group 1)	n (Group 2)	SE	Q Critical Value	Significant?	P
A vs. B	8.595238095	24	21	1.45752238	5.897156856	yes	9.29E-04
B vs. C	10.70186335	21	23	1.472234586	7.269129154	yes	4.76E-07
A vs. C	19.29710145	24	23	1.423323544	13.55777576	yes	2.53E-13

Table A7. ANOVA single factor and Tukey test for all species abundance

SUMMARY						
Groups	*Count*	*Sum*	*Average*	*Variance*	pooled variance:	2.607114625
Informally Trailed, Low Visitation	24	194	8.08333333	1.949275362	Q:	3.4
Informally Trailed, High Visitation	21	154	7.33333333	3.433333333		
Formally Trailed, High Visitation	23	174	7.56521739	2.438735178		

ANOVA						
Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Between Groups	6.730179028	2	3.36508951	1.30857298	0.2772278942	3.13814193
Within Groups	167.1521739	65	2.57157190			
Total	173.8823529	67				

Comparison	Abs. Mean Diff	n (Group 1)	n (Group 2)	SE	Q Critical Value	Significant?	P
A vs. B	0.75	24	21	0.3388249065	2.21353267	no	0.13
B vs. C	0.231884058	21	23	0.3422449994	0.6775381915	no	0.65
A vs. C	0.518115942	24	23	0.330874828	1.565897125	no	0.24

Table A8. ANOVA single factor and Tukey test for all species richness

SUMMARY							
Groups	*Count*	*Sum*	*Average*	*Variance*	pooled variance:	1.834330887	
Column 1	24	22	0.91666666	3.992753623	Q:	3.4	
Column 2	21	5	0.23809523	0.4904761905			
Column 3	23	17	0.73913043	1.019762846			

ANOVA						
Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Between Groups	5.451772013	2	2.72588600	1.42799775	0.2472103951	3.13814193
Within Groups	124.0776398	65	1.90888676			
Total	129.5294118	67				

Comparison	Abs. Mean Diff	n (Group 1)	n (Group 2)	SE	Q Critical Value	Significant?	P
A vs. B	0.6785714286	24	21	0.2919214949	2.324499704	no	0.15
B vs. C	0.5010351967	21	23	0.2948681456	1.69918387	no	0.07
A vs. C	0.1775362319	24	23	0.285071943	0.6227769385	no	0.70

Table A9. ANOVA single factor and Tukey test for BITH abundance