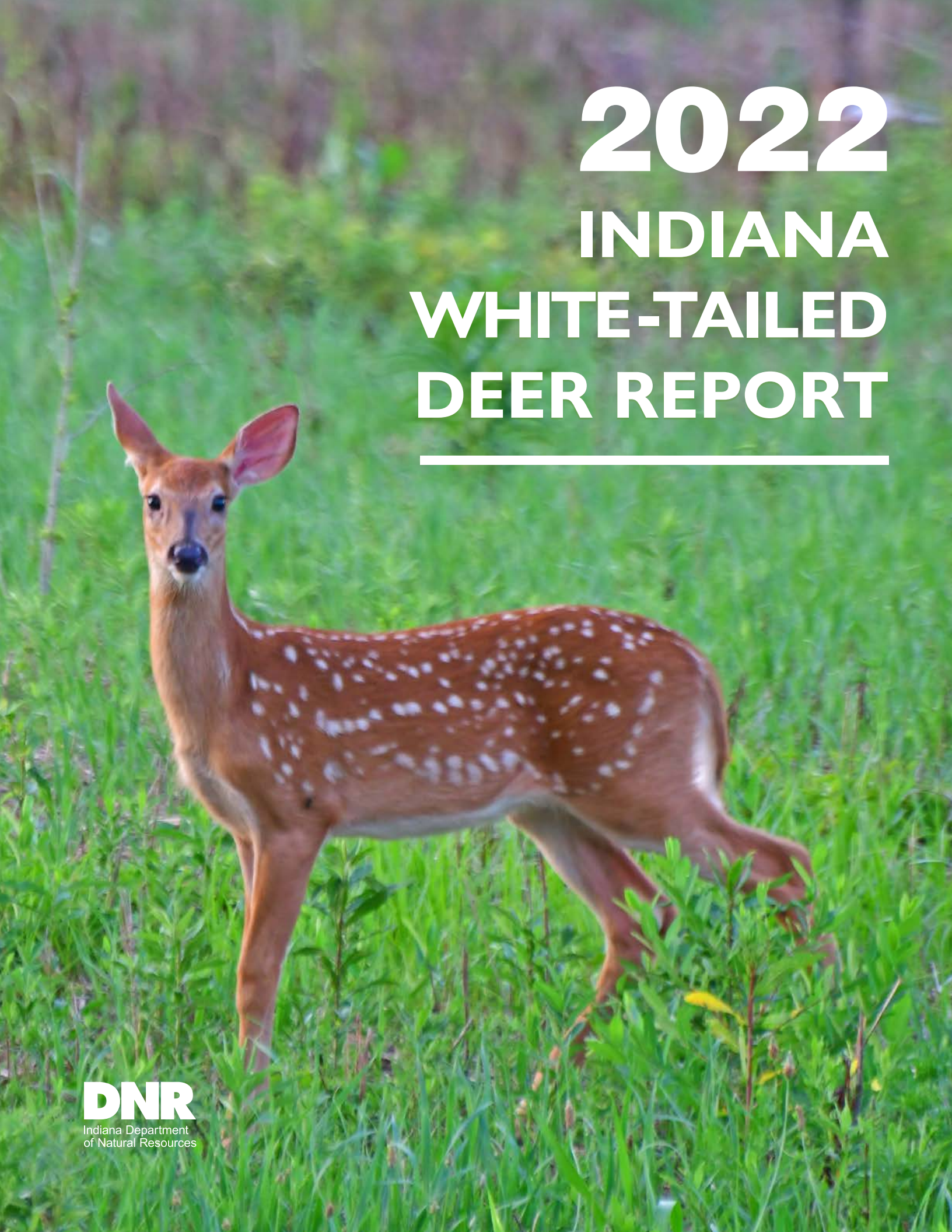

2022 INDIANA WHITE-TAILED DEER REPORT

DNR
Indiana Department
of Natural Resources

Federal Aid in Wildlife Restoration Program

This program supports state fish and wildlife agencies to conserve, protect, and enhance fish, wildlife, their habitats, and the hunting, sport fishing and recreational boating opportunities they provide. This program was initiated in 1937 as the Federal Aid in Wildlife Act and created a system where by taxes are paid on firearms, ammunition and archery equipment by the public who hunts. Today this excise tax generates over a hundred million dollars each year that are dedicated to state wildlife restoration and management projects across the United States.

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Cover Photo: A white-tailed deer fawn at Summit Lake State Park. DNR File.

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DNR File Photo

Chapter 1. OVERVIEW

Welcome to the 2022 Indiana White-tailed Deer Report. Every year, Indiana DNR publishes a comprehensive report of the state's deer herd and deer management research. The report includes deer hunting season results, use of control permits, deer-vehicle collision reports, disease monitoring efforts, survey results, and internal and external deer research projects. Historical reports are available at on.IN.gov/INDeerReport.

2022-2023 Deer Hunting Season

The 2022-2023 deer hunting season was composed of four statewide seasons: Youth (Sept. 24 and 25), Archery (Oct. 1, 2022 - Jan. 1, 2023), Firearms (Nov. 12 - 27), and Muzzleloader (Dec. 3 - 18). In addition to the four statewide seasons, the Special Antlerless Firearms season was closed for the 2022-2023 deer hunting season. Most resident deer licenses could be purchased for $39, nonresident licenses for $240. A deer license bundle was available for purchase at $91 for residents and $550 for nonresidents. The deer license bundle, which is valid in all deer seasons except the Deer Reduction Zone season, allows hunters to take up to three deer while attempting to satisfy statewide bag limits for Archery, Firearms, Muzzleloader, and Special Antlerless Firearms (when open) seasons. The three deer may be either two antlerless and one antlered, or three antlerless deer. A hunter may take only one antlered deer during all statewide seasons combined (Archery, Firearms, Muzzleloader, and Youth seasons). Resident landowners and lessees who own and/or lease Indiana farmland are exempt from needing deer licenses when hunting on their land. Hunters were required to register all harvested deer through the online CheckIN Game system within 48 hours of the kill of their deer.

Licensed youth, age 17 or younger, were eligible to participate in a youth-only season if accompanied by an adult at least 18 years old. Youth could take multiple deer (one antlered deer and the number of bonus antlerless deer per county quota) during this special season.

The statewide archery bag limit was two deer. Hunters could take one deer per license, for a total of either two antlerless or one antlered and one antlerless deer.

Hunters were allowed to use crossbows throughout the entire Archery season when in possession of a crossbow license. Any deer taken with a crossbow counted toward the hunter's two-deer archery bag limit.

The bag limit during Firearms season was one antlered deer. The bag limit for Muzzleloader season was one deer of either sex (antlered deer were only allowed for hunters who had yet to satisfy their one antlered bag limit across all statewide seasons). A single firearms license was required to hunt with any combination of shotgun, muzzleloader, rifle, or handgun during Firearms season. A muzzleloader license (separate from the firearms license) was required to hunt during Muzzleloader season.

Hunters could harvest additional deer beyond the statewide bag limits in designated Deer Reduction Zones. Beginning with an antlerless deer, hunters were allowed to harvest up to 10 additional deer under the Deer Reduction Zone bag limit, for a total of either 10 antlerless or one antlered ("earn-a-buck") and nine antlerless deer. Harvest of these additional deer required the possession of a Deer Reduction Zone license for each deer harvested. An antlered deer harvested under the Deer Reduction Zone license did not count toward a hunter's statewide bag limit of one antlered deer; however, deer harvested in designated Deer Reduction Zones with other license types (e.g., archery, bonus antlerless, and license bundle) counted toward statewide bag limits. The Deer Reduction Zone season opened Sept. 15, 2022, two weeks prior to the beginning of Archery season, and continued through Jan. 31, 2023.

Deer Control Permits and Deer-Vehicle Collisions

Deer permits were issued to Indiana residents experiencing an economic loss of $500 or more because of property damage caused by deer or where there was an identified disease risk to control humans or domestic livestock. Each control permit specified the number of deer a landowner was authorized to take under the permit. Permits were only valid on the permit holder's property, and the permit holder was allowed to designate assistants to remove deer in place of themselves. Control permits for deer are typically only issued outside of the deer hunting season.

Vehicle collisions involving deer and resulting in property damage of at least $2,500 or injury to any person were reported to the Indiana State Police and Indiana Department of Transportation by local and state law enforcement agencies. Information collected included location of collision (e.g., county, coordinates, intersection, etc.) and road type (e.g., county road, state road, interstate, etc.). The number of deer-vehicle collisions and the number of deer taken with control permits are factors that influence the bonus antlerless quotas for the hunting season and locations of Deer Reduction Zones.

Deer Health

Indiana DNR monitors deer health for major outbreaks of diseases such as epizootic hemorrhagic disease (EHD), bovine tuberculosis (bTB), and chronic wasting disease (CWD). In 2022, Indiana experienced severe EHD occurrences in several southeastern counties, which was a change from the minimal occurrence of EHD in 2021. DNR received 981 reports of potential EHD cases involving 1,020 deer from 62 counties, with 344 of these reports from Franklin County. Indiana DNR did not conduct bTB surveillance in Franklin County in 2022 because the level of bTB in the area was likely low to nonexistent. A total of 663 deer were tested for CWD statewide in 2022. To date, no wild deer from Indiana have tested positive for CWD.

Surveys and Volunteer Monitoring

Surveys of hunters, landowners, and other people are tools Indiana DNR uses to manage the state's deer herd. Before 2017, paper surveys were mailed to a subset of Indiana hunters and landowners every three or four years to ask questions about harvest, deer damage, and opinions on the size and management of deer in Indiana. In 2022, hunters had the opportunity to complete an online survey immediately after checking in their deer and to participate in the Deer Management Survey to share their opinions of Indiana deer management. These surveys gather specific information about the deer that were harvested (e.g., sex, age, approximate size, etc.), the hunting experience associated with those deer (e.g., number of does or bucks seen, happiness with the hunt, etc.), how hunters feel about the state's deer population, and how they would like deer to be managed. Indiana DNR also solicits hunter and public participation in volunteer monitoring projects to collect valuable data on fawn-to-doe and buck-to-doe ratios to better understand the recruitment rates of populations at the county and regional levels.

Deer Research

Indiana DNR conducts research within its deer program and works with universities to conduct research on various topics related to deer management. In 2022, Indiana DNR concluded the five-year Integrated Deer Management Project with Purdue University. Additionally, the deer program continued to work on CWD and economics of deer management. Internally, scientists in the deer program examined the feeding of deer by Indiana residents, the effectiveness of linear Deer Reduction Zones, the effects of EHD in Franklin and Fayette counties, public opinions regarding firearms season, the costs and benefits of sharpshooting to control deer disease, the cost effectiveness of obtaining samples for CWD from taxidermists, the market value of deer, deer movement patterns, and the willingness to pay for lifetime licenses.

Chapter 2. IMPROVEMENTS IN DEER MANAGEMENT

Joe N. Caudell, Zackary Delisle,
Indiana Department of Natural Resources

Introducing the New Deer Research Biologist

In February 2023, Dr. Zackary Delisle was hired as Indiana's new deer research biologist. This new position was developed to expand Indiana DNR's internal research capacity. Delisle conducted his Ph.D. work at Purdue University while studying the population ecology of white-tailed deer throughout Indiana. In prior pursuits, he has worked with waterfowl, invasive plants, upland game birds, reptiles, amphibians, small mammals, and coyotes. Currently, he is working on using population estimates of deer when making management decisions; examining the effects of Deer Reduction Zones on deer-vehicle collisions; and modeling relationships between deer behavior and hunter success rates, deer-vehicle collisions, human development, and natural predators such as coyotes.

Introducing the New Deer and Mammal Health Biologist

In April 2023, Janetta Kelly was hired as a fish & wildlife health biologist. She completed her bachelor's and master's degrees in Wildlife and Fisheries Science from the University of Tennessee. For her master's thesis, she studied the southern spread of Lyme disease and how variables such as climate, host selection, and host abundance influences its spread. Throughout her career, she has worked on a variety of different pathogens and taxa, primarily focusing on diseases of mammals and vector borne pathogens. Upon completing her master's, she worked for Minnesota DNR as a wildlife health specialist, primarily coordinating chronic wasting disease surveillance. Currently, she monitors the sick and dead mammal reports for the state and helps coordinate surveillance for pathogens of concern in mammals throughout Indiana.

Deer Hotline

In 2022, the Deer Hotline was moved from the receptionist desk at the Bloomington field office and placed within the deer program. This change should facilitate the flow of new information regarding changes in deer regulations to the hotline. The current hotline coordinator is Matthew Gross, a graduate student at Indiana University.

Applying the Integrated Deer Management Project to Indiana DNR's Deer Management Program

The DNR sought the support of Purdue University to enhance its use of efficient methods for the sustainable management of deer and the inclusion of different perspectives in understanding human-deer interactions. Through this collaboration, researchers were able to provide multiple recommendations for deer management in Indiana, including:

- Using aerial monitoring for estimating population densities due to its cost effectiveness.
- Using twig age indices for estimating browsing impacts in forests.
- Using insights into deer food selection to inform forest management about browsing impacts.
- Including different perspectives from a range of community groups interested in deer management when looking to the public for deer management perceptions.
- Including measures of emotion and direct experiences in social surveys that examine the public's interactions with deer.
- Continuing to emphasize transparency about how deer management decisions are made to reduce feelings of powerlessness regarding deer management and increase the likelihood of public support.
- Using social conflict indices to identify areas with diverging perceptions of deer management that should be targeted for public engagement.

As the name suggests, this project was done to assist DNR with ways to integrate biological, ecological, and social dimensions into a holistic management strategy. Overall, this data on deer density, deer's browsing of plants, and citizen viewpoints can provide landscape-level estimates of densities, browse intensity, and social conflict. These, in turn, can be combined to consider how deer population management goals in each region align with environmental conditions and public interests. The collaboration between DNR and Purdue University's team showcases the power of collaboration and shared interest in conserving Indiana's white-tailed deer. The results and recommendations from this project provide useful insights for monitoring deer populations and their browsing impacts, in addi-

tion to expanding who is consulted about deer management and what social factors should be considered. As DNR continues to implement the Wildlife Governance Principles, more opportunities are planned to enhance not only how deer are counted and managed, but also how the public is engaged in the process. To read more about this project, please see Chapter 10.

New Deer Hunting Rules are Being Proposed for the 2025-2026 Deer Seasons

The DNR is proposing several amendments to the deer hunting rules. Currently, there is confusion around the privileges allowed under each deer license, both among the public and among the DNR employees responsible for interpreting and enforcing the deer hunting rules found in 312 IAC 9-3-2. Much of the confusion is a result of the multiple license types available for deer hunting, each having different limits of take and season bag limits. For example, redefining the bonus antlerless license as a multiple-season antlerless license will simplify the privileges of a license holder and make the license easy to determine. Simplified regulations can also make hunting more accessible to individuals who are new at hunting deer and who may find license confusion to be a barrier of entry. Clearer regulations will also lead to less staff time being spent answering questions about license privileges from confused individuals. Below is a summary and brief justification of each proposed change:

312 IAC 9-3-2: Creating a single license for archery and crossbow equipment

The DNR proposes to eliminate the crossbow license by allowing individuals who use either a bow and arrow or a crossbow and bolt to purchase an archery license and use either equipment. This change will help reduce confusion and give deer hunters an additional equipment option with the one license. Both licenses are currently allowed during the entire deer archery season, so there is no change to the timeframe in which the licenses can be used. A recent survey of hunters found they were supportive of this change, although some do not consider crossbows to be "traditional" archery equipment. The change should not impact revenue for the DNR because an individual is still required to purchase a license, and most individuals use either a bow and an arrow or a crossbow to hunt, but not both. Since legalizing the use of a crossbow in 2012, less than 1% of resident and nonresident hunters have purchased both a crossbow and an archery license or used both equipment types in the same license year. As for hunters who use the deer license bundle, since 2016 there has never been more than 93 individuals check in a deer under both equipment types in a given year. Given these metrics, it is unlikely that eliminating the crossbow license and allowing crossbow use under an archery license would contribute to a significant revenue effect either from a decrease in archery or crossbow license sales or disincentivizing deer license bundle purchases. It is also unlikely to result in a change in harvest. Currently, individuals who hunt using archery equipment can take an antlered or antlerless deer with an archery or a crossbow license as long as they do not take more than one antlered deer in the regular deer seasons combined; however, the small percentage of individuals who purchase both an archery and a crossbow license could potentially save the cost of one license because a license holder could use either type of equipment on the one archery license.

A question in the 2022 Deer Management Survey asked about combining the archery and crossbow licenses into one license. We received 16,462 responses to this question. Of those, 73% supported this rule proposal (61% strongly supporting; 12% somewhat supporting), 12% were neutral, and 19% opposed (11% strongly opposing; 7% somewhat opposing).

In a 2021 survey, there were 894 archery-only respondents out of 16,462 total respondents (5.4%). Of those, 44% supported this proposal (31% strongly supporting; 13% somewhat supporting), 18% were neutral, and 38% opposed (30% strongly opposing; 8% somewhat opposing).

The DNR recognizes the desire of hunters to keep seasons specific to a type of equipment and to place certain limitations on others who hunt that season; however, the deer program aims to simplify the rules that govern deer hunting so that hunters desiring to enter the sport are less confused by the regulations.

312 IAC 9-3-2: Change the bundle license to one antlered deer and two antlerless deer

The DNR proposes to change the bundle license to allow hunters to take one buck and two antlerless deer and remove the option of harvesting three antlerless deer. This purpose is to further simplify regulations for hunters. Landowners and tenants of farmland who are exempt from needing a license to hunt deer on their own farmland would not be affected by this change and neither would resident youth and lifetime license holders. With only a small fraction of hunters using the

bundle to harvest three antlerless deer, this will also reflect how the vast majority of hunters use this license.

The DNR asked a question about changing the bundle to allow hunters to only harvest one buck and two does in the 2022 Deer Management Survey. There were 16,374 responses to this question. Of those, 62% of hunters supported the proposed rule (40% strongly supporting), 19% were neutral, 18% opposed (11% strongly opposing).

312 IAC 9-3-2: Creation of the multiple season antlerless deer license

This license will replace the bonus antlerless deer hunting license and allow an individual to take one antlerless deer per license using equipment authorized during the season in which they are hunting.

312 IAC 9-3-2: Creation of a statewide antlerless bag limit

The DNR proposes to create a statewide antlerless bag limit to go along with the current statewide antlered bag limit. This change is being proposed because the current county bonus antlerless quota (CBAQ) system allows individuals to shoot perceived excessive numbers of antlerless deer across multiple counties, if individuals in each county were to take the maximum number of bonus antlerless deer available in each county. The proposed changes to the rules governing deer hunting will allow an individual to still take no more than one antlered deer during the regular deer seasons combined, as is allowed now, but it will also allow them to purchase up to six additional multiple season antlerless deer licenses to take antlerless deer in any of the regular deer seasons (e.g., archery, firearms, and muzzleloader). This is not expected to create a significant change in revenue for the department because there are fewer than 70 individuals who currently take more than seven deer during a regular deer season each year. There are very few, if any, individuals who take the permitted six antlerless deer under the current rules.

Currently, an emergency rule is authorized each year to establish the bonus antlerless deer bag limits per county and other limitations on properties on which a bonus antlerless deer may not be taken. The proposed change would not affect military hunts, deer reduction zones, or other special licenses, so hunters will still be able to harvest additional deer if they desire.

The DNR asked a question about limiting the total number of antlerless deer that each hunter can harvest in Indiana to six antlerless deer in the 2022 Deer Management Survey, and there were 17,195 responses. Of those, 74% supported this to some degree (48% of those strongly supporting), 12% were neutral, and 14% opposed (7% opposing; 7% strongly opposing) this proposal.

312 IAC 9-3-2: Changing to the County Bonus Antlerless Quota to a County Antlerless Bag Limit

The DNR's current bonus antlerless quota (CBAQ) structure is confusing for hunters. Currently, the number of antlerless deer a hunter can harvest in a county includes bag limits for the season types as well as the county bonus antlerless limit. Because there are also individual bag limits for these seasons, hunters often struggle to determine how many antlerless deer they can harvest. Hunters can also make mistakes when purchasing licenses because they may be unaware of the bag limits for the seasons. Therefore, DNR proposes to change the CBAQ to a county antlerless bag limit that will provide a single number for how many antlerless deer can be harvested in a county, regardless of the equipment used to harvest the antlerless deer.

The DNR also asked a question about removing the "bonus" deer designation from rules in the 2022 Deer Management Survey, and there were 16,691 responses to this question. Of those, 64% of hunters supported this rule proposal (37% strongly supporting; 27% somewhat supporting), 24% were neutral, and 12% were opposed (6% opposing; 6% strongly opposing).

312 IAC 9-3-2: Prohibit hunters from harvesting antlerless deer on certain DNR properties with a firearm

Currently, hunters cannot use a bonus antlerless license or take a bonus antlerless deer on Fish & Wildlife areas as well as a few other properties (Mississinewa Lake, Salamonie Lake, Patoka Lake), which are authorized by emergency rule each year when the CBAQ is set. Because of HEA 1623, the DNR can no longer have an emergency rule to establish these county quotas or property limits. In a survey of deer hunters in 2022, hunters were asked their opinion of not allowing antlerless deer to be taken on Fish & Wildlife areas (FWAs) with a firearm. There were 16,478 responses to this question with 54% of hunters supporting this rule proposal (33% strongly supporting; 21% somewhat supporting), 29% were neutral, and 17% opposed this rule (9% strongly opposing; 8% somewhat opposing).

312 IAC 9-3-2: Replacement deer for deer harvested and determined to be unfit for consumption

The DNR proposes a rule that would allow a replacement deer to be taken if a deer that was legally

taken and has meat that is unfit for human consumption under 312 IAC 9-3-2(bb). An individual taking a deer that is unfit for human consumption occurs often during deer season, with a peak during firearms season. Currently, department staff examines photographs, evaluates the meat condition based on observations by biologists and conservation officers, or both. A decision is made whether to allow a person to take another deer if the staff determines the deer is inedible based on department guidelines. If an individual is concerned with the condition of an antlerless deer, and there is evidence of systemic infection, department staff allow the individual to take another antlerless deer on the current license used to hunt a deer. The only issue determined by the department is the usability of the meat to the individual. However, when an individual calls regarding the condition of a buck (antlered deer), there is often an issue regarding the desirability of the antlers to that individual. Department staff have found that some individuals who are dissatisfied with the antlers on their buck will call asking to be able to take another buck on their license if they can find something wrong with the carcass. Additionally, some individuals see this as another opportunity to take a second buck if the meat of the first buck is not edible and believe they will get two sets of antlers for the year. If department staff determines that a buck is unfit for human consumption, they are required to make arrangements to collect the antlers. The process is lengthened because the individual must decide if they are willing to live with the antlers, but not have meat from the deer. The willingness of an individual to give up antlers often helps department staff to determine whether the individual is trying to get another opportunity to shoot a second buck or whether the individual has an honest concern about the condition of the meat. Currently, department staff does not allow individuals who have shot a deer that is unfit for human consumption to keep the antlers. The change would allow DNR staff to offer to replace the meat with an antlerless deer privilege, making the response more uniform for the individual. This approach would replace the meat portion of the deer without needing to confiscate the antlers on the buck that was taken. If the department suspects a disease, such as bovine tuberculosis, department staff confiscate the whole deer and allow the individual to take another deer on that same license. This process is different from that described previously and will remain in place for a deer the DNR confiscates for disease reasons.

312 IAC 9-3-3: Allowing .40 caliber muzzleloaders during muzzleloader season

The DNR proposes allowing the use of a .40 caliber muzzleloader based on requests from hunters for this change. The DNR examined the muzzle velocity and energy and found than an example of a .40 caliber muzzleloader (CVA Paramount HTR) loaded to the recommended powder specifications with a 225-grain bullet is capable of a muzzle velocity of greater than 2,600 ft. per second with an energy of greater than 3,500 ft. lbs. At 200 yards, the velocity is still greater than 2,200 ft. per second with approximately 2,300 ft. lbs. of kinetic energy remaining. This is more than enough velocity and energy to kill a deer effectively at more than 200 yards with an expanding bullet.

312 IAC 9-3-3: Clarifying two pistol calibers for deer hunting

The DNR proposes to change the language in 312 IAC 9-3-3 to correct the terminology for a .25-20 Winchester and a .32-20 Winchester. This ammunition is currently allowed, but the terms need to accurately reflect the names of the cartridges used by the manufacturers.

312 IAC 9-3-3: Changing the dates for tree stands on public land in Deer Reduction Zones

The current rule that governs when tree stands can be placed and removed on public land does not account for areas where the deer season starts earlier and ends later on public land that is contained within a Deer Reduction Zone. Therefore, the proposed rule change is to allow portable tree stands and ground blinds to be placed on DNR properties between noon on Sept. 1 and Feb. 8. Allowing an individual to set up a stand on Sept. 1 gives the individual time to set up the deer stand prior to the start of the reduction zone season on Sept. 15 and allows the individual to leave it in place on the property until after the season ends Jan. 31. Therefore, these additional dates are proposed to be added in subsection (g) for properties that are in a Deer Reduction Zone.

312 IAC 9-3-3: Allow hunters to retrieve deer using thermal or infrared detectors

For the past several years, hunters have asked if DNR would allow the use of thermal and infrared detectors to locate and retrieve dead deer. DNR examined this issue and found the current language is inconsistent in that it is the only state law or rule that places a

prohibition on equipment or methods used to retrieve a dead deer. 312 IAC 9-3-3 allows methods such as dogs and horses to be used to track or trail a dead deer. This is also consistent with IC 14-22-6-16, which prohibits the use of unmanned aerial vehicles to aid in hunting but allows their use to retrieve a dead wild animal. Therefore, DNR proposes to change this rule to allow the use of thermal or infrared detectors to retrieve dead deer (but not for use when hunting deer).

312 IAC 9-3-4: Allow youth hunters to take no more than one deer on specific public land

Currently, youth hunters are limited to taking only one antlerless deer on certain department properties during the youth deer season. This rule language has been established by emergency rule in recent years, but HEA 1623 prohibits the use of emergency rules for this purpose, and the DNR proposes to add this to the permanent rule language.

312 IAC 9-3-4: Removal of the 'A' designation for County Bonus Antlerless Quotas

The 'A' designation was historically used in counties to limit the harvest of bonus antlerless deer to the last half of firearms season. Recent deer population data has shown this is not necessary, especially with the switch from the CBAQ system to using a total antlerless bag limit for each county. All counties are proposed to have a normal antlerless bag limit of at least one deer, and this is not expected to change in the near future.

312 IAC 9-3-4: Adding the Deer Reduction Zones to rule language

Deer Reduction Zones (DRZs) target areas that have high deer populations and high human density or use, resulting in concerns about deer-vehicle collisions and personal property damage. A DRZ has traditionally been established by an emergency rule to allow for changes as needed annually, but because of HEA 1623-2023, the DNR may no longer use emergency rules for this purpose. The DNR designates an area as a DRZ to manage deer conflicts through sport hunting. A DRZ provides individuals with additional opportunities to take a deer in that area. The goal is to reduce conflict between deer and humans, not to eliminate the deer population. Incorporating or increasing hunting helps manage deer populations and increases deer wariness of humans, which can also reduce conflicts.

The smallest deer management unit in the state has traditionally been the county; however, a DRZ allows the department to target areas within a county for management. This should allow a deer population in one part of a county to remain stable or increase while decreasing populations in another part of the same county. The approach coincides with the DNR's current deer management plan to strategically manage the state's deer herds. Therefore, in some areas of the state, there should be a larger deer population, while in others the population should be maintained or reduced. A DRZ allows managers to target such areas without reducing deer populations throughout an entire county.

Researchers identified potential areas with high conflict between humans and deer, high deer use by mapping areas with high human density, or high rates of deer-vehicle collisions. Conflicts may include reports of damage from deer by landowners, requests for deer damage permits, requests by community leaders, or calls for assistance through DNR's district and urban biologists. The designation process results in two types of DRZs, traditional and corridors. Traditional DRZs are established near or around urban areas and encompass a community. DRZ corridors are created along portions of major roadways to specifically address high rates of deer-vehicle collisions.

The increased allowable antlerless take and lengthened Deer Reduction Zone season means that the individuals who hunt deer can help address problem areas and potentially reduce the need for other measures, such as the use of deer damage permits. DRZs can increase deer-hunting opportunities in urban environments and help alleviate conflicts between humans and deer. The Indiana DNR deer program staff recently conducted an analysis to determine the effectiveness of DRZs in reducing deer- vehicle collisions. Department staff found a decrease of deer-vehicle collisions within DRZs of approximately 15% after allowing individuals to take additional deer within DRZs. These results demonstrate the effectiveness of using targeted recreational hunting as a management tool to reduce deer-vehicle collisions.

312 IAC 9-3-4: Removing the bag limits for archery and muzzleloader licenses

The DNR proposes a rule change that would remove the season bag limits for deer taken with muzzleloader and archery license. Individuals would be able to take the number of antlerless deer allowed per county within the proposed new statewide antlerless bag limit using archery and muzzleloader licenses. Allowing

an individual to take more than two antlerless deer using archery licenses and more than one antlerless deer on a muzzleloader license would reduce confusion over which license an individual is required to purchase, and how to check in a deer that is taken during a hunt. Much staff time and resources are taken up trying to explain the requirements of a license to an individual and correcting an accidental mistake made when checking in a deer. This change will result in improved individual service, reduced staff time, and increased understanding of the rules without making a change to the harvest.

312 IAC 9-3-2 and 312 IAC 9-3-4: Switching to an Antlerless Bag Limit for each county

Since 2017, county bonus antlerless quotas have been set on an annual basis by emergency rule to allow for changes each year. This is no longer an option under HEA 1623-2023; therefore, the county antlerless bag limits have been added to this rule. These county bag limits are established using the following: information on individual's desires for the deer population to change from the Annual Deer Management Survey; trends in various deer population indices including deer-vehicle collisions, the Archer's Index, changes in effort to take deer, deer damage permits, and others; professional opinions of wildlife biologists and conservation officers; the effects of disease; and the effects of changes on individuals and the deer population. Most recently, the DNR has added data about deer density from the Northeastern, East Central, and Southern Deer Management Units (DMUs) from the Purdue Integrated Deer Management Project. Because the county antlerless bag limit will now be a combination of the various equipment bag limits and the county bonus bag limit, DNR staff used the following method to create the proposed antlerless bag limit for inclusion in the rule:

- Because prior county bonus antlerless quota decisions were based on the data gathered each year, the DNR used this cumulative data set from prior years (county data available online) for its assessment.
- Department staff selected "normal" years (i.e., not a COVID year and not an epizootic hemorrhagic disease [EHD] recovery year). Most often, data from 2022 was selected unless a county was still in a recovery period from EHD. In those cases, 2018 was selected as the next best alternative.
- Department staff examined the number of affected individuals and the number of deer that would not be taken at a proposed county bag limit (or the increase in the take at a proposed county bag limit).
- Department staff selected a bag limit under which fewer than 10 hunters would be affected by this new bag limit, and a number with which individuals were using the available bag limit. For example, Steuben County could have a higher bag limit based on population data, but staff have observed from experience that individuals will not use additional antlerless deer bag limits even when it is available. The DNR has seen instances in the past in which individuals will decrease their personal take if they believe the county bag limit is too high. Therefore, the DNR will keep a designated a county bag limit of three for Steuben rather than a four or five, even though the deer population would support a higher bag limit.
- Minor changes were made to try to keep the counties similar within Deer Management Units.
- Currently, Franklin County and Fayette County have a low county bag limit to offset the effects of EHD. The department proposes a county bag limit of one be set beginning in 2024, and at two beginning in 2025. The department will continue to review the data for these counties over time and make changes to get them to their target county bag limit of three for Fayette County and four for Franklin County.

312 IAC 9-3-4 (h): Removing the Late Antlerless Firearms Season

Indiana currently has a firearms season for antlerless deer from Dec. 26 through the first Sunday in January of the next year in counties with a bonus antlerless quota of four or more deer. This rule was initially proposed to try to significantly increase the harvest of antlerless deer, but research on that season found that hunters harvested antlerless deer later in the season in counties where that season is in place. A survey of deer hunters in 2021 found that only 24% of hunters used the season in the previous year, and 38% of hunters reported hunting that season in the previous five-year period (see the 2020 Deer Report). Asked what the general level of opposition or support was for that season, the DNR found that 43% of hunters were supportive to some degree, and 27% were opposed to some degree. Therefore, because of the split interest by hunters for this season, the low use by hunters, and its ineffectiveness at changing the deer harvest, the DNR proposes to remove this season.

Chapter 3.
2022-2023 DEER HUNTING SEASON

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Errors in Reporting

The online check-in system, CheckIN Game, was started in 2012 as an option for hunters and was made the primary game-checking system in 2015. Hunters who check in their game online occasionally make errors in reporting their harvest. Errors include checking in deer with the wrong sex indicated, incorrect licenses, or multiple entries of the same deer. Indiana DNR is constantly working throughout deer season to correct these errors so that harvest numbers are as accurate as possible. In many cases, this involves calling or emailing hunters to determine what type of error has been made before a correction can be issued.

For this reason, the data in this document should be considered to have a certain amount of reporting error. Hunters or others who use these data should expect that the numbers reported in future Indiana White-tailed Deer Reports may change slightly based on corrections of errors. This is also true for the Deer Counter on the DNR Deer webpage (deer.dnr.IN.gov). Some hunters have observed the reported total harvest decreasing as the corrections to the data were made and have contacted the DNR to ask why.

Two error rates were calculated for this issue: an unreconciled error rate and a total error rate, which includes both reconciled errors and unreconciled errors (Table 3-1). Typically, the numbers reported in this document will only fluctuate by the unreconciled error rate, as the reconciled errors have already been voided and are not included in the data. However, occasionally a statistic might have been calculated without removing the voided transactions. Because error rates are relatively low, they have no effect on management decisions.

Harvest totals for the 2022 deer hunting season are current as of July 3, 2022. Additionally, harvest totals for the 2016-2021 seasons have been updated since previously reported. In this report, the updated totals are used in analyses and comparisons between years.

Harvest by Season

Harvest summary reports prior to 2016 did not include harvest numbers from Indiana State Park Deer Management Hunts because those deer were checked in at the properties and reported separately by the Division of State Parks. Now that the deer check-in process is online for all hunters and hunts, deer harvested during these hunts in state parks are included in the check-in database and can be reported with the statewide totals.

Shed bucks are checked in as antlerless deer in the CheckIN Game system and do not count against a hunter's buck limit. However, for the purpose of analyzing the harvest data, antlered bucks and shed bucks are grouped as antlered deer, while does and button bucks are grouped as antlerless deer, unless specified otherwise.

A total of 121,812 harvested deer were reported in Indiana during the 2022 season (Figures 3-1 and 3-2). This harvest was 8.3% higher than the 112,481 deer taken during the 2021 season. The antlered deer harvest of 58,547 was 8.9% higher than the 53,751 reported in 2021. The antlerless harvest of 63,265 was 7.7% higher than the 58,730 harvested in 2021. In 2022, the reported harvest for total deer ranks 14th highest all-time, while the total antlerless deer harvest ranks as the 19th highest all-time in Indiana history. The antlered harvest ranks the highest since reporting began in 1951. Approximately 4.35 million deer have been reported harvested during the past 72 deer-hunting seasons in Indiana.

The hunting season began with the Deer Reduction Zone on Sept. 15, followed by a youth-only weekend (Sept. 24-25). The number of deer harvested with archery equipment during the Deer Reduction Zone season was incorporated into Archery season totals, while deer harvested with firearms during Deer Reduction Zone season were incorporated into Firearms season totals.

Table 3-1. Error rates of hunter-reported deer harvests, 2016-2022. Total error includes reconciled and unreconciled errors. Reconciled errors have already been removed from the dataset.

	2016-2017	2017-2018	2018-2019	2019-2020	2020-2021	2021-2022	2022-2023
% total error	0.67	1.3	0.57	0.23	0.26	0.23	0.26
% unreconciled error	0.2	0.17	0.13	0.13	0.16	0.13	0.15

Youth season was created in 2006 and allowed youth 15 years old and younger to harvest one antlerless deer. It was changed in 2009 to include all youth 17 years old and younger. Youth hunters may harvest an antlered deer, which counts toward the statewide bag limit of one antlered deer and the number of antlerless deer determined by bonus antlerless quotas in each county. A total of 2,719 deer were reported as harvested in 2022 during this season, a decrease of 1.2% from the 2,751 deer harvested in 2021. This season resulted in 2.2% of the total harvest (Table 3-2). Approximately 39.8% of the Youth season harvest was antlered bucks (Figure 3-3).

There were 31,432 deer harvested during Archery season, which represented 25.8% of the overall harvest and was higher (1.1%) than the 31,082 deer harvested in 2021 (Table 3-2). Antlered deer (n=12,776) made up 40.6% of the total Archery season harvest (Figure 3-3).

The Firearms season harvest of 79,456 was 12.2% higher than the 70,837 deer harvested in 2021 and represented 65.2% of the total harvest (Table 3-2). The antlerless harvest of 37,041 was 3.0% higher than the 2021 antlerless harvest. The 2022 antlered harvest of 42,415 was 16.0% higher than the number of antlered deer harvested in 2021. The antlered harvest exceeded the antlerless harvest on the first seven days of the season. The antlerless deer harvest outnumbered antlered deer harvested during the other nine days of the season (Table 3-3). Opening weekend contributed 26.2% of the statewide total harvest for all 2022 seasons, compared to 22.8% in 2021. Antlered deer accounted for 53.4% of the total Firearms season harvest. (Figure 3-3).

At 8,205 deer, the Muzzleloader season harvest accounted for 6.74% of the total 2022 harvest, a 5.0% increase from the Muzzleloader season harvest of 2021 (Table 3-2). As in years past, a large percentage of the deer harvested during Muzzleloader season were antlerless (72.3%, Figure 3-3).

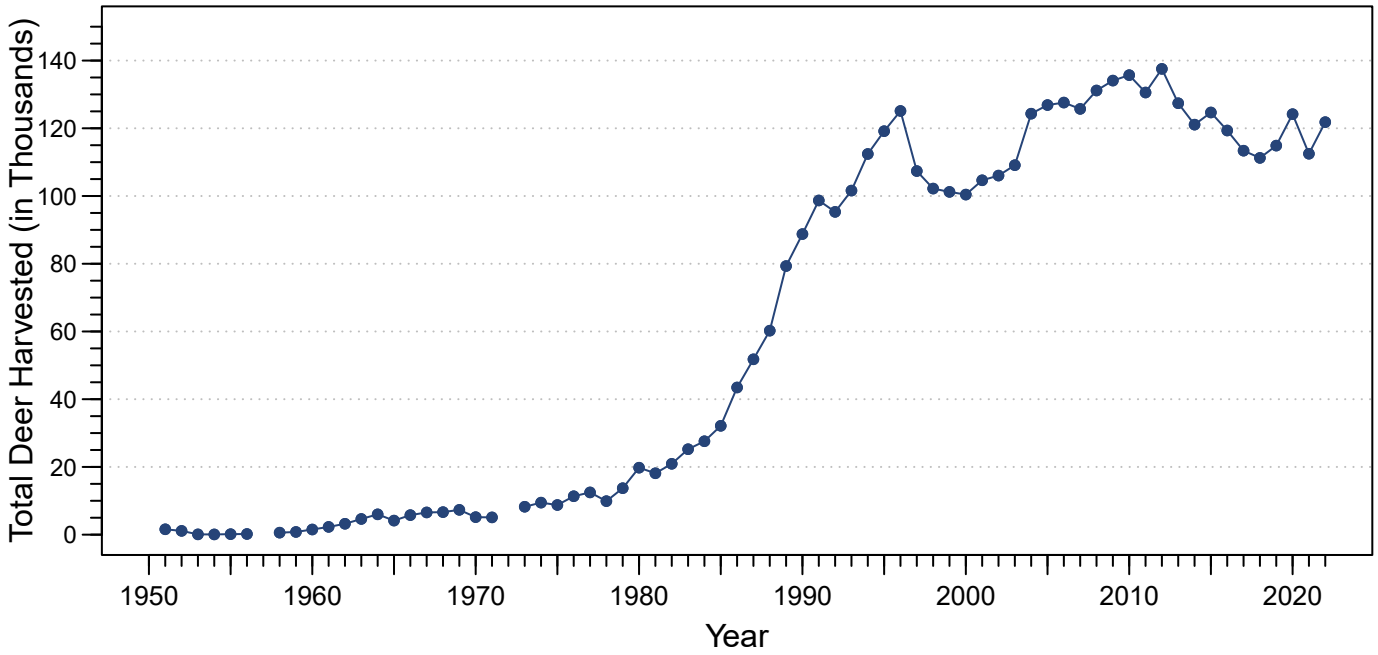

Figure 3-1. The total number of deer harvested in each Indiana deer season, 1951-2022. Totals include deer harvested in State Park Deer Management Hunts, 1993-2022. Reporting error rates: ±0.26 (2022), ±0.23 (2021), ±0.26% (2020), ±0.23% (2019), ±0.57% (2018), ±1.30% (2017), and ±0.67% (2016).

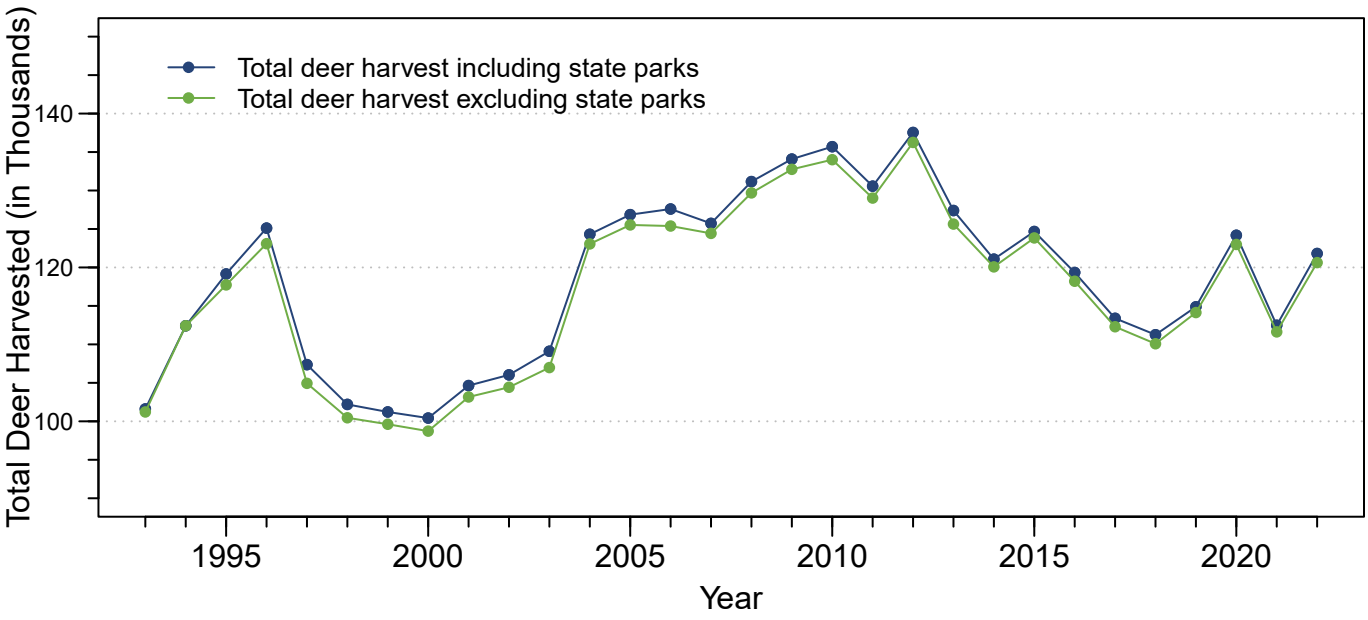

Figure 3-2. A comparison of the total number of deer harvested in each Indiana deer season, including and excluding deer harvested during State Park Deer Management Hunts, 1993–2021. Reporting error rates: ±0.26% (2022), ±0.23% (2021), ±0.26% (2020), ±0.23% (2019), ±0.57% (2018), ±1.3 (2017), ±0.67 (2016).

Table 3-2. Number of deer harvested by season during the 2022 Indiana deer hunting season. Total harvest and percent of total harvest are labeled by each season. Values may not total 100 due to rounding. Reporting error rate: ±0.26% (2022).

Season	Antlered	Antlerless	Total
Youth Deer (24 - 25 Sept)	1,082 (0.9%)	1,637 (1.3%)	2,719 (2.2%)
Archery (1 Oct - 1 Jan)	12,776 (10.5%)	18,656 (15.3%)	31,432 (25.8%)
Firearms (12 - 27 Nov)	42,415 (34.8%)	37,041 (30.4%)	79,456 (65.2%)
Muzzleloader (3 - 18 Dec)	2,274 (1.9%)	5,931 (4.9%)	8,205 (6.7%)
Totals	**58,547 (48.1%)**	**63,265 (51.9%)**	**121,812 (100%)**

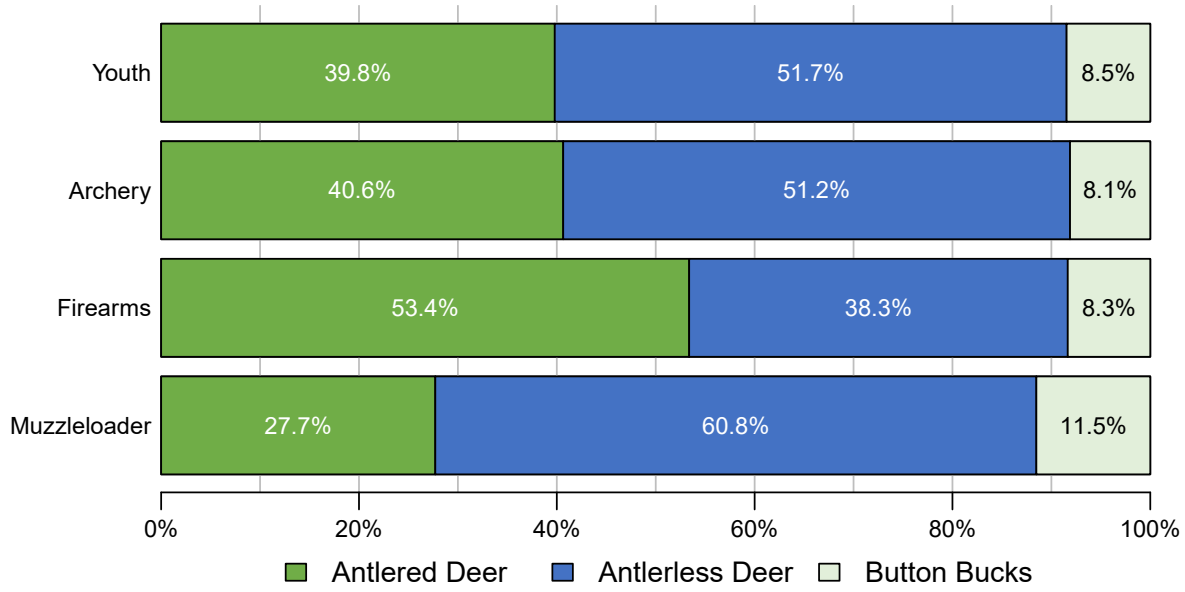

Figure 3-3. Composition of individual season harvests during the 2022 Indiana deer season. Reporting error rates: ±0.26% (2022).

Table 3-3. Antlered and antlerless daily harvest and percent of harvest by season and total harvest from the start of Firearms season through the end of Firearms season, Nov. 12-27. Reporting error rate: ±0.23% (2021).

Date	Day	Antlered Deer	Antlered % of Daily Total	Antlerless Deer	Antlerless % of Daily Total	Total Deer	% of Season Total	% of Total Harvest
12-Nov	Sat	12946	62.9	7634	37.0	20580	26.4	16.9
13-Nov	Sun	7007	62.0	4288	38.0	11295	14.5	9.3
14-Nov	Mon	3226	53.0	2856	47.0	6082	7.8	5.0
15-Nov	Tue	1693	54.0	1440	46.0	3133	4.0	2.6
16-Nov	Wed	1293	55.9	1021	44.1	2314	3.0	1.9
17-Nov	Thu	1374	53.8	1181	46.2	2555	3.3	2.1
18-Nov	Fri	1374	53.1	1216	46.9	2590	3.3	2.1
19-Nov	Sat	2849	48.7	2997	51.3	5846	7.5	4.8
20-Nov	Sun	2017	48.9	2106	51.1	4123	5.3	3.9
21-Nov	Mon	953	45.5	1165	55.0	2118	2.7	1.7
22-Nov	Tue	1056	46.7	1204	53.3	2260	2.9	1.9
23-Nov	Wed	1156	44.5	1443	55.5	2599	3.3	2.1
24-Nov	Thu	1379	44.9	1692	55.1	3071	3.9	2.5
25-Nov	Fri	1461	42.8	1951	57.2	3412	4.4	2.8
26-Nov	Sat	1605	35.9	2860	64.1	4465	5.7	3.7
27-Nov	Sun	610	40.9	883	59.1	1493	1.9	1.2
Total		**41999**		**35937**		**77936**	**100**	**64.0**

Harvest by County

The number of deer harvested in individual counties ranged from 155 in Benton County to 3,235 in Steuben County (Table 3-4). Harvest exceeded 1,000 deer in 62 counties and 2,000 deer in 12 counties. Antlered buck harvest exceeded 1,000 in 12 counties in 2021 compared to 10 in 2021, while antlerless harvest exceeded 1,000 deer in 18 counties, compared to 11 the previous year. Antlerless deer accounted for at least 50% of the total harvest in 60 of the state's 92 counties in 2022. The 10 counties with the highest harvests were, in descending order, Steuben, LaGrange, Noble, Kosciusko, Harrison, Dekalb, Washington, Parke, Putnam, and Lawrence. The 10 counties with the lowest harvests, beginning with the lowest, were Benton, Tipton, Hancock, Rush, Marion, Boone, Howard, Blackford, Union, and Shelby.

Table 3-4. Deer harvest by county during the 2022 Indiana deer hunting season. Reporting error rate: ±0.26% (2022).

County	Antlered	Antlerless	Total
Adams	370	411	781
Allen	914	1080	1994
Bartholomew	451	457	908
Benton	107	48	155
Blackford	235	276	511
Boone	276	224	500
Brown	686	919	1605
Carroll	506	523	1029
Cass	728	667	1395
Clark	673	667	1340
Clay	603	648	1251
Clinton	275	267	542
Crawford	904	866	1770
Daviess	523	675	1198
Dearborn	868	1112	1980
Decatur	266	419	685
Dekalb	1069	1202	2271
Delaware	422	454	876
Dubois	854	1068	1922
Elkhart	829	1077	1906
Fayette	253	312	565
Floyd	317	348	665
Fountain	701	692	1393
Franklin	685	723	1408
Fulton	728	818	1546
Gibson	648	628	1276
Grant	522	540	1062
Greene	1027	1060	2087
Hamilton	243	318	561
Hancock	166	149	315
Harrison	1178	1218	2396
Hendricks	379	323	702
Henry	318	348	666
Howard	262	244	506
Huntington	606	548	1154
Jackson	777	808	1585
Jasper	773	620	1393
Jay	540	633	1173
Jefferson	676	783	1459
Jennings	660	923	1583
Johnson	289	289	578
Knox	515	473	988
Kosciusko	1236	1393	2629
Lagrange	1188	1643	2831
Lake	584	842	1426
Laporte	963	1031	1994

County	Antlered	Antlerless	Total
Lawrence	1029	1111	2140
Madison	293	346	639
Marion	167	311	478
Marshall	1043	1087	2130
Martin	805	865	1670
Miami	719	879	1598
Monroe	688	719	1407
Montgomery	565	536	1101
Morgan	692	767	1459
Newton	484	479	963
Noble	1287	1498	2785
Ohio	258	302	560
Orange	954	936	1890
Owen	843	825	1668
Parke	1065	1157	2222
Perry	805	797	1602
Pike	820	867	1687
Porter	634	891	1525
Posey	614	677	1291
Pulaski	945	1049	1994
Putnam	1174	1006	2180
Randolph	378	387	765
Ripley	613	752	1365
Rush	176	255	431
Scott	338	406	744
Shelby	269	253	522
Spencer	615	673	1288
St. joseph	652	774	1426
Starke	759	787	1546
Steuben	1539	1696	3235
Sullivan	913	831	1744
Switzerland	720	786	1506
Tippecanoe	553	615	1168
Tipton	103	78	181
Union	219	295	514
Vanderburgh	288	456	744
Vermillion	588	527	1115
Vigo	810	689	1499
Wabash	838	794	1632
Warren	629	556	1185
Warrick	707	676	1383
Washington	1091	1136	2227
Wayne	485	472	957
Wells	408	400	808
White	531	526	1057
Whitley	648	573	1221

Harvest per Hunter

The majority of hunters (70.8%, n=61,808) in Indiana harvested one deer during the 2022 deer season (Table 3-5). Only 0.57% (n=499) of hunters statewide harvested more than four deer in 2022, which is 26% more than the number (n=395) who harvested more than four deer in 2021.

Table 3-5. Number of deer harvested, and percentage harvested by individual successful hunters during the 2021 and 2022 Indiana deer seasons. Reporting error rates: ±0.26% (2022) and ±0.23% (2021).

Number of Deer	2021 Hunters	2021 Percent of Total	2022 Hunters	2022 Percent of Total
1	60487	73.1	61808	71.0
2	16531	20.0	18618	21.3
3	4469	5.4	5319	6.1
4	825	1.0	1003	1.1
5	252	0.3	321	0.4
6	85	0.1	111	0.1
7	34	0.04	36	0.04
8	13	0.02	20	0.02
9	6	0.01	6	0.01
10	2	0.002	1	0.001
11	2	0.002	1	0.001
12	0	0	0	0
13	0	0	1	0.001
14	0	0	2	0.002
15	0	0	0	0
16	0	0	0	0
17	1	0.001	0	0
18	0	0	0	0

Harvest by Equipment Type

Six types of equipment were legal for hunting deer during 2022 (Figure 3-4): archery (traditional and compound bows), crossbows, handguns, muzzleloaders, rifles, and shotguns. Harvest increased relative to 2021 for equipment types including bow and arrow (0.8%), crossbow (1.4%), handgun (10.9%), muzzleloader (4.4%), rifle (13.9%), and shotgun (4.4%) (Table 3-6). The percent of total harvest relative to 2021 decreased for bow and arrow (-0.9%), crossbow (-1%), muzzleloader (-0.4%), and shotgun (-0.4%). It stayed the same for handgun (0.01%), and it increased for rifle (2.6%).

Harvest Age and Sex Structure

The age and sex structure of the 2022 deer harvest was 48.1% adult males, 43.4% adult females, and 8.5% male fawns (button bucks) (Table 3-7). Antlerless deer (does and button bucks) represent the highest proportion of the total deer harvest at 51.9% but dropped from an all-time high of 66% in 2012.

During opening weekend of Firearms season, DNR biologists have traditionally staffed check stations throughout the state to collect age-structure data and tissue samples for disease testing. Before the 2012 deer season, all deer had to be brought to a check station; therefore, age data collected during the opening weekend of Firearms season provided an unbiased method for determining the age structure of the harvest. All hunters had to check in deer online during the 2022 season; therefore, age estimates of adult deer, such as

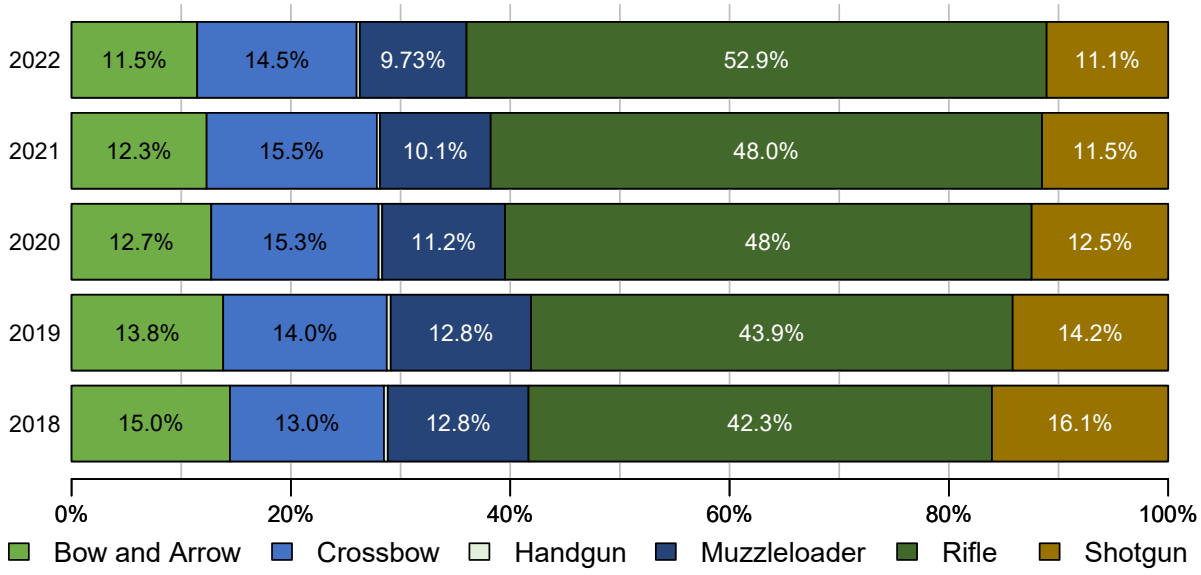

Figure 3-4. Percent harvest by equipment type, 2018-2022. Reporting error rates: ±0.26% (2022), ±0.23% (2021), ±0.26% (2020), ±0.23% (2019), and ±0.57% (2018), ±1.3% (2017).

Table 3-6. Number of deer harvested by type of legal hunting equipment across seasons, 2018-2022. Values within this table do not exactly equal those tallied by season (Figure 3-4) because multiple equipment types can be used during the Firearms season. Reporting error rates: ±0.26% (2022), ±0.23% (2021), ±0.26% (2020), ±0.23% (2019), and ±0.57% (2018).

Equipment	2018	2019	2020	2021	2022
Bow and Arrow	16,069 (14.4%)	15,884 (13.8%)	15,819 (12.7%)	13,851 (12.3%)	13,957 (11.5%)
Crossbow	15,623 (14.0%)	17,136 (14.9%)	18,950 (15.3%)	17,462 (15.5%)	17,706 (14.5%)
Handgun	388 (0.3%)	415 (0.4%)	412 (0.3%)	322 (0.3%)	357 (0.3%)
Muzzleloader	14,279 (12.8%)	14,706 (12.8%)	13,906 (11.2%)	11,354 (10.1%)	11,853 (9.7%)
Rifle	47,015 (42.3%)	50,449 (43.9%)	59,630 (48.0%)	56,557 (50.3%)	64,437 (52.9%)
Shotgun	17,878 (16.1%)	16,292 (14.2%)	15,463 (12.5%)	12,935 (11.5%)	13,502 (11.1%)
Total	**111,252**	**114,882**	**124,180**	**112,481**	**121,812**

the proportion of yearling bucks in the harvest, became unreliable. Evaluation of the online check-in data for the opening weekend of Firearms season historically showed that hunters were more likely to report antlered bucks at check stations than online but were more likely to report button bucks online than at check stations, thus biasing estimates toward an older age structure than the actual harvest. Therefore, age class estimates of adult deer are unavailable until a valid, scientific method for correcting this bias is obtained.

Table 3-7. Number of deer harvested, and percentage of total harvested by age and sex during the Indiana deer seasons from 1987-2022. Reporting error rate: ±0.26% (2022).

Year	Adult Males (%)	Adult Females (%)	Fawn Males (%)	Fawn Females (%)	Total
1987	29,530 (57%)	11,139 (21%)	6,164 (12%)	4,945 (10%)	51,778
1988	34,358 (57%)	13,170 (22%)	7,050 (12%)	5,656 (10%)	60,234
1989	40,503 (51%)	19,464 (24%)	10,737 (14%)	8,614 (11%)	79,318
1990	43,080 (48%)	23,680 (27%)	12,373 (14%)	9,630 (11%)	88,763
1991	41,593 (42%)	31,211 (32%)	14,626 (15%)	11,253 (11%)	98,683
1992	43,508 (46%)	25,387 (27%)	14,262 (15%)	12,157 (13%)	95,314
1993	44,424 (44%)	27,704 (27%)	14,751 (15%)	14,335 (14%)	101,214
1994	50,812 (45%)	32,466 (29%)	15,487 (14%)	13,651 (12%)	112,416
1995	47,098 (40%)	40,946 (35%)	16,398 (14%)	13,287 (11%)	117,729
1996	47,315 (38%)	39,913 (32%)	17,307 (14%)	18,551 (15%)	123,086
1997	42,537 (41%)	35,163 (34%)	14,039 (13%)	13,198 (12%)	104,937
1998	44,955 (45%)	30,711 (31%)	12,257 (12%)	12,538 (12%)	100,461
1999	46,371 (46%)	30,474 (31%)	11,645 (12%)	11,129 (11%)	99,618
2000	44,621 (45%)	31,986 (32%)	11,072 (11%)	11,046 (11%)	98,725
2001	48,357 (47%)	31,806 (31%)	11,230 (11%)	11,770 (11%)	103,163
2002	47,177 (45%)	35,357 (34%)	11,291 (11%)	10,603 (10%)	104,428
2003	49,533 (46%)	36,303 (34%)	10,262 (10%)	10,887 (10%)	106,986
2004	54,743 (44%)	41,749 (34%)	12,501 (10%)	14,065 (11%)	123,058
2005	52,488 (42%)	44,286 (35%)	13,030 (10%)	15,722 (13%)	125,526
2006	49,097 (39%)	45,257 (36%)	13,688 (11%)	17,339 (14%)	125,381
2007	49,375 (40%)	44,514 (36%)	13,313 (11%)	17,225 (14%)	124,427
2008	50,845 (39%)	46,666 (36%)	13,083 (11%)	19,154 (15%)	129,748
2009	52,878 (40%)	48,222 (36%)	13,040 (10%)	18,291 (14%)	132,431
2010	53,007 (40%)	49,911 (37%)	13,367 (10%)	17,719 (13%)	134,004
2011	50,717 (39%)	45,931 (36%)	13,058 (10%)	19,312 (15%)	129,018
2012	45,936 (34%)	54,983 (40%)	15,911 (12%)	19,418 (14%)	136,248
2013	46,240 (37%)	46,229 (37%)	14,100 (11%)	19,066 (15%)	125,635
2014	45,686 (38%)	46,760 (39%)	12,694 (11%)	14,933 (12%)	120,073
2015	51,075 (41%)	60,828 (49%)	12,765 (10%)	0	124,668
2016	51,646 (43%)	55,922 (47%)	11,774 (10%)	0	119,342
2017	44,884 (40%)	56,335 (50%)	12,167 (11%)	0	113,386
2018	47,256 (42%)	52,513 (47%)	11,483 (10%)	0	111,252
2019	51,646 (45%)	52,128 (45%)	11,108 (10%)	0	114,882
2020	55,446 (45%)	57,073 (46%)	11,661 (9%)	0	124,180
2021	53,751 (48%)	48,789 (43%)	9,941 (9%)	0	112,481
2022	58,547 (48%)	52,911 (43%)	10,354 (8%)	0	121,812

Public Lands Harvest

A total of 9,549 (an 18.4% increase from 2021) deer were harvested on public lands in Indiana during the 2022-2023 season, which resulted in 7.8% of the total deer harvest. Public lands included state Fish & Wildlife areas (FWAs), state nature preserves, state parks, state forests, national wildlife refuges, national forests, conservation areas, and military lands (Tables 3-8, 3-9, 3-10, and 3-11). Approximately 19% of the deer harvested on public lands were taken from across 25 FWAs. Pigeon River FWA had the largest harvest, 382 deer. Together, state park (12.4%) and state forest (12.6%) lands contributed to 25.4% of the public lands harvest. Hoosier National Forest accounted for 12.1% of the public lands harvest, while Crane Naval Support Activity (NSA) accounted for 2.8%. A total of 1,986 (20.8%) deer were harvested on public lands, but the specific property was not reported. The percent of antlered (46.7%) and antlerless (53.2 %) deer harvested on public lands was similar to the composition of the total harvest (48.1% antlered, 51.8% antlerless).

Property	Antlered - Buck	Antlerless - Button Buck	Antlerless - Doe	Total
FISH & WILDLIFE AREA	890	195	721	1806
Atterbury	36	5	12	53
Blue Grass	13	0	7	20
Chinook	9	1	2	12
Crosley	11	2	17	30
Deer Creek	9	4	13	26
Fairbanks Landing	40	8	27	75
Glendale	28	12	29	69
Goose Pond	18	1	11	30
Hillenbrand	17	7	15	39
Hovey Lake	27	8	22	57
J.E. Roush Lake	56	11	69	136
Jasper Pulaski	65	7	36	108
Kankakee	17	4	6	27
Kankakee Sands (TNC)	23	0	14	37
Kingsbury	60	18	41	119
Lasalle	30	9	38	77
Pigeon River	160	51	171	382
Splinter Ridge	14	5	11	30
Stucker Fork	3	0	1	4
Sugar Ridge	40	6	24	70
Tri-County	39	8	34	81
Wabashiki	32	2	7	41
Wilbur Wright	6	3	5	14
Willow Slough	72	12	56	140
Winamac	65	11	53	129
CONSERVATION AREA	28	2	5	35
Sugar Creek	5	1	3	9
Wabash River	23	1	2	26
GAMEBIRD HABITAT AREA	7	3	3	13
Hufford	3	3	3	9
Reynolds Creek	4	0	0	4
PUBLIC FISHING AREA	3	0	0	3
Green Valley	3	0	0	3
WETLAND CONSERVATION AREA	157	42	99	298
Aukiki	2	4	2	8
Austin Bottoms	10	4	3	17
Badal	8	2	4	14
Bittern Bog	0	0	2	2
Cedar Swamp	36	2	14	52
Dick Blythe	4	2	0	6
Durham Lake	8	6	6	20
Fish Lake	4	0	4	8
Galena	4	2	0	6
Koontz Lake	2	0	2	4
Lake Maxinkuckee	0	0	2	2
Little Pigeon Creek	16	0	8	24
Lost Hill	2	2	2	6
Mallard Roost	4	8	4	16
Manitou Lake Islands	16	0	6	22
Marsh Lake	12	0	20	32
Maxincukee	2	0	4	6
Menominee	12	4	4	20
Province Pond	0	0	2	2
Rome City	0	0	2	2
Swamper Bend	2	0	2	4
Tern Bar Slough	5	4	6	15
Turkey Creek	2	0	0	2
Whirledge	6	2	0	8
WILDLIFE MANAGEMENT AREA	25	11	21	57
Ashcraft	2	2	0	4
Elk Creek	1	0	0	1
Grouse Ridge	0	0	1	1
Hindostan	1	0	0	1
Howat 80	2	0	0	2
Huston Ditch	3	2	3	8
Modoc	0	1	0	1
Morgan Bluff	3	0	4	7
Pisgah Marsh	0	1	0	1
Randolph County	7	3	9	19
Westerkamp	1	0	0	1
White River Bend	5	2	4	11
RESOURCE AREA	2	1	0	3
Deniston	2	1	0	3

Table 3-8. Deer harvested during the 2022-2023 deer hunting season on public lands managed by Indiana DNR Division of Fish & Wildlife. Reporting error rate: ±0.26% (2022).

Table 3-9. Deer harvested during the 2022-2023 deer hunting season on public lands managed by Indiana DNR Division of State Parks. Deer harvested in state parks were taken during special state park deer management hunts. Reporting error rate: ±0.26% (2022).

Property	Antlered	Button Buck	Antlerless	Total
STATE PARKS	453	168	564	1185
Brown County	59	22	78	159
Chain O'Lakes	35	10	42	87
Charlestown	45	3	25	73
Fort Harrison	17	5	14	36
Harmonie	42	14	44	100
Lincoln	21	6	33	60
McCormick's Creek	13	2	15	30
Ouabache	18	19	39	76
Pokagon	14	3	14	31
Potato Creek	37	21	45	103
Prophetstown	11	5	14	30
Shades	44	9	48	101
Shakamak	8	5	18	31
Summit Lake	13	8	15	36
Tippecanoe River	65	26	94	185
Whitewater Memorial	11	10	26	47
NATURAL AREA	10	0	11	21
Cave River Valley	10	0	11	21
STATE RECREATION AREA	49	14	40	103
Deam Lake	8	1	1	10
Interlake	18	4	16	38
Lieber (Cagles Mill Lake)	17	6	10	33
Raccoon Lake	4	1	7	12
Starve Hollow	2	1	5	8
Trine	0	1	1	2
STATE RESERVOIRS	375	110	367	852
Brookville Lake	54	32	90	176
Hardy Lake	9	2	6	17
Mississinewa Lake	119	23	92	234
Monroe Lake	40	22	47	109
Patoka Lake	94	21	70	185
Salamonie Lake	59	10	62	131

Table 3-10. Deer harvested during the 2022-2023 deer hunting season on public lands managed by Indiana DNR divisions of Forestry and Nature Preserves. Reporting error rate: ±0.26% (2022).

Property	Antlered	Button Buck	Antlerless	Total
STATE FORESTS	579	118	508	1205
Clark	59	11	47	117
Ferdinand	15	4	14	33
Frances Slocum	8	0	5	13
Greene-Sullivan	26	7	19	52
Harrison-Crawford	113	16	98	227
Jackson-Washington	74	10	60	144
Martin	45	10	55	110
Morgan-Monroe	95	22	66	183
Owen-Putnam	29	6	19	54
Pike	24	5	23	52
Salamonie River	10	2	14	26
Selmier	4	3	3	10
Yellowwood	77	22	85	184
NATURE PRE-SERVES	25	5	13	43
Beaver Lake	4	0	0	4
Bob Kern	1	2	3	6
Conrad Savanna	11	0	5	16
Judy Burton	0	1	0	1
Section Six Southern Flatwoods	6	2	5	13
Wabash Lowlands	3	0	0	3

Table 3-11. Deer harvested during the 2022-2023 deer hunting season on public lands managed by federal agencies. Special draw hunts were held on the military lands and national wildlife refuge properties. Reporting error rate: ±0.26% (2022).

Property	Antlered	Button Buck	Antlerless	Total
MILITARY LANDS	223	25	195	443
Atterbury JMTC	68	19	84	171
Crane NSA	155	6	111	272
NATIONAL FORESTS	602	94	460	1156
Hooiser	602	94	460	1156
NATIONAL WILDLIFE REFUGE	225	54	192	471
Big Oaks	168	39	140	347
Muscatatuck	15	6	18	39
Patoka River	42	9	34	85

Deer Reduction Zones Harvest

Indiana Deer Reduction Zones (DRZs) are designated to target areas within the state that have high deer populations coupled with high human density, where the cultural carrying capacity has been exceeded due to concerns over local ecology, deer-vehicle collisions, or the amount of damage to personal property. DRZs aim to reduce deer-human conflict in these areas rather than to eliminate the deer population. Hunters may harvest up to 10 deer in the DRZs, 10 antlerless deer or nine antlerless deer, and one antlered deer after first harvesting an antlerless deer (i.e., earn-a-buck). An interactive map of the current DRZs along with information and a video about how DRZs are developed can be found at wildlife.IN.gov/wildlife-resources/animals/white-tailed-deer/deer-reduction-zones/.

Approximately 5,095 deer were harvested in DRZs in 2022 (Table 3-12), an 8.5% increase from 2021. These deer were harvested within a DRZ county using a valid license type for DRZs (DRZ license, lifetime license, youth license, or landowner or military exemptions) and were marked that they applied to the "zone bag limit" in the CheckIN Game system. Deer harvested on any other license type within the boundaries of a DRZ counted toward the statewide bag limit.

In 2022, antlerless deer made up 81.1% of the DRZ harvest. The percentage of the statewide antlerless harvest that was taken in a DRZ stayed stable in 2022 (4.2%) compared to 2021. A total of 958 antlered deer were taken in DRZs in 2022, which accounted for 2.1% of the statewide antlered harvest. Deer taken within a DRZ accounted for between 3.2% and 64.2% of each DRZ county's total harvest (Table 3-13).

Table 3-12. Number of antlered, antlerless, and total deer harvested within Deer Reduction Zones in 2020, 2021, and 2022. Reporting error rates: ±0.26% (2022), ±0.23% (2021), ±0.26% (2020), and ±0.23% (2019).

County	2020 Antlered	2020 Antlerless	2020 Total	2021 Antlered	2021 Antlerless	2021 Total	2022 Antlered	2022 Antlerless	2022 Total
Allen	93	413	506	85	387	472	96	406	502
Boone	7	23	30	4	14	18	5	18	23
Brown	11	71	82	14	73	87	14	97	111
Dearborn	40	155	195	45	171	216	30	153	183
Dekalb	23	94	117	17	72	89	28	84	112
Delaware	14	42	56	8	38	46	13	48	61
Elkhart	21	108	129	20	91	111	26	102	128
Fulton	5	29	34	7	37	44	6	46	52
Hamilton	41	135	176	38	137	175	33	149	182
Hendricks	13	49	62	10	43	53	13	56	69
Johnson	5	27	32	3	23	26	4	21	25
Kosciusko	29	180	209	28	171	199	46	200	246
Lagrange	42	179	221	29	153	182	31	169	200
Lake	146	622	768	106	495	601	122	529	651
Laporte	52	211	263	49	201	250	59	220	279
Madison	1	14	15	3	15	18	2	23	25
Marion	55	260	315	60	214	274	65	242	307
Monroe	17	72	89	19	45	64	12	60	72
Morgan	31	125	156	29	147	176	34	124	158
Porter	126	633	759	109	576	685	125	563	688
St Joseph	29	142	171	21	142	163	36	153	189
Steuben	40	248	288	41	203	244	52	234	286
Tippecanoe	15	82	97	8	65	73	20	82	102
Vanderburgh	76	322	398	49	282	331	60	270	330
Wabash	9	51	60	6	34	40	12	40	52
Warrick	18	56	74	14	43	57	14	48	62
Total	**959**	**4343**	**5302**	**822**	**3872**	**4694**	**958**	**4137**	**5095**
Percent Of Statewide Harvest Totals	**1.9**	**6.9**	**4.6**	**1.5**	**5.6**	**3.8**	**1.8**	**7.0**	**4.5**

County	DRZ Harvest	Total County Harvest	% DRZ
Allen	502	1994	25.2
Boone	23	500	4.6
Brown	111	1605	6.9
Dearborn	183	1980	9.2
Dekalb	112	2271	4.9
Delaware	61	876	7.0
Elkhart	128	1906	6.7
Fulton	52	1546	3.4
Hamilton	182	561	32.4
Hendricks	69	702	9.8
Johnson	25	578	4.3
Kosciusko	246	2629	9.4
Lagrange	200	2831	7.1
Lake	651	1426	45.7
Laporte	279	1994	14.0
Madison	25	639	3.9
Marion	307	478	64.2
Monroe	72	1407	5.1
Morgan	158	1459	10.8
Porter	688	1525	45.1
Steuben	286	3235	8.8
Tippecanoe	102	1168	8.7
Vanderburgh	330	744	44.4
Wabash	52	1632	3.2
Warrick	62	1383	4.5

Table 3-13. Proportion of each Deer Reduction Zone (DRZ) county's total deer harvest that was counted as deer harvested in the DRZ in 2022. DRZ deer were defined as deer harvested within a DRZ county using a valid license type (DRZ license, lifetime license, youth license, or landowner or military exemptions) and indicated as counting toward the zone bag limit in the CheckIN Game system. Reporting error rate: ±0.26% (2022).

Harvest by License Status

In 2022, 124,173 individual hunters purchased an annual deer hunting license of some kind, a decrease of 4.6% from 2021. Resident hunters harvested 95.2% of the total deer harvested in Indiana in 2022, while nonresidents harvested 4.8% of the total (Table 3-14). Annual license holders (license types purchased every year) harvested 72.9% of the total deer. Lifetime license holders harvested 15.4%, and landowner-exempt hunters (landowners and lessees who hunted on their own land without a license) harvested 11.7% of deer in 2022. A large proportion of deer were harvested using a deer bundle license (43.2% resident deer bundle, 1.7% nonresident deer bundle).

Deer License Sales

The number of deer licenses sold in 2021 decreased by 4.2% from 2020. The number of privileges (number of deer legally allowed to be harvested, excluding those harvested by youth) was 1.2% less than in 2020. Each deer license bundle included three deer privileges.

Table 3-14. Number of deer harvested by resident and nonresident license types during the 2022 deer hunting season. Reporting error rate: ±0.26% (2022).

License Type	Resident Harvest	Non-Resident Harvest	Total	% Resident Harvest	% Non-Resident Harvest
Bonus Antlerless	3,125	187	3,312	2.57	0.15
Deer Archery	2,030	509	2,539	1.67	0.42
Deer Bundle	52,653	2,029	54,682	43.22	1.67
Deer Crossbow	1,844	339	2,183	1.51	0.28
Deer Firearm	7,141	1,909	9,050	5.86	1.57
Deer Military/Refuge	407	11	418	0.33	0.01
Deer Muzzleloader	498	86	584	0.41	0.07
Deer Reduction Zone	3,065	45	3,110	2.52	0.04
Early State Park Reduction	923	3	926	0.76	0
Landowner Exemption	13,907	277	14,184	11.42	0.23
Late State Park Reduction	192	2	194	0.16	0
Lifetime License	18,479	330	18,809	15.17	0.27
Military Exempt - IC 14-22-11-11	61	6	67	0.05	0
Youth Free Hunt Days	10	0	10	0.01	0
Youth Hunt/Trap	11,634	110	11,744	9.55	0.09
Total	**115,969**	**5,843**	**121,812**	**95.2**	**4.8**

County Bonus Antlerless Quotas and Deer Population Indices

County Bonus Antlerless Quotas 2022-2023. In 2022, Indiana DNR maintained county bonus antlerless quotas (CBAQ) of two or fewer in all counties. Franklin, Fayette, Union, and Wayne counties had reduced CBAQs due to a widespread epizootic hemorrhagic disease (EHD) outbreak. The number of antlerless deer harvested in each county can be found at wildlife.IN.gov/wildlife-resources/animals/white-tailed-deer/deer-harvest-data/.

Deer Population Indices. Since 2012, CBAQs have been gradually lowered across the state as the deer-management goals of Indiana DNR have shifted from that of herd reduction to population maintenance. This approach, integrated with strategic harvest in Deer Reduction Zones (DRZs), has been adopted to provide a healthy deer population across the state while addressing human safety concerns along roadways that have historically experienced high levels of deer-vehicle collisions (DVC).

Every year the Indiana DNR deer program, private lands biologists, and conservation officers work collectively to analyze trends in deer population and public opinion indices to determine whether CBAQs should be adjusted. The following population and public opinion indices are gathered through the Deer Management Survey (see Chapter 7), harvest reports, and public comment and are used in CBAQ evaluations: annual deer harvest, hunter success rate, hunter effort, Archer's Index deer observations, DVC rates, public opinion on deer population size, and public desire for changes in populations. Because these data sources are not true estimates but rather indices of the deer population, trends in these data over time are weighed and collectively inform the final decision of Indiana DNR when setting CBAQs for the fall deer season.

County Bonus Antlerless Quotas 2022-2023. After reviewing deer population and public opinion indices, the following changes have been made to CBAQs for the 2022-2023 deer hunting season (Figure 3-5):

- Brown, Jackson, Lawrence, Martin, Monroe, Morgan, and Orange counties: CBAQ dropped to 2.
- Benton and Tipton counties: CBAQ raised to 1.
- Hancock, Randolph, Rush, and Whitley counties: CBAQ raised to 2.

Table 3-15. Number of deer harvested by resident and nonresident license types during the 2022 deer hunting season. Reporting error rate: ±0.26% (2022).

License Type	2015	2016	2017	2018	2019	2020	2021	2022
Resident Deer License Bundle	65,604	68,997	67,731	67,963	69,683	79,881	80,974	73,330
Resident Archery/Crossbow/ Reduction Zone	29,258	24,796	25,044	24,794	24,512	25,380	22,801	24,134
Resident Firearm	43,991	40,577	37,254	34,575	29,627	26,671	24,265	26,177
Resident Muzzleloader	6,088	4,669	4,376	3,898	3,607	3,715	2,902	2,759
Resident Military/Refuge	1,277	1,343	1,355	1,611	1,613	1,081	1,504	1,514
Resident Bonus Antlerless	21,088	18,065	16,188	13,866	15,149	14,378	11,267	10,053
Nonresident	10,165	10,493	10,796	10,773	10,989	11,781	12,380	10,652
Youth	34,529	33,900	31,378	29,273	28,073	31,285	30,276	29,166
Total Licenses (Excluding Resident Youth)	**177,471**	**168,940**	**162,744**	**157,480**	**155,180**	**162,887**	**156,093**	**148,619**
Total Privileges (Excluding Resident Youth)	**314,519**	**313,458**	**304,724**	**299,660**	**301,256**	**330,745**	**326,931**	**299,577**

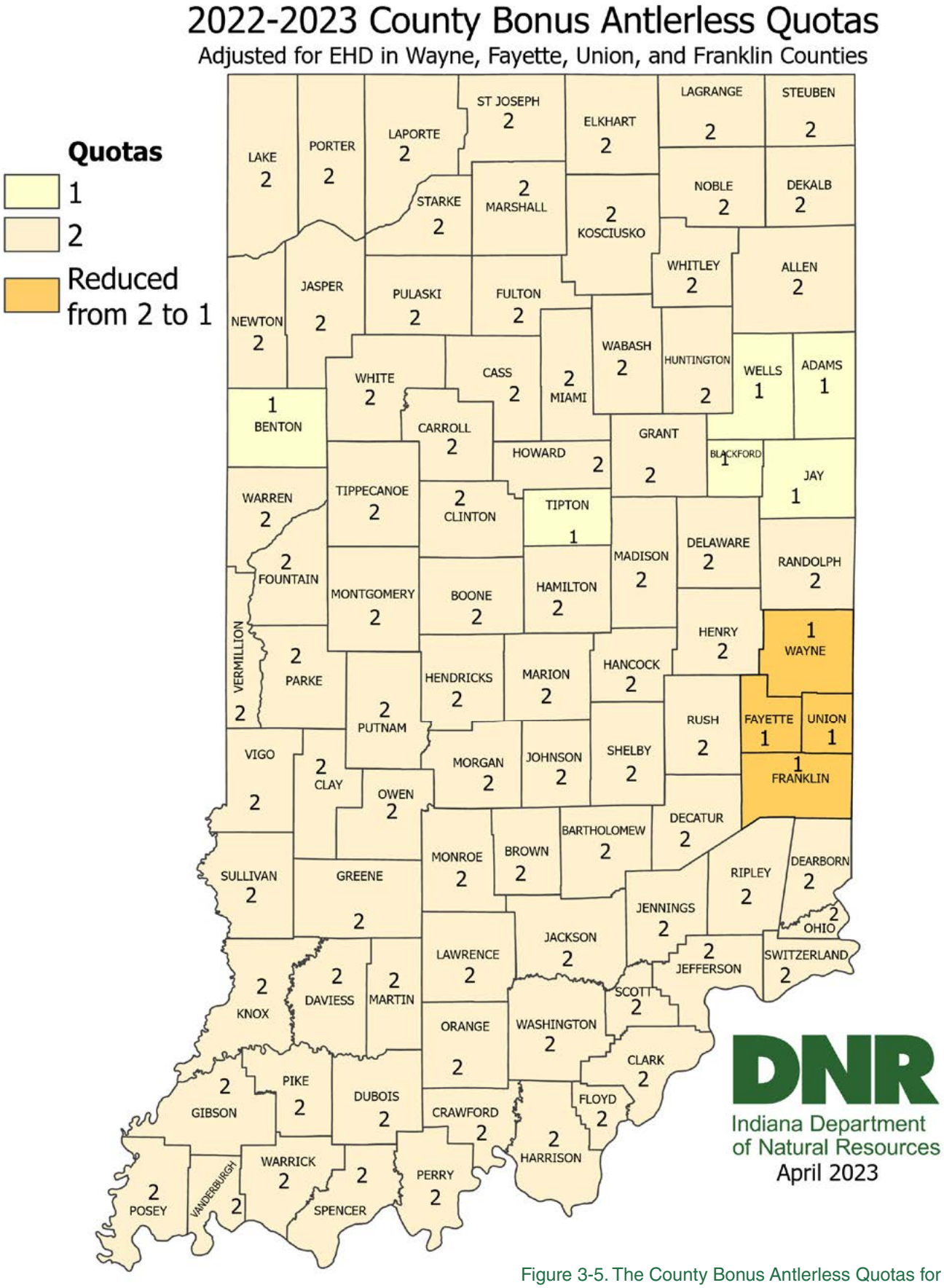

Figure 3-5. The County Bonus Antlerless Quotas for the 2022-2023 Indiana deer hunting season.

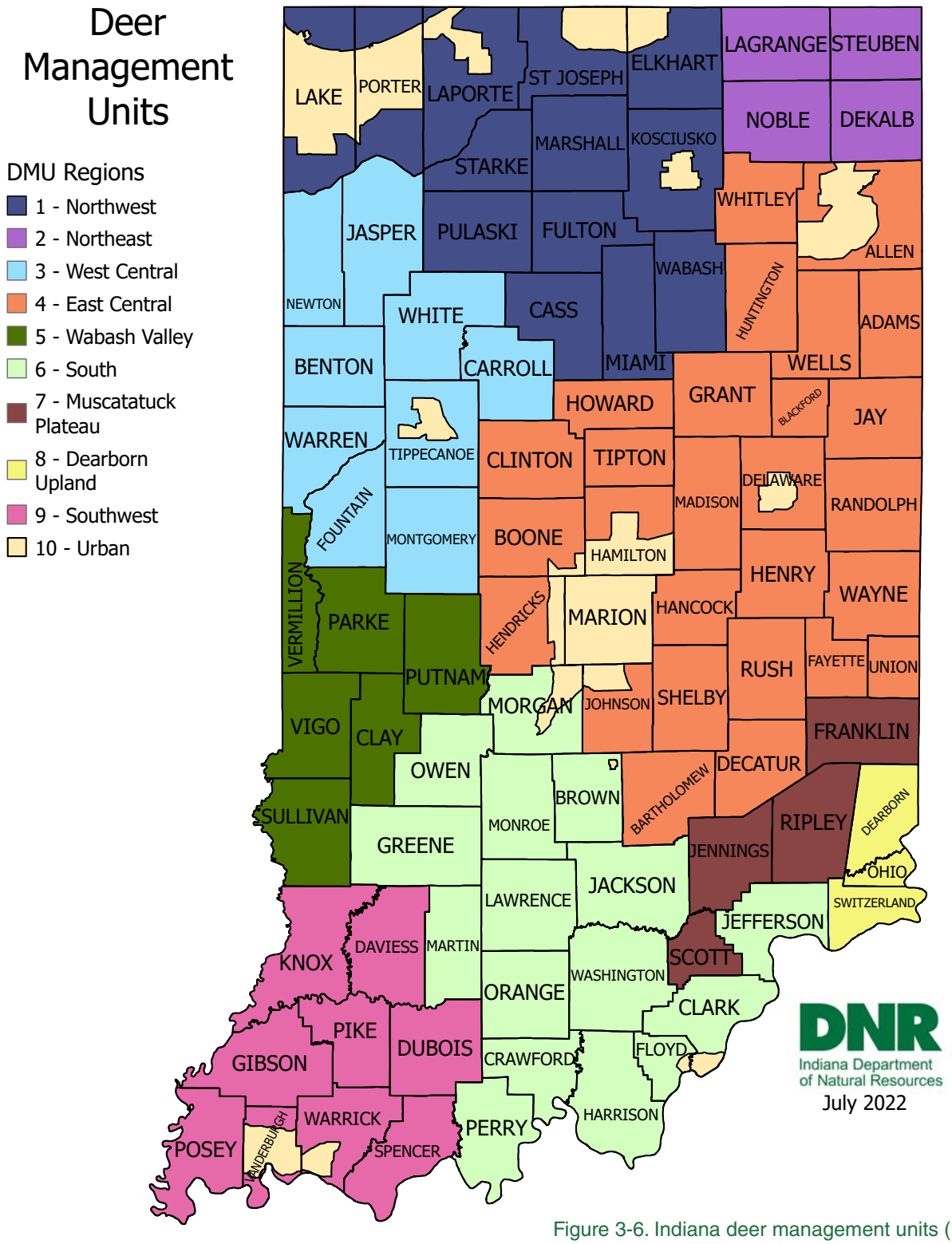

Figure 3-6. Indiana deer management units (DMUs) created by Indiana DNR and Purdue University to better understand survey data trends regionally.

DMU Summaries

Indiana DNR analyzes deer data on a regional scale based on Deer Management Units (DMUs; Figure 3-6). DMUs are defined groupings of counties based on similar characteristics such as habitat, hunter density, and urban development. Trends in a DMU's indices influence the CBAQs for the counties within it. County-specific data referenced below is available on the new Indiana DNR Deer Data Dashboard at wildlife.IN.gov/wildlife-resources/animals/white-tailed-deer/county-data/.

DNR file photo

Hunter Success and Hunters Afield

The number of Indiana deer hunting licenses sold each year represents the number of licensed hunters afield during the hunting season, but that number does not include all hunters attempting to harvest a deer in a given year. A portion of Indiana hunters have a lifetime license, which requires no annual purchase. These hunters are not tracked in yearly license sales data, and a hunter with a lifetime license is not necessarily still an active hunter. Indiana also allows for license exemptions for landowners and active military members who are not tracked in the license sales data. Lifetime license holders accounted for 16% of the deer harvest in 2021. More than 11% of deer were harvested by landowners or military-exempt hunters in 2021. Estimating the total number of hunters afield sheds light on how many hunters are using the resource and how they are using it (i.e., license or exemption type).

Indiana DNR defines a successful hunter as an individual who harvests at least one deer during hunting season, regardless of how many deer the hunter attempted to harvest. Hunter success can be calculated using license sales and harvest data: hunters who attempted to harvest a deer (i.e., hunters who purchased a license) compared to hunters who actually harvested a deer (i.e., hunters who bought a license and checked in a deer on that license). However, not every hunter is required to purchase an annual hunting license (e.g., lifetime license holders and landowner and military-exempt hunters), so with this method, success rates for lifetime and exempt license holders is assumed to be the same as those for annual licensed hunters. This calculation is not applicable at the county level because deer are not always harvested in the same county where a license was purchased.

Hunter success can also be calculated from hunter survey responses. During multiple years of the annual Deer Management Survey (DMS), hunters were asked to report the number of deer they wanted to harvest, the number of deer they harvested, and the license or exemption used to harvest the deer. This information allows us to calculate hunter success in a similar way

to using the license sales and harvest data: the number of hunters who attempted to harvest a deer compared to the number of those hunters who harvested a deer. Since the DMS was available for all hunters with a valid email address in the Indiana DNR system, this calculation captures all hunters regardless of license type or exemption, providing an accounting of success rates for lifetime license holders, landowners, and military-exempt hunters.

Hunter success rates themselves are an index that may indicate the relative herd size in an area (Roseberry and Woolf 1991). For example, a comparably high hunter success rate over time may mean it is becoming easier to harvest a deer because the deer population is increasing, while a low hunter success rate over time may mean it is becoming more difficult to harvest a deer because the deer population is decreasing in that area. These comparisons are useful for determining how the deer population fluctuates over time in an area, which then helps set hunting quotas and regulations.

Methods

For the 2022-2023 hunting season, license sales, the Deer Management Survey, and harvest data were used to estimate hunter success. We estimated success rates for all non-youth resident and nonresident annual license holders in our database for each deer season from 2015-2022. It was not possible to calculate youth success rates using the same methodology because youth licenses are not specific to deer. Success was defined as harvesting and checking in at least one deer during the 2022-2023 deer season using the same customer ID number that was used to purchase an annual deer license. To calculate success rate, we divided the number of successful hunters in each category by the total number of hunters in that category.

Resident License Success Rate (SRLR)=The number of non-youth hunters who purchased a resident annual deer license and checked in a deer using the same CID number/the total number of non-youth hunters who purchased a resident annual deer license

Nonresident License Success Rate (SRLNR)= The number of non-youth hunters who purchased a nonresident annual deer license and checked in a deer using the same CID number/The total number of non-youth hunters who purchased a nonresident annual deer license

Using the Deer Management Survey, we estimated success rates for all non-youth resident and nonresident annual license holders, lifetime license holders, and license-exempt hunters who participated in the annual Deer Management Survey for each deer season from 2017 to 2022. Although hunters can hunt using multiple license types per season, we categorized them into a single category to avoid double counting. Any hunter who purchased an annual license was categorized as an annual license holder. Any hunter who hunted using a lifetime license and did not buy an annual license was categorized as a lifetime license holder. Any hunter who hunted using a license exemption and did not purchase an annual license or hunt on a lifetime license was categorized as license exempt. As with the license success rate, the survey success rate was calculated as the number of successful hunters in each category divided by the total number of hunters in that category.

Resident Survey Success Rate (SRSR) = The number of non-youth hunters who reported purchasing a resident annual deer license and checked in a deer under the resident annual license category/ the total number of non-youth hunters who reported purchasing a resident annual deer license

Nonresident Survey Success Rate (SRS_N) = The number of non-youth hunters who reported purchasing a nonresident annual deer license and checked in a deer under the nonresident annual license category/the total number of non-youth hunters who reported purchasing a nonresident annual deer license

Lifetime Survey Success Rate (SRS_L) = The number of non-youth hunters who reported hunting using a lifetime license and checked in a deer under the lifetime license category/the total number of non-youth hunters who reported hunting using a lifetime license

Exemption Survey Success Rate (SRS_E) = The number of non-youth hunters who reported hunting using a license exemption and checked in a deer under a license exemption category/the total number of non-youth hunters who reported hunting using a license exemption

We used harvest data and license success rates to calculate the number of hunters afield for each deer season from 2015 to 2022. For each year we queried the number of unique hunters who checked in a deer under the following categories: resident annual license, nonresident annual license, lifetime license, landowner exemption, and military exemption. As with the Deer

Management Survey success rate calculation, hunters were exclusively assigned to a single category to avoid overestimating the number of hunters afield. To calculate the number of hunters afield, we divided the number of unique hunters in each category by the license success rate and summed the category estimates. We used the license success rates to estimate hunters afield, because survey responses appear to be biased toward successful hunters.

$$Hunters\ Afield = (HCD_{RAL}/SRL_{R}) + (HCD_{NAL}/SRL_{N}) + (HCD_{LL}/SRL_{R}) + (HCD_{LO}/SRL_{R}) + (HCD_{LO}/SRL_{R}) + (HCD_{ME}/SRL_{R}) + (HCD_{Y}/SRL_{R})$$

Where:

HCD_{RAL} = Adult hunters who checked in a deer and purchased a resident annual deer hunting license

HCD_{NAL} = Adult hunters who checked in a deer and purchased a nonresident annual deer hunting license

HCD_{LL} = Hunters who checked in a deer using a lifetime license

HCD_{LO} = Hunters who checked in a deer using a landowner exemption

HCD_{ME} = Hunters who checked in a deer using a military exemption

HCD_{Y} = Youth hunters who checked in a deer and purchased a youth license

Results

The resident license success rate was similar from 2015 through 2017, at ~0.35, and increased significantly in 2018 and 2019 (Figure 3-7). The 2020 success rate was similar to 2019's at 0.40 (CI_{95}=0.003), but it decreased slightly in 2021 to 0.39 (CI_{95}=0.003). In 2022, the resident success rate reached a new high at 0.43 (CI_{95}=0.003). The nonresident license success rate was similar to the resident license success rate in 2015 and 2017 but was higher in 2016 (Figure 3-7). From 2018-2021, the nonresident license success rate followed a similar pattern as the resident license success rate but was consistently lower with an annual success rate of 0.40 (CI_{95} = 0.010) in 2022.

Changes in survey success rates varied by type in 2022. Both resident annual success rates and nonresident annual success rates fell in 2022 (resident: 0.53 CI_{95} = 0.008; nonresident: 052 CI_{95} = 0.038) relative to 2021 (resident: 0.54 CI_{95} = 0.010; nonresident: 0.54 CI_{95} = 0.035; Figure 3-8). The lifetime license success rate increased from 0.49 (CI_{95} = 0.016) in 2021 to 0.54 (CI_{95} = 0.013) in 2022. For exempt hunters, success rates stayed the same at 0.44 (2021 CI_{95} = 0.025; 2022 CI_{95} = 0.021).

Survey success rates were consistently higher than license success rates, with a mean difference of 0.13 (CI_{95} 0.02) for resident annual hunters and 0.13 (CI_{95} 0.03) for nonresident annual hunters, but they displayed similar trends until this year. Both resident and nonresident license and survey success rates were lowest in 2017, increased until 2020, and decreased slightly in 2021. However, license success rates showed an increase in 2022 for both resident and nonresident hunters while survey success rates fell for both groups. Generally, nonresident success rates have been equal to or lower than resident success rates.

Many of the license categories saw a decrease in the number of hunters afield in 2022 relative to the number of hunters afield in 2021 (Figure 3-9). The number of resident annual hunters afield was the lowest it has been since 2019, and the number of nonresident hunters afield was the lowest it has been since we started calculating the trend in 2015. The number of lifetime license hunters and youth hunters also fell, relative to 2021. The only category to stay stable was license-exempt hunters. The total estimated number of hunters afield was highest in 2015 at 233,748, fell to 201,434 by 2019, and after a bump in 2020 to 213,357, readjusted to 209,189 in 2021. In 2022, we estimated a total of 199,475 hunters afield (Figure 3-10).

Discussion

An overall increase in hunter success rates for annual license holders was apparent in both the license success rate and the survey success rate. The lifetime license survey success rate was the only estimated success rate to decrease over time but is now more comparable to the other license categories. The large mean difference in success rates between the license data and the survey data is likely because of systematic biases in both data sets. The license data calculation is based on the success rate of only non-youth hunters who purchased a license and assumes that everyone who purchased a license took advantage of the hunting opportunity. Furthermore, a hunter is only counted as successful if they checked in a deer with the same CID they used to purchase an annual license. These underlying assumptions likely result in an underestimate of success rate and thus an underestimate in the number of hunters afield. However, we use the license success

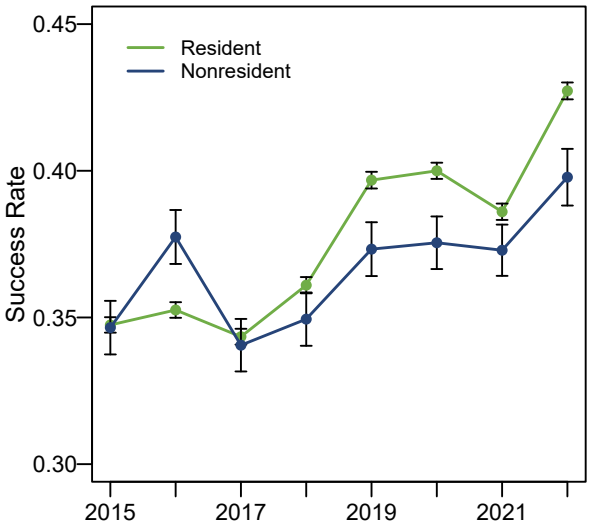

Figure 3-7. Calculated annual success rates of non-youth licensed resident and nonresident deer hunters who purchased an annual deer license and checked in at least one deer using the same Customer ID number.

rate for the hunters-afield calculation because we believe it is a more accurate estimate of success than the Deer Management Survey estimates, which are calculated from a nonrandom sample of deer hunters.

Based on the survey success estimates, we know that the success rate of hunters who purchased an annual license may not be the same as for other hunters. For example, lifetime license holder success rates were generally higher than other groups', and exempt success rates were generally lower. One of the goals of the DMS was to estimate success rates for different groups based on license category to help us more precisely estimate the number of hunters afield (Caudell and Vaught 2018); however, given the survey bias toward successful hunters, this is infeasible without a correction factor to adjust between hunter success based on license sales data and hunter success calculated from the DMS. In the future, our harvest-effort survey, which

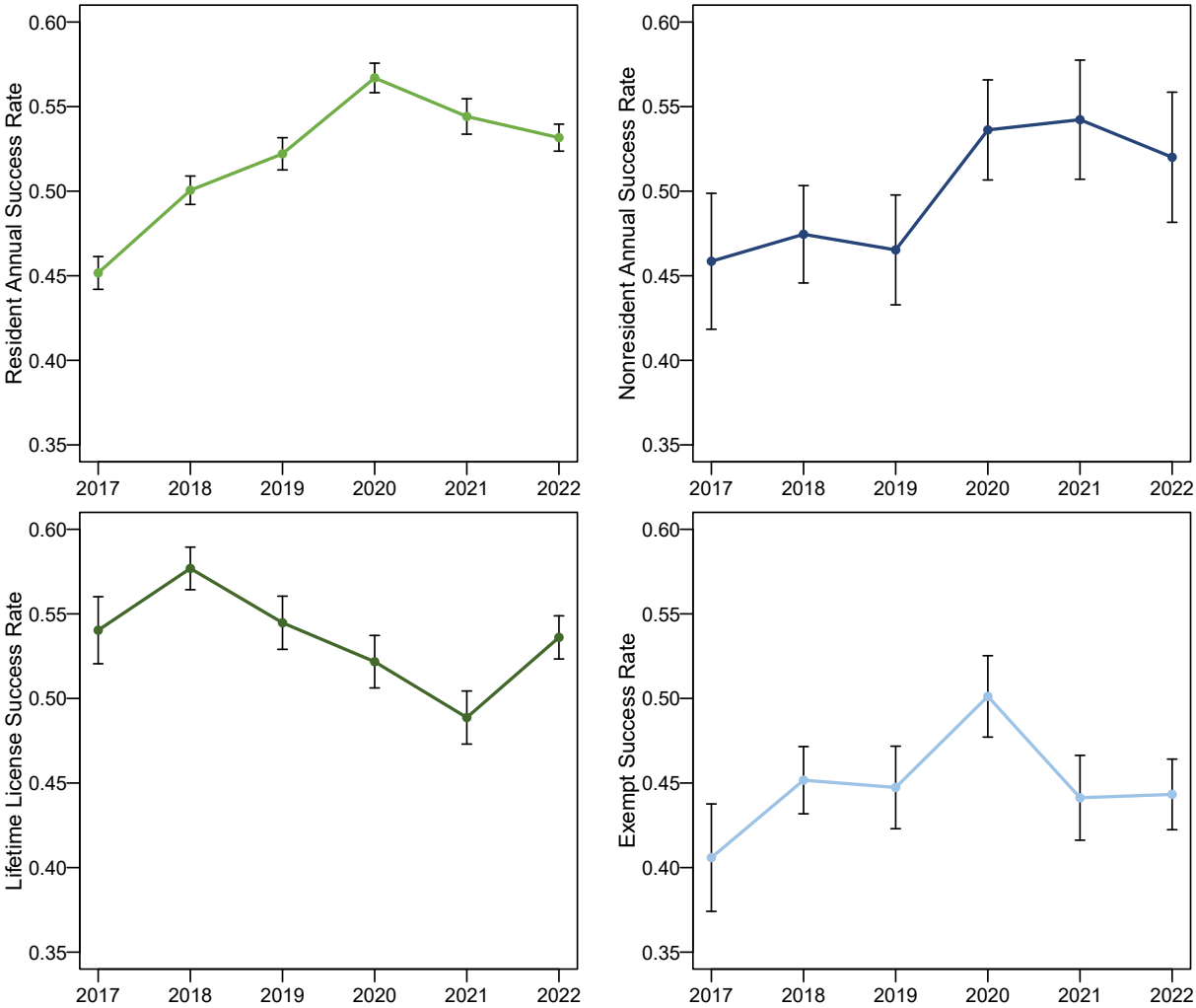

Figure 3-8. Calculated annual success rates of non-youth deer hunters who hunted using resident and nonresident annual licenses, lifetime licenses, and military and landowner exemptions, and participated in the annual Deer Management Survey.

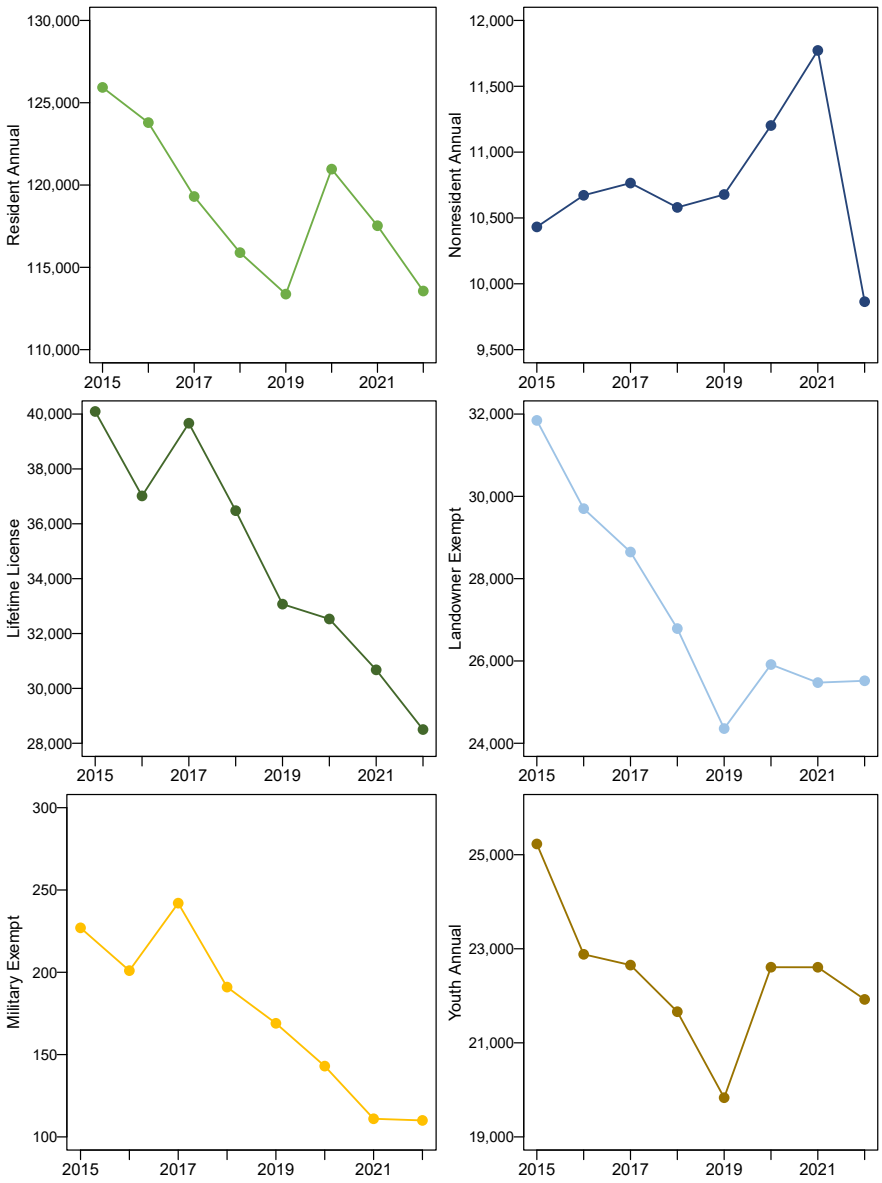

Figure 3-9. Estimated hunters afield in each license category, including resident annual license holders, nonresident annual license holders, lifetime license holders, landowner exemptions, military exemptions, and youth annual license holders.

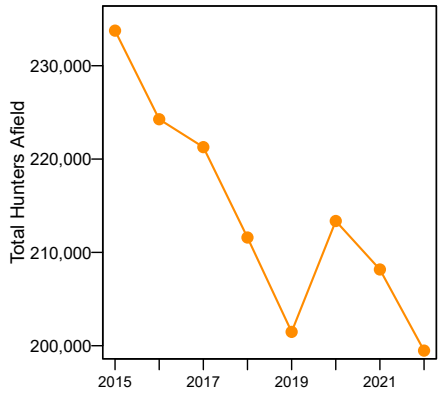

Figure 3-10. Total estimated hunters afield during Indiana deer hunting seasons, 2015-2016 through 2021-2022.

DNR file photo

is sent to a random sample of firearms hunters, may provide this correction factor.

There are several practical applications for estimating hunter success and hunters afield. Hunter success may act as an index of deer populations (Roseberry and Woolf 1991) and a predictor of hunter satisfaction (Gigliotti 2000). Estimating the number of hunters afield using a standardized method of calculation provides a repeatable index for hunter trends in Indiana. Because the proportion of the population actively participating in hunting has been declining over time (U. S. Fish & Wildlife Service 2018), it is important to have an accurate index of these trends. As Indiana DNR puts forth efforts to recruit new hunters, retain current hunters, and reactivate hunters who have stopped hunting, having an estimate of the number of hunters participating in the hunting season will help evaluate the success of these programs. Ultimately, the most accurate measure of hunter success and hunters afield requires documenting every hunter who attempts to harvest a deer through license sales, registration, or some other record.

Literature Cited

Caudell, J. N. and O. D. L. Vaught. 2018. 2017 Indiana White-tailed Deer Report. Indiana Department of Natural Resources, Bloomington, USA.

Gigliotti, L. M. 2000. A Classification Scheme to Better Understand Satisfaction of Black Hills Deer Hunters: The Role of Harvest Success. Human Dimensions of Wildlife: An International Journal 5: 32-51.

Roseberry, J. L. and A. Woolf. 1991. A Comparative Evaluation of Techniques for Analyzing White-tailed Deer Harvest Data. Wildlife Monographs 117: 3-59.

U. S. Fish and Wildlife Service. 2018. 2016 National Survey of Fishing, Hunting, and Wildlife-Associated Recreation. Washington DC, USA.

