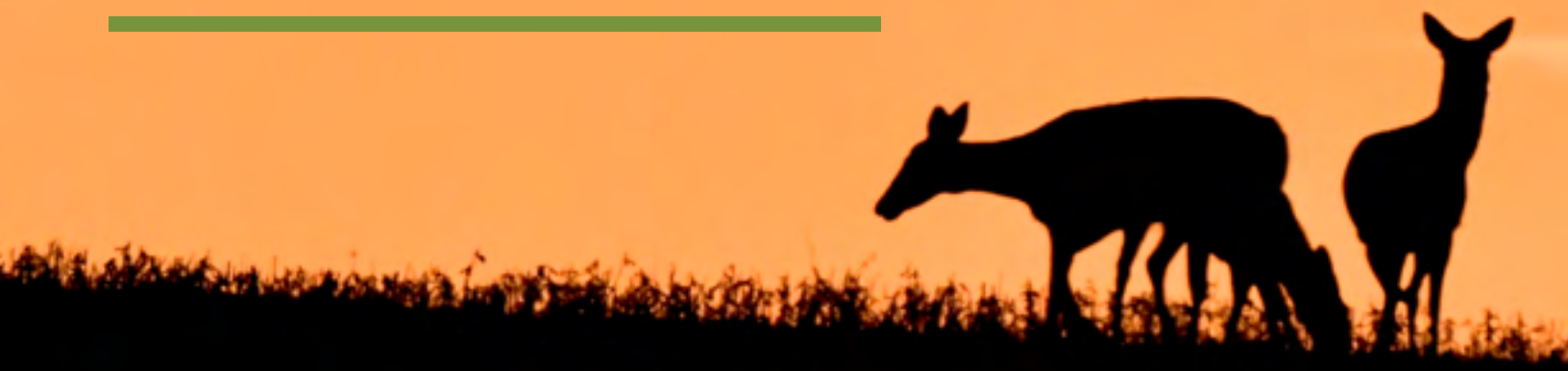
2019

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: John Maxwell

TABLE OF CONTENTS

“Harmony with land is like harmony with a friend; you cannot cherish his right hand and chop off his left. That is to say, you cannot love game and hate predators... The land is one organism.” — Aldo Leopold

Snapshot IN Photo

CHAPTER 1. OVERVIEW

The 2019 Indiana White-tailed Deer Report is a comprehensive report of the state's deer herd. The report includes deer hunting season results, use of depredation permits, deer-vehicle collision reports, disease monitoring efforts, survey results, and internal and external deer research projects.

2019-2020 Deer Hunting Season

The 2019 deer hunting season was composed of four statewide seasons: Youth (Sept. 28 and 29), Archery (Oct. 1 to Jan. 5), Firearms (Nov. 16 to Dec. 1), and Muzzleloader (Dec. 7-22). In addition to the four statewide seasons, the Special Antlerless Firearms season was open from Dec. 26 to Jan. 5 in 19 counties, with additional date restrictions for counties with "A" designated quotas. Most resident deer licenses could be purchased for $24, nonresident licenses for $150. A deer license bundle was available for purchase at $65 for residents and $295 for nonresidents. The deer license bundle, which is valid in all deer seasons except in 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 seasons. The three deer could be either two antlerless and one antlered, or three antlerless deer. A hunter could take only one antlered deer during all statewide seasons combined (Archery, Firearms, Muzzleloader, and Youth seasons). Resident landowners and lessees who own and/or work Indiana farmland were 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. For the second year in a row, hunters could use high-powered rifles as an equipment option 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, two weeks prior to the beginning of Archery season, and continued through Jan. 31.

There were multiple reserve draw hunts open to hunters with a valid deer hunting license. Reserve draw locations change annually. In 2019, reserve draw locations included, among others, Muscatatuck National Wildlife Refuge, Big Oaks National Wildlife Refuge, and Camp Atterbury Joint Maneuver Training Center. For a complete list of reserve draw deer hunts, please visit on.IN.gov/reservedhunt.

Deer Control Permits and Deer-Vehicle Collisions

Deer control permits were issued to Indiana residents experiencing an economic loss of $500 or more as a result of property damage caused by deer or where there was an identified disease risk to humans or domestic livestock. Each depredation 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. Depredation 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 $750 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 depredation permits are factors that influence the bonus antlerless quotas for the hunting season. Numerous deer-vehicle collisions and abundant damage due to deer in a county may indicate too many deer in that county. Thus, the bonus antlerless quotas may be adjusted to minimize the impacts deer have on roadways and properties.

Deer Health

Indiana DNR monitors deer health for major outbreaks of diseases such as epzootic hemorrhagic disease (EHD), bovine tuberculosis (bTB), and chronic wasting disease (CWD). In 2019, Indiana experienced a major EHD outbreak in the southern half of the state. Hunters and the public reported 1,719 deer potentially infected with EHD. Indiana DNR confirmed EHD in 36 counties. Indiana DNR did not conduct bTB surveillance in Franklin County in 2019 because the level of bTB in the area was likely low to non-existent. A total of 772 hunter-

Fish & Wildlife deer check station 52 Pik-Up, staff check the deer for Bovine Tuberculosis. Photo by John Maxwell.

harvested deer, 28 road-killed deer, and 32 targeted deer were tested for CWD statewide in 2019. Our ability to detect the disease in the targeted surveillance areas ranged from 1.53% to 5.10% in the northwest targeted area, and from 1.50% to 2.06% in the northeast targeted area (Table 6-2). To date, no wild deer from Indiana have tested positive for CWD.

Surveys and Citizen Science

Surveys of hunters, landowners, and the public 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, asking questions about harvest, deer damage, and opinions on the size and management of deer in Indiana. In 2019, 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, and happiness with the hunt), 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 citizen science projects to collect valuable data on fawn:doe and buck:doe ratios to better understand the recruitment rates of populations at the county and regional levels.

CHAPTER 2. IMPROVEMENTS IN DEER MANAGEMENT

Indiana Deer Harvest Data Webpage

In 2019, Indiana DNR created the Indiana Deer Harvest Data webpage, an online dashboard that allows hunters to access and query white-tailed deer daily harvest information. The webpage (deer.dnr.IN.gov) was created in response to feedback Indiana DNR received from hunters who want to see real-time harvest information.

The interactive webpage displays preliminary information obtained from the CheckIN Game system, including statewide and county-level harvests from the current season and the previous four seasons. Users can compare total county harvests across years by clicking on a single or multiple counties. Harvest totals can be filtered by equipment type, gender, and land type (public or private) to show specific harvest results. During the season, a bar chart compares the current harvest to the harvest during the previous four seasons leading up to and after the current date. Additionally, a pop-up displays the percentage difference in harvest between the current and previous years. This information is updated once each day during the hunting season, allowing hunters to track the progress of the harvest.

High-powered Rifle Law Update

This year, the Indiana General Assembly removed the sunset clause in Indiana Code 14-22-2-8, commonly known as the high-powered rifle law, in House Bill 1385. This change permanently establishes high-powered rifles that meet the specifications set forth in the law as an equipment type that can be used to harvest deer in Indiana. The effect of the high-powered rifle law on harvest over the past four hunting seasons can be found in Chapter 9 of this report.

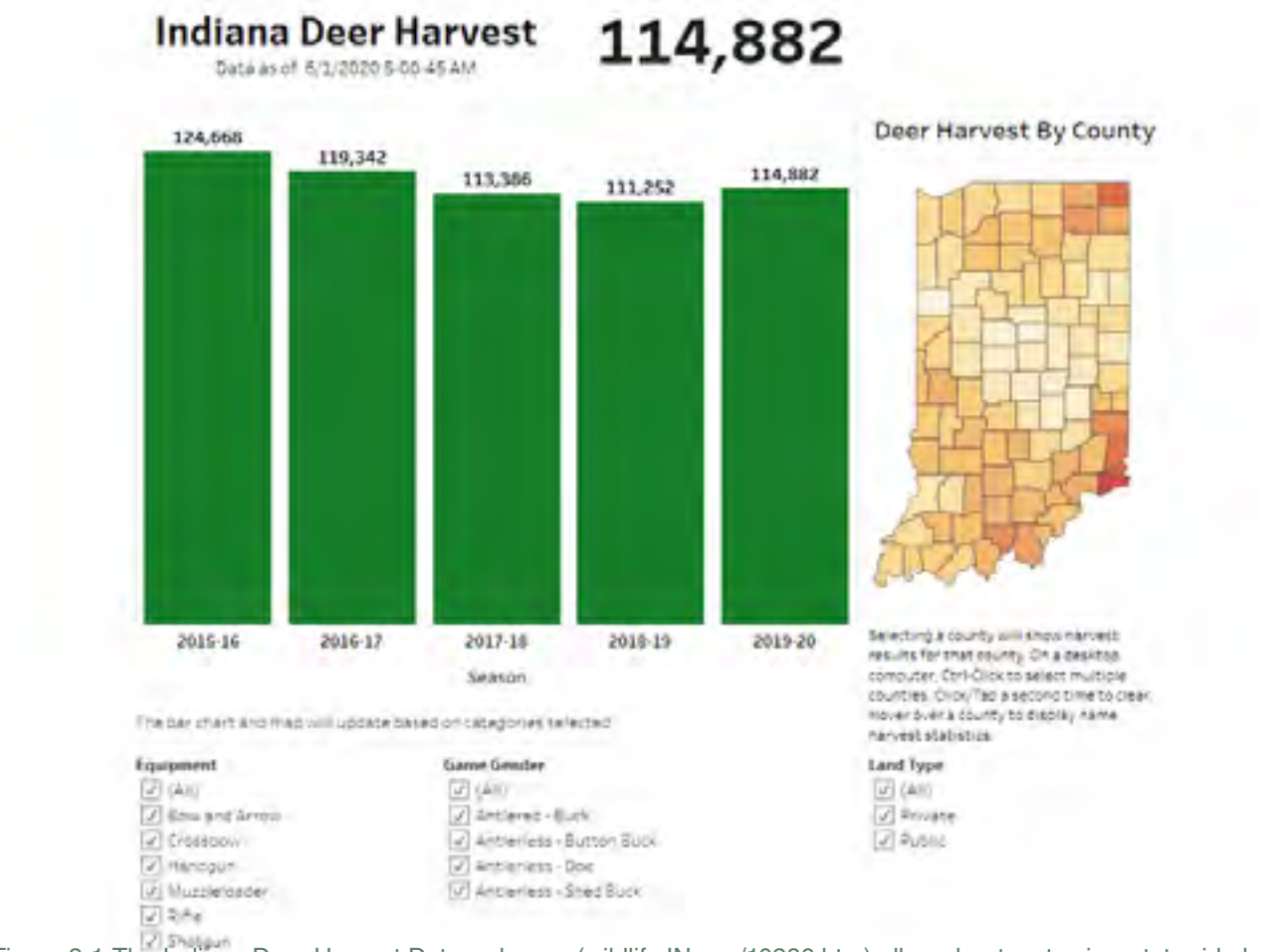

Figure 2-1. The Indiana Deer Harvest Data webpage (wildlife.IN.gov/10286.htm) allows hunters to view statewide harvest information in real time after successful hunters register their harvested deer in the CheckIN Game system.

New Style of Graphs to Represent Data

In the 2018 Indiana White-tailed Deer Report, the County Deer Data sheets included a new type of bar graph to better represent hunter opinion data than in previous years (Figure 2-2). This year, the same style of bar graph was also used throughout Chapter 7, Deer Management Survey, and may be incorporated in additional chapters in future reports. Because the style of graph is unique, it warrants a brief explanation on how to read it.

As an example, Figure 2-2 represents hunter (H) and non-hunter (NH) opinions about the size of the deer population in their county during the hunting season. Both hunter and non-hunter opinions from each year are represented by a separate horizontal bar. The number of responses included for each horizontal bar is labeled on the right (e.g. n=3,523). Figure 2-2 shows five different response options that are represented by separate colors or blocks within the horizontal bar. The size of each block is relative to the percent of responses it received. Larger blocks indicate more people chose that answer. Each horizontal bar totals 100%, and the percent scale at the bottom of the graph measures the relative percent of each block in negative % and positive %. The dark vertical line in the middle of the graph represents the midpoint of the neutral opinion at 0%. The entire neutral opinion spans equally to the left and right of the vertical line. Anything beyond the neutral opinion to the left is negative and anything beyond the neutral opinion to the right is positive on the percent scale. The farther the bar graph is shifted in either direction, the more extreme the opinion. The negative or positive percent signs are not correlated with the actual meaning of the response. Rather they help biologists quantify the two extremes.

These graphs help visualize all the response blocks relative to each other. Reading only the percentages of each block may lead the reader to misinterpret the data. For example, in Figure 2-2, the non-hunter horizontal bars are mostly balanced across the mid-line in all three years, with the number of "high"/ "too high" responses about the same as "low"/ "too low" responses. Overall, non-hunters are neutral in their opinion about the size of the deer population regardless of the individual percentages of each response block. The hunter horizontal bars, however, are skewed toward the left, indicating a mostly negative opinion ("low" or "too low"). In 2020, the percent of "about right" responses from hunters was slightly higher than the percent of "too low" responses. Based on percentages alone, it seems that more hunters thought the deer population was about right than too low. That is true, but it is not the entire story. When represented by this graph, the reader can see that, in fact, the "too low" response plus the "low" response totals much greater than the "about right" response indicating a very negative opinion rather than a neutral opinion. This style of graph provides biologists with an easy way gauge complex opinion data and to understand the yearly trends.

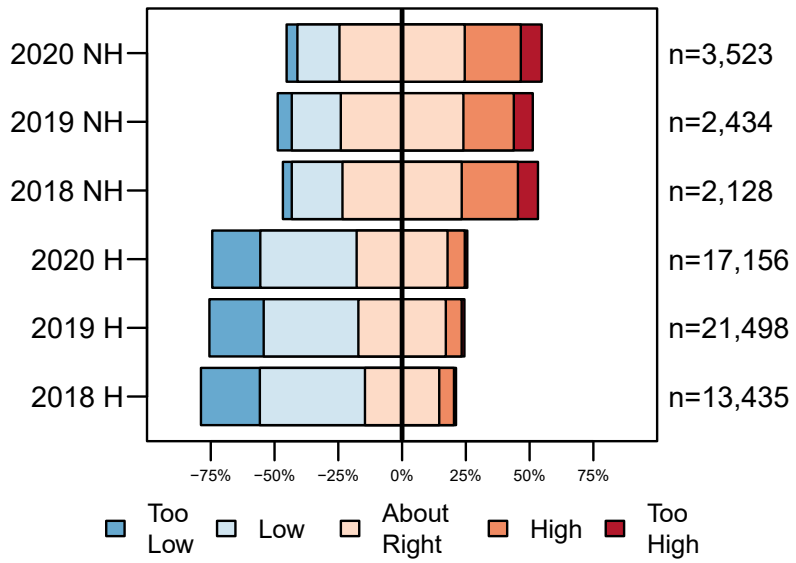

Figure 2-2. Example of the new graphs being using throughout the Indiana White-tailed Deer Report. This graph from the Deer Management Survey depicts hunter (H) and non-hunter (NH) opinions about the size of the deer herd in their county during the hunting season.

CHAPTER 3. 2019-2020 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 to report harvest 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 indicating the incorrect sex or license used, or entering the same deer multiple times. Indiana DNR is constantly working throughout the 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 so a correction can be made.

For this reason, 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. The same expectation should exist 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 Indiana DNR with questions.

Two error rates were calculated for this issue: an unreconciled error rate and a total error rate, the latter of which includes both reconciled errors and unreconciled errors (Table 3-1). Typically, the numbers reported in this document fluctuate only by the unreconciled error rate because 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 do not affect management decisions.

Harvest totals for the 2019 deer hunting season are current as of March 23, 2020. Additionally, harvest totals for the 2016, 2017, and 2018 seasons have been updated since previously reported. In this report, the updated totals are used in analyses and comparisons between years.

Table 3-1. Error rates of hunter-reported deer harvests, 2015-2019. Total error includes reconciled and unreconciled errors.

	2016-2017	2017-2018	2018-2019	2019-2020
% total error	0.51%	1.30%	0.57%	0.23%
% unreconciled error	0.05%	0.17%	0.13%	0.13%

Harvest by Season

Harvest summary reports prior to 2016 did not include harvest numbers from Indiana State Park Reduction 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 State Park Reduction Hunts 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 otherwise specified.

A total of 114,882 harvested deer were reported in Indiana during the 2019 season (Figures 3-1 and 3-2). The 2019 harvest was 3.3% greater than the 111,251 deer taken during the 2018 season. The 2019 antlered deer harvest of 51,646 was 9.3% higher than the 47,256 reported in 2018. Indiana's antlered deer harvest is similar to that of Iowa and Kansas, which averaged 44, 949 and 41,777 antlered deer, respectively, from 2013 to 2017 (QDMA 2020). On average, Illinois (63,906), Kentucky (69,519), Michigan (199,156), and Ohio (74,804) harvest more antlered deer each year that than Indiana (47,837; QDMA 2020).

The 2019 antlerless harvest of 63,236 was slightly lower (1.2%) than the 63,995 harvested in 2018. Compared to other Midwestern states, Indiana's antlerless deer harvest falls in the middle of the average range (13,319 in North Dakota to 167,539 in Wisconsin), and all neighboring states have higher average antlerless deer harvests than Indiana (QDMA 2020).

In 2019, the reported harvest for total deer ranks 16th highest all-time, while the total antlerless deer harvest ranks as the 18th highest in Indiana history. The antlered harvest ranks 6th highest since reporting began in 1951. Approximately 4 million deer have been reported harvested during the past 67 deer hunting seasons in Indiana.

The 2019 hunting season began with the Deer Reduction Zone season on Sept. 15. The number of deer harvested with archery equipment during the Deer Reduction Zone season were incorporated into the Archery season totals, while deer harvested with firearms during the Deer Reduction Zone season were incorporated into the Firearms season totals.

A youth-only weekend occurred Sept. 28 and 29. This Youth season was created in 2006 and allowed youth 15 years old and younger to harvest one antlerless deer. The Youth season 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 1,562 deer were reportedly harvested in 2019 during this season, a decrease of 5.2% from the 1,674 deer harvested in 2018. This season accounted for 1.4% of the total harvest (Table 3-2). Approximately 34% of the Youth season harvest were antlered bucks (Figure 3-3).

There were 32,911 deer harvested during the 2019 Archery season, which represented 28.4% of the overall harvest and was 4.3% greater than the 31,554 deer harvested in 2018 (Table 3-2). Antlerless deer (n=19,412) made up 59.0% of the total Archery season harvest (Figure 3-3).

The 2019 Firearms season harvest of 68,295 was slightly greater (1.7%) than the 67,165 deer harvested in 2018 and represented 59.4% of the total harvest (Table 3-2). The antlerless harvest of 33,527 was 6.4% less than the 2018 antlerless harvest. The 2019 antlered harvest during Firearms season was 10.9% greater than the number of antlered deer harvested in 2018. The antlered harvest exceeded the antlerless harvest on the first seven days of the season (Table 3-3). Opening weekend contributed 30.1% of the statewide total harvest for all 2019 seasons, compared to 27.0% in 2018.

At 10,183 deer, the 2019 Muzzleloader season harvest accounted for 8.9% of the total 2019 harvest, a 24.7% increase from the Muzzleloader season harvest of 2018 (Table 3-2). In 2019 the proportion of antlered versus

antlerless deer remained the same as in 2018. As in years past, a large percentage of the deer harvested during the Muzzleloader season were antlerless (72.4%, Figure 3-3).

The 2019 Special Antlerless Firearms season was available in counties with a bonus antlerless county designation of four or more before changes were made due to the 2019 epizootic hemorrhagic disease (EHD) outbreak (see "Bonus Antlerless Licenses and Quotas" and Chapter 6). A total of 19 counties met this criterion in 2019. Twenty-four counties participated in 2018. The reported harvest during this season was 1,931 with 98.0% of the harvest reported as antlerless does and button bucks (Figure 3-3). Nine shed bucks were reported harvested during the Special Antlerless Firearms season in 2019.

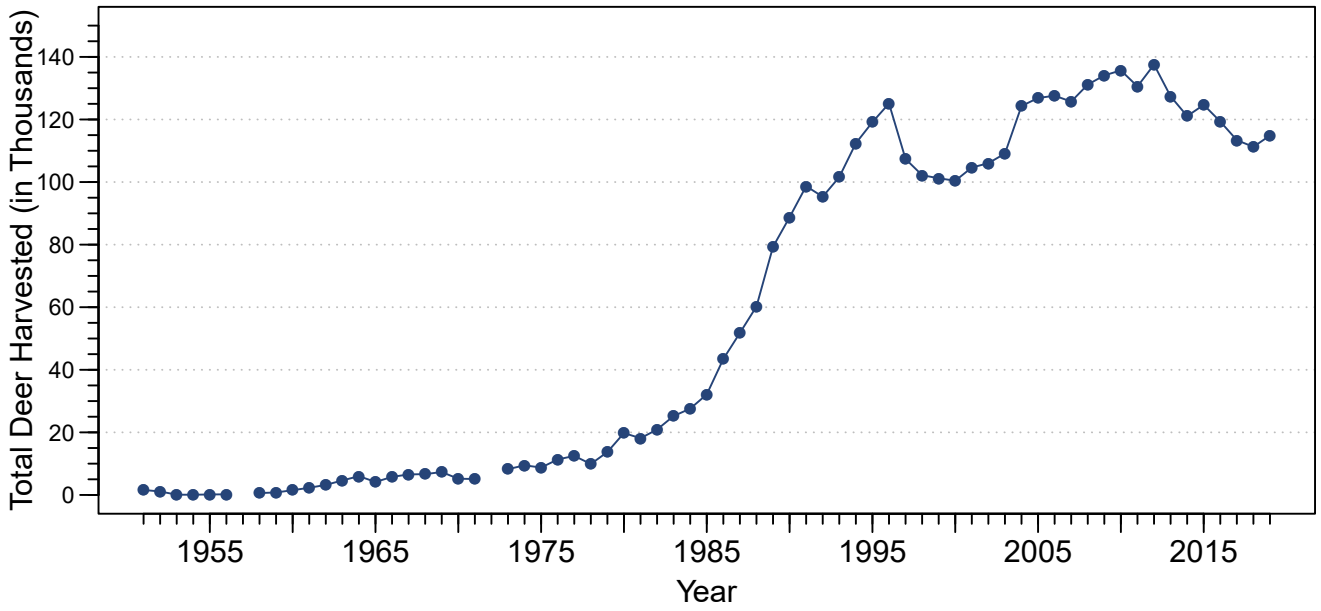

Figure 3-1. The total number of deer harvested in each Indiana deer season, 1951-2019. Totals include deer harvested in State Park Reduction Hunts, 1993-2019. Reporting error rates: ±0.23% (2019), ±0.57% (2018), ±1.30% (2017), and ±0.51% (2016).

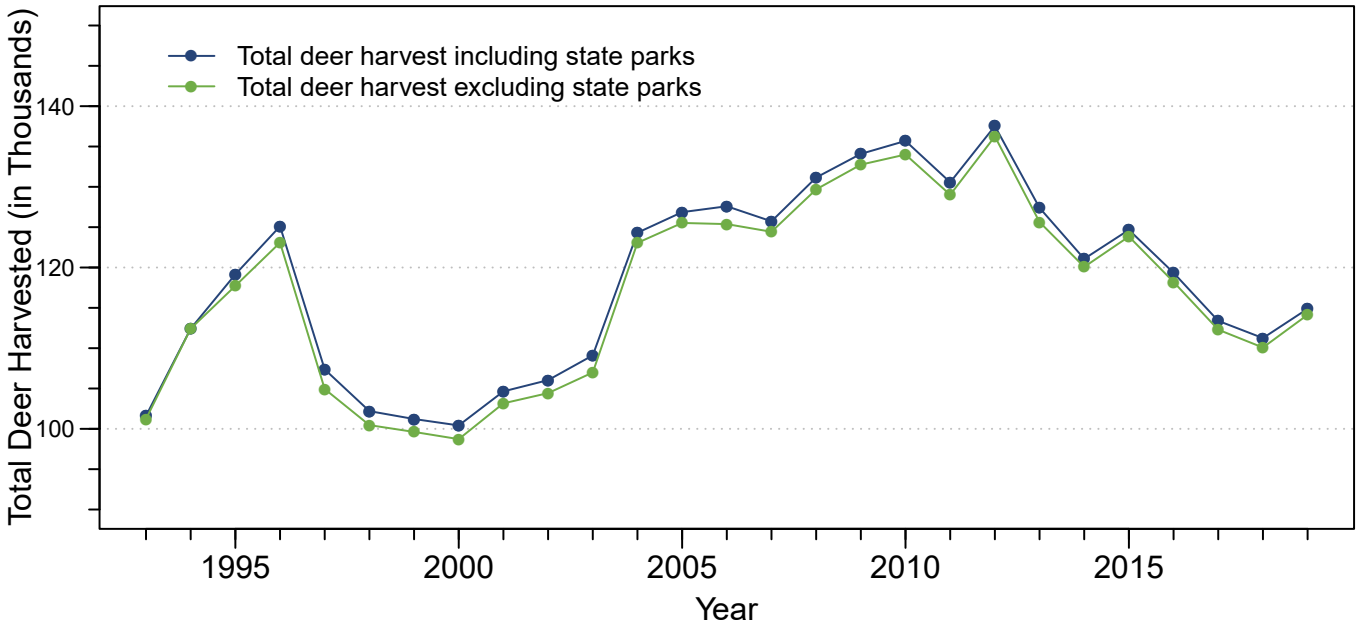

Figure 3-2. A comparison of the total number of deer harvested in each Indiana deer season, including and excluding deer harvested during State Park Reduction Hunts, 1993-2019. Reporting error rates: ±0.23% (2019), ±0.57% (2018), ±1.30% (2017), and ±0.51% (2016).

Table 3-2. Number of deer harvested per season during the 2019 Indiana deer hunting season. Values in parentheses represent percent of total harvest for each season. Values may not total 100 due to rounding. Reporting error rate: ±0.23% (2019).

	Number of deer harvested (% of total harvest)		
Season (Dates)	Antlered#	Antlerless##	Total
Youth Deer* (28 – 29 Sept)	531 (0.5%)	1,031 (89.7%)	1,562 (1.4%)
Archery* (1 Oct – 5 Jan)	13,499 (11.8%)	19,412 (16.9%)	32,911 (28.6%)
Firearms* (16 Nov – 1 Dec)	34,768 (30.3%)	33,527 (29.2%)	68,295 (59.4%)
Muzzleloader (7 – 22 Dec)	2,809 (2.4%)	7,374 (6.4%)	10,183 (8.9%)
Special Antlerless Firearms** (26 Dec – 5 Jan)	39 (0.3%)	1,892 (1.6%)	1,931 (1.7%)
Totals	51,646 (45.0%)	63,236 (55.0%)	114,882

*Includes Deer Reduction Zone harvests
**In 19 counties
#Includes shed buck harvest
##Includes button buck harvest

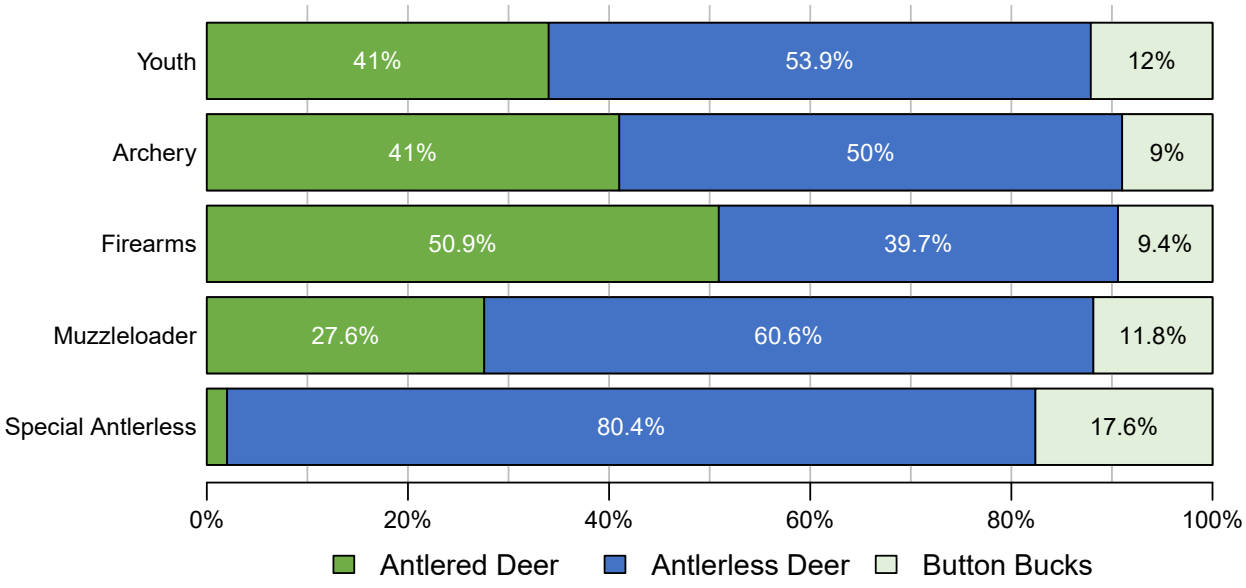

Figure 3-3. Composition of individual season harvests during the 2019 Indiana deer season. Reporting error rate: ±0.23% (2019).

Table 3-3. Number of deer harvested on each day of the 2019 Indiana Firearms season (includes deer taken by bow and arrow, crossbow, shotgun, handgun, rifle, and muzzleloader). Values may not total 100 due to rounding. Reporting error rate: ±0.23% (2019).

		Antlered		Antlerless		Total		
Date	Day	Deer	% of Daily Total	Deer	% of Daily Total	Deer	% of Season Total	% of Total 2019 Harvest
16 November	Sat	13,727	58.8%	9,621	41.2%	23,348	34.0%	20.3%
17 November	Sun	6,036	53.3%	5,290	46.7%	11,326	16.5%	9.9%
18 November	Mon	2,137	51.7%	1,993	48.3%	4,130	6.0%	3.6%
19 November	Tue	1,533	53.6%	1,328	46.4%	2,861	4.2%	2.5%
20 November	Wed	1,261	54.5%	1,053	45.5%	2,314	3.4%	2.0%
21 November	Thu	595	51.6%	558	48.4%	1,153	1.7%	1.0%
22 November	Fri	1,158	50.3%	1,146	49.7%	2,304	3.4%	2.0%
23 November	Sat	2,096	46.6%	2,401	53.4%	4,497	6.6%	3.9%
24 November	Sun	1,842	43.8%	2,366	56.2%	4,208	6.1%	3.7%
25 November	Mon	660	40.3%	977	59.7%	1,637	2.4%	1.4%
26 November	Tue	496	42.3%	677	57.7%	1,173	1.7%	1.0%
27 November	Wed	251	38.4%	402	61.6%	653	1.0%	0.6%
28 November	Thu	863	39.8%	1,305	60.2%	2,168	3.2%	1.9%
29 November	Fri	1,034	34.6%	1,953	65.4%	2,987	4.4%	2.6%
30 November	Sat	507	35.8%	910	64.2%	1,417	2.1%	1.2%
1 December	Sun	846	34.6%	1,601	65.4%	2,447	3.6%	2.1%
Total		35,042		33,581		68,623		59.7%

Snapshot IN Photo

Harvest by County

In 2019, the number of deer harvested in individual counties ranged from 102 in Benton County to 2,756 in Steuben County (Table 3-4). Harvest exceeded 1,000 deer in 57 counties and 2,000 deer in 10 counties. The antlered buck harvest exceeded 1,000 in six counties compared with two in 2018, while the antlerless harvest exceeded 1,000 deer in 21 counties compared with 23 the previous year. Antlerless deer accounted for at least 50% of the total harvest in 79 of the state's 92 counties in 2019. The 10 counties with the highest harvests were, in descending order, Steuben, Franklin, Noble, Harrison, Dearborn, Kosciusko, LaGrange, Lawrence, Dekalb, and Greene. The 10 counties with the lowest harvests, beginning with the lowest, were Benton, Tipton, Hancock, Howard, Rush, Clinton, Boone, Marion, Blackford, and Hamilton.

Table 3-4. Deer harvest by county during the 2019 Indiana deer hunting season. Reporting error rate: ±0.23% (2019).

County	Antlered	Antlerless	Total	County	Antlered	Antlerless	Total
Adams	338	397	735	Lawrence	987	1,211	2,198
Allen	780	936	1,716	Madison	232	276	508
Bartholomew	484	610	1,094	Marion	141	303	444
Benton	75	27	102	Marshall	881	1,076	1,957
Blackford	196	263	459	Martin	641	864	1,505
Boone	172	269	441	Miami	543	692	1,235
Brown	632	992	1,624	Monroe	677	827	1,504
Carroll	412	450	862	Montgomery	466	428	894
Cass	567	583	1,150	Morgan	558	720	1,278
Clark	556	722	1,278	Newton	441	447	888
Clay	498	634	1,132	Noble	1,099	1,526	2,625
Clinton	207	174	381	Ohio	297	307	604
Crawford	754	1,034	1,788	Orange	755	1,001	1,756
Daviess	457	510	967	Owen	686	1,026	1,712
Dearborn	1,069	1,245	2,314	Parke	832	1,132	1,964
Decatur	351	458	809	Perry	679	924	1,603
Dekalb	954	1,167	2,121	Pike	711	834	1,545
Delaware	330	396	726	Porter	580	888	1,468
Dubois	687	1,052	1,739	Posey	578	550	1,128
Elkhart	670	852	1,522	Pulaski	765	904	1,669
Fayette	393	540	933	Putnam	852	891	1,743
Floyd	264	368	632	Randolph	319	318	637
Fountain	576	643	1,219	Ripley	736	1,027	1,763
Franklin	1,134	1,502	2,636	Rush	192	187	379
Fulton	631	699	1,330	Saint Joseph	516	688	1,204
Gibson	595	660	1,255	Scott	261	464	725
Grant	410	434	844	Shelby	219	285	504
Greene	884	1,175	2,059	Spencer	502	606	1,108
Hamilton	227	251	478	Starke	687	762	1,449
Hancock	142	127	269	Steuben	1,326	1,430	2,756
Harrison	1,063	1,434	2,497	Sullivan	885	985	1,870
Hendricks	292	309	601	Switzerland	805	1,010	1,815
Henry	283	321	604	Tippecanoe	421	496	917
Howard	192	182	374	Tipton	81	44	125
Huntington	462	489	951	Union	284	380	664
Jackson	689	899	1,588	Vanderburgh	279	469	748
Jasper	650	648	1,298	Vermillion	500	533	1,033
Jay	443	587	1,030	Vigo	681	753	1,434
Jefferson	761	935	1,696	Wabash	658	721	1,379
Jennings	704	1,013	1,717	Warren	518	568	1,086
Johnson	227	296	523	Warrick	668	706	1,374
Knox	447	414	861	Washington	861	1,081	1,942
Kosciusko	1,022	1,270	2,292	Wayne	541	662	1,203
Lagrange	958	1,325	2,283	Wells	345	290	635
Lake	532	749	1,281	White	424	433	857
LaPorte	818	1,003	1,821	Whitley	548	467	1,015

Harvest per Hunter

The majority of hunters (70.8%, n=58,173) in Indiana harvested one deer during the 2019 deer season (Table 3-5). Only 0.62% (n=522) of hunters statewide harvested more than four deer in 2019, which is 19% less than the percentage (0.8%, n=642) that harvested more than four deer in 2018.

Table 3-5. Number of deer harvested by individual hunters during the 2018 and 2019 Indiana deer seasons. Reporting error rates: ±0.23% (2019) and ±0.57% (2018).

	2018		2019	
Number of Deer	Hunters	% of Total	Hunters	% of Total
1	56,245	71.3%	58,173	70.8%
2	16,094	20.4%	17,605	21.4%
3	4,687	5.9%	4,779	5.8%
4	1,266	1.6%	1,056	1.3%
5	381	0.5%	339	0.4%
6	140	0.2%	109	0.1%
7	68	0.1%	39	0.0%
8	33	0.0%	22	0.0%
9	6	0.0%	5	0.0%
10	7	0.0%	3	0.0%
11	5	0.0%	2	0.0%
12	0	0.0%	1	0.0%
13	0	0.0%	0	0.0%
14	1	0.0%	1	0.0%
15	0	0.0%	0	0.0%
16	1	0.0%	0	0.0%
17	0	0.0%	1	0.0%

Harvest by Equipment Type

Six types of equipment were legal for hunting deer during 2019 (Figure 3-4): archery (traditional and compound bows), crossbows, handguns, muzzleloaders, rifles, and shotguns. Harvest decreased from 2018 for bow and arrow (-1.2%) and shotgun (-8.8%) (Table 3-6). Harvest increased for crossbow (9.7%), handgun (7.0%), muzzleloader (3.0%), and rifle (7.3%). Similar to other Midwestern states, more than half of the total deer harvest was taken using a rifle or shotgun (QDMA 2020).

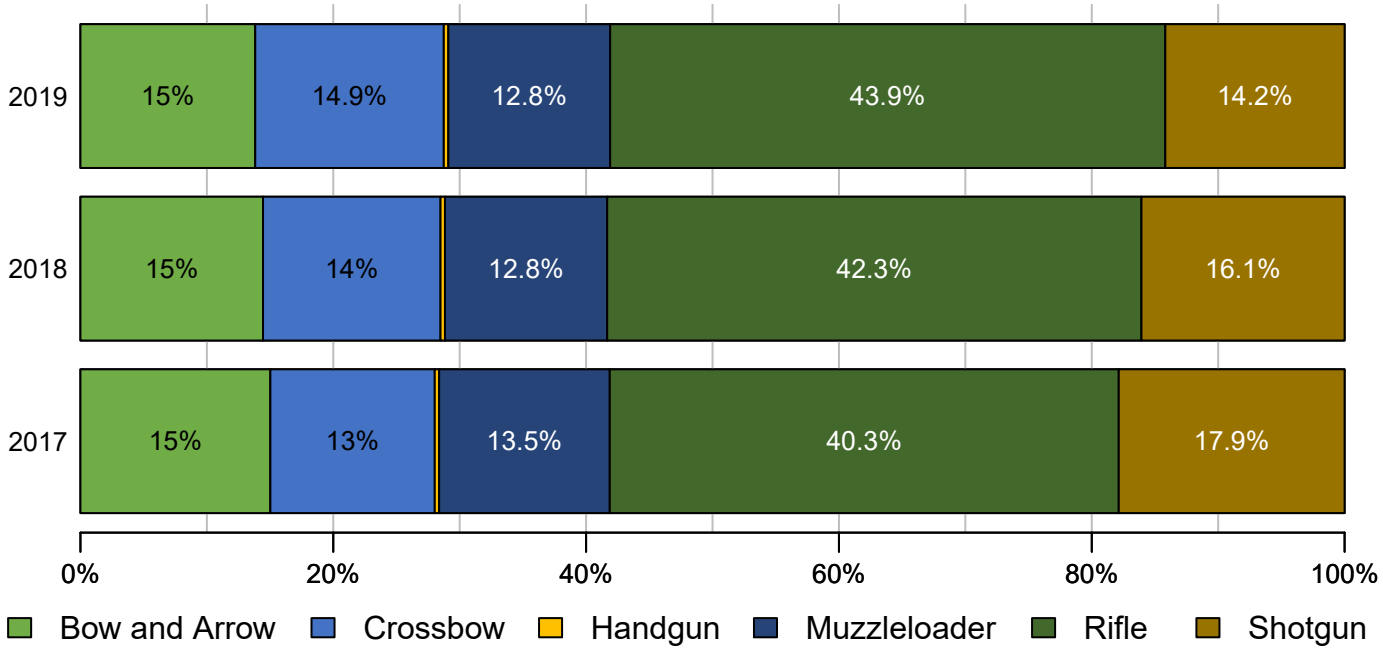

Figure 3-4. Percent harvest by equipment type 2017-2019. Reporting error rates: ±0.23% (2019), ±0.57% (2018), and ±1.30% (2017).

Table 3-6. Number of deer harvested by type of legal hunting equipment across seasons, 2015-2019. Values within this table do not exactly equal those tallied by season (Table 3-2) due to the fact that multiple equipment types can be used during the Firearms season. Approximate percent of total harvest shown in parentheses. Reporting error rates: ±0.23% (2019), ±0.57% (2018), ±1.30% (2017), and ±0.51% (2016).

	Number of deer harvested (% of total harvest)				
Equipment	2015	2016±	2017±	2018±	2019±
Bow and Arrow	20,309 (16.3%)	16,996 (14.2%)	17,034 (15.0%)	16,069 (14.4%)	15,884 (13.8%)
Crossbow	11,837 (9.5%)	11,260 (9.4%)	14,747 (13.0%)	15,623 (14.0%)	17,136 (14.9%)
Handgun	917 (0.7%)	604 (0.5%)	392 (0.3%)	388 (0.3%)	415 (0.4%)
Muzzleloader	24,746 (19.8%)	16,676 (14.0%)	15,304 (13.5%)	14,279 (12.8%)	14,706 (12.8%)
Rifle	23,296 (18.7%)	44,628 (37.4%)	45,653 (40.3%)	47,015 (42.3%)	50,449 (43.9%)
Shotgun	43,563 (35.0%)	29,178 (24.4%)	20,256 (17.9%)	17,878 (16.1%)	16,292 (14.2%)
Total	124,668	119,342	113,386	111,252	114,882

±Totals include State Park Reduction Hunts

Harvest Age and Sex Structure

The age and sex structure of the 2019 deer harvest was 44.9% adult males, 45.4% adult females, and 9.7% male fawns (button bucks) (Table 3-7). Antlerless deer (does and button bucks) represented the highest proportion of the total deer harvest at 55.1% but dropped from an all-time high of 66% in 2012.

During the opening weekend of Firearms season, Indiana DNR biologists have traditionally manned 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. The age data collected during the opening weekend of Firearms season provided an unbiased method for determining the age structure of the harvest. Because all hunters now check in deer online, age estimates of adult deer, such as the proportion of yearling bucks in the harvest, are unavailable. Indiana DNR is working to recapture age data through the After Hunt Survey, which asks successful hunters to report the ages of their harvested deer (see Chapter 8).

Table 3-7. Sex and age structure of the Indiana deer harvest 1987-2019, as determined from check stations and online registrations. Number in parentheses is the percentage of the total harvest for that age/sex class per year. Values may not total 100 due to rounding. Reporting error rates: ±0.23 (2019), ±0.57% (2018), ±1.30% (2017), and ±0.51% (2016).

	Adults		Fawns		Total
Year	Males (%)	Females (%)	Males (%)	Females (%)	
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)	€	124,668
2016±	51,646# (43)	55,922 (47)	11,774 (10)	€	119,342
2017±	44,884# (40)	56,335 (50)	12,167 (10)	€	113,386
2018±	47,256# (42)	52,513 (47)	11,483 (10)	€	111,252
2019±	51,646# (45)	52,128(45)	11,108 (10)	€	114,882

* Number of adult and fawn females is projected from the % fawns of all females aged at the biological check stations (not from the ratio of fawn doe to fawn bucks in the total deer harvest).

Includes shed antlered bucks

± Includes State Park Reduction Hunts

€ Due to the lack of biological check station and the implementation of 100% online check in of all harvested deer in 2015, female fawn numbers are not available.

Public Lands Harvest

A total of 6,596 (a 2.7% decrease from 2018) deer were harvested on 124 public lands in Indiana during the 2019-2020 season, which accounted for 5.7% 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). More than 25% of the deer harvested on public lands were taken from across 26 FWAs. Pigeon River FWA, with 318 deer, had the largest harvest. Hoosier National Forest accounted for 14.4% of the total public lands harvest. Big Oaks National Wildlife Refuge accounted for 6.2%. Together, state park (11.3%) and state forest (15.9%) lands contributed to 27.2% of the public lands harvest.

The percentage of antlered (42.9%) and antlerless (57.1 %) deer harvested on public lands was similar to the composition of the total harvest (44.9% antlered, 55.1% antlerless). Button bucks accounted for 11.9% of the antlerless harvest on public lands.

Table 3-8. Deer harvested during the 2019-2020 deer hunting season on public lands managed by Indiana DNR Division of Fish & Wildlife. Reporting error rate: ±0.23% (2019).

Property	Antlered	Button Buck	Antlerless	Total	Property	Antlered	Button Buck	Antlerless	Total
FISH & WILDLIFE AREA	**782**	**182**	**725**	**1,689**	**WILDLIFE CONSERVATION AREA**	**46**	**15**	**37**	**98**
Atterbury	20	5	13	38	Aukiki	2	0	0	2
Blue Grass	9	2	6	17	Badal	0	0	1	1
Chinook	6	0	5	11	Barnes-Seng	0	0	1	1
Crosley	21	3	20	44	Cedar Swamp	5	3	7	15
Deer Creek	4	8	13	25	Durham Lake	5	1	3	9
Fairbanks Landing	46	10	31	87	Fish Lake	3	0	1	4
Glendale	36	6	44	86	Galena	3	0	1	4
Goose Pond	13	3	16	32	Goose Lake	0	0	1	1
Hillenbrand	15	6	12	33	Little Pigeon Crk	7	2	3	12
Hovey Lake	21	3	29	53	Lost Hill	1	0	0	1
J.E. Roush	48	7	44	99	Mallard Roost	1	1	2	4
Jasper-Pulaski	73	12	55	140	Manitou Lake Islands	3	0	2	5
Kankakee	9	3	6	18	Marsh Lake	5	3	3	11
Kankakee Sands (TNC)	14	0	8	22	Maxincukee	1	2	1	4
Kingsbury	52	15	49	116	Menominee	6	2	8	16
Lasalle	32	5	29	66	Turkey Creek	1	0	1	2
Pigeon River	130	48	140	318	Turkey Foot	1	0	0	1
Splinter Ridge	10	2	10	22	Whirledge	2	1	2	5
Stucker Fork	3	0	1	4	**WILDLIFE MANAGEMENT AREA**	**15**	**7**	**10**	**32**
Sugar Ridge	42	5	18	65	Ashcraft	1	0	0	1
Tri-County	31	14	37	82	Howat 80	0	0	1	1
Wabashiki	21	0	13	34	Modoc	1	0	1	2
Wilbur Wright	5	3	7	15	Oak Grove	0	2	0	2
Willow Slough	78	10	65	153	Randolph County	3	1	2	6
Winamac	43	12	54	109	White River Bend	10	4	6	20
CONSERVATION AREA	**45**	**12**	**45**	**102**	**GAMEBIRD AREA**	**8**	**0**	**2**	**10**
Austin Bottoms	26	6	24	56	Brouillette	0	0	1	1
Sugar Creek	10	5	8	23	Cartmell	1	0	0	1
Wabash River	9	1	13	23	Cattail Slough	1	0	0	1
GAMEBIRD HABITAT AREA	**2**	**0**	**0**	**2**	Pine Creek	3	0	0	3
Reynolds Creek	2	0	0	2	Prudential	1	0	1	2
PUBLIC FISHING AREAS	**2**	**2**	**2**	**6**	Raub	1	0	0	1
Austin	0	2	0	2	Vinegar Hill	1	0	0	1
Driftwood	1	0	1	2	**RESOURCE AREA**	**3**	**2**	**7**	**12**
Green Valley	1	0	1	2	Deniston	3	2	7	12

Table 3-9. Deer harvested during the 2019-2020 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 reduction draw hunts. Reporting error rate: ±0.23% (2019).

Property	Antlered	Button Buck	Antlerless	Total
STATE PARKS	**271**	**113**	**361**	**745**
Brown County	11	2	13	26
Chain O'Lakes	26	12	46	84
Charlestown	48	12	32	92
Clifty Falls	5	1	8	14
Fort Harrison	14	8	8	30
Harmonie	41	11	40	92
Indiana Dunes	7	1	4	12
Lincoln	0	0	1	1
McCormick's Creek	14	9	23	46
Ouabache	10	18	36	64
Pokagon	12	7	25	44
Prophetstown	7	5	19	31
Shakamak	4	0	9	13
Spring Mill	13	10	32	55
Summit Lake	12	6	11	29
Tippecanoe River	29	4	31	64
Turkey Run	1	0	0	1
Whitewater Memorial	17	7	23	47
NATURAL AREA	**8**	**1**	**3**	**12**
Cave River Valley	8	1	3	12
STATE RECREATION AREAS	**37**	**13**	**42**	**92**
Deam Lake	4	2	4	10
Interlake	15	4	25	44
Lieber (Cagles Mill Lake)	12	5	11	28
Raccoon Lake	4	2	2	8
Starve Hollow	2	0	0	2
STATE RESERVOIRS	**296**	**94**	**389**	**778**
Brookville Lake	78	21	123	221
Hardy Lake	4	0	9	13
Mississinewa Lake	83	31	74	188
Monroe Lake	30	11	42	83
Patoka Lake	70	17	107	194
Salamonie Lake	31	14	34	79

Table 3-10. Deer harvested during the 2019-2020 deer hunting season on public lands managed by Indiana DNR Division of Forestry and the Division of Nature Preserves. Reporting error rate: ±0.23% (2019).

Property	Antlered	Button Buck	Antlerless	Total
STATE FORESTS	**440**	**147**	**462**	**1,049**
Clark	39	15	47	101
Ferdinand	11	3	11	25
Frances Slocum	2	1	4	7
Greene-Sullivan	36	20	36	92
Harrison-Crawford	74	21	89	184
Jackson-Washington	21	11	30	62
Martin	43	8	44	95
Morgan-Monroe	81	26	84	191
Owen-Putnam	17	7	18	42
Pike	30	3	14	47
Salamonie River	9	4	12	25
Selmier	4	0	3	7
Yellowwood	73	28	70	171
NATURE PRESERVES	**23**	**2**	**16**	**41**
Beaver Lake	5	0	3	8
Bob Kern	1	0	0	1
Conrad Savanna	6	0	3	9
Judy Burton	0	1	1	2
Section Six Southern Flatwoods	4	0	5	9
Twin Swamps	7	1	4	12

Table 3-11. Deer harvested during the 2019-2020 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: ±0.23% (2019).

Property	Antlered	Button Buck	Antlerless	Total
MILITARY LANDS	**203**	**37**	**233**	**473**
Camp Atterbury	68	22	128	218
Crane	135	15	105	255
NATIONAL FOREST	**411**	**99**	**443**	**953**
Hoosier	411	99	443	953
NATIONAL WILDLIFE REFUGE	**226**	**58**	**184**	**468**
Big Oaks	187	47	146	380
Muscatatuck	13	4	13	30
Patoka River	26	7	25	58

Deer Reduction Zones Harvest

Indiana Deer Reduction Zones (DRZs) are designated to target areas within the state that have high deer populations and 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, either 10 antlerless deer or nine antlerless deer and one antlered deer after first harvesting an antlerless deer (earn-a-buck). In 2018, traditional DRZs were added in Brown and Warrick counties. Also in 2018, DRZ corridors were added in Brown, Dearborn, Dekalb, Fulton, LaGrange, Madison, Monroe, Steuben, and Wabash counties. DRZ corridors are designated areas along sections of major roadways that have high rates of deer-vehicle collisions. The DRZ corridor extends ½ mile on either side of the centerline of the specified road and includes the entirety of any parcel of land that is intersected by the DRZ corridor. An interactive map of the current DRZs along with information and a video about how DRZs are determined can be found online at deer.dnr.IN.gov.

Approximately 4,269 deer were harvested in DRZs in 2019 (Table 3-12), a 9.1% increase from 2018. 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 2019, antlerless deer made up 81.8% of the DRZ harvest. The percentage of the statewide antlerless harvest that was taken in a DRZ increased by 9.5% in 2019 compared to 2018. A total of 775 antlered deer were taken in DRZs in 2019, which accounted for 1.5% of the statewide antlered harvest. Deer taken within a DRZ accounted for between 2.2% and 62.6% of each DRZ county's total harvest (Table 3-13).

Table 3-12. The number of antlered and antlerless deer harvested within a Deer Reduction Zone (DRZ), 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, 2017-2019. Also reported: the percentages of the statewide total harvest, statewide antlered harvest, and statewide antlerless harvest that were reported as harvested in a DRZ. Reporting error rates: ±0.23% (2019), ±0.57% (2018), and ±1.30% (2017).

	2017			2018			2019		
County	Antlered	Antlerless	Total	Antlered	Antlerless	Total	Antlered	Antlerless	Total
Allen	99	359	458	74	339	413	91	346	437
Boone	5	28	33	8	26	34	7	25	32
Brown	--	--	--	11	59	70	14	68	82
Dearborn	--	--	--	20	101	121	35	136	171
Dekalb	--	--	--	18	54	72	20	67	87
Delaware	5	25	30	5	19	24	6	32	38
Elkhart	10	29	39	13	57	70	19	78	97
Fulton	--	--	--	3	9	12	6	32	38
Hamilton	29	112	141	43	145	188	32	113	145
Hendricks	17	49	66	17	47	64	8	50	58
Johnson	3	32	35	4	31	35	7	23	30
Kosciusko	12	76	88	13	95	108	16	108	124
LaGrange	--	--	--	20	105	125	24	163	187
Lake	87	473	560	102	511	613	102	461	563
LaPorte	19	161	180	34	174	208	45	197	242
Madison	--	--	--	1	10	11	3	15	18
Marion	45	217	262	43	215	258	53	225	278
Monroe	--	--	--	3	18	21	6	36	42
Morgan	9	63	72	17	96	113	19	88	107
Porter	83	491	574	113	478	591	109	532	641
Saint Joseph	6	62	68	12	90	102	19	92	111
Steuben	--	--	--	23	155	178	31	194	225
Tippecanoe	12	46	58	7	50	57	11	43	54
Vanderburgh	70	338	408	77	270	347	77	295	372
Wabash	--	--	--	6	12	18	7	24	31
Warrick	--	--	--	10	49	59	8	51	59
Total	511	2,561	3,072	697	3,215	3,912	775	3,494	4,269
Percent of Statewide Harvest Totals	1.1	3.7	2.7	1.5	5.0	3.5	1.5	5.5	3.7

Table 3-13. Proportion of each Deer Reduction Zone county's total deer harvest that was counted as deer harvested in the DRZ, 2019-2020. 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: ±0.23% (2019).

County	DRZ Harvest	Total County Harvest	% DRZ
Allen	437	1,716	25.5%
Boone	32	441	7.3%
Brown	82	1,624	5.0%
Dearborn	171	2,314	7.4%
Dekalb	87	2,121	4.1%
Delaware	38	726	5.2%
Elkhart	97	1,522	6.4%
Fulton	38	1,330	2.9%
Hamilton	145	478	30.3%
Hendricks	58	601	9.7%
Johnson	30	523	5.7%
Kosciusko	124	2,292	5.4%
LaGrange	187	2,283	8.2%
Lake	563	1,281	44.0%
LaPorte	242	1,821	13.3%
Madison	18	508	3.5%
Marion	278	444	62.6%
Monroe	42	1,504	2.8%
Morgan	107	1,278	8.4%
Porter	641	1,468	43.7%
Saint Joseph	111	1,204	9.2%
Steuben	225	2,756	8.2%
Tippecanoe	54	917	5.9%
Vanderburgh	372	748	49.7%
Wabash	31	1,379	2.2%
Warrick	59	1,374	4.3%

Community hunting access program hunter, Eric Silkwood, at Oliver Woods near Keystone at the Crossing. Photo by John Mawell.

Community Hunting Access Program (CHAP)

The Division of Fish & Wildlife created the Community Hunting Access Program (CHAP) in 2017 to assist communities with using hunting as an effective deer management tool. This innovative program provides financial assistance to community partners who hire coordinators to manage and oversee recreational deer hunting. Their efforts provide a practical and economical method for reducing deer numbers in order to balance ecological and societal needs. CHAP allows community partners oversite and flexibility to determine when and where managed hunts occur. In 2019, seven applications were funded and seven applicants conducted CHAP hunts. In order to receive the agreed-upon funding, each applicant, with an approved CHAP agreement, is required to submit a final report, in writing, within 30 days after the completion of the last hunt each year of the two-year agreement. The seven applicants that successfully conducted CHAP hunts in 2019-2020 were awarded $105,312.50 cumulatively. These seven applicants made 3,191 acres available for hunter access, allocating 1,057 hunting opportunities and harvesting 119 deer. The actual cost per acre for allowing hunter access over the 2019-2020 CHAP hunting timeframe was $33.00. The Community Hunting Access Program will be accepting one-year agreements for the 2020-2021 hunting season. It is anticipated that the program may expand with additional community participation in 2020-2021. Additional information regarding the CHAP program is available at on.IN.gov/dnrchap.

Harvest by License Status

Resident hunters harvested 95% of the total deer harvested in Indiana in 2019 while non-residents harvested the remaining 5% (Table 3-14). Of resident Indiana hunters, annual license holders (license types purchased every year) took 71.2% of the total harvest. Lifetime license holders harvested 17.8% and landowner-exempt hunters (landowners and lessees who hunted on their own farmland or rented farmland without a license) harvested 11.0% of deer in 2019. A large proportion of hunters harvested deer using a deer license bundle (40.9% of resident hunters, 2.4% nonresident hunters).

Table 3-14. Number of deer harvested by resident and non-resident license types during the 2019 deer hunting season. Reporting error rate: ±0.23% (2019).

License Type	Resident Harvest	Non-Resident Harvest	Total
Bonus Antlerless	4,107 (3.6%)	170 (0.1%)	4,277
Deer Archery	2,474 (2.2%)	448 (0.4%)	2,922
Deer Bundle	46,971 (40.9%)	2,773 (2.4%)	49,744
Deer Crossbow	1,880 (1.6%)	238 (0.2%)	2,118
Deer Firearm	6,886 (6.0%)	1,364 (1.2%)	8,250
Deer Military/Refuge	445 (0.4%)	21 (0.0%)	466
Deer Muzzleloader	727 (0.6%)	79 (0.1%)	806
Deer Reduction Zone	2,457 (2.1%)	38 (0.0%)	2,495
Early State Park Reduction	517 (0.5%)	1 (0.0%)	518
Landowner Exemption	12,374 (10.8%)	299 (0.3%)	12,673
Late State Park Reduction	154 (0.1%)	0 (0.0%)	154
Lifetime License	20,095 (17.5%)	354 (0.3%)	20,449
Military Exempt - IC 14-22-11-11	87 (0.1%)	3 (0.0%)	90
Youth Free Hunt Days	146 (0.1%)	9 (0.0%)	155
Youth Hunt/Trap	9,669 (8.4%)	96 (0.1%)	9,765
Total	108,989 (94.9%)	5,893 (5.1%)	114,882

Deer License Sales

In 2019, 124,827 individual hunters purchased an annual deer hunting license of some kind (Table 3-15), a decrease of 1.89% from 2018. The number of deer licenses sold to those hunters decreased by 1.4% from 2018 (Table 3-16). As a result, the number of privileges (number of deer legally allowed to be harvested on those licenses, excluding youth) was 0.5% less than in 2018. Each deer license bundle included three deer privileges. Both the number of hunters purchasing a license and the number of licenses sold have steadily decreased since 2015.

Table 3-15. Number of individual hunters who purchased an annual deer hunting license and the percent change in the total from the previous year, 2015-2019.

Season	Number of hunters that purchased an annual license	Percent change from previous year
2015	137,246	--
2016	135,382	-1.36%
2017	130,938	-3.28%
2018	127,233	-2.83%
2019	124,827	-1.89%

Table 3-16. Deer license sales in Indiana by license type, 2015-2019. Total license sale numbers are subject to change slightly as refunds or voids are made.

License Type	2015	2016	2017	2018	2019
Resident Deer License Bundle	65,603	68,997	67,731	67,963	69,683
Resident Archery/Crossbow/Reduction Zone	29,258	24,796	25,044	24,794	24,513
Resident Firearm	43,991	40,577	37,254	34,575	29,627
Resident Muzzleloader	6,088	4,669	4,376	3,898	3,607
Resident Military/Refuge	1,276	1,343	1,355	1,611	1,613
Resident Bonus Antlerless	21,088	18,065	16,188	13,866	15,149
Nonresident	11,034	11,386	11,671	11,540	11,780
Youth	32,697	32,479	30,466	28,465	31,464
Total Licenses (Excluding Youth)	178,338	169,833	163,619	158,247	155,972
Total Privileges (Excluding Youth)*	315,384	314,351	305,599	300,427	302,048

* Includes additional privileges from nonresident license bundles

Snapshot IN Photo

Bonus Antlerless Licenses and Quotas

In addition to standard seasonal bag limits, hunters could purchase bonus antlerless licenses to take additional antlerless deer in any county. These licenses were valid for one antlerless deer, and licensed deer hunters could purchase an unlimited number of bonus antlerless licenses as long as the county quotas were observed. These licenses could be used during any deer hunting season, using equipment legal for that season, except during the Deer Reduction Zone season. Bonus antlerless licenses could only be used to take one antlerless deer in "A"-designated counties Nov. 28 through Jan. 5.

In 2019, Indiana DNR decreased the bonus antlerless quotas in 29 counties from the quotas set in 2018. Just prior to the 2019-2020 hunting season, Indiana DNR further decreased the bonus antlerless quotas to two in 27 counties in response to a widespread epizootic hemorrhagic disease (EHD) outbreak in southern and south-central Indiana. In total, quotas in 49 counties decreased from 2018 quotas (Table 3-17). Hunters were allowed to participate in the Special Antlerless Firearms season in the 19 counties that had a 2019 quota of four before the quotas were lowered further because of EHD. The number of Bonus Antlerless deer harvested in each county can be found in the County Deer Data sheets (Appendix C) which are available at on.IN.gov/INdeerreport.

Table 3-17. Indiana County Bonus Antlerless Quotas 2017-2019. In 2019, all quotas were lowered to a two or less in response to an epizootic hemorrhagic disease (EHD) outbreak in southern and south-central Indiana. Numbers in parentheses represent the original quotas for the 2019-2020 season before they were lowered due to EHD. Hunters were allowed to participate in the Special Antlerless Firearms season in the counties that had original quotas of four or more in 2019.

	Bonus Antlerless Quota				Bonus Antlerless Quota		
County	2017	2018	2019	County	2017	2018	2019
Adams	2	1	1	Lawrence	8	4	2 (4)
Allen	3	2	2	Madison	3	2	2
Bartholomew	4	4	2	Marion	8	3	2
Benton	A	A	A	Marshall	2	2	2
Blackford	1	1	1	Martin	4	4	2 (4)
Boone	4	2	2	Miami	2	2	2
Brown	4	4	2 (4)	Monroe	8	4	2 (4)
Carroll	2	2	2	Montgomery	4	2	2
Cass	2	2	2	Morgan	3	3	2 (3)
Clark	4	8	2 (4)	Newton	2	2	2
Clay	4	3	2 (3)	Noble	3	3	2
Clinton	2	2	2	Ohio	4	3	2
Crawford	8	4	2 (4)	Orange	4	4	2 (4)
Daviess	1	1	1	Owen	4	4	2 (4)
Dearborn	4	4	2 (3)	Parke	8	4	2 (3)
Decatur	3	3	2	Perry	4	4	2 (4)
Dekalb	3	2	2	Pike	2	2	2
Delaware	4	2	2	Porter	4	3	2
Dubois	3	3	2	Posey	1	1	1
Elkhart	4	3	2	Pulaski	4	3	2
Fayette	4	3	2	Putnam	4	4	2 (3)
Floyd	8	8	2 (4)	Randolph	2	1	1
Fountain	4	2	2	Ripley	8	4	2 (4)
Franklin	8	4	2 (4)	Rush	2	1	1
Fulton	3	2	2	Saint Joseph	4	3	2
Gibson	3	2	2	Scott	4	4	2 (4)
Grant	4	2	2	Shelby	3	2	2
Greene	4	4	2 (4)	Spencer	3	3	2
Hamilton	4	2	2	Starke	4	3	2
Hancock	3	1	1	Steuben	2	1	1
Harrison	8	8	2 (4)	Sullivan	3	3	2 (3)
Hendricks	8	3	2	Switzerland	4	3	2
Henry	4	2	2	Tippecanoe	3	2	2
Howard	2	2	2	Tipton	A	A	A
Huntington	2	2	2	Union	3	2	2
Jackson	4	4	2 (4)	Vanderburgh	4	2	2
Jasper	4	3	2	Vermillion	4	4	2 (3)
Jay	1	1	1	Vigo	4	3	2 (3)
Jefferson	8	4	2 (4)	Wabash	2	2	2
Jennings	8	4	2 (4)	Warren	3	2	2
Johnson	8	3	2	Warrick	2	2	2
Knox	4	2	2	Washington	8	4	2 (4)
Kosciusko	4	3	2	Wayne	3	3	2
Lagrange	2	1	1	Wells	A	A	A
Lake	4	3	2	White	4	3	2
LaPorte	4	3	2	Whitley	1	1	1

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 18% of the deer harvest in 2019. More than 11% of deer were harvested by landowners or military-exempt hunters in 2019. 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 the hunting season, regardless of how many deer the hunter attempted to harvest or actually harvested. Hunter success can be calculated using license sales and harvest data: hunters who attempted to harvest a deer (hunters who purchased a license) compared to hunters who actually harvested a deer (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 similar to those for annual licensed hunters. This calculation is not applicable at the county level because where a license was purchased may not have been where the deer was harvested. Only a statewide success rate is attainable.

Hunter success can also be calculated from hunter survey responses. In the 2019-2020 Deer Management Survey (DMS), hunters were asked to report the number of deer they wanted to harvest, the number of deer they actually harvested, the county of harvest, and the license or exemption used to harvest the deer. This information allows for the calculation of hunter success in a similar way as the license sales and harvest data: hunters who attempted to harvest a deer (based on reporting they wanted to harvest deer) compared to if those hunters actually 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, thus providing more accurate success rates for lifetime license holders, landowners, and military- exempt hunters.

In addition, 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 is fluctuating over time in an area that then helps in setting hunting quotas and regulations.

Methods. – For the 2019 hunting season, license sales and harvest data were used to determine the number of non-youth hunters who checked in a deer who also 1) purchased an annual deer hunting license (excluding youth licenses), 2) were lifetime license holders, 3) were landowners, or 4) were active military members. Hunters who purchased a license were only counted if the same CID number was used to check in a deer that was used to purchase the license. For example, a hunter may have purchased a license under a new CID number but checked in a deer under a previous CID number. In this case, the hunter was not counted in this calculation. Youth hunters were not included in the license sales or harvest check-ins because youth hunting licenses are valid for all game species in Indiana, not just deer, so it is impossible to determine which youth licenses were purchased specifically for deer hunting. The success rate for hunters who purchased an annual license was calculated using the formula:

License Success Rate (SRL) = Non-youth hunters who purchased an annual deer license and checked in a deer using the same CID number as the license ÷ Non-youth hunters who purchased an annual deer hunting license

To calculate hunter success rate using DMS data, hunter responses were first filtered (Microsoft Excel filter function) to better closely match the license sales data. In the survey, hunters were able to select all license types they used to harvest deer, including youth licenses, lifetime licenses, and landowner and military exemptions. We filtered out any responses that included youth licenses, lifetime licenses, and military exemptions because additional licenses are not necessary to harvest deer if using these types. We also filtered out any responses that were landowner exemptions only. However, if a hunter selected landowner exemption and another license type not already excluded, they were included. These remaining hunters represented non-youth hunters that purchased an annual hunting license.

The survey asked hunters how many deer they wanted to harvest during the deer hunting season. If any of the included hunters recorded a response, they attempted to harvest a deer and were considered equivalent to the non-youth hunters who purchased an annual hunting license. Of those hunters, we counted the number of hunters who actually harvested at least one deer (i.e., successful hunters).

Similar to the license sales and harvest data success rate calculation, hunter success was calculated for survey responses using the formula:

Survey Success Rate (SR_s) = Non-youth hunters who said they harvested a deer ÷ non-youth hunters who said they wanted to harvest a deer

Using the success rates of non-youth hunters who purchased a license, the number of non-youth hunters afield was calculated using the formula:

$$Hunters\ Afield = (HCD_{AL}/SR) + (HCD_{LL}/SR) + (HCD_{LO}/SR) + (HCD_{ME}/SR) + (HCD_{Y}/SR)$$

Where,

HCD_{AL} = Adult hunters who checked in a deer and purchased an annual deer hunting license
HCD_{LL} = Hunters who checked in a deer and are lifetime license holders
HCD_{LO} = Hunters who checked in a deer and are landowners
HCD_{ME} = Hunters who checked in a deer and are military exempt
HCD_{Y} = Youth hunters who checked in a deer and purchased a youth license

Results. – Hunter success rate and the total number of hunters afield were estimated for the 2019-2020 deer hunting season. In 2019, 124,079 non-youth hunters purchased a deer hunting license, and 48,788 of those hunters harvested a deer using the same CID as the license for a success rate of 39.3% (CI_{95}=39.0%, 39.6% Table 3-18). The success rate has steadily increased since 2016. An estimated 212,719 total hunters were afield during the 2019-2020 hunting season (Table 3-19).

In the DMS data, 17,682 hunters surveyed attempted to harvest a deer in 2019-2020, and 10,437 of them were successful, resulting in a success rate of 59.0% (CI_{95}=58.3%, 59.8%). This was higher than the success rate in the 2017-18 survey at 53.6% (CI_{95}=52.8%, 54.4%), but similar to the success rate in the 2018-19 survey at 59.3% (CI_{95}=58.7%,

59.9%). Hunter-success rates calculated from DMS responses were much higher than the license sales calculation, suggesting the DMS data may be biased toward successful hunters. As a result, we cannot use the success rate calculated from DMS responses as an estimate of actual hunter success or to calculate the estimated number of non-youth hunters afield. However, we can use it as an indicator of the trend in hunter success over time.

Discussion. – The hunters afield calculation provides a valuable estimate of the number of hunters attempting to harvest deer in a given year, but it has limitations that need to be refined as better data are collected. The entire 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. However, the success rate of hunters who purchased an annual license may not be the same for other hunters. For example, lifetime license holders may have more hunting experience, which may result in better success than a new license holder. Similarly, landowners may have higher success rates hunting on their own property if they have spent time tracking their deer and preparing for the hunt, compared to license holders hunting on someone else's property for the first time. Alternatively, they may have a lower success rate if their property is small, overhunted, or has poor-quality deer habitat. Differences in success rates that are factors of age, strength, and experience may also exist between adult hunters and youth hunters. Other factors that influence success rate, such as where and when a hunter hunts, weather patterns, skill, etc., are also not considered in this calculation.

Estimations for the total number of hunters is necessary because the total number of landowner hunters, active lifetime license holders, and military exempt hunters is unknown because they are not currently tracked in the license system. Further refining the understanding of the total number of hunters afield is only possible if these hunters are counted in some way. We stated previously (Caudell and Vaught 2018) that future hunter surveys may help overcome these shortcomings by directly asking all hunters for details of their hunt (e.g., when, where, how long, individual harvest, license or exemption type, etc.) regardless of whether they harvested a deer. This was one of the goals of the DMS; however, it is biased toward successful hunters. Before the DMS data can be used to calculate success rates, a correction factor would need to be applied to adjust between hunter success based on license sales data and hunter success calculated from the DMS. The trend in hunter success, however, should remain consistent regardless of the actual success rate. Thus, the DMS may provide success rates for lifetime license holders, landowners, and military exempt hunters after the correction factor is applied. Ultimately, the most accurate measure of hunter success requires documenting every hunter that attempts to harvest a deer through license sales, registration, or some other record.

There are several practical applications for estimating hunters afield, most notably understanding the change in hunter numbers. It is well known that the number of hunters actively participating in hunting is declining each year, and estimating the number of hunters afield using a standardized method of calculation provides a repeatable index for hunter trends in Indiana. 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 actually participating in the hunting season will aid in evaluation of the success of these programs.

Table 3-18. The number of hunters who checked in a deer per license category 2016-2019. The numbers reported this year differ slightly from previous years due to updated methodology. Reporting error rates: ±0.23% (2019), ±0.57% (2018), ±1.30% (2017), and ±0.51% (2016).

	Number of successful hunters			
Type of Hunter	2016-2017	2017-2018	2018-2019	2019-2020
HCD_{AL}	44,346	43,111	44,650	48,788
HCD_{LL}	13,249	14,157	13,363	13,189
HCD_{LO}	11,123	10,042	9,708	9,669
HCD_{ME}	78	84	69	67
HCD_{Y}	7,244	7,164	7,425	7,581

Table 3-19: The calculated success rates (SR) of non-youth hunters who purchased an annual deer license and checked in at least one deer using the same Customer ID number as the license and the estimated number of hunters afield in each Indiana deer hunting season, 2016-2019.

Year	Success Rate ± 95% CI	Est. Hunters Afield*
2016-2017	32.98% ± 0.25%	228,130
2017-2018	33.14% ± 0.26%	217,590
2018-2019	35.30% ± 0.26%	211,149
2019-2020	39.32% ± 0.27%	212,719

*Includes youth hunters; however youth licenses are valid for all Indiana game species. There is no way to tease out youth licenses purchased specifically for deer hunting.

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CHAPTER 4.
DEER CONTROL PERMITS

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Deer control permits grant special permission to take deer outside of the deer hunting season and are issued when individuals, businesses, and/or agencies experience problems with deer. These permits reduce conflict with landowners and 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 lower compared to the number of deer harvested during the hunting season (Table 4-1). An exception to this is Marion County, where few deer were harvested by hunters because of limited access, and a comparatively large number of deer were removed through the use of 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 and the sex, the equipment used, and the disposal method for each deer taken. Indiana DNR received reports from 254 of the 279 deer control permits issued statewide. An average of 16.2 (n=279; CI_{95}=14.2, 18.3) deer were authorized per permit, and an average of 6.4 (n=254; CI_{95}=4.8, 7.9) deer were taken per permit (Table 4-1). Damages reported at the time of the application ranged from $500 to $96,000. Permit recipients reported an average of 20.1% (n=138; CI_{95}=15.7%, 24.5%) of soybean crops damaged and 19.8% (n=125; CI_{95}=15.4%, 24.2%) of corn crops damaged.

A total of 1,625 deer were reported taken statewide on deer control permits, representing 1.4% of the cumulative deer taken, which is the aggregate number of hunter-harvested deer and the number of deer taken on control permits in 2019. Most of the deer that were taken on control permits were does and button bucks (n=1,273), which represented 2.0% of the total number of antlerless deer harvested by hunters and taken on permits in 2019. Fewer adult bucks (n=252) were taken on control permits, which represented 0.5% of the total number of antlered deer harvested by hunters and taken on permits in 2019. The majority of deer (77.2%) 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 4-1. Deer control permits issued by county in 2019, 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.

County	Permits Issued	Deer Taken	Avg Deer Taken / Permit	% of Cumulative Deer	County	Permits Issued	Deer Taken	Avg Deer Taken / Permit	% of Cumulative Deer
Adams	0	0	0	0.0%	Lawrence	4	33	8	1.5%
Allen	1	4	4	0.2%	Madison	3	3	1	0.6%
Bartholomew	4	5	1	0.5%	Marion	3	100	33	18.4%
Benton	1	0	0	0.0%	Marshall	11	41	4	2.1%
Blackford	0	0	0	0.0%	Martin	1	1	1	0.1%
Boone	0	0	0	0.0%	Miami	0	0	0	0.0%
Brown	11	97	8.8	5.6%	Monroe	8	36	5	2.3%
Carroll	0	0	0	0.0%	Montgomery	3	23	8	2.5%
Cass	1	2	2	0.2%	Morgan	2	8	4	0.6%
Clark	8	55	7	4.1%	Newton	0	0	0	0.0%
Clay	0	0	0	0.0%	Noble	4	19	5	0.7%
Clinton	0	0	0	0.0%	Ohio	4	34	9	5.3%
Crawford	2	3	1.5	0.2%	Orange	0	0	0	0.0%
Daviess	2	5	2.5	0.5%	Owen	1	18	18	1.0%
Dearborn	14	53	3.8	2.2%	Parke	1	3	3	0.2%
Decatur	1	1	1	0.1%	Perry	7	66	9	4.0%
DeKalb	2	13	7	0.6%	Pike	3	10	3	0.6%
Delaware	2	1	0.5	0.1%	Porter	3	17	6	1.1%
Dubois	1	1	1	0.1%	Posey	3	23	8	2.0%
Elkhart	3	1	0	0.1%	Pulaski	3	38	13	2.2%
Fayette	3	25	8	2.6%	Putnam	1	0	0	0.0%
Floyd	6	28	4.7	4.2%	Randolph	0	0	0	0.0%
Fountain	2	5	3	0.4%	Ripley	5	14	3	0.8%
Franklin	17	126	7.4	4.6%	Rush	0	0	0	0.0%
Fulton	1	10	10	0.7%	Saint Joseph	5	32	6	2.6%
Gibson	5	3	1	0.2%	Scott	3	4	1	0.5%
Grant	0	0	0	0.0%	Shelby	0	0	0	0.0%
Greene	6	8	1	0.4%	Spencer	4	9	2	0.8%
Hamilton	2	9	5	1.8%	Starke	5	11	2	0.8%
Hancock	1	2	2	0.7%	Steuben	9	20	2	0.7%
Harrison	13	67	5.2	2.6%	Sullivan	13	67	5	3.5%
Hendricks	1	0	0	0.0%	Switzerland	6	36	6	1.9%
Henry	0	0	0	0.0%	Tippecanoe	3	12	4	1.3%
Howard	0	0	0	0.0%	Tipton	1	3	3	2.3%
Huntington	0	0	0	0.0%	Union	1	2	2	0.3%
Jackson	9	25	2.8	1.5%	Vanderburgh	3	3	1	0.4%
Jasper	3	4	1	0.3%	Vermillion	1	9	9	0.9%
Jay	0	0	0	0.0%	Vigo	2	3	2	0.2%
Jefferson	6	32	5.3	1.9%	Wabash	1	2	2	0.1%
Jennings	7	25	4	1.4%	Warren	0	0	0	0.0%
Johnson	2	7	3.5	1.3%	Warrick	5	27	5	1.9%
Knox	0	0	0	0.0%	Washington	11	142	13	6.8%
Kosciusko	2	3	2	0.1%	Wayne	0	0	0	0.0%
Lagrange	5	9	1.8	0.4%	Wells	1	4	4	0.6%
Lake	1	9	9	0.7%	White	1	0	0	0.0%
LaPorte	5	14	2.8	0.8%	Whitley	0	0	0	0.0%

Table 4-2. Number of damage reports for each crop type or other reason for 2019 deer control permits. Some individuals reported multiple crops or reasons.

