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Research Article

Determining Presence/Absence and Abundance of Declining Shrubland-Dependent Songbirds in Human-created Shrublands in Southeastern New Hampshire

—Erica Holm and Jenny Kerr (Editor: Brigid C. Casellini)

Ticks, thorns, bogs, dense vegetation, and blazing hot gravel pits might not be your first thought when talking about birding in New England, but they are certainly the reality when conducting research in the field. In the winter of 2014, we were invited to join an ongoing bird study at the University of New Hampshire seeking to investigate distribution, dispersal, and response to habitat management by shrubland-dependent songbirds. We proposed a Summer Undergraduate Research Fellowship (SURF) project focusing on prairie warblers and field sparrows, two species with combined breeding seasons that cover the entire summer season and which inhabit a range of shrubland habitat types. These species are both versatile and charismatic, with distinct calls that can be identified in the field by the casual observer.

Little did we know at the outset of our study that the majority of our birds would be found in gravel pits and under power lines. These habitats are often viewed by humans to be undesirable, due to the continued removal of trees and amount of bare ground. However, these areas hold significant value for certain wildlife species. During our field study from May to August, our group caught and banded over 250 birds. We also saw a wide range of other wildlife species, including porcupines, turtles, snakes, and deer. We found that gravel pits are not the barren wasteland that they appear to be; presumed undesirable habitats can host quite a diversity of wildlife that are threatened or otherwise uncommon in our area.

Top: Prairie warbler; Bottom: Field sparrow

Why Our Study is Important

Shrublands are areas with dense, low-growing, woody vegetation and minimal tree cover (Schlossberg & King, 2007). Since the 1950s, shrubland habitat throughout most of New England has been declining due to human suppression of natural disturbances (e.g. beaver flooding and fire), a reduction in large-scale timber harvesting, and development on past agricultural land (Litvaitis, 1993; Askins, 2001; Thompson & DeGraaf, 2001). As a result, wildlife species that require shrubland habitat (including New England cottontails, and birds such as prairie warblers, field sparrows, and eastern towhees) have also been declining (Litvaitis, 1993; Thompson & DeGraaf, 2001; Lorimer & White, 2003). In fact, of the approximately forty species of shrubland-dependent songbirds in New England, over twenty species have been declining at a rate of four to seven percent per year (Schlossberg & King, 2007).

One of the primary reasons these birds are declining is because they are habitat specialists, meaning that they seek out plots of land of certain sizes and shapes with specific vegetation features; many of these birds require plots that are more than one hectare (about 2.5 acres) of land with shrubs (Askins, 2001; Dettmers, 2003). For example, field sparrows prefer scattered, low-growing shrubs, whereas prairie warblers prefer tall, dense shrub growth (Best, 1977; Carey et al., 2008; Parnell, 1969; Nolan et al., 1999). As a result, these birds require habitats that are disturbed periodically to keep them within their ideal vegetation conditions, and multiple habitats are needed in an area to meet the different needs of all species (King et al., 2009; Schlossberg et al., 2010).

Large shrubland openings are uncommon, and today's birds rely primarily on humans for the disturbances that create and maintain their required habitats (Oehler & Snyder, 2006). Creating and maintaining shrublands is expensive, so it is important that openings are made strategically to ensure the specific needs of each bird species are met within the landscape. Wildlife managers must assess bird response to landscape management to gauge the amount of shrubland acreage required to stabilize declining populations. In southeastern New Hampshire, natural resource agencies (e.g. New Hampshire Fish and Game, U.S. Fish and Wildlife Service, and Natural Resources Conservation Service) are currently collaborating with public and private landowners to provide habitat for shrubland-dependent wildlife species by creating and maintaining a variety of openings in various stages of vegetative succession. Specifically, managed shrublands in this area include powerline rights-of-way, recent clearcuts, abandoned fields, and active and abandoned gravel pits. Although there is much overlap in the bird species that utilize each of these habitats, differences in vegetation structure mean not all species occur in every opening. Understanding which birds occur in specific shrubland types, and how species abundance differs between shrubland types is the first step in determining the current amount of habitat available in the landscape to support functioning populations of these birds.