Chapter 4.
DEER CONTROL PERMITS

Joe Caudell, Julia Buchanan-Schwanke, and Linnea Petercheff, *Indiana Department of Natural Resources*

Deer control permits grant special permission to take deer outside of the deer hunting season and are issued when farmers and other landowners experience problems with deer. These permits reduce damage and other conflicts with landowners and help alleviate future property damage from deer in localized areas. Deer control permits are not issued for population control, and the number of deer taken on control permits is

Table 4-1. Deer control permits issued by county in 2022, including the number of deer authorized to be taken and the number of deer actually taken per permit. Cumulative deer is the number of hunter-harvested deer plus the number of deer taken on control permits. The sum of permits per county is greater than the total number of permits issued because some permits were issued for multiple counties and are counted for each county. The number of deer taken per permit was divided among multiple counties on a single permit.

County	Permits Issued	Deer Taken	Avg Deer Taken/ Permit	% Cumulative Deer Taken	County	Permits Issued	Deer Taken	Avg Deer Taken/Permit	% Cumulative Deer Taken
Allen	2	0	0.0	0.0%	Marshall	8	30	3.8	1.4%
Bartholomew	3	7	2.3	0.8%	Miami	1	6	6.0	0.4%
Benton	1	0	0.0	0.0%	Monroe	7	64	9.1	4.5%
Brown	9	67	7.4	4.2%	Montgomery	1	5	5.0	0.5%
Cass	3	6	2.0	0.4%	Morgan	2	0	0.0	0.0%
Clark	4	45	11.3	3.4%	Noble	3	8	2.7	0.3%
Clay	3	12	4.0	1.0%	Ohio	5	22	4.4	3.9%
Daviess	2	5	2.5	0.4%	Orange	3	9	3.0	0.5%
Dearborn	10	59	5.9	3.0%	Owen	3	13	4.3	0.8%
Decatur	1	7	7.0	1.0%	Parke	2	21	10.5	0.9%
DeKalb	3	38	12.7	1.7%	Perry	2	27	13.5	1.7%
Delaware	1	0	0.0	0.0%	Pike	1	0	0.0	0.0%
Dubois	2	5	2.5	0.3%	Porter	7	37	5.3	2.4%
Elkhart	2	8	4.0	0.4%	Posey	6	46	7.7	3.6%
Fayette	2	10	5.0	1.8%	Pulaski	4	33	8.3	1.7%
Floyd	5	16	3.2	2.4%	Ripley	5	28	5.6	2.1%
Fountain	3	30	10.0	2.2%	Saint Joseph	5	28	5.6	2.0%
Franklin	13	56	4.3	4.0%	Scott	1	5	5.0	0.7%
Fulton	4	39	9.8	2.5%	Spencer	4	32	8.0	2.5%
Gibson	2	1	0.5	0.1%	Starke	4	27	6.8	1.7%
Greene	2	2	1.0	0.1%	Steuben	9	23	2.6	0.7%
Harrison	12	54	4.5	2.3%	Sullivan	9	36	4.0	2.1%
Hendricks	1	0	0.0	0.0%	Switzerland	8	49	6.1	3.3%
Huntington	1	0	0.0	0.0%	Tippecanoe	2	0	0.0	0.0%
Jackson	6	20	3.3	1.3%	Tipton	1	2	2.0	1.1%
Jasper	3	7	2.3	0.5%	Union	1	5	5.0	1.0%
Jefferson	4	22	5.5	1.5%	Vanderburgh	3	5	1.7	0.7%
Jennings	6	18	3.0	1.1%	Vigo	2	0	0.0	0.0%
Johnson	2	3	1.5	0.5%	Wabash	3	25	8.3	1.5%
Lagrange	7	24	3.4	0.8%	Warren	1	0	0.0	0.0%
Lake	2	22	11.0	1.5%	Warrick	4	16	4.0	1.2%
LaPorte	5	2	0.4	0.1%	Washington	10	104	10.4	4.7%
Lawrence	1	1	1.0	0.0%	Wells	1	0	0.0	0.0%
Madison	1	3	3.0	0.5%	White	2	8	4.0	0.8%
Marion	3	80	26.7	16.7%	Whitley	1	0	0.0	0.0%

lower than the number of deer harvested during hunting season in each county (Table 4-1). An exception is Marion County, where few deer were harvested by hunters because of limited access, and a comparatively large number of deer were removed using control permits. Typical problems in Indiana resulting from deer include browsing damage to crops, orchards, nurseries, vineyards, and plants used for landscaping (Table 4-2). Deer control permits are issued to landowners who demonstrate damage in excess of $500, to address disease concerns (e.g., Franklin and Fayette counties to address issues with bovine tuberculosis), to protect endangered species (e.g., Porter County), or for the safety of the public.

When permits expire, permit holders are required to report to the Indiana DNR the number of deer taken on the permit, the sex of each, the equipment used, and the disposal method for each deer taken. Indiana DNR received reports from 235 of the 265 deer control permits issued statewide. Reports were not received from the remaining 30 permits. An average of 13.9 (n=265; CI_{95}=12.2, 15.6) deer were authorized per permit, and an average of 5.8 (n=265; CI_{95}=4.3, 7.3) deer were taken per permit (Table 4-1). Damages reported at the time of the application ranged from $15 to $88,000. Permit recipients reported an average of 21.2% (n=142; CI_{95}=17.2%, 25.2%) of soybean crops damaged and an average of 24.5% (n=133; CI_{95}=16.3%, 24.5%) of corn crops damaged.

A total of 1,533 deer were reported taken statewide on deer control permits, representing 1.3% of the cumulative deer taken, which is the total number of hunter-harvested deer and deer taken on control permits in 2022. Most of the deer taken on control permits were does and button bucks (n=1,318), which represented 1.1% of the cumulative number of deer taken in 2022. Fewer adult bucks (n=242) were taken on control permits, which represented 0.2% of the cumulative number of deer taken in 2022. The majority of deer (75.7%) taken on control permits were either consumed or donated for human consumption. Some error exists in the total number and the individual numbers of bucks, does, and button bucks reported taken on deer control permits due to permit-holder reporting error or due to the total take being split between counties for permits that cover multiple counties.

Table 4-2. Number of damage reports for each crop type or other reason for 2022 deer control permits. Some individuals reported multiple crops or reasons.

Crop or Reason for Permit	Number of Reports
Alfalfa	13
Barley	2
Tree Farms	4
Clover	2
Corn	168
CRP	1
Grapes	6
Hay	19
Health and Safety	2
Landscaping	3
Nursery Stock	1
Orchard	8
Popcorn	1
Produce	12
Pumpkins	11
Rye	5
Soybeans	173
Timber Production	4
Vehicle Training Facility	1
Wheat	10
Wildflowers	5
Woodland	3

Chapter 5.
DEER-VEHICLE COLLISIONS

Joe Caudell, Emily McCallen, and Julia Buchanan-Schwanke,
Indiana Department of Natural Resources

Deer-vehicle collisions are reported by state and local police to the Indiana Department of Transportation (INDOT) anytime an accident report is completed for insurance purposes. These reports include information on the direction the vehicle was moving, location of the accident, type of road (e.g., county road, state road, interstate, etc.), road conditions, estimated cost of damage, and other data used in road safety analyses. INDOT provides data on deer-vehicle collisions to DNR each year for this report and for deer population analysis. This data set is especially valuable for DNR because it is an independent data set that has been collected in a consistent way for a long period of time. Deer-vehicle collisions are also standardized across years and counties by using INDOT's statistics on Daily Vehicle Miles Traveled. Analyzing collisions per billion miles traveled accounts for changes in traffic volume between counties and allows for unbiased comparison between counties and years.

The total number of deer-vehicle collisions reported across the state decreased from 15,276 in 2021 to 14,677 in 2022 (Figure 5-1; Table 5-1). The number of deer-vehicle collisions per billion miles traveled (DVC/BMT) was 180 DVC/BMT in 2022, a decrease of 4.8% from 2020.

Ohio (1,198 DVC/BMT), Pulaski (1,169 DVC/BMT), and St. Joseph (1,043 DVC/BMT) counties had the highest number of DVC/BMT (Figure 5-2). Marion (7 DVC/BMT), Union (13 DVC/BMT), Lake (44 DVC/BMT), and Daviess (44 DVC/BMT) counties had fewer than 50 DVC/BMT. Compared to 2021, DVC/BMT decreased in 35 counties and increased in 57 counties. Thirteen counties showed a decrease greater than 15% in DVC/BMT compared to 2020, while 26 counties showed an increase greater than 15%.

Most deer-vehicle collisions in 2022 occurred on state roads (36.1%) and county roads (28.9%; Table 5-2). From 2017 to 2022, state roads had the highest average number of DVC/BMT by road type per year (437 DVC/BMT). U.S. routes had the highest average number of deer-vehicle collisions (81 DVC) per 100 miles of road from 2017 to 2022 (Table 5-2).

DNR file photo

Nearly 50% of deer-vehicle collisions in 2022 occurred between September and December (Figure 5-3). Compared to 2021, the number of collisions during February, March, and May increased by 5.4%, 10.3%, and 6.2%, respectively. Collisions in all other months decreased, with July decreasing by 16.4%. Additionally, deer-vehicle collisions occur most often during dawn and dusk, which varies by month as day length changes (Figure 5-4).

The estimated economic cost of deer-vehicle collisions from damage to vehicles in 2022 was $77.7 million, based on the average estimated cost per collision (Table 5-3). From 2017 to 2022, deer-vehicle collisions cost drivers a total of more than $409 million (Table 5-3).

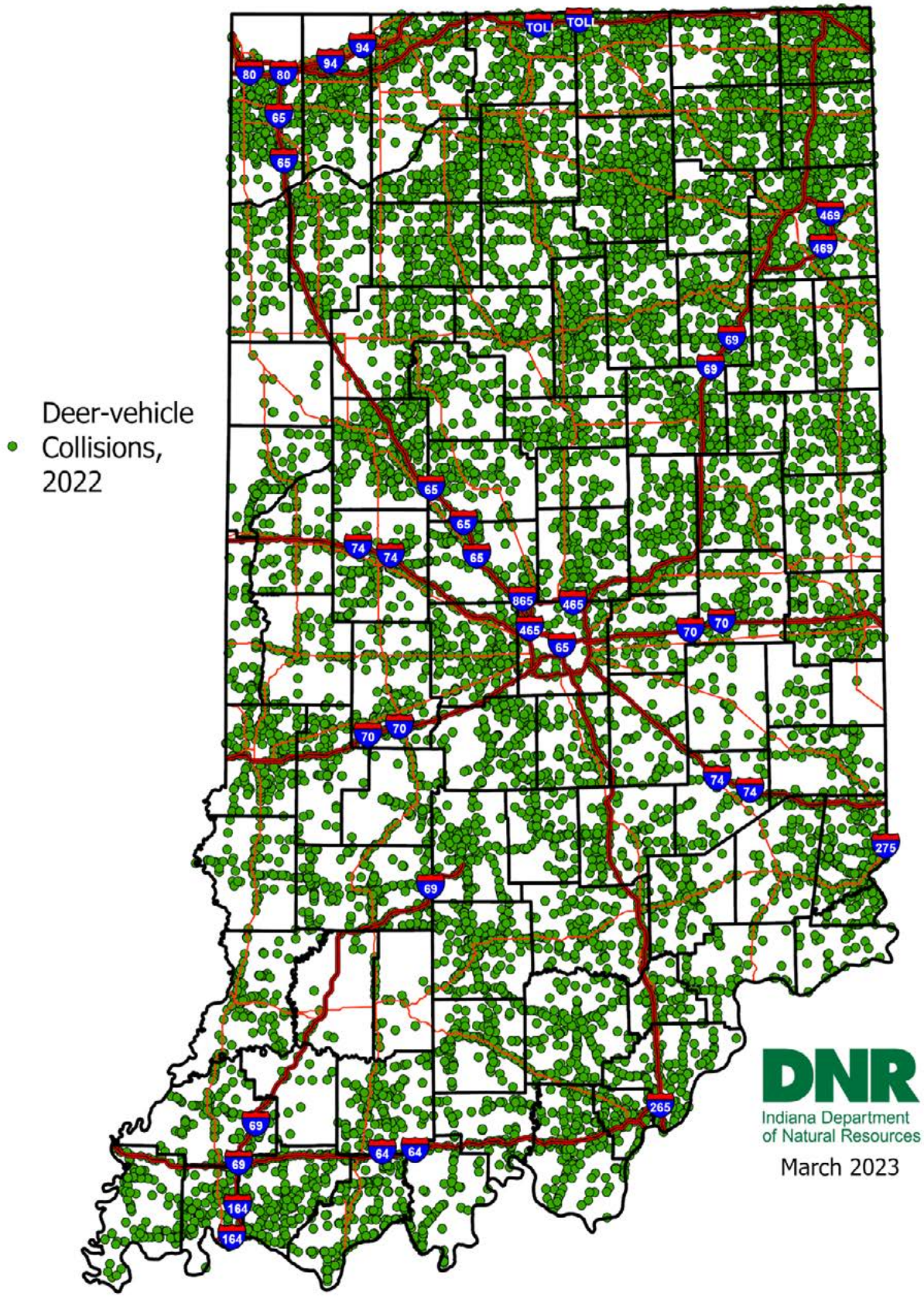

Figure 5-1. Locations of deer-vehicle collisions in Indiana in 2022; 14,275 (97.3%) of the 14,677 deer-vehicle collisions reported to INDOT included GPS location data to map.

Table 5-1. Number of deer-vehicle collisions by county in Indiana, 2021 and 2022.

	Deer-vehicle Collisions			Deer-vehicle Collisions	
County	**2021**	**2022**	**County**	**2021**	**2022**
Adams	99	115	Lawrence	256	239
Allen	438	467	Madison	172	200
Bartholomew	141	111	Marion	109	84
Benton	20	12	Marshall	358	325
Blackford	54	74	Martin	15	25
Boone	147	145	Miami	227	228
Brown	82	100	Monroe	165	160
Carroll	116	146	Montgomery	189	171
Cass	186	155	Morgan	149	146
Clark	156	139	Newton	101	108
Clay	79	98	Noble	311	301
Clinton	122	119	Ohio	70	54
Crawford	65	83	Orange	119	125
Daviess	25	16	Owen	75	86
Dearborn	225	183	Parke	155	144
Decatur	95	75	Perry	105	77
Dekalb	342	316	Pike	24	11
Delaware	184	177	Porter	396	361
Dubois	156	150	Posey	124	113
Elkhart	303	269	Pulaski	203	228
Fayette	33	32	Putnam	154	147
Floyd	123	105	Randolph	74	90
Fountain	94	91	Ripley	158	115
Franklin	148	107	Rush	52	45
Fulton	194	174	Saint Joseph	347	339
Gibson	143	145	Scott	86	53
Grant	191	217	Shelby	94	88
Greene	238	252	Spencer	206	187
Hamilton	259	189	Starke	174	187
Hancock	110	76	Steuben	507	501
Harrison	211	176	Sullivan	157	77
Hendricks	205	185	Switzerland	37	30
Henry	116	92	Tippecanoe	365	348
Howard	113	118	Tipton	51	61
Huntington	217	223	Union	5	1
Jackson	212	153	Vanderburgh	122	118
Jasper	227	223	Vermillion	75	76
Jay	136	142	Vigo	193	198
Jefferson	60	57	Wabash	190	218
Jennings	86	95	Warren	120	103
Johnson	125	127	Warrick	264	249
Knox	113	117	Washington	132	177
Kosciusko	493	547	Wayne	224	186
Lagrange	204	250	Wells	134	159
Lake	262	273	White	143	151
LaPorte	348	317	Whitley	193	154
			Totals	**15276**	**14677**

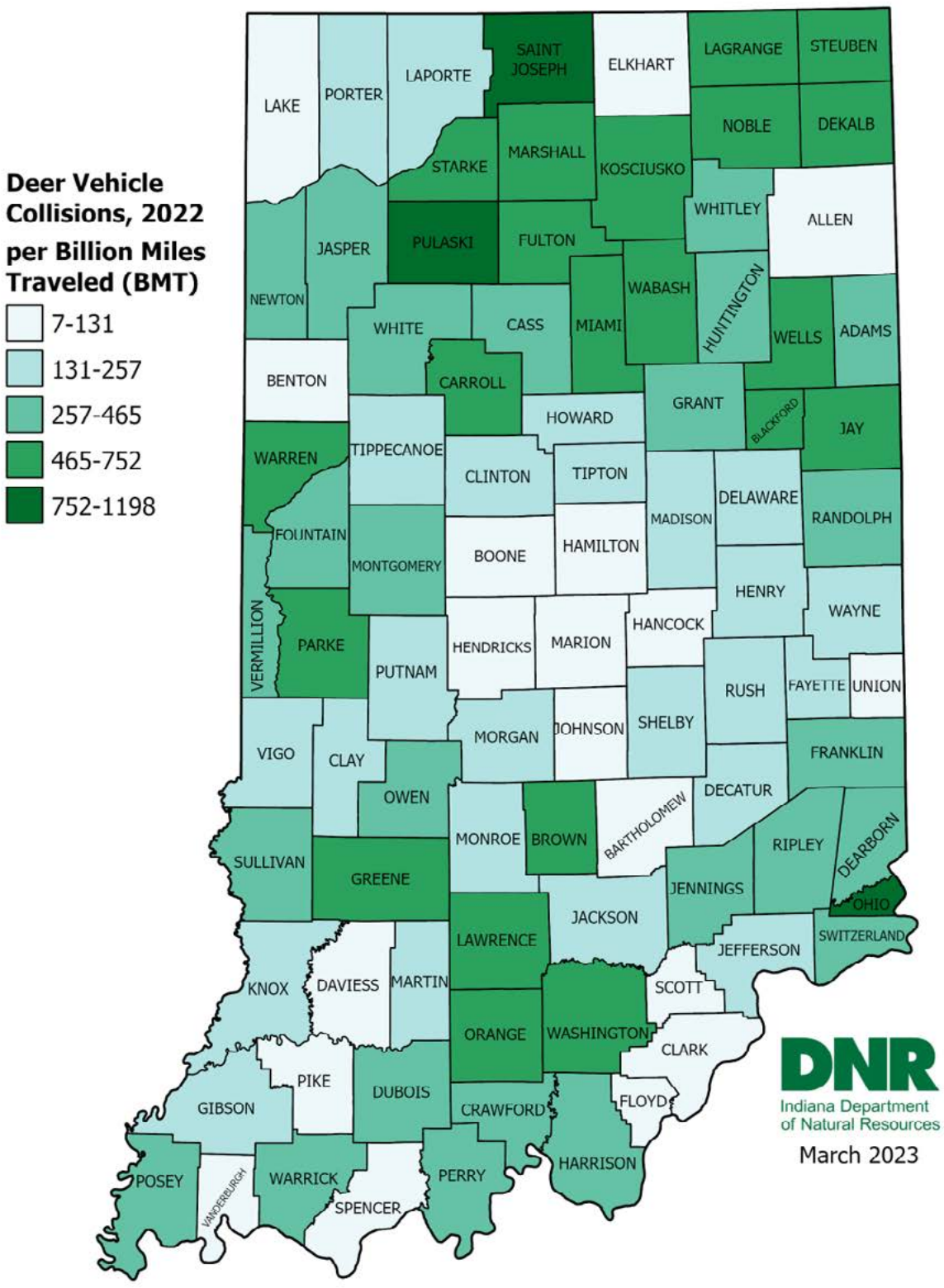

Figure 5-2. The number of deer-vehicle collisions per billion miles traveled (DVC/BMT) by county in Indiana in 2022. DVC/BMT provides a relative rate of deer-vehicle collisions given the number of miles driven in that county per year. Counties with high DVC/BMT have proportionally more deer-vehicle collisions per mile traveled than counties with lower DVC/BMT. Counties with low DVC/BMT may have a high number of deer-vehicle collisions that is offset by a high number of miles traveled (e.g., Lake County).

Table 5-2. The number of deer-vehicle collisions (DVC) in 2022 by road type, average number of deer-vehicle collisions per year from 2017-2022, miles of road, average deer-vehicle collisions per 100 miles, and average deer-vehicle collisions per billion miles traveled (DVC/BMT) from 2017-2022 by road type. Collision values were averaged from 2017-2022, and miles-traveled values were averaged from 2017-2021. Collisions on unknown road types (6.5%) were proportionally distributed among the other road types.

Road Type	2022	Avg DVCs 2017-2022	Road Length (mi)	Avg DVCs per 100mi of Road	Avg BMT per year	Avg DVC/BMT per year
County Road	4,488 (28.9%)	4331 (28.9%)	65213	6.9	18.8	238.7
Interstate	1,127 (7.4%)	1116 (7.4%)	1691	66.6	21.0	53.7
Local/City Road	1,599 (11.6%)	1737 (11.6%)	20302	7.9	20.9	76.5
State Road	5,145 (36.1%)	5414 (36.1%)	7177	71.7	11.8	437.2
US Route	2,318 (16.0%)	2408 (16.1%)	2865	80.9	10.0	232.1

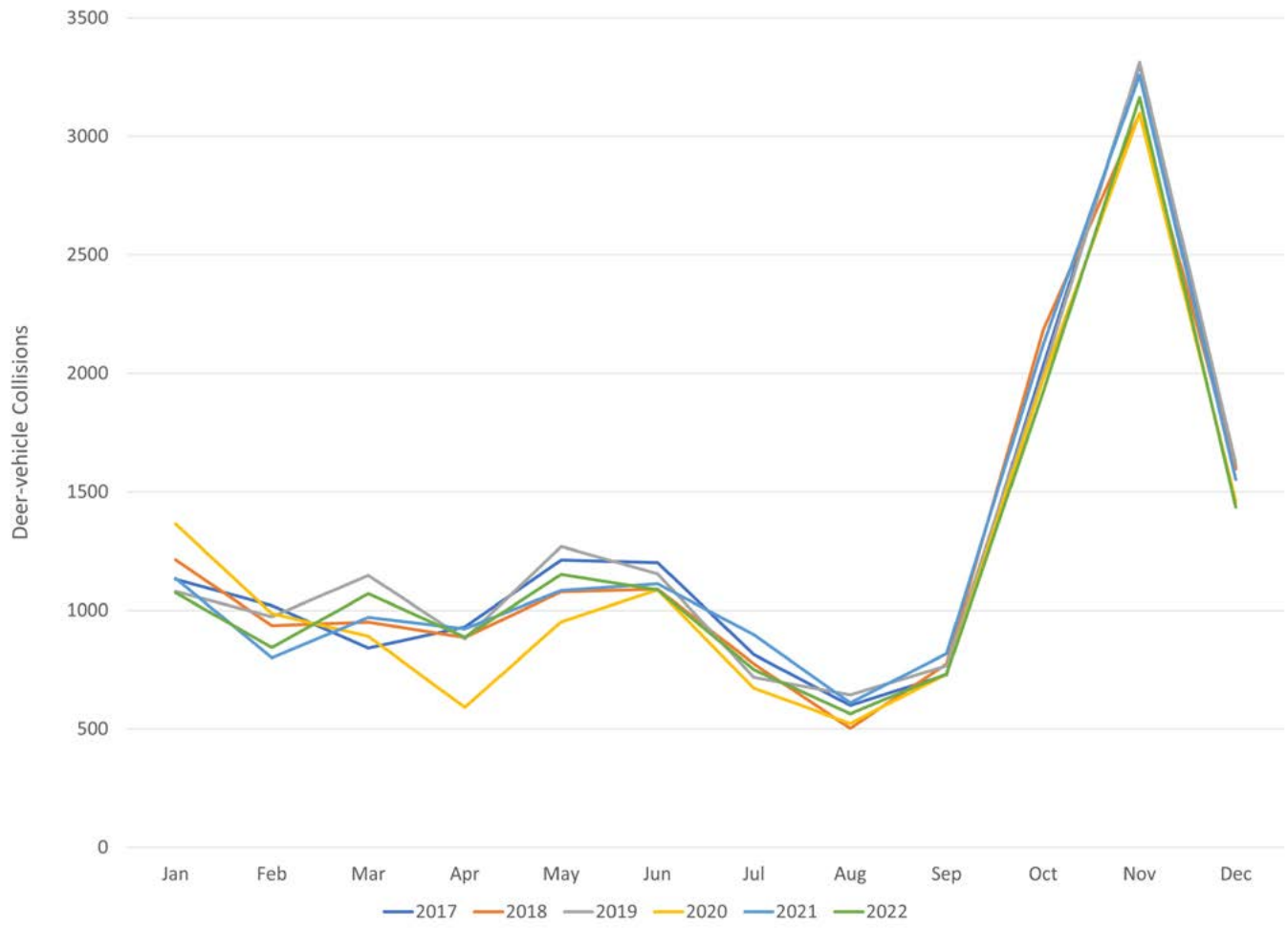

Figure 5-3. Number of deer-vehicle collisions by month in Indiana from 2017-2022. There was a noticeable decrease in collisions during March, April, and May 2020, most likely due to the stay-at-home orders during the beginning of the COVID-19 pandemic.

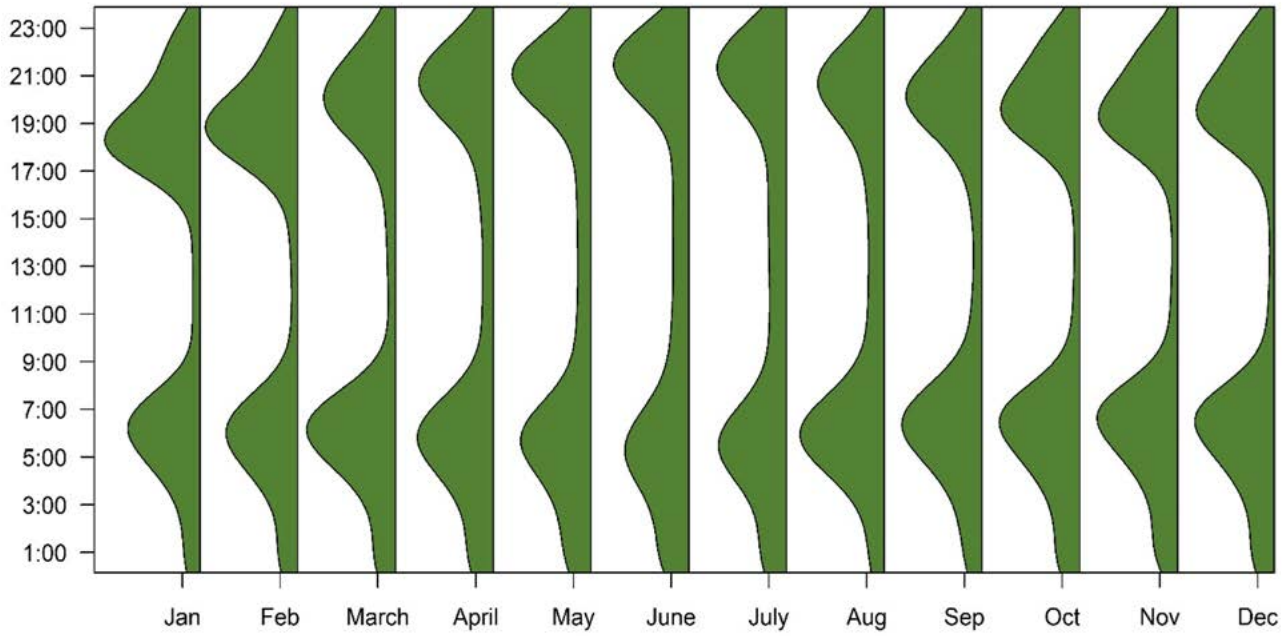

Figure 5-4. The proportion of deer-vehicle collisions by time of day in Indiana from 2016-2020.

Table 5-3. Reported economic loss due to deer-vehicle collisions in Indiana from 2017-2022. Collisions with an unknown estimate or an estimate of $1,000 or less were not included. Total Damage Estimate 2017-2022 is calculated by multiplying the total number of collisions for that damage estimate range by the average value of damage.

Damage Estimate Range	2022 DVCs	2021 DVCs	2020 DVCs	2019 DVCs	2018 DVCs	2017 DVCs	Total DVCs	Total Damage Estimate 2017-2022
$1,001 to $2,500	3,721 (26.1%)	4,477 (30.3%)	4,503 (32.6%)	5,234 (35.1%)	5,365 (36.7%)	5,501 (37.3%)	28,801 (33.1%)	$50,401,750
$2,501 to $5,000	5,833 (40.8%)	5,949 (40.3%)	5,615 (40.7%)	6,063 (40.6%)	5,851 (40.0%)	5,917 (40.1%)	35,228 (40.4%)	$132,105,000
$5,001 to $10,000	3,697 (25.9%)	3,485 (23.6%)	3,015 (21.9%)	3,029 (20.3%)	2,826 (19.3%)	2,806 (19.0%)	18,858 (21.6%)	$141,435,000
$10,001 to $25,000	913 (6.4%)	749 (5.1%)	606 (4.4%)	542 (3.6%)	520 (3.6%)	488 (3.3%)	3,818 (4.4%)	$66,815,000
$25,001 to $50,000	101 (0.7%)	70 (0.5%)	47 (0.3%)	42 (0.3%)	40 (0.3%)	30 (0.2%)	330 (0.4%)	$12,375,000
$50,001 to $100,000	16 (0.1%)	11 (0.1%)	9 (0.1%)	10 (0.1%)	7 (0%)	11 (0.1%)	64 (0.1%)	$4,800,000
Over $100,000	6 (0%)	1 (0%)	0 (0%)	1 (0%)	2 (0%)	4 (0%)	14 (0.0%)	$1,400,000
Total	**14,287**	**14,742**	**13,795**	**14,921**	**14,611**	**14,757**	**87,113**	**$409,331,750**

Chapter 6.
DEER HEALTH

Joe Caudell, Emily McCallen, and Julia Buchanan-Schwanke, Indiana Department of Natural Resources

Epizootic Hemorrhagic Disease

Epizootic hemorrhagic disease (EHD) is a virus spread to white-tailed deer by a biting midge (*Culicoides variipennis*). Often worse in drought years, outbreaks of EHD tend to occur in five- to 10-year cycles. Deer can be reported as sick, dead, or in a group with a sick or dead animals via the Indiana DNR's online Sick or Dead Wildlife Report form (on.IN.gov/sickwildlife) and by calls directly to DNR offices.

In 2022, Indiana DNR received 981 reports of potential EHD cases involving 1,016 deer from 62 counties. Testing for EHD requires fresh samples of the spleen, liver, kidney, or blood. Indiana DNR tests deer to confirm only the presence of EHD in a county and not the total number of infected animals. A total of 22 deer from 17 counties were tested, and 19 (86%) deer from 15 of the 17 counties tested positive for EHD. A total of 1,016 deer were reported in these 62 counties over an area of 23,732.3 square miles (approx. 0.04 deer/square mile). Franklin County had the highest number of deer reported (343 deer) and the highest density of deer reported (0.89 deer/square mile). The number of deer tested in each county ranged from zero to three (Fig. 1). Before 2022, the last major outbreak of EHD in Indiana occurred in 2019. Reports of EHD were spread throughout the state, but there were two hotspots identified in the southeastern portion of the state (Fig. 2).

The presence of EHD this year was more widespread than in the previous year, but less in comparison to the 2019 outbreak that occurred in more than half of the state's counties. Before 2019, the last major outbreak of EHD in Indiana was in 2012. A less widespread but significant outbreak occurred in 2013. Maps of deer reported, tested, and confirmed to have EHD are available online (https://www.in.gov/dnr/fishwild/8541.htm) and updated daily.

Chronic Wasting Disease

Chronic wasting disease (CWD) is a neurodegenerative disease that affects members of the cervid family, including white-tailed deer, mule deer (*O. hemionus*), elk (*Cervis elaphus*), moose (*Alces alces*), and reindeer (*Rangifer tarandus*). CWD is in a class of prion-caused diseases known as transmissible spongiform encephalopathies (TSEs) and is similar to mad cow disease in cattle or scrapie in sheep. Prions are misfolded proteins that cause lesions in the brains of infected animals. CWD is shed in the saliva, feces, and urine of infected deer and transmitted either by direct deer-to-deer contact or through contact with contaminated soil or other material.

Despite considerable ongoing research related to CWD, there is no effective cure or vaccine. CWD is fatal to infected cervids. CWD attacks the animal's brain and causes behavioral changes, excessive saliva production, and loss of appetite. It leads to progressive degradation of body condition and eventual death. CWD has a long incubation period that averages from 18 to 24 months between infection and clinical signs. Infected animals often appear healthy in the early stages of the disease. In advanced stages, infected animals become abnormally thin or weak, may lose fear of humans, stand with legs wide apart, and hold their head and ears low. Infected animals rarely live more than 2.5 years from the time they are infected (B. Richards, USGS National Wildlife Health Center, personal communication).

CWD was first detected as a clinical syndrome in 1967 in captive mule deer at a Colorado research facility. In 1978, CWD was determined to be a spongiform encephalopathy and was found in captive deer and elk in Wyoming. Three years later, the disease was observed in free-ranging elk in Colorado. By 2002, it had been detected in nine states (Colorado, Illinois, Kansas, Minnesota, Montana, Oklahoma, South Dakota, Wisconsin, and Wyoming) and two Canadian provinces. As of December 2021, CWD had been found in wild and/or captive cervid herds in 28 states, four Canadian provinces, Finland, Norway, South Korea, and Sweden (Richards 2021).

CWD has been detected in white-tailed deer in three states bordering Indiana: in wild and captive deer in Ohio, in wild and captive deer in Michigan, and in wild deer in Illinois (Richards 2021). Ohio confirmed its first case of CWD in a wild white-tailed deer in December 2020. The positive animal was found more than 60 miles from Indiana's eastern border (Ohio Department of Natural Resources 2020). In Michigan, the closest positive white-tailed deer was found approximately 30 miles from the Indiana border (Michigan Department of Natural Resources 2020). Illinois reported 176 new detections of CWD in wild deer during fiscal year 2020

(Dufford and McDonald 2020). The closest CWD cases in Illinois are approximately 25 miles from Indiana's western border.

Each year, Indiana DNR collects tissues from hunter-harvested and road-killed deer throughout the state for CWD testing. Samples are collected as part of the statewide CWD surveillance program to monitor for the presence of the disease in Indiana. Sick deer reported by the public are also tested through the statewide CWD surveillance program. Because prions accumulate in the lymph nodes, brain, and spinal cord, CWD is diagnosed by examination of brain or lymphoid tissue from a dead animal.

After the CWD surveillance efforts focused in the southeast, west-central, and northeast regions of Indiana during the 2021 season, Indiana DNR altered their focus to seven counties (Allen, Boone, Clark, Clinton, Harrison, Steuben, and Washington) based on the risk assessment (see 2021 Indiana White-tailed Deer Report). The Indiana DNR was stationed at 10 different processors on the opening weekend of firearms season (Nov. 12-13, 2021) in an effort to retrieve samples from target counties. Submission of samples for CWD testing was voluntary, and hunters received a metal tag reminiscent of historic confirmation tags for participating.

In an effort to collect more samples and effectively lower the cost per sample, the Indiana DNR piloted a taxidermist program. Taxidermists in or around the surrounding counties of interest were contacted and asked if they would participate in a program where the Indiana DNR would pay them to collect samples from hunters bringing in their deer for taxidermy services. Twenty taxidermists across 16 counties agreed to participate. Of the 935 samples collected this year, 291 (about 31%) came from this program. The final cost per sample taken in the taxidermist program came to $45.46, compared to $116.48 per sample when collected from a traditional sampling station.

In addition to the targeted surveillance, hunters interested in having their deer tested for CWD were able to drop off deer heads at any participating Fish & Wildlife area (FWA), State Fish Hatchery (SFH), or National Wildlife Refuge (NWR) throughout the season. The heads were later sampled by Indiana DNR. Wildlife biologists and property managers collected routine samples from road-killed and hunter-harvested deer, and biologists responded to calls and online reports about sick deer that were consistent with clinical signs of CWD. The public was able to report sick deer online through the Sick/Dead Wildlife Report form. Hunters were also able to submit the heads or lymph nodes from their harvested deer directly to the Animal Disease Diagnostic Lab (ADDL) at Purdue University to be tested, for a fee.

Samples collected by staff during opening weekend of firearms season were submitted to Purdue University's Animal Disease and Diagnostic Lab for ELISA testing, and other samples were submitted to approved laboratories and tested using immunohistochemical (IHC) staining procedures. Results were posted online for hunters to access using the confirmation number for that hunter-harvested deer. Any positive deer would have resulted in a phone call to the hunter before the results were posted online.

Totals of 930 hunter-harvested deer, 40 road-killed deer, 34 targeted deer, and 61 opportunistic deer from Indiana were tested statewide in 2022 (Table 6-1). To date, no wild deer from Indiana have tested positive for CWD. The CWD detectability rates were calculated for all 92 counties based on sampling intensity (Figure 6-3). The detectability provides us with a calculated prevalence of CWD in free-ranging deer for which there is a 95% probability the true prevalence falls below. For example, if CWD is present in the deer population in Owen County, there is a 95% chance that it occurs in less than 1.7% of the population (Jennelle et al. 2018) based on our sampling efforts.

Bovine Tuberculosis Surveillance

Bovine tuberculosis (bTB) is a chronic disease caused by the bacterium Mycobacterium bovis. Indiana DNR and other state and federal partners test wild white-tailed deer for bTB because it was found in Franklin County cattle in 2008, 2009, and 2016, and in Dearborn County in 2011. The disease was also detected in captive deer from a farm in Franklin County in 2009. Between 2009 and early 2021, a total of 4,144 wild hunter-harvested white-tailed deer were sampled in the bTB surveillance zones, and none of those deer tested positive for the disease.

In addition to testing hunter-harvested deer, small mammals and other deer have been sampled for bTB on the affected 2016 cattle farm or from lands within a 1.5-mile radius of that farm since 2017. In 2020, U.S. Department of Agriculture, Animal and Plant Health Inspection Service, Wildlife Services (USDA APHIS WS) collected 117 raccoons, 13 opossums, three groundhogs, and one skunk from that area as targeted clean-

up. As of early 2021, the total number of non-hunter-harvested deer and small mammals sampled in that area is 111 deer, 180 raccoons, 33 opossums, three groundhogs and one skunk. One wild raccoon tested positive for bTB in 2017. Another wild raccoon tested positive for bTB in 2020.

To date, all wild deer sampled through hunter-harvest surveillance, disease permits, and USDA APHIS WS targeted clean-up have tested negative for bTB. Additionally, all sampled wild deer exhibiting signs of potential bTB infection have tested negative for bTB. These results suggest that the prevalence of bTB in wild deer in the Franklin County surveillance zone is at a level difficult to detect and is likely very low to nonexistent. As a result, Indiana DNR did not conduct intensive bTB surveillance in Fayette and Franklin counties during the 2021-2022 deer hunting season.

Automated Animal Disease Report Form

The automated animal disease report form has remained active since its launch in mid-2020. The report form is used to track trends over time from reports of animals presenting with signs of disease or reports of animals that died under unusual circumstances. During the system's first year, deer were the most reported animal. In 2021, deer were the second most-reported animal, behind birds, to die from the spread of an unknown disease. While reports of various animals come in year-round, most reports about deer come in between late July, when EHD becomes most prominent, and late January, near the end of hunting season (Figure 6-3).

While the report form is a tool to assist biologists in locating sick or dead wildlife, it is the responsibility of the biologists to use the information provided to investigate what has caused the animal's condition. The biologists use evidence to hypothesize what happened to the deer, and the deer are then classified into seven different categories: suspected EHD, suspected respiratory infection, other disease, injury, nontarget, tumor, or unknown death (Figure 6-4). The number of reports classified as suspected EHD nears 80 during September 2020, versus the maximum of around 20 during 2021 in October. During the hunting season of 2021, there is an increase in the number of reports classified as other disease and unknown death that can be attributed to the increase in number of brain abscesses traditionally seen during this time of year. Brain abscesses often occur due to sparring between males during breeding season, but injuries caused by other means can also cause brain abscesses. There is also a slight increase in 2021 of nontarget reports during hunting season that can be attributed to roadkill deer, dead-deer removal, and incidents involving law enforcement (i.e., poaching).

Anyone can report sick or dead deer directly to Indiana DNR through the online Sick or Dead Wildlife Report form (on.IN.gov/sickwildlife). This form is useful for tracking reports of sick deer with clinical signs consistent with diseases of interest, such as EHD and CWD. The person who reports a deer showing clinical signs of EHD, CWD, or other diseases of potential concern receives a phone call from a wildlife biologist or technician to verify the clinical signs and lack of obvious injury, assess if the animal's location is still known, and determine whether to collect a sample or submit the animal for testing if necessary.

Literature Cited

Caudell, J. N., and O. D. L. Vaught. 2017. 2016 Indiana White-tailed Deer Report. Indiana Department of Natural Resources, Bloomington, USA.

Caudell, J. N., and O. D. L. Vaught. 2018. 2017 Indiana White-tailed Deer Report. Indiana Department of Natural Resources, Bloomington, USA.

Caudell, J. N., and O. D. L. Vaught. 2019. 2018 Indiana White-tailed Deer Report. Indiana Department of Natural Resources, Bloomington, USA.

Caudell, J. N., and O. D. L. Vaught. 2020. 2019 Indiana White-tailed Deer Report. Indiana Department of Natural Resources, Bloomington, USA.

Boggess, C. M., and O. D. L. Vaught. 2021. 2020 Indiana White-tailed Deer Report. Indiana Department of Natural Resources, Bloomington, USA.

Carlson, C. M., M. C. Hopkins, M. T. Nguyen, B. T. Richards, D. P. Walsh, and W. David Walter. 2018. Chronic Wasting Disease: Status, Science, and Management Support by the U.S. Geological Survey. Open-file Report 2017-1138. Wildlife Health Center, Madison, Wisconsin, USA.

Dufford, D. and P. McDonald. 2020. Illinois Chronic Wasting Disease (CWD): 2019-2020 Surveillance and Management Report. Illinois Department of Natural Resources, Wildlife Disease Program, Springfield, USA.

Jennelle, C. S., D. P. Walsh, M. D. Samuel, E. E. Osnas, R. Rolley, J. Langenberg, J. G. Powers, R. J. Monello, E. D. Demarest, R. Gubler, and D. M. Heisey. 2018. Applying a Bayesian weighted surveillance

approach to detect chronic wasting disease in deer. Journal of Applied Ecology 55:2944-2953.
Michigan Department of Natural Resources. 2021. 2020 CWD Testing Results as of January 29, 2021. Michigan Department of Natural Resources, Lansing, USA. https://www.michigan.gov/dnr/0,4570,7-350-79136_79608_90516_90536-538324--,00.html.
Ohio Department of Natural Resources. 2020. Tissue Sample Confirmed Positive for Chronic Wasting Disease in One Wild Ohio Deer. 14 December 2020. https://ohiodnr.gov/wps/portal/gov/odnr/discover-and-learn/safety-conservation/about-odnr/news/confirmed-positive-cwd-in-one-ohio-wild-deer
Richards, B. 2022. Distribution of chronic wasting disease in North America, updated February 6, 2022. https://www.usgs.gov/centers/nwhc/science/expanding-distribution-chronic-wasting-disease?qt-science_center_objects=0#qt-science_center_objects.

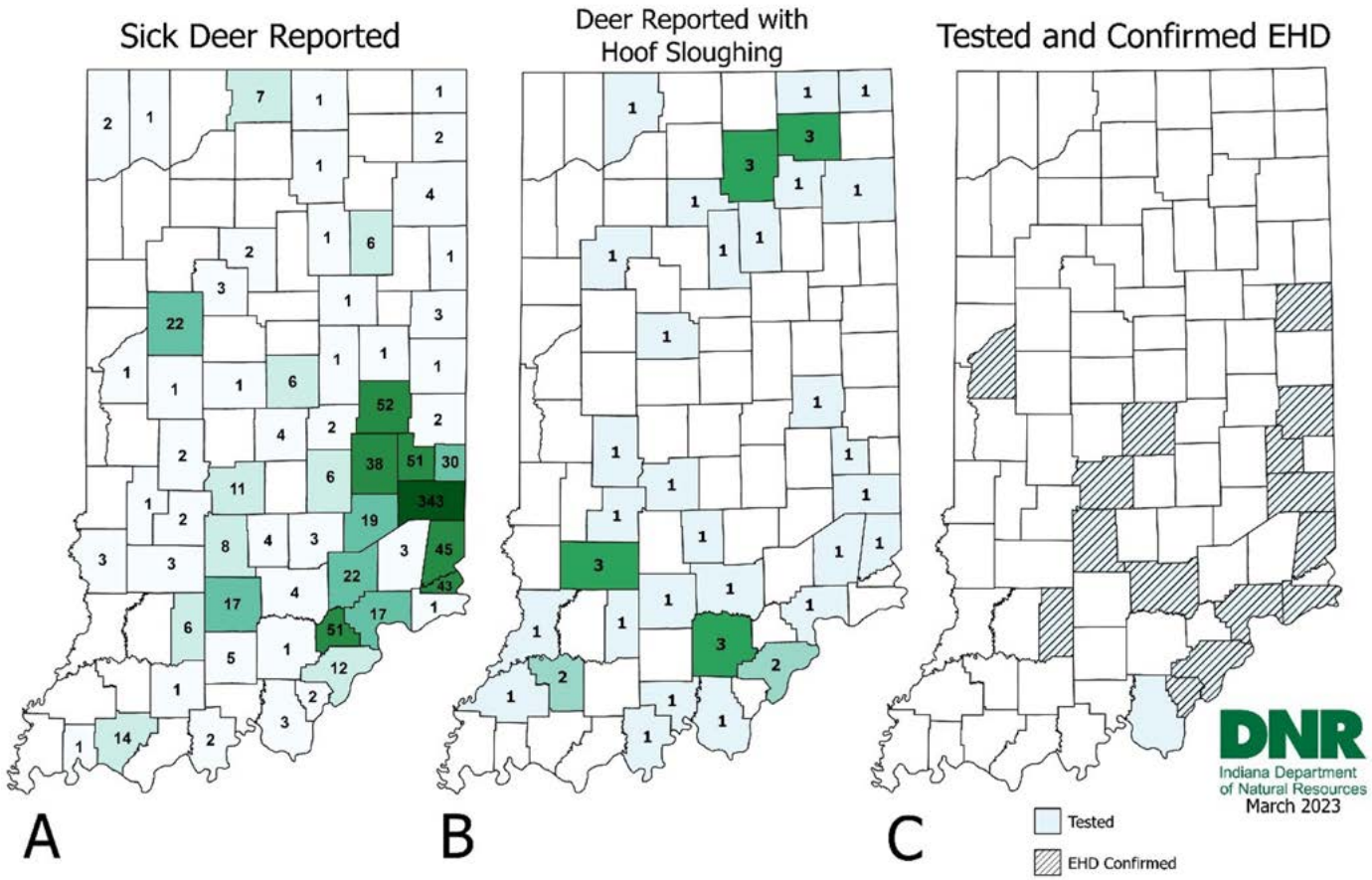

Figure 6-1. A) Number of deer reported as suspects of EHD in each county in 2022, B) Number of deer reported with hoof malformations related to EHD in 2022, C) Number of deer tested and confirmed for EHD by county in 2022.

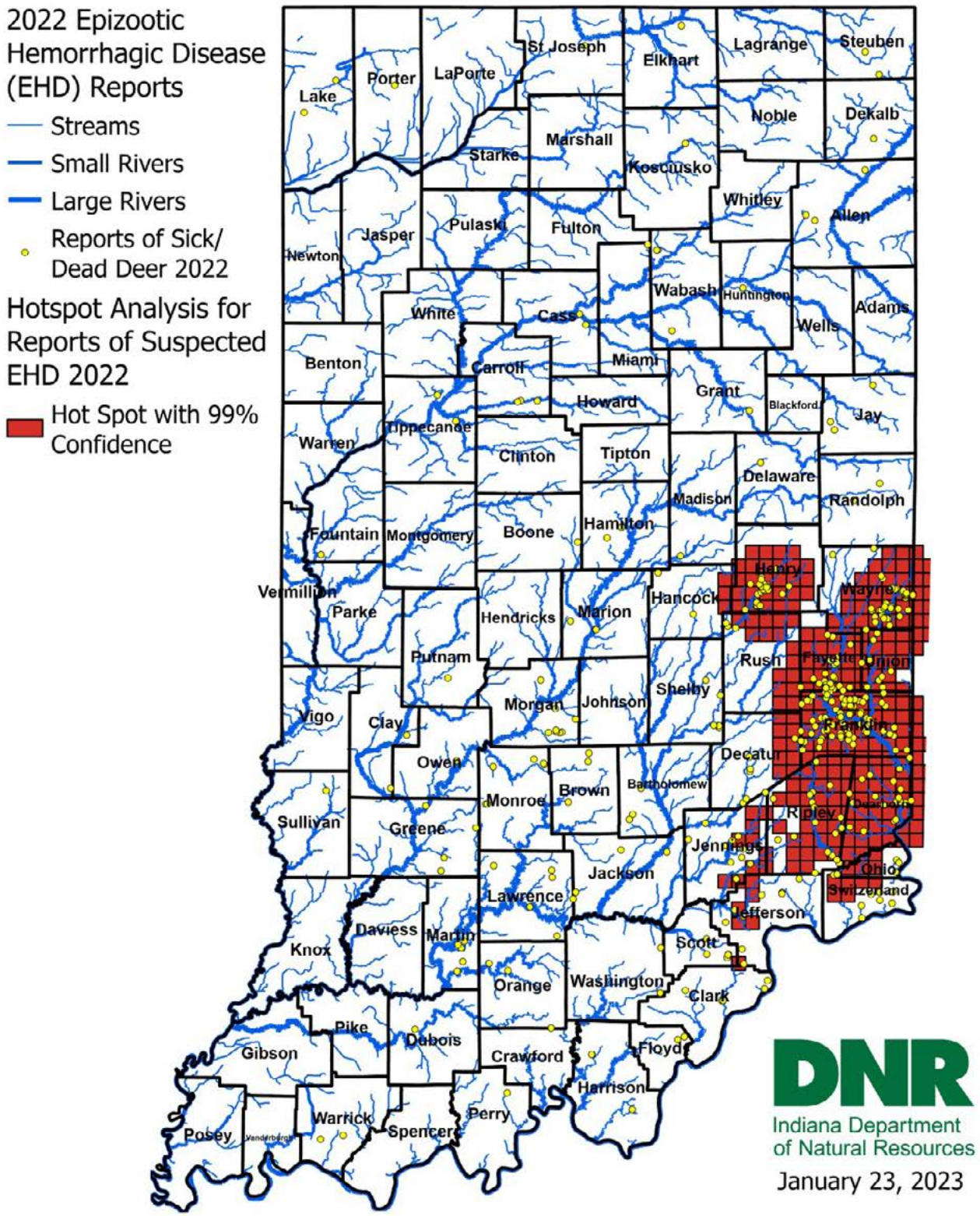

Figure 6-2. Confirmed locations of reported 2022 suspect EHD deer overlaying three types of water features (streams, small rivers, large rivers) with an Optimized Hot Spot Analysis conducted to determine local hotspots of the disease in four square-mile grids.

Table 6-1. Results of CWD surveillance by county during Indiana's 2022-2023 deer hunting season. *Denotes a combination of Opportunistic, Sick Animal, and Found Dead samples.

County	Hunter-Harvested Samples	Road Killed Samples	Targeted Samples	Opportunistic Samples*	Total Samples
Adams	7	0	0	0	7
Allen	34	0	1	1	36
Bartholomew	1	1	0	0	2
Benton	3	0	0	0	3
Blackford	2	0	0	0	2
Boone	7	0	0	0	7
Brown	11	7	0	0	18
Carroll	1	0	0	0	1
Cass	0	0	0	0	0
Clark	1	0	2	0	3
Clay	6	0	0	0	6
Clinton	1	0	0	0	1
Crawford	4	0	0	0	4
Daviess	5	1	0	0	6
Dearborn	3	0	2	0	5
Decatur	10	0	0	0	10
DeKalb	26	0	0	0	26
Delaware	10	1	0	0	11
Dubois	13	0	0	0	13
Elkhart	0	0	1	0	1
Fayette	2	0	1	0	3
Floyd	3	0	0	0	3
Fountain	7	0	1	0	8
Franklin	6	2	2	1	11
Fulton	3	1	1	0	5
Gibson	2	0	0	0	2
Grant	0	0	1	0	1
Greene	32	2	1	1	36
Hamilton	3	0	0	0	3
Hancock	0	0	0	0	0
Harrison	0	0	1	0	1
Hendricks	15	0	0	0	15
Henry	18	0	1	0	19
Howard	1	0	0	1	2
Huntington	13	4	0	0	17
Jackson	1	1	2	0	4
Jasper	5	0	0	0	5
Jay	8	0	2	0	10
Jefferson	7	0	1	0	8
Jennings	11	0	0	0	11
Johnson	5	0	0	0	5
Knox	1	0	1	0	2
Kosciusko	5	0	0	0	5
Lagrange	3	0	1	0	4
Lake	0	0	0	0	0
LaPorte	0	0	1	0	1
Lawrence	33	2	1	0	36
Madison	3	1	0	2	6
Marion	2	0	0	51	53
Marshall	3	0	0	0	3
Martin	60	0	2	1	63
Miami	0	3	0	0	3
Monroe	19	8	1	0	28
Montgomery	29	0	0	0	29
Morgan	30	2	1	0	33
Newton	2	0	0	0	2
Noble	19	0	0	0	19
Ohio	5	0	0	0	5
Orange	12	0	0	0	12
Owen	75	0	1	1	77
Parke	30	0	0	0	30
Perry	0	0	0	0	0
Pike	4	0	0	0	4
Porter	110	1	0	0	111
Posey	3	0	0	0	3
Pulaski	7	0	0	0	7
Putnam	67	1	0	0	68
Randolph	6	0	0	0	6
Ripley	11	0	0	0	11
Rush	2	0	0	0	2
Scott	1	0	0	0	1
Shelby	2	1	0	0	3
Spencer	0	0	0	0	0
Saint Joseph	3	0	1	0	4
Starke	2	0	0	0	2
Steuben	17	1	2	0	20
Sullivan	4	0	0	1	5
Switzerland	6	0	0	0	6
Tippecanoe	1	0	0	0	1
Tipton	1	0	0	0	1
Union	1	0	0	0	1
Unknown	9	0	0	0	9
Vanderburgh	0	0	0	0	0
Vermillion	4	0	0	0	4
Vigo	4	0	0	0	4
Wabash	9	0	0	0	9
Warren	4	0	0	0	4
Warrick	0	0	0	0	0
Washington	3	0	0	0	3
Wayne	1	0	2	0	3
Wells	9	0	0	0	9
White	0	0	0	0	0
Whitley	21	0	0	1	22
Total Samples	**930**	**40**	**34**	**61**	**1065**

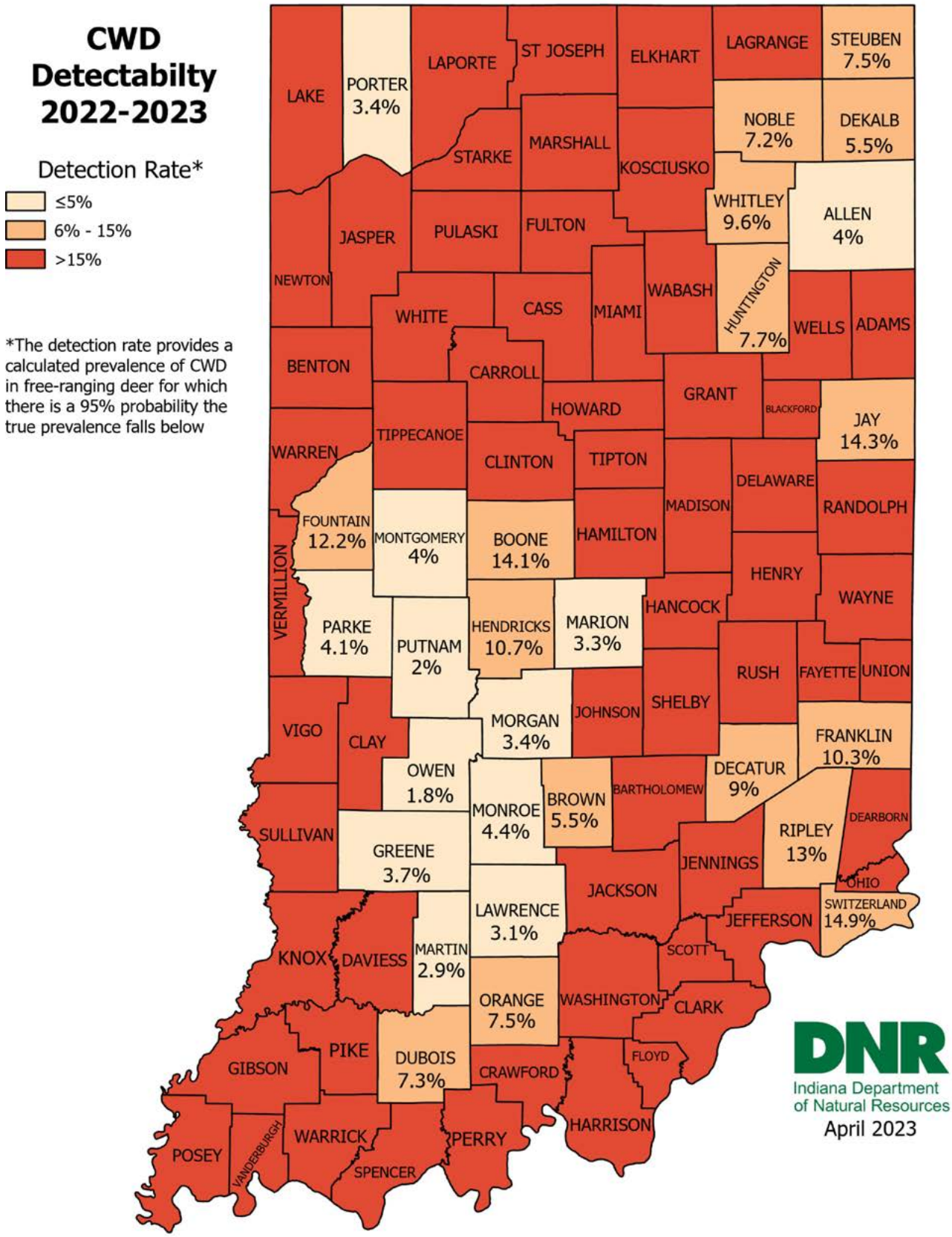

Figure 6-3. Statewide CWD detectability rates for the 2022-2023 deer hunting season. Based on sampling intensity, detectability provides the rate for which there is a 95% probability the true prevalence falls below. For example, if CWD is present in the deer population in Owen County, there is a 95% chance that the disease occurs in less than 1.7% of the population (Jennelle et al. 2018) based on our sampling efforts.

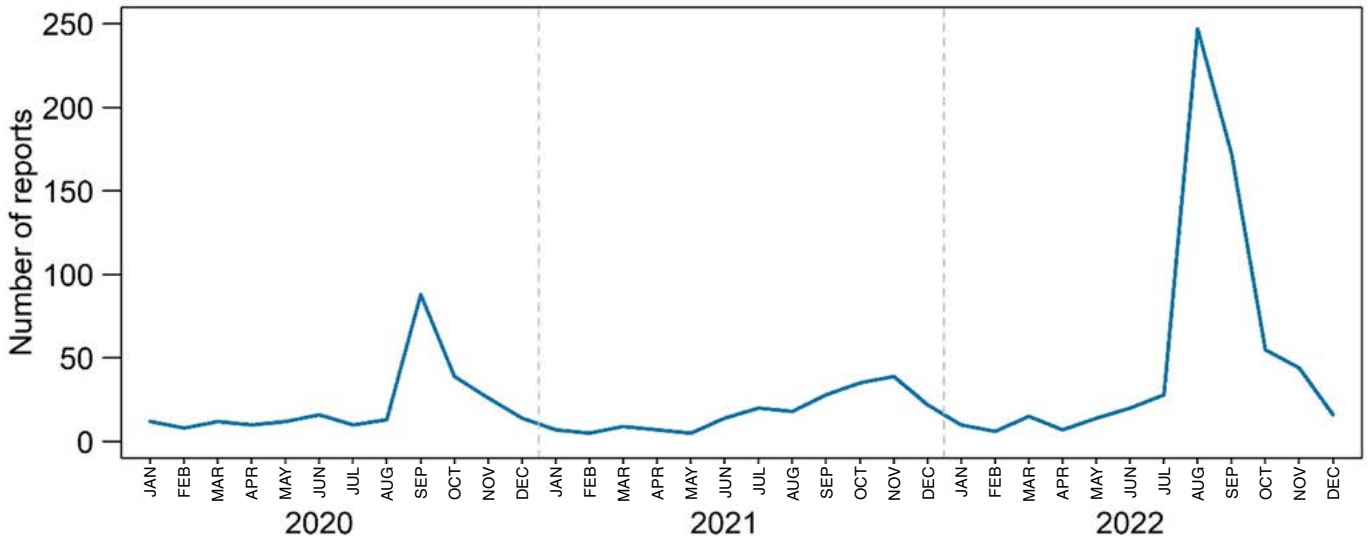

Figure 6-4. Number of reports on deer from the online Sick or Dead Wildlife Report form spread from January 2020 to December 2022. The majority of reports concerning deer are received during late July through the end of hunting season in January of the following year.

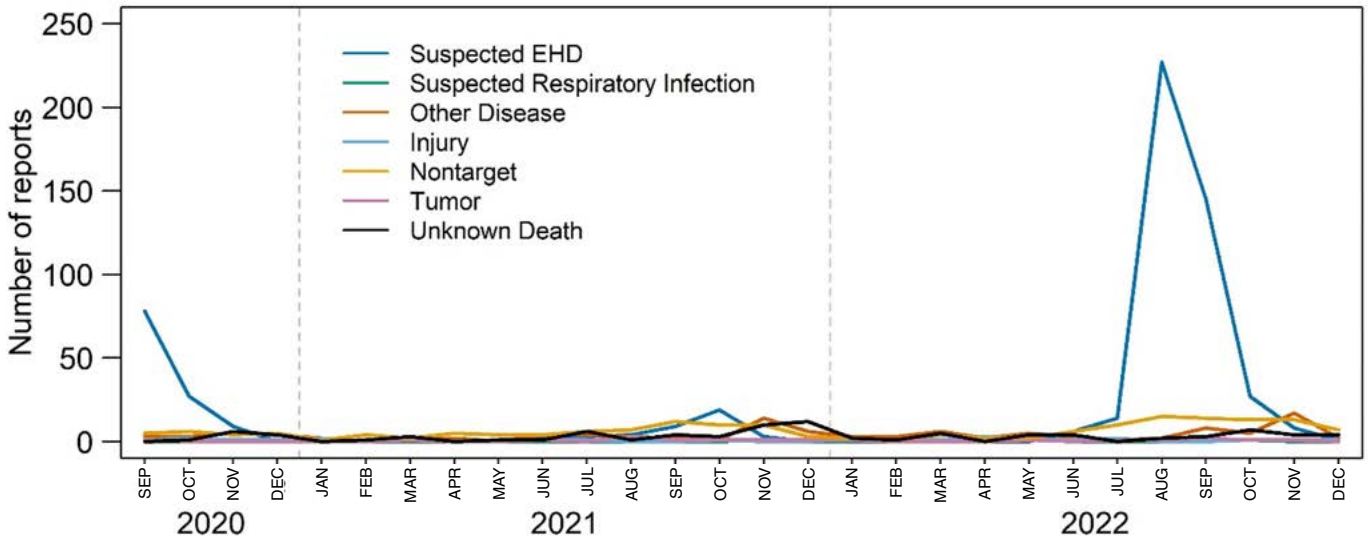

Figure 6-5. Number of sick or dead deer reported from September 2020 to December 2022, classified into seven different categories based on evaluation by a biologist: suspected EHD, suspected respiratory infection, other disease, injury, nontarget, tumor, or unknown death.

Chapter 7.
DEER MANAGEMENT SURVEY

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Understanding public opinion on topics and policies that affect deer hunting and management is an important part of the decision-making process for Indiana DNR. These data are used to set harvest regulations and to examine the potential effect of proposed regulatory changes. Since 2018, Indiana DNR has administered the Deer Management Survey to provide a convenient method for interested hunters and nonhunters to share their opinions.

The Deer Management Survey consists of a core set of questions that remain the same every year to collect longitudinal data, with additional sets of unique questions that change each year to address emerging issues in state deer management. In the 2023 survey, Indiana DNR asked several questions designed to assess opinions and behaviors related to DNR deer rule proposals, deer interactions, use of meat processors, and trophy deer management. The inclusion of specific questions should not be interpreted as a change or a desire for a particular regulation by Indiana DNR or the public.

The information gathered from this survey is often useful in answering questions from the public about Indiana DNR regulations, hunter behavior, and the need for programs designed to assist hunters (e.g., hunter access program). Here we report the results of the 2023 survey on these topics across the entire state. Questions regarding the desires of hunters and nonhunters about the direction of the size of the deer herd, number of deer desired and taken, and other questions related to the deer population status at the scale of counties or deer management units (DMUs) are reported on the online Deer Management Survey Dashboard and can be queried by county or DMU at wildlife.IN.gov/wildlife-resources/animals/white-tailed-deer/deer-management-survey-results/.

Methods

The 2023 survey was sent to individuals that the Division of Fish & Wildlife had prior contact with and had an email address for. Individuals included residents and nonresidents who had purchased any type of hunting, trapping, or fishing license since 2006; anyone who checked in a deer in the last five years; anyone who created an electronic account with Indiana DNR for other reasons (such as obtaining the survey); and anyone who signed up for the Indiana DNR Wild Bulletin e-newsletter. Because lifetime license holders and landowner hunters do not have to purchase a yearly license, they can only be surveyed if they harvest a deer, purchase another license type (e.g., fishing, deer reduction zone license, etc.), or sign up on Indiana DNR's electronic system specifically to receive the survey. Because of this, lifetime license holders and hunters who only use their landowner exemption and do not harvest a deer are likely underrepresented in the survey. Survey invitations were distributed by GovDelivery, a mailing subscription service, in February and March 2023. The survey was developed in the program Qualtrics. All survey results were downloaded in March 2023, and descriptive statistics were generated using Program R.

Results and Discussion

General Demographics of Respondents

On Jan. 31, 2023, we distributed the annual Deer Management Survey via email to 809,763 individuals consisting of anyone who had purchased a license since 2015 (n=611,059) and Wild Bulletin subscribers who have never checked in a deer or purchased an annual hunting, trapping, or fishing license from DFW (n=198,704). Respondents were asked to self-identify as a deer hunter or non-deer hunter and to answer basic demographic questions, although response to these questions was not required. From our total distribution group, 39,889 individuals started the survey (response rate = 4.9%) with a completion rate of 91%. We received 32,559 responses from current and lapsed hunters and 5,125 responses from nonhunters (Table 7-1). Because much of the survey depends upon potential respondents being assigned to a county for reporting, survey respondents had to include a county they hunted in or lived in to be included in the final data.

When residents of Indiana were asked **Do you consider yourself a deer hunter even if you did not hunt during the 2022-2023 deer hunting season**, 31,684 residents indicated they were deer hunters, while 5,125 residents indicated they were not deer hunters but wanted to provide input on deer management where they live (i.e., were resident nonhunters; Table 7-1). Of the Indiana hunters, 24,747 hunted during the 2022-

2023 deer season (i.e., were active resident hunters). An additional 6,937 did not hunt in the past season but still wanted to provide input on deer around where they live in Indiana (i.e., were inactive resident hunters). Of the nonresidents who responded to the survey, 875 reported they hunted during the 2022-2023 deer hunting season (i.e., were active nonresident hunters; Table 7-1).

Indiana hunters were asked about **where they lived and hunted**. Of the 23,884 hunters who responded, the most common responses were, "I hunt only in the county that I live in" (27.7%) and "I hunt mostly in the county that I live in, but I also occasionally hunt in other counties" (33.7%). These were followed by "I never hunt in the county that I live in, I only hunt deer in a different county" (20.6%). The remaining 18.1% responded "occasionally hunt in the county that I live in, but mostly hunt in other counties."

We asked hunters to select **How many total years they had been a deer hunter and how many total years they have hunted deer in Indiana**. A total of 24,961 hunters reported the total number of years they had been a deer hunter. Most (63.4%) reported they had been a hunter for more than 20 years total, followed by 19.6% who reported 10-20 years of deer hunting experience, 8.7% who reported 6-10 years hunting, 6.8% who reported 2-5 years hunting, and 1.5% who reported that this was their first year hunting deer. A total of 24,943 hunters reported the number of years they had hunted in Indiana. Most (56.8%) reported they had hunted deer in Indiana for more than 20 years, followed by 21.1% who reported 10-20 years of deer hunting in Indiana, 10.5% who reported 6-10 years hunting deer in Indiana, 9.3% who reported 2-5 years hunting deer in Indiana, and 2.3% who reported that this was their first year hunting deer in Indiana.

Respondents were asked to **report all types of equipment they used during the 2022-2023 deer season**. A total of 25,510 hunters reported which type of equipment they used to hunt deer. The most common responses were high-powered rifles (58.9% of hunters), crossbows (41.7%), compound bows (39.3%), modern in-line muzzleloaders (32.0%), and shotguns (26.6%). Few respondents (13.4%) indicated that they used pistol-caliber rifles or other low-powered rifles. Hunters used traditional muzzleloaders (8.7%), handguns (4.5%), traditional bows (3.0%), or modern recurve bows (1.1%) less often. Breech-loading muzzleloaders (1.1%), air rifles (0.1%), and arrow guns (0.1%) were seldomly used by hunters. Most deer hunters (33.0%) reported hunting with two types of equipment, while 27.8% hunted with one, and 25.7% hunted with three equipment types. Only 13.5% of Indiana deer hunters used four or more types of equipment.

We asked hunters to **select which license(s) they used in the 2022-2023 deer hunting season**. A total of 25,363 hunters responded. The most commonly reported answer was the license bundle (45.5% of hunters), followed by the lifetime license (25.4%), landowner exemption (14.0%), and firearms (13.7%). Few hunters used archery (8.1%), bonus antlerless (4.7%), deer reduction zone (4.0%), crossbow (3.7%), muzzleloader (2.4%), youth (1.4%), or military exemption (0.5%) licenses.

We asked hunters to **report how many deer they wanted to harvest in the 2022-2023 deer hunting season by selecting from harvest combinations that included both bucks and does**. A total of 25,157 hunters responded. Most respondents (77.5%) wanted to harvest a buck. The most common combination was one buck and one doe (30.4%), followed by one buck and two does (22.2%), and just a single buck (18.8%). Few individuals wanted to harvest one buck and three does (3.9%) or one buck and more than three does (2.2%). Only 1.2% reported wanting to harvest only a single doe. In total, under a quarter of hunters wanted to hunt deer regardless of its sex (one deer 6.1%, two deer 8.0%, three deer 4.8%, four deer 1.1%, and more than four deer 1.3%).

Perceptions about Deer Populations and Management

Both hunters and nonhunters responded to a series of questions about deer population sizes and how harvest should change. We asked **how hunters they would like to see the County Bonus Antlerless Quota change next year in [County] for the 2022-2023 deer hunting season**. To avoid using terminology they may be unfamiliar with, nonhunters were asked How would you like to see the number of does that can be harvested by hunters change in the next year in [County]? (Figure 7-1). Hunters and nonhunters were asked Please describe the size of the deer population in [County] during the 2022-2023 deer hunting season (Figure 7-2), How does the number of deer you saw in [County] during the 2022-2023 deer hunting season compare to the number you saw five years ago? (Figure 7-3), and How would you like to see the number of deer change in the next five years in [County]? (Figure 7-4).

In the 2023 survey, asked about **how quotas**

should change, most hunters and nonhunters thought quotas should be maintained (56.0% and 53.7%, respectively). During the past five years, the proportion of hunters who want to see quotas decrease has fallen, while the opinion of nonhunters has slightly increased (Figure 7-1). Most hunters (51.3%) perceived the size of the deer population as low or too low, while 20.7% of nonhunters felt the same. Conversely, 27.7% of nonhunters perceived the size of the deer population as high or too high, while 8.7% of hunters felt the same. In both hunters and nonhunters, opinions about the size of the deer population have changed little over time (Figure 7-2).

Asked about **how the deer population had changed over the last five years**, most hunters thought it was substantially, moderately, or slightly decreasing (19.6%, 16.9%, and 20.5%, respectively) or being maintained (20.9%). Most nonhunters thought it was being maintained (29.1%), and the rest were equally divided between reporting the population was decreasing (30.7%) or increasing (40.1%). Both hunter and nonhunter perceptions have remained largely stable since 2018 (Figure 7-3).

Asked about **how deer populations should change over the next five years**, most hunters thought populations should increase to some degree (75.4%). Another 18.5% thought populations should be maintained. Responses from nonhunters were evenly distributed, with most indicating that the population should be maintained (36.5%). There has been a slight decrease in the percentage of hunters desiring a considerable increase in the deer population over the next five years (Figure 7-4).

Hunters were asked a few attitudinal questions to rate their hunting satisfaction and experience. Hunters were asked, **How do you think the total deer harvested in this hunting county has changed compared to five years ago?** Most hunters reported that they thought total deer harvest had decreased (52.4%). An additional 26.6% reported they thought there was no change. Hunters were asked, **How does the number of deer you harvested in this hunting county in the most recent season compare to five years ago?** Most hunters thought there was some degree of decrease (53.7%). A third of respondents (38.2%) thought there was no change. For both questions, the distribution of answers has been relatively stable, though fewer hunters perceived a considerable decrease in total or personal harvest over time (Figure 7-5). Hunters were also asked to **describe the QUALITY of the bucks in this hunting county during the most recent deer hunting season**. Most hunters (51.4%) thought the bucks were of average quality, followed by low quality (28.5%). This hunter opinion has remained stable since 2018 (Figure 7-6).

Respondents were also asked about attitudes toward deer management, including **On a scale of 0 (terrible) to 100 (excellent), how would you rate the job the Indiana DNR is doing managing deer STATEWIDE?** Nonhunters rated the DNR 77.1 ± 0.64 on average, while hunters rated it 69.4 ± 0.33 on average out of 100 (Figure 7-7). Both nonhunters and hunters were asked the same question about how well Indiana DNR is doing managing deer in their county. On average, nonhunters rated the DNR at 77.6 ± 0.68, while hunters rated the DNR at 69.0 ± 0.36 out of 100 (Figure 7-8). Finally, hunters were asked, **On a scale of 0 (no enjoyment) - 100 (great enjoyment), how would you rate your overall enjoyment of your hunting experience during the 2022-2023 deer hunting season?** This rating has remained largely steady since 2018 (Figure 7-9). Hunters rated their enjoyment, on average, at 81.4 ± 0.27 out of 100.

Table 7.1. Categories of individuals responding to the Deer Management Survey between 2018 and 2023.

Type	Description	Question Type	2018	2019	2020	2021	2022	2023
Active Nonresident Hunters	Nonresident Indiana deer hunters who hunted during the most recent deer season	County where they hunt	676	1,318	1,066	1,210	921	875
Active Resident Hunters	Resident Indiana deer hunters who hunted during the most recent deer season	County where they hunt and county where they live (when they differ)	14,839	22,604	16,894	18,340	15,157	24,747
Inactive Resident Hunters	Resident Indiana deer hunters who did not hunt during the most recent deer season	County where they live	2,752	3,859	3,528	2,252	3,047	6,937
Resident Nonhunters	Indiana residents who are not deer hunters	County where they live	2,343	2,574	3,718	1,983	4,458	5,125
Invalid Responses	Participants who were not qualified to take the survey (nonresident nonhunters) and participants who did not answer enough questions to be categorized.	None	2,675	3,633	4,883	2,227	4,526	2,204
Total Reported	Total sample included for data analysis	All	20,610	30,355	25,206	23,785	23,583	37,684

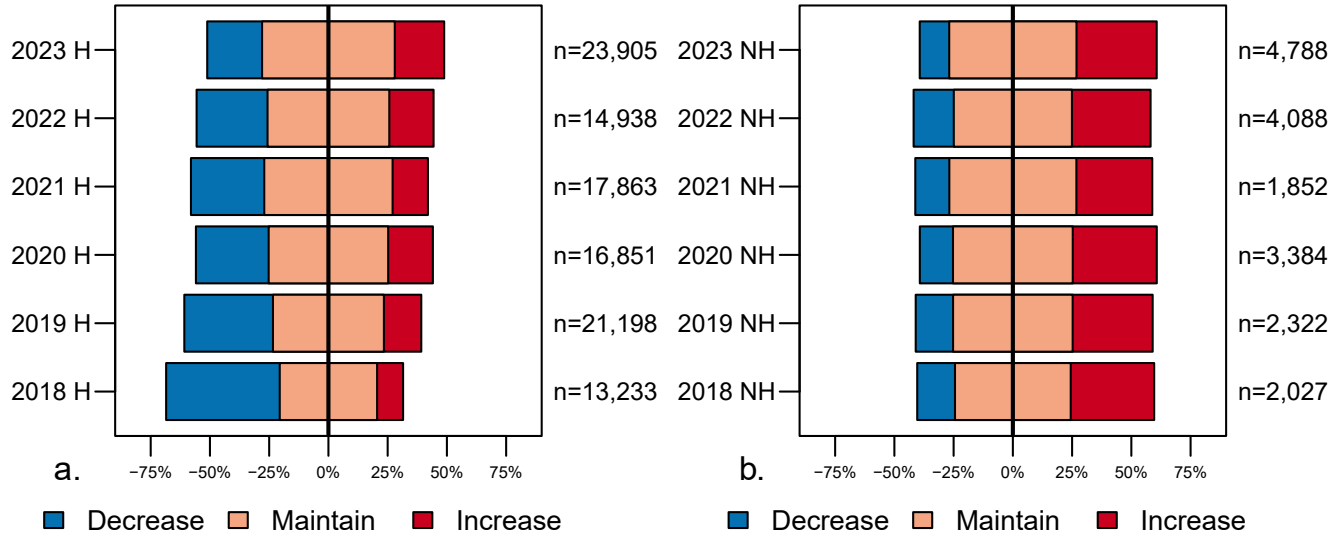

Figure 7-1. Hunter (a.) and nonhunter (b.) opinion on how the County Bonus Antlerless Quota should change the next year in Indiana.

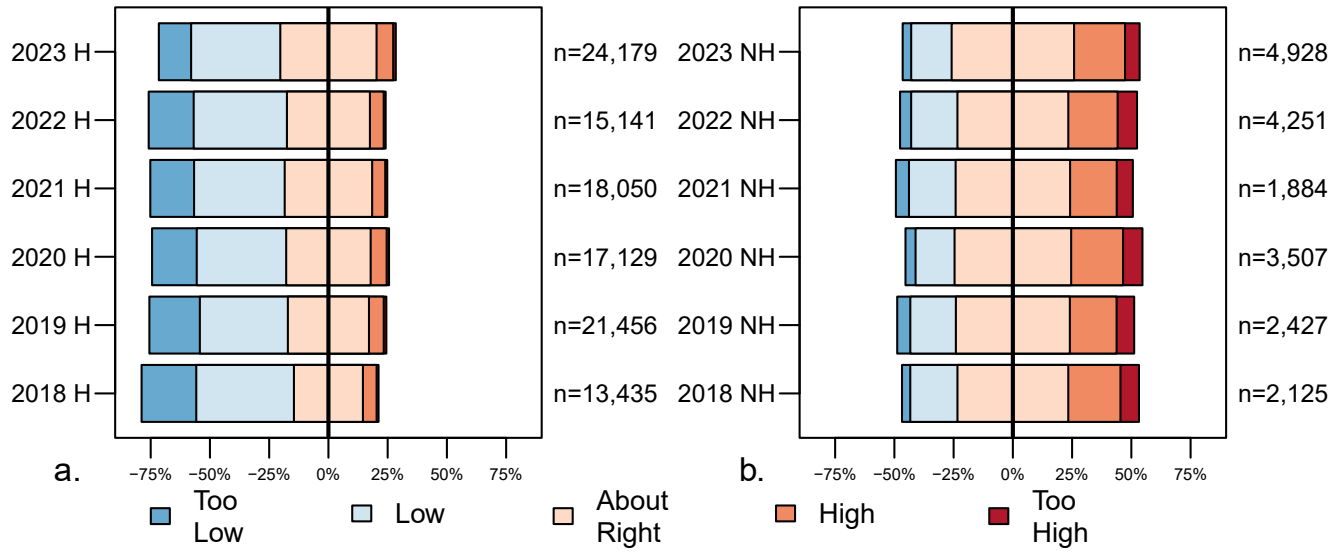

Figure 7-2. Hunters (a.) and nonhunters (b.) describe the current size of the deer population in the county where they hunt and/or live in Indiana.

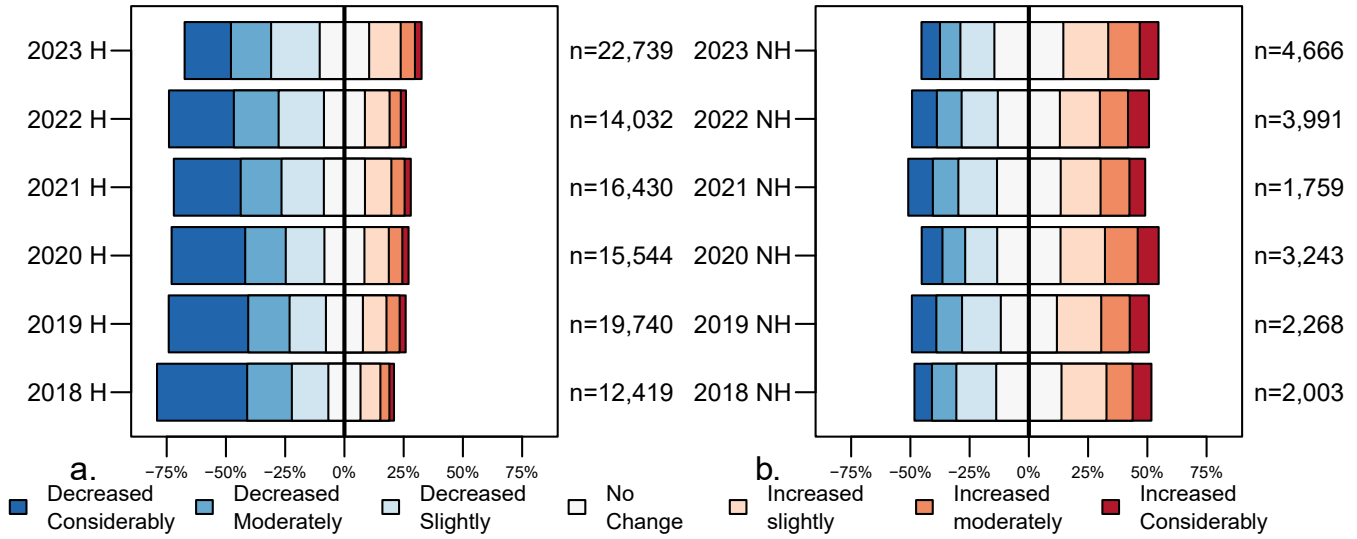

Figure 7-3. Hunters (a.) and nonhunters (b.) describe the number of deer seen now compared to five years ago in the county where they hunt and/or live in Indiana.

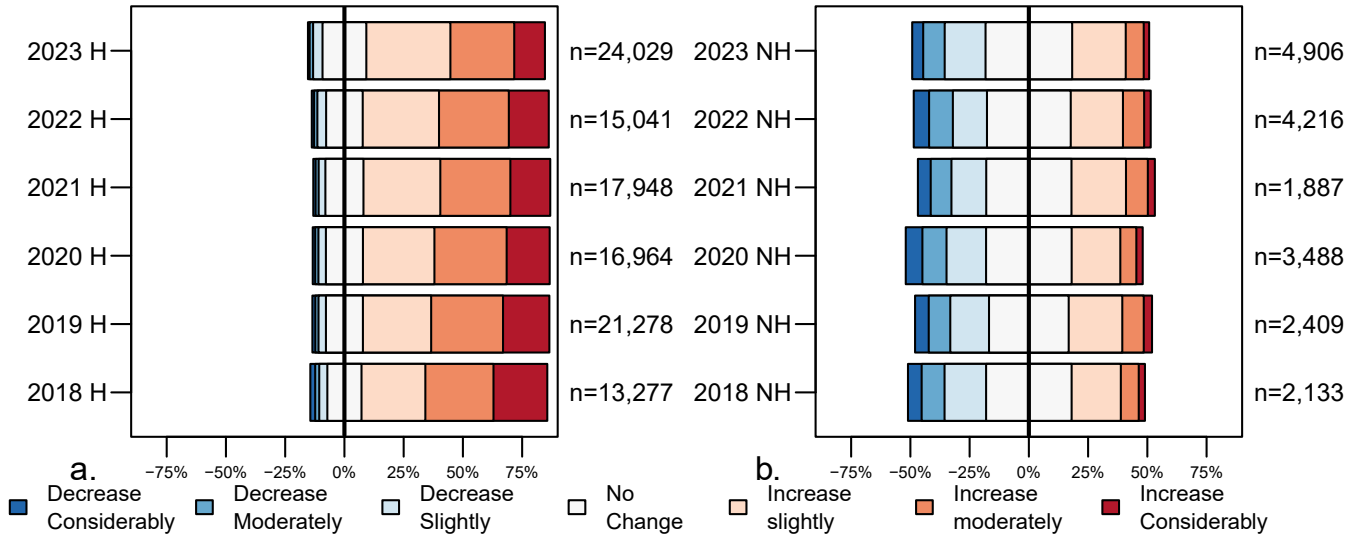

Figure 7-4. Hunters (a.) and nonhunters (b.) describe their desired change in the size of the deer population in the county where they hunt and/or live in Indiana.

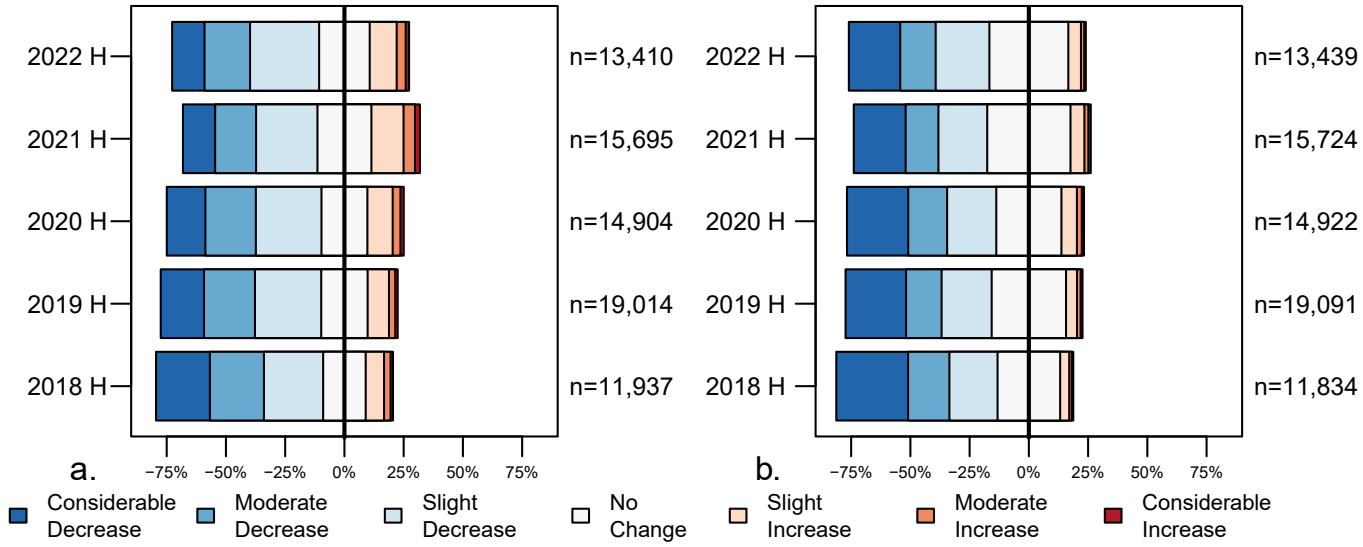

Figure 7-5. Hunter opinion on how the total number of harvested deer (a.) and their personal number of harvested deer (b.) in Indiana has changed over the last five years.

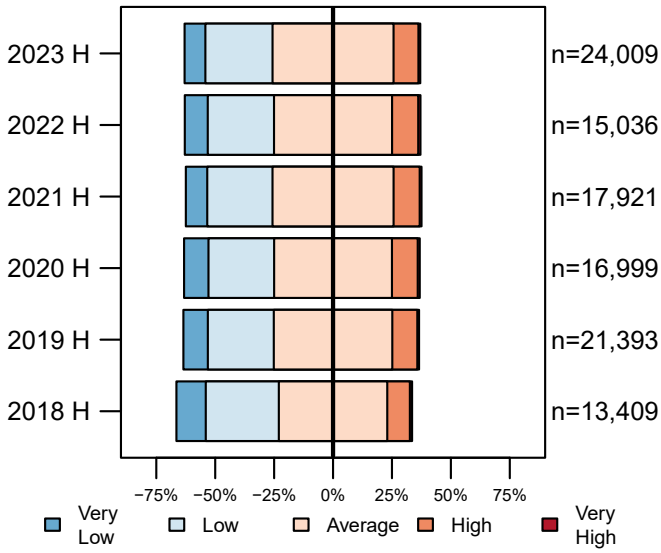

Figure 7–6. Hunters describe the quality of bucks in the county where they hunt in Indiana.

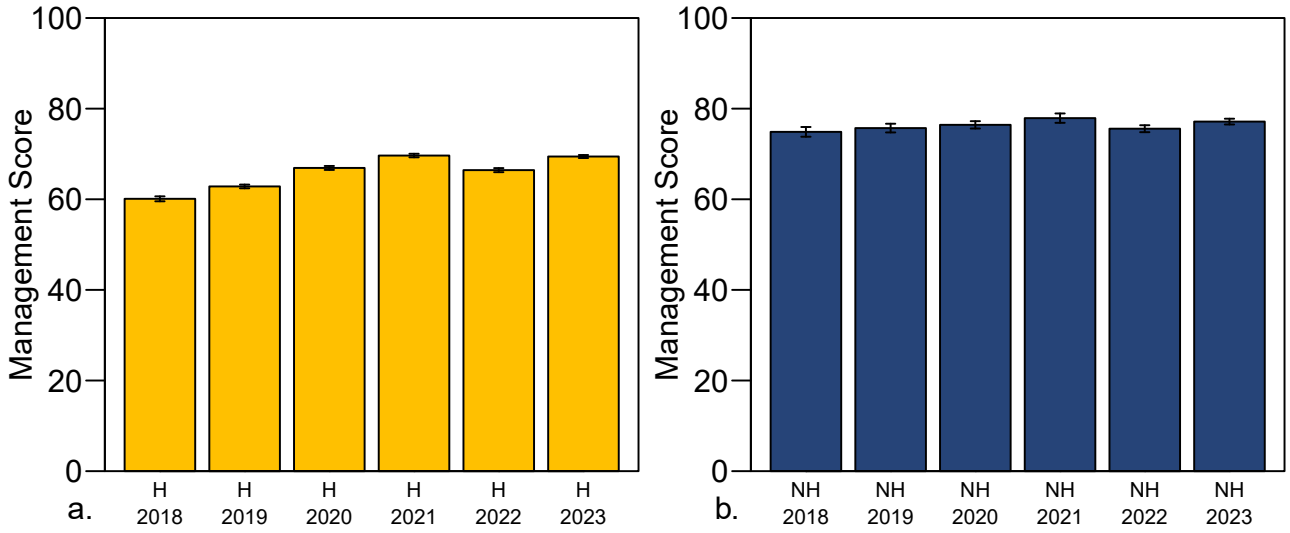

Figure 7-7. Hunters (a.) and nonhunters (b.) were asked to score the Indiana DNR's statewide deer management on a scale of 0 (poor) to 100 (excellent).

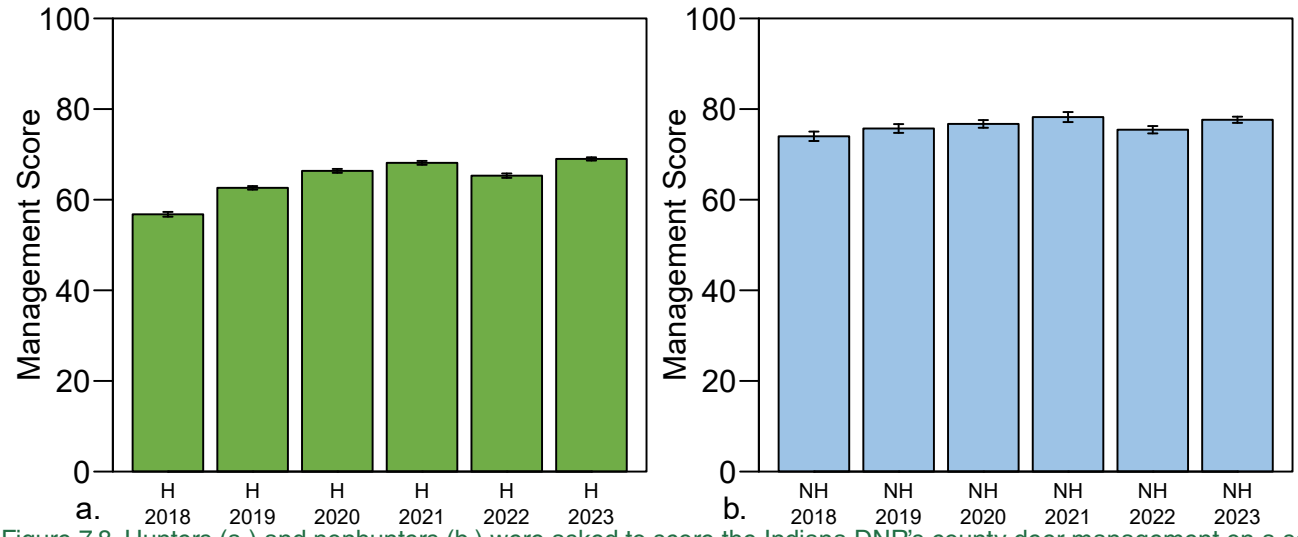

Figure 7-8. Hunters (a.) and nonhunters (b.) were asked to score the Indiana DNR's county deer management on a scale of 0 (poor) to 100 (excellent).

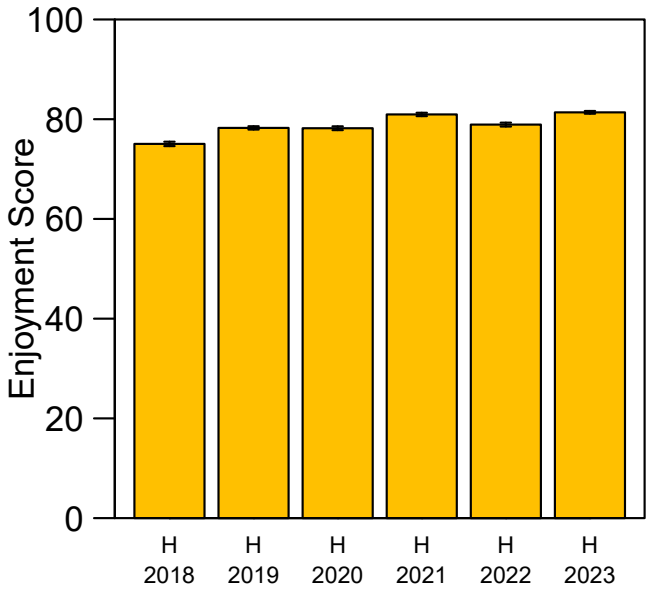

Figure 7-9. Hunters were asked to score their hunting experience on a scale of 0 (no enjoyment) to 100 (great enjoyment) during the previous Indiana deer season.

DNR File Photo

Chapter 8.
Volunteer Monitoring

ARCHER'S INDEX

Joe Caudell, Emily McCallen, and Geriann Albers,
Indiana Department of Natural Resources

Archery hunters play an important role in monitoring the abundance of furbearer and other wildlife species in Indiana. Since the early 1990s, Indiana archery hunters have voluntarily shared their wildlife observations with Indiana DNR to monitor trends in statewide wildlife populations. The partnership between archery hunters and Indiana DNR has provided a consistent and inexpensive method for monitoring many wildlife species. The Division of Fish & Wildlife (DFW) furbearer program currently manages the Archer's Index and has shared its data on deer observations for analysis in the White-tailed Deer Report. The complete Archer's Index report is available on a yearly basis and contains indices for several furbearer species. See previous Archer's Index reports at wildlife.IN.gov/wildlife-resources/wildlife-and-fisheries-reports/. Volunteers may sign up to participate in the Archer's Index online at on.IN.gov/archersindex.

Methods

Before archery hunting season, hunters who volunteered to participate in the survey were sent a standardized survey form and directions for recording wildlife observations. Hunters were asked to record the number of hours spent hunting each day, noting either morning or evening hunts, and the total number of each wildlife species observed daily.

Historically, the survey ended on the same day as early archery season, typically in late November; however, regulation changes were implemented in 2012 that extended archery season to one continuous season that ended in early January. Since then, the Archer's Index has ended one day before the opening of firearms season to ensure an unbiased and standard survey period. After the end of the survey period, participants returned their completed survey form to Indiana DNR.

Population indices were tabulated by dividing the total number of each wildlife species sighted by the total number of hours hunted. Observations per hour, fawn:doe ratios, and doe:buck ratios were calculated statewide and at a regional level based on the 10 deer management units (DMU) the deer research program created in partnership with Purdue University to better understand deer trends across broad habitats. Statewide results are reported in this section, and regional results are reported in the DMU Data Sheets section. Bootstrapped confidence intervals (CI_{95}) were calculated for observations per hour each year.

Results and Discussion

In 2022, a total of 314 hunters in 90 counties reported deer observations in the Archer's Index. Hunters observed a total of 12,305 deer in 14,055 hours during 4,360 observational periods ranging from 0.5 to 12 hours. Hunters observed an average of 0.93 deer per hour (CI_{95}=0.89 – 0.97; Figure 8-1). A total of 3,147 bucks, 5,295 does, 2,902 fawns, and 961 deer of an undetermined age and sex were observed. From the Archer's Index, the statewide fawn:doe ratio was 0.55:1 (CI_{95}=0.52 – 0.57), and the doe:buck ratio was 1.67:1 (CI_{95}=1.59 – 1.74). Comparatively, the harvest doe:buck ratio was 0.77:1 (CI_{95}=0.76 – 0.78; Figure 8-3).

The Archer's Index provides several trends or indices of the size, composition, and recruitment of the deer population and may be useful for monitoring how these populations change over time; however, because these values have not been measured against a known population, it is unclear how closely the values from these indices reflect true population values. Therefore, the results of the Archer's Index can only be used to monitor trends of deer population and not the actual size. One potential bias proposed by critics of volunteer monitoring observer indices is that fawn observations may be underrepresented. Older fawns can look similar to young does, especially if the fawns are not traveling with their doe. Thus, fawn:doe ratios and recruitment data may become skewed. However, the period when the Archer's Index occurs (October to mid-November) is considered an ideal time, because bias from fawns not traveling with their mother is minimized. Fawns are likely at their smallest body size, routinely traveling with their mother, and loss of the parent is minimized before firearms season. Furthermore, if the fawn:doe ratios are biased in favor of does, due to misidentified fawns, then the doe:buck ratio would likewise be skewed toward does. This does not appear to be the case for our data, as doe:buck ratios are between 1.4:1 and 2.5:1 in most areas (see DMU sheets in the Appendices).

Fawn recruitment is the number of fawns that are born and survive to join the huntable population in the fall. The recruitment value is lower than the total number of fawns born each spring. Fawns die or are killed

between birth and the hunting season due to predation, disease, exposure, abandonment, deer-vehicle collisions, haying operations, and other reasons. Therefore, the recruitment rate is almost always lower than the birth rate. For example, the reproductive characteristics of does were recently studied in Illinois. Green et al. (2017) found an average of 20.5% of recruited fawns and 85.5% of adult does were bred by the end of the breeding season. Their average litter size was 1.9 ± 0.54 fawns. In 2015, Illinois reported its statewide recruitment, based on their fawn:doe ratio, was 0.5:1 (QDMA 2016). Even though a large proportion of deer were bred, resulting in a high rate of births, fawns experienced a high rate of mortality. Fawn recruitment values can be used for several different purposes, including modeling for allowable buck and/ or doe harvest and as an indicator of potential problems with a deer herd, such a slow growth rate.

Initially, it may appear that fawn:doe ratios are low for many of the DMUs and statewide; however, Indiana has similar fawn:doe ratios compared to nearby states, according to the 2015 recruitment data reported to QDMA (2019): Ohio (0.60:1), Illinois (1.18:1), Michigan (0.47:1; QDMA 2015), or the Midwest average (0.81; QDMA 2019). Although these reported ratios are similar, caution should be taken when directly comparing fawn:doe ratios across states, because the respective methodologies they use to calculate the fawn:doe ratios differ. These differences are often based on how the data have been historically collected. For example, Ohio uses the ratio of fawns to does in the harvest, whereas Wisconsin calculates its fawn:doe ratios on a regional basis, using the total number of biologist observations of fawns and does (0.90:1 in 2017; QDMA 2019). It may seem that all states should use the same system, but for each state's deer management program, the long-term trend (i.e., index) is more important than a comparison with neighboring states. Therefore, readers must understand how the data are collected in other states before comparing to Indiana's fawn:doe ratios.

Currently, Indiana has an approximately balanced prehunt sex ratio (1.67:1). Balanced doe:buck ratios are generally considered to be desirable because they increase the likelihood of all does being bred during the period when they are most receptive, a more condensed rut, and an earlier fawning season (Guynn and Hamilton 1986; Neuman et al. 2017).

Observations per hour is an index that can be used to examine long-term trends in the deer population. It is important to understand that this is an index of the population and does not represent population numbers or an expectation for hunters (i.e., if the average reported observation per hour is 1.1, hunters should not expect to see a deer every hour they are in the woods). Observations per hour for bucks have been level since 2011 but have increased slightly over time for total deer (Figure 8-2).

Literature Cited

Guynn, D. C., and R. J. Hamilton. 1986. The effects of adult sex ratio on reproduction in white-tailed deer. Proceedings of the International Ranchers Roundup 1986:233-240.

Green, M. L., A. C. Kelly, D. Satterthwaite-Phillips, M. B. Manjerovic, P. Shelton, J. Novakofski, and N. Mateus-Pinilla. 2017. Reproductive characteristics of female white-tailed deer (Odocoileus virginianus) in the Midwestern USA. Theriogenology 94:71-78.

Neuman, T. J., C. H. Newbolt, and S. S. Ditchkoff. 2017. The influence of population demographics on white-tailed deer fawning season. Journal of the Southeastern Association of Fish and Wildlife Agencies 4:115-120.

QDMA. 2019. QDMA's Whitetail Report 2019: An Annual Report on the Status of White-tailed deer. Quality Deer Management Association, Bogart, Georgia, USA.

QDMA. 2021. QDMA's Whitetail Report 2021: An Annual Report on the Status of White-tailed deer. Quality Deer Management Association, Bogart, Georgia, USA.

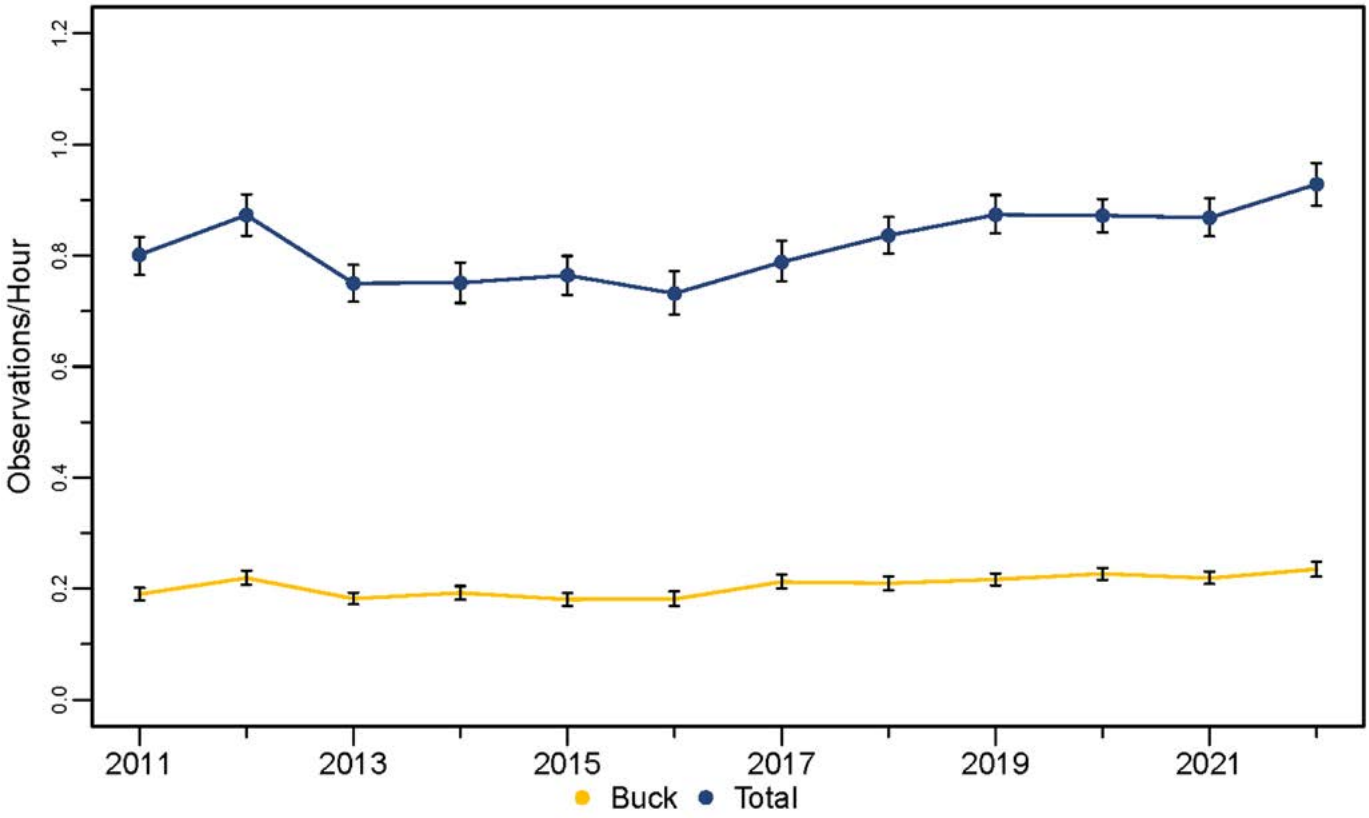

Figure 8-1. Annual mean observations per hour of bucks and total deer based on the Archer's Index.

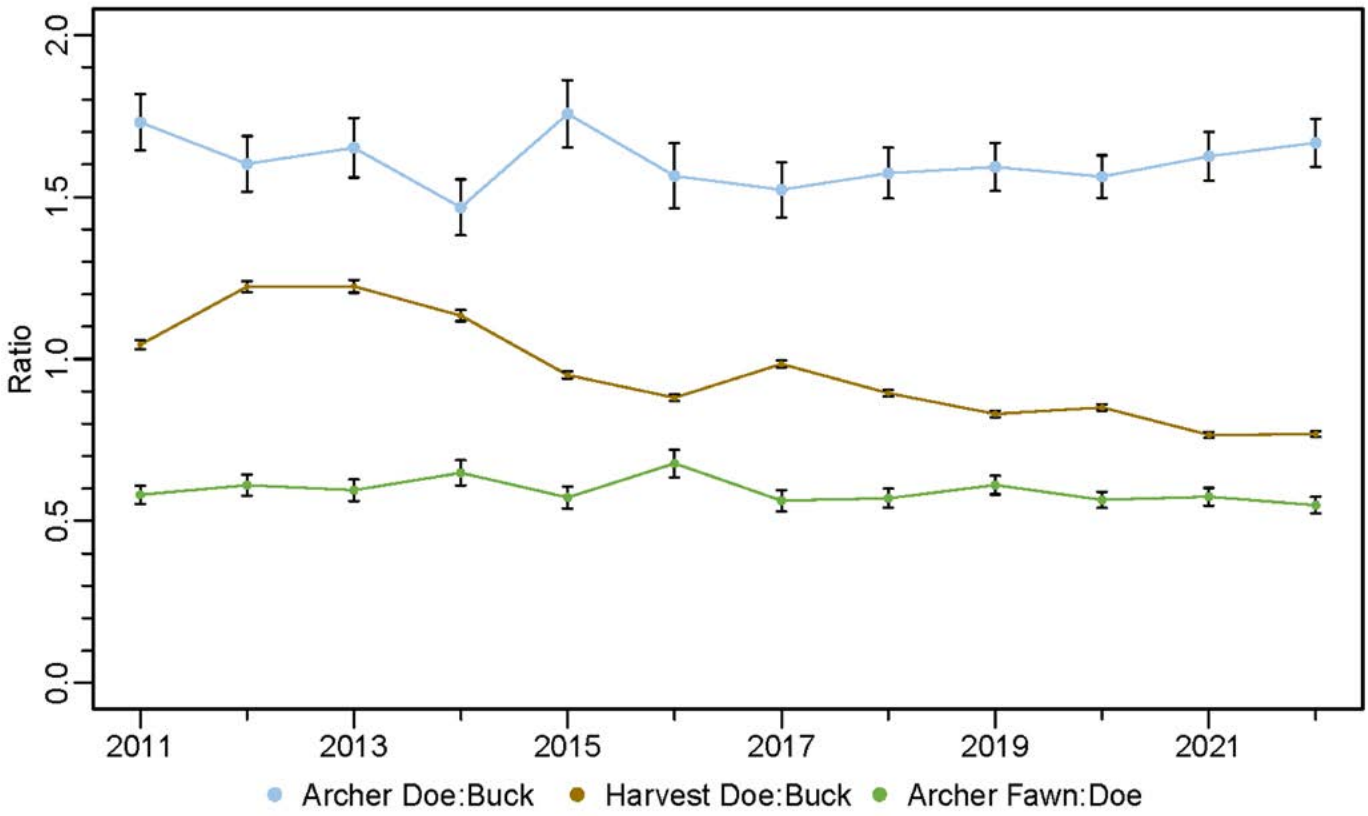

Figure 8-2. Annual doe:buck and fawn:doe ratios based on Archer's Index and harvest records.

