

# Wisconsin's Evaluation of Crossbow Use and Season Structure

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A Report to the Natural Resources Board  
from the  
Department of Natural Resources



# Acknowledgements

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## Glossary of Terms

For purposes of this report, we use the term **“archer”** to mean someone who hunts deer with a vertical bow (compound, long bow, or recurve) under an archery hunting license.

**“Crossbow hunters”** refers to those hunting deer with a crossbow under a crossbow hunting license or “upgrade” archery license.

The term **“bowhunter”** is used as an umbrella term to describe both archers and crossbow hunters.

**“Gun hunter”** refers to people hunting deer under any kind of gun deer hunting authorization (e.g., annual, Sportsmen’s, Conservation Patron, etc.)

It is important to note that the labels “archers,” “crossbow hunters,” and “gun hunters” are not mutually exclusive among individual customers. In other words, many deer hunters in the state hold two or three of the license types that form these definitions in any given year.

The terms **“firearm hunter”** and **“vertical bow hunter”** appear in the section of the report on Weapon Motivations and are synonymous with “gun hunter” and “archer,” respectively. In the Weapon Motivations section, we refer to hunters based on their self-categorization for which weapon type they most prefer to use when hunting deer rather than the specific weapon authorizations held.

**“Lapsed hunters”** refers to customers who have not purchased a particular type of license for two years after having purchased that same type of license at least two years in the past.

## Executive Summary

This evaluation of crossbow use in Wisconsin is one of the most comprehensive efforts ever conducted to assess the use of crossbows and the potential impacts on the biological and social factors involved with white-tail deer management. The Wisconsin Department of Natural Resources (Wisconsin DNR) initiated this review in March 2019 at the request of the Natural Resources Board (NRB) to provide a detailed collection and review of crossbow information relative to several areas of interest described herein. We approached this assignment from several independent lines of inquiry that included data mining of licenses sales, trend analysis, literature reviews, reviews of recent bow technology changes, surveys of current and lapsed deer hunters, key informant interviews of agency personnel in other states, and telephone interviews of Wisconsin businesses that sell archery and crossbow equipment. The preponderance of the evidence from these multiple lines of inquiry suggests that all-inclusive crossbow use is not currently a biological concern for deer herd management or a pressing social issue for most hunters.

At the highest level, our evaluation did not identify any biological concerns about the current or anticipated number of bucks or total deer harvested under the current crossbow season structure. Therefore, any future discussion about adjustments to the crossbow season or license structure are social issues that are best informed through hunter surveys and contacts with the hunting community. Addressing social issues, especially those that relate to the Wisconsin deer hunting traditions, are likely far more challenging than dealing with the biological aspects of deer management.

One concern that has been raised under the current deer hunting season framework is that decreasing gun deer hunting license sales may be the result of hunters choosing to hunt with a crossbow instead of a gun, thereby reducing revenue generated from gun license sales and eroding the Wisconsin gun hunting heritage. We investigated this idea by examining patterns in license sales data pre- and post-adoption of the all-inclusive crossbow rule and by surveying customers who have lapsed from the gun license pool since 2016.

Our [review of annual deer hunting license sales](#) indicates that, on average, gun-only hunters are more likely to add a crossbow license rather than give up their gun hunting license. Meanwhile archery-only hunters are equally likely to add a crossbow license as they are to switch to only buying a crossbow license. Hunters that purchased both a gun and an archery hunting license are least likely to drop both licenses to hunt exclusively with a crossbow. Since 2014, the largest percent decline in license sales relative to the five-year period prior to 2014 has occurred in archery licenses. Comparatively, the rate of decline among gun license sales has been much smaller. Interestingly, combination licenses (i.e. Sports and Conservation Patron licenses) have seen improved sales relative to the five-year period before crossbows were introduced. Overall, revenue from hunting licenses is up by an average \$50,000 per year over the past five years, following average losses of about \$450,000 for the five-year period before the adoption of all-

inclusive crossbow use. Caution should be exercised in attributing any of these trends to crossbows, as their introduction is confounded by other changes in deer management that were introduced by emergency rule in 2014, prior to becoming permanent in 2015. Changing economic conditions between 2009 and 2018 are another factor that may contribute to license sales trends

We [surveyed “lapsed” gun hunters](#) to determine if they were picking up crossbows. The survey results match what we found through our internal reviews of license sales records—only a tiny fraction of lapsed gun hunters is switching to crossbows. To be exact, two percent of lapsed gun hunters reported that they began using a crossbow in the past two seasons and three percent picked up a vertical bow. In both cases, a preference to hunt during the bow season appears to be a relatively strong influence on gun hunting lapse. The survey responses of lapsed gun hunters through our questionnaire confirm the earlier data mining described above which show that erosion among gun-license buyers is predominately occurring among single-season hunters who are not substituting their participation during the bow season with either weapon type in significant numbers.

But the question remains—Are gun hunters dropping out of deer hunting completely because of crossbows? We asked gun hunters to rate the impact of archery season buck harvest (by crossbow hunters and by archers) on their decision to stop gun hunting and found it to be a contributing factor for about four to five percent of the respondents. We also asked lapsed gun hunters what effect, if any, the legalization of crossbows for everyone had on their deer hunting experience. Most respondents told us the effect on them was neither positive nor negative, but overall, a higher percentage of lapsed gun hunters were positive (40%) about crossbow than were negative (18%).

While there is no denying that fewer hunters are buying gun deer licenses, many factors are influencing this trend and crossbow use does not appear to be a major contributor. Overall trends in deer hunting participation, irrespective of weapon type, parallel national participation trends predicted prior to the introduction of all-inclusive crossbow hunting based on observed demographic shifts in the hunting population and expanding urbanization. Our lapsed hunter survey points to shifting life and family priorities and loss of interest spurred by not seeing enough deer and lack of land access. In the 2018 Whitetail Report from the Quality Deer Management Association, Wisconsin ranked third in total deer hunting license sales and the 10-year trend in license sales is near the average for states in the Midwest. On the contrary, crossbow license sales may be helping Wisconsin stay ahead of the national average in hunter declines. It should be noted, similar to what has been observed in other states, crossbows provide hunting opportunities to people that have difficulty pulling back a vertical bow—especially young hunters and older hunters beginning at age 40 without the need of obtaining a disabled hunting permit.

We also [surveyed current deer hunters about their motivations](#) and opinions according to their preferred weapon of choice (gun, archery, crossbow). Regarding general motivations for

hunting, those who preferred to use guns are the most likely of the three groups to rank venison, camaraderie of hunting buddies, or participating in family tradition as most important reasons for hunting. Hunters who prefer to use vertical bows are most likely to rank aspects of hunting related to skill, challenge, and solitude as most important, while those who prefer to use a crossbow are most likely to rank the sense of accomplishment that comes with a successful hunt as the most important reason to hunt.

Regarding motivations for weapon choice, hunters who preferred crossbows placed the least importance on improving their chances of getting a buck, while those who preferred guns placed the most importance on this aspect. Half of the hunters who preferred crossbow agreed that they started using a crossbow because they could not use a vertical bow. Trying something new was also a common reason for taking up a crossbow. By contrast, hunting during the rut was a reason for about one in four hunters to take up a crossbow, while not being able to use a gun applied to only one in 10 hunters.

Not surprisingly, hunters who preferred crossbow overwhelmingly rated the effect of making crossbows legal for all as having a positive effect on their hunting experience. Hunters preferring guns tended to be more indifferent, with a slight skew to the positive. Hunters preferring vertical bows skewed slightly more negative. All three preference groups tended to agree that the shares of annual deer harvests taken by archery, crossbows, and guns should reflect the number of hunters who hold a deer license authorizing them to use each weapon type, although nearly half of each group expressed either no opinion or a neutral opinion on these questions. Interestingly, hunters did not differentiate between buck harvest and overall harvest in their opinions.

Another area of interest is the distance at which deer can be harvested by crossbows compared with compound bows. On the motivations survey, the maximum range at which hunters reported they would take a shot at a deer differed between guns and stringed weapons; but no significant difference was found in the reported maximum ranges for crossbow and compound bow users.

We performed a [content analysis to synthesize industry trade reviews](#) of technology advancement for both compound bows and crossbows. Innovation in the materials used to make crossbows as well as the overall structure and cocking systems have been designed to make crossbows easier to use, more powerful, and more accurate. However, there are often substantial differences between manufacturers as it relates to the tradeoffs between overall size, ease of cocking, power, and accuracy of a crossbow and taking full advantage of these features is subject to user skill, to a degree. Since 2014 compound bows have not seen substantial changes in length, weight, or top advertised arrow speeds.