Crop or Reason for Permit	Number of Reports
Alfalfa	16
Apples	4
Christmas Trees	4
Corn	152
CRP	2
Bees	1
Disease	8
Endangered Species	1
Fruit Trees	2
Grapes	6
Hay	21
Health and Safety	8
Landscaping	7
Orchard	4
Pasture	4
Popcorn	2
Produce	24
Proving Grounds	1
Pumpkins	12
Reforestation	1
Rye	3
Soybeans	170
Timber Production	4
Wheat	4
Woods	8

CHAPTER 5.
DEER-VEHICLE COLLISIONS

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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 the DNR, as it is an independent data set that has been collected in a similar fashion over a long period of time. Deer-vehicle collisions are also standardized across years and counties by using INDOT's statistics on the Daily Vehicle Miles Traveled. Analyzing collisions per billion miles traveled accounts for changes in traffic volume between counties and allows for an unbiased comparison between counties and years.

The total number of deer-vehicle collisions reported across the state increased from 15,270 in 2018 to 15,559 in 2019 (Figure 5-1; Table 5-1). The number of deer-vehicle collisions per billion miles traveled (DVC/BMT) was 195 DVC/BMT in 2019, similar to the 194 DVC/BMT reported in 2018.

Ohio (1,120 DVC/BMT), Pulaski (1,058 DVC/BMT), and Brown (913 DVC/BMT) had the highest number of DVC/BMT (Figure 5-2). Marion (8 DVC/BMT) and Lake (45 DVC/BMT) had fewer than 50 DVC/BMT. Compared to 2018, DVC/BMT decreased in 38 counties and increased in 54 counties. Fifteen counties showed a greater than 15% increase in DVC/BMT compared to 2018, while 17 counties showed a greater than 15% decrease. Only one county, Switzerland, had a greater than 50% increase in the number of DVC/BMT compared to 2018.

Most deer-vehicle collisions in 2019 occurred on state roads (36.7%) and county roads (28.3%; Table 5-2). From 2014 to 2019, state roads had the highest average number of DVC/BMT by road type per year (444 DVC/BMT). U.S. routes had the highest average number of deer-vehicle collisions (85 DVC) per 100 miles of road from 2014 to 2019 (Table 5-2).

Nearly 50% of deer-vehicle collisions in 2019 occurred between September and December (Figure 5-3). Additionally, deer-vehicle collisions occurred most often during dawn and dusk, which varies by month and coincides with the average length of daylight (Figure 5-4).

The estimated economic cost of deer-vehicle collisions from damage to vehicles in 2019 was more than $66.5 million, based on the average estimated cost per collision (Table 5-3). From 2014 to 2019, deer-vehicle collisions cost drivers a total of more than $361 million (Table 5-3).

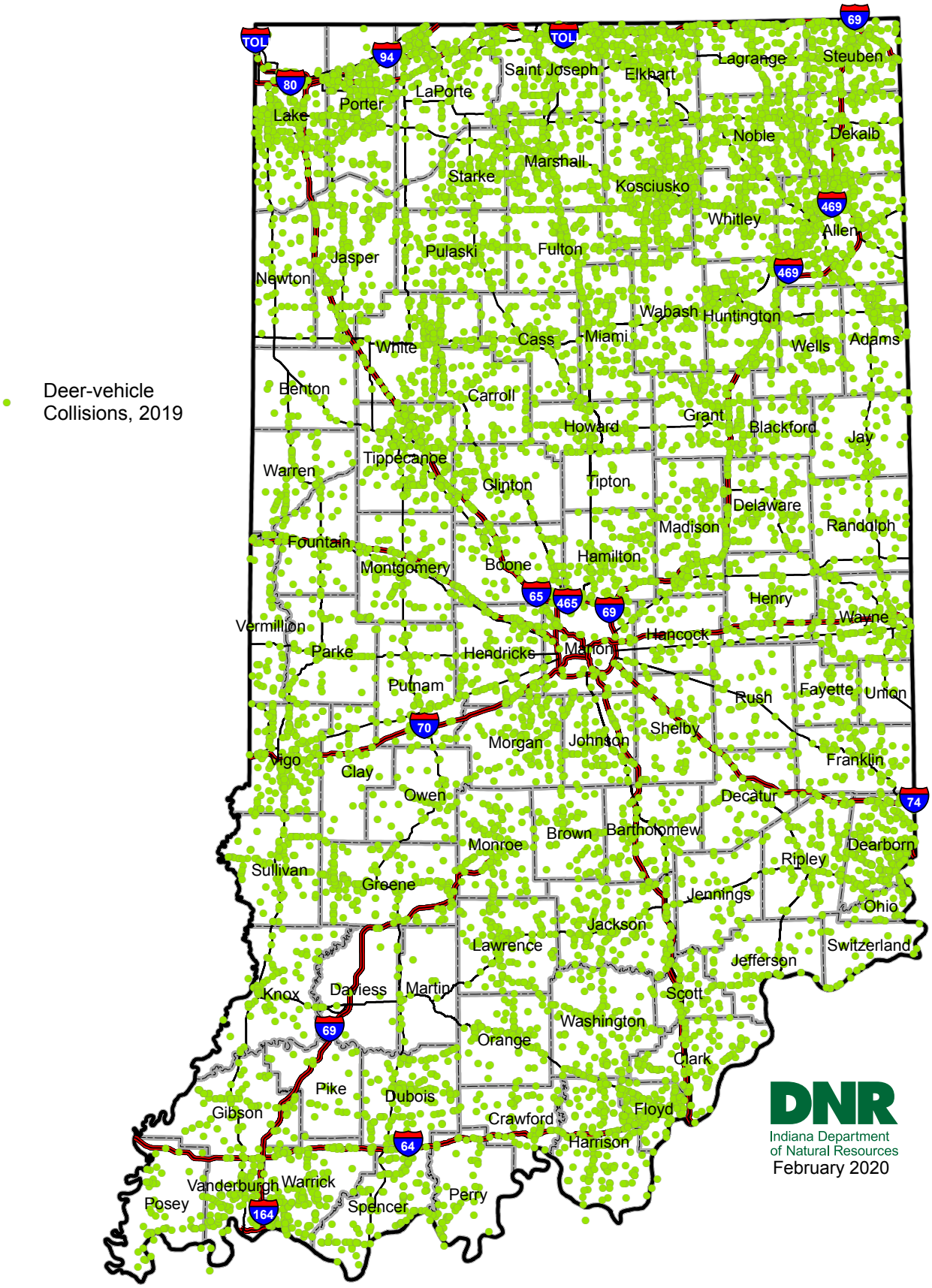

Figure 5-1. Locations of 2019 deer-vehicle collisions. Only 12,482 (80.2%) of the 15,559 deer-vehicle collisions reported to INDOT included GPS location data to map.

Table 5-1. Number of deer-vehicle collisions by county in Indiana, 2018 and 2019.

	Deer-vehicle Collisions			Deer-vehicle Collisions	
County	2018	2019	County	2018	2019
Adams	116	153	Lawrence	200	211
Allen	475	462	Madison	165	162
Bartholomew	166	144	Marion	113	87
Benton	25	26	Marshall	342	309
Blackford	52	57	Martin	15	21
Boone	134	143	Miami	189	201
Brown	99	122	Monroe	158	161
Carroll	128	122	Montgomery	145	164
Cass	169	200	Morgan	174	182
Clark	198	161	Newton	88	87
Clay	109	74	Noble	365	353
Clinton	78	115	Ohio	56	53
Crawford	120	90	Orange	147	124
Daviess	32	31	Owen	105	87
Dearborn	256	310	Parke	155	120
Decatur	82	93	Perry	87	99
Dekalb	308	349	Pike	24	25
Delaware	202	174	Porter	340	375
Dubois	207	233	Posey	118	95
Elkhart	341	368	Pulaski	191	207
Fayette	53	58	Putnam	174	139
Floyd	161	153	Randolph	88	104
Fountain	122	105	Ripley	124	141
Franklin	111	130	Rush	42	54
Fulton	163	178	Saint Joseph	169	350
Gibson	162	137	Scott	320	71
Grant	183	204	Shelby	64	96
Greene	262	271	Spencer	106	189
Hamilton	223	206	Starke	148	156
Hancock	122	109	Steuben	470	470
Harrison	289	241	Sullivan	127	140
Hendricks	207	174	Switzerland	21	36
Henry	86	111	Tippecanoe	312	310
Howard	129	127	Tipton	36	37
Huntington	228	245	Union	10	5
Jackson	204	228	Vanderburgh	154	152
Jasper	217	241	Vermillion	72	100
Jay	132	105	Vigo	216	225
Jefferson	86	66	Wabash	182	195
Jennings	104	53	Warren	119	98
Johnson	120	139	Warrick	258	234
Knox	131	141	Washington	213	195
Kosciusko	447	519	Wayne	196	199
Lagrange	222	246	Wells	127	151
Lake	241	270	White	158	175
LaPorte	339	334	Whitley	146	196

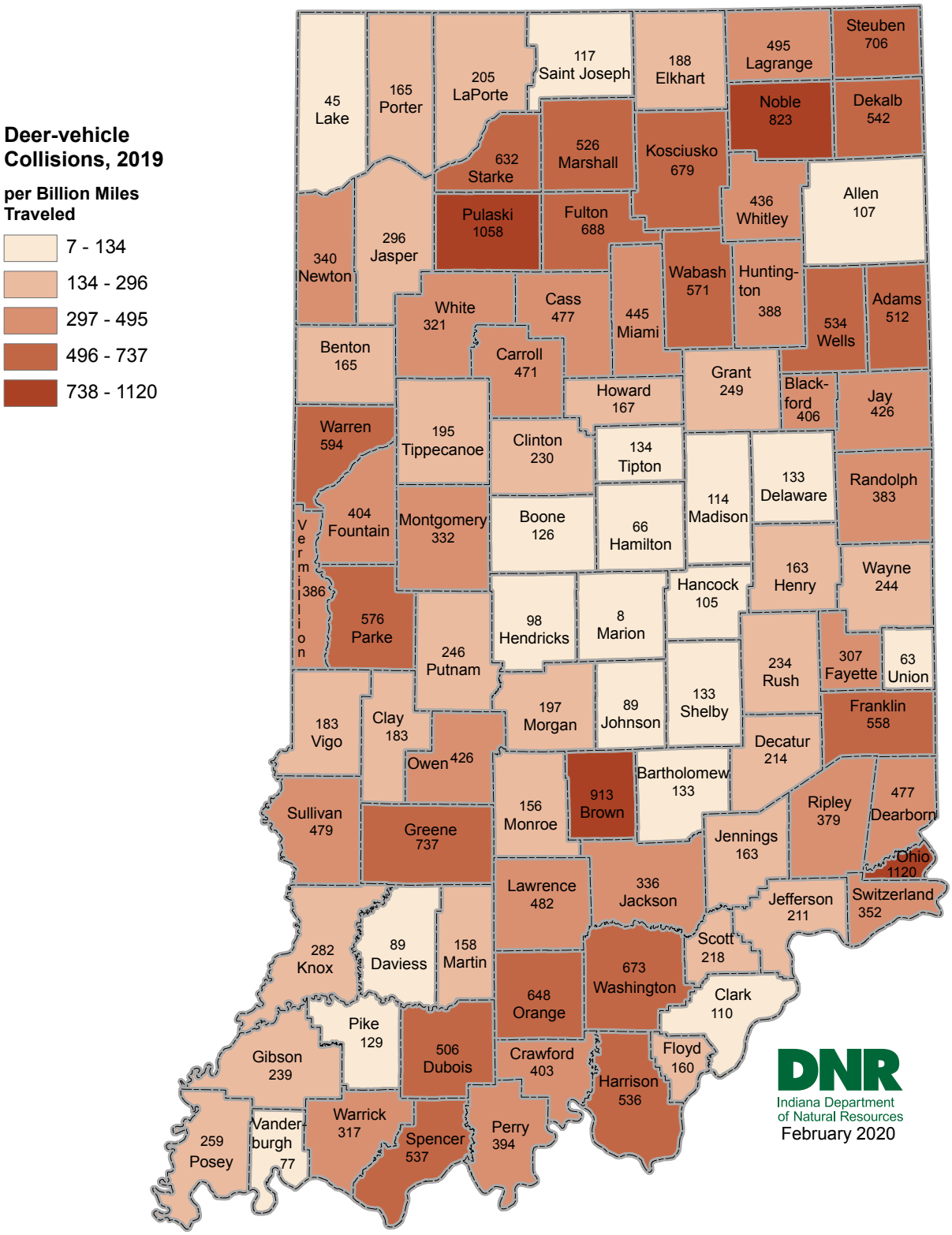

Figure 5-2. The number of 2019 deer-vehicle collisions per billion miles traveled (DVC/BMT) by Indiana county. DVC/BMT provides the relative rate of deer-vehicle collisions given the amount of miles driven in that county per year. Counties with high DVC/BMT have proportionally more deer-vehicle collisions per the number of miles 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 estimate of miles traveled (e.g., Lake County).

Table 5-2. By road type: number of 2019 deer-vehicle collisions (DVC), average number of deer-vehicle collisions per year from 2014-2019, miles of road, average deer-vehicle collisions per 100 miles, and average deer-vehicle collisions per billion miles traveled (DVC/BMT) from 2014-2019. Collision values were averaged from 2014-2019, and miles-traveled values were averaged from 2014-2018. Collisions on unknown road type were proportionally distributed among the other road types.

Road Type	DVCs 2019	Avg DVCs 2014-2019	Road Length (mi)	Avg DVCs per 100mi of Road	Avg BMT per year	Avg /BMT per year
County Road	4,408 (28.3%)	4,207 (28.0%)	65,283	6.4	19.4	217.4
Interstate	1,096 (7.0%)	1,201 (8.0%)	1,643	73.1	18.9	63.5
Local/City Road	1,734 (11.1%)	1,604 (10.7%)	19,909	8.1	20.8	77.3
State Road	5,714 (36.7%)	5,544 (36.9%)	7,246	76.5	12.5	443.5
US Route	2,532 (16.3%)	2,453 (16.3%)	2,887	85.0	10.1	242.8

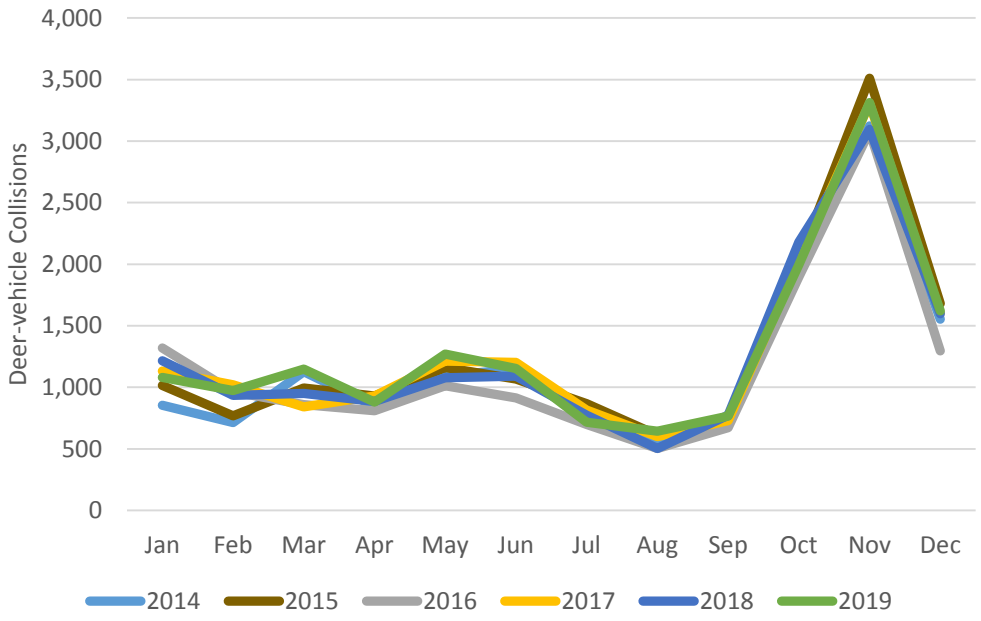

Figure 5-3. Number of deer-vehicle collisions by month in Indiana from 2014-2019.

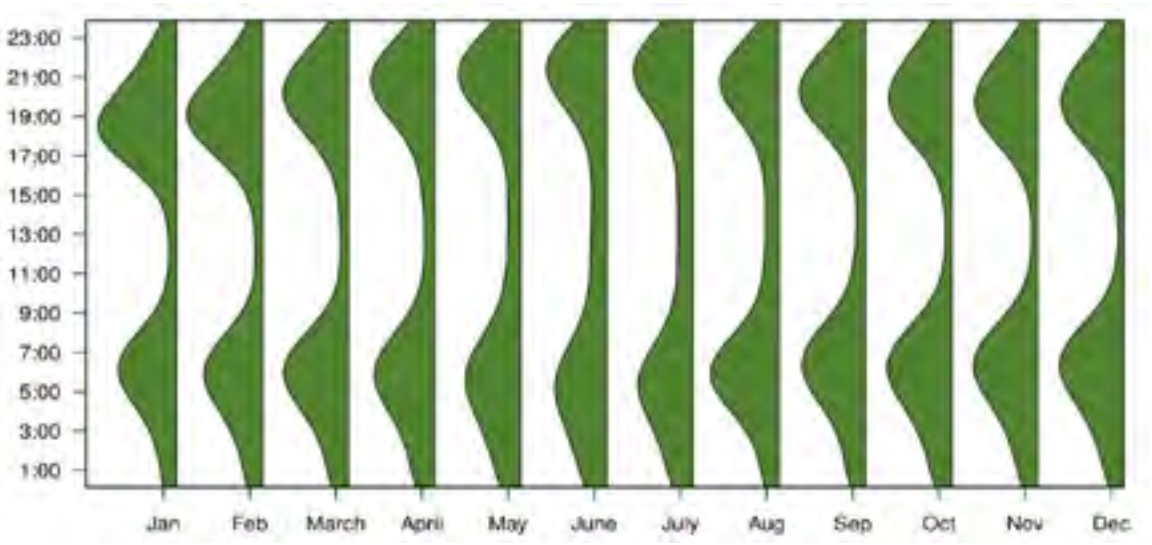

Figure 5-4. The proportion of deer-vehicle collisions by time of day in Indiana from 2014-2019.

Table 5-3. Reported economic loss due to deer-vehicle collisions in Indiana from 2014-2019. Collisions with an unknown estimate or an estimate less than $1,000 were not included. Total Damage Estimate 2014-2019 is calculated by multiplying the total number of collisions for that damage estimate range by the average value of damage.

Damage Estimate Range	2019 DVCs	2018 DVCs	2017 DVCs	2016 DVCs	2015 DVCs	2014 DVCs	Total DVCs	Total Damage Estimate 2014-2019
$1,001 to $2,500	5,234 (35.1%)	5,365 (36.7%)	5,501 (37.3%)	5,157 (38.7%)	6,017 (41.2%)	5,817 (41.9%)	33,091 (38.4%)	$57,909,250
$2,501 to $5,000	6,063 (40.6%)	5,851 (40.0%)	5,917 (40.1%)	5,397 (40.5%)	5,750 (39.4%)	5,541 (39.9%)	34,519 (40.1%)	$129,446,250
$5,001 to $10,000	3,029 (20.3%)	2,826 (19.3%)	2,806 (19.0%)	2,366 (17.7%)	2,456 (16.8%)	2,208 (15.9%)	15,691 (18.2%)	$117,682,500
$10,001 to $25,000	542 (3.6%)	520 (3.6%)	488 (3.3%)	373 (2.8%)	345 (2.4%)	273 (2.0%)	2,541 (3.0%)	$44,467,500
$25,001 to $50,000	42 (0.3%)	40 (0.3%)	30 (0.2%)	37 (0.3%)	22 (0.2%)	25 (0.2%)	196 (0.2%)	$7,350,000
$50,001 to $100,000	10 (0.1%)	7 (0%)	11 (0.1%)	5 (0%)	4 (0%)	4 (0%)	41 (0%)	$3,075,000
Over $100,000	1 (0%)	2 (0%)	4 (0%)	1 (0%)	1 (0%)	5 (0%)	14 (0%)	$1,400,000
Total	14,921	14,611	14,757	13,336	14,595	13,873	86,093	$361,330,500

Hooves characteristic of a deer that survived an EHD infection. The grooves indicate the deer had a high fever. Hunters may see deer with hooves like this during the hunting season.

CHAPTER 6. DEER HEALTH

Joe Caudell and Olivia Vaught, *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 are reported as sick, dead, or in a group with a sick or dead animal via the Indiana DNR's online Report a Dead or Sick Animal form (on.IN.gov/sickwildlife) and by calls directly to DNR offices.

In 2019, Indiana DNR received 981 reports of potential EHD cases involving 1,719 deer from 85 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 61 deer from 43 counties were tested, and 48 (79%) deer from 36 counties tested positive for EHD. A total of 1,297 deer were reported in these 36 counties over an area of 14,102 square miles (approx. 0.09 deer/square mile). Clark County had the highest number of deer reported (116 deer) and the highest density of deer reported (0.31 deer/square mile). The number of deer tested in each county ranged from zero to four. Prior to 2019, the last major outbreak of EHD in Indiana occurred in 2012. A less-widespread but significant outbreak occurred in 2013.

In response to reports of potential EHD, Indiana DNR reduced the county bonus antlerless quotas to two in the 27 counties in which EHD was confirmed. These changes were enacted just prior to the start of the 2019 hunting season. Hunters, however, could still participate in the Special Antlerless Firearms season in the 19 counties that were participating before the quota adjustment (see Table 3-16). Chapter 9 provides detailed information about Indiana's 2019 EHD outbreak and an analysis of the impacts to its deer harvest.

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 (TSE). Prions are misfolded proteins that cause lesions in the brains of infected animals. CWD is thought to be 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 susceptible, infected cervids. CWD attacks the animal's brain and causes behavioral changes, excessive salivation, and loss of appetite. It leads to progressive degradation of body condition and 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, however, they become emaciated, may lose fear of humans, stand with legs wide apart, and hold their head and ears low. Infected individuals rarely live more than 2.5 years from the time they are infected until death (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 early 2020, CWD had been found in wild and captive cervid herds in 26 states, three Canadian provinces, Norway, South Korea, Finland, and Sweden (Richards 2020).

CWD has been detected in white-tailed deer in three states bordering Indiana: in captive deer in Ohio, in both wild and captive deer in Michigan, and in wild deer in Illinois (Carlson et al. 2018). 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 90 new detections of CWD in wild deer during fiscal year 2019. Two of these new cases were reported in Kankakee County, Illinois, approximately 25 miles west of the Illinois/Indiana state line. Six total CWD-positive deer have been detected in that county since 2014 (Dufford and McDonald 2019).

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 lymphoid and neural tissues, CWD is diagnosed by examination of brain or lymphoid tissue from a dead animal.

After the CWD surveillance efforts in northwest and northeast Indiana during the 2018 season (Caudell and Vaught 2019), Indiana DNR returned to those areas during opening weekend of firearms season in 2019 to conduct targeted CWD surveillance. Biologists were stationed at 15 northwest locations throughout Newton, Jasper, Lake, LaPorte, Porter, Pulaski, and Starke counties, and at 10 northeast locations throughout Steuben, LaGrange, Noble, and DeKalb counties. Submission of samples for CWD testing was voluntary, and hunters received a commemorative Deer Management Partner magnet and a metal tag reminiscent of historic confirmation tags for participating.

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) office throughout the season. The heads were later sampled by Indiana DNR. Wildlife biologists and FWA property managers collected routine samples from road-killed and hunter-harvested deer, and biologists and veterinary staff 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 Report a Dead or Sick Animal form. Hunters were also able to submit the heads or lymph nodes from their harvested deer to the Animal Disease Diagnostic Lab (ADDL) at Purdue University to be tested, for a fee.

Samples collected by staff 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 prior to results being posted online.

Totals of 772 hunter-harvested deer, 28 road-killed deer, and 32 targeted deer were tested statewide in 2019, including nine hunter-harvested deer from Ohio and Michigan (Table 6-1). To date, no wild deer from Indiana have tested positive for CWD. The CWD detectability rates were calculated for each of the 11 targeted surveillance counties and non-target counties (Figure 6-1) based on sampling intensity. 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 LaGrange 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. The ability to detect the disease ranged from 1.53% to 5.10% in the northwest targeted area and from 1.50% to 2.06% in the northeast targeted area (Table 6-2).

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 2017, a total of 3,524 wild hunter-harvested white-tailed deer were sampled in the bTB surveillance zones, and none of those deer tested positive for the disease (Caudell and Vaught 2017).

In December 2016, bTB was detected in a new cattle farm in Franklin County. As a result, surveillance in the 2017-2018 deer hunting season was focused in a 225-square-mile area in Franklin and Fayette counties centered on the affected farm. Just prior to the 2017-2018 hunting season, U.S. Department of Agriculture, Animal and Plant Health Inspection Service (USDA-APHIS) Wildlife Services collected 37 raccoons, 12 opossums, and 16 deer from or adjacent to the affected premises for testing. One wild raccoon from the December 2016 farm was positive for bTB. Genetic analysis of the mycobacterial organism strongly suggested that the infection was transmitted from cattle to the raccoon. During the 2017-2018 hunting season, hunters brought in a total of 531 deer to Indiana DNR check stations, and bTB was not detected in any of these deer sampled (Caudell and Vaught 2018).

During the 2018-2019 hunting season, the bTB surveillance area was reduced to a 1.5-mile radius centered on the affected farm, although deer harvested from within the 225-square-mile area could be submitted if hunters were concerned about bTB. Indiana DNR tested samples from 89 deer within the bTB surveillance area, and two deer from outside the surveillance area that exhibited signs of a potential bTB infection. Bovine tuberculosis was not detected in these deer or in any other deer tested during the season (Caudell and Vaught 2019).

After the 2018-2019 hunting season, Indiana DNR issued special disease permits to landowners directly surrounding the 2016 affected cattle farm in Franklin County to reduce the risk of potential disease transmission. Landowners removed 16 deer from the 1.5-mile radius area around the affected farm. Additionally, USDA-APHIS Wildlife Services removed 79 deer, 26 raccoons, and eight opossums from the affected cattle farm as part of a targeted clean-up process. One raccoon tested positive for bTB; however, bTB was not detected in any of the deer tested.

To date, all deer sampled through intensive surveillance since the 2016-2017 hunting season 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 non-existent. As a result, Indiana DNR did not conduct intensive bTB surveillance in Fayette and Franklin counties during the 2019-2020 hunting season. However, Indiana Board of Animal Health (BOAH) collected samples from four deer exhibiting signs of potential bTB infection, one each from Allen, Decatur, Franklin/Ripley line, and Pike counties. All tested negative for bTB.

Automated Deer Disease Report Form

Hunters and the public can report sick or dead deer directly to Indiana DNR through the online Report a Dead or Sick Animal 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. Reports of deer with clinical signs of EHD, CWD, or other diseases of potential concern receive 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.

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Table 6-1: Results of CWD surveillance by county during Indiana's 2019-2020 deer hunting season.

County	Hunter-Harvested Samples	Road Killed Samples	Targeted Deer	Total Samples
Adams	0	0	0	0
Allen	1	0	0	1
Bartholomew	2	1	1	4
Benton	2	0	1	3
Blackford	0	0	0	0
Boone	1	0	0	1
Brown	0	0	0	0
Carroll	0	0	0	0
Cass	0	0	0	0
Clark	1	0	0	1
Clay	1	0	0	1
Clinton	0	0	0	0
Crawford	2	0	0	2
Daviess	5	2	0	7
Dearborn	0	0	0	0
Decatur	0	0	0	0
Dekalb	50	0	3	53
Delaware	0	0	2	2
Dubois	5	1	2	8
Elkhart	9	0	0	9
Fayette	4	0	0	4
Floyd	0	0	0	0
Fountain	0	0	0	0
Franklin	4	0	0	4
Fulton	8	0	0	8
Gibson	0	1	0	1
Grant	0	0	0	0
Greene	1	0	0	1
Hamilton	2	0	0	2
Hancock	0	0	0	0
Harrison	2	0	0	2
Hendricks	0	0	0	0
Henry	2	1	0	3
Howard	0	0	0	0
Huntington	10	1	0	11
Jackson	3	2	1	6
Jasper	33	1	0	34
Jay	0	0	0	0
Jefferson	0	1	0	1
Jennings	2	0	1	3
Johnson	6	5	0	11
Knox	2	0	0	2
Kosciusko	9	1	0	10
Lagrange	59	1	2	62
Lake	32	0	2	34
LaPorte	90	3	1	94
Lawrence	11	2	0	13
Madison	1	0	1	2
Marion	0	0	0	0
Marshall	8	0	0	8
Martin	1	0	0	1
Miami	0	0	0	0
Monroe	2	2	4	8
Montgomery	0	0	0	0
Morgan	1	0	0	1
Newton	36	1	0	37
Noble	45	0	2	47
Ohio	1	0	0	1
Orange	3	0	0	3
Owen	1	0	0	1
Parke	8	0	1	9
Perry	2	0	0	2
Pike	3	1	0	4
Porter	60	0	0	60
Posey	5	0	0	5
Pulaski	70	0	1	71
Putnam	5	0	0	5
Randolph	0	0	0	0
Ripley	2	0	1	3
Rush	0	0	0	0
Saint Joseph	12	0	1	13
Scott	2	0	0	2
Shelby	0	0	0	0
Spencer	0	0	0	0
Starke	41	0	0	41
Steuben	78	1	1	80
Sullivan	4	0	0	4
Switzerland	1	0	0	1
Tippecanoe	0	0	0	0
Tipton	0	0	0	0
Union	0	0	0	0
Vanderburgh	0	0	0	0
Vermillion	1	0	0	1
Vigo	1	0	1	2
Wabash	1	0	0	1
Warren	1	0	0	1
Warrick	5	0	0	5
Washington	1	0	0	1
Wayne	1	0	0	1
Wells	0	0	0	0
White	2	0	1	3
Whitley	0	0	1	1
Other States				
Branch County, MI	3	0	1	4
Hillsdale County, MI	1	0	0	1
St. Joseph County, MI	1	0	0	1
Van Buren County, MI	1	0	0	1
Unknown county, MI	1	0	0	1
Defiance County, OH	1	0	0	1

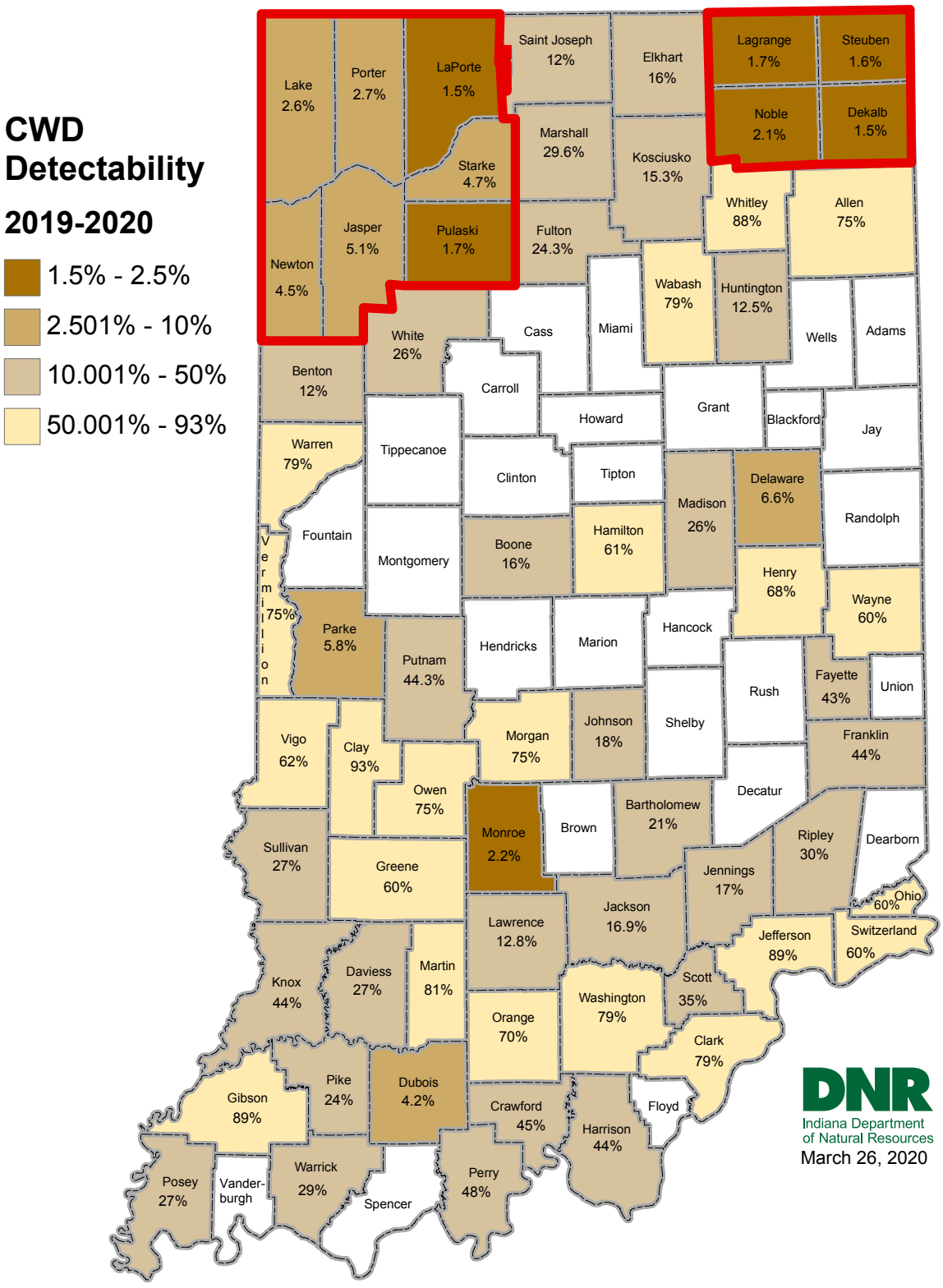

Figure 6-1. Statewide CWD detectability rates for the 2019-2020 deer hunting season. Based on sampling intensity, detectability provides the rate for which there is a 95% probability the true prevalence falls below. For example, if CWD is present in the deer population in LaGrange County, there is a 95% chance that the disease occurs in less than 1.7% of the population (Jennelle et al. 2018) based on our sampling efforts. CWD samples were not collected from counties with no detectability rate during 2019. Red outlines indicate the 2019 CWD targeted surveillance areas.

Table 6-2: CWD detectability rates for the 2019-2020 CWD surveillance areas in northwest and northeast Indiana compared to the 2018-2019 season. Percentages are the level for which CWD must be present in the population in order for that season's surveillance efforts to have the ability to detect the disease.

	CWD Detectability	
County	2018-2019	2019-2020
Northwest Indiana		
JASPER	2.29%	5.10%
LAKE	3.19%	2.59%
LAPORTE	3.26%	1.53%
NEWTON	1.94%	4.52%
PORTER	1.63%	2.66%
PULASKI	1.88%	1.72%
STARKE	2.45%	4.70%
Northeast Indiana		
STEUBEN	1.31%	1.64%
DEKALB	18.00%	1.50%
LAGRANGE	2.90%	1.70%
NOBLE	5.10%	2.06%

CHAPTER 7.
DEER MANAGEMENT SURVEY

Colleen Hartel and Emily McCallen, *Indiana Department of Natural Resources*

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 in setting harvest regulations and for examining the potential effect of proposed regulatory changes. In the 2017 Deer Management Review, hunters indicated they would like the opportunity to provide more input in the deer management process (Caudell and Vaught 2018). Other states such as Wisconsin (Wisconsin DNR 2016) and Pennsylvania (Fleegle et al. 2013) have used County Deer Advisory Councils in an attempt to obtain input from both hunters and non-hunters. Some states such as Ohio and Wisconsin have, for years, used random hunter surveys to seek input on deer management. Likewise, Indiana used random surveys of a portion of hunters and landowners to assess opinions about deer management until 2016. To increase hunter participation and to provide a convenient method for any interested hunter or non-hunter to share their opinions, we started a survey program in 2018 using Qualtrics, an online survey tool.

Since 2018, we have maintained a core set of questions to collect longitudinal data, as well as investigate special topics each year. In the 2020 Deer Management Survey, the Indiana DNR asked several questions designed to assess opinions and/or gather data about hunting in other states, the use of high-powered rifles, the potential use of new or alternative types of equipment, and the motivations for desires to harvest a high number (at least four) of 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 information gathered from these questions are 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). Some questions are useful for long-term trend studies in hunter opinion. Here we report on the results of the 2020 Deer Management Survey on these topics. Other portions of the Deer Management Survey are referenced elsewhere in this report. For example, questions regarding the desires of hunters and non-hunters 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 are reported in the County and Deer Management Unit data sheets.

Methods

The 2020 Deer Management 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 non-residents who had purchased any type of hunting, trapping, or fishing license in the last five years; anyone who checked in a deer in the last five years; and anyone who created an electronic account with Indiana DNR for other reasons (such as obtaining the survey). 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 not represented in the survey. Survey invitations were distributed by GovDelivery, a mailing subscription service, in February and March 2020. Descriptive statistics were generated using Program R.

Results and Discussion

General Demographics of Respondents

The 2020 Deer Management Survey was sent to 500,641 individuals who purchased some type of license(s) through the Indiana DNR online point of sale system (i.e., hunting, fishing, and trapping), had signed up for an Indiana DNR account, or had checked in a white-tailed deer within the past five years, all of which were dependent upon the individual providing a valid email. Duplicate emails were identified and removed before surveys were emailed. Of those sent, 31,594 emails bounced back as undeliverable, for an adjusted sample size of 469,047. Out of the surveys successfully sent, 30,078 surveys were started, for a response rate of 6.4%, and 27,266 surveys were finished, for a completion rate of approximately 90.7%.

Because much of the survey is dependent 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. Respondents from 27,252 surveys included a county of residence. Of the non-residents who responded to the survey, 2,084 started the survey, and 2,057 non-residents self-identified as being a hunter (1,069 reported they hunted during the 2019-2020 deer hunting season). When residents of Indiana were asked ***Do you consider yourself a deer hunter even if you did not hunt during the 2019-2020 deer hunting season***, 20,650 residents indicated they were deer hunters while 4,391 residents indicated they were not deer hunters. Of the Indiana hunters, 16,918 hunted during the 2019-2020 deer season. An additional 3,540 did not hunt in the past season but still wanted to provide input on deer around where they live in Indiana. Of the non-hunting Indiana residents, 3,729 wanted to provide input on deer management where they live.

Indiana hunters were asked about where they lived and hunted. Of the 16,435 hunters who responded, the most common response was *I hunt mostly in the county that I live in, but I also occasionally hunt in other counties* (32.0%). The second most common response was *I hunt only in the county that I live in* (28.5%) followed by *I never hunt in the county that I live in; I only hunt deer in a different county* (21.7%). The remaining 17.8% *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 17,551 hunters reported the number of total years they had been a deer hunter. Most (62.7%) reported they had been a hunter for more than 20 years total, followed by 18.2% who reported 10-20 years deer hunting experience, 9.0% who reported 6-10 years hunting, 7.8% who reported 2-5 years hunting, and just 2.2% who reported that this was their first year hunting deer. A total of 17,486 hunters reported the number of years they had hunted in Indiana. Most (54.0%) reported they had hunted deer in Indiana for more than 20 years, followed by 19.6% who reported 10-20 years of deer hunting in Indiana, 11.0% who reported 6-10 years hunting deer in Indiana, 11.2% who reported 2-5 years hunting in Indiana, and 4.2% 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 2019-2020 deer season. A total of 17,911 hunters reported which type of equipment they used to hunt deer. The most common responses were high-powered rifles (50.8%), crossbows (38.1%), shotguns (31.4%), and modern in-line muzzleloaders (37.3%). Few respondents indicated that they used pistol-caliber rifles or other low-powered rifles (13.3%). Less than 10% of hunters used traditional muzzleloaders (7.8%), handguns (5.3%), compound bows (4.3%), traditional bows (2.4%), or modern recurve bows (1.1%).

We asked hunters to select which license(s) they used in the 2019-2020 deer hunting season. A total of 17,763 reported which license they used to hunt deer. The most commonly reported answer was the license bundle (44.4%) followed by the lifetime license (23.2%), firearms license (14.6%), and landowner exemption (13.4%). Less than 10% of hunters used archery (8.9%), bonus antlerless (6.2%), crossbow (4.2%), deer reduction zone (3.4%), muzzleloader (3.1%), youth (2.2%), and military exemption (0.5%) licenses.

We asked hunters to report how many deer they wanted to harvest in the 2019-2020 deer hunting season by selecting from harvest combinations that included both bucks and does. A total of 17,682 hunters responded to this question. Most respondents (76.7%) wanted to harvest a buck. The most common combination was one buck and one doe (30.1%), followed by one buck and two does (21.1%) and just a single buck (19.1%). Very few individuals wanted to harvest one buck and three does (4.0%) or one buck and more than three does (2.4%). Less than 10% of hunters wanted to hunt a number of deer regardless of its sex (one deer 6.4%, two deer 8.2%, three deer 4.8%, four deer 1.0%, and more than four deer 1.3%). Only 1.5% reported wanting to harvest only a single doe.

Perceptions about Deer Populations and Management

Both hunters and non-hunters responded to a series of questions about deer population sizes and how harvest should change. Hunters were asked ***How would you like to see the County Bonus Antlerless Quota change next year in [County] for the 2020-2021 deer hunting season***? To avoid using terminology they may be unfamiliar with, non-hunters 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 were asked ***Please describe the size of the deer population in [County] during the 2019-2020 deer hunting season*** (Figure 7-2), ***How does the number of deer you saw in [County] during the 2019-2020 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). County-specific results for hunters are presented in the county sheets. Due to small sample sizes, we do not include results for non-hunters at the county level, and statewide findings for non-hunters may not be representative.

In the 2020 survey, asked about how quotas should change, most hunters and non-hunters thought quotas should be maintained (47.2% and 50.2%, respectively; Figure 7-1). Hunters' perceptions about the deer population were skewed toward the low side, with 35.7% responding that it was low, and 18.8% believing that it was too low (Figure 7-2). Responses from non-hunters were normally distributed, with most indicating their perception of the population is about right (48.3%). Both hunter and non-hunter perceptions have remained largely stable since 2018.

Asked about how the deer population had changed over the last five years, most hunters thought it was substantially, moderately, or slightly decreasing (21.9%, 15.9%, and 17.3%, respectively) or being maintained (21.3%). Most non-hunters thought it was being maintained (25.9%) or increasing slightly (18.8%) (Figure 7-3). Both hunter and non-hunter perceptions have remained largely stable since 2018. Asked about how deer populations should change over the next five years, most hunters thought populations should increase to some degree (52.6%). Another 21.7% thought populations should be maintained. Responses from non-hunters were normally distributed, with most indicating the perception that the population should be maintained (35.0%; 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*** (Figure 7-5). Most hunters reported that they thought total deer harvest had decreased (56.7%). An additional 17.1% 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*** (Figure 7-6). Most hunters thought there was some degree of decrease (55.5%). Roughly a quarter of respondents (24.2%) thought there was no change. (Hunters were also asked to ***describe the QUALITY of the bucks in this hunting county during the most recent deer hunting season*** (Figure 7-7). Most (50.0%) hunters thought the bucks were of average quality, followed by low quality (27.9%).

Respondents were also asked about attitudes toward 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?*** (Figure 7-8). Non-hunters rated the DNR, on average, 75.9

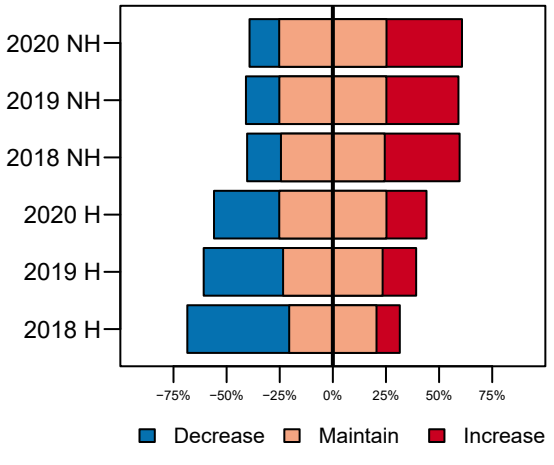

Figure 7-1. Opinion on how the County Bonus Antlerless Quota should change from hunters (H) and non-hunters (NH)

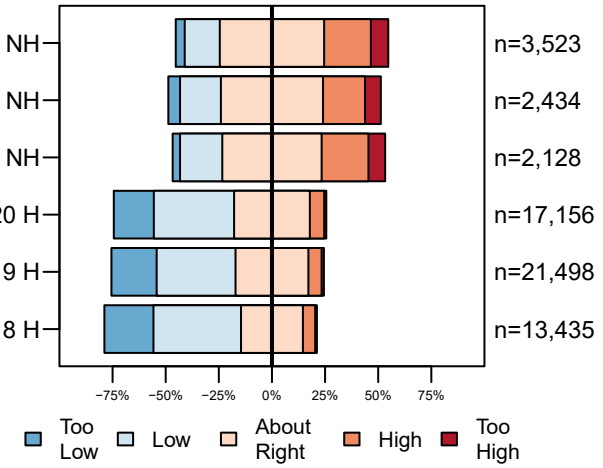

Figure 7-2. Perceptions of the current size of the deer population described by hunters (H) and non-hunters (NH).

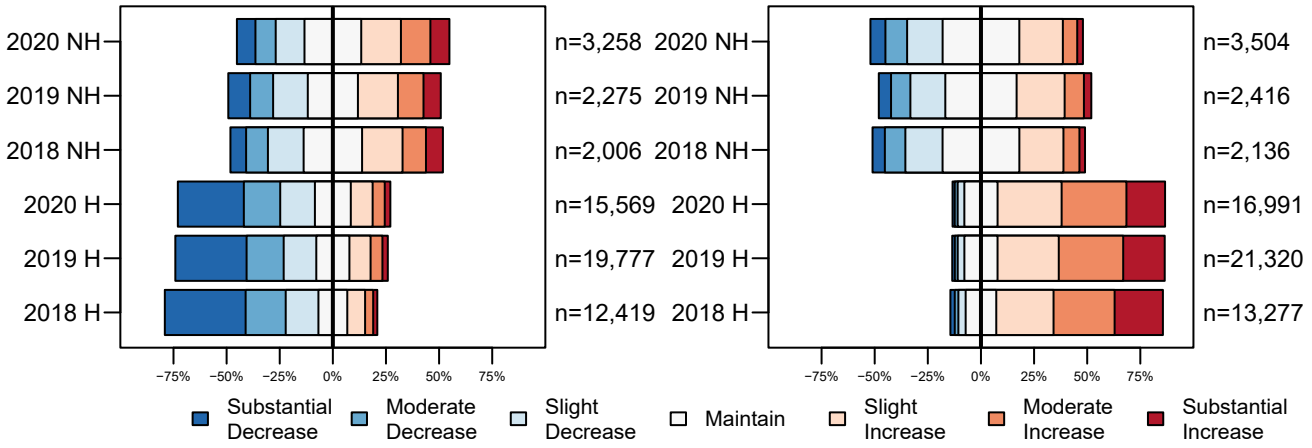

Figure 7-3. The number of deer seen compared to five years ago described by hunters (H) and non-hunters (NH).

Figure 7-4. The desired change in the size of the deer population described by hunters (H) and non-hunters (NH).

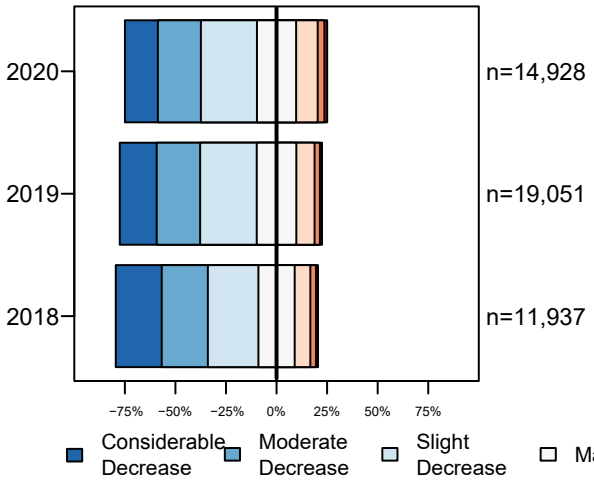

Figure 7-5. Opinion of hunters on how the total number of harvested deer has changed over the last five years.

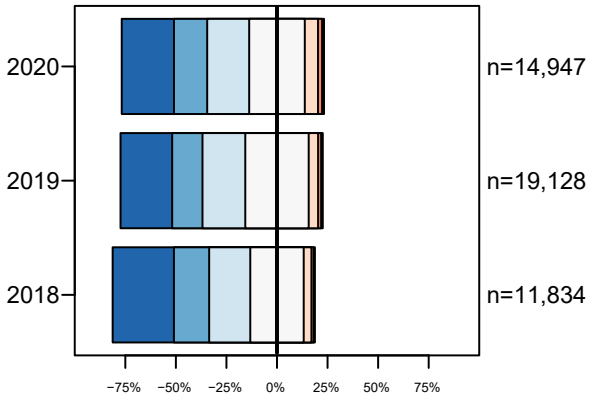

Figure 7-6. Opinion of hunters on how their personal number of harvested deer has changed over the last five years.

while hunters, on average, rated it 64.4 out of 100. Both non-hunters and hunters were asked the same question about how well Indiana DNR is doing managing deer in their county (Figure 7-9). On average, non-hunters rated the DNR at 75.6, while hunters rated the DNR at 64.3 out of 100. Over the past three years, hunters have indicated significant improvement in how well they think DNR is managing deer in their county, while non-hunters have stayed consistent.

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 2019-2020 deer hunting season?*** (Figure 7-10). On average, this rating has remained largely steady over the past few years. Hunters rated their enjoyment, on average, at 77.3 out of 100.

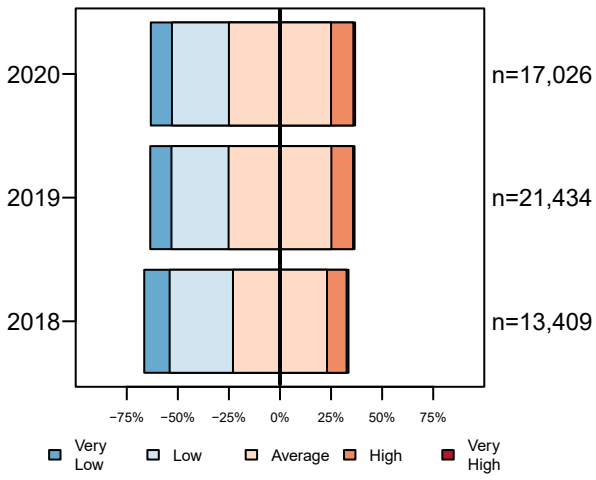

Figure 7-7. Hunters describe the quality of bucks in the county where they hunt.

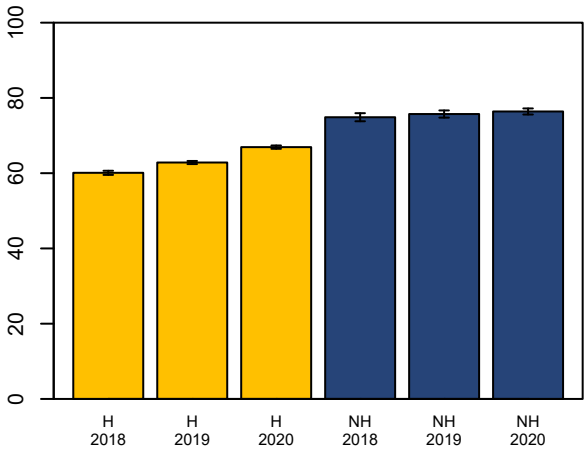

Figure 7-8. Hunters (H) and non-hunters (NH) were asked to score the Indiana DNR's statewide deer management on a scale of 0 (poor) to 100 (excellent).

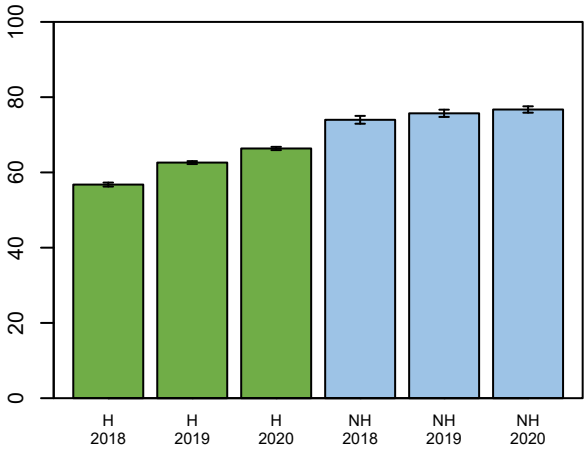

Figure 7-9. Opinion of county deer management on a scale of 0 (poor) to 100 (excellent) from hunters (H) and non-hunters (NH).

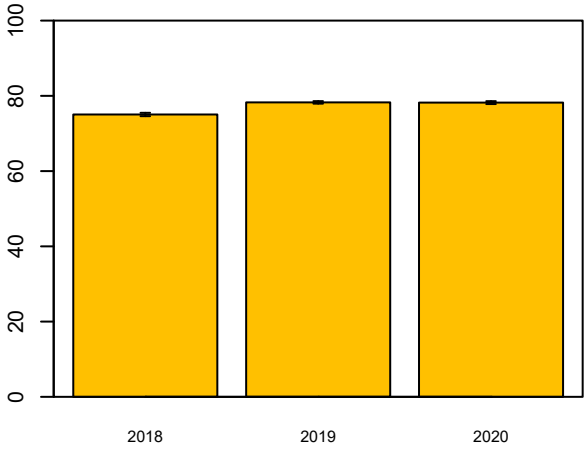

Figure 7-10. Hunters were asked to score their hunting experience on a scale of 0 (no enjoyment) to 100 (great enjoyment).

High-powered Rifles

Use of high-powered rifles to hunt deer on private land became legal in 2016. In this context, high-powered rifles were defined as having a bullet diameter that is at least .234 and a cartridge case length between 1.16 and 3 inches. All active deer hunters, regardless of whether they currently hunted with high-powered rifles, were asked a set of questions to gauge both hunter perception of use of high-powered rifles and how hunter behavior may have shifted since high-powered rifles' legalization. A summary of these findings is reported in Figure 7-11.

Choosing an Area to Hunt – Respondents were asked to rate their agreement with a series of statements about the areas that they choose to hunt within the context of high-powered rifles including ***I choose hunting areas so that I can use high-powered rifles to hunt deer, I choose hunting areas so that I can avoid other hunters who may use high-powered rifles***, and ***I changed the areas that I hunt because high-powered rifles are now allowed***. Overall, the legalization of high-powered rifles and presence or absence of other hunters who may be using high-powered rifles appeared to have relatively little impact on hunter decisions on where to hunt. For the statement ***I choose hunting areas so that I can use high-powered rifles to hunt deer***, most (36.5%) individuals reported they did not agree or disagree that they chose areas specifically to use high-powered rifles. Remaining individuals were split about equally between agree or strongly agree (17.5% and 13.4%) and disagree or strongly disagree (14.0% and 18.6%, respectively). Individuals followed the same pattern for the statement ***I choose hunting areas so that I can avoid other hunters who may use high-powered rifles***, with the largest proportion of individuals remaining neutral (37.1%). The remaining individuals were split about equally between agree or strongly agree (18.5% and 14.5%) and disagree or strongly disagree (16.2% and 13.7%, respectively). Asked specifically if they had ***changed the areas that I hunt because high-powered rifles are now allowed***, most individuals disagreed or strongly disagreed (39.4% and 17.8%, respectively), with the remaining being mostly neutral (33.0%). Very few agreed or strongly agreed (7.3% and 2.5%, respectively). Asked if respondents ***feel safe while others may be using high-powered rifles to hunt deer in or near the same area***, most agreed or strongly agreed (32.8% and 12.2%, respectively). Fewer respondents disagreed or strongly disagreed with this statement (15.3% and 12.4%, respectively). Respon-

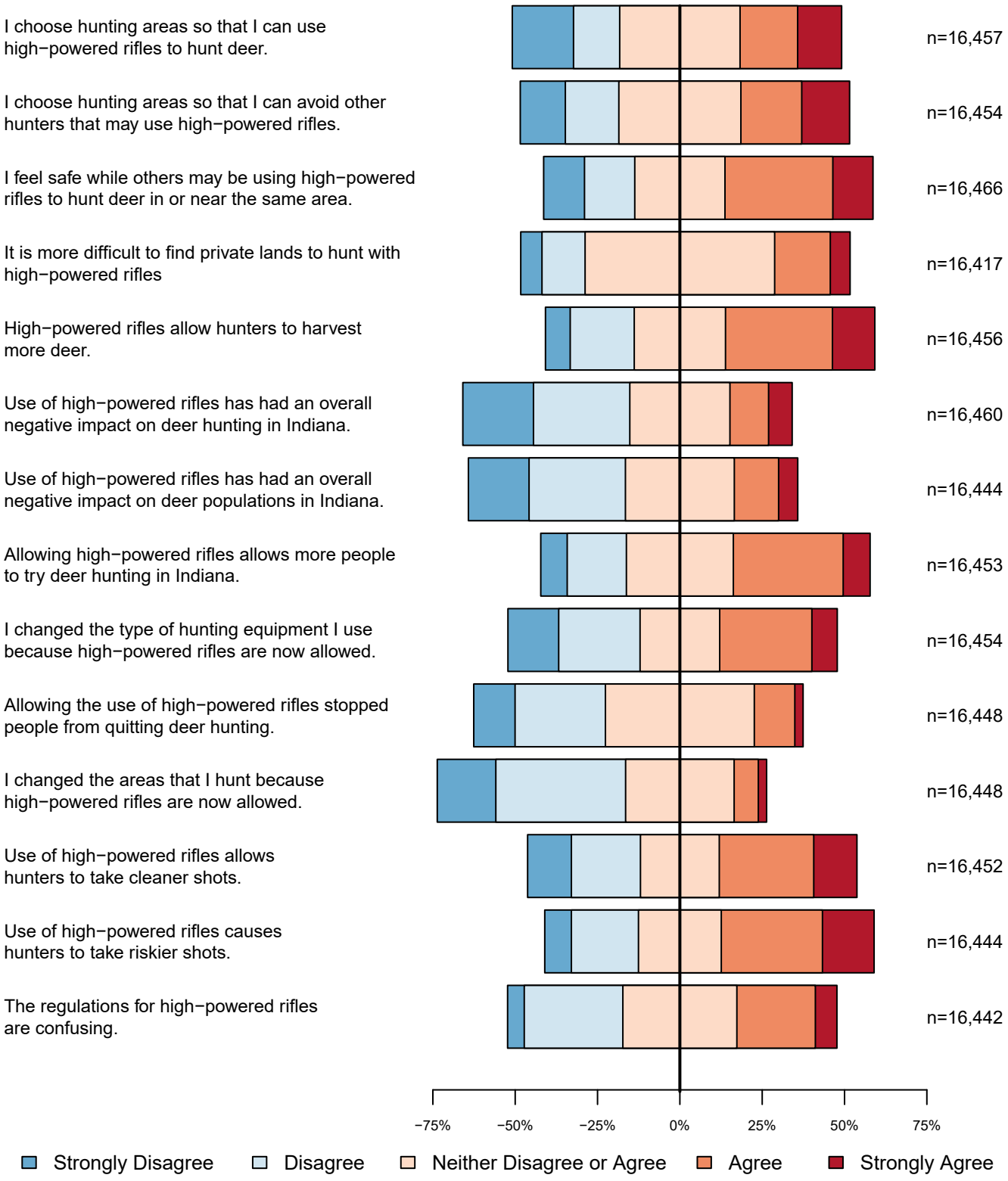

Figure 7-11. The opinion of hunters on the use of high-powered rifles in Indiana.

dents were also asked if they agreed or disagreed with the statement ***It is more difficult to find private lands to hunt with high-powered rifles than it is to find private land to hunt with other equipment***. The majority neither agreed nor disagreed (57.6%). The remaining individuals were split relatively equally between those who agree or strongly agree (16.9% and 6.0%, respectively) and those who disagree or strongly disagree (13.1% and 6.4%, respectively).

Expected Hunting Behavior Change – Respondents were asked to rate their agreement with a series of statements about how hunting behavior and participation may change because of the legalization of high-powered rifles, including ***Allowing high-powered rifles allows more people to try deer hunting in Indiana, Allowing the use of high-powered rifles stopped people from quitting deer hunting, and I changed the type of hunting equipment I use because high-powered rifles are now allowed***. The statement ***Allowing high-powered rifles allows more people to try deer hunting in Indiana*** was aimed at measuring respondents' perceived ability of a new equipment type to attract or recruit individuals to deer hunting. Most individuals agreed or strongly agreed with this statement (33.3% and 8.2%, respectively), but a large proportion reported neither agreement nor disagreement (32.5%). Relatively few individuals disagreed (18.0%) or strongly disagreed (8.0%). The statement ***Allowing the use of high-powered rifles stopped people from quitting deer hunting*** was aimed at measuring the perceived effectiveness of a new equipment type to retain individuals. Most respondents neither agreed nor disagreed with this statement (45.2%). The remaining individuals were more likely to disagree or strongly disagree (27.4% and 12.5%, respectively) compared to agree or strongly agree (12.3% and 2.5%, respectively). Respondents were asked about how they perceive the use of high-powered rifles affects hunter behavior in the field with the statements ***Use of high-powered rifles allows hunters to take cleaner shots*** and ***Use of high-powered rifles causes hunters to take riskier shots***. More respondents agreed or strongly agreed (28.7% and 13.1%, respectively) than disagreed or strongly disagreed (21.0% and 13.3%) with the statement about allowing hunters to take cleaner shots. Respondents followed this same pattern for the statement about taking riskier shots, with 30.7% agreeing and 14.7% strongly agreeing compared to 20.4% disagreeing and 8.1% strongly disagreeing.

Expected biological impact – Respondents were asked to rate their agreement with a series of statements related to their perception of how the legalization of high-powered rifles for deer hunting affected their experience and harvest. For the statement ***High-powered rifles allow hunters to harvest more deer***, more respondents agreed or strongly agreed (32.5% and 12.9%, respectively) than disagreed or strongly disagreed (19.4% and 7.5%, respectively). This indicates that respondents perceive high-powered rifles as increasing individual hunter success. When asked about their perception if ***use of high-powered rifles has had an overall negative impact on deer hunting in Indiana***, more individuals disagreed or strongly disagreed (29.2% and 21.5%, respectively) than agreed or strongly agreed (11.7% and 7.2%, respectively). Similarly, asked if ***use of high-powered rifles has had an overall negative impact on deer populations in Indiana***, more respondents disagreed or strongly disagreed (29.3% and 18.4%, respectively) than agreed or strongly agreed (13.5% and 5.8%, respectively). Overall, these results indicate that respondents perceive that use of high-powered rifles has a positive impact on individual hunter success without negatively impacting the deer population and overall hunting experience.

Use of high-powered rifles –Asked to rate their agreement with the statement ***The regulations for high-powered rifles are confusing***, slightly more respondents disagreed or strongly disagreed (30.0% and 5.1%, respectively) than agreed or strongly agreed (23.8% and 6.6%, respectively). Respondents were asked directly about how their hunting behavior may have shifted with the statement ***I changed the type of hunting equipment I use because high-powered rifles are now allowed***. Slightly more respondents disagreed or strongly disagreed (24.7% and 15.4%, respectively) with this statement than agreed or strongly agreed (28.0% and 7.7%, respectively). Most individuals do hunt with a high-powered rifle but with varying levels of avidity (Figure 7-12). Few use high-powered rifles exclusively (2.8%) or as their primary equipment (11.5%). Individuals most commonly hunt primarily with other equipment but sometimes use a high-powered rifle (27.3%), or hunt with other equipment and a high-powered rifle about equally (26.5%). The remaining individuals do not hunt with a high-powered rifle (31.9%).

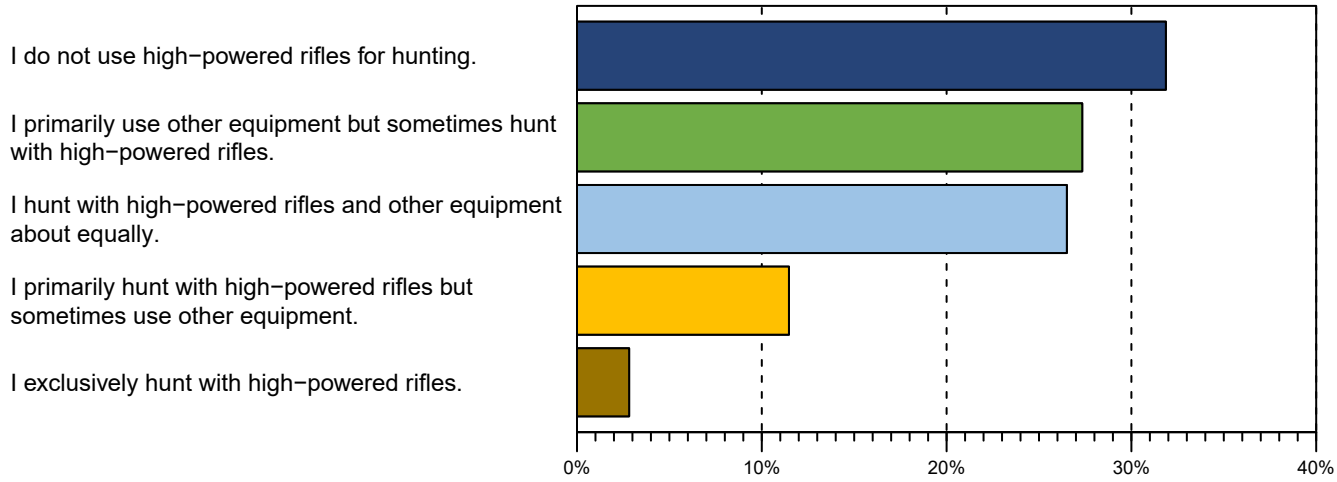

Figure 7-12. Deer hunters in Indiana describe their use of high-powered rifles (n=16,445).

Out of State Hunting

Hunters were asked if they ***have hunted deer, elk, or moose in states other than Indiana in the past five years***? Most Indiana hunters had not hunted deer, elk, or moose in states other than Indiana in the past five years (77.1%, n=15508). Indiana hunters who had traveled out of state most frequently hunted in Colorado and Kentucky (25.3% and 20.2%, respectively; Figure 7-13).

Indiana hunters who had hunted out of state were asked to select the reasons why they hunted out of state (Figure 7-14). The most frequently cited reason was ***I have family or friends who I can hunt with in other states*** (40.2%). More than a quarter of respondents also selected ***additional opportunities to hunt more white-tailed deer*** (34.6%), more opportunity to harvest a larger white-tailed buck (32.7%), ***I want to enjoy the scenery or environment of other states*** (29.3%), and ***I enjoy the challenge of hunting white-tailed deer in other places*** (28.4%). Relatively few respondents selected ***other states have different regulations that I prefer*** (11.3%) and ***I own land in other states*** (9.7%).

Motivations for High Harvest

We were interested in investigating the motivations of hunters who indicated they wanted to harvest four or more deer (any combination of bucks or does). Relatively few hunters (8.7%, n=1,536) indicated they wanted to harvest at least four deer, and only 1.8% or 1,578 hunters actually harvested four or more deer in 2019 (Table 3-5). These hunters were asked to rate the importance of different factors that may influence their desire to harvest a higher number of deer (Figure 7-15). Overall, this group generally rated all of the factors as important or extremely important, indicating that hunters who want to harvest a higher number of deer may do so for a variety of reasons.

Social aspects such as ***to provide food for me or my family*** and ***to spend time with family and friends*** were identified as important motivations for harvesting a high number of deer. The great majority of respondents identified ***providing food for me or my family*** as extremely important or important (51.4% and 35.6%, respectively), while only 5.7% and 2.2% identified this as unimportant or extremely unimportant, respectively. Similarly, the majority of respondents identified ***spending time with family and friends*** as very important or important (43.8% and 41.2%, respectively), while only 2.2% and 2.3% identified it as extremely unimportant or unimportant, respectively. ***To be alone in nature*** was also identified as a very important reason, with 42.8% and 45.2% finding it extremely important and important, respectively. Only 1.9% and 1.1% found this factor to be extremely unimportant or important. ***Providing food for my community*** was rated as generally important, but to a lesser extent compared to other reasons. Only 9.9% and 35.5% rated this motivation as extremely important or important, respectively, with 6.0% and 12.2% rating it as extremely unimportant or unimportant, respectively.

Participants identified ***managing the deer population overall*** as important or extremely important (52.7% and

19.7%, respectively) with only 3.6% and 4.6% identifying this as extremely unimportant or unimportant, respectively. However, only 12.8% and 29.2% identified ***controlling the impact of deer on my land*** as extremely important or important, respectively, with 10.3% and 17.0% responding with extremely unimportant or unimportant, respectively. While respondents identified the role of high deer harvest in controlling deer populations, the individuals themselves are not necessarily doing it to protect their own property.

Participants were asked about the importance of factors related to the hunting experience, including ***to take advantage of different seasons or hunting opportunities and to sharpen or employ my hunting skills***. Both factors were largely rated as important, with 22.5% and 50.8% regarding ***to take advantage of different seasons or hunting opportunities*** as extremely important or important, respectively. Only 3.5% and 3.9% rated this as extremely unimportant or unimportant. Similarly, 20.0% and 45.9% rated ***to sharpen or employ my hunting skills*** as extremely important or important, respectively, while only 3.5% and 5.9% rated this factor as extremely unimportant or unimportant, respectively.

Alternative Equipment

Indiana DNR is sometimes asked to consider types of equipment that are not yet legal for deer hunting in Indiana. This section featured three pieces of equipment the DNR is frequently asked about to gauge its potential use by our deer hunters. In the survey, respondents were displayed definitions for each of the alternative types of equipment they were asked to consider. Air rifles were defined as guns that launch ammunition using compressed air or other pressurized gasses instead of an explosive charge like in traditional firearms use. Air bows were defined as bows that launch arrows using compressed air or other pressurized gasses. Sling bows were described as small bows that use a slingshot-like mechanism to launch arrows. Of the hunters who responded to these questions, 11.1% were exclusively archery hunters, 26.1% were exclusively firearm hunters, and 62.8% hunted with both archery and firearm equipment.

Air rifles – Figure 7-16 shows the anticipated likelihood that Indiana residents would use air rifles within Indiana and outside it. Indiana residents were unlikely ***to hunt deer using air rifles in Indiana if they became legal***. The majority answered they were extremely or moderately unlikely (81.4%) to use this equipment if it became legal. Just 8.3% of respondents indicated they were extremely or moderately likely to hunt with air rifles if they became legal. Respondents were also unlikely ***to travel to states bordering Indiana (i.e., Illinois, Michigan, Ohio, Kentucky) to hunt deer with air rifles***. The majority of respondents reported they were unlikely (90.0%) to travel to bordering states to hunt with air rifles. Only 8.2% reported that they would be likely to travel to bordering states to hunt with air rifles. Respondents (91.5%) were also unlikely to ***travel to another state that is not next to Indiana to hunt deer with air rifles***. Just 1.7% of respondents reported that they were likely to travel to a state that is not bordering Indiana to hunt deer with air rifles. Participants were asked to report the acceptability of ***others to hunt deer using air rifles during archery season*** and the acceptability of ***others to hunt deer using air rifles during firearms season*** (Figure 7-17). The majority of respondents (70.7%) reported that others using an air rifle during archery season was extremely or moderately unacceptable. Almost 10% found hunting with an air rifle during archery season to be acceptable. Other hunters using an air rifle during firearms season was slightly more acceptable. Still, a large proportion of respondents found this extremely or moderately unacceptable (40.0%). Fewer respondents found other hunters using air rifles during firearms season acceptable (32.0%).

Participants were also asked to report the acceptability of shortening existing seasons to create a dedicated season for air rifles (Figure 7-18). Generally, respondents said shortening any of the existing seasons is extremely unacceptable. ***Shortening archery seasons*** was described as extremely or moderately unacceptable by 86.4% of the respondents. Only 4.1% found shortening archery season to create a dedicated air rifles season was extremely or moderately acceptable. ***Shortening muzzleloader season*** was also described as unacceptable by the majority of respondents (84.5%), while 5.6% found shortening muzzleloader season to create a dedicated season for air rifles acceptable. ***Shortening firearms season*** was largely unacceptable (86.7%). Just 8.7% found shortening firearms season to create a dedicated season for air rifles extremely or moderately acceptable.

Air bows. – Figure 7-19 shows the anticipated likelihood that Indiana residents would use air bows within Indiana and outside it. Indiana residents were unlikely (81.7%) ***to hunt deer using air bows in Indiana if they became legal*** while 7.9% of respondents indicated they were likely to hunt with air bows if air bows became legal. Similarly, respondents were unlikely (91.1%) to ***travel to states bordering Indiana (i.e., Illinois, Michigan, Ohio, Kentucky) to hunt deer with air bows***. Only 7.4% indicated that they would be extremely or moderately likely to travel to bordering states. Respondents were even more unlikely (91.9%) to ***travel to another state that is not next to Indiana to hunt deer with air bows***. Only 1.5% of respondents reported that they were likely to travel to a state that is not bordering Indiana. Participants were asked to report the acceptability of ***others using air bows to hunt deer during archery season*** (Figure 7-17). The most common response was extremely unacceptable (40.8%), and 13.6% reported it was moderately unacceptable. Almost 20% found use of air bows during archery season to be extremely or moderately acceptable.

Participants were also asked to report the acceptability of shortening existing seasons to create a dedicated season for air bows (Figure 7-20). Generally, respondents found shortening any of the existing seasons to be extremely unacceptable. ***Shortening archery seasons*** was described as extremely unacceptable by 80.4% of the respondents and moderately unacceptable by 8.7% of the respondents. Only 3.2% found shortening archery season to create a dedicated air bow season as acceptable. ***Shortening muzzleloader season*** was also described as unacceptable by the majority of respondents (88.0%). Only 4.0% found this option acceptable. ***Shortening firearms season*** was largely unacceptable (88.8%). Just 4.7% found this acceptable.

Sling bows – Figure 7-21 shows the anticipated likelihood that Indiana residents would use sling bows within Indiana and outside it. Indiana residents were unlikely (85.5%) ***to hunt deer using sling bows in Indiana if they became legal***, and only 3.8% of respondents indicated they were likely to hunt deer with sling bows. Similarly, respondents were unlikely (92.5%) to ***travel to states bordering Indiana (i.e., Illinois, Michigan, Ohio, Kentucky) to hunt deer with sling bows***. Only 1.2% reported that they would be likely to travel to bordering states to hunt deer with sling bows. Respondents were even more unlikely (92.8%) to ***travel to another state that is not next to Indiana to hunt deer with sling bows***. Just 1% of respondents reported that they were likely to travel to a state that is not bordering Indiana to hunt deer with sling bows. Participants were asked to report the acceptability of ***others using sling bows to hunt deer during archery season*** (Figure 7-17). The most common response was extremely unacceptable (37.2%), and 12.4% reported it was moderately unacceptable. A total of 20.5% found use of sling bows during archery season to be extremely or moderately acceptable.