The goal of our study was to determine the presence or absence, and abundance, of prairie warblers and field sparrows in fifty-three shrubland habitats. Additionally, we determined if specific site vegetation characteristics could be used to predict the presence/absence and abundance of these birds.

The results of our study will be used to help guide habitat management and land conservation efforts aimed at benefiting these declining shrubland birds.

How We Did It

Our study area was located in Strafford County, New Hampshire, and included fifty-three human-created shrubland study sites: thirteen powerline rights-of-way, thirteen recent clearcuts, thirteen old fields, and fourteen gravel pits. All shrublands were at least .08 hectare in size, and some were previous bird banding sites from the ongoing study by Associate Extension Professor Matt Tarr and graduate student Randy Shoe. Starting the second week of May, we visited each shrubland and determined the presence/absence of prairie warblers and field sparrows by walking slowly through each site and broadcasting the songs and calls of each species using an iPad and a hand-held speaker. Once we located a male of either species, we set up mist nets and used recorded songs and decoys to lure each bird into the nets. Once they flew into the net, we extracted them immediately. We marked each bird we captured with a numbered, aluminum U.S. Geological Survey leg band and a unique combination of three colored leg bands that allowed us to identify individual birds later in the field with binoculars. We visited each site at least once every three weeks between early May and early August, 2015.

The authors in the field with their mentor, Matt Tarr, and graduate student Randy Shoe.

With Randy Shoe's assistance, we measured the area (in hectares) and perimeter (in meters) of each shrubland using the computer program ArcGIS, and we calculated the edge to area ratio of each opening. Within each opening, we measured the height and percentage of cover by shrubs, grasses, ferns, and forbs (i.e., non-woody wildflowers) within thirty circular 4.1 m^2 plots located randomly throughout each shrubland. At each point, we placed a pole marked in 0.1 m increments vertically into the ground, and used a 1.1 m rope attached to the pole to form a 2.3 m diameter plot (4.1 m^2 circle). Within each plot, we recorded the height of the tallest specimen of each vegetation type and estimated the percentage of cover of each type from a bird's-eye view, looking down on the plot.

To determine how presence/absence and abundance of each species related to site type and vegetation characteristics within site types, we used several different statistical analysis tools, including JMP 12, Microsoft Excel, ANOVA, and Kruskal-Wallis.

What We Found

We captured 59 field sparrows and 272 prairie warblers in 53 shrubland sites. From this data, we first wanted to determine: In which type of shrubland were we most likely to find *at least one*field sparrow? We found that field sparrows were most likely to occur in gravel pits (present in 64.3% of gravel pits surveyed), followed by powerlines (38.5%), old fields (15.4%), and clearcuts (7.7%). They were significantly more likely to occur in gravel pits than in clearcuts (See Fig. 1). There were no other significant differences in field sparrow presence/absence between the other shrubland types.

We found that prairie warblers were most likely to occur in gravel pits (present in 100% of gravel pits we surveyed), followed by powerlines (69.2%), clearcuts (53.9%), and old fields (30.1%), and they were significantly more likely to occur in gravel pits than in either clearcuts or old fields (See Fig. 2). There were no other significant differences in prairie warbler presence/absence between the other shrubland types.

We then wanted to determine: In which type of shrubland will you find the greatest number of field sparrows (i.e., where are field sparrows most abundant)? We found that field sparrow abundance was significantly greater in gravel pits than in clearcuts, and that prairie warbler abundance was significantly greater in gravel pits than in old fields (Table 1).