We [interviewed 10 retail businesses](#) that sell crossbows in Wisconsin. Retailers reported that the full inclusion of crossbows into the archery season has been good for business because crossbows have brought new groups of customers into their businesses. The audiences noted



as most interested in using crossbows were youth, women, and men who are new to bow hunting. Five of the 10 businesses reported no change in their compound bow sales, while the other five reported a decrease. In the first one to two years after the full inclusion of the crossbow into the bow season, crossbow sales boomed. Recently, crossbow sales have stabilized; although, many stores reported crossbows sales are still stronger than compound bow sales. Business owners had different opinions on whether hunters will pick up a compound bow if they are initially introduced to bow hunting through a crossbow. Of the six business owners who made a related comment, three business owners believe hunters—especially youth hunters—will not switch to a compound bow, while three business owners believe youth hunters will switch as their confidence and bow-hunting skills develop or that the full-inclusion of the crossbow is too recent of a change to determine if hunters who start with a crossbow will eventually change to use a compound bow after developing more bow experience.

Finally, we [surveyed state agencies in 19 states](#) about the establishment of crossbows as a legal weapon in their state, who their crossbow users were, and any effects on the state's deer herd the addition of crossbows may have had. Most states that allow crossbow use allow it statewide during the entire archery season. States that did not allow crossbow use for all bow hunters, restricted their use because of concerns for perceived crowding, overharvest (primarily of mule deer), appropriate weapon classification, and/or opposition by archery organizations. No state interviewed that allowed crossbow use has shortened its season or restricted crossbow use from the original law.

Few states measure weapon-specific success rates. States that did showed higher success rates for crossbow users than archers. The addition of crossbows in these states showed little impact on established seasons/traditions or hunters' willingness to bag deer, and crossbows did not cause any change in total deer harvest or any measurable biological impact on the state's deer herd. State studies that have tracked wounding and/or hit rates found there was little difference between archery and crossbow users.

Another area of interest are the observed differences in the number of bucks being harvested relative to the number of hunters participating with various weapon types. A suggestion has been made that season frameworks should be developed to allocate buck harvest proportional to the number of license holders for archery, crossbow, and gun hunters. For example, if gun hunters make up 60% of deer license sales, then gun hunters would get 60% of the total antlered bucks harvested. The current assessment indicates differences are slight, but gun and archery hunters are harvesting fewer bucks relative to their license sales contribution and crossbow hunters are harvesting more.

Redistributing a proportional allocation among weapon types may not be simply accomplished by adjusting season dates and bag limits. Reducing crossbow hunter opportunity by closing the season during the rut in an attempt to redistribute these differences may simply result in those hunters adjusting their timing and effort to harvest the same number of bucks. In addition, many crossbow hunters are also gun hunters that typically harvest one buck per year. Any

shortening of the crossbow season is removing opportunity for them to spend time in the field to harvest the one buck they would attempt to take with a crossbow or gun.

Moreover, the basis of comparing weapon-specific success rates or harvest allocations as a criterion for determining “equality” or “fairness” may be flawed given that hunter harvest success is known to be influenced by effort and selectivity (e.g., passing up shots)—both of which are known to differ among archers and gun hunters (Dhuey 2018). In other words, varying success rates are not simply about weapon capabilities, but also about the differing motivations and choices of the hunter holding the weapon, as well as the amount of opportunity (e.g., length of season) afforded to them. Currently, we do not have well developed estimates of hunter selectivity by season but the department is preparing to gather data on this aspect of hunter success starting this fall.

In summary, the various surveys and methods used to perform this evaluation of crossbows in Wisconsin suggest that crossbows are a welcomed addition by most in the deer hunting community. Wisconsin is fairly unique in having a crossbow season that is not combined with the archery season, allowing the season dates to be adjusted as desired independent of the archery season. As observed in other states with some level of crossbow use, if trends in license sales and deer harvest in Wisconsin continue, we can anticipate that crossbow hunters are likely to continue to harvest a higher percentage of bucks relative to their license sales. Additionally, deer hunters tended to agree that the shares of annual deer (and buck) harvests taken by archery, crossbows, and guns should reflect the number of hunters who hold a deer license authorizing them to use each weapon type. However, competition with crossbow users does not appear to be a significant factor in the lapse of gun hunters; and it is unclear that shortening the crossbow season will be effective at adjusting the allocation of buck harvest among weapon types. Crossbow users may simply intensify their activity within a shortened season, with no change in buck harvest. Given that relatively few hunters harvest more than one buck, and that many crossbow hunters are also gun hunters, the impact of crossbows has largely been simply to shift when these hunters harvest their buck to earlier in the season. Shortening the crossbow season will reduce opportunity to harvest a deer using the weapon of choice for some deer hunters. Given Wisconsin’s abundant deer resource and the challenges of maintaining hunter numbers in the future, taking such an approach would require careful consideration.

Like many changes in outdoor recreation, deer hunting traditions in Wisconsin are also changing over time. For example, the large groups of hunters (predominantly men) in northern deer camps during the gun season are fading. Today’s deer hunters are establishing their own motivations and traditions. This begs the question—Is it the Wisconsin DNR’s responsibility to ensure continuation of deer hunting traditions? Or should the department focus on working with society to responsibly manage our deer herd, enforce regulations, promote hunter safety and recruitment, and allow hunting traditions to develop naturally? Concerns have been expressed about the erosion of Wisconsin’s nine-day gun deer season traditions and the

cherished archery season that was enjoyed almost exclusively by vertical bow hunters prior to 2014. As society changes and as the use of technology continues to evolve, it is the department's responsibility to ensure the deer herd is managed properly and to provide deer hunters the flexibility to establish their own deer hunting traditions. In other words, the department is responsible for adapting to changing social and technological changes, but the agency should neither be the drivers of these changes nor the resistance to them.

## Introduction

Prior to 2014, only hunters 65 and older, or those issued a disabled permit could use crossbows to hunt deer in Wisconsin. In 2014, the first all-inclusive crossbow season was offered to all deer hunters. The all-inclusive season removed age limits and the requirement for disability permits. Although recognized as a separate season, the crossbow season runs concurrently with Wisconsin's archery and gun deer seasons. At the writing of this report, the Wisconsin Department of Natural Resources (Wisconsin DNR) has five years of deer harvest and license sales data with the all-inclusive crossbow season that allows for analysis and review of the season structure and regulations.

In 2018, the Natural Resources Board (NRB) requested public input on crossbows by placing a question on the annual spring fish and wildlife public hearing ballot. The question provided background information on the crossbow season and deer hunter success rates and asked if there is support for the Wisconsin DNR to adjust the length of the crossbow season for those that are not disabled or elderly to better reflect harvest success rates of bucks similar to the gun and archery seasons. The question did not receive majority support (2,660 "yes" votes, 3,164 "no" votes) and was rejected in 54 of 72 counties. This was an advisory question asked by the NRB, so no follow-up action was taken or required.

The report that follows is a detailed evaluation of crossbow use in Wisconsin as it relates to deer harvest, hunter success, license sales and revenue, comparison with other states, advances in technology, and sporting good retail sales. Data and information provided in this report can be used to make informed management decisions in the best interests of Wisconsin's deer herd and its deer hunting heritage.

The work reflected in this document is in response to a series of questions raised by the NRB following board discussion and consideration of a series of proposals to shorten the crossbow during the December 2019 NRB meeting. The Bureau of Wildlife Management committed to compiling information to address a list of 21 questions (see Index) raised by board members. Since many of these questions involved deer hunter preferences and participation and the need to conduct original research, the department's social science team assisted the program in preparing this report.

This document is arranged according to the six studies completed by department staff in response to the NRB's information request. Following the presentation of data from the six studies, there are two discussion sections that address options for changing the current season framework including a discussion of the tradeoffs associated with Wisconsin becoming a "one-buck" state.



## **STUDY # 1: Analysis of Wisconsin Deer Hunting License Sales Trends**

Wisconsin is one of a few states that has a separate crossbow hunting season that allows for adjustment of season dates independent of the archery hunting season. This separate season authority allows deer hunters to purchase a crossbow, archery, or gun hunting license depending on the weapon with which they intend to hunt. Questions about the current crossbow season structure include a concern that hunters who previously purchased gun licenses may now only purchase crossbow licenses. Those worried about this potential shift cite the erosion of gun hunting traditions, increased crowding and safety issues during the early bow season, and increased harvest pressure on bucks when they are most vulnerable during the rut.

Likewise, current archery hunters may also choose to switch weapons and only hunt with a crossbow. A shift between these license types may not generate the same concerns as described for gun hunting because it would be revenue-neutral. The differences in efficiencies between archery equipment and crossbows, however, will likely continue the increasing trend of buck harvest prior to the gun deer hunting season.

Finally, hunters that previously purchased multiple deer hunting licenses (gun, archery, and/or crossbow) may now choose to only purchase a crossbow license. In addition to the concerns mentioned for each weapon above, this scenario results in lost revenue from license sales as these hunters who previously purchased two licenses would now be purchasing only one.