AFTER HUNT SURVEY

Joe Caudell and Emily McCallen,
Indiana Department of Natural Resources

For many years, Indiana DNR biologists examined deer at check stations where hunters brought their deer to record their harvest. Biologists recorded age, sex, and other biological information that was useful for managing the deer herd. In 2015, Indiana moved to an online system, CheckIN Game, to make the process more convenient for hunters. The After Hunt Survey was created in 2017 to allow hunters the opportunity to continue providing biological information about their harvested deer. The goal of the After Hunt Survey is for hunters to self-report on enough deer so that both hunters and managers can examine deer population biology, ecology, and demographics at the county level. The 2022 deer season was the sixth year the

Table 8-1. Number of After Hunt Survey responses by Deer Management Unit, 2022-2023. *The Urban DMU incorporates portions of 19 counties (Lake, Porter, Laporte, St. Joseph, Elkhart, Kosciusko, Allen, Tippecanoe, Delaware, Hamilton, Boone, Hendricks, Marion, Morgan, Johnson, Vanderburgh, Warrick, Floyd, and Clark). As such, the total number of counties will not equal 92 when the Urban DMU is included.

Deer Management Units	Number of Counties in Unit	Number of Responses	% of Total Responses
1 - Northwest	13	688	19%
2 - Northeast	4	264	7%
3 - West Central	9	282	8%
4 - East Central	28	607	17%
5 - Wabash Valley	6	241	7%
6 - South	16	737	21%
7 - Muscatatuck Plateau	4	160	4%
8 - Dearborn Upland	3	142	4%
9 - Southwest	9	437	12%
Total		**3558**	

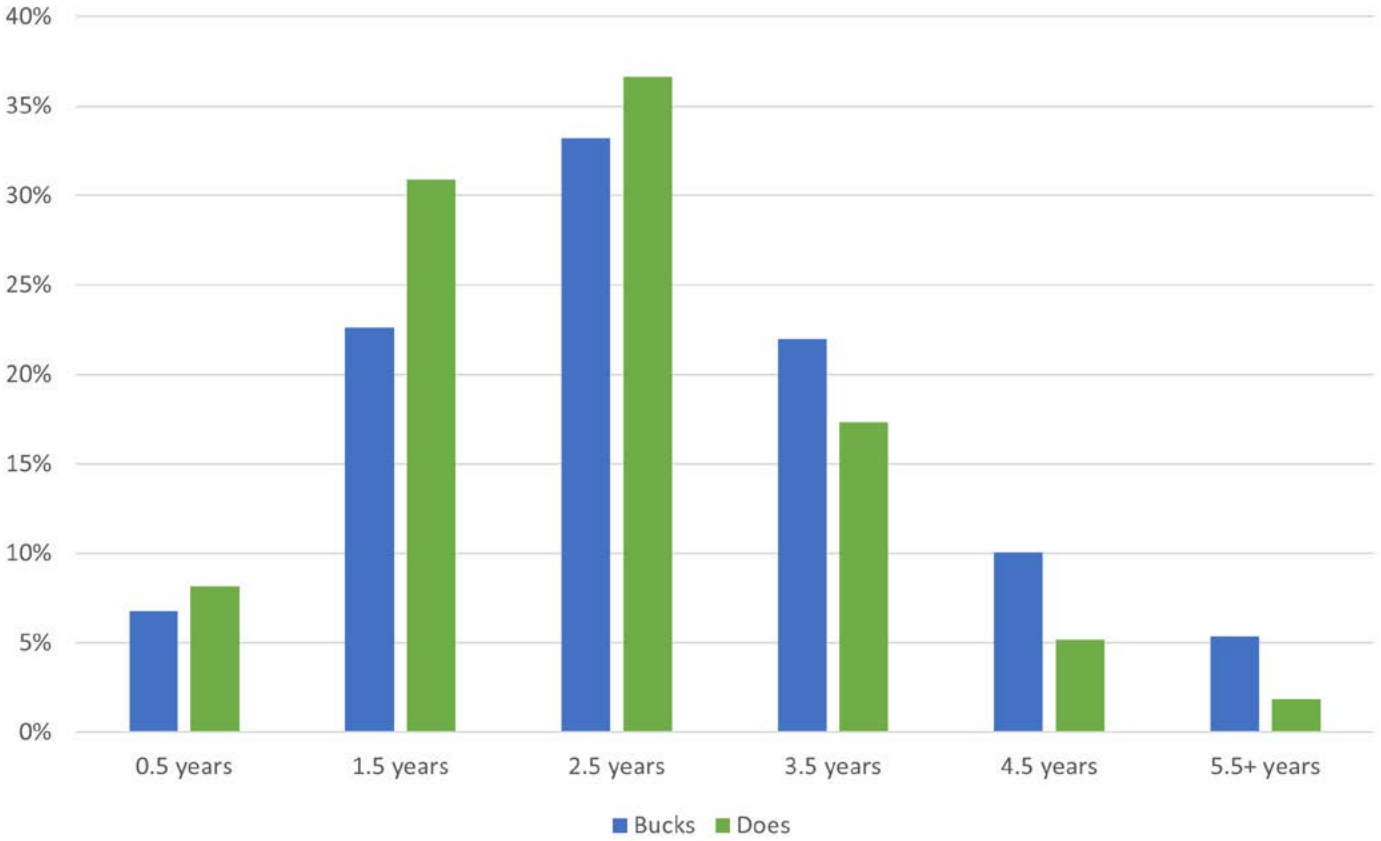

Figure 8-3. Age distribution of the statewide deer harvest reported in the 2022-2023 After Hunt Survey.

After Hunt Survey was available. Because the sample size for most counties was insufficient to report results to the county level, results are reported at regional and statewide levels. The After Hunt Survey was administered using Qualtrics, an electronic survey system. Hunters were asked to participate in the survey after they had checked in their deer. They could also access the survey later by visiting deer.dnr.IN.gov and clicking on the After Hunt Survey link under Deer Management. Questions included: the equipment used to harvest the deer, the location of harvest, the number of hours spent hunting for that deer, their opinion of that particular hunt, and biological information for that deer. Table 1 and Figures 8-3 through 8-9 present the results of the 2022 After Hunt Survey.

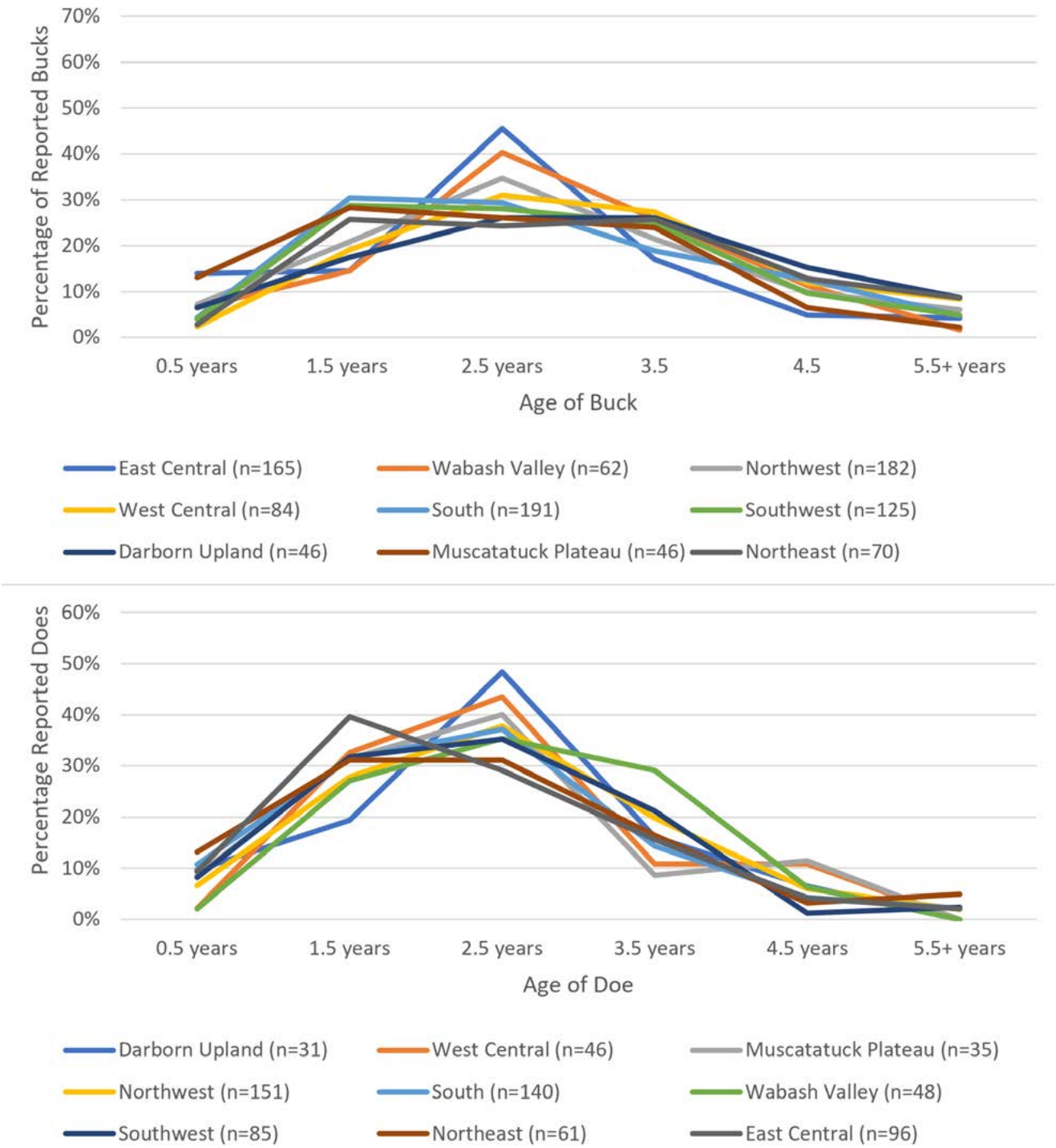

Figure 8-4. Age distribution of harvested bucks (upper graph) and does (lower graph) by Deer Management Unit reported in the 2022-2023 After Hunt Survey. The number of responses in each DMU is next to its name. Due to the lack of data from the Urban DMU, age estimates for bucks and does could not be calculated.

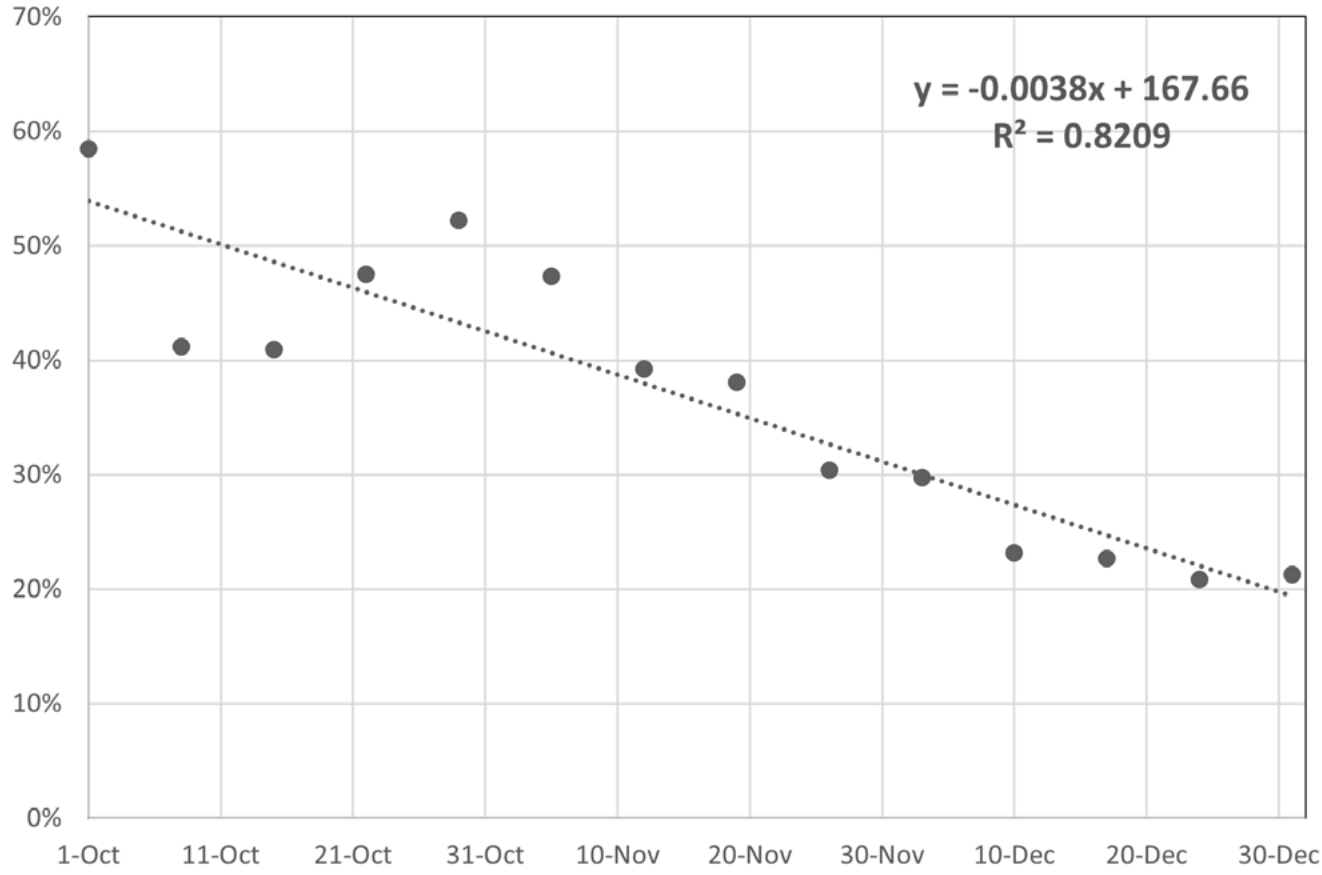

Figure 8-5. Cumulative weekly lactation rates of does at least 2.5 years old reported in the After Hunt Surveys from 2017-2018 to 2022-2023. The trend line indicates a gradual decline in lactation rates as the season ends.

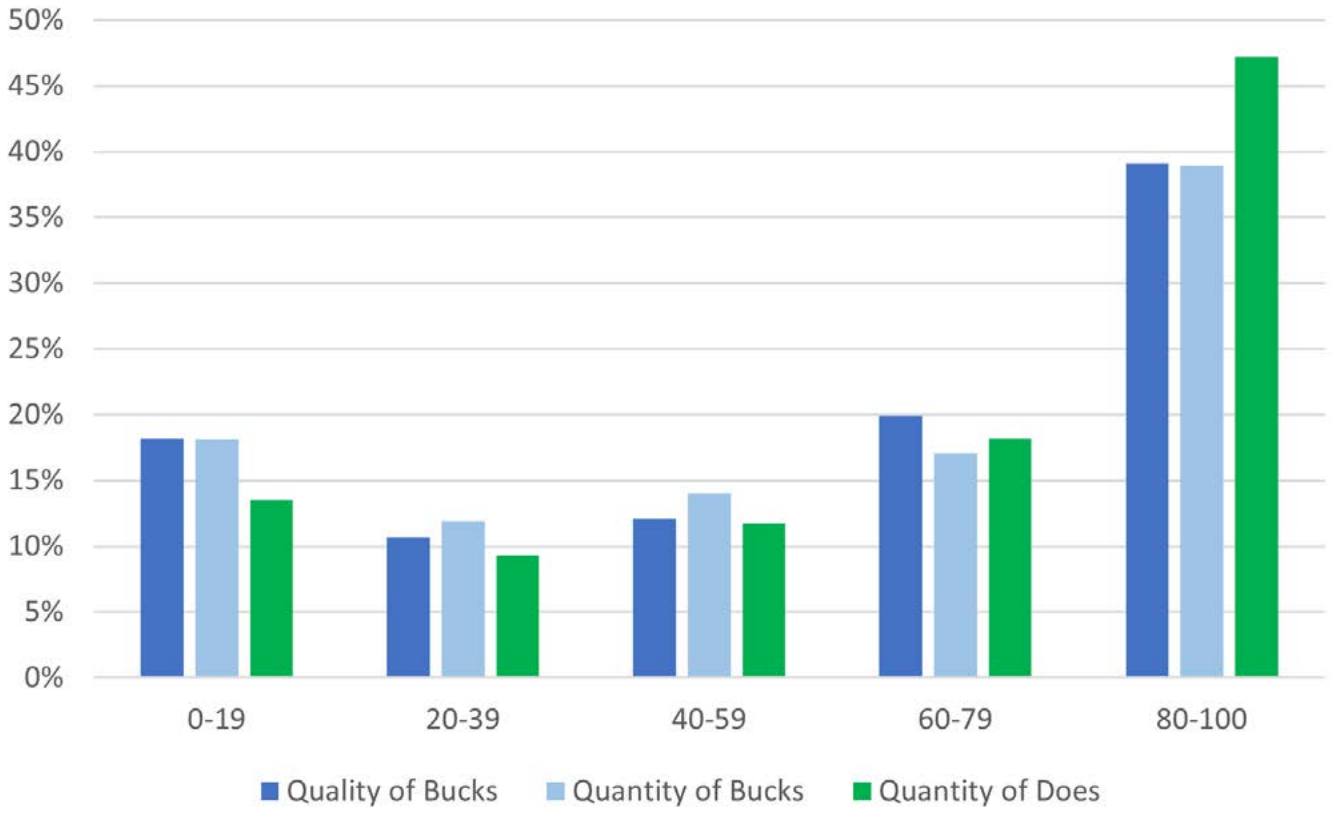

Figure 8-6. Hunter opinion about the quality and quantity of bucks and the quantity of does observed while hunting during the 2022-2023 deer hunting season. Scores range from 0 (poor) to 100 (excellent).

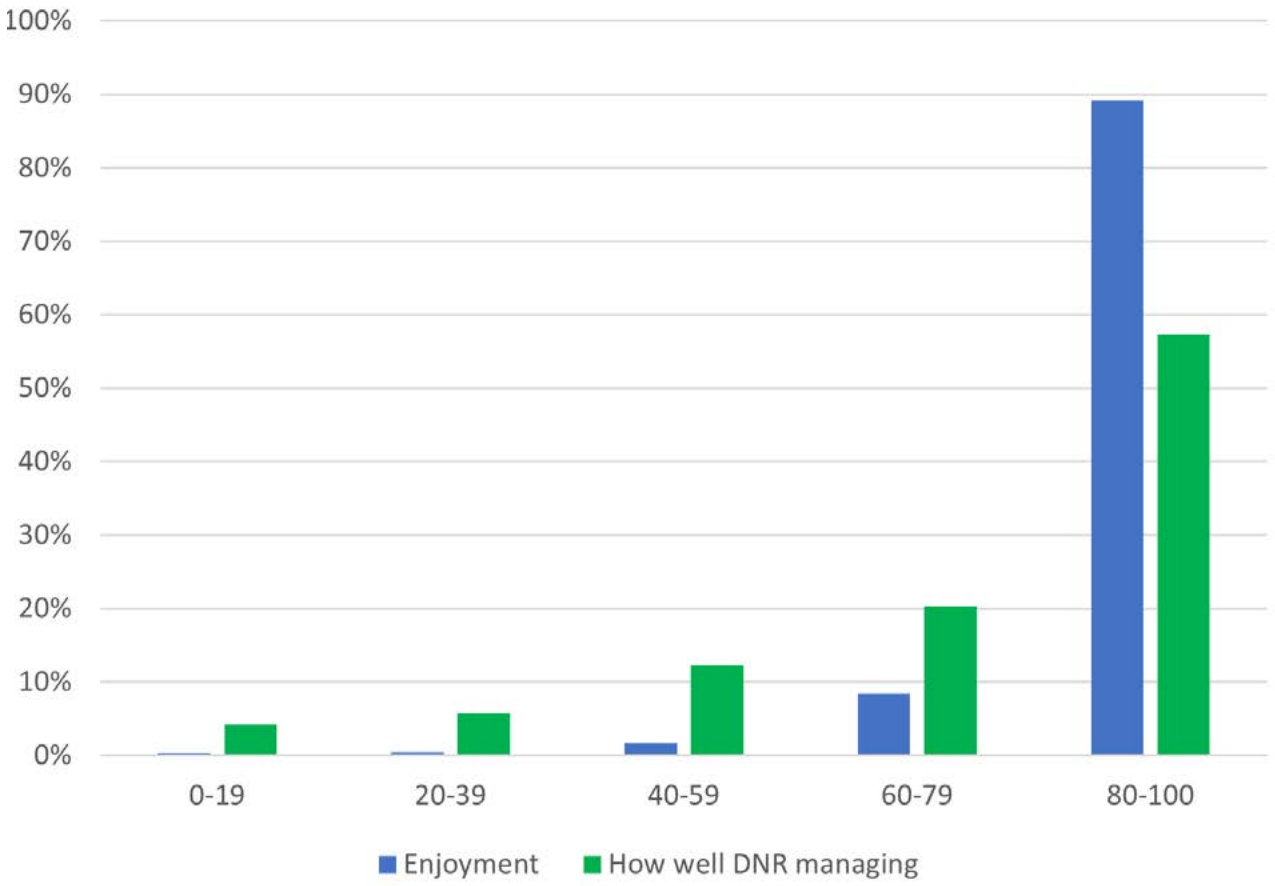

Figure 8-7. Hunter opinion about how the Indiana DNR is managing the deer in the county where they hunted and their enjoyment of the hunt during the 2021-2022 deer hunting season. Scores range from 0 (poor) to 100 (excellent).

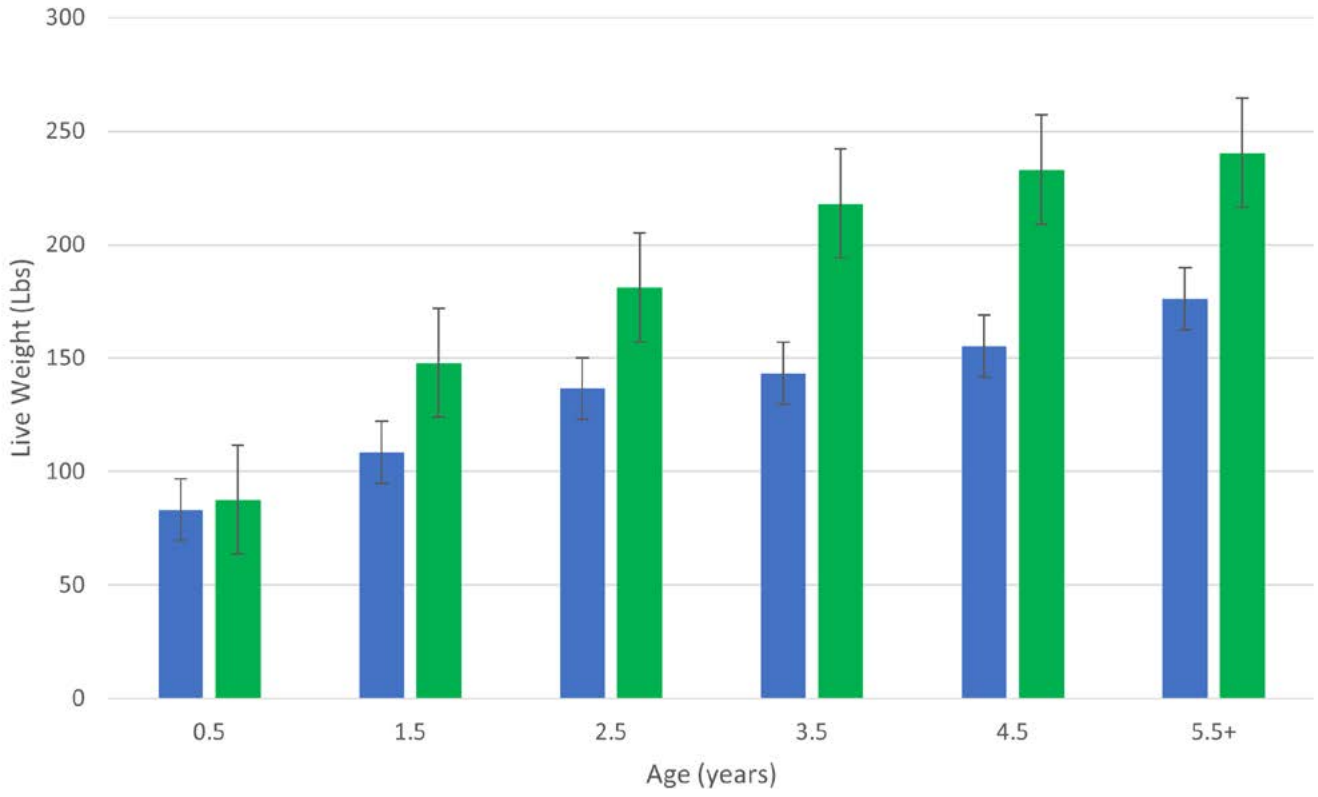

Figure 8-8. Live weights of deer by age class reported in the 2022-2023 After Hunt Survey.

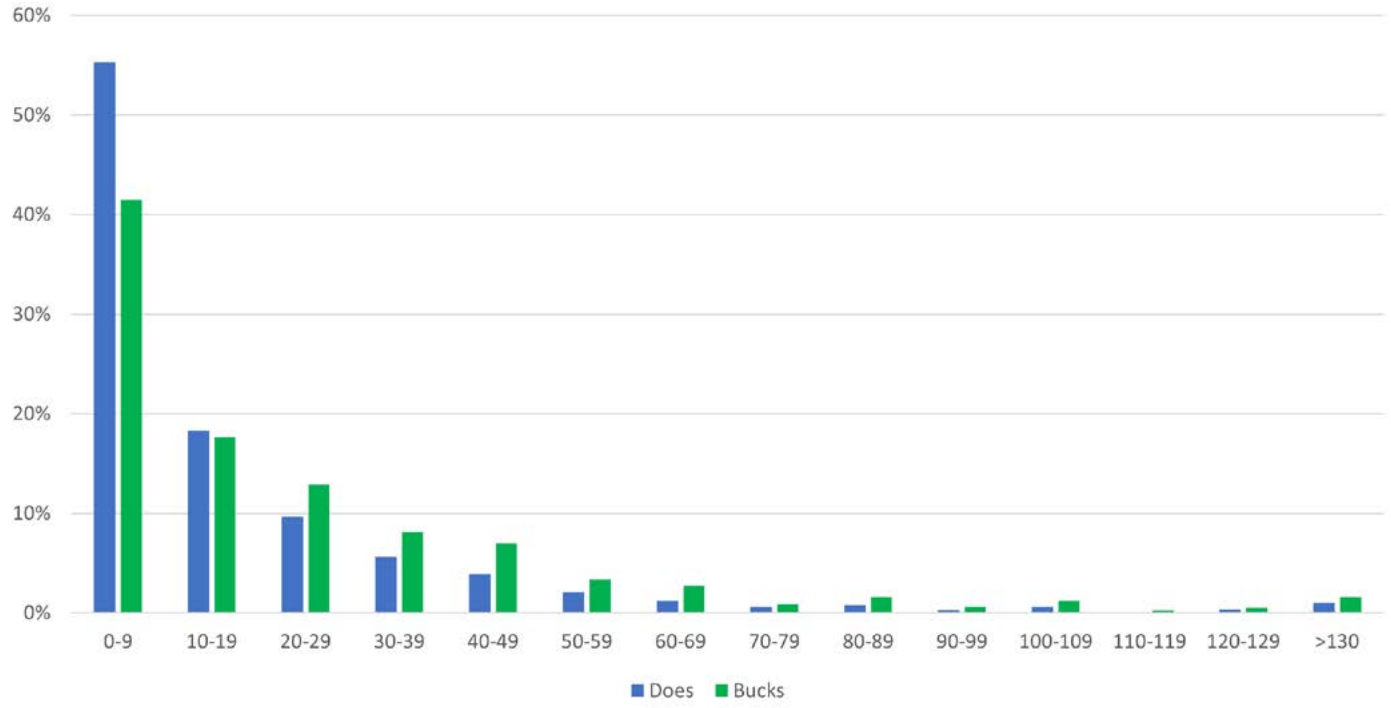

Figure 8-9. Number of hours hunters spent actively hunting before harvesting a buck or a doe during the 2022-2023 deer hunting season, as reported in the 2022-2023 After Hunt Survey.

CHAPTER 9.
DNR DEER RESEARCH

FEEDING WILD WHITE-TAILED DEER AND INTERACTIONS WITH FAWNS BY THE PUBLIC IN INDIANA

Julia Buchanan-Schwanke and Joe Caudell, *Indiana Department of Natural Resources*

The Indiana Department of Natural Resources (DNR) is responsible for managing white-tailed deer in Indiana. Decker et al. (2016) put forth wildlife governance principles that are used as a model for deer management in Indiana. Two key principles of this model are to (1) be adaptable and responsive to the needs and interests of a state's citizens, and (2) to seek and incorporate diverse perspectives. In order to understand the diverse needs and interests of Indiana's citizens regarding deer management, DNR conducted an annual survey of hunting and nonhunting customers of the Division of Fish & Wildlife (DFW). The objectives of this survey are to monitor changes in opinions toward deer population size, understand opinions regarding deer that may affect regulations, and better understand the relationship between citizens of Indiana and deer.

Feeding birds and other wildlife is a popular activity within the United States (US Department of Interior et al. 2016). Both hunters and nonhunters use food to attract deer for photos, view deer, and provide sustenance during periods where food availability is limited, but little is known about the extent to which deer are fed in Indiana. Because it is illegal to bait deer while deer hunting in Indiana, any feed provided to deer by hunters is likely for the purposes of providing additional nutrition and/or wildlife watching, with the exception being food plots that mature during the fall. In addition to feeding, contact between citizens and wildlife occurs frequently when people discover newborn wildlife. The most frequent type of call to the DFW Deer Program from mid-May to early July is about presumably orphaned fawns (unpublished data). The advice we provide to the public about abandoned fawns is to not disturb them, to observe them from a distance to ensure the mother doe returns, and to contact a wildlife rehabilitator if a fawn is truly abandoned. It is unclear what interactions occur with fawns after this information is provided. Therefore, to better manage deer for Indiana's citizens, DNR sought to understand more about two primary forms of nonhunting interaction between people and deer: (1) the recreational feeding of deer; and (2) interactions with fawns.

Methods and Results

DNR created an annual online survey in 2018 that is distributed to all customers who purchased a hunting, trapping, and/or fishing license and who provided a valid email and opted into communications with DFW (Caudell and Vaught 2019). In order to obtain opinions from a broader segment of the public, we expanded this survey to anyone who had signed up for the DFW quarterly email newsletter Wild Bulletin in 2022. On Jan. 31 2022, we distributed the annual deer management survey via email to 1,012,126 individuals consisting of anyone who had purchased a license since 2015 (n=811,121) and Wild Bulletin subscribers who have never checked in a deer or purchased an annual hunting, trapping, or fishing license from DFW (n=200,980). Respondents were asked to self-identify as a deer hunter or non-deer hunter and to answer basic demographic questions (latter not required). From our total distribution group, 28,109 individuals started the survey (response rate = 2.8%) with a completion rate of 88.2%. We received 22,842 responses from current or lapsed hunters, and 5,267 responses from nonhunters.

In the survey, we asked, ***do you provide any of these on your property for the benefit of deer and select the option(s) that best describes your interactions with fawns*** to assess the level and type of contact that individuals have with deer. Respondents could choose a combination of the following answers for the support question: (1) feeding with corn/grains; (2) feeding with foods other than corn/grains, such as fruits or hay; (3) food plots; (4) mineral blocks; (5) water; (6) other; and (7) none. Respondents could choose a combination of the following answers to describe their interactions with fawns: (1) I have no direct contact with fawns; (2) I see fawns but don't go near them; (3) I see fawns and watch over them until I'm sure the mother is around or returns; (4) I have taken fawns to rehabilitators; (5) I have raised fawns myself; and (6) other.

Of those that started the survey, 89% were started by license holders and 11% started by Wild Bulletin subscribers. Survey respondents were mostly deer hunters (78%), male (89%), White/Caucasian (92%), and 45-64 years old (45%; Table 9.1). A total of 19,988 individuals responded to the questions about feeding deer (Table 9.2), and 19,931 individuals responded to the question about contact with fawns (Table 9.3). Nearly half (54.2%) of hunters provided some type of

support to deer, and 28.8% of nonhunters provided support (Table 9.2). Deer hunters commonly provided food plots (33.8%), mineral blocks (27.1%), a water source (21.3%), and corn (17.8%; Table 9.2). Non-deer hunters provided water (14.4%), mineral blocks (8.8%), and corn (8.7%; Table 9.2). Most non-deer hunters did not have direct contact with fawns (45.5%) or did not see fawns and do not go near them (53.1%; Table 9.3). Likewise, most deer hunters either had no direct contact with fawns (50.8%) or saw fawns but do not go near them (49.3%; Table 9.3).

Discussion

Humans can form strong emotional connections with wildlife. When those emotional interactions are positive, people seek out additional interactions (Jacobs and Vaske 2019, Stinchcomb et al. 2022). These interactions include providing care to wildlife by providing food and other supplements (especially during the winter) and caring for wildlife directly (e.g., orphaned fawns). Therefore, it is not surprising to find that almost half of hunters, along with many nonhunters, reported providing some form of supplemental support to deer.

Very few people responded that they have direct contact with fawns, even though they frequently see fawns (Table 9.2). While surprising, this result is positive, as attempting to "rescue" fawns is often unnecessary and potentially harmful to the fawn. The DNR will continue its efforts to teach citizens that unattended fawns should be left alone, monitored from a distance, and that intervention should only occur after the fawn is left unattended for several days.

Decker et al. (2016) stressed the importance of understanding the needs of all citizens within a state when managing wildlife populations. Our deer management surveys are sent to all individuals whom the DFW has an email address for and who do not object to receiving a survey. Thus, the citizens receiving our survey are potentially not a representative sample of the population in Indiana, but when the demographics of our non-deer hunter respondents were investigated, they were similar to past surveys with more representative sampling (Stinchcomb 2022). Therefore, the respondents that we are obtaining from our surveys of nonhunters may indeed be representative of Indiana citizens. If a representative sample of the population is desired in order to determine the magnitude of these behaviors in the population, we would likely require oversampling population segments, panels, or qualitative methods to obtain the desired results.

Our results provide additional insight for DNR to better understand the potential magnitude of deer feeding occurring outside of hunting season by deer hunters and non-deer hunters. Through this understanding, agencies can better adapt and respond to the needs and interests of citizens, which may include providing advice for responsible wildlife feeding, or through disease modeling for better understanding of potential impacts of increased contact between multiple deer, and deer contacting people.

Literature Cited

Decker, D., C. Smith, A. Forstchen, D. Hare, E. Pomeranz, C. Doyle-Chapitman, K. Schuler, and J. Organ. 2016. Governance principles for wildlife conservation in the 21st century. Conservation Letters 9(4) 290-295. doi: 10.1111/conl.12211

Caudell, J.N., and O.D.L. Vaught. 2018. Indiana White-tailed Deer Report. Indiana Department of Natural Resources, Bloomington, Indiana.

Jacobs, M., and J. J. Vaske. 2019. Understanding emotion as opportunities for and barriers to coexistence with wildlife. Pages 65-84 in B. Frank, J. A. Glikman, and S. Marchini, editors. Human-Wildlife Interactions: Turning Conflict into Coexistence. Cambridge University Press, Cambridge, United Kingdom.

Martins, M., P. M. Boggiatto, A. Buckley, E. D. Cassmann, S. Falkenberg, L. C. Caserta, M. H. V. Fernandes, C. Kanipe, K. Lager, M. V. Palmer, and D. G. Diel. 2022. From deer-to-deer: SARS-CoV-2 is efficiently transmitted and presents broad tissue tropism and replication sites in white-tailed deer. PLoS Pathogens 18(3): e101097.

Stinchcomb, T. R. 2022. Beyond Bambi and Big Bucks: Exploring the Social Complexity of Deer Management in Indiana. Dissertation. Purdue University, West Lafayette, Indiana.

Stinchcomb, T. R., Z. Ma, and Z. Nyssa. 2022. Complex human-deer interactions challenge conventional management approaches: the need to consider power, trust, and emotion. Ecology and Society 27(1):13.

U.S. Department of the Interior, U.S. Fish and Wildlife Service, and U.S. Department of Commerce, U.S. Census Bureau. 2016 National Survey of Fishing, Hunting, and Wildlife-Associated Recreation.

Table 9.1. Observed proportions on characteristics of survey respondents (n=28090) for the 2021 Indiana Deer Management Survey. Statewide proportions are from Stinchcomb (2022).

Demographic Questions	n	Sample Proportion	Statewide Proportion
Identifies as a Deer Hunter	**23364**		
Yes		0.78	0.04
No		0.21	0.96
Gender	**23364**		
Man		0.89	0.49
Woman		0.09	0.51
Ethnicity	**19244**		
White/Caucasian		0.92	0.62
Black/African American		0.003	0.12
Hispanic / LatinX		0.003	0.19
Asian/Asian American		0.001	0.06
Native American/Alaska Native		0.002	0.01
Pacific Islander		0.0002	0
Household Income	**14226**		
<$50,000		0.16	0.43
$50,000 - $99,999		0.39	0.32
>$100,000		0.45	0.25
Highest Education	**18639**		
High school or less		0.25	0.44
Associated degree or some college		0.39	0.29
College or graduate degree		0.37	0.27
Age	**17663**		
18 to 24		0.03	0.1
24 to 44		0.29	0.26
45 to 64		0.45	0.25
65 and older		0.23	0.17

Table 9.2. Responses to the 2022 Indiana Deer Management Survey when participants were asked to select any type of support provided to deer. Because respondents could select multiple answers, results do not tally to 100%.

Type of support	Nonhunter	(n)	Hunter	(n)
Corn	8.7%	(350)	17.8%	(2704)
Fruit and/or hay	4.9%	(197)	6.3%	(956)
Food plot	3.1%	(125)	33.8%	(5139)
Mineral blocks	8.8%	(352)	27.1%	(4121)
Water	14.4%	(580)	21.3%	(3240)
Other support	5.6%	(225)	4.8%	(727)
None	71.2%	(2858)	45.8%	(6971)

Table 9.3. Responses to the 2022 Indiana Deer Management Survey when participants were asked to select their interactions with fawns. Because respondents could select multiple answers, results do not tally to 100%.

Type of contact with fawns	Nonhunter	(n)	Hunter	(n)
I have no direct contact with fawns	45.5%	(1821)	50.8%	(7690)
I have raised or rehabilitated fawns	0.5%	(19)	0.3%	(48)
I have taken fawns to rehabilitators	0.3%	(13)	0.3%	(47)
I watch over fawns until mother returns	3.9%	(156)	3.7%	(565)
I see fawns but don't go near them	53.1%	(2134)	49.3%	(7474)
Other	1.3%	(51)	0.6%	(89)

EVALUATING THE USE OF TARGETED RECREATIONAL HARVEST OF WHITE-TAILED DEER TO REDUCE DEER-VEHICLE COLLISIONS

Zackary J. Delisle, Robert K. Swihart, Emily McCallen, Carson Reeling, and Joe N. Caudell

Introduction

Wildlife management agencies are tasked with reducing damage caused by wildlife (Leopold et al. 2018). Deer-vehicle collisions (DVCs) are a major concern for wildlife management agencies because they cause billions of dollars in vehicular damages worldwide (Conover 1997), can be a substantial source of deer mortality in some populations (VerCauteren and Hygnstrom 2011), and cause human casualties (Bissonette et al. 2008). Therefore, minimizing the occurrence of DVCs is prudent for wildlife management agencies.

Human hunting of deer brings in substantial revenue for wildlife agencies through license fees and taxes and is the primary management tool used by state wildlife agencies to manage deer (Hewitt 2011). Hunting alters many aspects of deer behavior (Marantz et al. 2016, Schuttler et al. 2017) but may have limited success reducing deer density (Simard et al. 2013, Williams et al. 2013). Case studies testing and demonstrating the effectiveness of traditional hunting to reduce DVCs across large areas over which deer are usually managed do not exist. Considering this, we tested the ability of increased human hunting, through longer hunting seasons with increased harvest limits, to decrease DVCs in problematic areas of Indiana.

Methods

Study Site

We conducted our study along select roadways of Indiana experiencing DVCs within the upper 99th percentile (henceforth, deer reduction zones or DRZs; Figure 9.1). We centered all DRZs along the road with a width of 1 mile (i.e., each side of the DRZ extended a ½ mile on each side of the road). We bounded the length of DRZs at major intersections or county borders. We designated all land parcels located within a ½ mile of the problematic road within the DRZ. If any part of a private land parcel was within a ½ mile of the designated road, the entirety of that land parcel was included in the DRZ. For public lands, only the area of the land parcel within a ½ mile from the road was included in the DRZ.

Within DRZs, we relaxed hunting regulations to the following: (1) hunting season from Sept. 15 to Jan. 31; (2) hunters could harvest deer prior to other hunting seasons using archery equipment (regular archery season starts Oct. 1); (3) where permitted, firearms can be used to harvest a deer from the beginning of the normal firearms season (~ Nov. 18) until the conclusion of the DRZ season; and (4) hunters may harvest up to 10 deer in the DRZs consisting of 10 antlerless deer, or nine antlerless and one antlered deer after first harvesting an antlerless deer (commonly referred to as "earn-a-buck"; Boulanger et al. 2012b). We initiated DRZs in 2018. We also tallied DVCs within other areas of Indiana that were not within DRZs.

Data Collection

We used spatially explicit data on DVCs collected by the Indiana Department of Transportation from 2003 to 2022. We used the R programming language to classify whether each DVC occurred within or outside of DRZs (R Development Core Team 2023). We removed DVCs that did not have geospatial coordinates.

Data Analysis

How often or to what length people drive can change annually based upon external factors unrelated to deer ecology (Zhou et al. 2016). To account for this, we transformed the annual number of DVCs within DRZs to the proportion of the total number of DVCs within Indiana in a given year that occurred inside DRZs.

We modeled the annual proportion of DVCs occurring within DRZs using a beta regression via the "glmmTMB" package in R (Brooks et al. 2023). To examine the effects of DRZs, we fit the beta model with a two-level factor covariate for pre (<2018) or post (≥2018) creation of DRZs. We used simulated scaled residuals to check all model assumptions via the "DHARMa" package in R (Hartig and Lohse 2022).

Results

Our model predicted that the initiation of DRZs decreased the proportion of DVCs occurring within DRZs by ~20% (Figure 9.3).

Discussion

Human hunting can influence many aspects of deer ecology (Marantz et al. 2016, Schuttler et al. 2017). We hypothesize that either, or both, deer behavior or

deer population density are being affected by human hunting in DRZs. Regarding behavioral alterations, Kilgo et al. (1998) found deer to select sheltered (i.e., less exposed) areas that were farther from roads and become more nocturnal in response to disturbances from human hunters. Little et al. (2016) found deer to reduce movement rates during the hunting season, likely to avoid detection by human hunters. Inhabiting areas farther from roads, becoming more nocturnal (when vehicular traffic is less dense), and reducing movement rates all likely decrease the probability of DVC occurrence. However, regarding population density, Simard et al. (2013) found that hunting had limited success with reducing deer density. Doerr et al. (2001) did document that hunting in conjunction with other methodologies reduced deer density but concluded sharpshooting (not hunting) to be the most effective of the methods they simultaneously tested. Organized human hunting (i.e., training human hunters to hunt deer in an organized fashion to increase harvest) have been used to reduce deer densities but require additional costs for training and coordinating hunting efforts (Williams et al. 2013). Ultimately, the exact ecological mechanisms our DRZs manipulated that are reducing DVCs are currently unknown to us. Therefore, further research is required for more complete understanding of the ecological effects of DRZs.

References

Beringer, J., Hansen, L.P., Demand, J.A., Sartwell, J., Wallendorf, M. and Mange, R., 2002. Efficacy of translocation to control urban deer in Missouri: costs, efficiency, and outcome. Wildlife Society Bulletin, pp.767-774.

Bissonette, J.A., Kassar, C.A. and Cook, L.J., 2008. Assessment of costs associated with deer–vehicle collisions: human death and injury, vehicle damage, and deer loss. Human-Wildlife Conflicts, 2(1), pp.17-27.

Bissonette, J.A. and Rosa, S., 2012. An evaluation of a mitigation strategy for deer- vehicle collisions. Wildlife Biology, 18(4), pp.414-423.

Boulanger, J.R., Curtis, P.D., Cooch, E.G. and DeNicola, A.J., 2012a. Sterilization as an alternative deer control technique: a review. Human-Wildlife Interactions, 6(2), pp.273-282.

Boulanger, J.R., Goff, G.R. and Curtis, P.D., 2012b. Use of “earn-a-buck” hunting to manage local deer overabundance. Northeastern Naturalist, 19(sp6), pp.159-172.

Brooks, M, B. Bolker, K. Kristensen, M. Maechler, A. Magnusson, M. McGillycuddy, H. Skaug, A. Nielsen, C. Berg, K. van Bentham, N. Sadat, D. Lüdecke, R. Lenth, J. O’Brien, C. J. Geyer, M. Jagan, B. Wiernik, and D. B. Stouffer. 2023. glmmTMB: Generalized Linear Mixed Models using Template Model Builder. R Package Version 1.1.7.

Burnham, K. P., and D. R. Anderson. 2002. Model Selection and Inference: A Practical Information-Theoretic Approach. Springer-Verlag, New York, New York, USA.

Conover, M.R., 1997. Monetary and intangible valuation of deer in the United States. Wildlife Society Bulletin, 25(2), pp.298-305.

DeNicola, A.J. and Williams, S.C., 2008. Sharpshooting suburban white-tailed deer reduces deer–vehicle collisions. Human-Wildlife Conflicts, 2(1), pp.28-33.

Doerr, M.L., McAninch, J.B. and Wiggers, E.P., 2001. Comparison of 4 methods to reduce white-tailed deer abundance in an urban community. Wildlife Society Bulletin, pp.1105-1113.

Hartig, F., and L. Lohse. 2022. DHARMa: Residual Diagnostics for Hierarchical (Multi-Level / Mixed) Regression Models. R Package Version 0.4.6.

Hewitt, D. G., editor. 2011. Biology and management of white- tailed deer. CRC Press, Boca- Raton, Florida, USA.

Ishmael, W. E., D. E. Katsma, T. A. Issac, and B. K. Bryant. 1993. Live-capture and translocation of suburban white-tailed deer in River Hills, Wisconsin. Pages 87–96 in J. B. McAninch, editor. Urban deer a manageable resource. Proceedings of a symposium held at the 55th Midwest fish and wildlife conference, St. Louis, Missouri, USA.

Kilgo, J.C., Labisky, R.F. and Fritzen, D.E., 1998. Influences of hunting on the behavior of white- tailed deer: implications for conservation of the Florida panther. Conservation Biology, 12(6), pp.1359-1364.

Knapp, K. K., X. Yi, T. Oakasa, W. Thimm, E. Hudson, and C. Rathmann. 2004. Deer–vehicle crash countermeasure toolbox: a decision and choice resource. Midwest Regional University Transportation Center, Madison, Wisconsin, USA.

Leopold, B. D., W. B. Kessler, and J. L. Cummins. 2018. North American wildlife policy and law. Boone & Crockett Club, Missoula, Montana, USA.

Little, A.R., Webb, S.L., Demarais, S., Gee, K.L., Riffell,

S.K. and Gaskamp, J.A., 2016. Hunting intensity alters movement behaviour of white-tailed deer. Basic and Applied Ecology, 17(4), pp.360-369.

Marantz, S.A., Long, J.A., Webb, S.L., Gee, K.L., Little, A.R. and Demarais, S., 2016. Impacts of human hunting on spatial behavior of white-tailed deer (Odocoileus virginianus). Canadian Journal of Zoology, 94(12), pp.853-861.

Mastro, L.L., Conover, M.R. and Frey, S.N., 2008. Deer–vehicle collision prevention techniques. Human-Wildlife Conflicts, 2(1), pp.80-92.

McCollister, M.F. and Van Manen, F.T., 2010. Effectiveness of wildlife underpasses and fencing to reduce wildlife-vehicle collisions. The Journal of Wildlife Management, 74(8), pp.1722-1731.

R Development Core Team (2023). R: A Language and Environment for Statistical Computing. Vienna: R Foundation for Statistical Computing.

Schuttler, S.G., Parsons, A.W., Forrester, T.D., Baker, M.C., McShea, W.J., Costello, R. and Kays, R., 2017. Deer on the lookout: how hunting, hiking and coyotes affect white-tailed deer vigilance. Journal of Zoology, 301(4), pp.320-327.

Simard, M.A., Dussault, C., Huot, J. and Côté, S.D., 2013. Is hunting an effective tool to control overabundant deer? A test using an experimental approach. The Journal of Wildlife Management, 77(2), pp.254-269.

Sullivan, T.L., Williams, A.F., Messmer, T.A., Hellinga, L.A. and Kyrychenko, S.Y., 2004. Effectiveness of temporary warning signs in reducing deer-vehicle collisions during mule deer migrations. Wildlife Society Bulletin, 32(3), pp.907-915.

Sutherland, M., McKenney, M. and Elkbuli, A., 2020. Vehicle related injury patterns during the COVID-19 pandemic: what has changed?. The American Journal of Emergency Medicine, 38(9), pp.1710-1714.

Vanlaar, W.G., Woods-Fry, H., Barrett, H., Lyon, C., Brown, S., Wicklund, C. and Robertson, R.D., 2021. The impact of COVID-19 on road safety in Canada and the United States. Accident Analysis & Prevention, 160, p.106324.

VerCauteren, K. C., and S. E. Hygnstrom. 2011. "Managing white-tailed deer: midwest north America." In Biology and Management of White-Tailed Deer, edited by D. G. Hewitt, 514–549. Boca Baton, Florida, USA: CRC Press.

Williams, S.C., Denicola, A.J., Almendinger, T. and Maddock, J., 2013. Evaluation of organized hunting as a management technique for overabundant white-tailed deer in suburban landscapes. Wildlife Society Bulletin, 37(1), pp.137-145.

Zhou, M., Jin, H. and Wang, W., 2016. A review of vehicle fuel consumption models to evaluate eco-driving and eco-routing. Transportation Research Part D: Transport and Environment, 49, pp.203-218.

Zhou, K., Hu, D. and Li, F., 2022. Impact of COVID-19 on private driving behavior: Evidence from electric vehicle charging data. Transport policy, 125, pp.164-178.

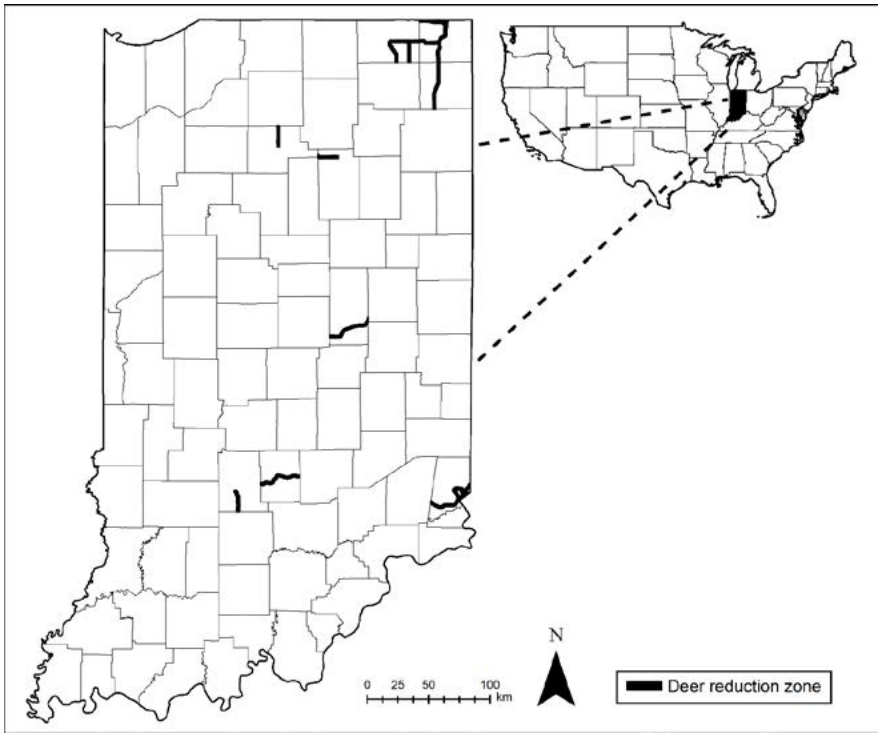

Figure 9.1. Locations of deer reductions zones within counties of Indiana.

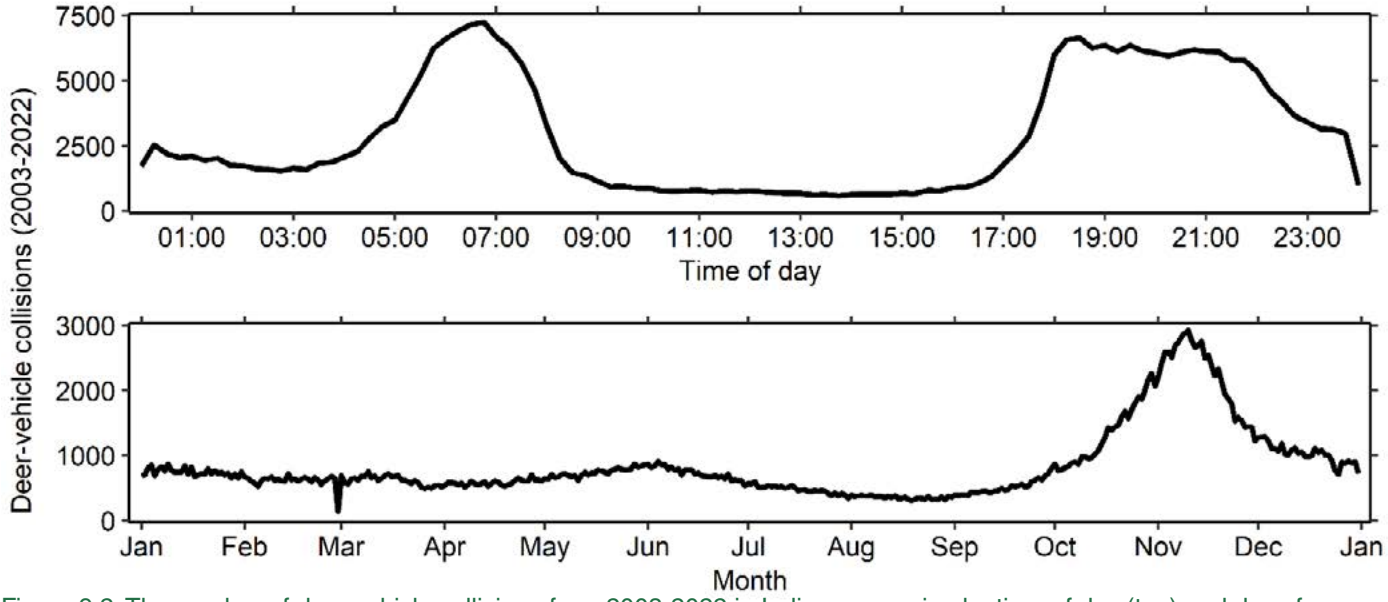

Figure 9.2. The number of deer-vehicle collisions from 2003-2022 in Indiana occurring by time of day (top) and day of year (bottom).

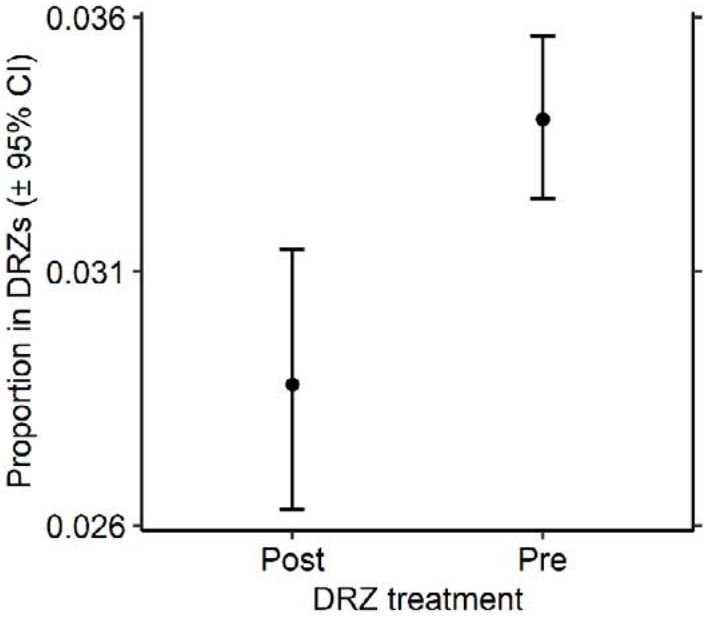

Figure 9.3. Effects plot for beta model regressing the proportion of annual deer-vehicle collisions occurring within deer reduction zones (DRZs; ± 95% confidence intervals, CI) of Indiana as a function of whether DRZs were established (not established = Pre; established = Post).

ESTIMATING THE EFFECT OF EHD IN SOUTHEASTERN INDIANA IN 2022 AND RECOMMENDATION FOR REDUCTIONS IN COUNTY BONUS ANTLERLESS QUOTAS

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Introduction

Epizootic hemorrhagic disease (EHD) is a virus spread among white-tailed deer by a biting midge (*Culicoides variipennis*). Often worse in drought years, severe outbreaks of EHD tend to occur in five- to 10-year cycles in Indiana. Deer can be reported as sick, dead, or in a group with a sick or dead animal via the DNR's online Sick or Dead Wildlife Report form (on.IN.gov/sickwildlife) and by calls directly to DNR offices.

In July of 2022, the DNR began receiving reports about deer dying in northern Franklin and southern Fayette counties. Initial testing attributed this mortality to EHD. Over time, reports of dead deer expanded to Union, Wayne, Henry, Rush, Decatur, Jennings Jefferson, Ripley, Dearborn, Ohio, and Switzerland counties, with scattered reports also coming from throughout the state, but most reports were concentrated in Franklin, Ohio, Wayne, Fayette, and Union (Figure 9.4). Therefore, we lowered the County Bonus Antlerless Quota to 1 in Franklin, Fayette, and Union counties in September 2022.

To assess the effects of EHD on deer population sizes, we did the following: (1) reviewed the harvest and opinion data from the other similarly affected counties; and (2) conducted aerial surveys for deer within areas experiencing the highest mortality.

Methods

In January 2023, we reviewed the number of reported dead deer from the Sick and Dead Wildlife reporting system and recorded the number of reports per square mile for each county. As a correction factor, we multiplied the number of reports by 10 to provide an estimate of the amount of actual mortality for each county (because not every dead deer is reported). This correction factor is based on a report by Hoff et al. (1973) that stated that during an EHD event in North Dakota they believed that the number of deer discovered represented less than 10% of the deer that had died.

In February 2023, we mailed the annual Deer Management Survey to hunters and nonhunters whom we had an email address for and who opted into communications with DFW. We asked each group about their opinions of the population size, their hunting effort, and their hunting experience for 2022 and 2023. Results from the Deer Management Survey are posted on the DNR website for each county at wildlife.IN.gov/wildlife-resources/animals/white-tailed-deer/deer-management-survey-results/.

In March 2023, researchers from Purdue University flew a series of transects and captured deer on infrared cameras to estimate the deer density in northern Franklin and southern Fayette counties. DNR reviewed the infrared videos and recorded the number of deer and the type of cover they where they were located. The population size of deer across Fayette and Franklin counties was then estimated based on the area of open and forested cover types within each respective county.

Results, Discussion, and Harvest Recommendations

In 2022, we received 981 reports of potential EHD cases involving 1,016 deer from 62 counties. Testing for EHD requires fresh samples of the spleen, liver, kidney, or blood. We tested 22 deer from 17 counties; 19 (86%) deer from 15 of the 17 counties tested positive for EHD. Maps of deer reported, tested, and confirmed to have EHD are available online (on.IN.gov/ehd) and updated daily as reports are received. Reports of EHD were spread throughout the state, but the largest concentration was in its southeastern portion (Figure 9.4).

Dearborn County

We received 36 reports of dead deer from Union County or 0.12 reports per square mile for the entire county. We used a correction factor of 10 and estimated the number of dead deer from EHD to be at least 360 (1.2 deer per square mile); however, the effects of EHD did not significantly affect hunting. The hunting experience, buck and doe firearm efforts, and success rates were similar to those of previous years. To offset the effect of EHD, we have lowered the bonus antlerless quota to one for Dearborn County (down from the normal county bonus antlerless quota of three).

Fayette County

We received 46 reports of dead deer from Fayette County or 0.21 reports per square mile for the entire county; however, most reports were from the southern 1/3 of the county. When we take this into account, we found that we received 0.64 reports per square mile for

the most heavily affected area. With the correction factor of 10, the estimated number of dead deer from EHD was at least 460 (6.4 deer per square mile in the most heavily affected area). The hunting experience was at its lowest point since 2017, which was a significant drop compared that of previous years. While the buck firearm effort was similar to that of previous years, the antlerless firearm effort was significantly lower. Overall estimated success rates were also significantly lower than in the previous four years.

Based on flight data, we estimated the postharvest density in the lower 1/3 of Fayette County to be 9.4 deer per square mile (95% CI ± 1.5). It is likely the density of deer in southern Fayette should have been around 27 to 30 deer per square mile after the harvest (according to other previously monitored areas that were similar to Fayette County). Given this, only about 1/3 of what the population size would normally be postharvest was present after the EHD outbreak. A deer population can withstand up to roughly a 50% annual harvest (or mortality) without a significant drop in the population the next year. Because this was about a 66% population decrease, we need to significantly cut back on the harvest in Fayette County during the next one or two years. Therefore, we have lowered the bonus antlerless quota to zero for Fayette County (down from the normal county bonus antlerless quota of three). At a quota of zero for one to two years, we expect the population will fully recover in about ficw years. With a county bonus antlerless quota of zero, we still expect about 125 antlerless deer to be harvested in Fayette County using crossbows, archery equipment, and muzzleloaders.

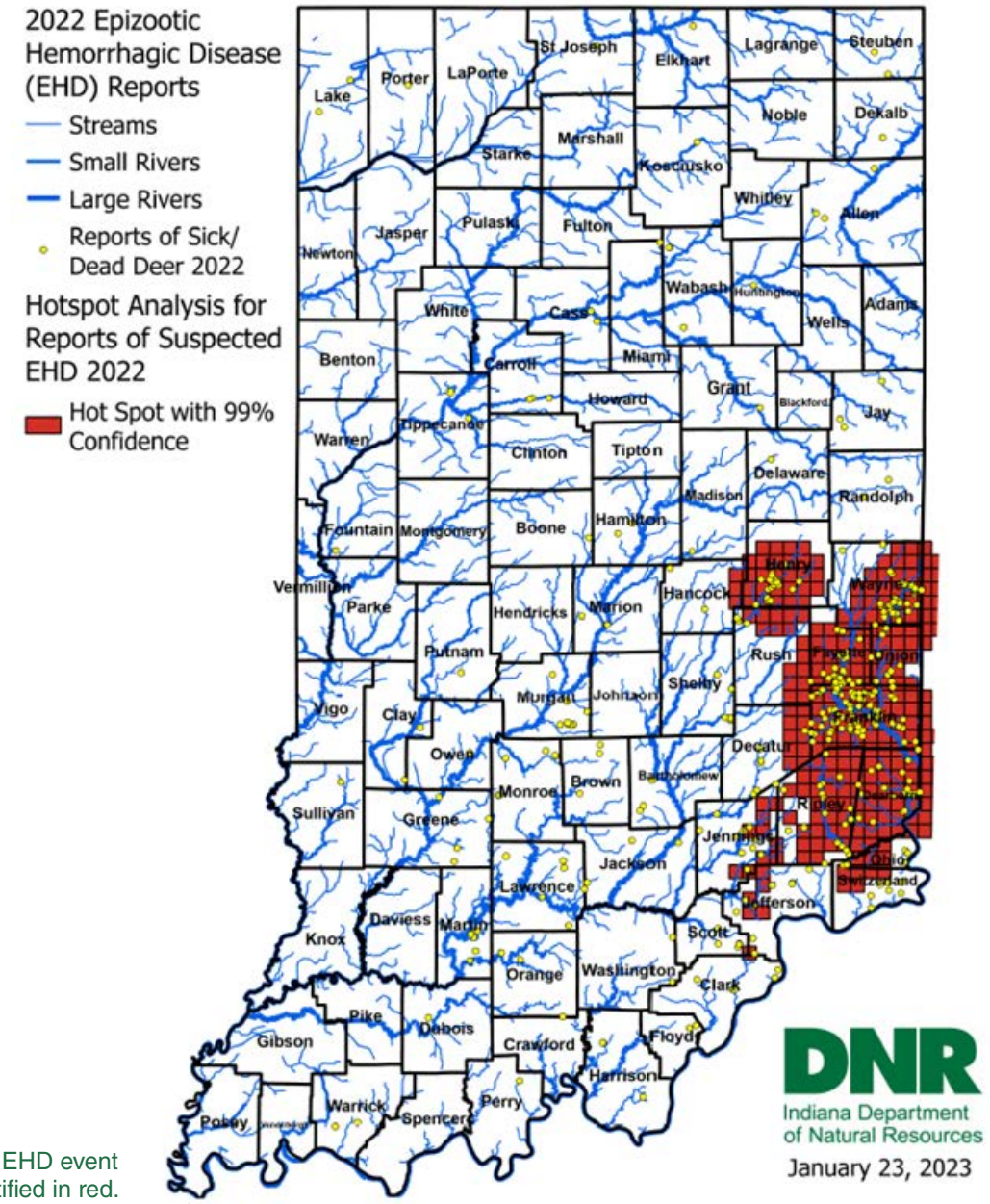

Figure 9.4: Map of 2022 EHD event with hotspots identified in red.

Franklin County

We received 294 reports of dead deer from Franklin County (0.76 reports per square mile). With the correction factor of 10, the estimated number of dead deer from EHD was at least 2,940 (7.7 deer per square mile). The hunting experience was at its lowest point since 2017, which was a significant drop compared to the lowest year (2017). While the buck firearm effort was similar to that of previous years, the antlerless firearm effort was significantly lower. Overall estimated success rates were also significantly lower than in the previous four years.

Based on flight data, we estimated the postharvest density to be 9.4 deer per square mile (similar to Fayette County; 95% CI $\pm$ 1.5). For comparison, the average postharvest deer density that we estimate in the central hardwoods area of Indiana ranges from around 14.7 deer per square mile (Morgan County) to 34.9 deer per square mile (Monroe). Counties closer to Franklin are typically in the higher range (for example, Jefferson is 31.2 deer per square mile). While we do not have a "normal" postharvest density for comparison, it is likely the density of deer in Franklin County should have been around 27 to 30 deer per square mile after the harvest, leaving about 1/3 of what it would normally be postharvest. We estimate this to be about a 66% decrease in the population size. For the same reasons as with Fayette County, we need to significantly cut back on the harvest over the next one to two years. Therefore, we have lowered the bonus antlerless quota to zero for Franklin County (down from the normal county bonus antlerless quota of three or four). At a quota of zero for one to two years, we expect the population will fully recover in about five years. With a county bonus antlerless quota of zero, we still expect about 400 antlerless deer to be harvested in Franklin County using crossbows, archery equipment, and muzzleloaders.

Henry County

We received 50 reports of dead deer from Rush County or 0.13 reports per square mile for the entire county; however, most reports were from the southwest corner of the county, which is about 1/4th of the county. When we take this into account, we found that we received 0.51 reports per square mile for the most heavily affected area. With the correction factor of 10, the estimated number of dead deer from EHD was at least 500 (5.1 deer per square mile in the most heavily affected area); however, the effects of EHD did not significantly affect hunting as it did in Franklin and Fayette counties. The hunting experience, buck and doe firearm efforts, and success rates were similar to those of previous years. To offset the effect of EHD, we have lowered the bonus antlerless quota to one for Henry County (down from the normal county bonus antlerless quota of two).

Ohio County

We received 37 reports of dead deer from Ohio County or 0.43 reports per square mile for the entire county. With the correction factor of 10, the estimated number of dead deer from EHD was at least 370 or (4.3 deer per square mile); however, the effects of EHD did not significantly affect hunting as it did in Franklin and Fayette counties. The hunting experience, buck and doe firearm efforts, and success rates were lower but still similar to those of previous years. To offset the effect of EHD, we have lowered the bonus antlerless quota to one for Ohio County (down from the normal county bonus antlerless quota of three).

Ripley County

We received 48 reports of dead deer from Rush County or 0.12 reports per square mile for the entire county. With the correction factor of 10, the estimated number of dead deer from EHD was at least 480 or (1.2 deer per square mile); however, the effects of EHD did not significantly affect hunting as it did in Franklin and Fayette counties. The hunting experience, buck and doe firearm efforts, and success rates were lower but still similar to those of previous years. To offset the effect of EHD, we have lowered the bonus antlerless quota to one for Ripely County (down from the normal county bonus antlerless quota of three).

Rush County

We received 48 reports of dead deer from Rush County or 0.12 reports per square mile for the entire county. With the correction factor of 10, the estimated number of dead deer from EHD was at least 480 or (1.2 deer per square mile); however, the effects of EHD did not significantly affect hunting as it did in Franklin and Fayette counties. The hunting experience, buck and doe firearm efforts, and success rates were similar to previous years. To offset the effect of EHD, we have lowered the bonus antlerless quota to one for Rush County (down from the normal county bonus antlerless quota of three).

Switzerland County

We received 19 reports of dead deer from Switzerland County or 0.09 reports per square mile for

the entire county. With the correction factor of 10, the estimated number of dead deer from EHD was at least 190 or (0.9 deer per square mile); however, the effects of EHD did not significantly affect hunting as it did in Franklin and Fayette counties. The hunting experience, buck and doe firearm efforts, and success rates were similar to those of previous years. Because of the low effect of EHD, and because Switzerland County had already been lowered to adjust for increasing efforts toward harvesting does (adjusted from a quota of a three to two in 2020), we did not lower the quota further due to EHD.

Union County

We received 26 reports of dead deer from Union County or 0.16 reports per square mile for the entire county. With the correction factor of 10, the estimated number of dead deer from EHD was at least 260 or (1.6 deer per square mile); however, the effects of EHD did not significantly affect hunting as it did in Franklin and Fayette counties. The hunting experience was lower when compared to past years, but the buck and doe firearm effort was similar to those of previous years. Overall estimated success rates were lower but still similar when compared to 2020. Because of limited funds, we were not able to conduct flights in this area to monitor the effects of EHD; however, we will conduct flights in this area in upcoming years. To offset the effect of EHD, we have lowered the bonus antlerless quota to one for Union County (down from the normal county bonus antlerless quota of three).

Wayne County

We received 102 reports of dead deer from Wayne County or 0.25 reports per square mile for the entire county. Most reports were from an area concentrated in the southeastern ¼ of the county. When we take this into account, we found that we received 1.02 reports per square mile for the most heavily affected area. With the correction factor of 10, the estimated number of dead deer from EHD was at least 1020 (10.16 deer per square mile in the most heavily affected area); however, the effects from EHD did not significantly affect hunting as it did in Franklin and Fayette counties. The hunting experience was similar to that of 2017, but was a significant drop compared to that of the most recent years. While the buck firearm effort was similar to that of previous years, the antlerless firearm effort was significantly lower. Overall estimated success rates were similar when compared to those of the previous four years. Because of limited funds, we were not able to conduct flights in this area to monitor the effects of EHD; however, we will conduct flights in this area in upcoming years. To offset the effect of EHD, we have lowered the bonus antlerless quota to one for Wayne County (down from the normal county bonus antlerless quota of two).

Other Counties

As expected, cases of EHD occurred throughout many counties in Indiana, but these were often low reported numbers or were limited to very small areas within the county; therefore, no further adjustments to the quotas were made.

Recovery from the 2017 EHD Event

In 2017, Indiana experienced a widespread EHD event throughout much of the southern portion of the state, and we lowered the quotas to offset these effects. Information from Michigan shows that in the absence of any adjustments to harvest, deer population will quickly recover, but DNR chose to decrease quotas to speed recovery of the deer herd to a level near population densities before the 2017 event. Therefore, we increased quotas in much of the Southern and Wabash DMU from quotas of two to three.

Future Monitoring

We expect cases of EHD to be an annual occurrence. DNR uses the Sick and Dead Deer Report Form (on.IN.gov/sickwildlife) as the primarily surveillance method. Reports are reviewed quickly to obtain samples, and we review the reports at the end of August to determine if any last-minute adjustments to the county bonus antlerless quotas need to be made.

We will continue to monitor population recovery through a combination of flights to estimate deer density. We will also use camera surveys to estimate changes in recruitment rate (i.e., the number of 6-month-old fawns that enter the hunting population in the fall). Changes in recruitment rates are important because declining recruitment rates indicate when deer populations are approaching carrying capacity.

Hunters and Landowner Monitoring Assistance

DNR collects information on fawn recruitment (which is the number of fawns that survive for 6 months and enter the population with the other adults) using a combination of camera data and archers who participate the Archer's Index, but the data quality is limited

by the relatively small number of participants in each program. If DNR can significantly increase the number of people participating in providing data on fawn recruitment, then our ability to manage the deer herd will be much improved. Therefore, the DNR Deer Program has started a program in which any hunter or landowner with game cameras can submit their observations on fawn recruitment. Hunters and landowners report data captured from their own trail cameras. In early September, hunters who have filled out the After Hunt Survey, filled out the annual deer management survey, or live and hunt in Henry, Wayne, Fayette, Franklin, Union, Ripley, Dearborn, Ohio, and Switzerland counties will receive an invitation to a survey. Those who do not receive an invitation can contact email DeerSurvey@dnr.IN.gov to request a survey. Hunters who use game cameras can review their game camera photos each week between Sept. 3 and Oct. 14 and report the number of does, fawn, and bucks that are observed for each camera. They can report on as many cameras as they like, for as many weeks as they like. Having more hunters and landowners participating will improve the quality of the data. The information generated will be used to monitor large population changes, such as what we observed in Fayette and Franklin counties during the 2022 EHD outbreak. It will also be used to set harvest limits for antlerless deer and help monitor statewide doe/buck ratios.

Literature Cited

Hoff, G. L., S. H. Richards, and D. O. Trainer. 1973. Epizootic of hemorrhagic disease in North Dakota deer. Journal of Wildlife Management 37:331-335.

EVALUATING PUBLIC OPINION OF FIREARM SEASON

Joe Caudell and Zack Delisle, *Indiana Department of Natural Resources*

Introduction

The Deer Program within the DNR takes into consideration many factors when deciding upon what time of year firearms season takes place. Among these factors is the opinion of the public. Therefore, to ensure the desires of the public are taken into consideration, we asked the public through the Deer Management Survey if the firearms hunting season for white-tailed deer should be changed and, if so, what alternative date was preferred.

Methods

The survey consists of a core set of questions that remain the same every year, with additional sets of unique questions that change each year to address emerging issues in state deer management. In the 2023 survey, the DNR asked several questions designed to assess opinions of the timing of the firearms season for white-tailed deer. The inclusion of specific questions should not be interpreted as a change or a desire for a particular regulation by DNR or the public.

The 2023 survey was sent to individuals that the Division of Fish & Wildlife had prior contact with and thus had an email address for. These included: (1) residents and nonresidents who had purchased any type of hunting, trapping, or fishing license since 2006; (2) anyone who checked in a deer in the last five years; (3) anyone who created an electronic account with DNR for other reasons (such as obtaining the survey); and (4) anyone who signed up for the Wild Bulletin e-newsletter. Because lifetime license holders and landowner hunters do not have to purchase a yearly license, they can only be surveyed if they harvest a deer, purchase another license type (e.g., fishing, deer reduction zone license, etc.), or sign up on DNR's electronic system specifically to receive the survey. Because of this, lifetime license holders and hunters who only use their landowner exemption and do not harvest a deer are likely underrepresented in the survey. Survey invitations were distributed by GovDelivery, a mailing subscription service, in February and March of 2023. The survey was developed in the program Qualtrics and asked, "Should the firearms season be changed?". If the respondent stated they wished the season to be changed, the opportunity was then given to specify what date they wished the firearms season to start. All survey results were downloaded in March 2023 and descriptive statistics were generated using the R Programing Language.

Results

On Jan. 31, 2023, we distributed the annual deer management survey via email to 809,763 individuals consisting of anyone who had purchased a license since 2015 (n=611,059) and Wild Bulletin subscribers who have never checked in a deer or purchased an annual hunting, trapping, or fishing license from DFW (n=198,704). From our total distribution group, 39,889 individuals started the survey (response rate = 4.9%) with a completion rate of 91%. We received 32,559 responses from current and lapsed hunters and 5,125 responses from nonhunters. Because much of the survey depends upon potential respondents being assigned to a county for reporting, survey respondents had to include a county they hunted in or lived in to be included in the final data.

Just over half of respondents to our question regarding start date of the firearms season stated that they desired no change (53.00%; Figure 9.5). Of these same respondents, 20.21%, 8.42%, and 5.63% wanted to change the start date to the first, second, and third Saturday in November, respectively. No other alternative date had more than 5% of respondents.

We asked hunters how many total days the firearms season should be (ranging from 0 to 30 days) and found no consensus on the total number of days for a change to the length of the firearms season (Figure 9.5). Of hunters who responded to this question (n=28,197), 17% would like the season expanded to 21 days, 16% would like the season expanded to 30 days, 15% would like the season reduced to 15 days, and 13% would like the season reduced to 14 days. Looking at the total number who would like the season to be expanded or shortened, 49% responded positively to a category that was more than the current number of days (i.e., 17 to 30 days) and 45% responded positively to a category that was less than the current number of days (i.e., 0 to 15 days). Only 6% of hunters selected that the number of days should be 16 days, which is the current number of days in the firearms season.

We also asked if the firearms season should be split into an early and late firearms season. Of those who responded (n=27,975) 67% of hunters did not want to see the firearms season split into an early and late firearms season, and 33% would like to see a split season.

Discussion

The start date of the firearms season established in Indiana Administrative Code is the first Saturday after Nov. 11. Just over half of all respondents preferred this traditional start date, and hence desired no change in the firearms season. Although the other respondents did desire a change to the start date of firearms season, there was little agreement among these respondents as to when the start date should be. Therefore, we recommend keeping the start date to the firearms season on the first Saturday after Nov. 11, as we have traditionally done in past years.

Hunters were also split on whether to increase or decrease the number of days in the firearms season. Only 6% of hunters selected 16 days, which might indicate a change is desired. Based on survey responses, if a change were to be made to the total number of days for the firearms season, it would be to increase the total number of days, but there is currently no clear consensus for what a change might look like. Therefore, we recommend no change be made to the number of days for the firearms season at this time.

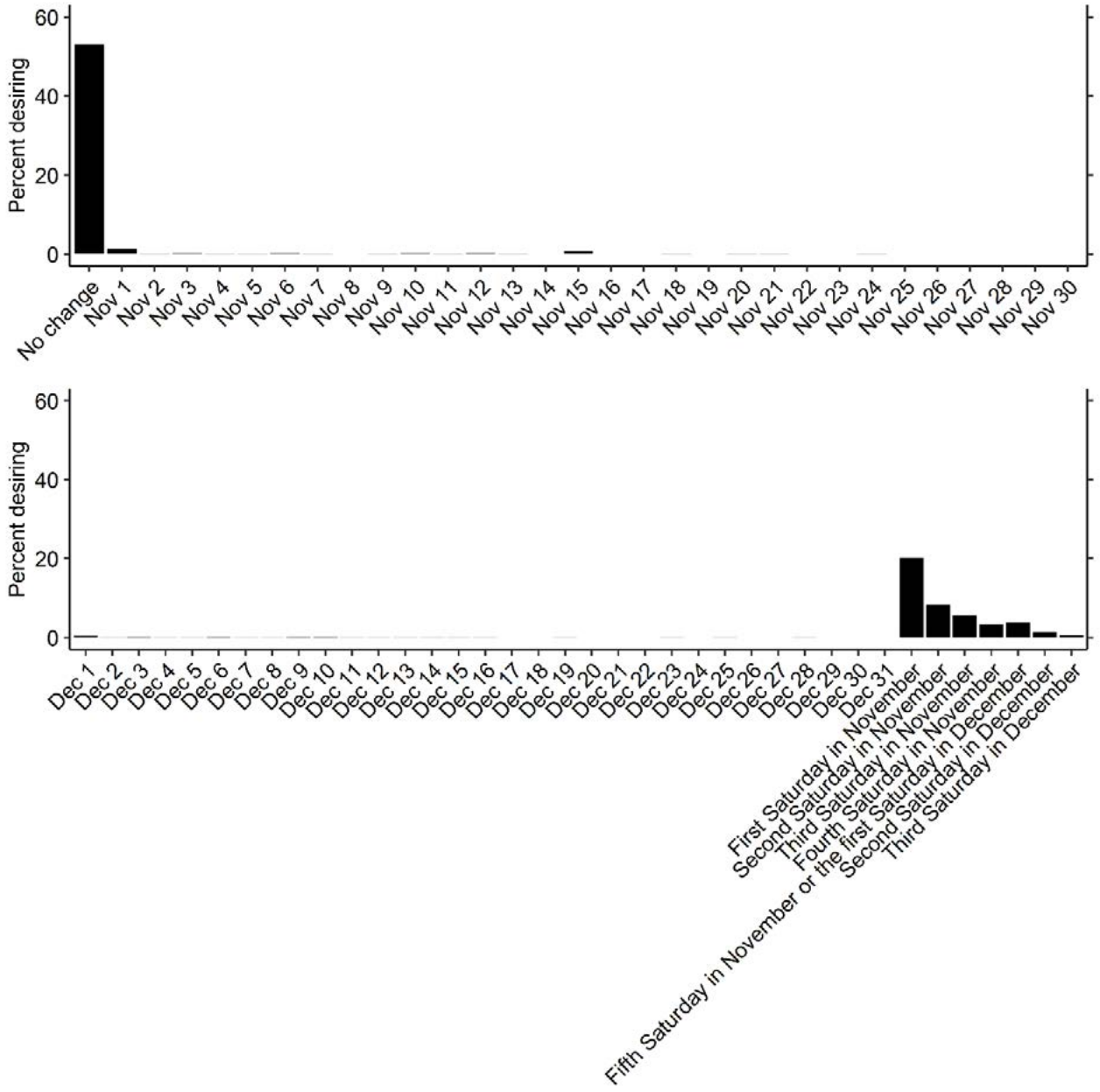

Figure 9.5. Percent of respondents to questions regarding the start date of the firearms season who desired specific outcomes (Percent desiring). Choices included no change to the firearms season start date (No change) and other alternative dates in November and December.

THE COST EFFECTIVENESS OF ESTABLISHING A TAXIDERMIST PROGRAM VERSUS THE USE OF CHECK STATIONS IN THE COLLECTION OF CHRONIC WASTING DISEASE (CWD) SAMPLES IN INDIANA

Joe N. Caudell and Julia C. Buchanan-Schwanke,
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Abstract

DNR has conducted surveillance of chronic wasting disease (CWD) in road-killed and hunter-harvested deer since 2001. DNR uses a point system to evaluate the relative value of each deer to detect CWD. Prevalence rates of CWD, and hence point value, are lower in male deer 1.5 years old and lower in females. Conversely, prevalence and point value is higher in adult (>2.5 years old) males. Older deer are also valued by hunters and are often taken to taxidermists for mounting. Because older bucks are often taken to taxidermists for mounting, older bucks are often not taken to processors, or the hunters do not allow for tissue extraction needed for CWD testing. To sample these older bucks, the DNR created a program that partnered with taxidermists to collect high point-value samples from older adult males. The cost effectiveness of this partnership in comparison to traditional collection of deer from processors was unknown. Therefore, we used a cost-effectiveness analysis to determine which was more cost-effective. Ten taxidermists collected ~44% (676.6) of the points at a mean cost of $15.64 per point for the 2021-2022 season, versus a mean cost of ~$60 per point using traditional methods. In 2022-2023 20 participating taxidermists collected ~43% (902.8) of points, increasing point collection by 43.7% with a mean cost of $15.43 per sample. While the taxidermy partnership is still in its infancy, its cost-effectiveness is superior. As this program matures, agency surveillance efforts may prove even more cost-effective.

Introduction

CWD is a neurodegenerative disease that affects members of the cervid family, including white-tailed deer (*Odocoileus virginianus*). CWD is in a class of prion-caused diseases known as transmissible spongiform encephalopathies and is similar to mad cow disease in cattle or scrapie in sheep. This disease misfolds proteins referred to as prions, causing lesions in the brain of infected animals. The disease is transmitted directly by deer-to-deer contact or through contaminated soil or other material. While CWD continues to spread with no seemingly effective method for containment, state and federal agencies continue to conduct surveillance for CWD as costs continue to rise with new research being conducted and few methods for detection. If wildlife managers wish to be effective in their management efforts while under the restraints of budgets, efficient alternatives are necessary in the continued efforts for monitoring CWD among wild animal populations. Without analyzing the associated costs to conduct disease monitoring, it proves difficult to find where efficiency can be improved. Therefore, we break down the costs to conduct disease surveillance for CWD in Indiana.

The continuous spread of CWD throughout the United States is a wide concern among federal and state wildlife agencies. While CWD continues to spread, the costs for surveillance and management efforts continue to increase. The costs associated with CWD surveillance in free-ranging deer and elk has been studied by Samuel et al. (2002) and was approximately $83 per sample for the collection and testing from a hunter-harvested animal. Chiavacci (2022) found that state natural resources agencies spent more than $25.5 million on work connected to CWD efforts, including but not limited to personnel time, sample processing, travel expenditures, supplies, and management.

As of 2023, CWD has yet to be detected in Indiana, but monitoring for CWD in Indiana has occurred since 2001. Biologists collected samples at partnering meat processors from volunteer hunters. In 2020, the goal for detection of CWD was altered in Indiana, and a new method of selecting target counties was deployed using a risk assessment that evaluated the most at-risk counties based on four parameters: (1) the number of captive cervid facilities within a county, (2) out-of-area hunters, (3) number of taxidermists and/or processors, and (4) the wild cervid abundance (Boggess and Vaught 2020). The detection goal was set to 5% (58 points/county) for target counties and relied on a rotating surveillance technique to sample the entire state during a five-year period.

Jenelle et al. (2018) found that the most valuable samples from hunter-harvested deer are from adult males (≥2.5 years old). As bucks age, their desirable attributes (e.g., large body size and large antlers) become more prominent, leading to an increased likelihood of the deer being mounted by taxidermists. New York was the first state to publish the use of the Taxi-

dermy Partnership Program (TPP), whereby partnering with taxidermists, training them to collect CWD samples, and rewarding them for viable samples collected (Ableman et al. 2019). As a result of the TPP, communication and awareness of CWD has increased among taxidermists in New York State reducing the amount of effort required among wildlife agencies for CWD sampling and increasing cost effectiveness. Indiana DNR has conducted surveillance for CWD since 2002. In 2021, the Indiana DNR partnered with the National Deer Association (NDA) to implement a taxidermist program, much like the TPP in New York, as an effort to reduce the costs required to conduct continual surveillance efforts in a state with no confirmed CWD detections.

Materials and Methods

Before the 2020-2021 white-tailed deer hunting season in Indiana, the DNR began communicating with taxidermists throughout the state to gauge interest in starting a TPP focusing on the collection of CWD samples from high-valued male white-tailed deer 2.5 years or older. As a requirement for Indiana, all taxidermists must register with the DNR and submit paperwork annually. As of Nov. 17, 2021, there were 654 registered taxidermists. Before the 2021-2022 deer season, biologists reached out to registered taxidermists in or around counties targeted for CWD surveillance that year. The DNR was successful in recruiting respective totals of 10 and 20 taxidermist businesses across nine and 15 counties for the 2021-2022 and 2022-2023 deer seasons. The taxidermists participating in the program were taught how to record hunter information, collect the retropharyngeal lymph nodes of white-tailed deer for CWD sampling, collect an incisor for aging purposes, and collect a tissue sample for archival DNA. Training of the taxidermists to collect these samples was done using deer heads produced as refuse at local deer processors and were not submitted for testing. Samples were collected during the entirety of all deer seasons (between Sept. 15, 2021, through Jan. 31, 2022; Sept. 15, 2022, through Jan. 31, 2023).

For a single deer, the supplies required for extracting a CWD sample are a boning knife, forceps, a disposable scalpel, disinfecting wipes, paper plates, paper towels, a pair of gloves, one jar of formalin, a strip of electrical tape (IHC) or a sample collection bag (ELISA), a results card, and a datasheet. Since certain items can be reused several times before needing replacement, some items are not factored into the base cost of collecting a single sample, such as a boning knife and forceps. After calculating the cost of the supplies, we purchased in bulk, and dividing the cost of the item by the number of samples those supplies can be used for, we calculated a base value for the cost of the physical collection of a CWD sample at $4.30 plus the cost of testing ($20 to $30).

The taxidermists participating in the program do not require the same supplies as a biologist at a check station because the nature of their business requires similar tools. The taxidermist businesses were provided disposable scalpels, formalin jars, electrical tape, sample collection bags, coin envelopes, and a sharps container. Biologists were contacted when a taxidermist business had samples ready for testing or when additional supplies were needed. Samples were collected via pick-up from the taxidermist business, and supplies were dropped off at the taxidermist business.

The cost effectiveness was calculated using the number of miles traveled to the taxidermists from the DNR's Bloomington field office and back, the cost of fuel at the organization's base rate per mile (mean of $0.41/mile), the amount of time spent traveling to and from the taxidermist, the amount of time spent at the taxidermist (training and sample collection), and the number of samples recovered from taxidermists. The drive time and time spent at the taxidermist was then translated into terms of cost per hour because the primary employees used for collecting samples are temporary employees (approx. rate = $12/hour). The number of miles driven was translated into cost per mile by multiplying the number of miles by the base rate. Finally, the cost for recovered samples was multiplied by 10 as the taxidermists are compensated $10 per viable sample collected.

Results and Discussion

The supply estimate per sample for a deer collected from a biologist at a check station is $4.30 versus $1.80 for a sample collected from the taxidermist program, a 58% reduction. Employee hours averaged 136.3 hours during the two years of sampling, consisting of driving time and time spent working with the taxidermist, culminating in a mean value of $1,635.3. The mean number of miles driven was estimated to be 6,089 with an average cost of $2,496.49 ($0.41/mile) in fuel.

The 2021-2022 Indiana deer season yielded a total of 1,548.3 points collected between check stations and taxidermists; in total, each county averaged 16.8 points with a maximum of 93.88 points collected in a

single county. Of those points, the taxidermist program was responsible for collecting ~44% (676.6 points; Fig. 9.6). The taxidermist program collected an average 7.4 points per county, with the most being 71.1 in a single county. The 2022-2023 Indiana deer season yielded a total of 2,135.8 points collected between check stations and taxidermists; in total, each county averaged 23.2 points, with a maximum of 169.7 points collected in a single county. Of those points, the taxidermist program was responsible for collecting ~43% (902.8 points; Fig. 9.7). The taxidermist program collected an average 9.8 points per county, with the most being 77.5 in a single county. Overall, there was a 21.5% increase in the number of adult buck samples collected from the 2020-2021 deer season to the 2021-2022 deer season. From the 2021-2022 season to the 2022-2023 season, there was a continued increase of 34% in these high value samples (Fig. 9.8). The mean cost of a single point in the taxidermist program during the two-year period was $15.54, a 74% reduction in cost versus collection from a biologist at a check station.

In conclusion, the introduction of the taxidermist program into Indiana's surveillance plan has proven to be more cost effective than collection of samples from a biologist at a check station. In an effort to continue to control costs associated with disease monitoring, we suggest that reliance on sample collection should shift to the expansion of the taxidermist program. Additional efforts should be placed on further growth of the program through advertisement, and DNR should continue to explore additional methods to further enhance the cost effectiveness of the program, such as the mailing of supplies to participants, return of samples via shipping, remote learning opportunities for sample collection, and an automated sign-up process.

Literature Cited

Samuel, M. D., D. O. Joly, M. A. Wild, S. D. Wright, D. L. Otis, R. W. Werge, and M. W. Miller. 2003. Surveillance Strategies for Detecting Chronic Wasting Disease in Free-Ranging Deer and Elk: Results of a CWD Surveillance Workshop. USGS-National Wildlife Health Center, Madison, Wisconsin, USA.

Plan for Assisting States, Federal Agencies, and Tribes in Managing Chronic Wasting Disease in Wild and Captive Cervids. U. S. Department of the Interior and U. S. Department of Agriculture. 26 June 2002.

Chiavacci, S. J. 2022. The Economic Costs of Chronic Wasting Disease in the United States. PLoS ONE 17(12): e0278366.

Boggess, C. M. and O. D. L. Vaught. 2021. 2020 Indiana White-tailed Deer Report. Indiana Department of Natural Resources, Bloomington, Indiana.

Jenelle, C. S., D. P. Walsh, M. D. Samuel, E. E. Osnas, R. Rolley, J. Langenberg, J. G. Powers, R. J. Monello, E. D. Demarest, R. Gubler, and D. M. Heisey. 2018. Applying a Bayesian Weighted Surveillance Approach to Detect Chronic Wasting Disease in White-tailed Deer. Journal of Applied Ecology 55:2944-2953.

Walsh, D. P. and D. L. Otis. 2012. Disease Surveillance Incorporating Available Information to Enhance Disease-Detection Efforts. Pages 11-23 in D. P. Walsh. Enhanced Surveillance Strategies for Detecting and Monitoring Chronic Wasting Disease in Free-Ranging Cervids. U. S. Geological Survey, Reston, Virginia, USA.

Ableman, A., K. Hynes, K. Schuler, and A. Martin. 2019. Partnering with Taxidermists for Improved Chronic Wasting Disease Surveillance. Animals 9(12):1113.

Evans, T. S., K. L. Schuler, and W. D. Walter. 2014. Surveillance and Monitoring of White-Tailed Deer for Chronic Wasting Disease in the Northeastern United States. Journal of Fish and Wildlife Management 5(2):387-393.

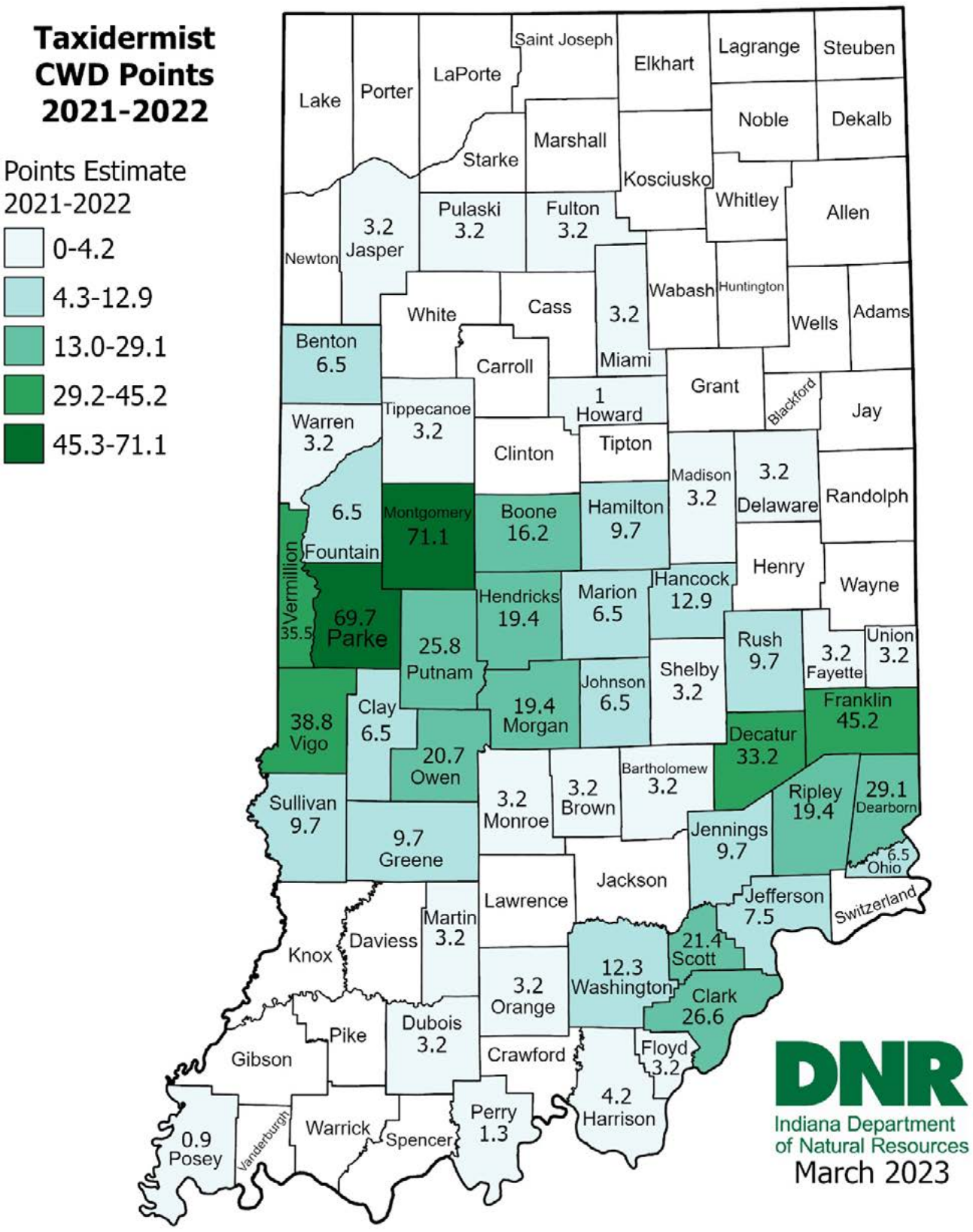

Figure 9.6. A total of 676.6 points were collected from 51 different counties across Indiana from the taxidermist program during the 2021-2022 deer season.

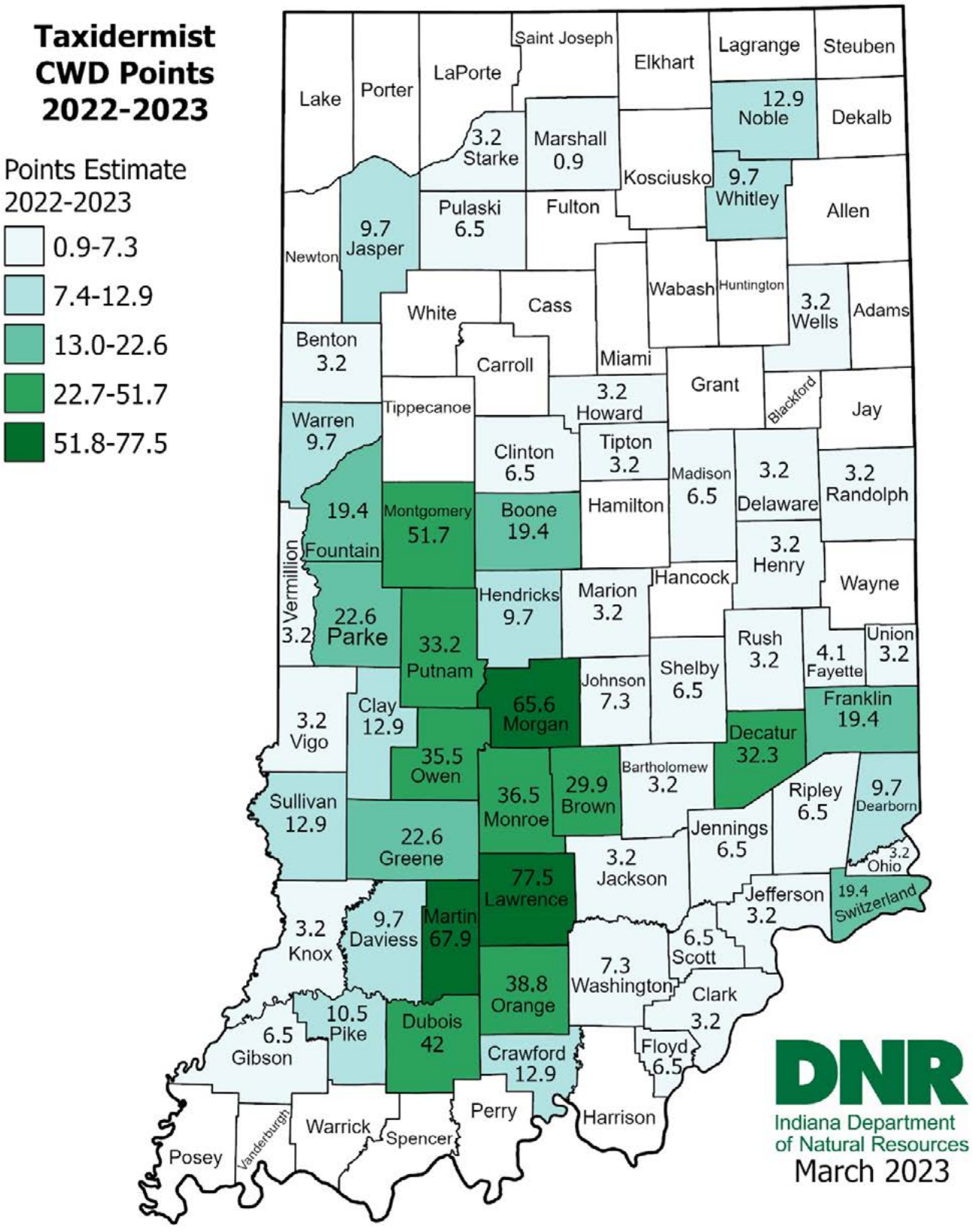

Figure 9.7. A total of 902.8 points were collected from 61 different counties across Indiana from the taxidermist program during the 2022-2023 deer season.

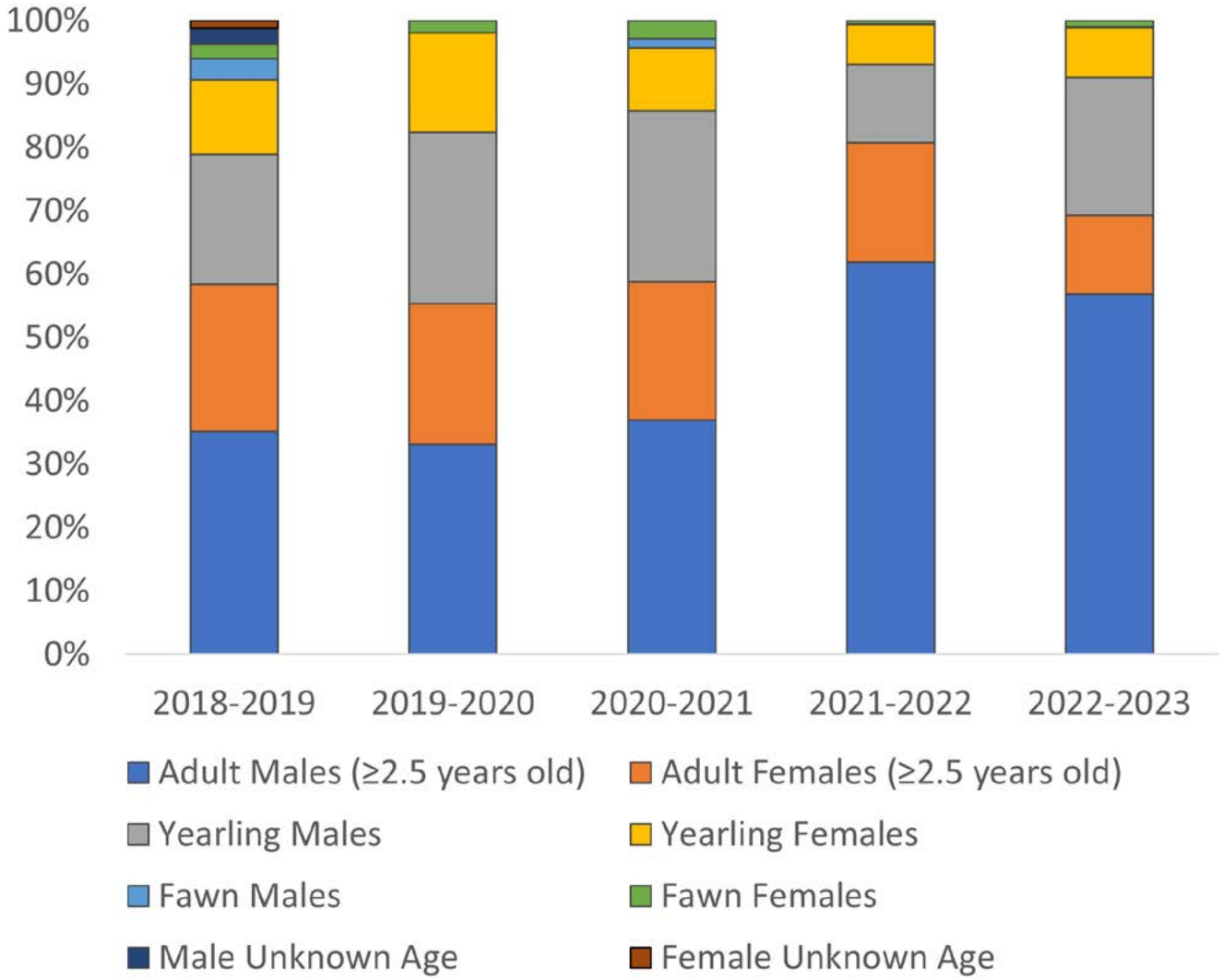

Figure 9.8. Percentage of samples collected relative to age and sex of the deer from the 2018-2019 deer season through the 2022-2023 deer season, where the last two years the taxidermist program was active.

Determining Hunting Pressure Across Indiana

Zackary J. Delisle and Joe N. Caudell, *Indiana Department of Natural Resources*

How many hunters are hunting within a given area is a very common question received by the DNR Deer Program. In the past, the DNR did not know how hunting pressure changed across Indiana; therefore, the annual Deer Management Survey asked where respondents hunted within Indiana.

The survey consists of a core set of questions that remain the same every year, with additional sets of unique questions that change each year to address emerging issues in state deer management. The 2023 survey asked several questions designed to assess opinions of the timing of firearms season for white-tailed deer. The inclusion of specific questions should not be interpreted as a change or a desire for a particular regulation by DNR or the public. For more information on the survey, please see Chapter 7.

The 2023 survey asked what 4x4-mile grid cell within Indiana each respondent hunted. Because not every hunter within Indiana responds to the survey, we corrected the number of respondents hunting in each grid by the estimated fraction of Indiana hunters who responded to the question.

We found high numbers of hunters within southern and northern Indiana and fewer hunters within central Indiana (Figure 9.9). Indiana hunters can use this information to see where hunting pressure is higher.

Results from this study are not meant to be estimates of the true number of hunters in each 4x4-mile grid cell. Instead, readers should interpret this map as a spatially explicit index of hunting pressure (i.e., where hunting pressure is high versus low).

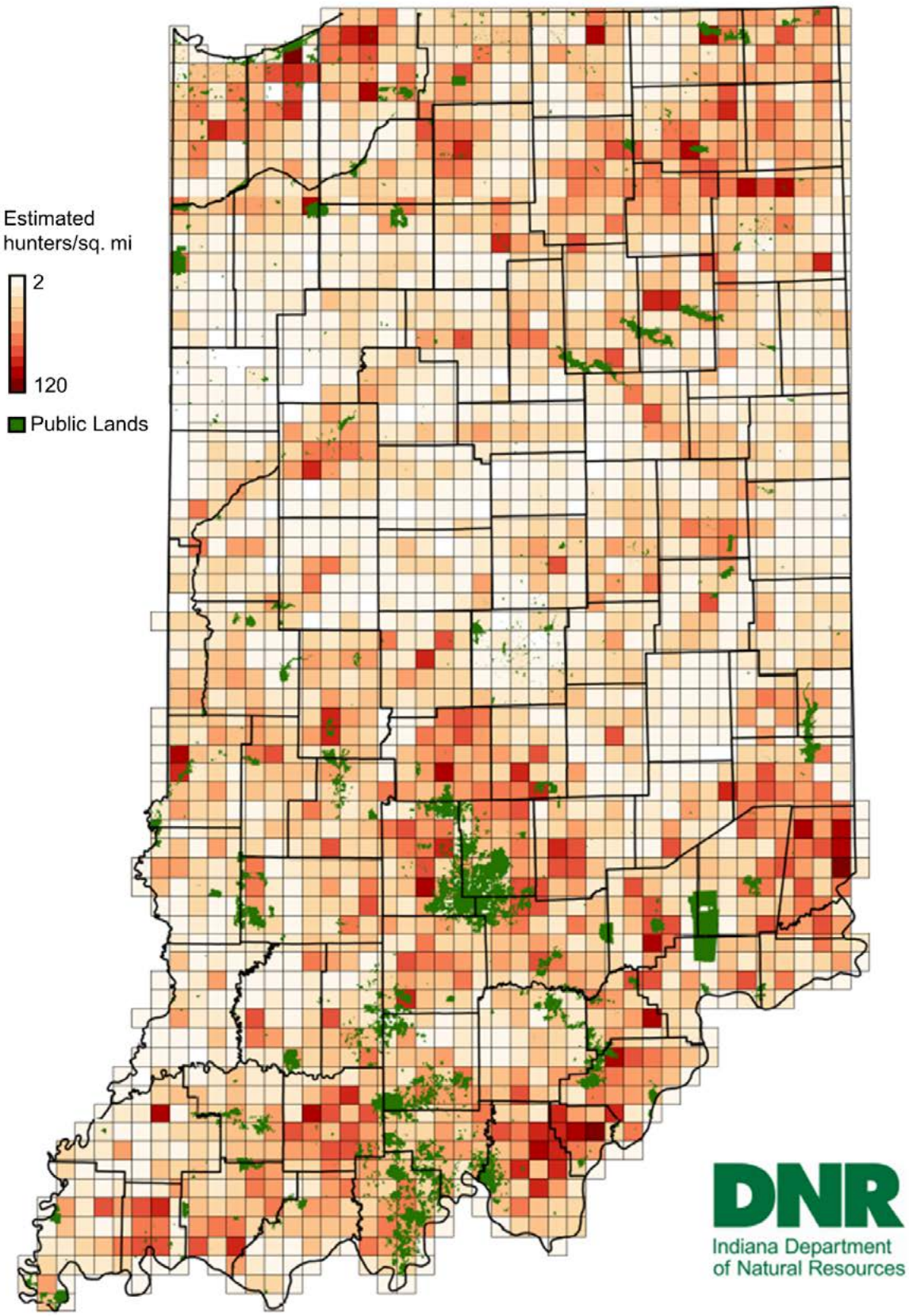

Figure 9.9. Estimated number of hunters within 4x4 mile grid cells of Indiana. Public lands are also depicted in green.