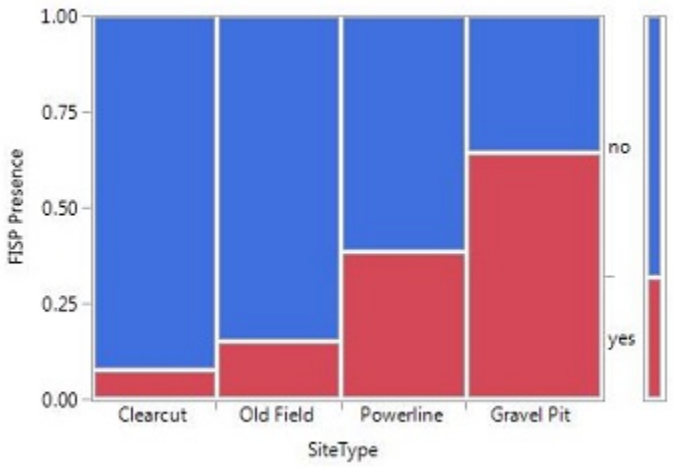

Figure 1. Contingency analysis of field sparrow (FISP) presence/absence by shrubland type. Y-axis shows percent. "Yes," (red bars) indicates present, and "No" (blue bars) indicates absent. For example, 64% of the gravel pits we surveyed had field sparrows present, as indicated by the red shading for yes.

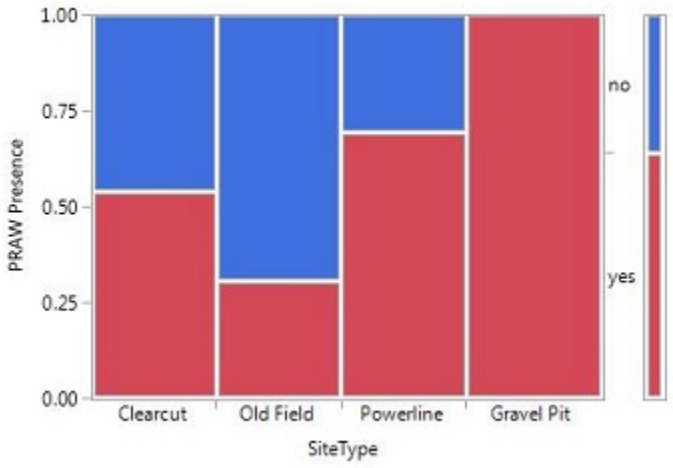

Figure 2. Contingency analysis of prairie warbler (PRAW) presence/absence by site type. Y-axis shows percent of prairie warblers detected in each site type from the total number of prairie warbers found. "Yes"(red bars) indicates present, and "No" (blue bars) indicates absent.

	Old Fields	Clearcuts	Powerlines	Gravel Pits
Prairie Warblers	0.7 ± 1.6 (0 to 2.3) a[1]	2.9 ± 1.6 (1.3 to 4.6) ab	7.6 ± 1.6 (6.0 to 9.3) ab	9.0 ± 1.6 (7.4 to 10.6) b
Field Sparrows	0.2 ± 0.6 (0 to 0.7) ab	0.3 ± 0.6 (0 to 0.9) b	2.3 ± 0.6 (1.7 to 2.9) ab	1.6 ± 0.6 (1.1 to 2.2) a
[1]Rows with different letters are significantly different (p < 0.008)				

Table 1. Prairie warbler and field sparrow abundance (#adult males/hectare (ha) banded in old fields, clearcuts, powerlines and gravel pits in southeastern New Hampshire, 2015.

There was no significant difference in presence/absence or abundance of either prairie warblers or field sparrows between gravel pits and powerlines, but both species were most abundant and most likely to occur in gravel pits compared to all of the other shrubland types. Based on this finding, we wanted to explore what made gravel pits different from the other shrubland types we surveyed. First, gravel pits averaged 25 hectares and were significantly larger than our average powerlines (mean = 8.9 hectares) clearcuts (mean = 7.4 hectares) and old fields (mean = 7.5 hectares). Gravel pits also differed from the other shrubland types in a number of vegetation characteristics; in particular, gravel pits had significantly greater bare ground cover and lower fern height than old fields, clearcuts, or powerlines (Table 2).

Vegetation Characteristic	Gravel pit vs. Clearcut	Gravel pit vs. Old field
Average Open Water Cover	0	0
Average Bare Ground Cover	Significantly more	Significantly more
Average Grass Cover	0	Significantly less
Average Fern Cover	0	Significantly less
Average Native Shrub Cover	Significantly less	0
Average Exotic Shrub Cover	0	0
Average Tree Cover	0	0
Average Forb Cover	0	Significantly less
Average Open Water Height	0	0
Average Bare Ground Height	0	Significantly less
Average Grass Height	0	Significantly less
Average Fern Height	Significantly less	Significantly less
Average Native Shrub Height	Significantly less	0
Average Exotic Shrub Height	Significantly less	Significantly less
Average Tree Height	0	0
Average Forb Height	0	Significantly less

Table 2. Kruskal-Wallis analysis results comparing vegetation characteristics of gravel pits to all other site types. With Bonferroni adjustment of 6, critical p-value for significance was 0.008.