Participants were also asked to report the acceptability of shortening existing seasons to create a dedicated season for sling bows (Figure 7-22). Generally, respondents found shortening any of the existing seasons to be extremely unacceptable. ***Shortening archery seasons*** was described as extremely unacceptable by 81.4% of the respondents and moderately unacceptable by 8.4% of the respondents. Only 2.6% found shortening archery season to create a dedicated sling bow season to be acceptable. ***Shortening muzzleloader season*** was also described as extremely unacceptable by the majority of respondents (83.6%), followed by moderately unacceptable (6.3%). Only 4% found this option to be acceptable. ***Shortening firearms season*** was also largely unacceptable (89.3%). Just 3.5% found this acceptable.

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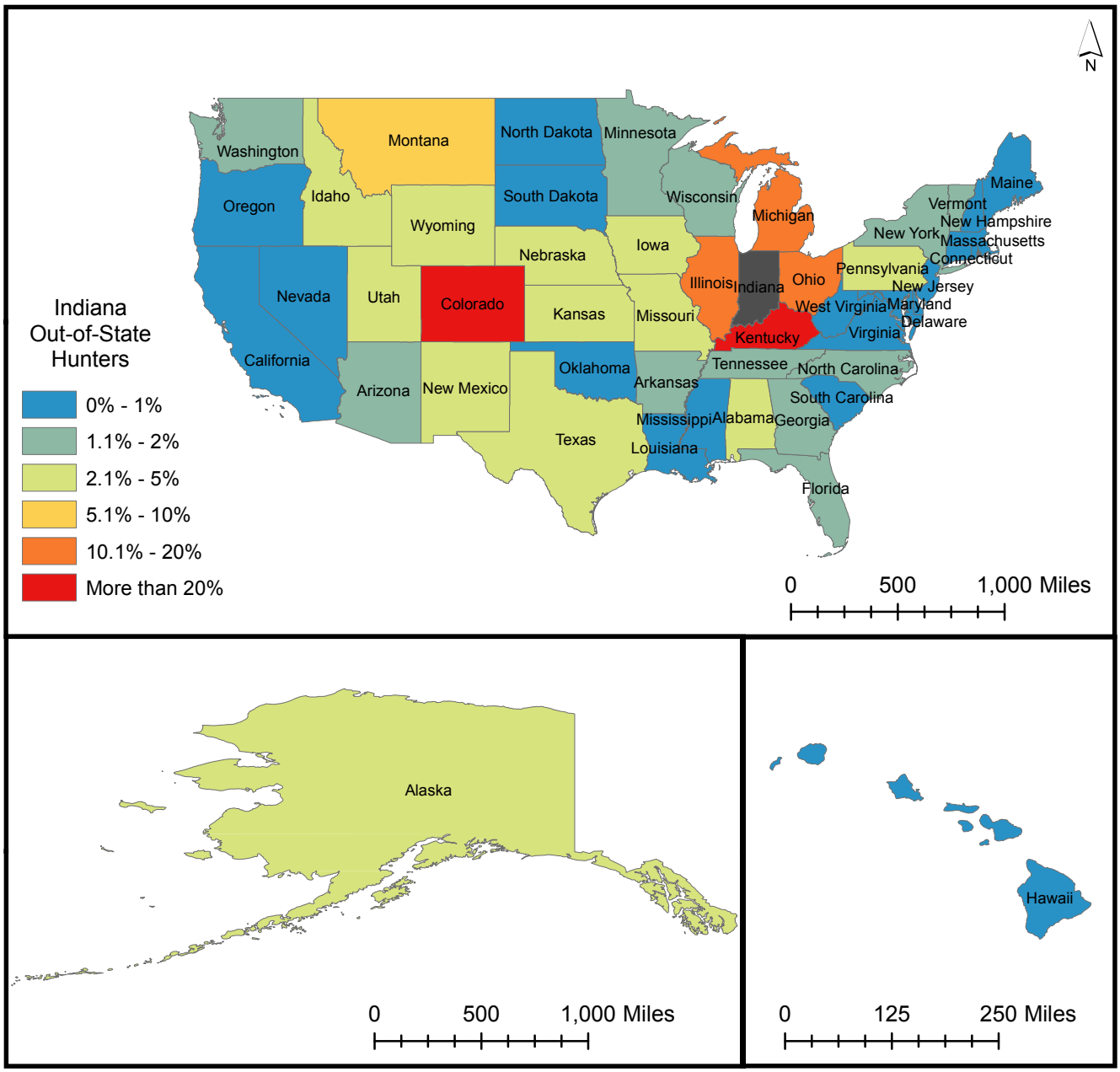

Figure 7-13. Percent of Indiana deer hunters who reported hunting out-of-state in the last five years that hunted in each state (n=3,464).

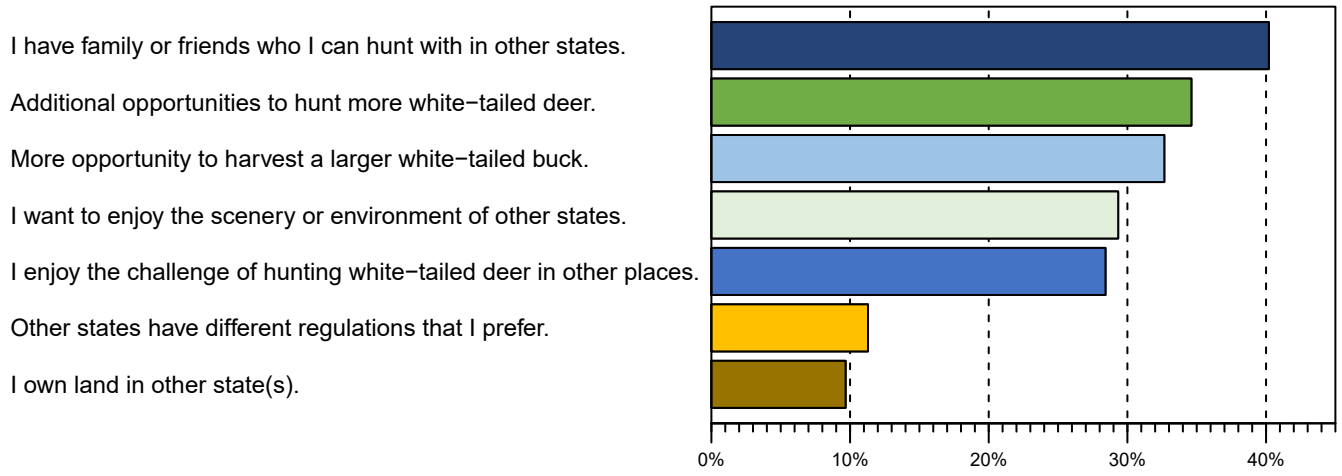

Figure 7-14. Indiana hunters that reported hunting out-of-state in the last five years describe their reasons hunting in other states (n=3,276).

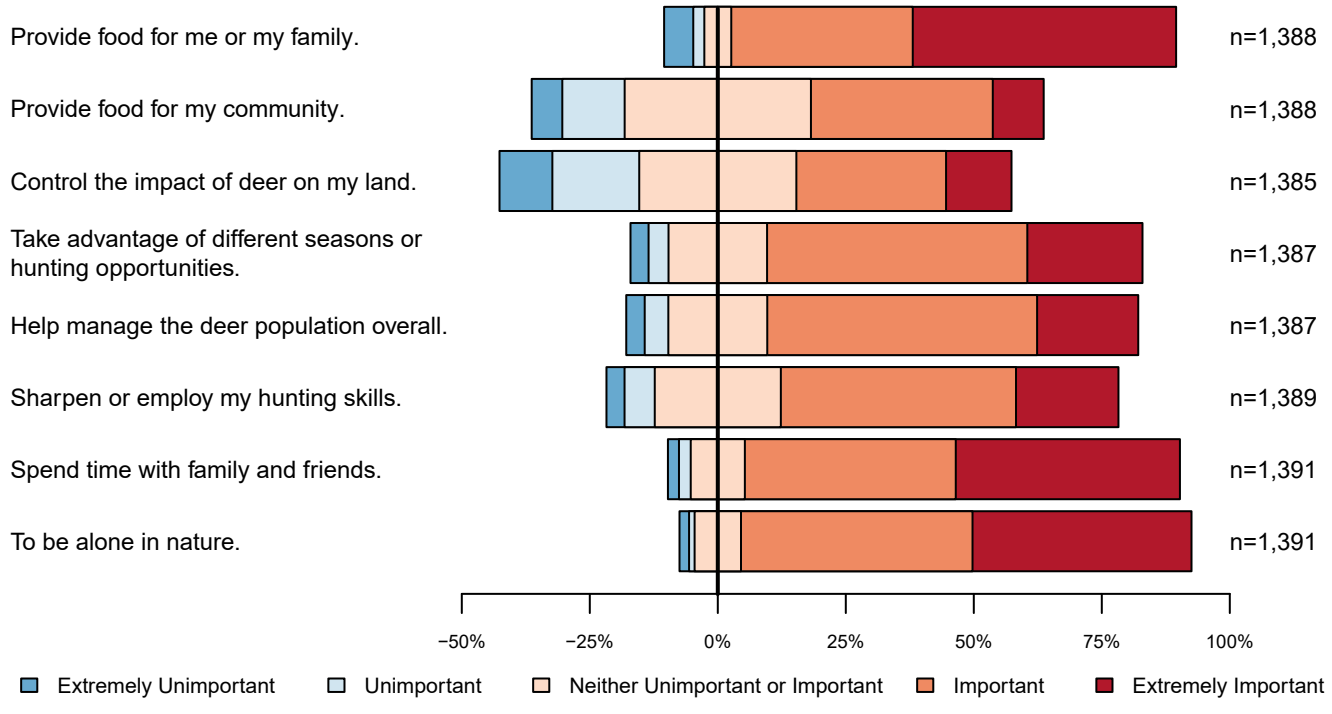

Figure 7-15. Hunters in Indiana who wanted to harvest four or more deer were asked about their motivations for high harvest.

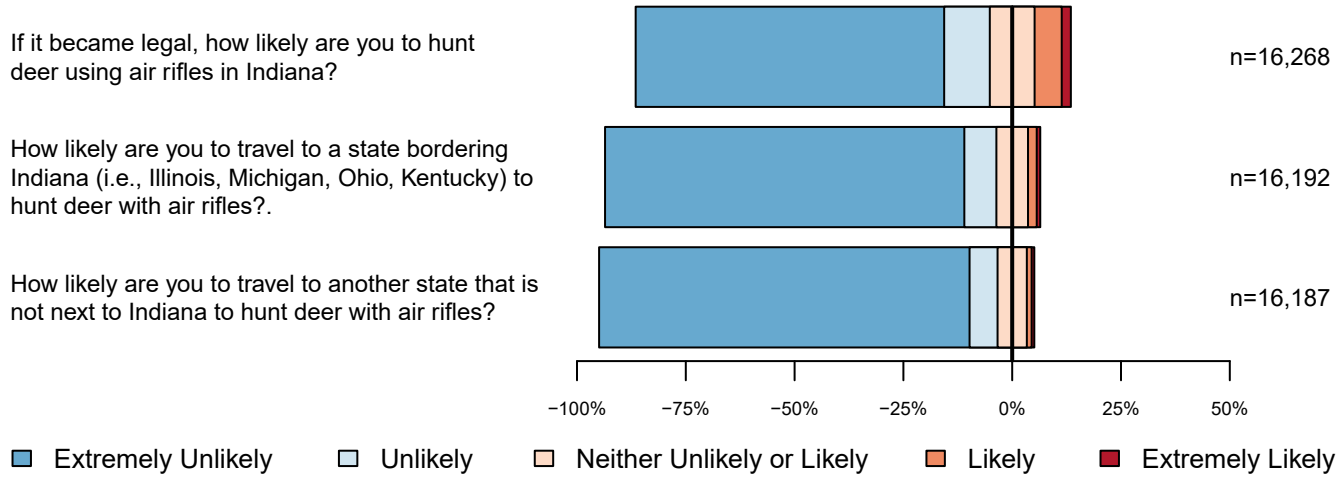

Figure 7-16. Hunters in Indiana were asked about their inclination to hunt with air rifles.

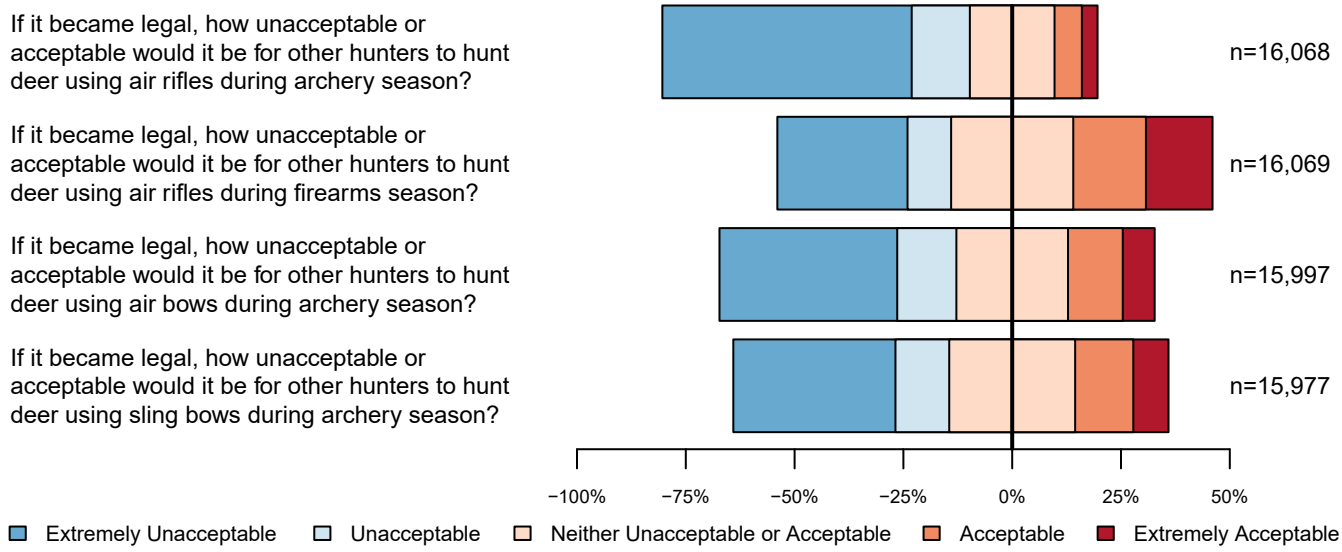

Figure 7-17. Hunters in Indiana were asked about the acceptability of hunting with alternative equipment during current deer seasons.

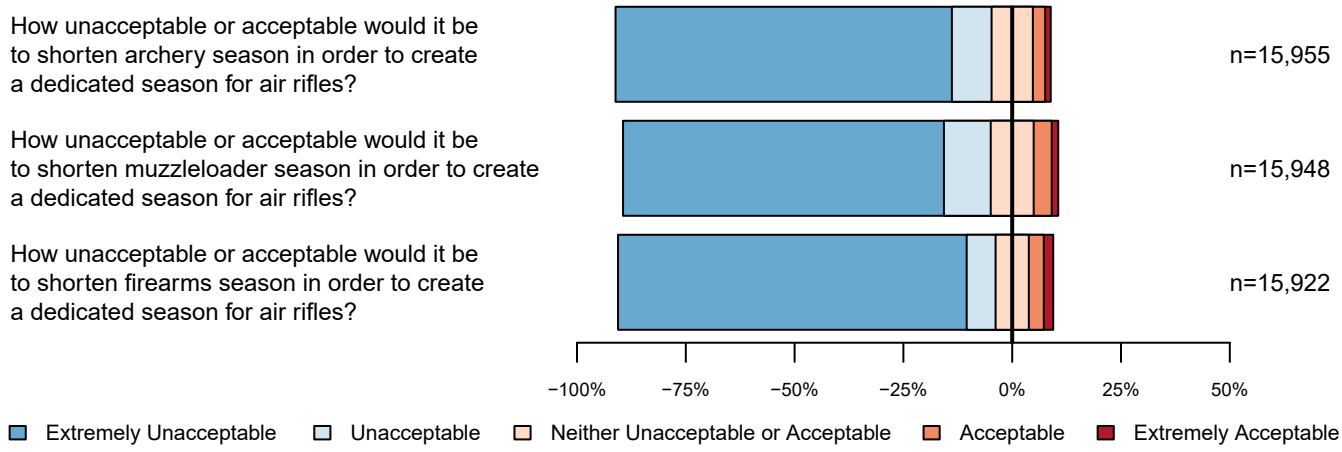

Figure 7-18. Hunters were asked about the acceptability of shortening current deer seasons to create a season for air rifle hunting.

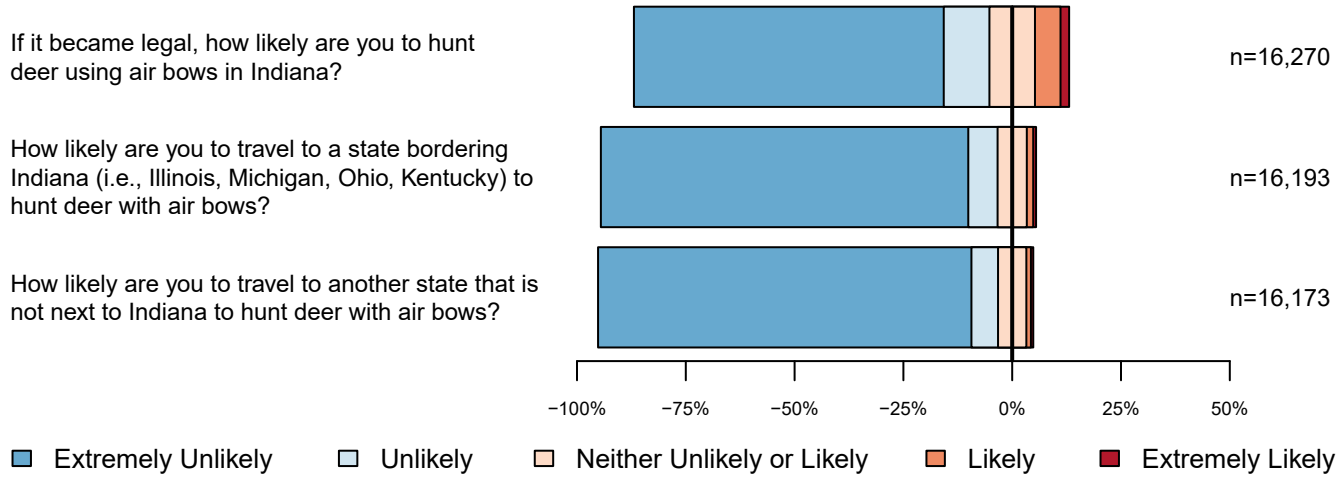

Figure 7-19. Hunters in Indiana were asked about their inclination to hunt with air bows.

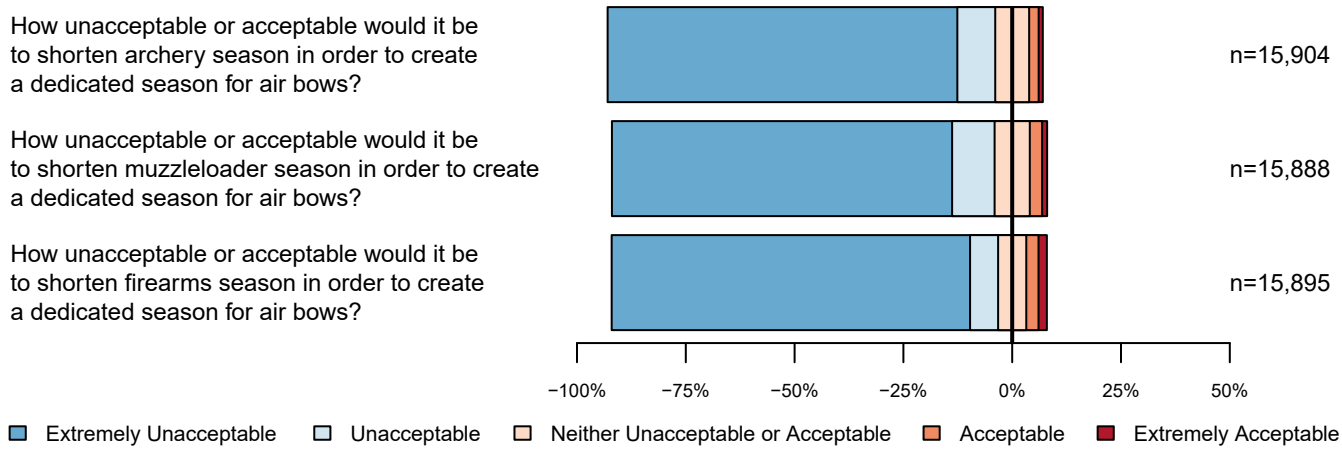

Figure 7-20. Hunters were asked about the acceptability of shortening current deer seasons to create a season for air bow hunting.

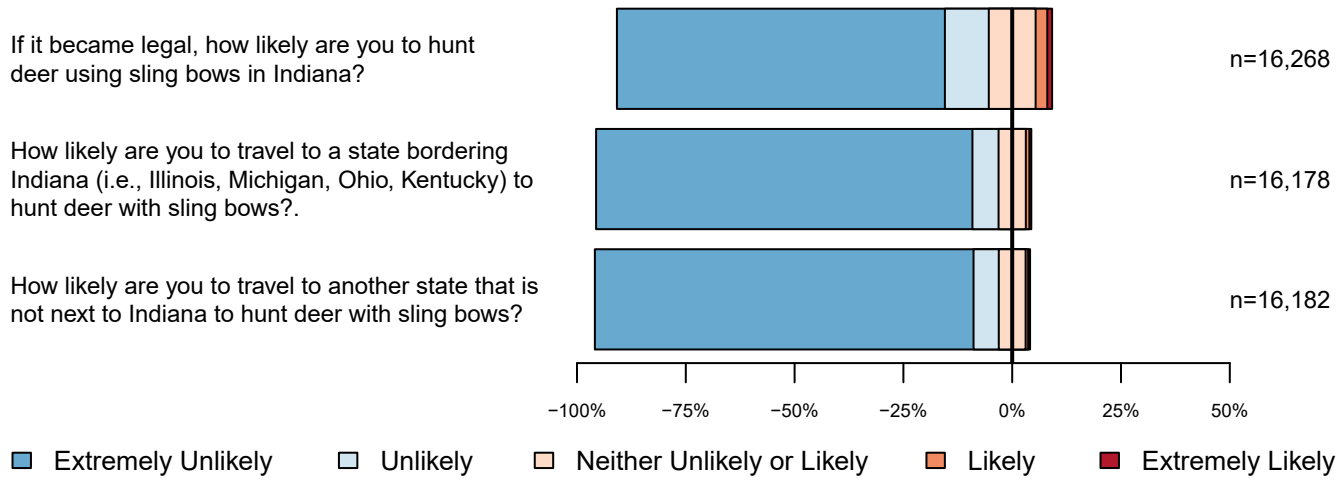

Figure 7-21. Hunters in Indiana were asked about their inclination to hunt with sling bows.

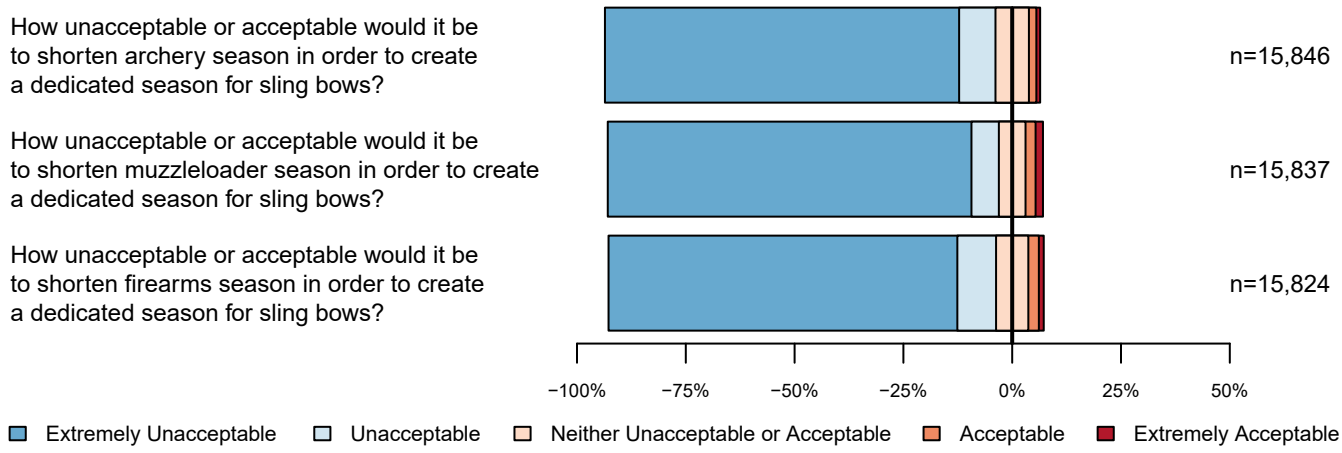

Figure 7-22. Hunters were asked about the acceptability of shortening current deer seasons to create a season for sling bow hunting.

CHAPTER 8. CITIZEN SCIENCE

Citizen science is public participation in data collection and analysis of natural resources. The Indiana DNR seeks assistance from citizen scientists as an alternative way to collect data traditionally obtained by biologists. Citizen science provides the public an opportunity to participate in resource management and allows for collection of a wider set of data from a broader scale, thus saving Indiana DNR time and resources. Currently, the Deer Research Program relies on citizen scientists for three projects: Snapshot Indiana, the Archer's Index, and the After Hunt Survey.

SNAPSHOT INDIANA

Joe Caudell, Olivia Vaught, Emily McCallen, and Gerian Albers, *Indiana Department of Natural Resources*

Snapshot Indiana is a citizen science project that uses trail cameras to collect data on a variety of wildlife species in Indiana. Remote-trigger cameras, aka trail cameras, can be a useful tool for DNR wildlife managers because data can be collected with only a moderate amount of effort, and photos allow for easier identification than other types of surveys. Photos can provide a variety of data, including whether a species is expanding into new counties, long-term population trends, activity patterns, or documentation of uncommon species (e.g., American badger, *Taxidea taxus*). The Deer Research Program is working on analyzing these data as a measure of doe:buck ratios and fawn:doe ratios.

A doe:buck ratio measures the number of does relative to the number of bucks in an adult deer population. In general, a deer population with a balanced ratio of males to females is characteristic of an unhunted population and is generally considered a desirable trait for deer management. A fawn:doe ratio is the number of fawns present per adult doe. Fawn:doe ratios have several management implications, depending on the time of year the ratios are measured. Fawn:doe ratios measured just before birth (i.e., the number of fawns counted in the uterus of road-killed or selectively shot deer) are useful for estimating birth rate. Fawn:doe ratios observed in the fall, just prior to deer hunting season and/or in early archery season, are a measure of recruitment, or the number of new deer that will enter the hunting population.

Snapshot IN Photo

Each year, trail cameras are sent to volunteers who meet certain criteria. They must have at least 10 acres and cannot have bait or feeders for wildlife near where the camera is set. Volunteers receive training on how to set up and use cameras. Cameras are set for at least 30 consecutive days during October and November. Biologists review the photos and record the number of bucks, does, and fawns seen in each photograph.

Completed 2018 data revealed a total of 53,082 photos taken on 81 cameras during 2,473 camera trap nights. White-tailed deer were the most commonly detected species. At least one buck (9,338 photos), doe (13,762 photos), or fawn (10,329 photos) was detected in more than 24,000 photos. Some deer appeared in multiple photos, and some photos were of more than one deer. Based on observations, the statewide doe:buck ratio was 1.43:1 (CI_{95}=1.43 – 1.43), and the statewide fawn:doe ratio was 0.74:1 (CI_{95}=0.74 – 0.74).

The 2019 Snapshot Indiana season yielded nearly 140,000 photos. Analysis of these photos is ongoing, and results will be published in the 2020 Indiana White-tailed Deer Report. Currently, there are plans to expand the Snapshot Indiana program to new volunteers, state lands, and other underrepresented areas. Photographic data have the potential to serve as a method for developing long-term datasets for a variety of metrics, such as recruitment, buck quality, age ratios, and sex ratios. Individuals desiring to volunteer can sign up for the Snapshot Indiana program at on.IN.gov/snapshotindiana.

ARCHER'S INDEX

Joe Caudell, Olivia Vaught, Emily McCallen, and Gerianne 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 as a way 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 a number of furbearer species. See previous Archer's Index reports by searching wildlife.IN.gov. Volunteers may sign up to participate in the Archer's Index online at on.IN.gov/archersindex.

Methods

Prior to the 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 the early archery season, typically in late November. However, regulation changes were implemented in 2012 that extended the Archery season to one continuous season that ended in early January. Since then, the Archer's Index has ended one day prior to 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 (Figure 8-1). 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 2019, a total of 267 hunters in 91 counties reported deer observations in the Archer's Index. Hunters observed a total of 11,827 deer in 13,452 hours during 4,280 observational periods ranging from 0.25 to 10 hours. Hunters observed an average of 0.87 deer per hour (n=4,280, CI95=0.84 – 0.91; Figure 8-2). A total of 3,005 bucks, 4,833 does, 2,922 fawns, and 1,067 deer of an undetermined age and sex were observed. From the Archer's Index, the statewide fawn:doe ratio was 0.61:1 (CI_{95}=0.58 – 0.64), and the doe:buck ratio was 1.59:1 (CI_{95}=1.52 – 1.67). Comparatively, the harvest doe:buck ratio was 0.83:1 (CI_{95}=0.82 – 0.84; 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 citizen science 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 prior to gun 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 appear to be 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 their 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 prior to comparing to Indiana's fawn:doe ratios.

Currently, Indiana has an approximately balanced pre-hunt sex ratio (1.59:1). 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). The trend over the past 10 years apparently reflects the previous management strategy, with a decrease in observations that corresponds to a general management goal of decreasing the deer population by increasing harvest of does. Observations per hour have leveled off since 2013 (Figure 8-2), with only minor fluctuations since then.

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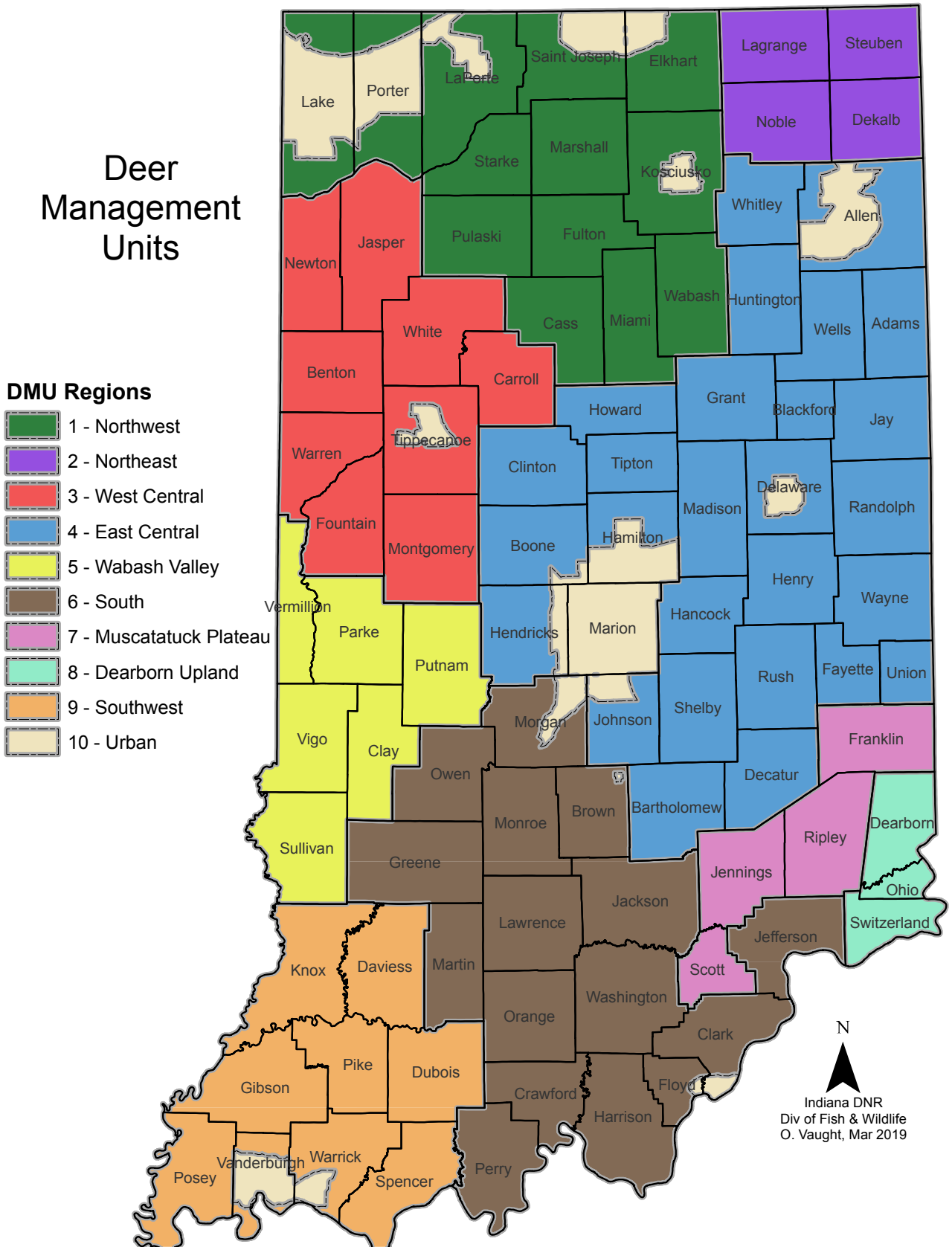

Figure 8-1. Deer management units (DMUs) created by Indiana DNR and Purdue University to better understand survey data trends regionally.

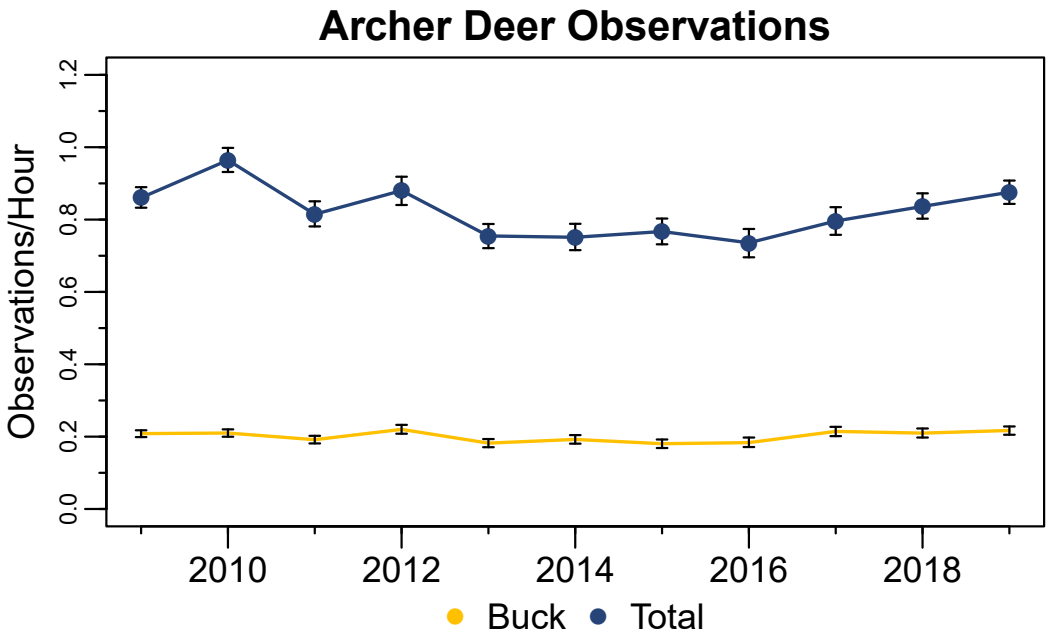

Figure 8-2. Statewide observations of bucks and total deer reported in the Archer's Index.

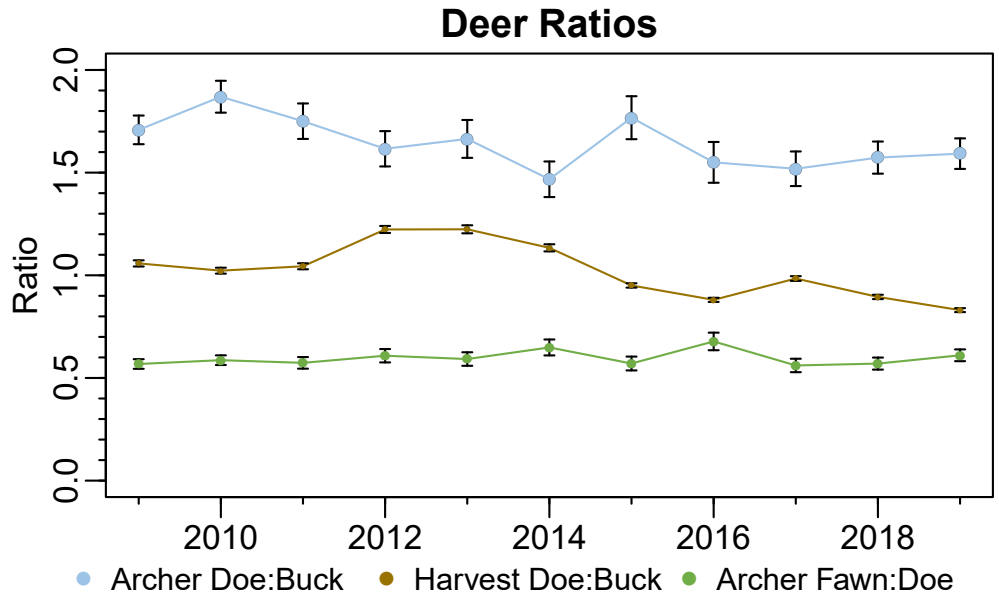

Figure 8-3. Statewide observation of doe:buck and fawn:doe ratios reported in the Archer's Index and the reported doe:buck harvest ratio from CheckIN Game data.

AFTER HUNT SURVEY

Joe Caudell, Olivia Vaught, and Emily McCallen, *Indiana Department of Natural Resources*

For many years, Indiana DNR biologists examined deer at manned check stations to which 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. In an effort to recapture information that had been collected at manned check stations, the After Hunt Survey was created in 2017 to allow hunters the opportunity to provide biological information about their harvested deer. The goal of the After Hunt Survey is for hunters to self-report on a sufficient number of deer, so that both hunters and managers can examine deer population biology, ecology, and demographics at the county level. The 2019-2020 deer season was the third year the 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.

Methods

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 later access the survey 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.

Results and Discussion

Sample Size – A total of 2,041 hunters responded to the survey, a 13% increase from the 2018-2019 survey. At least one response was received from each county; the highest number was 50 from Franklin County. Of all responses, 86.7% were completed entirely, while 13.3% were partially completed. To be able to assess data at the county level, 80-120 responses are needed from each county, depending on the number of categories for each question. If these numbers aren't obtained, data can be analyzed at a regional level based on nine of Indiana's 10 Deer Management Units (DMUs; Figure 8-1). Number of responses in DMU ranged from 84 (Dearborn Upland Unit) to 479 (South Unit; Table 8-1). No responses were attributed to the Urban Deer Management Unit.

Deer Ages – Hunters were asked to age their deer using tooth wear and replacement patterns. Excluding incomplete responses, hunters did not report the ages of 188 does and 347 bucks, including 69 bucks that were going to be mounted. In total, hunters reported the age of 409 does and 582 bucks.

Statewide, most deer were reported as 2.5 years old (Figure 8-4). There was an insufficient number of aged deer reported to summarize the age structure at the county level. Regional age structures were similar to the statewide distribution with two exceptions. Most of the aged does in the South (35.9%), Muscatatuck Plateau (39.1%), and Southwest (34.2%) DMUs were 1.5 years old. In the Dearborn Upland DMU, most of the aged bucks (30%) were 3.5 years old (Figure 8-5). Although the Muscatatuck Plateau DMU had a greater percentage of bucks 2.5 years old, the distribution of age classes was similar to that observed for other DMUs.

To access the accuracy and determine error rates for hunter-aged deer, hunters were asked to submit a photo of the deer's jaw. Only 15 photos were submitted, of which seven included an age estimate. Six were aged correctly; the other was aged two years older than what tooth wear indicated. Since the first After Hunt Survey in 2017-2018, hunters have submitted 51 photos of deer jaws, of which 36 included an age estimate. Twenty-nine (80.6%) were aged correctly. As more photos that include age estimates are submitted, Indiana DNR will be able to develop error rates for hunter-aged deer to better understand the age structure of the statewide deer herd.

Lactation Rates – Lactation rates provide an estimate of fawn recruitment, which is especially useful in setting harvest quotas. Low fawn recruitment may warrant a change to quotas because it indicates fewer deer are surviving and entering into next year's population.

During the 2019-2020 season, 771 hunters who harvested a doe reported that 160 (20.8%) were lactating and 429 (55.6%) were not; the remaining 182 hunters (23.6%) did not report the lactation status. From Octo-

ber 1, 2019 to January 6, 2020, 38% of adult does aged 2.5 years or older were reported lactating (Figure 8-6). Lactation rates for does aged 2.5 years or older (n=334) obtained from all three After Hunt Surveys depict a gradual decline as the season progresses (Figure 8-7). To report lactation rates at the county or regional level, especially for one season, the number of responses must increase substantially. The variation that results from the small sample sizes obtained thus far preclude reliable estimates of recruitment.

Hunter Experience – The After Hunt Survey asks several questions related to a particular hunting experience. On a scale of 0 (poor) to 100 (excellent), hunters were asked to rate their overall enjoyment of the hunt, the number of does and bucks they saw on the hunt, the quality of those bucks they observed, and how they felt Indiana DNR was managing deer in the county in which they hunt. Responses from quality of bucks (n=1,846), quantity of bucks (n=1,852), and quantity of does (n=1,881) were bimodal (Figure 8-8), meaning most responses were either at the low end or the high end of the scale. Responses about how Indiana DNR was managing deer in the county where they hunted (n=1,807) and how much they enjoyed their hunt (n=1,971) both indicated higher levels of satisfaction (Figure 8-9).

Antler Characteristics – Hunters reported 90% of the bucks harvested had a typical rack; the remaining 10% were non-typical. The total number of points on 1,053 harvested bucks averaged 7.3 (SD=3.1, CI95+0.2) with a median, or midpoint in the range of responses, of eight points. The average inside spread of 817 bucks was 13.5 inches (SD=4.9, CI95+0.3) with a median measurement of 14.5 inches. The total inches of antler, defined as the length of the main beam plus the length of each of the tines as measured from the center of the main beam along the longest portion of the tine, from 531 bucks, averaged 48.7 inches (SD=73.5, CI95+6.4).

Body Weights – Body weights can provide valuable information about the quality of deer and the relationship of recruitment to nutrition if data are frequently reported on small scales (i.e., county or 16-mile^2 grid level). Hunters (n=555) reported the field-dressed weight of their deer only if it had been weighed on a scale. Live weights (Figure 8-10) were calculated by multiplying the field-dressed weight by 1.26 as reported in Smart et al. (1973). The number of responses was insufficient to summarize body weights by age class at either the county or regional level. Self-reporting of body weights by hunters needs to be significantly higher for this factor to inform management.

Hunter Effort – The number of hours it takes to harvest a deer can be used to calculate harvest per unit effort, which can serve as an index for deer population size. Because this index may have an inherent selective bias, it should be viewed with caution. To illustrate, hunters may spend more time to harvest a particular buck than they would to harvest a doe.

Hunters (n = 1,192) reported they hunted an average of 24.5 hours (SD=34.4, CI_{95}+2.0) and a median of 12 hours before harvesting their buck (Figure 8-11). During this time, hunters (n = 1,190) saw an average of 3.0 bucks (SD=3.8, CI_{95}+0.1), with a median of two bucks; they (n = 1,189) saw an average of 5.8 does (SD= 9.5, CI_{95}+0.6), with a median of three does.

Hunters (n = 777) reported they hunted an average of 20.3 hours (SD=33.0, CI_{95}+2.4) and a median of eight hours before harvesting their doe (Figure 8-11). During this time, they saw an average of 1.1 bucks (SD=2.1, CI_{95}+0.1), with a median of zero bucks and an average of 5.0 does (SD=8.9, CI_{95}+0.6), with a median of three does. A significantly greater level of reporting is needed for hunter effort to inform management strategies at the county or regional level.

Hunter Preference – Hunters (n=678) who saw more than one buck when hunting were asked why they waited for the buck they harvested. They were allowed to choose more than one reason, which produced 785 total responses. A total of 245 hunters (36.1%) were waiting for a buck with larger antlers, 165 (24.3%) felt that the other bucks were out of the range for their equipment, 142 (20.9%) were waiting for an older buck, 87 (12.8%) felt it would not have been a safe shot, and 54 (8.0%) were waiting for a specific buck. A total of 92 hunters (13.6%) reported their reason was not listed.

Hunters (n=576) who saw more than one doe while hunting were asked why they waited for the doe they harvested. Hunters were again allowed to choose more than one reason, which produced 746 total responses. A total of 235 hunters (40.8%) were waiting for a larger, older doe, 161 (28.0%) felt that the other does were out

of range, 100 (17.4%) passed on does because they had fawns with them, 96 (16.7%) felt it would not have been a safe shot, 32 (5.6%) did not want to disturb the buck that was with the doe, and 22 (3.8%) were looking for a smaller, younger doe. A total of 100 hunters (17.4%) reported their reason was not listed.

The After Hunt Survey has potential to provide valuable biological information from harvested deer, including age, sex, and reproductive status. It may also be used to develop an index of harvest per unit effort. However, additional research is needed to evaluate the utility of harvest per unit effort as an accurate estimator of population size. Reporting must increase significantly before information collected in the After Hunt Survey can be reliably applied at the regional, county, or sub-county level. Increasing promotion of the survey in the annual Hunting/Trapping Guide, media outlets, and on social media will help to ensure a sufficient number of responses are obtained in order for this information to be used for management purposes.

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Smart, C.W., R. H. Giles, Jr., and D. C. Guynn, Jr. 1973. Weight tape for white-tailed deer in Virginia. Journal of Wildlife Management 34:553-555.

Table 8-1. Number of After Hunt Survey responses by Deer Management Unit, 2019-2020.

Deer Management Unit	Number of Counties in Unit	Number of Responses	% of Total Responses
1-Northwest	13	346	17.8%
2-Northeast	4	133	6.5%
3-West Central	9	146	7.2%
4-East Central	28	372	18.2%
5-Wabash Valley	6	167	8.2%
6-South	16	479	23.5%
7-Muscatatuck Plateau	4	125	6.1%
8-Dearborn Upland	3	84	4.1%
9-Southwest	9	171	8.4%
Total		2,041	

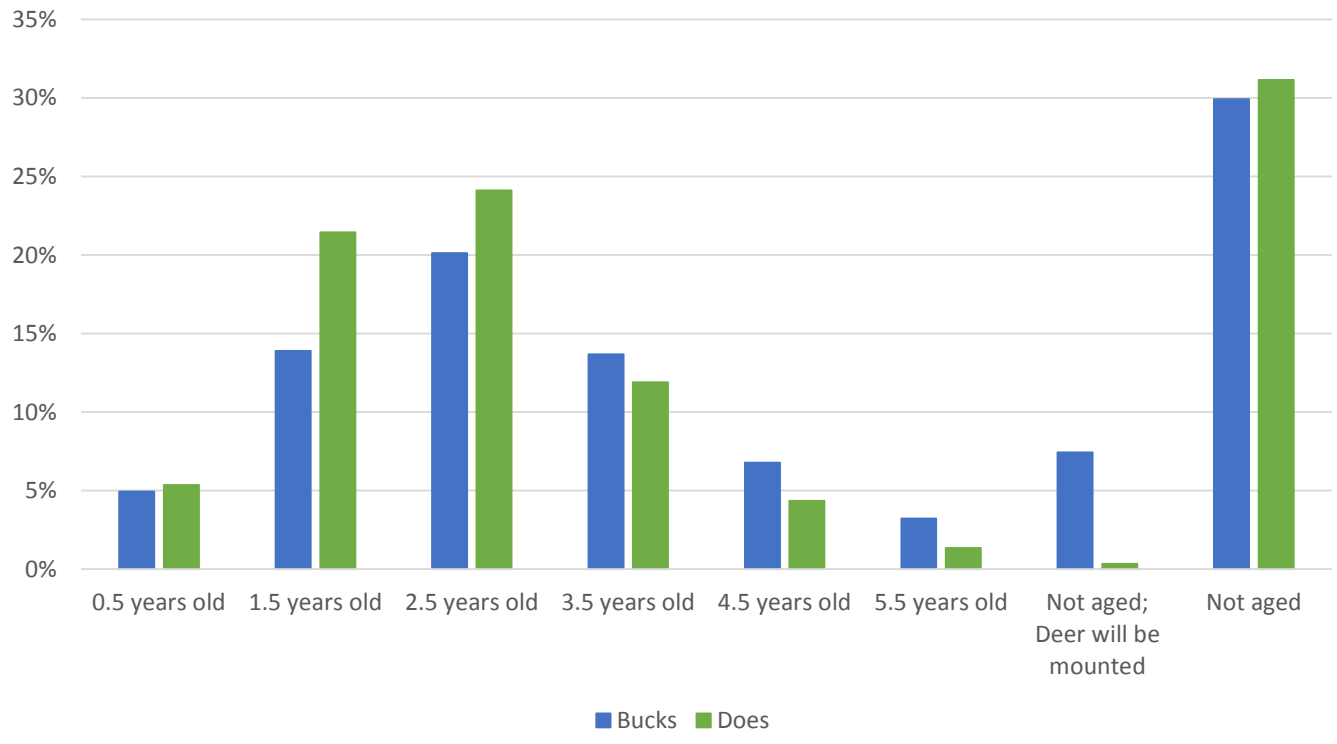
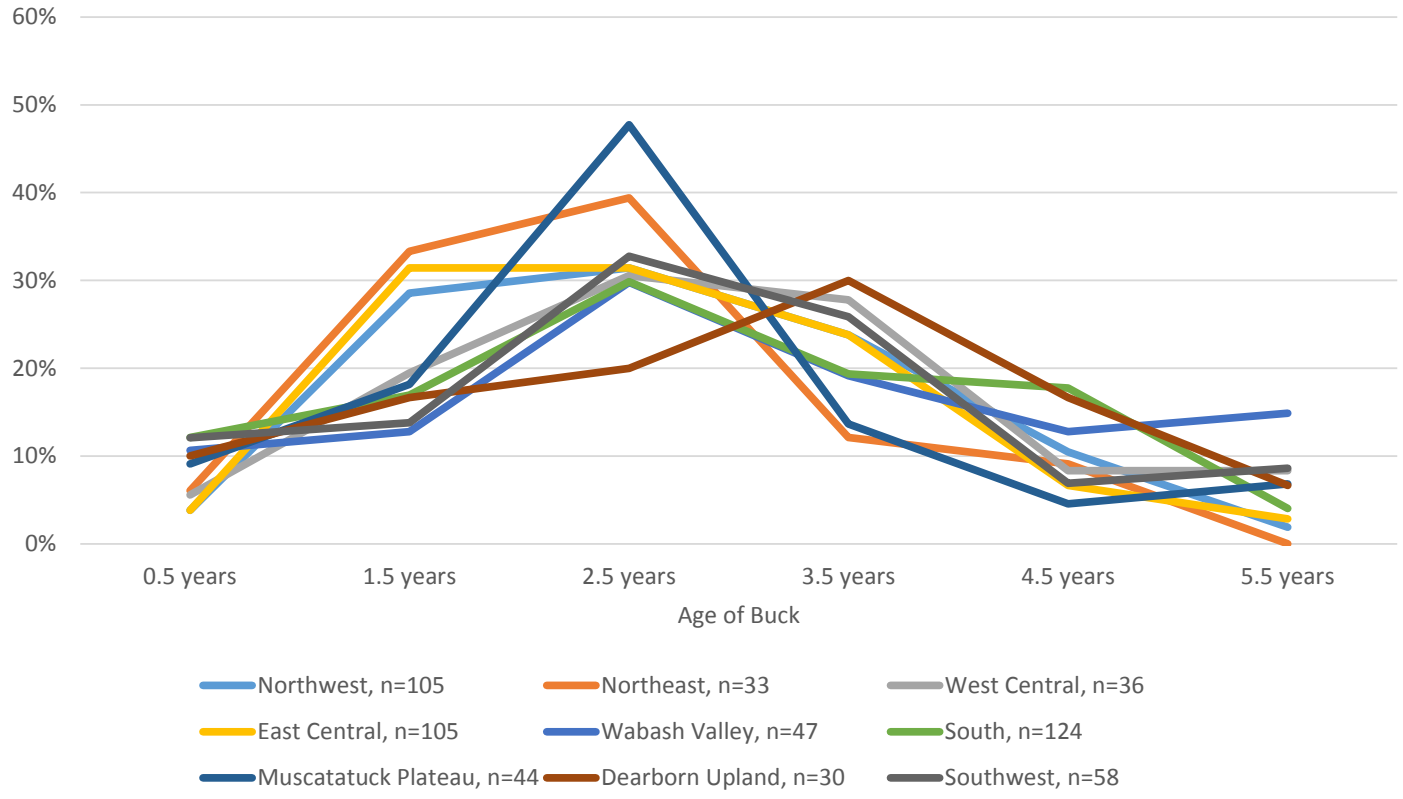


Figure 8-4. Age distribution of the statewide deer harvest reported in the 2019-2020 After Hunt Survey.



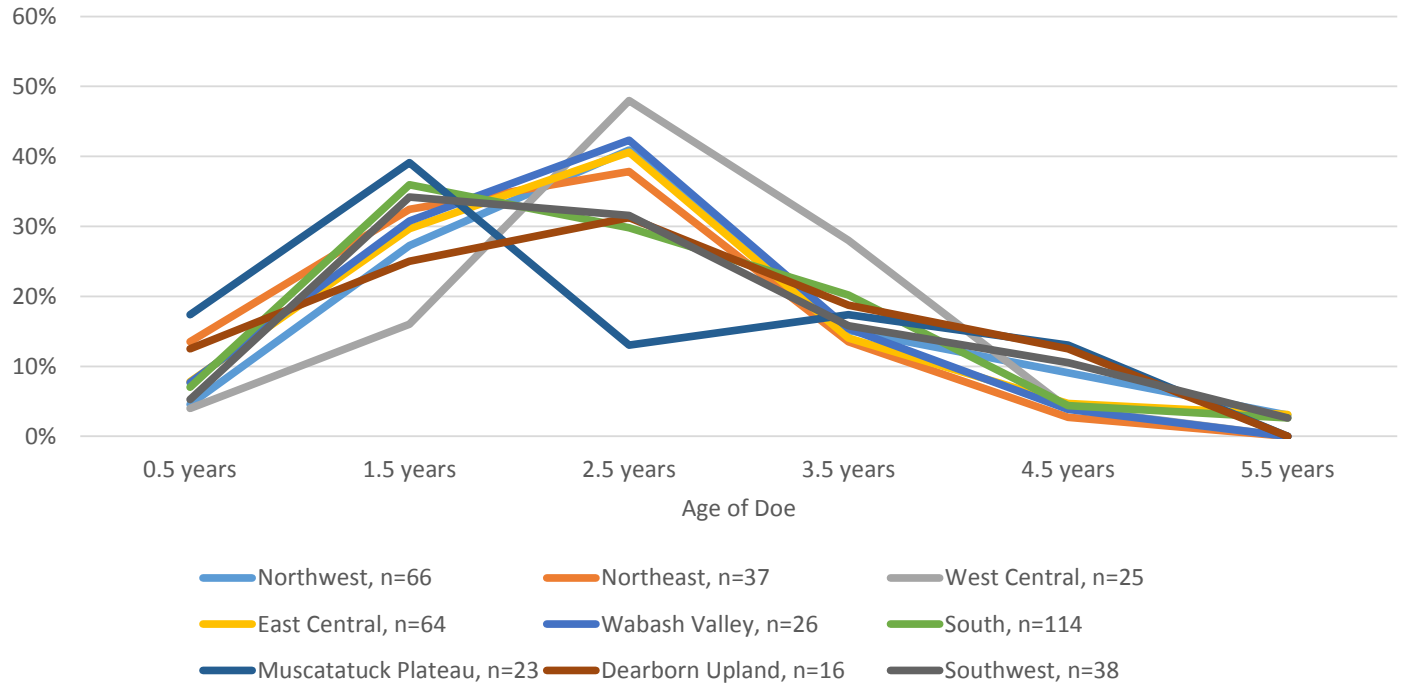


Figure 8-5. Age distribution of harvested bucks (upper graph) and does (lower graph) by Deer Management Unit reported in the 2019-2020 After Hunt Survey. The number of responses in each DMU is next to its name.

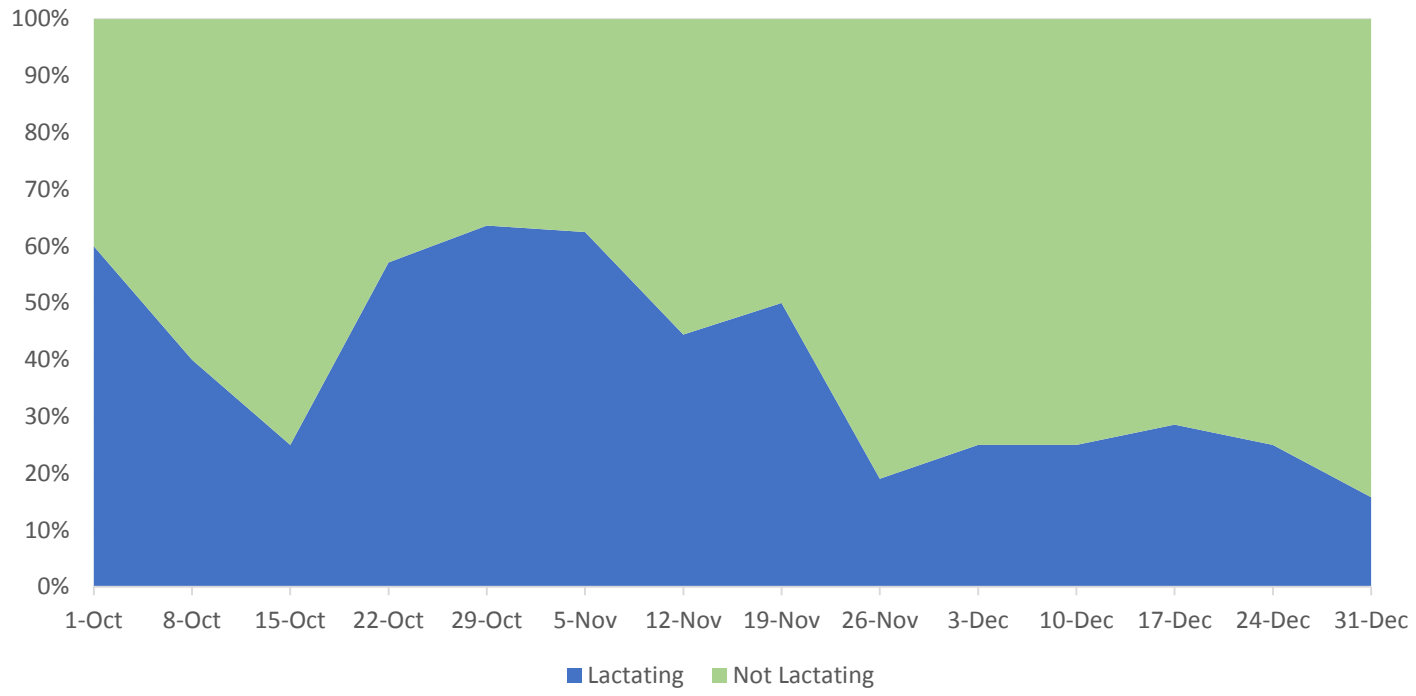


Figure 8-6. Weekly lactation rates of does at least 2.5 years old during the regular deer hunting season (October 1, 2019 – January 6, 2020) reported in the 2019-2020 After Hunt Survey.

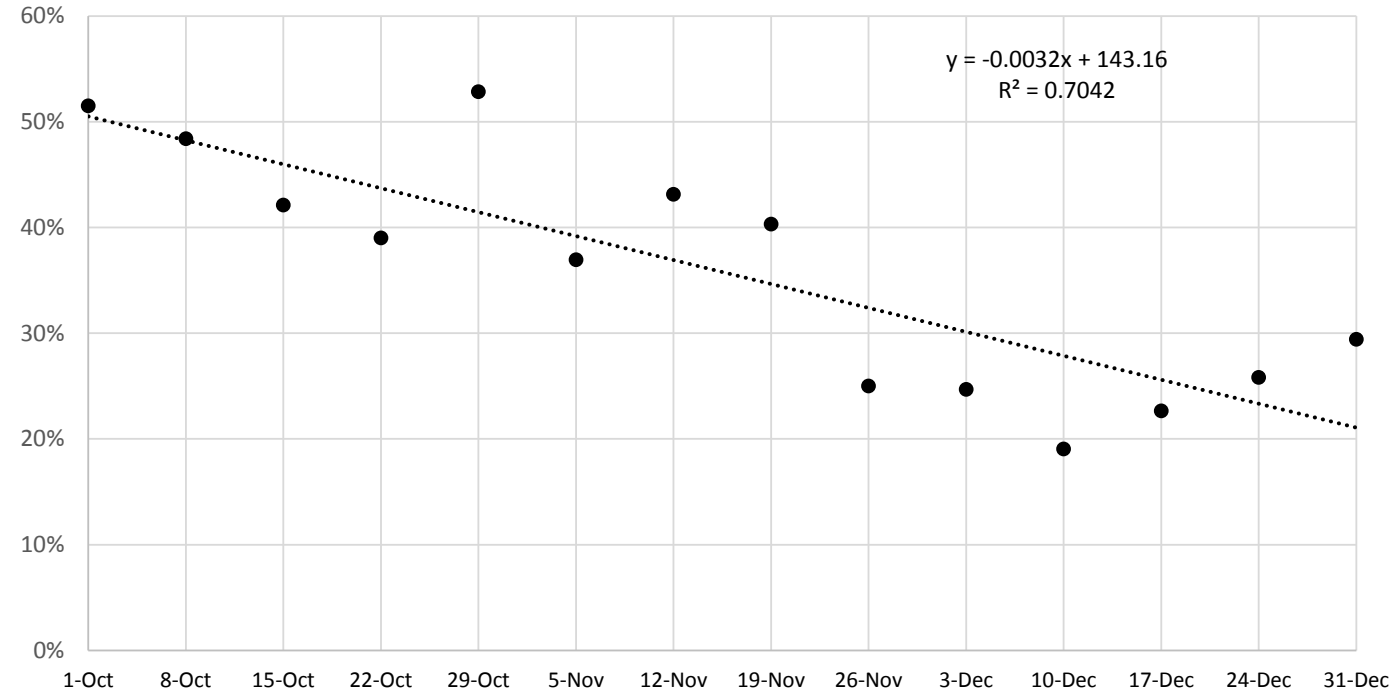


Figure 8-7. Cumulative weekly lactation rates of does at least 2.5 years old reported in the After Hunt Surveys from 2017-2018 to 2019-2020. The trend line indicates a gradual decline in lactation rates as the season ends.

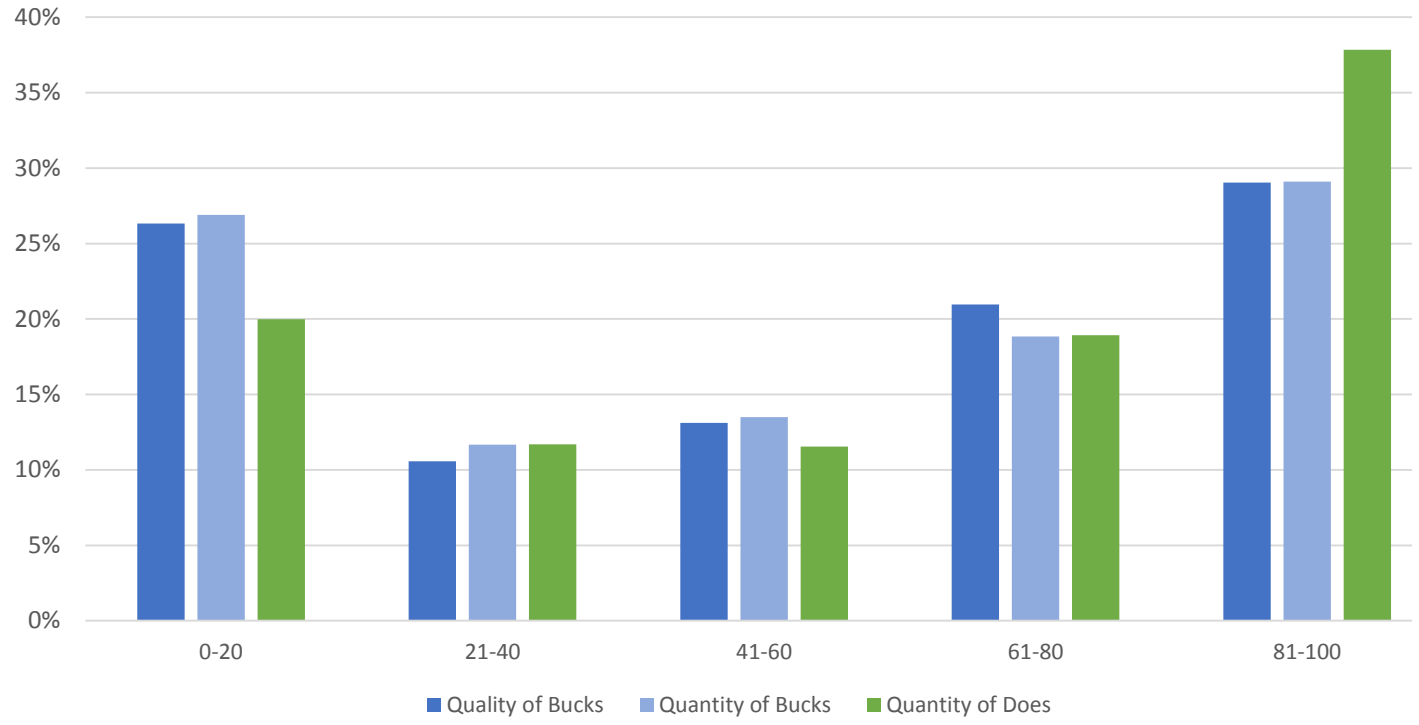


Figure 8-8. Hunter opinion about the quality and quantity of bucks and the quantity of does observed while hunting during the 2019-2020 deer hunting season. Scores range from 0 (poor) to 100 (excellent).

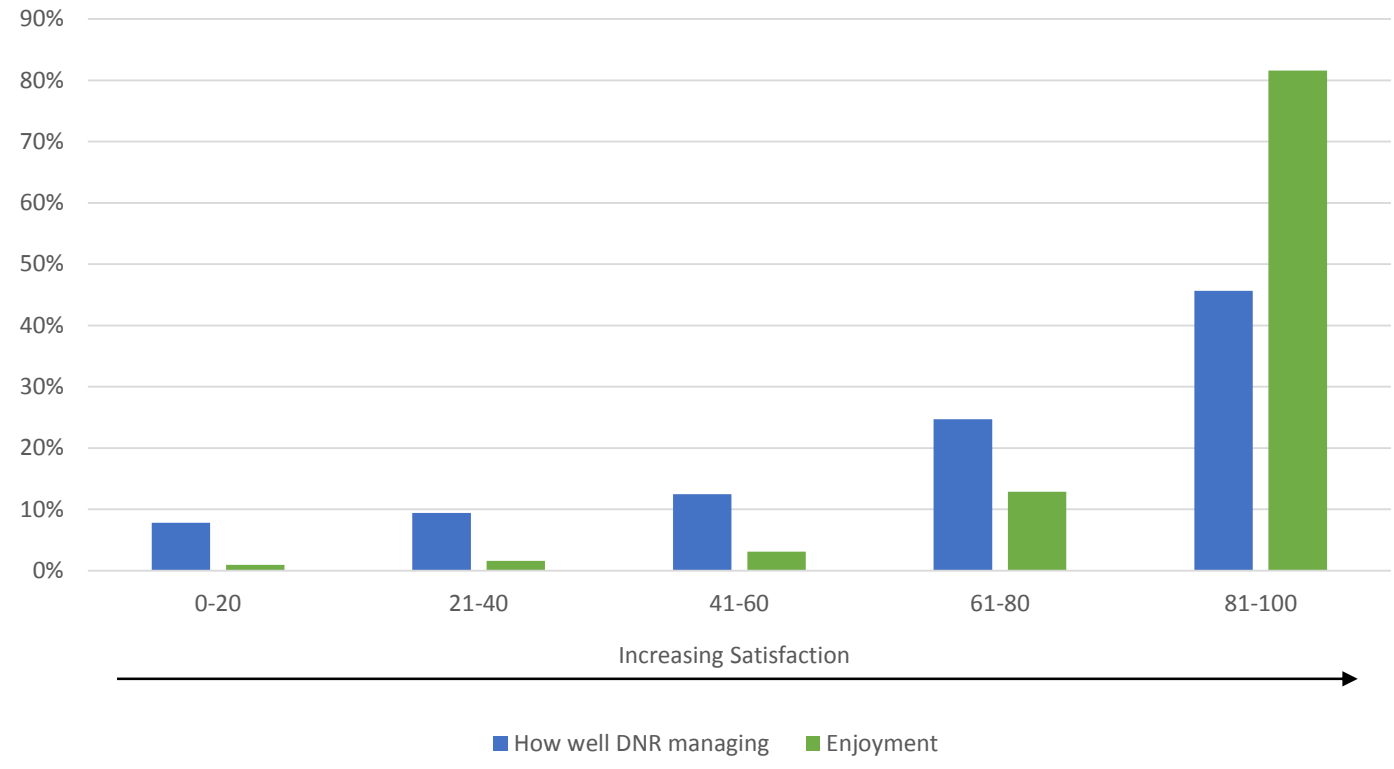


Figure 8-9. Hunter opinion about how the Indiana DNR is managing the deer in the county where they hunted and their enjoyment of the hunt during the 2019-2020 deer hunting season. Scores range from 0 (poor) to 100 (excellent).

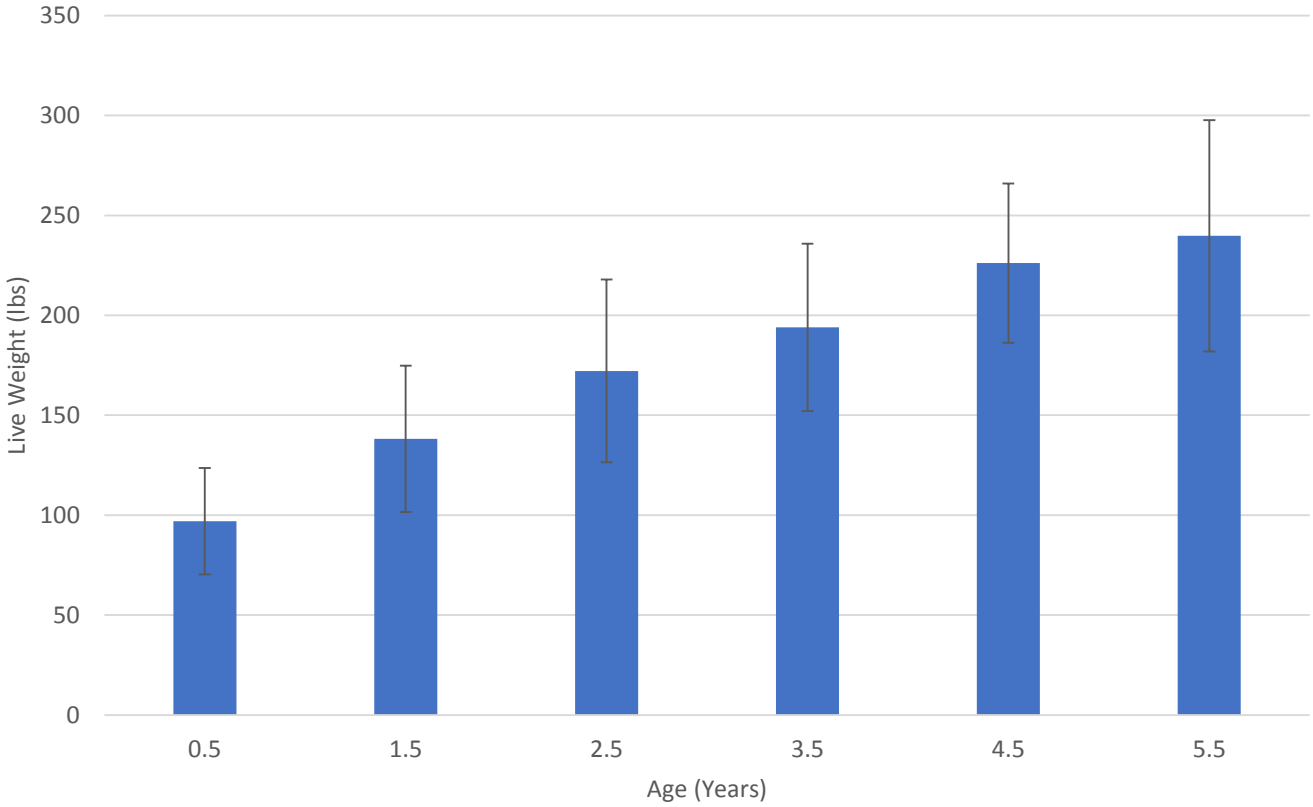


Figure 8-10. Live weights of deer by age class reported in the 2019-2020 After Hunt Survey. Of the 555 hunters who reported a weight, only 338 (61%) also reported the age of the deer.

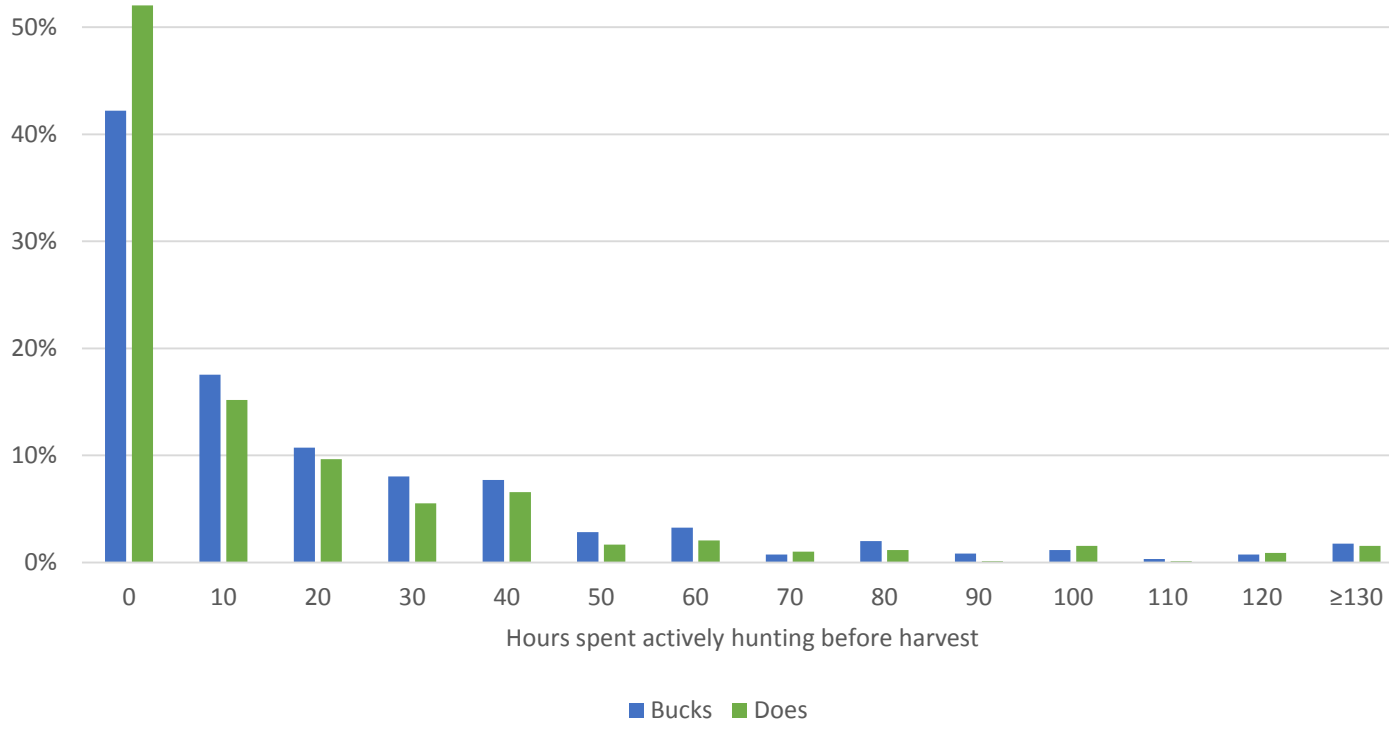


Figure 8-11. Number of hours hunters spent actively hunting before harvesting a buck or a doe during the 2019-2020 deer hunting season, as reported in the 2019-2020 After Hunt Survey.

