Bird Friendly Beef: Exploring the Impacts of Regenerative Forage Production

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Abstract

In the eastern US, managed hayfields and pasturelands represent a significant portion of remaining available grassland bird habitat, hosting several declining species including the eastern meadowlark (*Sturnella magna*) and the grasshopper sparrow (*Ammodramus savannarum*). However, these working landscapes have deteriorated in their ability to support grassland birds in recent decades due to more frequent and early hay cuttings and intensive grazing. Since the conservation of grassland birds is inextricably linked to agricultural systems, for conservation to be effective, land management must aim to benefit both producers and birds. Regenerative agriculture is an emerging approach that incorporates land management practices that benefit agricultural ecosystems and increase efficiency and profitability. Regenerative grazing has demonstrated associations with greater bird abundance, but there is a significant gap in research that investigates whether these practices contribute to successful nesting. Collaborators from Smithsonian's Virginia Working Landscapes, American Farmland Trust, and George Mason University set out to explore the effects of regenerative grazing practices on forage quality and the reproductive success of grassland birds. We established four experimental grazing and haying treatments on private working lands. For each treatment, we collected forage samples for nutrient analysis and quantified reproductive success using a combination of territory mapping and systematic nest searching. Our preliminary analysis suggests that grazing pastures early and stockpiling for fall and winter grazing results in standing forages suitable in quality for several different production classes of livestock while reducing producer reliance on harvested feeds such as hay. Our observations also identified this system to provide the greatest propensity for fledgling success of grassland birds due to the lack of disturbances during peak nesting periods which traditionally are due to trampling, haying, and predation.

Introduction

Grassland birds, or birds that depend on grassland and shrub habitat for survival, are the most imperiled ecological group of birds in North America (Brennan and Kuvlesky 2005, Rosenberg et al. 2019). Widespread loss of habitat primarily through agricultural conversion of grasslands and intensified

agricultural practices are recognized as the primary driver of these declines (Brennan and Kuvlesky 2005, Green et al. 2005, Hill et al. 2014). In the Eastern United States, managed hayfields and pasturelands represent a significant portion of grassland bird habitat. Adult birds often struggle to raise young in fields under intense haying regimes, as early and frequent hay cuttings do not provide sufficient time for birds to complete their nesting cycle (Bollinger et al. 1990, Perlut et al. 2006, McGowan et al. 2021). In addition, high stocking rates can lead to overgrazed pastures resulting in excessive disturbance and unsuitable habitat for nesting birds (Sabatier et al. 2016, Barzan et al. 2021, Kraus et al. 2022). The timing and approach of management activities is the most crucial factor for the successful breeding of grassland birds in agricultural systems. However, for conservation of nesting habitat to be successful, it is important to identify opportunities where agriculture and conservation can work together hand-in-hand. Regenerative grazing is a holistic land management practice used by producers to restore soil, pasture health, and ecosystem services (LaCanne and Lundgren 2018, Teague and Kreuter 2020). Although there is evidence that regenerative grazing systems could be used to support both livestock and birds (Temple, S. et al. 1999, Perlut and Strong 2011, Campomizzi et al. 2019), there is a significant gap in research that investigates how holistic practices impact the reproductive success of birds in the eastern U.S.

In a collaboration between Smithsonian's Virginia Working Landscapes, American Farmland Trust, and George Mason University, we examined the impacts of regenerative grazing and modified haying practices on forage quality and reproductive success of grassland birds on working farms in Virginia. We then applied preliminary research results to develop and pilot a new producer incentive program that provides reimbursement to producers for adopting practices demonstrated to increase nesting success.

Methods

We coordinated with local cattle producers to implement four experimental treatments on working lands in the Piedmont region of Virginia. These treatments included fields that were: (1) Summer stockpiled — grazed before May 15 and rested until at least July 15; (2) Grazed— continuously grazed from May 15 to July 15; (3) Early Hayed— cut before June 1 and rested until at least July 15; and (4) Delayed Hayed— hayed after June 15 and rested until at least July 30. All experimental plots included in this study were ≥10 acres and comprised of cool-season grasses and forbs.