### ***Methods***

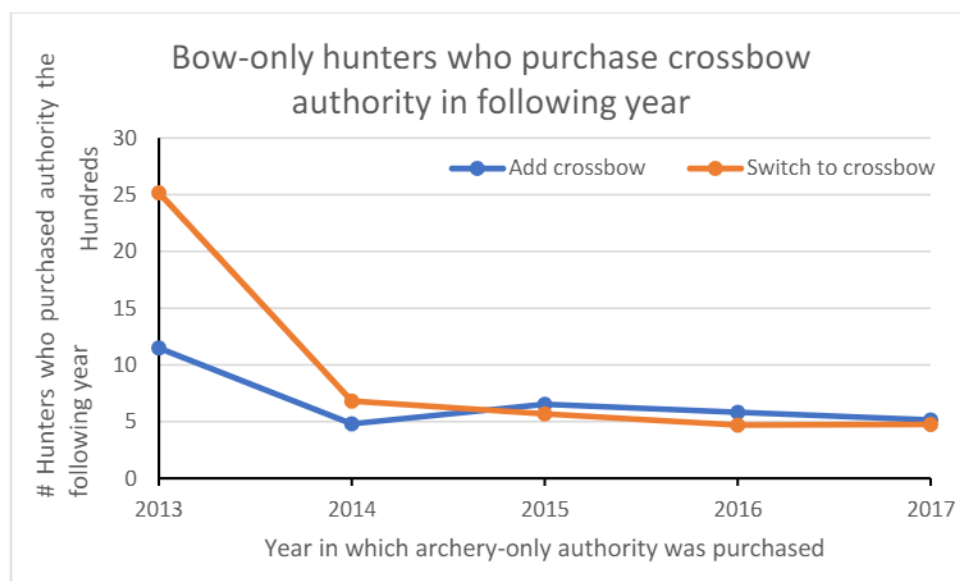
To evaluate the degree that hunters' purchasing patterns are shifting, we used the Go Wild customer license database to review deer hunting licenses bought between 2014 and 2018. Focusing on the transactions table, counts of the number of completed, unrefunded transactions were queried by specific license type. These counts were then summed for each weapon type authority (gun, archery, crossbow, Sports, and Conservation Patron license) to capture the number of individuals (resident and non-resident) who purchased that weapon's license. A separate tally was made for crossbow and archery upgrades. Similarly, revenue was calculated and summed for each weapon type authority.

Defining when a hunter "quits" a weapon type is not straight forward, as hunters may return to using a weapon after several years (see discussion in lapsed study results). With only five years of crossbow license data, we cannot answer with certainty how many hunters have "quit" a weapon "for good." When addressing this question, we therefore only looked at year-to-year trends in weapons authorizations. The following numbers include hunters who are part of the annual "churn" in license sales and may not have truly given up using a particular weapon type.

## Results

When the crossbow license was first introduced, approximately 2,500 archers switched to a crossbow license, while 1,200 added a crossbow authority to their archery license. Much of this initial difference is explained by those hunters who used crossbows prior to the introduction of the crossbow license either due to age or disability. After the initial year, however, archers have been about equally likely to substitute a crossbow license as a replacement for their archery license than to buy a crossbow license in addition to their archery license (Figure 1).

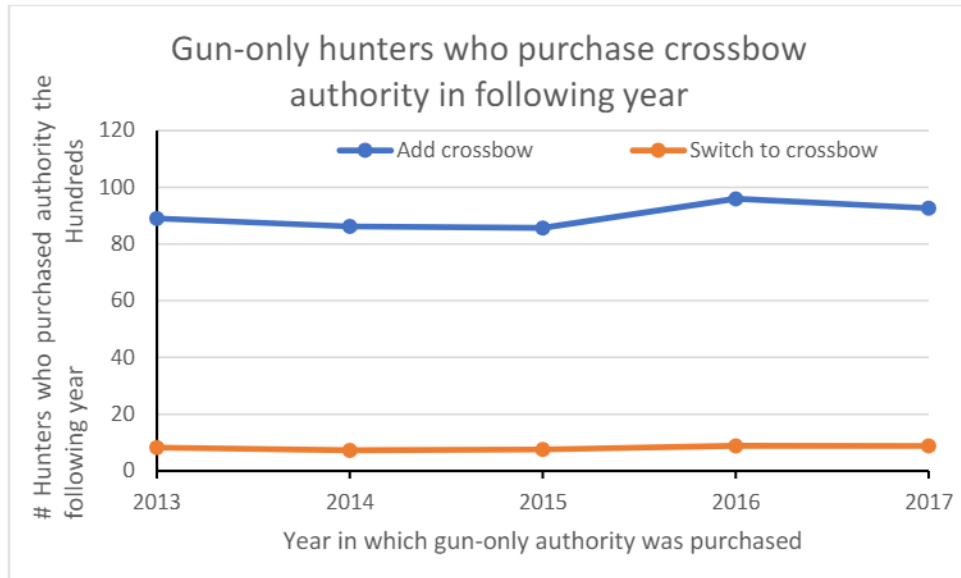
- On average 0.8% (942) bow-only users convert to crossbow-only in the following year.
- On average 0.6% (676) bow-only users add a crossbow license in the following year.



**Figure 1.** Trends in the number of bow-only hunters who purchase a crossbow license in the following year.

Unlike the archery license, trends in gun-only hunters adding or switching to a crossbow have not appreciably changed since 2014 (the year that crossbow licenses were introduced). When looked at year-to-year, gun-only users are approximately 10 times more likely to add a crossbow to their participation than to stop gun hunting and switch to exclusively use a crossbow (Figure 2).

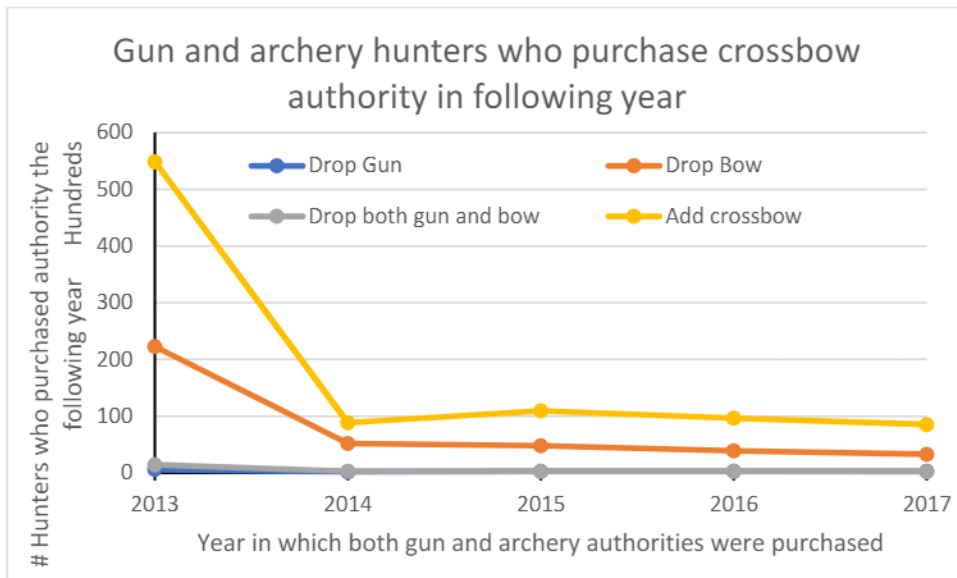
- On average 0.3% (813) gun-only hunters converted to crossbow-only in the following year.
- On average 2.8% (8,988) gun-only hunters added a crossbow license in the following year.



**Figure 2.** Trends in the number of gun-only hunters who purchase a crossbow license in the following year.

When looking at the trends in crossbow adoption by hunters that purchased both gun *and* archery licenses the previous year, similar patterns emerge as when looking at single license holders (Figure 3). From 2014 to 2018, on average 124,685 hunters purchased both gun and bow licenses annually. In the initial year of crossbow licenses, approximately 55,000 of these hunters added a crossbow authorization to their options, largely though the continued purchase of a Conservation Patron license. Roughly 10,000 hunters each subsequent year have added a crossbow authorization since then. About 22,000 of these hunters dropped their vertical bow for a crossbow in the initial year, but in subsequent years this number has been relatively stable and much lower. Very few of these hunters have dropped their gun hunting authority or switched exclusively to hunting with a crossbow. Averaging across all five years:

- 0.7% (873) dropped gun and archery licenses to hunt exclusively with a crossbow.
- 0.2% (249) dropped their gun license to hunt with archery tackle and crossbow.
- 6.3% (7,855) dropped their archery license to hunt with gun and crossbow.
- 7.6% (9,486) added a crossbow authorization to be able to hunt with all three weapon types.