EVALUATING INDIANA HUNTERS' INTEREST IN LIFETIME LICENSES

Joe Caudell and Zack Delisle, *Indiana Department of Natural Resources*

Introduction

The DNR is considering bringing back lifetime licenses. These could include a lifetime deer bundle, a lifetime fishing license, a lifetime "sportsperson license" that includes all hunting, fishing, and trapping privileges (similar to the original lifetime license), or other types of lifetime license. The public's desire for these licenses is pertinent to the DNR when making this consideration. Historically, the lifetime license was priced so that it was a significant discount for hunters, but the lifetime licenses were priced so low that it had to be phased out. To determine if there is interest in bringing back a lifetime license that is more closely aligned to the value of the license, we need to understand the demand for lifetime license. If demand for a more appropriately priced license is low, then there may not be enough interest in bringing them back to warrant a change in Indiana Administrative Code. Therefore, in the most recent Deer Management Survey we asked a series of questions to assess hunters' interest in having the lifetime deer-bundle license, lifetime fishing license, and a lifetime sportsperson license available as an option to purchase.

Methods

The Deer Management Survey consists of a core set of questions that remain the same every year, with additional sets of unique questions that change each year to address emerging issues in state deer management. In the 2023 survey, the Indiana DNR asked several questions designed to assess opinions of the timing of the firearms season for white-tailed deer. The inclusion of specific questions should not be interpreted as a change or a desire for a particular regulation by Indiana DNR or the public.

The 2023 survey was sent to individuals that the Division of Fish & Wildlife had prior contact with and thus had an email address for. These included: (1) residents and nonresidents who had purchased any type of hunting, trapping, or fishing license since 2006; (2) anyone who checked in a deer in the last five years; (3) anyone who created an electronic account with DNR for other reasons (such as obtaining the survey); and (4) anyone who signed up for the Wild Bulletin e-newsletter. Because current lifetime license holders and landowner hunters do not have to purchase a yearly license, they can only be surveyed if they harvest a deer, purchase another license type (e.g., fishing, deer reduction zone license, etc.), or sign up on DNR's electronic system specifically to receive the survey. Because of this, lifetime license holders and hunters who only use their landowner exemption and do not harvest a deer are likely underrepresented in the survey. Survey invitations were distributed by Qualtrics in January and February 2023. The survey was developed in the program Qualtrics.

Because age may influence the willingness to pay for a license, we first asked respondents their age. Based upon what age the respondent specified, prices between a lower and upper bound were presented, and the respondent was asked if they would be willing to pay that amount of money for a lifetime license. We used the following bins for ages (henceforth, age classes): (1) 34 years old or younger; (2) between 35 and 54 years old; (3) between 55 and 64 years old; and (4) 65 years old or older. All survey results were downloaded in March 2023, and descriptive statistics were generated using the R Programing Language.

Results and Discussion

On Jan. 31, 2023, we distributed the survey via email to 809,763 individuals consisting of anyone who had purchased a license since 2015 (n=611,059) and Wild Bulletin subscribers who had never checked in a deer or purchased an annual hunting, trapping, or fishing license (n=198,704). From our total distribution group, 39,889 individuals started the survey (response rate = 4.9%) with a completion rate of 91%. We received 32,559 responses from current and lapsed hunters and 5,125 responses from nonhunters. Because much of the survey depends upon potential respondents being assigned to a county for reporting, survey respondents had to include a county they hunted in or lived in to be included in the final data.

We asked survey respondents how frequently they hunt deer. Of the 29,094 respondents, 0.7% indicated they do not hunt deer, 3.5% indicated they participate in deer hunting every now and then, such as when someone asks them to go, 2.8% only plan on hunting every two to three years, 10.4% hunt deer at least once per year, and 82.6% plan on hunting deer multiple times per year. While we do not know the avidity statistics of hunters in Indiana, the result from the question indicates that the survey is likely skewed toward hunt-

ers who are avid deer hunters; therefore, it is important not to draw general conclusions from this survey to the general deer hunting public.

We asked survey respondents if we brought back the lifetime licenses, would they be willing to complete a survey every year related to their intent to harvest fish and wildlife. Of the 28,755 who responded, 93% were willing to fill out the survey annually. An annual survey of intent to harvest fish and game is important so that we know how many hunters and anglers are participating. Currently, we do not know how many lifetime hunters and anglers are still active, making it difficult to estimate the number of deer hunters who actively pursue deer on an annual basis. This information is especially useful for monitoring trends in success rates and catch-per-unit effort that is used to monitor trends in deer population. If a lifetime license is sold once again in Indiana, an annual "intent to harvest" survey should be implemented.

We asked survey respondents if they have children or grandchildren, would they want the ability to purchase a lifetime license for them. Of the 28,858 hunters who responded to the question, 92% of respondents desired that ability. When the DNR is considering whether to bring back this license type, we recommend a mechanism be put into place that would allow a person to purchase a license as a gift to another person.

We asked survey respondents how frequently they fish (not including trout or salmon) to gain an understanding of how many people might be interested in purchasing a lifetime fishing license as an add-on to a lifetime deer license or for an all-inclusive sportsperson license. Of the 29,122 hunters who responded to this question, only 4.5% indicated they do not fish; 11.6% indicated they only fish every now and again (such as when someone asks them to go); 1.4% indicated they plan on fishing every 2-3 years; 9% indicated they plan to go fishing at least once per year; and 73.5% indicated they plan on fishing multiple times per year. We also asked survey respondents if they fished for trout or salmon. Of the 29,033 individuals who responded to the survey, 67.3% indicated they do not fish for trout or salmon; 13.0% indicated they would go fishing for trout or salmon every now and again; 3.8% indicated they plan on fishing for trout or salmon every two to three years; 8.4% indicated they plan on fishing for trout or salmon at least once per year; and 7.4% indicated they plan on fishing for trout or salmon multiple times per year. With more than 80% of hunters fishing at least annually, providing an option for adding-on a lifetime fishing license to a lifetime deer bundle license would be useful; however, because so few individuals fished for trout or salmon, the additional cost of adding a trout or salmon stamp to the lifetime license price would not significantly increase the value to most deer hunters.

We asked survey respondents how frequently they hunt wild turkey to understand the added value of adding a lifetime turkey license. Of the 29,110 individuals who responded to this question, 27.4% selected that they do not hunt turkey; 12.2% participate in turkey hunting every now and then; 5.1% only plan on hunting every 2-3 years; 15.5% reported they plan to hunt turkey at least once per year; and 39.9% responded that they plan on hunting turkeys multiple times per year. With more than 55% reporting they either hunt turkey at least once per year, having the option of adding a lifetime turkey license to the lifetime bundle would likely be a popular option for deer hunters.

We asked survey respondents how frequently they hunt waterfowl. Of the 29,093 individuals who responded to this question, 59.8% do not hunt waterfowl; 14.1% participate in waterfowl hunting every now and then; 4.1% plan on hunting waterfowl every two to three years; 7.3% plan on hunting waterfowl at least once per year; and 14.7% plan on hunting waterfowl multiple times per year.

We asked survey respondents how frequently they hunt small game. Of the 29,110 individuals who responded to this question, 18.7% indicated they do not hunt small game; 15.7% indicated they participate in small game hunting every now and again, such as when someone asks them to go; 5.6% hunt small game every two to three years; 18.1% plan on hunting small game at least once per year; and 42.0% plan on hunting small game multiple times per year.

We asked survey respondents how frequently they hunt furbearers. Of the 29,064 individuals who responded to the survey, 44.7% indicated they do not hunt furbearers; 16.1% indicated they hunt furbearers every now and again, such as when someone asks them to go; 4.0% indicated they plan on hunting furbearers every two to three years; 14.3% stated they plan on hunting furbearers at least once per year; and 20.9% stated they plan on hunting furbearers multiple times per year. This is likely a high estimate for the number of furbearer hunters who make furbearer hunting trips separate from deer hunting; however, this may accurately reflect the number of hunters who also will opportunistically take coyotes or other furbearers if they see then while deer hunting. Therefore, it is likely that the addition of a

lifetime small game license would be popular for deer hunters so that they could legally opportunistically harvest furbearers while deer hunting.

We asked survey respondents how frequently they trapped furbearers. Of the 29,050 individuals who responded to this question, 81% indicated they do not trap furbearers; 6.2% indicated they participate in trapping every now and then, such as when they are asked to go; 2.7% plan on trapping furbearers every two to three years; 3.4% plan on trapping furbearers at least once per year; and 6.7% stated they plan on trapping furbearers multiple times per year. The number of deer hunters who indicated they are also trappers appeared to be high compared to the number of licensed trappers in the state. Because landowners do not need a license to remove nuisance raccoons or other furbearers when they are causing damage to private property, many of the trapping activities of these deer hunter may fall into that category; therefore, it is unlikely that adding a lifetime trapping license would result in much additional value for most deer hunters.

Hunters in four different age classes were shown random prices for a lifetime deer bundle ranging from the minimum that would be necessary to bring three lifetime licenses back to Indiana (which equated to approximately 20 years of purchasing the various combinations of licenses) to the expected revenue-maximizing prices as estimated by a Purdue research project (Kim et al. 2023) that conducted a survey of Indiana sportspersons and estimated the revenue-maximizing prices for the deer bundle was $2,752, deer bundle + fishing was $3,203; deer bundle + hunting was $3,478, deer bundle + spring turkey was $3,234, deer bundle + fishing + hunting was $3,701, deer bundle + fishing + spring turkey was $3,788, and deer bundle + fishing + hunting + spring turkey was $4,205. These amounts were then adjusted for each age class. People in older age classes saw a less expensive range of prices to account for the fewer number of years they would be using the license, while younger individuals saw a more expensive range of prices to account for the greater number of years they would be using the license. Prices for the lifetime angler license were calculated using the same ratio for different ages and licenses as the deer bundle. The sportsperson license was estimated based on the same method but included every possible license combination, including all deer licenses and quotas, lifetime fishing and trout stamp, all turkey, all hunting and trapping, and the possible creation of future licenses.

There was a variable relationship between age and price for each license type (Figure 9.10). Individuals between 35 and 54 were less willing to pay for a lifetime license of any type compared to individuals in older and younger age groups. Individuals in the <35 age group were the most likely to purchase a lifetime license after being shown prices in their range. This is likely due to the length of time they have to hunt, and

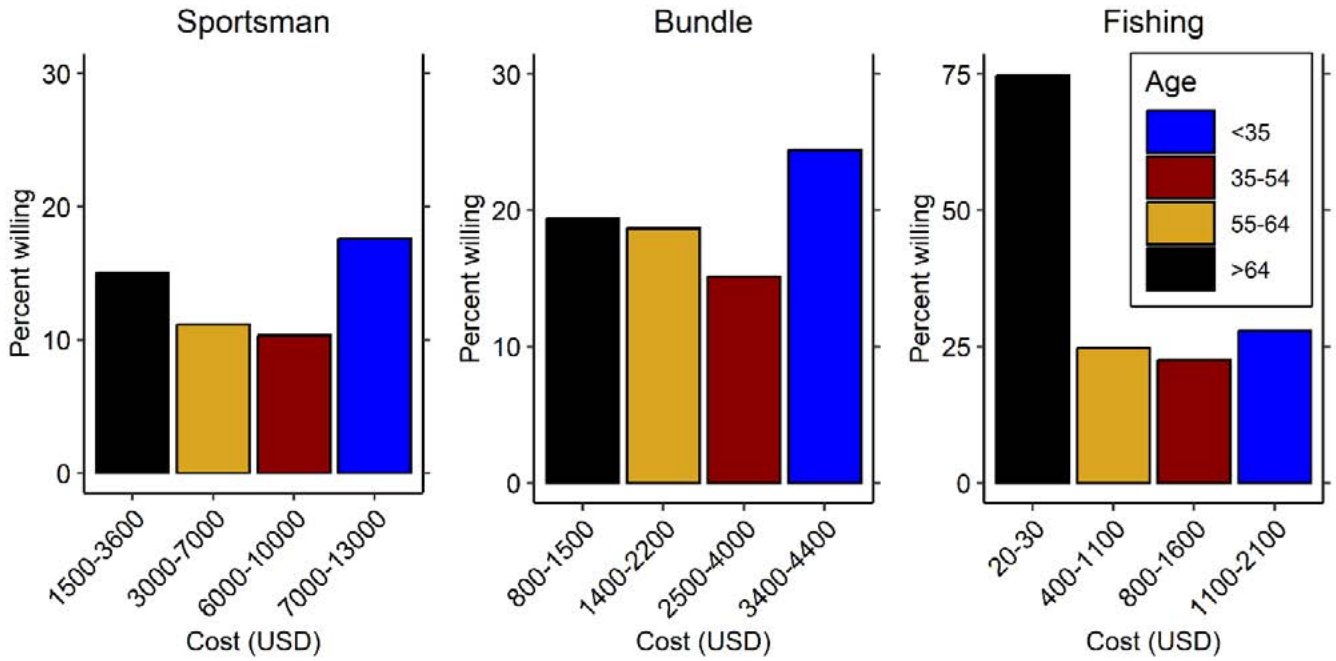

Figure 9.10. The percentage of respondents willing to pay (percent willing) certain costs (USD) for a lifetime deer-bundle license. Different panels are depicted for different age groups.

because many of these individuals missed out on the opportunity to purchase a lifetime license the last time they were offered. The exception to this was individuals older than 65, who were the most willing to purchase a lifetime license for fishing, which they already have access to at the stated prices.

The sportsperson license had the most associated hunting and fishing privileges but was also the most expensive and least desired option. It is likely that the additional privileges did not provide enough value to justify the additional price; however, it may also be that the sportsperson license becomes an aspirational purchase for those who already possess a lifetime deer bundle or a lifetime fishing license and may be considered as an add-on license later for individuals who purchase one of the new lifetime licenses.

Currently, there are no firm plans to bring back the lifetime license. DNR administrators and staff must first fully understand the consequences of pricing and demand on future revenue. Therefore, research into the proper pricing of these licenses will continue until a final decision is made.

Literature Cited

Kim, Y., C. Reeling, N. J. O. Widmar, J. G. Lee. 2023. Estimating a model of forward-looking behavior with discrete choice experiments: The case of lifetime hunting license demand. Journal of Choice Modeling 47:100414.

Chapter 10.
EXTERNAL DEER RESEARCH

Studies described in the External Deer Research chapter are projects being conducted by university partners to better understand deer and inform management decisions in Indiana.

INTEGRATED DEER MANAGEMENT PROJECT

Cost: $2,626,340 for the complete five-year project

Project Personnel

- Dr. Robert Swihart - Principal Investigator, Purdue University
- Dr. J. Andrew DeWoody - co-Principal Investigator, Purdue University
- Dr. Brian Dillman - co-Principal Investigator, Purdue University
- Dr. Elizabeth Flaherty - co-Principal Investigator, Purdue University
- Dr. Michael Jenkins - co-Principal Investigator, Purdue University
- Dr. Zhao Ma - co-Principal Investigator, Purdue University
- Jarred Brooke - co-Principal Investigator, Purdue University
- Elizabeth Jackson - co-Principal Investigators, Purdue University
- Patrick McGovern - Project Coordinator, Purdue University
- Scott Allaire - Field Research Coordinator, Purdue University
- Zackary Delisle- Ph.D. Student, Graduate Research Assistant, Purdue University
- Jessie Elliott – M.S. Student, Graduate Research Assistant, Purdue University
- Richard Sample - Ph.D. Student, Graduate Research Assistant, Purdue University
- Taylor Stinchcomb - Ph.D. Student, Graduate Research Assistants, Purdue University
- Dr. Rebecca Cain - Postdoctoral Research Associate, Purdue University
- Dr. Safia Janjua - Postdoctoral Research Associate, Purdue University
- Dr. Joe N. Caudell – DNR Project Liaison, Indiana Division of Fish and Wildlife
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White-tailed deer are perhaps the most popular and economically important resource managed by the Indiana DNR Division of Fish & Wildlife (DFW). Sound management requires DFW to be able to measure and incorporate into agency decisions the biological, ecological, and social factors that affect deer populations. The purpose of this project is to collect and evaluate biological, ecological, and sociological information for its potential to improve management decisions in an integrated context, with the goal to maintain deer populations within both ecologically and socially acceptable limits. Biological information currently is collected by DFW from multiple sources, including harvest returns, indexes of hunter effort, license sales, archer surveys, depredation permits, and deer-vehicle collisions. In this project, we will explore the utility of augmenting current data with population estimates derived from systematic counts collected using different sampling methods. We also will supplement our understanding of potential fawn predators by estimating population parameters from non-invasively collected genetic samples. Ecological information on habitat condition and the effects of deer on forest communities in Indiana has relied on scattered studies, mostly local in scale and relying on non-standardized methods. The systematic statewide assessment of deer impacts on state parks is an exception; however, parks rely on hunting and land use not representative of the rest of the state. We will explore the utility of multiple measures of habitat condition and plant community integrity and their associations with deer abundance as well as prevailing land use and land cover. From a societal perspective, information on public perceptions of deer and deer management by DFW has received even less attention than biological or ecological information and focused primarily on hunters. We will solicit perceptions of a wide range of stakeholders to gain greater understanding of their attitudes, values, beliefs, and expectations regarding Indiana deer and deer management. The specific objectives of the project are to:

- Estimate deer population density using counts derived from aerial surveys, remotely triggered cameras, and ground-based pellet-group surveys.
- Evaluate cost-effectiveness of these count-based methods of estimating deer abundance.
- Estimate coyote population density using genetically determined individual identities of systematically collected scat and hair samples.
- Evaluate deer impacts on vegetation using elapsed time since browsing of woody twigs, fencing and

oak sentinel plantings, herbaceous indicators of browse pressure, and a metric of browsing intensity on woody plants.

- Evaluate the utility of stump sprouts to index browse pressure in closed-canopy stands.
- Rank browse selection of woody plants and quantify associations between deer abundance, browse intensity, and plant communities.
- Identify key social factors shaping deer-human interactions.
- Investigate how judgments about deer management are affected by emotions, beliefs, and attitudes.
- Assess existing levels and drivers of public satisfaction with deer management.
- Develop tools DFW can use to better account for social perceptions and concerns in its planning process.

The project identified 10 regional management units (RMUs) in Indiana that serve as project study areas. Currently, studies are being conducted in RMUs 3, 4, and 9 (Figure 10-1). RMU 3 includes nine primarily agricultural counties spanning from Newton County south to Montgomery County. RMU 4 stretches from Morgan County south to the Ohio River. These 16 counties are mostly forested and unglaciated; they include many state and federal properties such as Brown County State Park, Martin State Forest, and Hoosier National Forest. RMU 9 is in Indiana's natural lakes region in the northeast corner of the state. Land cover is a mix of woodlots, wetlands, forested riparian areas, cultivated crops, and pasture.

DNR adapted the RMUs into deer management units (DMUs; Figure 3-6) to make them more suitable for management applications. The DMUs are referenced throughout the Indiana White-tailed Deer Report and have slightly different county groupings and labels than the RMUs.

In our third year, we concluded data collection pertaining to deer density, impacts on vegetation, and stakeholder perceptions. These data were supplemented with data on predator populations and stump sprout performance. Analysis of data is in full swing, and results are being shared with a diverse array of stakeholders to improve wildlife management generally and management of Indiana deer specifically.

Population Biology

Deer population density will be estimated using a statistical approach known as distance sampling. Aerial surveys were flown along parallel transects, and the distance from the transect line was measured for each deer detected. Flights occurred at altitudes of 1,000-1,500 feet, high enough so deer wouldn't react to the aircraft. A high-resolution digital camera was used alongside an infrared camera to confirm that detected heat signatures were actually deer. Ground-based surveys were walked along transects, and distances were measured for each pellet group encountered. Cameras are increasingly used to study wildlife behavior and ecology, but only recently in conjunction with distance sampling (reviewed by Delisle et al. 2021). For surveys using remotely triggered cameras, the distance from the camera to each deer in an image was recorded. The utility of each of the three methods will be assessed by conducting a cost-effectiveness analysis to estimate cost of the method relative to precision of its density estimate.

Population density of coyotes and occurrence of bobcats will be estimated from scat and hair samples as well as camera trapping. Surveys were repeatedly driven on transects to collect scat, and hair samples were collected by deploying a pair of snares at multiple sites in each RMU, a rub pad design for coyotes and a "cubby" design for bobcats. DNA was extracted, purified, concentrated, and used in conjunction with a panel of 96 genetic markers to genotype each sample and identify species, sex, parasite occurrence, and for coyotes, individual identity.

After data collection was completed in 2021 (see previous Indiana Deer Reports for more information), we found that aerial sampling was the most cost-effective method for estimating deer populations in Indiana. For this reason, the DNR plans to use aerial sampling each year to estimate deer density in various RMUs of Indiana.

In addition to finding that aerial sampling was the most cost-effective method for estimating deer density, this project was also successful at estimating coyote density in the same three RMUs using both camera sampling and genetic sampling from scat. When using camera sampling, we found coyote densities of 0.34 (95% confidence intervals = 0.17 to 0.47), 0.85 (95% confidence intervals = 0.29 to 1.37), and 0.65 (95% confidence intervals = 0.32 to 0.89) coyotes/mi2 in RMUs 3, 4, and 9, respectively. When using genetic sampling, we found coyote densities of 0.35 (standard

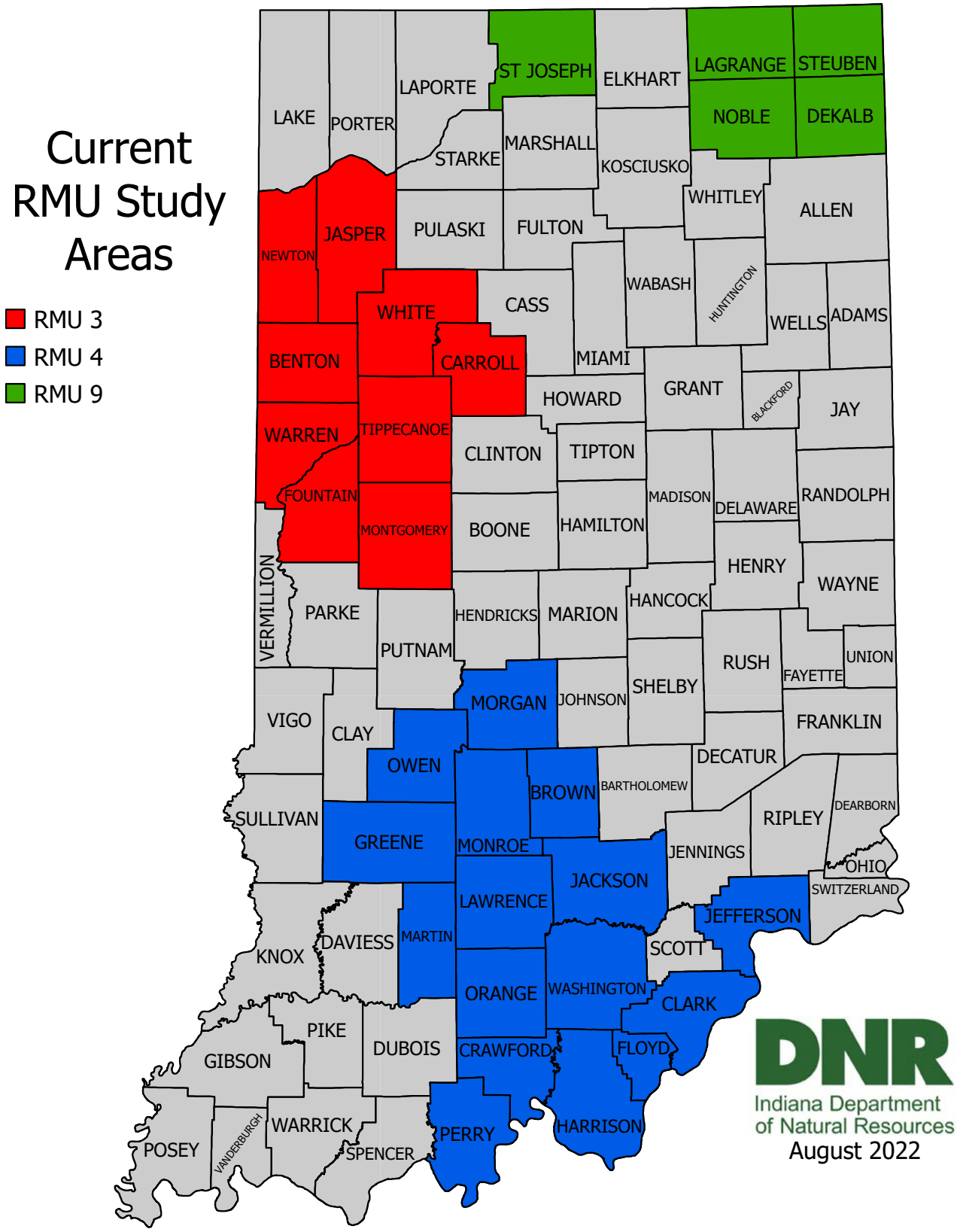

Figure 10-1. Current regional management unit (RMU) study areas for Purdue University deer management research projects.

error = 0.06), 0.40 (standard error = 0.19), and 0.38 (standard error = 0.14) coyotes/mi2 in RMUs 3, 4, and 9, respectively.

Habitat Condition and Deer Impacts

Four methods were compared to assess deer impacts on vegetation at selected woodlots within each RMU. All sampling was conducted in the "deer molar zone," the height at which plants are available to deer: 1) The twig aging method relies on age determination of 50-60 randomly selected twigs in each woodlot back to a browsed parent twig. Given that greater twig age signifies a greater number of years since a twig was last browsed, greater twig age indicates lower browsing intensity. 2) Oaks are generally regarded as palatable to deer, and heavy deer use can inhibit oak regeneration. The oak sentinel method compares growth and survival of 10 oak seedlings planted inside of deer-proof fences to 20 planted outside them. In other words, the oak seedlings are either protected or unprotected from deer browsing. 3) Prior work in Indiana has shown that three common Indiana plant species, sweet cicely, jack-in-the-pulpit, and white baneberry, are indicators for deer browse impacts on native herbaceous plant communities. Heights of the tallest individuals of each species were measured in each woodlot; shorter height is correlated with higher deer impacts. 4) Browsing intensity of woody plants also was assessed by estimating the proportion of twigs available to deer that were browsed by deer. Counts of all available and browsed twigs were made for each species in regularly spaced plots along transects. The proportion of available twigs browsed was computed for all species other than those highly avoided by deer.

Recent research has suggested that stump sprouts may be useful as indicators of high browse intensity, but no evaluation of stump sprout indicators has been conducted in closed-canopy forests such as those typical of Indiana. To examine stump sprout performance under these conditions, we created stumps in nine different stands across the southern, central, and northern regions of Indiana. Sixty stumps from two different species were created at each site, and 1/3 of these were protected from browsing. Camera traps were also installed at each of the stands from May 20 – June 20, 2021. Sprouting performance and the proportion of browsed twigs on sprouts and neighboring seed-origin stems were assessed from late June to early July. Leaf nutrient levels were compared between parent trees, sprouts, and neighboring stems.

Overstory, midstory, and understory sampling was conducted to determine whether plant communities and deer browsing differed with deer use and landscape characteristics. To quantify preferred browse species for deer, we used the same data we recorded for estimating the proportion of available twigs browsed and separated species into five preference classes: highly preferred, marginally preferred, neutral, marginally avoided, and highly avoided. Intensity of deer use of each locality was estimated from the remotely triggered camera stations. Land cover and use measures were computed from 2016 satellite images.

After completing field work in 2021 (see past Indiana Deer Reports for more information), we found that the twig age method was an effective and efficient measure of deer browsing intensity. This method relies on the premise that low twig age in an area suggests greater browsing pressure from more deer.

Similarly, we found deer to highly select hackberry, greenbrier, oak, dogwood, and viburnum, while highly avoided species included spicebush, Japanese barberry, beech, multiflora rose, winged burning bush, buck honeysuckle, and pawpaw. Using these lists, managers can both identify species that are at risk of being damaged by severe browsing and species that can decrease foraging habitat quality for deer.

We created 540 stumps in nine different stands, with 30 stumps for each of two species at each stand. Hackberry, Northern red oak, red maple, and white ash stumps sprouted vigorously, with 85%, 93%, 83%, and 92% of stumps sprouting, respectively. Sugar maple sprouted moderately well, with 62% of stumps sprouting, and only 23% of sassafras stumps sprouted. Hackberry produced the highest number of sprouts per stump (sprout density), with 25 sprouts per stump, followed by white ash, Northern red oak, and red maple with 16, 12, and 10 sprouts per stump, respectively. Northern red oak (136 cm) and white ash stumps (119 cm) produced the tallest sprouts, followed by hackberry (97 cm) and red maple (94 cm), while sugar maple (34 cm) and sassafras sprouts (22 cm) were the shortest. In general, stump sprouts had greater nutrient contents than parent and uncut neighbor stems grown from seed. The increased nutrient contents in stump sprouts generally led to an increased proportion of browse on stump sprouts compared to seed-origin stems. Hackberry was the most nutritious stump-sprout species, with the highest crude protein, calcium, phosphorous, and total digestible nutrients. A moderate correlation occurred between the height discrepancy of caged

and open sprouts and the percent of available twigs browsed on seed-origin stems. Thus, stump sprouts may be useful for monitoring deer browsing intensity within woodlots.

Societal Perspectives on Deer and Deer Management

Existing perceptions, beliefs, attitudes, and emotions of Indiana residents related to deer and deer management were assessed with 59 semi-structured interviews conducted around the state and two focus groups in Bloomington. These results informed development of a quantitative survey distributed to 6,000 residents across the state. Statistical analysis of survey responses was used to predict anticipated emotional responses to hypothetical human-deer encounters in relation to their influence on the acceptability of lethal control. Survey responses also will be used to develop and analyze indices of public satisfaction with DFW and potential for social conflict over deer management approaches.

Findings from the semi-structured interviews (Stinchcomb et al. 2022) were used to develop a statewide survey that was implemented June through August 2021. Of 6,000 residents sampled, 1,806 responses were received and formed the basis for analyses. In one part of the survey, participants answered questions after being presented with four scenarios of encounters with a deer appearing in front of the participant while walking on a path: 1) an adult deer appears, stops, and begins eating plants; 2) a buck appears on the path, stops, and looks your way; 3) a fawn appears, stops, and looks your way; 4) an adult deer stops, looking diseased. Statistical models were built to show relationships among general deer attitudes, mutualist wildlife beliefs, scenario-specific emotions, and scenario-specific acceptability of hunting or culling. Emotions influenced decisions, but the strength of emotional influence depends on the type of deer encountered. Emotions mediated 14% of the effect of general attitudes on lethal control acceptability in the fawn encounter, and completely mediated this effect in the encounter with a diseased deer, but they showed no effect when encountering a large buck nor a deer eating the nearest plants. Because emotions play a significant role in formulating people's perceptions of human-wildlife interactions, accounting for emotions in decision making will help practitioners develop more effective and socially accepted approaches to wildlife conservation and management.

Survey responses also were used to develop an index of public satisfaction with deer management based on service quality, agency performance, trust in the agency, and trust in information. The satisfaction index was used in regression analyses to examine what variables explain whether residents are satisfied with and trusting of the DNR and its management of deer. Preliminary results indicate that residents' perceived acceptability of management approaches and deer-related concerns most strongly affected performance and quality measures of satisfaction. In contrast, demographic characteristics including self-identity, wildlife value orientation, and allowance of hunting on one's property exerted the strongest influences on trust.

Survey results also were used to quantify the potential for social conflict regarding six deer management methods among (a) resident self-identity ("stakeholder") groups and (b) resident political ideologies. The resulting conflict index was mapped across Indiana to enable an analysis identifying areas of significantly high social conflict ("hotspots") and significantly low social conflict ("coldspots"). Preliminary results suggest that conflict potential varied across resident self-identities and management methods but showed more predictable variation with political ideologies. Hotspots of conflict regarding lethal methods clustered around urban areas.

Integrating Deer Management

At the beginning of this project, DNR sought the support of Purdue University in enhancing its use of efficient methods for the sustainable management of deer and the inclusion of different perspectives in understanding human-deer interactions. Through this collaboration, researchers were able to provide multiple recommendations including:

- Use aerial monitoring for estimating population densities due to its cost-effectiveness.
- Use twig age indices for estimating browsing impacts in forests.
- Use insights into deer food selection to inform forest management about browsing impacts.
- Include different perspectives from a range of community groups interested in deer management when looking to the public for deer management perceptions.
- Include measures of emotion and direct experiences in social surveys examining the public's interactions with deer.
- Continue to emphasize transparency about how

deer management decisions are made in order to reduce feelings of powerlessness regarding deer management and increase the likelihood of public support.

- Use social conflict indices to identify areas with diverging perceptions of deer management that should be targeted for public engagement.

Finally, as the name suggests, this project was assisting DNR with ways to integrate biological, ecological, and social dimensions into a holistic management strategy. Overall, this data on deer density, their browsing of plants, and citizen viewpoints can provide landscape-level estimates of densities, browse intensity, and social conflict. These, in turn, can be combined to consider how deer population management goals in a given region align with environmental conditions and public interests. The collaboration between DNR and Purdue University's team showcases the power of collaboration and shared interest in conserving Indiana's white-tailed deer. The results and recommendations from this project provide useful insights for monitoring deer populations and their browsing impacts, in addition to expanding who is consulted about deer management and what social factors should be considered. As DNR continues to implement the Wildlife Governance Principles, more opportunities are planned to enhance not only how deer are counted and managed but also how the public is engaged in the process. You are invited to get involved. Follow DNR's work through its website and social media or get involved yourself in future town halls or events or by taking a deer survey if you receive one. Integrated deer management involves not only the integration of various methods of assessment, but also the integration of different experiences and knowledge. Therefore, we encourage you to be part of that integration and hope to see you at future events.

Want to Read More About Work from This Project?

Creation of the Regional Management Units

1. Swihart, R. K., Caudell, J. N., Brooke, J. M., & Ma, Z. (2020). A flexible model-based approach to delineate wildlife management units. Wildlife Society Bulletin 44(1):77-85.

Abstract: Delineation of management units for harvested wildlife should strive to maximize homogeneity within each unit subject to constraints imposed by geography and heterogeneity in factors related to human-caused changes in vital rates. Prior efforts to delineate management units for white-tailed deer (*Odocoileus virginianus*) used regression to identify environmental and sociological factors related to female harvest density, followed by spatially constrained cluster analysis to select multi-county units for management purposes. We used county-level data in Indiana, USA, from 2012 to 2017 to present a modified approach that 1) simultaneously models variation in 4 types of human-mediated deer mortality with spatial, environmental, and socio-cultural explanatory variables; 2) clusters counties using a partial contiguity constraint that explicitly considers nonspatial variables; and 3) relies on expert opinion to assess model adequacy and suggest improvements. Multivariate negative binomial regression of mortality from 4 sources (legal antlerless and antlered harvest, reported deer–vehicle collisions, crop depredation permits) yielded additive models with adequate fit and sizable effects for all univariate models due to latitude (standardized coefficient, β range = –0.18–0.24), and the nonspatial variables deer habitat (β range = 0.26–1.02) and hunter density (β range = 0.25–1.02). Fraction of cropland enrolled in the Conservation Reserve Program was positively related to harvest (β range = 0.10–0.13), and general human development was positively related to deer collision deaths (β range = 0.25–0.28) and take with depredation permits (β range = 0.07–0.24). Clustering counties with partial contiguity increased within-unit nonspatial homogeneity 1.7–1.9 times more than clustering with strict contiguity. Responses to online surveys by 10 agency biologists and conservation officers provided congruence (mean ± SD = 85.2 ± 3.4%) of expert and model-derived maps and useful suggestions for incorporating a separate urban management unit. Combining mortality-based statistical models and expert assessment offers a rigorous yet flexible approach to delineating spatial units for wildlife management that is easily adaptable for various harvested species in multiple jurisdictions.

Measuring deer density

1. Delisle, Z. J., McGovern, P. G., Dillman, B. G., Reeling, C. J., Caudell, J. N., & Swihart, R. K. (2023). Using cost-effectiveness analysis to compare

density-estimation methods for large-scale wildlife management. Wildlife Society Bulletin, e1430. https://doi.org/10.1002/wsb.1430.

Abstract: Density estimates for animal populations often inform conservation and management decisions. Many methods to estimate animal density exist but deciding between competing alternatives traditionally has depended upon assessing multiple factors (e.g., precision, total cost, area sampled) independently and often in an ad hoc manner. Cost-effectiveness analysis is a tool that economists use to decide objectively between competing alternatives. We extend cost-effectiveness analysis to simultaneously integrate precision and per-area cost of sampling when selecting between competing techniques used to estimate animal density both after a single application of a method and across several applications of capital equipment. Our extension allows for weighting of factors that may vary with the objectives and constraints of decision makers. We apply our extension of cost-effectiveness analysis to a case study in which population density of white-tailed deer (*Odocoileus virginianus*) was estimated in 3 large management units in Indiana, USA, using 3 competing distance-sampling methods: fecal-pellet, camera-trap, and aerial sampling. The unweighted cost effectiveness of aerial sampling with color and infrared sensors was usually superior after a single application of each method and was always superior across several applications in differing landscapes. Pellet sampling was the most cost effective after a single application of each method in an agriculturally dominated management unit. Although camera sampling has increased in popularity, the cost effectiveness of camera sampling was poorer than the other 2 methods, even when allowing for potential future innovations to streamline data processing. Cost-effectiveness analysis can be useful when selecting among competing methods for monitoring animal populations of conservation and management importance. The same principles used in our cost-effectiveness analysis can be used to decide among competing alternatives related to any ecological monitoring in addition to density estimation.

2. Delisle, Z. J., McGovern, P. G., Dillman, B. G., & Swihart, R. K. (2022). Imperfect detection and wildlife density estimation using aerial surveys with infrared and visible sensors. Remote Sensing in Ecology and Conservation 9(2):222-234. https://doi.org/10.1002/rse2.305.

Abstract: Aerial vehicles equipped with infrared thermal sensors facilitate quick density estimates of wildlife, but detection error can arise from the thermal sensor and viewer of the infrared video. We reviewed published research to determine how commonly these sources of error have been assessed in studies using infrared video from aerial platforms to sample wildlife. The number of annual articles pertaining to aerial sampling using infrared thermography has increased drastically since 2018, but past studies inconsistently assessed sources of imperfect detection. We illustrate the importance of accounting for some of these types of error in a case study on white-tailed deer (*Odocoileus virginianus*) in Indiana using a simple double-observer approach. In our case study, we found evidence of false negatives associated with the viewer of infrared video. Additionally, we found that concordance between the detections of two viewers increased when using a red-green-blue camera paired with the infrared thermal sensor, when altitude decreased and when more stringent criteria were used to classify thermal signatures as deer. We encourage future managers and ecologists recording infrared video from aerial platforms to use double-observer methods to account for viewer-induced false negatives when video is manually viewed by humans. We also recommend combining infrared video with red-green-blue video to reduce false positives, applying stringent verification standards to detections in infrared and red-green-blue video and collecting data at lower altitudes over snow when needed.

3. Delisle, Z. J., Miller, D. L., & Swihart, R. K. (2023). Modelling density surfaces of intraspecific classes using camera trap distance sampling. Methods in Ecology and Evolution 14:1287-1298 https://doi.org/10.1111/2041-210X.14093.

Abstract: Spatially explicit densities of wildlife are important for understanding environmental drivers of populations, and density surfaces of intraspecific classes allow exploration of links between

demographic ratios and environmental conditions. Although spatially explicit densities and class densities are valuable, conventional design-based estimators remain prevalent when using camera-trapping methods for unmarked populations. We developed a density surface model that used camera trap distance sampling data within a hierarchical generalized additive modeling framework. We estimated density surfaces of intraspecific classes of a common ungulate, white-tailed deer (*Odocoileus virginianus*), across three large management regions in Indiana. We then extended simple statistical theory to test for differences in two ratios of density. Deer density was influenced by landscape fragmentation, wetlands, and anthropogenic development. We documented class-specific responses of density to availability of concealment cover and found strong evidence that increased recruitment of young was tied to increased resource availability from anthropogenic agricultural land use. The coefficients of variation of the total density estimates within the three regions we surveyed were 0.11, 0.10 and 0.06. Our strategy extends camera trap distance sampling and enables managers to use camera traps to better understand spatial predictors of density. Our density estimates were more precise than previous estimates from camera trap distance sampling. Population managers can use our methods to detect finer spatiotemporal changes in density or ratios of intraspecific-class densities. Such changes in density can be linked to land use or to management regimes on habitat and harvest limits of game species.

4. Delisle, Z. J., Swihart, R. K., Quinby, B. M., Sample, R. D., Kinser-Mcbee, K. J., Tauber, E. K., & Flaherty, E. A. (2022). Density from pellet groups: Comparing methods for estimating dung persistence time. Wildlife Society Bulletin, 46(3), e1325.

   Abstract: Effective wildlife management often relies on estimates of animal density, and cue counting is a viable estimation strategy. A key component of density estimation from dung, a form of cue counting, is estimation of the persistence time, $\hat{t}$, of dung piles. However, differences between observers on what constitutes a dung pile may alter subsequent density estimates. Additionally, many researchers studying white-tailed deer (*Odocoileus virginianus*) have substituted for $\hat{t}$ the number of days between the date in which 98% of deciduous trees shed leaves in autumn and field sampling. To address these two concerns, we compared three methods for estimating $\hat{t}$ of white-tailed deer pellet groups: (1) a common modelling approach based on observations from a single observer (single-observer method), (2) a method that accommodates interobserver variation on the status of dung during field surveys (interobserver method), and (3) the days elapsed since 98% of deciduous trees shed autumn leaves (leaf-off method). We then applied these three $\hat{t}$ estimates to distance-sampling data on pellet groups from white-tailed deer that we collected along transects during three sampling seasons from 2019–2021 in west-central Indiana. We estimated habitat- and year-specific deer densities. Persistence probability of pellet groups varied across habitats and years, positively with age and number of pellets, and negatively with precipitation and temperature. In several instances, we found strong or marginal differences between densities estimated using the leaf-off method and the other two methods. The densities using the interobserver and single-observer methods were similar, with the latter being larger by an average of 8.0% (SE = 1.71). The latter also yielded coefficients of variation (CV) that averaged 16.6% (SE = 4.8) larger, attributable to interobserver discrepancies in scoring dung persistence. Density estimates from the leaf-off method were 32.6% (SE = 15.3) and 37.8% (SE = 13.0) less than the density estimates from the interobserver and single-observer methods, respectively. We encourage future researchers who estimate density using multiple observers and dung sampling techniques to incorporate interobserver variation. We advocate that biologists relying on dung-based estimation of density for white-tailed deer abandon the conventional leaf-off method and adopt other modeling approaches.

5. Delisle, Z. J., Flaherty, E. A., Nobbe, M. R., Wzientek, C. M., & Swihart, R. K. (2021). Next-generation camera trapping: systematic review of historic trends suggests keys to expanded research applications in ecology and conservation. Frontiers in Ecology and Evolution 9:617996. https://doi.org/10.3389/fevo.2021.617996.

   Abstract: Camera trapping is an effective noninvasive method for collecting data on wildlife species

to address questions of ecological and conservation interest. We reviewed 2,167 camera trap (CT) articles from 1994 to 2020. Through the lens of technological diffusion, we assessed trends in: (1) CT adoption measured by published research output, (2) topic, taxonomic, and geographic diversification and composition of CT applications, and (3) sampling effort, spatial extent, and temporal duration of CT studies. Annual publications of CT articles have grown 81-fold since 1994, increasing at a rate of 1.26 (SE = 0.068) per year since 2005, but with decelerating growth since 2017. Topic, taxonomic, and geographic richness of CT studies increased to encompass 100% of topics, 59.4% of ecoregions, and 6.4% of terrestrial vertebrates. However, declines in per-article rates of accretion and plateaus in Shannon's H for topics and major taxa studied suggest upper limits to further diversification of CT research as currently practiced. Notable compositional changes of topics included a decrease in capture-recapture, recent decrease in spatial-capture-recapture, and increases in occupancy, interspecific interactions, and automated image classification. Mammals were the dominant taxon studied; within mammalian orders, carnivores exhibited a unimodal peak, whereas primates, rodents and lagomorphs steadily increased. Among biogeographic realms, we observed decreases in Oceania and Nearctic, increases in Afrotropic and Palearctic, and unimodal peaks for Indomalayan and Neotropic. Camera days, temporal extent, and area sampled increased, with much greater rates for the 0.90 quantile of CT studies compared to the median. Next-generation CT studies are poised to expand knowledge valuable to wildlife ecology and conservation by posing previously infeasible questions at unprecedented spatiotemporal scales, on a greater array of species, and in a wider variety of environments. Converting potential into broad-based application will require transferable models of automated image classification and data sharing among users across multiple platforms in a coordinated manner. Further taxonomic diversification likely will require technological modifications that permit more efficient sampling of smaller species and adoption of recent improvements in modeling of unmarked populations. Environmental diversification can benefit from engineering solutions that expand ease of CT sampling in traditionally challenging sites.

6. Sample, R. D., Tomey, R. D., Delisle, Z. J., Trumbower, A. R., Habeck, P. J., Brooke, J. M., and Jenkins, M. A. (2022). Comparing methods of estimating fecal-pellet-group density in woodlots of the Midwestern United States. Journal of Fish and Wildlife Management 13(2): e1944-687X. https://doi.org/10.3996/JFWM-21-098.

Abstract: Fecal-pellet surveys provide density estimates of pellet groups, which offer a quick and reliable index of population densities for white-tailed deer (*Odocoileus virginianus*) and other wildlife species. Comparisons of differing fecal-pellet survey methodologies have previously shown that they vary in their precision; however, researchers made these comparisons outside of the United States in regions with lower white-tailed deer densities. In this study, we compared pellet-group density estimates and precision from line transects, quadrat sampling, and strip transects. At each site, three observers surveyed simultaneously with each being responsible for one method. Like other studies, we found that each method produced similar estimates of pellet-group density, but quadrat sampling produced the most precise estimates. Furthermore, all three methods suggested that the central region of Indiana had both the highest pellet-group density and the highest precision. These results suggest a more homogenous distribution of pellet groups in areas with higher white-tailed deer densities, which may increase the precision of all methods. Our results suggest that quadrat sampling may be the most effective method for estimating pellet-group densities within woodlots of the U.S. Midwest, and that precision may increase in areas with higher white-tailed deer densities. This study not only improves deer management within the Midwest, but also provides guidelines for other studies to potentially advance the conservation and management of other species.

Assessing browsing influence of deer and stump sprouting

1. Sample, R. D., Delisle, Z. J., Pierce, J. M., Swihart, R. K., Caudell, J. N., & Jenkins, M. A. (2023). Selection rankings of woody species for white-tailed deer vary with browse intensity and landscape context within the Central Hardwood Forest Region. Forest

Ecology and Management, 537, 120969.

Abstract: White-tailed deer (*Odocoileus virginianus*) selection of woody species can be influenced by deer densities, food availability, and local and regional landscape characteristics. Determining selection rankings across varying regional landscapes is important to the management of both deer and forests; however, these regional-scale rankings are currently lacking. Here, we develop selection rankings for 63 species within woodlots across the southern, central, and northern regions of Indiana by counting the number of available and browsed twigs by species along transects. We then classified species into five selection classes: highly selected, slightly selected, neutral, slightly avoided, and strongly avoided. Some species displayed consistent classification across regions, including selection for greenbrier (*Smilax spp.*), hackberry (*Celtis occidentalis*), white ash (*Fraxinus americana*), and white oak (*Quercus alba*), and avoidance of spicebush (*Lindera benzoin*) and pawpaw (*Asimina triloba*). For the 16 species that exhibited significant regional variation in selection, we modeled the probability of a twig being browsed using explanatory variables measured at the woodlot scale, and within 200-, 500-, 1,000-, and 1500-m buffers around woodlots. Browsing intensity within a focal woodlot was more often associated with increased selection of an individual species than other explanatory variables. Nonetheless, both woodlot and landscape-scale variables influenced selection of woody browse by deer. In general, factors that increased browsing opportunities (e.g., increased density of non-avoided twigs, increased forest edge density, and increased woodlot edge) increased the selection of an individual species, while those that decreased browsing opportunities (e.g., increased nonnative stem density and increased avoided twig density) decreased selection. Our selection classifications for common species in the Central Hardwood Forest Region highlight species that may be at risk of being negatively affected by severe browsing, while simultaneously identifying species that decrease foraging habitat quality. Our results also provide evidence that local and regional conditions drive differences in selection and thus require evaluation before management. More broadly, we showcase that multiple variables and spatial scales can affect selection of individual browse species by deer and merit consideration by researchers when studying the effects of browsing on forest ecosystems.

2. Sample, R. D., Delisle, Z. J., Pierce, J. M., Swihart, R. K., Caudell, J. N., Webster, C. R., & Jenkins, M. A. (2023). Predicting and indexing ungulate browse intensity from local to regional scales. Ecological Indicators, 154, 110564.

Abstract: The intensity of browsing by white-tailed deer (*Odocoileus virginianus*; hereafter deer) can be influenced directly by deer densities and food availability, and indirectly by landscape characteristics that influence these factors. However, the variables and spatial scales that influence browsing intensity likely differ in landscapes with varying composition and land use. Furthermore, because high browsing intensity can influence the structure and function of forests, determining the most effective and efficient indices of browsing intensity can aid forest management decisions. To evaluate differences in browsing intensity, we used Bayesian hierarchical models to estimate the probability of browsing for twigs from non-avoided species based upon woodlot and landscape-scale variables that were calculated within 200-, 500-, 1,000-, and 1500-m buffers. We then evaluated the efficacy of the twig age, oak sentinel, and herbaceous indicator methods of indexing browsing intensity by correlating these to browsing intensity and deer density. We also evaluated the expense and required work time associated with each index method. Food availability seemed to drive browsing intensities in our study; however, deer density was also important in the region with the lowest cover of forest. When meaningful, landscape characteristics fit data best at the 500 m buffer size. The twig age method showed the strongest correlations to both browsing intensity and deer density, and was among the most efficient methods, suggesting it is a reliable index of browsing intensity within Indiana and similar regions. Together, our results highlight that landscape characteristics can mediate the relationship between deer and forest plant communities, which emphasizes the need to tailor management actions to variable landscapes that may occur within a single state or region. Addition-

ally, our results suggest that the twig age method is the most efficient and effective index to monitor browse intensity in agriculturally dominated landscapes, such as those of the Central Hardwood Forest Region.

3. Sample, R. D., Orpurt, C., Habeck, P., Pierce, J. M., Ghaste, M., Widhalm, J. R., ... & Jenkins, M. A. (2022). Changes in White-Tailed Deer Browsing Selection of Hardwood Tree Species with Increasing Stem Height. Natural Areas Journal, 42(4), 268-277.

   Abstract: To forage optimally, deer select individual plants highest in limiting nutrients, while avoiding individuals that are high in anti-herbivore defenses. For some woody species, deer may selectively browse on larger stems, which can provide a larger amount of younger, more nutritious tissue per individual; however, in some species, larger stems may possess increased levels of anti-herbivore defenses, ultimately discouraging deer from browsing on these larger individuals. We examined differences in the proportion of twigs and stems (individual seedlings/saplings/trees) browsed across three height classes for four species: blue ash (*Fraxinus quadrangulata Michx*), white ash (*F. americana L.*), sassafras (*Sassafras albidium Nutt.*), and sugar maple (*Acer saccharum L.*), across multiple sites in central Indiana. Overall, we found that taller stems had a higher likelihood of being browsed, but smaller stems were browsed more heavily. We also found that sugar maple twigs and stems were most likely to be browsed, while sassafras twigs and white ash twigs and stems were least likely to be browsed. Our results indicate that under intense browsing pressure, preference should be given to protecting smaller stems, and that stands with greater vertical stratification of palatable species are more resilient to the effects of deer browsing.

4. Sample, R. D., Boggess, C. M., Brooke, J. M., & Jenkins, M. A. (2022). Stump sprouting performance of common tree species in the midstory of hardwood forests in Indiana. Forest Science, 68(5-6), 440-446.

   Abstract: Many studies have examined the performance of stump sprouts across variables such as tree diameter, light availability, and site quality; however, most of these studies created large openings following even-aged silviculture, which is not typically employed in small woodlots typical of the Midwest United States. To address this, we evaluated sprouting performance after felling stems of six common midstory species, simulating a midstory removal treatment. We created 510 stumps across nine sites in Indiana and measured the probability of stumps sprouting, sprout density, and the height of the tallest sprout after one year after cutting for hackberry (*Celtis occidentalis L.*), red maple and sugar maple (*Acer rubrum L.* and *A. saccharum Marsh.*, respectively), Northern red oak (*Quercus rubra L.*), sassafras (*Sassafras albidum Nutt.*), and white ash (*Fraxinus Americana L.*). We observed that hackberry, Northern red oak, red maple, and white ash stumps sprouted prolifically, but sugar maple and sassafras stumps did not. Furthermore, we found that white-tailed deer (*Odocoileus virginianus*) herbivory depressed sprout heights; whereas, the effects of diameter and light availability were variable. Our results suggest that midstory removals may result in vigorous sprouting; thus, follow-up treatments such an herbicide may be needed to reduce competition.

Understanding human-deer interactions

1. Stinchcomb, T., Ma, Z., and Nyssa, Z. (2023). "Complex human-deer interactions challenge conventional management approaches: the need to consider power, trust, and emotion." Ecology and Society 27(1):13. https://doi.org/10.5751/ES-12899-270113

   Abstract: In the United States, the management of white-tailed deer (*Odocoileus virginianus*) has typically focused on improving hunting opportunities and mitigating human-deer conflicts. Yet, the expansion and diversification of human communities and activities implies that human-deer interactions may also be diversifying. Approaches based on complex adaptive systems theories have been posited as a way to better attend to the diversity of these interactions between humans and wildlife. Using Indiana as a case, this study draws from the Integrated Adaptive Behavior Model (IABM) to understand human-deer interactions as a complex system. We use empirical social science to understand how citizens across Indiana perceive

deer populations, what outcomes they desire, and how these perceptions could be integrated into Indiana's deer management plan. In Indiana, neither wildlife managers nor researchers have assessed public perceptions of deer beyond those of hunting and farming stakeholders. From May to September 2019, we collected 59 semi-structured interviews and two focus groups (n = 14) with deer stakeholders including woodland owners, farmers, deer hunters, and urban area residents. Through mixed inductive-deductive coding, we found that Indiana citizens hold complex emotions toward deer regardless of their stakeholder identity. Factors influencing these emotions include past experiences, current livelihood and behavioral contexts, beliefs about responsibilities and ethics in deer management, and beliefs about other social groups. Our results suggest that the IABM, despite adding much-needed complexity and realism to the analysis of human-wildlife interactions, still lacks explanatory power over several important dynamics that emerged from our interviews. Here, we discuss how mixed emotions, situational context, and power dynamics challenge conventional management approaches that focus narrowly on mitigating human-deer conflicts and reduce public interests to demographic categorizations. To better inform social-ecological governance, models of complex human behavior should account for power within management institutions and across management scales. Our work contributes a refined understanding of how multidimensional emotions and experiences influence public (dis)interest in natural-resource management, and what this implies for managers who aim to balance competing social interests with ecological conditions.

2. Stinchcomb, T. R., Ma, Z., Swihart, R. K., & Caudell, J. N. (2022). Expanding and Evaluating Public Satisfaction with Wildlife Governance: Insights from Deer Management in Indiana, USA. Environmental Management, 70(5), 780-792. https://doi.org/10.1007/s00267-022-01698-5.

Abstract: Wildlife agencies in North America desire to incorporate broader public interests into decision-making so they can realize the principle of governing wildlife in the public trust. Public satisfaction is a key component of good governance, but evaluating satisfaction with wildlife management focuses on traditional user experiences rather than perceptions of agency performance. We draw from political science, business, and conservation social science to develop a multidimensional concept of satisfaction with wildlife management that includes agency performance, service quality, trust in the managing agency, and informational trust. We use data collected from a 2021 survey of Indiana residents to analyze the social and cognitive determinants of satisfaction with white-tailed deer (*Odocoileus virginianus*) management. Quantile regression models revealed that respondents' acceptability of management methods and deer-related concerns most strongly affected performance and quality components, whereas respondent characteristics mostly affected trust components of the index. Future research should associate satisfaction with key variables we did not fully capture, including perceived control, psychological distance, and norms of interaction between wildlife agencies and the public. Expanding agency conceptions of public satisfaction represents a critical step toward public trust thinking and the practice of good wildlife governance in North America.

MITIGATING SPREAD OF CHRONIC WASTING DISEASE THROUGH AN ECOLOGICAL TRAP

Cost: $236,174 for the complete two-year project

Project Personnel

- Dr. Patrick Zollner - Principal Investigator, Purdue University
- Dr. Aniruddha Belsare - Research Scientist (Academic Research), Emory University
- Jonathan Brooks - Ph.D. Student, Graduate Research Assistant, Purdue University
- Dr. Zhao Ma - Professor of Natural Resource Social Science, Purdue University
- Lan Zhao - Research Scientist, Purdue University
- I Luk Kim - Ph.D. Candidate, Graduate Research Assistant, Purdue University
- Dr. Joe N. Caudell - DNR Project Liaison, Indiana Division of Fish and Wildlife

Disease outbreaks are an increasingly common cause of severe declines in wildlife populations. One disease with the potential to cause declines in large ungulates such as white-tailed deer is chronic wasting disease (CWD). CWD has been detected in free-ranging cervids in 25 states, including Illinois, Michigan, and Ohio; however, as of the 2021 deer hunting season, CWD has not been detected in Indiana. The nearest documented occurrences of CWD to Indiana come from four infected deer near Kankakee, Illinois. These occurrences were approximately 30 miles from the Indiana border. Given the history of CWD spread and its proximity to Indiana, there is a clear need to consider strategies that may mitigate the risk of CWD infecting Indiana's white-tailed deer populations.

Forested corridors along the Kankakee River provide one of the mostly likely routes by which CWD-infected deer may enter Indiana. This narrow strip of permanent forest cover amid a landscape dominated by agriculture connects Indiana deer populations to the portion of Illinois where CWD has been detected. Given the significance of this forested cover for deer movement, it may be possible to reduce the likelihood of CWD spreading to Indiana by establishing an artificial ecological trap (AET) in this corridor. An AET is an area that white-tailed deer perceive as favorable but will actually decrease survival through greater harvest mortality. This increased mortality could be accomplished by establishing a deer management zone with increased hunting pressure or implementing a sharpshooter culling program within a focal area.

Measuring the effect of an AET as a preventive measure against CWD spread along the Kankakee River through field experiments would be challenging. Quantitative approaches like mathematical models or computer simulations provide an effective alternative to investigate such questions. One approach that is particularly well suited to modeling disease in mammal populations is agent-based modeling. An agent-based model (ABM) of CWD spread in white-tailed deer would virtually represent deer movement and behaviors across a digital landscape. The virtual deer are given characteristics such as age, sex, and disease infection status and perform actions in the virtual landscape such as moving, giving birth, dying, and transferring infection. By tracking the location and number of infected individuals over time, we can estimate population-level metrics such as disease prevalence and rate of contact. ABMs make it easier to simulate rare events and individual differences in behaviors like dispersal because they track each individual deer within a population. Similarly, ABMs make no assumptions about rates of contact because those emerge from model inputs specifying the behavior of individuals.

ABMs are useful tools for wildlife managers to compare the relative effectiveness of different AET scenarios; however, implementing an AET in the real world requires stakeholder support. For example, deer hunters must be willing to harvest more deer or allow sharpshooters to cull deer to implement an AET. Furthermore, landowners must be willing to allow hunters or sharpshooters to harvest deer on their land. Although stakeholder cooperation is critical for effective CWD management, stakeholders have resisted these policies in some states. This resistance stems from a number of factors, including conflict with traditions, a lack of certainty about disease spread, and mistrust. To successfully implement an AET along the Kankakee River, wildlife management agencies would benefit from addressing these barriers to stakeholder acceptance.

One way to reduce stakeholder barrier to acceptance is through providing information about how implementation of an AET will affect deer populations; however, information does not always lead to action. The Theory of Planned Behavior provides a framework that can be used to predict whether an individual will engage in a behavior. This theory states that the best predictor behavior is the individual's plans, and an individual's planned behaviors result from attitudes toward the behavior, perceived ability to successfully engage

in the behavior, and norms of important social groups regarding the behavior. The Theory of Planned Behavior has been successfully used to explain willingness to engage in waste recycling and pro-climate behaviorssuch as recycling, is an emerging focus in public health. Purpose: This study was designed to examine the determinants of recycling intention on a college campus. Methods: Undergraduate students (N=189. By considering the behavior that information is intended to promote or discourage in the context of the Theory of Planned Behavior, management agencies can improve the likelihood that information on CWD will lead to support for disease control policies.

The objectives of this project are to (1) simulate the spread of CWD along the Kankakee River under different CWD management scenarios using an ABM and (2) develop a web-based tool that the public can use to compare simulations across different scenarios and use the Theory of Planned Behavior to investigate how use of this tool affects stakeholders' support of various scenarios for mitigating the spread of CWD into Indiana.

We will implement the *Ov*CWD model framework in northwest Indiana and northeast Illinois to simulate CWD spread in a white-tailed deer population. The *Ov*CWD framework represents the landscape as a grid with cells that correspond to a 1.0 square mile area. Each grid cell represents the percentage of forested land within that area. We determined the percentage forest cover of each cell using the National Landcover Database data. The model begins by placing virtual deer on the landscape based on the percentage of forest cover. The number of deer initially placed within each cell is a function of estimates of deer density in the scientific literature and from Indiana DNR data (Delisle, personal communication; Boggess and Vaught, 2020; Nixon et al., 2021). Each virtual deer is assigned characteristics including sex, age, herd membership, and infection status. The model represents the passage of time by simulating each deer's location and status every month for 10 to 25 years. During each run, virtual deer perform actions such as giving birth, dying, dispersing to another grid cell, or transferring infection. This simulates real-world processes such as population dynamics and CWD spread. By modifying parameters like the probability of dying in the model, we can emulate different approaches to addressing CWD. The effectiveness of each CWD management scenario can then be compared by summarizing the deer population size and CWD prevalence at the end of a time period. Scenarios we test will include countywide increased hunting, subcounty increased hunting, and targeted sharpshooter culling.

Knowledge gained from the comparisons of scenarios with the ABM will have a larger impact if it is communicated in an understandable way to stakeholders. One way to do this is using a web tool that allows stakeholders to select control scenarios and view a summary of outcomes from those choices. This stakeholder version of the ABM allows anyone to construct scenarios by manipulating the timing, duration, and location of the AET to reduce the deer population and see the predicted impacts upon CWD transmission. In addition to building a tool for displaying ABM results in a way that increases public acceptance of management decisions, we will also test how the visual elements included in the user interface affect stakeholder willingness to engage in action to prevent CWD spread. To do this, we will create a version of the tool that displays an illustration of healthy deer or CWD-infected deer, depending on the prevalence of CWD in the scenario selected. Images of sick deer have been shown to evoke strong emotions regarding CWD (Stinchcomb et al., 2022) and may increase stakeholder intention to prevent CWD spread. Before using the tool, users will take a survey assessing their willingness to take action to prevent CWD spread. The survey will be designed in a Theory of Planned Behavior context (Ajzen, 1991). In this context, willingness to act is a function of individual attitudes, the attitudes of socially relevant peers, and perceived ability to perform the action. Users will take the same survey again after using the tool, a process that will provide data to evaluate how inclusion of illustrations changes willingness to engage in actions to reduce CWD spread.

For Objective 1, we have completed a function version of the model and have run and evaluated the results of 288 parameter sets. We also further adjusted the model structure through adding a compensatory mechanism to increase recruitment of fawns when deer densities are low. This new feature is currently being tested. After that, we will use it to simulate a new set of results that will be much more realistic and useful as a decision-making tool.

For Objective 2, we began to build a web app that will enable members of the public to interactively view results of the control scenarios simulated during Objective 1. We expanded the design of the web app to include an image of healthy or sick deer. We have finished working with artist Gaby Sincich to produce drawings of healthy and sick deer to be used in this

web app. We have also designed a pre/post survey to assess web app user willingness to support CWD management. Once the results from the updated version of the model from Objective 1 are complete, that data will be input into the web app. After the addition of that new data, beta testing will begin to be followed by any revisions, and then distribution of that tool and analysis of data will be collected via the pre/post survey.

IMPACTS ON HARVEST RESULTING FROM LICENSE STRUCTURE CHANGES

Cost: $279,324 for the complete three-year project

Project Personnel

- Dr. John Lee - Principal Investigator, Purdue University
- Dr. Carson Reeling - Principal Investigator, Purdue University
- Dr. Nicole Widmar - Investigator, Purdue University
- Dr. Joe N. Caudell - DNR Project Liaison, Indiana Division of Fish and Wildlife

Traditionally, hunting has been the primary vehicle for managing wildlife populations, and state wildlife management agencies have relied on hunting and fishing license revenue for most of their funding. Deer hunting is particularly important for Indiana, where it accounts for 58% of all hunting efforts. Deer hunting effort is primarily managed though a license and quota system, making license design (e.g., pricing, privileges conveyed) important for encouraging hunter participation. Changes to license structure are relatively infrequent. Since 1987, there have been only three major changes to deer hunting licenses and regulations in Indiana. Changes in license structure and harvest rules make deer hunting complex, which may serve as an obstacle to legal participation in deer hunting.

This project will study the optimal design of deer license structure for Indiana. We propose developing a model of deer harvests in Indiana that captures the relationships between license structure, license demand, and harvest effort. We will use this model to simulate the effect of license pricing and structure decisions on harvest, with an eye toward maximizing participation in Indiana deer hunting. Our objectives are to:

1. Systematically investigate qualities of other states' hunting license structures as well as social and environmental factors as they relate to changes in hunting participation, and to identify which factors may be transferable or relevant in Indiana.
2. Assess hunter preference for different license structure attributes (cost, number of licenses, privileges conveyed, etc.).
3. Forecast changes in hunter participation and harvest based on alternative license structures.

We will conduct a review of other Midwestern states and select Southeastern states to catalog deer license rules and regulations. We will focus on these states because they (i) are similar to Indiana in terms of deer species targeted (i.e., white-tailed deer; Odocoileus virginianus) and means of license allocation (i.e., licenses are sold over the counter in all of these states); (ii) represent a wide distribution of hunter backgrounds and profiles, which is important for identifying ways of encouraging participation of underrepresented groups in Indiana, and (iii) represent a wide distribution of environmental characteristics that may interact with license design and influence participation. Our review will provide an initial set of license structures and pricing options relevant to Indiana that have not been available to hunters to date.

We will use this set of structures and pricing options as a starting point for developing several surveys that we will use to identify optimal license prices and structure. We will collect demographic data and deer-hunting behavior for each respondent. Each survey will include a discrete choice experiment to elicit hunter preferences for different license structures. Respondents undertaking the choice experiment will be presented with a series of different choice exercises. Each choice exercise will ask the respondent to choose whether they would purchase a deer license with certain attributes (such as price, what sex of deer can be harvested, and how many can be harvested per license) or opt not to purchase a license (and hence forgo hunting). The license structure and price will differ across choice exercises. By observing how respondents' choices vary with license structure and price, we can infer individuals' preferences for license attributes and estimate demand for different license types.

We will conduct different versions of this survey. The first will be a mail-based survey of 10,000 Indiana residents who have hunted deer in Indiana in the past five years. These 10,000 respondents will be divided into two groups. Three-quarters of the respondents will receive a survey with a choice experiment asking them

about their preferences for potential single-season licenses (like those currently offered by the Indiana Department of Natural Resources [IN DNR]). The remainder will receive a survey with a choice experiment asking them about their preferences for potential lifetime deer hunting licenses. These licenses, which the Indiana DNR is considering offering, would allow the buyer to harvest a given number of deer each year for the rest of their life in exchange for a relatively large up-front license fee. The second version will be a web survey of all nonresident Indiana deer hunters with email addresses listed in the Indiana DNR license database. Each respondent will be shown both the single-season and lifetime license choice experiments.

As a final step, we will estimate (i) individual harvest effort conditional on buying a given license based on our survey information, and (ii) total deer harvest at each location. We will use these models of effort and harvest to forecast the effect of different license structures and prices on deer population dynamics within different regions of Indiana using bioeconomic models.

In Year 1 of the project, we have reviewed neighboring states' license structures, implemented our mail and web surveys, and analyzed our survey data (objectives 1 and 2). We collected 1,398 and 1,603 usable resident and nonresident single-season surveys, respectively, along with 487 and 901 usable resident and nonresident lifetime surveys, respectively. We have used these surveys to estimate robust models of demand for different licenses that are under consideration by the DNR and to identify license prices that maximize agency revenues.

Our efforts in Year 2 focused on refining our demand estimates and drafting manuscripts for peer-reviewed journals. We estimated two different models. The first was a model of single-season license demand. We used data from a choice experiment embedded in our survey to estimate hunter preferences for different deer license attributes, including season and bag limits. From this model, we can simulate the license choices of hunters facing different sets of licenses. An issue with using choice experiment data to simulate aggregate demand is that the models estimated from these data often fail to replicate real-world demand (e.g., observed license sales data). It is hard to have confidence in simulated demand estimates if our model does not reasonably predict observed demand. We rectified this problem by developing a statistical approach that effectively calibrates our demand model to replicate observed demand for existing licenses (Reeling et al. 2023). We also refined our estimates of demand for different lifetime licenses (Kim et al. 2023).

For the remainder of our project term, we will focus on using our estimated demand models to calibrate bioeconomic models so that we can simulate the effect of different license structures on deer population dynamics.

Want to Read More About Work from This Project?

1. Kim, Y., Reeling, C., Widmar, N. J., & Lee, J. G. (2023). Estimating a model of forward-looking behavior with discrete choice experiments: The case of lifetime hunting license demand. Journal of choice modelling, 47, 100414.

   Abstract: Sales of deer licenses, one of the most important revenue sources for wildlife management at the Indiana Department of Natural Resources (DNR), have been declining for a decade. To increase its revenue, the DNR is considering introducing a new lifetime deer license for sale. This license would allow hunters to harvest deer (and possibly other species) each year for the rest of their lives in exchange for a relatively large up-front fee. The forward-looking nature of the decision to buy a lifetime license means hunters' choice behavior is necessarily dynamic. Prior work estimates preferences for long-lived, durable goods using standard discrete choice experiments underpinned by static models. We derive a dynamic discrete choice model of lifetime license purchases. Our model informs the design of a novel, dynamic discrete choice experiment, generating data that allows us to consistently estimate individuals' forward-looking preferences for lifetime hunting licenses. We use our model to estimate the price of lifetime licenses that maximizes DNR revenues.

2. Reeling, C., Erickson, D., Kim, Y., Lee, J. G., & Widmar, N. J. (2023). Combining Aggregate Demand and Discrete Choice Data with Application to Deer License Demand in Indiana. Land Economics.

   Abstract: Estimating demand for licenses for recreational activities is complicated due to a lack of meaningful variation across time, space, buyer types, and license attributes, including price. Prior work uses discrete choice experiments (DCEs) to overcome this challenge, but the resulting demand

models are unlikely to replicate observed demands in the absence of ad hoc calibration procedures. We use a generalized method of moments-based approach that combines DCE data with observed market share data to estimate a choice model that yields demand functions that much more closely replicate observed data.

WHITE-TAILED DEER AND FURBEARER ECONOMICS

Cost: $725,606 for the complete three-year project

Project Personnel

- Dr. Carson Reeling - Project Co-Lead Investigator, Purdue University
- Dr. Mo Zhou - Project Co-Lead Investigator, Purdue University
- Dr. John Lee - Project Co-Lead Investigator, Purdue University
- Dr. Zhao Ma - Co-Principal Investigator, Purdue University
- Dr. Richard Melstrom - Project Co-Lead Investigator, Loyola University – Chicago
- Dr. Robert Swihart - Project Co-Lead Investigator, Purdue University
- Dr. Joe N. Caudell - DNR Project Liaison, Indiana Division of Fish and Wildlife
- Geriann Albers - DNR Project Liaison, Indiana Division of Fish and Wildlife

Indiana's deer and furbearers generate economic value from both "consumptive" and "nonconsumptive" uses. Consumptive uses of deer and furbearers primarily include hunting and trapping. The direct economic value hunters receive from hunting takes the form of surplus, equal to the maximum amount a hunter would be willing to give up to obtain a hunting opportunity. Indirect values take the form of changes in regional incomes spurred by hunting-related spending. Hunters may buy equipment, incur travel costs to reach a hunting site, and may pay processing fees upon completing their hunt. These expenditures increase incomes of related business owners. Nonconsumptive uses of deer and furbearers include wildlife watching and the "existence" values individuals receive from knowing their state contains a healthy deer and furbearer population. Of course, deer and furbearers can also generate economic damages through vehicle collisions and damage to crops and other property. White-tailed deer are involved in more than 14,000 deer-vehicle collisions per year in Indiana alone. Additionally, deer and furbearers can serve as vectors for infectious disease.

Efficient deer and furbearer management in Indiana requires weighing the economic benefits from consumptive and nonconsumptive uses against the associated economic damages and management activity costs, yet these benefits and costs for Indiana are not well known. The overarching goal of our research involves quantifying the value of economically important white-tailed deer and furbearer species (beavers, coyotes, gray and red foxes, long-tailed weasels, minks, muskrats, opossum, raccoons, river otters, and striped skunks). Our objectives are to:

1. Estimate the benefits of consumptive uses of white-tailed deer.
2. Estimate the benefits of consumptive uses of furbearers.
3. Estimate the nonconsumptive benefits and costs of white-tailed deer and furbearers.
4. Assess the distributional effects of outdoor activities and deer-and-furbearer management.
5. Derive an integrated dynamic model of hunter-and-nonhunter behavior and deer-and- furbearer population dynamics to simulate the effects of various management decisions on the economic value of deer and furbearers.

The consumptive value of white-tailed deer and furbearers (objectives 1 and 2) is derived primarily from hunting and trapping. The surplus hunters and trappers receive from harvesting these species depends on the number of hunting and trapping trips taken—that is, on the demand for trips. We will estimate a model of deer hunters' demand for trips using existing Deer Management Survey data collected by the Indiana Department of Natural Resources (DNR). This survey collects information on hunters' site choices and trip frequency, among other details. We can use this information to estimate the cost of hunting trips. This information, along with data on trip frequency, will allow us to estimate the demand for deer hunting trips among deer hunters and, hence, the surplus from consumptive uses of deer.

No such survey exists for furbearer harvesters. We will develop a survey of licensed Indiana hunters and trappers to collect this information. This survey will collect information on (i) participation in furbearer harvesting, trip frequency, harvest locations, methods, and harvest quantity, (ii) spending on hunting for different game species and hunting events (e.g., predator

hunting tournaments), and (iii) hunter and trapper demographics, including income, residential location, and age. We can use the harvest and trip-demand models to estimate economic values from furbearer hunting.

We will estimate nonconsumptive values for deer and furbearers (Objective 3) with data collected from a separate household survey. We will conduct the survey in two stages. The first stage will collect data about nonconsumptive activities related to deer and furbearers, including viewing, photography, and the value of deer and furbearers' ecological role from Indiana households. The survey instrument used in this stage will include questions to assess individuals' knowledge and experience with these species and their related ecosystem services, a discrete choice experiment to measure their preferences for different levels of deer and furbearers on the landscape, and demographics. We will use the data from the first stage to measure the value of deer and furbearers' ecological role. The first part of the survey will also serve to screen households that have experienced deer and furbearer damages. The second stage of the survey will follow up with these households to measure the quantity and value of damages as well as any spending on repairs and mitigation associated with deer- and furbearer-related damages.

Using the data collected from objectives 1 and 2, we will assess the total economic contributions made by outdoor activities related to hunting and trapping in Indiana (Objective 4), with a static input-output (I-O) model that tracks the flow of goods and services among interconnected sectors within an economic system, at one point in time. Then we will calculate two types of multipliers typically used in I-O analysis to measure the total or partial effects relative to the direct effect. The type-I multiplier is defined as the sum of direct and indirect effects divided by the direct effects, indicating industrial integration or linkage relative to the economic system of interest. The type-II multiplier is calculated as the total effects divided by the direct effect, thus capturing consumption patterns of households and their impacts on the economic system. Next, we will analyze how changes in recreational behavior and government regulations will affect the participants' expenditures in different sectors as well as in the economy-wide impacts.

Finally, we will combine the information derived from outputs from objectives 1–4 into an integrated bioeconomic model that can simulate the effects of management decisions on the economic value of deer and furbearer populations We can calibrate these models using data on species populations, growth rates, net migration, and harvest. Data on deer populations for various deer management units in Indiana are available through an ongoing DNR-funded project overseen by our co-investigators. We will work with contacts at DNR to obtain data for calibrating models of furbearer population dynamics.

Progress Update

For Objective 1, we developed a set of recreation demand models to estimate consumptive uses for deer. Each demand model relates an individual's decision about where to hunt with location characteristics, using utility theory. We estimated these models using several sources of hunting, land cover, and land use data, with different sources of hunting data producing different models. We collected hunting data from the 2019 Deer Management Survey, 2019 harvest check-in records, and customer characteristics. We based one demand model on survey responses about the county in which a respondent spent the most time hunting in the past season. We estimated two versions of this demand model with and without the participation option, by including or excluding respondents who reported not going on a hunt. We based an additional model on the locations of harvested deer in the check-in data. We found the three model versions often yield qualitatively similar predictions and estimates of hunting value. For example, all the models estimate that Indiana hunters value keeping Allen County open for hunting at about $0.31/trip, or $3.1 million, if there are 10 million hunting trips in Indiana in a year. Two important exceptions include the effects of population density and developed land on location choice and consumptive values; the check-in model attributes a larger effect of developed land on these outcomes while the survey data-based models attribute a larger effect of population density. The next task is to integrate a measure of deer population into the models.

For Objective 2, we developed and implemented the furbearer harvester survey. We sent the survey to a random sample of 2,000 licensed furbearer hunters and trappers and received 421 completed surveys. A main goal of this survey was to elicit harvesters' willingness to pay (WTP) for bobcat harvest licenses. Bobcat hunting and trapping are currently not permitted in Indiana but are being considered by the DNR. We found a mean willingness to pay between $10.40 and $26.40, depending on the bag limit and harvest quota. The total statewide economic outputs of hunting and trapping

activities were estimated to be $238.7 and $6.7 million, respectively.

For Objective 3, we focused on three distinct activities. First, we implemented household surveys to estimate nonconsumptive values for deer and furbearers. We divided our work into two separate surveys. The first was meant to elicit Hoosiers' WTP for seeing different wildlife species in recreational settings at Indiana State Parks and Recreation Areas. We sent a two-wave mail survey to 7,500 Indiana residents in summer 2022 containing a choice experiment and questions on wildlife perceptions. Analysis and WTP estimation are ongoing. Statistical estimation of WTP is complicated by the fact that many respondents that we randomly selected do not visit state parks or recreation areas. These respondents are likely to have systematically different preferences for wildlife than those who visit, and we have had to write custom statistical routines to estimate WTP in this context. The second survey is meant to elicit Hoosiers' WTP for seeing or avoiding different wildlife species around their home. Our intent is to send this survey to another random sample of 7,500 Indiana residents. This survey contains yet another choice experiment along with questions meant to elicit homeowner estimates of damages caused by various wildlife species around their property. Eventually, we plan to apply averting expenditure methods to estimate the monetary value of these damages.

For Objective 4, the total economic impacts of furbearer hunting were roughly $143.9 million during the 2020 hunting season, of which about $81.7 million was direct output. The output multiplier was 1.76, meaning for every dollar produced from hunting activities an additional $0.76 was generated. Demand shocks of hunting were transmitted mostly through daily and season expenditures on hunting. Most of the daily spending impacted the retail sector, including gasoline and groceries. Restaurants were also primary beneficiaries of changes in these expenses. Warehousing and storage were the most affected among all indirectly impacted industries. For the seasonal expenses category, retail-sporting goods were most impacted, followed by general merchandise stores, dogfood manufacturers, and truck transportation. During the 2020 trapping season, the total economic impact generated from these activities was roughly $2.5 million, out of which about $1.4 million was direct output. Similarly, demand shocks in trapping were most felt by retail sectors selling general merchandise, gasoline, and restaurants in the daily spending category. Retail industries that sell clothing, sporting goods, and general merchandise were most impacted in the seasonal spending category, followed by trucking and the production of synthetic dyes and pigments. Shocks in spending on durable items were captured mainly by boat building, motor vehicles and parts dealers, truck trailer manufacturers, and small arms, ordnance, and accessories manufacturers.

Appendix A.
DMU DEER DATA SHEETS 2022

A detailed explanation of how to read and interpret the DMU Deer Data Sheets is available in the 2018 Indiana White-tailed Deer Report (Page 140).

DMU 1: Northwest

3/24/2023

Total Square Miles: 6,022
Square Miles of Deer Habitat: 1,245
Percent Deer Habitat: 21

Table 1. Total harvest, buck harvest, and doe harvest (error < 1 percent). Damage permits are issued by DNR to landowners to control deer damage. Deer vehicle collisions (DVC) and miles traveled are reported by the Indiana Department of Transportation. Mean CBAQ is the average county bonus antlerless quota of all counties in the DMU. The trend in total harvest, buck harvest, doe harvest, and DVCs are in standard deviations (SD) and are equivalent to effect size. A change greater than 2 SD is considered both a large and statistically significant effect size.

Year	Total	Total Trend in SD	Buck Harvest	Buck Trend in SD	Buck Harvest per SQ MI Habitat	Doe Harvest	Doe Trend in SD	Doe Harvest per SQ MI Habitat	% Doe in Harvest	Damage Permit Deer Taken	DVC per Billion Miles Traveled	DVC Trend in SD	Mean CBAQ
2009	24,688		11,806		9.5	12,882		10.3	52.2		256.6		6.3
2010	25,088	1.3	12,043	1.2	9.7	13,045	1.3	10.5	52.0		241.1	-1.3	6.4
2011	22,870	-0.4	11,139	-0.8	8.9	11,731	-0.2	9.4	51.3		232.8	-2.7	7.1
2012	23,755	-0.2	10,527	-3.3	8.5	13,228	1.4	10.6	55.7		206.4	-3.4	6.8
2013	20,195	-4.5	9,402	-3.3	7.6	10,793	-2.8	8.7	53.4		210.4	-1.4	5.8
2014	19,810	-1.8	9,456	-1.4	7.6	10,354	-1.9	8.3	52.3		200.0	-1.4	4.4
2015	19,854	-1.1	9,968	-0.5	8.0	9,886	-1.5	7.9	49.8		207.3	-0.6	4.3
2016	19,132	-1.2	9,849	-0.3	7.9	9,283	-1.4	7.5	48.5	165	185.7	-2.0	4.6
2017	17,327	-1.8	8,418	-3.1	6.8	8,909	-1.2	7.2	51.4	295	194.4	-0.8	3.3
2018	18,245	-0.9	9,463	0.1	7.6	8,782	-1.4	7.1	48.1	188	191.6	-0.8	2.6
2019	19,757	0.8	10,626	2.0	8.5	9,131	-0.5	7.3	46.2	180	201.4	0.7	2.0
2020	22,730	3.6	11,899	2.7	9.6	10,831	3.8	8.7	47.7	179	186.4	-1.1	2.0
2021	19,329	-0.1	10,482	0.3	8.4	8,847	-0.7	7.1	45.8	245	196.9	0.8	2.0
2022	22,747	1.6	12,558	1.8	10.1	10,189	1.0	8.2	44.8	263	207.6	2.4	2.0

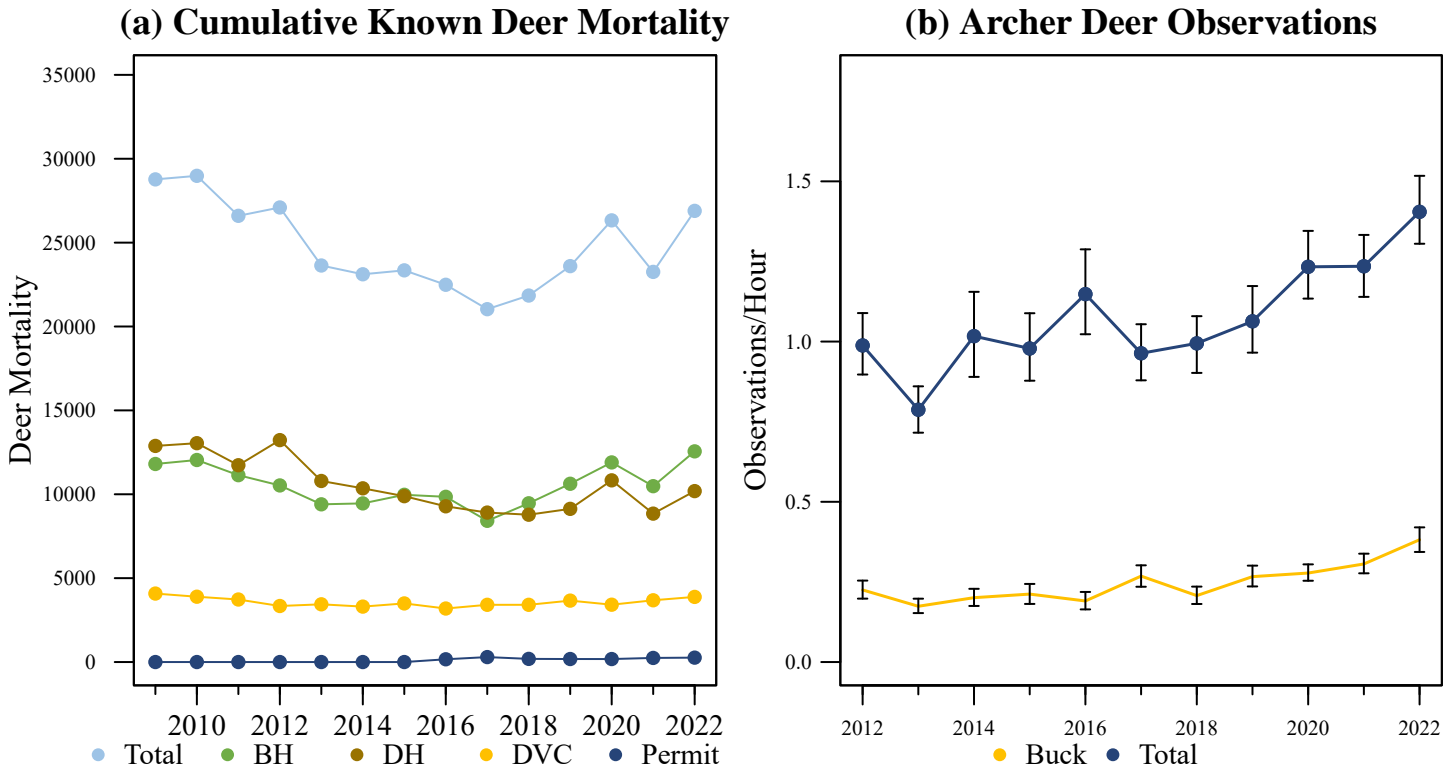

Figure 1. (a) The total known annual deer mortality based on buck harvests (BH), doe harvests (DH), deer vehicle collisions (DVC), and deer permit takes. (b) Total deer and buck observations per hour based on the Archer's Index.

DMU 1: Northwest

3/24/2023

Total Square Miles: 6,022
Square Miles of Deer Habitat: 1,245
Percent Deer Habitat: 21

Table 2. Estimated number of antlered (A) and antlerless (AL) deer harvested per hunter. Estimated totals may not match exactly with total number of deer harvested. Reporting errors are examined and investigated as they are located; therefore, subsequent reports may contain corrected totals.

Year	Total Hunters	0 A	1 A	2 A	3 A	0 AL	1 AL	2 AL	3 AL	4 AL	5 AL	6 AL	7 AL	8 AL	9 AL	10 AL
2016	14,283	6,488	7,740	54	1	5,665	6,580	1,580	347	72	24	13	2	0	0	0
2017	12,917	6,368	6,488	61	0	4,630	6,398	1,492	292	82	14	4	3	2	0	0
2018	13,603	6,088	7,428	86	1	5,356	6,340	1,535	302	47	13	6	2	0	0	1
2019	14,758	6,011	8,633	113	1	6,077	6,839	1,580	199	38	15	5	2	2	0	0
2020	16,468	6,993	9,329	145	1	6,327	7,703	2,058	289	63	15	6	5	0	0	0
2021	14,541	5,951	8,472	118	0	6,131	6,587	1,550	208	41	12	7	2	1	1	0
2022	16,638	6,137	10,347	151	3	7,171	7,280	1,862	246	62	11	3	1	0	1	1

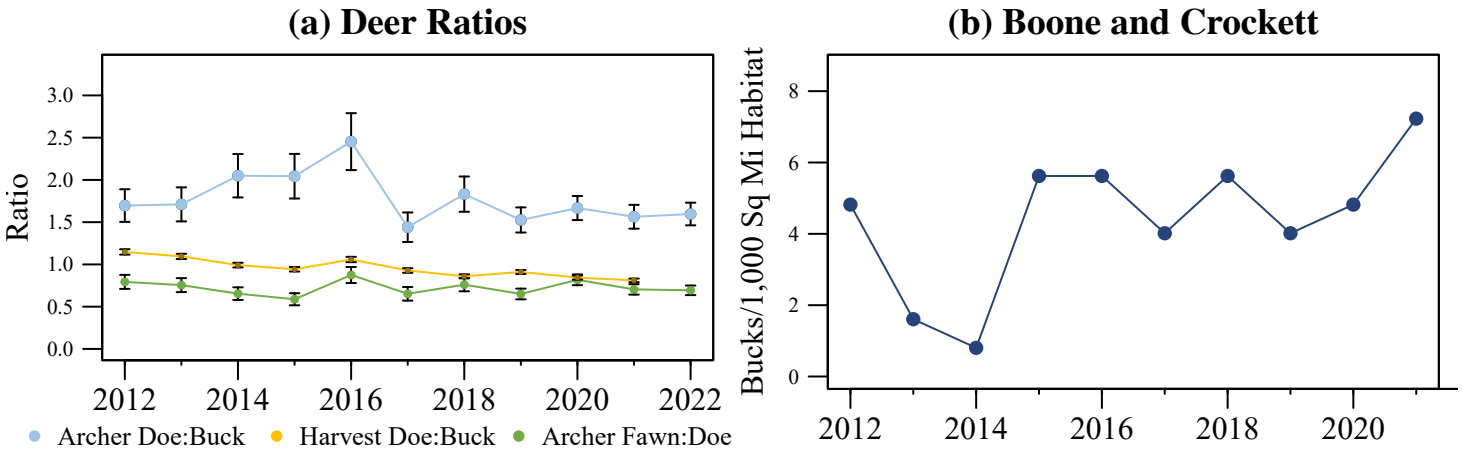

Figure 2. (a) Annual doe:buck ratios and fawn:doe ratios based on the Archer's Index and harvest records. (b) The number of Boone and Crockett bucks (minimum 160 score) per 1,000 square miles of deer habitat.

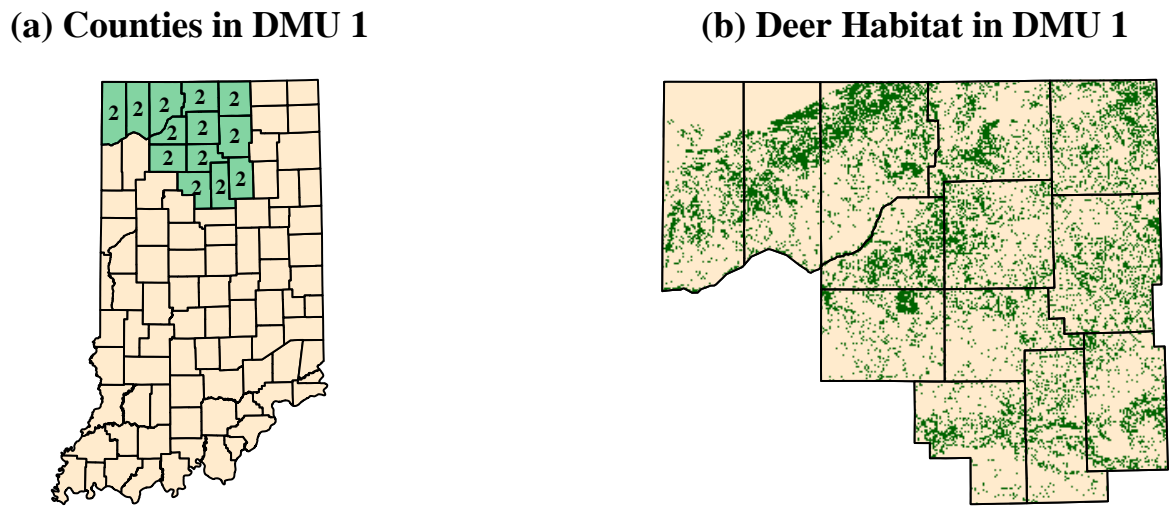

Figure 3. (a) Counties included in DMU 1 for summarizing harvest and deer management survey statistics. Labels are the 2022 county bonus antlerless quotas. (b) Green represents the land use types classified as deer habitat in DMU 1.

DMU 1: Northwest

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Deer Management Survey Results

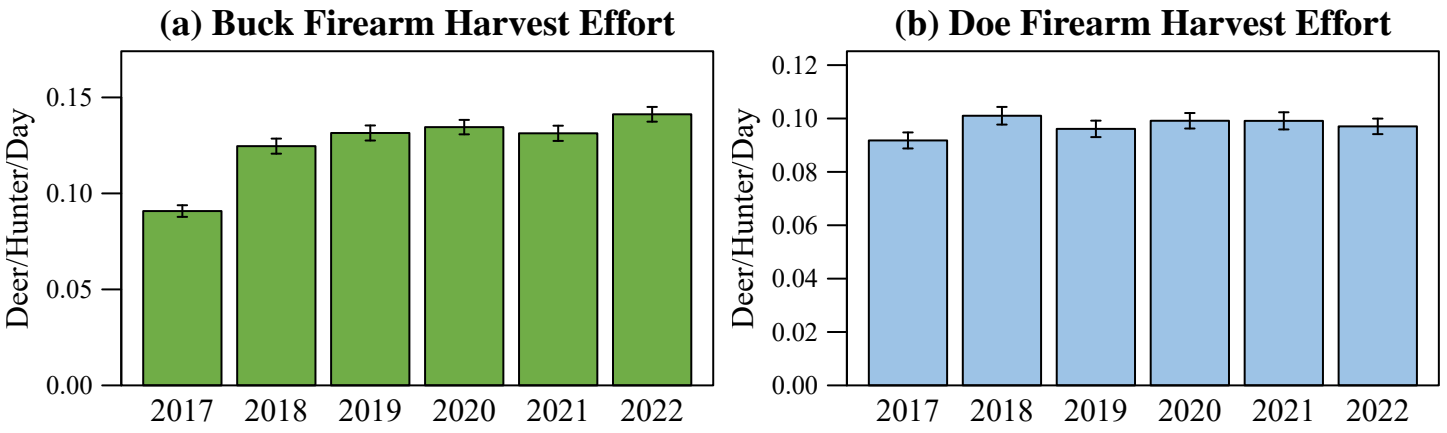

Figure 4. Firearm harvest effort is the number of bucks (a) and does (b) killed by firearms per hunter divided by the mean number of days hunted per hunter during the firearm season based on data reported in the deer management survey. Larger values (i.e taller bars) indicate less effort required to harvest a deer.

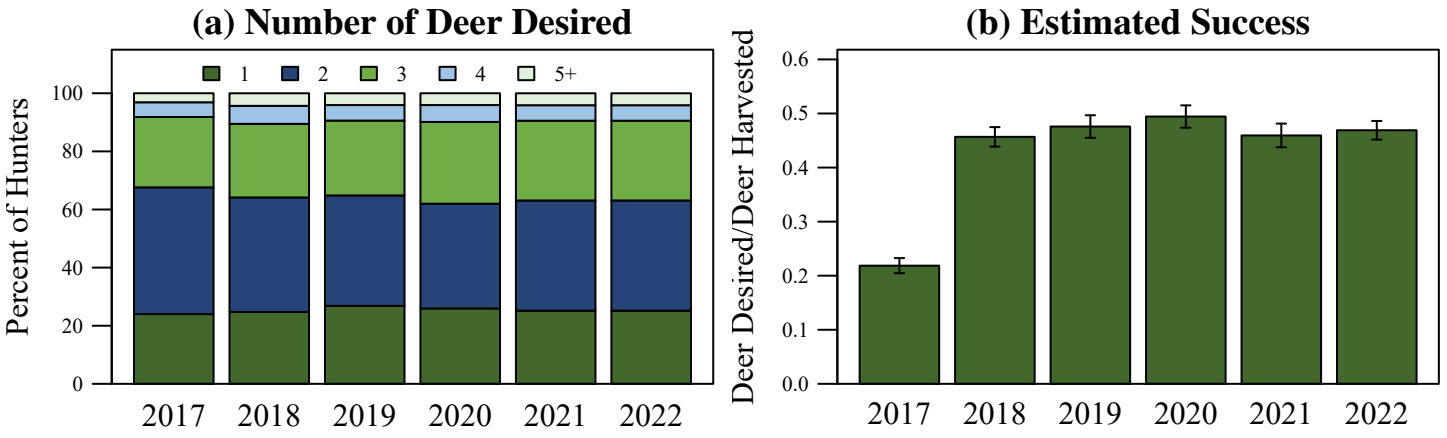

Figure 5. (a) The annual percent of hunters wishing to harvest each number of deer as reported in the deer management survey. (b) Success rate is estimated from the deer management survey as the Number of Harvested Deer/Number of Deer Desired (reported only; does not account for attempts that were not made). Larger values (i.e. taller bars) indicate greater success.

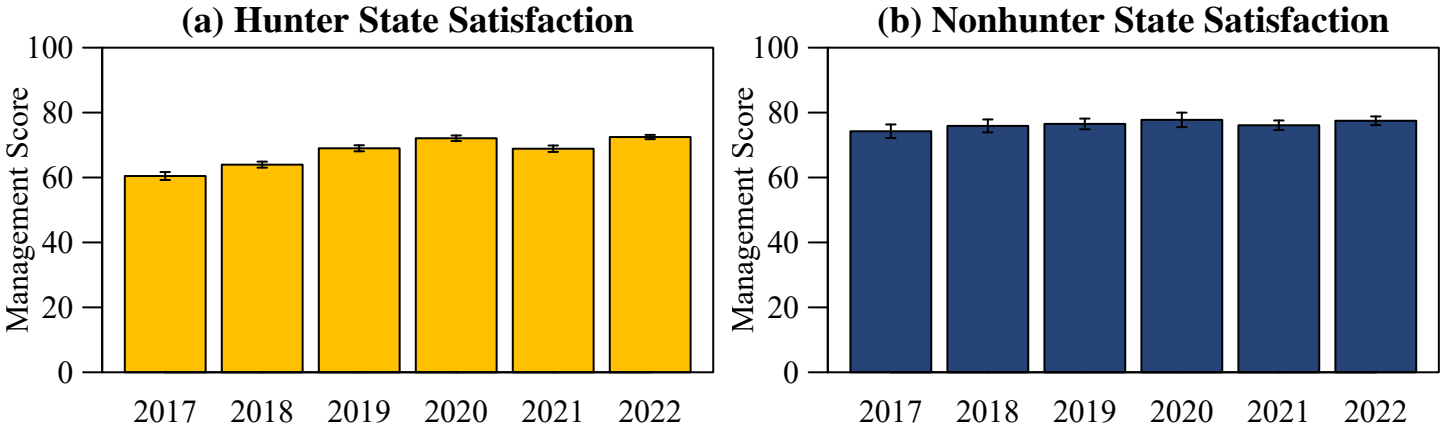

Figure 6. Hunters (a) and nonhunters (b) were asked to score the DNR's statewide deer management on a scale of 0 (poor) to 100 (excellent).

DMU 1: Northwest

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Deer Management Survey Results

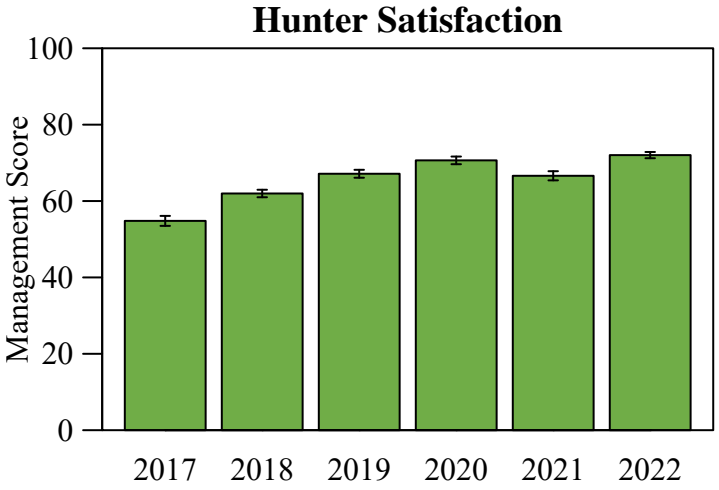

Figure 7. Hunters were asked to score the DNR's county deer management on a scale of 0 (poor) to 100 (excellent) for the county in DMU 1 where they hunt.

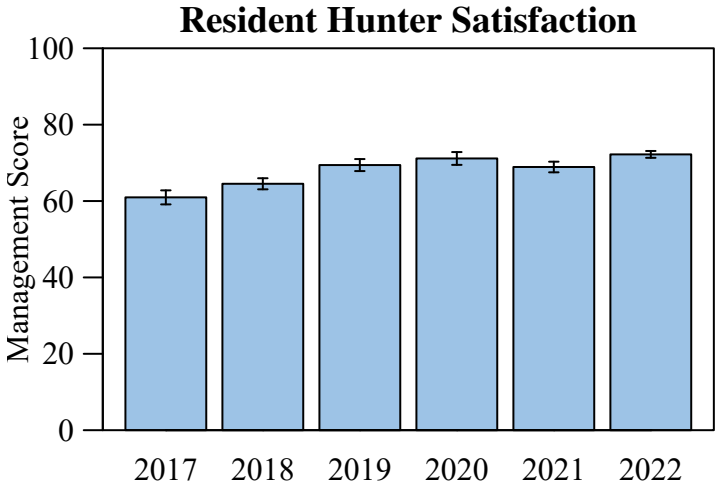

Figure 8. Hunters were asked to score the DNR's county deer management on a scale of 0 (poor) to 100 (excellent) for the county in DMU 1 where they live.

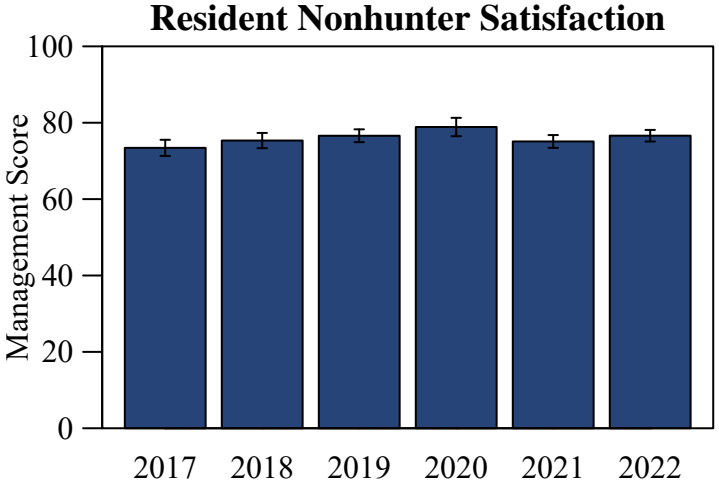

Figure 9. Nonhunters were asked to score the DNR's county deer management on a scale of 0 (poor) to 100 (excellent) for the county in DMU 1 where they live.

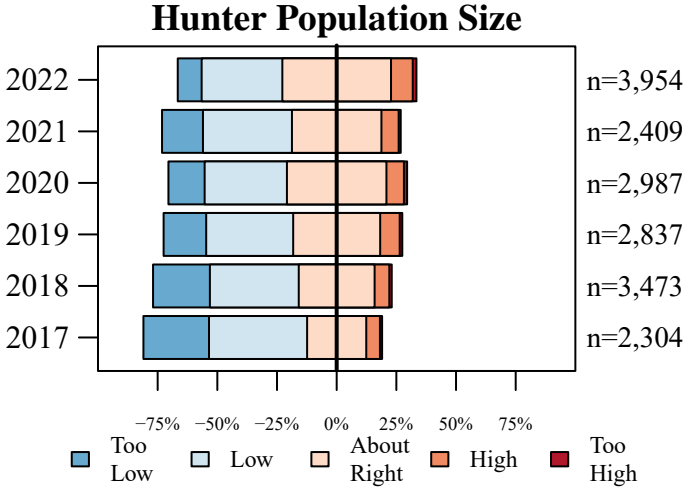

Figure 10. The current size of the deer population described by hunters in the county where they hunt in DMU 1.

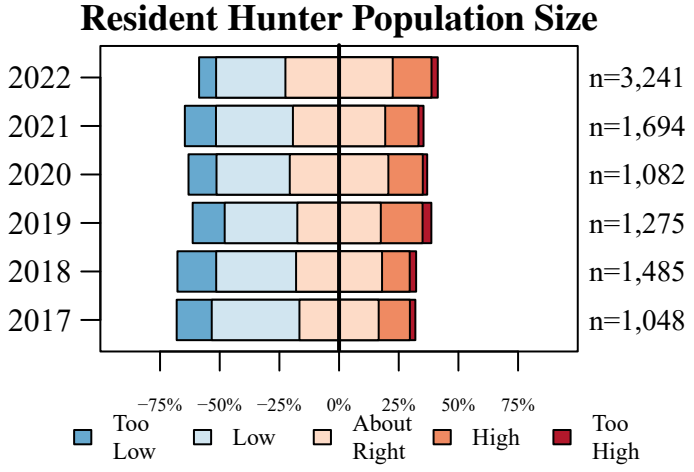

Figure 11. The current size of the deer population described by hunters in the county where they live in DMU 1.

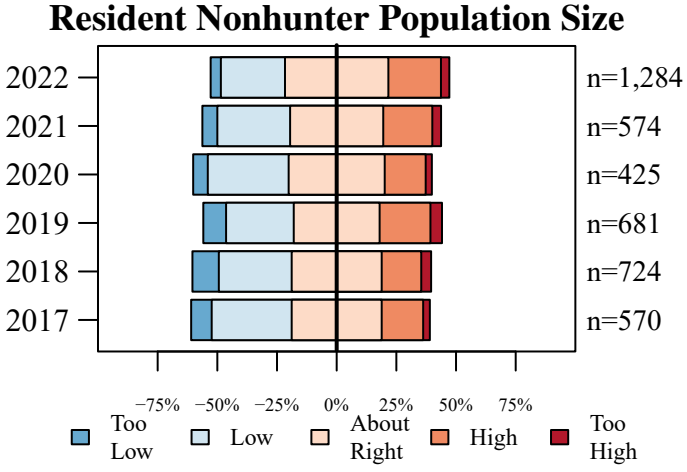

Figure 12. The current size of the deer population described by nonhunters in the county where they live in DMU 1.

DMU 1: Northwest

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Deer Management Survey Results

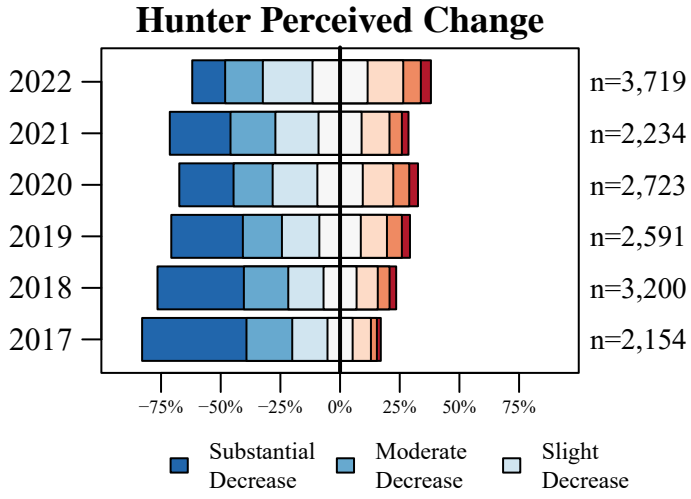

Figure 13. The number of deer seen compared to five years ago described by hunters in the county where they hunt in DMU 1.

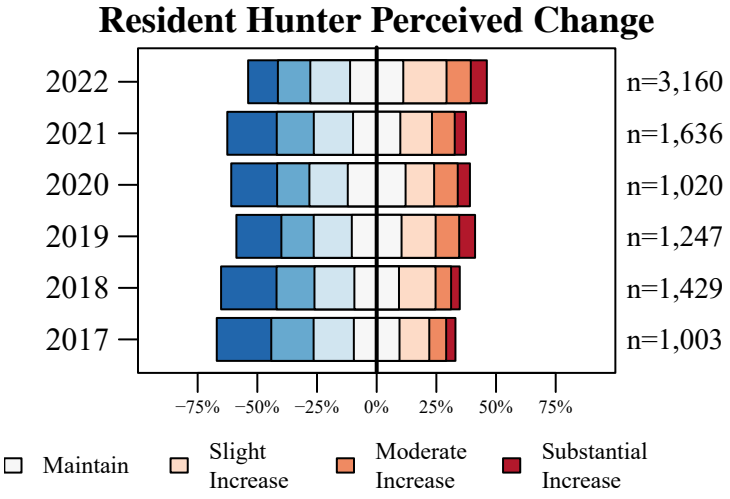

Figure 14. The number of deer seen compared to five years ago described by hunters in the county where they live in DMU 1.