We studied ground nesting grassland specialists common to the Virginia region including eastern meadowlark, grasshopper sparrow, bobolink (*Dolichonyx oryzivorus*), and savannah sparrow (*Passerculus sandwichensis*). To increase sample sizes, we also included red-winged blackbirds (*Agelaius phoeniceus*), an abundant generalist species and above-ground nester found across our study site. To monitor nesting activity within each treatment, we conducted behavioral surveys along with nest searching and monitoring. Territories were considered successful if we observed adults carrying food beyond the nestling period, if adults were observed delivering food to various locations, or if we detected recently fledged young within the territory (Wiens 1969 and Campomizzi et al. 2019). In addition to territory mapping, we searched for nests within each treatment using methods described by Winter et al. (2003), which involved both behavioral cues and systematic searching. Nests were checked approximately every 4-7 days with minimal disturbance until the nest had either fledged or failed. Cues such as observed recently fledged young, parents alarm calling, adults delivering food, and undiscarded fecal sacs were considered along with age of brood to determine if a nest was successful (Campomizzi et al. 2019).

Hay samples were collected using an 18-inch forage probe from a randomized set of bales harvested from each early cut hay field, combined as one representative sample, and were submitted to Cumberland Valley Analytical Services for Near Infrared Reflectance spectroscopy (NIR) analysis. This process was replicated for the late cut hay fields enrolled in the study as well. Pasture grab samples were also collected in early grazed and continuous grazed pastures. Careful attention was taken to collect a small representative sample between the thumb and first finger to represent what the cattle would be eating. Forages were collected at the same height (4 inches) at which the cattle would graze the pasture. During the pasture sample collection process, a randomized pattern was used throughout the pasture to ensure the samples were not biased and plants not desired by livestock such as buttercups and thistles were excluded. Specific NIR results included Dry Matter, Crude Protein (CP), ADF, NDF, Lignin, TDN % and Relative Feed Value.

Results and Discussion

Preliminary results from the first two years of the study (n = 335 territories) suggest that summer stockpiling and delayed haying practices can result in increased reproductive success for grassland birds nesting in eastern working grasslands compared to fields that are grazed or hayed during peak nesting periods (Figure 1; chi-square, $p<0.05$). Territories in fields hayed after June 15th and in summer stockpiled pastures were 65% and 68% successful respectively. These rates are comparable to reproductive rates of grassland birds in natural undisturbed areas. Meanwhile, fields that were grazed throughout the peak nesting period exhibited 46% success while fields hayed prior to June 15th exhibited 33% success. This research is also providing important insights into the nesting phenology of grassland specialists common to Virginia farms. As expected, nest initiation dates differ among species, with eastern meadowlarks initiating nests as early as mid-April and bobolinks initiating nearly one month later. While this data does suggest that a small number of eastern meadowlarks may fledge young early enough to avoid first hay cuttings, it also corroborates previous literature demonstrating that most species' peak nesting periods overlap with peak haying activity. As such, we have used this preliminary data to create guidelines for both grazed and hayed fields to optimize reproductive success of grassland birds on working lands in Virginia.

On average, there was not a statistically significant difference in crude protein or TDN % between the early and continuous grazed pastures which were both sampled during the last week of June 2021. The average of all pasture grab samples was 14.6 % CP and 57.8 % TDN. Based on the beef cattle nutrient requirement tables derived from the Nutrient Requirements of Beef Cattle, Eighth Revised Edition (2016, a.k.a. NRC) and published in the University of Arkansas's guiding document MP391, cows weighing 1300 lbs. with 18 lbs. of milk production require 58.9 % TDN and 10.2 % CP with estimated dry matter intake at 27 lbs. per head per day. In comparison, nutritional requirements for that same 1300 lb. late gestation, non-lactating cow are 52 % TDN and 7.4 % CP at an estimated 22.7 lbs. of dry matter intake per head per day. The 2021 early made hay was harvested between May 17th and June 1st on 3 different farms studied and averaged 8.56 % CP and 57.4 % TDN. This compares to the diminished results of the late hay made after June 17th at 6.85 % CP and 52.65 % TDN which is inadequate for most classes of cattle based upon NRC tables. These preliminary results demonstrate that grazing pastures early and then summer stockpiling those pastures for fall and winter grazing is the optimal practice to balance the forage requirements for livestock producers while also providing optimal habitat for ground nesting birds.

In 2022, this research was the foundation for a new farmer incentive program through the Virginia Grassland Bird Initiative, providing funds to producers that either delayed haying until after July 1st or set aside fields for stockpiling between April 15th and July 1st. Funded by a pilot grant from the Cornell Land Trust Bird Conservation Initiative, this program enrolled more than 1,800 acres of grassland bird nesting habitat in 2022.