**Figure 3.** Trends in the number of hunters who purchased both a gun and an archery authorization that subsequently purchase a crossbow license in the following year.

### Key Findings

- Gun-only hunters are more likely to add a crossbow license (2.8%) than to give up their gun hunting license (0.3%).
- Bow-only hunters are equally likely to add a crossbow license (0.6%) as they are to convert to a crossbow license (0.8%).
- Hunters who purchased both a gun and bow hunting license are most likely to upgrade to a Conservation Patron license to add a crossbow authority (7.6%). If switching behavior does occur, they more likely to drop the bow license (6.3%) than either their gun license (0.2%) or both licenses (0.7%) in favor of a crossbow license.

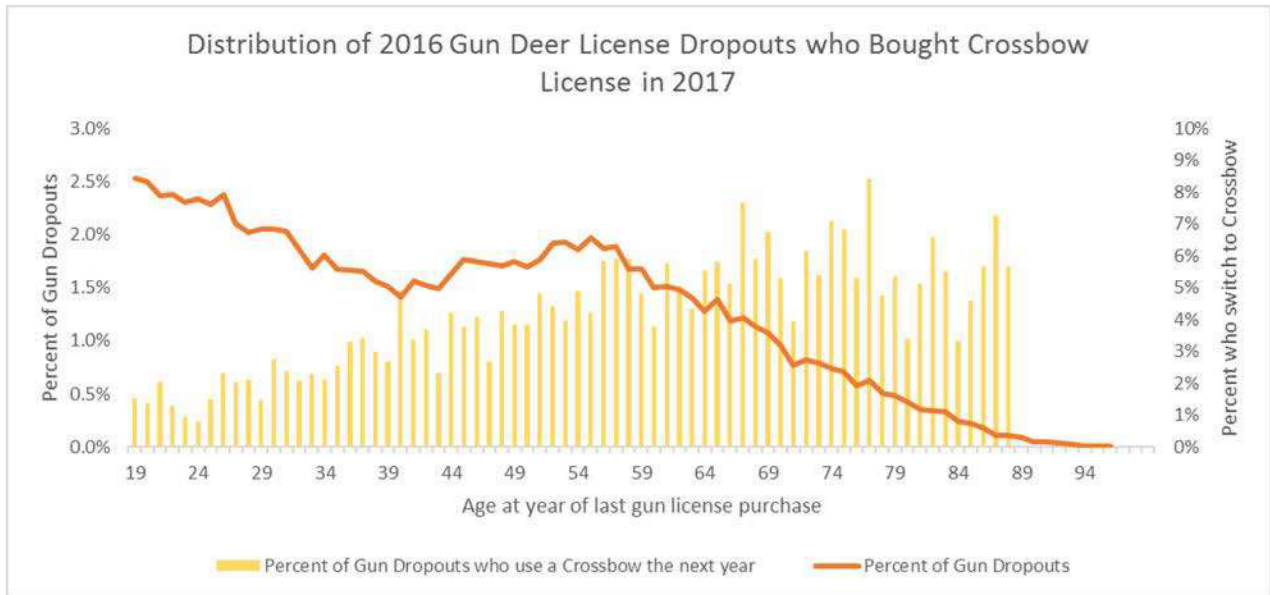
## ***Age Distribution of Lapsed Gun Hunters that Continue to Hunt with a Vertical Bow and Crossbow***

To undertake this exercise, we needed to operationalize a definition for a hunter that we consider lapsed. Two opposing constraints were considered for this purpose. First, crossbow licenses have only been available for a relatively short timeframe (five years), thus a hunter who lapses from gun hunting to take up a crossbow has had a limited window of time in which to do so—and may not have permanently quit gun hunting. Second, some deer hunters churn in and out of license buying (NSSF & Southwick and Associates 2010). Consequently, we considered hunters as “lapsed” if they had not purchased a gun license for two consecutive years subsequent to their purchase in a given year. This approach excludes hunters that miss a single year, thereby reducing the influence of license churn, while also allowing us to focus investigation on the period since crossbows became established in Wisconsin’s hunting landscape.

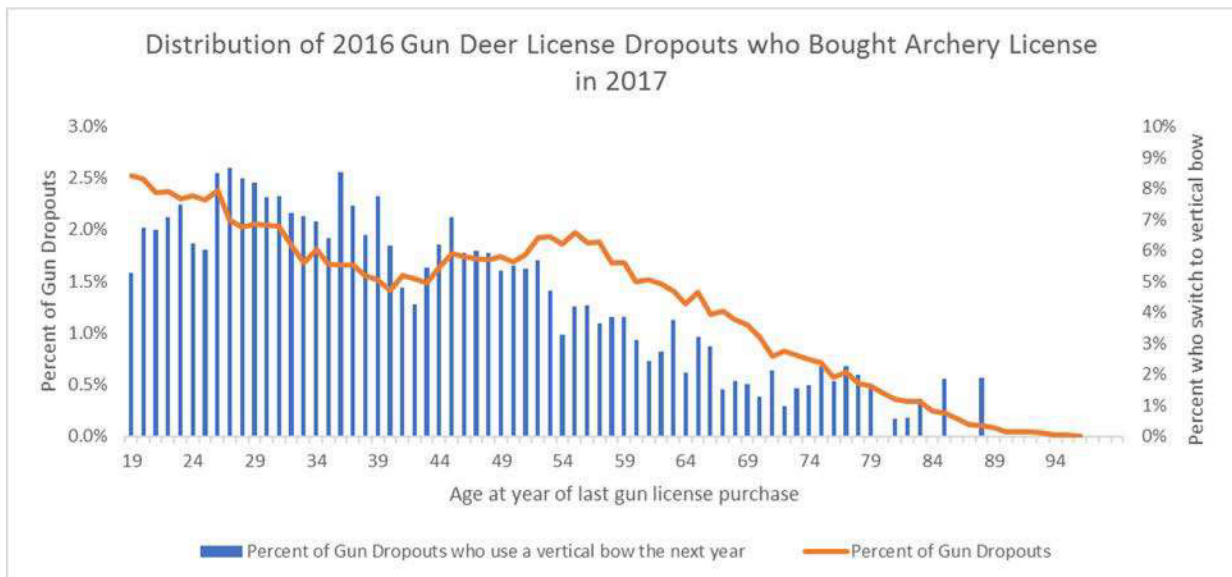
Two years of gun license data were selected as the focus for this effort. The 2012 license year provides a convenient pre-crossbow reference point for two reasons. First, it corresponds with a previous hunter dropout study conducted in Wisconsin (Holsman, 2013), which provides a solid baseline for understanding gun hunter dropout rates at that time. Second, 2012 is two years prior to the introduction of crossbow use by all deer hunters, thus the potential effect of crossbow introductions (or indeed, the Deer Trustee rule package as a whole) was eliminated. The post-crossbow year selected for examination was 2016. Not only is this license year the most recent for which can apply our requirement of a two-year lapse, but it also corresponds with the selection criteria for the current hunter dropout study, which follows in this report.

In all, 49,430 resident hunters over the age of seventeen purchased a license authorizing them to hunt deer with a gun in 2016 but did not do so in either 2017 or 2018. License types included in the analysis include the sports license and gun-deer license. Conservation Patron license buyers were excluded from the analysis, because they already have the authority to use a crossbow or archery tackle.

Figure 4 and 5 show the percentage of lapsed gun deer hunters by age (see left y-axis). This line shows declining fractions of dropouts with age for in those under 40, increasing prevalence of dropouts between 40 and 55, and declining prevalence in those over 55. To this information, the percent of lapsed gun hunters within each age who bought a crossbow license (Figure 4) or an archery license (Figure 5) in 2017 have been plotted (see right y-axis). From these graphs we can see that the likelihood of purchasing a crossbow increases somewhat with age, while the likelihood of purchasing an archery license decreases sharply with age. It is important to note, however, that these trends should be interpreted in the context of the orange line. Seven percent of 85-year-olds who took up a cross bow after putting down their gun is substantially fewer individuals than the three percent of 40-year-olds who did the same.