CHAPTER 9. DNR DEER RESEARCH

EFFECTS OF HIGH-POWERED RIFLE LAW

Joe Caudell and Olivia Vaught, *Indiana Department of Natural Resources*

Indiana law IC 14-22-2-8, a law permitting the use of high-powered rifles to hunt deer on private land, was established in 2016 and given an expiration date of June 30, 2020 to determine if there were any issues related to the law. The DNR Division of Law Enforcement closely monitors hunting related incidents. Since the law was initiated, there have been no confirmed reports of injury or damage to property as a direct result of using high-powered rifles while deer hunting. Some hunting incidents have occurred since 2016, but these were no different than what normally occurs with using non-high-powered rifles or pistol-caliber rifles.

During the first year of the new legislation, many hunters changed the type of equipment they used to harvest deer. Of hunters who used equipment types other than a rifle in 2015, 8,399 used a rifle to harvest at least one deer in 2016. Specifically by equipment type, more than 20% of the hunters who used a bow, crossbow, handgun, or muzzleloader in 2015 used a rifle in 2016, either in place of or in combination with non-rifle equipment (see 2016 Indiana White-tailed Deer Summary; on.IN.gov/IN-deerreport).

In 2015, 17,918 hunters harvested at least one deer using a rifle. This number increased from that of the previous year to 34,347 hunters (+92%) in 2016; 35,025 hunters (+2%) in 2017; and 36,951 hunters (+6%) in 2018 (Figure 9-1). During the 2019 season, 40,536 hunters harvested at least one deer using a rifle, a 10% increase from the 2018 season. About 3,000 hunters in 2016 and nearly 2,400 in 2017 purchased a license for the first time and used it to harvest at least one deer using a rifle. This number increased slightly to 2,455 hunters in 2018 and to 2,662 hunters in 2019.

The 2016 total deer harvest was 4% less than in 2015, despite a 92% increase in the number of deer harvested with a rifle. This indicated a shift in equipment type used to harvest deer rather than a change in the total number of deer harvested. Harvests using shotguns had the greatest decline in both 2016 (33%) and 2017 (31%), and continued to decline, by 12% in 2018 and by 9% in 2019 (Figure 9-2). Muzzleloader use decreased from the preceding year by 33% in 2016, 8% in 2017, and 7% in 2018, but increased by 3% in 2019. From 2017 to 2019, the use of rifles to harvest deer steadily increased each year.

Hunters took more than twice the number of antlered bucks with a rifle in 2016 than in 2015, but 8% fewer in 2017 than in 2016 (Figure 9-3). In 2018, hunters harvested 12% more antlered deer with a rifle than in 2017. Antlerless harvest using a rifle decreased by 4% in 2018. In 2019, hunters harvested 17% more antlered deer and a similar number (-0.9%) of antlerless deer with a rifle when compared to 2018.

These data indicate rifles were a popular alternative to other firearms types traditionally used to harvest deer, particularly during the firearms season. Firearms hunters chose high-powered rifles over shotguns, muzzleloaders, and other equipment, but harvested a similar number or slightly fewer deer each year (Figure 9-4). Overall, this implies the use of high-powered rifles is a popular equipment choice, but does not result in a significant increase in harvest.

A concern expressed by hunters is how the new rifle law would affect their ability to access private land. To address this, in the 2019 Deer Management Survey, hunters were asked What reasons have private landowners given to you when you have been denied access to private land? Hunters were allowed to provide a write-in response why they had been denied access. Of the 3,468 respondents, only 0.6% reported they had been denied access because the landowners were concerned with the law allowing high-powered rifles to be used on private land, primarily related to beliefs of reduced safety.

Indiana DNR also asked hunters Have you ever lost permission to hunt on private land where you previously had permission to hunt it? Less than 1% of hunters who provided a write-in response reported they had been denied access because the landowners were concerned with the law allowing high-powered rifles to be used on private land, primarily related to beliefs of reduced safety, especially on smaller parcels of land.

The survey data indicate that the ability for hunters to use high-powered rifles is not a major factor for being denied access to private land or the loss of access to private land for hunting, even though it does occur occasionally. It is not surprising that it is not a major factor because private landowners have the ability to restrict which type of equipment hunters can use on their land. When landowners prefer that hunters do not use rifles on their land, it is common for landowners to still allow hunting with bows, crossbows, muzzleloaders, and other short-range equipment to address safety concerns, or equipment to avoid disturbing other family members, pets, livestock, or neighbors. Even if landowners have a concern for safety, they are still protected from liability under state law IC 34-31-9, which states a landowner/tenant is not liable for the injury or death of someone participating in natural resources-based activities on that person's property if the death or injury results from the inherent risks of such activity. Additionally, Indiana DNR provides a permission form for use by landowners to give to those who hunt their land that includes this information.

Another common concern among hunters is that high-powered rifles provide a significant advantage over other types of equipment, such as shotguns, muzzleloaders, and archery. In the 2018-19 After Hunt Survey, hunters were asked to report the equipment they used to harvest their deer, the perceived maximum range of that equipment, and the number of hours they spent harvesting their deer. If the equipment type provides a significant advantage, hunters who use more efficient equipment (defined as the maximum range that equipment can be used to harvest a deer) should require less time to harvest a deer. High-powered rifles were reported as having the greatest maximum range, and 77% of hunters reported they felt they could successfully harvest a deer between 150 and more than 200 yards. Other firearms (pistol-caliber rifles, shotguns, and muzzleloaders) were in the next category, with more than 80% of hunters reporting the maximum range with this equipment was between 50 and 150 yards. Bows, crossbows, and pistols were ranked as having the shortest range, with most hunters selecting that the maximum range was between 30 and 50 yards. High-powered rifles do provide an advantage in terms of the greatest distance from which a deer can be harvested. However, the amount of time spent to harvest a deer did not differ statistically between rifles and other equipment, including the shortest-range equipment. Hunters are likely more selective for the type of buck they want to harvest compared with harvesting a doe to fill their freezer. Although equipment does affect the time spent to harvest a deer, the large variation in hours spent hunting suggests other factors such as hunter skill level, selectivity, experience, and weather conditions have a greater effect on the time needed to harvest a deer than the equipment used.

Indiana DNR believes that the use of rifles for deer hunting is gaining popularity. Deer hunters are abandoning the use of other equipment, especially shotguns, and using rifles to deer hunt. The ability to use high-powered rifles is not a significant factor in limiting access to private land for deer hunting, increasing hunter success, or causing additional hunting accidents. In addition to hunting logistics, Indiana DNR is also interested in understanding how perceptions of hunting have changed after the legalization of high-powered rifles. In the 2020 Deer Management Survey, hunters were asked a series of questions about their hunting related to high-powered rifles. A summary of the questions and responses can be found in Chapter 7 of this report.

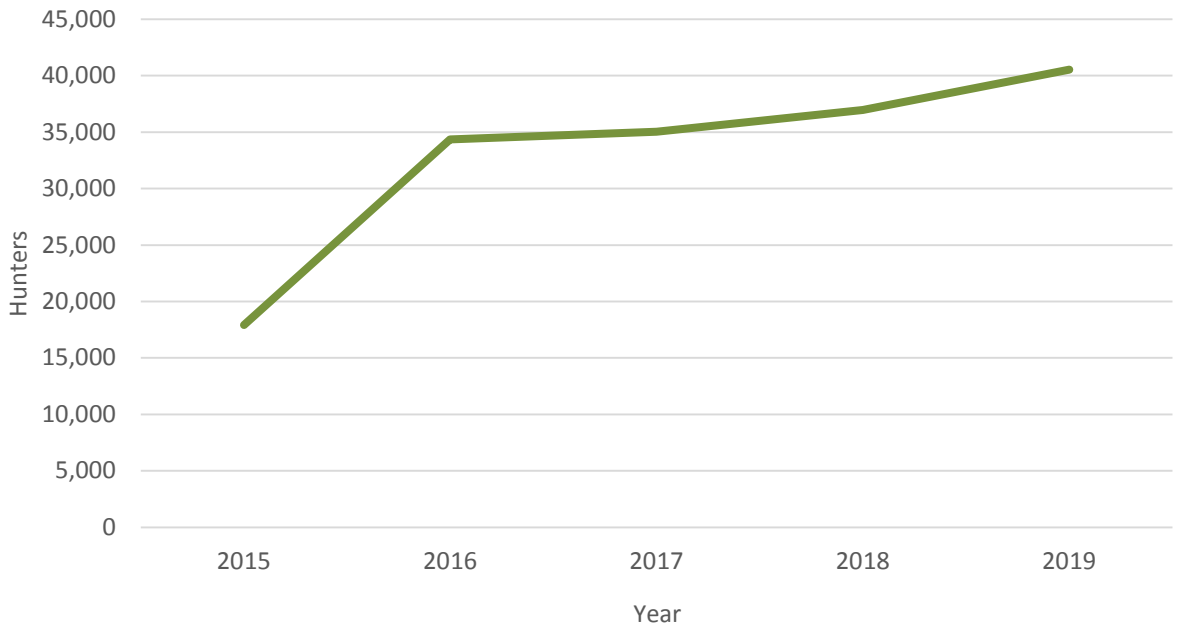


Figure 9-1. Number of hunters who used a rifle to harvest at least one deer during the hunting season, 2015-2019.

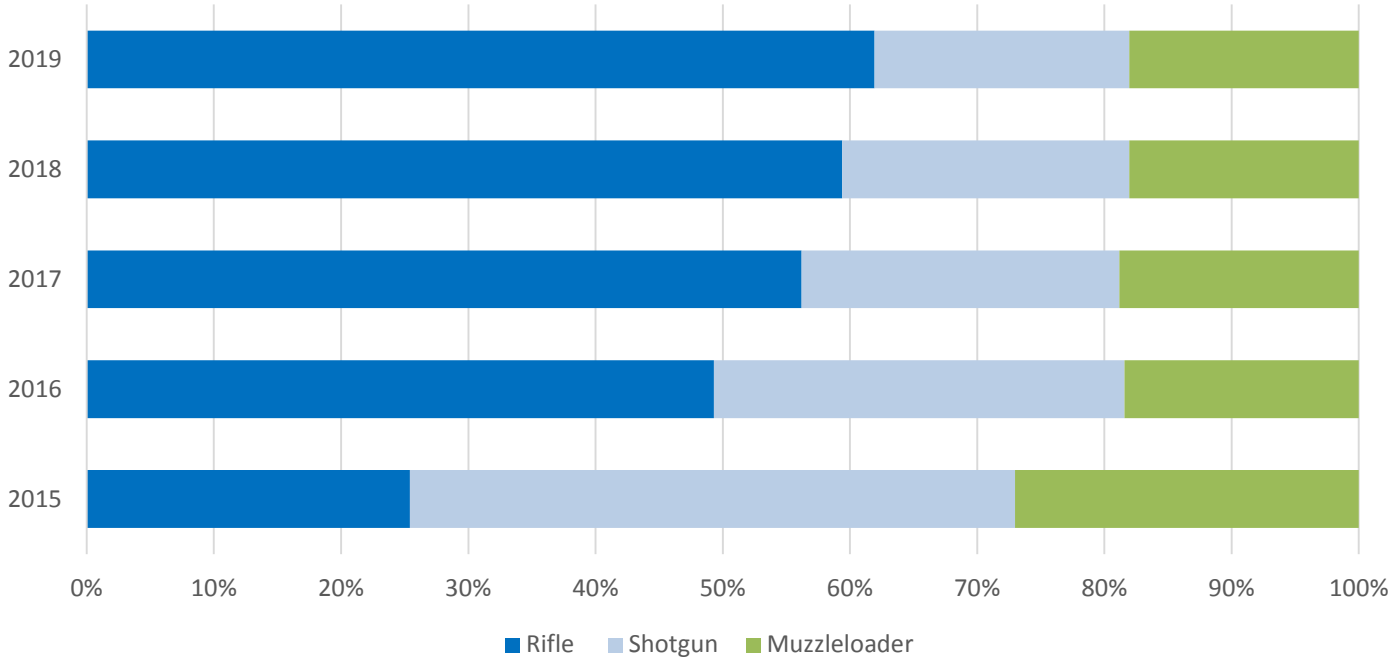


Figure 9-2. Proportions of deer harvested using a rifle, shotgun, or muzzleloader during the deer hunting seasons, 2015-2019.

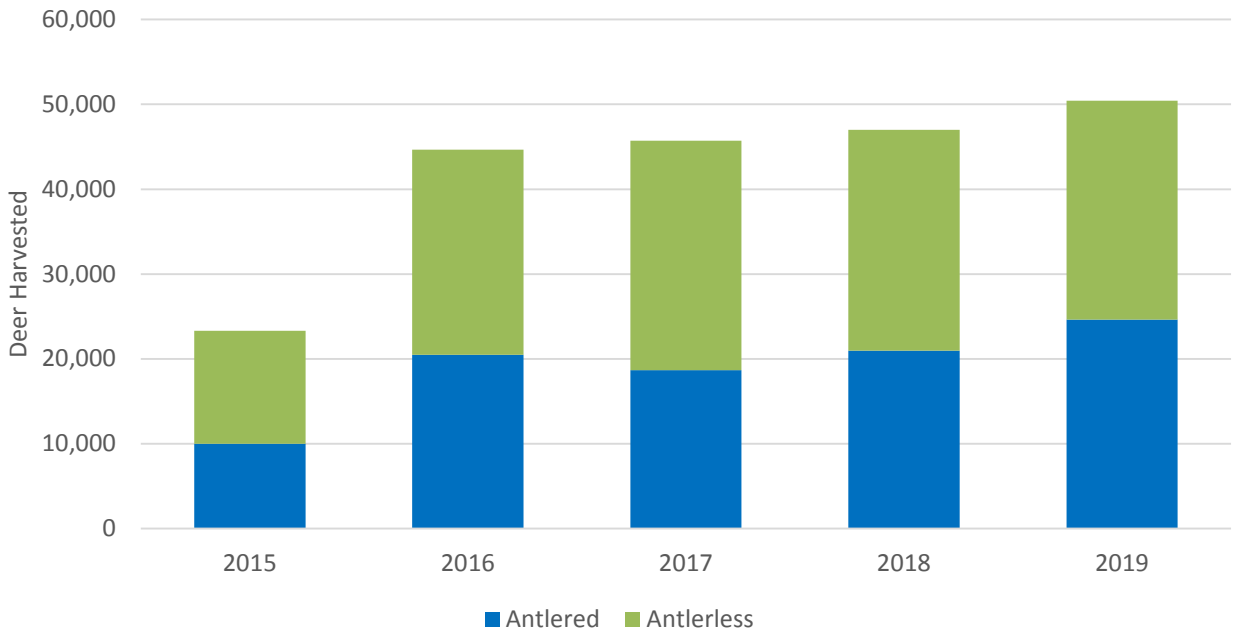


Figure 9-3. Number of antlered and antlerless deer harvested using a rifle in 2015-2019.

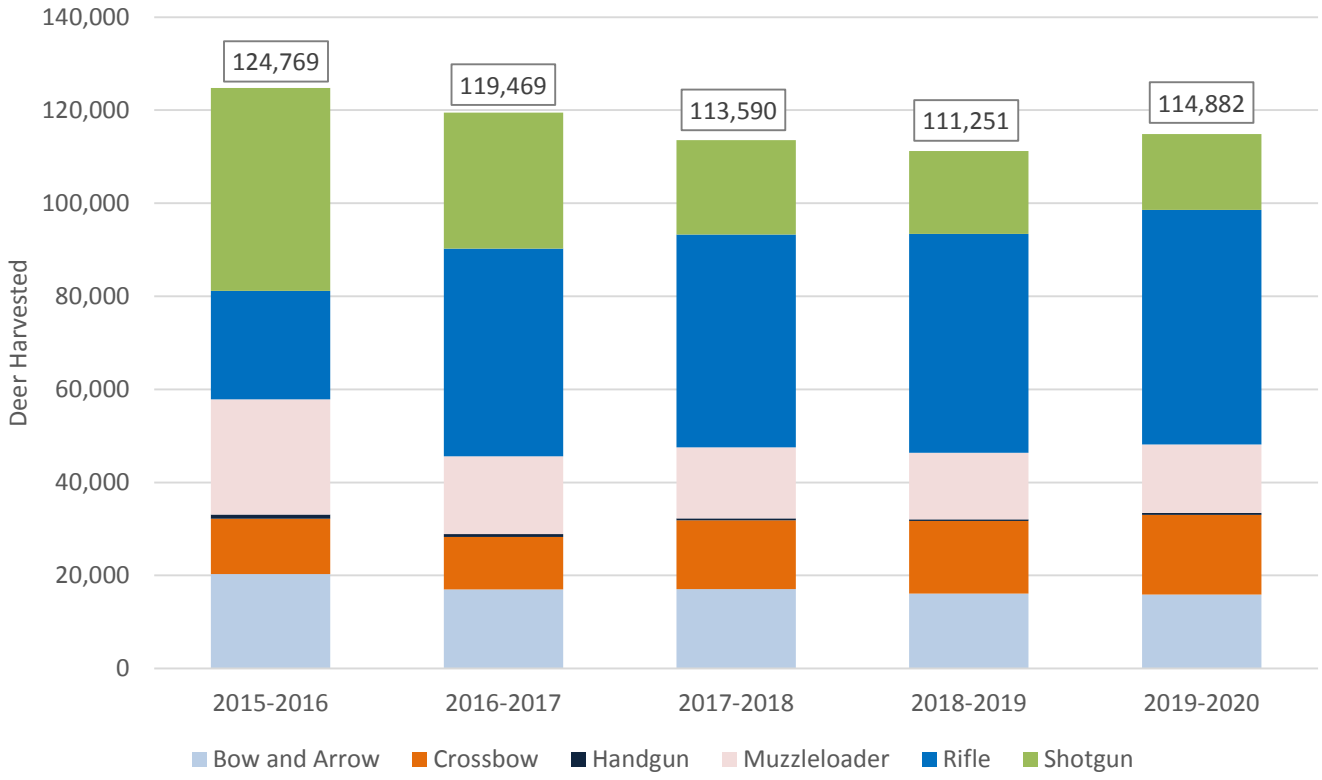


Figure 9-4. Number of deer harvested by equipment type during the deer hunting season, 2015-2019. Each bar is labeled with that year's harvest total.

EXAMINING TEMPORAL AND SPATIAL PATTERNS IN WHITE-TAILED DEER BREEDING ACTIVITY USING DEER-VEHICLE COLLISIONS

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

The peak of the rut is the point in the breeding season when bucks are most active and distracted searching for does. Hunters are interested in this time period because of the greater potential for seeing and harvesting a buck. Deer breeding begins when antlers become hardened, and it ends when the antlers drop off. The timing of deer breeding follows a bell-shaped curve that tracks the number of does that are bred on any given day. Most does are bred in the middle of the breeding season, and fewer does are bred at the beginning and the end. Peak rut typically occurs about halfway between these points, resulting in the high level of breeding.

Peak rut information is typically obtained through herd health checks where deer are shot in the spring and examined for indicators of condition, reproduction, and disease to inform management. With this technique, deer fetuses are measured, and the conception dates of the does are back-dated. Conception dates are plotted on a graph to determine when the peak rut occurred. Herd health checks have not been used in Indiana, and as a result, Indiana DNR has not had peak rut data in the past. In Georgia, researchers found that the number of deer-vehicle collisions peaked at the same time as peak rut. Essentially, as the rut increased, peaked, and then decreased, so did the number of deer-vehicles collisions (Stickles et al. 2015). The collision data matched up with the conception data collected from fetus measurements. Indiana DNR has access to a wealth of deer-vehicle collision data from the Indiana Department of Transportation (INDOT) that can be used as an indicator of rut timing.

The number of collisions between white-tailed deer and vehicles peaks during the breeding season because of increased movement and decreased vigilance of deer (Steiner et al. 2014). The deer-vehicle collision records from INDOT include both location and time data, so the seasonal variation in deer-vehicle collisions and breeding activity can be estimated through both space and time (Stickles et al. 2015). We used 17 years of deer-vehicle collision data provided by INDOT to track peak rut across years and counties in Indiana.

To determine peak rut in each year, we first extracted all deer-vehicle collisions that occurred from Sept. 1 to Dec. 31 in a given year. To normalize this data by county, we calculated the percentage of deer-vehicle collisions that occurred each day in each county and averaged these values across all counties. We used local regression to smooth the data and determined the day that the regression curve predicted the greatest number of collisions (Figure 9-5).

We used a similar approach to determine county peaks. After extracting all deer-vehicle collisions that occurred in a given county, we normalized the data by year. We calculated the percent of deer-vehicle collisions that occurred each day in each year and averaged these values across all years before we smoothed the data and used local regression to predict the day with the greatest number of collisions. We used contiguity-constrained clustering (Assunção et al. 2006) to form groups of counties with similar dates of peak rut.

A total of 132,889 deer-vehicle collisions were included in the analysis. In the yearly analysis, the average date of peak rut was Nov. 10 and ranged from Nov. 6 to Nov. 14 (Figure 9-6). There has been no discernable change in peak rut from year to year, but there has been a detectable difference in peak run throughout different parts of Indiana. In the county analysis, the average date of peak rut was still Nov. 10 but ranged from Nov. 2 to Nov. 16 (Figure 9-7). Based on the clustering analysis, there is some evidence of a spatial gradient in the state, with the earliest rut occurring in northeastern counties, and the latest rut occurring in southwestern counties (Figure 9-8). However, three counties (Wells, Blackford, and Jay) have a later rut than their surrounding northeast and north-central neighbors.

Our analyses indicate that peak rut is relatively stable in Indiana, which is expected for Northern and Midwestern states (Adams 2013). However, spatial variation is apparent across the state, with the average date of peak rut differing up to two weeks in some counties. In the next stage of analysis, we will use fetal data taken on past deer damage permits to verify the predictions of peak rut based on deer-vehicle collisions.

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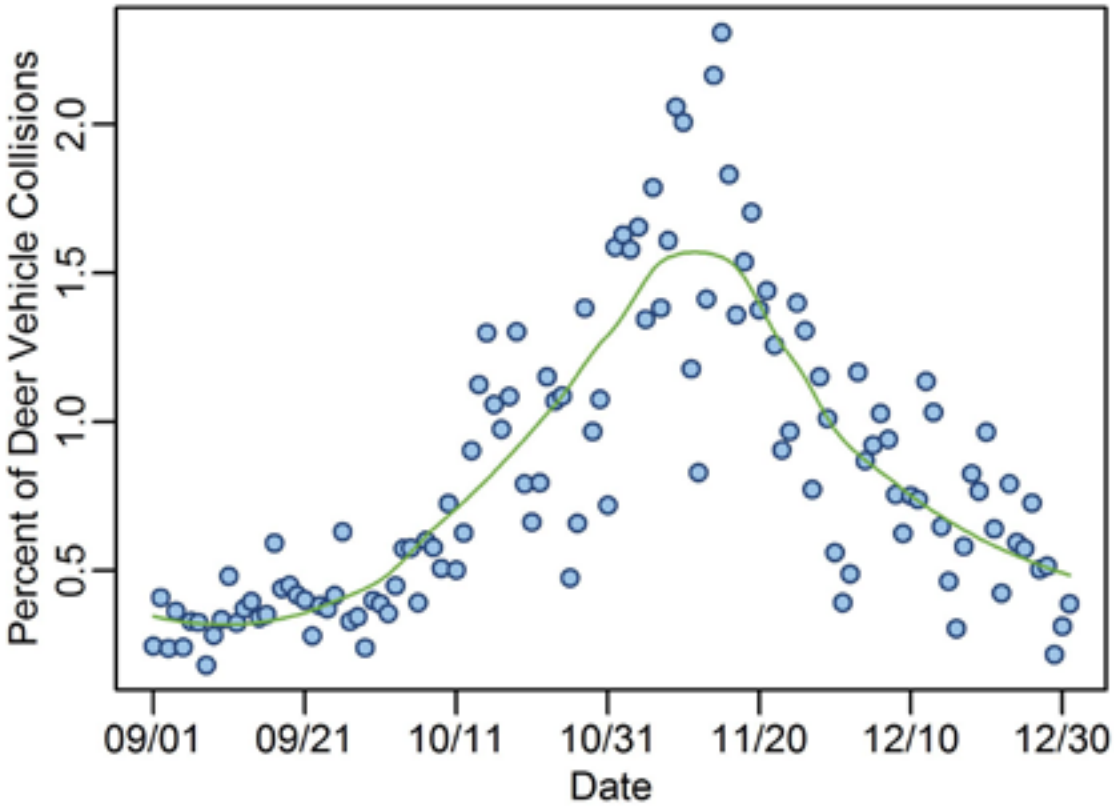

Figure 9-5. Percentage of deer-vehicle collisions each day during late 2019. The green line is a smoothed trend line calculated with local regression.

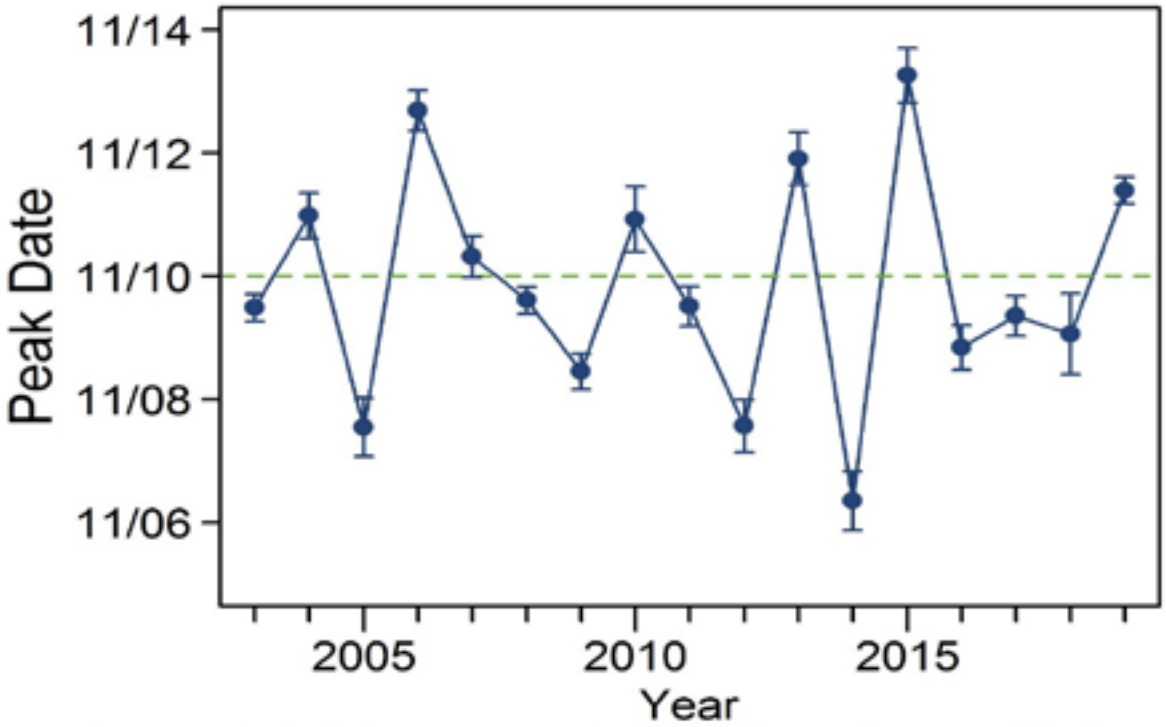

Figure 9-6. The annual date that deer-vehicle collisions peak in Indiana. The number of collisions increase during rut. Bars represent 95% confidence intervals.

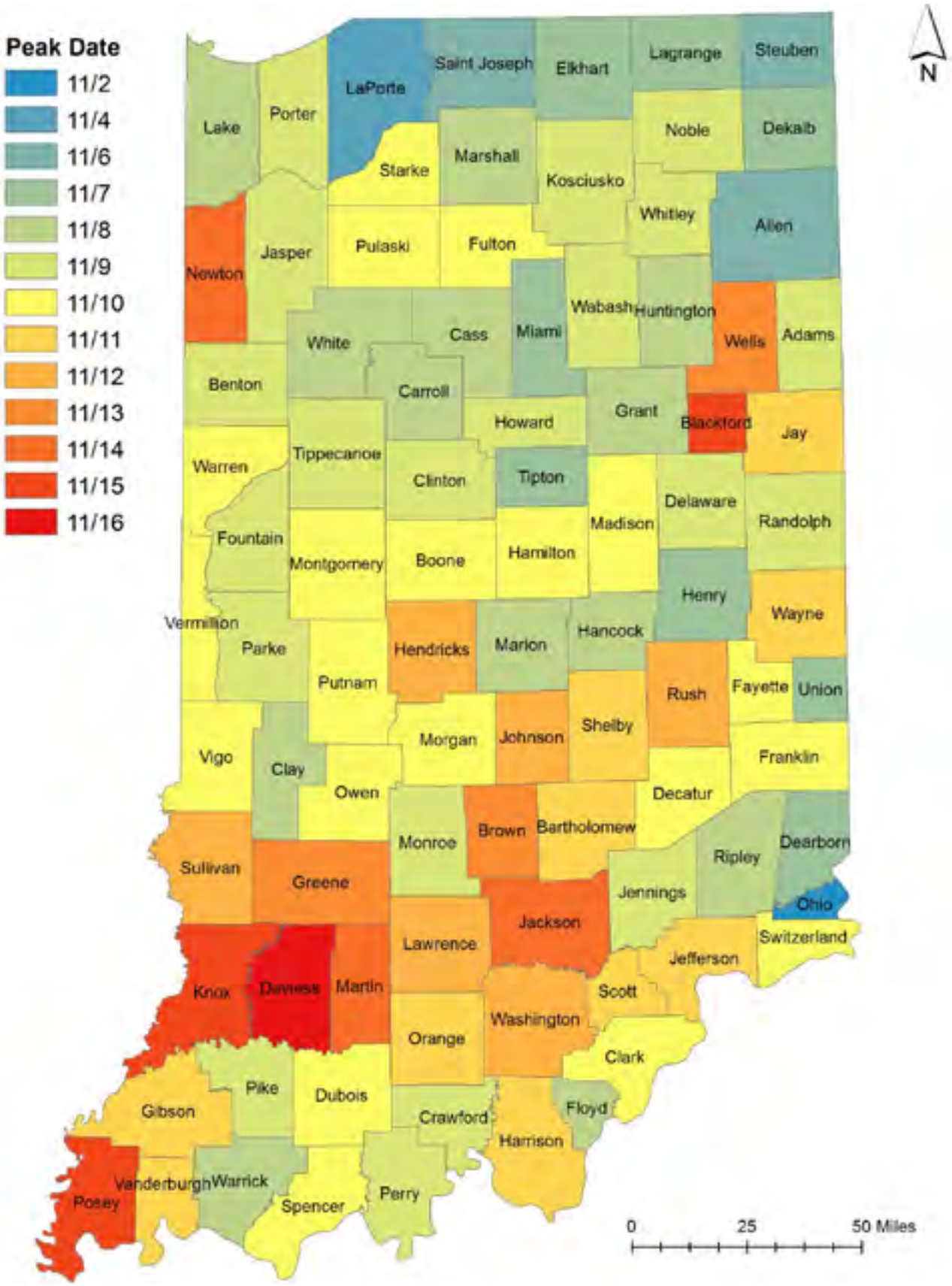

Figure 9-7. The mean date of peak rut in each county in Indiana, based on the number of deer-vehicle collisions from 2003-2019.

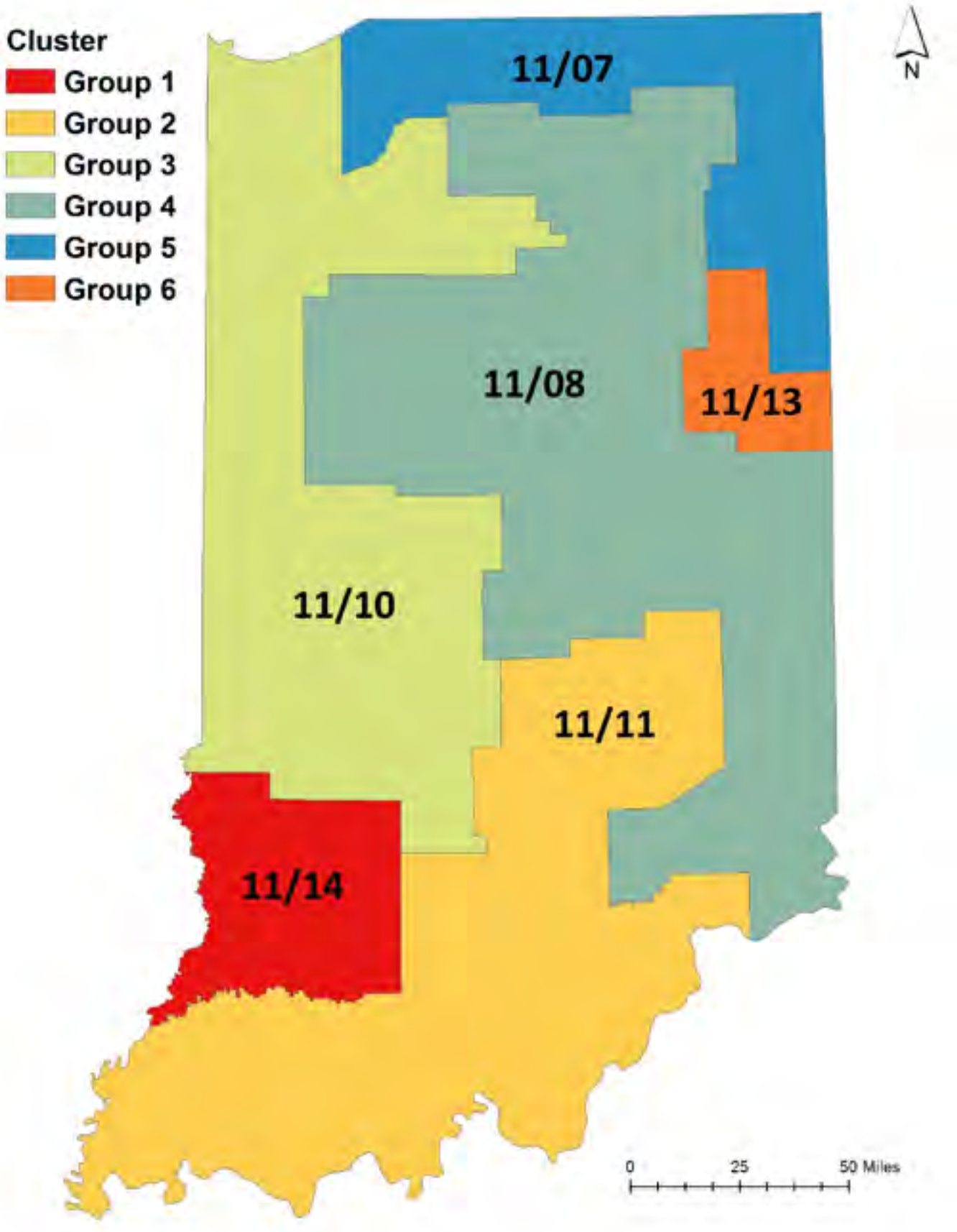

Figure 9-8. Results of a contiguity-constrained clustering used to form groups of Indiana counties with similar dates of peak rut.

THE EFFECTS OF THE SPECIAL ANTLERLESS FIREARMS SEASON ON ANTLERLESS HARVEST

Emily McCallen, *Indiana Department of Natural Resources*

The special antlerless firearms season was started during the 2012-2013 Indiana deer season to provide hunters with additional opportunities to harvest antlerless deer in counties with high county bonus antlerless quotas (CBAQ) and to draw hunters into those areas with abundant deer. The season runs from Dec. 26 until the first Sunday of the following January in counties with a CBAQ of four or more. We were interested in determining the effect of the season on antlerless harvest.

To answer this question we examined trends in antlerless harvest in counties that dropped from a CBAQ of 4 to a CBAQ of 3 in 2017 or 2018. Because so few hunters harvest more than three antlerless deer per season (< 1% in counties with a CBAQ of 4), changes to antlerless harvest in these counties should be largely attributable to the loss of the special antlerless firearms season. We excluded counties with deer reduction zones from our analysis because they also provide additional opportunities to harvest antlerless deer.

In each county, we compared harvest metrics from the last season with a CBAQ of 4 to the first season with a CBAQ of 3. We examined the percent change in firearms antlerless harvest and total antlerless harvest. We also examined changes in underlying variables that affect antlerless harvest. These included percent change in the total number of successful firearms hunters, the number of successful firearms hunters that harvest an antlerless deer, and the number of antlerless deer harvested per successful antlerless deer hunter. To account for normal annual variation, we adjusted estimates based on counties in the same deer management unit that did not see a change in CBAQ during the same period. In this way, we estimated the percent change beyond what we would expect due to annual variation alone.

There were 10 counties in Indiana that met the qualifications, including two that changed in 2017, and eight that changed in 2018 (Figure 9-9). Antlerless firearms harvest decreased 15.78% ± 2.4%, and total antlerless harvest decreased 17.6% ± 3.0%. The total number of successful firearms hunters decreased 6.61% ± 1.0%, the number of successful firearms hunters that harvest an antlerless deer decreased 2.05% ± 1.4%, and the number of antlerless deer harvested per successful antlerless deer hunter decreased 4.32% ± 0.6%.

In these counties, both the decrease in antlerless deer harvested by firearms and decrease in total antlerless deer harvested exceeded the percentage of deer harvested during the previous year's special antlerless firearms season (12.31 ± 0.6). This suggests that the change in CBAQ drove a decrease in antlerless harvest beyond what we would expect from losing the season alone. This is likely because of the drop in the number of firearms hunters in these counties after the change. The projected change in antlerless deer harvested by firearms is only 6.3% when based exclusively on changes in the number of firearms hunters harvesting antlerless deer and the number of antlerless deer harvested per successful antlerless deer hunter.

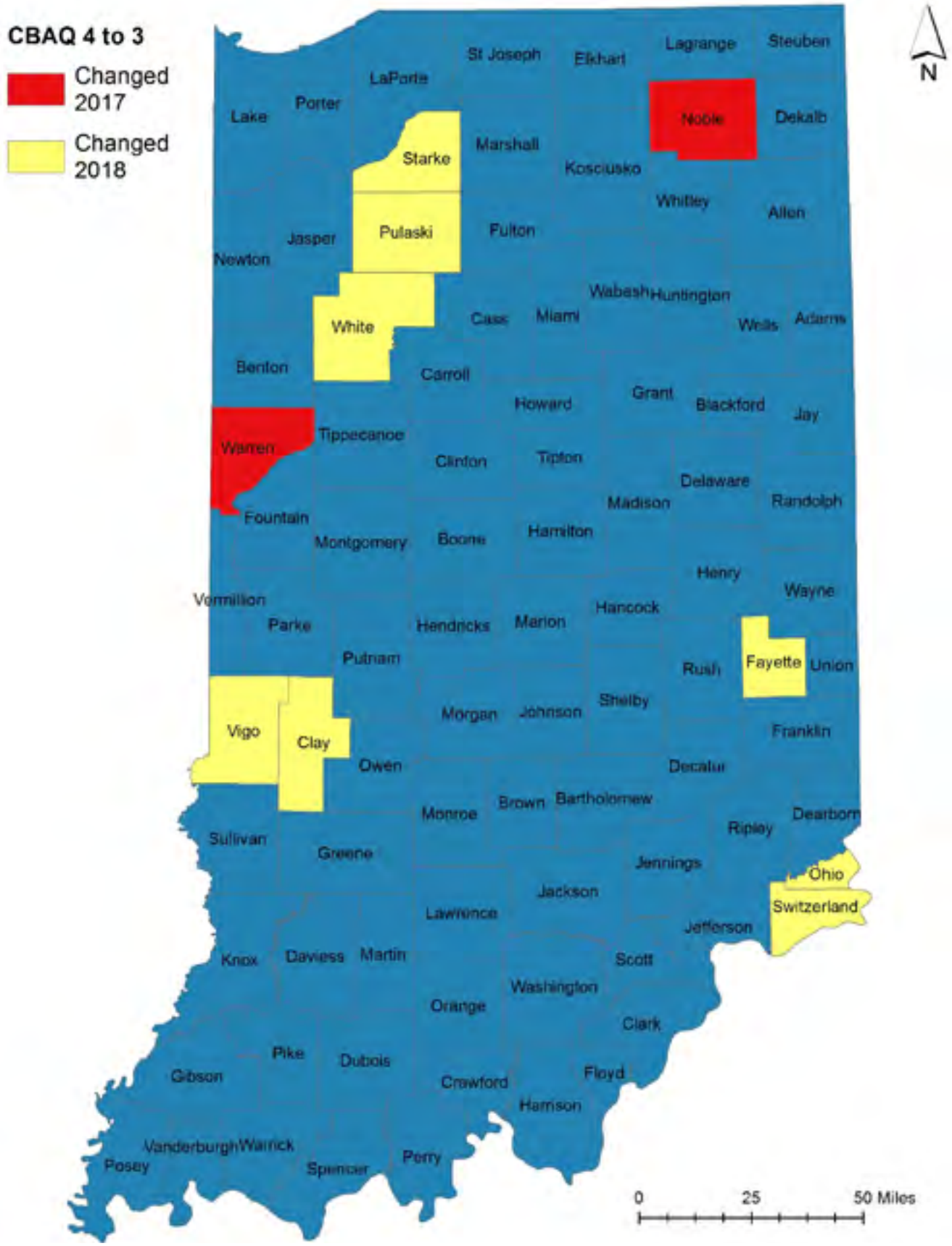

Figure 9-9. Counties in Indiana with no deer reduction zones that changed from a county bonus antlerless quota of 4 to a county bonus antlerless quota of 3 in 2017 or 2018. These counties were included in an analysis on the effects of the special antlerless firearms season on antlerless harvest.

ASSESSING THE IMPACTS OF THE 2019 EPIZOOTIC HEMORRHAGIC DISEASE OUTBREAK ON ANNUAL DEER HARVEST

Emily McCallen and Joe Caudell, *Indiana Department of Natural Resources*

Epizootic hemorrhagic disease (EHD) is a viral disease that periodically affects Indiana's white-tailed deer population. EHD is transmitted by biting midges and likely occurs in isolated cases across the state each year (Howerth et al. 2001). While EHD is not believed to cause long-term or sustained impacts to deer populations, it is important for managers to understand short-term impacts of the disease because EHD can potentially affect localized harvest success and hunter satisfaction.

Extensive outbreaks occur periodically, often following a six- to eight-year cycle (Xu et al. 2013; Baygents and Bani-Yaghoub 2018). The spatial extent of outbreaks can vary, and local rates of illness and death are often high during these events (Gaydos et al. 2004; Baygents and Bani-Yaghoub 2018). Indiana experienced large-scale EHD outbreaks in 2007 (confirmed in 36 counties), in 2012 (confirmed in 29 counties), and in 2019 (confirmed in 36 counties).

In the past, Indiana DNR did not have a convenient or economically efficient monitoring tool to assess the localized effects of EHD beyond the presence or absence of the disease within a county. Counties were categorized as EHD confirmed, EHD not confirmed, EHD suspected, or EHD not suspected. This coarse measure of effect often led to a misunderstanding of the true impact and extent of the disease because counties were grouped together without regard to the number of confirmed or suspected cases. For example, a county with one or two suspected cases and a confirmed case of EHD was reported the same as a county that had hundreds of suspected cases and a confirmed case of EHD. Alternatively, a county with hundreds of suspected cases of EHD but no confirmed cases was interpreted as being less significant than a county with one confirmed case and only a few suspected cases because a fresh deer could not be sampled.

Reporting the impact of EHD this way can be problematic because EHD is likely always present in the environment and always affecting deer at low levels. Outbreaks typically occur when ecological conditions are optimal for the spread of the disease, such as when herds have low immunity to EHD, biting midges are abundant, and drought conditions stress deer to concentrate around water sources. Outside of these conditions, deer still may become infected with EHD in localized areas and in smaller numbers. This background level of EHD is not well understood because agencies often only focus on reporting during outbreak years. However, public reports during an outbreak year may provide information about the baseline level of EHD on the landscape because public vigilance for sick and dead deer is high. As a result, valid reports are received from counties that have deer infected with EHD but that are not in an area where there is a widespread or significant outbreak.

Past reporting of EHD has also been hindered by a lack of location data from reports and the ability of Indiana DNR staff to collect samples. In the past, there was no spatial data associated with suspected EHD case reports, which led to a belief that multiple reports from a county meant the entire county was being affected by EHD. However, it is possible to have an extensive localized outbreak in one part of the county with no other cases in the remaining part of the county or in surrounding counties. A single property owner may report 10 suspected cases of EHD in an area far removed from the rest of an EHD outbreak, but this would not necessarily mean the entire county is affected.

Historically, EHD monitoring and confirmation has been the sole responsibility of Indiana DNR divisions of Fish & Wildlife and Law Enforcement. Given staffing limitations, the level of surveillance was not consistent from county to county. For example, a county far from a Fish & Wildlife office may have received less attention than one in which Fish & Wildlife biologists were stationed. Additionally, confirmation of EHD in remote counties was more difficult because samples were generally more difficult to obtain. In the summer, deer have to be sampled within a few hours after death to ensure the collected tissues are viable for testing. Typically, a biologist would receive a call about a dead deer and determine whether to attempt to collect a tissue sample from the deer without knowing the exact time of death (i.e., how fresh the carcass was).

A biologist may then drive to a location just to find the deer had already undergone decomposition, rendering the sample useless. Indiana DNR cannot sample all deer because of the opportunity cost dilemma (i.e., if a biologist responds to a deer that cannot be sampled, they may lose out on the opportunity to sample a fresh deer or to complete other tasks).

In the most recent EHD outbreak event, Indiana DNR began receiving reports of sick and dead deer in July 2019. To address issues from previous years, Indiana DNR enacted a plan for EHD surveillance that used four methods: public reporting, collecting geographic locations for each suspected case, working with additional individuals to collect samples including conservation officers and the public, and responding only to deer that were still alive and exhibiting clinical signs of the disease.

A combination of methods was used to confirm EHD: laboratory testing deer for EHD; clinical signs of EHD from harvested deer (sloughing hooves and behavioral signs consistent with EHD) reported by biologists, the public, and processors; and high instances of widespread reports within counties. To address public concerns over the outbreak, reported, suspected, and confirmed cases of EHD were posted online and regularly updated. Indiana DNR evaluated the effects of EHD on the population to distinguish between counties that had a background level of infection detected by the public and those counties that were experiencing a significant EHD event. Counties were classified into low, medium, and high incidence regions based on the number of EHD reports. Additionally, we examined differences in harvest trends between the groups to further assess the effect of the 2019 EHD outbreak event.

EHD Reporting and Investigation Process

Indiana DNR created an online reporting system for the public to report sick and dead deer in 2018 to receive suspected reports about CWD, EHD, and other potential diseases. Public reports of potential EHD events were also received from calls to DNR Division of Law Enforcement Central Dispatch, wildlife biologists, and DNR properties. Each report was documented in the online system and included precise location (i.e., coordinates or address), contact information, observed clinical signs, number of deer affected, and current state of the deer (i.e., alive and sick or dead). The state deer biologist evaluated each EHD report to determine the status of the deer (i.e., alive or dead), and if samples could be collected. Additionally, Central Dispatch and conservation officers notified the state deer biologist of sick deer that could potentially be sampled. When the likelihood was high that a viable sample could be obtained from the deer, the state deer biologist coordinated a response from conservation officers, biologists, DNR property managers, and the public to euthanize the deer and collect samples.

In many cases the state deer biologist would ask those who reported the deer if they were comfortable euthanizing and collecting a sample from a sick deer. Indiana DNR created a relatively quick process to obtain a disease collection permit for individuals, and the state deer biologist developed a set of instructions to assist the public in conducting a targeted necropsy to locate and collect the spleen. To simplify and facilitate the process, only the spleen was collected by untrained individuals. The state deer biologist instructed the sample collector using non-technical terms on how to orient the deer first (e.g., lay the deer on the right-hand side, so that the left-hand side of the deer is facing up); described the location and appearance of the spleen (e.g., the spleen is a flat, liver-looking organ behind the wall of the lung cavity, just under the backbone, and on top of the stomach); texted pictures of the spleen and incision location when possible; provided instruction for how to collect the sample (e.g., cut the skin in the location described just behind the rib cage, but up toward the backbone, and the spleen should be right there); provided alternatives to typical collection materials (e.g., the sample can go in a clean ziplock bag); and described how to store the sample (e.g., in a cooler with some ice, but not frozen). An Indiana DNR employee was then dispatched to collect the sample.

All samples were sent to the Southeastern Cooperative Wildlife Disease Study for initial PCR and virus-typing (if positive). Once a county had a single deer test positive for EHD, no further samples were collected. Some counties had multiple deer tested because samples were collected until a positive was confirmed, and sampling continued to occur on DNR properties. After a positive was found, Indiana DNR continued to document all reported cases for suspected EHD in the county. Results

from testing and reporting were published every one to five days on a DNR website that displayed the data in map and table form using the program Tableau (see deer.dnr.IN.gov) to allow the public to keep track of the current outbreak events.

Methods

Indiana DNR used hotspot analysis to classify Indiana counties based on the number of sick and dead deer reported that fit the pattern for EHD cases. Hotspot analysis identifies clusters of high and low values by comparing the value of a county and its neighbors to the value of all counties (Getis and Ord 1992). In this way, a county is only considered a hot or cold spot if it is surrounded by counties with a similar number of sick and dead deer reported. For this analysis, counties within 80 km (~50 miles) of each other were considered neighbors.

Indiana counties were divided into three groups based on the results of the hotspot analysis: low incidence (statistically significant cold spots), medium incidence (not significant), and high incidence (statistically significant hotspots). Within each group, DNR staff examined the number of counties where EHD was confirmed and the percent of EHD-positive samples. During deer season, DNR also collected data on EHD from hunters, deer processors, and DNR biologists.

Indiana DNR asked individuals to examine harvested deer for cracked or sloughing hooves because hoof abnormalities are typical in animals that recover from an EHD infection (Howerth et al. 2001). In the After Hunt Survey, hunters were asked whether any of the hooves on the deer they harvested showed evidence of EHD. Participating deer processors were asked to record the number of EHD-positive deer they saw from each county as well as the total number of deer they processed from each county. DNR biologists were asked to do the same when they collected CWD samples from check stations. DNR calculated the percent of EHD-positive deer reported in the After Hunt Survey and the percent of EHD positive deer reported by processors and biologists for the low, medium, and high incidence groups.

Finally, DNR examined harvest trends in each group. For each county, Indiana DNR calculated the trend in this year's harvest by comparing the 2019 harvest to the previous five years. To standardize the data between counties, the difference in standard deviations are reported. DNR calculated the average trend in total harvest, buck harvest, and doe harvest for the low, medium, and high incidence groups. ANOVA tests were used to determine whether harvest trends differed between the three groups.

Results

Indiana DNR received a total of 981 EHD case reports from 85 counties. Some reports were of individual deer while others were of small groups of deer. The reports totaled 1,719 individual deer, of which 1,158 (67.3%) were reported dead, and 254 (14.8%) were reported sick (Figure 9-10). Forty-three deer were euthanized because of their severe stage of illness and/or to collect a sample for disease testing. In total, 61 deer were tested for EHD (Table 9-1).

Most counties in the northern portion of Indiana were identified as cold spots (Figures 9-10; 25 counties). Counties in the central and southwestern region of the state were not significant cold spots or hotspots (Figure 9-10; 44 counties) and counties in the south and southeastern region of the state identified as hotspots (Figure 9-10; 23 counties). EHD was confirmed (Figure 9-11) in one low-incidence county (4%), 16 medium-incidence counties (36%), and 19 high- incidence counties (83%).

The percent of positive EHD tests was high in both the medium- and high-incidence groups and low in the low-incidence group (Figure 9-12). Data from the After Hunt Survey followed the expected pattern, with the highest percentage of positive deer in the high-incidence group and the lowest percentage of positive deer in the low-incidence group (Figure 9-13). The percentage of positive deer was low regardless of group in the data collected from biologists and processors (Figure 9-14).

Harvest trends followed a consistent pattern regardless of the type of harvest. Total harvest was lower than normal in high-incidence counties, about normal in medium-incidence counties, and considerably higher than normal in low-incidence counties (Figure 9-15). Buck harvest was slightly lower than normal in high-incidence counties, higher than normal in medium-incidence counties, and considerably higher than normal in low-incidence

Table 9-1. The number of deer reported as sick and/or dead and the number of EHD positive deer per source and prevalence group.

Group	Number of Counties	After Hunt Survey Positive	After Hunt Survey Total	Biologist and Processor Positive	Biologist and Processor Total	Sample Positive	Sample Total
High Incidence	23	17	380	16	715	26	30
Medium Incidence	44	13	474	27	1,351	21	25
Low Incidence	25	3	343	25	1,203	1	6

counties (Figure 9-16). Doe harvest was considerably lower than normal in high-incidence counties, lower than normal in medium-incidence counties, and about normal in low-incidence counties (Figure 9-17). ANOVA tests were significant for all harvest types, with all groups significantly differing from each other.

Discussion

The improved method of data collection and reporting allowed Indiana DNR to understand the potential effects of EHD as the outbreak was occurring. Indiana DNR was previously unable to assess effects of an ongoing EHD outbreak in real time, causing a year lag in management action. By mid-August 2019, it was clear what the likely extent of the disease was, as well as the estimated current impact. While EHD is not expected to have a long-term effect on the population, it can have localized effects, and hunters generally believe there should be a response.

Thus, Indiana DNR reduced the county bonus antlerless quotas (CBAQ) in each county to match the current effect EHD was having on the deer population. To do this, we calculated the number of deer that had likely died on the landscape from EHD, based on the number of reported cases and compared that to the expected harvest numbers at a given CBAQ (Indiana DNR regulates female deer harvest by setting the number of antlerless deer that can be harvested by a hunter through individual hunter quotas set for each county with the quotas typically ranging from 1 to 8 antlerless deer; Caudell and Vaught 2019). The number of reported deer does not reflect the total number of deer that have likely died from EHD and gone undetected. Hoff et al. (1973) suggested that the rate at which dead deer are identified on the landscape is approximately 10%. Therefore, to create a correction factor for deer that had likely died from EHD based on the number of deer that had been observed, we multiplied the number of reported EHD dead deer by 10 to develop an estimate for the number of detected and undetected deer that had likely died on the landscape. We then used this corrected number for EHD-caused mortality and reduced quotas to a number that would approximately offset the amount that had already died from EHD, allowing DNR to make a last-minute adjustment to the CBAQ to account for the ongoing EHD event. Based on anecdotal information (i.e., call to the DNR offices, emails, and comments on our survey), hunters were generally pleased with the actions of Indiana DNR.

Enlisting the public to help collect tissue samples from deer potentially infected with EHD proved to be worthwhile in Indiana. The state deer biologist was able to communicate clearly and effectively to collect viable samples in 100% of the cases where the public assisted. Additionally, in all of those cases, the public was able to correctly identify and collect the spleen. Public participation improved both response time and the number of samples collected. Working closely with the public throughout the process of reporting, locating, euthanizing, and sampling EHD deer helped to improve hunter acceptance of the EHD results and management recommendations because hunters were an active part of the process.

The results of the hotspot analysis demonstrated a clear spatial gradient of EHD intensity during the 2019 outbreak in Indiana. Reasons for this variation in intensity are unclear and may be related to complex factors, including herd health, previous exposure, and vector activity (Howerth et al. 2001; Berry et al. 2013). The high percentage of positive EHD tests in high- incidence and medium-incidence counties occurred because we only tested deer with clinical signs of the disease. Random tests within the deer population would have revealed a much lower incidence of the disease. Although the percentage of positive deer in the After Hunt Survey followed the pattern we would expect between groups, it is

not representative of the true incidence rate, because not all EHD positive deer display hoof abnormalities (Beringer et al. 2000). The overall low percent of positive deer reported by biologists and processors was likely driven by underreporting. Because both groups process a large number of harvested deer and EHD data collection is not their primary objective, they may be more likely to miss the signs of an EHD-positive individual.

There were clear signs of differences in harvest trends between the three groups. Overall harvest trends were positive in the low-incidence counties and negative in high-incidence counties. Doe harvest was normal or lower than average throughout the state. This result was expected, because the CBAQ was dropped to 2 in all counties that previously had a quota of 3 or 4 in response to the EHD outbreak. The largest average drop in CBAQ occurred in the high-incidence group (CI_{95}=2.2 ± 0.6), followed by the medium-incidence group (CI_{95}=0.5 ± 0.2), and the low-incidence group (CI_{95}=0.4 ± 0.2). However, differences were still apparent in buck harvest trends, which should not have been affected by changes in CBAQ, suggesting that harvest trends were not driven entirely by management decisions. Though extensive EHD outbreaks can lead to population level changes (Gaydos et al. 2004), it is difficult to demonstrate this effect through harvest data alone. Reduced herd size because of the EHD outbreak is one explanation for lower harvest in the high-incidence counties. However, it is possible that hunters diminished their efforts in these counties or shifted their efforts farther north, leading to the increased harvest we saw in the low-incidence counties. Indiana DNR will continue to monitor harvest differences in these groups in subsequent years.

Public reporting of sick and dead deer during the 2019 EHD outbreak was an essential component of this research. Indiana DNR encourages the public to report sick deer and dead deer that display evidence of disease even when an outbreak in not occurring at on.IN.gov/sickwildlife. Understanding baseline levels of non-hunting deer mortality will allow Indiana DNR to more quickly identify and respond to disease outbreaks in the future.

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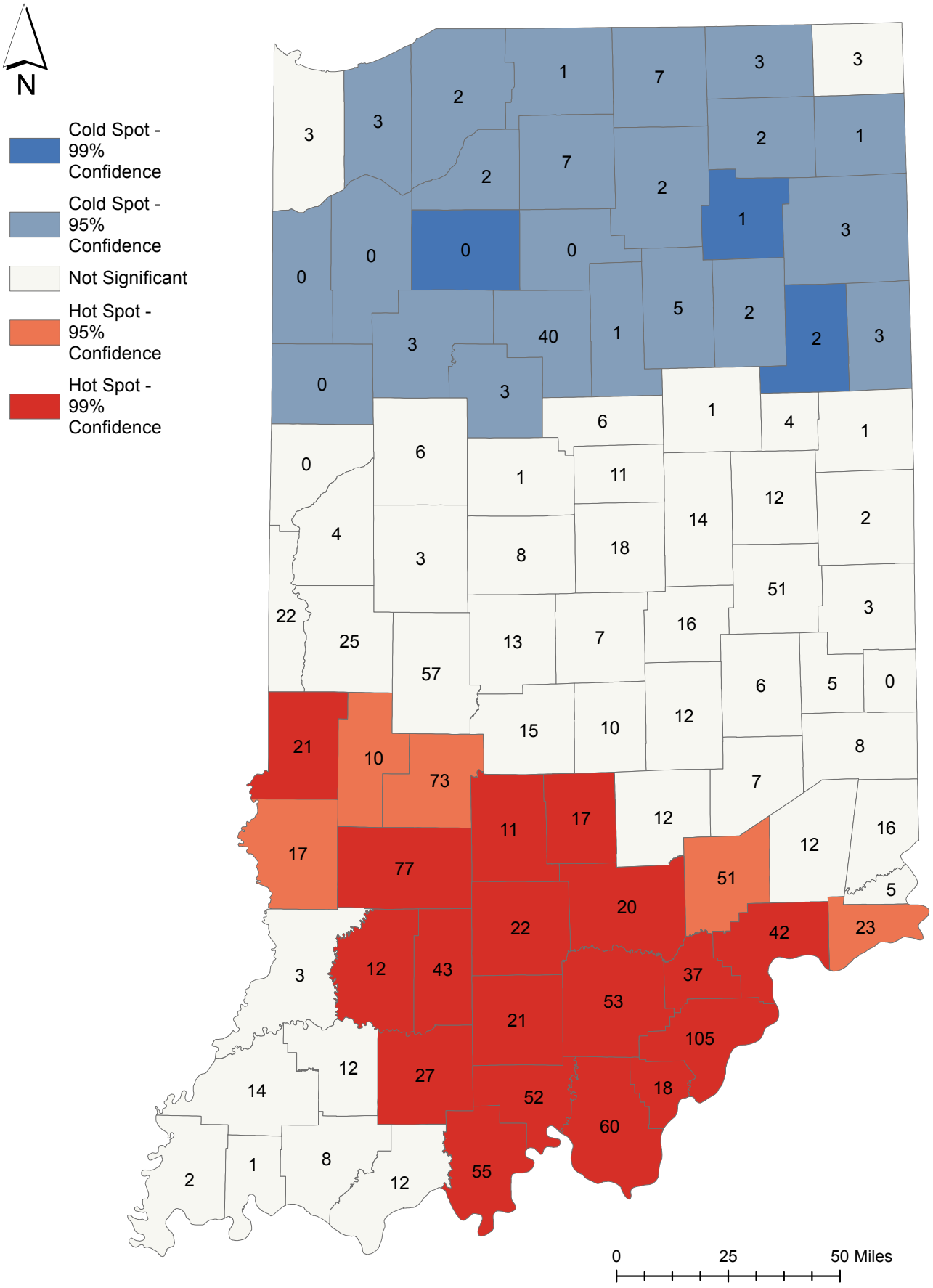

Figure 9-10. Results of a hotspot analysis of sick and dead deer reported during a 2019 EHD outbreak in Indiana. The number of sick and dead deer reported in each county are presented.

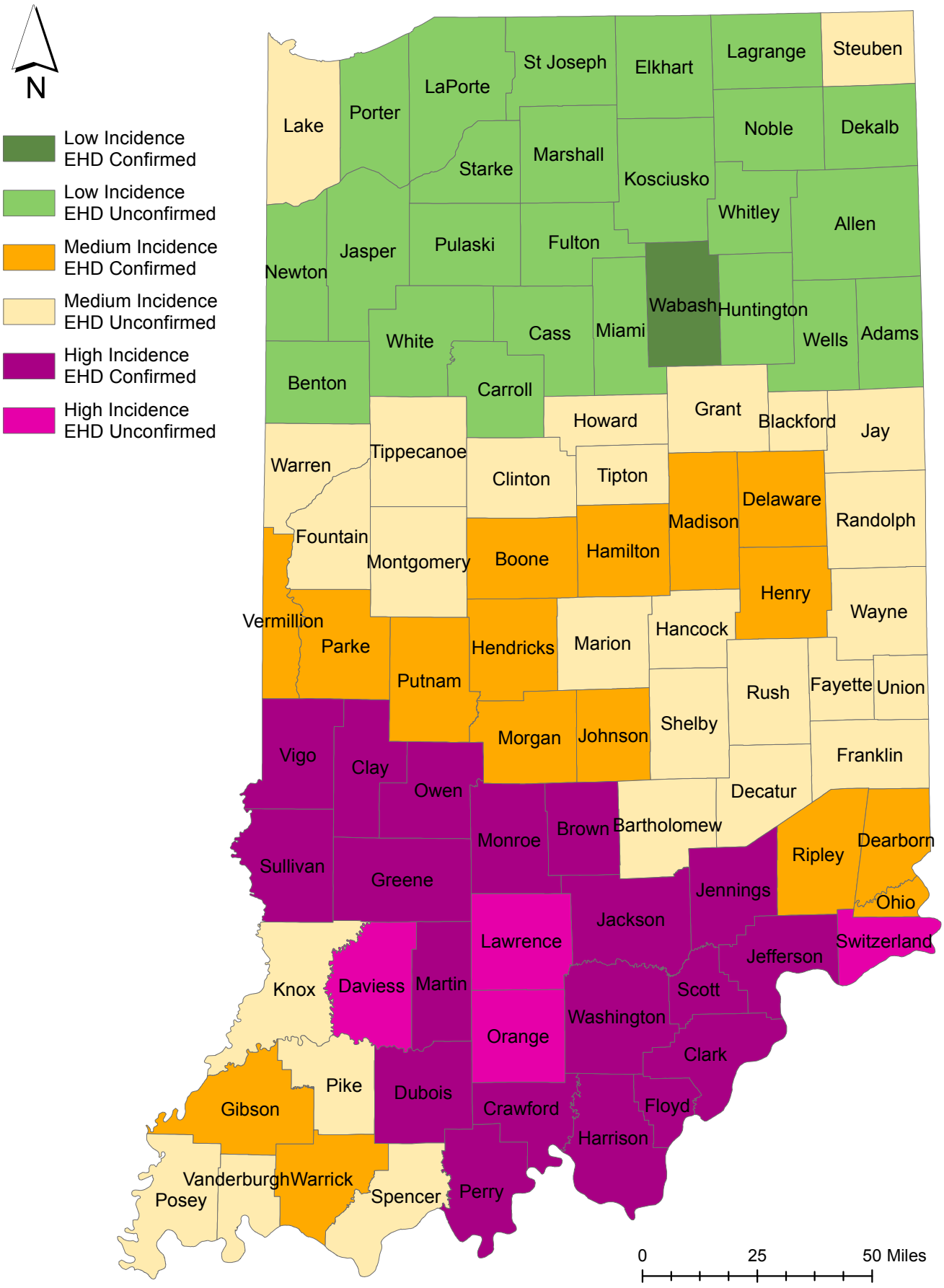

Figure 9-11. Indiana counties classified into low-, medium-, and high-incidence groups based on the results of a hotspot analysis of sick and dead deer reported during a 2019 EHD outbreak.

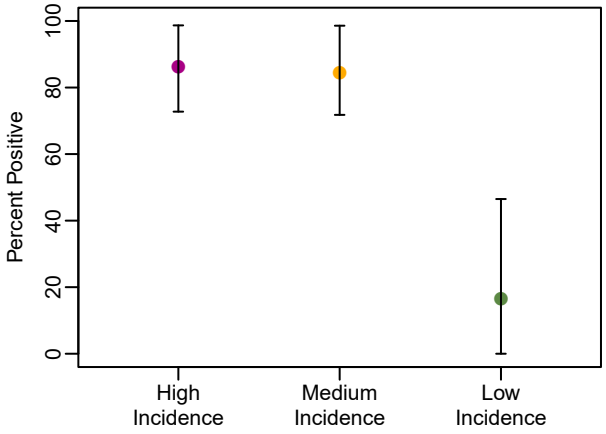

Figure 9-12. Percentage of EHD-positive samples in each region. Bars represent 95% confidence intervals.

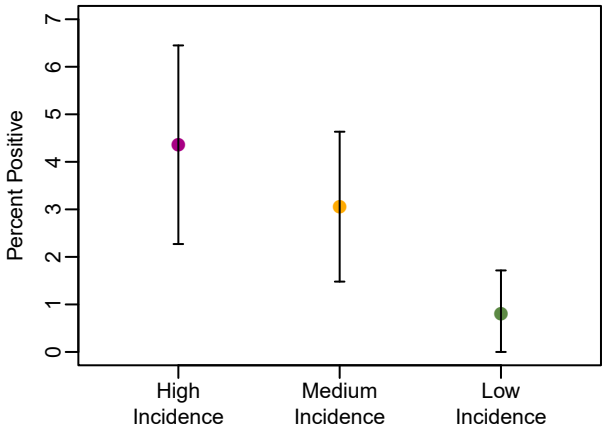

Figure 9-13. Percentage of EHD-positive deer reported in the After Hunt Survey in each region. Bars represent 95% confidence intervals.

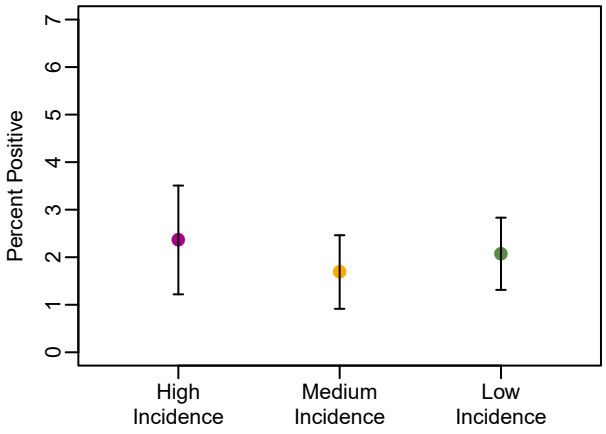

Figure 9-14. Percentage of EHD-positive deer reported by biologists and processors in each region. Bars represent 95% confidence intervals.

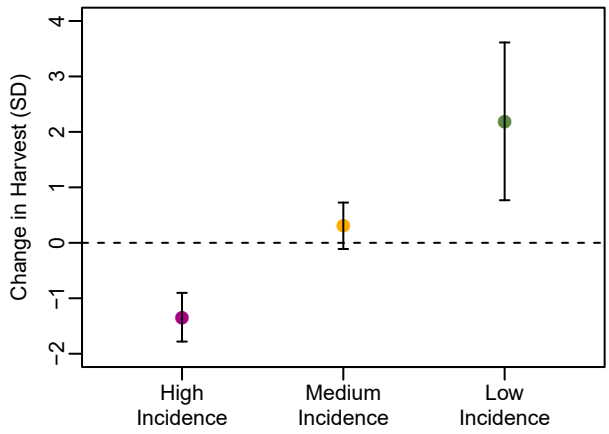

Figure 9-15. Change in 2019 total harvest (in standard deviations) in each region. Bars represent 95% confidence intervals.

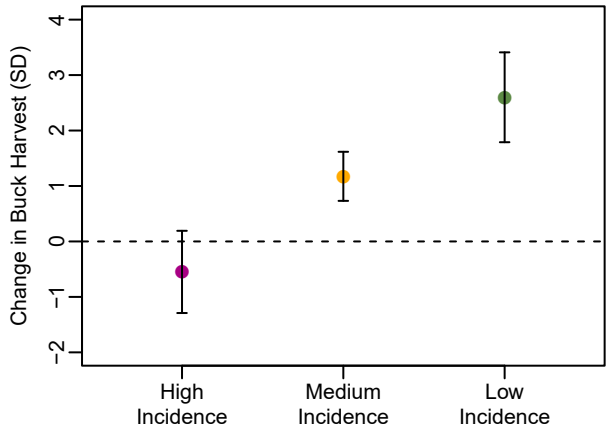

Figure 9-16. Change in 2019 buck harvest (in standard deviations) in each region. Bars represent 95% confidence intervals.

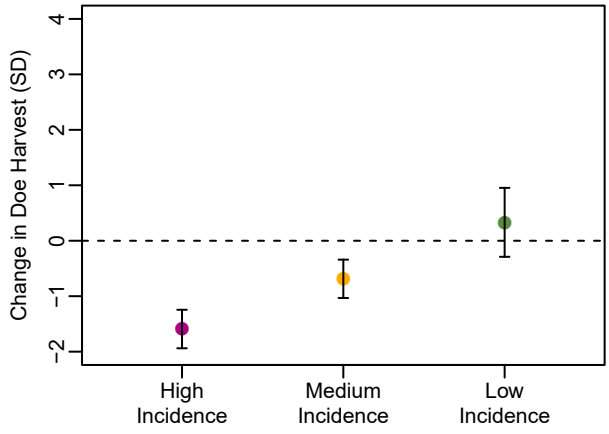

Figure 9-17. Change in 2019 doe harvest (in standard deviations) in each region. Bars represent 95% confidence intervals.

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CHAPTER 10. EXTERNAL DEER RESEARCH

Studies described in the External Deer Research chapter are part of a collaborative deer management project between Indiana DNR and Purdue University. 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. 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 located 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 land.

Indiana DNR adapted the RMUs into deer management units (DMUs; Figure A-1) 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.

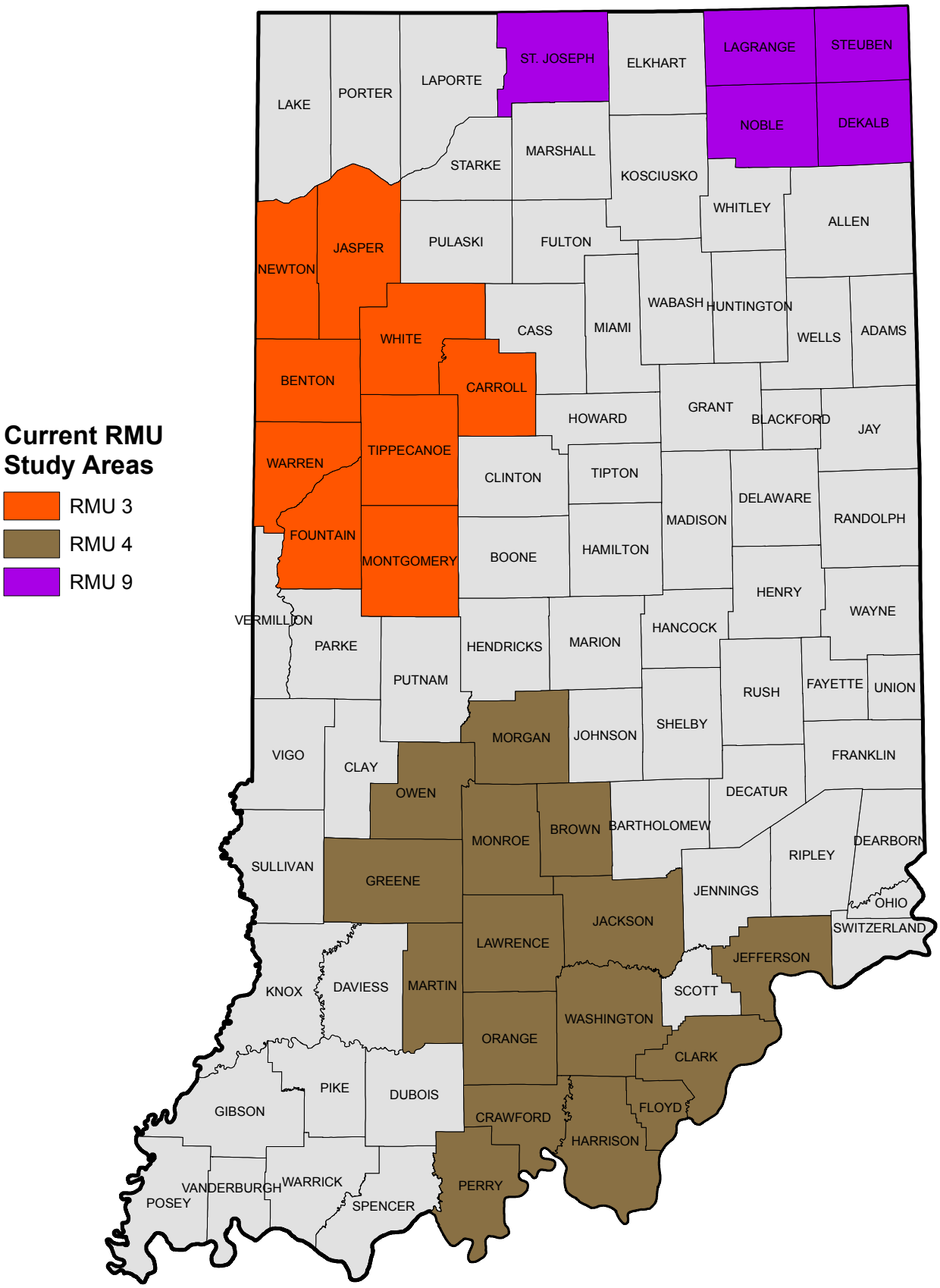

Figure 10-1. Current regional management unit (RMU) study areas for Purdue University deer management research projects.

ESTIMATING DEER DENSITY ACROSS INDIANA

Zackary J. Delisle and Robert K. Swihart, *Purdue University*

An accurate and precise estimate of the number of white-tailed deer in an area is critical to manage the state's deer herd. Several methods for estimating deer population density are effective (Mandujano and Gallina 1995), but many are not suitable for estimating deer density over an area as large as the state of Indiana (Anderson et al. 2013, Collier et al. 2013). Indiana DNR has partnered with Purdue University to evaluate density estimation methods and increase reliability and cost effectiveness in large-scale monitoring. To accomplish this, Zackary Delisle, a Ph.D. student from the Department of Forestry and Natural Resources at Purdue University, is estimating deer density in Regional Management Units (RMUs) 3, 4, and 9 (Swihart et al. 2020), using three different methods: fecal-pellet transects, trail cameras, and aerial surveying from a small airplane. These density estimates will be conducted during 2019-2021, and will evaluate the advantages and disadvantages of each method based upon their cost, accuracy, and precision.