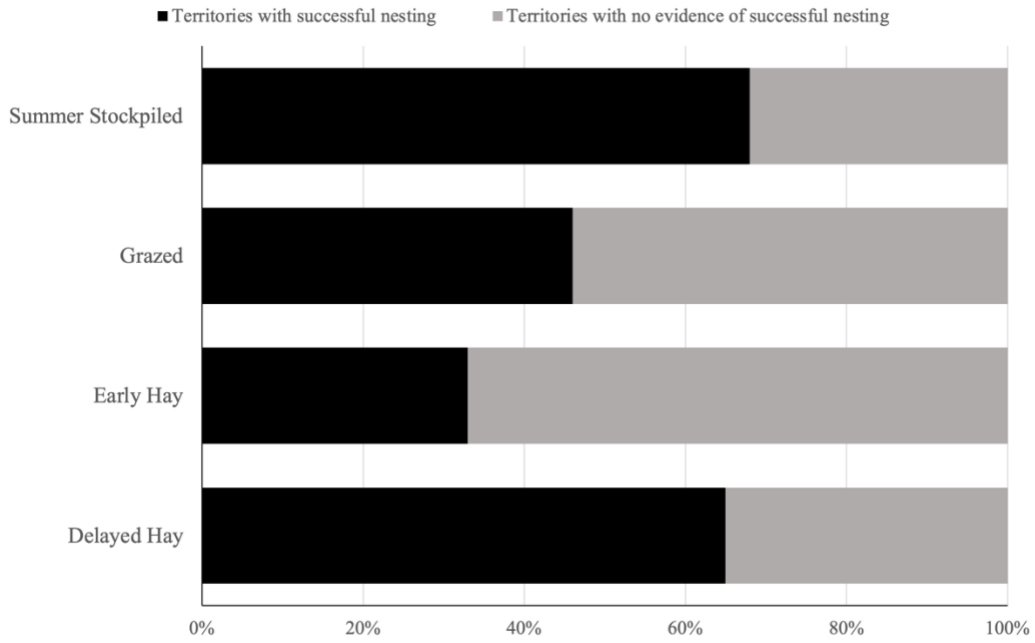

Figure 1. Percentage of territories that fledged young in each treatment from 2020-2021 (n=335).

Conclusions

Traditional grazing and haying practices run counter to grassland bird conservation recommendations. In addition, financial and social pressures to maximize production on working lands often curtails the adoption of current bird-friendly recommendations. Results of this study have the potential to provide local land managers and stewards with effective grassland bird conservation strategies while adopting livestock production systems positioned to reduce producer input cost. The bird-friendly production systems identified here also provide opportunities to add value through improved marketing, resulting in a greater probability of sustained, long-term profitability. Discerning peak breeding activity for grassland birds will allow for better informed timing of haying fields and grazing pastures to enhance their conservation potential. Results of this study, and lessons learned from the associated incentive program, have the prospect to act as a catalyst for community-driven conservation in Virginia, and can pose as a model for other eastern states aiming to amplify science-driven conservation strategies that benefit both birds and producers.

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References

Barzan, Flavia, Laura Bellis, and Sebastian Dardanelli. "Livestock Grazing Constrains Bird Abundance and Species Richness: A Global Meta-Analysis." *Basic and Applied Ecology* 56 (August 1, 2021). https://doi.org/10.1016/j.baae.2021.08.007.

Bollinger, Eric K., Patricia Blair Bollinger, and Thomas A. Gavin. "Effects of Hay-Cropping on Eastern Populations of the Bobolink." *Wildlife Society Bulletin (1973-2006)* 18, no. 2 (1990): 142–50. http://www.jstor.org/stable/3782128.

Brennan, Leonard A., and William P. Kuvlesky. "North American Grassland Birds: An Unfolding Conservation Crisis?" *The Journal of Wildlife Management* 69, no. 1 (2005): 1–13. https://doi.org/10.2193/0022-541X(2005)069<0001:NAGBAU>2.0.CO;2.

Campomizzi, Andrew J., Zoé M. Lebrun-Southcott, Laura D. Van Vliet, and Gerald A. Morris. "Rotational Grazing of Beef Cattle to Support Bobolink Breeding Success." *Avian Conservation and Ecology* 14, no. 2 (2019): art13. https://doi.org/10.5751/ACE-01420-140213.