Interpreting What We Found

Prairie warblers and field sparrows are both area-sensitive species, meaning the larger size of gravel pits alone may explain why these birds are most likely to occur there than in other shrubland types. Perhaps our gravel pits are simply the largest and most easy-to-locate habitats for these birds. Once a bird finds a gravel pit, perhaps the large opening, which contains a variety of highly interspersed

growing conditions (e.g., dry/moist, hot/shaded) and plant structures (e.g., dense/sparse shrubs, dense herbaceous cover/bare ground), increases the likelihood that each bird species can find the specific combination of microhabitats they prefer for nesting or foraging (Rudnicky & Hunter, 1993). The large size of gravel pits may also simply provide enough space to accommodate many breeding territories for each bird species, and this could provide social cues that birds find favorable when selecting their breeding habitats (Schlossberg & King, 2007). For example, although males and females of most shrubland-bird species pair with and maintain a breeding territory with an individual mate, both males and females are known to sneak out of their territories to also mate with their neighbor's mates (Griffith et al., 2002). This can benefit a male bird by increasing the likelihood that he will pass on his genes to a greater number of offspring, and it can benefit a female by increasing the genetic diversity (i.e., the health, viability, adaptability) of her young. This means that is not uncommon to have nestlings within the same nest that have been fathered by different males (Griffith et al., 2002). Gravel pits may be especially attractive to prairie warblers and field sparrows because the large number of breeding territories they support may provide adults with an abundance of potential easily accessible mates.

The greater amount of non-vegetated bare ground and shorter ferns heights in gravel pits may also attract prairie warblers and field sparrows, which in our study area, seem to avoid shrublands with tall, dense fern, grass, and wildflower cover. Having areas of bare ground interspersed with short shrubs may provide these birds with the best combination of habitat structures suitable for nesting and feeding. Overall, our results suggest that efforts to create and manage shrublands for prairie warblers and field sparrows should focus on large openings that contain some areas with dry, infertile soils that will remain unvegetated or at least unlikely to support tall, dense, herbaceous growth.

Although both prairie warblers and field sparrows were most likely to occur in gravel pits, it is important to note that the other shrubland types should not be discounted, as both species were present in all site types. Thus, powerlines, clearcuts, and old fields are used as habitat by prairie warblers and field sparrows, and powerlines were where we found the second greatest abundance of both species. Prairie warblers seemed to prefer clearcuts to old fields, while field sparrows seemed to prefer just the opposite.

Gravel pits also provide homes to many other creatures. They provide nesting sites for bank swallows, *Riparia riparia* (Hunt et al., 2011), plovers, *Charadrius* spp. (*pers. obs.*), and wood turtles, *Glyptemys insculpta* (UNH, 2011). In addition to wildlife habitat, these areas provide economic benefits via sales of sand, gravel, loam, and other minerals. Shrubland habitat is itself an ephemeral and usually unfavorable land cover type for most landowners, and economic benefits combined with the significant benefits for many New England species can support the creation and/or maintenance of these habitats in the landscape.

The results of our study provide some insight into how wildlife managers could view the New Hampshire landscape from our birds' perspectives. Conservation of gravel pits and powerline rights-of-way may be the easiest way to maintain large shrublands for wildlife in the southeastern New Hampshire landscape. Currently, powerlines are maintained by the power companies, primarily by

mowing every three to five years, and this management seems adequate to provide habitat for a variety of shrubland-dependent birds. For gravel pits, actively mined pits support some of the largest numbers of our study birds. When gravel pits are abandoned in New Hampshire, the New Hampshire Department of Environmental Services currently recommends reclaiming them with grasses and legumes (e.g., clover or lespedeza pea) rather than shrubs, to help prevent soil erosion (Genes, 2000). However, our study suggests that maintaining areas of low-growing shrubs interspersed with bare ground would be more effective in conserving habitat for at least some shrubland bird species.