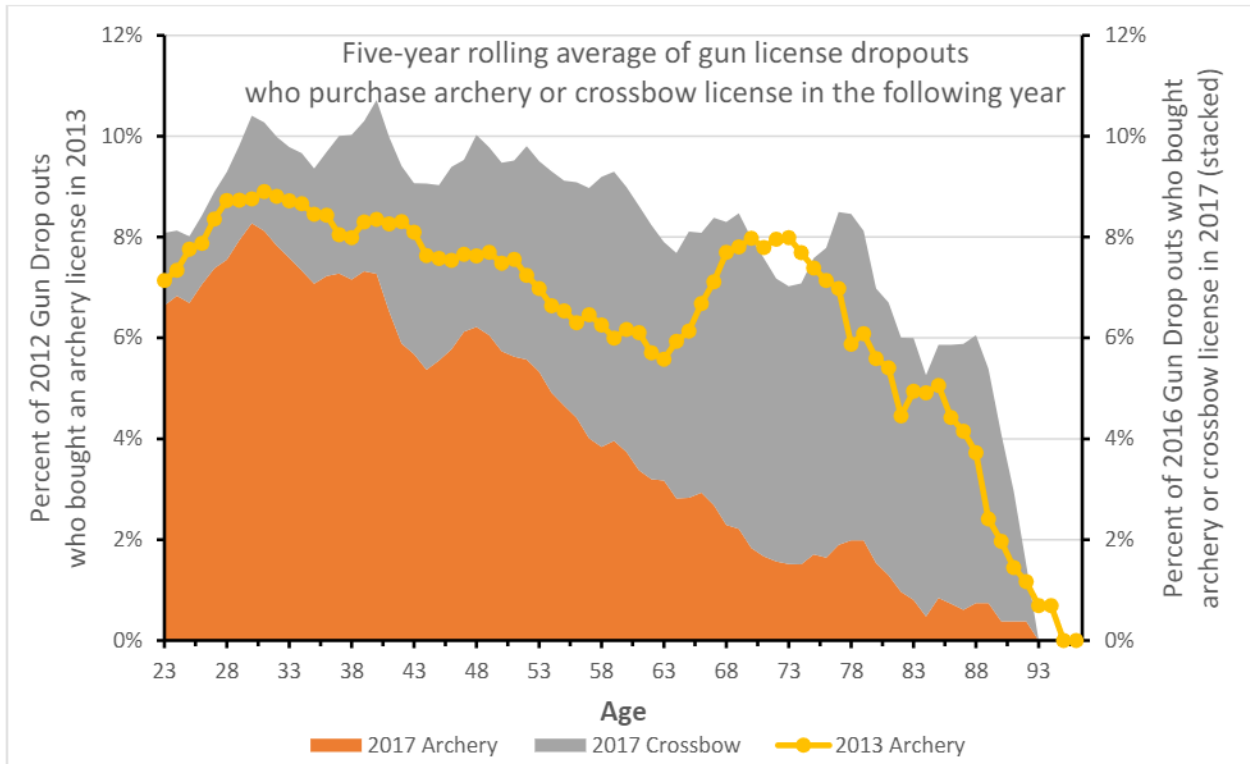
**Figure 4.** Age distribution of deer hunters who purchased a crossbow license in 2017 after dropping out from gun hunting in 2016. The orange line (left axis) is the age distribution of gun hunter dropouts, while the bars (right axis) represent the percentage of individuals who dropped out at that age who purchased a crossbow license the following year.



**Figure 5.** Age distribution of deer hunters who purchased an archery (i.e. vertical bow) license in 2017 after dropping out from gun hunting in 2016. The orange line (left axis) is repeated from Figure 4, while the bars (right axis) represent the percentage of dropouts at that age who purchased a vertical bow license the following year.



Because the crossbow license did not yet exist in 2013, no direct comparison of the effect of being able to use a crossbow can be made between the 2012 and 2016 lapsed gun hunters. That said, we can draw some insights by examining how archery license sales differed between the 2012 cohort and the 2016 cohort. Figure 6 presents the 2016 cohort data stacking the individuals who purchased an archery **and** those who purchased a crossbow license in 2017. Doing so flattens out the trend somewhat, which is what we would expect to see if we could not differentiate crossbows from vertical bows in our license database, which was the case in 2013. This figure also presents the 2013 archery license purchasing rates for the 2012 cohort of dropouts. Like the 2016 cohort, it shows a much flatter distribution across all ages than either Figures 4 or 5, but of interest is a slight decrease in archery license uptake between ages 40 and 65, followed by a noticeable bump in sales at age 65. This bump in 2013 senior archery licenses reflects the regulation at that time which allowed seniors to use a crossbow under the archery license. Archery license uptake among hunters between 40 and 65 who could not use a crossbow in 2013 is like that for vertical bows among the 2016 group (Figure 5). Differences in the heights of the columns may be attributable, at least in part, to the availability of crossbow licenses. While prior to 2014, gun deer dropouts were required to purchase an archery license if they wished to continue to hunt, after crossbow legalization, another option became available. Consequently, the percent of dropouts who purchase a vertical bow license declined in 2016 compared to 2013, but this decline was more than offset by hunters purchasing a crossbow license. The gray area above the 2013 line in Figure 6 indicates the number of hunters who would likely have dropped out of hunting entirely if crossbows had not been an option. The gray area below the 2013 line indicates the number of hunters who prefer to use a crossbow but who would likely have purchased an archery license anyway. These results highlight that the primary retention value for crossbows is among hunters ages 40-65, who were unable to use crossbows legally before 2014, but who were unable or unwilling to pick up a vertical bow.



**Figure 6.** Archery or crossbow license purchases following lapse in gun-deer purchase in 2012 and 2016.

### Key Findings

- *Crossbow use among hunters who have stopped buying a gun license appears to increase with age.*
- *Younger adult hunters who stop using a gun (i.e. those under 40) are still more likely to use a vertical bow than a crossbow.*
- *The effect of crossbow license availability among seniors age 65+ appears to be minimal.*
- *Among gun hunting “dropouts,” 40 to 65 appears to be the age range that has benefited the most from extended hunting opportunities provided by the crossbow season.*



## ***License Sales and Revenue Trends***

The figures below show trends in the number of deer hunting authorities sold (Figure 7) and revenue generated from those sales (Figure 8) five years prior to and following the all-inclusive crossbow hunting season in 2014. These figures do not include the \$3.00 “upgrade” licenses sold or revenue generated from those sales; however, upgrades are listed in the accompanying tables as separate line items for revenue. With respect to license sales, total deer hunting license sales ranged from 844,000 in 2009 to 817,000 in 2018, after peaking at 854,500 in 2016. The general trends for archery, gun, and sports license sales appear to be decreasing, while Conservation Patron and crossbow license sales are steady to increasing. The general trend for the number of all deer hunting licenses sold five years before and after the full-inclusion crossbow season is fairly flat (Figure 7, Table 1).

Gun deer license sales accounted for 47 percent of revenues in 2009 and 44 percent in 2018. When Sports licenses are included, revenue from gun hunters accounts for 59 percent (2009) and 54 percent (2018) of all deer license revenue. Excluding upgrades, the number of crossbow licenses sold grew from 47,500 in 2014 to 89,600 in 2018 and accounted for four and seven percent of revenues, respectively, in 2014 and 2018. The general trends in revenue generated from license sales follows the trends described above with decreasing revenue generated from archery, gun, and Sports license sales, with increasing revenue from Conservation Patron and crossbow license sales. The total revenue generated from deer hunting license sales is lower five years following implementation of the all-inclusive crossbow season than it was five years before the season. Revenue generated from increasing sales of Conservation Patron licenses since 2015 and crossbow licenses alone are not enough to return revenue figures to pre-crossbow season levels (Figure 8, Table 2).

In assessing trends in license revenue, it is useful to compare average annual change in revenue for two periods, before and after the introduction of the crossbow season. One important caution, however, is warranted. While 2014 was associated with the introduction of the crossbow license in Wisconsin, this year also saw the implementation of the Deer Trustee Reports’ rule package as an emergency rule, before finalization for the 2015 hunting season. Furthermore, improving economic conditions in the 10 years following the Great Recession are another factor that has likely affected license sales, especially sales of higher priced combination licenses. Consequently, trends in license sales following the introduction of crossbow licenses cannot be attributed to crossbow introduction entirely but may also reflect hunter response to other these other changes.

Table 3 presents the average annual change in revenue for each deer license type, averaging the years 2009 through 2013 (before) and 2014 through 2018 (after). While revenues from all available license types were in decline before 2013, and many continue to decline after 2014, some substantive shifts for the positive have also occurred. First, the negative trend in Conservation Patron licenses observed prior to 2013 has been reversed, with sales of these

licenses associated with an increase of almost \$250,000 per year on average in the last five years. The reasons for this change however are unknown. Second, the decline in Sports license sales revenue has also substantially diminished, though this shift may be unrelated to the availability of crossbow licenses. Other declines appear to have accelerated such as the annual revenue from archery license sales. The difference in the annual decline in gun license sales before and after the introduction of crossbows, on the other hand, is marginal and consistent with the tendency for gun hunters to add a crossbow license rather than switch entirely to a crossbow. It is unknown at this time how substitution of combination licenses for gun licenses may also have played a role in declines in gun license sales. Taken altogether, total revenue from the sales of deer licenses have plateaued in the last five years, halting five years of declining revenue prior to 2015. While this finding is good news for wildlife conservation, it does not address the problem of declines in the number of hunters, as much of the revenue increase is due to increases in the higher priced Conservation Patron license.