Each method uses a "distance sampling" approach to estimate deer density (Buckland et al. 1991, Buckland et al. 2001, Buckland et al. 2004). The concept of distance sampling is simple and logical: as the distance between a surveyor and a deer increases, the surveyor is less likely to detect the deer (or pellet group). By collecting data on the detection distance for each sighting, researchers can use statistical software to estimate a "detection function," which is the probability of detecting an object based on its distance from the surveyor. The detection function combines counts with an estimate of the effective area sampled to yield density estimates for each of the three methods.

Fecal-pellet surveying is a common method used to estimate deer density (Marques et al. 2001, Urbanek et al. 2012, DeCalesta 2013, Burt et al. 2014). By estimating the density of fecal-pellet groups deposited by deer, density estimates of deer can be calculated if the following are known: 1) the defecation rates of deer (how many times a deer defecates per day); 2) how long fecal-pellet groups persist in nature before degrading beyond recognition; and 3) the time period during which fecal pellets could have been deposited. Surveyors walk and search along randomly placed 200-meter transects for fecal-pellet groups during March and April. The distance from the transect line to each detected pellet group is measured to calculate the detection function for density estimation. Separate projects also are being conducted to determine how long fecal-pellet groups persist in nature before degrading beyond recognition and the time period over which fecal pellets have been deposited (i.e., the time since leaf-off the previous fall, because leaves will cover all fecal-pellet groups deposited earlier). The results of prior projects that have estimated the defecation rates of deer also will be used.

Snapshot IN Photo

Motion-triggered trail cameras are being evaluated to determine their efficacy at estimating density in local landscapes and across multiple counties (Jacobson et al. 1997, Curtis et al. 2009, Weckel et al. 2011, Howe et al. 2017). Browning Strike Force HD Cameras (Browning, Morgan, UT) are deployed in the same areas as the fecal-pellet surveys and mounted on trees in forests, grasslands, pastures, and wetlands. In certain areas of the state, additional cameras are set on T-posts in row-crop fields to access deer density in agricultural areas. The distance from trail cameras to photographed deer will be estimated to calculate the detection function for camera sampling, which will facilitate an estimate of deer density. Cameras are deployed in January and retrieved in early spring. All cameras are marked with a sticker that reads "Purdue University Integrated Deer Management Project." If you come across one of these cameras, please do not touch or alter the camera in any way.

Purdue University also will attempt to estimate deer density by flying aerial transects with a small airplane (LeResche and Rausch 1974, White et al. 1989, Pojar et al. 1995, Whittaker et al. 2003, Beaver et al. 2014). The sampling protocol for flying aerial transects is similar to

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walking transects and searching for fecal-pellet groups on foot. However, instead of walking randomly placed transects, transects will be systematically flown in an airplane. And instead of searching for fecal-pellet groups, infrared cameras will be used to search for deer from the airplane. A high-resolution digital camera also will be used to confirm that a heat signature detected by the infrared camera is a deer rather than a goat, cow, sheep, coyote, or other mammal that can produce similar heat signature (Franke et al. 2012). The distance from the centerline of the infrared video to each heat signature will be measured using computer software and will be used to calculate the detection function for estimating deer density. Aerial transects will be conducted during March in the same areas that fecal-pellet and trail-camera surveying are conducted.

In a state like Indiana where the vast majority of deer habitat is privately owned, the success of this project depends greatly upon the willingness of landowners to allow Purdue students and staff to walk transects and place cameras on their land. If a member of the research team asks for permission to sample on your property for the project, please grant them access. In doing so, you will be contributing to the greater understanding and improved management of white-tailed deer in Indiana.

Results from Year 1 Sampling

In total, we walked 291 fecal-pellet transects (36.16 miles) from March 9, 2019 to April 17, 2019 and found 1,346 pellet groups in year 1 (Figure 10-1). In natural cover, such as deciduous forest, evergreen forest, mixed forest, shrub/scrub, grassland/herbaceous, pasture/hay, woody wetlands, and emergent herbaceous wetlands, we walked 203 transects and found 1,244 pellet groups. In row crop landscapes, we walked 88 transects and found 102 pellet groups. Using the pellet sampling technique, we found deer densities of 10.59 (coefficient of variation, CV = 0.176), 14.17 (CV = 0.142), and 13.09 (CV = 0.219) individuals per mi2 in RMUs 3, 4, and 9, respectively (Figure 10-2).

We deployed 389 cameras in year 1 (Figure 10-3). Of these, we deployed 74 cameras in row crop (corn = 54, soybean = 18, wheat = 2) and 315 cameras in natural cover (deciduous forest = 240, mixed forest = 34, evergreen forest = 4, grassland/herbaceous = 7, pasture/hay = 5, emergent herbaceous wetlands = 1, woody wetlands = 22, scrub/shrub = 2). Three cameras went missing during the survey period. In total, we captured 1,116,275 photos from 386 cameras from January 9, 2019 to April 23, 2019. Currently, we are: 1) identifying species in photos and will pursue a machine learning approach to sort photos using previously identified images (species have been identified in 582,175 images; 41% contain deer); and 2) measuring distances in photos to estimate deer density (37,585 unique distances measured).

We flew aerial transects in 13 test landscapes (TL; 16 square mile grids used by Indiana DNR for deer management) from April 6, 2019 to April 15, 2019 in year 1:

five TLs in RMU 3 (39, 67, 168, 172, 192), four TLs in RMU 4 (46, 96, 270, 273), and four TLs in RMU 9 (39, 44, 45, 81). Not all TLs were flown due to difficulties acquiring the infrared camera. We extracted aerial data from IR video using RemoteGeo System's Line Vision software.

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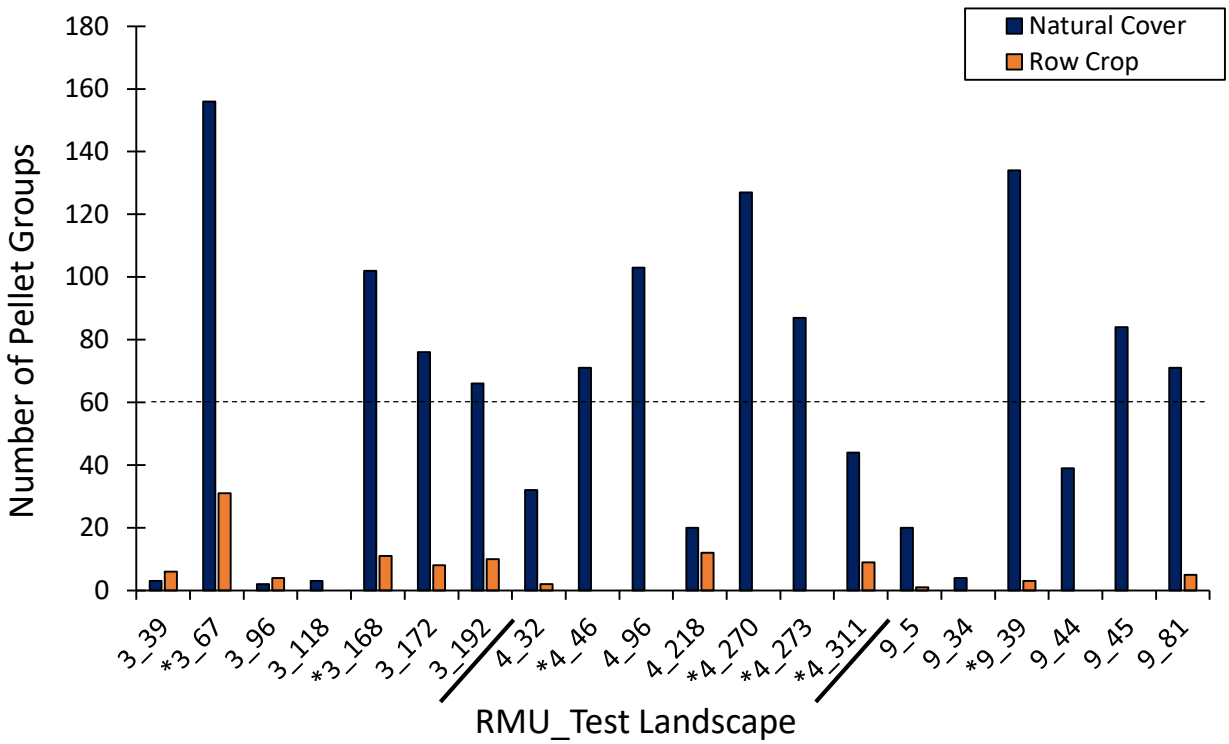

Figure 10-2. Number of pellet groups found in natural cover (NC), and row crop (RC) per test landscape. At least 60 pellet groups (dotted line) are to estimate density (Buckland et al. 1991). An asterisk identifies seven test landscapes where we walked the number of transects needed to achieve optimal precision (CV = 0.15) according to a priori calculations.

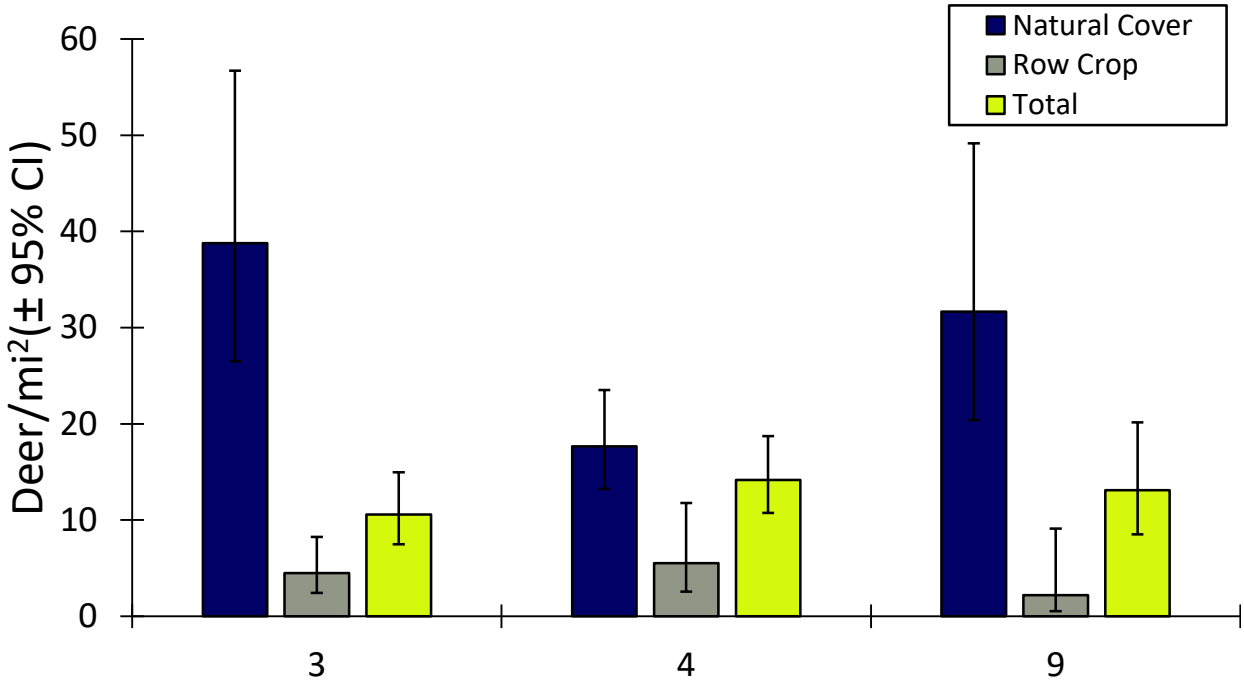

Figure 10-3. Density estimates (mi² ± 95% confidence interval (CI)) of deer in RMUs 3, 4, and 9. Area-specific estimates and the corresponding measures of precision are provided for natural cover (deciduous forest, evergreen forest, mixed forest, shrub/scrub, grassland/herbaceous, pasture/hay, woody wetlands, and emergent herbaceous wetlands), row crop, and total (row crop and natural cover).

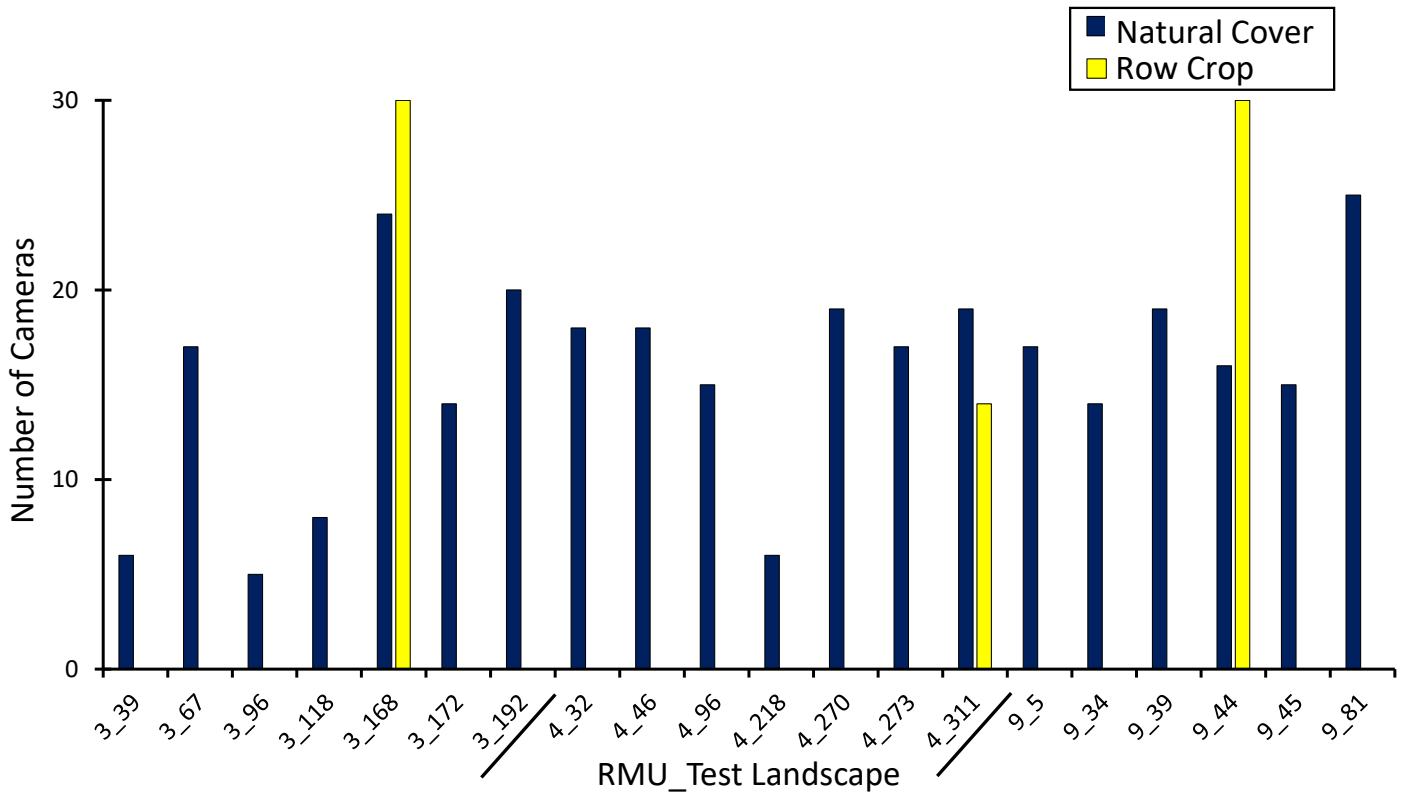

Figure 10-4. Number of cameras deployed in natural cover types and row crop across all test landscapes, January – April 2019.

RELATIONSHIP BETWEEN DEER AND HABITAT

Richard D. Sample, *Purdue University*

White-tailed deer rely on nutrients from plants for reproduction, growth, and antler production (Tajchman et al. 2018), but high levels of deer browsing may reduce habitat quality (Rooney and Waller 2003), ultimately affecting deer growth and the carrying capacity of the landscape. Therefore, there is a need to accurately assess the impact of deer on vegetation communities. Deer densities and landscape characteristics vary across Indiana, thus techniques are needed to assess impacts of herbivory across a range of conditions. We have three objectives to help determine the effect deer have on their habitats. First, we will employ different methods of measuring browse intensity in woodlots and evaluate these different methods to determine which are best suited for measuring browsing intensity in different regions of Indiana. Second, we will determine how different deer densities, browsing intensities, and landscape characteristics influence vegetation communities in woodlots. Lastly, we will examine diet composition of deer and how it relates to plant species availability.

Methods

In 2019, we sampled seven test landscapes in RMUs 3 and 4, and six test landscapes in RMU 9. In total, we sampled 69 woodlots across all three RMUs. RMU 3 had the most woodlots (32), followed by RMUs 9 and 4 with 23 and 14 woodlots, respectively. Within each woodlot, we sampled on 50-meter transects, and sampled 210 transects in total. Along transects, we measured the density of overstory trees, saplings, and seedlings by species, the number of browsed and available twigs, and browsing intensity. We measured browsing intensity using three different methods. First, proportional browse, which is the proportion of available twigs that are browsed, and a twig is considered available for browse if it is 8-71 inches (known as the "molar zone" where deer browse the most) in height. Using these data, we can also determine which species are preferred or avoided for browse. Second, twig age, which represents the number of years since a twig has been browsed (Waller et al. 2017); a low twig age indicates a high browse intensity because there have been fewer years since the twig was last browed. Lastly, the oak sentinel method, which involves planting red oak species, a favored browse species for deer (Wakeland and Swihart 2009) inside and outside of exclosures to monitor the growth, browsing, and survival rates of seedlings, all of which may be indicators of deer browse intensity. At each location, we constructed one exclosure, and planted 30 seedlings (20 outside exclosures and 10 inside). In total, we constructed 60 exclosures (21 each in RMUs 3 and 4, and 18 in RMU 9), and planted 1,800 seedlings (630 each in RMUs 3 and 4, and 540 in RMU 9).

In 2020, we sampled in five new test landscapes in RMUs 4 and 9, and three new test landscapes in RMU 3. We repeated two test landscapes in each RMU to control for annual variation. In total, we sampled 68 woodlots, 47 of which were new. RMU 9 had the most woodlots (36), 29 of which were new. RMU 3 and 4 had 17 and 15 woodlots respectively, nine of which were new in each. In total, we sampled 247 transects, including 172 new transects. We constructed 39 new exclosures and planted 1,680 red oak seedlings across all RMUs (630 each in RMUs 4 and 9, and 420 in RMU 3).

Preliminary Results

Browsing Intensity – Proportional browse was marginally highest in RMU 3, with 15% of all available twigs being browsed. Proportional browse in woodlots in RMUs 4 and 9 were similar with 12 and 13% of twigs browsed, respectively. Proportional browse of non-strongly avoided twigs (see below for a classification of "non-strongly avoided") was similar among RMUs, with 17%, 16% and 14% of twigs browsed in woodlots in RMUs 3, 4, and 9, respectively. For twig age, our target species were originally maple and ash, because they are common and tolerate deer browsing. However, we also sampled sassafras, white oak, red oak, and hackberry in some woodlots because they were locally abundant, could be aged, and were browsed by deer. Twig age was lowest (indicating highest browse intensity) in RMU 4, with an average age of 2.6 years. Twig age was similar in RMUs 3 and 9 with average ages of 3.1 and 3.3 years, respectively. The proportion of planted oak seedlings browsed was highest in RMU 3 with 41% of oaks being browsed. Proportion browse of oaks was similar in RMUs 4 and 9 with 38% and 35% of oaks browsed, respectively. Browsing had a direct impact on growth, as seedlings in RMU

9 had a 27% increase in height, but seedlings in RMUs 3 and 4 only increased in height by 18% and 20%, respectively. Together, these results suggest that browsing intensity is lowest in RMU 9 and similar in RMUs 3 and 4 (Table 10-1).

Vegetation Communities – Identifying species that are preferred for browse is beneficial to people who manage their woods for quality deer habitat because it provides a list of plants that managers may want to increase the availability of (preferred species) and those that they may want to decrease (avoided species). Based on the number of available and browsed twigs we sampled, we sorted species into five different browse preference groupings: strongly preferred, marginally preferred, intermediate, marginally avoided, and strongly avoided (Tables 10-2, 10-3, 10-4).

Total basal area, which is the area occupied by tree stems, was highest in RMU 9 (108 ft2/acre). RMUs 3 and 4 had similar basal areas (88 and 89 ft2/acre, respectively). Basal area of oak species is a strong predictor of acorn production (Long et al. 2018), as the number of acorns produced increases as the basal area of oak does. Basal area of red oak species group (i.e., northern red oak, black oak, pin oak, shingle oak) was highest in RMU 3 at 10 ft2/acre. However, this is because one test landscape (#172) had 46 ft2/acre of trees in the red oak species group. For all other test landscapes in RMU 3, basal areas of this species group ranged between 0 and 8 ft2/acre. Basal area of red oak species group in RMU 4 and 9 was 7 and 3 ft2/acre, respectively. Basal area of white oak species group (i.e., white oak, swamp white oak, chinkapin oak, bur oak, chestnut oak) was highest in RMU 4 at 15 ft2/acre, while RMUs 3 and 9 were similar (5 ft2/acre and 4 ft2/acre, respectively, Table 10-5).

Saplings, which provide food and/or cover for deer, were defined individual stems greater than 4.5 feet in height with branches in the molar zone. Sapling density was highest in RMU 4 (605 saplings/acre), lowest in RMU 3 (409 saplings/acre), and RMU 9 had 528 saplings/acre. Density of all seedlings (woody stems less than 4.5 feet tall) in the molar zone (8-71 inches tall) was highest in RMU 9 with 11,934 seedlings/acre whereas RMUs 3 and 4 had, respectively, 8,303 and 9,734 seedlings/acre. RMU 9 also had the highest density of non-strongly avoided seedlings (7,732 seedlings/acre), while RMUs 3 and 4 had 3,732 and 5,111 seedlings/acre, respectively (Table 10-5).

Diet composition – In 2019 we collected 99 pellet groups across all three RMUs. We collected the most groups in RMU 4 (n = 40) and 30 and 29 groups in RMUs 3 and 9, respectively. We are currently determining diet composition from the pellet groups using genetics to identify plant species that were eaten.

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Table 10-1. Proportion browse of non-strongly avoided species, twig age, proportion browse of planted red oak seedlings, and growth of oak seedlings in woodlots across all RMUs in 2019.

RMU	Test Landscape	County	Browse of Non-Avoided Species (%)	Average Twig Age (years)	Oaks Browsed (%)	Increase in Height Growth (%)
3	39	Montgomery	27	0.2	59	15
3	67	Warren	16	2.2	55	17
3	96	Carrol	6	3.4	5	35
3	118	Benton	8	4.5	36	14
3	168	Jasper	18	2.8	52	14
3	172	White	13	3	36	21
3	192	Newton	23	3.8	32	16
4	32	Crawford	12	2.5	33	22
4	46	Harrison	15	2.8	28	21
4	96	Orange	26	2.9	35	19
4	218	Greene	24	1.6	37	21
4	270	Brown	16	1.8	33	29
4	273	Brown	16	2.4	36	22
4	311	Morgan	16	2.9	58	16
9	5	Noble	14	2.9	37	31
9	34	St. Joseph	11	3.4	35	27
9	39	Noble	18	3	40	28
9	44	DeKalb	15	3.6	40	21
9	45	DeKalb	12	3	24	30
9	81	Steuben	11	3.7	31	24

Table 10-2. Browse preference rankings for species sampled in RMU 3 in 2019.

RMU 3				
Strongly Preferred	Marginally Preferred	Intermediate	Marginally Avoided	Strongly Avoided
Elderberry	Multiflora rose	American plum	Black cherry	Amur honeysuckle
Hackberry		Autumn olive	Black raspberry	Common blackberry
Mapleleaf viburnum		Black oak		
Pin oak		Downy serviceberry		
White mulberry		Hazelnut		
White oak		Red maple		
		Sassafras		
		Spicebush		
		Sugar maple		
		Swamp dewberry		

Table 10-3. Browse preference rankings for species sampled in RMU 4 in 2019.

RMU 4				
Strongly Preferred	Marginally Preferred	Intermediate	Marginally Avoided	Strongly Avoided
Greenbrier	Hackberry	Amur honeysuckle	American elm	American beech
Sugar maple	Mapleleaf viburnum	blueberry	Black cherry	Coralberry
White ash	Pignut hickory	Green ash	Black raspberry	Ironwood
Strawberry bush	Red maple	Red oak	Common blackberry	Multiflora rose
	Sassafras	Slippery elm	Musclewood	Spicebush
		White oak		

Table 10-4. Browse preference rankings for species sampled in RMU 9 in 2019.

RMU 9				
Strongly Preferred	Marginally Preferred	Intermediate	Marginally Avoided	Strongly Avoided
Gray dogwood	American plum	American elm	Black cherry	Ironwood
Hackberry	Gooseberry	Chokecherry	Black raspberry	Multiflora rose
Sugar maple	Green ash	Red Raspberry	Blackhaw	Prickly ash
	Morrows honeysuckle		Common blackberry	Spicebush
	Musclewood			
	Tartarian honeysuckle			

Table 10-5. Basal area of red and white oak species groups, sapling, and non-strongly avoided seedling densities in woodlots across by test landscapes in 2019.

RMU	Test Landscape	County	Red Oak Group Basal Area (ft^2/acre)	White Oak Group Basal Area (ft^2/acre)	Sapling Density (per acre)	Non-Avoided Seedling Density (per acre)
3	39	Montgomery	0	10	86	1,214
3	67	Warren	6	14	140	5,234
3	96	Carrol	8	5	293	3,642
3	118	Benton	0	0	768	0
3	168	Jasper	4	3	382	3,729
3	172	White	46	2	315	7,160
3	192	Newton	6	4	877	5,145
4	32	Crawford	1	30	1,040	59
4	46	Harrison	2	1	445	8,566
4	96	Orange	3	0	807	10,984
4	218	Greene	0	5	864	1,079
4	270	Brown	15	34	380	5,482
4	273	Brown	22	34	257	7,098
4	311	Morgan	1	2	413	2,511
9	5	Noble	2	2	384	4,856
9	34	St. Joseph	4	9	733	6,471
9	39	Noble	3	0	459	7,318
9	44	DeKalb	4	3	328	7,419
9	45	DeKalb	3	4	475	9,420
9	81	Steuben	2	5	787	10,910

MEASURING HUMAN VALUES TOWARD DEER OF INDIANA RESIDENTS

Taylor Stinchcomb, *Purdue University*

As both white-tailed deer and human populations expand across rural to urban landscapes, deer-human interactions become a regular occurrence. Deer management typically emphasizes controlling deer populations and damage to property, but emerging positive values for wildlife may reflect desires to protect deer even when wild populations threaten private property or livelihoods. Different values for deer among different social groups could lead to social conflicts that make management of white-tailed deer difficult, especially when managers try to meet the needs of all residents in the state. More work is needed to understand how we can measure human values for and experiences with deer and what role they play in social conflict over wildlife management.

Addressing social conflicts related to wildlife requires that we re-examine existing management frameworks. In the U.S., wildlife and other natural resources are managed as public trusts, whereby appointed or elected government officials ("trustees") establish direction and set broad, goals for management in their jurisdictional areas. Resource agencies ("trust administrators"), such as Indiana DNR, have the responsibility to apply these goals in local contexts and manage wildlife populations for the equal benefit of their constituents (the residents of Indiana).

Attaining the public trust ideal in white-tailed deer management faces several challenges. These include arriving at shared goals and clear responsibilities among resource managers and diverse stakeholder groups; accounting for the emotional, cultural, and situational factors that can lead to human-human conflicts over white-tailed deer; and increasing both state transparency about management decisions and public awareness about white-tailed deer ecology.

Our study begins to integrate the social dimension into deer management in Indiana, aiming to address the above challenges. We are using a mixed-methods approach involving semi-structured interviews, a statewide survey, comparative analysis, and an integrative phase to answer the following questions:

1. How do Indiana residents and natural resource management professionals currently perceive, value, and experience deer populations across the state? What outcomes do residents and managers desire from deer management?
2. What is the existing relationship between Indiana residents and deer management professionals? How can this relationship be shifted to more equitably incorporate stakeholder interests?
3. How can the social and ecological data be integrated effectively to inform white-tailed deer decision-making in Indiana?

Preliminary Results

During the summer of 2019, we conducted 75 semi-structured interviews and two focus group sessions from five broad white-tailed deer stakeholder groups: woodland owners, farmland owners and producers, deer hunters, urban residents, and resource managers (Figure 10-4). Through preliminary interview analysis, several themes have emerged suggesting interactions with deer are often multidimensional and influenced by contextual factors. We found that regardless of stakeholder group, Indiana citizens hold mixed emotions towards deer and deer management that are rooted in past experiences, current livelihood and behavioral contexts, beliefs about responsibilities and ethics in deer management, and beliefs about other social groups.

"I enjoy [seeing deer], a natural setting…I would be happy if I didn't see them as frequently as I do."—FARM02

"We've been growing some trees, trying to get them bigger to sell…And I had to prune the heck out of some that are five, six, seven years old because the deer had eaten them so many times, they looked more like bushes. They'd resprouted and resprouted and resprouted. The deer just kept hammering them. Some of them, you just cut them down. You just cut them down and hope that they resprout into one nice stem, because, I mean, what are you going to do? There's no saving what was left. So yeah. I kind of have a love-hate relationship with deer."—MGR13

"I do. I hate it that they eat my plants, but I love it that I can see the deer…They eat anything I plant. Anything. I've got six and a half acres of woods they can eat, and they'll come and eat whatever I plant. So I'm looking at deer fencing right now to at least enclose a garden. I love seeing them. I do."—WLO04

"I would hate to think that in one hundred years, the only place you're going to see a white-tailed deer is in a zoo because there's is nothing more exciting than to be walking in the woods, whether you're in a state park or you're walking across a farm field, seeing deer pop out or see a big buck. I mean, that's just thrilling because they are beautiful animals…As far as seeing the damage to my trees, I've finally come to accept it because it's a good source of, obviously, for nutrition for the deer…But when they eat the seedlings, that's kind of tough. And I think I've tried a number of different things. I think just letting them hide will be the best thing."—HUNT01

Moreover, many Hoosiers express conflicting perceptions related to deer management, such as a desire for more deer to be hunted but an unwillingness to allow more hunters on one's land.

"So what is there here to control the population? They don't have any apex predators other than the hunters. And if they act responsibly and they only take-- They only do the certain things. That's okay. Personally, again I don't hunt. I think they're wonderful beautiful animals. I don't really want to shoot them or do anything. And if somebody could come up with a real realistic means of giving them birth control I'd say, "Okay, let's try it." Rather than hunting but I haven't seen that happen."—WLO05

"I think they [the deer] need to be managed. I don't know what the appropriate level is but I think there needs to be a scientifically targeted population level… and I manage [hunting]. At one point, I was not cash leasing, hunting lease, the property and I had a lot of local trespassing that was going on with hunters who would come onto the property and deer hunt. I don't have a giant problem with that like some people do but I really want to know who's on the property, I don't want people trashing it, and I want to make sure that the hunting is all legal and good sportsmanship."—WLO02

"Last fall when we were out there [in our woods], there was one evidence of a hunter. And we put a sign up saying get out of here… There were truck tracks there and it was very disconcerting to me because our wood is locked. It has a gate. It's very difficult to get into those woods in a truck… There's one man to whom we've given a key to our woods…And somehow or other his son in law found that key and went into our woods and oh, his friend…So I consider that an interaction with the hunter. I think it was profoundly disrespectful. I think it's disrespectful toward us. I think it's disrespectful towards his father in law. And this is a good guy. He just has a whole different attitude about whether he is right to be in our wood when shooting deer."–RES01

Currently, we are continuing our interview analysis to explore why these conflicting perceptions exist and how wildlife managers could potentially navigate them. This will help to understand how personal experiences and emotions influence interest in deer management, and what this implies for managers who face the challenge of balancing competing social interests alongside ecosystem dynamics.

Next Steps

Results from these interviews will help us develop a survey that measures deer-related values, attitudes, and experiences among a larger, more representative sample of Indiana residents. We will develop the survey in summer 2020, pilot test it in late summer (Jul-Aug), and administer a final version in fall 2020 via mail with an online option enclosed.

The survey will include questions about attitudes towards deer and management activities, behavioral responses to deer, as well as the individual, social, political, and environmental factors that may influence these attitudes and behaviors. We will focus on identifying what challenges ('barriers') residents perceive related to deer management, what benefits they derive from deer

Snapshot IN Photo

populations, and how fundamental values influence the barriers and benefits they perceive. The concepts of barriers and benefits offer a means for managers to address the underlying drivers of social conflicts over deer and potentially develop long-term approaches to promote deer-human and human-human tolerance.

In addition to the general Indiana population, we will survey Indiana landowners who live in proximity to the test landscapes in which deer population and habitat sampling are being studied by our colleagues. Doing so will allow us to map social values and attitudes towards white-tailed deer and deer management together with existing ecological conditions across the state. We will examine 'hot spots' where social perceptions conflict or align with each other and with ecological conditions. This integration process aims to assess where trade-offs exist among social interests, ecological conditions, and management decision-making, how these trade-offs vary across Indiana, and what this spatial variation implies for developing a more integrated and adaptive approach to deer management in Indiana.

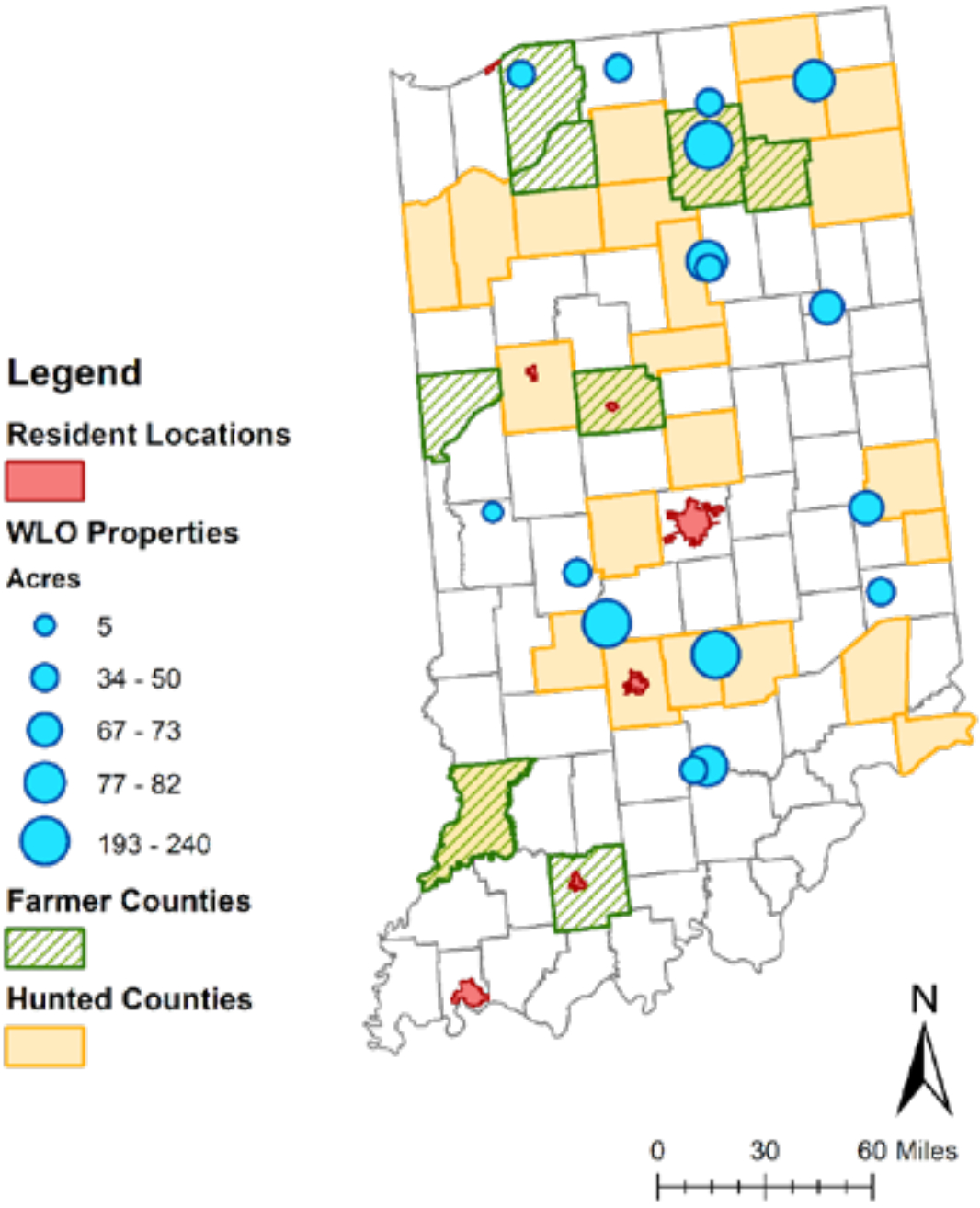


Figure 10-5. Counties and locations across Indiana represented by interview participants from four stakeholder categories: urban area residents (17 interviewees plus 14 individuals in a focus group in Bloomington, IN), woodland owners (WLO; 16 interviewees), farmland owners and producers (10 interviewees), and deer hunters (16 interviewees). Locations are where participants live, manage land, and/or hunt, not necessarily where the interview took place. Many hunters hunt multiple counties. Not pictured are the jurisdictions of resource managers who participated in our interviews.

APPENDIX A. UNDERSTANDING DMU AND COUNTY DEER DATA

The Deer Management Unit (DMU) and County Deer Data are tools used by Indiana DNR to monitor trends related to the deer population. Those trends are monitored over time to make decisions about harvest goals. This section discusses the data and how they are applied to make harvest decisions in each DMU and Indiana county.

Deer Management Units

In 2018, Indiana DNR began analyzing deer data on a regional scale, based on Deer Management Units (DMUs). DMUs are defined groupings of Indiana counties that were developed as part of a collaborative research project between Purdue University and Indiana DNR. Counties were grouped based on similar characteristics such as habitat, hunter density, and urban development. A detailed explanation of the project is available online at https://doi.org/10.1002/wsb.1037.

The project originally defined Regional Management Units (RMUs) that Purdue University is using to conduct research on deer populations and deer management. However, Indiana DNR adapted the RMUs into the DMUs referenced throughout this report to make them better suited for management applications (Figure A-1). The DMUs are only used for statistical analyses to inform deer management. They do not alter any county-level hunting regulations.

Historically, the county has been the base unit for deer management in Indiana. However, Indiana DNR is often unable to collect enough data at the county level to accurately interpret deer data trends. Therefore, the DMUs provide a larger quantity of data for analysis and interpretation. This allows us to evaluate deer harvest, provide harvest recommendations, and report survey data on a broader scale. For example, Indiana DNR uses data from Snapshot Indiana, a citizen science trail camera project (see Chapter 8), to estimate annual deer recruitment (i.e., fawn:doe ratio in the fall prior to the hunting season). On average, there are only one or two cameras set up in each county. That is not enough cameras to provide sufficient data to evaluate recruitment for individual counties. The data can be used to estimate recruitment statewide; however, recruitment varies based on the quality of fawning habitat, which differs across the state. Using the DMU groupings, Indiana DNR is able to pool camera data from multiple counties with similar habitat. Having more data results in improved quality of analysis, which better informs management decisions.

The DMUs are also not rigid groupings. They may change slightly over time, as we develop better datasets and reassess counties that may have been only a slightly better fit for inclusion in one DMU over another. However, we expect these changes to be relatively minor, and changes will only be made to improve the data quality from counties that are grouped together. DMUs 1 through 9 are grouped based on similar characteristics among counties. DMU 10 is the Urban Deer Management Unit and includes Marion County and other highly urbanized areas, most of which are designated Deer Reduction Zones. Because the Urban Deer Management Unit is based on a sub-county level, some data, such as the deer harvest data, cannot be reported for this unit. Only certain datasets that are reported at the sub-county level by a 16-sq. mi. grid system can be described for the Urban Deer Management Unit.

Throughout the 2019 Indiana White-tailed Deer Report, we report data at the county level, the regional DMU level, and statewide. As in years past, data for individual counties can be found in the County Deer Data sheets. Similarly, data for each DMU can be found in the DMU Data Sheets.

Changes to the County Deer Data Sheets

County Deer Data sheets were first included in the 2016 Indiana White-tailed Deer Report, and consisted primarily of harvest data, take from deer control permits, and deer-vehicle collision trends. In 2017, they were expanded to include hunter and farmer opinion data from past and current surveys. As Indiana DNR has developed a more robust data collection system for citizen input, we have developed additional indices and trends that can be analyzed at the county level. Likewise, we are expanding the amount of biological data that can be used to evaluate the deer population, mortality, and harvest trends.

The county deer data sheets were expanded further for the 2018 Indiana White-tailed Deer Report to a total of four pages of data dedicated to each county. The first and second pages include the biological and harvest data, while the third and fourth pages are typically the opinion data from both hunters and non-hunters. The data are used by deer scientists, wildlife biologists, and program administrators to assess the harvest and mortality of deer, examine trends in the population, and assess public desire for the direction of the deer population.

Over time, Indiana DNR will continue to assess the deer population using improved datasets and the latest statistical methods available. As we expand the types of data collected, we will continue to update the DMU and County Deer Data sheets with new analyses.

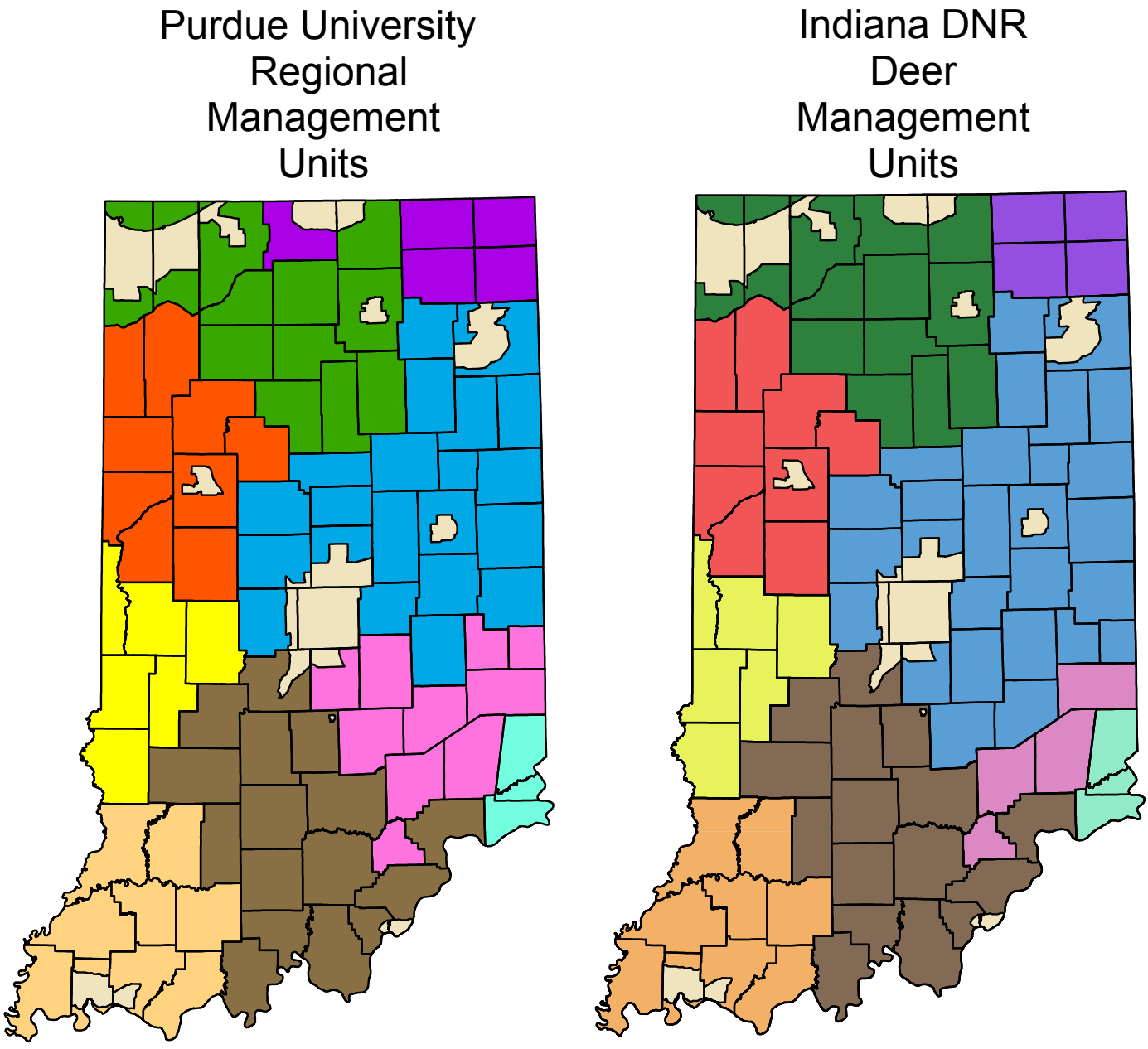


Figure A-1: The Regional Management Units (RMUs), developed through a collaborative research project by Purdue University and Indiana DNR (left), and the Deer Management Units (DMUs) that Indiana DNR adapted from the RMUs for deer management in Indiana (right).

Population Indices

A generally accepted fact in wildlife management is that, except for in very limited situations, it is effectively impossible to directly measure wildlife populations on a large scale. Wildlife managers can never know exactly how many individuals of a species are present on the landscape. On a small scale, such as on someone's property that is managed for deer, the deer can be counted, and an estimated population can be calculated. But on a broad scale, this can be nearly impossible. Thus, biologists use measurable factors that are related to the trends in the population. These factors create a population index.

With an ideal population index, the index number would go up or down in a synchronous fashion with the deer population. A common index employed by wildlife managers to assess deer populations on their property is the spotlight count. Individuals drive around in a predetermined route and count the deer they see. The amount of area they can see while driving is estimated, and the visibility of the deer is also taken into consideration. The wildlife manager then conducts multiple routes over time; for example, five more times over the next two weeks to account for differences in movement by the deer. At the end, the wildlife manager calculates how many deer were seen per square mile, then that number is applied to the entire property. An important aspect of the survey is that the area sampled is representative of the property as a whole. So, if a property is 70% upland and 30% wetland, then that same habitat in the same percentages should be covered in the spotlight count route. If not, other adjustments using math and statistics would need to be made to account for those differences. Once the manager has the count (for example, 30 deer per square mile), that does not mean there are exactly that many (30) deer per square mile on that property. That is just the index value.

The true usefulness of an index is only realized over time. Each year, the wildlife manager plans out his spotlight counts in the exact same fashion. Ideally, there are no differences from year to year. If there are, that has to be taken into account during the calculations. Over a six-year period, the manager may count 30 deer/sq. mi., 32 deer/sq. mi., 35 deer/sq. mi., 27 deer/sq. mi., 36 deer/sq. mi., and 34 deer/sq. mi. The trend in these estimates is what is important, not the individual numbers. Remember, this is just an indicator of what the deer population is doing. In this example, there is a general increase in the deer population. If the manager is happy with this, he would maintain his management strategies until another indicator, such as the amount of fawning habitat or forage quality, reaches a point at which the manager would need to increase the harvest to decrease the deer population. Because the spotlight counts may be expensive compared to doing a habitat survey, once the manager knows how the habitat survey is affected by a changing deer population, the manager may decide to only use the habitat survey as an indicator of the direction of the deer population.

Notice in the example spotlight survey counts above, there was a sharp drop in the measured deer population during the fourth spotlight survey. This could be caused by a variety of reasons such as unseasonably hot or cold weather that significantly altered deer movements; there could have been a significant modification in the habitat, such as a 5-year burn; neighboring properties could have changed their management practices; or there could have been a significant mortality event caused by EHD or another disease. In this case, it would have been a mistake for the manager to try to immediately make a change to offset that decrease, especially if the manager did not know exactly why the change occurred. Similarly, this is why the Indiana DNR does not immediately respond to sharp changes in population indices; rather, we wait and observe the trends over time. A sharp change in the deer harvest regulations based on any given year's data could result in wild changes in the deer population, whereas the general goal of managing a hunted species is to minimize these changes.

Indices Used by Indiana DNR to Monitor Deer Population Trends

The primary indices Indiana DNR uses to monitor deer population trends include: 1) various harvest metrics such as number of deer harvested per county and the ratio of males to females harvested, 2) trends in deer damage complaints, 3) trends in deer-vehicle collisions, and 4) trends in hunter and landowner attitudes. The data are examined for significant trends as the results change over time. One way that biologists do this is by looking at the Effect Size of the change from a five-year average.

Effect size is a statistic that compares one statistic to another statistic measured in the same fashion. In this case, the current year's deer harvest and DVCs are compared with a five-year average of the same value to determine how much the current year's data differ from the average. If the raw data are examined on their own, it can be difficult to determine if a change is significant. For example, in Cass County from 2018 to 2019, there was an increase in DVC per billion miles traveled (DVC/BMT) by 75.69 DVC/BMT. Now the question is, "Is this a big or important increase in DVC/BMT?" When the 2019 value is compared with the five-year average (431 DVC/BMT) instead of just the previous year's, the increase in DVCs is 45.61. But is 45.61 DVC/BMT a big increase? To determine that, the effect size statistics are calculated for each index. When 2019's data point is compared to the five-year average (2014-2018), it is only an increase of 0.66 standard deviation (SD). A standard deviation is a statistic that looks at a number of different magnitudes on the same scale. In Cass County, there was an increase of 0.66 SD. In Allen County, the increase in DVC/BMT was 0.00 SD (no increase from the previous five years). In Adams County, there was an increase in DVC/BMT of 3.95SD, which is huge, especially when compared to other counties. So, the effect size allows for comparison between counties without having to look at the raw data and then making a separate judgment each time. Right now, an increase or decrease of less than two SD is considered non-significant. Part of the research Indiana DNR is conducting aims to determine the level of change that should be considered significant.

The effect size also allows for the comparison of different data types from different indices. For example, in the total harvest trend in Adams County, there was an increase in the harvest by 8.60 SD. This would be considered a significant increase in the harvest over time. Looking at the trend in SDs, the harvest has been increasing in Adams County for several years. An increase in harvest only means that more deer were harvested—it does not explain why. However, the increase in harvest compared with the trend in DVC/BMT shows a general increase in DVC/BMT as well. This might indicate an actual increase in the deer population in that county.

Requests for deer damage permits have been included in the past as a metric for assessing damage caused by deer. However, because the individual number of permits requested by landowners is so low, typically fewer than five to 10 per county, this metric is only useful in general terms. Indiana DNR is currently working to convert this number into cost of damage and/or acres damaged.

Another trend that is monitored that is linked to population size is satisfaction of hunters and landowners with the perceived size of the deer population. Historically on a three-year cycle and now annually, Indiana DNR conducts surveys to assess hunters and farming landowners for a variety of factors, including satisfaction. Declining hunter satisfaction and increasing desires by landowners for more deer may be an indicator of a declining deer herd. Increasing satisfaction by hunters with deer management in the state and decreasing desires of landowners for more deer may be an indicator of an increasing herd. It is unclear how this index tracks with deer populations other than in a much more generalized fashion because many factors influence hunter and landowner satisfaction. In both cases, an attitude score is calculated each time a survey is conducted, and the percentage of change is used to gauge the change over time. .

When each of these four indices are considered together, a general trend can form for what is occurring with the deer population. Again, these data are just used to monitor the generalized trend in the deer data. It is unclear what the actual population is, but the trends provide relative insight. Currently, there is a research project underway with wildlife researchers at Purdue University to re-verify the relationship of the indices currently used with the deer population size and to identify new cost-effective indices that could be used in addition to those currently employed.

Indices Used by Indiana DNR to Determine Desired Trends in Deer Populations

The various indices discussed that are used to monitor population trends are just the first step in setting harvest limits. The next step is to look at factors that affect what the desired direction of the deer population should be. In general, various human dimension surveys provide this input. In the DMU and County Deer Data sections, most of these data are included on the third and fourth pages of each region and county's report. Indiana DNR looks

at a combination of factors to assess what trends in the deer population Indiana's hunters and landowners want, including the desired management priorities, hunter satisfaction with deer management, landowner desire for the direction of the deer population, and satisfaction with various management practices. Other factors such as the presence of disease or deer reduction zones are also considered.

Data Summarized with Factor Analysis

The DMU and County Deer Data sheets include a more detailed analysis of hunter and non-hunter opinions. The response to the individual deer management survey questions are presented graphically and were also summarized using factor analysis. The Deer Management Survey provides a large number of questions that offer a wealth of information, but can be overwhelming to analyze individually, particularly when the data are further broken down into counties or management units. Although we ask many questions, we are more interested in the underlying thoughts and feelings that drive the responses than in individual answers. In this scenario, factor analysis is a useful tool for aggregating, visualizing, and understanding patterns in survey responses. Factor analysis is a statistical method used to cluster shared variability in survey responses into a smaller number of unobserved latent variables or factors. This analysis assumes that the questions we ask have a similar pattern of responses because they are all associated with an underlying factor that we can extract and measure. The relationship between each question and the underlying factor is expressed as a factor loading, with larger absolute values indicating a stronger correlation with the factor.

We performed two factor analyses on questions from the deer management survey. The first factor analysis was performed on questions asked of all individuals that participated in the survey (Figure A-2). If hunters harvested deer in a county other than one in which they lived, they were given the option of answering these questions about both counties. The second factor analysis was performed on questions asked only of individuals that hunted about the county in which they hunt (Figure A-3). In the first factor analysis, two important factors were extracted (Figure A-2). The first factor was related to questions about the deer population size, and the second was related to questions about deer management (Figure A-2). In the second factor analysis, a single factor was extracted and was most strongly associated with questions related to changes in deer harvest over the past five years (Figure A-3). The first factor analysis accounted for approximately 61% of the variation in the responses, and the second factor analysis accounted for approximately 47% of the variation in the responses.

We can see clear differences in the participant groups during three years of the deer management survey for the population size factor (Figure A-4). Non-hunters were fairly neutral about the deer population size, whereas hunters believed it was too low, particularly where they hunt (Figure A-4). For the deer management factor, we see changes between groups and between years (Figure A-5). Non-hunters were more satisfied with deer management than hunters, and hunters were more satisfied with deer management where they live than where they hunt (Figure A-5). All groups of participants were more satisfied with management over time (Figure A-5). The hunter opinion factor also increased slightly over time (Figure A-6). Overall, these factors help provide a clearer picture of deer management in Indiana, and we will continue to track how they change over time. .

Putting it All Together to Form Management Recommendations for Each County

Once the data are collected and analyzed by the Deer Research Program, it is shared with various biologists, administrators, and the public. Indiana DNR private lands biologists examine the data provided, in addition to data they may have collected throughout the year, such as additional damage reports or comments from individuals living within those counties. They then make recommendations for the upcoming year's bonus antlerless quotas for the counties they oversee. Indiana DNR accepts comments and recommendations from Indiana DNR Law Enforcement conservation officers who are assigned to each county, as well as accepting comments directly from the general public. Indiana DNR administrators collect those comments and recommendations and make their own recommendations. The Deer Research Program also makes recommendations exclusively on the data collected throughout the year.

Once all of the information and recommendations are gathered, a group of Indiana DNR administrators, representatives from Indiana DNR Law Enforcement and biologists from the Deer Research Program meet to discuss the data and recommendations provided by their respective sections. Once a recommendation for the upcoming year's bonus antlerless quotas is agreed upon by the group, those recommendation are recorded and presented to the Indiana DNR director for approval.

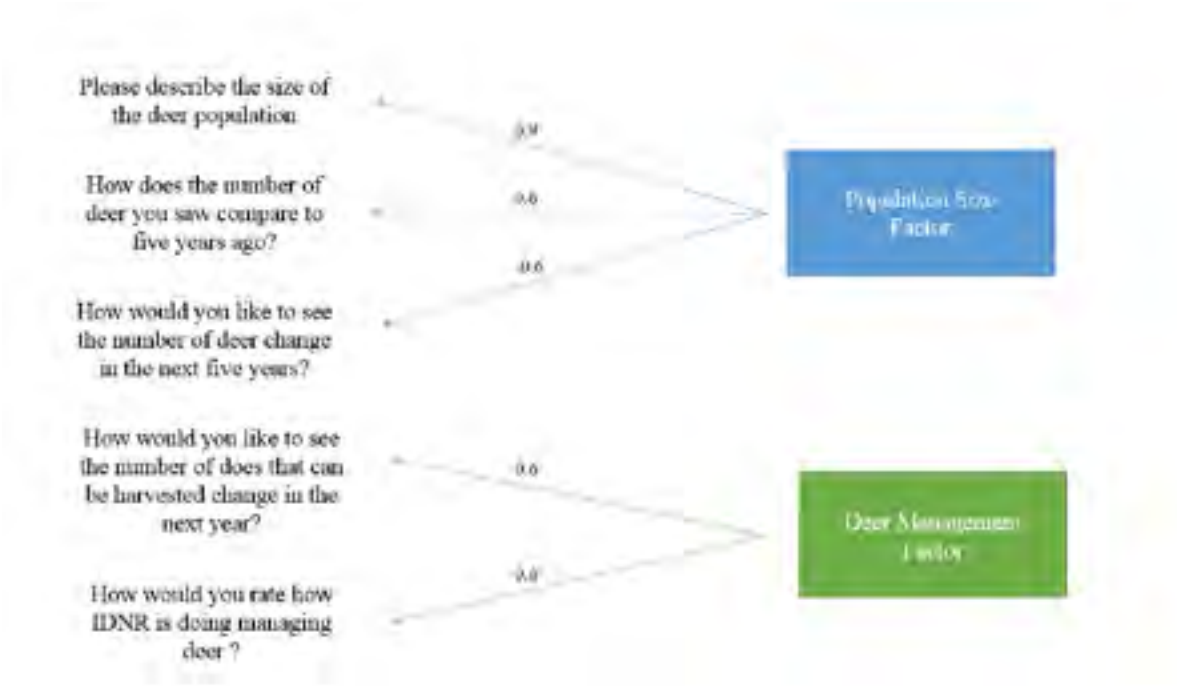


Figure A-2. Questions asked to all participants in the deer management survey and how they relate to factors extracted via factor analysis. The numbers represent factor loadings with larger absolute values indicating a stronger association.

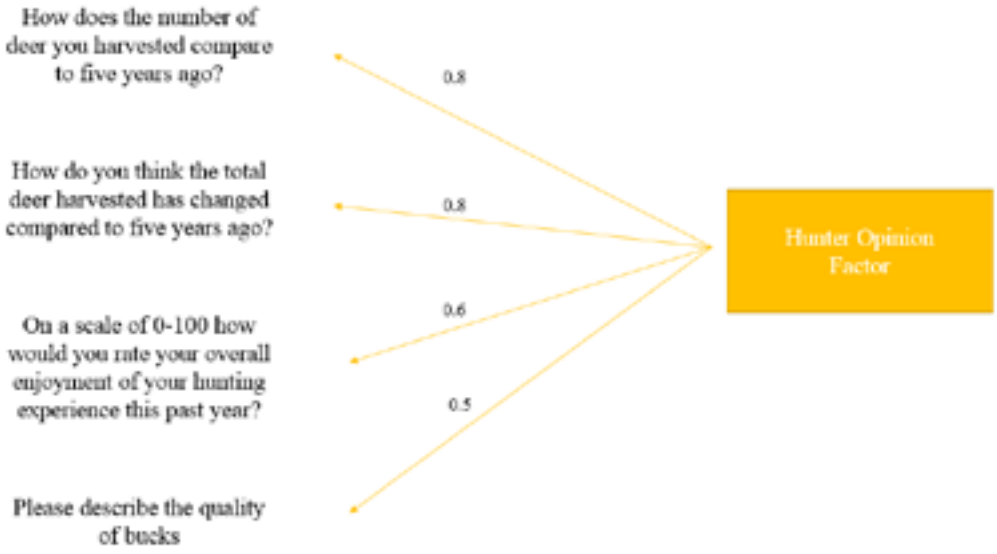


Figure A-3. Questions asked only of hunters in the deer management survey and how they relate to the factor extracted via factor analysis. The numbers represent factor loadings with larger absolute values indicating a stronger association.

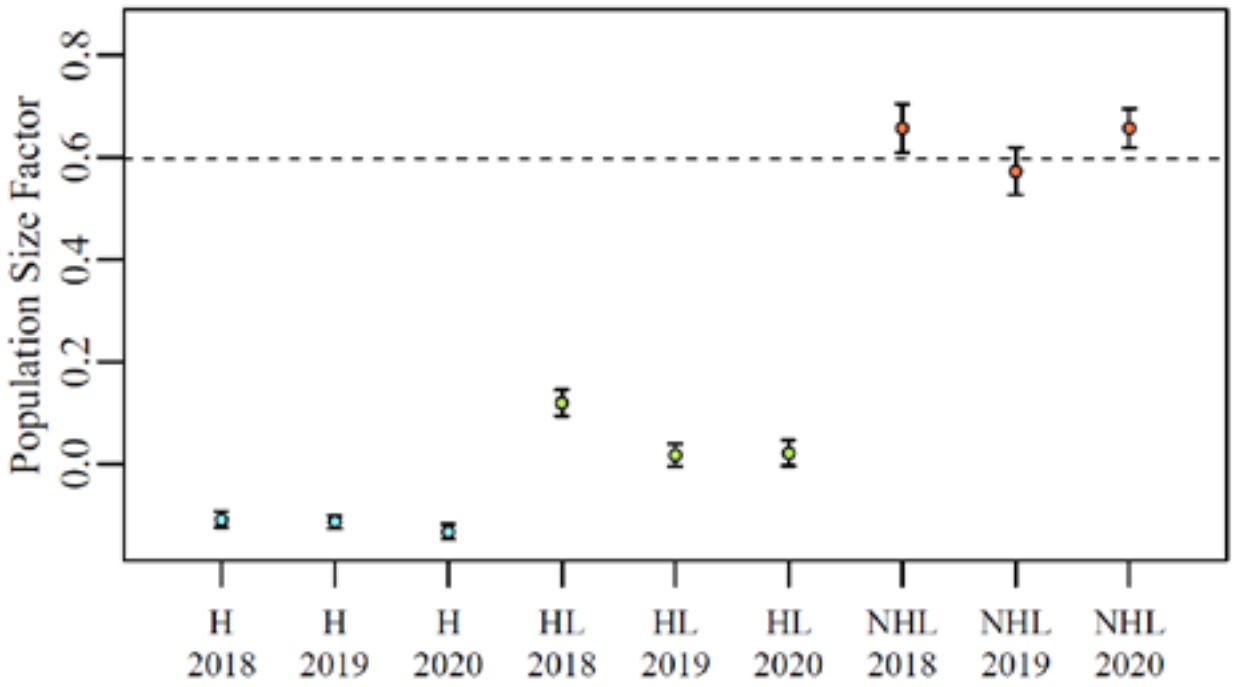


Figure A-4. Mean population size factor scores (with 95% confidence intervals) for hunters in the county where they hunt (H), hunters in the county where they live (HL), and non-hunters in the county where they live (NHL). The dashed line represents the score if all questions were answered neutrally.

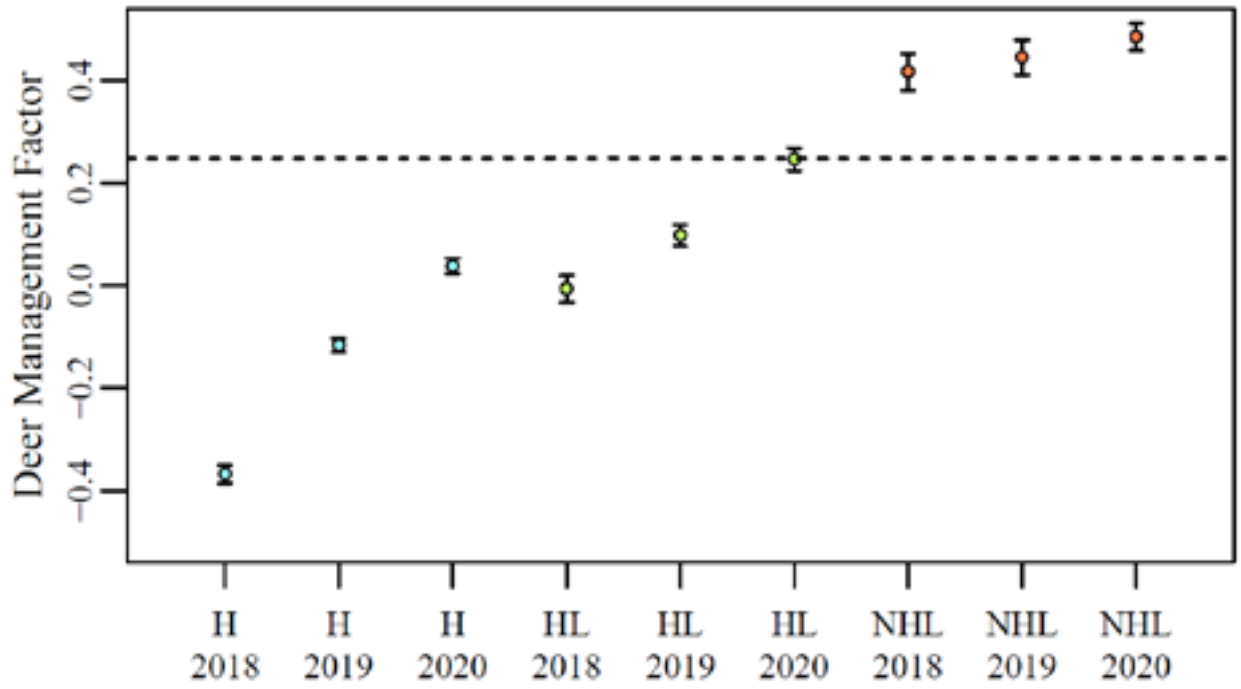


Figure A-5. Mean deer management factor scores (with 95% confidence intervals) for hunters in the county where they hunt (H), hunters in the county where they live (HL), and non-hunters in the county where they live (NHL). The dashed line represents the score if all questions were answered neutrally.

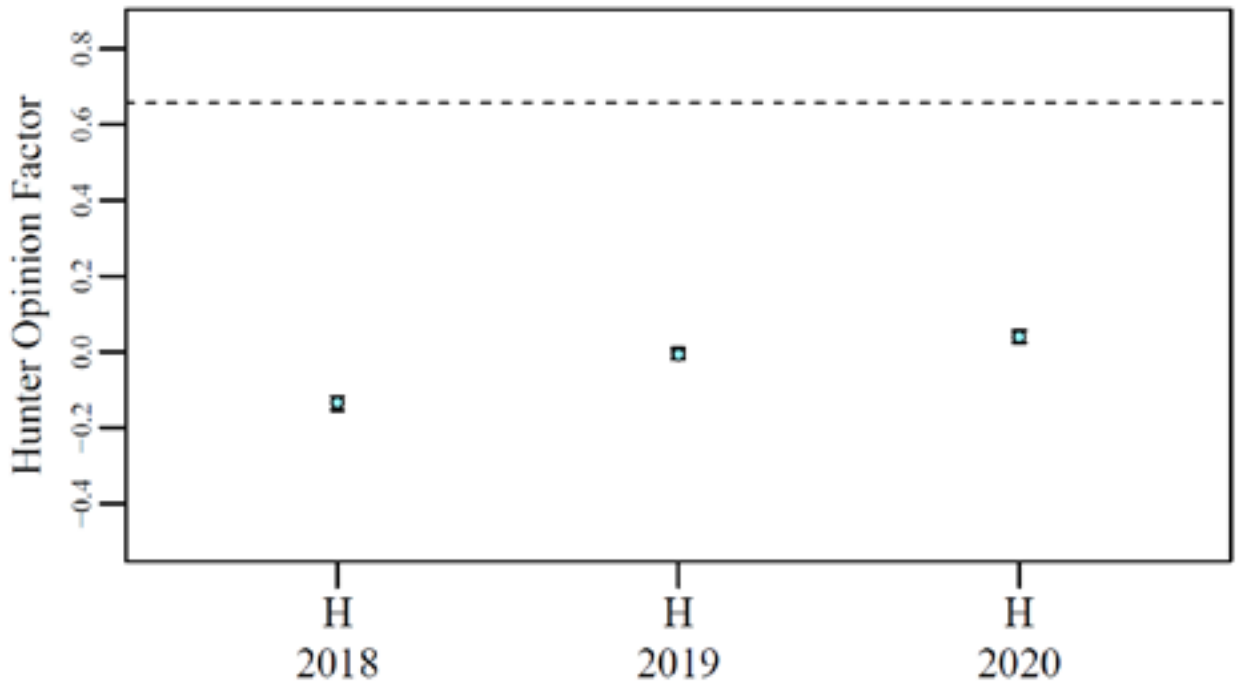


Figure A-6. Mean hunter opinion factor scores (with 95% confidence intervals) for hunters in the county where they hunt (H) in 2018, 2019, and 2020. The dashed line represents the score if all questions were answered neutrally.

APPENDIX B. DMU DEER DATA SHEET 2019

DMU 1: Northwest

4/17/2020

Total Square Miles: 6,022
Square Miles of Deer Habitat: 1,154
Percent Deer Habitat: 19

Table 1. Total harvest, buck harvest, and doe harvest (error approximately 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
2010	25,088	1.28	12,043	1.21	9.61	13,045	1.28	10.41	52.00		241.13	-1.32	6.38
2011	22,870	-0.42	11,139	-0.82	8.89	11,731	-0.21	9.36	51.29		232.75	-2.72	7.08
2012	23,755	-0.16	10,527	-3.27	8.40	13,228	1.36	10.56	55.69		206.44	-3.45	6.77
2013	20,195	-4.53	9,402	-3.27	7.50	10,793	-2.84	8.61	53.44		210.44	-1.36	5.77
2014	19,810	-1.80	9,456	-1.43	7.55	10,354	-1.90	8.26	52.27		199.97	-1.40	4.38
2015	19,854	-1.09	9,968	-0.48	7.96	9,886	-1.50	7.89	49.79		207.28	-0.61	4.31
2016	19,132	-1.16	9,849	-0.34	8.53	9,283	-1.45	8.04	48.52	165	185.73	-2.05	4.62
2017	17,327	-1.76	8,418	-3.13	7.29	8,909	-1.19	7.72	51.42	295	194.37	-0.77	3.31
2018	18,245	-0.89	9,463	0.07	8.20	8,782	-1.39	7.61	48.13	188	191.59	-0.80	2.62
2019	19,757	0.82	10,626	1.96	9.21	9,131	-0.47	7.91	46.22	180	201.43	0.69	2.00

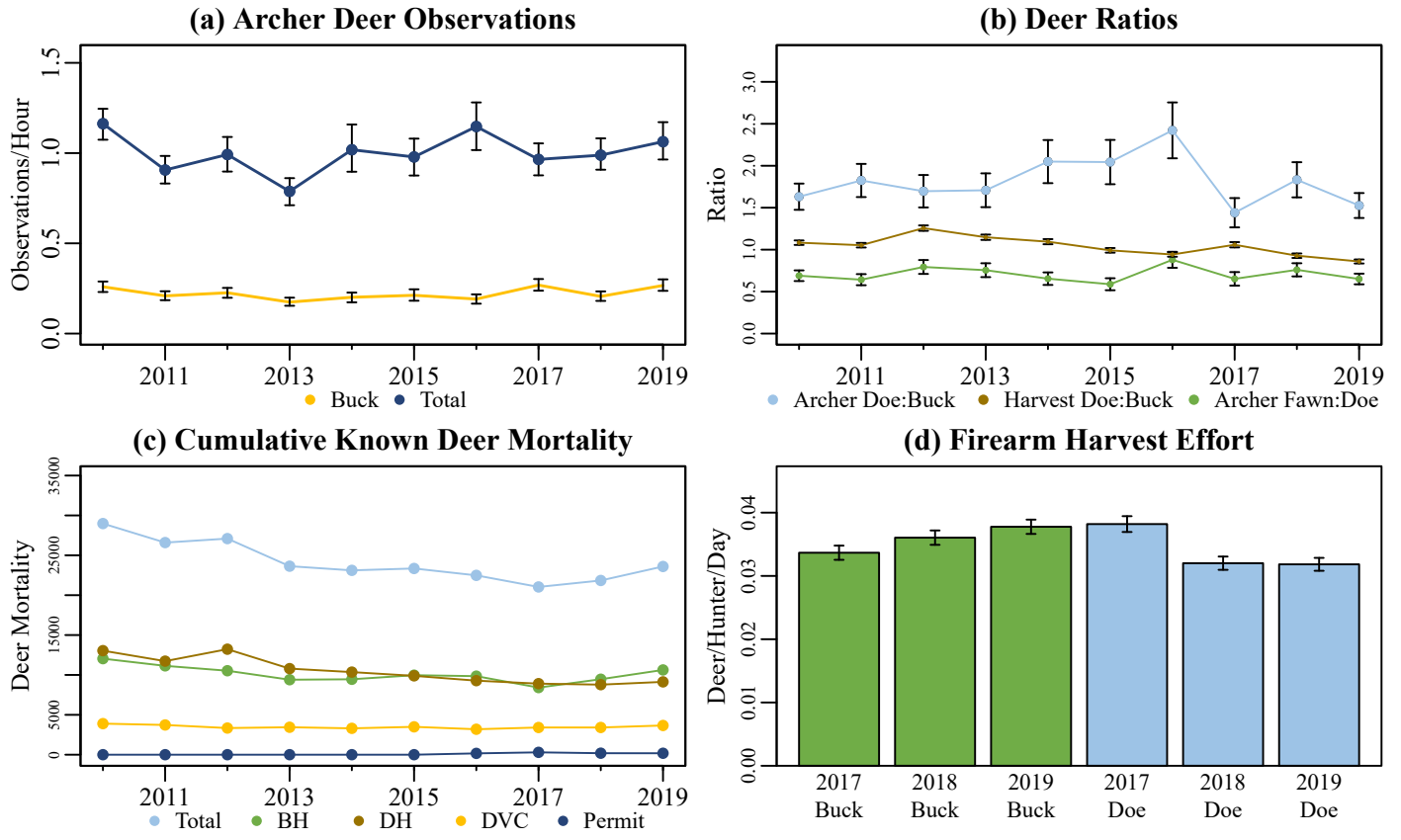


Figure 1. (a) Total deer and buck observations based on the Archer's Index. (b) Annual doe:buck ratios and fawn:doe ratios based on the Archer's Index and harvest records. (c) The total known annual deer mortality based on buck harvests (BH), doe harvests (DH), deer vehicle collisions (DVC), and deer permit takes. (d) Firearm harvest effort is the number of deer 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.

DMU 1: Northwest

4/17/2020

Total Square Miles: 6,022
Square Miles of Deer Habitat: 1,154
Percent Deer Habitat: 19

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	14,757	6,010	8,633	113	1	6,076	6,839	1,580	199	38	15	5	2	2	0	0

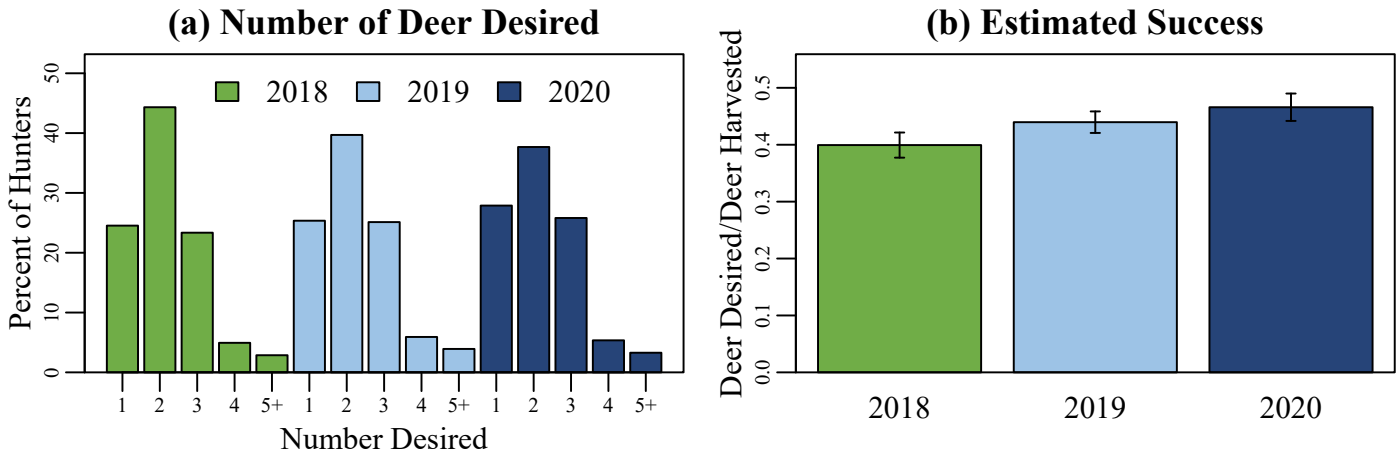


Figure 2. (a) The annual percent of hunters wishing to harvest each number of deer as reported in the deer management survey. (b) Success rate is estimated from the deer management survey as the Number of Harvested Deer/Number of Deer Desired (reported only; does not account for attempts that were not made).