Gadberry, Shane. "Beef Cattle Nutrition Series Part 3: Nutrient Requirement Tables" MP391 (2018) https://www.uaex.uada.edu/publications/pdf/MP391.pdf

Green, Rhys E., Stephen J. Cornell, Jörn P. W. Scharlemann, and Andrew Balmford. "Farming and the Fate of Wild Nature." *Science* 307, no. 5709 (January 28, 2005): 550–55. https://doi.org/10.1126/science.1106049.

Hill, Jason M., J. Franklin Egan, Glenn E. Stauffer, and Duane R. Diefenbach. "Habitat Availability Is a More Plausible Explanation than Insecticide Acute Toxicity for U.S. Grassland Bird Species Declines." Edited by R. Mark Brigham. *PLoS ONE* 9, no. 5 (May 20, 2014): e98064. https://doi.org/10.1371/journal.pone.0098064.

Kraus, Heather M., William E. Jensen, Gregory R. Houseman, Mary Liz Jameson, Molly M. Reichenborn, D. Fraser Watson, and Esben L. Kjaer. "Cattle Grazing in CRP Grasslands during the Nesting Season: Effects on Avian Reproduction." *The Journal of Wildlife Management* 86, no. 2 (2022): e22152. https://doi.org/10.1002/jwmg.22152.

LaCanne, Claire E., and Jonathan G. Lundgren. "Regenerative Agriculture: Merging Farming and Natural Resource Conservation Profitably." *PeerJ* 6 (February 26, 2018). https://doi.org/10.7717/peerj.4428.

McGowan, Maeve M., Noah G. Perlut, and Allan M. Strong. "Agriculture Is Adapting to Phenological Shifts Caused by Climate Change, but Grassland Songbirds Are Not." *Ecology and Evolution* 11, no. 11 (2021): 6993–7002. https://doi.org/10.1002/ece3.7548.

Perlut, Noah G., and Allan M. Strong. "Grassland Birds and Rotational-grazing in the Northeast: Breeding Ecology, Survival and Management Opportunities." *The Journal of Wildlife Management* 75, no. 3 (April 2011): 715–20. https://doi.org/10.1002/jwmg.81.

Perlut, Noah G., Allan M. Strong, Therese M. Donovan, and Neil J. Buckley. "Grassland Songbirds in a Dynamic Management Landscape: Behavioral Responses and Management Strategies."

Ecological Applications 16, no. 6 (2006): 2235–47. https://doi.org/10.1890/1051-0761(2006)016[2235:GSIADM]2.0.CO;2.

Rosenberg, Kenneth V., Adriaan M. Dokter, Peter J. Blancher, John R. Sauer, Adam C. Smith, Paul A. Smith, Jessica C. Stanton, et al. "Decline of the North American Avifauna." *Science* 366, no. 6461 (October 4, 2019): 120–24. https://doi.org/10.1126/science.aaw1313.

Sabatier, Rodolphe, Daphné Durant, Sameh Ferchichi, Khalil Haranne, François Léger, and Muriel Tichit. "Effect of Cattle Trampling on Ground Nesting Birds on Pastures: An Experiment with Artificial Nests." *European Journal of Ecology* 1 (January 10, 2016). https://doi.org/10.1515/eje-2015-0012.

Teague, Richard, and Urs Kreuter. "Managing Grazing to Restore Soil Health, Ecosystem Function, and Ecosystem Services." *Frontiers in Sustainable Food Systems* 4 (2020). https://www.frontiersin.org/articles/10.3389/fsufs.2020.534187.

Temple, S., Fevold, B., Paine, L., Undersander, D., and Sample, D. "Nesting Birds and Grazing Cattle: Accommodating Both on Midwestern Pastures." *Avian Biology*, no. 19 (1999): 196–202.

Wiens, John A. "An Approach to the Study of Ecological Relationships among Grassland Birds." *Ornithological Monographs*, no. 8 (1969): 1–93. https://doi.org/10.2307/40166677.

Winter, Maiken, Shawn E Hawks, Jill A Shaffer, and Douglas H Johnson. "Guidelines for Finding Nests of Passerine Birds in Tallgrass Prairie," 2003, 16.