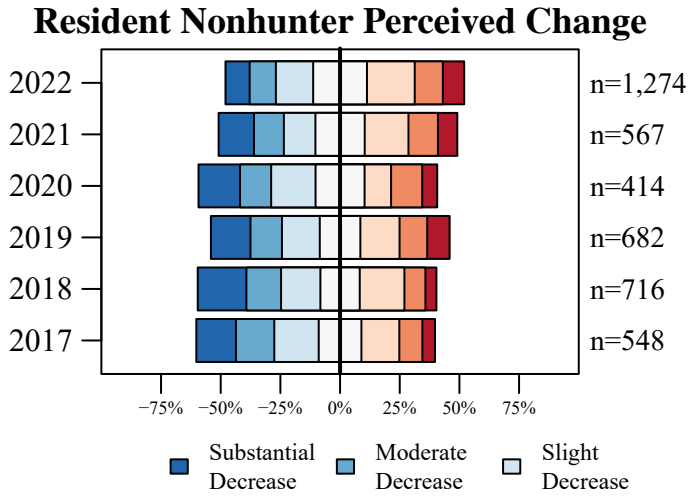

Figure 15. The number of deer seen compared to five years ago described by nonhunters in the county where they live in DMU 1.

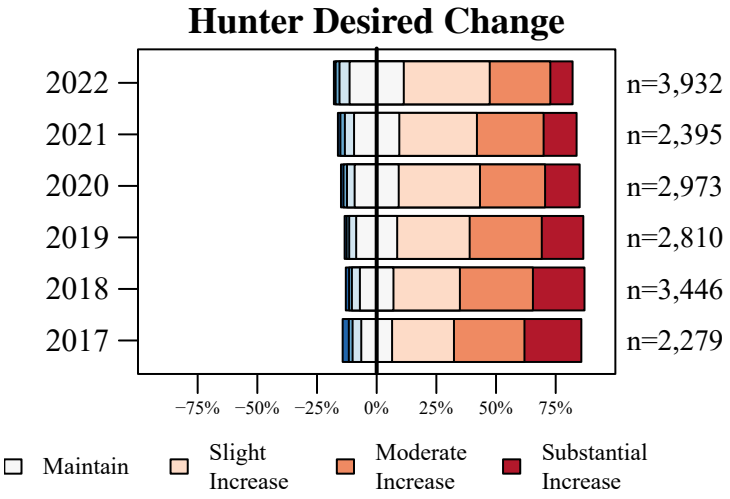

Figure 16. The desired change in the size of the deer population described by hunters in the county where they hunt in DMU 1.

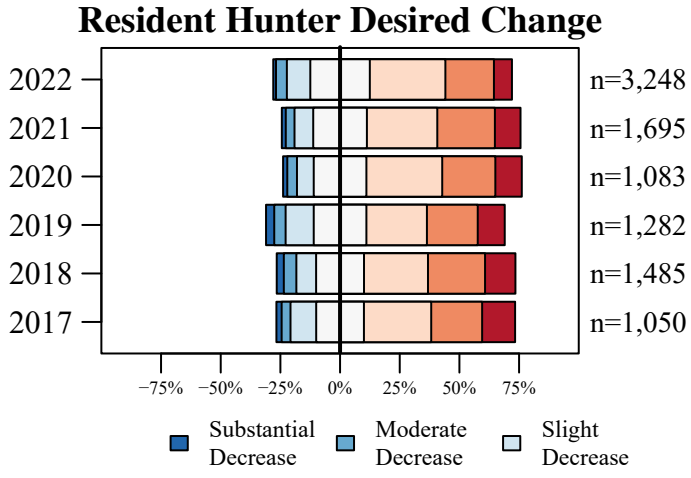

Figure 17. The desired change in the size of the deer population described by hunters in the county where they live in DMU 1.

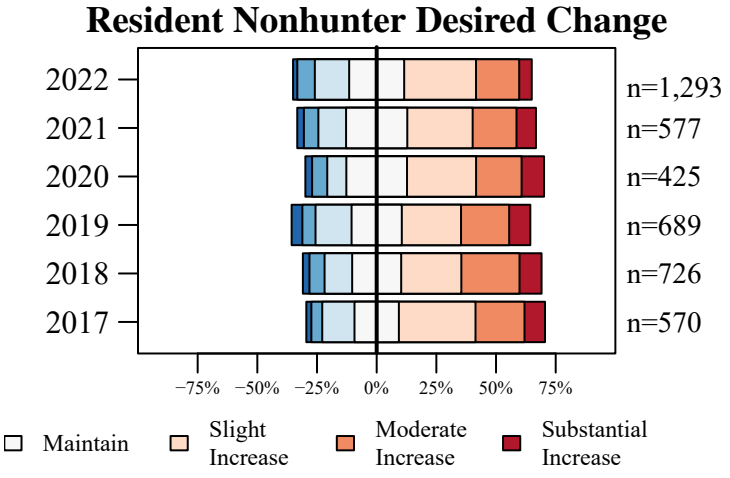

Figure 18. The desired change in the size of the deer population described by nonhunters in the county where they live in DMU 1.

DMU 1: Northwest

3/24/2023

Deer Management Survey Results

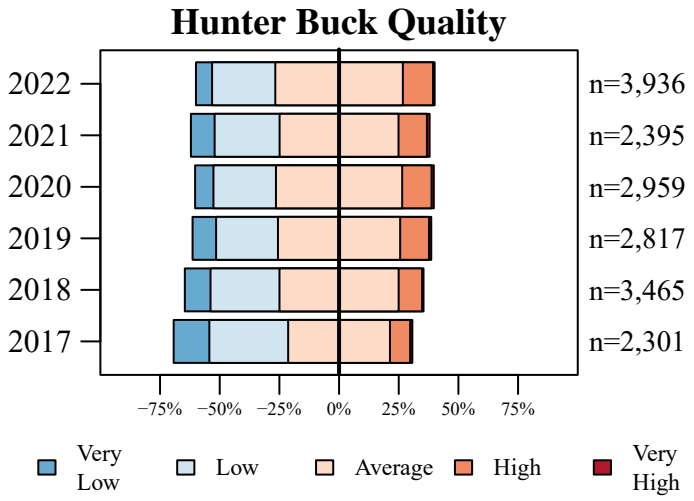

Figure 19. Hunters describe the quality of bucks in the county where they hunt in DMU 1.

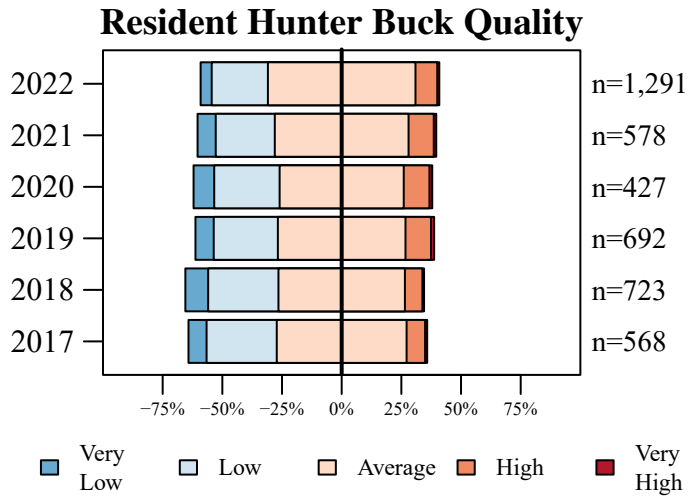

Figure 20. Hunters describe the quality of bucks in the county where they live in DMU 1.

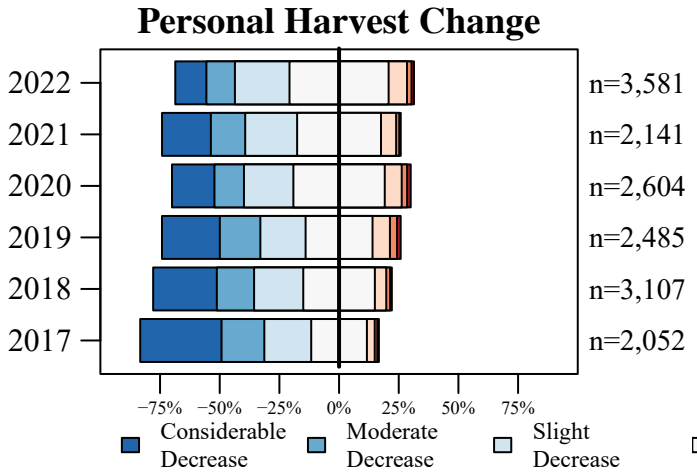

Figure 21. Opinion of hunters on how their personal number of harvested deer has changed over the last five years in a county in DMU 1.

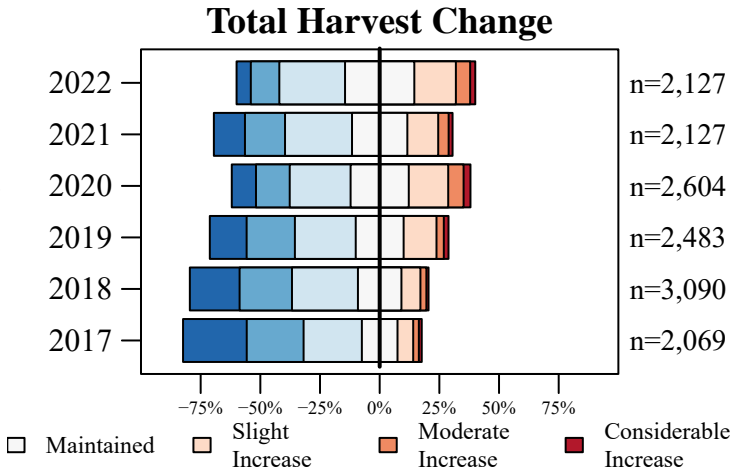

Figure 22. Opinion of hunters on how the total number of harvested deer has changed over the last five years in a county in DMU 1.

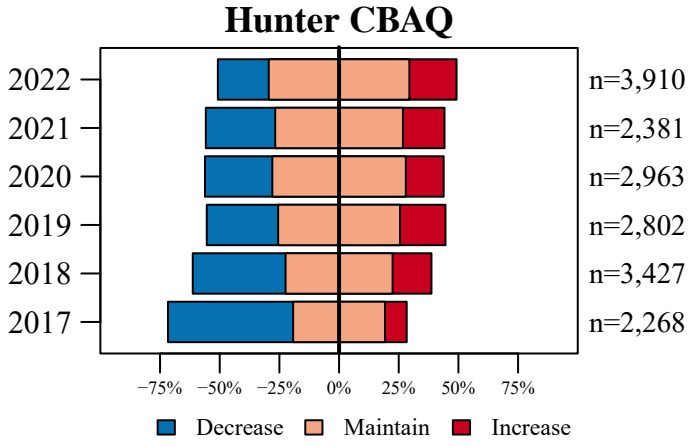

Figure 23. Opinion on how the County Bonus Antlerless Quota should change from hunters in the county where they hunt in DMU 1.

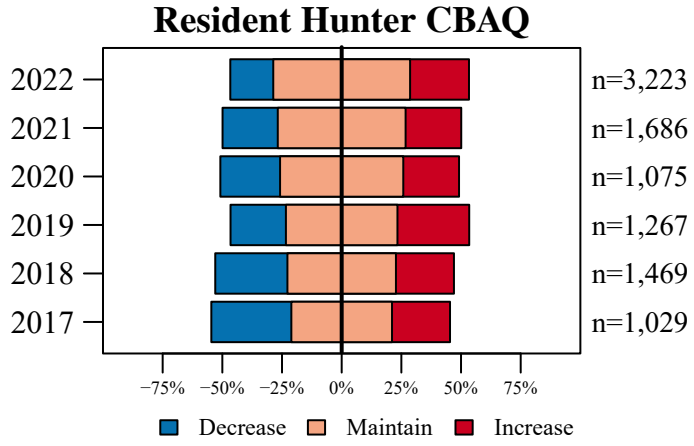

Figure 24. Opinion on how the County Bonus Antlerless Quota should change from hunters in the county where they live in DMU 1.

DMU 1: Northwest

3/24/2023

Deer Management Survey Results

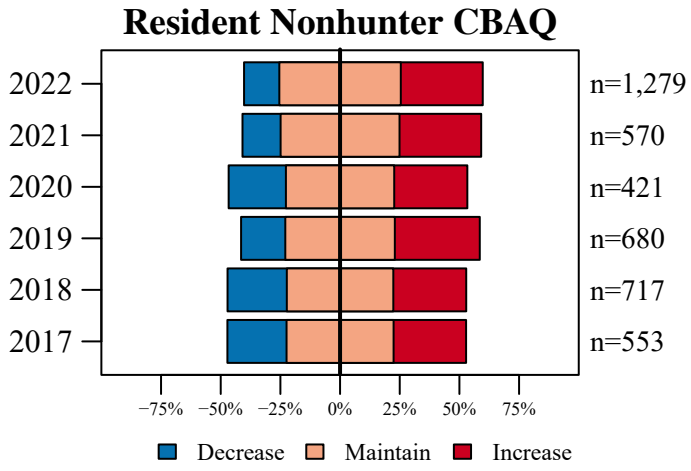

Figure 25. Opinion on how the County Bonus Antlerless Quota should change from nonhunters in the county where they live in DMU 1.

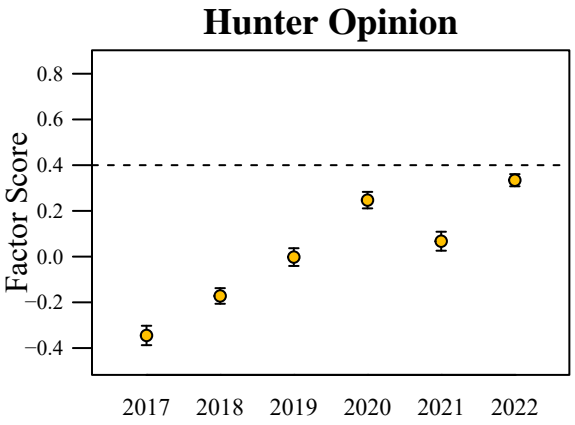

Figure 26. Hunter opinon scores over five years of the deer management survey. The score was aggregated using factor analysis of questions asked only to hunters. The dashed line represents the score if all questions are answered neutrally.

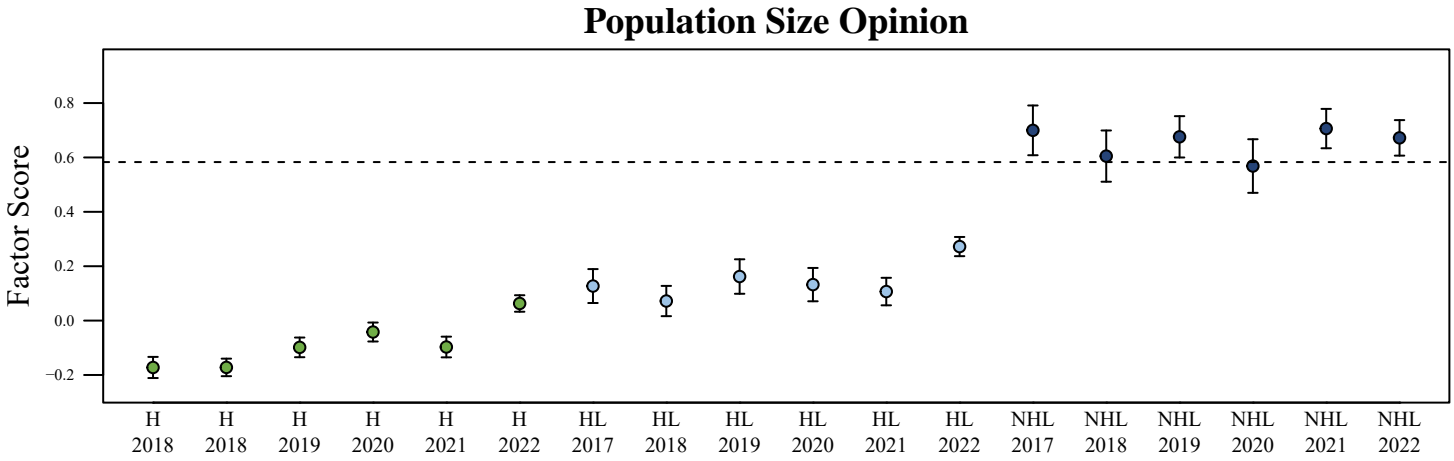

Figure 27. The opinion of nonhunters (NHL) and hunters in the county where they live (HL) and hunters in the county where they hunt (H) on deer population size. The score was aggregated using factor analysis of questions asked to all participants. The dashed line represents the score if all questions are answered neutrally.

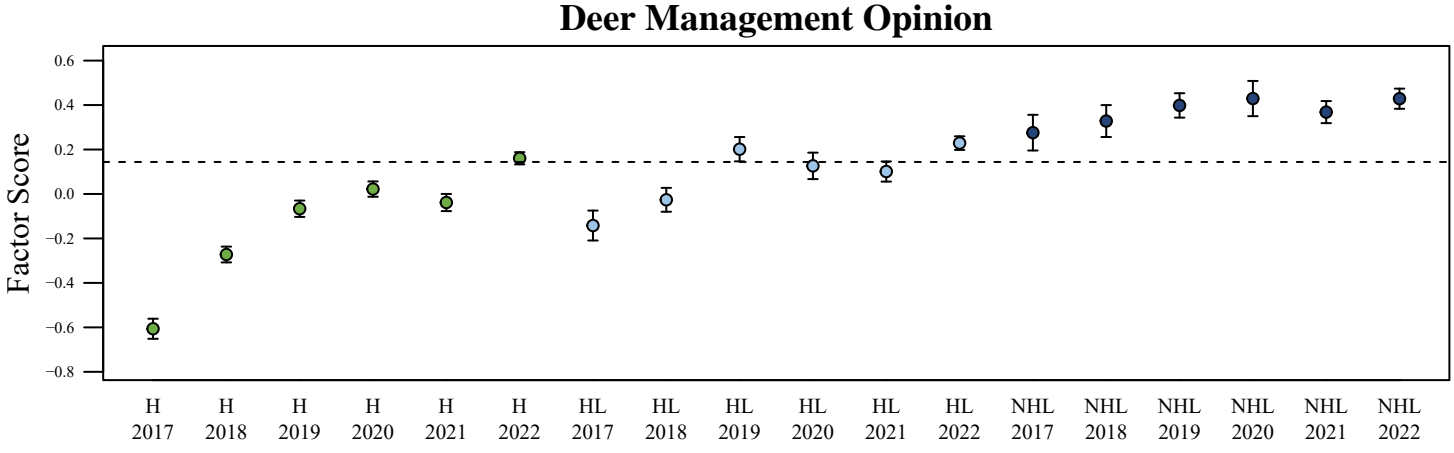

Figure 28. The opinion of nonhunters (NHL) and hunters in the county where they live (HL) and hunters in the county where they hunt (H) on deer management. The score was aggregated using factor analysis of questions asked to all participants. The dashed line represents the score if all questions are answered neutrally.

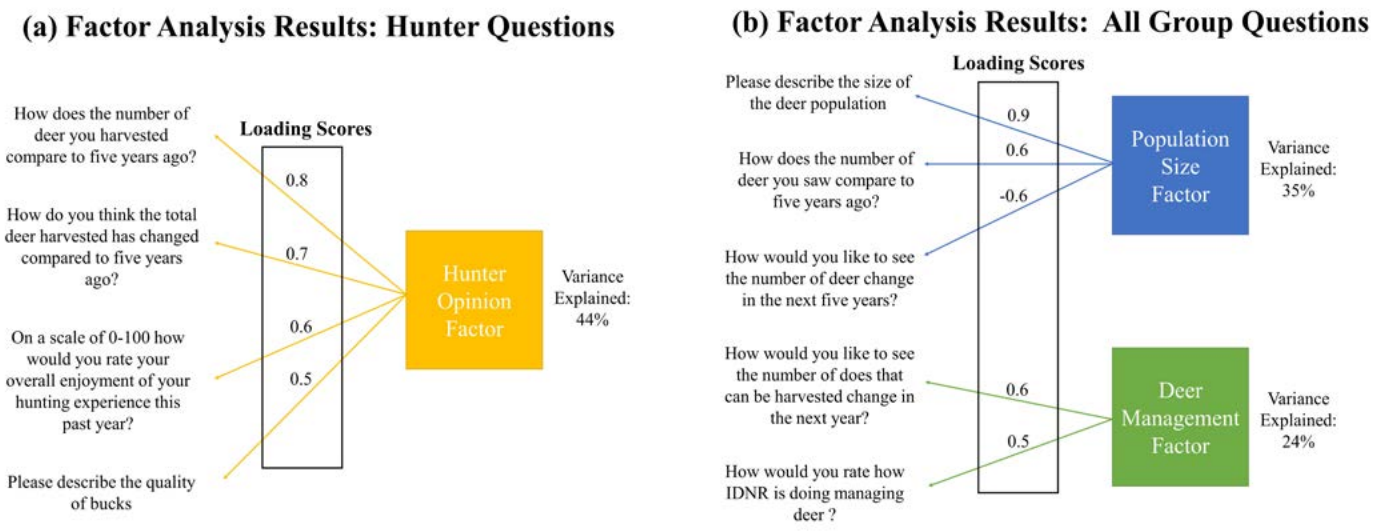

Figure 29. Results from two factor analyses used to develop the hunter opinion (a), population opinion (b), management opinion (b), and scores. Higher loading scores indicate a stronger correlation between the original question and the derived factor. These figures are included to help interpret Figure 26, Figure 27, and Figure 28.

DMU 2: Northeast

3/24/2023

Total Square Miles: 1,490
Square Miles of Deer Habitat: 506
Percent Deer Habitat: 34

Table 1. Total harvest, buck harvest, and doe harvest (error < 1 percent). Damage permits are issued by DNR to landowners to control deer damage. Deer vehicle collisions (DVC) and miles traveled are reported by the Indiana Department of Transportation. Mean CBAQ is the average county bonus antlerless quota of all counties in the DMU. The trend in total harvest, buck harvest, doe harvest, and DVCs are in standard deviations (SD) and are equivalent to effect size. A change greater than 2 SD is considered both a large and statistically significant effect size.

Year	Total	Total Trend in SD	Buck Harvest	Buck Trend in SD	Buck Harvest per SQ MI Habitat	Doe Harvest	Doe Trend in SD	Doe Harvest per SQ MI Habitat	% Doe in Harvest	Damage Permit Deer Taken	DVC per Billion Miles Traveled	DVC Trend in SD	Mean CBAQ
2009	12,268		5,375		10.6	6,893		13.6	56.2		588.9		6.0
2010	12,661	1.6	5,730	2.2	11.3	6,931	1.1	13.7	54.7		577.0	-0.6	6.0
2011	11,499	-0.3	5,150	-0.3	10.2	6,349	-0.3	12.5	55.2		519.2	-6.9	8.0
2012	9,941	-3.7	4,306	-4.3	8.5	5,635	-2.9	11.1	56.7		491.8	-2.7	8.0
2013	9,540	-2.0	4,412	-1.4	8.7	5,128	-2.5	10.1	53.8		533.1	-0.4	5.0
2014	8,610	-1.9	4,132	-1.4	8.2	4,478	-2.2	8.8	52.0		515.9	-0.6	4.0
2015	9,123	-0.8	4,609	-0.2	9.1	4,514	-1.2	8.9	49.5		507.5	-0.6	3.5
2016	9,090	-0.6	4,676	0.4	9.2	4,414	-1.0	8.7	48.6	90	523.6	0.7	3.5
2017	7,994	-2.5	3,989	-2.0	7.9	4,005	-1.6	7.9	50.1	68	554.9	2.6	2.5
2018	8,880	0.0	4,600	0.8	9.1	4,280	-0.6	8.5	48.2	79	605.9	4.3	1.8
2019	9,785	2.3	5,141	2.3	10.2	4,644	1.5	9.2	47.5	61	634.2	2.3	1.5
2020	11,058	3.2	5,642	2.5	11.2	5,416	4.3	10.7	49.0	77	548.0	-0.3	1.5
2021	9,284	-0.1	4,986	0.3	9.9	4,298	-0.5	8.5	46.3	77	608.4	0.8	2.0
2022	11,122	1.5	5,959	1.8	11.8	5,163	1.2	10.2	46.4	85	625.2	0.9	2.0

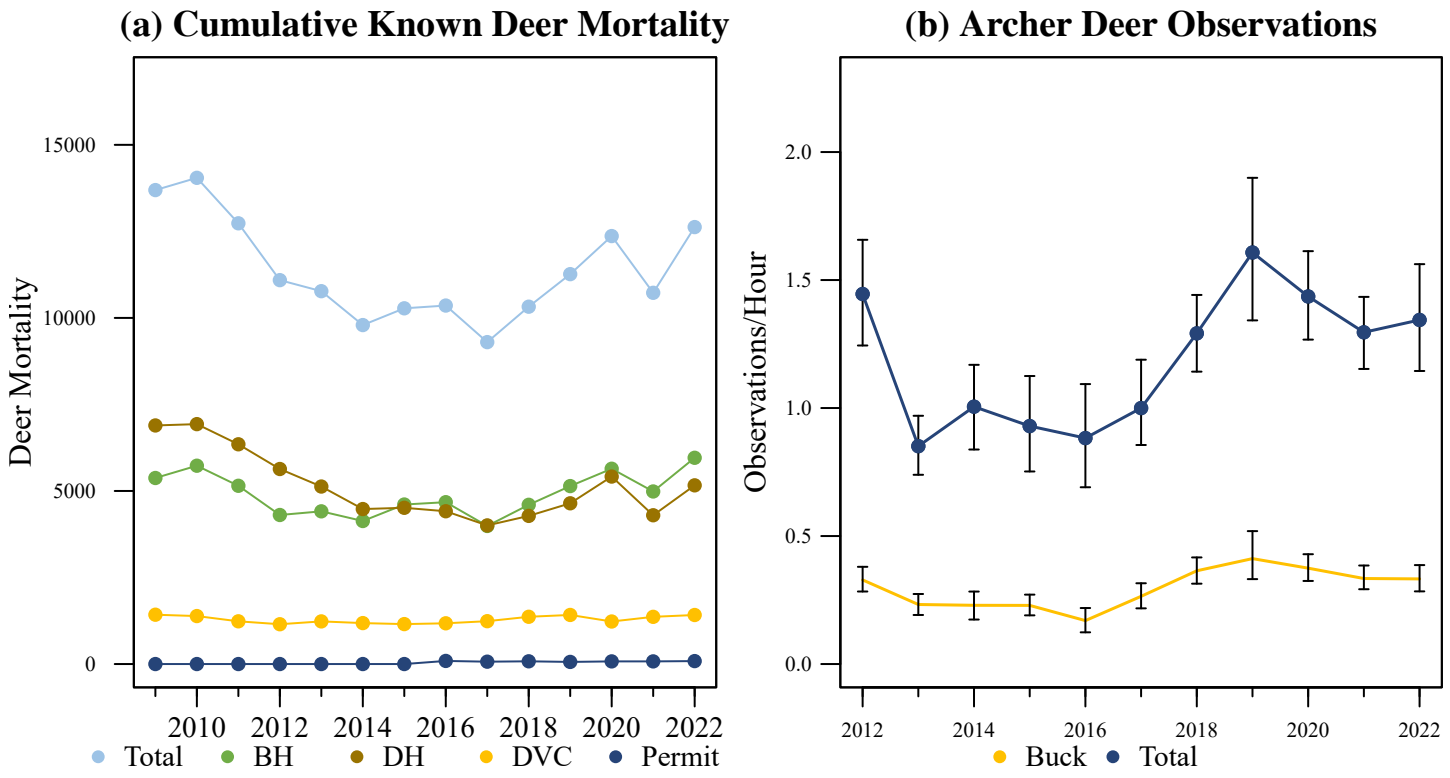

Figure 1. (a) The total known annual deer mortality based on buck harvests (BH), doe harvests (DH), deer vehicle collisions (DVC), and deer permit takes. (b) Total deer and buck observations per hour based on the Archer's Index.

DMU 2: Northeast

3/24/2023

Total Square Miles: 1,490
Square Miles of Deer Habitat: 506
Percent Deer Habitat: 34

Table 2. Estimated number of antlered (A) and antlerless (AL) deer harvested per hunter. Estimated totals may not match exactly with total number of deer harvested. Reporting errors are examined and investigated as they are located; therefore, subsequent reports may contain corrected totals.

Year	Total Hunters	0 A	1 A	2 A	3 A	0 AL	1 AL	2 AL	3 AL	4 AL	5 AL	6 AL	7 AL	8 AL	9 AL	10 AL
2016	6,866	3,128	3,726	11	1	2,729	3,175	772	147	36	7	0	0	0	0	0
2017	6,172	3,009	3,157	6	0	2,307	3,051	691	104	16	2	1	0	0	0	0
2018	6,874	3,127	3,716	31	0	2,693	3,401	662	100	15	2	0	1	0	0	0
2019	7,487	3,189	4,261	37	0	2,988	3,682	712	87	13	2	1	1	1	0	0
2020	8,193	3,583	4,558	52	0	3,090	3,990	971	109	28	5	0	0	0	0	0
2021	7,101	2,927	4,131	42	1	2,979	3,306	716	79	17	1	3	0	0	0	0
2022	8,309	3,279	4,977	53	0	3,513	3,725	935	113	16	2	4	1	0	0	0

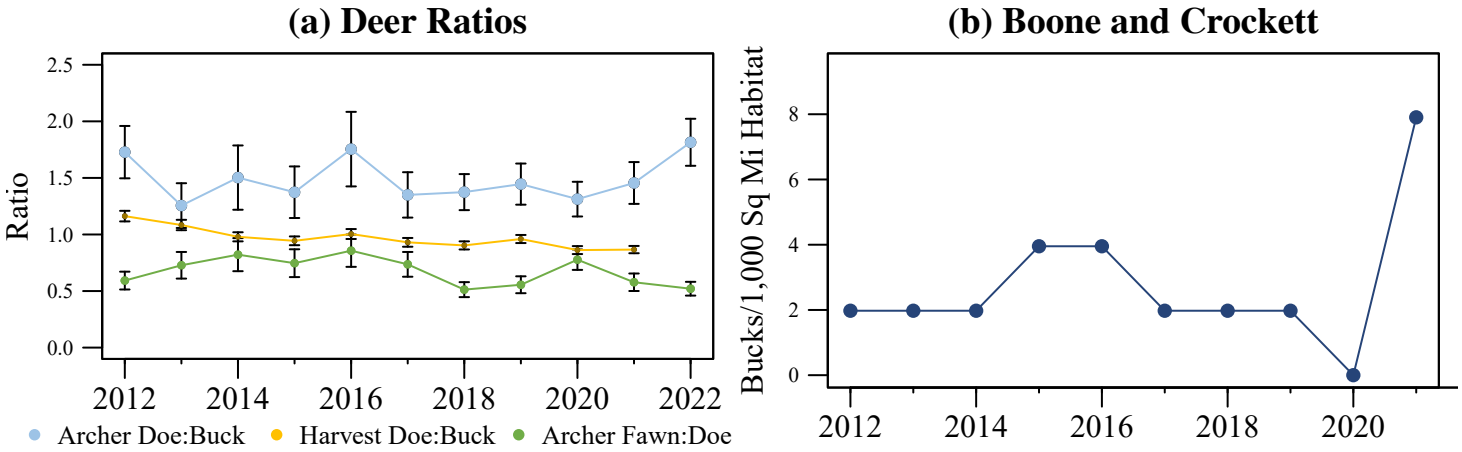

Figure 2. (a) Annual doe:buck ratios and fawn:doe ratios based on the Archer's Index and harvest records. (b) The number of Boone and Crockett bucks (minimum 160 score) per 1,000 square miles of deer habitat.

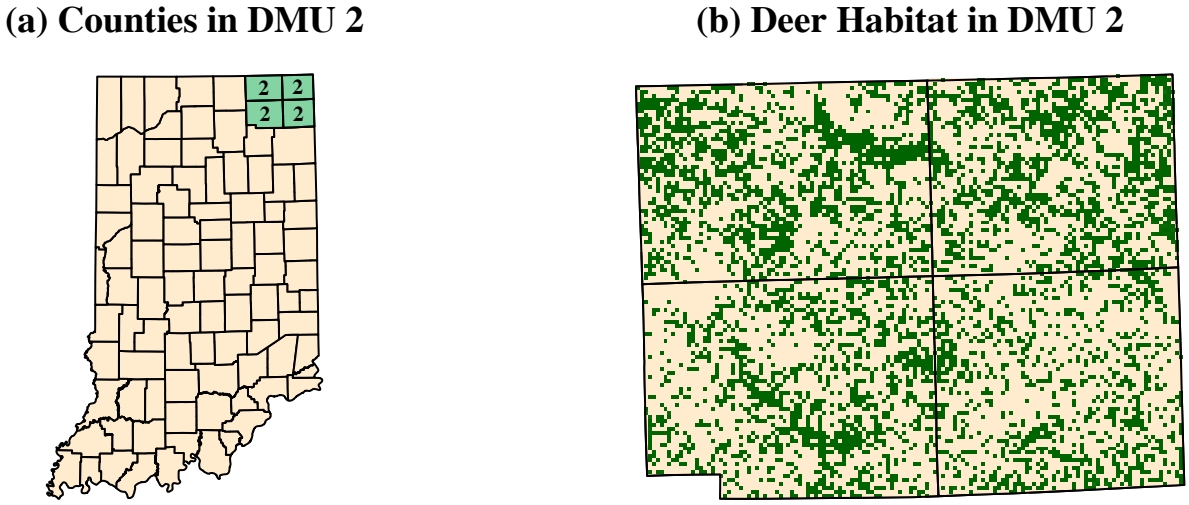

Figure 3. (a) Counties included in DMU 2 for summarizing harvest and deer management survey statistics. Labels are the 2022 county bonus antlerless quotas. (b) Green represents the land use types classified as deer habitat in DMU 2.

DMU 2: Northeast

3/24/2023

Deer Management Survey Results

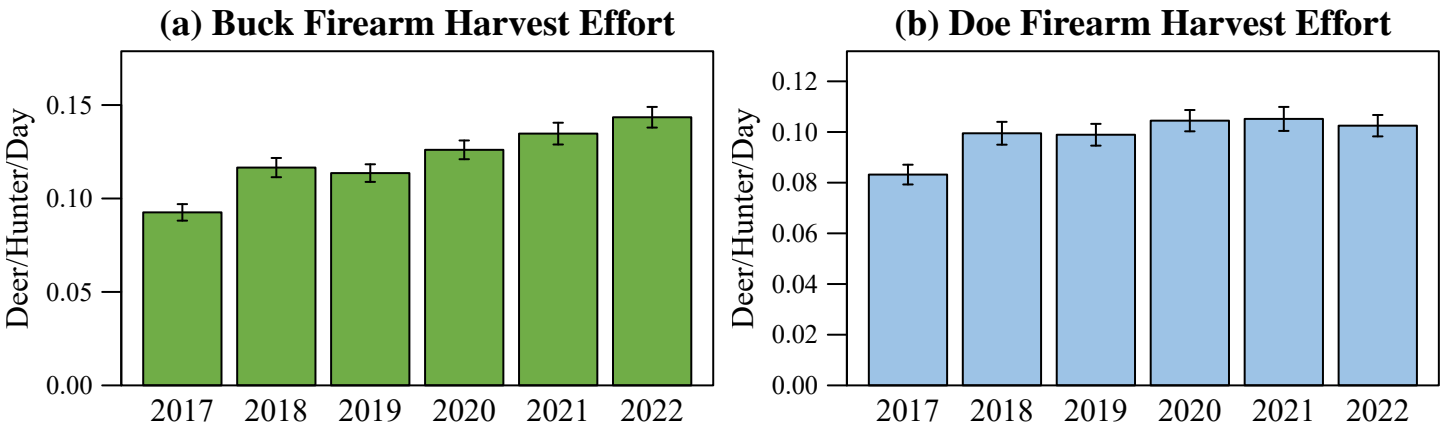

Figure 4. Firearm harvest effort is the number of bucks (a) and does (b) killed by firearms per hunter divided by the mean number of days hunted per hunter during the firearm season based on data reported in the deer management survey. Larger values (i.e taller bars) indicate less effort required to harvest a deer.

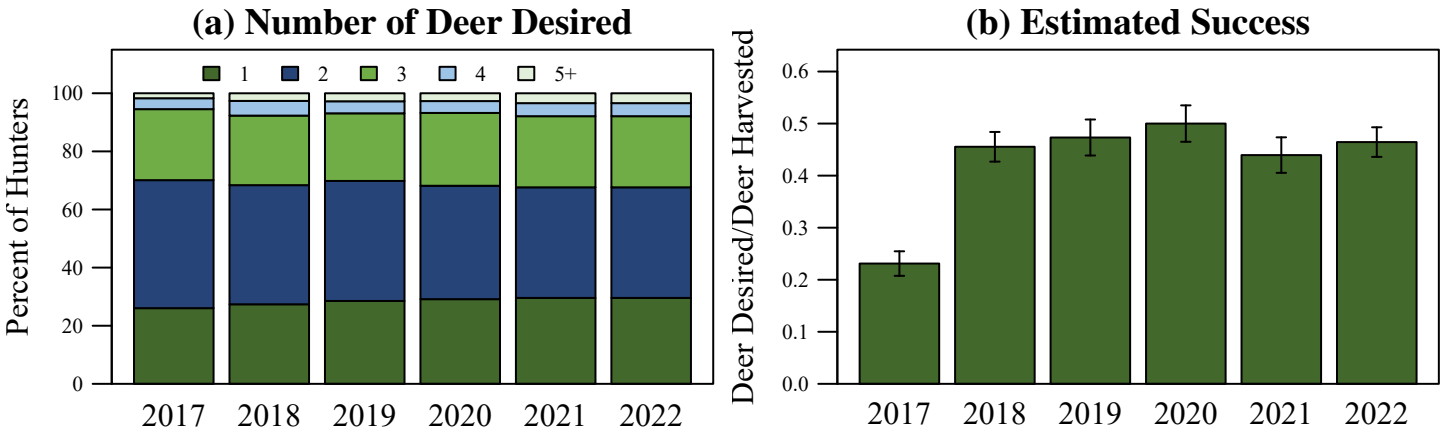

Figure 5. (a) The annual percent of hunters wishing to harvest each number of deer as reported in the deer management survey. (b) Success rate is estimated from the deer management survey as the Number of Harvested Deer/Number of Deer Desired (reported only; does not account for attempts that were not made). Larger values (i.e. taller bars) indicate greater success.

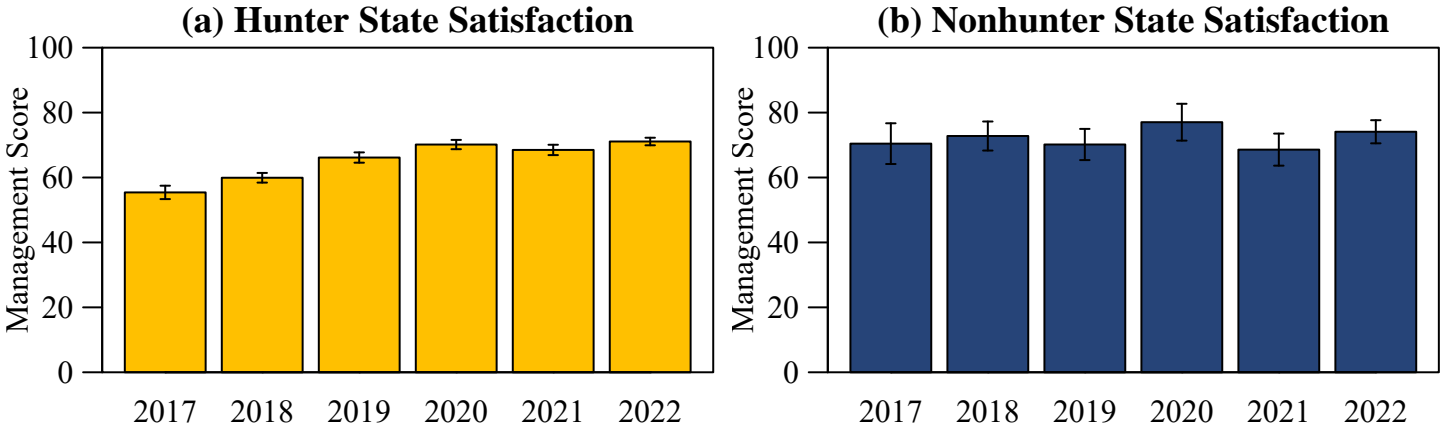

Figure 6. Hunters (a) and nonhunters (b) were asked to score the DNR's statewide deer management on a scale of 0 (poor) to 100 (excellent).

DMU 2: Northeast

3/24/2023

Deer Management Survey Results

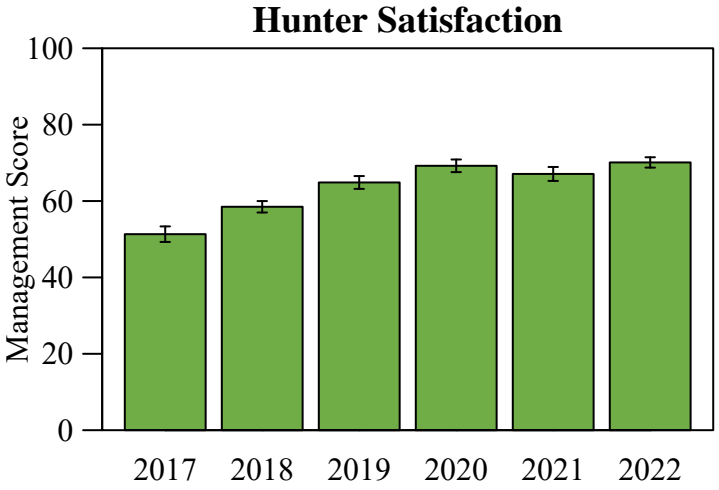

Figure 7. Hunters were asked to score the DNR's county deer management on a scale of 0 (poor) to 100 (excellent) for the county in DMU 2 where they hunt.

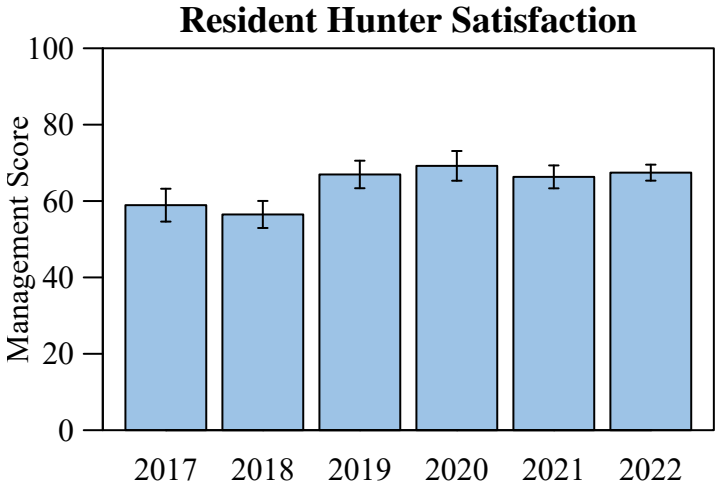

Figure 8. Hunters were asked to score the DNR's county deer management on a scale of 0 (poor) to 100 (excellent) for the county in DMU 2 where they live.

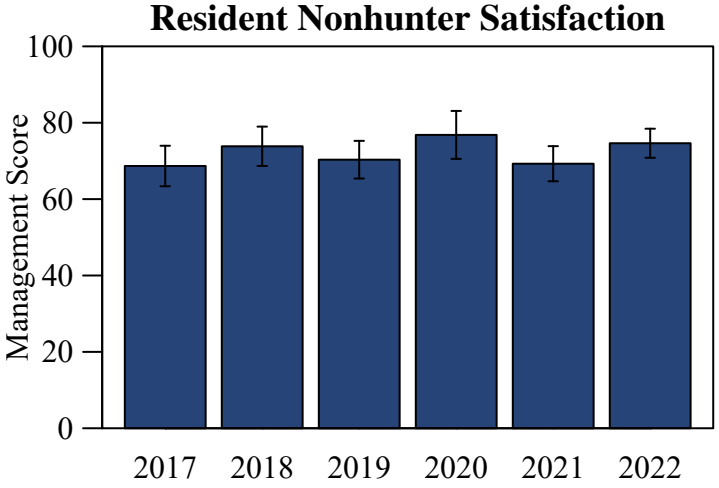

Figure 9. Nonhunters were asked to score the DNR's county deer management on a scale of 0 (poor) to 100 (excellent) for the county in DMU 2 where they live.

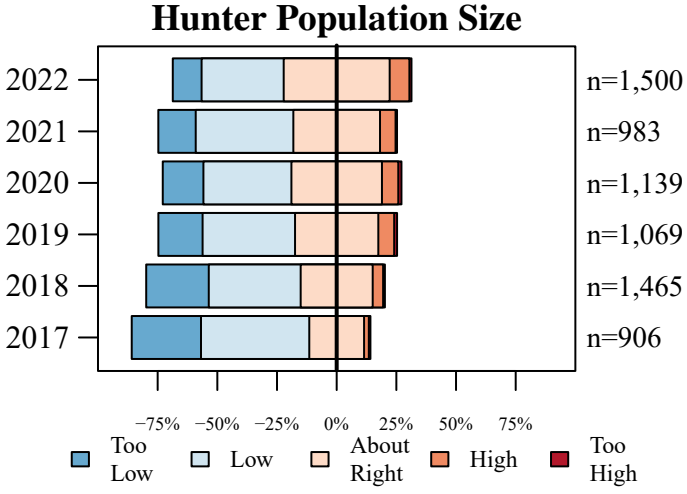

Figure 10. The current size of the deer population described by hunters in the county where they hunt in DMU 2.

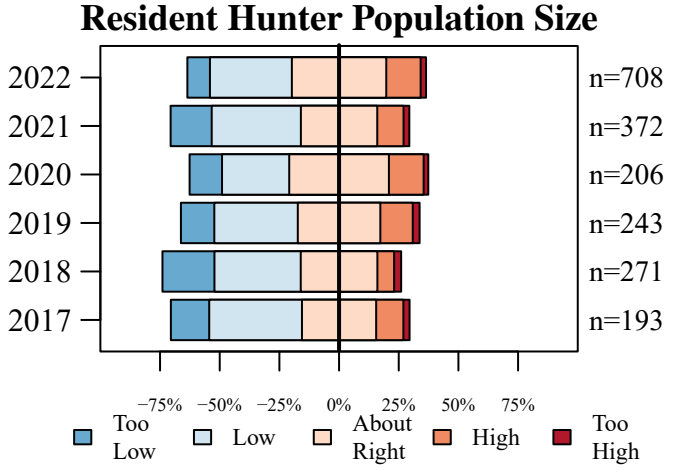

Figure 11. The current size of the deer population described by hunters in the county where they live in DMU 2.

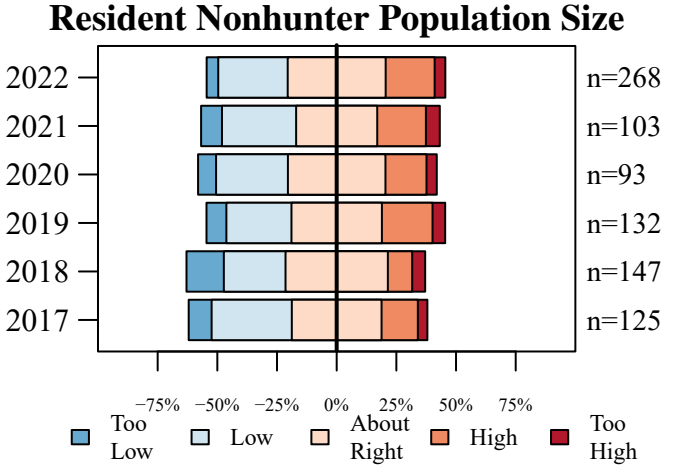

Figure 12. The current size of the deer population described by nonhunters in the county where they live in DMU 2.

DMU 2: Northeast

3/24/2023

Deer Management Survey Results

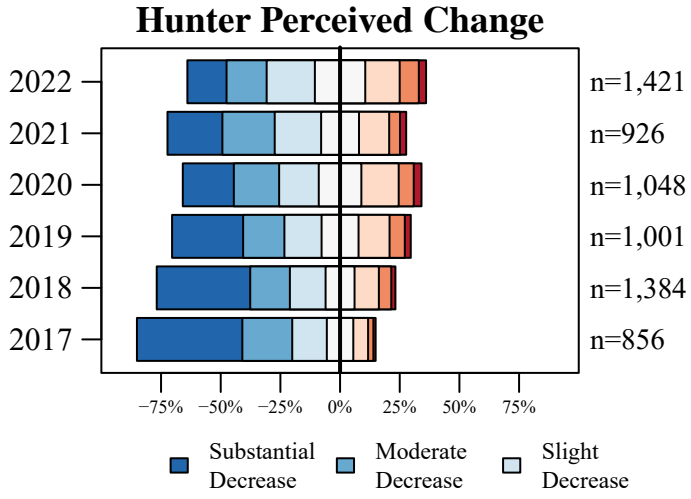

Figure 13. The number of deer seen compared to five years ago described by hunters in the county where they hunt in DMU 2.

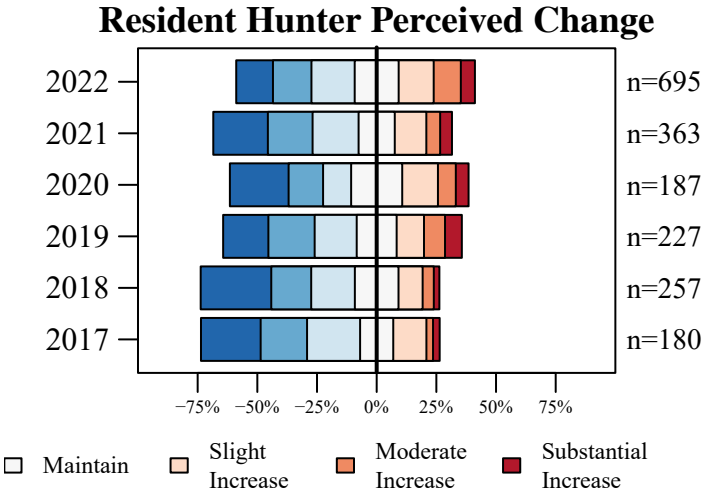

Figure 14. The number of deer seen compared to five years ago described by hunters in the county where they live in DMU 2.

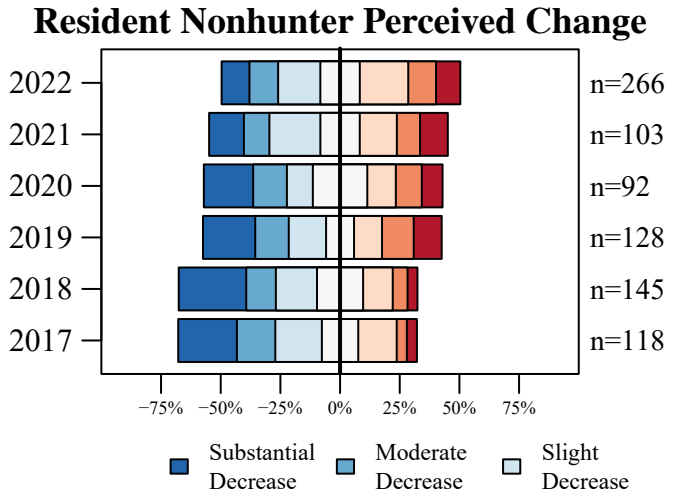

Figure 15. The number of deer seen compared to five years ago described by nonhunters in the county where they live in DMU 2.

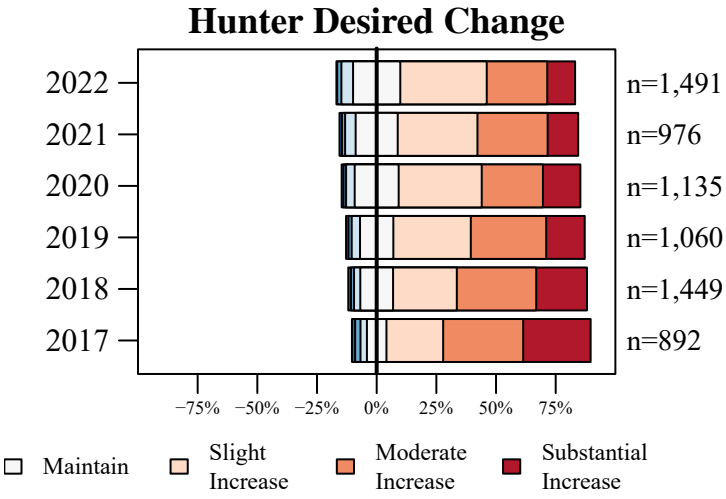

Figure 16. The desired change in the size of the deer population described by hunters in the county where they hunt in DMU 2.

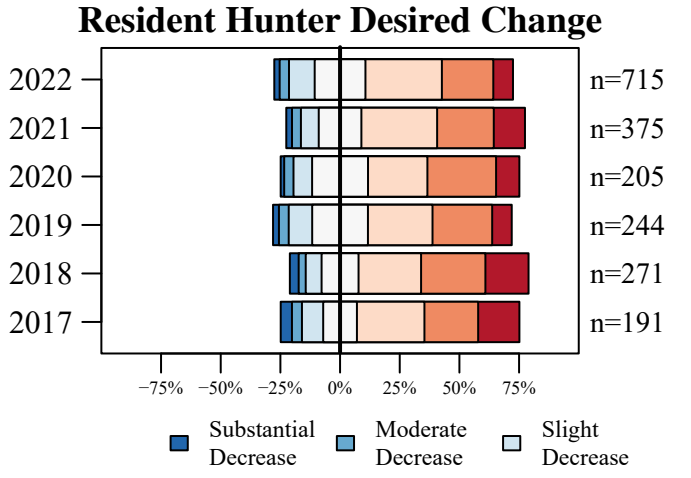

Figure 17. The desired change in the size of the deer population described by hunters in the county where they live in DMU 2.

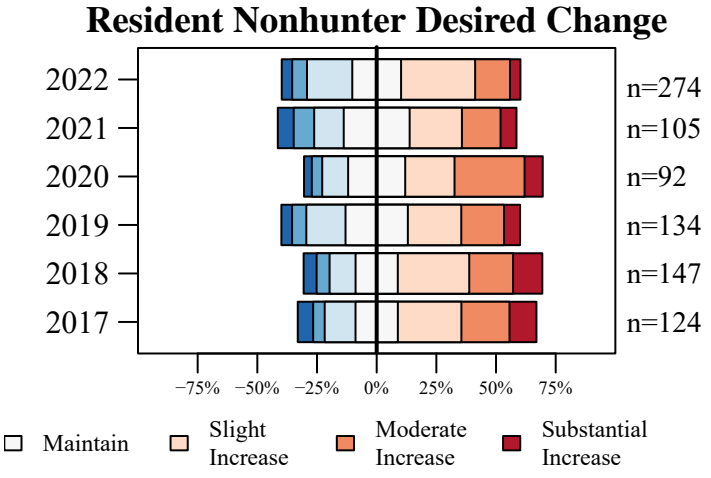

Figure 18. The desired change in the size of the deer population described by nonhunters in the county where they live in DMU 2.

DMU 2: Northeast

3/24/2023

Deer Management Survey Results

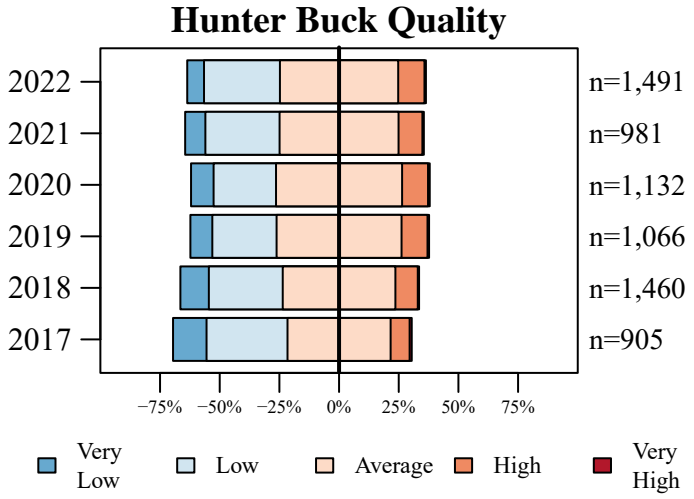

Figure 19. Hunters describe the quality of bucks in the county where they hunt in DMU 2.

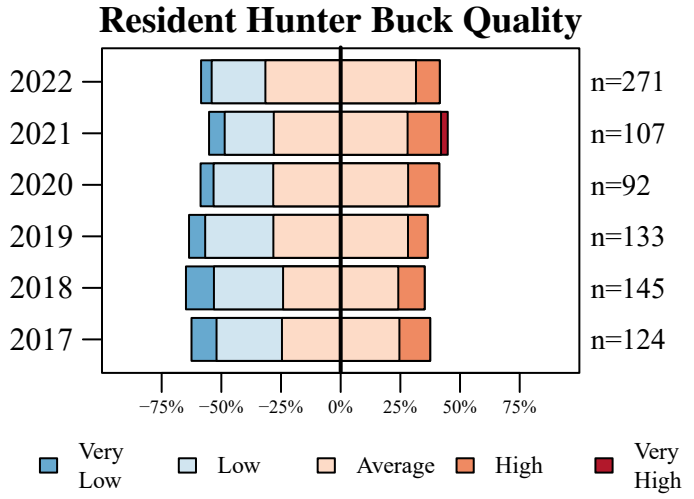

Figure 20. Hunters describe the quality of bucks in the county where they live in DMU 2.

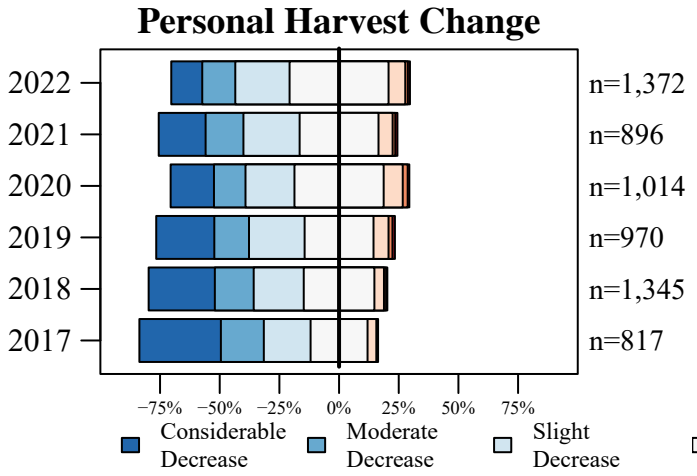

Figure 21. Opinion of hunters on how their personal number of harvested deer has changed over the last five years in a county in DMU 2.

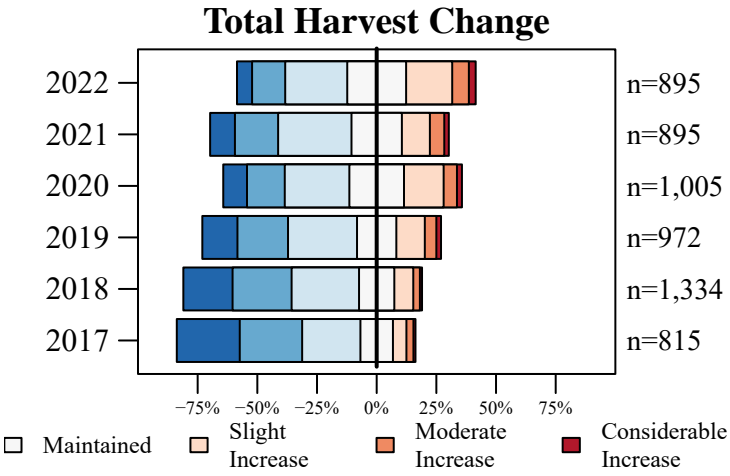

Figure 22. Opinion of hunters on how the total number of harvested deer has changed over the last five years in a county in DMU 2.

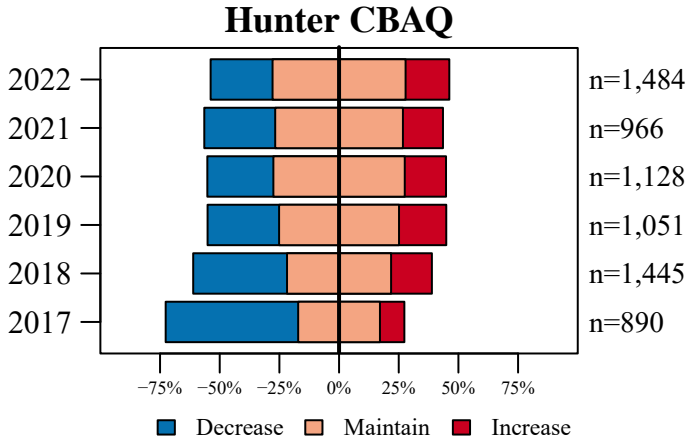

Figure 23. Opinion on how the County Bonus Antlerless Quota should change from hunters in the county where they hunt in DMU 2.

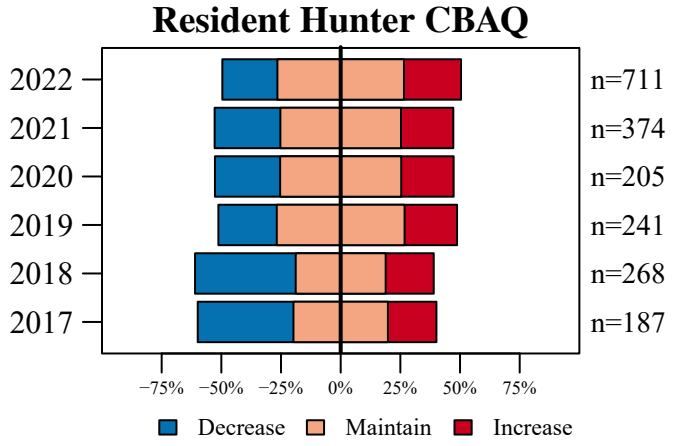

Figure 24. Opinion on how the County Bonus Antlerless Quota should change from hunters in the county where they live in DMU 2.

DMU 2: Northeast

3/24/2023

Deer Management Survey Results

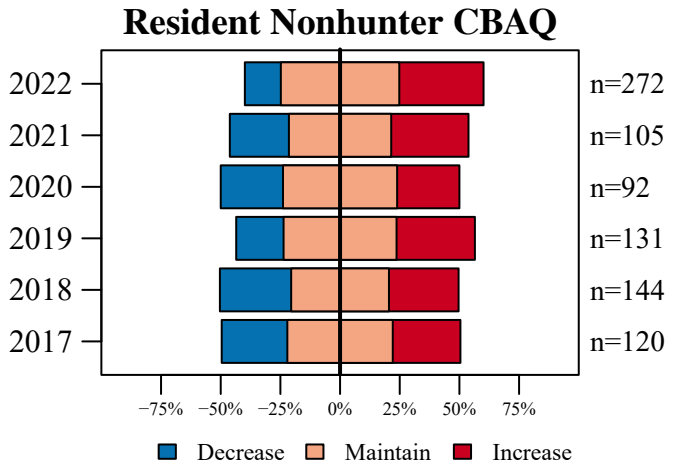

Figure 25. Opinion on how the County Bonus Antlerless Quota should change from nonhunters in the county where they live in DMU 2.

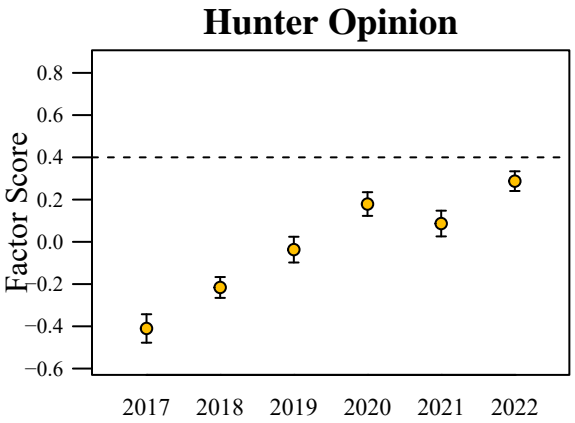

Figure 26. Hunter opinon scores over five years of the deer management survey. The score was aggregated using factor analysis of questions asked only to hunters. The dashed line represents the score if all questions are answered neutrally.

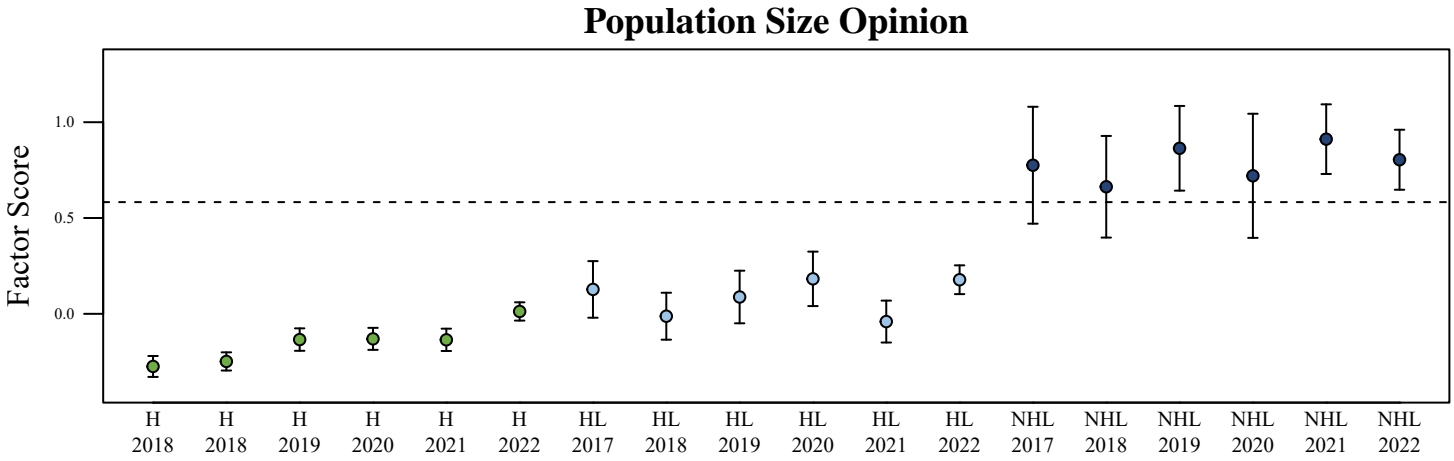

Figure 27. The opinion of nonhunters (NHL) and hunters in the county where they live (HL) and hunters in the county where they hunt (H) on deer population size. The score was aggregated using factor analysis of questions asked to all participants. The dashed line represents the score if all questions are answered neutrally.

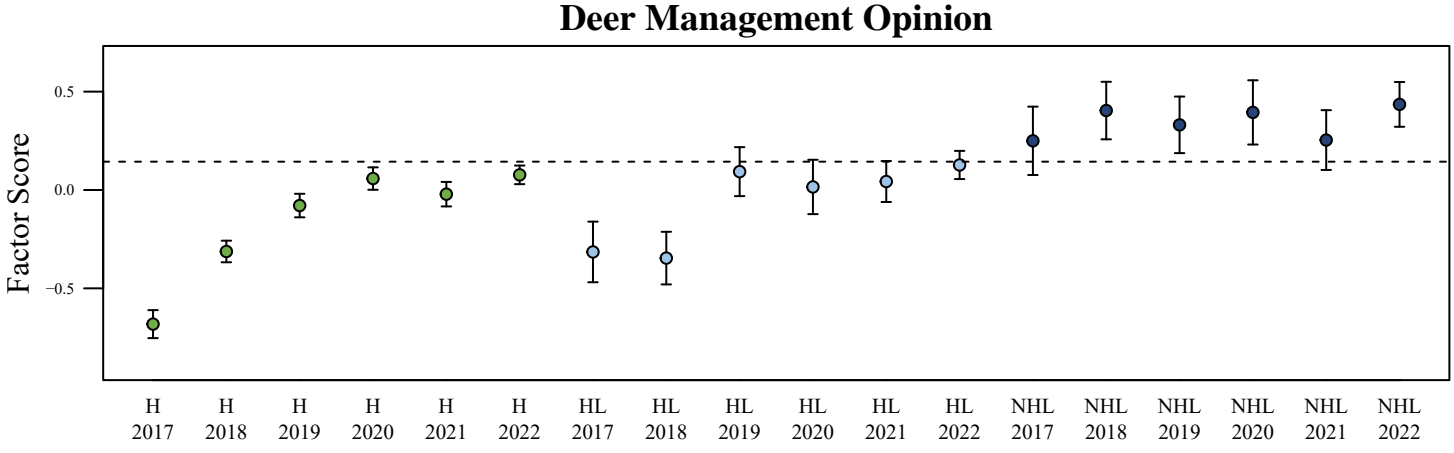

Figure 28. The opinion of nonhunters (NHL) and hunters in the county where they live (HL) and hunters in the county where they hunt (H) on deer management. The score was aggregated using factor analysis of questions asked to all participants. The dashed line represents the score if all questions are answered neutrally.

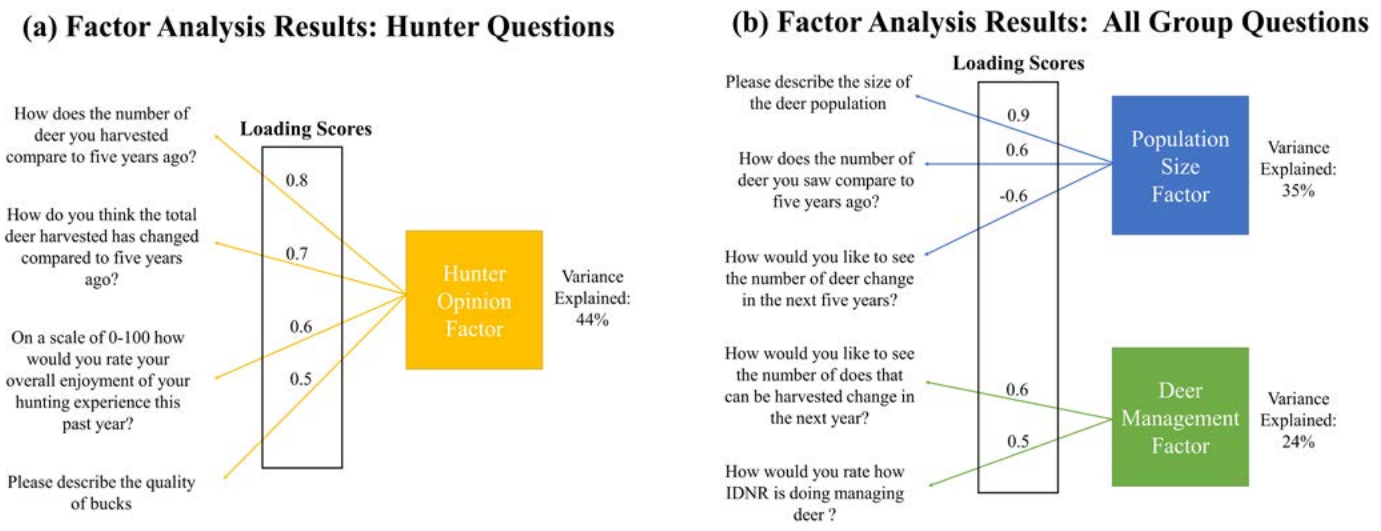

Figure 29. Results from two factor analyses used to develop the hunter opinion (a), population opinion (b), management opinion (b), and scores. Higher loading scores indicate a stronger correlation between the original question and the derived factor. These figures are included to help interpret Figure 26, Figure 27, and Figure 28.

DMU 3: West Central

3/24/2023

Total Square Miles: 4,025
Square Miles of Deer Habitat: 565
Percent Deer Habitat: 14

Table 1. Total harvest, buck harvest, and doe harvest (error < 1 percent). Damage permits are issued by DNR to landowners to control deer damage. Deer vehicle collisions (DVC) and miles traveled are reported by the Indiana Department of Transportation. Mean CBAQ is the average county bonus antlerless quota of all counties in the DMU. The trend in total harvest, buck harvest, doe harvest, and DVCs are in standard deviations (SD) and are equivalent to effect size. A change greater than 2 SD is considered both a large and statistically significant effect size.

Year	Total	Total Trend in SD	Buck Harvest	Buck Trend in SD	Buck Harvest per SQ MI Habitat	Doe Harvest	Doe Trend in SD	Doe Harvest per SQ MI Habitat	% Doe in Harvest	Damage Permit Deer Taken	DVC per Billion Miles Traveled	DVC Trend in SD	Mean CBAQ
2009	9,446		4,831		8.6	4,615		8.2	48.9		343.1		5.3
2010	10,294	3.0	5,379	3.3	9.5	4,915	2.0	8.7	47.7		308.4	-2.1	5.3
2011	10,218	1.4	5,338	1.3	9.4	4,880	1.3	8.6	47.8		301.7	-2.1	5.9
2012	10,781	2.4	5,001	-0.6	8.9	5,780	5.5	10.2	53.6		271.4	-2.5	5.9
2013	9,176	-1.6	4,456	-2.8	7.9	4,720	-0.5	8.4	51.4		309.3	-0.2	5.4
2014	8,698	-2.0	4,424	-1.5	7.8	4,274	-1.5	7.6	49.1		293.9	-0.5	4.3
2015	8,344	-1.7	4,380	-1.2	7.8	3,964	-1.7	7.0	47.5		274.4	-1.5	4.3
2016	8,057	-1.3	4,471	-0.6	7.9	3,586	-1.6	6.3	44.5	102	257.4	-2.0	4.2
2017	7,017	-1.9	3,705	-3.3	6.6	3,312	-1.4	5.9	47.2	61	276.3	-0.2	2.9
2018	7,191	-1.3	4,023	-0.8	7.1	3,168	-1.4	5.6	44.1	42	290.3	0.4	2.1
2019	8,123	0.4	4,695	1.5	8.3	3,428	-0.5	6.1	42.2	44	292.5	1.0	1.8
2020	9,358	2.7	5,226	2.5	9.2	4,132	2.1	7.3	44.2	39	290.8	0.9	1.8
2021	8,240	0.3	4,874	0.8	8.6	3,366	-0.4	6.0	40.8	48	298.6	1.1	1.8
2022	9,444	1.6	5,580	1.7	9.9	3,864	1.0	6.8	40.9	55	311.3	2.6	1.9

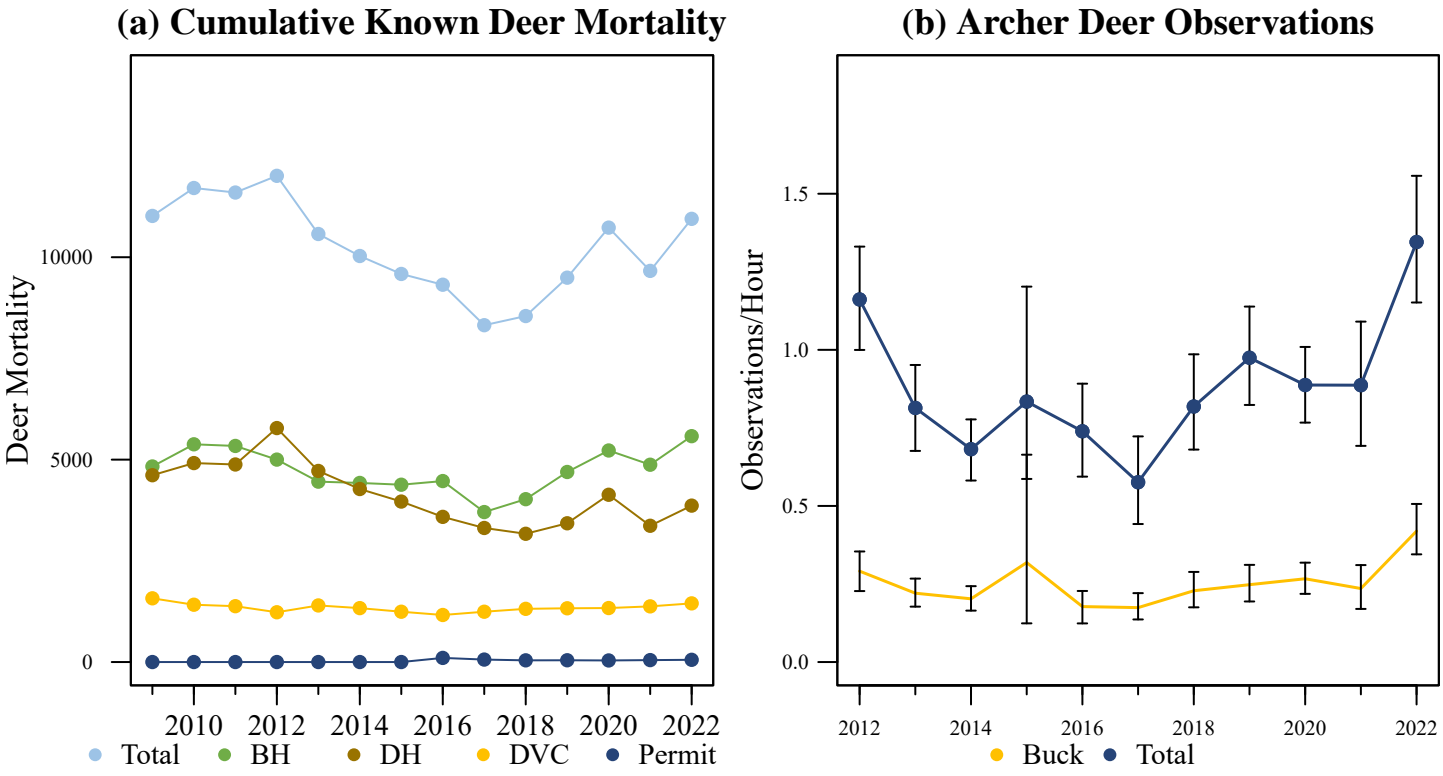

Figure 1. (a) The total known annual deer mortality based on buck harvests (BH), doe harvests (DH), deer vehicle collisions (DVC), and deer permit takes. (b) Total deer and buck observations per hour based on the Archer's Index.

DMU 3: West Central

3/24/2023

Total Square Miles: 4,025
Square Miles of Deer Habitat: 565
Percent Deer Habitat: 14

Table 2. Estimated number of antlered (A) and antlerless (AL) deer harvested per hunter. Estimated totals may not match exactly with total number of deer harvested. Reporting errors are examined and investigated as they are located; therefore, subsequent reports may contain corrected totals.

Year	Total Hunters	0 A	1 A	2 A	3 A	0 AL	1 AL	2 AL	3 AL	4 AL	5 AL	6 AL	7 AL	8 AL	9 AL	10 AL
2016	6,209	2,547	3,655	7	0	2,797	2,633	636	102	30	9	2	0	0	0	0
2017	5,364	2,439	2,916	8	0	2,213	2,388	629	102	31	1	0	0	0	0	0
2018	5,646	2,302	3,329	15	0	2,519	2,493	570	59	3	2	0	0	0	0	0
2019	6,215	2,246	3,955	14	0	2,873	2,625	651	54	10	1	1	0	0	0	0
2020	6,993	2,682	4,290	21	0	3,038	3,006	853	77	16	2	0	0	0	1	0
2021	6,418	2,229	4,183	6	0	3,159	2,543	657	52	5	1	0	1	0	0	0
2022	7,116	2,282	4,820	13	1	3,475	2,787	773	66	12	2	1	0	0	0	0

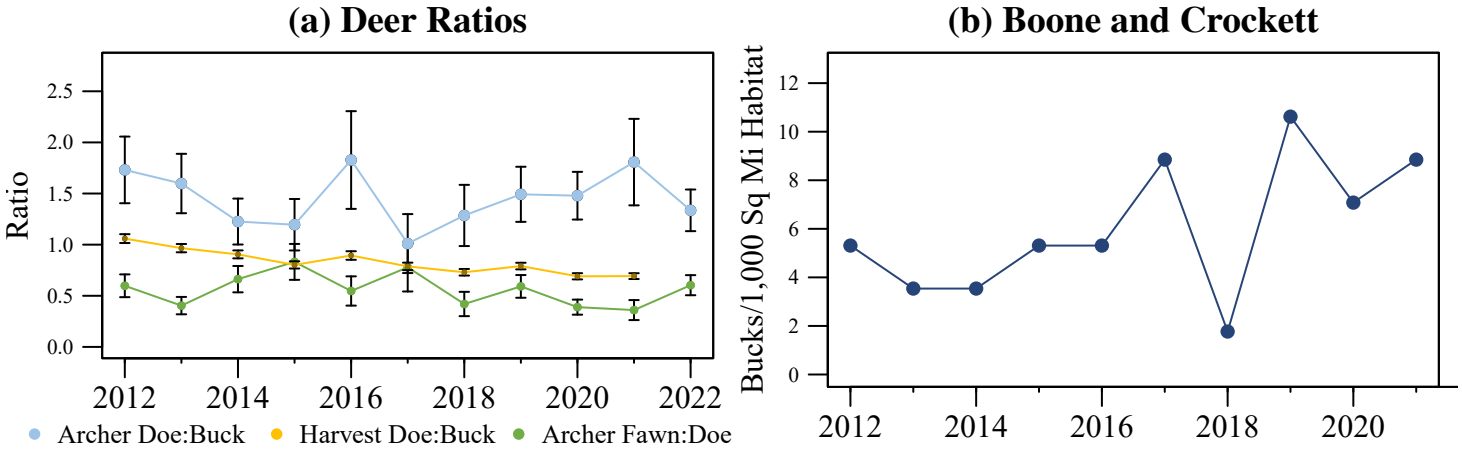

Figure 2. (a) Annual doe:buck ratios and fawn:doe ratios based on the Archer's Index and harvest records. (b) The number of Boone and Crockett bucks (minimum 160 score) per 1,000 square miles of deer habitat.

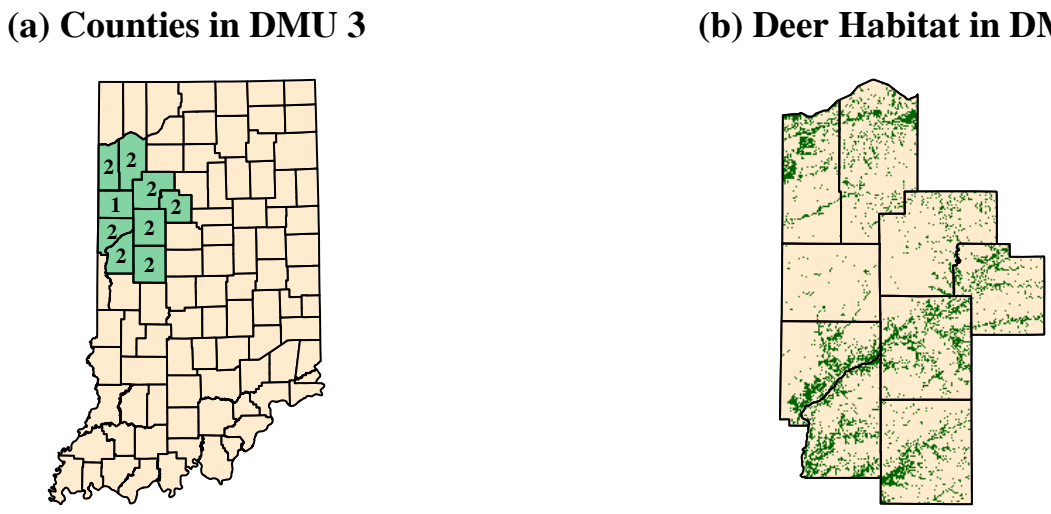

Figure 3. (a) Counties included in DMU 3 for summarizing harvest and deer management survey statistics. Labels are the 2022 county bonus antlerless quotas. (b) Green represents the land use types classified as deer habitat in DMU 3.

DMU 3: West Central

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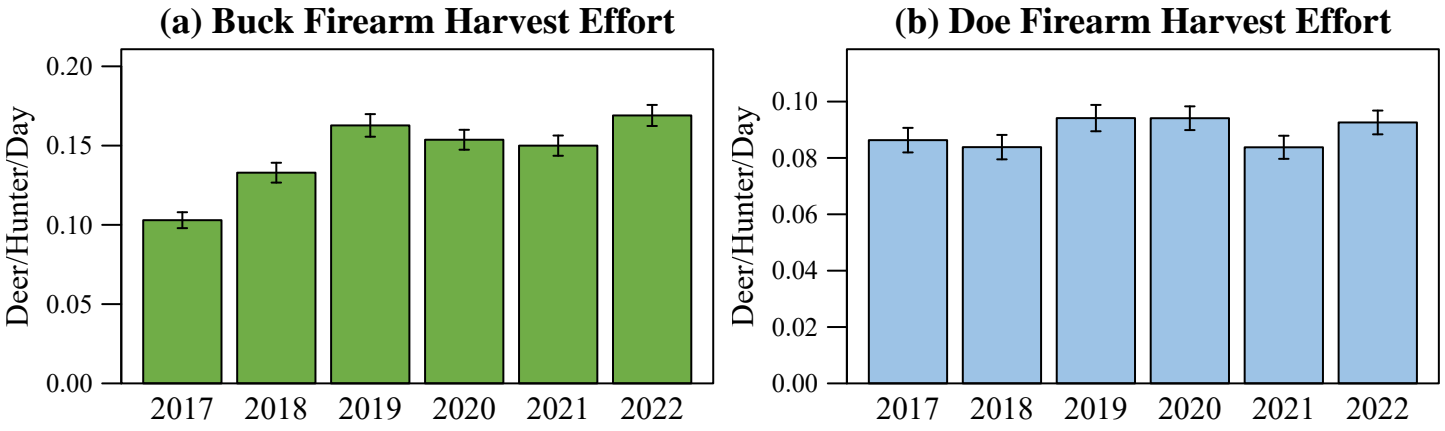

Figure 4. Firearm harvest effort is the number of bucks (a) and does (b) killed by firearms per hunter divided by the mean number of days hunted per hunter during the firearm season based on data reported in the deer management survey. Larger values (i.e taller bars) indicate less effort required to harvest a deer.

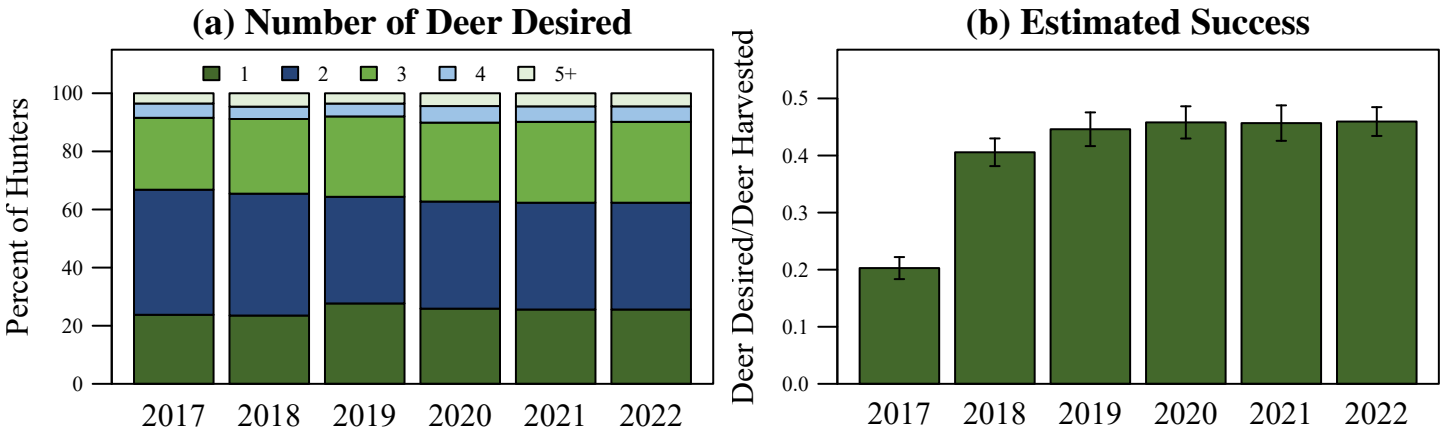

Figure 5. (a) The annual percent of hunters wishing to harvest each number of deer as reported in the deer management survey. (b) Success rate is estimated from the deer management survey as the Number of Harvested Deer/Number of Deer Desired (reported only; does not account for attempts that were not made). Larger values (i.e. taller bars) indicate greater success.

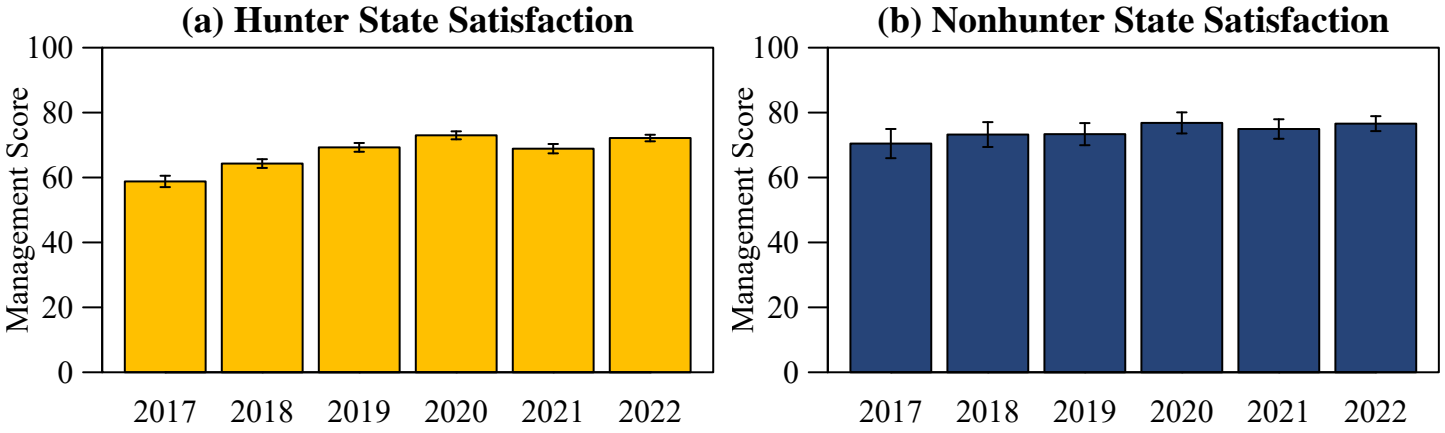

Figure 6. Hunters (a) and nonhunters (b) were asked to score the DNR's statewide deer management on a scale of 0 (poor) to 100 (excellent).

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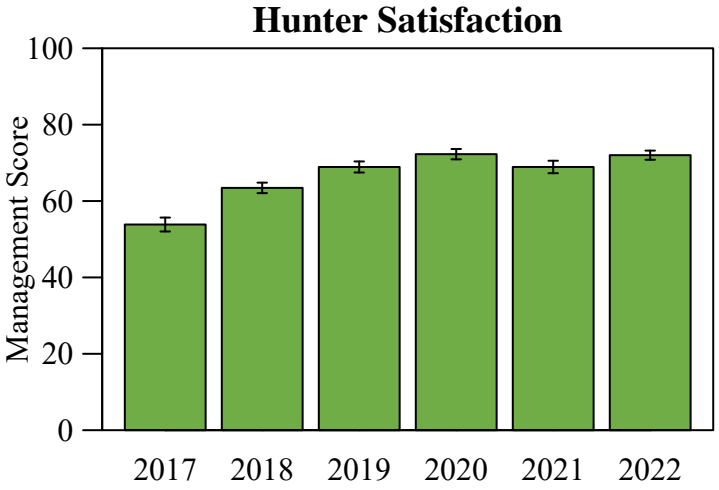

Figure 7. Hunters were asked to score the DNR's county deer management on a scale of 0 (poor) to 100 (excellent) for the county in DMU 3 where they hunt.

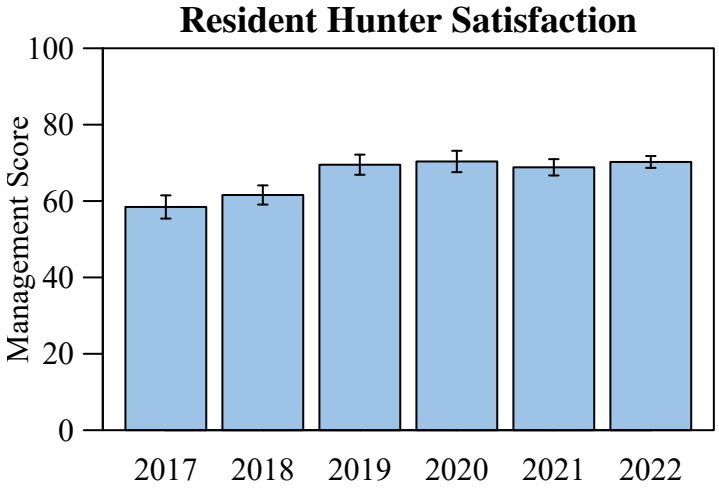

Figure 8. Hunters were asked to score the DNR's county deer management on a scale of 0 (poor) to 100 (excellent) for the county in DMU 3 where they live.

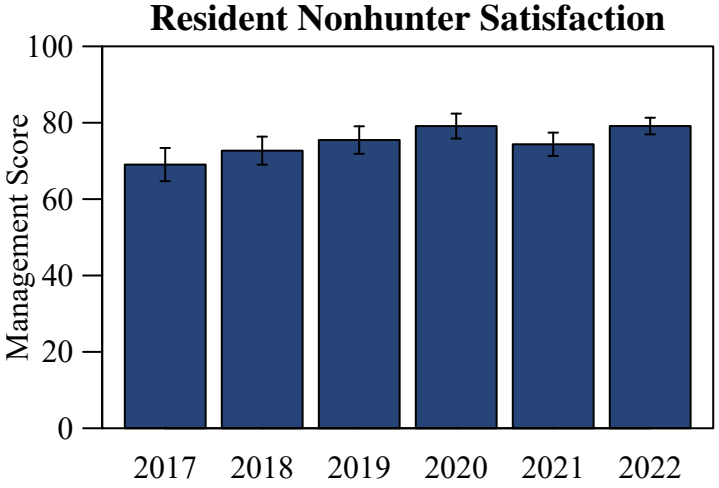

Figure 9. Nonhunters were asked to score the DNR's county deer management on a scale of 0 (poor) to 100 (excellent) for the county in DMU 3 where they live.

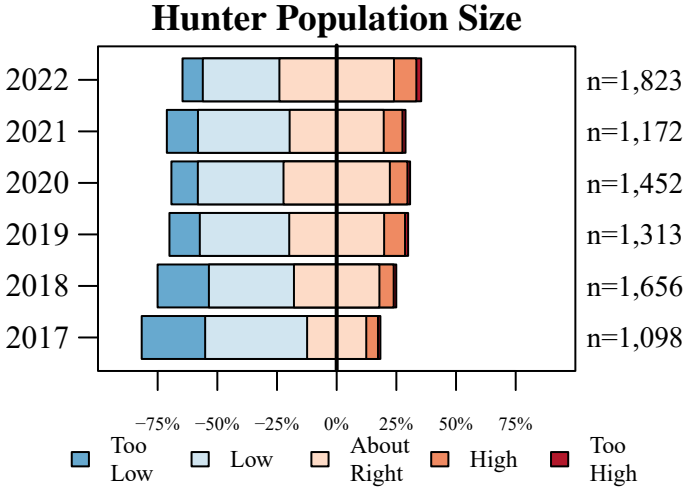

Figure 10. The current size of the deer population described by hunters in the county where they hunt in DMU 3.

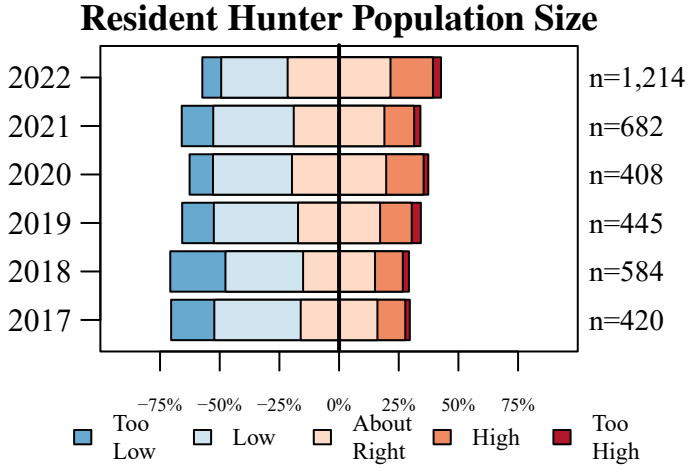

Figure 11. The current size of the deer population described by hunters in the county where they live in DMU 3.

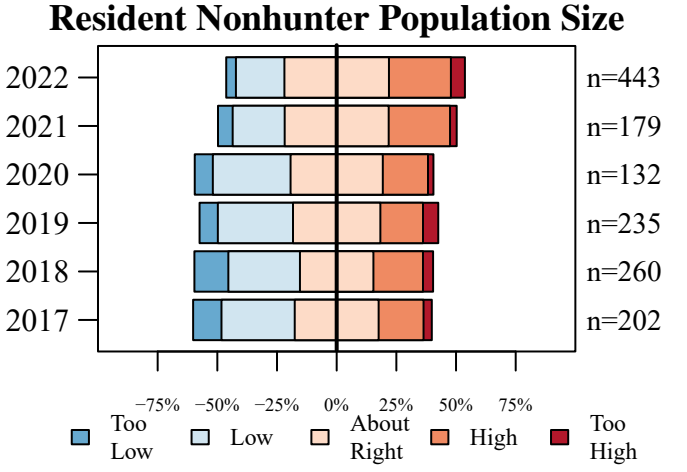

Figure 12. The current size of the deer population described by nonhunters in the county where they live in DMU 3.

DMU 3: West Central

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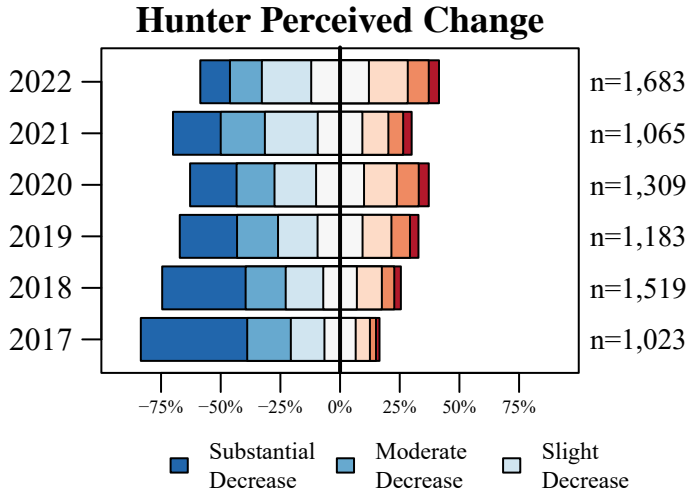

Figure 13. The number of deer seen compared to five years ago described by hunters in the county where they hunt in DMU 3.

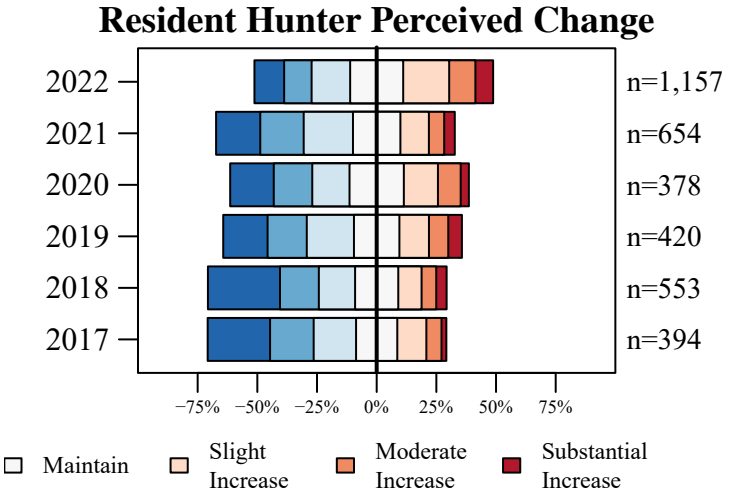

Figure 14. The number of deer seen compared to five years ago described by hunters in the county where they live in DMU 3.

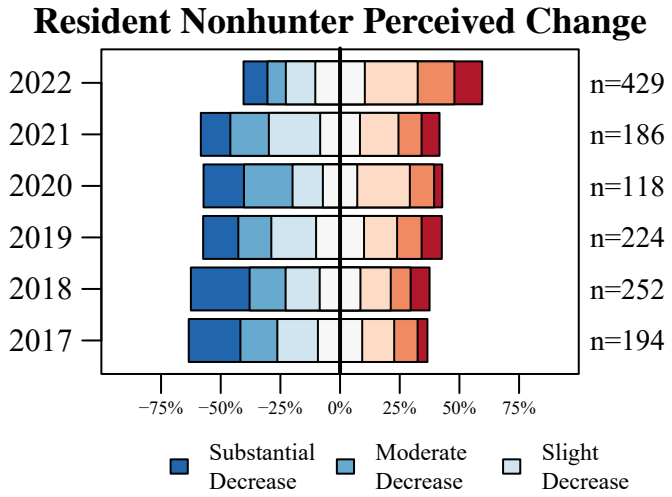

Figure 15. The number of deer seen compared to five years ago described by nonhunters in the county where they live in DMU 3.

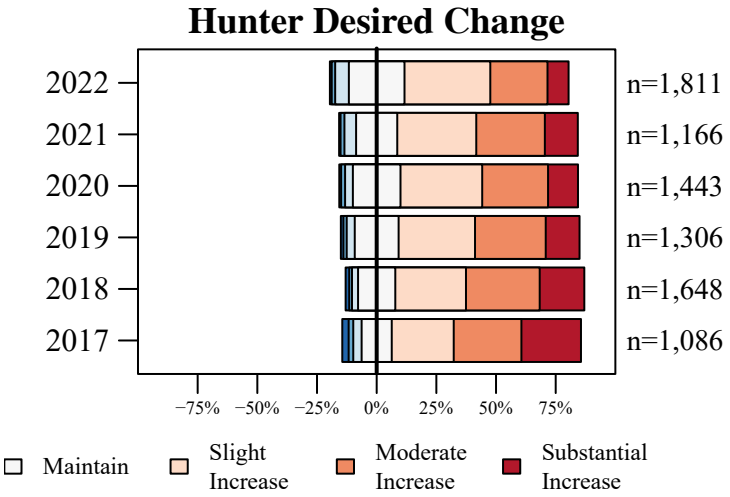

Figure 16. The desired change in the size of the deer population described by hunters in the county where they hunt in DMU 3.

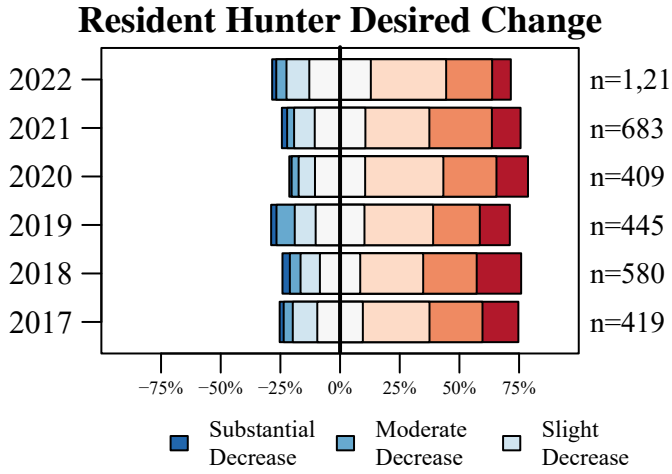

Figure 17. The desired change in the size of the deer population described by hunters in the county where they live in DMU 3.

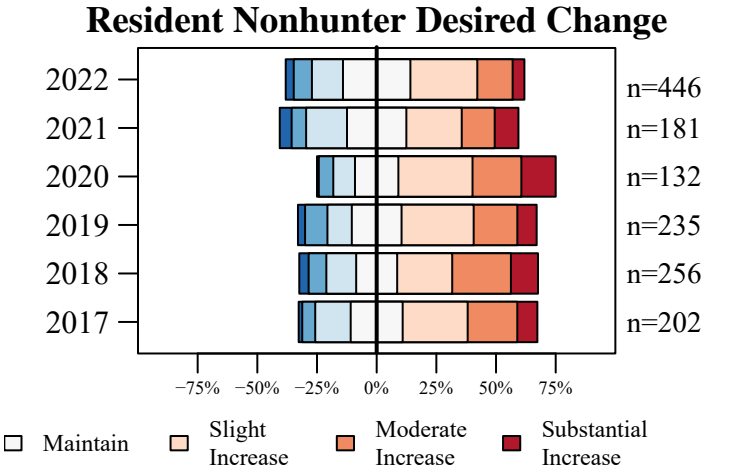

Figure 18. The desired change in the size of the deer population described by nonhunters in the county where they live in DMU 3.

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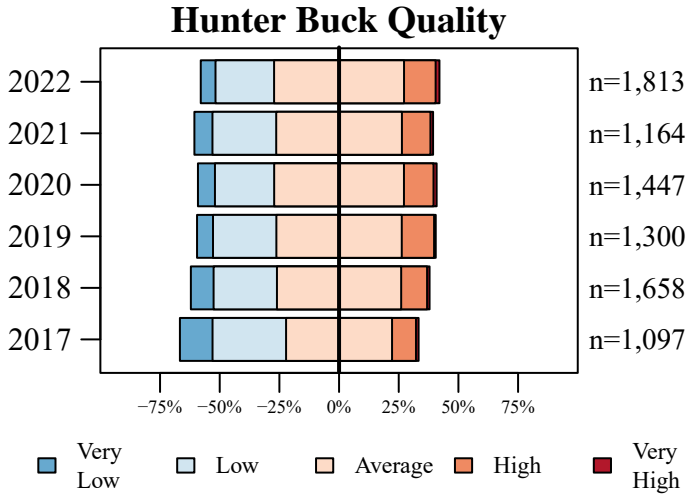

Figure 19. Hunters describe the quality of bucks in the county where they hunt in DMU 3.

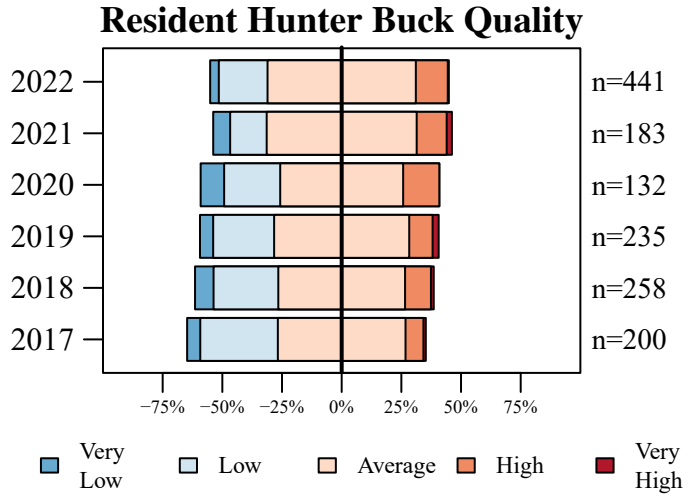

Figure 20. Hunters describe the quality of bucks in the county where they live in DMU 3.

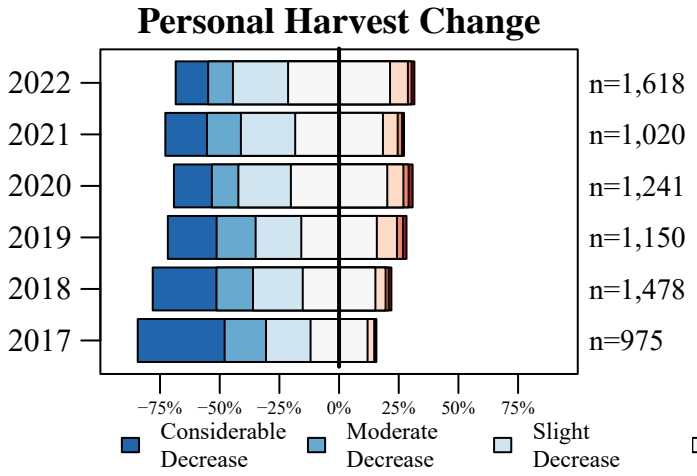

Figure 21. Opinion of hunters on how their personal number of harvested deer has changed over the last five years in a county in DMU 3.

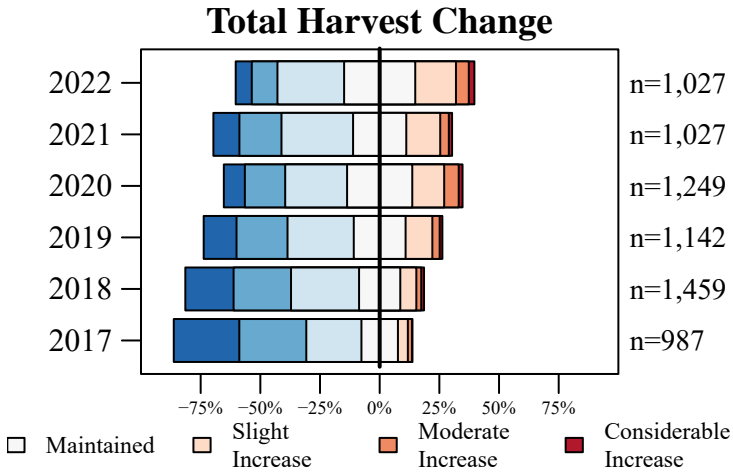

Figure 22. Opinion of hunters on how the total number of harvested deer has changed over the last five years in a county in DMU 3.