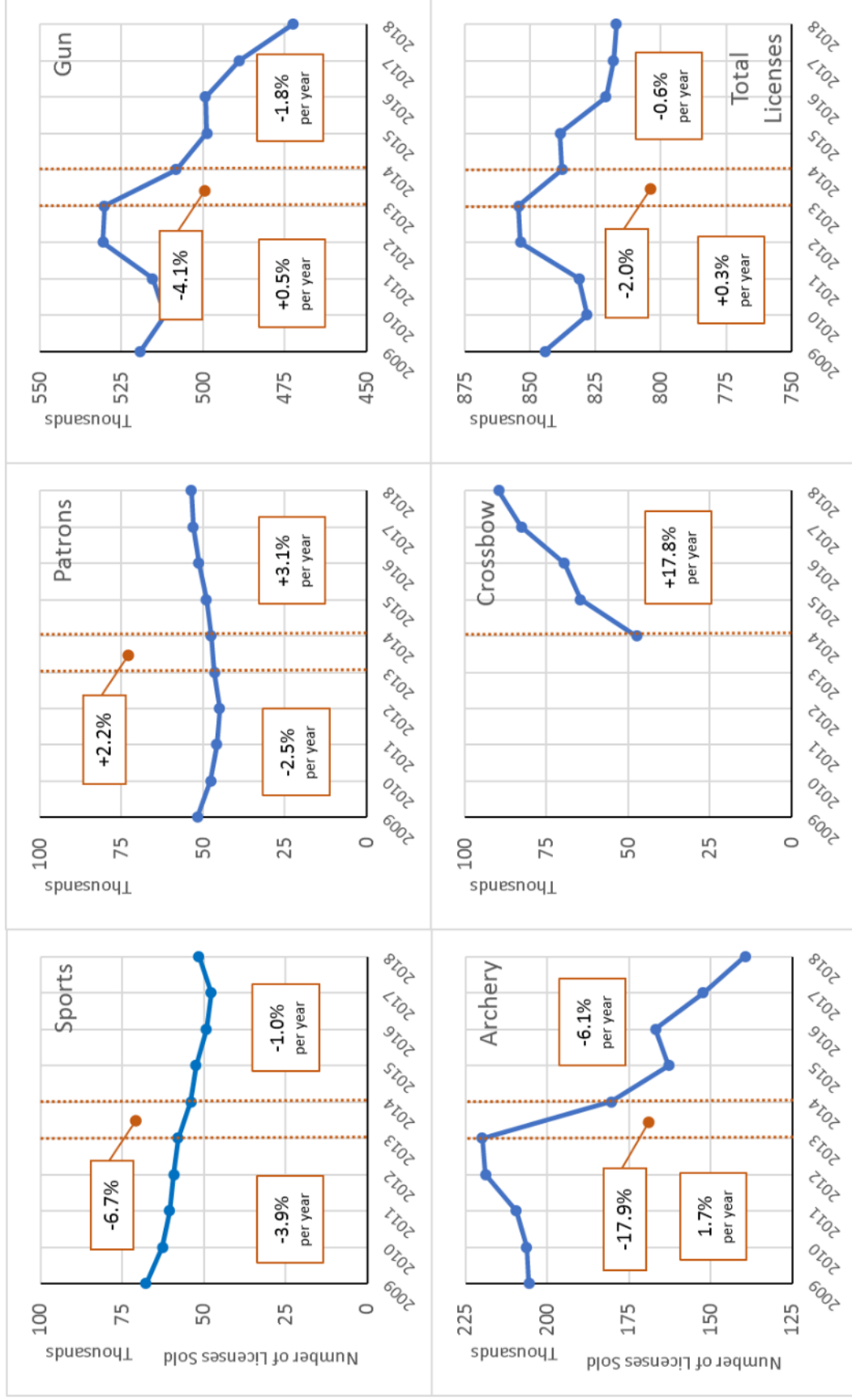
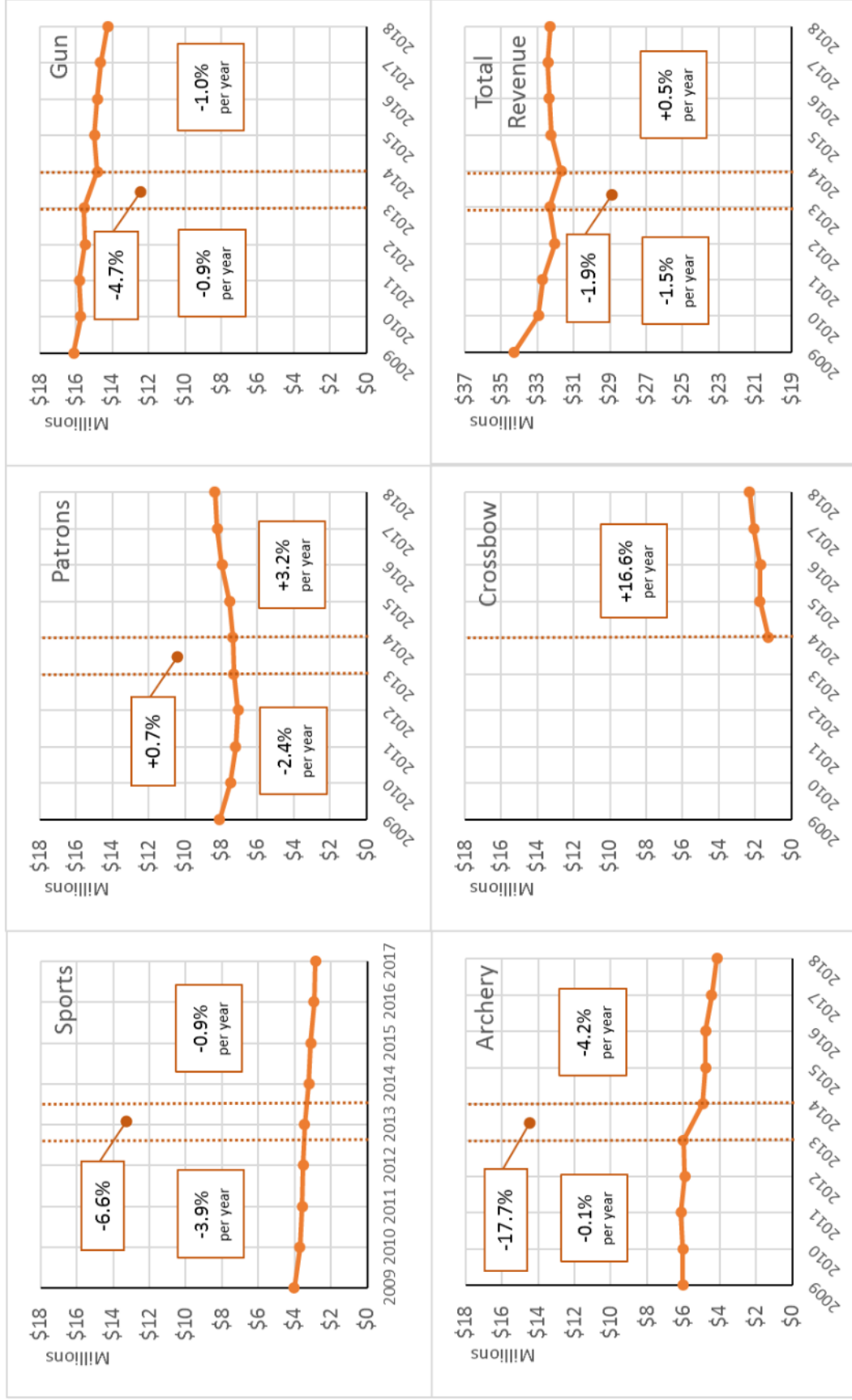


Figure 7. Trends in deer hunting license sales five years before and after implementation of the all-inclusive crossbow hunting season in 2014.



**Figure 8.** Trends in revenue generated from deer hunting license sales five years before and after implementation of the all-inclusive crossbow hunting season in 2014.