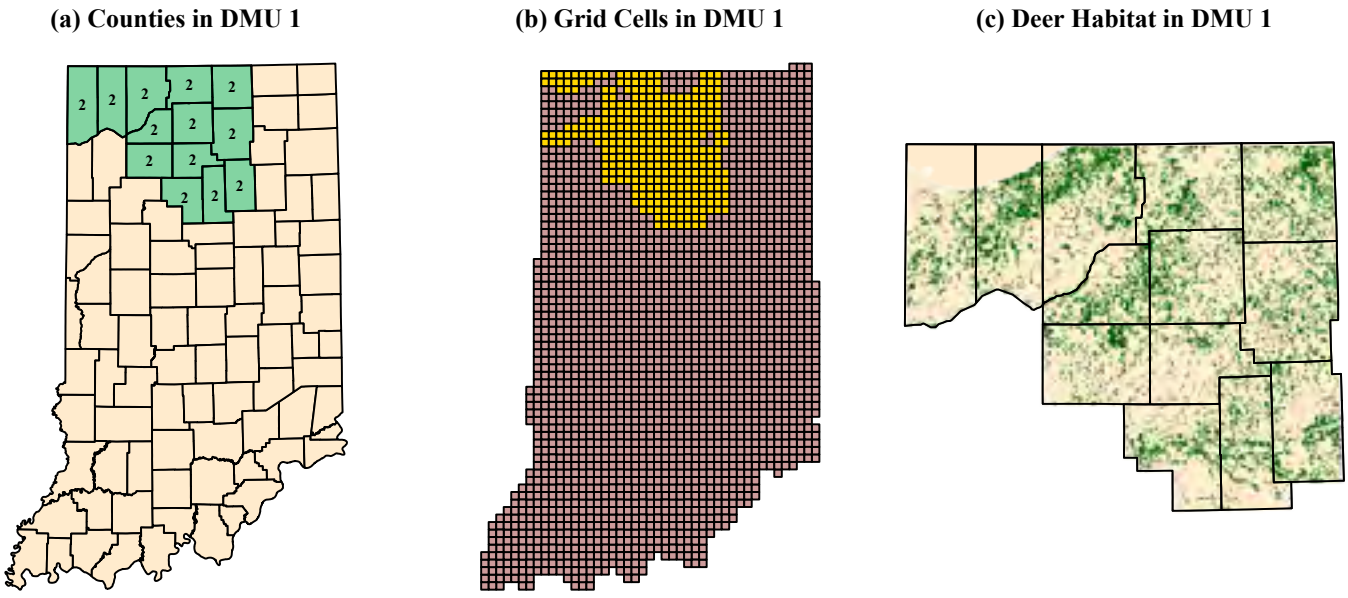


Figure 3. (a) Counties included in DMU 1 for summarizing harvest statistics. Labels are the 2019 county bonus anterless quotas. (b) 4 x 4 mile grid cells included in DMU 1 for summarizing annual deer management survey statistics. (c) Green represents the land use types classified as deer habitat in DMU 1.

DMU 1: Northwest

4/17/2020

Deer Management Survey Results

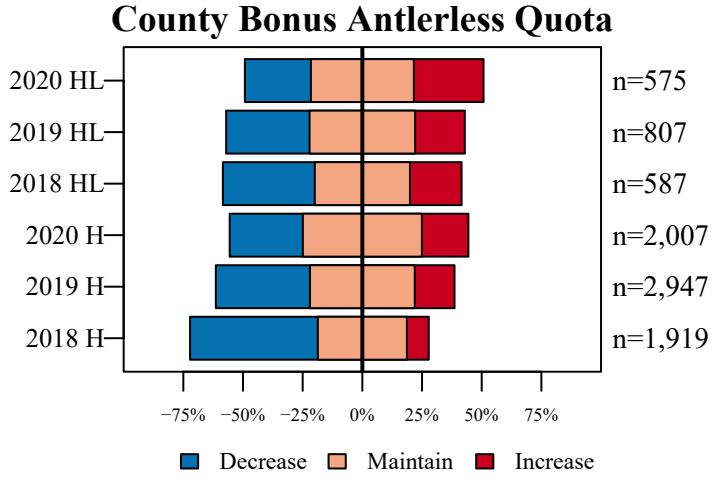


Figure 4. Opinion on how the County Bonus Antlerless Quota should change from hunters in the county where they live (HL) and hunters in the county where they hunt (H).

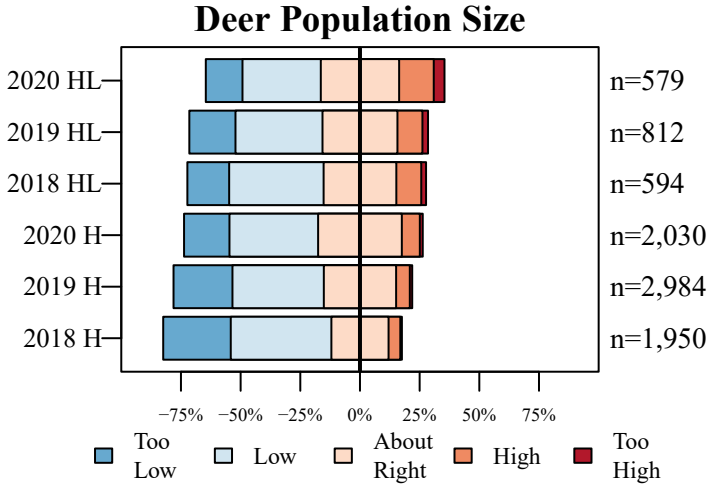


Figure 5. The current size of the deer population described by hunters in the county where they live (HL) and hunters in the county where they hunt (H).

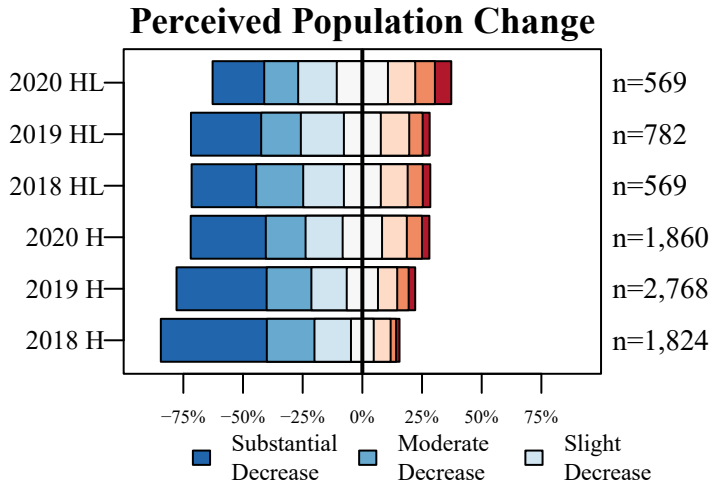


Figure 6. The number of deer seen compared to five years ago described by hunters in the county where they live (HL) and hunters in the county where they hunt (H).

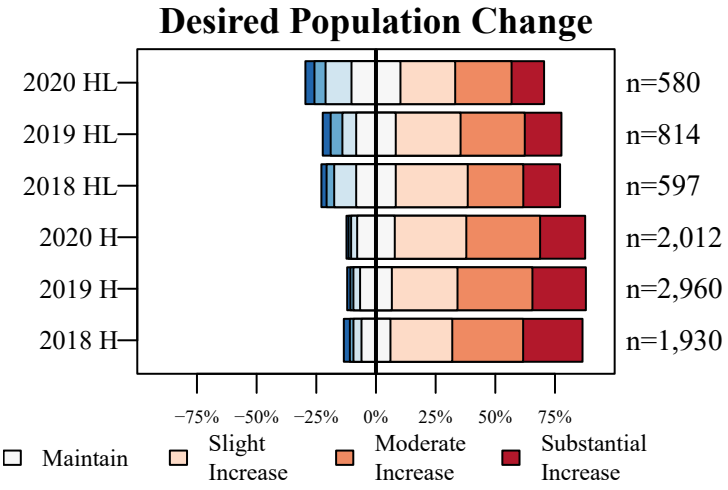


Figure 7. The desired change in the size of the deer population described by hunters in the county where they live (HL) and hunters in the county where they hunt (H).

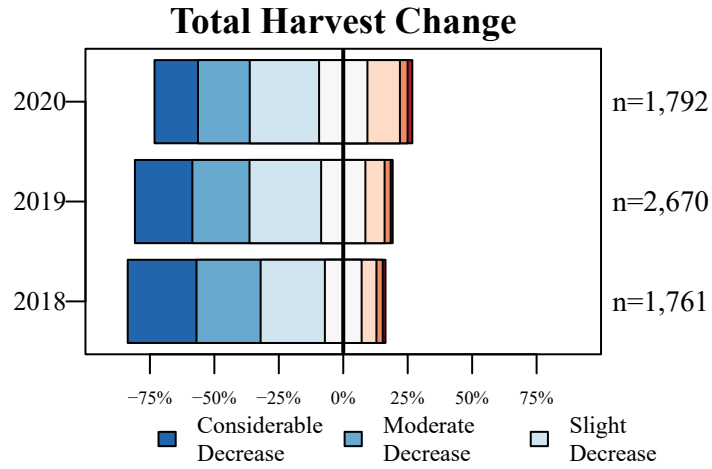


Figure 8. Opinion of hunters on how the total number of harvested deer has changed over the last five years.

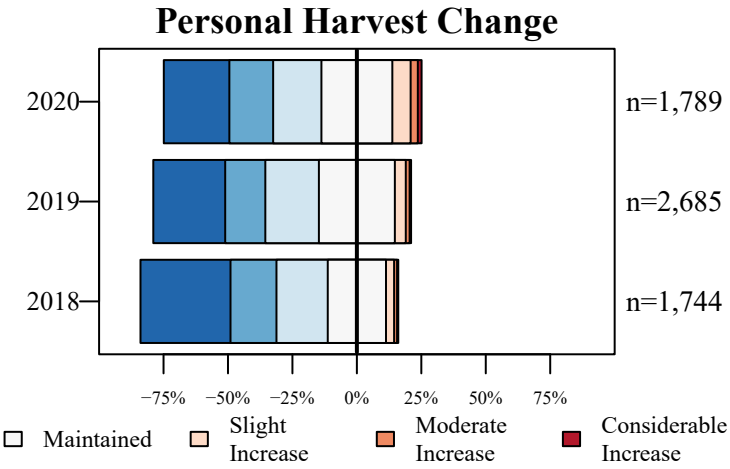


Figure 9. Opinion of hunters on how their personal number of harvested deer has changed over the last five years.

DMU 1: Northwest

4/17/2020

Deer Management Survey Results

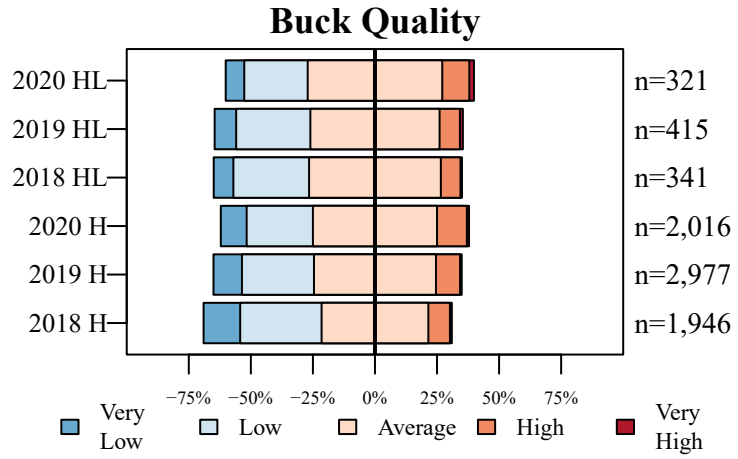


Figure 10. Hunters describe the quality of bucks in the county where they live (HL) and the county where they hunt (H).

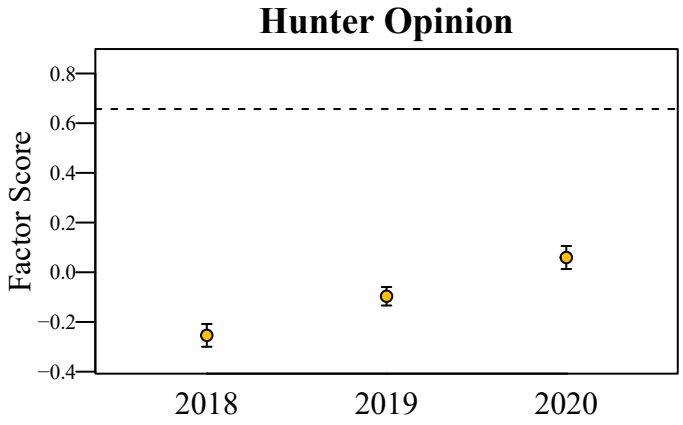


Figure 11. Hunter opinon scores over three years of the deer management survey. The score was aggregated using factor analysis of questions asked only to hunters. The dashed line represents the score if all questions are answered neutrally.

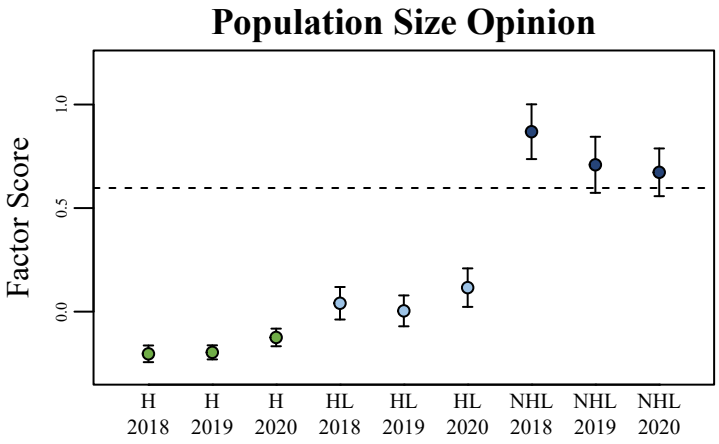
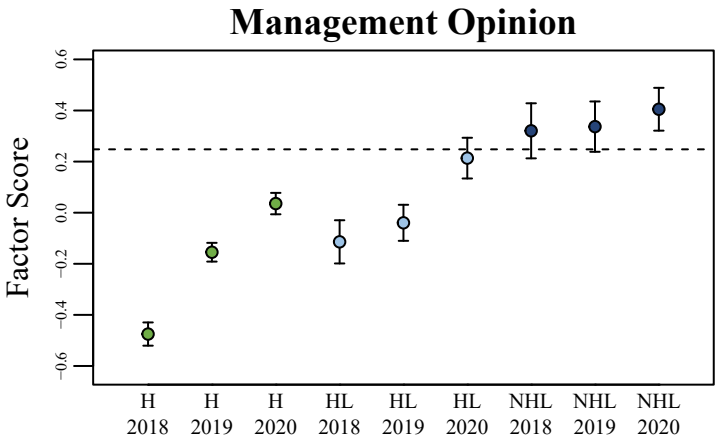


Figure 12. The opinion of nonhunters (NHL) and hunters in the county where they live (HL) and hunters in the county where they hunt (H) on deer population size. The score was aggregated using factor analysis of questions asked to all participants. The dashed line represents the score if all questions are answered neutrally.



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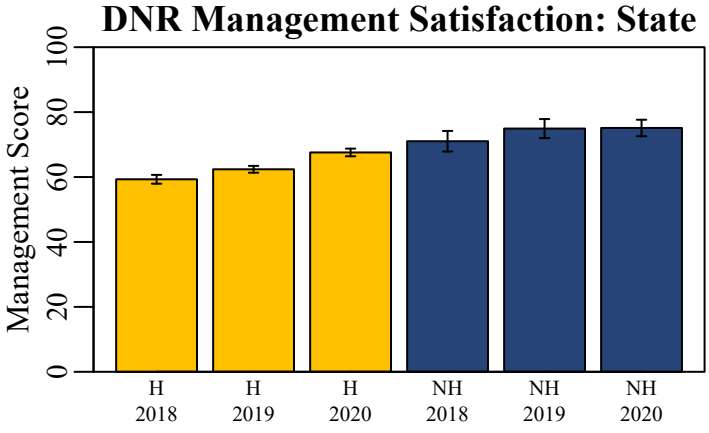

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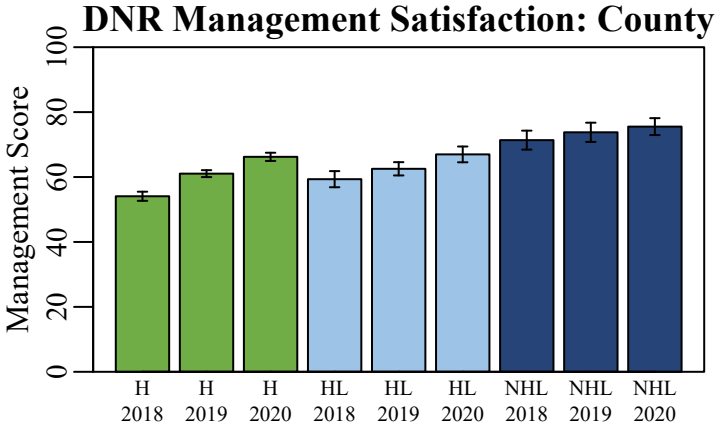

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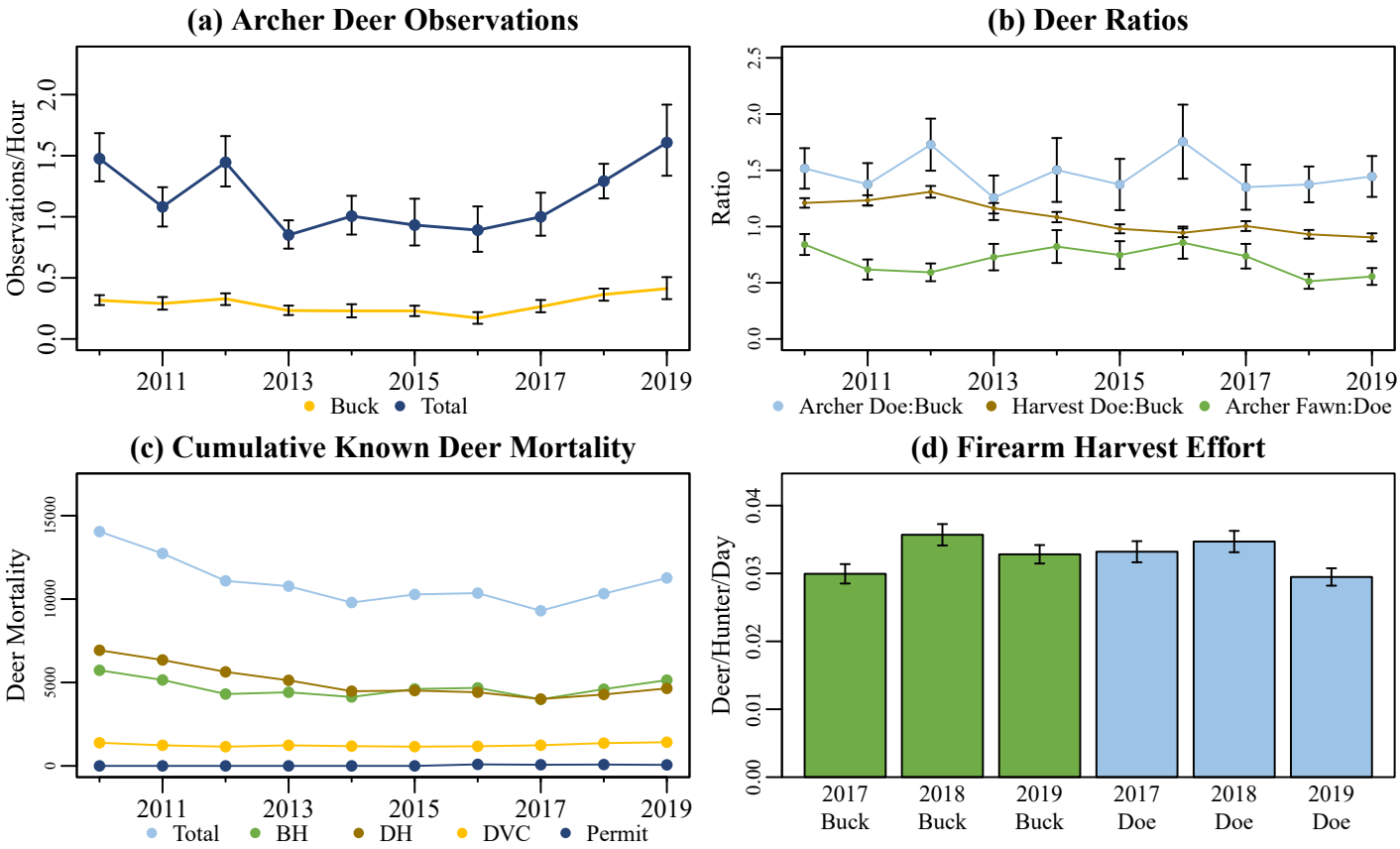
DMU 2: Northeast

4/17/2020

Total Square Miles: 1,490
Square Miles of Deer Habitat: 499
Percent Deer Habitat: 34

Table 1. Total harvest, buck harvest, and doe harvest (error approximately 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
2010	12,661	1.59	5,730	2.20	10.81	6,931	1.14	13.08	54.74		576.96	-0.61	6.00
2011	11,499	-0.26	5,150	-0.25	9.72	6,349	-0.26	11.98	55.21		519.25	-6.93	8.00
2012	9,941	-3.67	4,306	-4.29	8.12	5,635	-2.85	10.63	56.68		491.75	-2.75	8.00
2013	9,540	-2.02	4,412	-1.43	8.32	5,128	-2.54	9.68	53.75		533.07	-0.42	5.00
2014	8,610	-1.85	4,132	-1.40	7.80	4,478	-2.16	8.45	52.01		515.89	-0.65	4.00
2015	9,123	-0.82	4,609	-0.20	8.70	4,514	-1.23	8.52	49.48		507.48	-0.63	3.50
2016	9,090	-0.59	4,676	0.39	9.37	4,414	-1.02	8.85	48.56	90	523.62	0.66	3.50
2017	7,994	-2.52	3,989	-1.97	7.99	4,005	-1.56	8.03	50.10	68	554.90	2.57	2.50
2018	8,880	0.01	4,600	0.79	9.22	4,280	-0.57	8.58	48.20	79	605.89	4.32	1.75
2019	9,785	2.25	5,141	2.34	10.30	4,644	1.48	9.31	47.46	61	634.15	2.30	1.50



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DMU 2: Northeast

4/17/2020

Total Square Miles: 1,490
Square Miles of Deer Habitat: 499
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

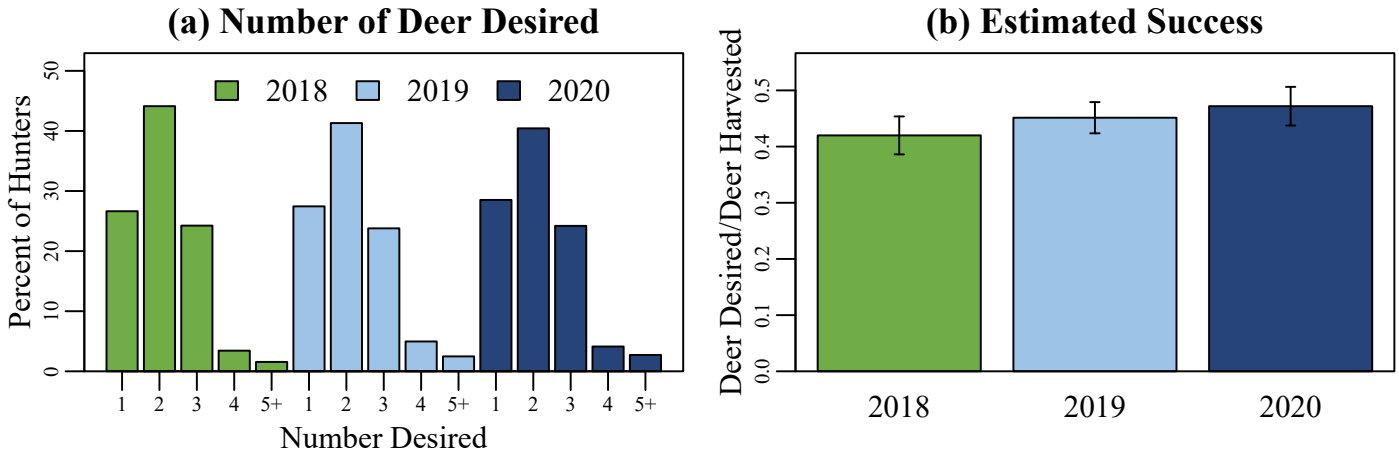


Figure 2. (a) The annual percent of hunters wishing to harvest each number of deer as reported in the deer management survey. (b) Success rate is estimated from the deer management survey as the Number of Harvested Deer/Number of Deer Desired (reported only; does not account for attempts that were not made).

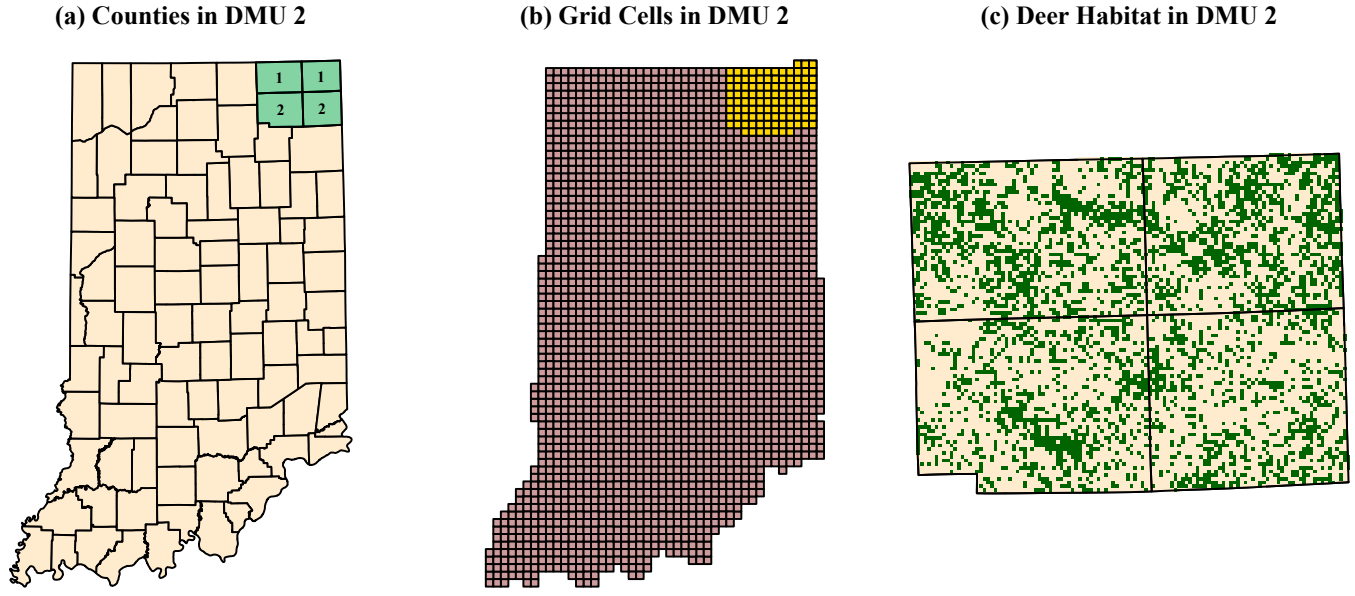
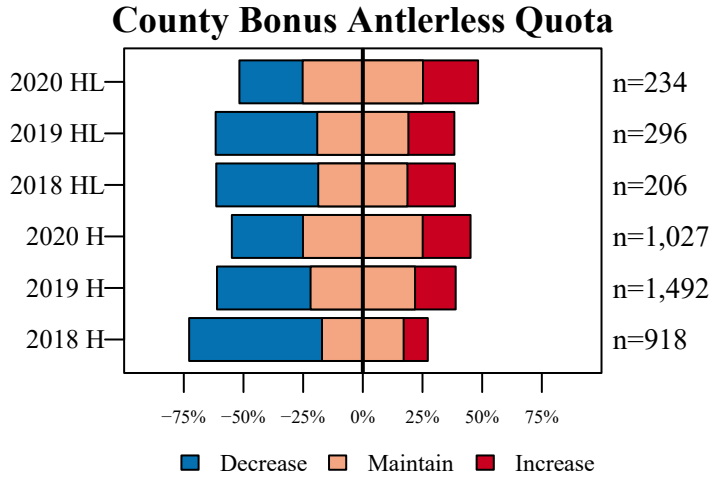


Figure 3. (a) Counties included in DMU 2 for summarizing harvest statistics. Labels are the 2019 county bonus anterless quotas. (b) 4 x 4 mile grid cells included in DMU 2 for summarizing annual deer management survey statistics. (c) Green represents the land use types classified as deer habitat in DMU 2.

DMU 2: Northeast

4/17/2020

Deer Management Survey Results



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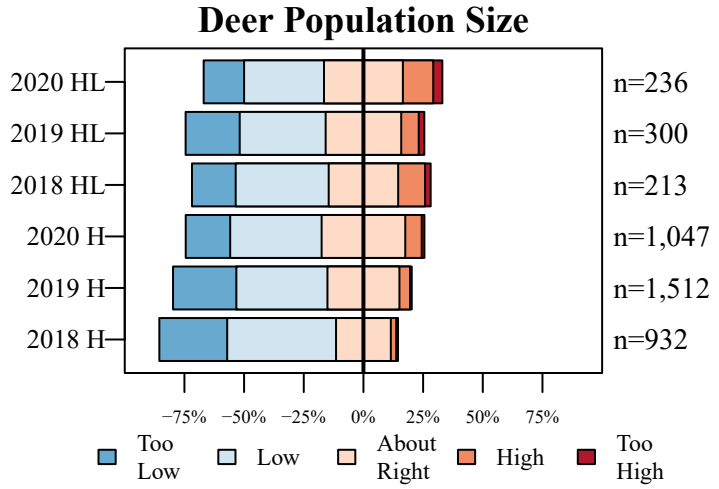

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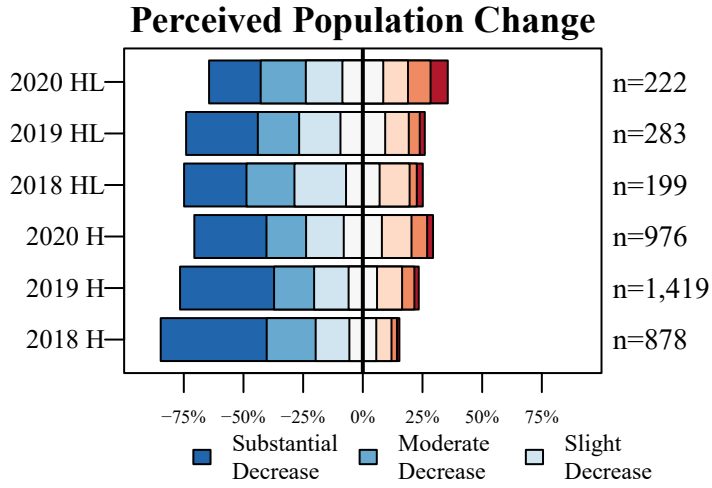

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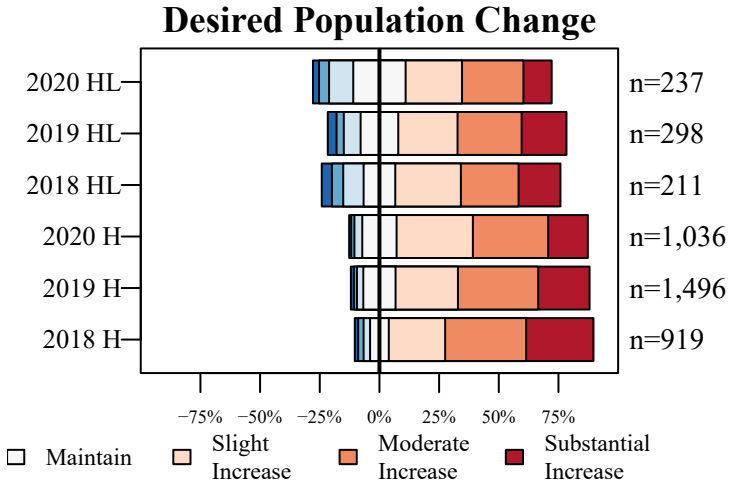

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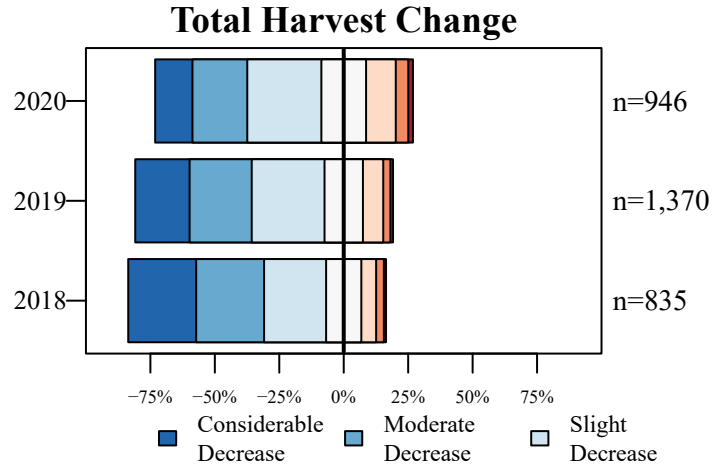

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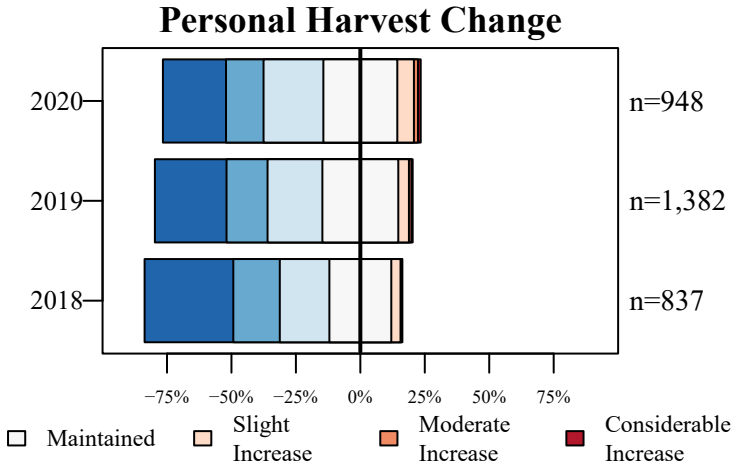

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DMU 2: Northeast

4/17/2020

Deer Management Survey Results

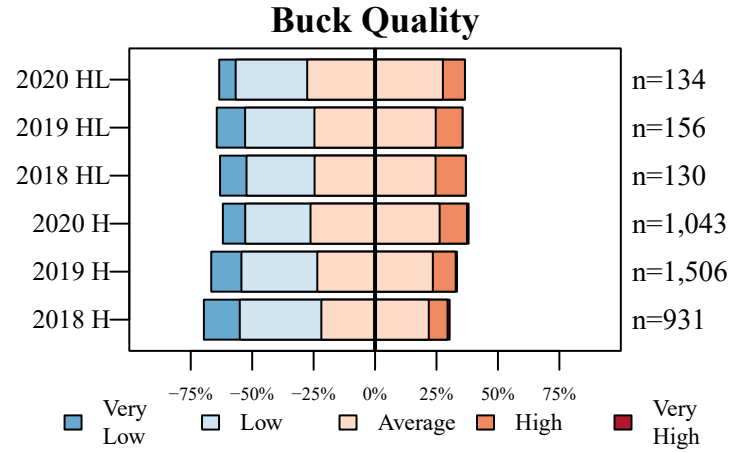
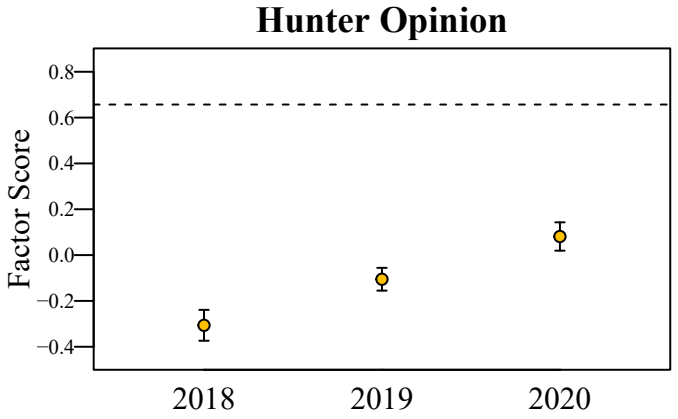


Figure 10. Hunters describe the quality of bucks in the county where they live (HL) and the county where they hunt (H).



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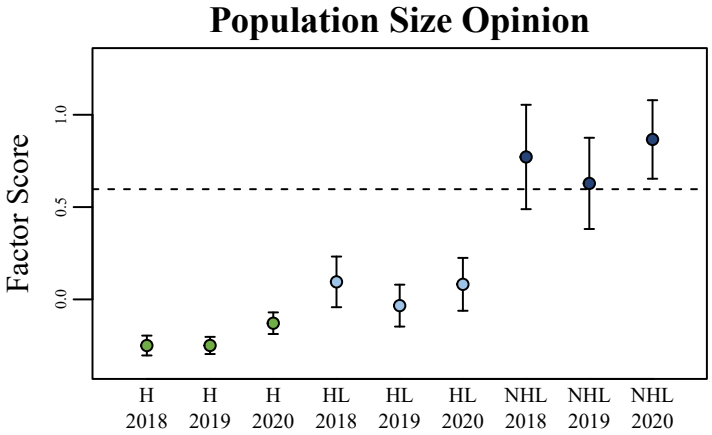

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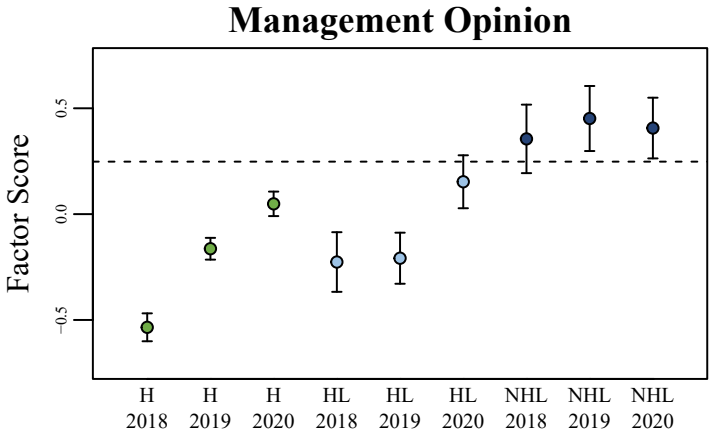

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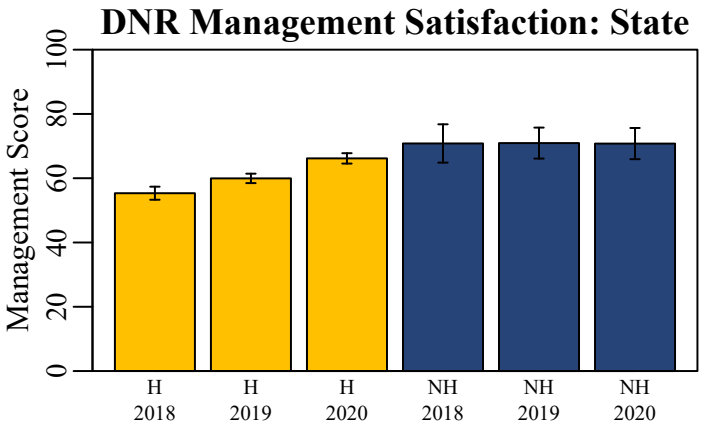

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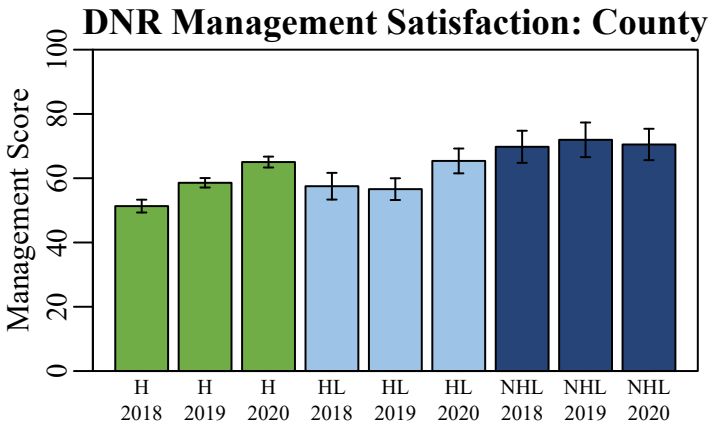

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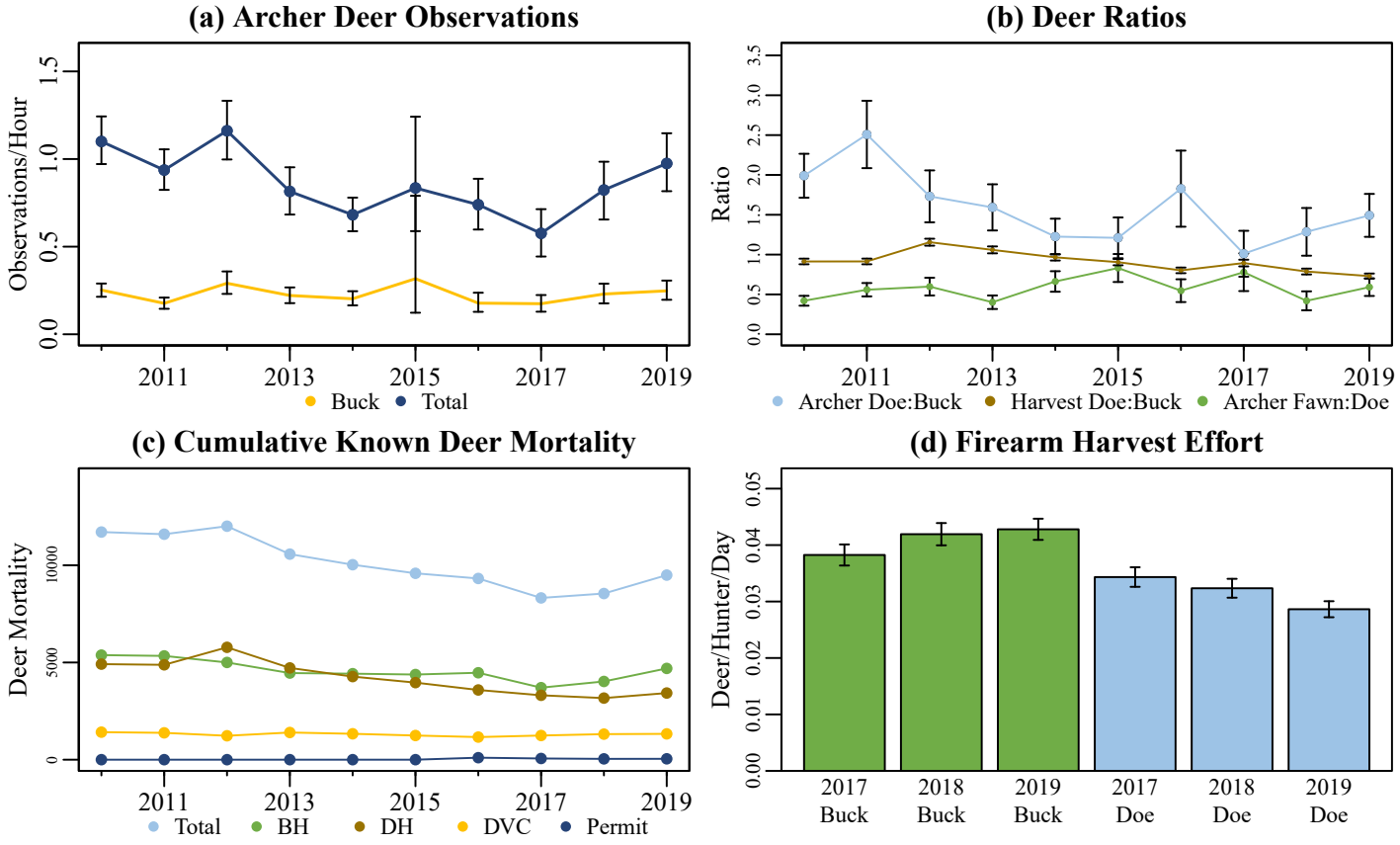
DMU 3: West Central

4/17/2020

Total Square Miles: 4,025
Square Miles of Deer Habitat: 540
Percent Deer Habitat: 13

Table 1. Total harvest, buck harvest, and doe harvest (error approximately 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
2010	10,294	2.98	5,379	3.27	8.82	4,915	2.00	8.06	47.75		308.40	-2.09	5.33
2011	10,218	1.36	5,338	1.30	8.75	4,880	1.26	8.00	47.76		301.74	-2.09	5.89
2012	10,781	2.39	5,001	-0.59	8.20	5,780	5.54	9.48	53.61		271.44	-2.53	5.89
2013	9,176	-1.58	4,456	-2.75	7.30	4,720	-0.46	7.74	51.44		309.32	-0.19	5.44
2014	8,698	-1.95	4,424	-1.51	7.25	4,274	-1.53	7.01	49.14		293.92	-0.50	4.33
2015	8,344	-1.73	4,380	-1.17	7.18	3,964	-1.74	6.50	47.51		274.40	-1.45	4.28
2016	8,057	-1.35	4,471	-0.58	8.28	3,586	-1.64	6.64	44.51	102	257.39	-1.96	4.17
2017	7,017	-1.86	3,705	-3.28	6.86	3,312	-1.36	6.13	47.20	61	276.25	-0.25	2.94
2018	7,191	-1.32	4,023	-0.81	7.45	3,168	-1.45	5.87	44.06	42	290.33	0.41	2.06
2019	8,123	0.36	4,695	1.50	8.69	3,428	-0.51	6.35	42.20	44	292.50	0.97	1.83



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DMU 3: West Central

4/17/2020

Total Square Miles: 4,025
Square Miles of Deer Habitat: 540
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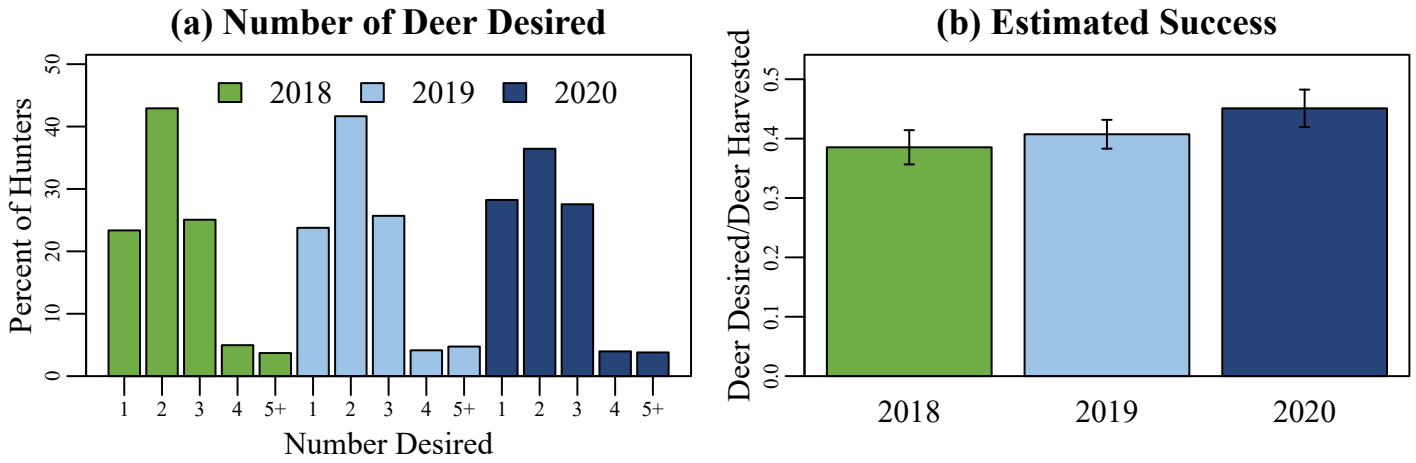
Table 2. Estimated number of antlered (A) and antlerless (AL) deer harvested per hunter. Estimated totals may not match exactly with total number of deer harvested. Reporting errors are examined and investigated as they are located; therefore, subsequent reports may contain corrected totals.

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	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



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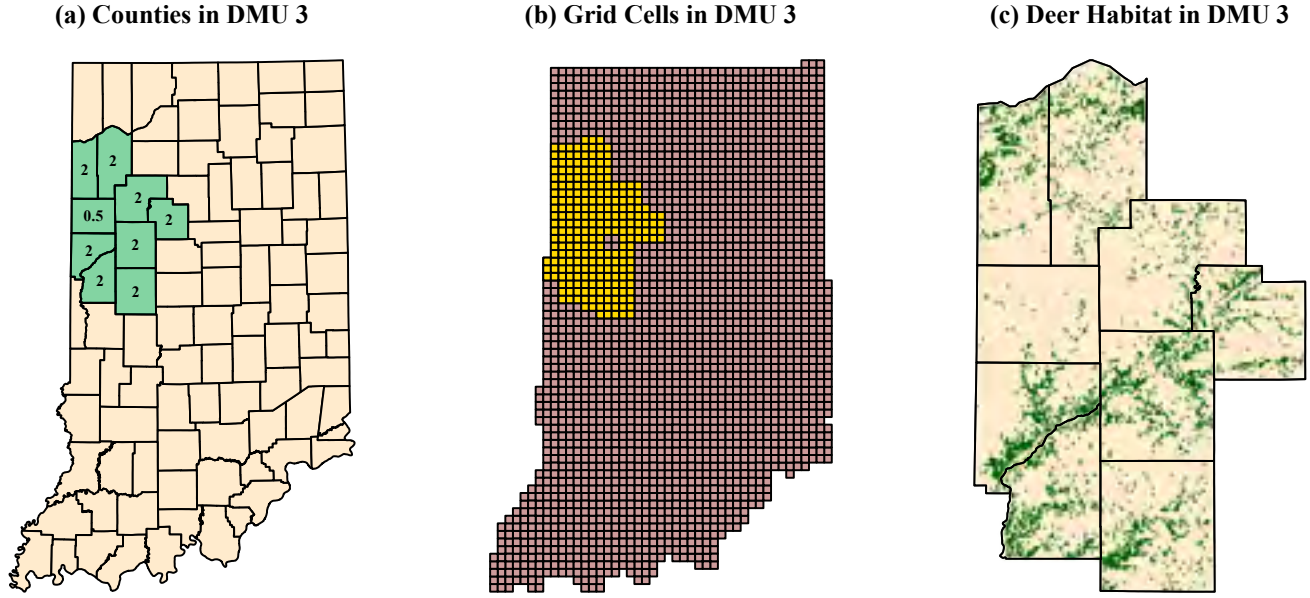

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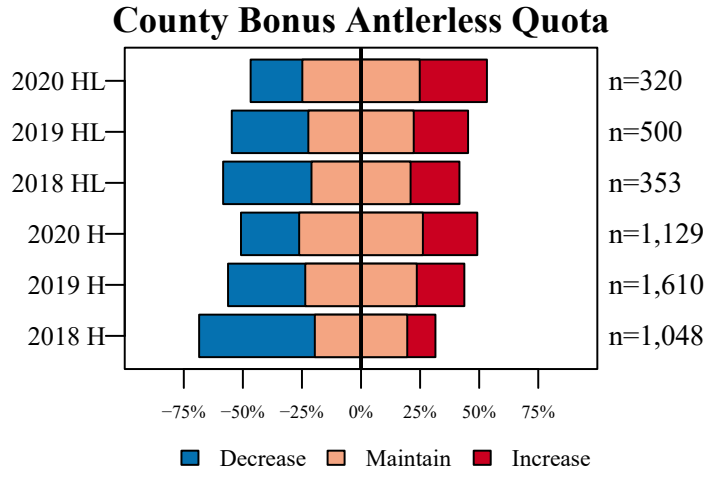
DMU 3: West Central

4/17/2020

Deer Management Survey Results



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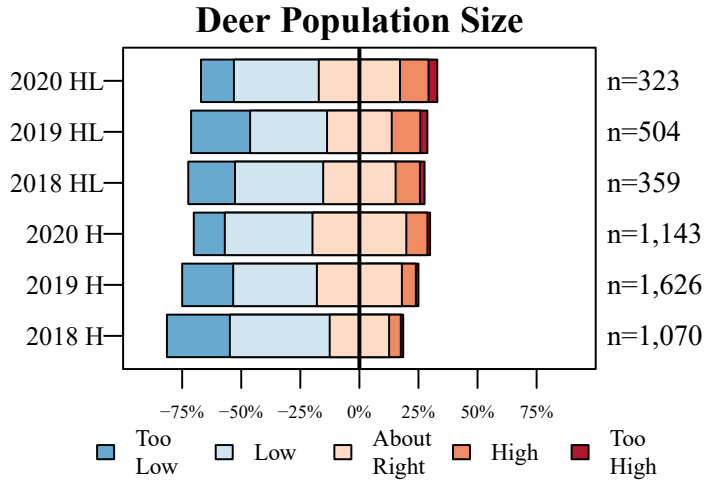

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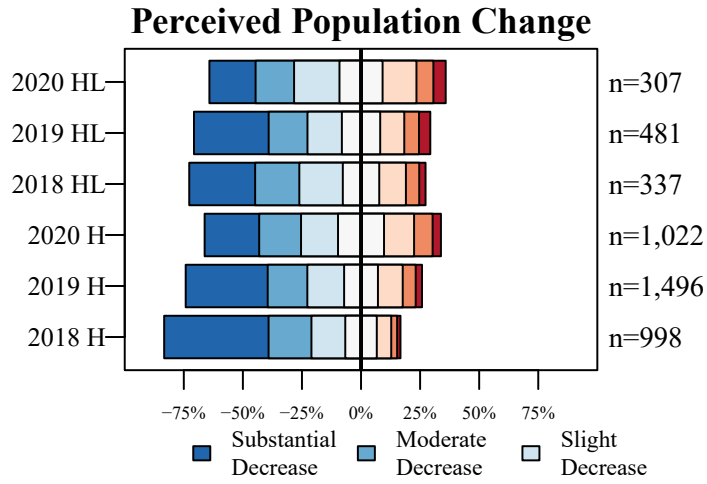

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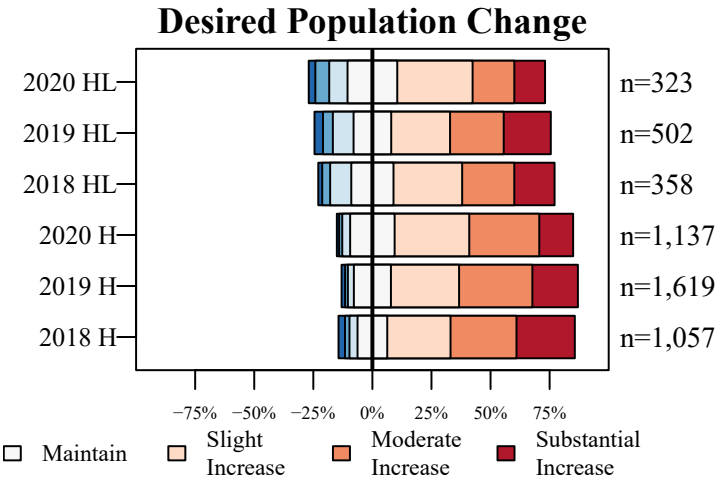

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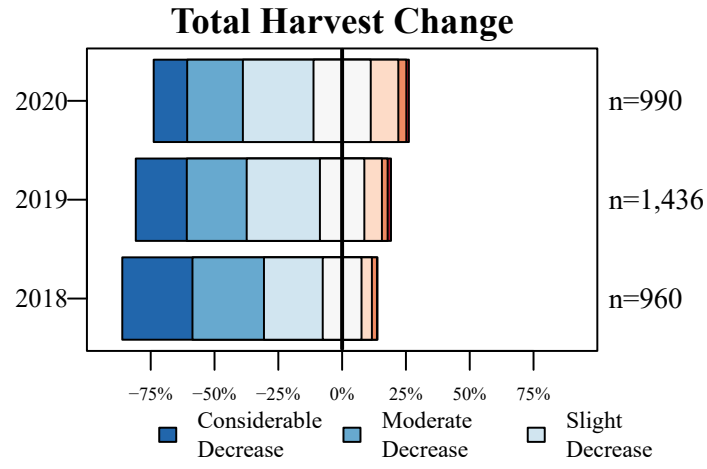

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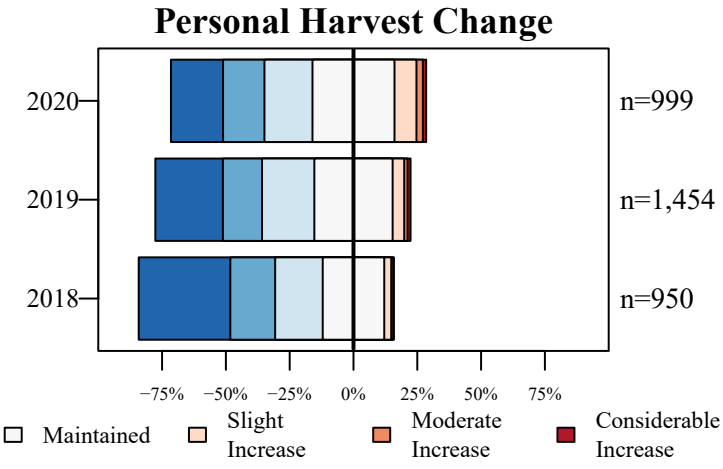

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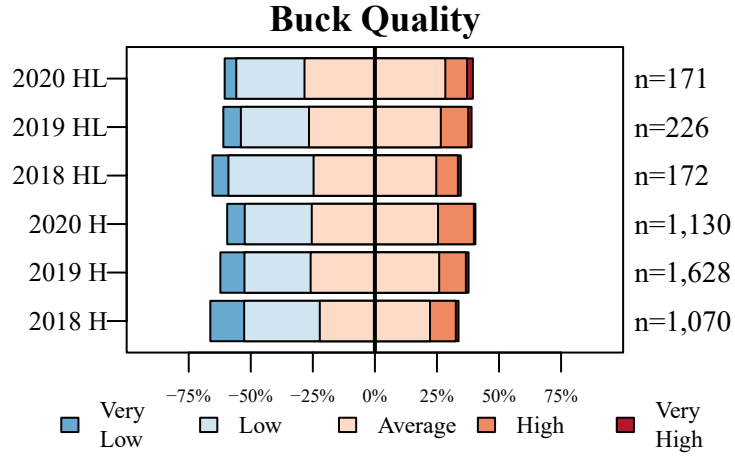
DMU 3: West Central

4/17/2020

Deer Management Survey Results



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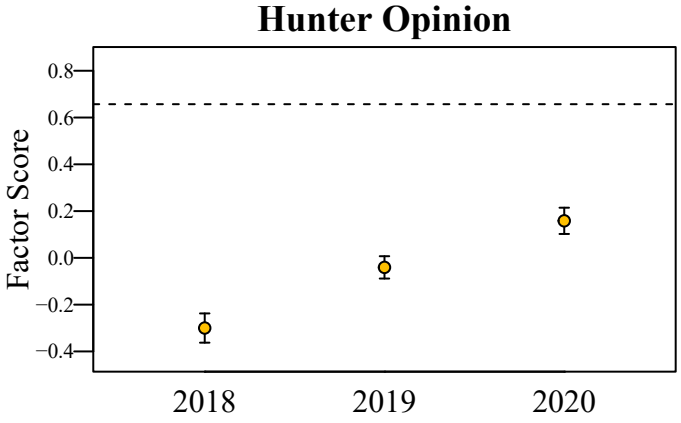

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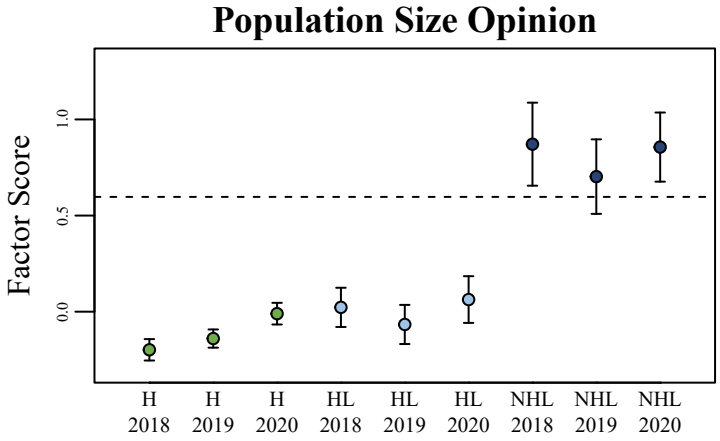

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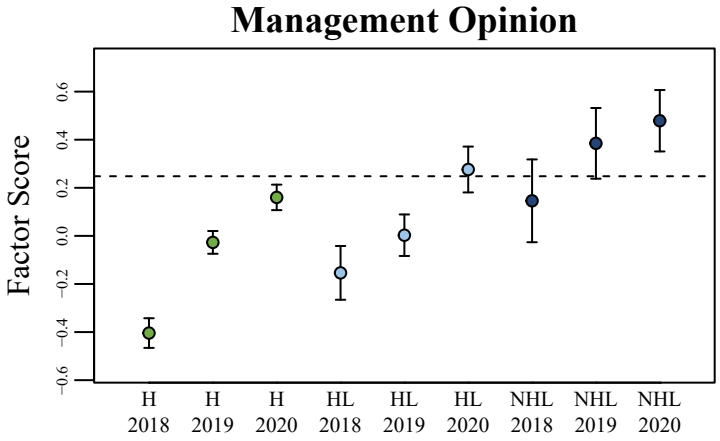
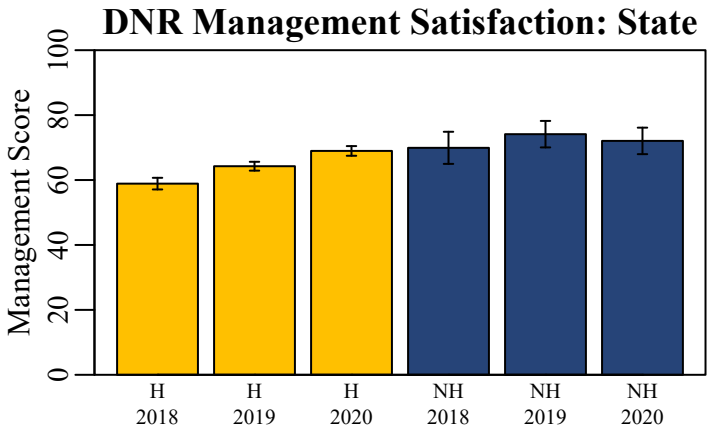


Figure 13. The opinion of nonhunters (NHL) and hunters in the county where they live (HL) and hunters in the county where they hunt (H) on deer management. The score was aggregated using factor analysis of questions asked to all participants. The dashed line represents the score if all questions are answered neutrally.



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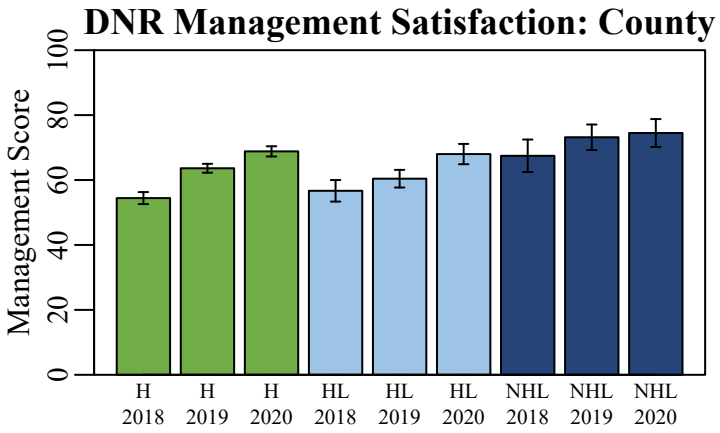


Figure 15. Opionion of county deer management on a scale of 0 (poor) to 100 (excellent) from individuals who hunt in a county (H), individuals that live in a county but hunt elsewhere (HL), and nonhunters that live in a county (NHL).

DMU 4: East Central

4/17/2020

Total Square Miles: 9,965
Square Miles of Deer Habitat: 1,568
Percent Deer Habitat: 16

Table 1. Total harvest, buck harvest, and doe harvest (error approximately 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
2010	17,914	0.67	9,538	0.58	6.50	8,376	0.58	5.71	46.76		164.26	-1.34	3.50
2011	18,487	1.20	9,673	0.79	6.59	8,814	1.68	6.00	47.68		162.07	-1.88	3.94
2012	18,258	0.51	8,873	-2.02	6.04	9,385	3.59	6.39	51.40		150.76	-2.50	3.83
2013	17,243	-1.47	8,733	-1.59	5.95	8,510	-0.37	5.80	49.35		146.69	-1.85	3.50
2014	18,029	0.01	9,321	0.10	6.35	8,708	-0.10	5.93	48.30		154.20	-0.49	3.37
2015	18,299	0.67	9,755	1.28	6.65	8,544	-0.55	5.82	46.69		155.68	0.01	3.33
2016	17,875	-0.39	9,838	1.23	6.27	8,037	-2.14	5.13	44.96	44	136.52	-3.03	3.33
2017	16,481	-3.42	8,651	-1.31	5.52	7,830	-1.66	4.99	47.51	43	149.34	0.07	3.00
2018	16,985	-0.82	9,476	0.39	6.04	7,509	-2.19	4.79	44.21	43	152.31	0.50	1.89
2019	18,638	1.44	10,644	2.62	6.79	7,994	-0.26	5.10	42.89	69	155.28	0.74	1.63

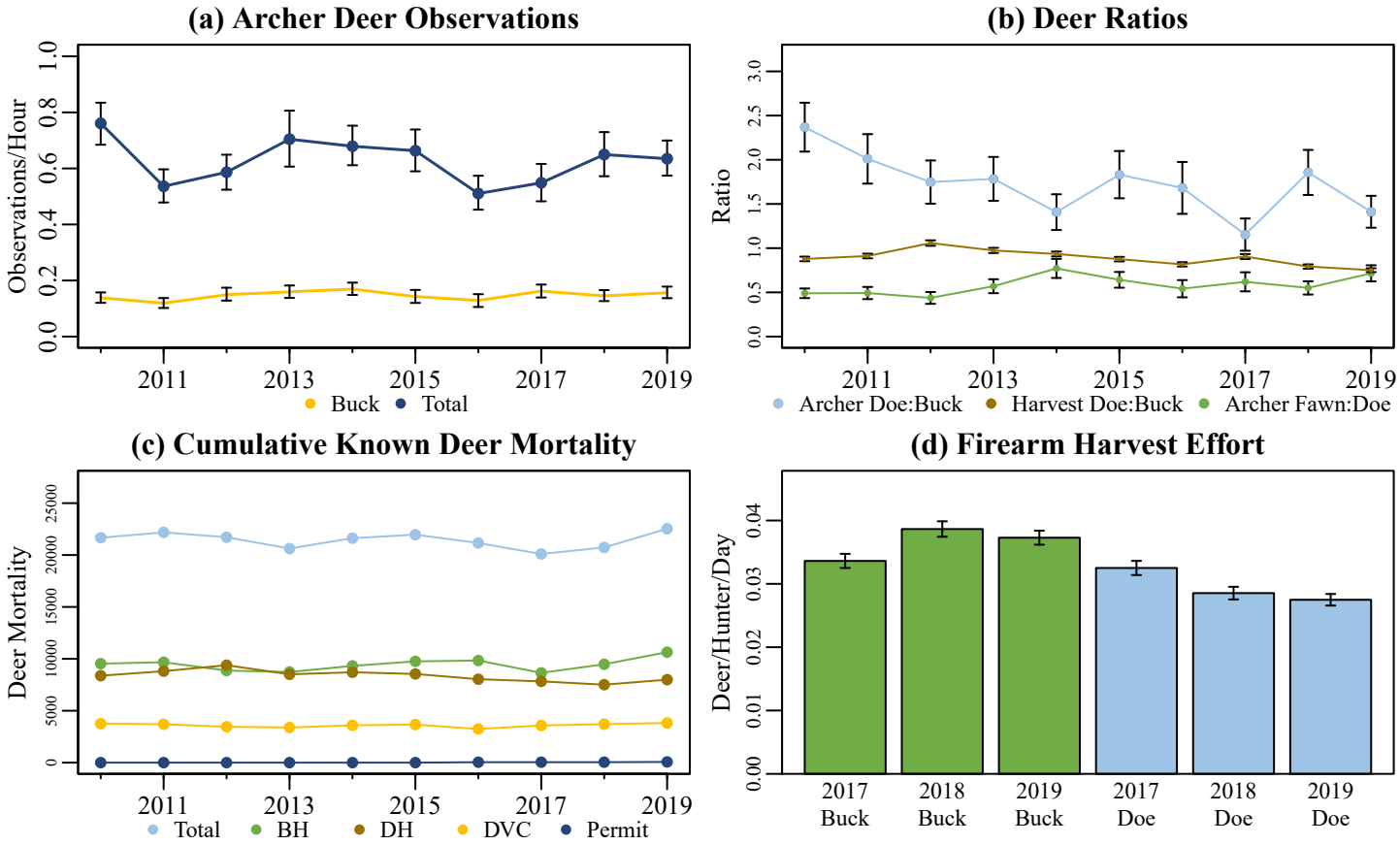


Figure 1. (a) Total deer and buck observations based on the Archer's Index. (b) Annual doe:buck ratios and fawn:doe ratios based on the Archer's Index and harvest records. (c) The total known annual deer mortality based on buck harvests (BH), doe harvests (DH), deer vehicle collisions (DVC), and deer permit takes. (d) Firearm harvest effort is the number of deer 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.

DMU 4: East Central

4/17/2020

Total Square Miles: 9,965
Square Miles of Deer Habitat: 1,568
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

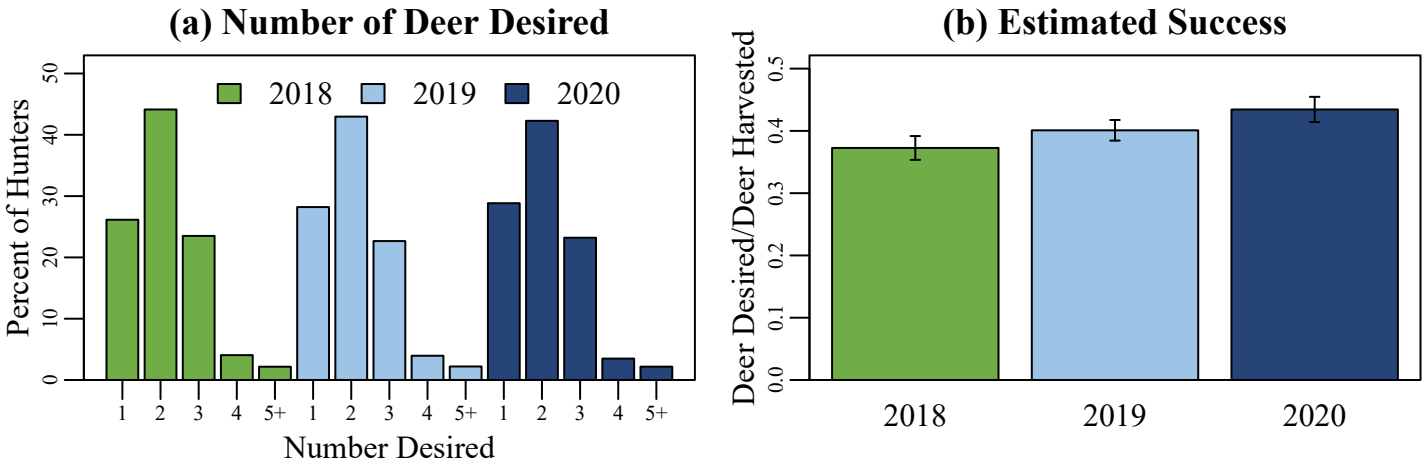


Figure 2. (a) The annual percent of hunters wishing to harvest each number of deer as reported in the deer management survey. (b) Success rate is estimated from the deer management survey as the Number of Harvested Deer/Number of Deer Desired (reported only; does not account for attempts that were not made).

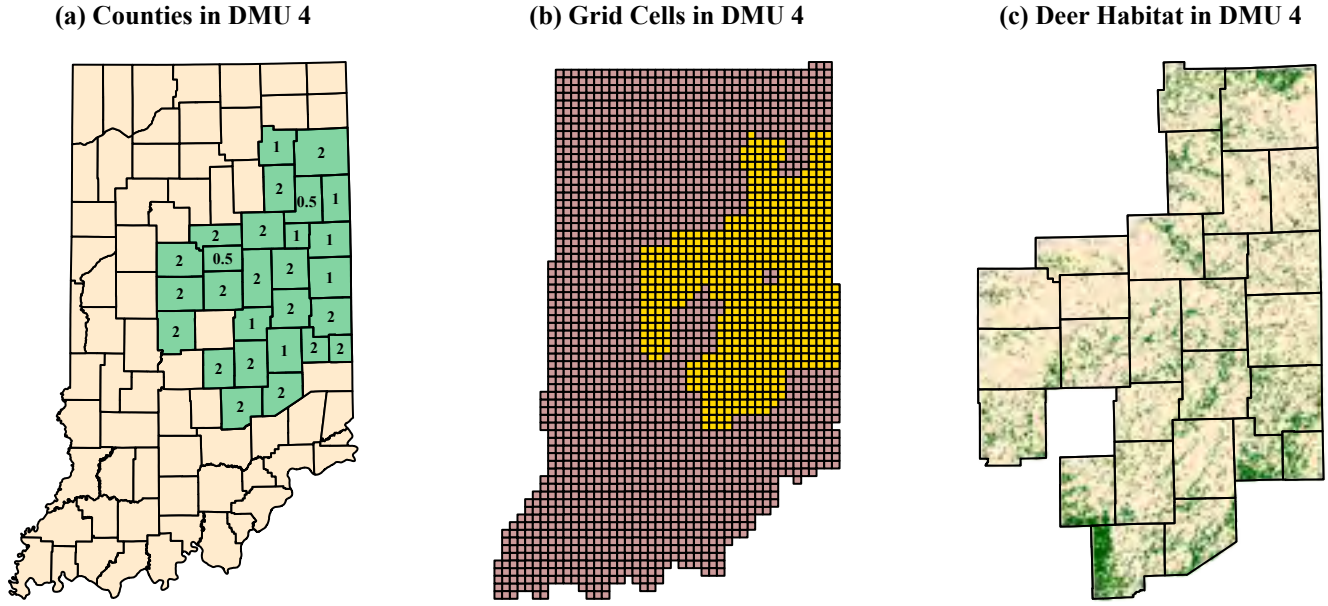


Figure 3. (a) Counties included in DMU 4 for summarizing harvest statistics. Labels are the 2019 county bonus anterless quotas. (b) 4 x 4 mile grid cells included in DMU 4 for summarizing annual deer management survey statistics. (c) Green represents the land use types classified as deer habitat in DMU 4.

DMU 4: East Central

4/17/2020

Deer Management Survey Results

County Bonus Antlerless Quota

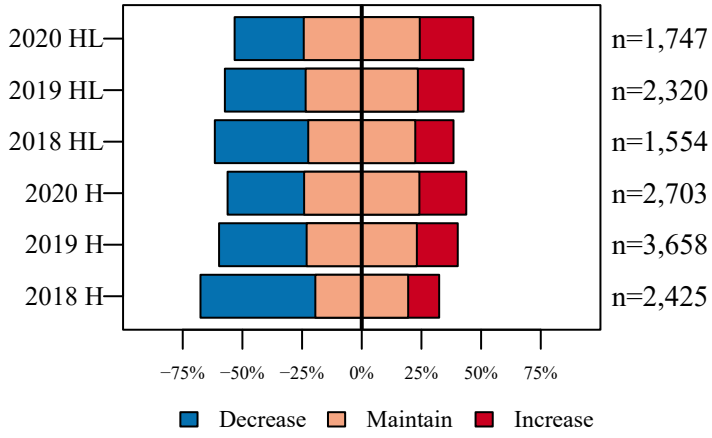


Figure 4. Opinion on how the County Bonus Antlerless Quota should change from hunters in the county where they live (HL) and hunters in the county where they hunt (H).