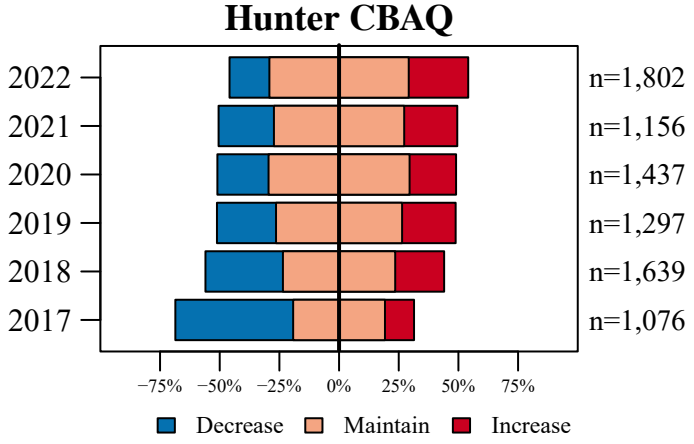

Figure 23. Opinion on how the County Bonus Antlerless Quota should change from hunters in the county where they hunt in DMU 3.

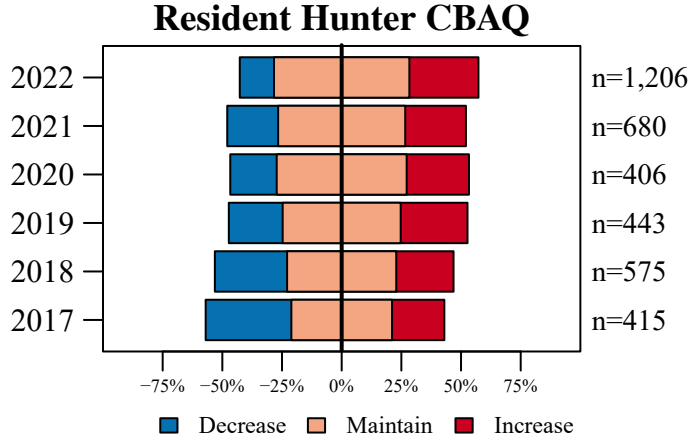

Figure 24. Opinion on how the County Bonus Antlerless Quota should change from hunters in the county where they live in DMU 3.

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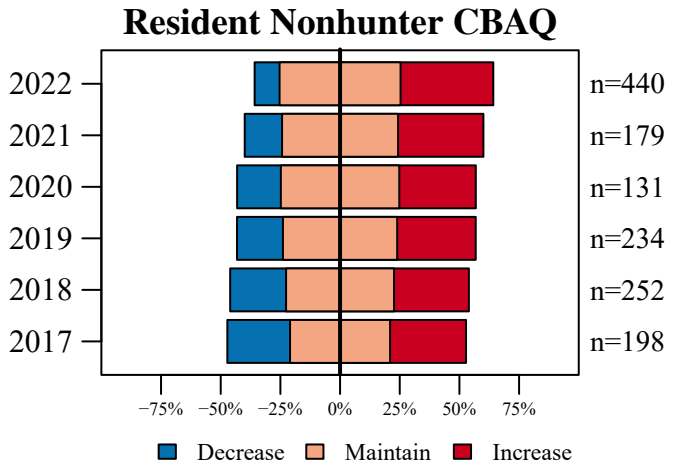

Figure 25. Opinion on how the County Bonus Antlerless Quota should change from nonhunters in the county where they live in DMU 3.

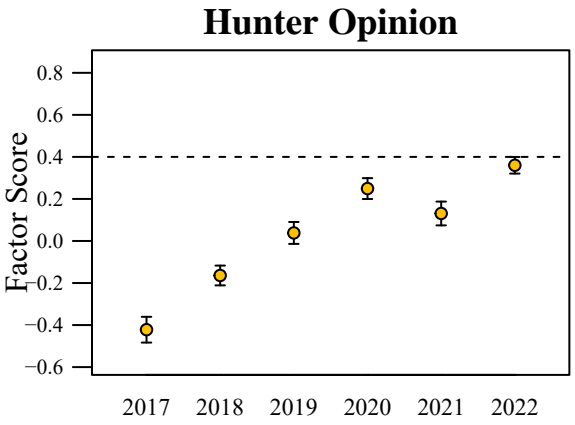

Figure 26. Hunter opinon scores over five years of the deer management survey. The score was aggregated using factor analysis of questions asked only to hunters. The dashed line represents the score if all questions are answered neutrally.

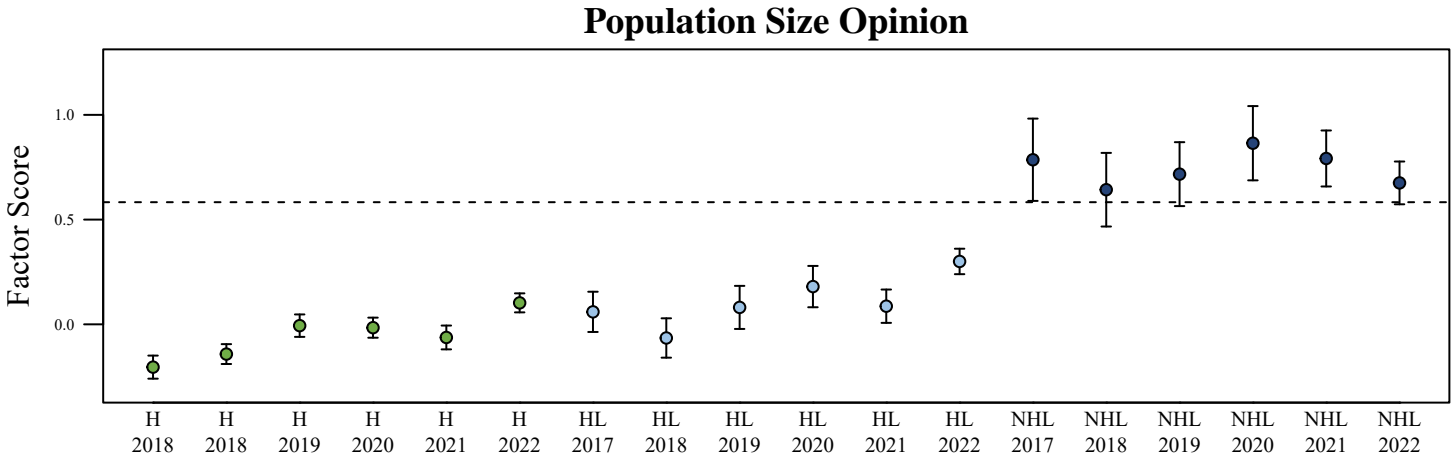

Figure 27. The opinion of nonhunters (NHL) and hunters in the county where they live (HL) and hunters in the county where they hunt (H) on deer population size. The score was aggregated using factor analysis of questions asked to all participants. The dashed line represents the score if all questions are answered neutrally.

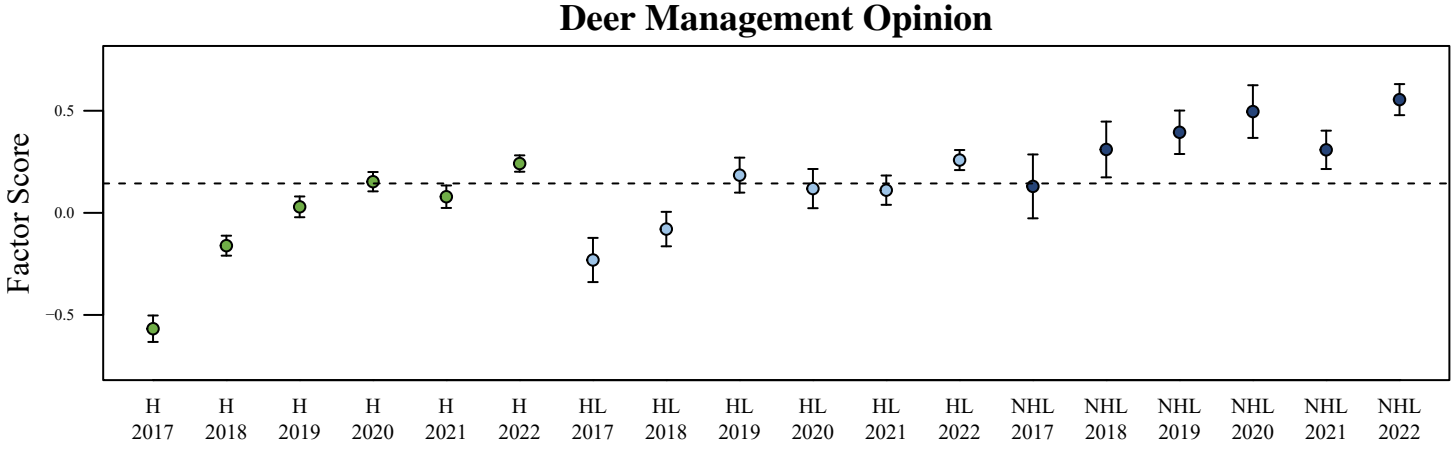

Figure 28. The opinion of nonhunters (NHL) and hunters in the county where they live (HL) and hunters in the county where they hunt (H) on deer management. The score was aggregated using factor analysis of questions asked to all participants. The dashed line represents the score if all questions are answered neutrally.

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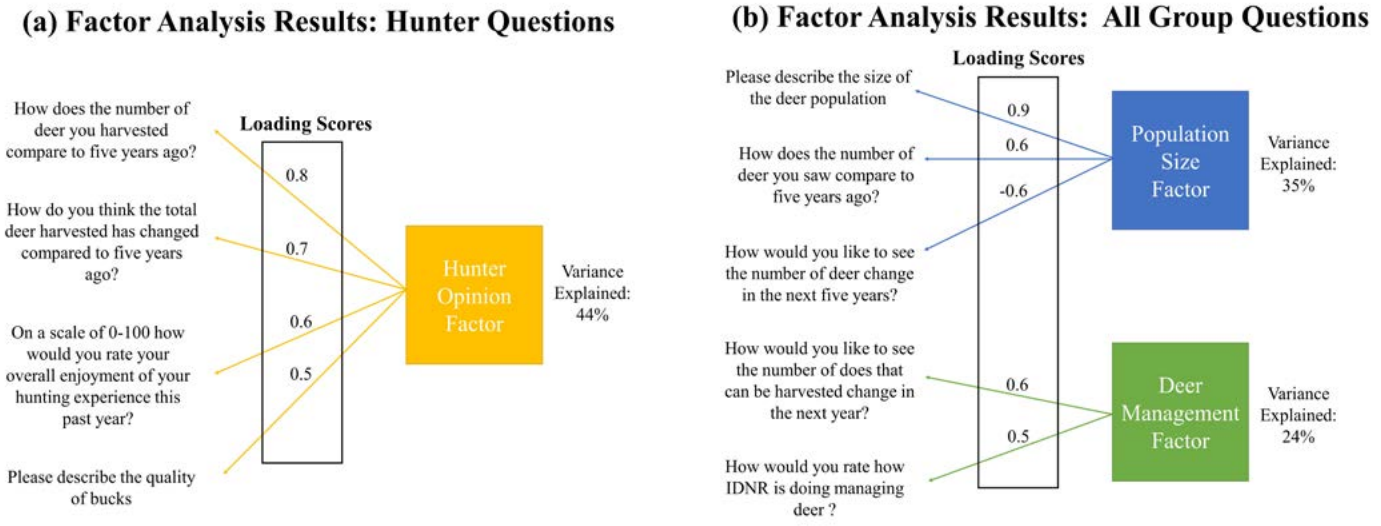


Figure 29. Results from two factor analyses used to develop the hunter opinion (a), population opinion (b), management opinion (b), and scores. Higher loading scores indicate a stronger correlation between the original question and the derived factor. These figures are included to help interpret Figure 26, Figure 27, and Figure 28.

DMU 4: East Central

3/24/2023

Total Square Miles: 9,965
Square Miles of Deer Habitat: 1,589
Percent Deer Habitat: 16

Table 1. Total harvest, buck harvest, and doe harvest (error < 1 percent). Damage permits are issued by DNR to landowners to control deer damage. Deer vehicle collisions (DVC) and miles traveled are reported by the Indiana Department of Transportation. Mean CBAQ is the average county bonus antlerless quota of all counties in the DMU. The trend in total harvest, buck harvest, doe harvest, and DVCs are in standard deviations (SD) and are equivalent to effect size. A change greater than 2 SD is considered both a large and statistically significant effect size.

Year	Total	Total Trend in SD	Buck Harvest	Buck Trend in SD	Buck Harvest per SQ MI Habitat	Doe Harvest	Doe Trend in SD	Doe Harvest per SQ MI Habitat	% Doe in Harvest	Damage Permit Deer Taken	DVC per Billion Miles Traveled	DVC Trend in SD	Mean CBAQ
2009	18,223		9,567		6.0	8,656		5.4	47.5		174.5		3.2
2010	17,914	0.7	9,538	0.6	6.0	8,376	0.6	5.3	46.8		164.3	-1.3	3.5
2011	18,487	1.2	9,673	0.8	6.1	8,814	1.7	5.5	47.7		162.1	-1.9	3.9
2012	18,258	0.5	8,873	-2.0	5.6	9,385	3.6	5.9	51.4		150.8	-2.5	3.8
2013	17,243	-1.5	8,733	-1.6	5.5	8,510	-0.4	5.4	49.4		146.7	-1.8	3.5
2014	18,029	0.0	9,321	0.1	5.9	8,708	-0.1	5.5	48.3		154.2	-0.5	3.4
2015	18,299	0.7	9,755	1.3	6.1	8,544	-0.6	5.4	46.7		155.7	0.0	3.3
2016	17,875	-0.4	9,838	1.2	6.2	8,037	-2.1	5.1	45.0	44	136.5	-3.0	3.3
2017	16,481	-3.4	8,651	-1.3	5.4	7,830	-1.7	4.9	47.5	43	149.3	0.1	3.0
2018	16,985	-0.8	9,476	0.4	6.0	7,509	-2.2	4.7	44.2	43	152.3	0.5	1.9
2019	18,638	1.4	10,644	2.6	6.7	7,994	-0.3	5.0	42.9	69	155.3	0.7	1.6
2020	20,441	3.1	11,337	2.3	7.1	9,104	3.0	5.7	44.5	51	145.3	-0.6	1.6
2021	18,006	-0.1	10,393	0.4	6.5	7,613	-0.8	4.8	42.3	60	151.0	0.4	1.6
2022	20,117	1.3	11,786	1.6	7.4	8,331	0.5	5.2	41.4	30	159.5	2.4	1.7

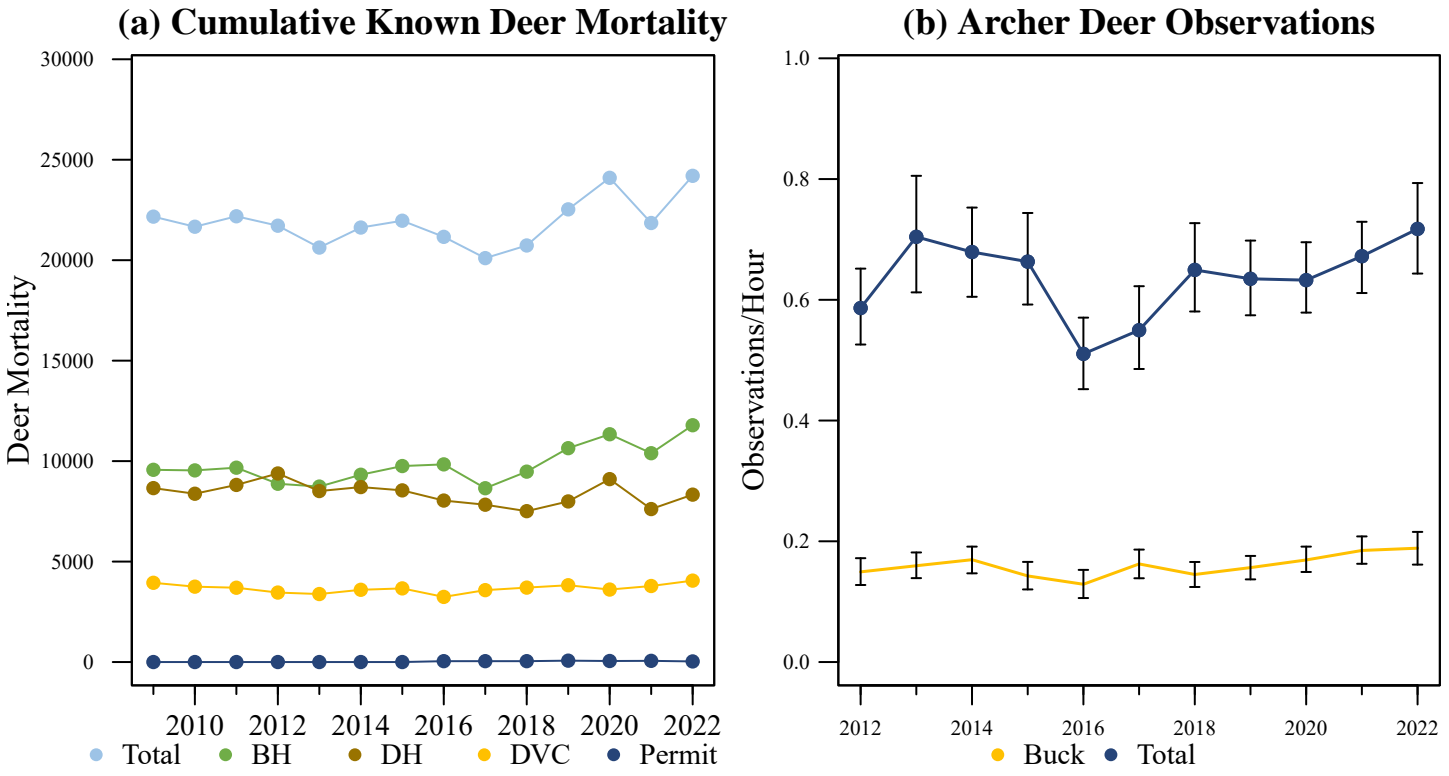


Figure 1. (a) The total known annual deer mortality based on buck harvests (BH), doe harvests (DH), deer vehicle collisions (DVC), and deer permit takes. (b) Total deer and buck observations per hour based on the Archer's Index.

DMU 4: East Central

3/24/2023

Total Square Miles: 9,965
Square Miles of Deer Habitat: 1,589
Percent Deer Habitat: 16

Table 2. Estimated number of antlered (A) and antlerless (AL) deer harvested per hunter. Estimated totals may not match exactly with total number of deer harvested. Reporting errors are examined and investigated as they are located; therefore, subsequent reports may contain corrected totals.

Year	Total Hunters	0 A	1 A	2 A	3 A	0 AL	1 AL	2 AL	3 AL	4 AL	5 AL	6 AL	7 AL	8 AL	9 AL	10 AL
2016	14,211	6,526	7,628	55	2	5,968	6,705	1,277	203	42	7	4	4	1	0	0
2017	12,981	6,363	6,573	43	1	4,976	6,470	1,311	182	33	9	0	0	0	0	0
2018	13,655	6,203	7,404	48	0	5,709	6,596	1,197	126	21	4	1	1	0	0	0
2019	14,887	6,256	8,578	51	2	6,468	7,035	1,274	90	12	3	3	0	1	0	1
2020	16,167	7,044	9,064	59	0	6,725	7,811	1,473	135	19	3	1	0	0	0	0
2021	14,507	5,932	8,517	57	1	6,585	6,601	1,213	95	9	2	1	0	1	0	0
2022	15,907	6,218	9,612	77	0	7,173	7,301	1,285	126	12	8	1	0	1	0	0

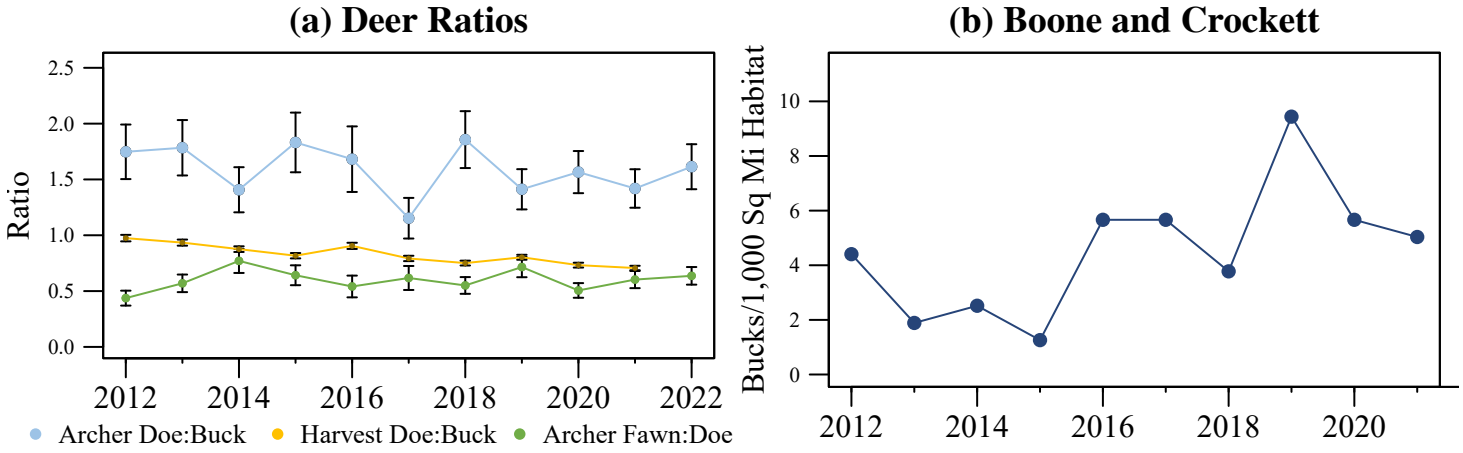


Figure 2. (a) Annual doe:buck ratios and fawn:doe ratios based on the Archer's Index and harvest records. (b) The number of Boone and Crockett bucks (minimum 160 score) per 1,000 square miles of deer habitat.

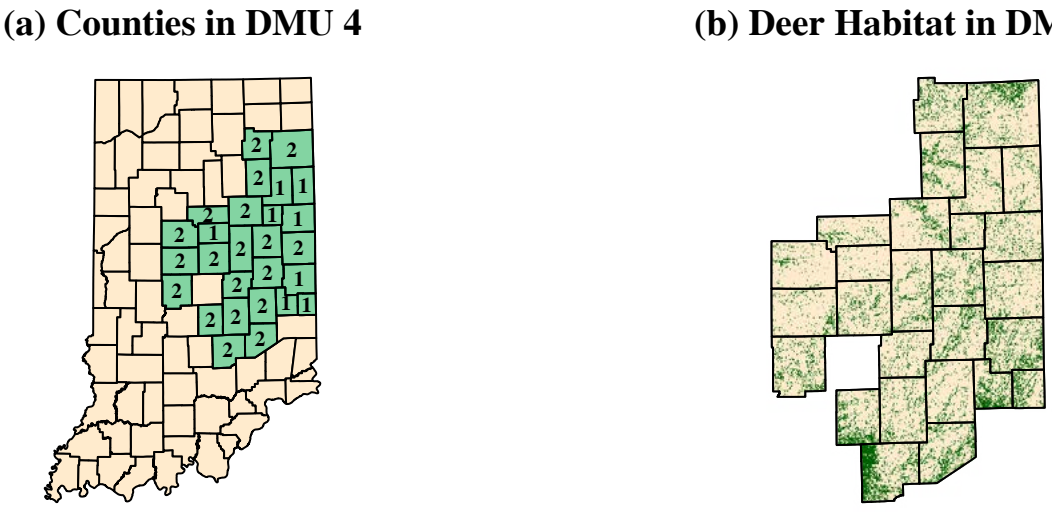


Figure 3. (a) Counties included in DMU 4 for summarizing harvest and deer management survey statistics. Labels are the 2022 county bonus antlerless quotas. (b) Green represents the land use types classified as deer habitat in DMU 4.

DMU 4: East Central

3/24/2023

Deer Management Survey Results

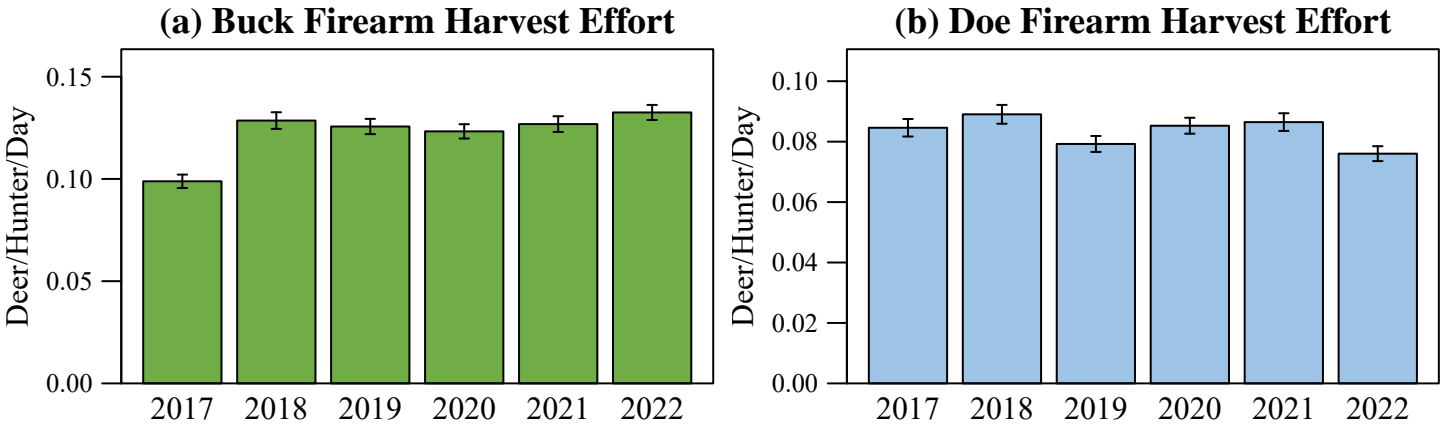


Figure 4. Firearm harvest effort is the number of bucks (a) and does (b) killed by firearms per hunter divided by the mean number of days hunted per hunter during the firearm season based on data reported in the deer management survey. Larger values (i.e taller bars) indicate less effort required to harvest a deer.

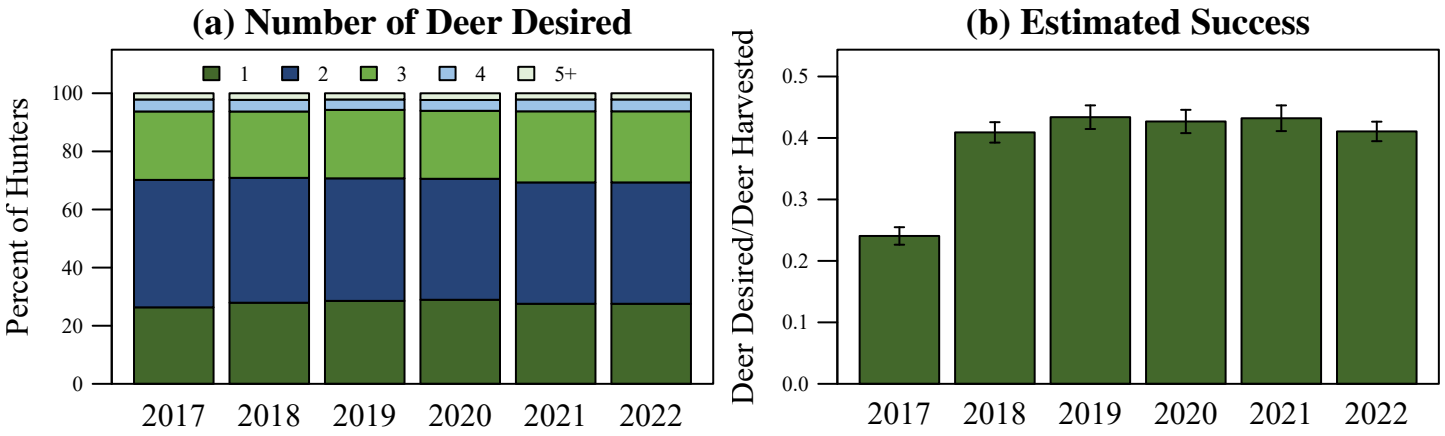
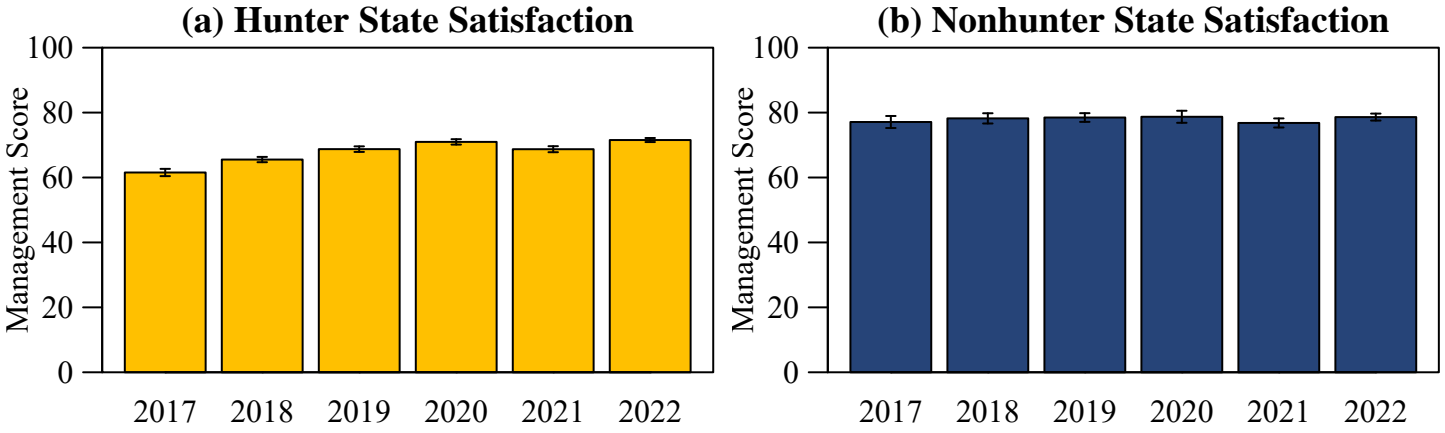


Figure 5. (a) The annual percent of hunters wishing to harvest each number of deer as reported in the deer management survey. (b) Success rate is estimated from the deer management survey as the Number of Harvested Deer/Number of Deer Desired (reported only; does not account for attempts that were not made). Larger values (i.e. taller bars) indicate greater success.



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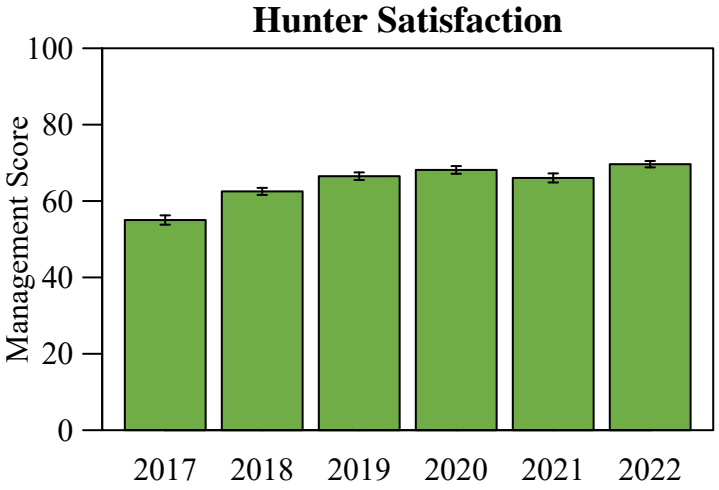
DMU 4: East Central

3/24/2023

Deer Management Survey Results



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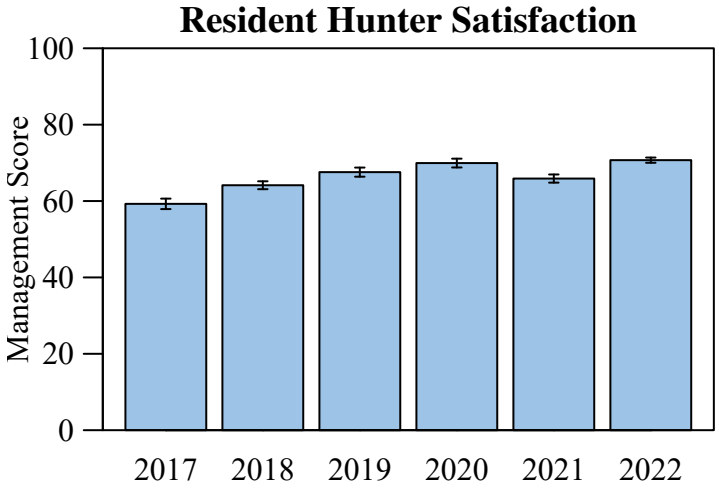
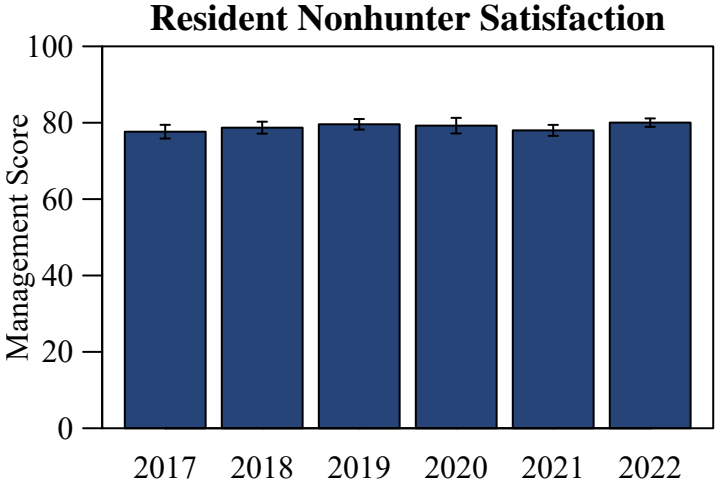


Figure 8. Hunters were asked to score the DNR's county deer management on a scale of 0 (poor) to 100 (excellent) for the county in DMU 4 where they live.



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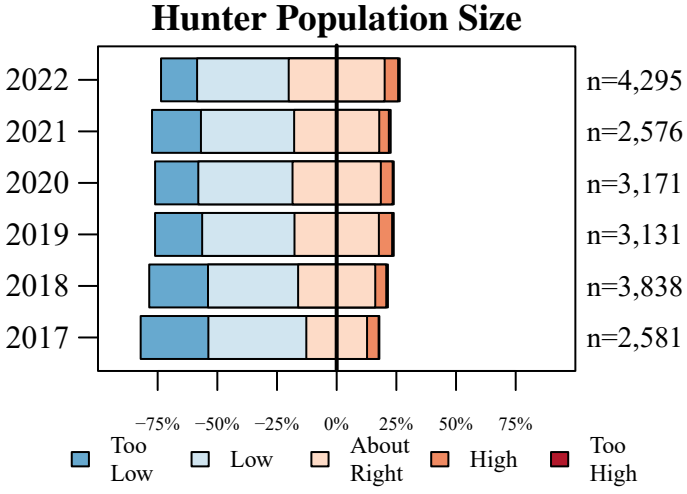

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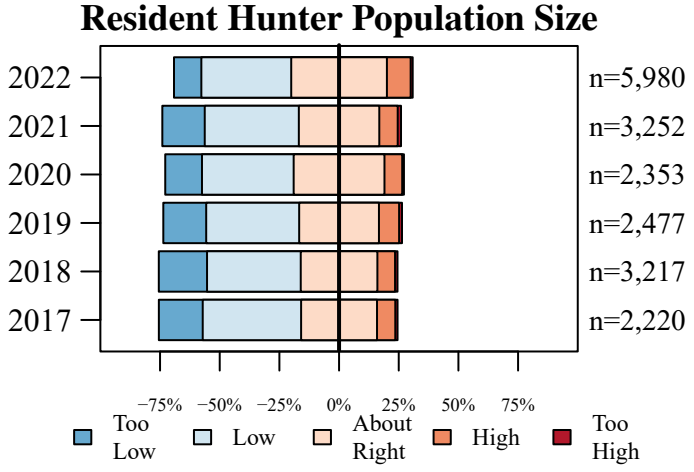


Figure 11. The current size of the deer population described by hunters in the county where they live in DMU 4.

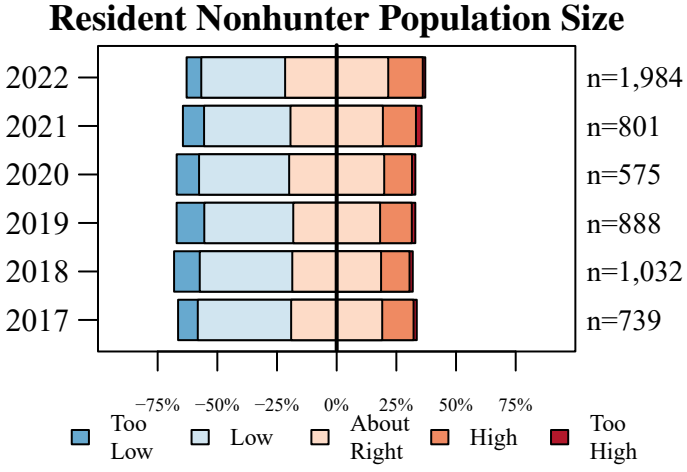


Figure 12. The current size of the deer population described by nonhunters in the county where they live in DMU 4.

DMU 4: East Central

3/24/2023

Deer Management Survey Results

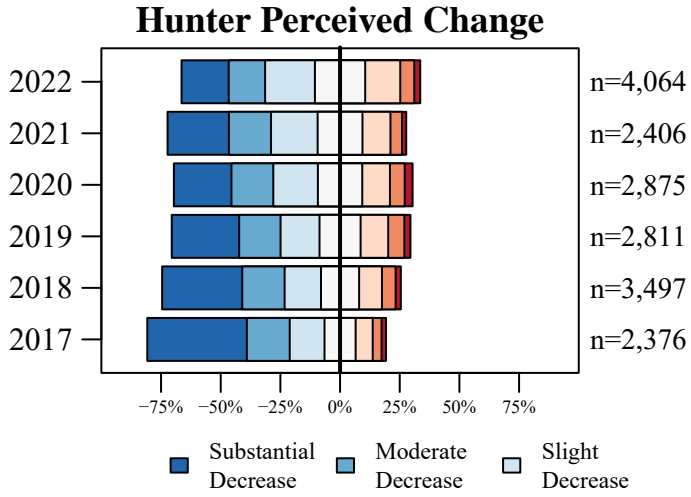
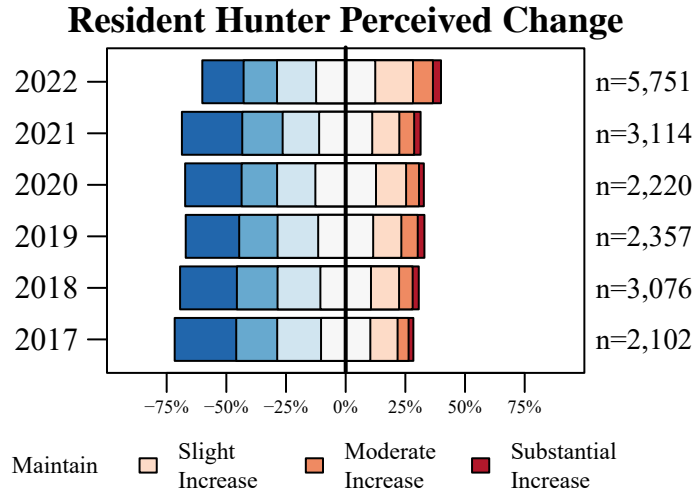


Figure 13. The number of deer seen compared to five years ago described by hunters in the county where they hunt in DMU 4.



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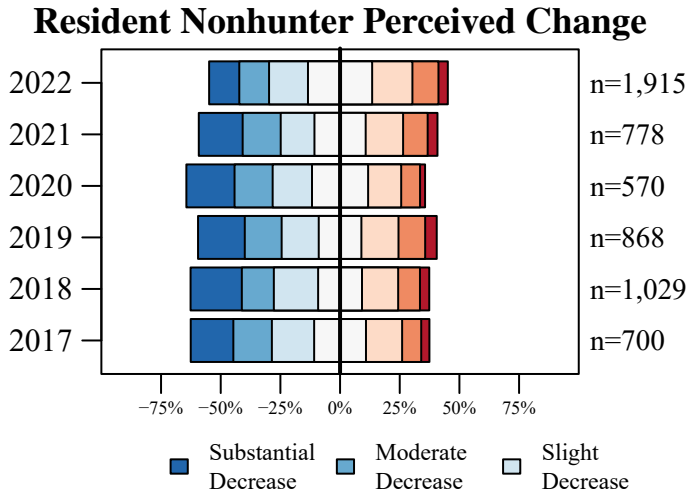


Figure 15. The number of deer seen compared to five years ago described by nonhunters in the county where they live in DMU 4.

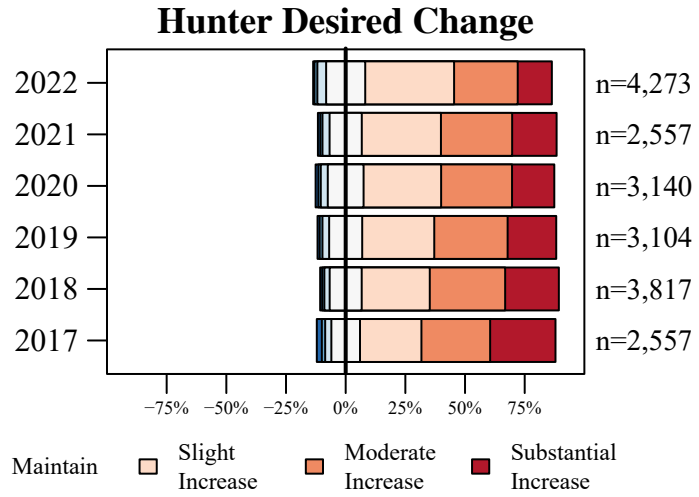


Figure 16. The desired change in the size of the deer population described by hunters in the county where they hunt in DMU 4.

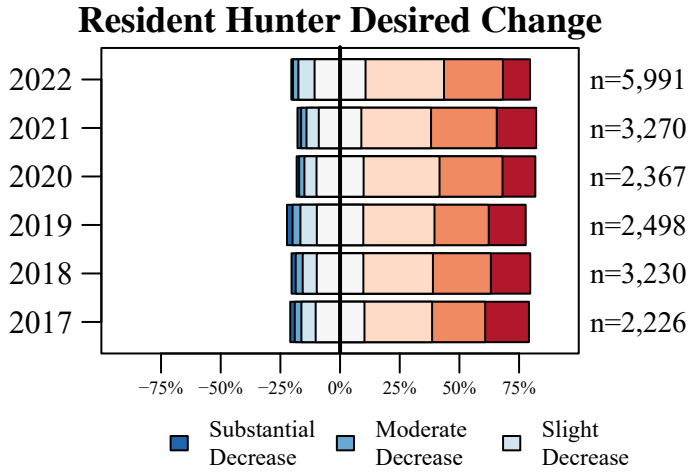


Figure 17. The desired change in the size of the deer population described by hunters in the county where they live in DMU 4.

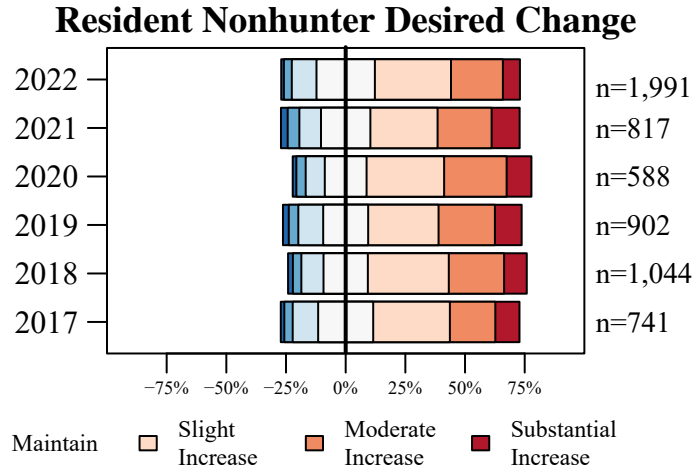


Figure 18. The desired change in the size of the deer population described by nonhunters in the county where they live in DMU 4.

DMU 4: East Central

3/24/2023

Deer Management Survey Results

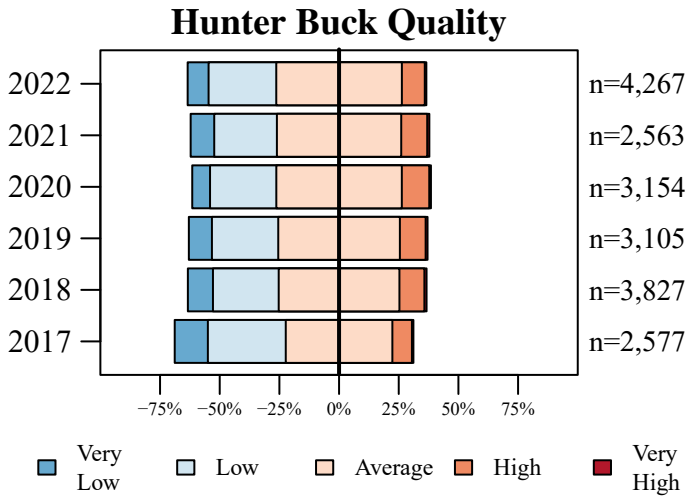


Figure 19. Hunters describe the quality of bucks in the county where they hunt in DMU 4.

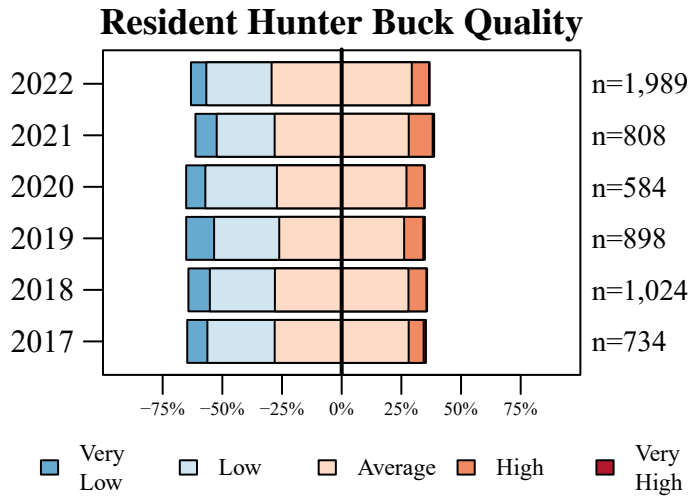


Figure 20. Hunters describe the quality of bucks in the county where they live in DMU 4.

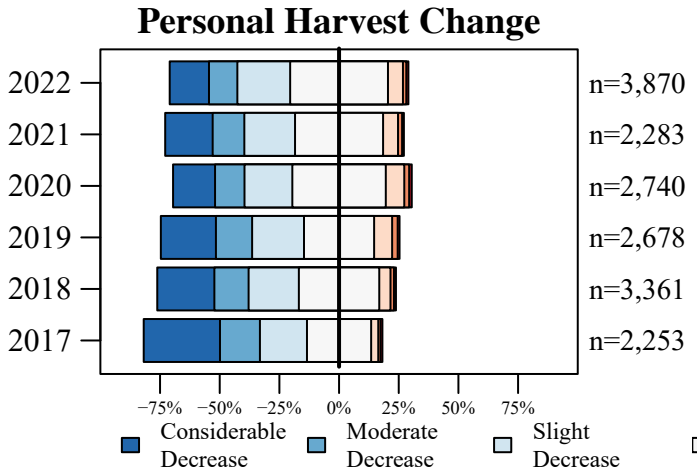


Figure 21. Opinion of hunters on how their personal number of harvested deer has changed over the last five years in a county in DMU 4.

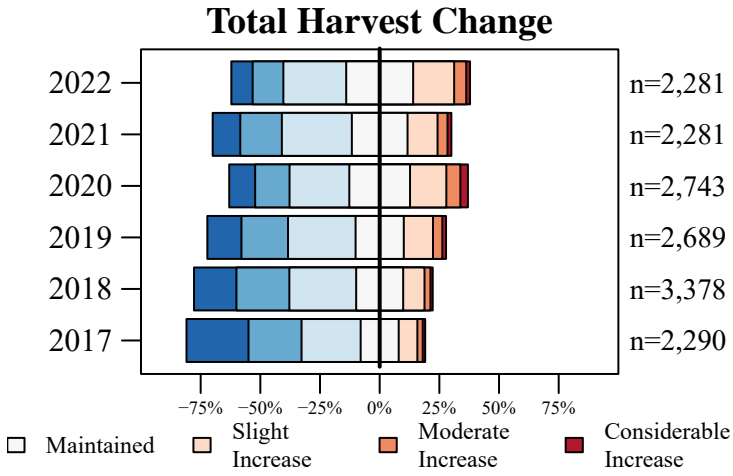


Figure 22. Opinion of hunters on how the total number of harvested deer has changed over the last five years in a county in DMU 4.

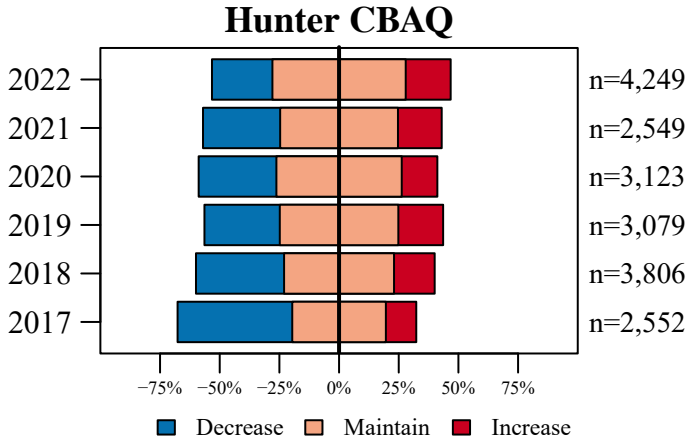


Figure 23. Opinion on how the County Bonus Antlerless Quota should change from hunters in the county where they hunt in DMU 4.

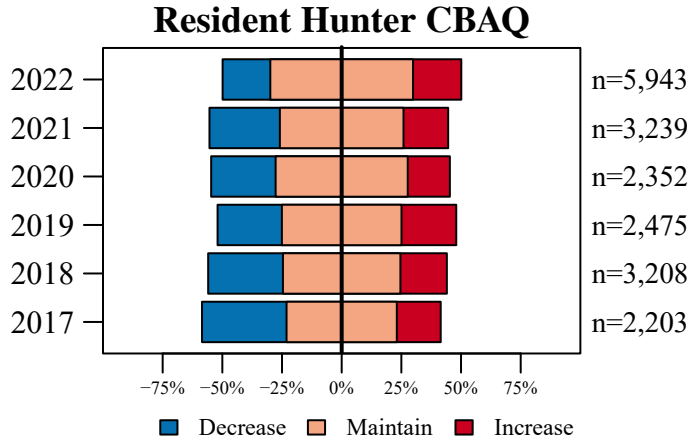


Figure 24. Opinion on how the County Bonus Antlerless Quota should change from hunters in the county where they live in DMU 4.

DMU 4: East Central

3/24/2023

Deer Management Survey Results

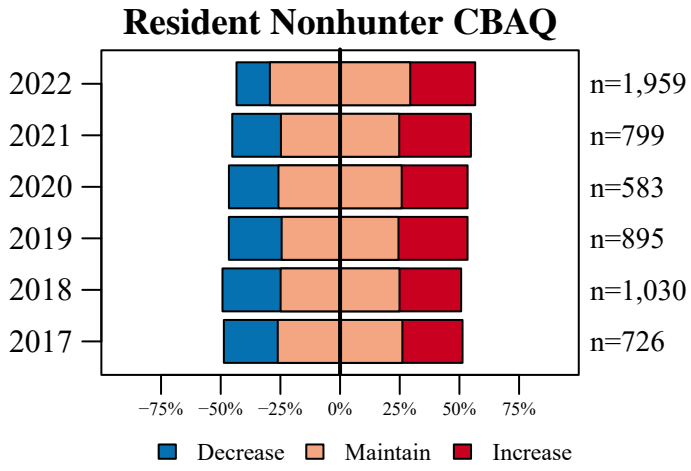


Figure 25. Opinion on how the County Bonus Antlerless Quota should change from nonhunters in the county where they live in DMU 4.

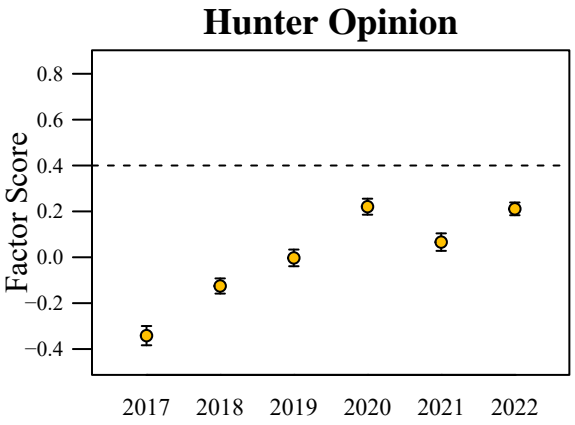


Figure 26. Hunter opinon scores over five years of the deer management survey. The score was aggregated using factor analysis of questions asked only to hunters. The dashed line represents the score if all questions are answered neutrally.

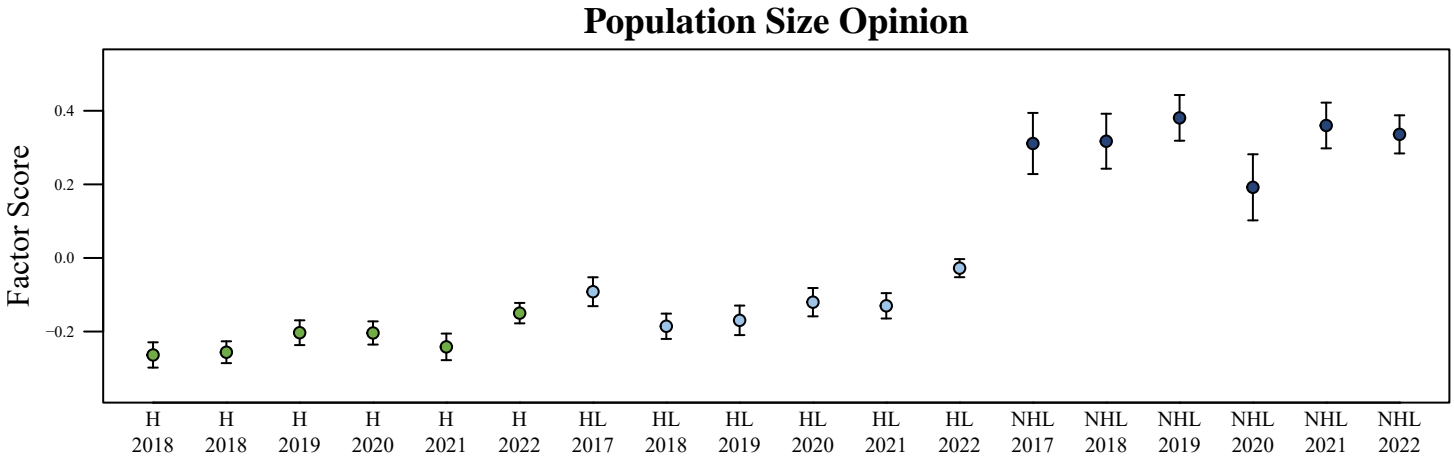


Figure 27. The opinion of nonhunters (NHL) and hunters in the county where they live (HL) and hunters in the county where they hunt (H) on deer population size. The score was aggregated using factor analysis of questions asked to all participants. The dashed line represents the score if all questions are answered neutrally.

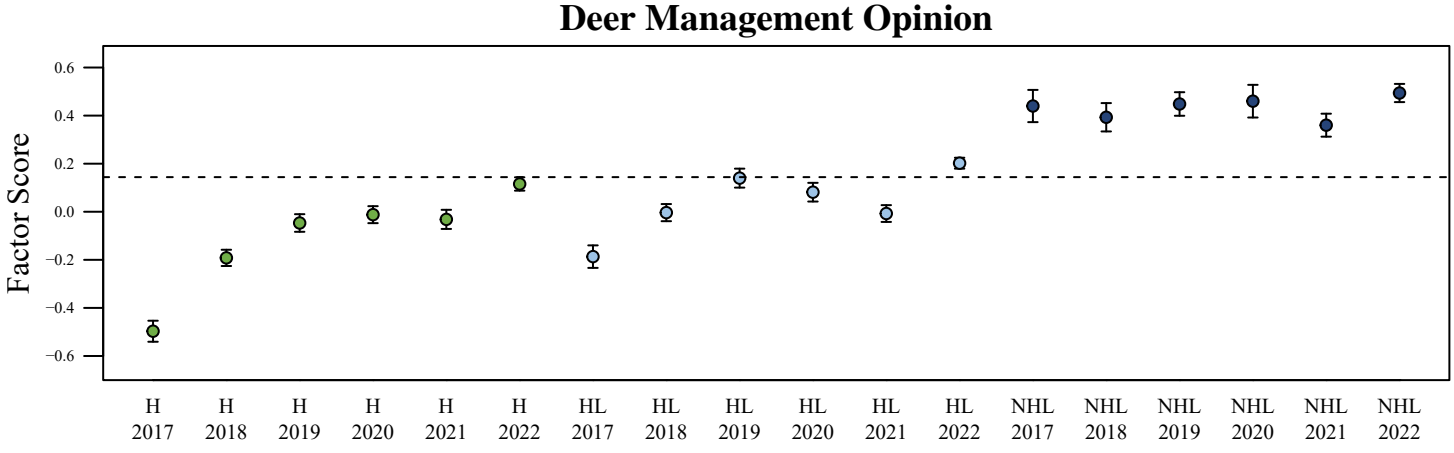


Figure 28. The opinion of nonhunters (NHL) and hunters in the county where they live (HL) and hunters in the county where they hunt (H) on deer management. The score was aggregated using factor analysis of questions asked to all participants. The dashed line represents the score if all questions are answered neutrally.

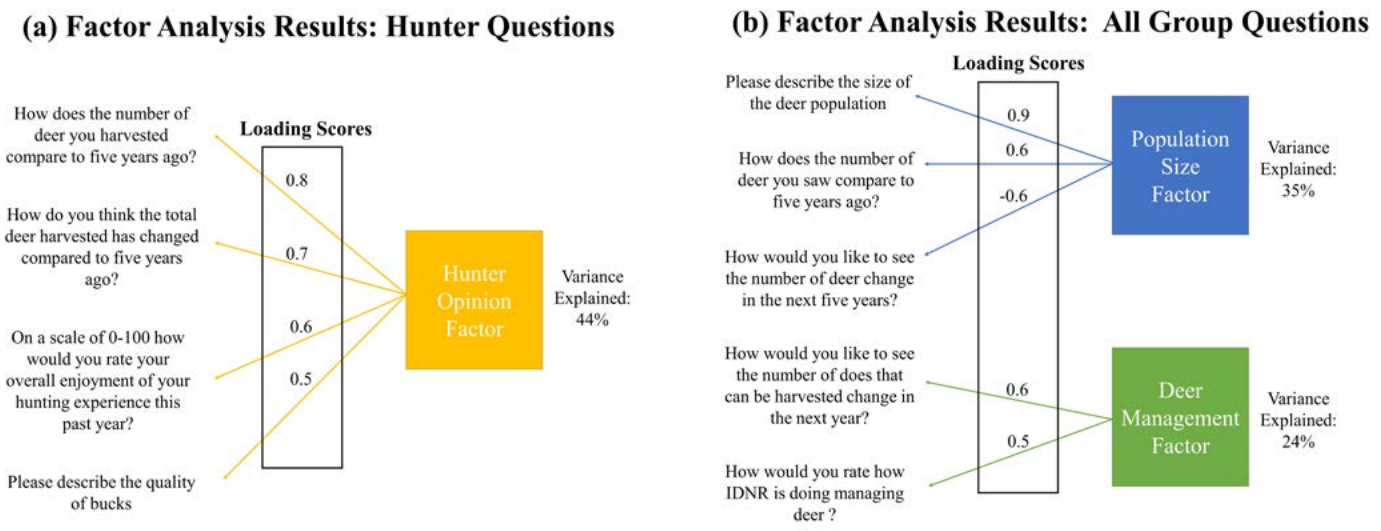


Figure 29. Results from two factor analyses used to develop the hunter opinion (a), population opinion (b), management opinion (b), and scores. Higher loading scores indicate a stronger correlation between the original question and the derived factor. These figures are included to help interpret Figure 26, Figure 27, and Figure 28.

DMU 5: Wabash

3/24/2023

Total Square Miles: 2,416
Square Miles of Deer Habitat: 957
Percent Deer Habitat: 40

Table 1. Total harvest, buck harvest, and doe harvest (error < 1 percent). Damage permits are issued by DNR to landowners to control deer damage. Deer vehicle collisions (DVC) and miles traveled are reported by the Indiana Department of Transportation. Mean CBAQ is the average county bonus antlerless quota of all counties in the DMU. The trend in total harvest, buck harvest, doe harvest, and DVCs are in standard deviations (SD) and are equivalent to effect size. A change greater than 2 SD is considered both a large and statistically significant effect size.

Year	Total	Total Trend in SD	Buck Harvest	Buck Trend in SD	Buck Harvest per SQ MI Habitat	Doe Harvest	Doe Trend in SD	Doe Harvest per SQ MI Habitat	% Doe in Harvest	Damage Permit Deer Taken	DVC per Billion Miles Traveled	DVC Trend in SD	Mean CBAQ
2009	10,377		5,429		5.7	4,948		5.2	47.7		289.6		5.8
2010	10,633	1.6	5,599	1.3	5.9	5,034	1.3	5.3	47.3		259.4	-0.5	6.7
2011	10,827	1.7	5,657	1.5	5.9	5,170	1.5	5.4	47.8		265.2	-0.7	6.7
2012	11,128	1.6	5,243	-0.8	5.5	5,885	3.1	6.1	52.9		237.9	-2.1	7.3
2013	9,510	-2.2	4,840	-2.8	5.1	4,670	-1.1	4.9	49.1		253.7	-0.6	6.0
2014	9,116	-2.2	4,727	-1.9	4.9	4,389	-1.7	4.6	48.1		236.8	-1.3	5.3
2015	9,785	-0.5	5,115	-0.2	5.3	4,670	-0.6	4.9	47.7		267.1	1.3	5.2
2016	9,931	-0.2	5,475	1.0	5.7	4,456	-0.8	4.7	44.9	78	284.5	2.2	5.2
2017	9,619	-0.4	5,013	-0.2	5.2	4,606	-0.3	4.8	47.9	76	268.7	0.6	4.5
2018	9,831	0.8	5,387	1.2	5.6	4,444	-0.9	4.6	45.2	72	288.1	1.5	3.5
2019	9,176	-1.5	5,185	0.1	5.4	3,991	-4.4	4.2	43.5	82	269.4	0.0	2.0
2020	10,103	1.5	5,813	3.0	6.1	4,290	-0.5	4.5	42.5	63	251.4	-2.4	2.0
2021	9,594	-0.4	5,658	0.9	5.9	3,936	-1.8	4.1	41.0	67	275.9	0.2	2.0
2022	10,011	1.0	5,885	1.4	6.1	4,126	-0.4	4.3	41.2	69	270.1	0.0	2.0

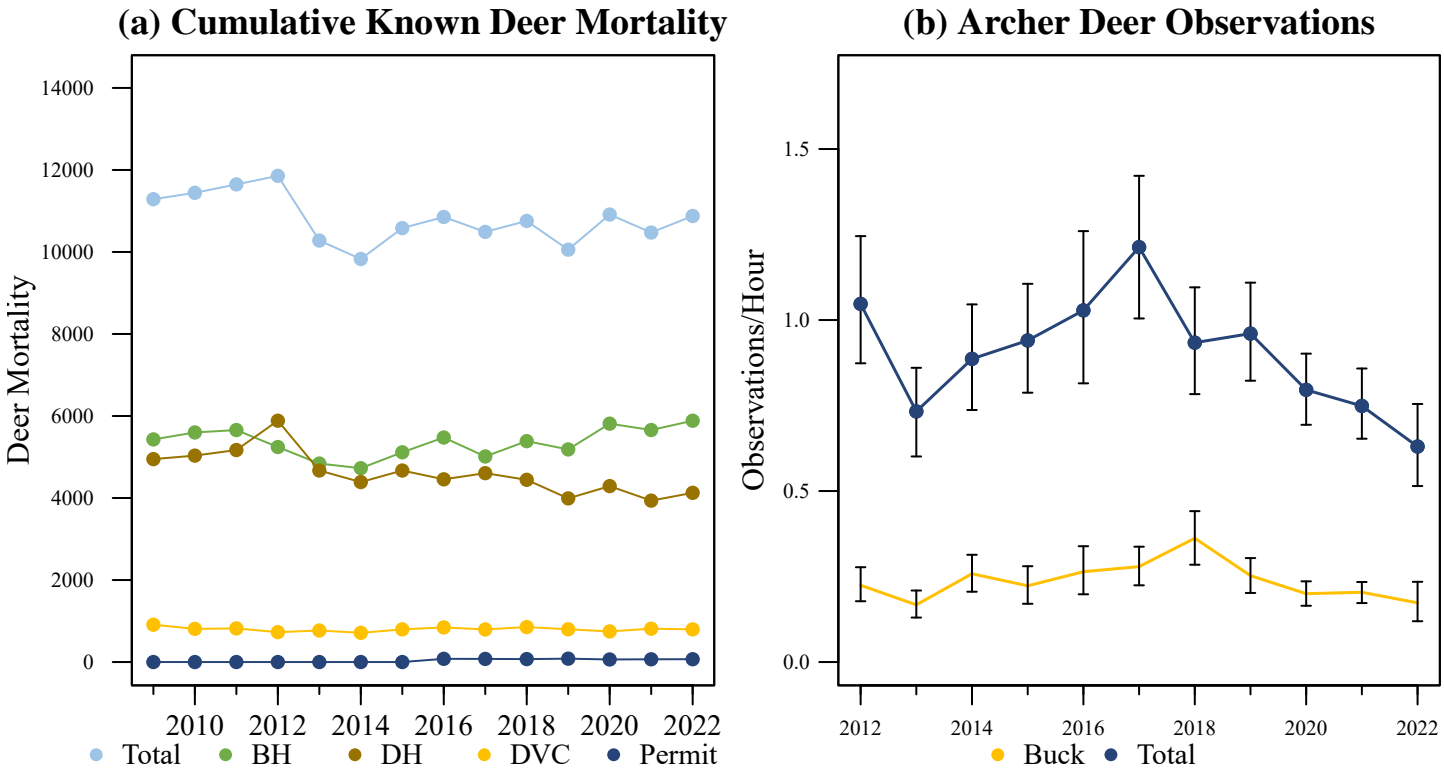


Figure 1. (a) The total known annual deer mortality based on buck harvests (BH), doe harvests (DH), deer vehicle collisions (DVC), and deer permit takes. (b) Total deer and buck observations per hour based on the Archer's Index.

DMU 5: Wabash

3/24/2023

Total Square Miles: 2,416
Square Miles of Deer Habitat: 957
Percent Deer Habitat: 40

Table 2. Estimated number of antlered (A) and antlerless (AL) deer harvested per hunter. Estimated totals may not match exactly with total number of deer harvested. Reporting errors are examined and investigated as they are located; therefore, subsequent reports may contain corrected totals.

Year	Total Hunters	0 A	1 A	2 A	3 A	0 AL	1 AL	2 AL	3 AL	4 AL	5 AL	6 AL	7 AL	8 AL	9 AL	10 AL
2016	7,573	3,006	4,557	9	1	3,454	3,158	763	143	42	9	2	1	1	0	0
2017	7,115	3,098	4,007	7	3	2,974	3,036	872	157	55	11	7	3	0	0	0
2018	7,379	2,930	4,436	12	1	3,262	3,101	818	166	28	3	1	0	0	0	0
2019	7,083	2,844	4,230	9	0	3,127	3,085	784	76	8	3	0	0	0	0	0
2020	7,784	2,820	4,946	18	0	3,662	3,229	804	73	15	1	0	0	0	0	0
2021	7,554	2,663	4,884	7	0	3,697	3,089	704	58	5	1	0	0	0	0	0
2022	7,805	2,664	5,130	10	1	3,853	3,123	764	53	12	0	0	0	0	0	0

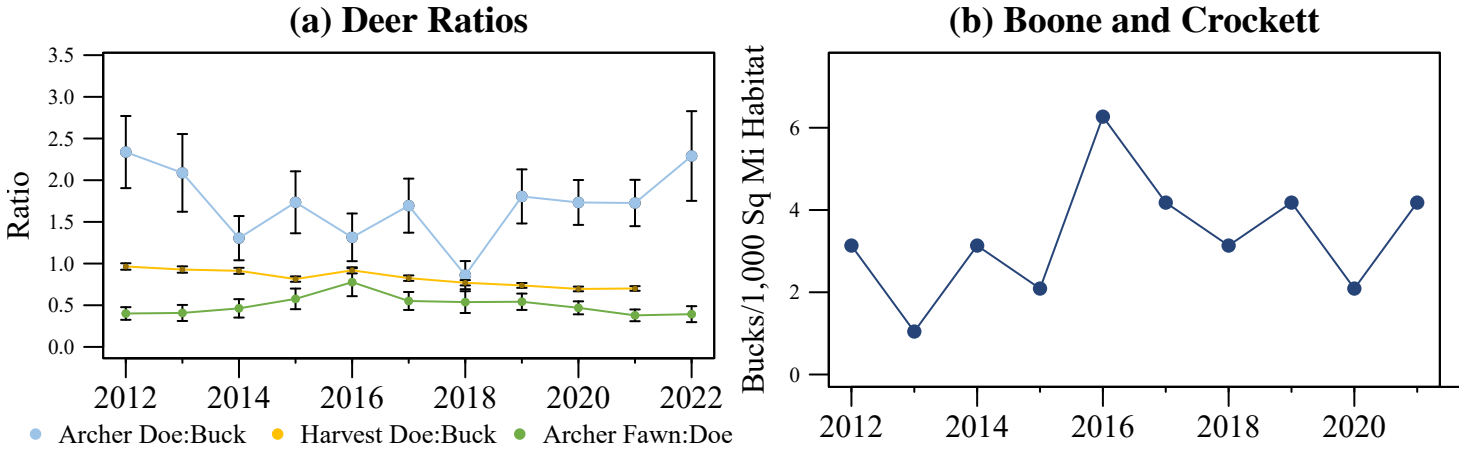


Figure 2. (a) Annual doe:buck ratios and fawn:doe ratios based on the Archer's Index and harvest records. (b) The number of Boone and Crockett bucks (minimum 160 score) per 1,000 square miles of deer habitat.

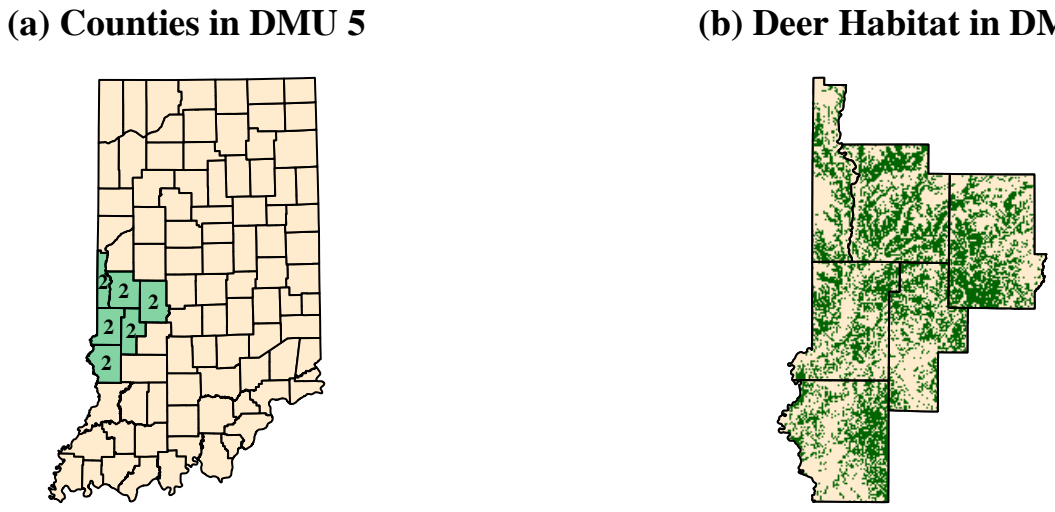
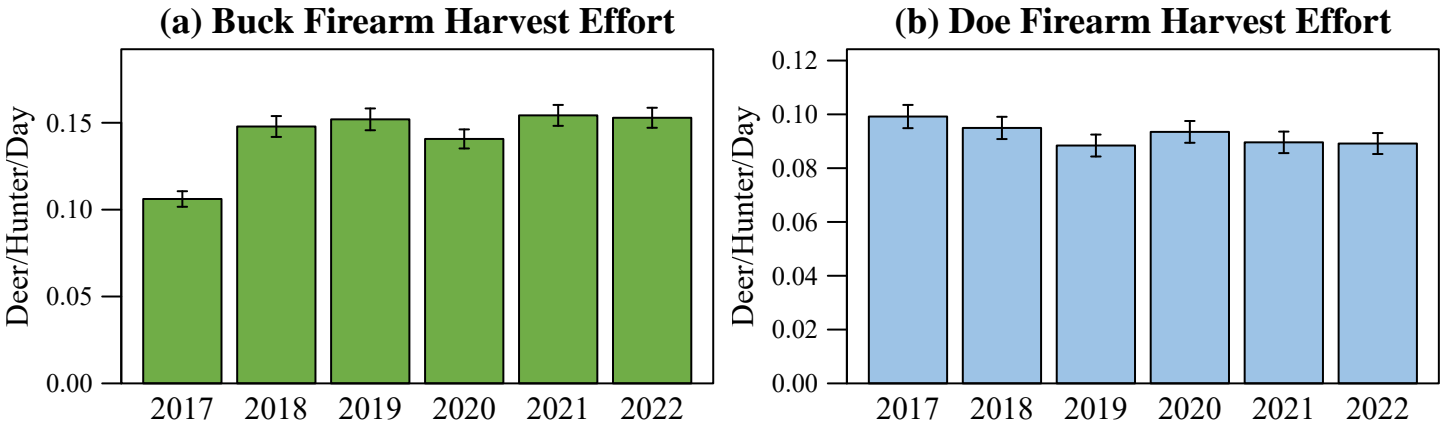


Figure 3. (a) Counties included in DMU 5 for summarizing harvest and deer management survey statistics. Labels are the 2022 county bonus antlerless quotas. (b) Green represents the land use types classified as deer habitat in DMU 5.

DMU 5: Wabash

3/24/2023

Deer Management Survey Results



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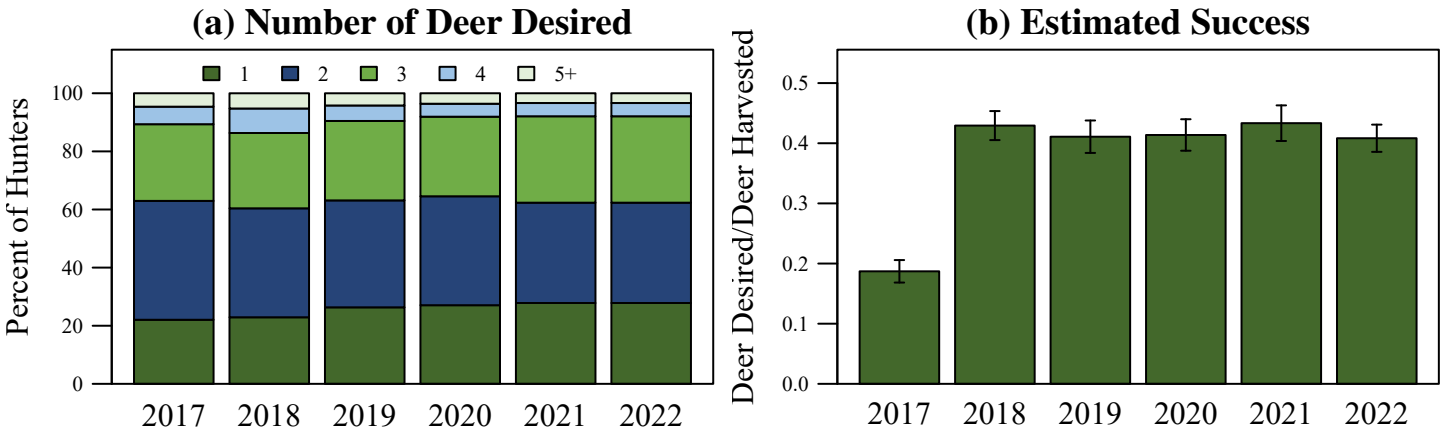

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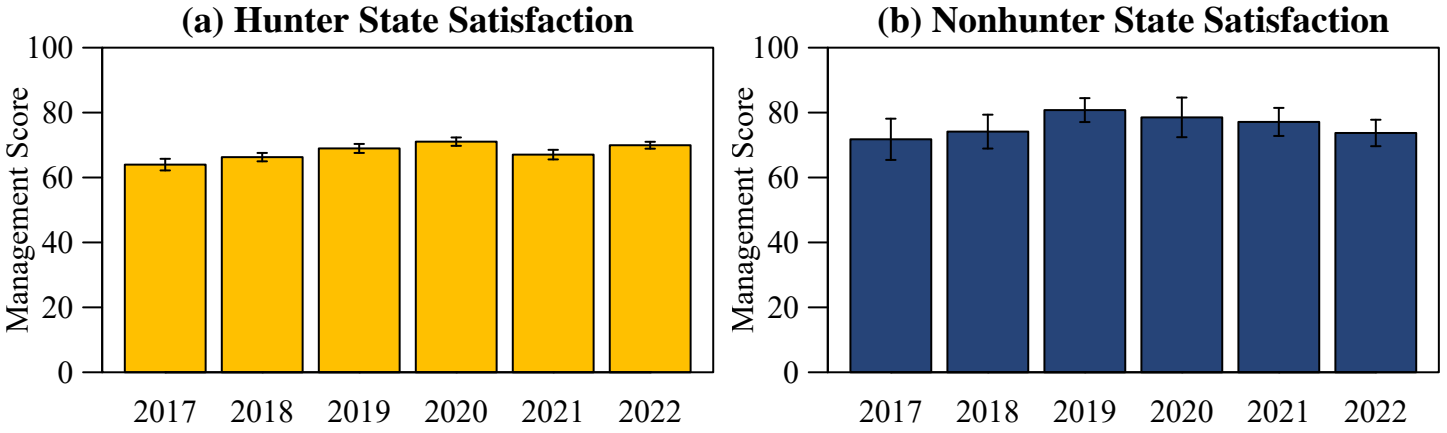

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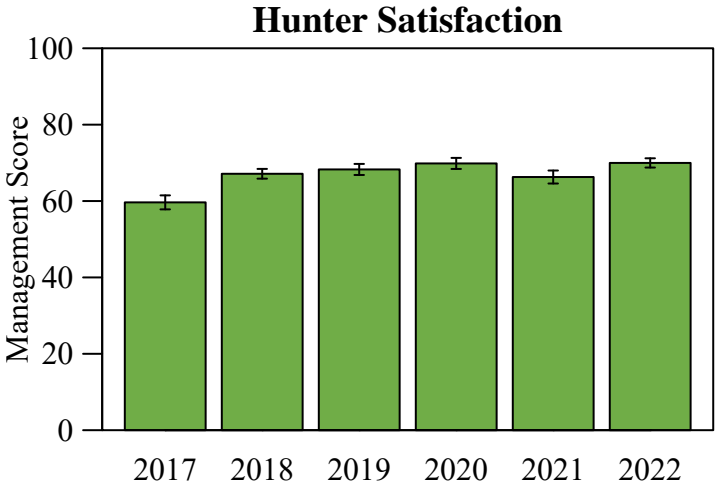
DMU 5: Wabash

3/24/2023

Deer Management Survey Results



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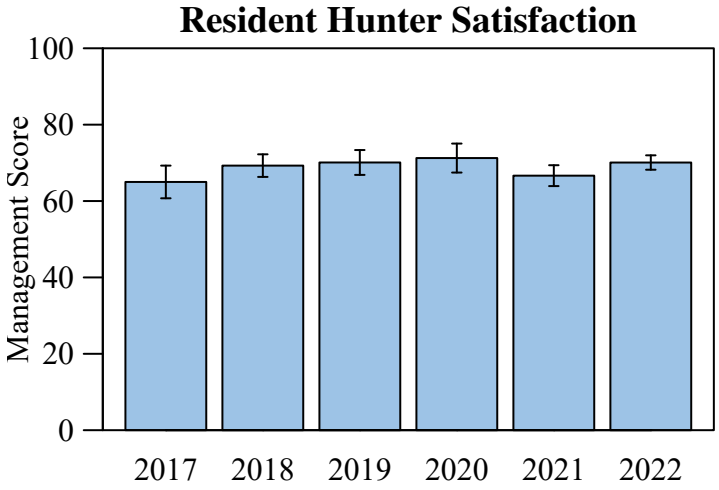

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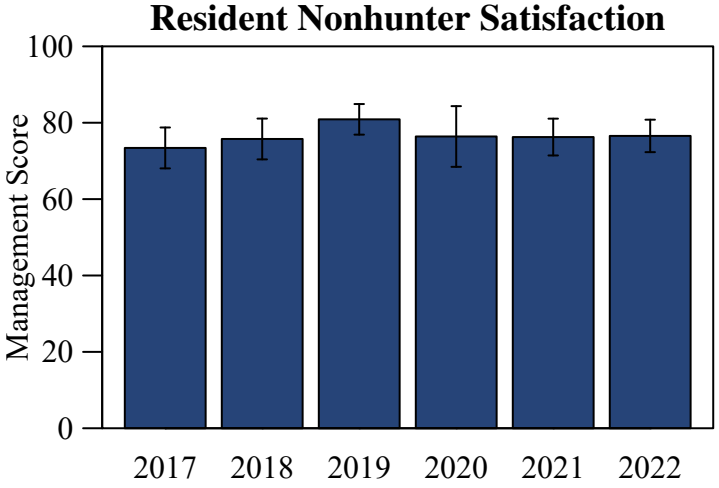

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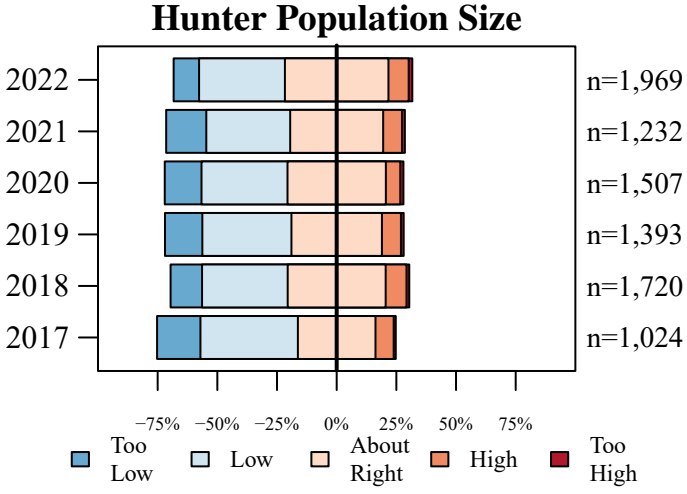

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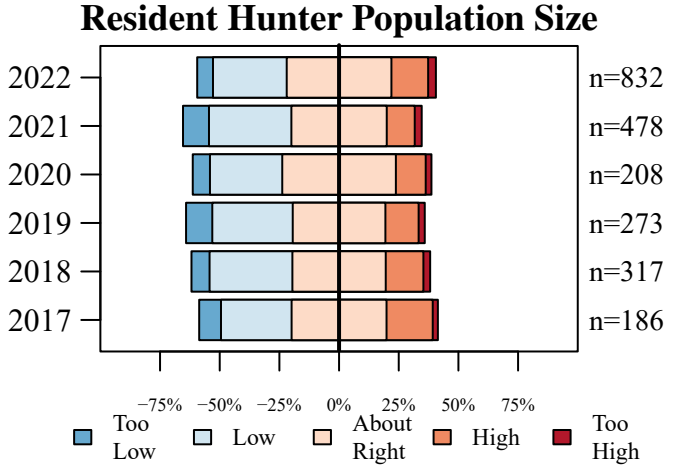

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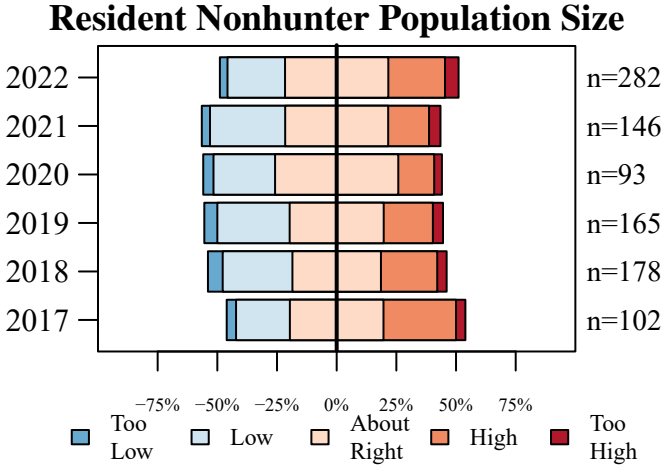


Figure 12. The current size of the deer population described by nonhunters in the county where they live in DMU 5.

DMU 5: Wabash

3/24/2023

Deer Management Survey Results

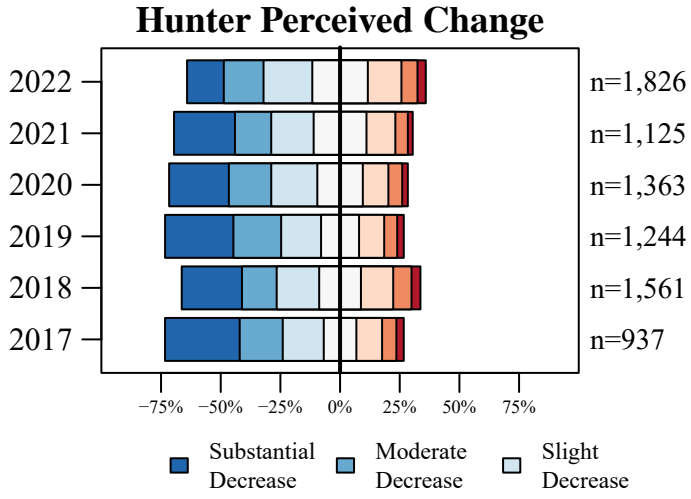
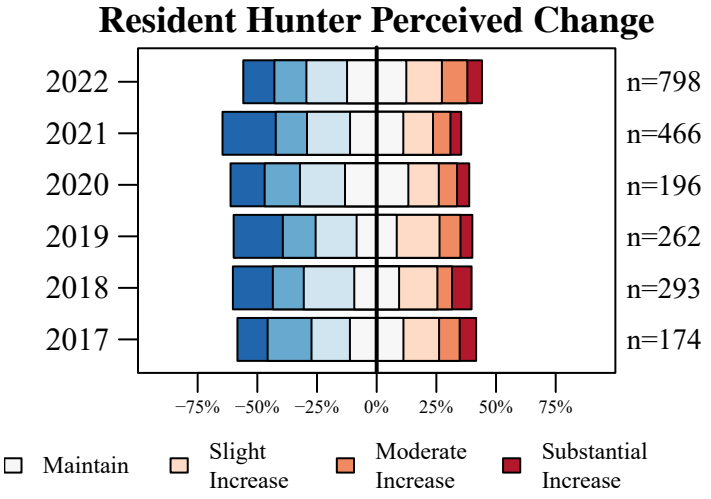


Figure 13. The number of deer seen compared to five years ago described by hunters in the county where they hunt in DMU 5.



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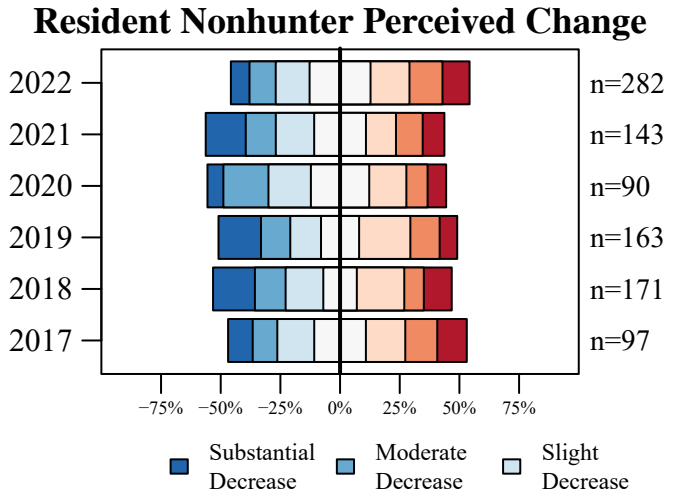

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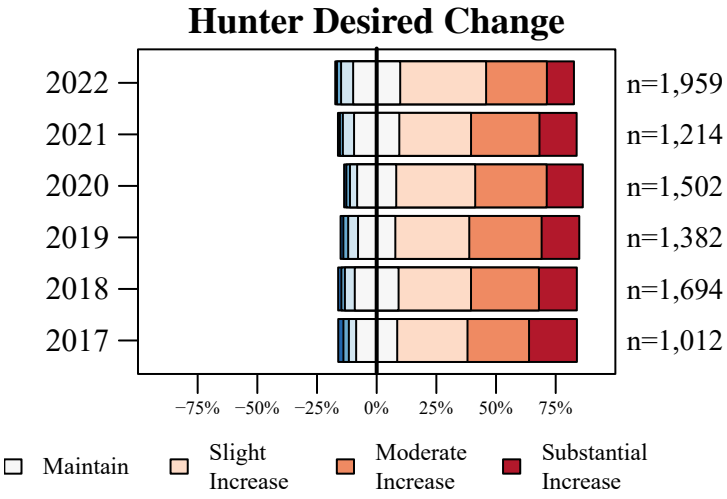
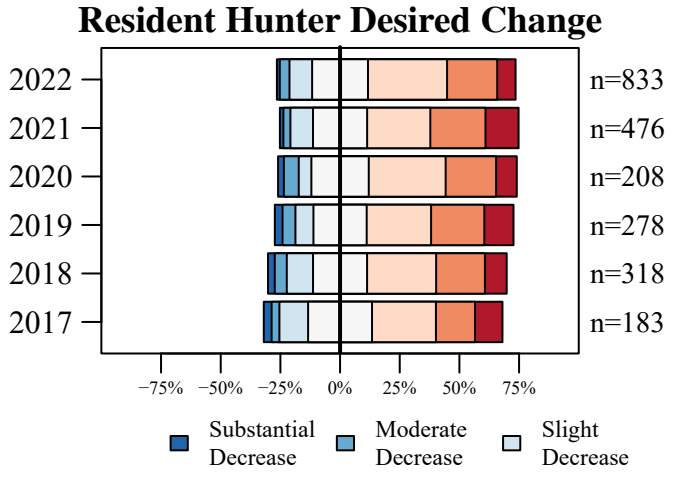


Figure 16. The desired change in the size of the deer population described by hunters in the county where they hunt in DMU 5.



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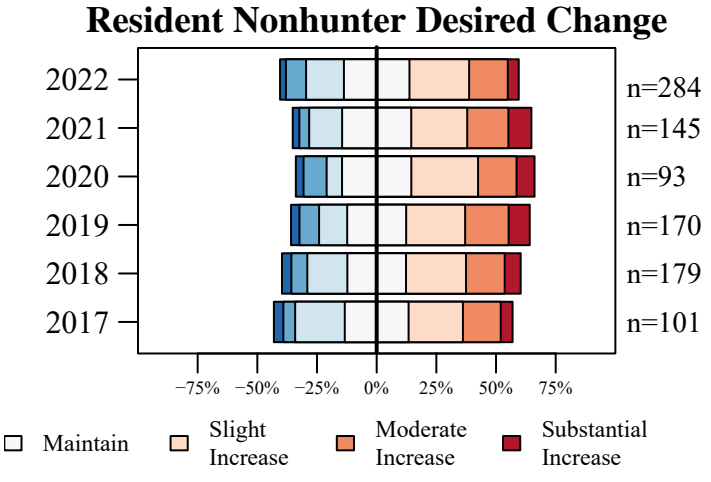


Figure 18. The desired change in the size of the deer population described by nonhunters in the county where they live in DMU 5.

DMU 5: Wabash

3/24/2023

Deer Management Survey Results

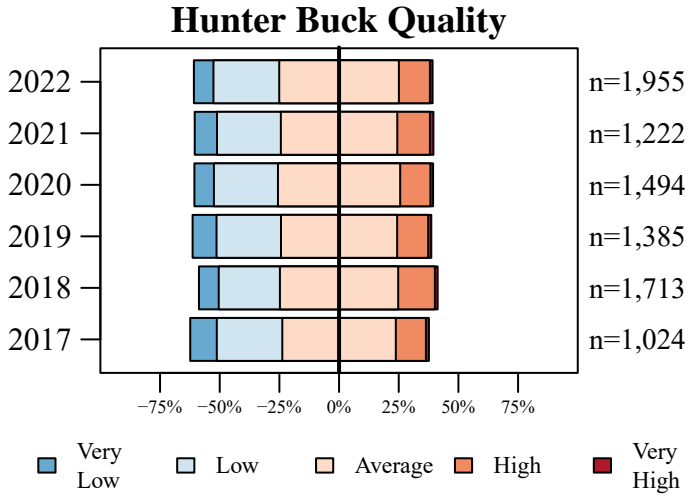
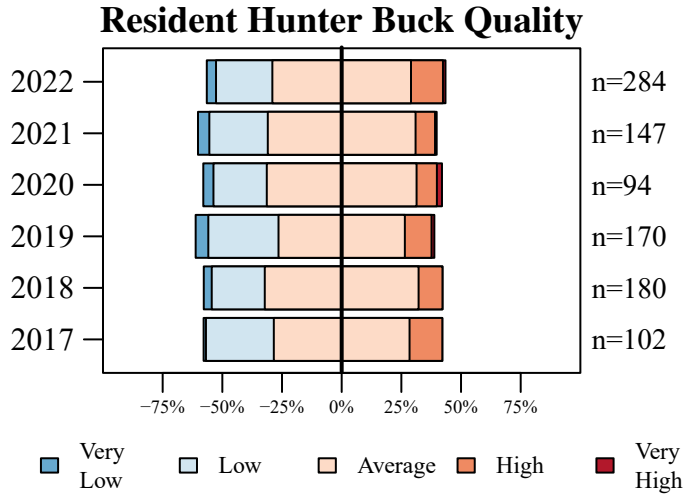


Figure 19. Hunters describe the quality of bucks in the county where they hunt in DMU 5.



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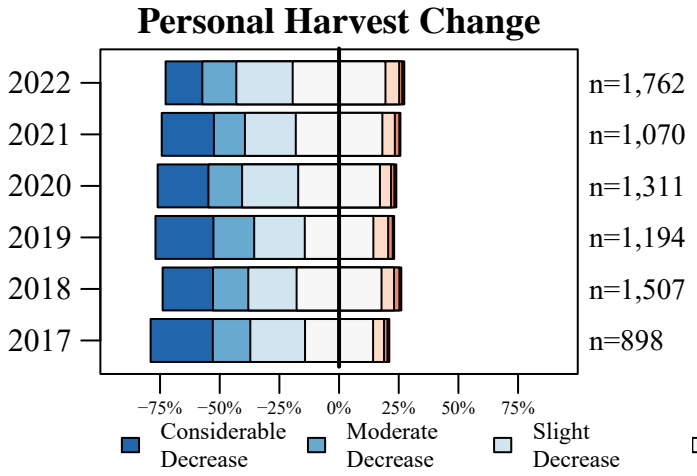

Figure 21. Opinion of hunters on how their personal number of harvested deer has changed over the last five years in a county in DMU 5.

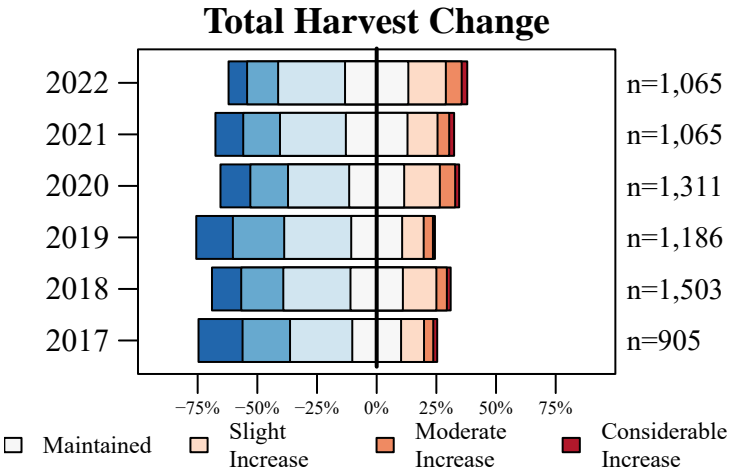

Figure 22. Opinion of hunters on how the total number of harvested deer has changed over the last five years in a county in DMU 5.

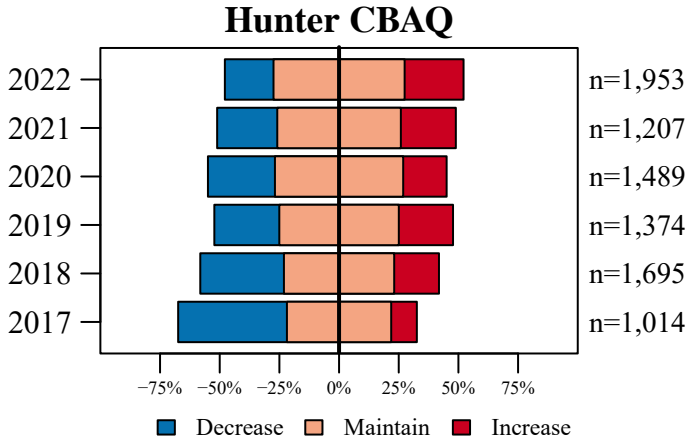

Figure 23. Opinion on how the County Bonus Antlerless Quota should change from hunters in the county where they hunt in DMU 5.

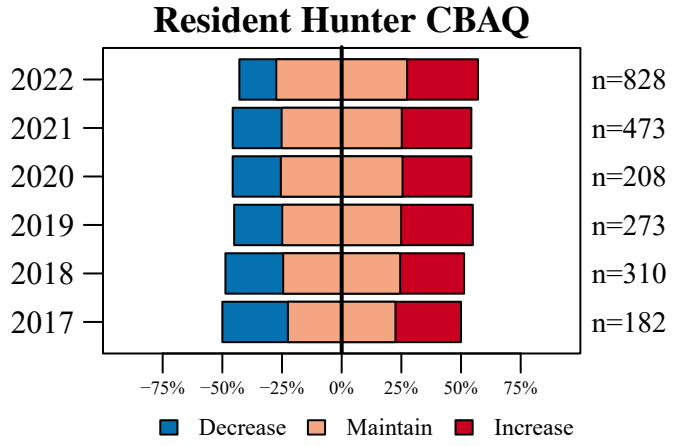

Figure 24. Opinion on how the County Bonus Antlerless Quota should change from hunters in the county where they live in DMU 5.

DMU 5: Wabash

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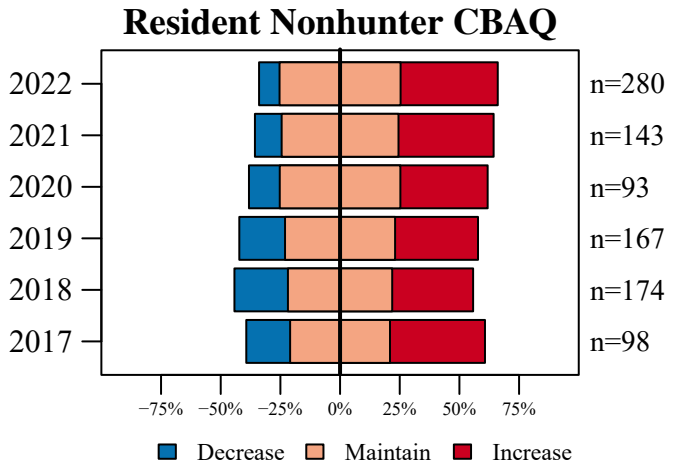

Figure 25. Opinion on how the County Bonus Antlerless Quota should change from nonhunters in the county where they live in DMU 5.

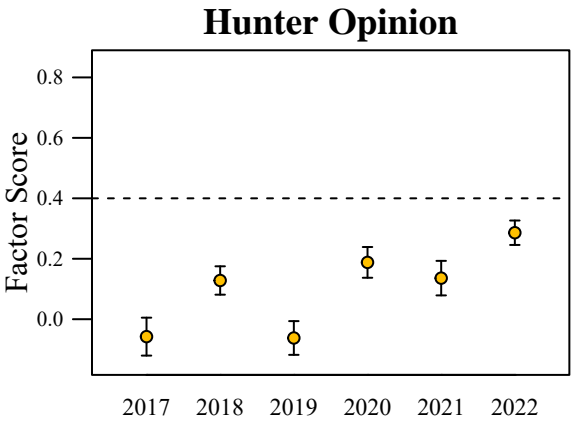

Figure 26. Hunter opinon scores over five years of the deer management survey. The score was aggregated using factor analysis of questions asked only to hunters. The dashed line represents the score if all questions are answered neutrally.

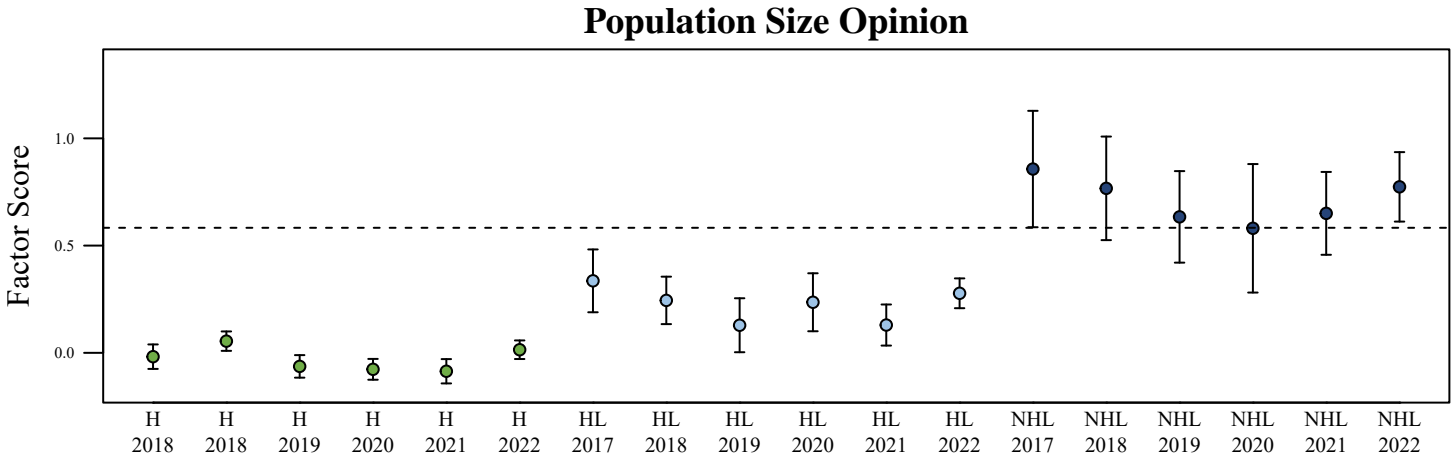

Figure 27. The opinion of nonhunters (NHL) and hunters in the county where they live (HL) and hunters in the county where they hunt (H) on deer population size. The score was aggregated using factor analysis of questions asked to all participants. The dashed line represents the score if all questions are answered neutrally.

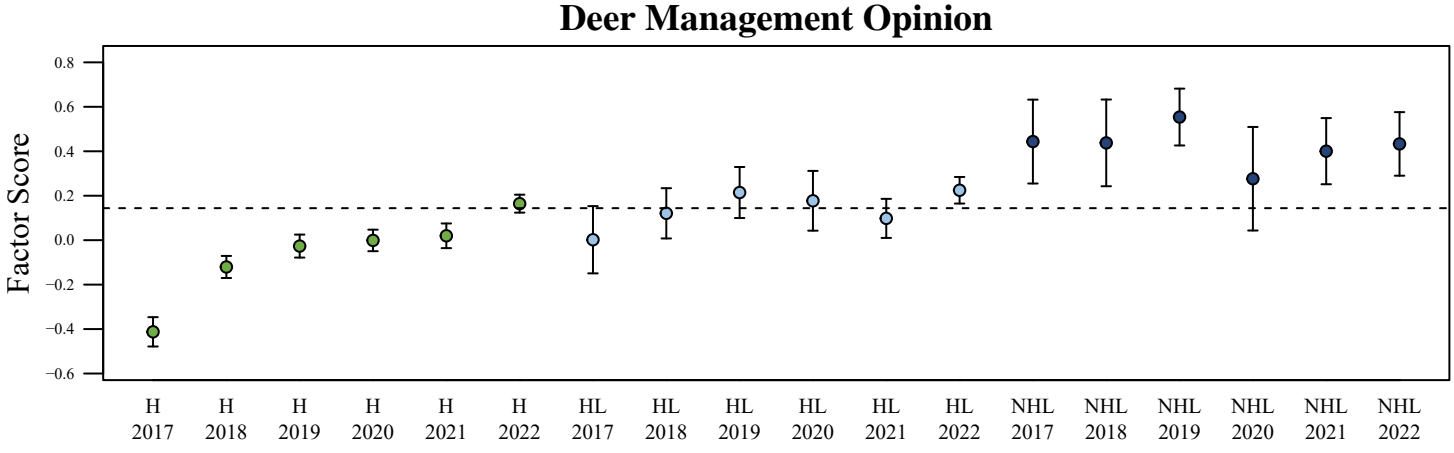

Figure 28. The opinion of nonhunters (NHL) and hunters in the county where they live (HL) and hunters in the county where they hunt (H) on deer management. The score was aggregated using factor analysis of questions asked to all participants. The dashed line represents the score if all questions are answered neutrally.

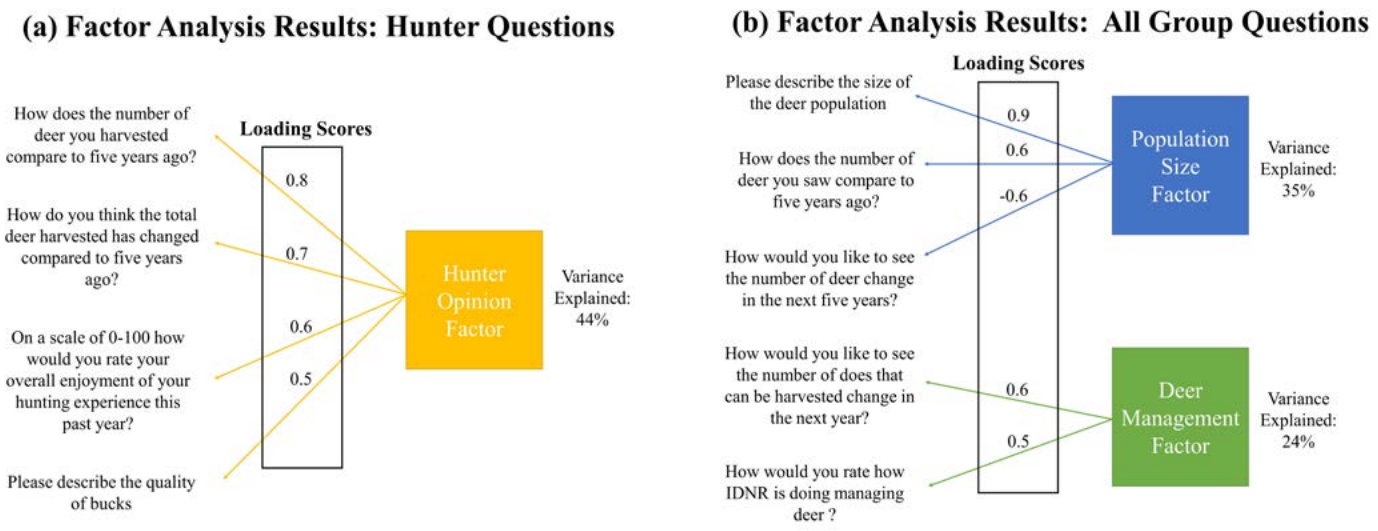

Figure 29. Results from two factor analyses used to develop the hunter opinion (a), population opinion (b), management opinion (b), and scores. Higher loading scores indicate a stronger correlation between the original question and the derived factor. These figures are included to help interpret Figure 26, Figure 27, and Figure 28.

DMU 6: South

3/24/2023

Total Square Miles: 6,368
Square Miles of Deer Habitat: 4,482
Percent Deer Habitat: 70

Table 1. Total harvest, buck harvest, and doe harvest (error < 1 percent). Damage permits are issued by DNR to landowners to control deer damage. Deer vehicle collisions (DVC) and miles traveled are reported by the Indiana Department of Transportation. Mean CBAQ is the average county bonus antlerless quota of all counties in the DMU. The trend in total harvest, buck harvest, doe harvest, and DVCs are in standard deviations (SD) and are equivalent to effect size. A change greater than 2 SD is considered both a large and statistically significant effect size.