**Table 1. Resident and nonresident deer hunting licenses sold between 2009 and 2018.<sup>1</sup>**

Resident and nonresident deer licenses (x1000)							
License Year	Sports	Patrons	Archery	Crossbow	Archery and Crossbow Upgrades	Gun	Total Licenses (excluding upgrades)
2009	67.8	51.8	205.6	0.0	0.0	519.3	844.4
2010	62.6	47.8	206.2	0.0	0.0	511.6	828.3
2011	60.5	45.9	209.5	0.0	0.0	515.5	831.4
2012	59.2	45.0	218.9	0.0	0.0	530.7	853.7
2013	57.9	46.5	219.8	0.0	0.0	530.2	854.5
2014	54.0	47.6	180.5	47.5	23.1	508.3	837.8
2015	52.4	48.9	162.8	64.6	22.4	498.9	838.5
2016	49.2	51.4	166.9	69.5	39.9	499.3	821.0
2017	47.7	53.1	152.2	82.7	42.7	488.9	818.2
2018	51.6	53.7	139.4	89.6	43.9	472.5	817.0

**Table 2. Resident and nonresident deer hunting license revenue between 2009 and 2018.<sup>2</sup>**

Revenue by source (x\$1,000)							
License Year	Sports	Patrons	Archery	Crossbow	Archery and Crossbow Upgrades	Gun	Total Revenue
2009	\$4,012	\$8,099	\$6,025			\$16,138	\$34,274
2010	\$3,711	\$7,488	\$6,015			\$15,741	\$32,954
2011	\$3,579	\$7,195	\$6,122			\$15,818	\$32,713
2012	\$3,515	\$7,073	\$5,933			\$15,520	\$32,041
2013	\$3,440	\$7,313	\$5,997			\$15,570	\$32,320
2014	\$3,213	\$7,368	\$4,938	\$1,286	\$69	\$14,832	\$31,706
2015	\$3,120	\$7,555	\$4,778	\$1,753	\$67	\$14,978	\$32,252
2016	\$2,932	\$7,949	\$4,783	\$1,708	\$120	\$14,844	\$32,335
2017	\$2,859	\$8,225	\$4,447	\$2,094	\$128	\$14,662	\$32,416
2018	\$3,079	\$8,362	\$4,152	\$2,308	\$132	\$14,269	\$32,302

<sup>1</sup> To ensure comparability across years and license types, the numbers presented here are based on a single database query performed on 8 October 2019 for all license years. These numbers may differ from previous reports due to the use of different methodologies and subsequent updates to the license database.

<sup>2</sup> Revenue figures presented in this report are based on the number of each license type (based on the SKU and Price Code used by Go Wild) sold and its full retail price. Agent fees and other costs have not been deducted.

**Table 3.** Average annual change in license revenue before and after the 2014 introduction of the all-inclusive crossbow season. Note: the change in license revenue in 2013-2014 has been omitted to prevent bias associated with this transitional year. Declines in revenue are presented in parentheses and in red.

	Average Annual Revenue Change	
	2009-2013	2014-2018
Sports	(\$142,900)	(\$33,400)
Patrons	(\$196,575)	\$248,700
Archery	(\$6,925)	(\$196,500)
Crossbow		\$255,350
Archery and Crossbow Upgrades		\$15,575
Gun	(\$142,125)	(\$140,725)
Total Revenue	(\$488,550)	\$149,000

## Key Findings

- Total deer hunting license sales are at similar levels five years before and after implementation of the all-inclusive crossbow season; however, they peaked in 2016.
- Total revenue generated from deer hunting license sales in 2018 is lower five years following implementation of the all-inclusive crossbow season than it was in 2009, but the declining trends in total revenue including all license types that authorize hunting deer prior to 2014 have now stabilized.
- Overall trends in deer hunting participation, irrespective of weapon type, parallel national participation trends predicted prior to the introduction of the all-inclusive crossbow license based on observed demographic shifts in the hunting population.

## **STUDY # 2: Lapsed Gun Hunter Survey**

This section summarizes the crossbow-related findings from the recently completed survey of lapsed gun hunters. This work was undertaken in response to the questions raised by the NRB to inform the board's on-going discussions regarding the impacts of crossbow use on deer hunting. Complete study methods and detailed findings on causes of gun hunter lapse will be presented in a more comprehensive report to be published later this fall.

### ***The Underlying Problem***

Fewer people are purchasing gun hunting licenses in Wisconsin, down about 10 percent since 2012 (Table 4). Fewer gun hunters means less revenue for the department to support its public trust responsibilities in wildlife conservation. It also erodes important economic and cultural values, especially for rural communities and businesses. The sale of deer hunting licenses peaked in the state in 2000 and declined between 10,000 and 13,000 in each of the past four seasons (2015-2018). While it may be tempting to pin this decline on the myriad of changes that have occurred in deer management, including the legalization of crossbows in 2014, it is worth noting that the current rate of decline in the state closely tracks predictions made by researchers at the University of Wisconsin's Applied Population Laboratory based on demographic models (Winkler and Kaz 2011). Those predictions suggest we will have 28 percent fewer deer hunters in the state by 2030 (Winkler and Warnke 2013).

### ***The Causes***

The decline in deer hunting participation (and license buying) is fueled by a constellation of complex and interwoven factors. There are three primary schools of thought on why fewer people are hunting. The first one attributes the root cause to cultural mega-trends like an aging population, declining rural population, and changing societal values that are less consumption oriented when it comes to wildlife. The second body of research has examined the constraints to participation such as lack of time, lack of access, cost, and regulations. The third thread views hunting as a consumer choice and looks at meeting expectations and satisfactions as means to sustain customers. This latter body of work suggests that hunting is simply becoming less desirable as a recreational product in a consumer market with many other choices. The bottom line is that there are many direct and indirect forces contributing to the observed decline and there is not a silver bullet available for reversing it. A comprehensive summary of causes of these trends in hunting participation (Holsman 2016) is available at <https://dnr.wi.gov/files/PDF/pubs/ss/SS1164.pdf>.

### ***Hunter Lapses and the Purpose of This Study***

The population of license buyers can decrease by failing to recruit new participants and by failing to retain existing participants. Wisconsin is experiencing both problems, but this study focuses on the latter issue: why do people discontinue participation? Our previous research



(Holsman 2012) has shown that few people “quit” hunting (i.e. few people consciously decided “I am done” and sell all their gear and walk away from important financial, social, and identity investments). Instead, individuals decide they aren’t going “this year” and some of those then realize they do not miss it, which may make it easier to skip the next year. After two or more years, they have “lapsed” from the license pool and are less likely to become reengaged (Beardmore 2019). For others, they may not actively choose at all, but merely lose the motivation to overcome some perceived constraint (e.g., getting time off from work). Holsman (2013) studied lapses among 35- to 55-year-old, male, gun hunters during the 2011 and 2012 seasons and found the three primary drivers of their behavior were: 1) dissatisfaction with deer numbers, 2) lack of access to private land (distrust/disinterest in public lands), and 3) frustration with deer management approaches, largely as it related to deer herd reductions (e.g., Earn-a-Buck, T-zones, youth hunt, etc.). Lapsed hunters were *more likely* to hunt by themselves or in smaller groups, to rely on public lands, and to have initiated hunting as adults than were a comparison group of still-active gun hunters (Holsman 2013).

The NRB asked that the 2011-2012 survey be replicated with an eye toward finding an answer to the question: *What, if any, impacts did the removal of age restrictions for crossbow use have had on recent declines in gun license sales?* In other words, is there a link between the change in the legalization of crossbows for all hunters to use during the archery season in 2014 and the observed decline in gun licenses that appears to have begun that same year?

There are two hypotheses related to the question. The first is that the availability of crossbows offers such an array of desirable advantages (e.g., hunting during the rut, hunting in warmer temperatures, easier weapon mastery, etc.) that gun hunters are converting their participation from gun season to bow season to take advantage of these opportunities. Previous reviews of customer license data, including the one described in the previous section, did not find support for this hypothesis (also see Dhuey [2018] in Appendix A). Nonetheless, we tested it again through a questionnaire administered to a scientifically drawn sample of lapsed gun hunters.

The second hypothesis to explain a possible link between legalized crossbow use and declining gun license sales comes from the idea that gun hunters may lapse out of frustration that the allocation of deer harvest, particularly buck harvest, to crossbow users has risen to the point where it is negatively impacting the gun hunting experience. Unlike the first hypotheses, the second one contains an argument that can be applied to archery use as well. Indeed, even before crossbows were made legal for all hunters during the 2014 season, the proportion of bucks taken by archers in the state exceeded 30 percent beginning in 2009 (Dhuey and Wallenfang 2018). While it is true that the total buck harvest from crossbows exceeded the number killed by archery hunters in 2017 and 2018, the combined proportion in those years was only slightly higher than achieved by archery season participants in 2013, the year before crossbow restrictions were lifted. In fairness, we included questions that assessed how frustration with deer being harvested by both weapon types may contribute to gun hunter lapses.



## ***Survey Methods***

We surveyed lapsed gun hunters during the summer of 2019 using a mixed mode sampling approach. We contacted customers by mail or by email (online, closed access survey) with a request to complete a questionnaire (Appendix B). We received just over 2,100 survey responses to our scientific sample, drawn randomly of resident adults who had not purchased a gun license since the 2016 season after previously having bought one at least two times before that. Our survey achieved a 36 percent response rate and non-response bias checks confirmed that our data were representative of the sample population.