While our data indicates the different shrubland types where prairie warblers and field sparrows occur and are most abundant, we did not determine whether these birds were breeding successfully in these habitats, or how many young they produced in the different shrubland types. Information on where birds can reproduce successfully is important for assessing differences in habitat quality. This work will be conducted by our faculty advisor beginning in 2016. Our study provided an important first step for determining how different shrublands function in providing habitat for declining shrubland-dependent birds in southeastern New Hampshire. Moving forward, we can use this information to fine-tune our knowledge of shrubland-dependent species in our area, and hopefully stop their decline.

First and foremost, we would like to thank Matt Tarr for inviting us to join his project, for all the guidance he has provided leading up to, during, and following the study, and his contributions to this article. We thank Randy Shoe for the mentoring and leadership he provided during the study. We would also like to thank Mr. Dana Hamel and Dr. and Mrs. Arthur G. Rand for funding our study through a Summer Undergraduate Research Fellowship. Without their support, our participation in this study would not have been possible. We thank our fellow field techs, including Ryan Brown, Kyle Crafts, Erin Smith, Liz Godin, and Mike Doherty, for all their help with data collection, net repair, and company.

References

Askins, R. A. (2001). Sustaining biological diversity in early successional communities: the challenge of managing unpopular habitats. *Wildlife Society Bulletin* 29, 407-412. Retrieved from http://www.jstor.org/stable/3784165

Best, L. B. (1977). Territory quality and mating success in the field sparrow (*Spizella pusilla*). *The Condor 79,* 192-204.

Bodin, M. (2011). Powerlines as habitat. *Northern Woodlands.* Retrieved fromhttp://northernwoodlands.org/articles/article/powerlines-as-habitat

Carey, M., Burhans, D.E., & Nelson, D.A. (2008). Field sparrow (*Spizella pusilla*).*The Birds of North America Online* (A. Poole, Ed.). Ithaca: Corn ell Lab of Ornithology. doi:10.2173/bna.103

Dettmers, R. (2003). Status and conservation of shrubland birds in the northeastern U.S. *Forest Ecology and Management, 185*, 81-93. doi: 10.1016/S0378-1127(03)00248-2

Genes, D. (2000). Vegetating New Hampshire Sand and Gravel Pits. *USDA Natural Resources Conservation Service*. Retrieved from http://des.nh.gov/organization/divisions/water/aot/documents/vegetating-...

Griffith, S. C., Owens, I.P.F., & Thuman, K.A. (2002). Extra pair paternity in birds: a review of interspecific variation and adaptive function. *Molecular Ecology, 11* (11), 2195-2212.

Hunt, P., Watkins, M., & Suomala, R. (2011). *The State of New Hampshire's Birds – A Conservation Guide*. New Hampshire Audubon, Concord, NH. Retrieved from http://www.nhaudubon.org/wp-content/uploads/2011/08/SOTB-WEB.pdf

King, D. I, Chandler, R. B., Schlossberg, S., & Chandler, C. C. (2009). Habitat use and nest success of scrub-shrub birds in wildlife and silvicultural openings in western Massachusetts, USA. *Forest Ecology and Management,257*(2), 421-426. doi:10.1016/j.foreco.2008.09.014

Litvaitis, J. A. (1993). Response of early-successional vertebrates to historic changes in land use. *Conservation Biology, 7*(4), 866-873. Retrieved from http://www.jstor.org/stable/2386818

Lorimer, C. G. & White, A.S. (2003). Scale and frequency of natural disturbances in the northeastern US: implications for early successional forest habitats and regional age distributions. *Forest Ecology and Management, 185*, 41-64. doi:10.1016/S0378-1127(03)00245-7

Nolan Jr., V., Ketterson, E.D., & Buerkle,
C.A. (1999). Prairie warbler (*Dendroica discolor*).*The Birds of North America Online* (A. Poole, Ed.). Ithaca: Cornell Lab of Ornithology. doi:10.2173/bna.455