Year	Total	Total Trend in SD	Buck Harvest	Buck Trend in SD	Buck Harvest per SQ MI Habitat	Doe Harvest	Doe Trend in SD	Doe Harvest per SQ MI Habitat	% Doe in Harvest	Damage Permit Deer Taken	DVC per Billion Miles Traveled	DVC Trend in SD	Mean CBAQ
2009	28,970		14,840		3.3	14,130		3.2	48.8		278.6		5.0
2010	28,143	-0.4	14,197	-0.5	3.2	13,946	-0.1	3.1	49.6		263.7	-1.0	5.4
2011	29,468	1.3	14,809	0.9	3.3	14,659	1.4	3.3	49.7		275.0	-0.5	5.7
2012	31,458	3.2	14,485	0.3	3.2	16,973	5.2	3.8	54.0		283.3	0.6	5.6
2013	33,888	3.5	16,201	4.9	3.6	17,687	2.3	3.9	52.2		316.5	5.7	5.3
2014	30,442	0.0	14,599	-0.4	3.3	15,843	0.2	3.5	52.0		293.6	0.5	6.1
2015	32,927	1.0	16,736	2.4	3.7	16,191	0.2	3.6	49.2		332.1	2.3	5.9
2016	30,864	-0.4	16,234	0.8	3.6	14,630	-1.4	3.3	47.4	675	301.0	0.0	5.9
2017	31,315	-0.4	15,475	-0.2	3.5	15,840	-0.4	3.5	50.6	749	335.9	1.6	5.7
2018	27,746	-2.8	14,274	-1.9	3.2	13,472	-2.3	3.0	48.6	722	314.6	-0.1	4.7
2019	26,660	-2.1	14,233	-1.2	3.2	12,427	-2.4	2.8	46.6	612	299.6	-0.9	2.0
2020	26,639	-1.3	14,746	-0.6	3.3	11,893	-1.7	2.7	44.6	360	254.0	-3.7	2.4
2021	25,784	-1.3	14,997	0.0	3.3	10,787	-1.8	2.4	41.8	495	265.5	-1.2	2.4
2022	26,970	-0.3	15,378	1.2	3.4	11,592	-0.7	2.6	43.0	444	280.0	-0.4	2.0

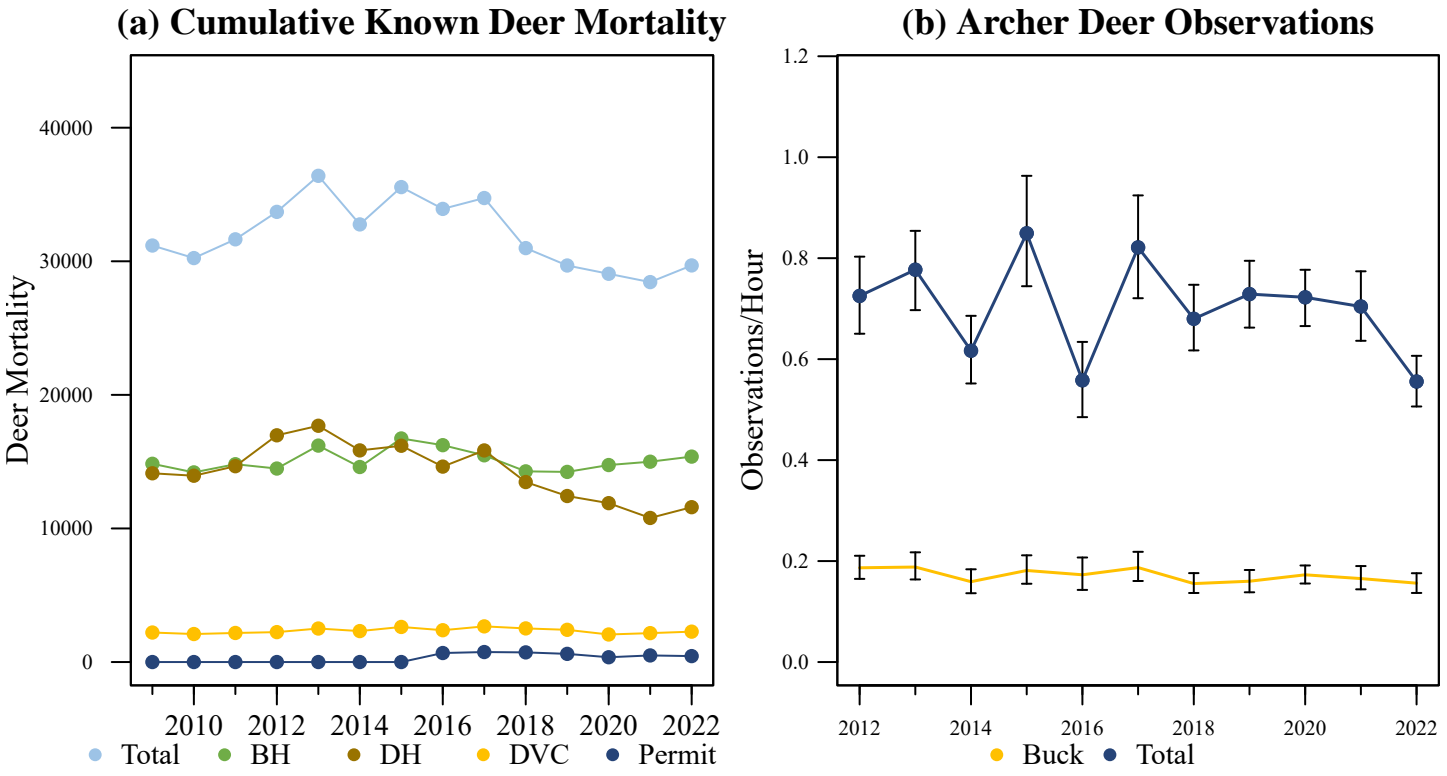

Figure 1. (a) The total known annual deer mortality based on buck harvests (BH), doe harvests (DH), deer vehicle collisions (DVC), and deer permit takes. (b) Total deer and buck observations per hour based on the Archer's Index.

DMU 6: South

3/24/2023

Total Square Miles: 6,368
Square Miles of Deer Habitat: 4,482
Percent Deer Habitat: 70

Table 2. Estimated number of antlered (A) and antlerless (AL) deer harvested per hunter. Estimated totals may not match exactly with total number of deer harvested. Reporting errors are examined and investigated as they are located; therefore, subsequent reports may contain corrected totals.

Year	Total Hunters	0 A	1 A	2 A	3 A	0 AL	1 AL	2 AL	3 AL	4 AL	5 AL	6 AL	7 AL	8 AL	9 AL	10 AL
2016	23,189	10,040	13,087	60	2	9,839	10,155	2,439	518	163	51	16	5	2	0	1
2017	22,834	10,709	12,071	52	2	8,741	10,404	2,787	614	195	51	25	8	8	1	0
2018	20,707	9,465	11,176	63	3	8,301	9,297	2,429	504	133	33	7	2	0	0	0
2019	20,569	9,206	11,287	74	2	8,422	9,403	2,473	228	36	6	0	0	0	0	0
2020	20,849	8,527	12,255	65	2	9,337	9,106	2,126	240	34	2	4	0	0	0	0
2021	20,504	7,851	12,590	61	1	9,810	8,565	1,923	180	20	5	0	0	1	0	0
2022	21,241	8,183	12,973	83	2	9,915	9,063	2,072	155	28	7	1	0	0	0	0

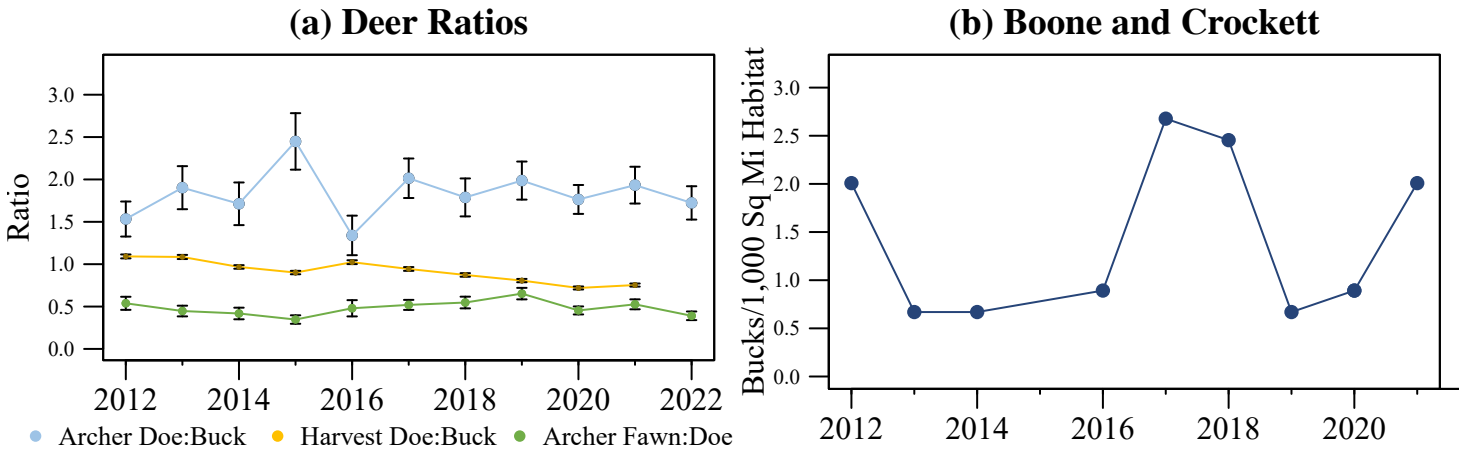

Figure 2. (a) Annual doe:buck ratios and fawn:doe ratios based on the Archer's Index and harvest records. (b) The number of Boone and Crockett bucks (minimum 160 score) per 1,000 square miles of deer habitat.

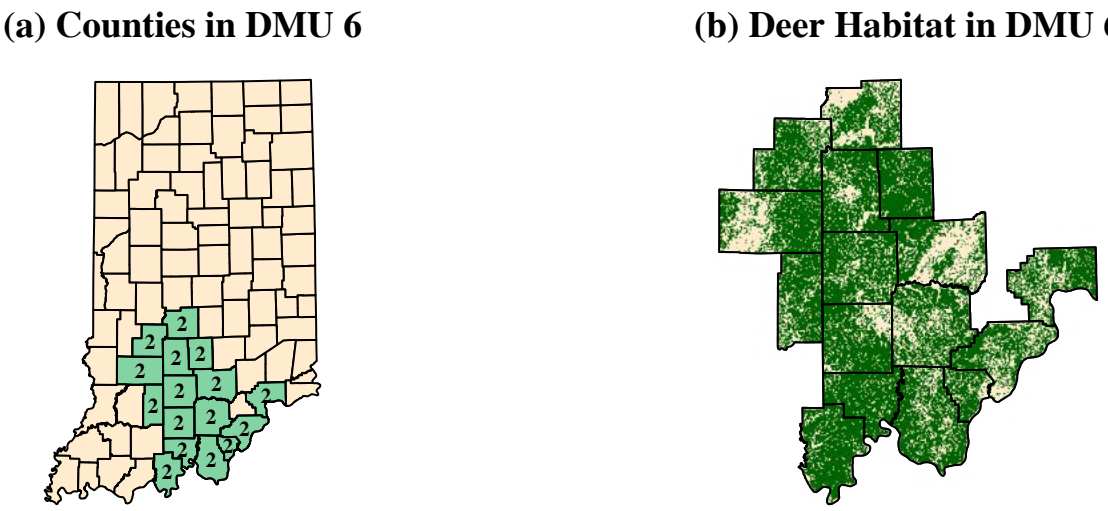

Figure 3. (a) Counties included in DMU 6 for summarizing harvest and deer management survey statistics. Labels are the 2022 county bonus antlerless quotas. (b) Green represents the land use types classified as deer habitat in DMU 6.

DMU 6: South

3/24/2023

Deer Management Survey Results

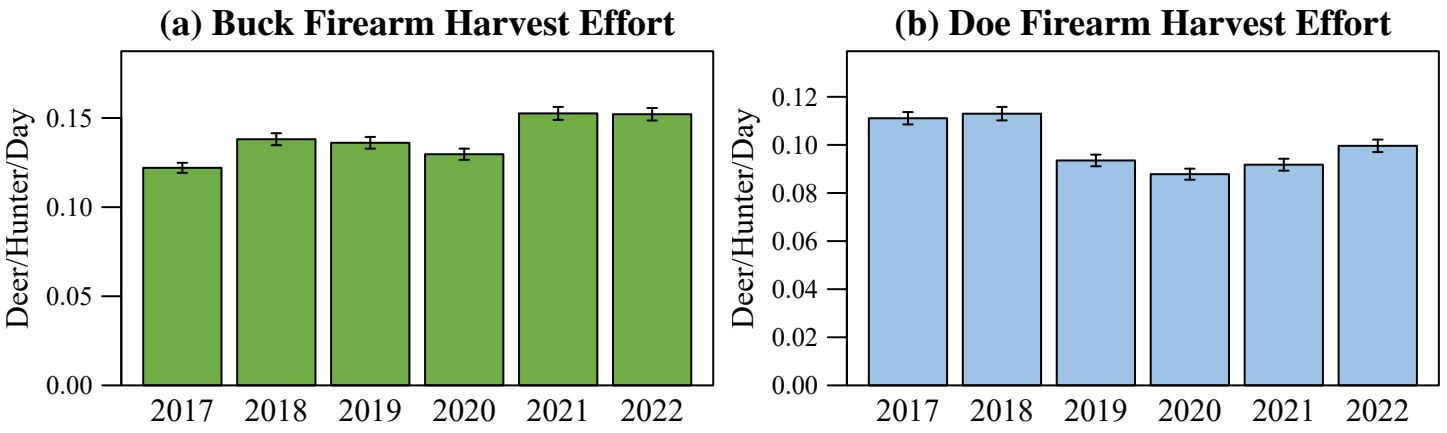

Figure 4. Firearm harvest effort is the number of bucks (a) and does (b) killed by firearms per hunter divided by the mean number of days hunted per hunter during the firearm season based on data reported in the deer management survey. Larger values (i.e taller bars) indicate less effort required to harvest a deer.

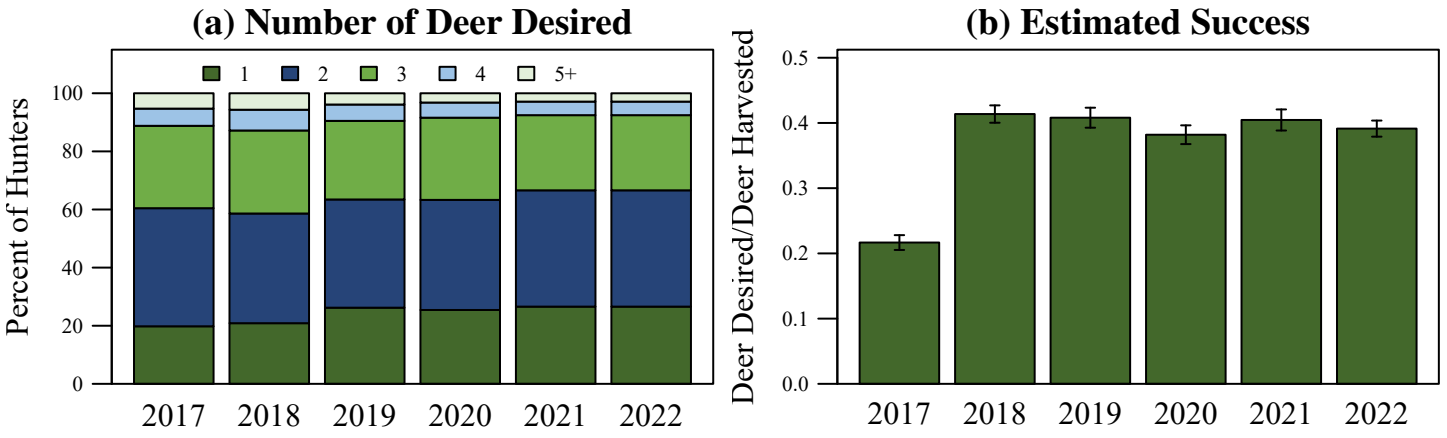

Figure 5. (a) The annual percent of hunters wishing to harvest each number of deer as reported in the deer management survey. (b) Success rate is estimated from the deer management survey as the Number of Harvested Deer/Number of Deer Desired (reported only; does not account for attempts that were not made). Larger values (i.e. taller bars) indicate greater success.

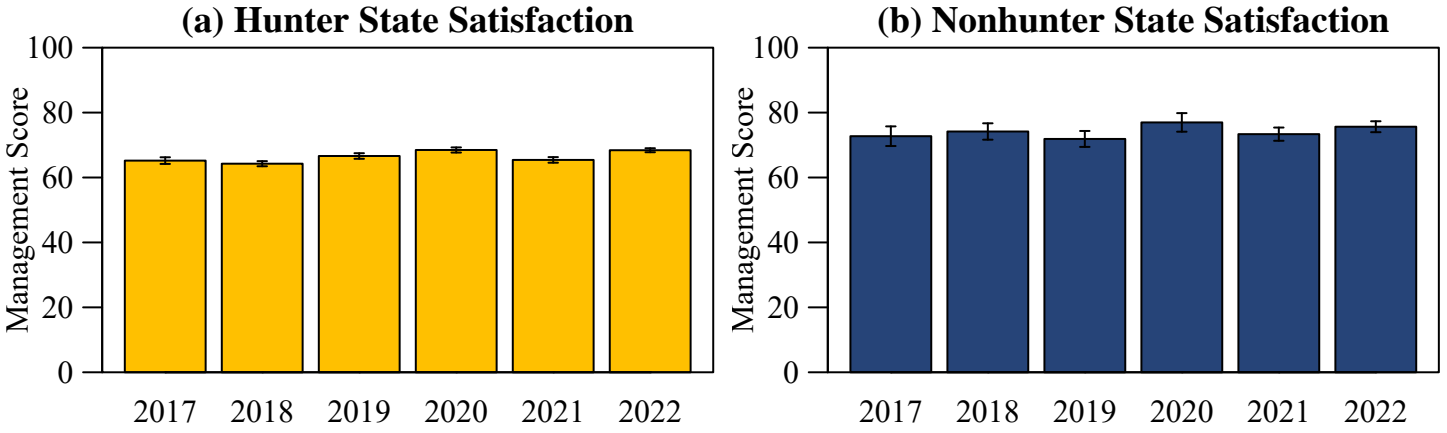

Figure 6. Hunters (a) and nonhunters (b) were asked to score the DNR's statewide deer management on a scale of 0 (poor) to 100 (excellent).

DMU 6: South

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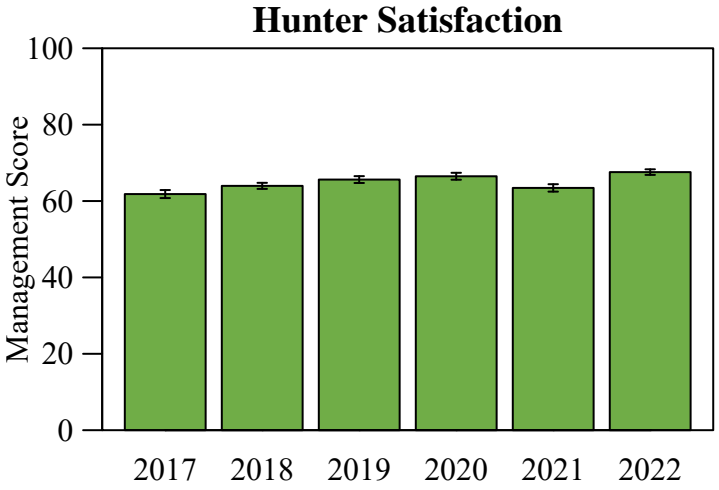


Figure 7. Hunters were asked to score the DNR's county deer management on a scale of 0 (poor) to 100 (excellent) for the county in DMU 6 where they hunt.

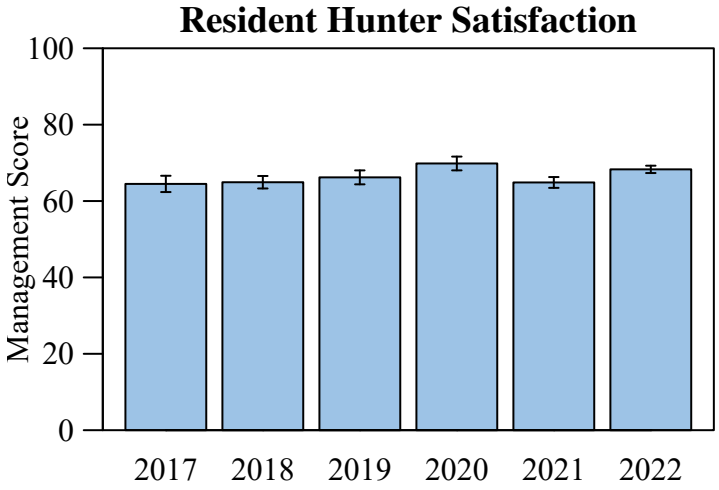


Figure 8. Hunters were asked to score the DNR's county deer management on a scale of 0 (poor) to 100 (excellent) for the county in DMU 6 where they live.

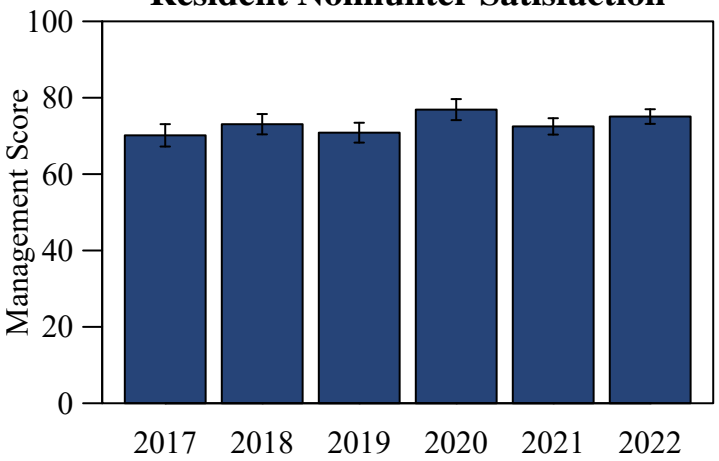


Figure 9. Nonhunters were asked to score the DNR's county deer management on a scale of 0 (poor) to 100 (excellent) for the county in DMU 6 where they live.

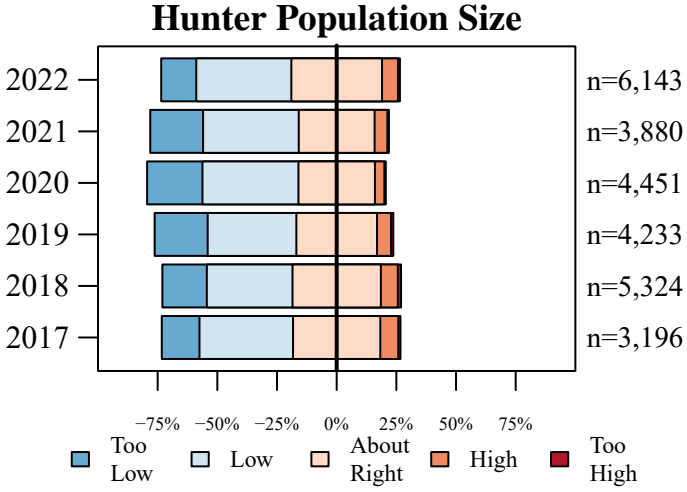
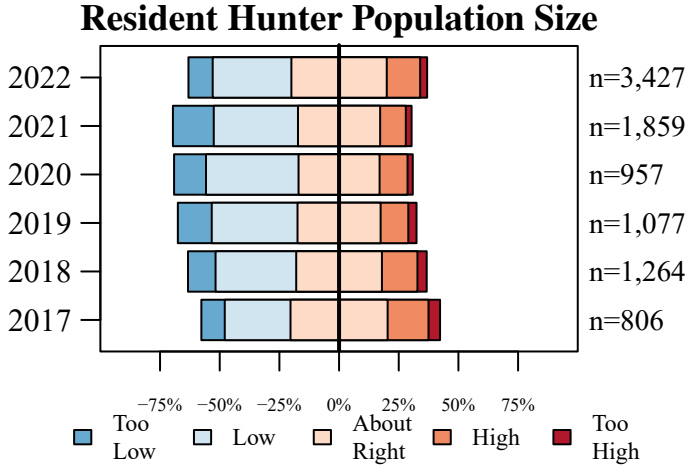


Figure 10. The current size of the deer population described by hunters in the county where they hunt in DMU 6.



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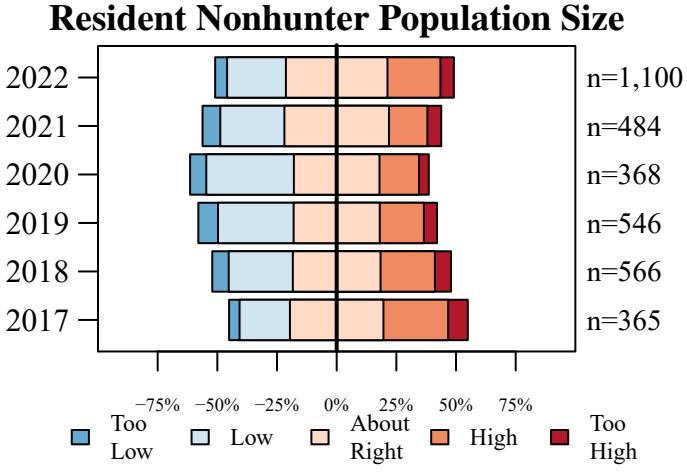
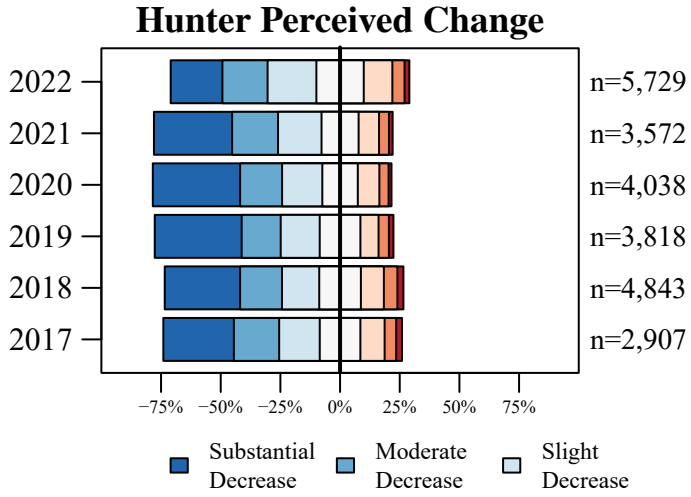


Figure 12. The current size of the deer population described by nonhunters in the county where they live in DMU 6.

DMU 6: South

3/24/2023

Deer Management Survey Results



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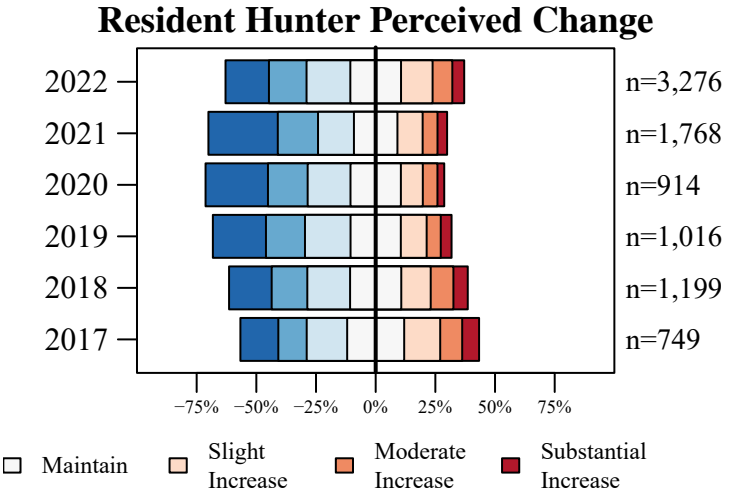

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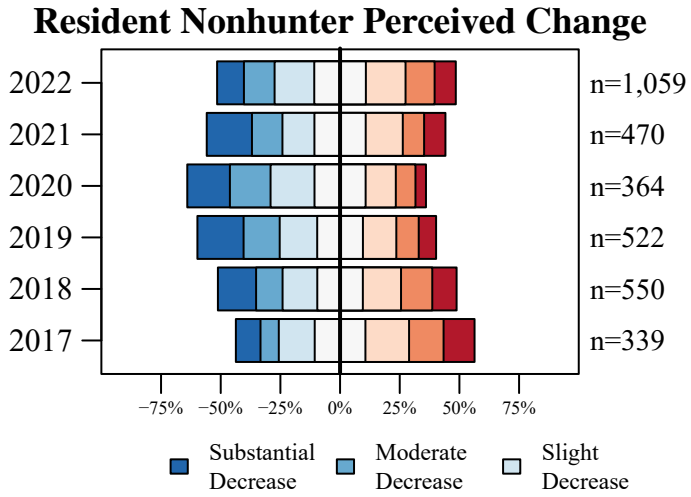

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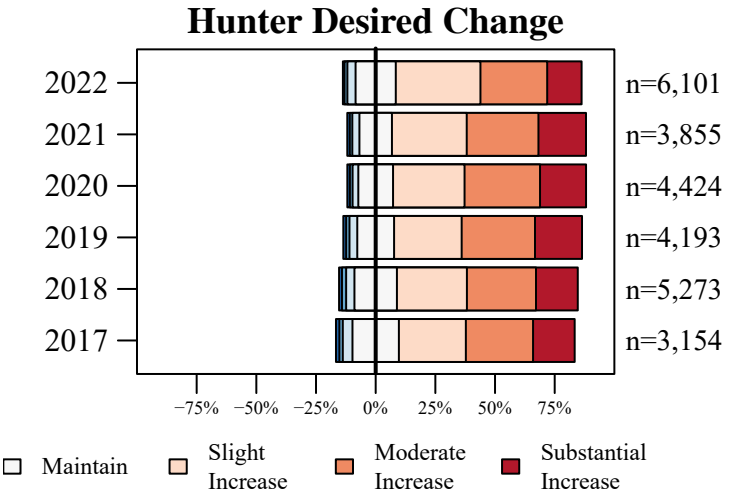

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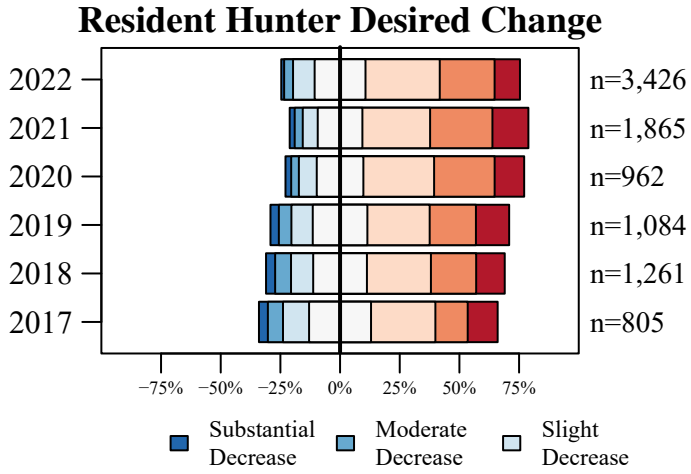

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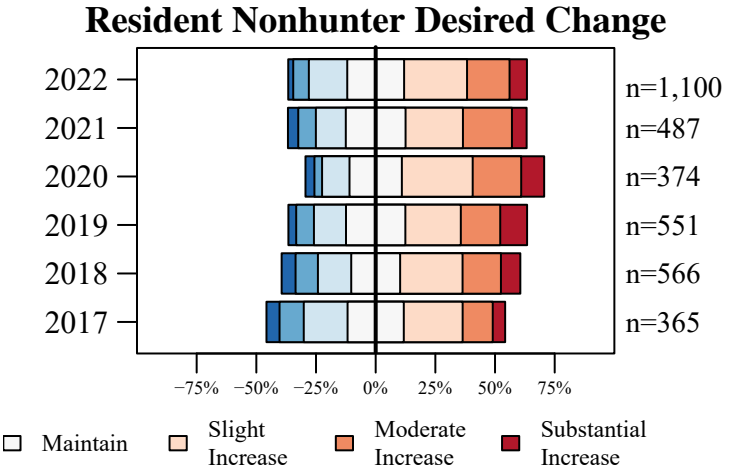
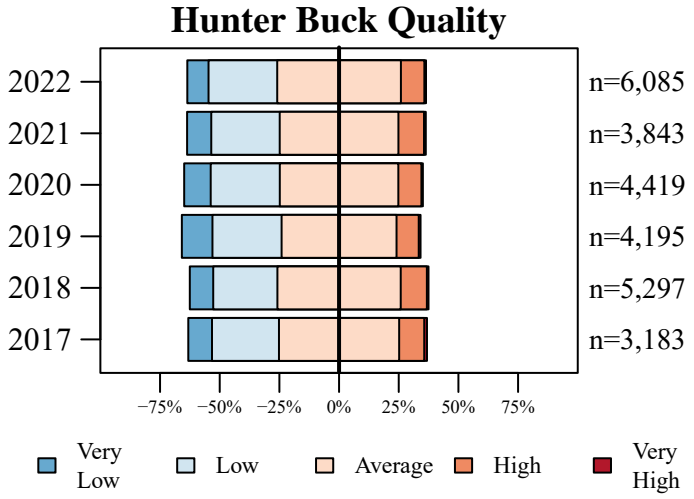


Figure 18. The desired change in the size of the deer population described by nonhunters in the county where they live in DMU 6.

DMU 6: South

3/24/2023

Deer Management Survey Results



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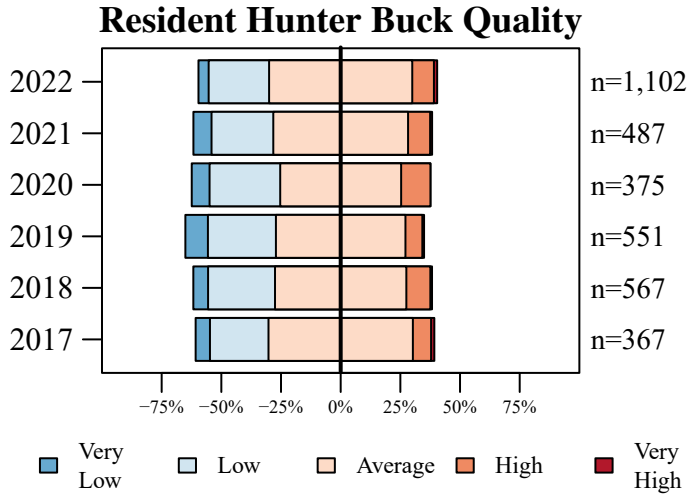

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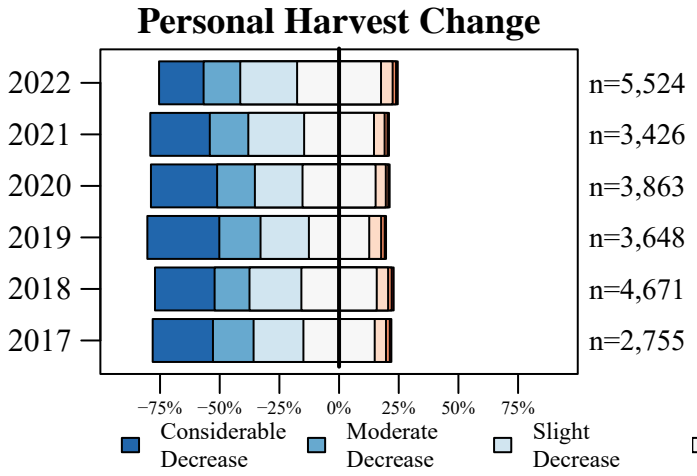
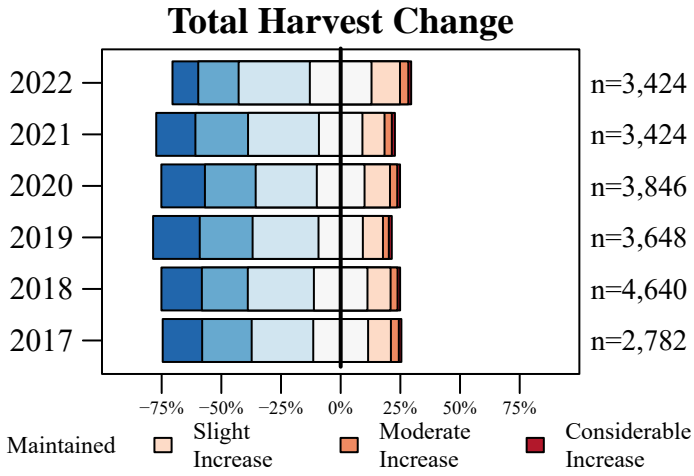


Figure 21. Opinion of hunters on how their personal number of harvested deer has changed over the last five years in a county in DMU 6.



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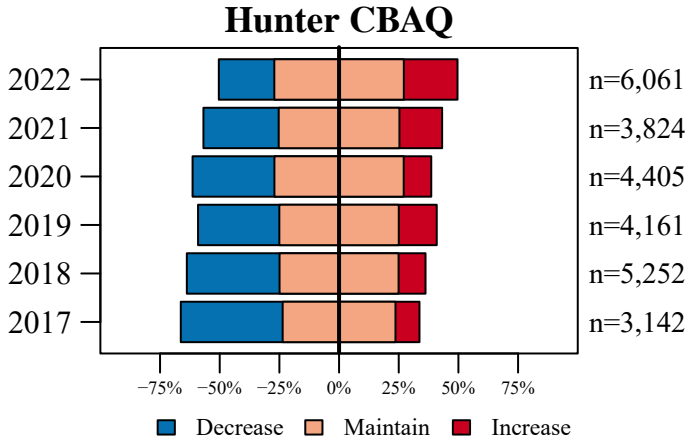


Figure 23. Opinion on how the County Bonus Antlerless Quota should change from hunters in the county where they hunt in DMU 6.

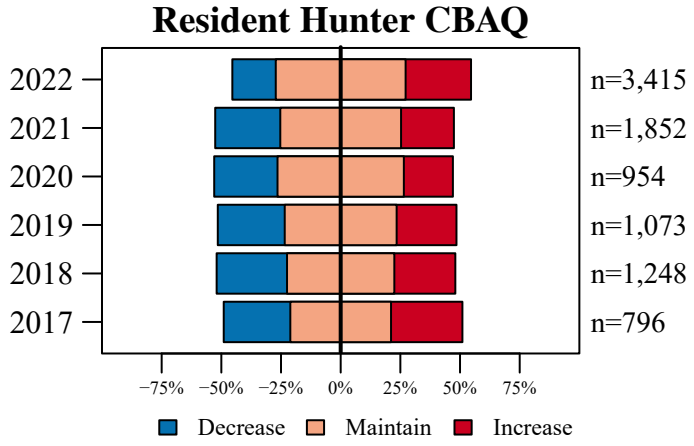


Figure 24. Opinion on how the County Bonus Antlerless Quota should change from hunters in the county where they live in DMU 6.

DMU 6: South

3/24/2023

Deer Management Survey Results

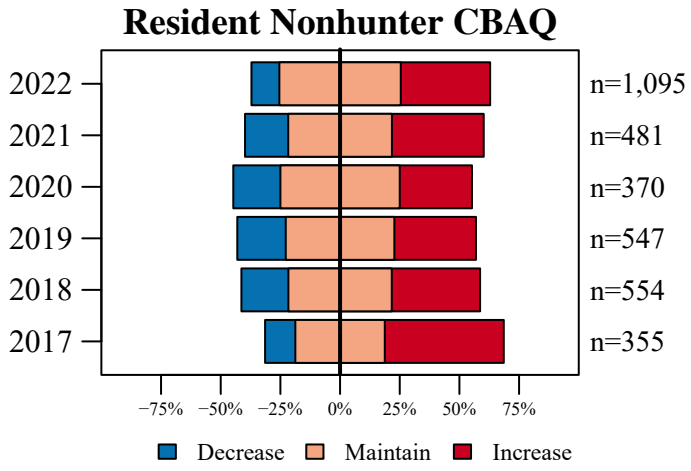
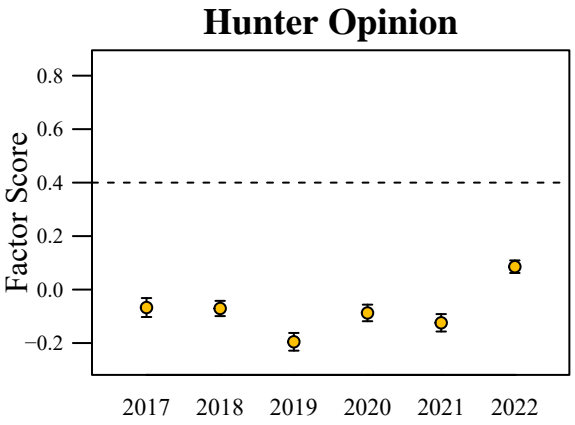


Figure 25. Opinion on how the County Bonus Antlerless Quota should change from nonhunters in the county where they live in DMU 6.



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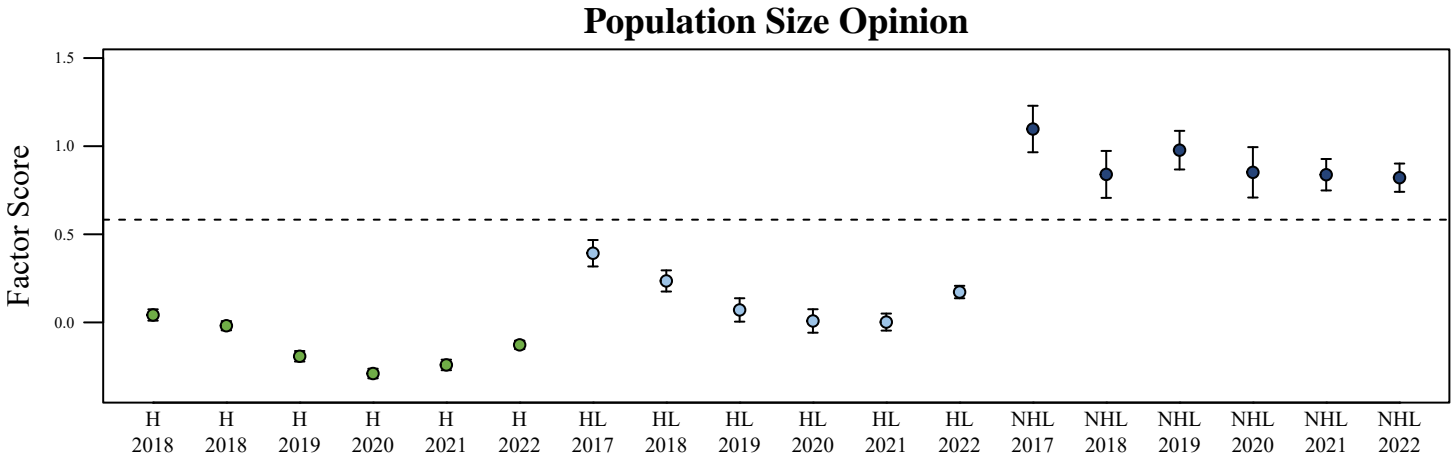

Figure 27. The opinion of nonhunters (NHL) and hunters in the county where they live (HL) and hunters in the county where they hunt (H) on deer population size. The score was aggregated using factor analysis of questions asked to all participants. The dashed line represents the score if all questions are answered neutrally.

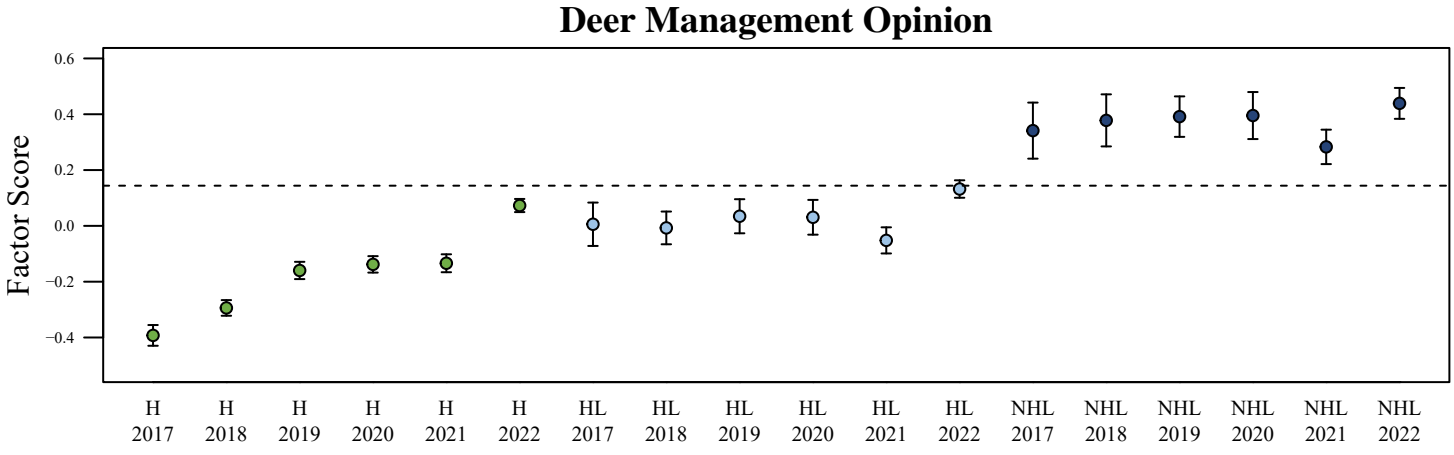

Figure 28. The opinion of nonhunters (NHL) and hunters in the county where they live (HL) and hunters in the county where they hunt (H) on deer management. The score was aggregated using factor analysis of questions asked to all participants. The dashed line represents the score if all questions are answered neutrally.

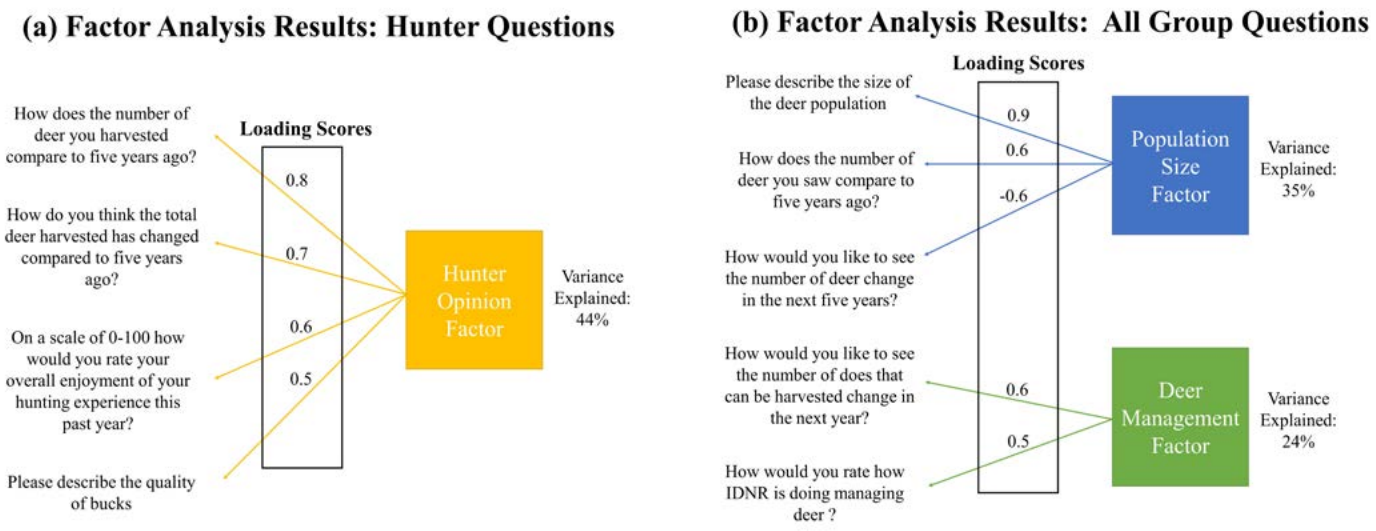

Figure 29. Results from two factor analyses used to develop the hunter opinion (a), population opinion (b), management opinion (b), and scores. Higher loading scores indicate a stronger correlation between the original question and the derived factor. These figures are included to help interpret Figure 26, Figure 27, and Figure 28.

DMU 7: Muscatatuck

3/24/2023

Total Square Miles: 1,410
Square Miles of Deer Habitat: 824
Percent Deer Habitat: 58

Table 1. Total harvest, buck harvest, and doe harvest (error < 1 percent). Damage permits are issued by DNR to landowners to control deer damage. Deer vehicle collisions (DVC) and miles traveled are reported by the Indiana Department of Transportation. Mean CBAQ is the average county bonus antlerless quota of all counties in the DMU. The trend in total harvest, buck harvest, doe harvest, and DVCs are in standard deviations (SD) and are equivalent to effect size. A change greater than 2 SD is considered both a large and statistically significant effect size.

Year	Total	Total Trend in SD	Buck Harvest	Buck Trend in SD	Buck Harvest per SQ MI Habitat	Doe Harvest	Doe Trend in SD	Doe Harvest per SQ MI Habitat	% Doe in Harvest	Damage Permit Deer Taken	DVC per Billion Miles Traveled	DVC Trend in SD	Mean CBAQ
2009	7,794		3,828		4.6	3,966		4.8	50.9		239.0		6.0
2010	7,970	1.5	3,890	1.4	4.7	4,080	1.7	5.0	51.2		256.3	0.6	6.0
2011	7,747	0.7	3,790	0.7	4.6	3,957	0.7	4.8	51.1		275.5	2.0	7.0
2012	8,797	1.9	3,948	0.9	4.8	4,849	3.0	5.9	55.1		248.7	-0.2	8.0
2013	8,185	0.5	3,895	0.6	4.7	4,290	0.4	5.2	52.4		272.8	1.4	7.0
2014	7,639	-1.1	3,643	-3.7	4.4	3,996	-0.6	4.8	52.3		275.4	1.1	7.0
2015	8,380	0.7	4,219	3.2	5.1	4,161	-0.2	5.0	49.7		315.3	4.0	7.0
2016	7,641	-1.1	4,040	0.7	4.9	3,601	-1.8	4.4	47.1	117	339.5	2.6	7.0
2017	7,323	-1.6	3,602	-1.6	4.4	3,721	-1.0	4.5	50.8	138	370.3	2.2	7.0
2018	6,878	-2.2	3,462	-1.6	4.2	3,416	-1.9	4.1	49.7	81	318.7	0.1	4.0
2019	6,841	-1.3	3,589	-0.6	4.4	3,252	-1.8	3.9	47.5	169	314.2	-0.3	2.0
2020	6,510	-1.4	3,351	-1.3	4.1	3,159	-1.4	3.8	48.5	87	307.6	-1.0	2.5
2021	6,577	-1.0	3,745	0.5	4.5	2,832	-2.6	3.4	43.1	65	382.3	2.1	2.0
2022	5,100	-5.4	2,876	-4.5	3.5	2,224	-3.2	2.7	43.6	101	322.3	-0.5	1.8

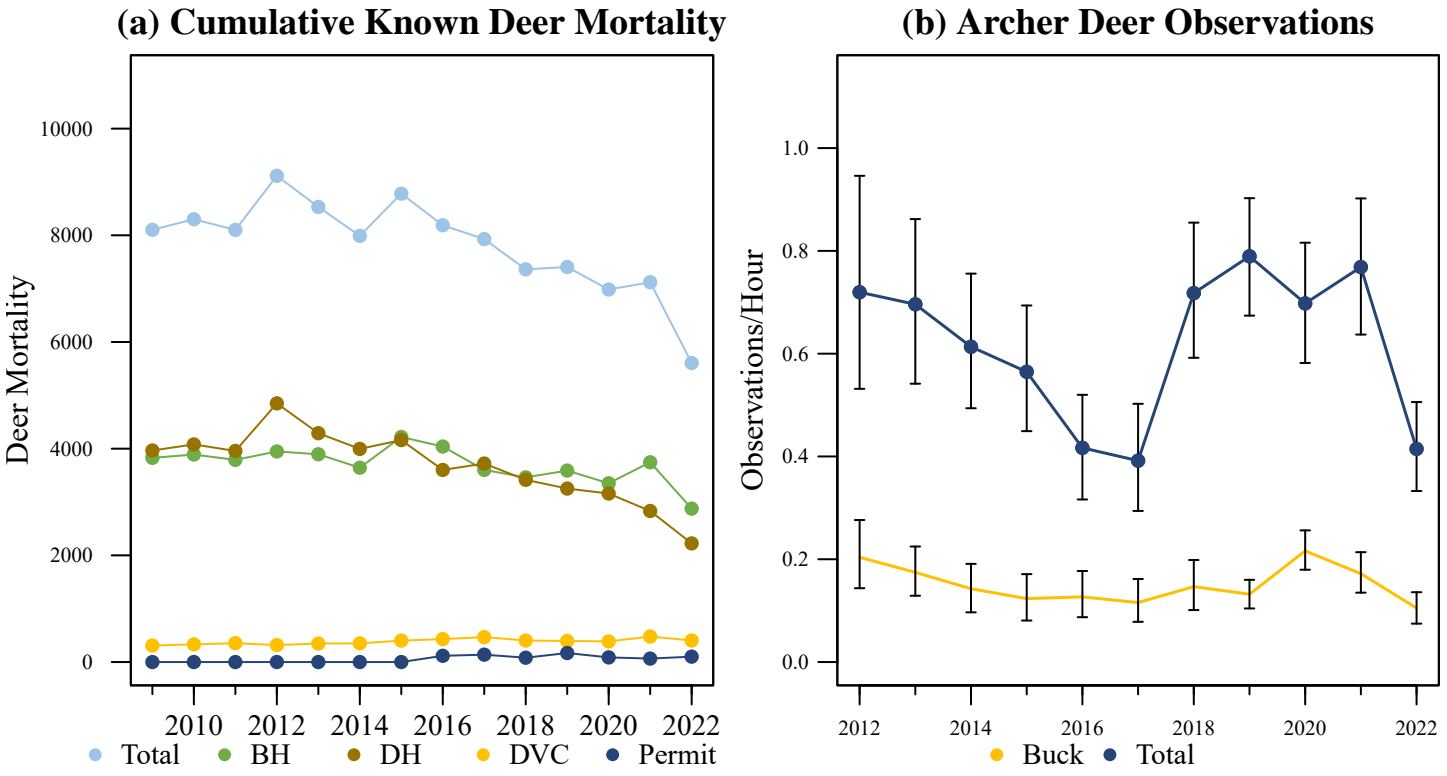

Figure 1. (a) The total known annual deer mortality based on buck harvests (BH), doe harvests (DH), deer vehicle collisions (DVC), and deer permit takes. (b) Total deer and buck observations per hour based on the Archer's Index.

DMU 7: Muscatatuck

3/24/2023

Total Square Miles: 1,410
Square Miles of Deer Habitat: 824
Percent Deer Habitat: 58

Table 2. Estimated number of antlered (A) and antlerless (AL) deer harvested per hunter. Estimated totals may not match exactly with total number of deer harvested. Reporting errors are examined and investigated as they are located; therefore, subsequent reports may contain corrected totals.

Year	Total Hunters	0 A	1 A	2 A	3 A	0 AL	1 AL	2 AL	3 AL	4 AL	5 AL	6 AL	7 AL	8 AL	9 AL	10 AL
2016	5,548	2,428	3,051	69	0	2,288	2,388	652	161	36	14	5	2	0	1	1
2017	5,280	2,566	2,699	15	0	2,014	2,367	638	159	61	25	11	2	2	1	0
2018	5,010	2,408	2,589	13	0	1,864	2,290	648	162	39	7	0	0	0	0	0
2019	5,230	2,415	2,802	11	2	2,041	2,474	626	71	18	0	0	0	0	0	0
2020	4,906	2,264	2,629	12	1	1,916	2,252	631	91	13	3	0	0	0	0	0
2021	5,186	2,141	3,034	11	0	2,303	2,289	558	30	5	0	1	0	0	0	0
2022	4,129	1,838	2,286	5	0	1,743	1,995	368	20	2	1	0	0	0	0	0

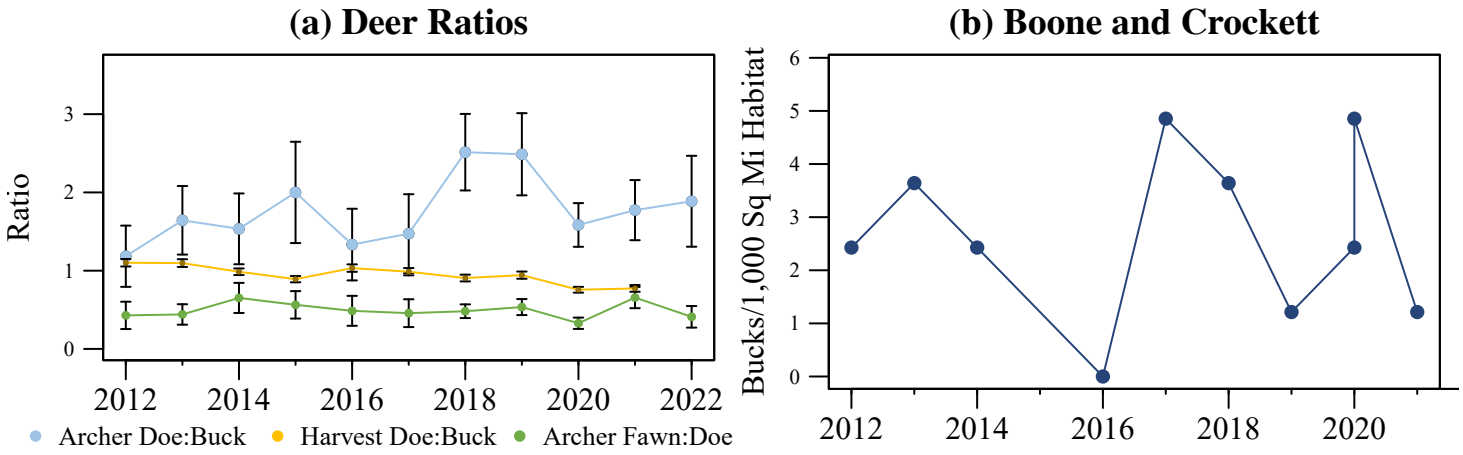

Figure 2. (a) Annual doe:buck ratios and fawn:doe ratios based on the Archer's Index and harvest records. (b) The number of Boone and Crockett bucks (minimum 160 score) per 1,000 square miles of deer habitat.

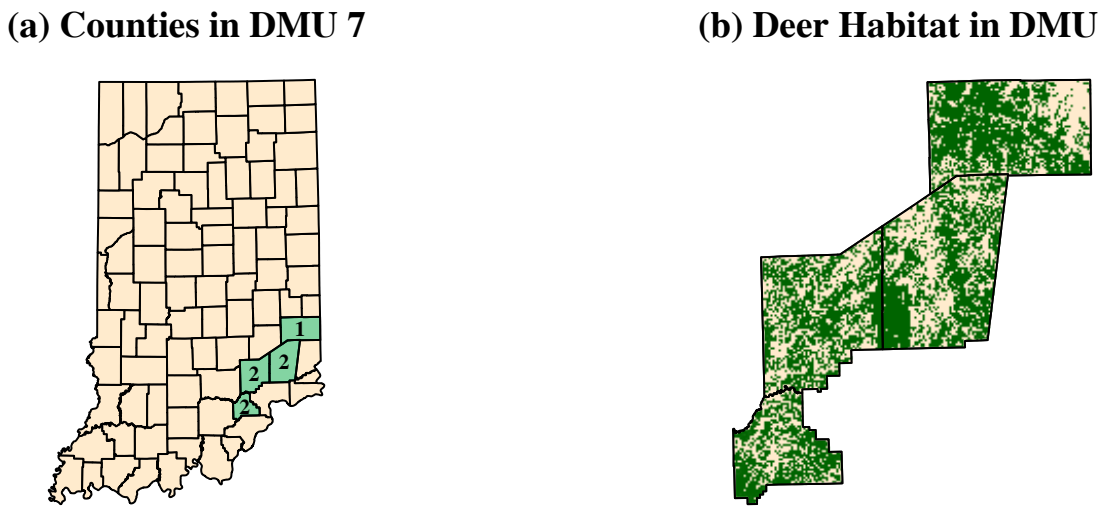

Figure 3. (a) Counties included in DMU 7 for summarizing harvest and deer management survey statistics. Labels are the 2022 county bonus antlerless quotas. (b) Green represents the land use types classified as deer habitat in DMU 7.

DMU 7: Muscatatuck

3/24/2023

Deer Management Survey Results

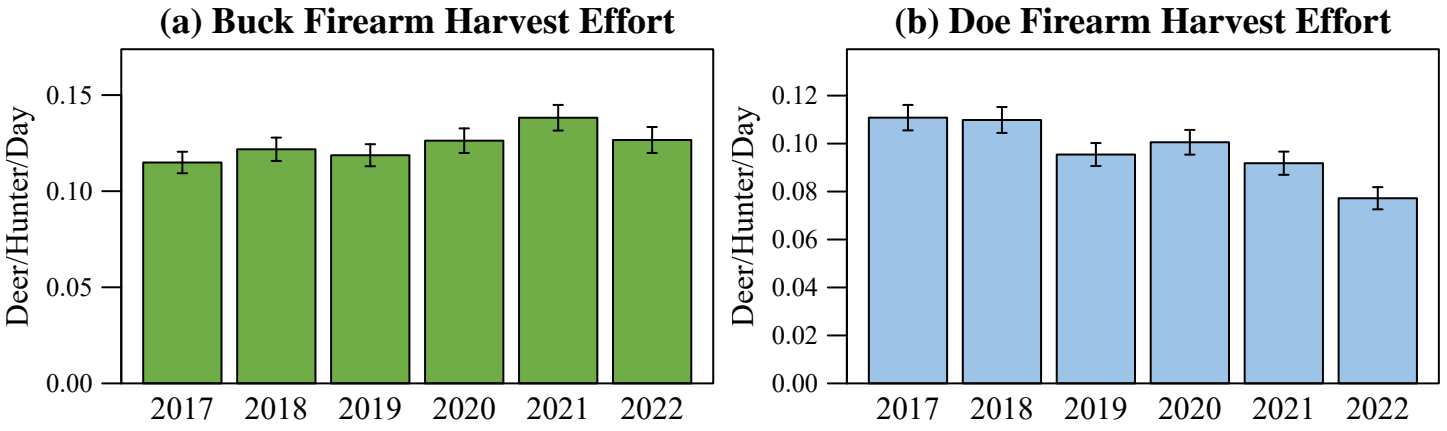

Figure 4. Firearm harvest effort is the number of bucks (a) and does (b) killed by firearms per hunter divided by the mean number of days hunted per hunter during the firearm season based on data reported in the deer management survey. Larger values (i.e taller bars) indicate less effort required to harvest a deer.

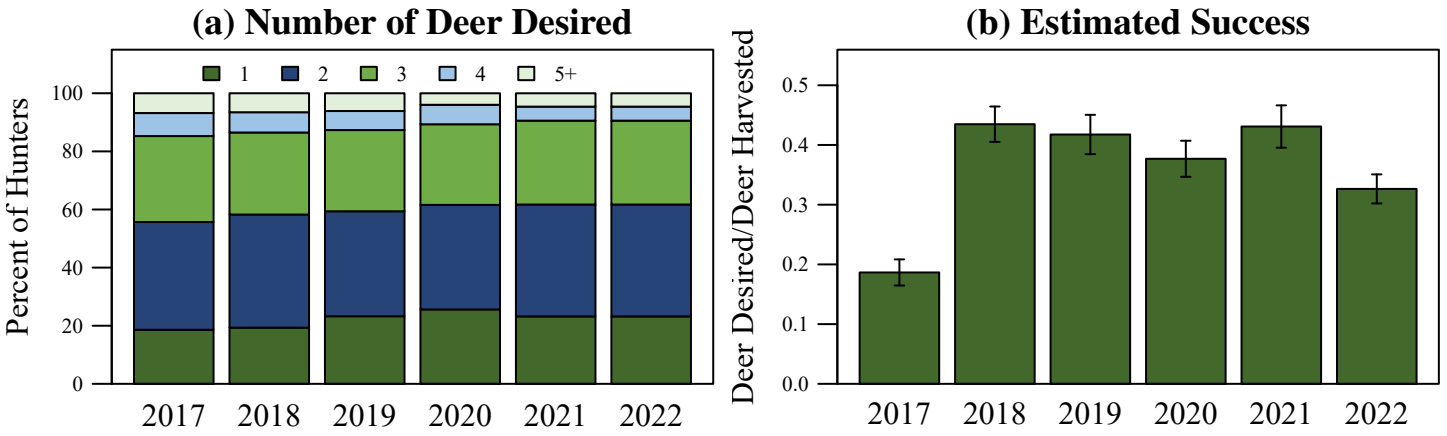

Figure 5. (a) The annual percent of hunters wishing to harvest each number of deer as reported in the deer management survey. (b) Success rate is estimated from the deer management survey as the Number of Harvested Deer/Number of Deer Desired (reported only; does not account for attempts that were not made). Larger values (i.e. taller bars) indicate greater success.

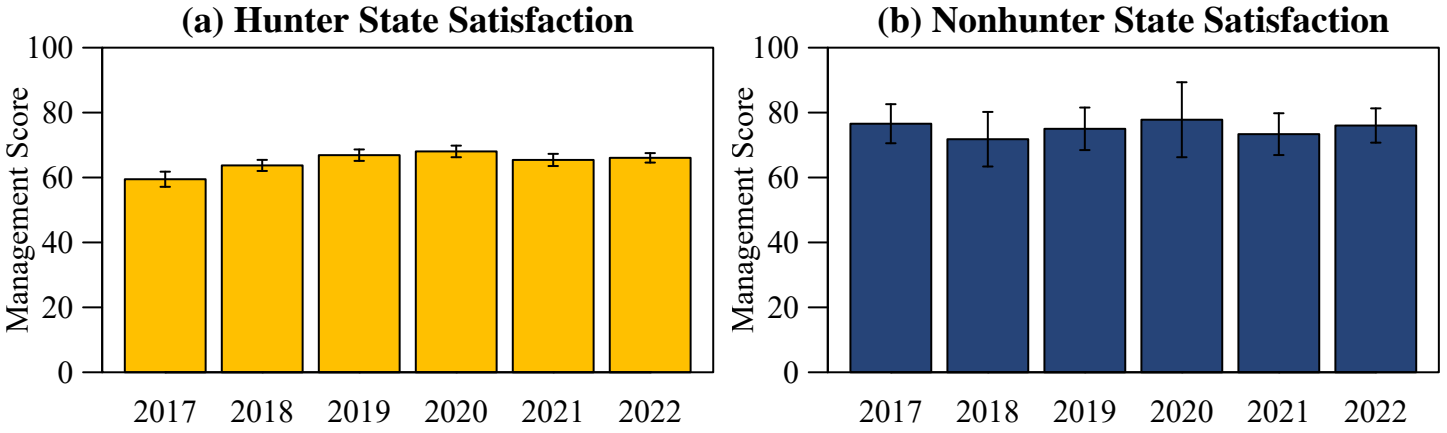

Figure 6. Hunters (a) and nonhunters (b) were asked to score the DNR's statewide deer management on a scale of 0 (poor) to 100 (excellent).

DMU 7: Muscatatuck

3/24/2023

Deer Management Survey Results

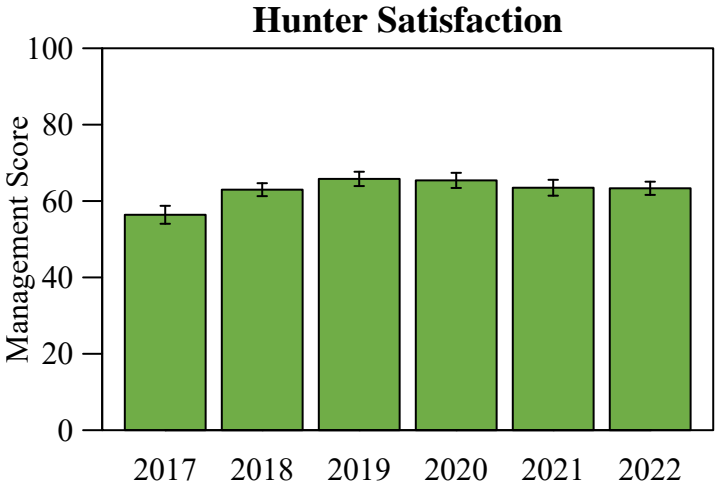

Figure 7. Hunters were asked to score the DNR's county deer management on a scale of 0 (poor) to 100 (excellent) for the county in DMU 7 where they hunt.

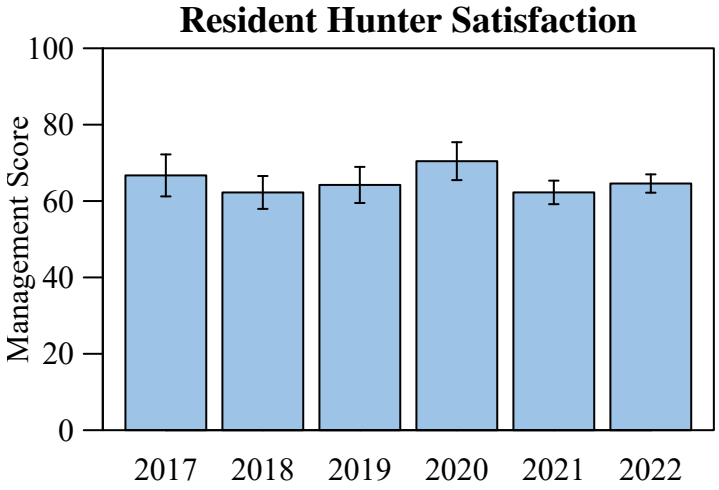

Figure 8. Hunters were asked to score the DNR's county deer management on a scale of 0 (poor) to 100 (excellent) for the county in DMU 7 where they live.

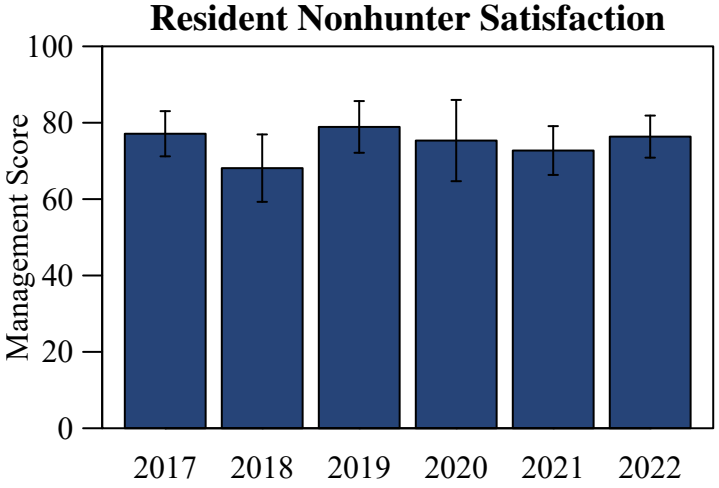

Figure 9. Nonhunters were asked to score the DNR's county deer management on a scale of 0 (poor) to 100 (excellent) for the county in DMU 7 where they live.

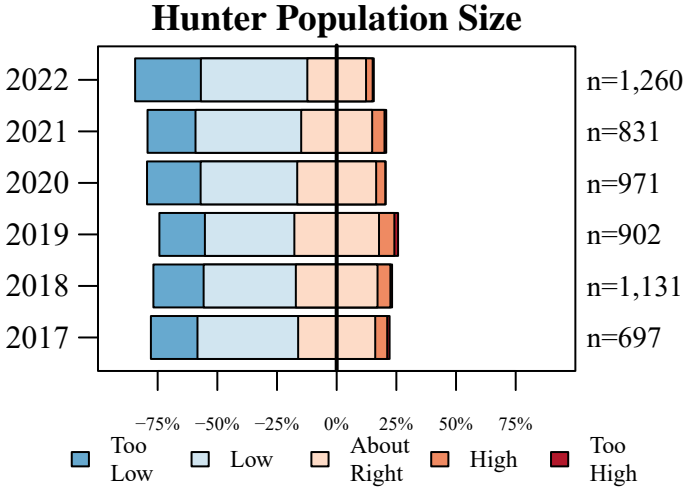

Figure 10. The current size of the deer population described by hunters in the county where they hunt in DMU 7.

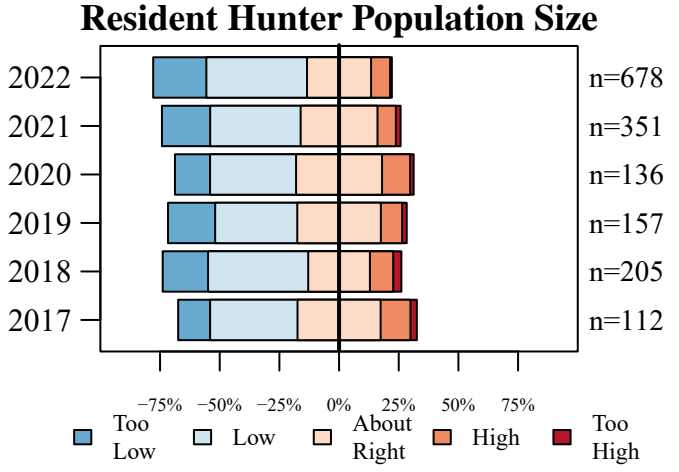

Figure 11. The current size of the deer population described by hunters in the county where they live in DMU 7.

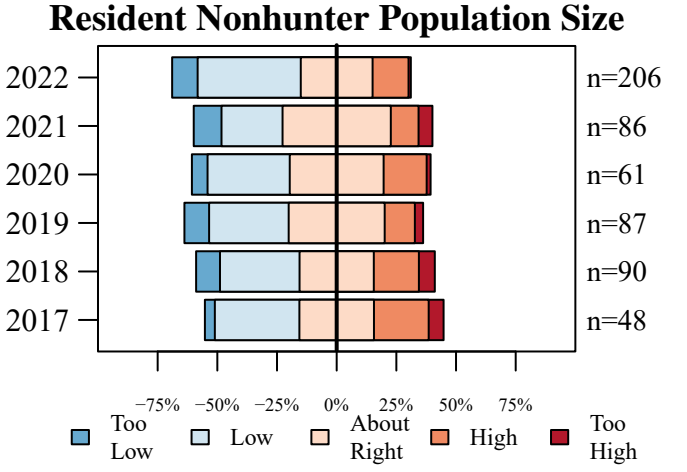

Figure 12. The current size of the deer population described by nonhunters in the county where they live in DMU 7.

DMU 7: Muscatatuck

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Deer Management Survey Results

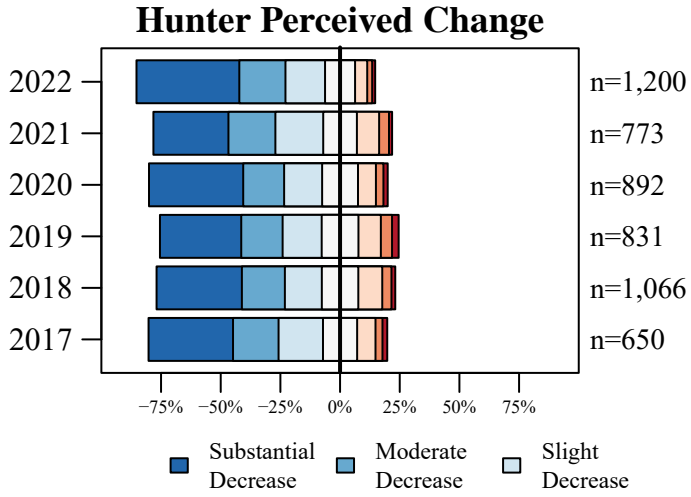
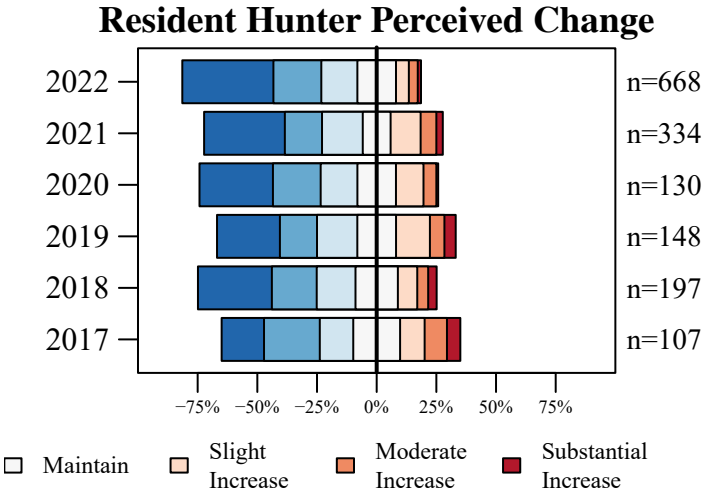


Figure 13. The number of deer seen compared to five years ago described by hunters in the county where they hunt in DMU 7.



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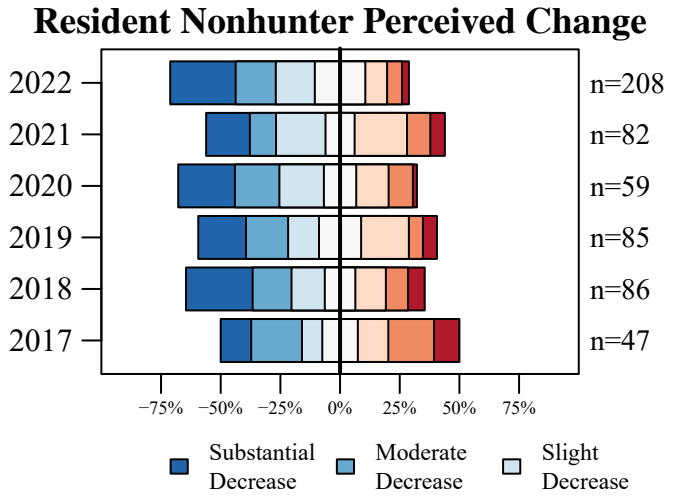


Figure 15. The number of deer seen compared to five years ago described by nonhunters in the county where they live in DMU 7.

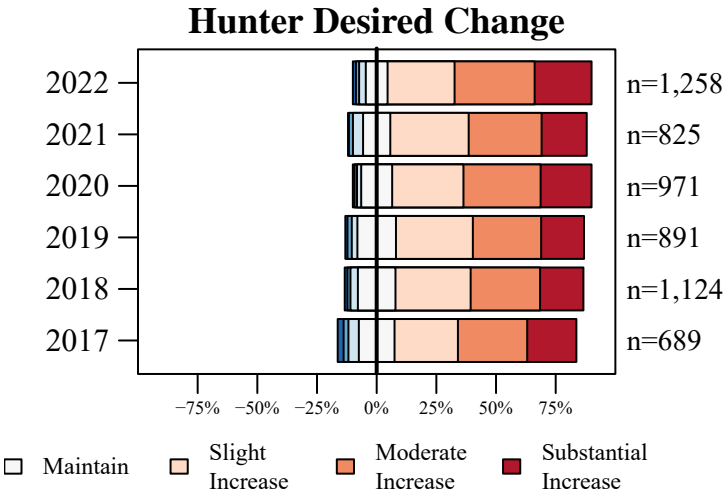
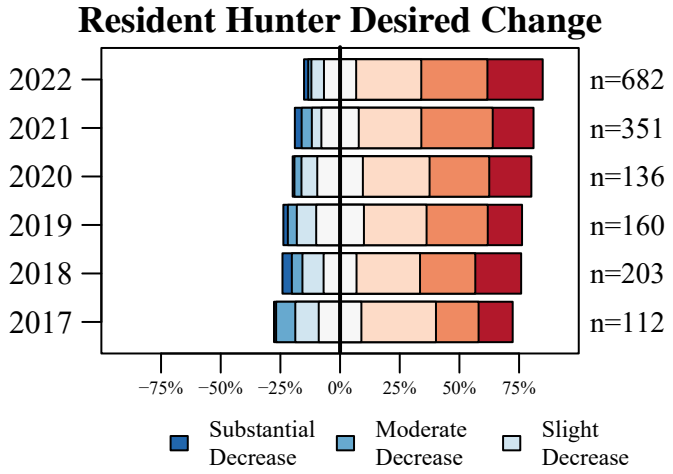


Figure 16. The desired change in the size of the deer population described by hunters in the county where they hunt in DMU 7.



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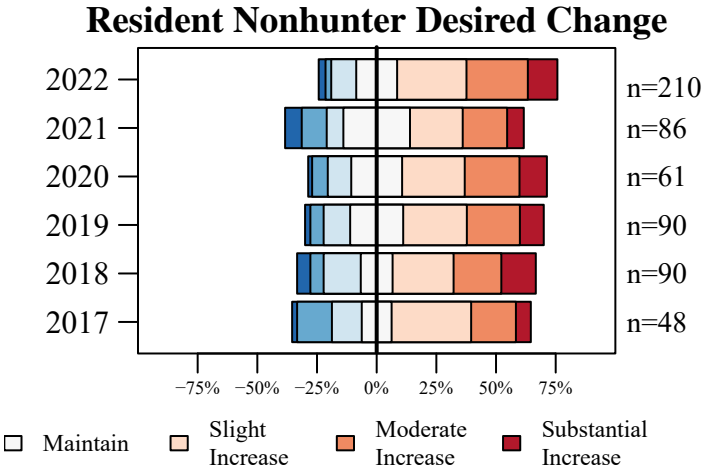

Figure 18. The desired change in the size of the deer population described by nonhunters in the county where they live in DMU 7.

DMU 7: Muscatatuck

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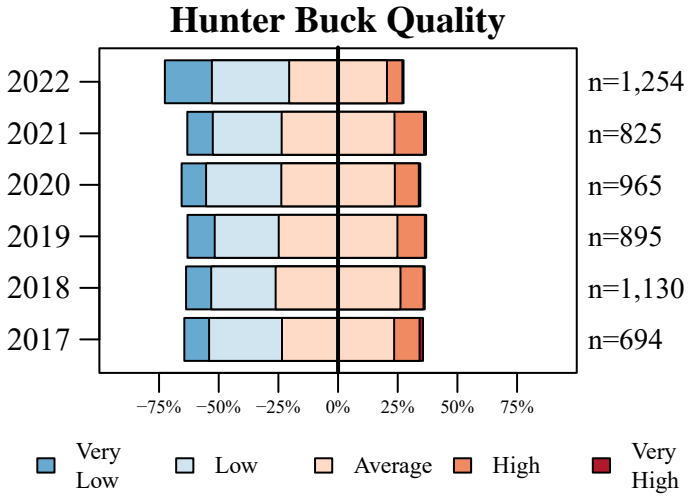
Deer Management Survey Results



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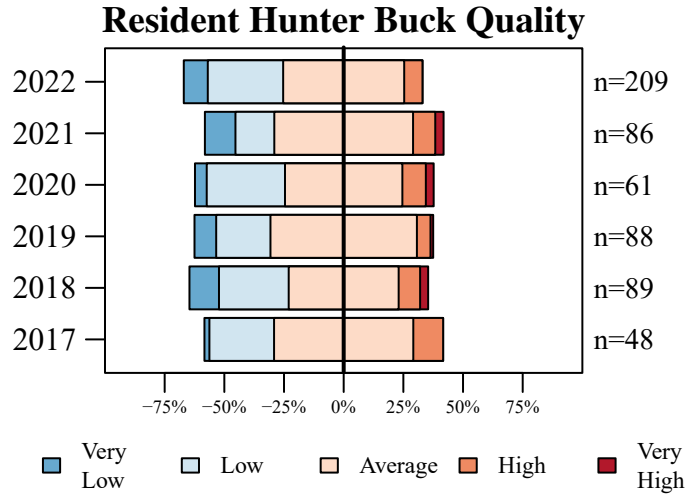

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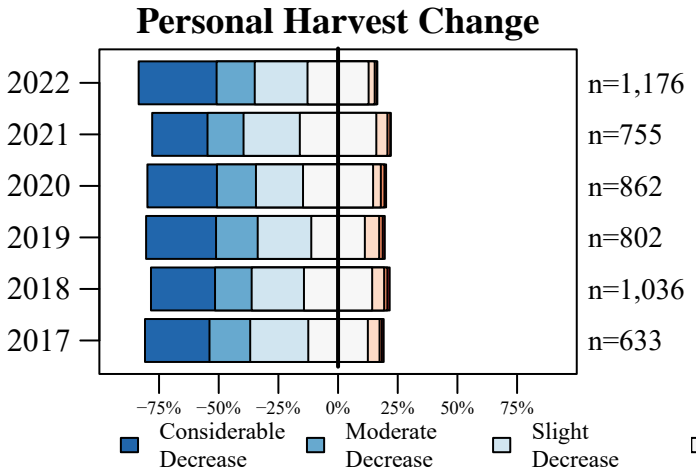

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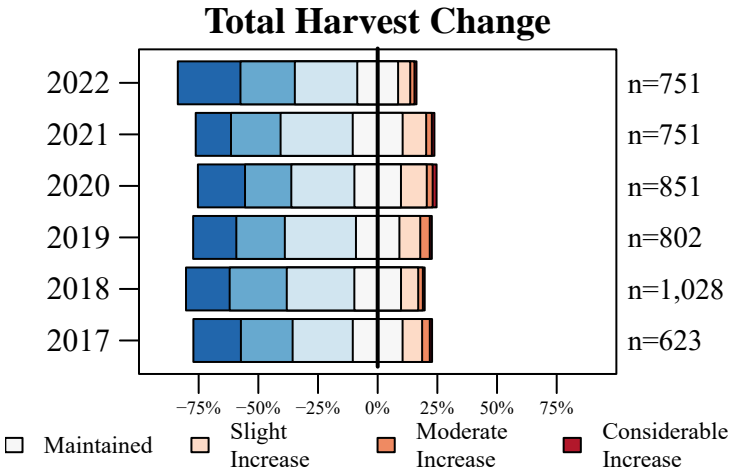

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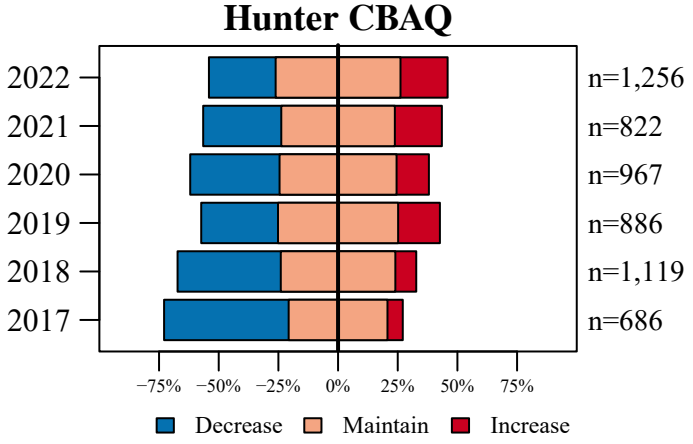

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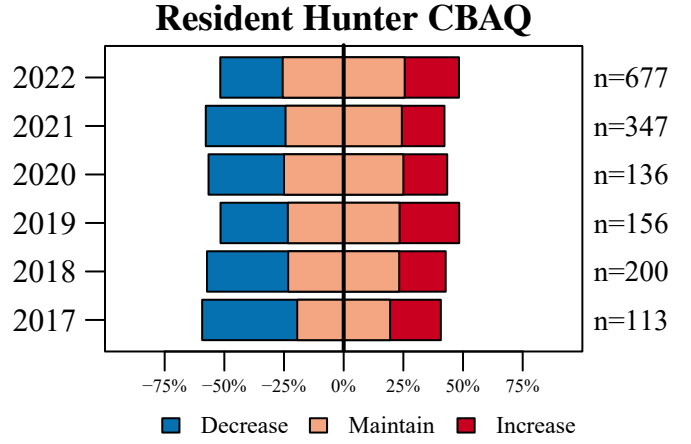

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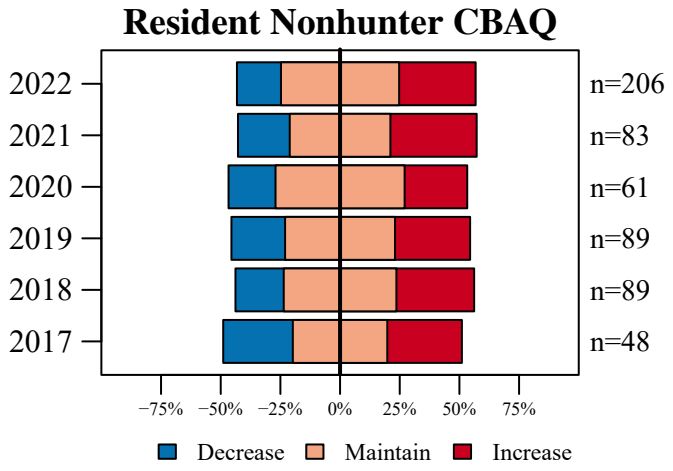
DMU 7: Muscatatuck

3/24/2023

Deer Management Survey Results



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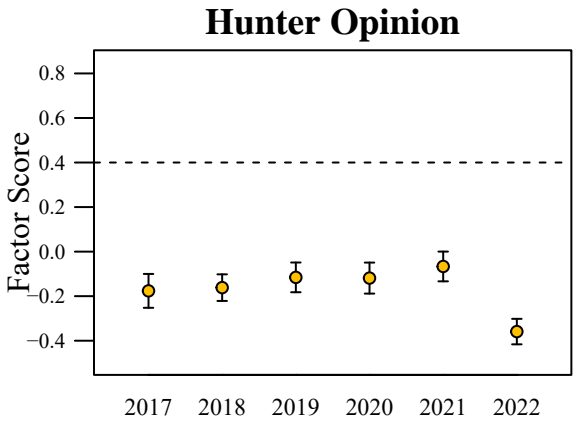

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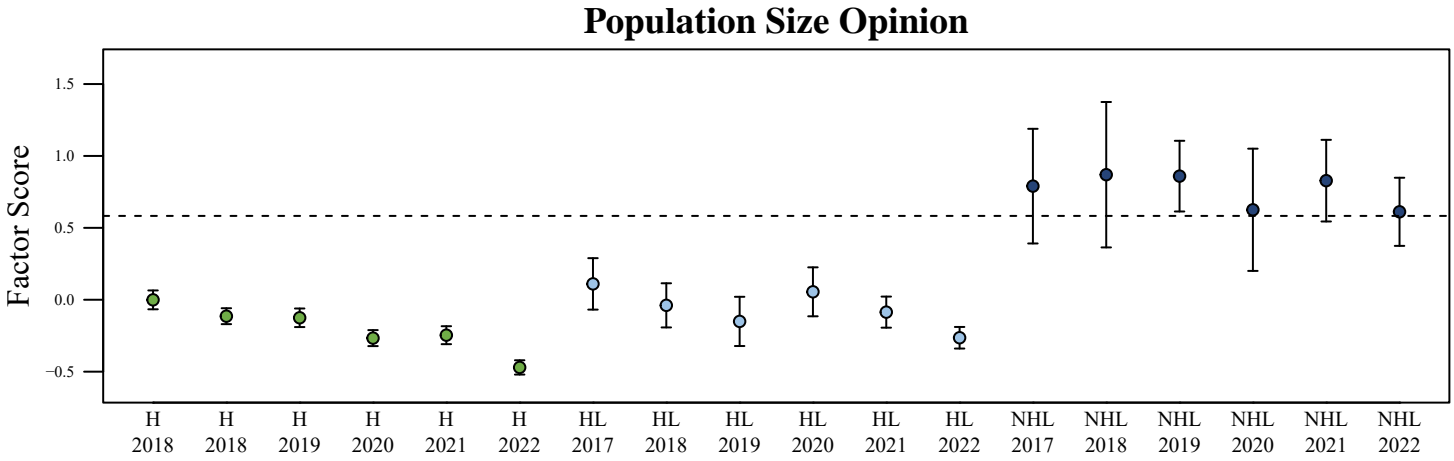

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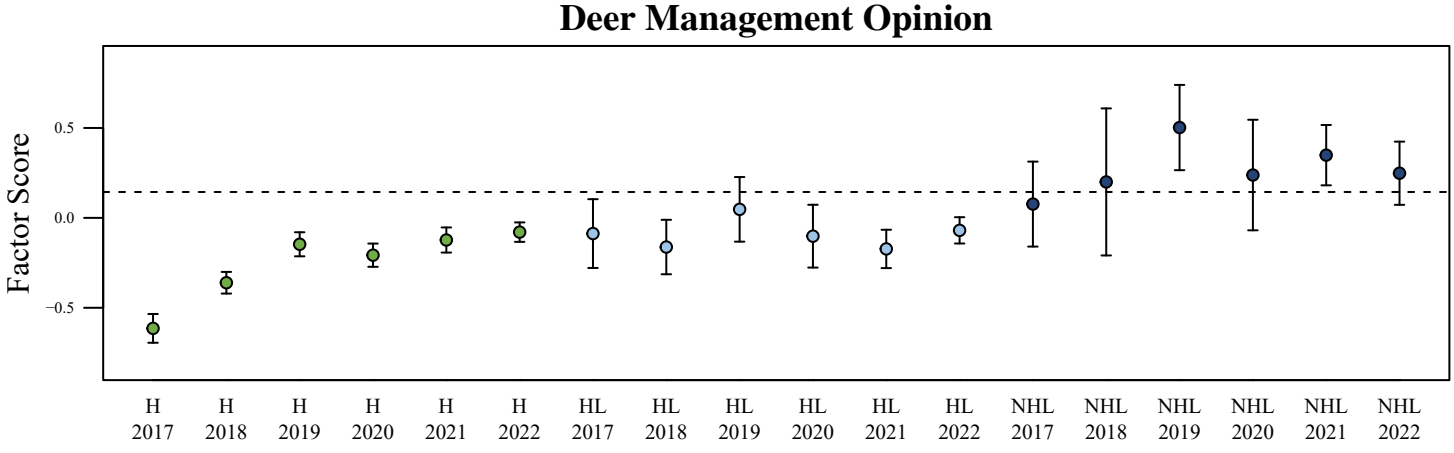

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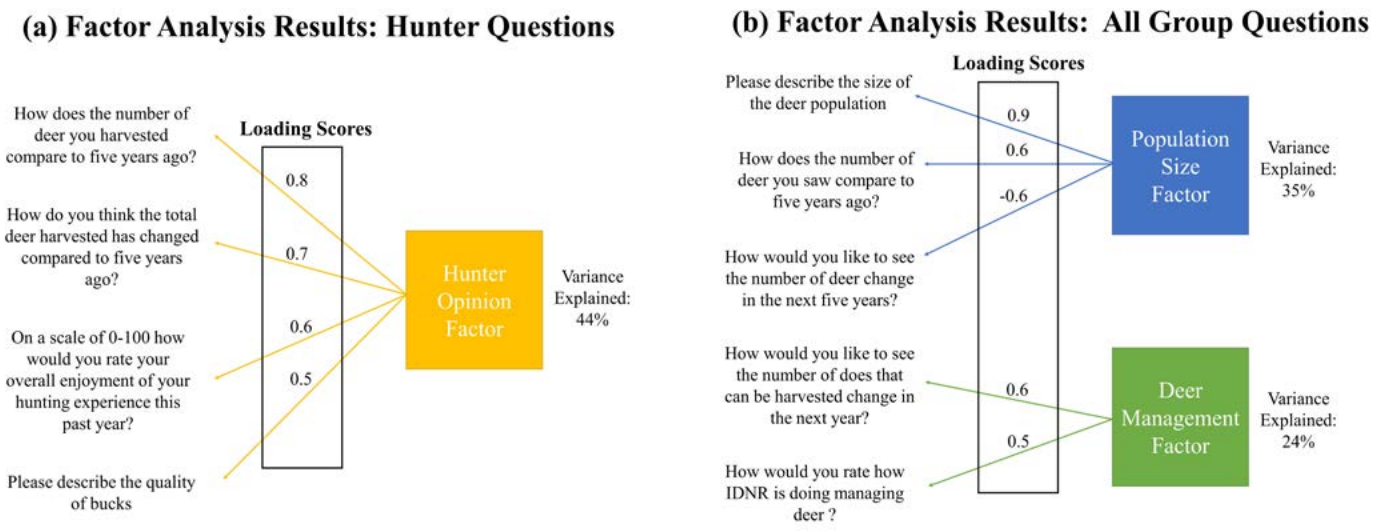

Figure 29. Results from two factor analyses used to develop the hunter opinion (a), population opinion (b), management opinion (b), and scores. Higher loading scores indicate a stronger correlation between the original question and the derived factor. These figures are included to help interpret Figure 26, Figure 27, and Figure 28.

DMU 8: Dearborn

3/24/2023

Total Square Miles: 618
Square Miles of Deer Habitat: 504
Percent Deer Habitat: 82

Table 1. Total harvest, buck harvest, and doe harvest (error < 1 percent). Damage permits are issued by DNR to landowners to control deer damage. Deer vehicle collisions (DVC) and miles traveled are reported by the Indiana Department of Transportation. Mean CBAQ is the average county bonus antlerless quota of all counties in the DMU. The trend in total harvest, buck harvest, doe harvest, and DVCs are in standard deviations (SD) and are equivalent to effect size. A change greater than 2 SD is considered both a large and statistically significant effect size.

Year	Total	Total Trend in SD	Buck Harvest	Buck Trend in SD	Buck Harvest per SQ MI Habitat	Doe Harvest	Doe Trend in SD	Doe Harvest per SQ MI Habitat	% Doe in Harvest	Damage Permit Deer Taken	DVC per Billion Miles Traveled	DVC Trend in SD	Mean CBAQ
2009	7,264		3,444		6.8	3,820		7.6	52.6		567.6		8.0
2010	7,333	1.6	3,403	1.3	6.8	3,930	1.9	7.8	53.6		614.9	0.3	8.0
2011	7,323	1.0	3,353	0.8	6.7	3,970	1.4	7.9	54.2		511.7	-1.7	8.0
2012	7,849	2.1	3,333	0.5	6.6	4,516	5.2	9.0	57.5		486.7	-1.5	8.0
2013	6,226	-2.0	2,789	-1.8	5.5	3,437	-1.6	6.8	55.2		512.5	-0.7	8.0
2014	6,077	-1.9	2,733	-2.0	5.4	3,344	-1.5	6.6	55.0		462.9	-1.5	6.7
2015	6,023	-1.2	3,108	0.0	6.2	2,915	-2.0	5.8	48.4		540.3	0.4	5.3
2016	5,514	-1.4	2,965	-0.3	5.9	2,549	-1.8	5.1	46.2	175	424.9	-2.7	4.0
2017	5,205	-1.3	2,537	-1.8	5.0	2,668	-0.9	5.3	51.3	130	438.6	-1.1	4.0
2018	4,684	-2.6	2,353	-2.2	4.7	2,331	-1.6	4.6	49.8	174	415.6	-1.2	3.3
2019	4,733	-1.3	2,586	-0.5	5.1	2,147	-1.6	4.3	45.4	127	499.3	0.9	2.0
2020	4,921	-0.6	2,549	-0.5	5.1	2,372	-0.5	4.7	48.2	107	409.6	-1.0	2.0
2021	4,452	-1.6	2,478	-0.5	4.9	1,974	-2.2	3.9	44.3	102	429.3	-0.2	2.0
2022	4,046	-2.7	2,200	-3.3	4.4	1,846	-1.7	3.7	45.6	130	364.5	-2.1	2.0

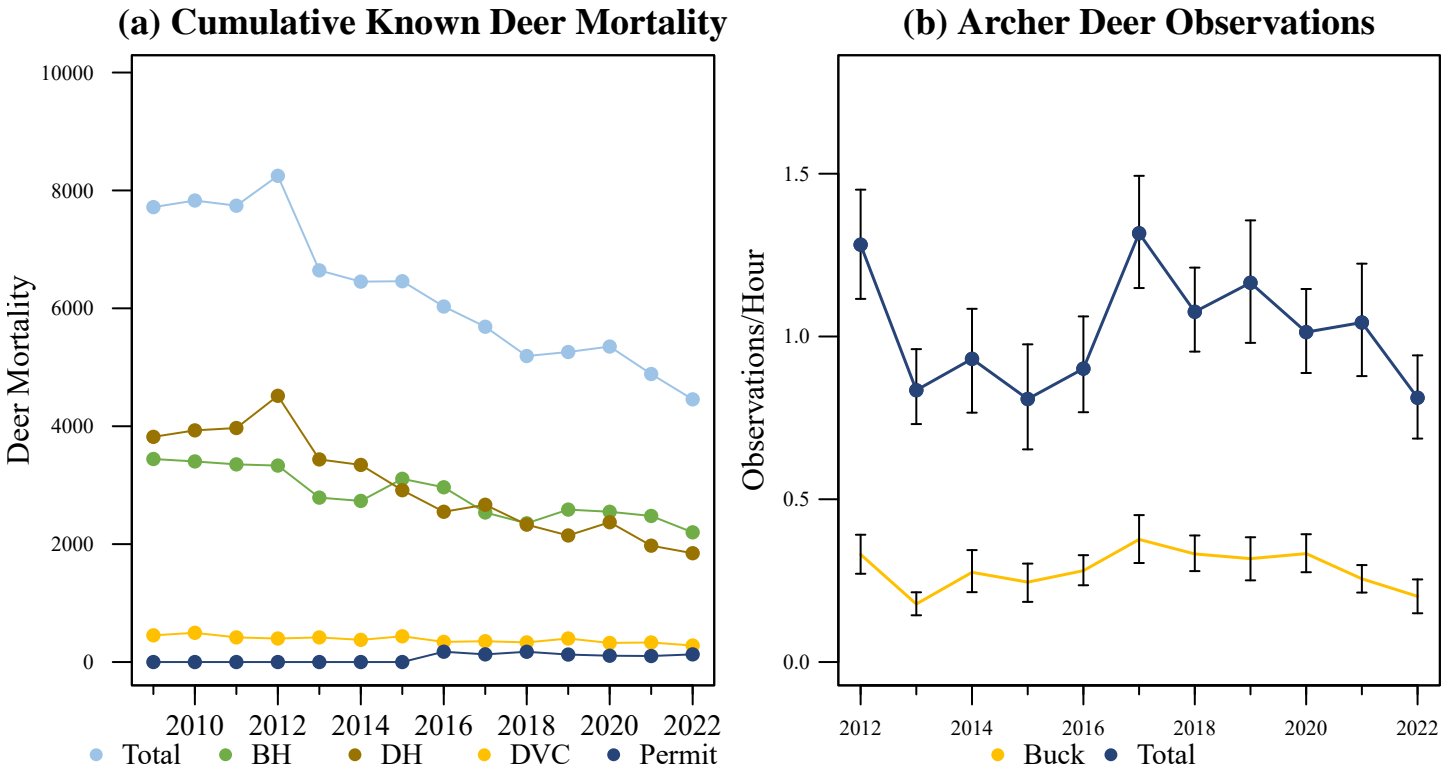

Figure 1. (a) The total known annual deer mortality based on buck harvests (BH), doe harvests (DH), deer vehicle collisions (DVC), and deer permit takes. (b) Total deer and buck observations per hour based on the Archer's Index.

DMU 8: Dearborn

3/24/2023

Total Square Miles: 618
Square Miles of Deer Habitat: 504
Percent Deer Habitat: 82

Table 2. Estimated number of antlered (A) and antlerless (AL) deer harvested per hunter. Estimated totals may not match exactly with total number of deer harvested. Reporting errors are examined and investigated as they are located; therefore, subsequent reports may contain corrected totals.

Year	Total Hunters	0 A	1 A	2 A	3 A	0 AL	1 AL	2 AL	3 AL	4 AL	5 AL	6 AL	7 AL	8 AL	9 AL	10 AL
2016	4,164	1,739	2,389	36	0	1,847	1,740	452	94	29	1	1	0	0	0	0
2017	3,772	1,787	1,979	6	0	1,467	1,634	486	141	37	5	2	0	0	0	0
2018	3,425	1,550	1,868	7	0	1,354	1,514	421	107	24	4	0	0	0	1	0
2019	3,619	1,459	2,151	9	0	1,595	1,560	412	34	14	3	0	1	0	0	0
2020	3,710	1,594	2,098	18	0	1,543	1,646	441	66	10	3	1	0	0	0	0
2021	3,454	1,327	2,108	19	0	1,592	1,468	358	28	4	2	2	0	0	0	0
2022	3,093	1,257	1,826	10	0	1,376	1,300	372	32	7	5	0	1	0	0	0

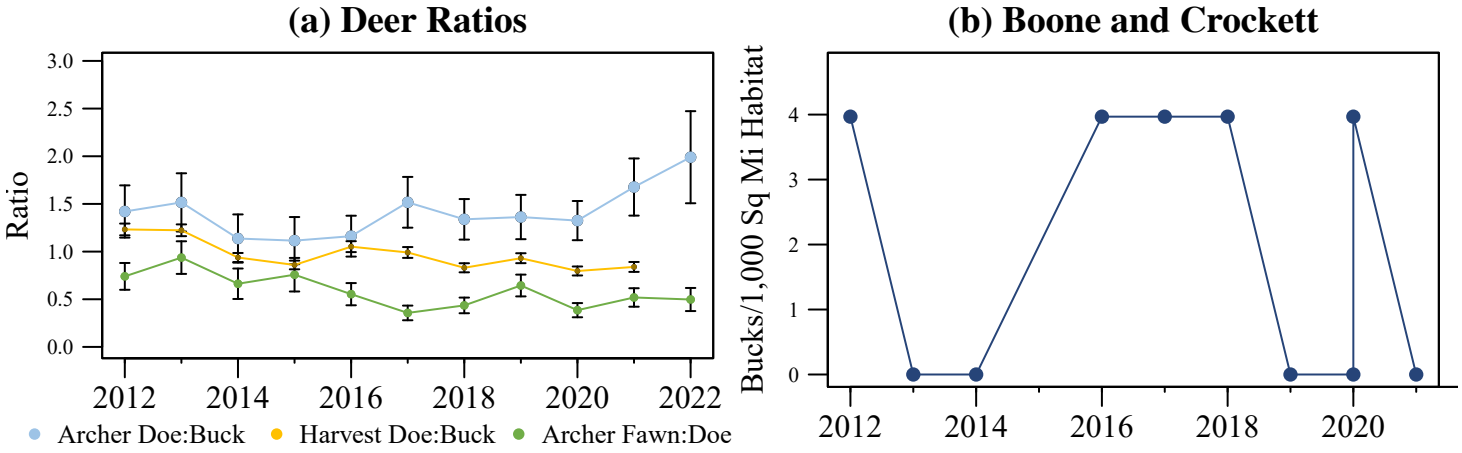

Figure 2. (a) Annual doe:buck ratios and fawn:doe ratios based on the Archer's Index and harvest records. (b) The number of Boone and Crockett bucks (minimum 160 score) per 1,000 square miles of deer habitat.

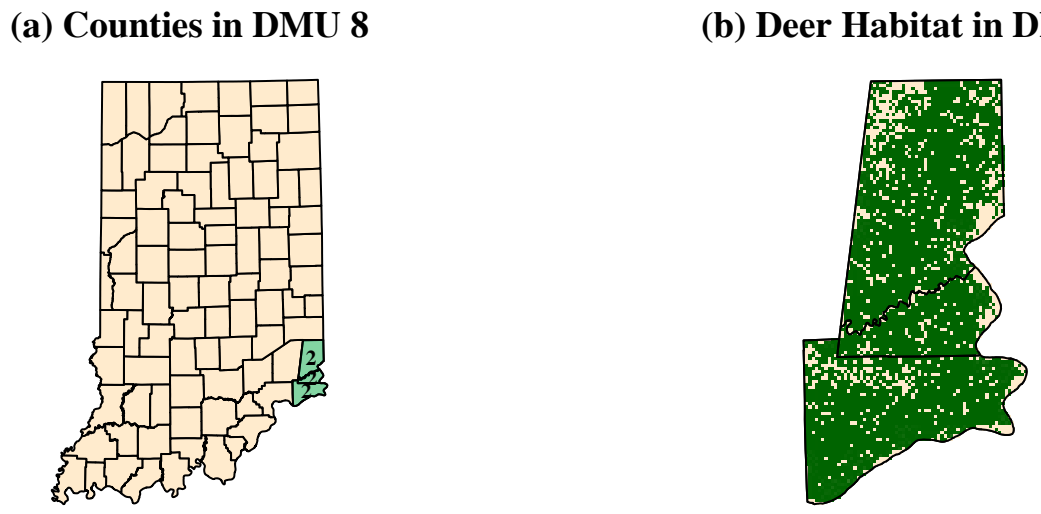

Figure 3. (a) Counties included in DMU 8 for summarizing harvest and deer management survey statistics. Labels are the 2022 county bonus antlerless quotas. (b) Green represents the land use types classified as deer habitat in DMU 8.

DMU 8: Dearborn

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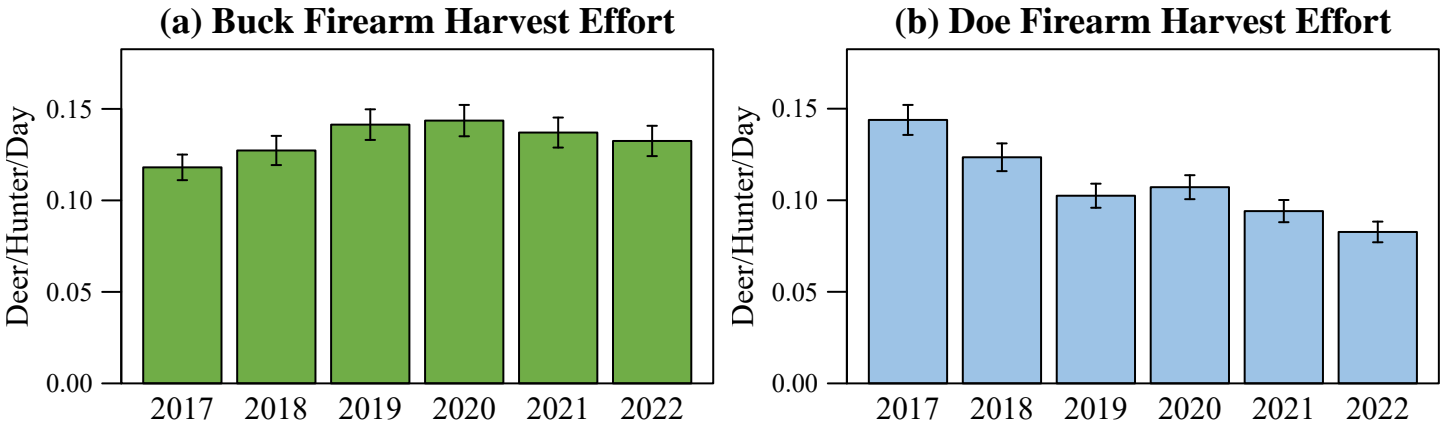

Figure 4. Firearm harvest effort is the number of bucks (a) and does (b) killed by firearms per hunter divided by the mean number of days hunted per hunter during the firearm season based on data reported in the deer management survey. Larger values (i.e taller bars) indicate less effort required to harvest a deer.

