



2022 MINNESOTA DEER HUNTER OBSERVATION PROJECT REPORT

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INTRODUCTION

White-tailed deer (*Odocoileus virginianus*; hereafter, deer) hunting season recommendations should incorporate objective and reliable information to move populations towards a desired density goal. Because the Minnesota Department of Natural Resources (MNDNR) adjusts regulatory decisions (seasons and bag limits) annually, agencies require current information. In Minnesota, deer densities are modeled at the larger deer modeling unit (DMU; $N = 23$) scale but are managed at the smaller deer permit area (DPA; $N = 130$) scale. Traditional firearm season lengths are 9 (200-series areas), 16 (100-series areas), or 18 (300-series areas; 2 seasons) days. Bag limits also vary by permit area and range from bucks only (1 antlered deer) to 3-deer limit (1 buck or doe and up to 2 additional antlerless deer) management designations. Additionally, early antlerless seasons are used in limited situations and DPAs within disease management zones have allowable harvests of up to 5 deer, including one legal buck per each archery, firearm, and muzzleloader season per hunter (3 total bucks). To inform these annual decisions, MNDNR incorporates mandatory hunter-reported harvest, hunter effort, winter severity, and vital rate parameters (survival, fecundity, etc) into a population model to make population trend inferences (λ ; Michel and Giudice 2022). Population model indices are sensitive to varying hunting season regulations and changes in the relationship between winter severity and deer survival. Confidence in the population model is improved by collecting annually recurrent information to independently estimate the population trend. The Office of Legislative Auditors (OLA) conducted an independent evaluation of the MNDNR deer population management program (OLA 2016) and recommended additional data collection to improve deer population estimates. Winter aerial surveys can provide an index, but logistical and environmental (e.g., adequate snow cover) constraints limit their use to every 5 to 10 years. Furthermore, aerial surveys are not considered reliable across much of northern Minnesota where predominant coniferous cover results in insufficient detection probability (Haroldson 2014) or across southwestern Minnesota where deer movements vary throughout the year (winter migrations).

Several Midwestern states have explored the use of annual hunter observation surveys for monitoring white-tailed deer population trends (Rolley et al. 2016) and trends of populations of other species of interest (Bauder et al. 2021). We conducted a pilot study from 2017 to 2019 to collect archery hunters' observations of deer using survey methods (mail and online versions). Although the information MNDNR biologists gained from this bowhunter survey was useful in developing age and sex ratios to use as indices to measure deer model performance, response rates were low statewide. Therefore, in 2020, we took a community science approach by allowing all deer hunters, regardless of the season they are hunting, to provide observational data in an online format in an attempt to increase hunter participation. Our primary objective was to evaluate this community science approach for monitoring trends in white-tailed deer and other wildlife populations. Our secondary objective was to estimate fawn:adult female deer ratios from deer hunter observations. In Minnesota, there is greater diversity in biogeography

than other Midwestern states. Because of the variability of habitat, we chose to report results for three ecozones: 1) farmland, 2) transition, and 3) forest.

METHODS

We moved from a traditional mail survey to a community science approach by soliciting participation using a variety of methods. We solicited participation using direct emails to hunters with recorded emails, radio interviews, agency social media (e.g., Facebook, Twitter) and through agency newsletters such as the Deer Notes emails sent to subscribers. Hunters had the option to print off logs to manually record observations from multiple hunts and then submit them online all at once, or they could document their observations online after each hunt.

We asked deer hunters to document white-tailed deer, badger (*Taxidea taxus*), American black bear (*Ursus americanus*), bobcat (*Lynx rufus*), coyote (*Canis latrans*), fisher (*Martes pennanti*), gray fox (*Urocyon cinereoargenteus*), gray wolf (*Canis lupus*), and wild turkey (*Meleagris gallopavo*) observations and differentiate between antlered, adult female, fawn, and unknown deer age-sex classes while hunting. We also asked hunters to record DPA for hunting trip observations. We produced summary statistics describing the total number of observations for all species, calculated two indices (total deer observed per hour and antlered deer observed per hour), and calculated the fawn-to-adult female deer ratio as a representation of recruitment.