Deer Population Size

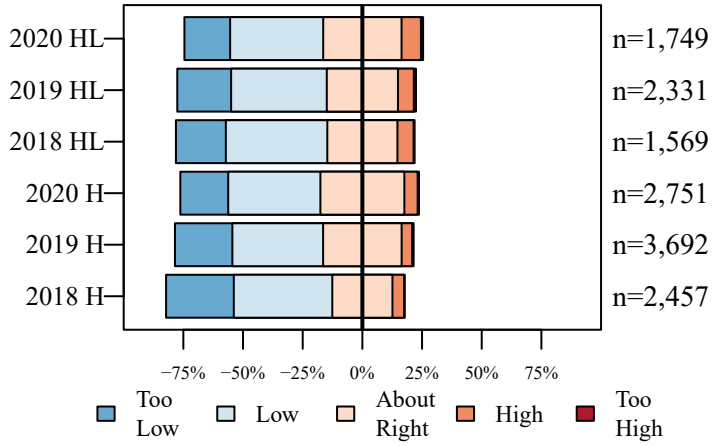


Figure 5. The current size of the deer population described by hunters in the county where they live (HL) and hunters in the county where they hunt (H).

Perceived Population Change

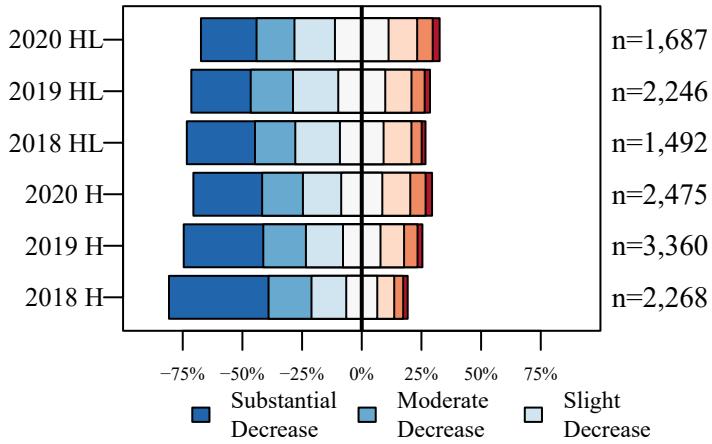


Figure 6. The number of deer seen compared to five years ago described by hunters in the county where they live (HL) and hunters in the county where they hunt (H).

Desired Population Change

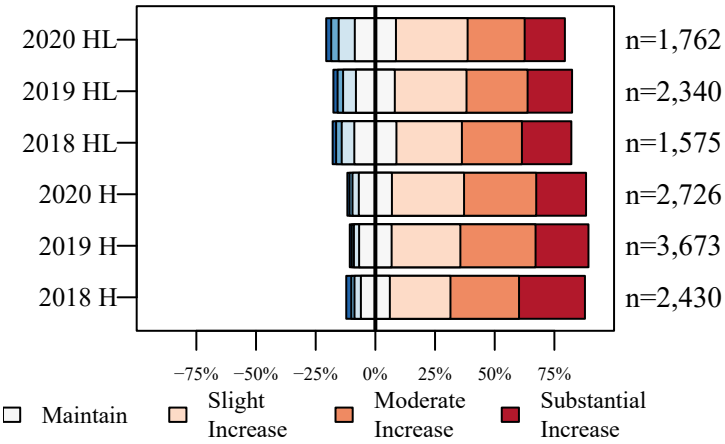


Figure 7. The desired change in the size of the deer population described by hunters in the county where they live (HL) and hunters in the county where they hunt (H).

Total Harvest Change

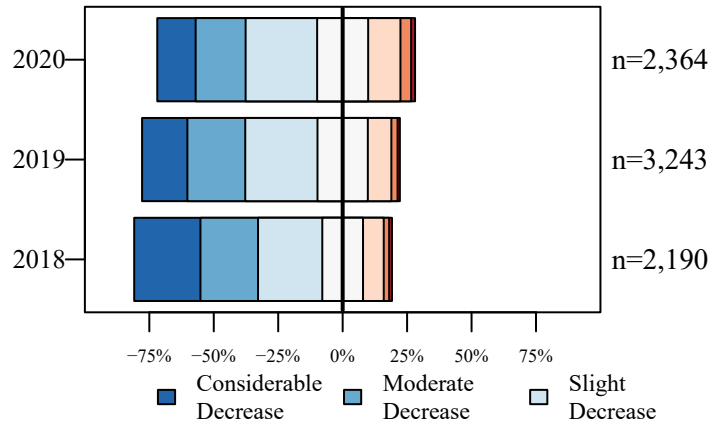
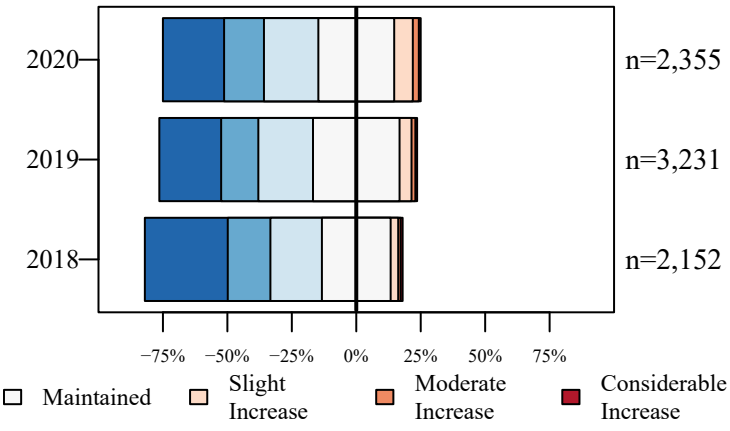


Figure 8. Opinion of hunters on how the total number of harvested deer has changed over the last five years.

Personal Harvest Change



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DMU 4: East Central

4/17/2020

Deer Management Survey Results

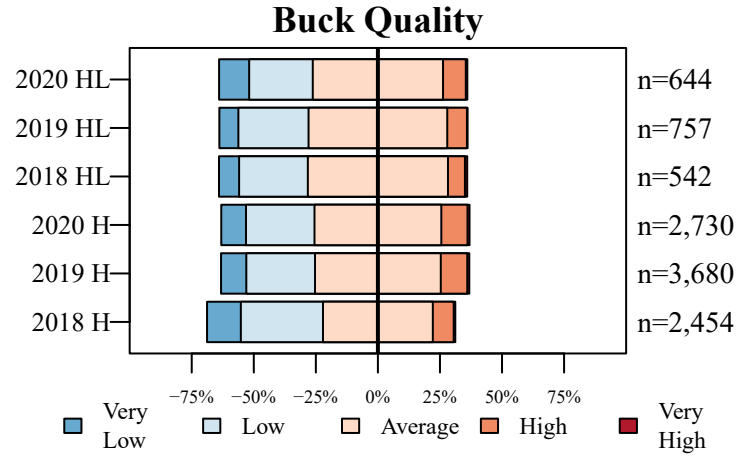
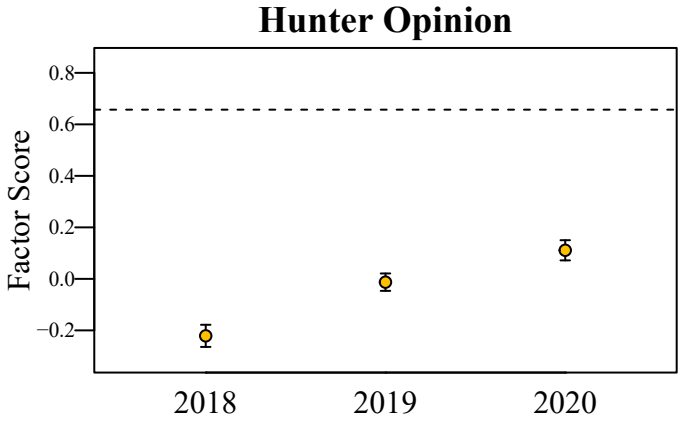


Figure 10. Hunters describe the quality of bucks in the county where they live (HL) and the county where they hunt (H).



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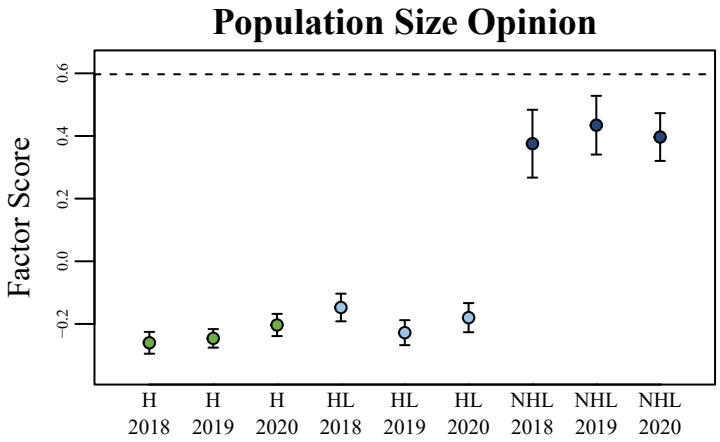
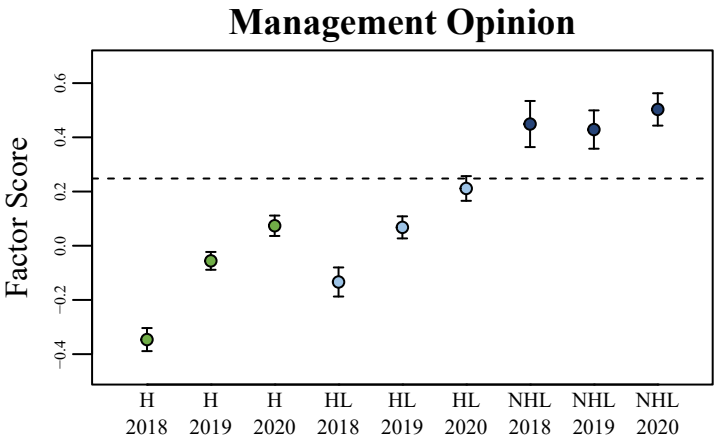


Figure 12. The opinion of nonhunters (NHL) and hunters in the county where they live (HL) and hunters in the county where they hunt (H) on deer population size. The score was aggregated using factor analysis of questions asked to all participants. The dashed line represents the score if all questions are answered neutrally.



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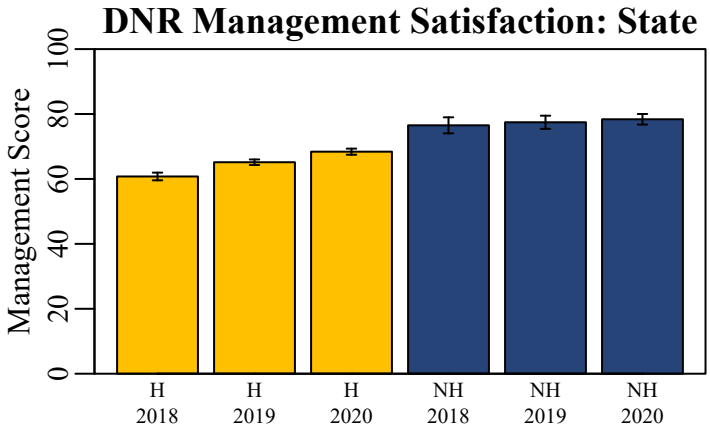

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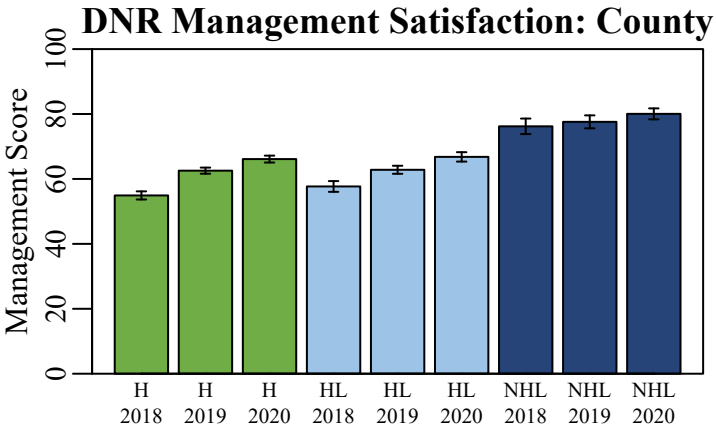

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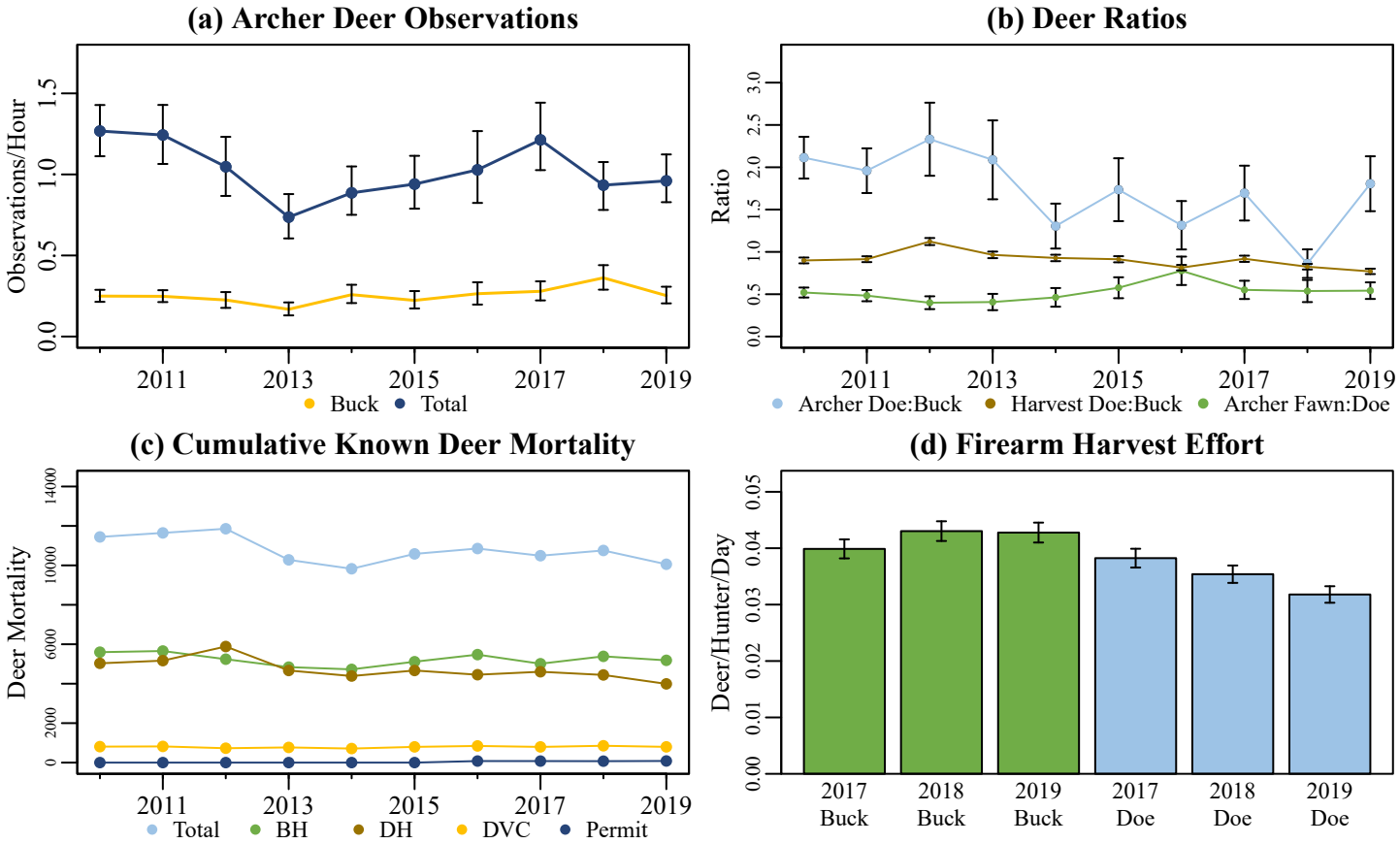
DMU 5: Wabash

4/17/2020

Total Square Miles: 2,416
Square Miles of Deer Habitat: 943
Percent Deer Habitat: 39

Table 1. Total harvest, buck harvest, and doe harvest (error approximately 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
2010	10,633	1.64	5,599	1.33	5.93	5,034	1.34	5.33	47.34		259.38	-0.51	6.67
2011	10,827	1.71	5,657	1.49	5.99	5,170	1.49	5.48	47.75		265.23	-0.69	6.67
2012	11,128	1.62	5,243	-0.77	5.55	5,885	3.11	6.23	52.88		237.87	-2.11	7.33
2013	9,510	-2.21	4,840	-2.76	5.13	4,670	-1.06	4.95	49.11		253.66	-0.64	6.00
2014	9,116	-2.24	4,727	-1.90	5.01	4,389	-1.66	4.65	48.15		236.78	-1.29	5.33
2015	9,785	-0.52	5,115	-0.23	5.42	4,670	-0.63	4.95	47.73		267.05	1.29	5.17
2016	9,931	-0.16	5,475	0.98	5.81	4,456	-0.85	4.73	44.87	78	284.47	2.24	5.17
2017	9,619	-0.36	5,013	-0.22	5.32	4,606	-0.34	4.88	47.88	76	268.68	0.63	4.50
2018	9,831	0.77	5,387	1.22	5.71	4,444	-0.89	4.71	45.20	72	288.12	1.45	3.50
2019	9,176	-1.49	5,185	0.14	5.50	3,991	-4.39	4.23	43.49	82	269.38	0.02	2.00



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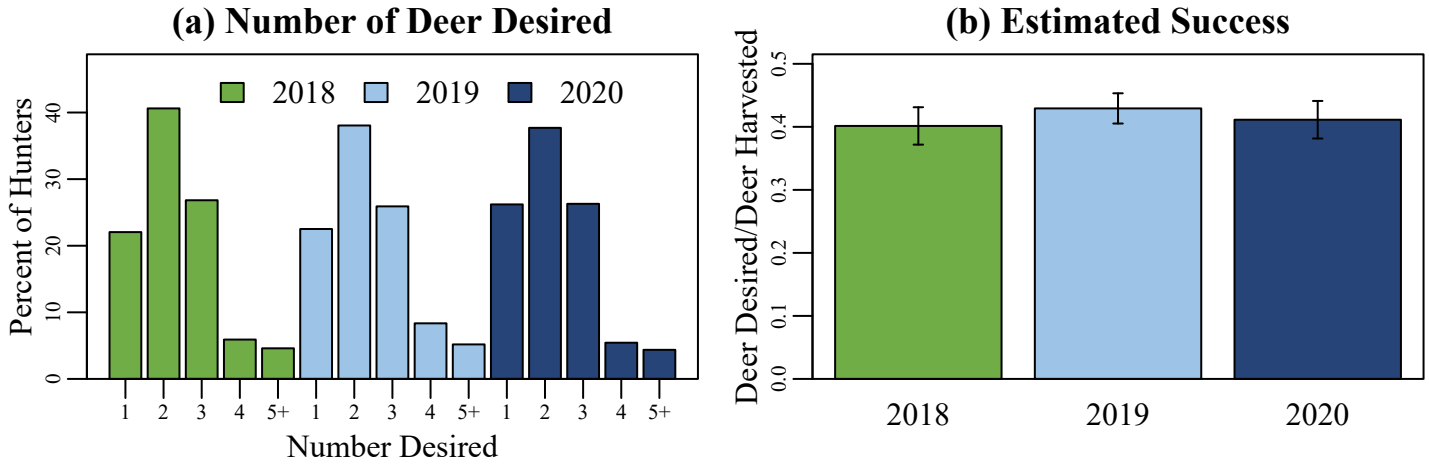
DMU 5: Wabash

4/17/2020

Total Square Miles: 2,416
Square Miles of Deer Habitat: 943
Percent Deer Habitat: 39

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



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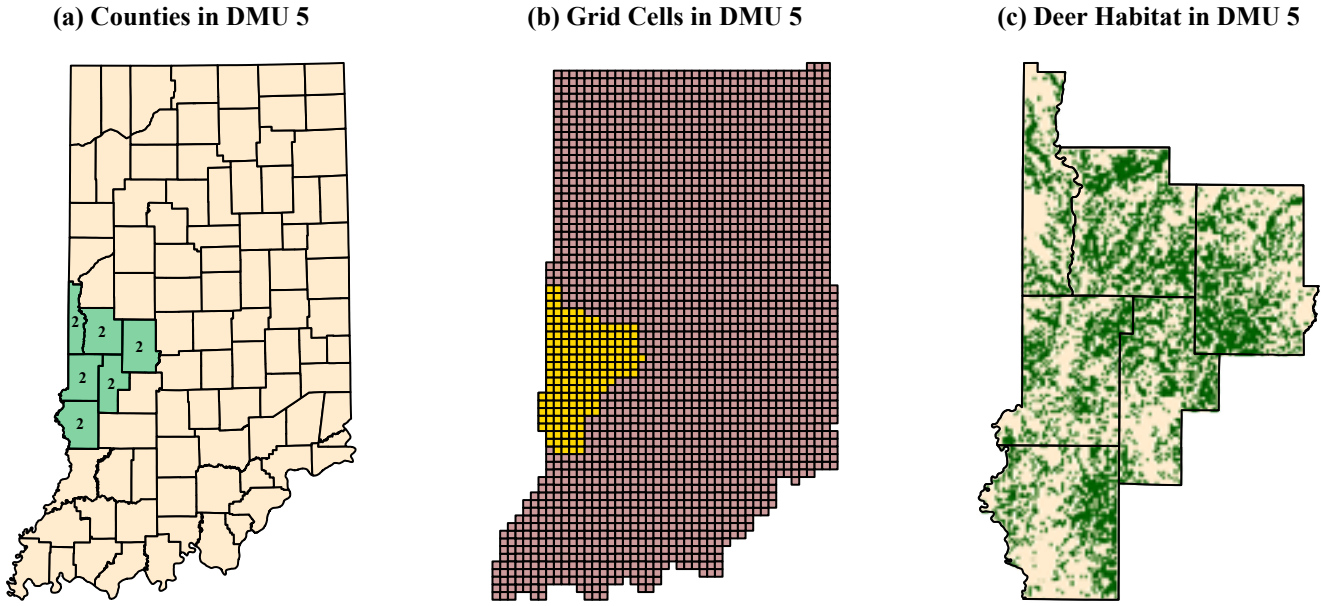

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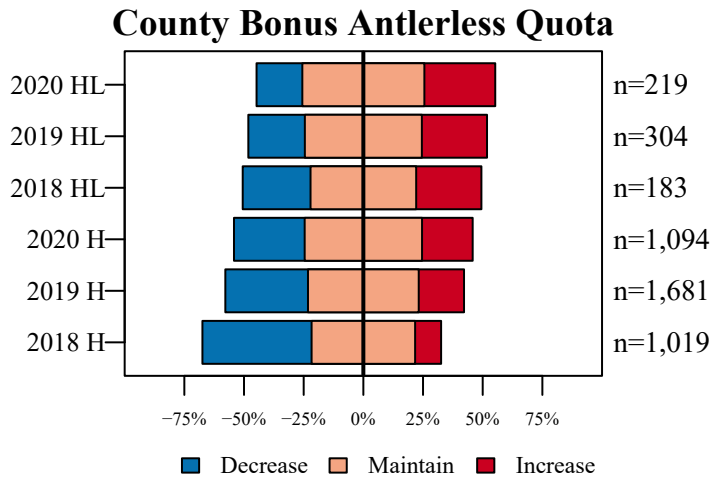
DMU 5: Wabash

4/17/2020

Deer Management Survey Results



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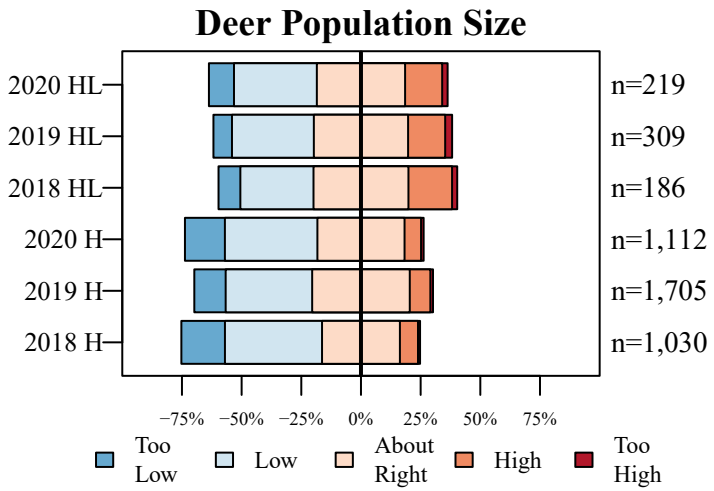

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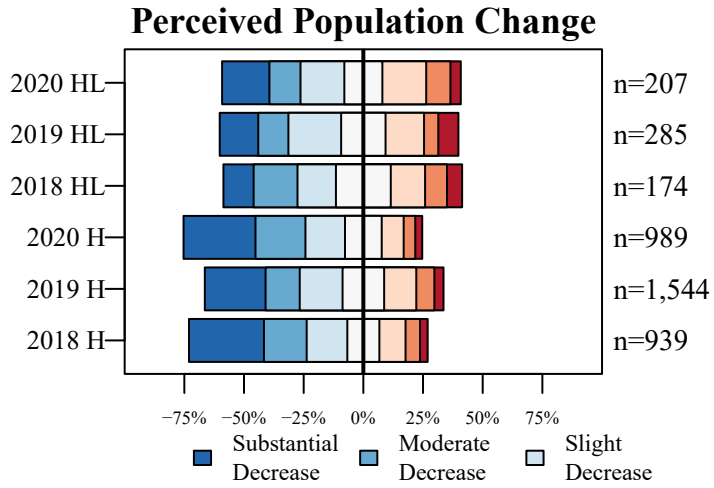

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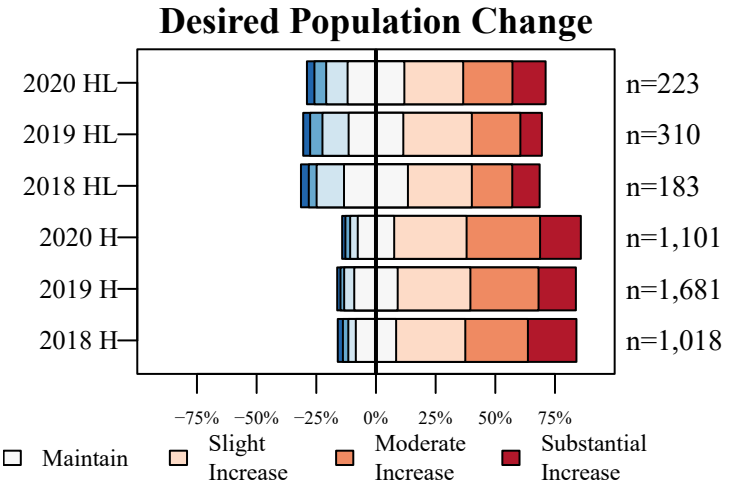

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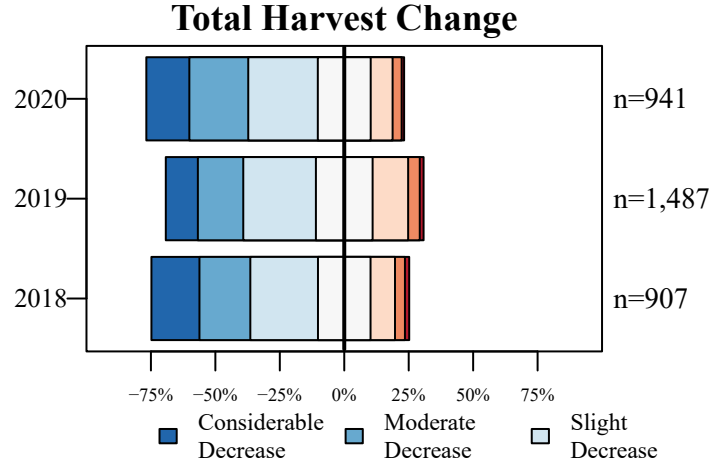

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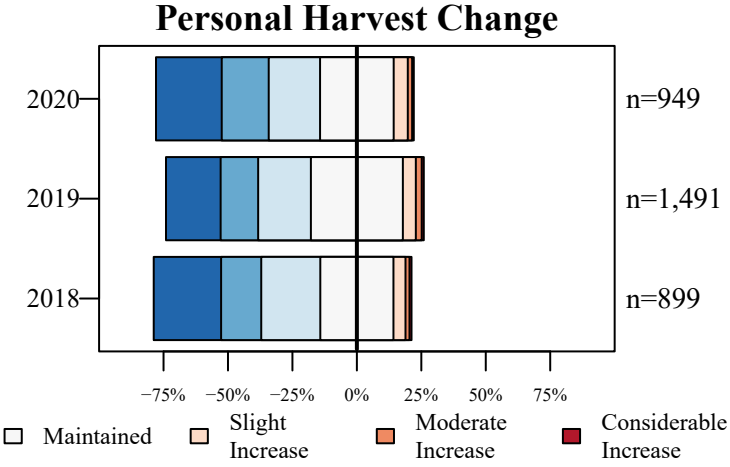

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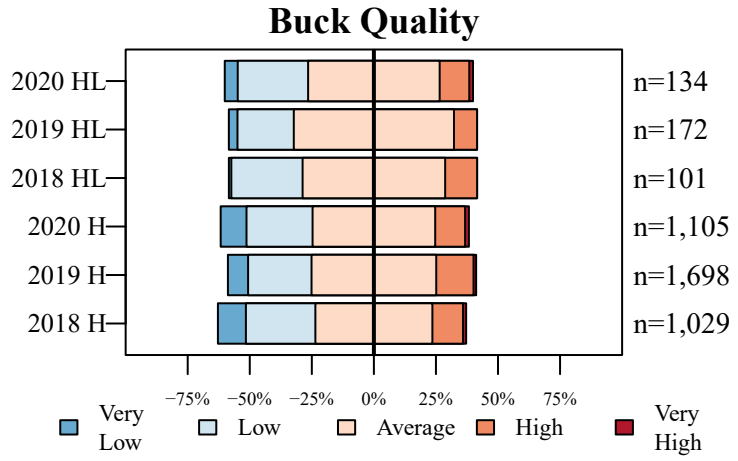
DMU 5: Wabash

4/17/2020

Deer Management Survey Results



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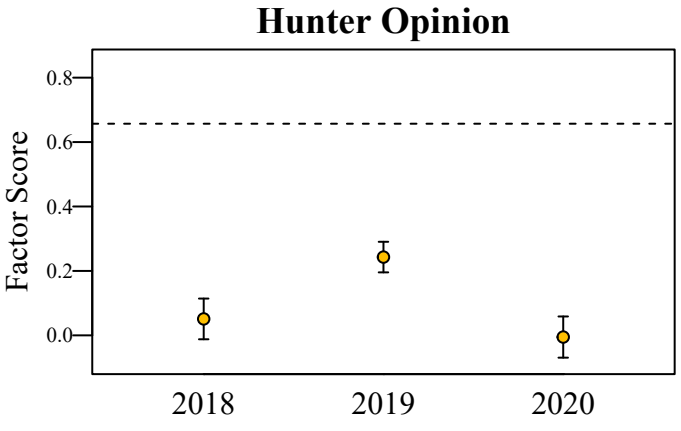

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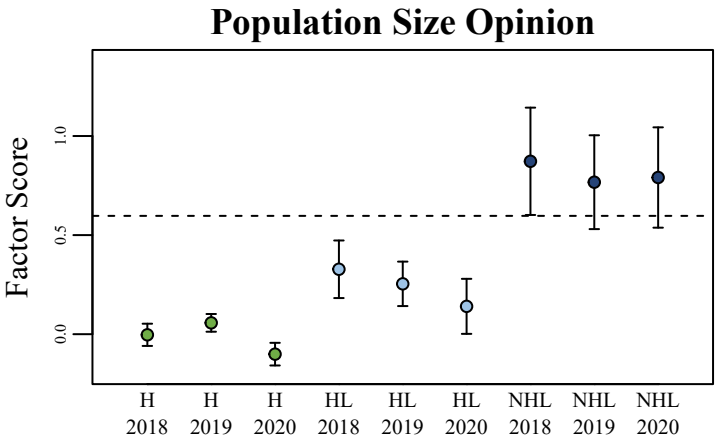

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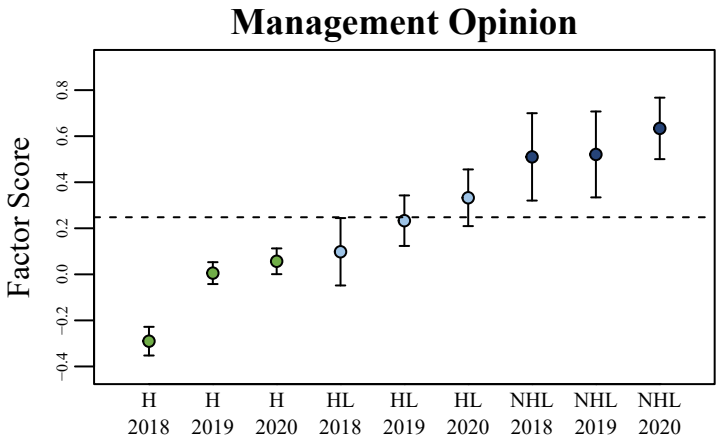

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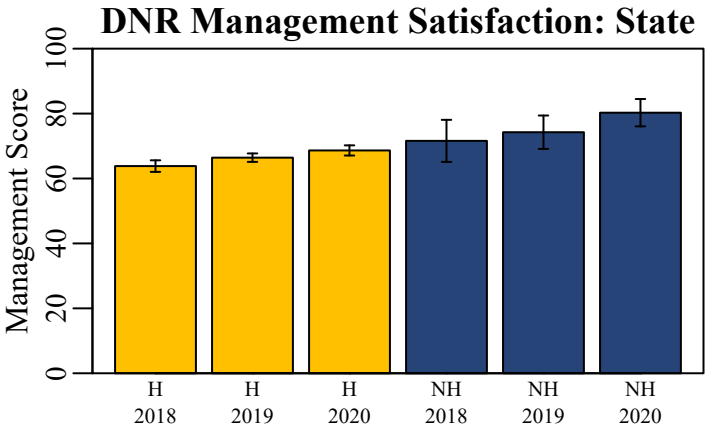

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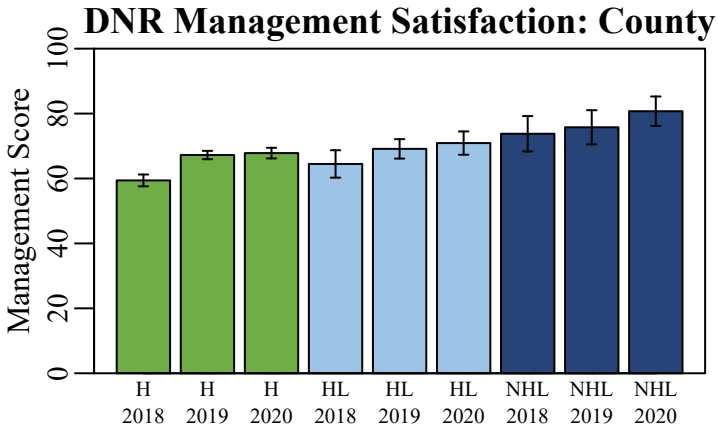

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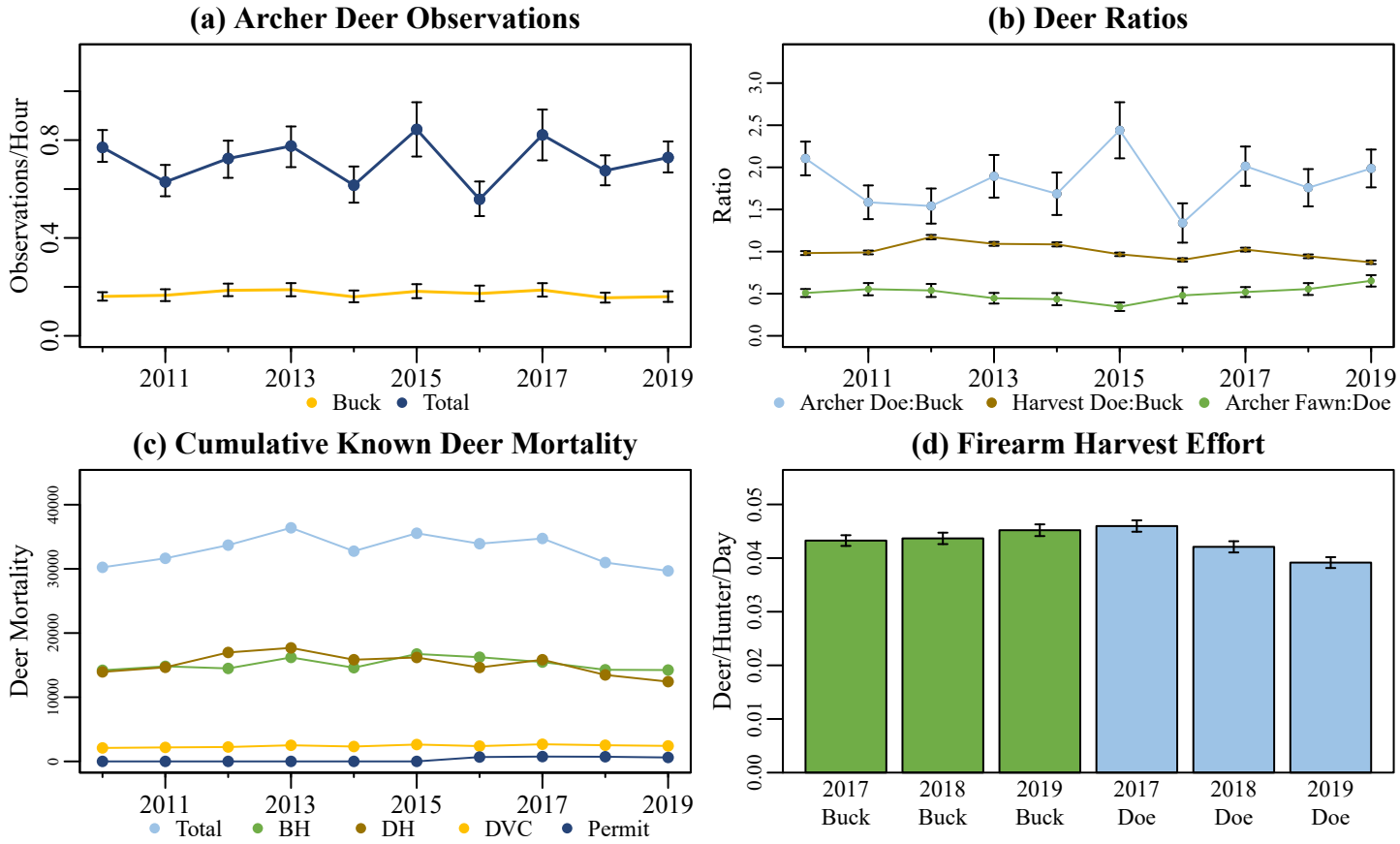
DMU 6: South

4/17/2020

Total Square Miles: 6,368
Square Miles of Deer Habitat: 4,498
Percent Deer Habitat: 71

Table 1. Total harvest, buck harvest, and doe harvest (error approximately 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
2010	28,143	-0.38	14,197	-0.54	3.02	13,946	-0.05	2.97	49.55		263.74	-1.01	5.44
2011	29,468	1.30	14,809	0.89	3.15	14,659	1.42	3.12	49.75		274.96	-0.49	5.69
2012	31,458	3.19	14,485	0.33	3.08	16,973	5.21	3.61	53.95		283.28	0.61	5.62
2013	33,888	3.53	16,201	4.91	3.44	17,687	2.32	3.76	52.19		316.48	5.74	5.31
2014	30,442	0.02	14,599	-0.40	3.10	15,843	0.21	3.37	52.04		293.59	0.51	6.06
2015	32,927	1.03	16,736	2.40	3.56	16,191	0.24	3.44	49.17		332.11	2.28	5.88
2016	30,864	-0.43	16,234	0.84	3.61	14,630	-1.43	3.25	47.40	675	301.00	0.04	5.94
2017	31,315	-0.41	15,475	-0.17	3.44	15,840	-0.37	3.52	50.58	749	335.92	1.59	5.69
2018	27,746	-2.83	14,274	-1.90	3.17	13,472	-2.34	3.00	48.55	722	314.60	-0.07	4.69
2019	26,660	-2.13	14,233	-1.18	3.16	12,427	-2.45	2.76	46.61	612	299.62	-0.85	2.00



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DMU 6: South

4/17/2020

Total Square Miles: 6,368
Square Miles of Deer Habitat: 4,498
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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	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

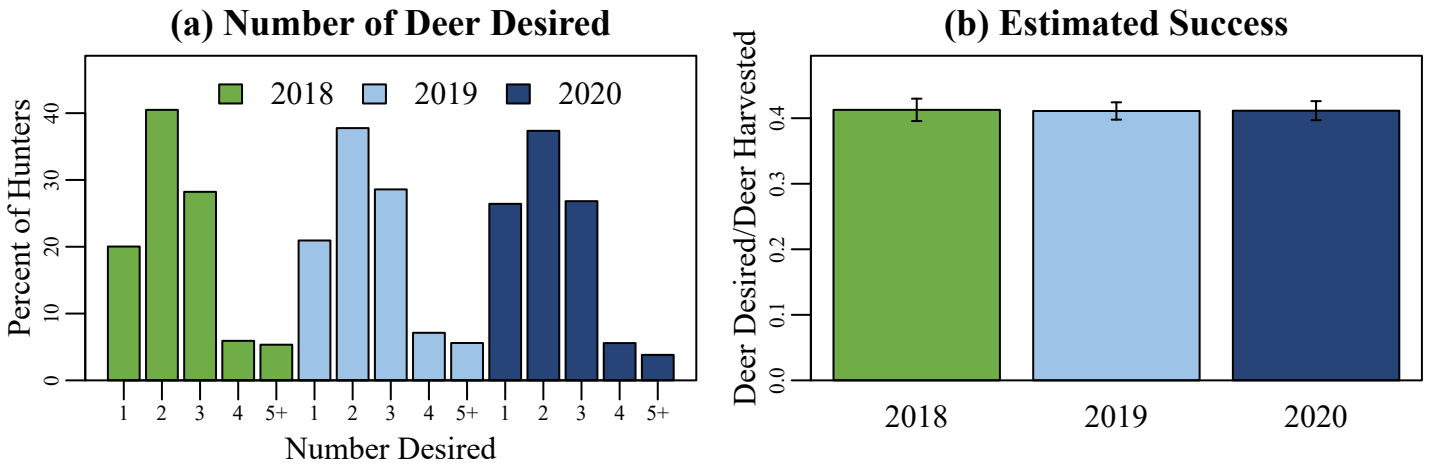


Figure 2. (a) The annual percent of hunters wishing to harvest each number of deer as reported in the deer management survey. (b) Success rate is estimated from the deer management survey as the Number of Harvested Deer/Number of Deer Desired (reported only; does not account for attempts that were not made).

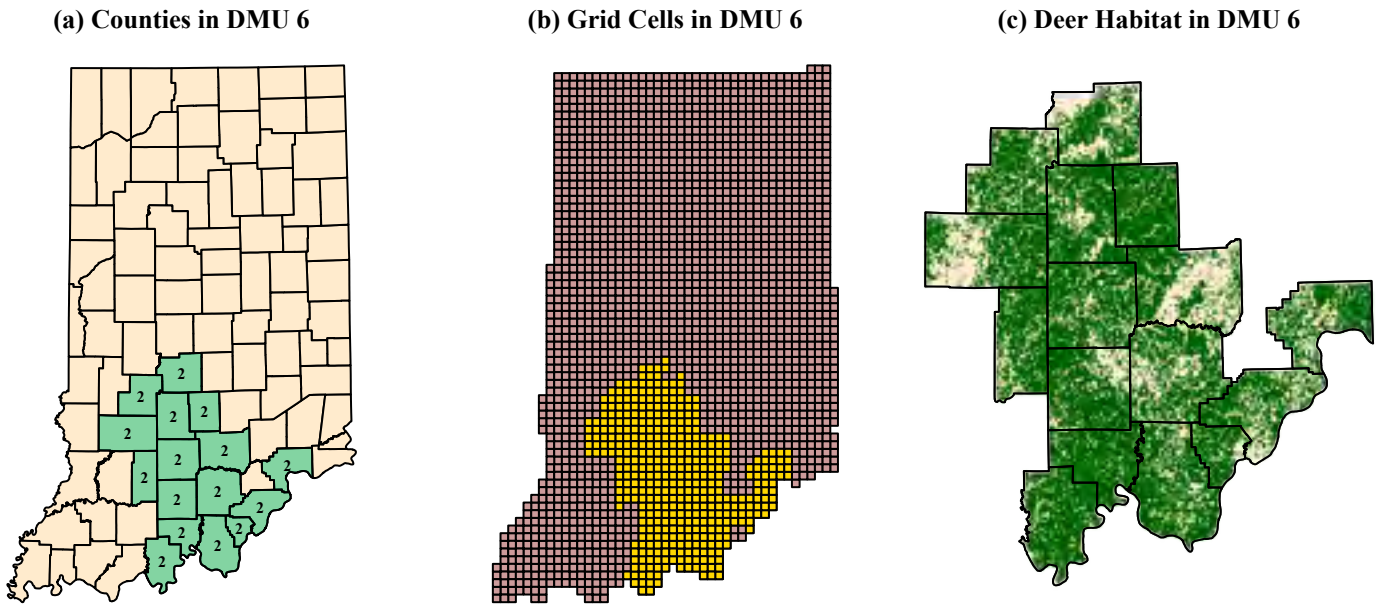


Figure 3. (a) Counties included in DMU 6 for summarizing harvest statistics. Labels are the 2019 county bonus anterless quotas. (b) 4 x 4 mile grid cells included in DMU 6 for summarizing annual deer management survey statistics. (c) Green represents the land use types classified as deer habitat in DMU 6.

DMU 6: South

4/17/2020

Deer Management Survey Results

County Bonus Antlerless Quota

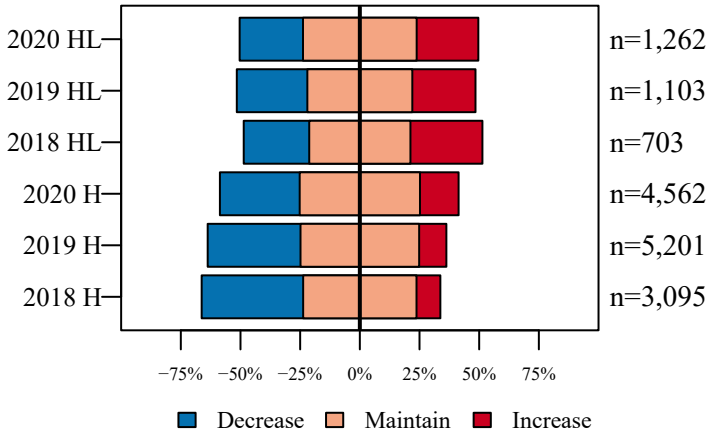


Figure 4. Opinion on how the County Bonus Antlerless Quota should change from hunters in the county where they live (HL) and hunters in the county where they hunt (H).

Deer Population Size

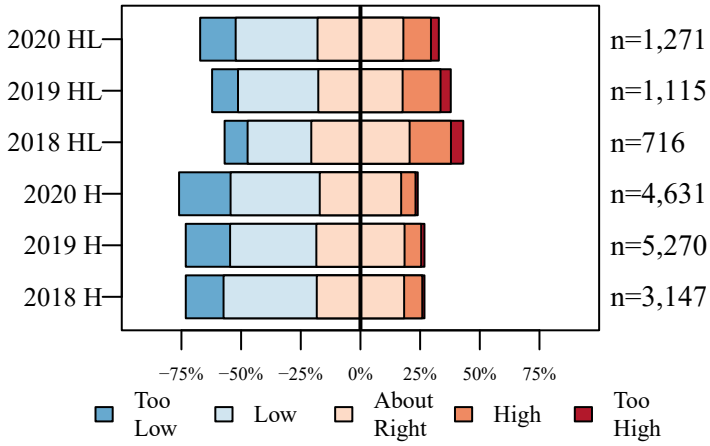


Figure 5. The current size of the deer population described by hunters in the county where they live (HL) and hunters in the county where they hunt (H).

Perceived Population Change

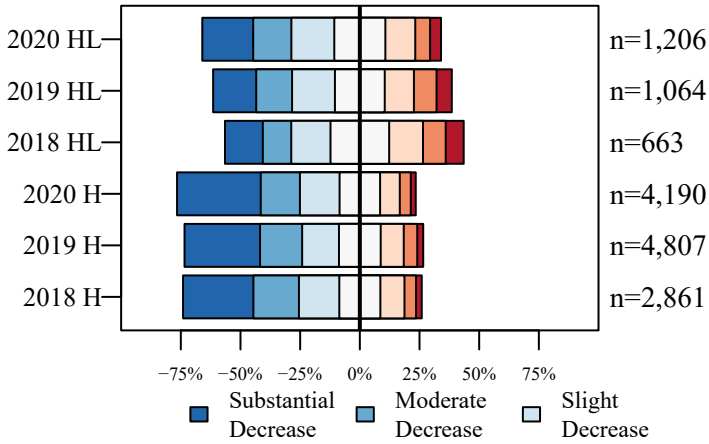


Figure 6. The number of deer seen compared to five years ago described by hunters in the county where they live (HL) and hunters in the county where they hunt (H).

Desired Population Change

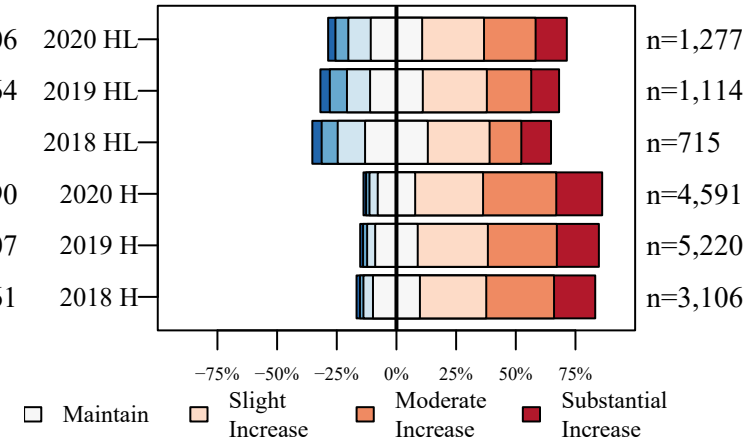


Figure 7. The desired change in the size of the deer population described by hunters in the county where they live (HL) and hunters in the county where they hunt (H).

Total Harvest Change

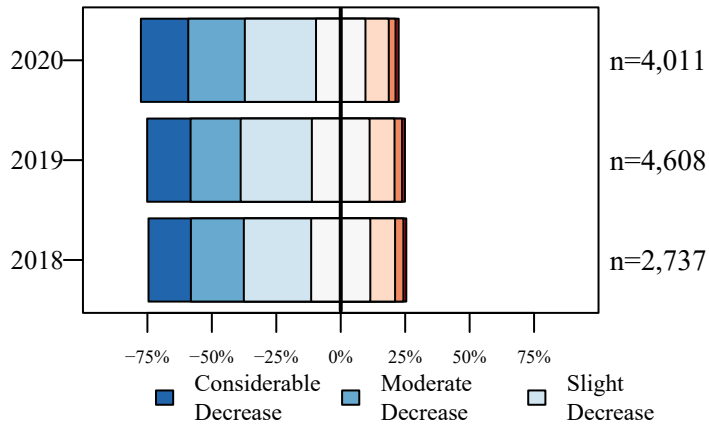
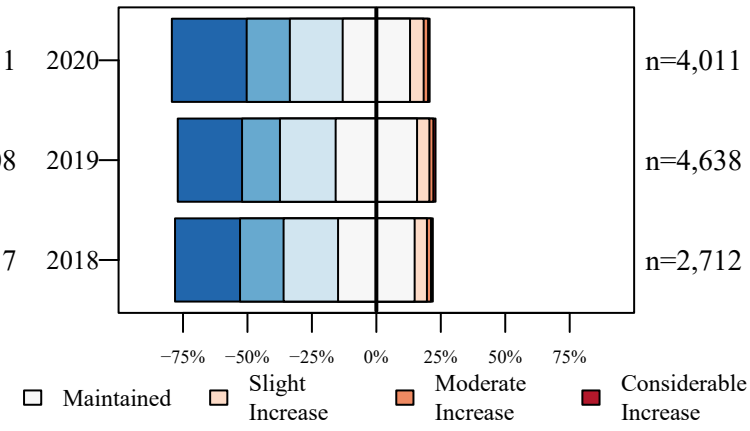


Figure 8. Opinion of hunters on how the total number of harvested deer has changed over the last five years.

Personal Harvest Change



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DMU 6: South

4/17/2020

Deer Management Survey Results

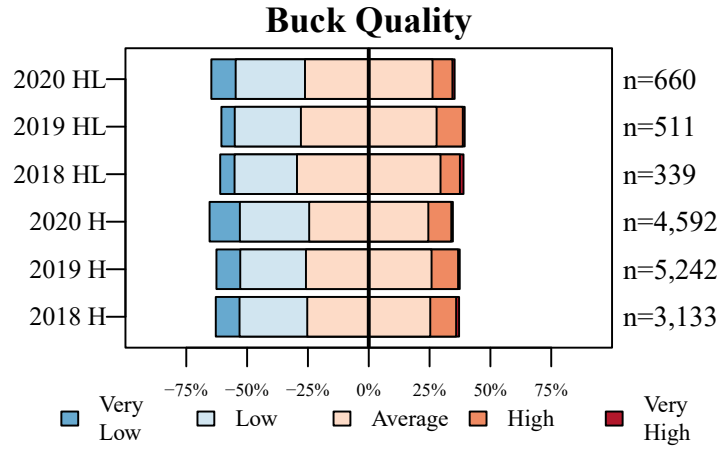
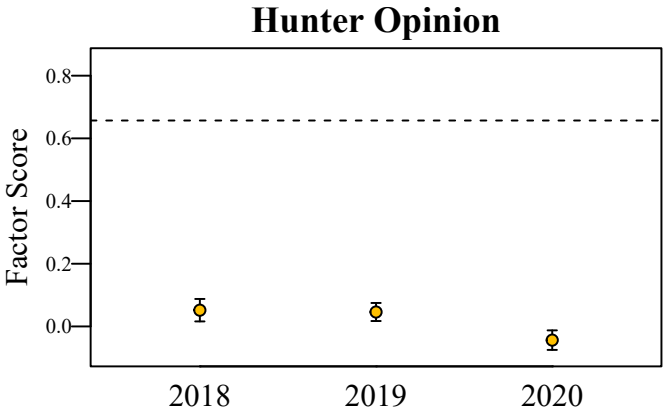


Figure 10. Hunters describe the quality of bucks in the county where they live (HL) and the county where they hunt (H).



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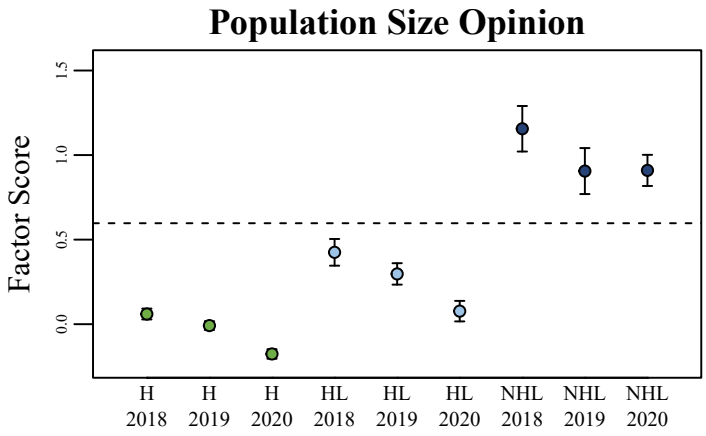

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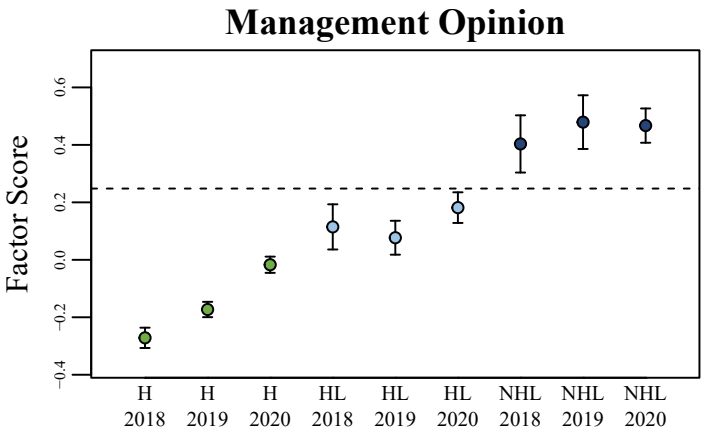

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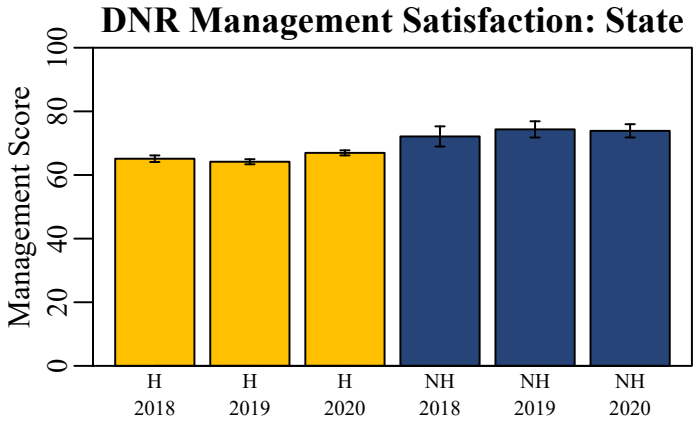

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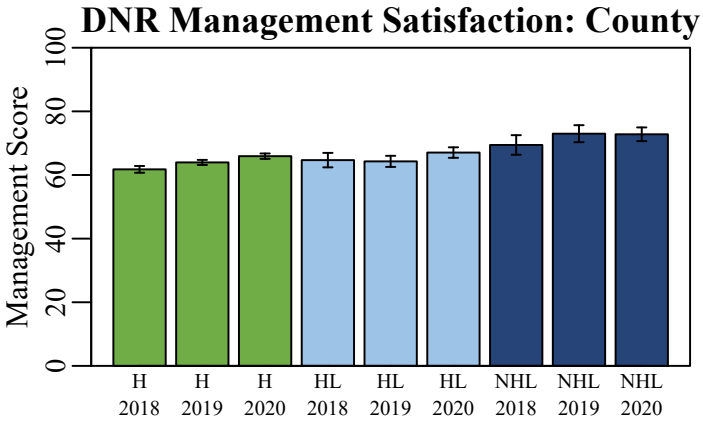

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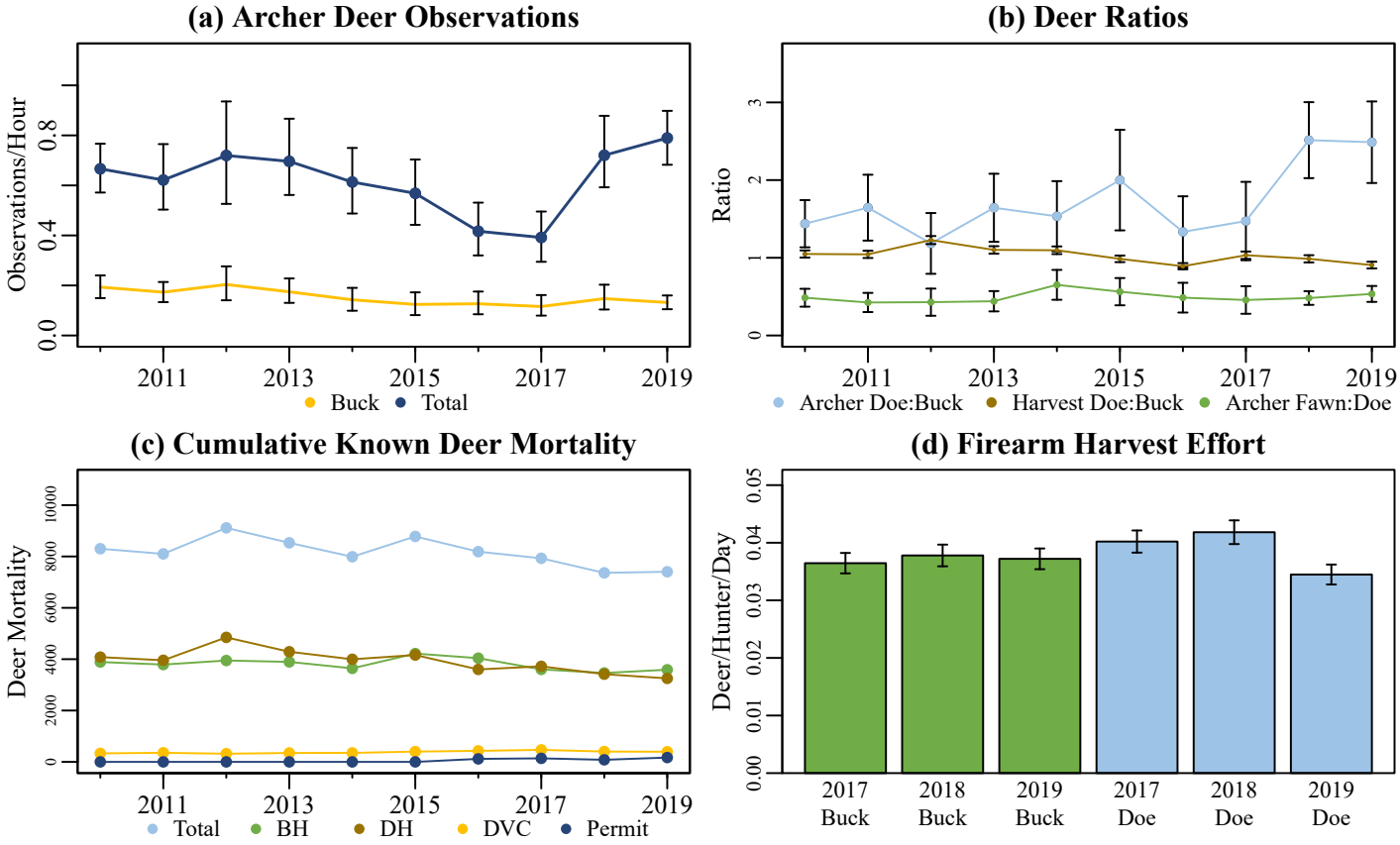
DMU 7: Muscatatuck

4/17/2020

Total Square Miles: 1,410
Square Miles of Deer Habitat: 839
Percent Deer Habitat: 60

Table 1. Total harvest, buck harvest, and doe harvest (error approximately 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
2010	7,970	1.53	3,890	1.36	4.57	4,080	1.71	4.79	51.19		256.29	0.59	6
2011	7,747	0.72	3,790	0.69	4.45	3,957	0.74	4.65	51.08		275.50	1.97	7
2012	8,797	1.90	3,948	0.89	4.64	4,849	3.00	5.70	55.12		248.75	-0.18	8
2013	8,185	0.48	3,895	0.62	4.58	4,290	0.41	5.04	52.41		272.81	1.39	7
2014	7,639	-1.08	3,643	-3.68	4.28	3,996	-0.62	4.70	52.31		275.44	1.09	7
2015	8,380	0.68	4,219	3.20	4.96	4,161	-0.20	4.89	49.65		315.32	3.99	7
2016	7,641	-1.07	4,040	0.66	4.82	3,601	-1.80	4.29	47.13	117	339.51	2.59	7
2017	7,323	-1.62	3,602	-1.65	4.29	3,721	-1.01	4.44	50.81	138	370.31	2.20	7
2018	6,878	-2.20	3,462	-1.60	4.13	3,416	-1.85	4.07	49.67	81	318.74	0.10	4
2019	6,841	-1.33	3,589	-0.64	4.28	3,252	-1.76	3.88	47.54	169	314.23	-0.28	2



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DMU 7: Muscatatuck

4/17/2020

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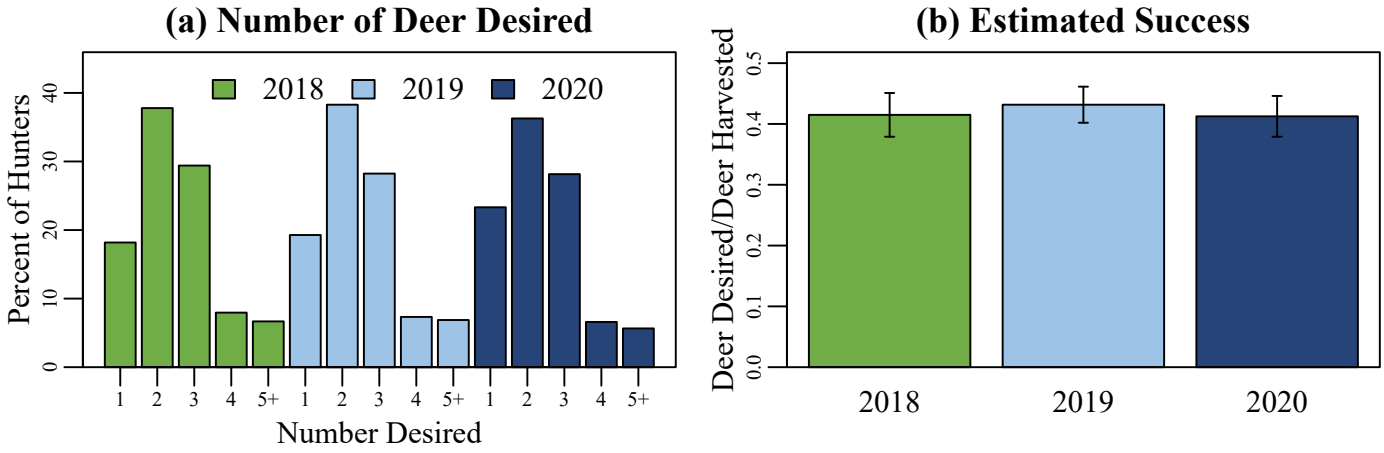
Table 2. Estimated number of antlered (A) and antlerless (AL) deer harvested per hunter. Estimated totals may not match exactly with total number of deer harvested. Reporting errors are examined and investigated as they are located; therefore, subsequent reports may contain corrected totals.