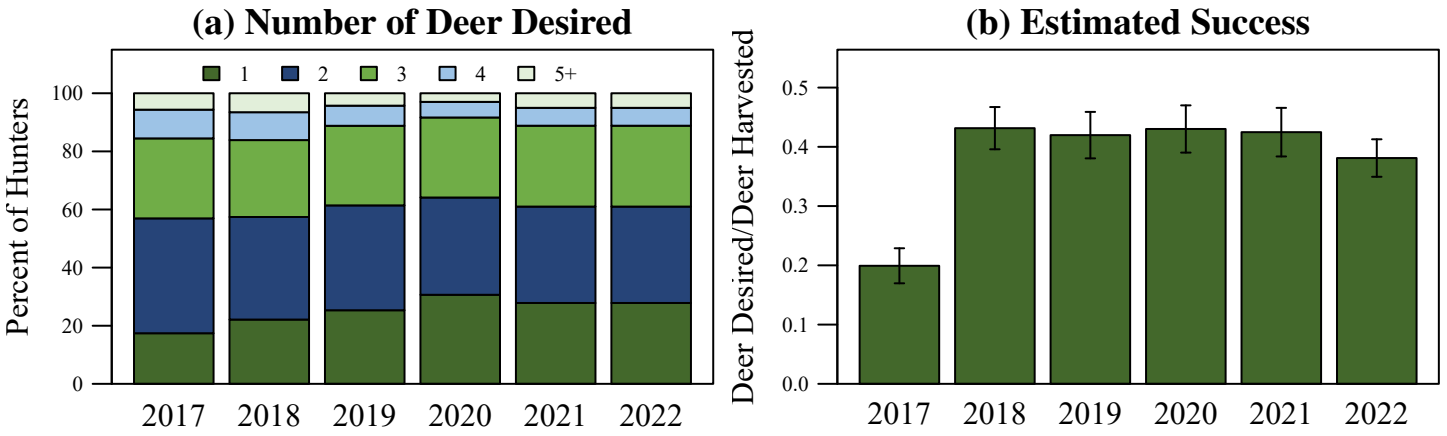

Figure 5. (a) The annual percent of hunters wishing to harvest each number of deer as reported in the deer management survey. (b) Success rate is estimated from the deer management survey as the Number of Harvested Deer/Number of Deer Desired (reported only; does not account for attempts that were not made). Larger values (i.e. taller bars) indicate greater success.

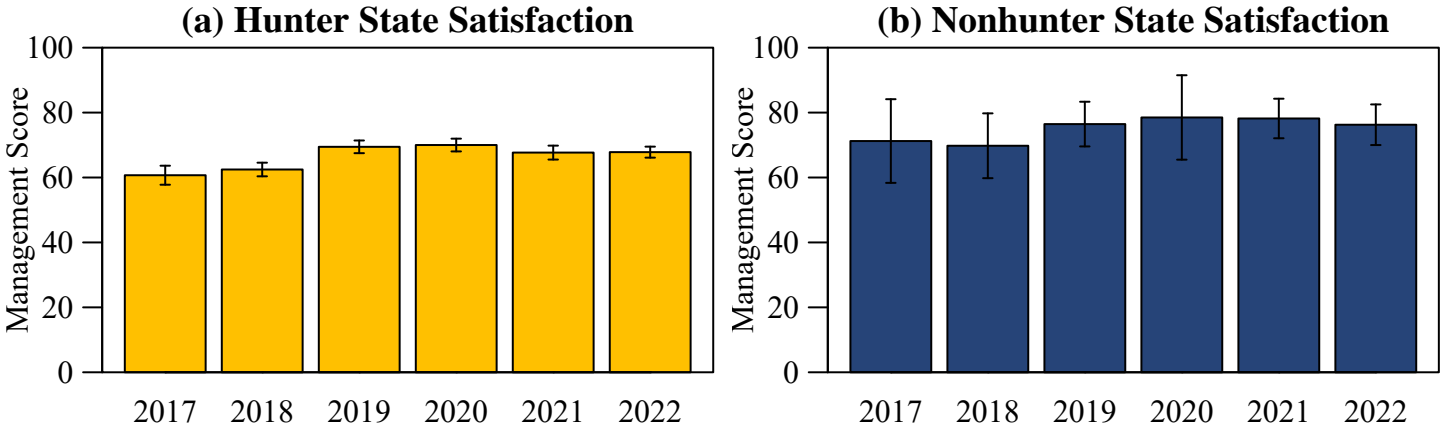

Figure 6. Hunters (a) and nonhunters (b) were asked to score the DNR's statewide deer management on a scale of 0 (poor) to 100 (excellent).

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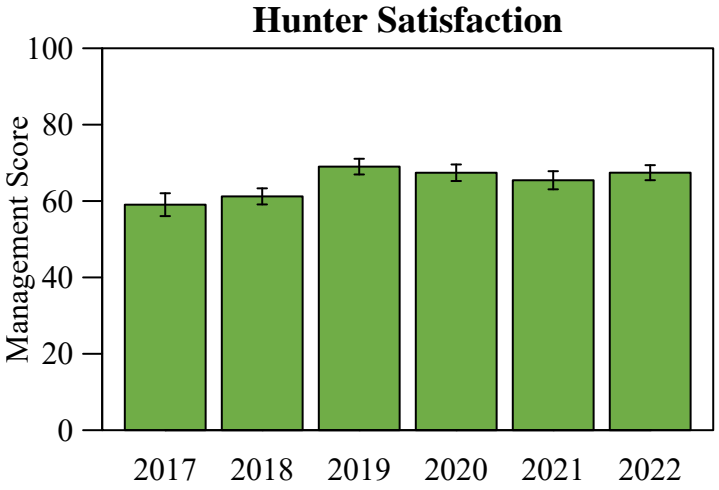

Figure 7. Hunters were asked to score the DNR's county deer management on a scale of 0 (poor) to 100 (excellent) for the county in DMU 8 where they hunt.

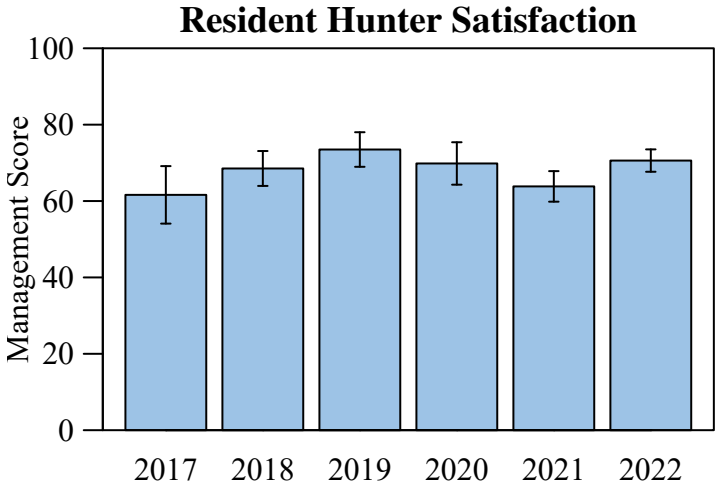

Figure 8. Hunters were asked to score the DNR's county deer management on a scale of 0 (poor) to 100 (excellent) for the county in DMU 8 where they live.

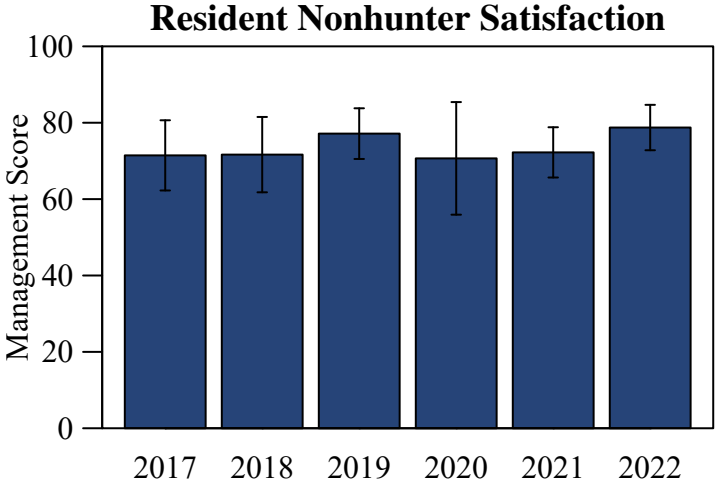

Figure 9. Nonhunters were asked to score the DNR's county deer management on a scale of 0 (poor) to 100 (excellent) for the county in DMU 8 where they live.

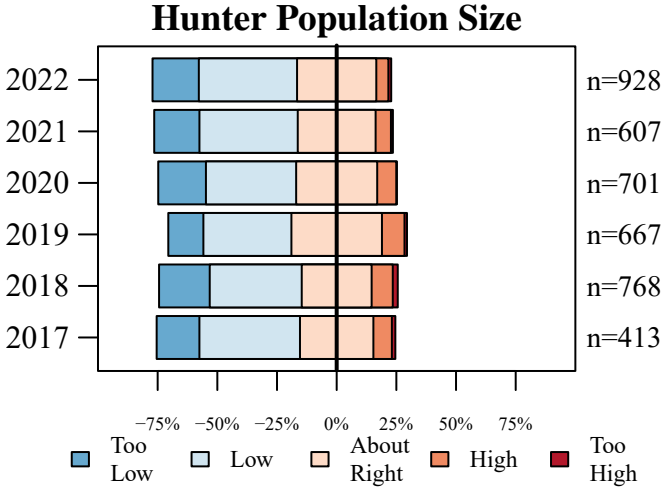

Figure 10. The current size of the deer population described by hunters in the county where they hunt in DMU 8.

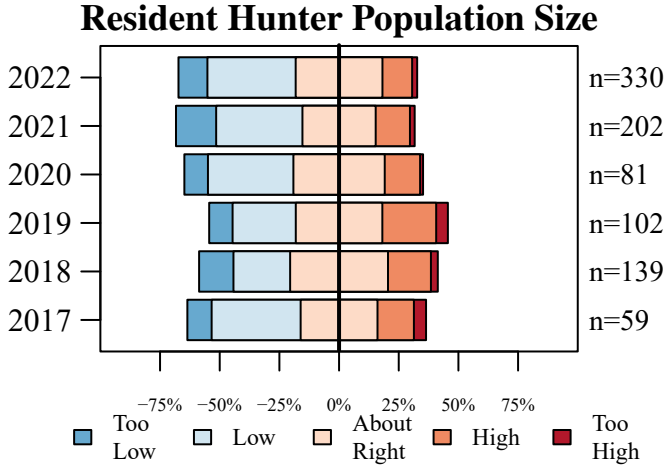

Figure 11. The current size of the deer population described by hunters in the county where they live in DMU 8.

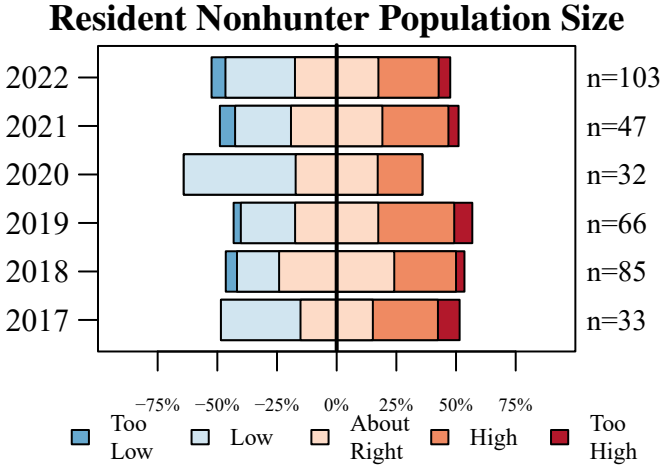

Figure 12. The current size of the deer population described by nonhunters in the county where they live in DMU 8.

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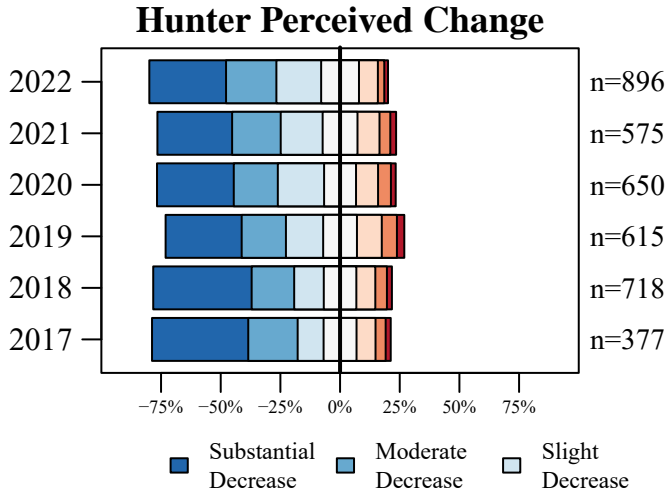

Figure 13. The number of deer seen compared to five years ago described by hunters in the county where they hunt in DMU 8.

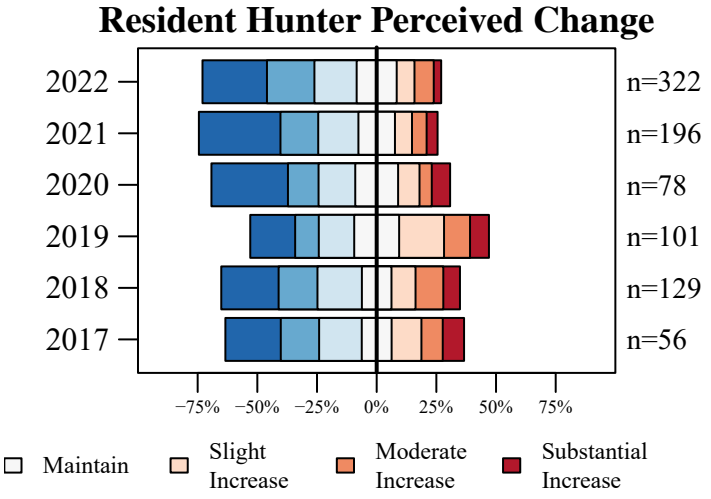

Figure 14. The number of deer seen compared to five years ago described by hunters in the county where they live in DMU 8.

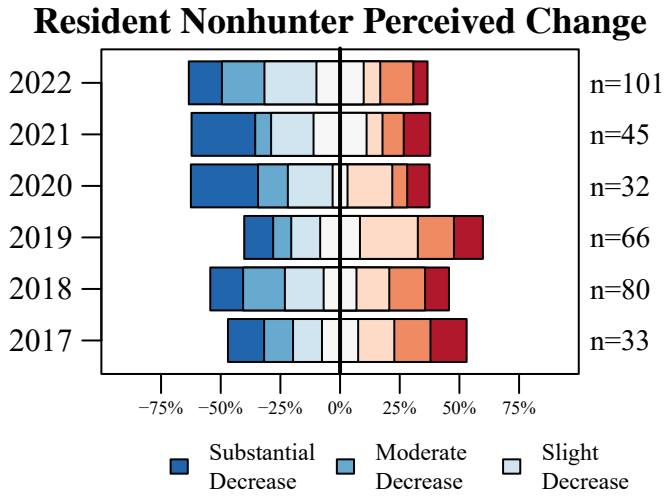

Figure 15. The number of deer seen compared to five years ago described by nonhunters in the county where they live in DMU 8.

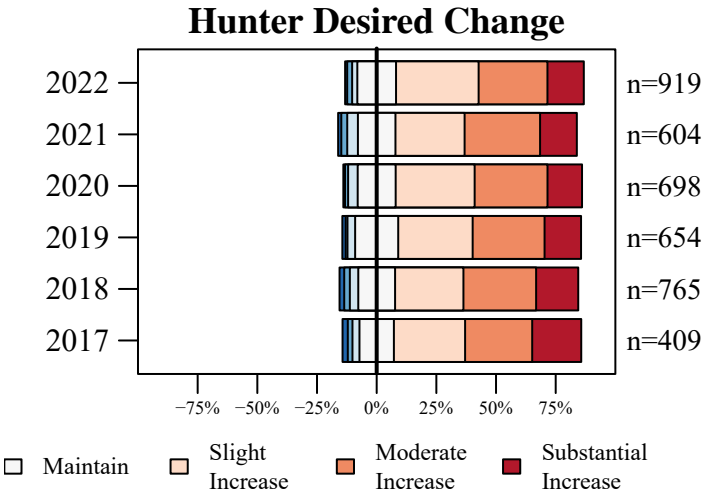

Figure 16. The desired change in the size of the deer population described by hunters in the county where they hunt in DMU 8.

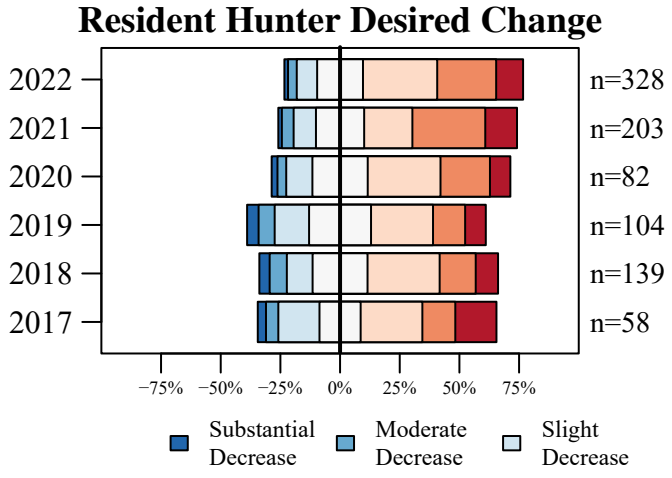

Figure 17. The desired change in the size of the deer population described by hunters in the county where they live in DMU 8.

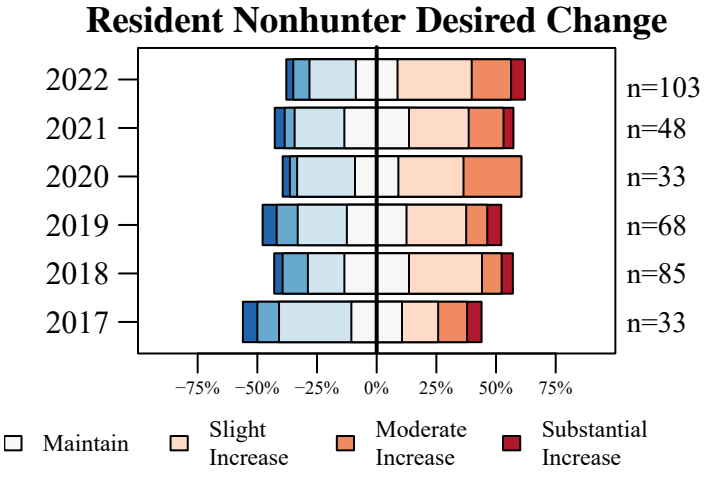

Figure 18. The desired change in the size of the deer population described by nonhunters in the county where they live in DMU 8.

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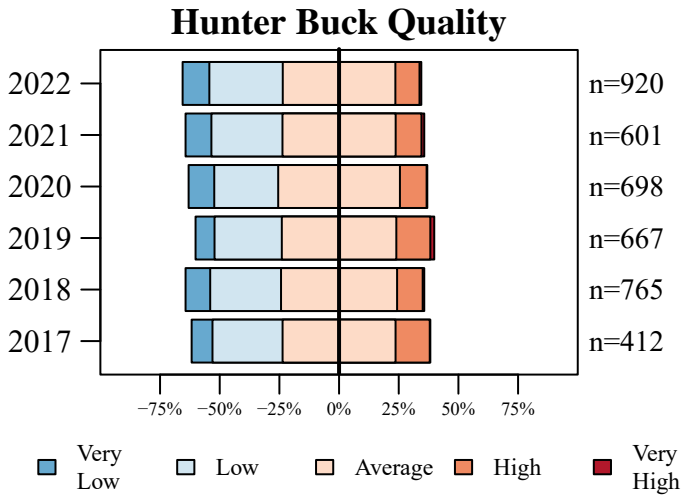

Figure 19. Hunters describe the quality of bucks in the county where they hunt in DMU 8.

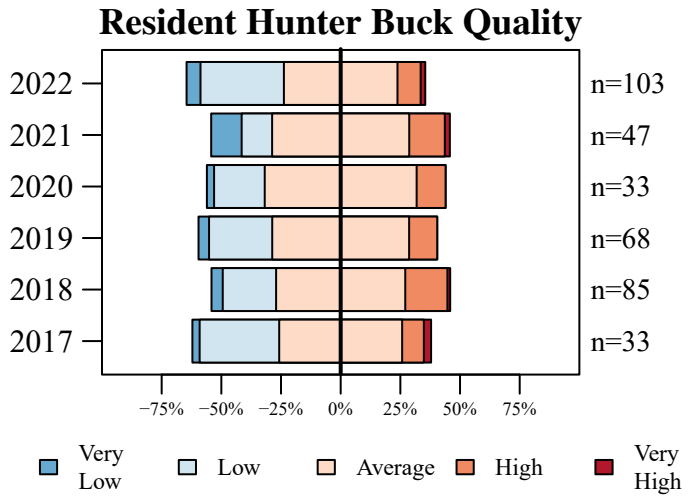

Figure 20. Hunters describe the quality of bucks in the county where they live in DMU 8.

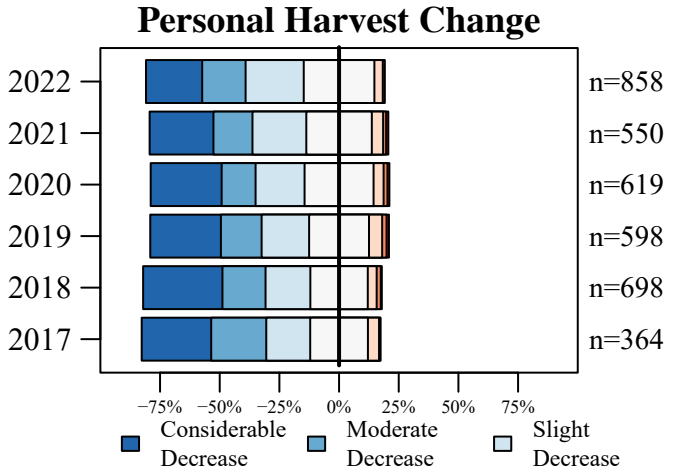

Figure 21. Opinion of hunters on how their personal number of harvested deer has changed over the last five years in a county in DMU 8.

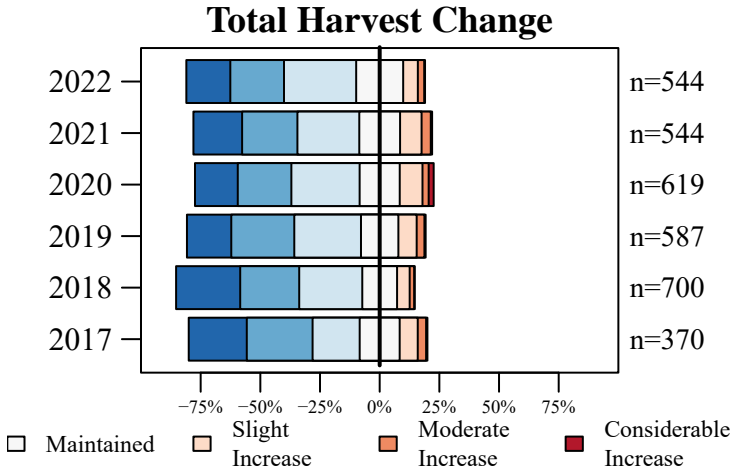

Figure 22. Opinion of hunters on how the total number of harvested deer has changed over the last five years in a county in DMU 8.

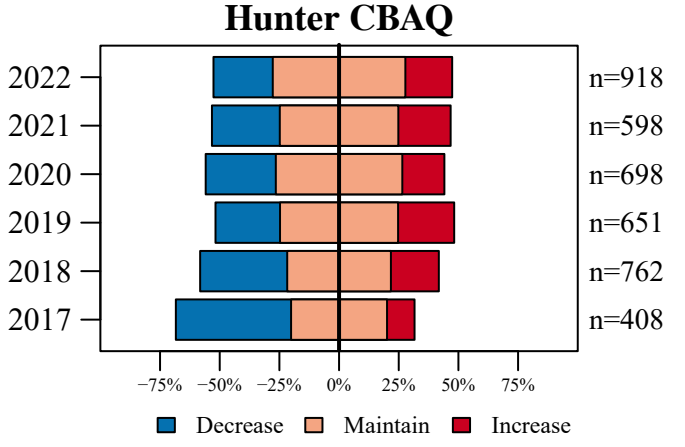

Figure 23. Opinion on how the County Bonus Antlerless Quota should change from hunters in the county where they hunt in DMU 8.

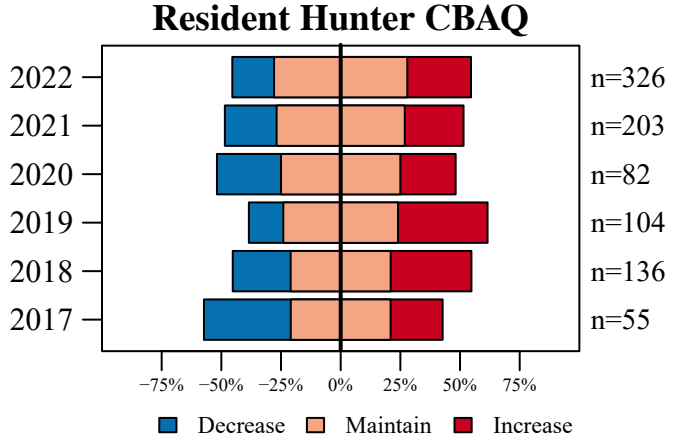

Figure 24. Opinion on how the County Bonus Antlerless Quota should change from hunters in the county where they live in DMU 8.

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3/24/2023

Deer Management Survey Results

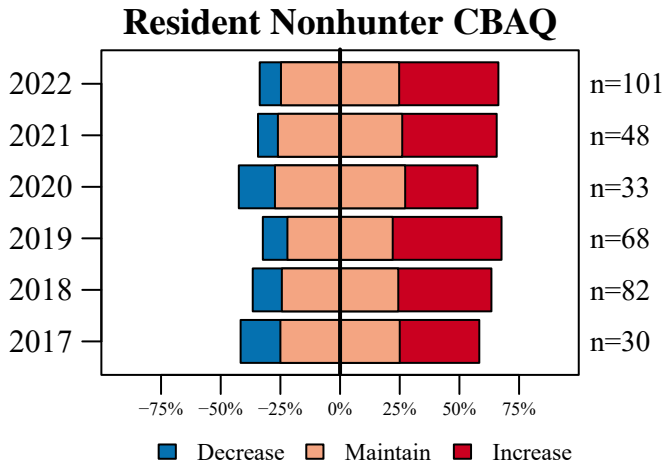

Figure 25. Opinion on how the County Bonus Antlerless Quota should change from nonhunters in the county where they live in DMU 8.

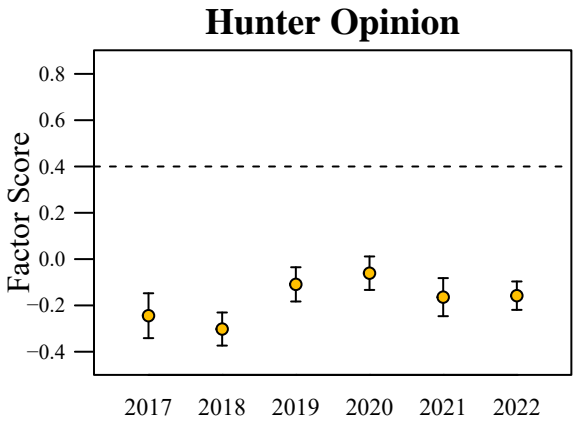

Figure 26. Hunter opinon scores over five years of the deer management survey. The score was aggregated using factor analysis of questions asked only to hunters. The dashed line represents the score if all questions are answered neutrally.

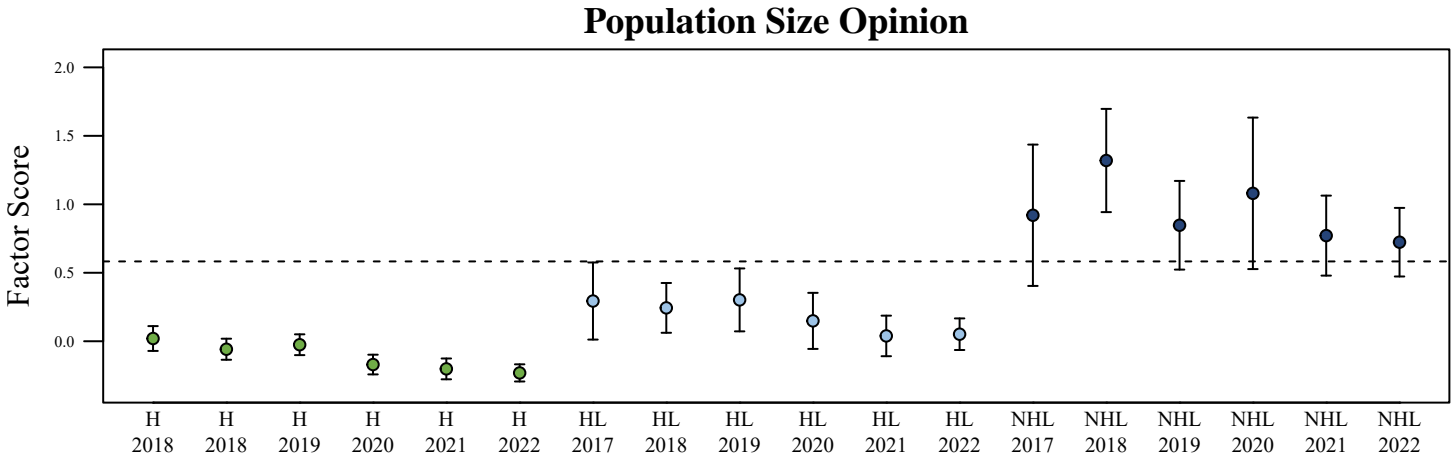

Figure 27. The opinion of nonhunters (NHL) and hunters in the county where they live (HL) and hunters in the county where they hunt (H) on deer population size. The score was aggregated using factor analysis of questions asked to all participants. The dashed line represents the score if all questions are answered neutrally.

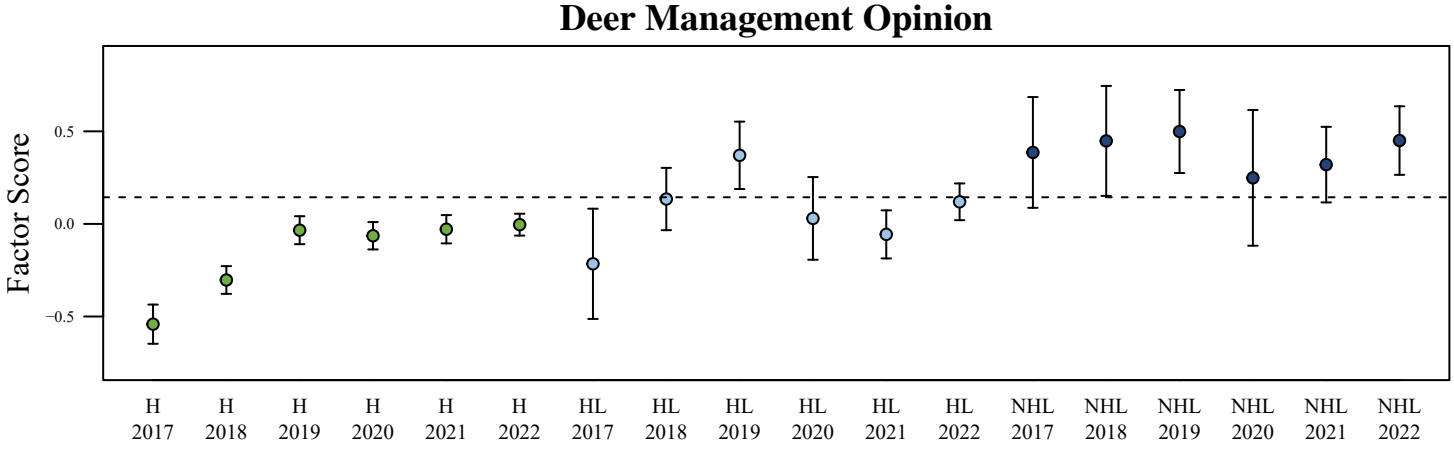

Figure 28. The opinion of nonhunters (NHL) and hunters in the county where they live (HL) and hunters in the county where they hunt (H) on deer management. The score was aggregated using factor analysis of questions asked to all participants. The dashed line represents the score if all questions are answered neutrally.

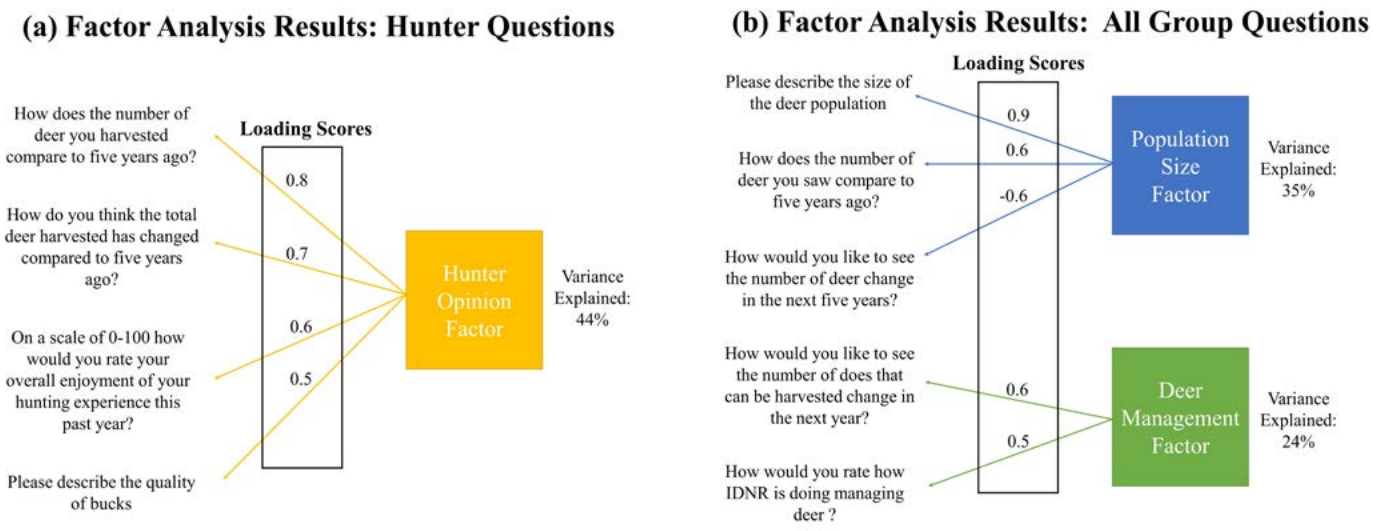

Figure 29. Results from two factor analyses used to develop the hunter opinion (a), population opinion (b), management opinion (b), and scores. Higher loading scores indicate a stronger correlation between the original question and the derived factor. These figures are included to help interpret Figure 26, Figure 27, and Figure 28.

DMU 9: Southwest

3/24/2023

Total Square Miles: 3,682
Square Miles of Deer Habitat: 1,305
Percent Deer Habitat: 35

Table 1. Total harvest, buck harvest, and doe harvest (error < 1 percent). Damage permits are issued by DNR to landowners to control deer damage. Deer vehicle collisions (DVC) and miles traveled are reported by the Indiana Department of Transportation. Mean CBAQ is the average county bonus antlerless quota of all counties in the DMU. The trend in total harvest, buck harvest, doe harvest, and DVCs are in standard deviations (SD) and are equivalent to effect size. A change greater than 2 SD is considered both a large and statistically significant effect size.

Year	Total	Total Trend in SD	Buck Harvest	Buck Trend in SD	Buck Harvest per SQ MI Habitat	Doe Harvest	Doe Trend in SD	Doe Harvest per SQ MI Habitat	% Doe in Harvest	Damage Permit Deer Taken	DVC per Billion Miles Traveled	DVC Trend in SD	Mean CBAQ
2009	11,818		6,178		4.7	5,640		4.3	47.7		226.3		4.8
2010	11,780	-0.5	6,075	-0.5	4.7	5,705	-0.6	4.4	48.4		219.0	0.0	4.7
2011	11,747	-0.3	6,019	-0.3	4.6	5,728	-0.3	4.4	48.8		238.5	2.1	4.7
2012	12,409	1.6	5,802	-0.9	4.4	6,607	4.0	5.1	53.2		224.7	0.0	4.7
2013	12,172	0.6	5,888	-1.0	4.5	6,284	0.8	4.8	51.6		260.3	3.5	4.4
2014	11,929	-0.2	5,891	-0.7	4.5	6,038	0.1	4.6	50.6		265.0	1.9	3.9
2015	11,589	-1.5	5,883	-0.5	4.5	5,706	-1.0	4.4	49.2		276.0	1.7	3.9
2016	10,822	-3.5	5,706	-2.4	4.4	5,116	-2.5	3.9	47.3	107	219.0	-1.6	3.6
2017	10,657	-1.8	5,474	-4.5	4.2	5,183	-1.3	4.0	48.6	128	232.4	-0.6	2.6
2018	10,377	-1.6	5,531	-1.3	4.2	4,846	-1.6	3.7	46.7	65	231.7	-0.8	2.0
2019	10,725	-0.5	5,859	0.8	4.5	4,866	-1.1	3.7	45.4	81	224.2	-0.8	1.8
2020	11,927	2.4	6,348	3.5	4.9	5,579	1.3	4.3	46.8	94	199.5	-1.6	2.0
2021	10,787	-0.2	5,905	0.3	4.5	4,882	-0.8	3.7	45.3	96	207.3	-1.0	2.0
2022	11,777	1.5	6,470	1.8	5.0	5,307	0.7	4.1	45.1	110	208.3	-0.7	2.0

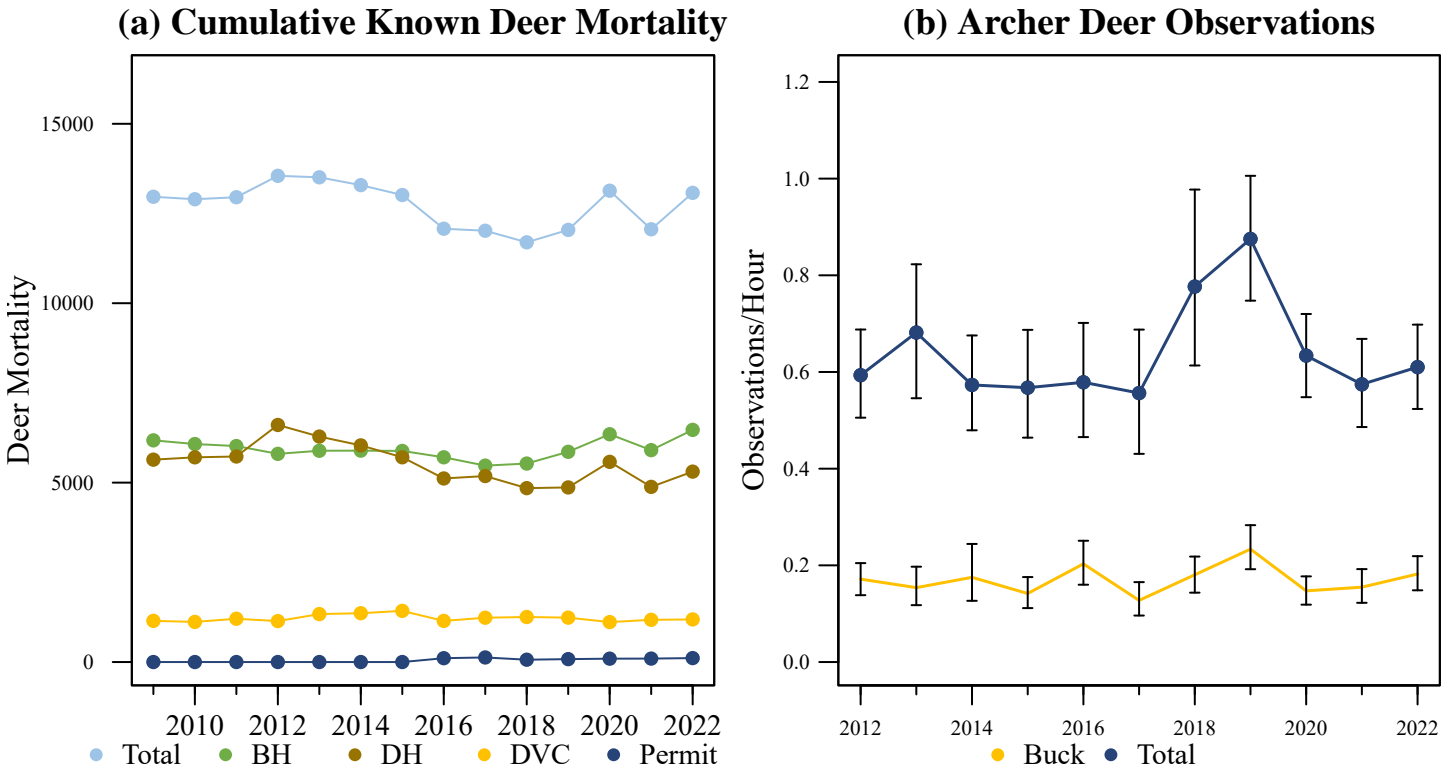

Figure 1. (a) The total known annual deer mortality based on buck harvests (BH), doe harvests (DH), deer vehicle collisions (DVC), and deer permit takes. (b) Total deer and buck observations per hour based on the Archer's Index.

DMU 9: Southwest

3/24/2023

Total Square Miles: 3,682
Square Miles of Deer Habitat: 1,305
Percent Deer Habitat: 35

Table 2. Estimated number of antlered (A) and antlerless (AL) deer harvested per hunter. Estimated totals may not match exactly with total number of deer harvested. Reporting errors are examined and investigated as they are located; therefore, subsequent reports may contain corrected totals.

Year	Total Hunters	0 A	1 A	2 A	3 A	0 AL	1 AL	2 AL	3 AL	4 AL	5 AL	6 AL	7 AL	8 AL	9 AL	10 AL
2016	8,489	3,705	4,765	18	0	3,649	3,852	832	127	25	4	0	0	0	0	0
2017	8,305	3,903	4,386	16	0	3,260	4,030	864	129	18	2	2	0	0	0	0
2018	8,218	3,624	4,572	21	1	3,459	3,866	797	86	9	0	1	0	0	0	0
2019	8,359	3,462	4,870	27	0	3,569	3,869	851	57	10	0	2	1	0	0	0
2020	9,192	3,906	5,254	29	2	3,785	4,331	975	85	13	2	1	0	0	0	0
2021	8,523	3,515	4,986	22	0	3,725	3,913	823	52	8	2	0	0	0	0	0
2022	9,100	3,543	5,531	25	1	4,053	4,006	953	73	13	2	0	0	0	0	0

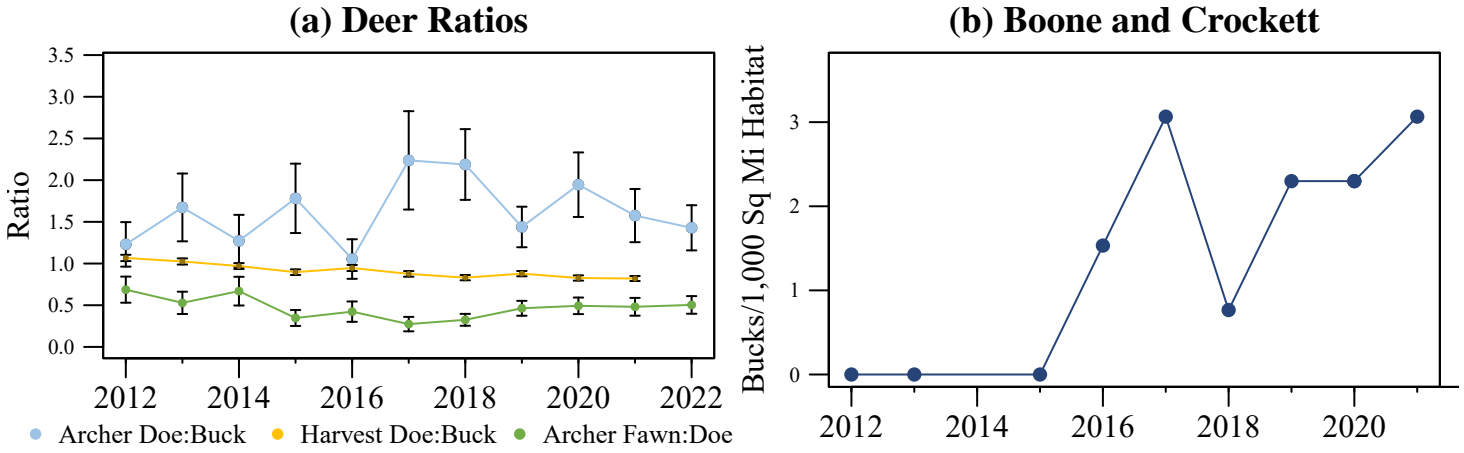

Figure 2. (a) Annual doe:buck ratios and fawn:doe ratios based on the Archer's Index and harvest records. (b) The number of Boone and Crockett bucks (minimum 160 score) per 1,000 square miles of deer habitat.

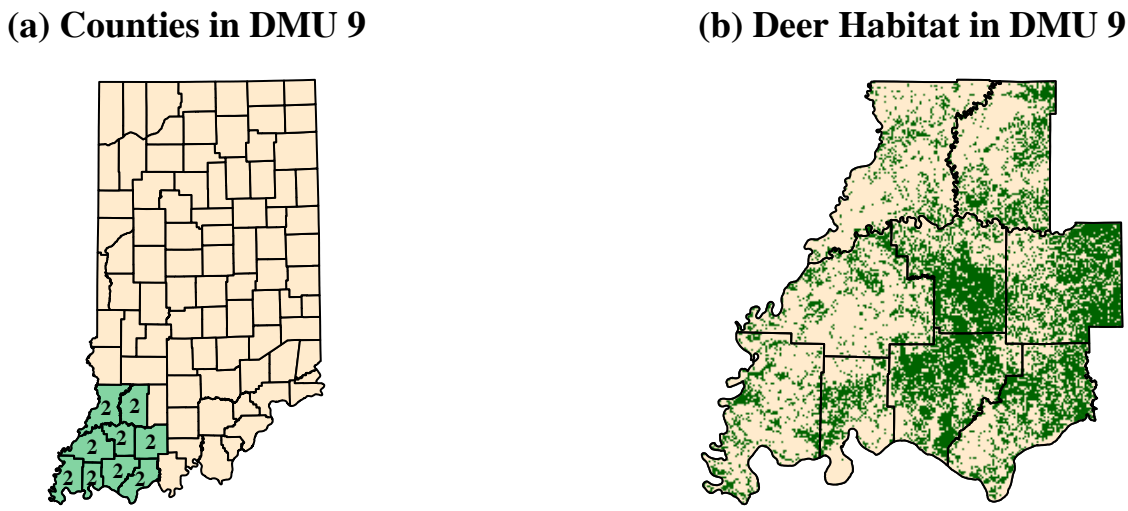

Figure 3. (a) Counties included in DMU 9 for summarizing harvest and deer management survey statistics. Labels are the 2022 county bonus antlerless quotas. (b) Green represents the land use types classified as deer habitat in DMU 9.

DMU 9: Southwest

3/24/2023

Deer Management Survey Results

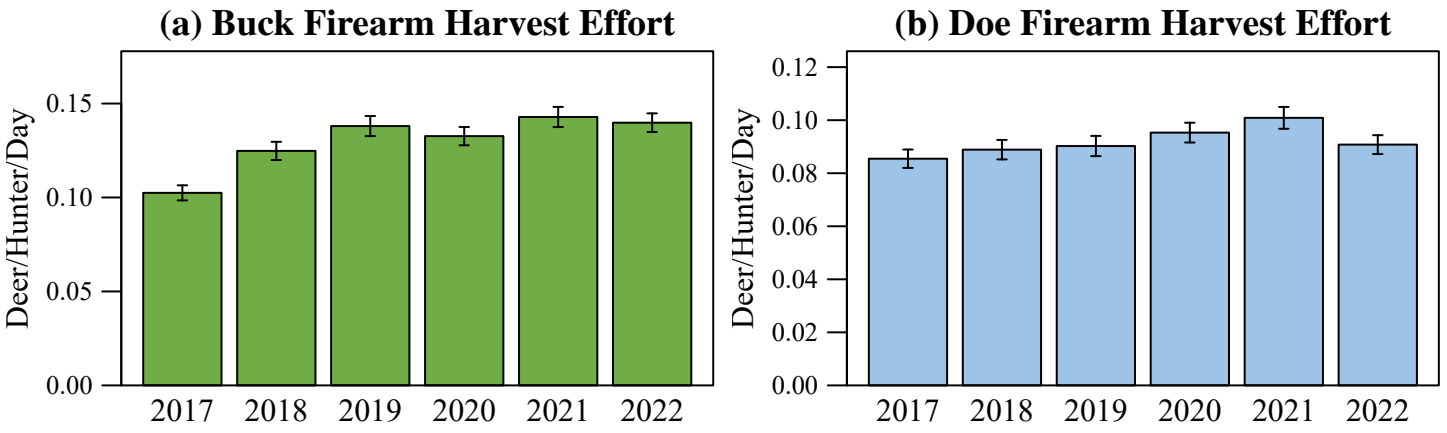

Figure 4. Firearm harvest effort is the number of bucks (a) and does (b) killed by firearms per hunter divided by the mean number of days hunted per hunter during the firearm season based on data reported in the deer management survey. Larger values (i.e taller bars) indicate less effort required to harvest a deer.

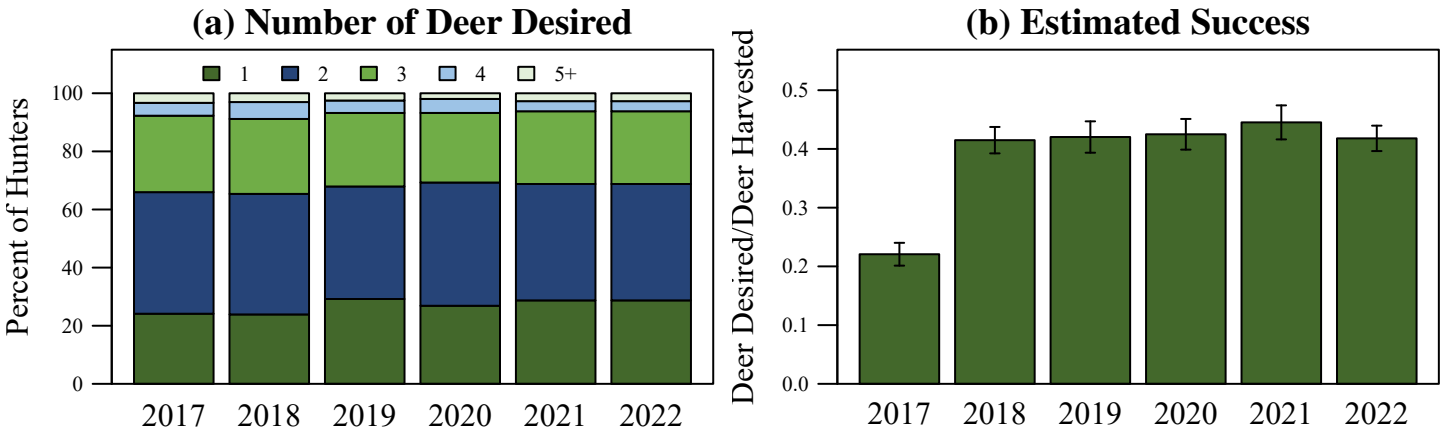

Figure 5. (a) The annual percent of hunters wishing to harvest each number of deer as reported in the deer management survey. (b) Success rate is estimated from the deer management survey as the Number of Harvested Deer/Number of Deer Desired (reported only; does not account for attempts that were not made). Larger values (i.e. taller bars) indicate greater success.

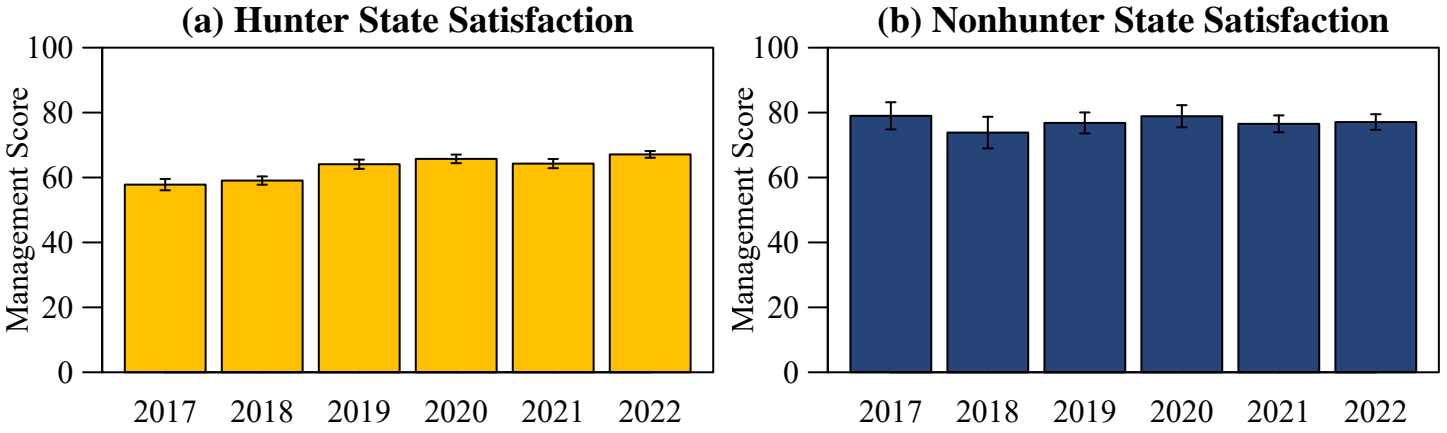

Figure 6. Hunters (a) and nonhunters (b) were asked to score the DNR's statewide deer management on a scale of 0 (poor) to 100 (excellent).

DMU 9: Southwest

3/24/2023

Deer Management Survey Results

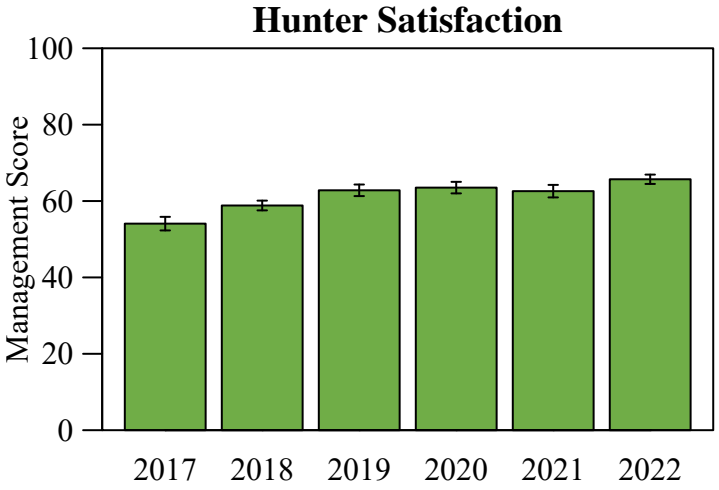

Figure 7. Hunters were asked to score the DNR's county deer management on a scale of 0 (poor) to 100 (excellent) for the county in DMU 9 where they hunt.

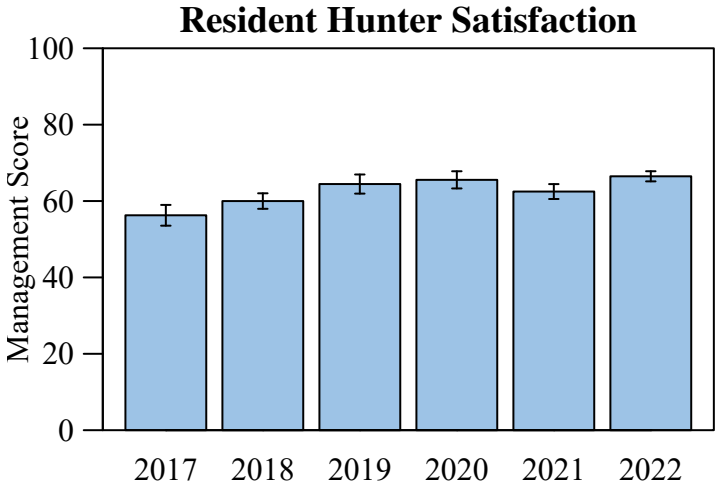

Figure 8. Hunters were asked to score the DNR's county deer management on a scale of 0 (poor) to 100 (excellent) for the county in DMU 9 where they live.

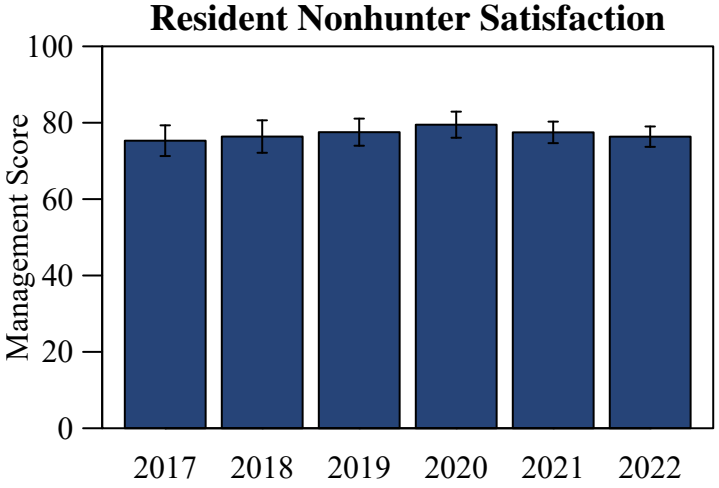

Figure 9. Nonhunters were asked to score the DNR's county deer management on a scale of 0 (poor) to 100 (excellent) for the county in DMU 9 where they live.

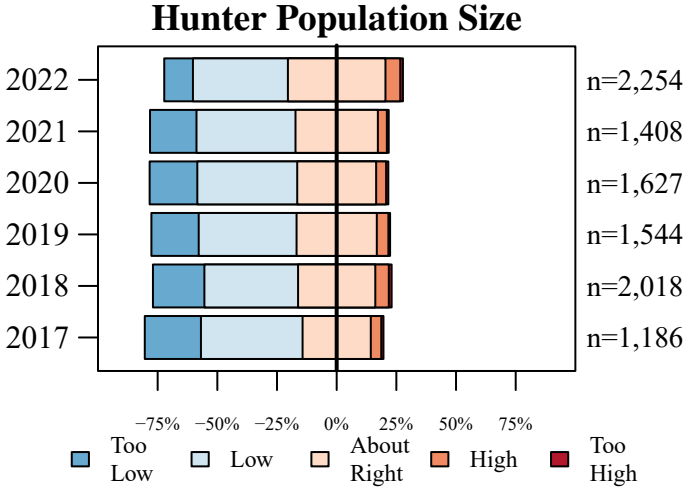

Figure 10. The current size of the deer population described by hunters in the county where they hunt in DMU 9.

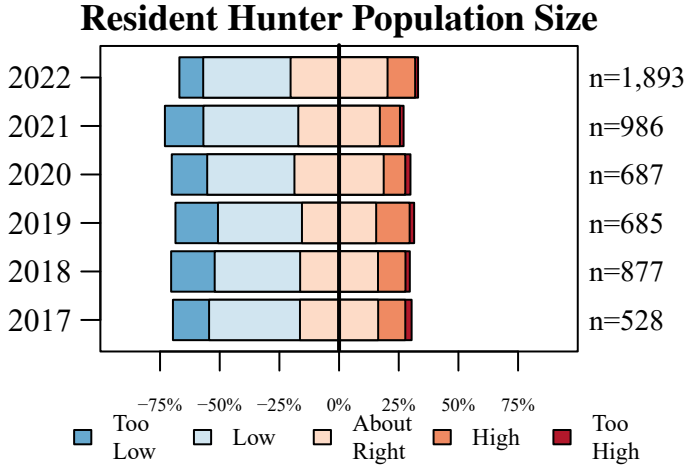

Figure 11. The current size of the deer population described by hunters in the county where they live in DMU 9.

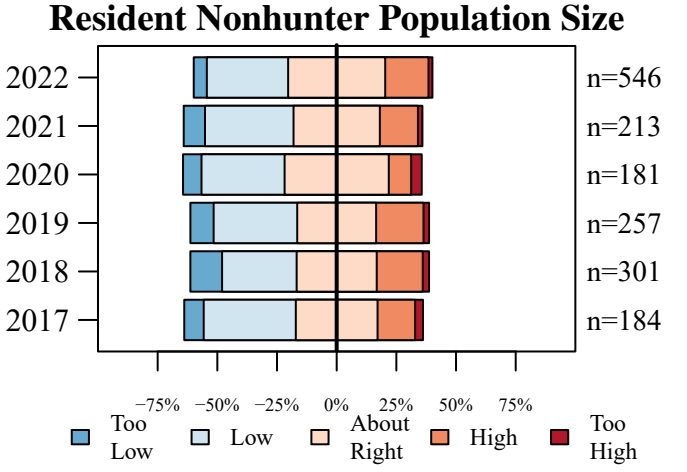

Figure 12. The current size of the deer population described by nonhunters in the county where they live in DMU 9.

DMU 9: Southwest

3/24/2023

Deer Management Survey Results

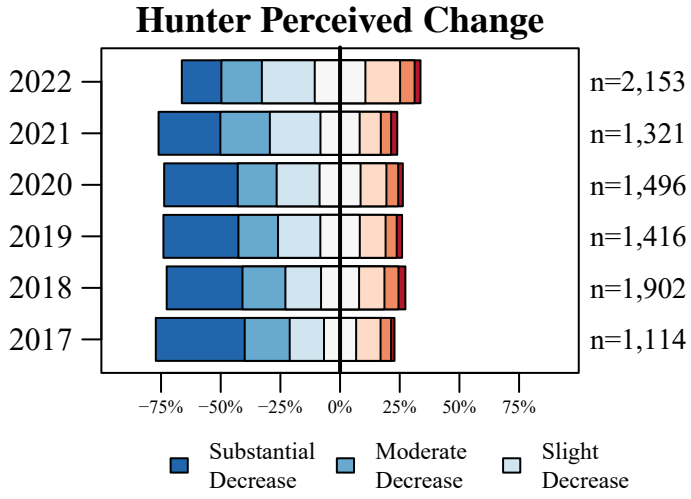

Figure 13. The number of deer seen compared to five years ago described by hunters in the county where they hunt in DMU 9.

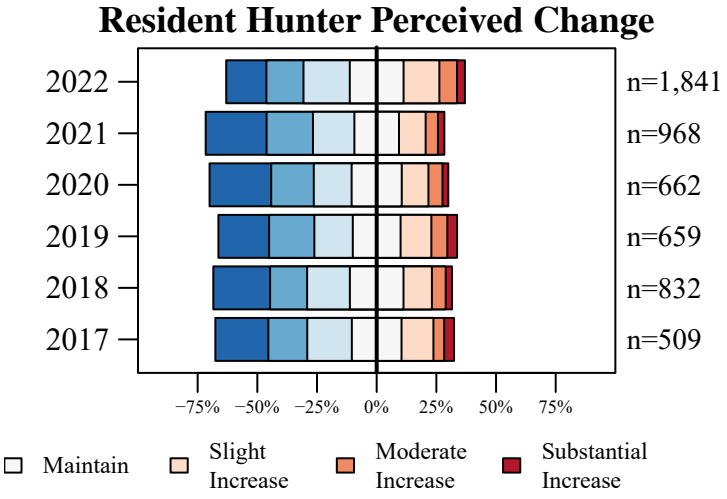

Figure 14. The number of deer seen compared to five years ago described by hunters in the county where they live in DMU 9.

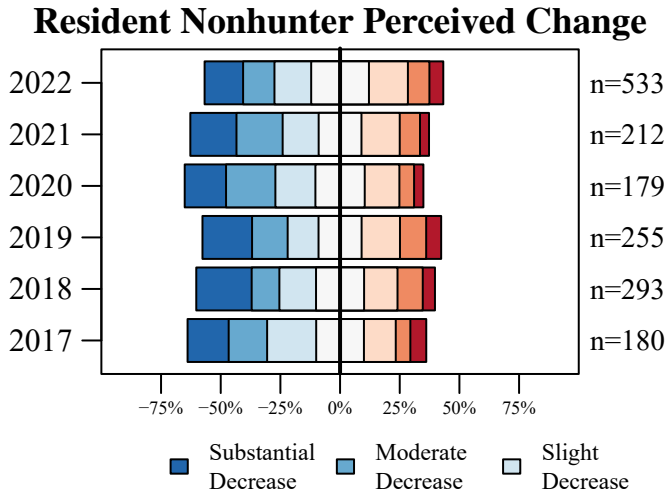

Figure 15. The number of deer seen compared to five years ago described by nonhunters in the county where they live in DMU 9.

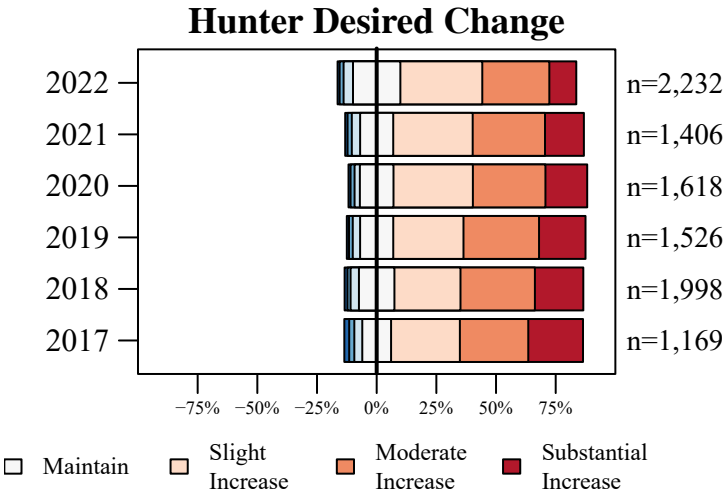

Figure 16. The desired change in the size of the deer population described by hunters in the county where they hunt in DMU 9.

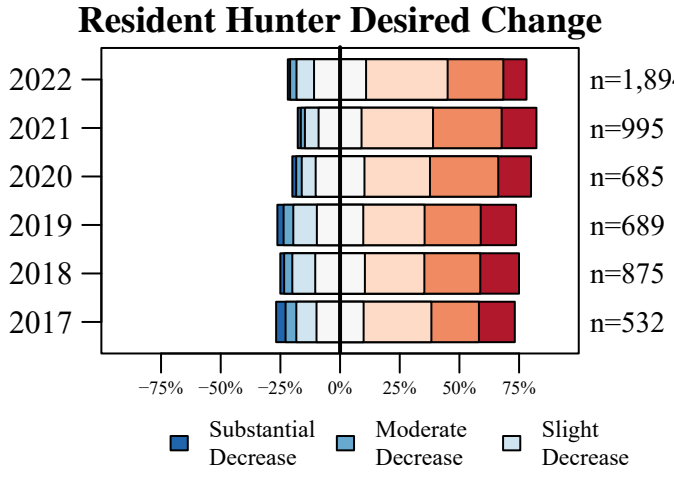

Figure 17. The desired change in the size of the deer population described by hunters in the county where they live in DMU 9.

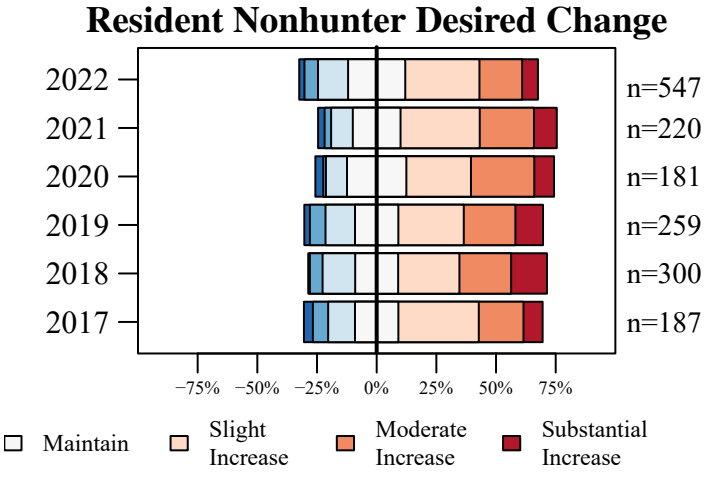

Figure 18. The desired change in the size of the deer population described by nonhunters in the county where they live in DMU 9.

DMU 9: Southwest

3/24/2023

Deer Management Survey Results

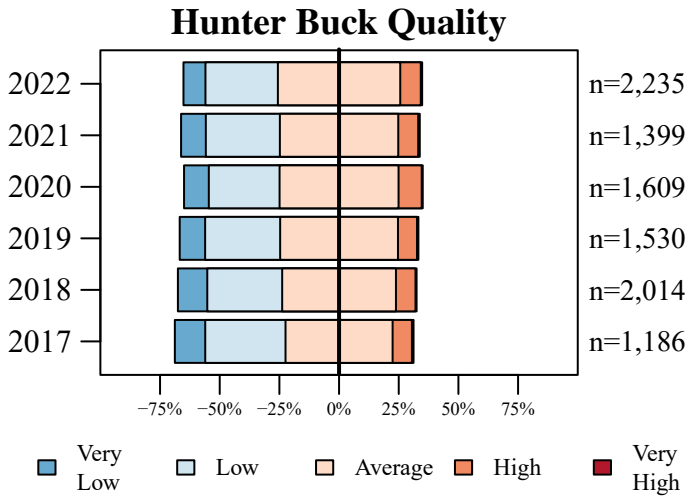

Figure 19. Hunters describe the quality of bucks in the county where they hunt in DMU 9.

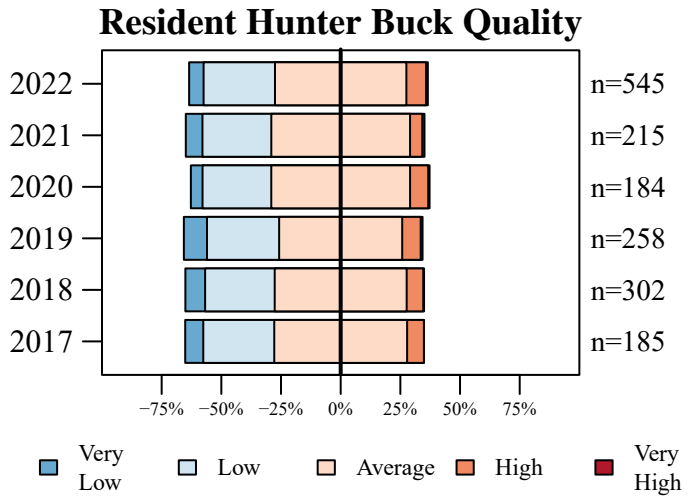

Figure 20. Hunters describe the quality of bucks in the county where they live in DMU 9.

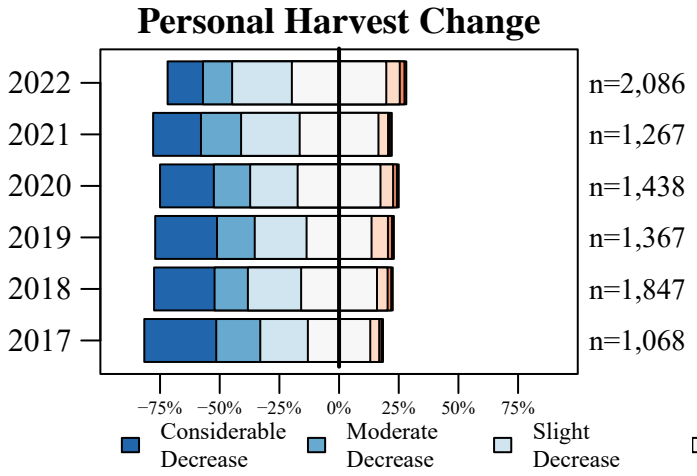

Figure 21. Opinion of hunters on how their personal number of harvested deer has changed over the last five years in a county in DMU 9.

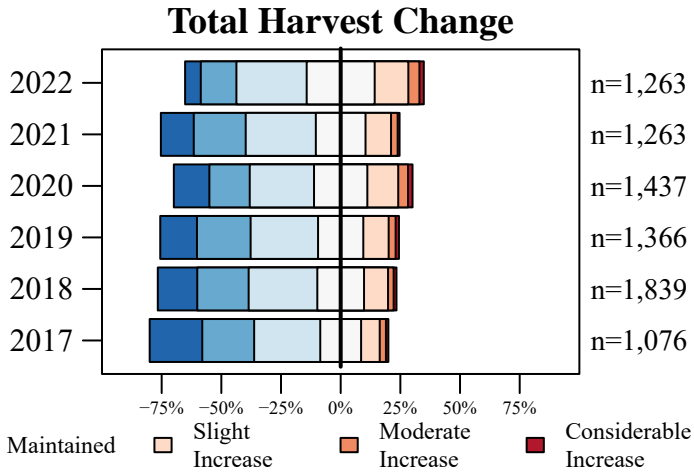

Figure 22. Opinion of hunters on how the total number of harvested deer has changed over the last five years in a county in DMU 9.

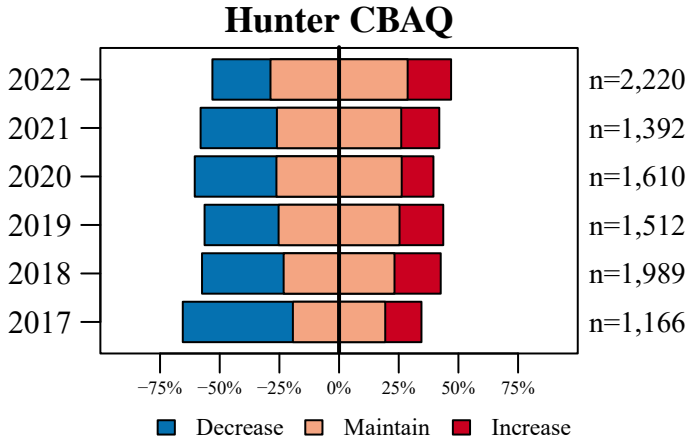

Figure 23. Opinion on how the County Bonus Antlerless Quota should change from hunters in the county where they hunt in DMU 9.

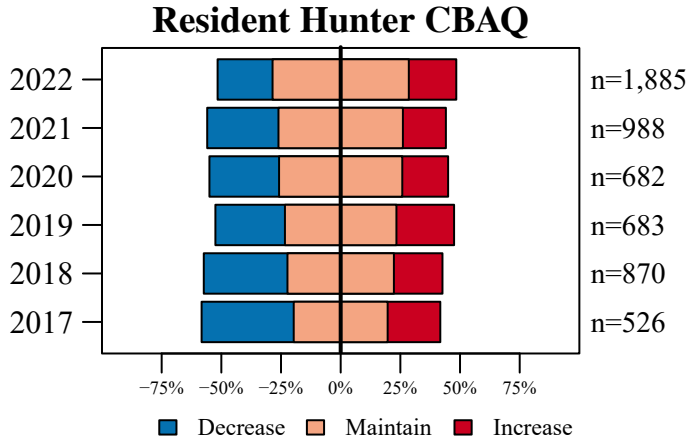

Figure 24. Opinion on how the County Bonus Antlerless Quota should change from hunters in the county where they live in DMU 9.

DMU 9: Southwest

3/24/2023

Deer Management Survey Results

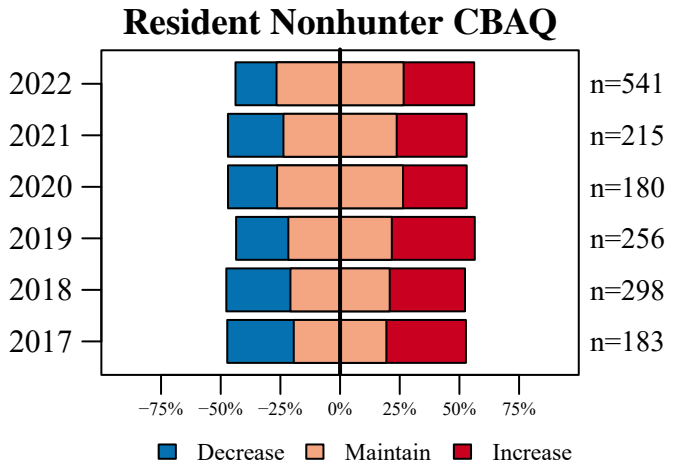

Figure 25. Opinion on how the County Bonus Antlerless Quota should change from nonhunters in the county where they live in DMU 9.

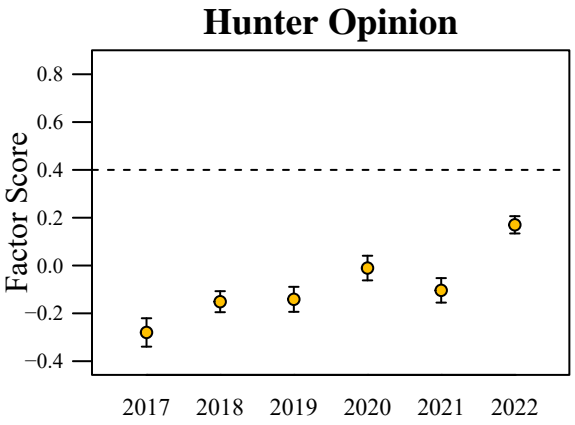

Figure 26. Hunter opinon scores over five years of the deer management survey. The score was aggregated using factor analysis of questions asked only to hunters. The dashed line represents the score if all questions are answered neutrally.

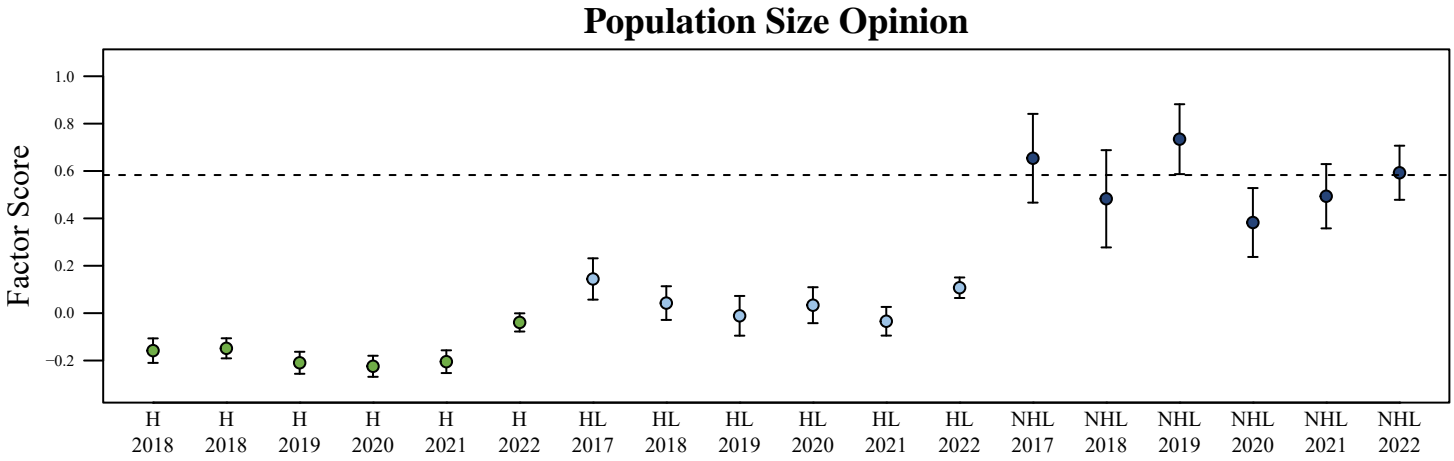

Figure 27. The opinion of nonhunters (NHL) and hunters in the county where they live (HL) and hunters in the county where they hunt (H) on deer population size. The score was aggregated using factor analysis of questions asked to all participants. The dashed line represents the score if all questions are answered neutrally.

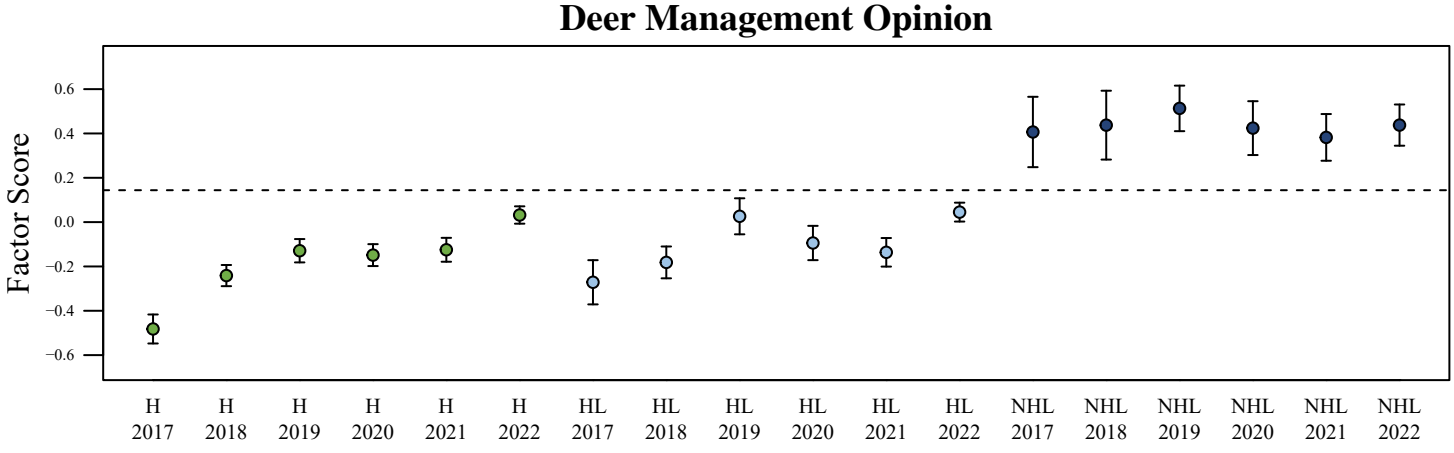

Figure 28. The opinion of nonhunters (NHL) and hunters in the county where they live (HL) and hunters in the county where they hunt (H) on deer management. The score was aggregated using factor analysis of questions asked to all participants. The dashed line represents the score if all questions are answered neutrally.

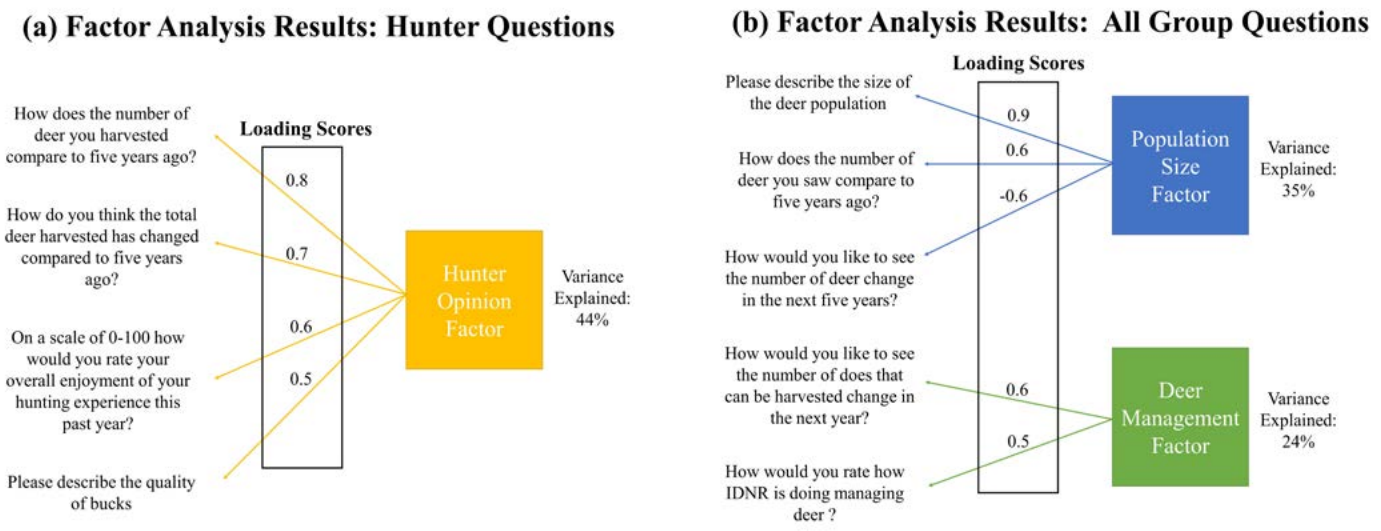

Figure 29. Results from two factor analyses used to develop the hunter opinion (a), population opinion (b), management opinion (b), and scores. Higher loading scores indicate a stronger correlation between the original question and the derived factor. These figures are included to help interpret Figure 26, Figure 27, and Figure 28.

DMU 10: Urban

3/24/2023

Total Square Miles: 403
Square Miles of Deer Habitat: 42
Percent Deer Habitat: 10

Table 1. Total harvest, buck harvest, and doe harvest (error < 1 percent). Damage permits are issued by DNR to landowners to control deer damage. Deer vehicle collisions (DVC) and miles traveled are reported by the Indiana Department of Transportation. Mean CBAQ is the average county bonus antlerless quota of all counties in the DMU. The trend in total harvest, buck harvest, doe harvest, and DVCs are in standard deviations (SD) and are equivalent to effect size. A change greater than 2 SD is considered both a large and statistically significant effect size.

Year	Total	Total Trend in SD	Buck Harvest	Buck Trend in SD	Buck Harvest per SQ MI Habitat	Doe Harvest	Doe Trend in SD	Doe Harvest per SQ MI Habitat	% Doe in Harvest	Damage Permit Deer Taken	DVC per Billion Miles Traveled	DVC Trend in SD	Mean CBAQ
2008	328		192		4.6	136		3.2	41.5		11.4		8
2009	351		224		5.3	127		3.0	36.2		12.4		8
2010	352	1.0	191	0.2	4.5	161	2.1	3.8	45.7		11.6	-0.4	8
2011	375	1.4	207	0.5	4.9	168	1.8	4.0	44.8		12.2	0.3	8
2012	501	7.5	179	-1.9	4.3	322	8.1	7.7	64.3		9.0	-2.1	8
2013	510	1.9	203	0.3	4.8	307	1.6	7.3	60.2		11.2	-0.1	8
2014	469	0.6	166	-2.0	4.0	303	1.0	7.2	64.6		9.5	-1.3	8
2015	444	0.0	167	-1.3	4.0	277	0.3	6.6	62.4		10.5	-0.1	8
2016	416	-0.8	166	-0.9	4.0	250	-0.4	6.0	60.1	3	9.8	-0.5	8
2017	448	-0.5	187	0.7	4.5	261	-1.1	6.2	58.3	174	11.0	1.2	8
2018	435	-0.6	170	-0.5	4.0	265	-0.6	6.3	60.9	123	10.0	-0.5	3
2019	444	0.1	196	2.8	4.7	248	-1.1	5.9	55.9	100	7.6	-4.3	2
2020	493	4.3	196	1.4	4.7	297	3.1	7.1	60.2		8.7	-0.8	2
2021	428	-0.7	174	-0.6	4.1	254	-0.5	6.0	59.3	94	9.5	0.1	2
2022	478	1.1	209	2.0	5.0	269	0.2	6.4	56.3	80	9.2	-0.1	2

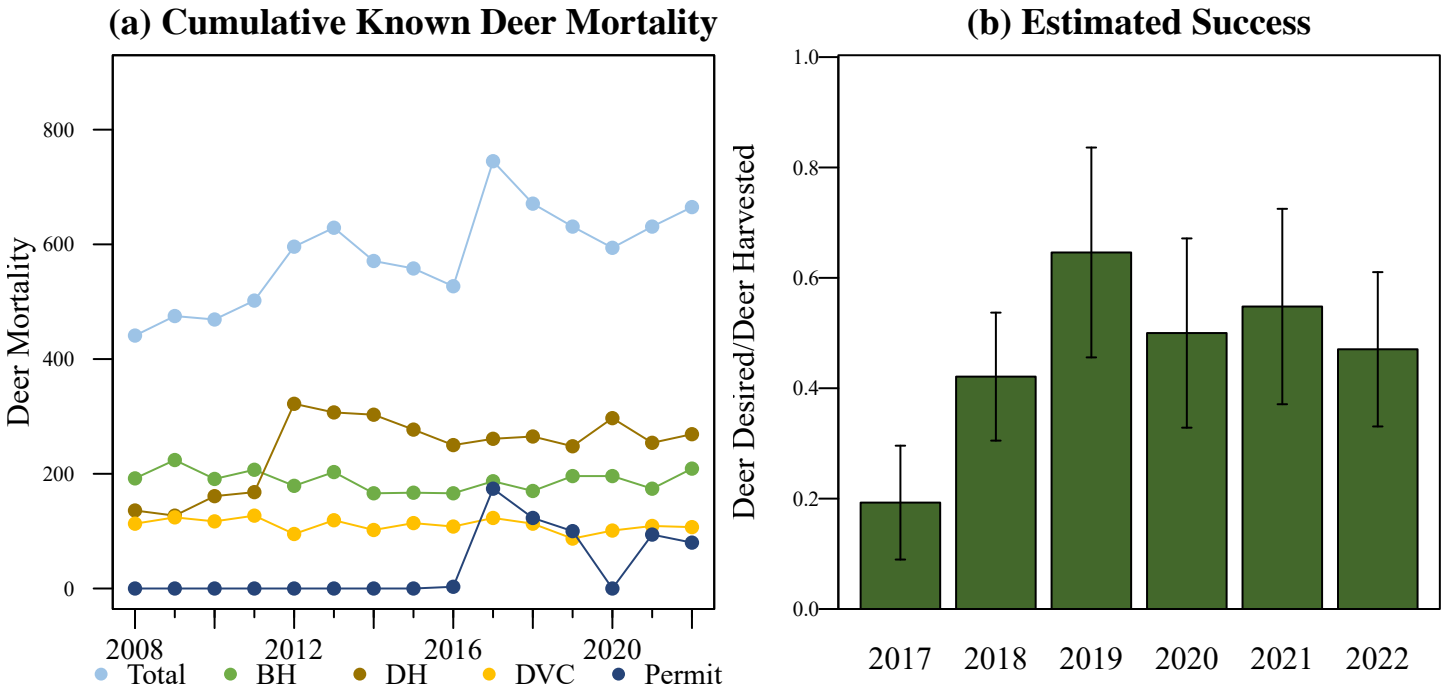

Figure 1. (a) The total known annual deer mortality based on buck harvests (BH), doe harvests (DH), deer vehicle collisions (DVC), and deer permit takes. (b) Success rate is estimated from the deer management survey as the Number of Harvested Deer/Number of Deer Desired (reported only; does not account for attempts that were not made). Larger values (i.e. taller bars) indicate greater success.

DMU 10: Urban

3/24/2023

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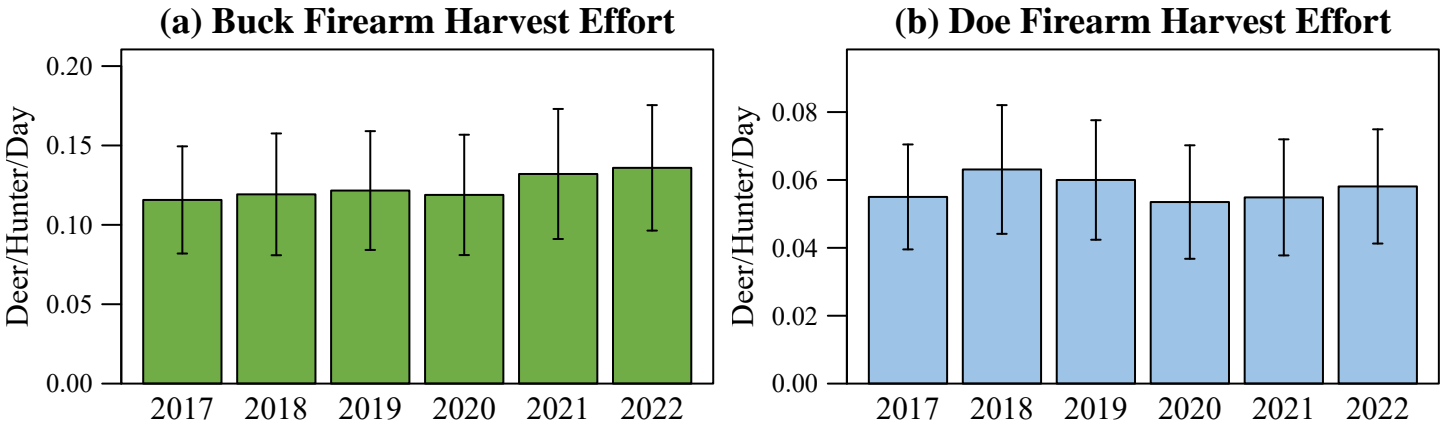
Table 2. Estimated number of antlered (A) and antlerless (AL) deer harvested per hunter. Estimated totals may not match exactly with total number of deer harvested. Reporting errors are examined and investigated as they are located; therefore, subsequent reports may contain corrected totals.

Year	Total Hunters	0 A	1 A	2 A	3 A	0 AL	1 AL	2 AL	3 AL	4 AL	5 AL	6 AL	7 AL	8 AL	9 AL	10 AL
2016	313	182	127	4	0	71	211	24	6	1	0	0	0	0	0	0
2017	316	187	120	9	0	65	206	35	8	0	2	0	0	0	0	0
2018	303	179	120	4	0	63	188	40	10	1	1	0	0	0	0	0
2019	311	186	112	13	0	64	198	40	8	1	0	0	0	0	0	0
2020	337	190	140	7	0	64	227	32	8	6	0	0	0	0	0	0
2021	311	171	134	6	0	63	220	22	6	0	0	0	0	0	0	0
2022	335	179	145	11	0	70	229	29	4	3	0	0	0	0	0	0



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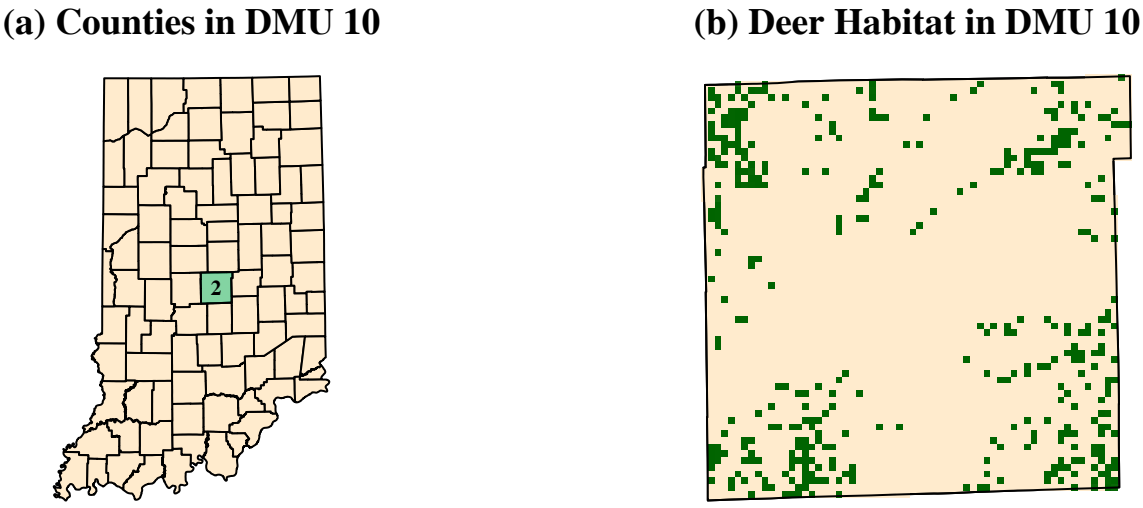


Figure 3. (a) Counties included in DMU 10 for summarizing harvest and deer management survey statistics. Labels are the 2022 county bonus antlerless quotas. (b) Green represents the land use types classified as deer habitat in DMU 10.

DMU 10: Urban

3/24/2023

Deer Management Survey Results

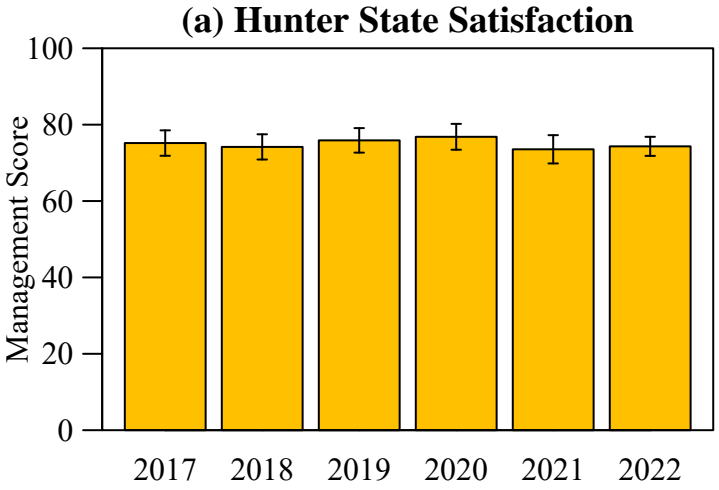
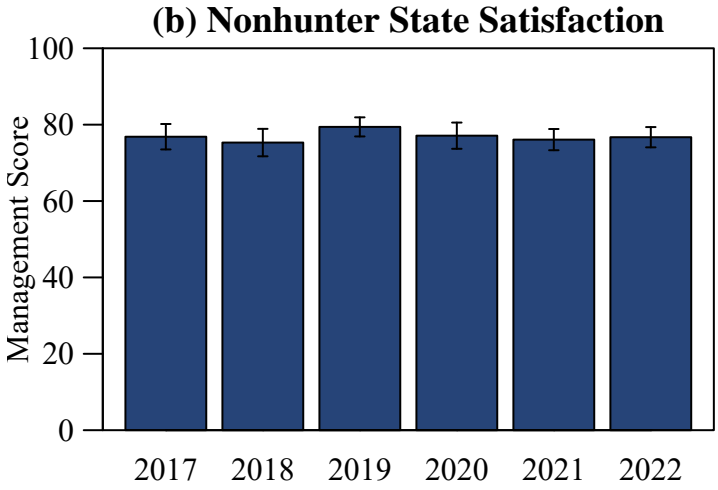


Figure 4. Hunters were asked to score the DNR's state deer management on a scale of 0 (poor) to 100 (excellent) for the county in DMU 10 where they live.



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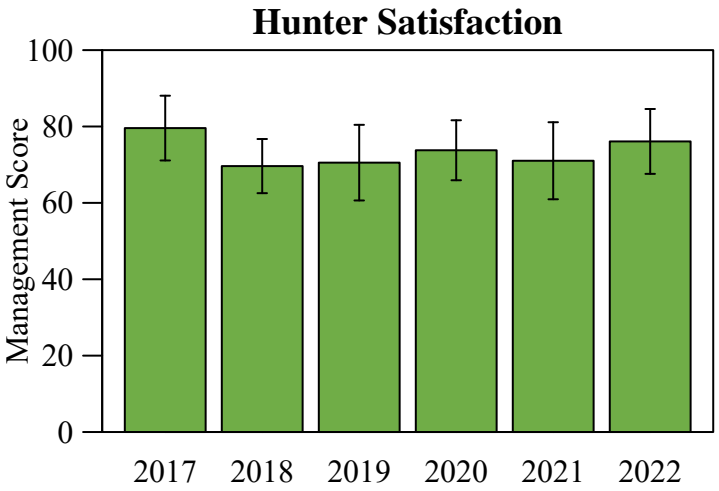
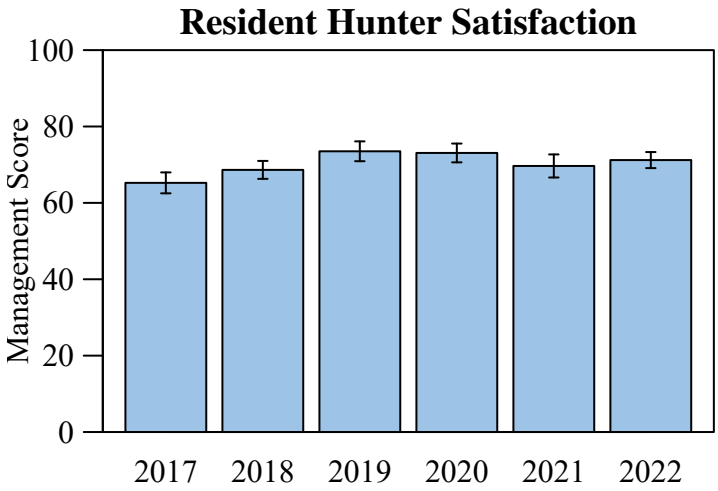


Figure 6. Hunters were asked to score the DNR's county deer management on a scale of 0 (poor) to 100 (excellent) for the county in DMU 10 where they hunt.



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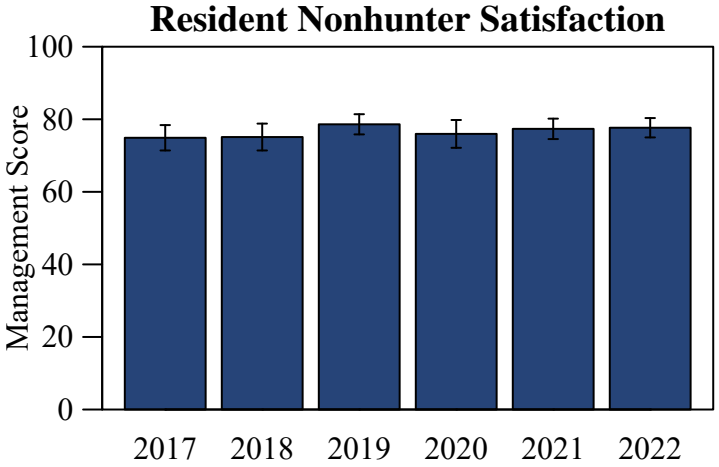

Figure 8. Nonhunters were asked to score the DNR's county deer management on a scale of 0 (poor) to 100 (excellent) for the county in DMU 10 where they live.

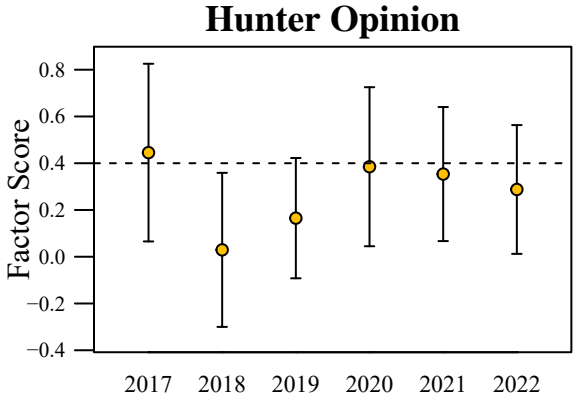

Figure 9. Hunter opinon scores over five years of the deer management survey. The score was aggregated using factor analysis of questions asked only to hunters. The dashed line represents the score if all questions are answered neutrally.

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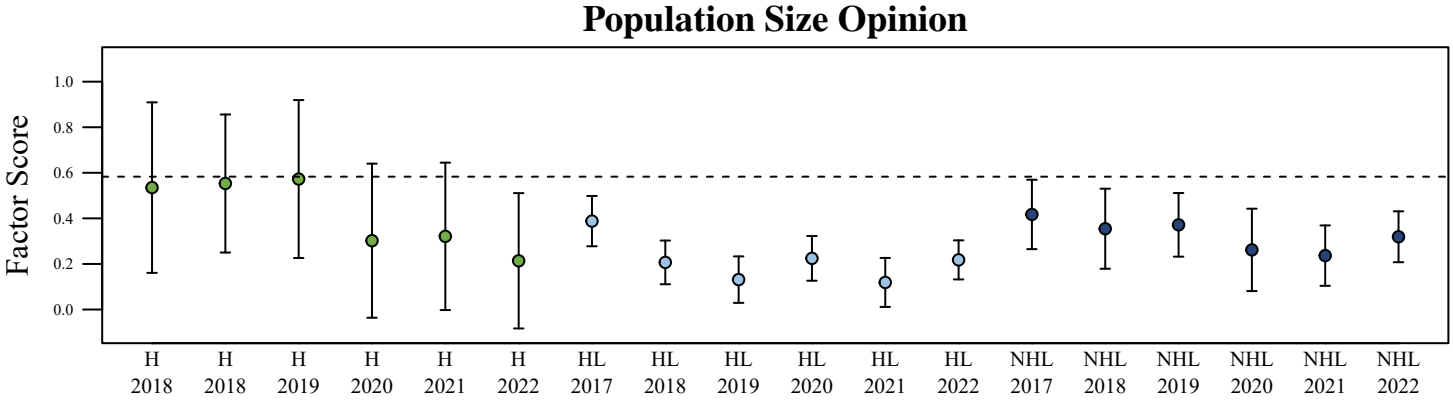

Figure 10. The opinion of nonhunters (NHL) and hunters in the county where they live (HL) and hunters in the county where they hunt (H) on deer population size. The score was aggregated using factor analysis of questions asked to all participants. The dashed line represents the score if all questions are answered neutrally.

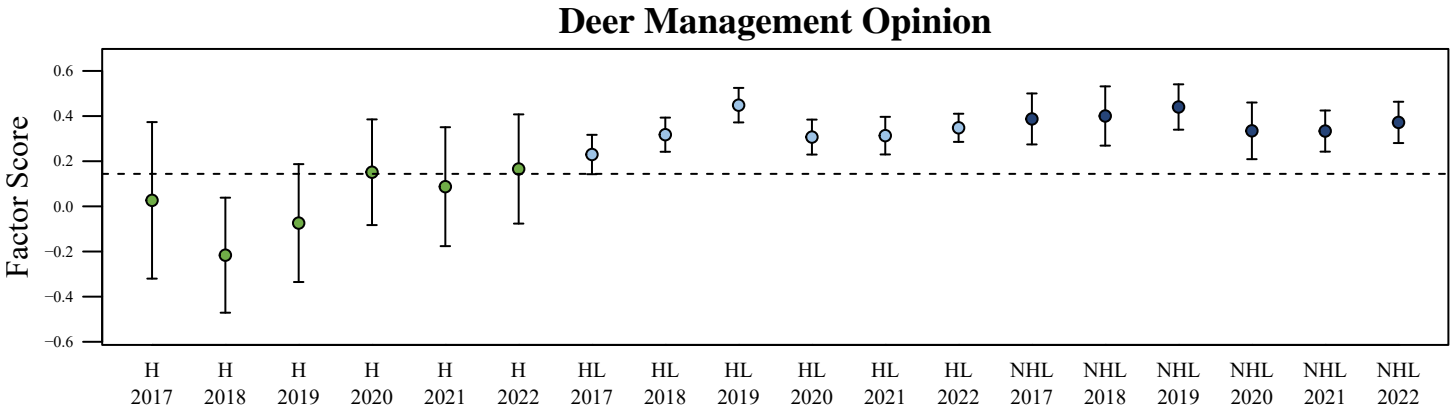

Figure 11. The opinion of nonhunters (NHL) and hunters in the county where they live (HL) and hunters in the county where they hunt (H) on deer management. The score was aggregated using factor analysis of questions asked to all participants. The dashed line represents the score if all questions are answered neutrally.

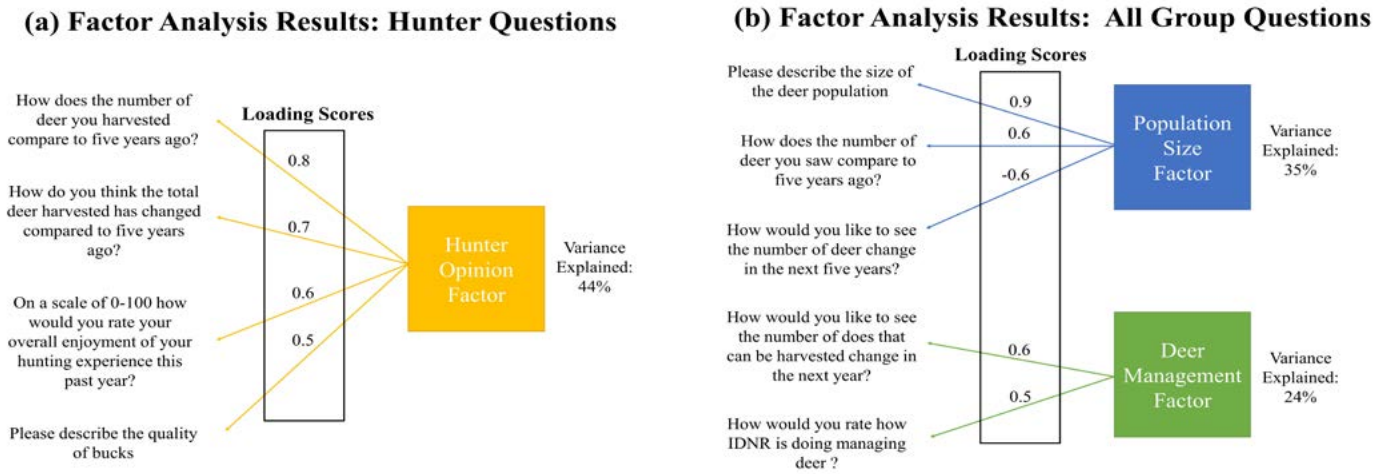

Figure 12. Results from two factor analyses used to develop the hunter opinion (a), population opinion (b), management opinion (b), and scores. Higher loading scores indicate a stronger correlation between the original question and the derived factor. These figures are included to help interpret Figure 9, Figure 10, and Figure 11.