RESULTS

We sent two direct emails to 177,719 hunters (including hunters purchasing licenses for all game species) for which we had an email on record. We also advertised via social media, radio interviews, and Deer Notes. Although we did not collect any information from hunters that would allow us to quantify participation in 2022 for comparison to previous years, we determined the total number of recorded observations. We recorded 4,644 observations from hunters representing 127 of 130 DPAs in 2022, which represented a 2400% increase from 2021 (Table 1). All DMUs and ecozones were represented with the 2022 observations. Hunters recorded 2,295 observations in 14,010 hours in the forest zone, 1,916 observations in 8,506 hours in the transition zone, and 433 observations in 1,891 hours in the farmland zone. Statewide observations for each species ranged from 9 observations of badgers to 17,397 observations of deer (Table 2). Firearms hunters submitted 2,862 observations, archery hunters submitted 1,657 observations, and muzzleloader hunters submitted 95 observations; 40 observations did not indicate weapon type. Most hunters recorded observations while hunting out of a tree stand (3,593) or a ground blind (622; Table 3).

In 2022, there were 1,632, 1,133, and 576 observations of antlered deer for the transition, forest, and farmland zones, respectively. Hunters observed 9,224, 4,582, and 3,586 total deer (bucks, adult females, antlerless, and unidentified combined; Table 4) for the transition, forest, and farmland zones, respectively. Fawn-to-adult female deer ratio was 0.68, 0.58, and 0.57 in the farmland, forest, and transition zones, respectively. Antlered bucks observed per hour was 0.30, 0.08, and 0.19 in the farmland, transition, and forest zones, respectively. Total deer observed per hour was 1.90, 1.08, and 0.33 in the farmland, transition, and forest zones, respectively. Although comparing indices across years is difficult due to differences in methodology and low sample sizes in 2020 and 2021, there appears to be consistent variation among the ecozones for fawn-to-adult female deer (Figure 1), number of antlered deer observed per hour (Figure 2), and total deer observed per hour (Figure 3); however, it will take 3-5 years of collecting data under this new methodology to establish trends. Until then, annual comparisons should be made and interpreted with caution.

DISCUSSION

Using a combination of direct emails and advertising via social media and radio interviews resulted in a drastic increase from total observations collected in 2021, but was still a 75% decrease from 2019, which was the final year of the bowhunter survey. Regardless, this increase indicates our modified methodology was successful. The total number of observations may also increase in subsequent years of data collection. For example, the total number of observations from the bowhunter survey increased throughout the three-year study period. We will continue to improve our outreach by directly working with conservation groups (e.g., National Deer Association, Backcountry Hunters and Anglers, etc) to promote this project.

The goal of this project is to derive an independent index to evaluate population trends for comparison to deer population model output. Additionally, estimating fawn-to-adult female deer ratios will provide information on recruitment and could help inform the deer population model. Although we currently have 6 years of data from this project, variation in methodology and low sample sizes preclude us from interpreting trends. We will need at least 3 years of information gained using similar methodology and adequate sample sizes to start interpreting trends. However, we will not be able to make full comparisons to the deer population model until after we have 5 years of data because the deer population model assesses changes in populations over a 5-year time period.

Although we were able to increase the total number of observations in 2022, we will still need to evaluate the potential for bias with this project. For example, hunters may not be as likely to record their observations if they do not see any deer while hunting, though this is a vital piece of information when calculating our indices. Once we establish that we are collecting enough observations to allow for reasonable interpretations of trends, we will then explore potential methods to evaluate for non-reporting bias.

ACKNOWLEDGMENTS

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Table 1. Deer hunter observations by year for each ecozone from 2017 to 2022 in Minnesota, USA.

Year	Ecozone		
	Farmland	Transition	Forest
2017 ^a	1,654	6,992	3,066
2018 ^a	4,215	6,548	4,260
2019 ^a	4,986	8,568	4,936
2020 ^b	67	433	2,66
2021 ^b	37	107	42
2022 ^c	542	1,807	2,295

^aBowhunter observation survey with direct mailings to hunters.

^bCommunity science approach without direct emails.

^cCommunity science approach with direct emails.

Table 2. Total number of 9 species observed by deer hunters in 2022 for each ecozone in Minnesota, USA.

Ecozone	Species								
	Deer	Wild Turkey	Badger	Grey Fox	Black Bear	Fisher	Bobcat	Coyote	Wolf
Farmland	3,586	1,016	3	2	0	3	1	76	0
Transition	9,224	4,550	4	57	22	26	18	244	46
Forest	4,587	2,907	2	53	110	39	52	239	730
Statewide total	17,397	8,473	9	112	132	68	71	559	776

Table 3. Hunting methods used by deer hunters submitting observations in 2022, by ecozone, in Minnesota, USA.

Hunting Method	Ecozone		
	Farmland	Transition	Forest
Treestand	268	1,489	1,836
Ground blind	98	262	262
Stalking	22	50	121
Deer drive	17	23	10
Other	27	88	60

Table 4. Total deer hunter observations of antlered deer, adult females, fawns, and unknown by ecozone for 2022 in Minnesota, USA.