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	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



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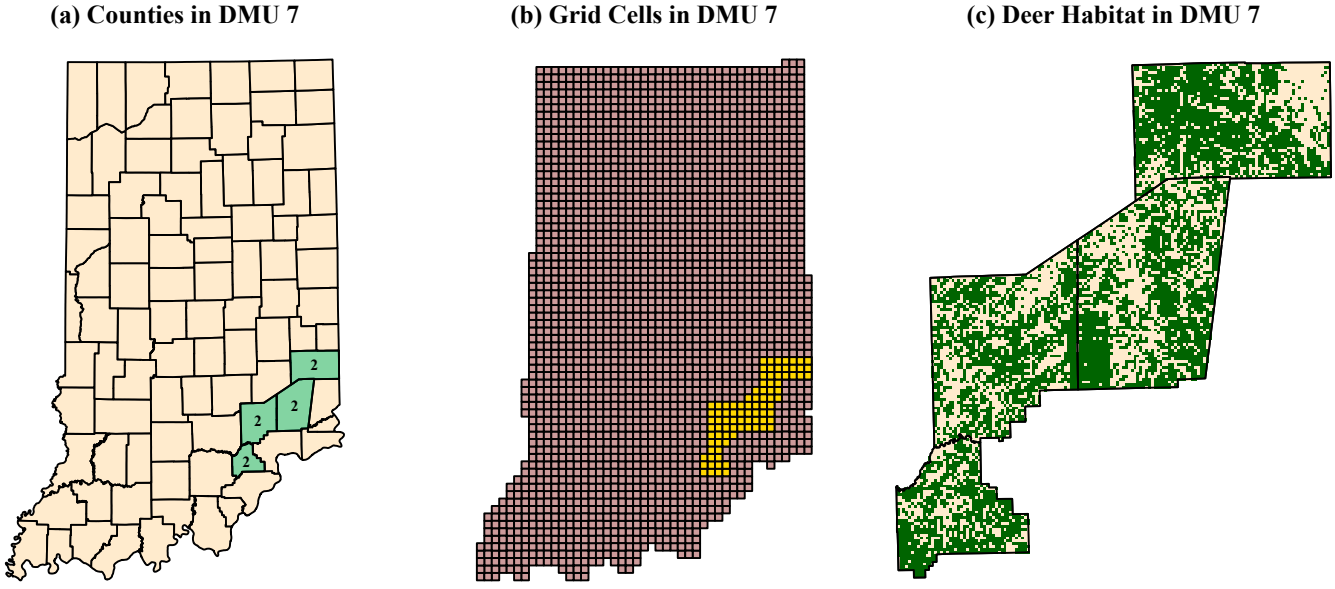

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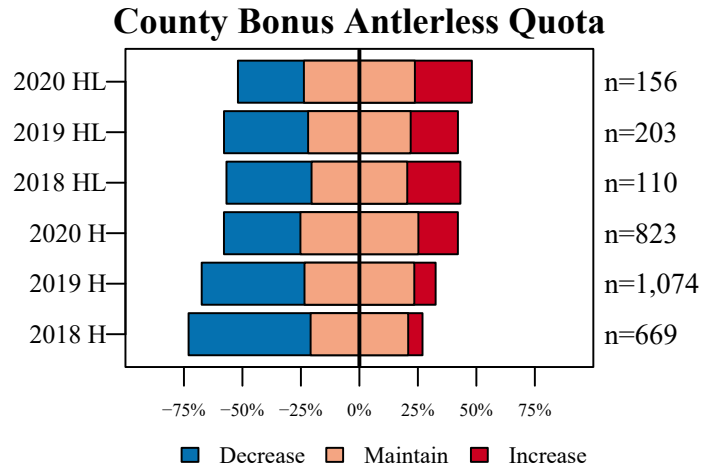
DMU 7: Muscatatuck

4/17/2020

Deer Management Survey Results



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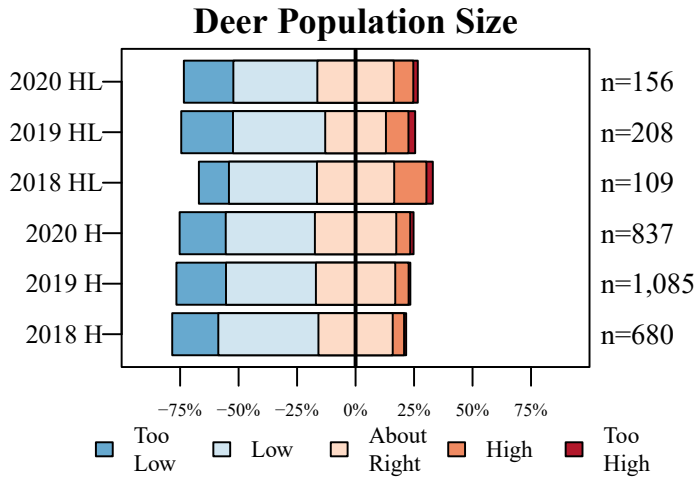

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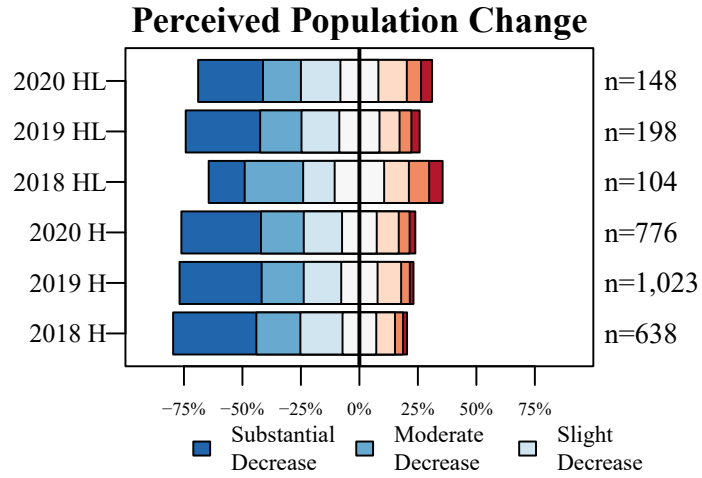

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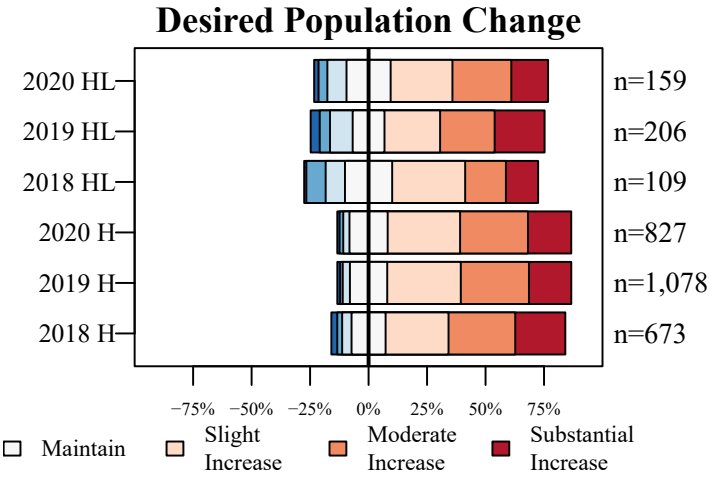

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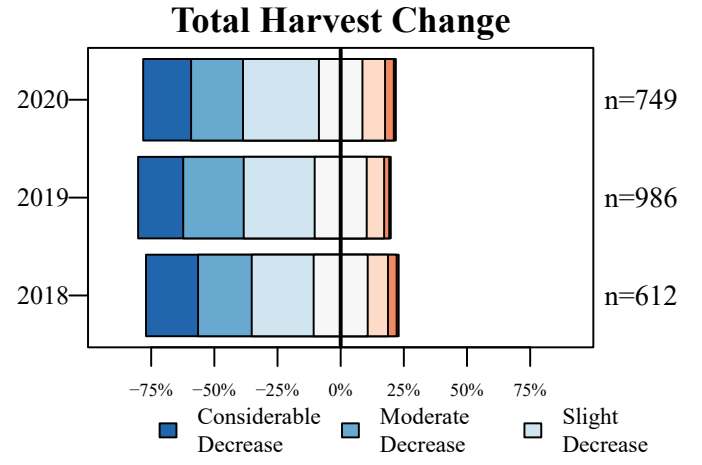

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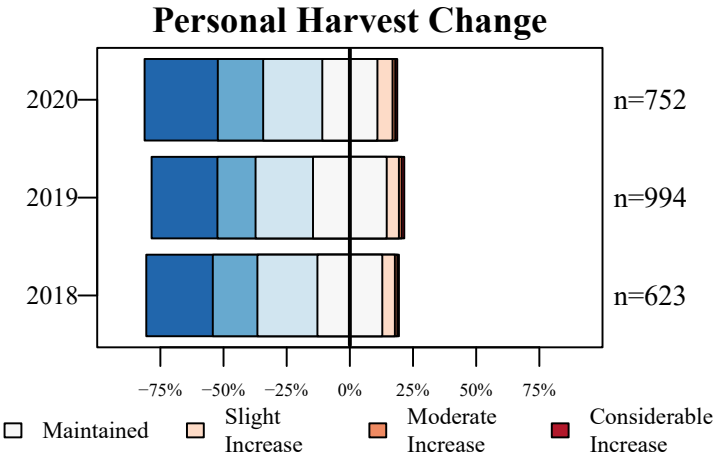

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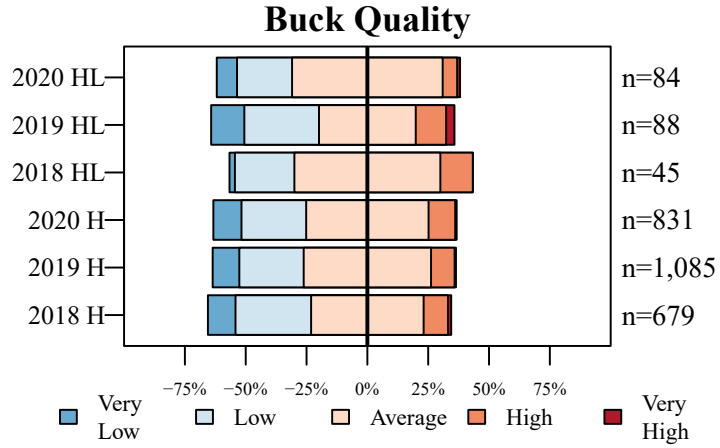
DMU 7: Muscatatuck

4/17/2020

Deer Management Survey Results



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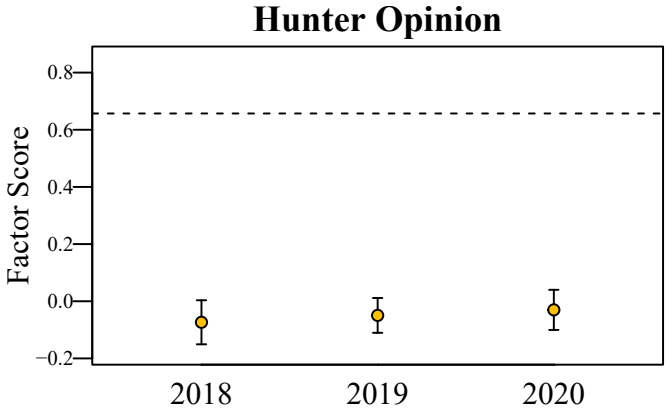

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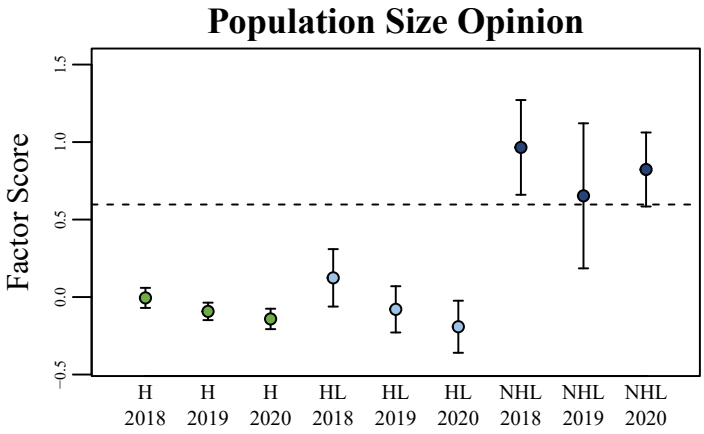

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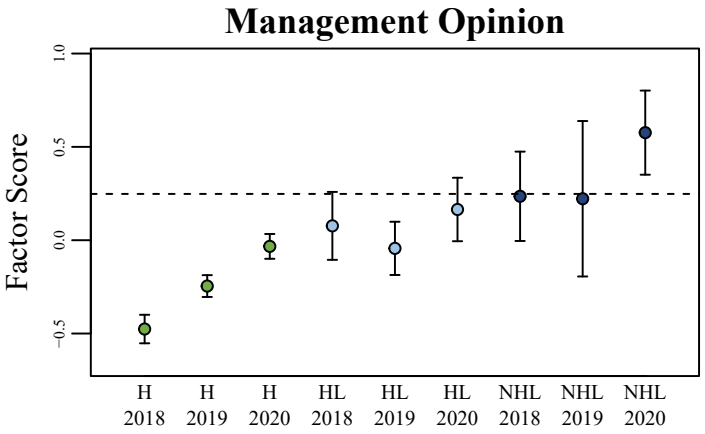

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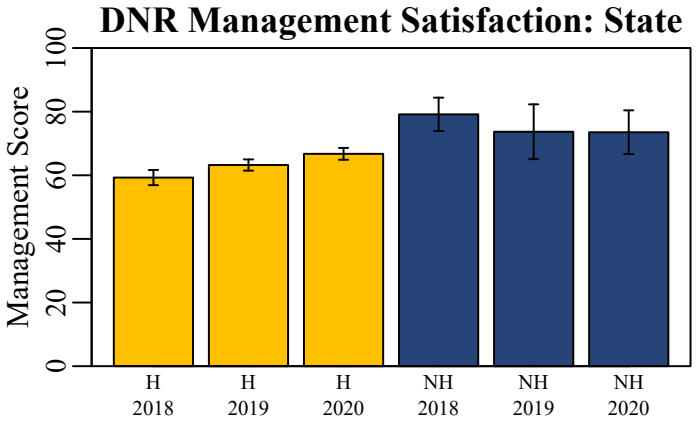

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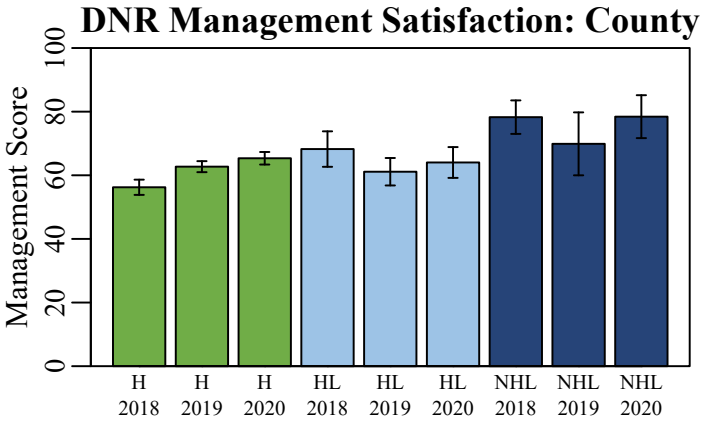

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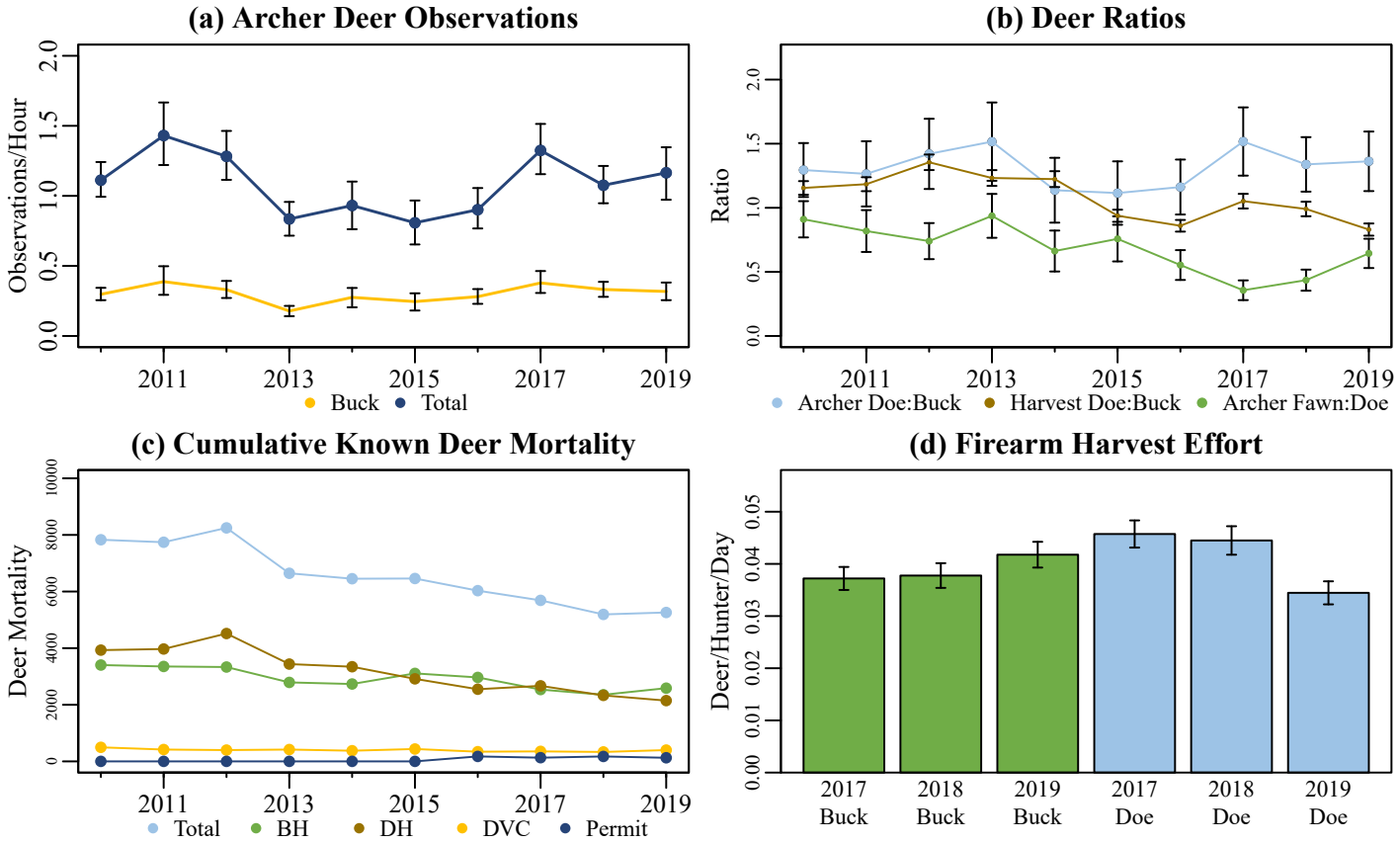
DMU 8: Dearborn

4/17/2020

Total Square Miles: 618
Square Miles of Deer Habitat: 512
Percent Deer Habitat: 83

Table 1. Total harvest, buck harvest, and doe harvest (error approximately 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
2010	7,333	1.56	3,403	1.26	6.54	3,930	1.88	7.56	53.59		614.89	0.33	8.00
2011	7,323	1.05	3,353	0.84	6.45	3,970	1.38	7.63	54.21		511.69	-1.73	8.00
2012	7,849	2.05	3,333	0.48	6.41	4,516	5.20	8.68	57.54		486.69	-1.46	8.00
2013	6,226	-2.00	2,789	-1.83	5.36	3,437	-1.63	6.61	55.20		512.50	-0.70	8.00
2014	6,077	-1.89	2,733	-1.97	5.26	3,344	-1.52	6.43	55.03		462.88	-1.46	6.67
2015	6,023	-1.22	3,108	-0.04	5.98	2,915	-1.96	5.61	48.40		540.34	0.39	5.33
2016	5,514	-1.42	2,965	-0.34	5.79	2,549	-1.76	4.98	46.23	175	424.95	-2.66	4.00
2017	5,205	-1.28	2,537	-1.84	4.96	2,668	-0.92	5.21	51.26	130	438.58	-1.05	4.00
2018	4,684	-2.61	2,353	-2.16	4.60	2,331	-1.64	4.55	49.77	174	415.58	-1.23	3.33
2019	4,733	-1.32	2,586	-0.50	5.05	2,147	-1.58	4.19	45.36	127	499.26	0.85	2.00



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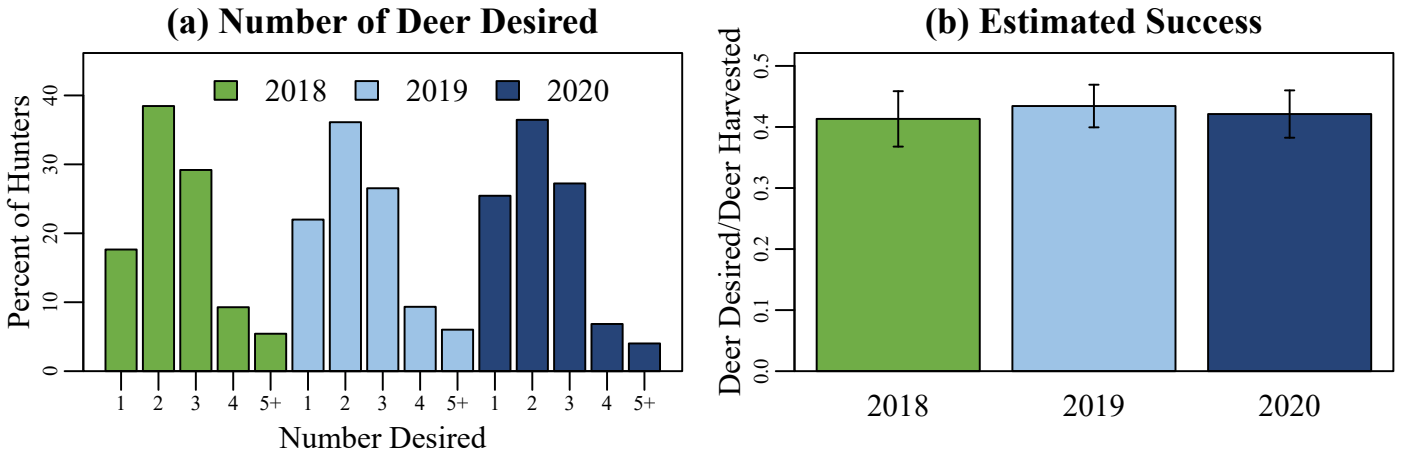
DMU 8: Dearborn

4/17/2020

Total Square Miles: 618
Square Miles of Deer Habitat: 512
Percent Deer Habitat: 83

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



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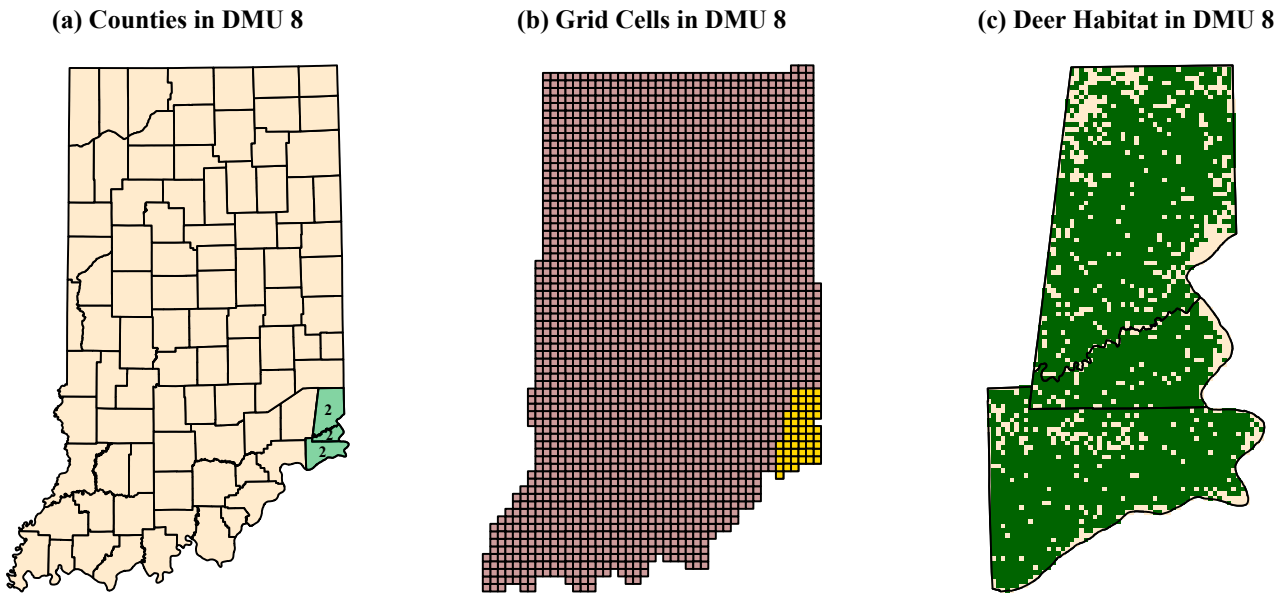
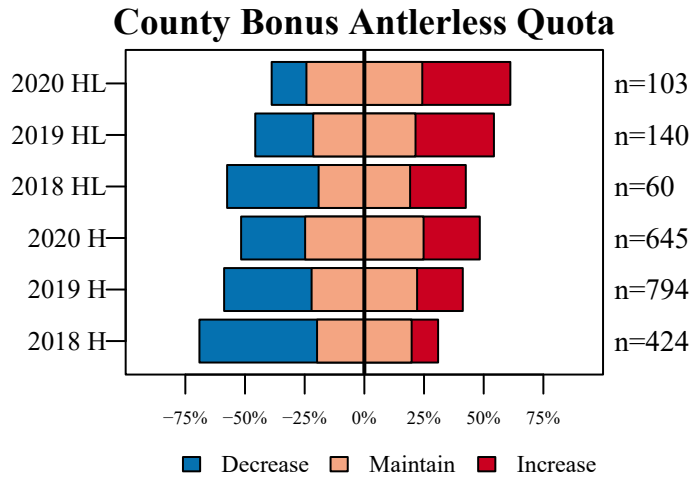


Figure 3. (a) Counties included in DMU 8 for summarizing harvest statistics. Labels are the 2019 county bonus anterless quotas. (b) 4 x 4 mile grid cells included in DMU 8 for summarizing annual deer management survey statistics. (c) Green represents the land use types classified as deer habitat in DMU 8.

DMU 8: Dearborn

4/17/2020

Deer Management Survey Results



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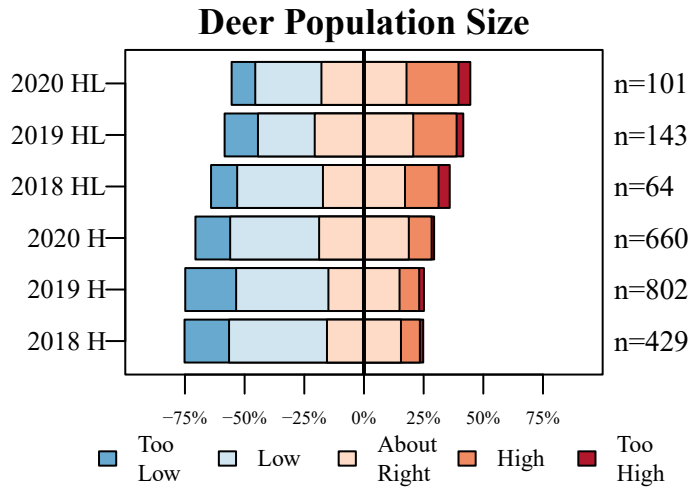

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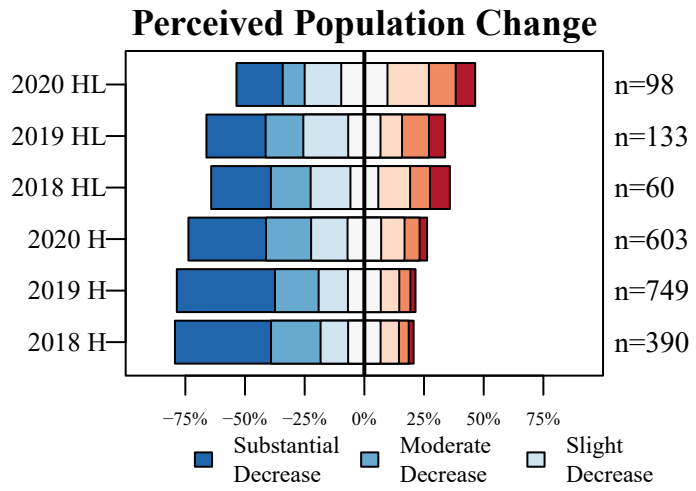

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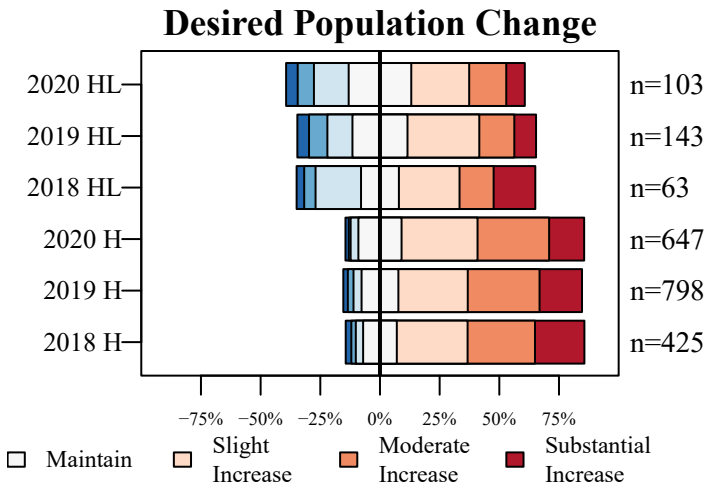

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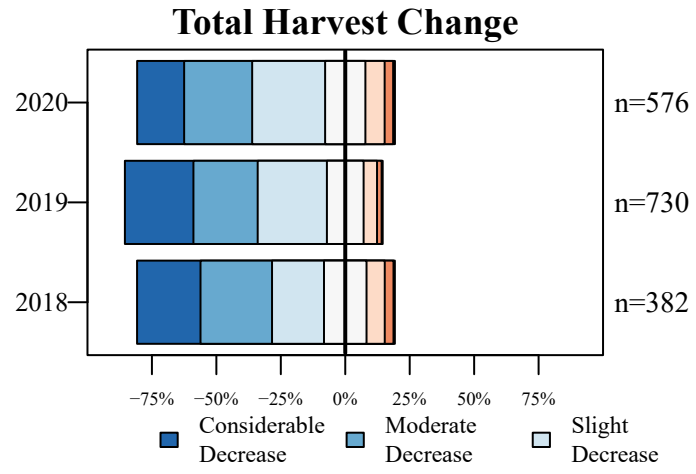

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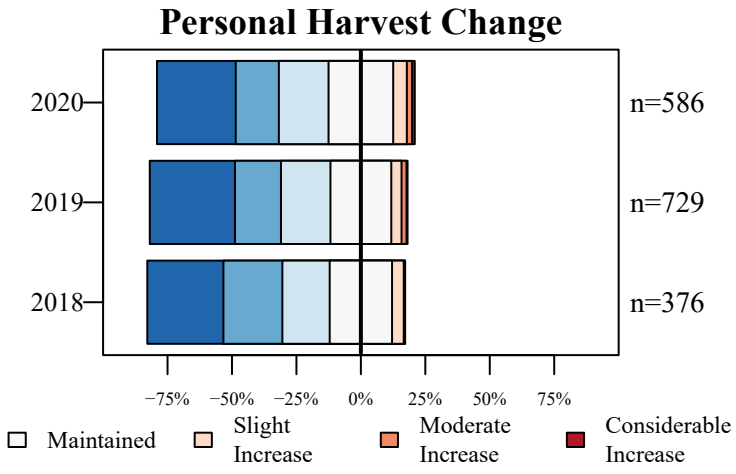

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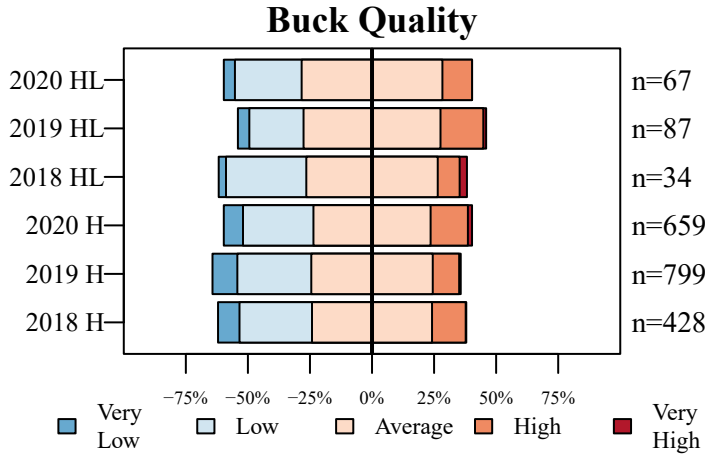
DMU 8: Dearborn

4/17/2020

Deer Management Survey Results



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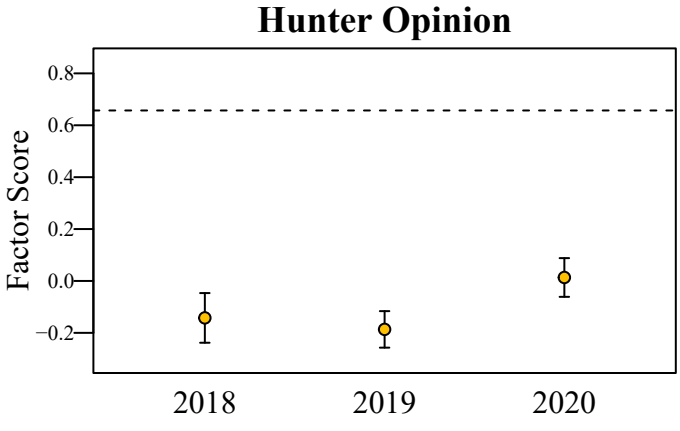

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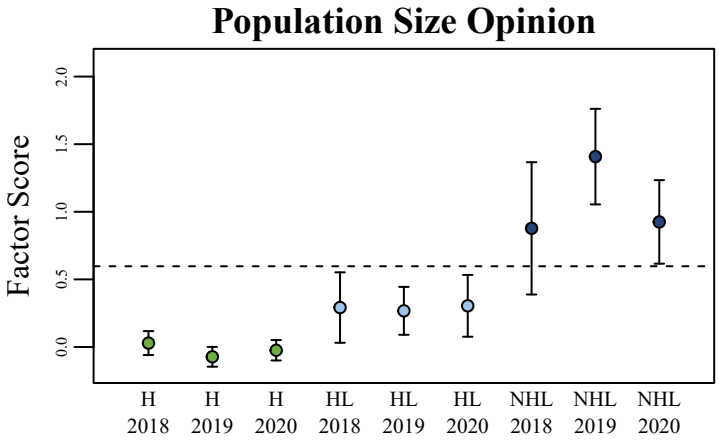

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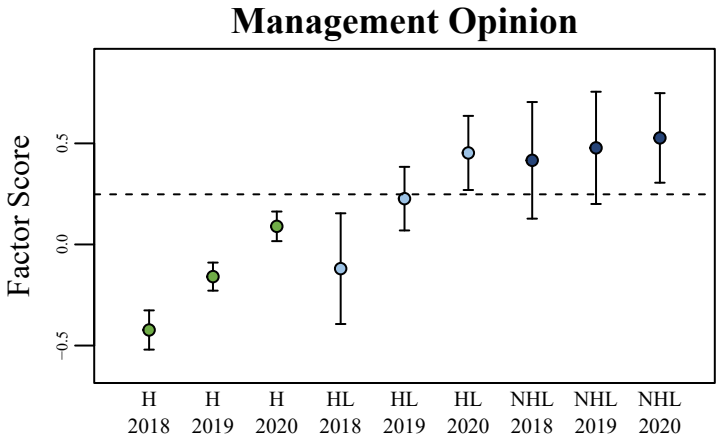

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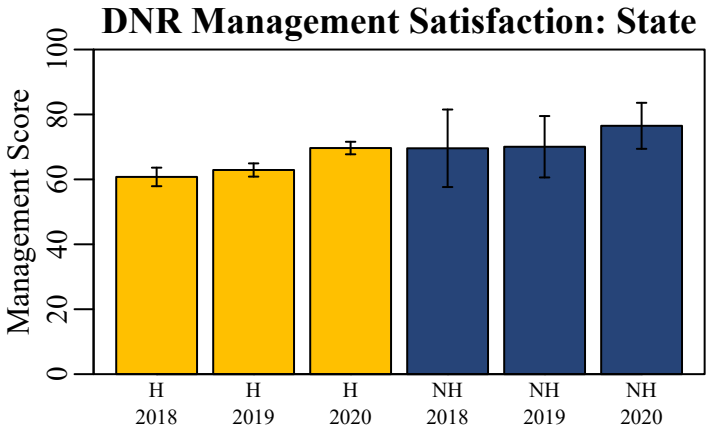

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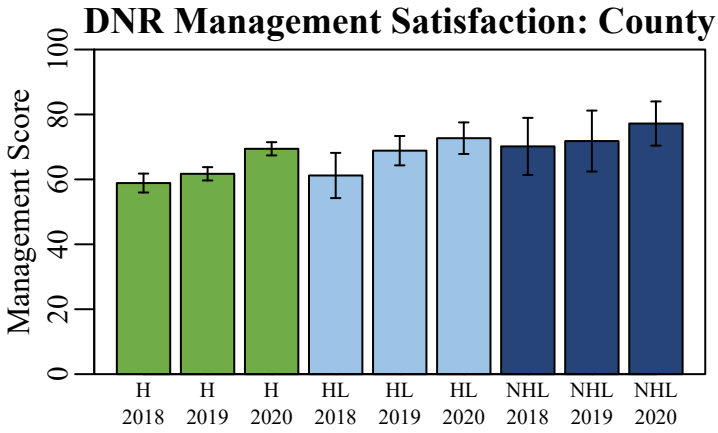

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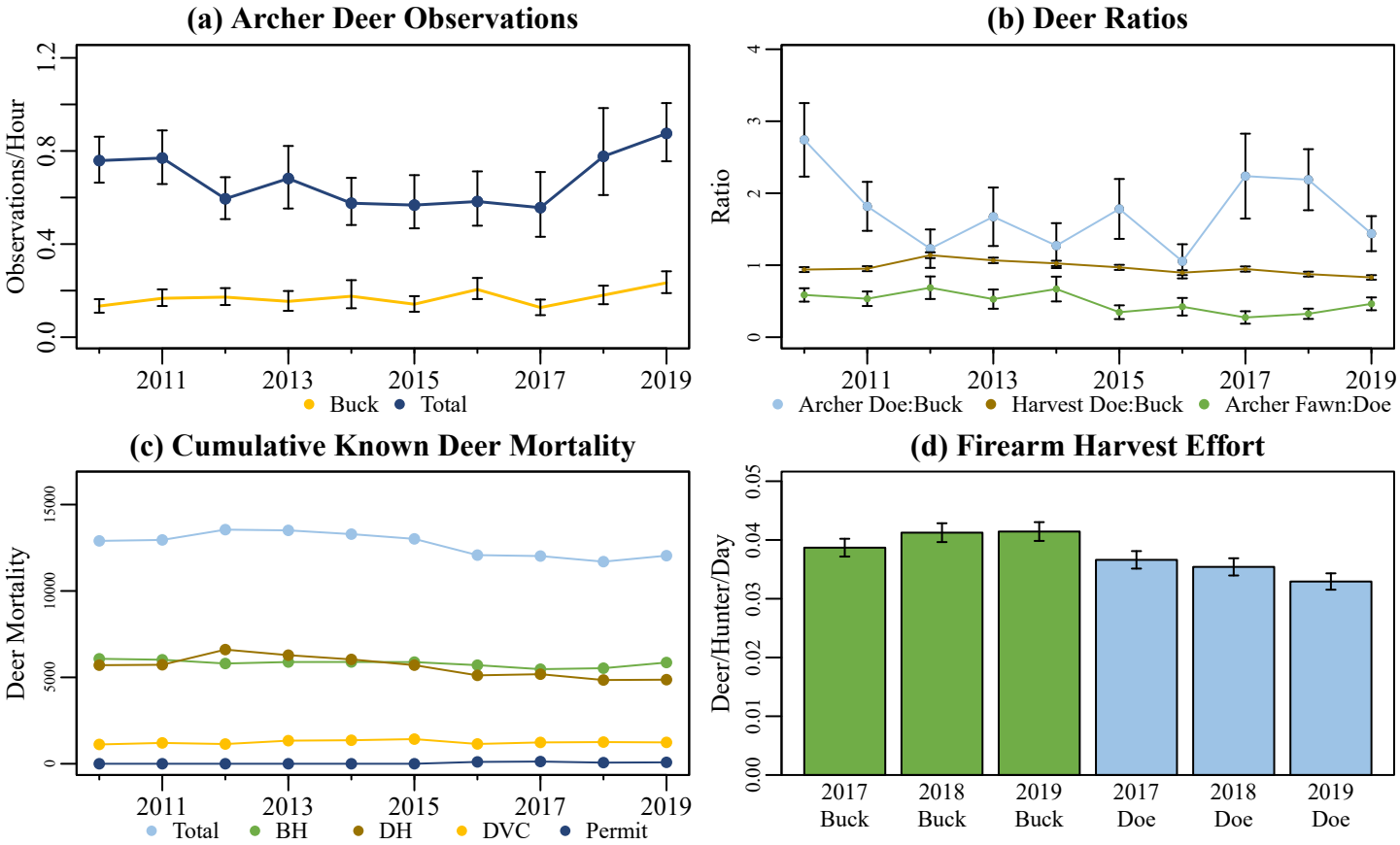
DMU 9: Southwest

4/17/2020

Total Square Miles: 3,682
Square Miles of Deer Habitat: 1,307
Percent Deer Habitat: 36

Table 1. Total harvest, buck harvest, and doe harvest (error approximately 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
2010	11,780	-0.54	6,075	-0.46	5.00	5,705	-0.60	4.70	48.43		219.05	0.03	4.67
2011	11,747	-0.34	6,019	-0.33	4.96	5,728	-0.33	4.72	48.76		238.46	2.15	4.67
2012	12,409	1.65	5,802	-0.89	4.78	6,607	4.02	5.44	53.24		224.72	-0.01	4.67
2013	12,172	0.60	5,888	-1.05	4.85	6,284	0.83	5.18	51.63		260.27	3.48	4.44
2014	11,929	-0.19	5,891	-0.68	4.85	6,038	0.11	4.97	50.62		264.95	1.90	3.89
2015	11,589	-1.49	5,883	-0.47	4.85	5,706	-0.96	4.70	49.24		276.03	1.68	3.89
2016	10,822	-3.50	5,706	-2.45	4.37	5,116	-2.50	3.91	47.27	107	219.02	-1.63	3.56
2017	10,657	-1.83	5,474	-4.47	4.19	5,183	-1.34	3.97	48.63	128	232.43	-0.65	2.56
2018	10,377	-1.58	5,531	-1.30	4.23	4,846	-1.59	3.71	46.70	65	231.74	-0.79	2.00
2019	10,725	-0.53	5,859	0.84	4.48	4,866	-1.06	3.72	45.37	81	224.24	-0.85	1.78



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DMU 9: Southwest

4/17/2020

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Square Miles of Deer Habitat: 1,307
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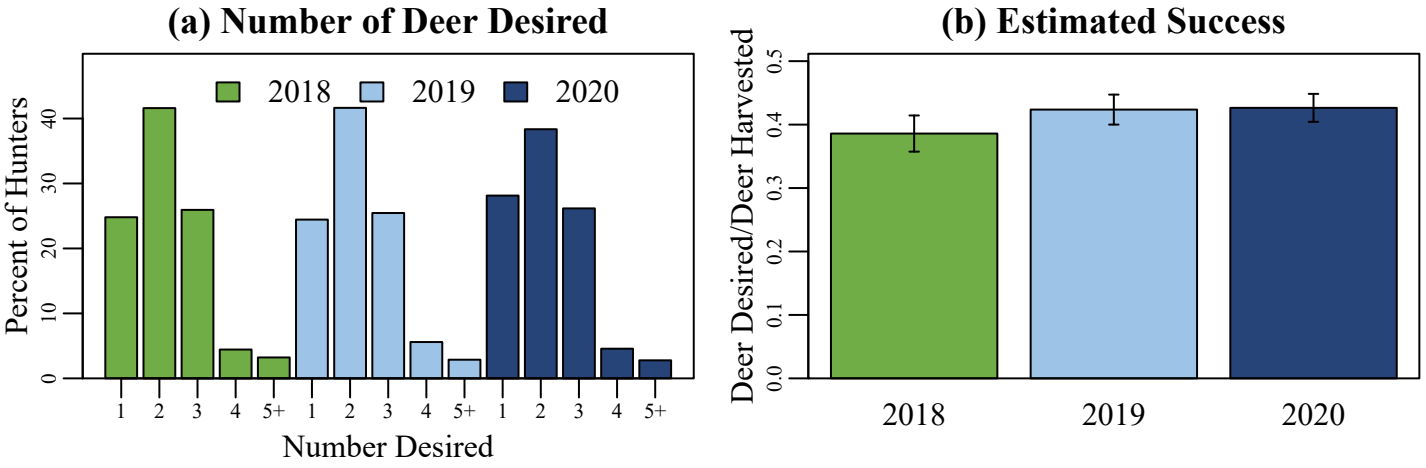
Table 2. Estimated number of antlered (A) and antlerless (AL) deer harvested per hunter. Estimated totals may not match exactly with total number of deer harvested. Reporting errors are examined and investigated as they are located; therefore, subsequent reports may contain corrected totals.

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	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



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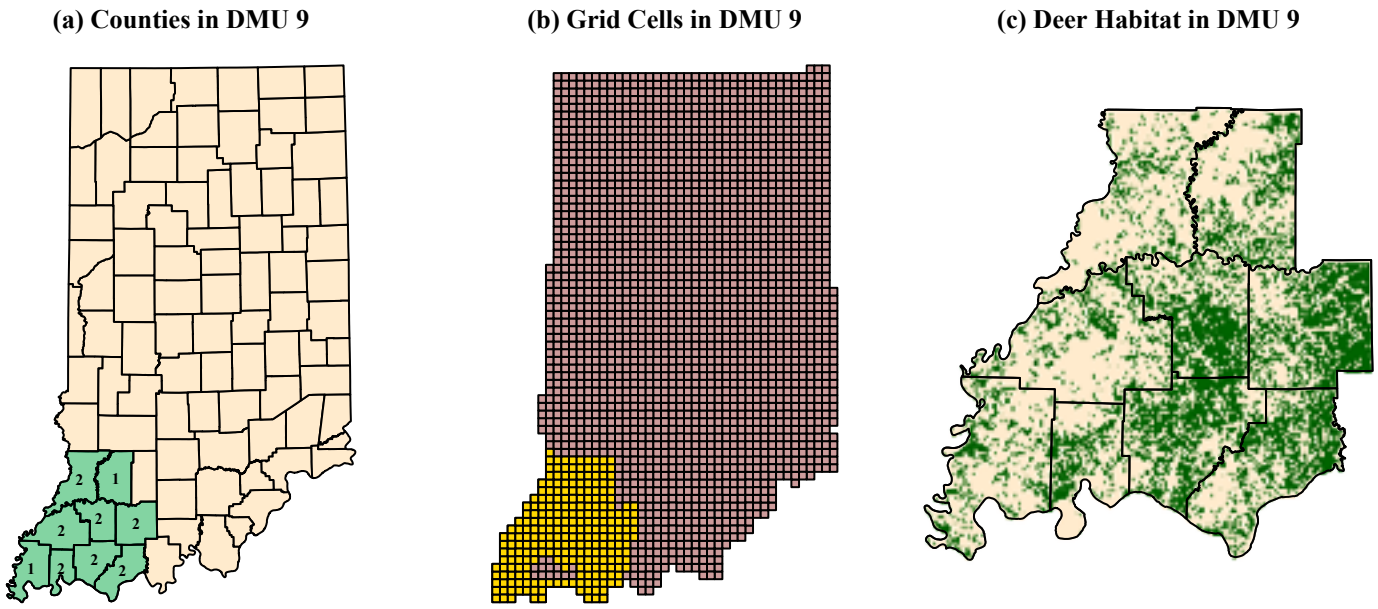

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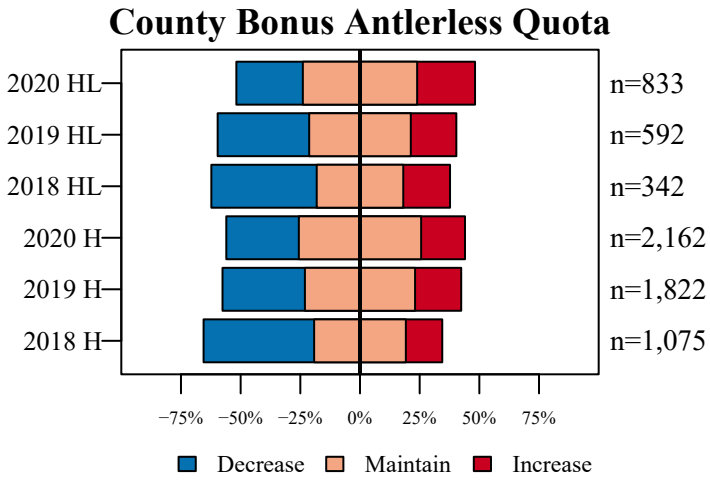
DMU 9: Southwest

4/17/2020

Deer Management Survey Results



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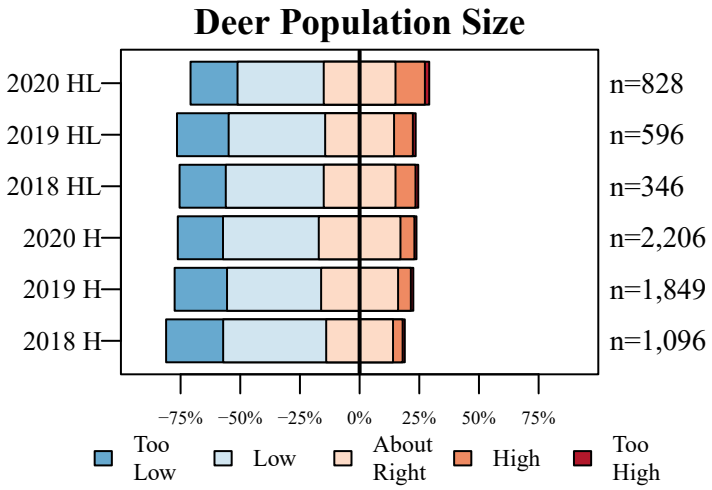

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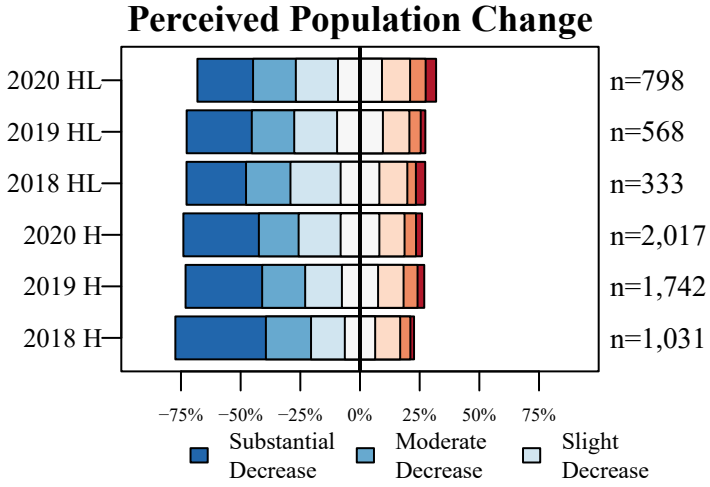

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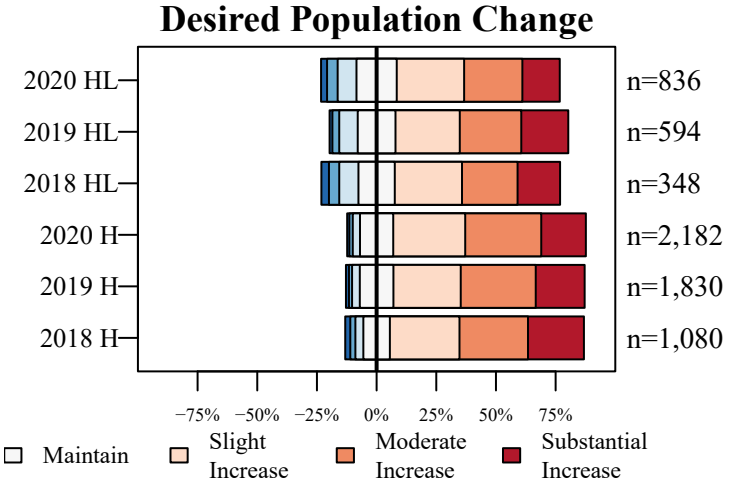

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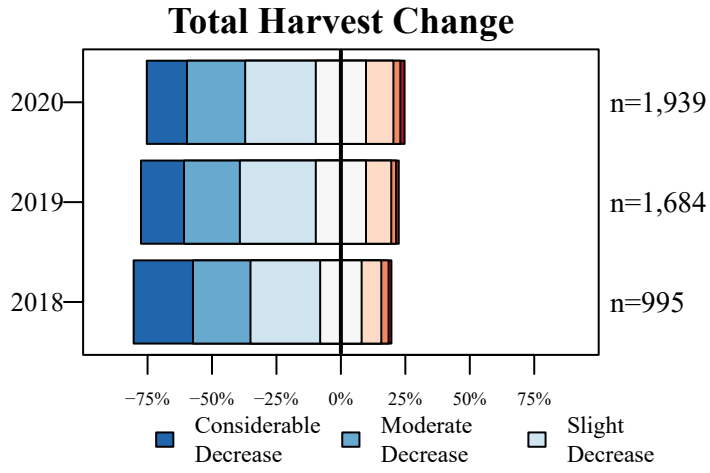

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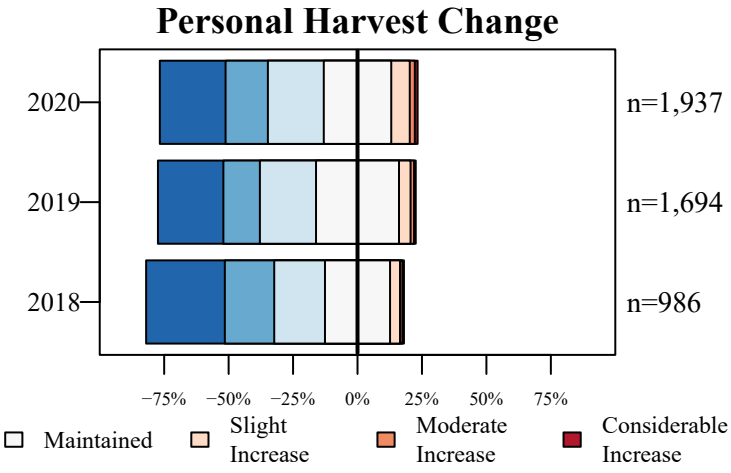

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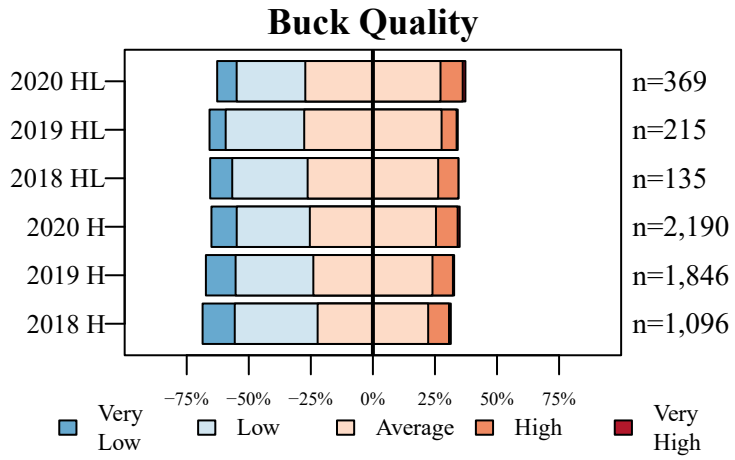
DMU 9: Southwest

4/17/2020

Deer Management Survey Results



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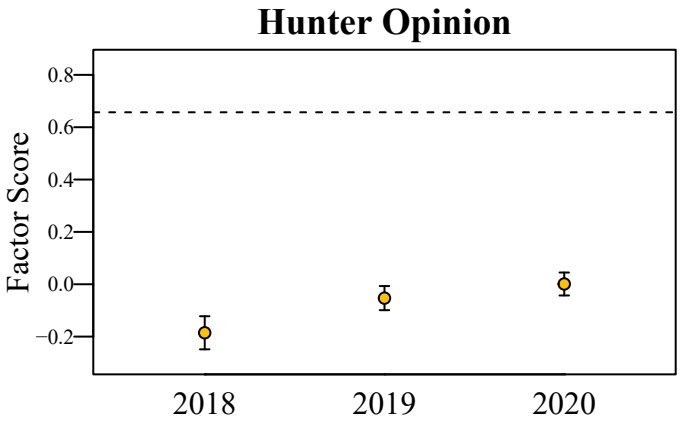

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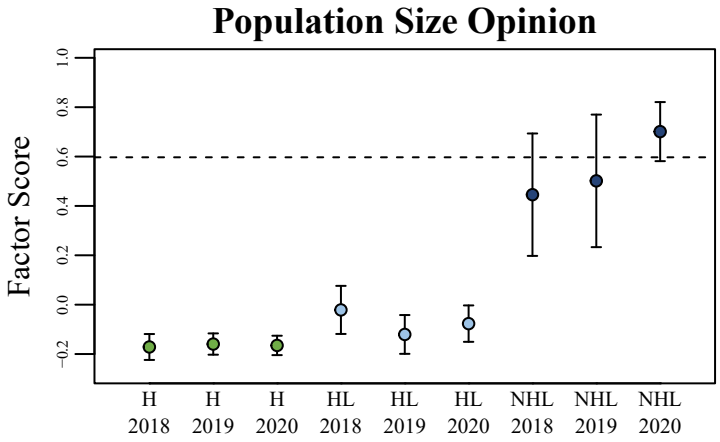

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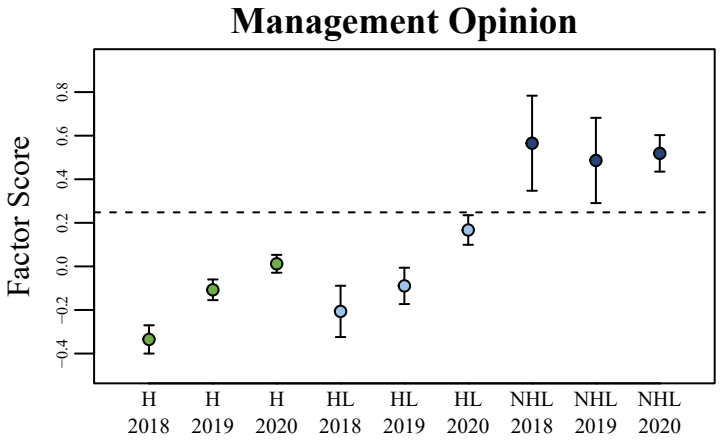

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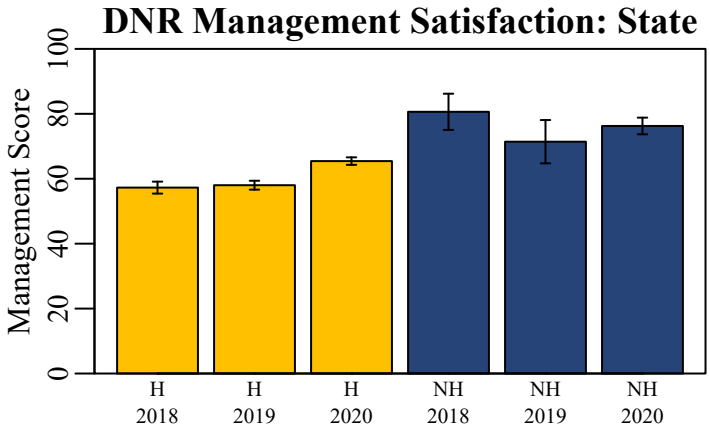


Figure 14. Hunters (H) and nonhunters (NH) were asked to score the DNR's statewide deer management on a scale of 0 (poor) to 100 (excellent).

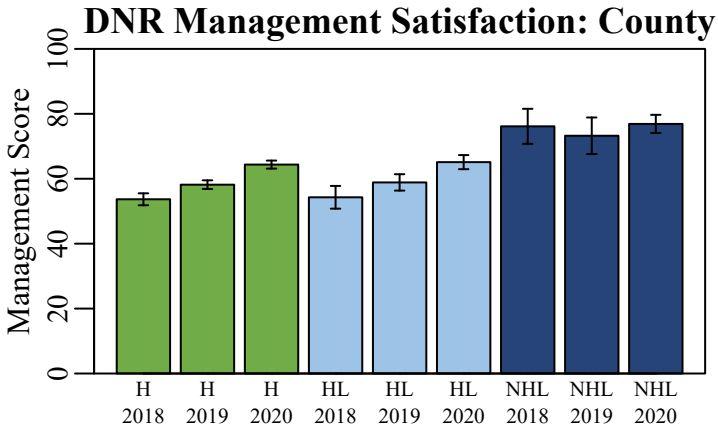


Figure 15. Opionion of county deer management on a scale of 0 (poor) to 100 (excellent) from individuals who hunt in a county (H), individuals that live in a county but hunt elsewhere (HL), and nonhunters that live in a county (NHL).

DMU 10: Urban

4/17/2020

Total Square Miles: 403
Square Miles of Deer Habitat: 42
Percent Deer Habitat: 11

Table 1. Total harvest, buck harvest, and doe harvest (error approximately 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
2006	264		162		4.63	102		2.91	38.64		13.66		8
2007	324		208		5.94	116		3.31	35.80		9.52		8
2008	328		192		5.49	136		3.89	41.46		11.37		8
2009	351		224		6.40	127		3.63	36.18		12.44		8
2010	352	0.96	191	0.22	5.46	161	2.11	4.60	45.74		11.61	-0.38	8
2011	375	1.43	207	0.50	5.91	168	1.78	4.80	44.80		12.23	0.33	8
2012	501	7.50	179	-1.87	5.11	322	8.12	9.20	64.27		9.02	-2.09	8
2013	510	1.87	203	0.25	5.80	307	1.56	8.77	60.20		11.19	-0.10	8
2014	469	0.63	166	-2.05	4.74	303	0.95	8.66	64.61		9.46	-1.34	8
2015	444	0.04	167	-1.31	4.77	277	0.31	7.91	62.39		10.50	-0.15	8
2016	416	-0.81	166	-0.94	3.95	250	-0.41	5.95	60.10	3	9.81	-0.51	8
2017	448	-0.51	187	0.68	4.45	261	-1.08	6.21	58.26	174	11.00	1.16	8
2018	435	-0.64	170	-0.47	4.05	265	-0.58	6.31	60.92	123	10.00	-0.53	3
2019	444	0.08	196	2.76	4.67	248	-1.15	5.90	55.86	100	7.55	-4.32	2

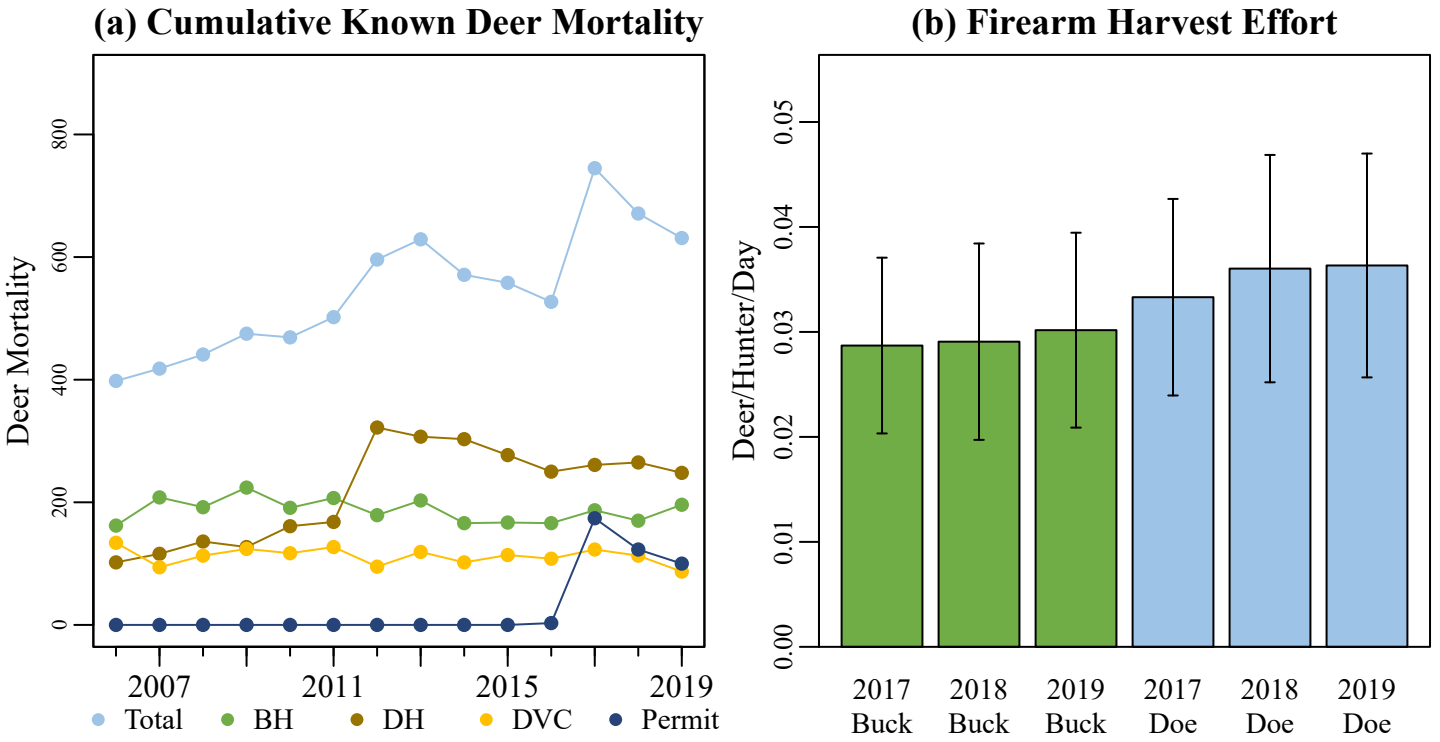


Figure 1. (a) The total known annual deer mortality based on buck harvests (BH), doe harvests (DH), deer vehicle collisions (DVC), and deer permit takes. (b) Firearm harvest effort is the number of deer killed by firearms per hunter divided by the mean number of days hunted per hunter during the firearm season based on data reported in the deer management survey.

DMU 10: Urban

4/17/2020

Total Square Miles: 403
Square Miles of Deer Habitat: 42
Percent Deer Habitat: 11

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

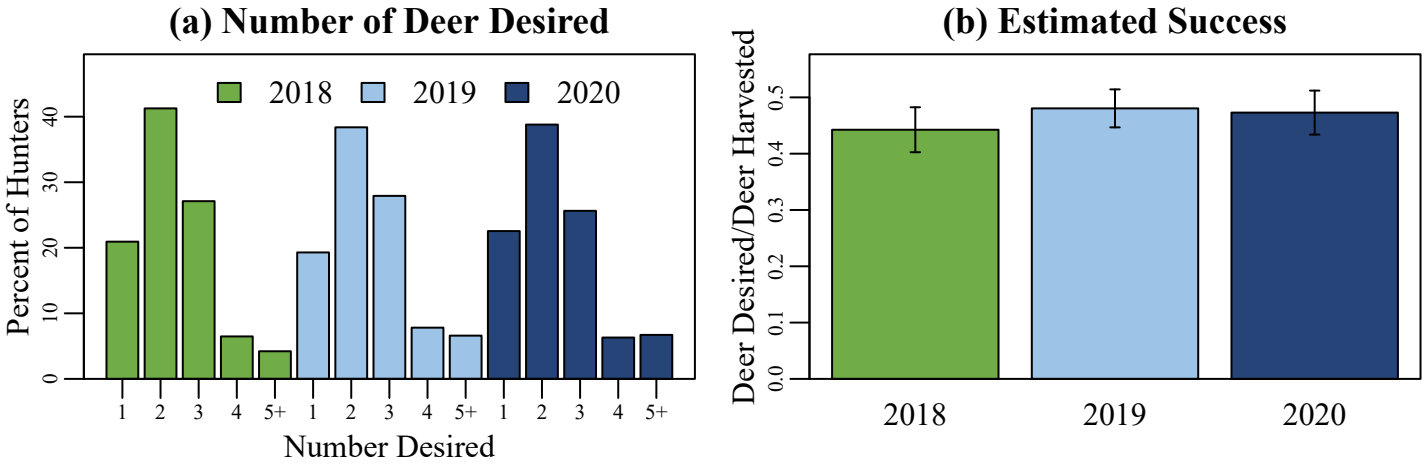


Figure 2. (a) The annual percent of hunters wishing to harvest each number of deer as reported in the deer management survey. (b) Success rate is estimated from the deer management survey as the Number of Harvested Deer/Number of Deer Desired (reported only; does not account for attempts that were not made).

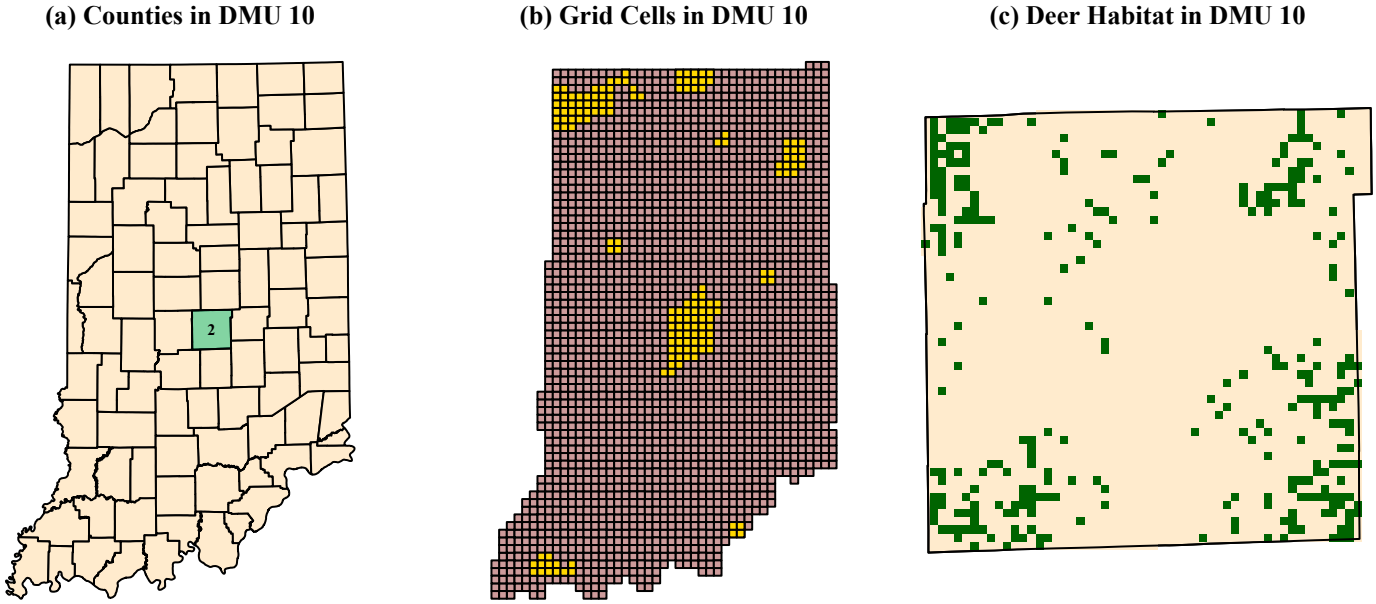


Figure 3. (a) Counties included in DMU 10 for summarizing harvest statistics. Labels are the 2019 county bonus anterless quotas. (b) 4 x 4 mile grid cells included in DMU 10 for summarizing annual deer management survey statistics. (c) Green represents the land use types classified as deer habitat in DMU 10.

DMU 10: Urban

4/17/2020

Deer Management Survey Results

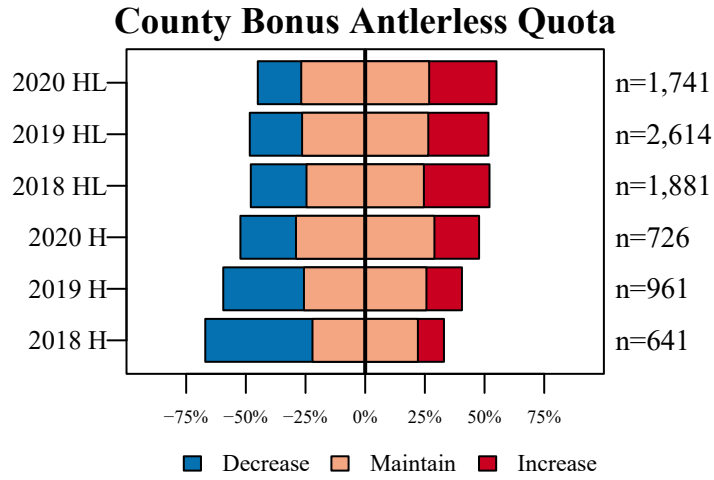


Figure 4. Opinion on how the County Bonus Antlerless Quota should change from hunters in the county where they live (HL) and hunters in the county where they hunt (H).

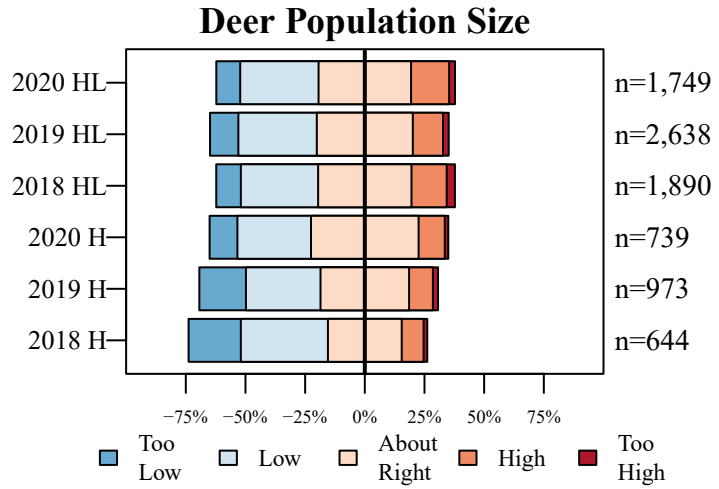


Figure 5. The current size of the deer population described by hunters in the county where they live (HL) and hunters in the county where they hunt (H).

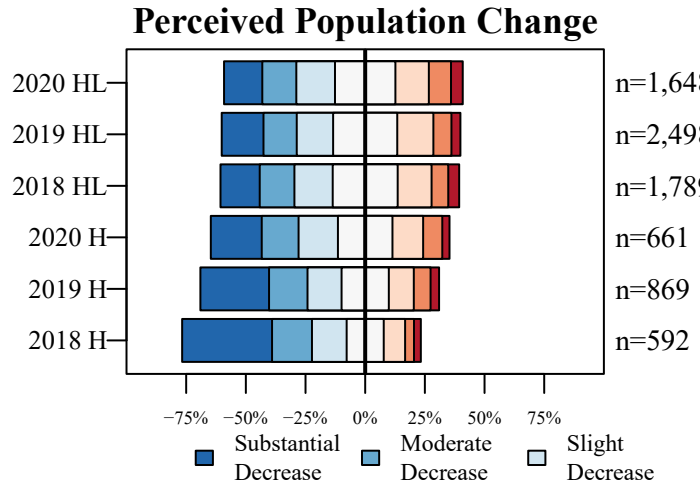


Figure 6. The number of deer seen compared to five years ago described by hunters in the county where they live (HL) and hunters in the county where they hunt (H).

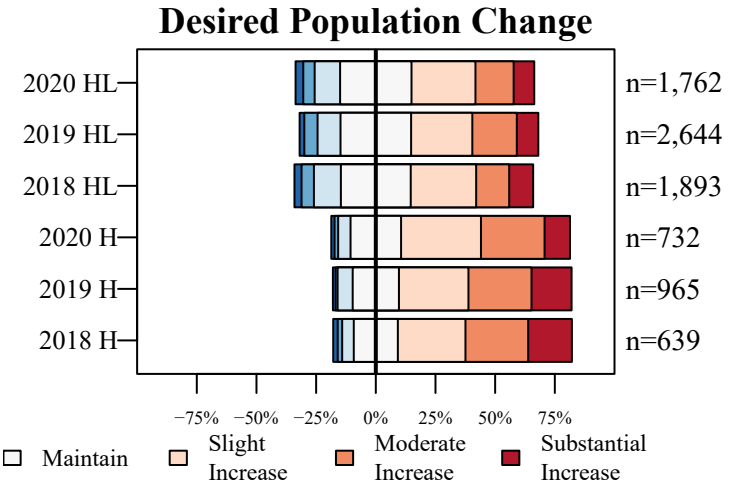


Figure 7. The desired change in the size of the deer population described by hunters in the county where they live (HL) and hunters in the county where they hunt (H).

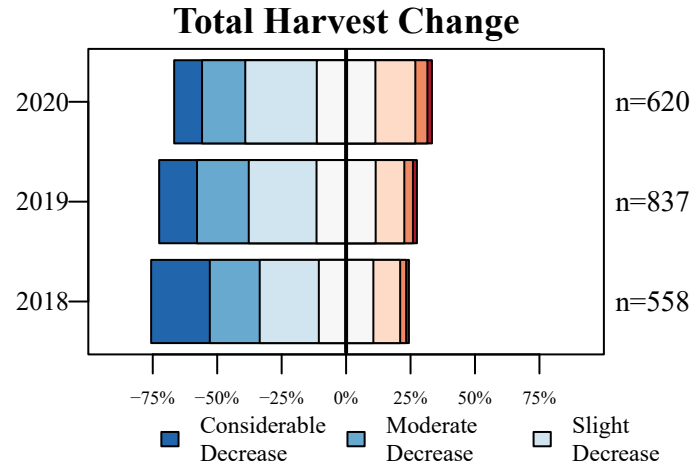


Figure 8. Opinion of hunters on how the total number of harvested deer has changed over the last five years.

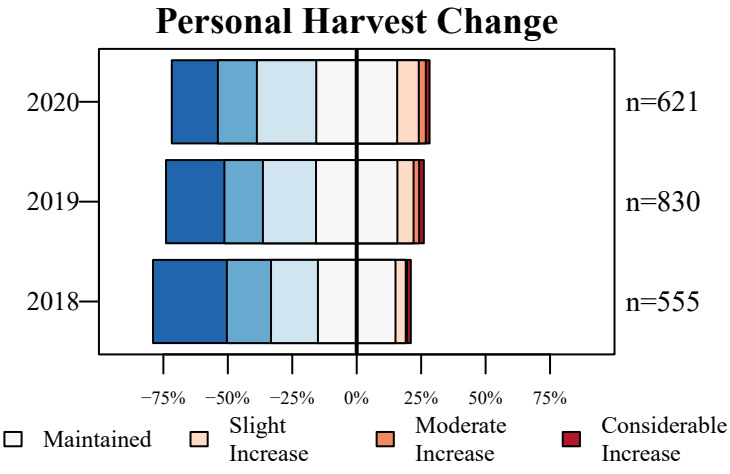


Figure 9. Opinion of hunters on how their personal number of harvested deer has changed over the last five years.

DMU 10: Urban

4/17/2020

Deer Management Survey Results

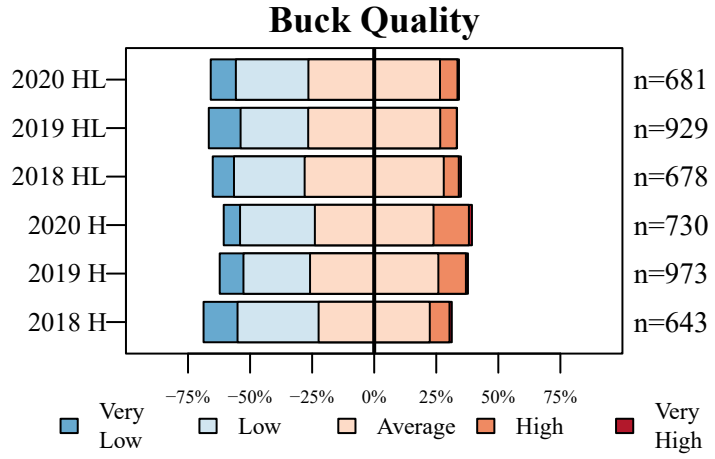


Figure 10. Hunters describe the quality of bucks in the county where they live (HL) and the county where they hunt (H).

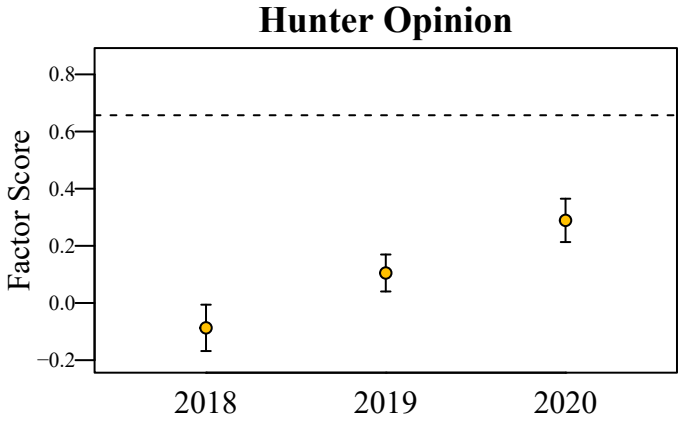


Figure 11. Hunter opinon scores over three years of the deer management survey. The score was aggregated using factor analysis of questions asked only to hunters. The dashed line represents the score if all questions are answered neutrally.

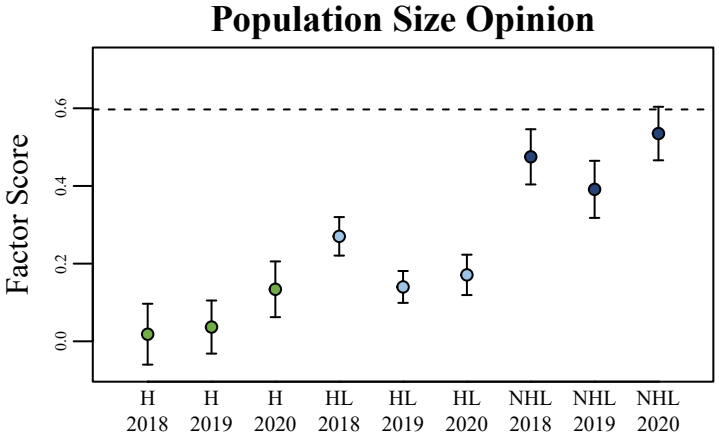


Figure 12. The opinion of nonhunters (NHL) and hunters in the county where they live (HL) and hunters in the county where they hunt (H) on deer population size. The score was aggregated using factor analysis of questions asked to all participants. The dashed line represents the score if all questions are answered neutrally.

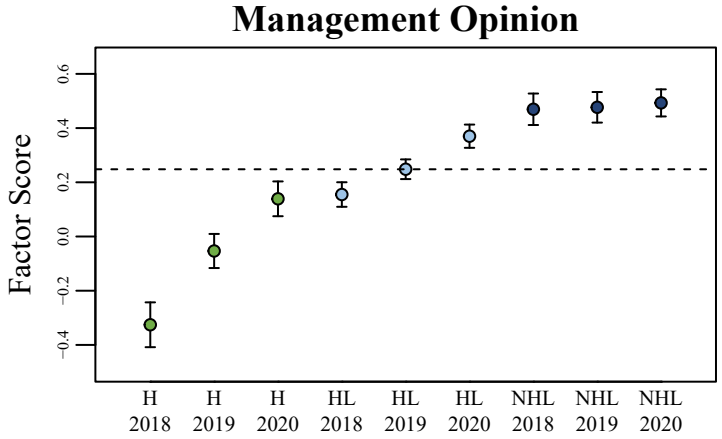
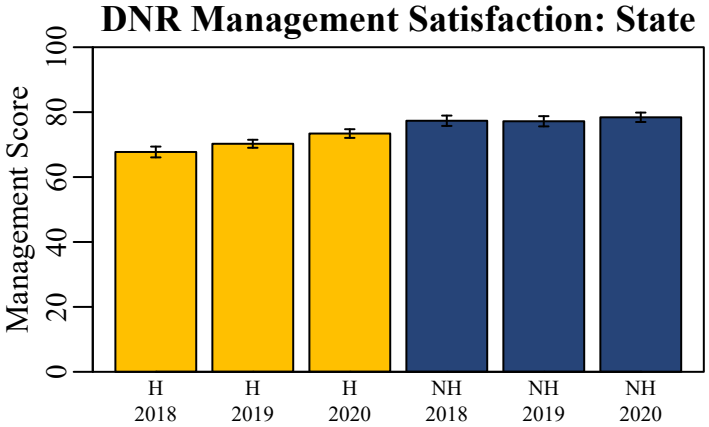


Figure 13. The opinion of nonhunters (NHL) and hunters in the county where they live (HL) and hunters in the county where they hunt (H) on deer management. The score was aggregated using factor analysis of questions asked to all participants. The dashed line represents the score if all questions are answered neutrally.



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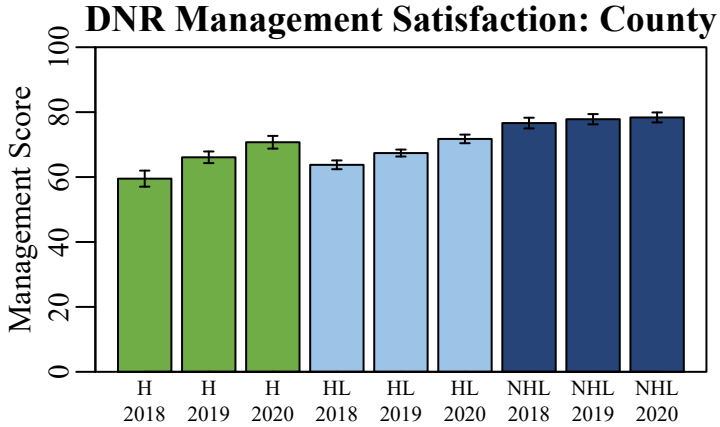

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APPENDIX C. COUNTY DEER DATA SHEETS 2019

PDFs of the County Deer Data Sheets can be found at on.IN.gov/INdeerreport