Oehler, J. D. & Snyder, E. (2006). Habitat profile: shrublands. New Hampshire wildlife action plan. Appendix B: Habitat Profiles. *New Hampshire Fish and Game*. Retrieved fromhttp://www.wildlife.state.nh.us/wildlife/documents/shrublands.pdf

Parnell, J. F. (1969). Habitat relations of the Parulidae during spring migration. *The Auk, 86*(3), 505-521. doi: 10.2307/4083411

Rudnicky, T. C., & Hunter, Jr., M. L. (1993). Reversing the fragmentation perspective: effects of clearcut size on bird species richness in Maine. *Ecological Applications, 3*(2), 357-366. doi: 10.2307/1941838

Schlossberg, S. & King, D.I. (2007). Ecology and management of scrub-shrub birds in New England: a comprehensive review. *USDA Natural Resources Conservation Service Resource Inventory and Assessment Division*. Retrieved from http://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/nrcs143_013252.pdf

Schlossberg, S., King, D.I., Chandler, R. B., & Mazzei, B. A. (2010). Regional Synthesis of Habitat Relationships in Shrubland Birds. *Journal of Wildlife Management, 74* (7), 1513-1522. http://dx.doi.org/10.2193/2008-601

Thompson, F. R., & DeGraaf, R. M. (2001). Conservation Approaches for Woody, Early Successional Communities in the Eastern United States. *Wildlife Society Bulletin, 29*(2), 483-494.

UNH Cooperative Extension. (2011). Hemlock-Hardwood-Pine Forest Brochure. Habitat Stewardship Series: New Hampshire Wildlife Action Plan. Retrieved from http://www.wildlife.state.nh.us/nongame/documents/brochurehemlockhardwoo...

Author and Mentor Bios

Erica Holm knows something about making plans. This native of Hudson, New Hampshire is a member of the University Honors Program and will graduate in 2016 with a bachelor's of science in wildlife and conservation biology. From there, she plans to work a few seasons in the field, go to grad school, and secure a state or private position as a wildlife biologist. Despite her own strong planning, Erica learned that "the process of research is not often smooth . . . it's like planning something that is almost certain to veer off!" Despite the tumult, Erica appreciated the excitement of research and working with species she had not yet encountered in the field. "It taught me how to apply classroom techniques and principles to real-life situations . . . and to develop knowledge of many subtleties of shrubland birds, especially in regards to birdsong." The project brought Erica new networks and opportunities as well. "It opens up opportunities for connections with birders and the Audubon society, and has secured another season of field work for me for the coming summer," she says. "It also showed me that the job of a wildlife technician encompasses more than I expected!"

For **Jenny Leigh Gibson Kerr,** a bird in the hand might very well be worth two in the bush. An aspiring conservationist, Jenny is a zoology major with a minor in wildlife and conservation biology, and she will graduate in 2016 with a bachelor's of science. Encouraged by Professor Matt Tarr, with whom she took a course in wildlife habitats, Jenny investigated the decline of shrubland birds in New Hampshire with the support of a Summer Undergraduate Research Fellowship (SURF). The experience had many rewards; Jenny was delighted by "unexpected sightings in the field," and the chance to "learn different birdcalls," which, she says, was similar to learning a new language. Jenny plans to work in conservation behavior in the future, and this research provided her with firsthand experience "with how songbirds behave in the nesting season versus how they behave at the end of the season." Jenny was also excited to gain experience in mist netting and bird banding techniques. She says that the best part, however, is that "the data gained from this study may go on to help slow the decline of some shrubland birds in New Hampshire."

Professor **Matt Tarr** is an associate extension professor wildlife specialist at the University of New Hampshire (UNH) Cooperative Extension/ NREN, and has been with UNH for thirteen years. His specialty lies in wildlife-habitat associations. His current research focuses on shrubland bird ecology and invasive plants. A veteran mentor, with over twenty previous undergraduate mentees, Professor Tarr has sheparded many students through Summer Undergraduate Research Fellowships, but Jenny and Erica are his first *Inquiry* authors. Working with them, Professor Tarr watched with pleasure as they "completely immersed themselves in their project to quickly become integral members of our UNH research team."