Ecozone	Antlered Deer	Adult Females	Fawns	Unknown
Farmland	576	1,682	1,147	181
Transition	1,632	4,214	2,422	956
Forest	1,133	1,982	1,149	323

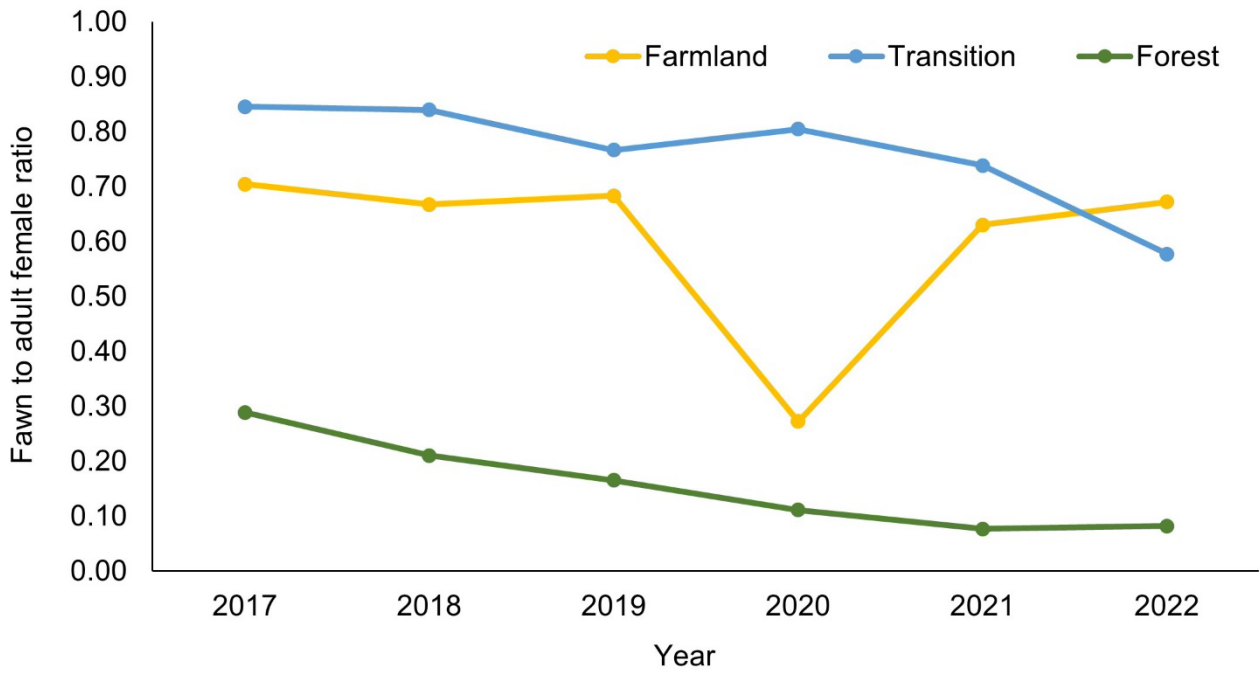


Figure 1. Index of the number of fawns-to-adult female deer for the farmland, transition, and forest ecozones from 2017 to 2022 in Minnesota, USA.

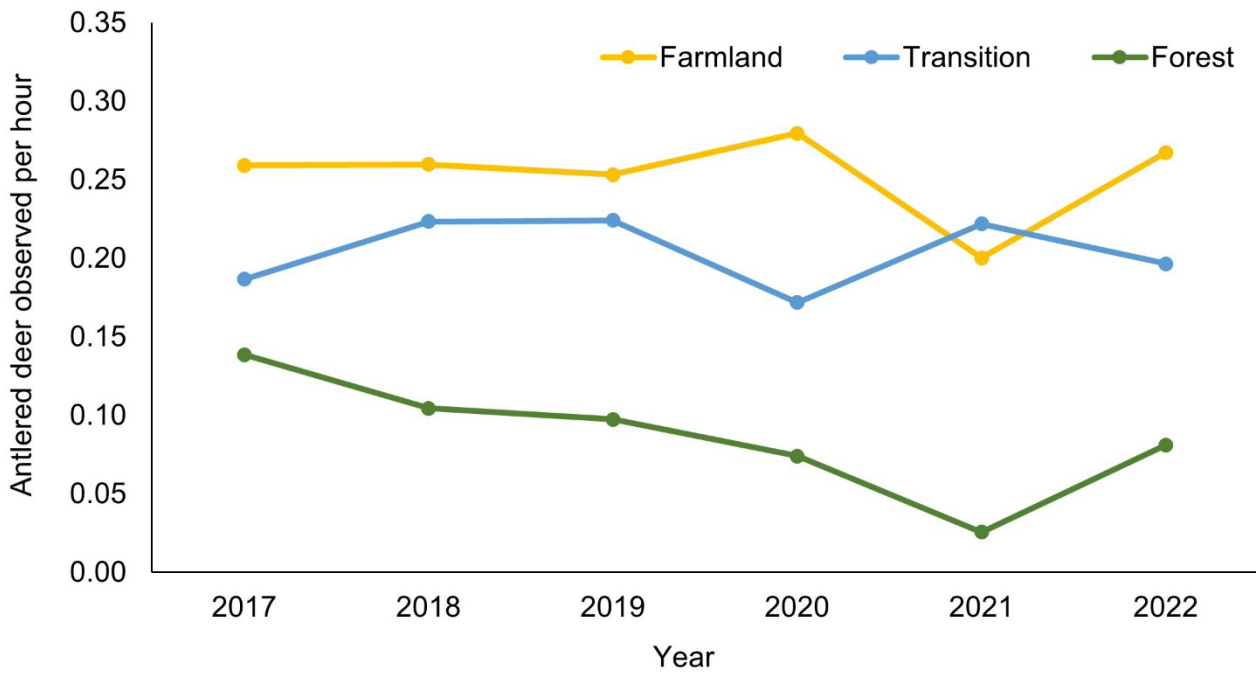


Figure 2. Total number of antlered deer observed per hour for the farmland, transition, and forest zones from 2017 to 2022 in Minnesota, USA.

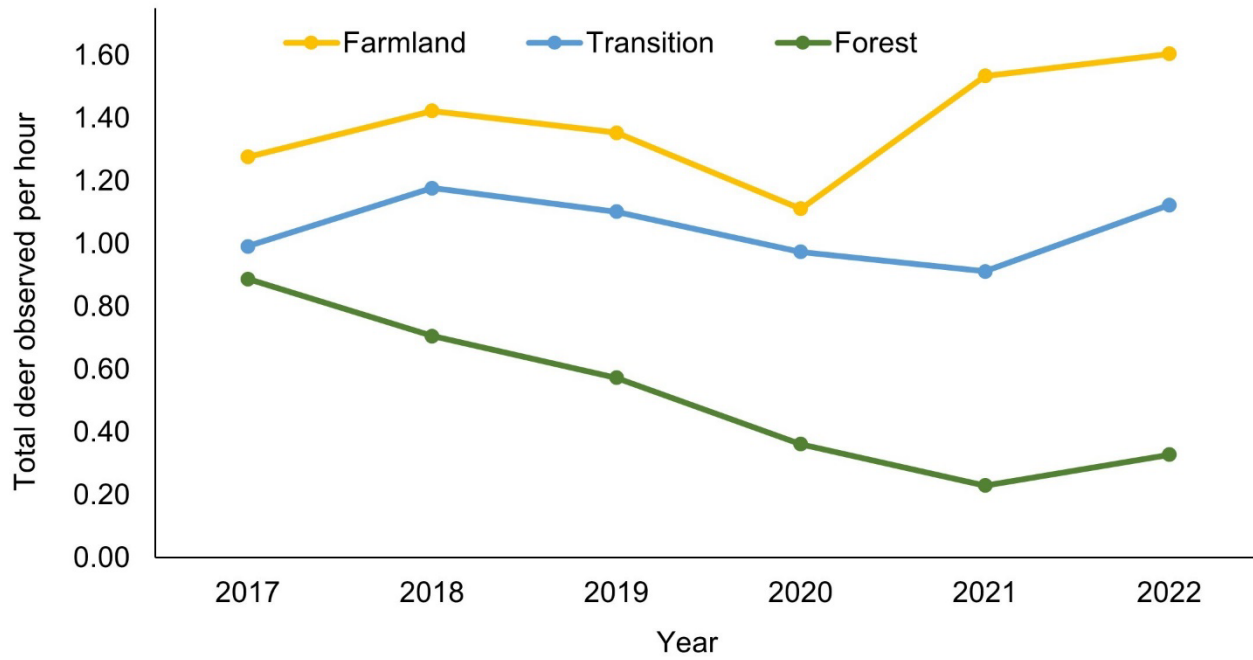


Figure 3. Total number of deer observed per hour in the farmland, transition, and forest zones from 2017 to 2022 in Minnesota, USA