We updated the questionnaire that was used in the 2013 study to include changes to deer management and regulations, including crossbow authorization, that have been made in recent years (Appendix B). We conducted focus groups with target audience members in Rhinelander, Oshkosh, and Dodgeville to pilot test question wording and presentation formats. During focus groups, some of the familiar reasons for lapse emerged, but mentions of crossbows did not come up organically. When asked directly about the impact of crossbows on their hunting participation, most focus group participants sat silently, and a few offered positive comments.

For purposes of this study, “lapsed gun hunters” were defined as Wisconsin residents aged 18- to 70-years-old, who did not purchase a gun hunting authorization in 2017 or 2018, but who had previously purchased licenses in at least two years in the past, with the most recent purchase being in 2016. “Gun hunting authorizations” included all license types (e.g., Sports, Conservation Patron, etc.) except for first-time buyers which, by definition, did not meet the threshold of at least two years of purchasing. Lapsed gun hunters may have purchased archery and/or crossbow licenses in the past, including the 2017 or 2018 seasons, and those results are shown below.

It should be noted that we expanded our sample demographically from the previous lapsed hunter survey in two important ways. First, we included women in our sample. (Women were not sampled in 2013 because the research objective for that study was to shed light on the observed decline in male gun hunters noted in the University of Wisconsin Applied Population Laboratory study; Winkler and Kaz 2011). The second change was that we sampled lapsed hunters younger than 35 years-old and older than 55 because younger and older hunters may be more likely to participate as crossbow hunters. Because the data presented here reflect a broader audience of lapsed hunters than what was included in the 2013 study, it is not appropriate to make direct comparisons of results between the two studies.

## Results

### Test of Hypothesis 1

*Gun hunters are putting down their guns and picking up crossbows to hunt during bow season.*

We asked respondents to indicate whether they had purchased archery and/or crossbow licenses over the previous five seasons coinciding with the time period that age restrictions on crossbows were lifted. Respondents who did not buy either type of bow hunting authorization for the past 5 years were classified as gun-only deer hunters. Most of the people (64%) who had lapsed from gun hunting in 2017 and 2018 were gun-only participants (Table 4). About one in three (33%) lapsed gun hunters reported hunting with a vertical bow sometime in the past five seasons. Twelve percent had used crossbows. Nine percent of the respondents purchased an archery license in all five of the previous seasons; only one percent purchased a crossbow license every year (Table 5).

**Table 4.** *Lapsed gun hunters use of weapon types for deer hunting between 2014 and 2018.*

License Type	% of Respondents Who Hunted by Weapon Type at Least Once between 2014 and 2018
Gun-only	64%
Gun and Archery	25%
Gun and Crossbow	4%
Gun and Archery and Crossbow	8%

**Table 5.** *Number of archery and crossbow licenses purchased by lapsed gun hunters during the previous five years.*

Number of Licenses Purchased in Past 5 Years	Archery	Crossbow
0 out past 5	67%	88%
1 out of 5	7%	4%
2 out of 5	7%	3%
3 out of 4	6%	2%
4 out of 5	4%	1%
5 out of 5	9%	1%

The annual frequency of purchases of archery and crossbow licenses over the past five seasons as provided by survey respondents is depicted in Table 6. There was a decline in archery participation in 2017 and 2018 among hunters who lapsed from gun hunting during those two seasons as well. Crossbow participation—while comparatively lower—appeared to be stable during the past two seasons.

Overall, we found that two percent of the lapsed gun hunters told us they purchased a crossbow license since 2016 and not before that time. By comparison, three percent of respondents bought an archery license in either 2017 or 2018, and not prior to their lapse from gun hunting. Results described for hypothesis 2 below provide some hints to help interpret the small percentage of customers that archery hunted during their gun hunting lapse. Twenty-two percent of survey respondents said their preference for hunting during the archery season held some sway in their decision to lapse from gun hunting in 2017 and 2018 (Table 6). Among that group, 12 percent bought crossbow licenses in the past two years while nine percent bought archery licenses. Fifty-eight percent of those who apparently switched to crossbows in the past two years said their preference for hunting during the bow season was a moderate to very high influence on their decision *not* to gun hunt. Among those using a vertical bow in 2017 and 2018, 51 percent said their preference for the archery season was moderate to very high influence.

These hunter self-reports are consistent with our previous internal reviews of license sales and fail to support the hypothesis that deer hunters are abandoning the 9-day gun season to hunt earlier in the year with crossbows. They do, however, suggest that some hunters are choosing to direct their efforts to the bow season instead of the gun season, and those hunters are comprised of both vertical and crossbow users.

**Table 6.** Annual rates of archery and crossbow licenses among lapsed gun hunters since 2014.

License year	Archery License (Vertical Bow)	Crossbow License	Both Types
2018	13%	6%	3%
2017	17%	7%	2%
2016	22%	5%	2%
2015	24%	4%	2%
2014	24%	3%	1%

## Test of Hypothesis 2

*Crossbow and compound harvest success is reducing gun hunters' chances, leading them to stop hunting.*

We asked survey respondents to rate the influence of 60 different individual factors on their decision to lapse from the gun license pool over the previous two seasons. Four of these factors were deemed to be single-reasons that reduced or eliminated a person's decision to hunt based on past research: military deployment, moved out-of-state, felony conviction, or health issue/serious injury. Survey respondents were initially asked if any of the four issues explained their lapse and, if so, they were directed to check a box and discontinue the questionnaire. Nineteen percent of lapsed hunters fit one of these single reason explanations for lapse. Family members of an additional three percent contacted us to indicate that the hunter in our sample had died in the past two years. For the remaining 78 percent of lapsed gun hunters in our sample, the picture was much more complicated.

The relative importance of factors contributing to an individual's decision to stop buying a gun license are considered in several different ways. The first way is to simply observe the rank order of the proportion of the respondents that indicated that a factor held *some degree of influence* in their decision not to hunt. The most frequently selected item reflects a general loss of interest: *"I no longer enjoy deer hunting like I once did"* (Table 7). Several other factors in the top 10 reflect a general dissatisfaction with deer hunting opportunities. Two items that explored the negative impacts of crossbow harvest and archery harvest were the 36<sup>th</sup> and 45<sup>th</sup> most frequently cited influences, respectively, in the list of 56 choices. Sixteen percent of lapsed gun hunters identified crossbow harvest as negative impact on their chances during gun season; and 11 percent pointed to archers.

The same 56 factors can be ordered by the *average strength of influence* on a person's decision to stop hunting (Table 8). Several items in the top 10 suggest dissatisfaction with deer numbers, land access challenges, and distrust of hunting public lands are the biggest drivers of lapse. Frustration with crossbow harvest and archery harvest rank 34<sup>th</sup> and 45<sup>th</sup> in their strength of influence among all factors tested. To put that in context, five percent of lapsed gun hunters cited crossbow harvest as a "high" or "very high" influence on their decision not to hunt. Meanwhile, four percent of respondents said harvest by archers was a "high" or "very high" influence.

We posed many reasons to explain respondents' decisions to drop out to be comprehensive, yet the results underscore that it is difficult to find single answers to explain lapse. For example, the fact that 55 of 56 items did not exert any influence for most respondents tells us that the decision to drop out is difficult to assign to single factors. Furthermore, the relatively low mean score measuring the strength of influence—even among the most frequently cited influences—also supports the observation that lapse is typically driven by several additive factors rather than a single driver of one's decision

**Table 7.** Relative importance of influences on gun-deer lapse according to frequency of selection.

Sort number	List of items influencing lapse	Does not apply	No influence	Minor influence	Moderate influence	High influence	Very High influence
1	I no longer enjoy gun-deer hunting like I once did.	42	7	16	16	12	8
2	I do not see enough deer in the area(s) I hunt.	41	10	12	12	13	12
3	I am not comfortable hunting on public land because of other hunters.	43	9	10	12	11	15
4	I think my chances of seeing deer are poor.	43	10	11	15	10	11
5	I see too few deer compared to the past.	45	11	10	12	10	12
6	I think there are a lack of decent bucks in the area(s) that I hunt.	42	16	11	12	10	10
7	It seems to me there are too few deer to make it worth hunting on public land.	51	11	8	9	9	13
8	I prefer other outdoor activities to gun-deer hunting.	50	13	14	12	7	5
9	I'd rather spend my free time doing other things.	51	12	16	10	7	5
10	I don't like being out in the cold.	48	16	16	9	6	6
...							
24	I prefer deer hunting during the archery season now.	68	10	6	5	5	6
36	All the deer being taken by crossbow users negatively impacts my chances during the 9-day season.	64	20	6	5	2	3
45	All the deer being taken by compound archers negatively impacts my chances during the 9-day season.	67	22	6	3	1	2

**Table 8.** Relative importance of influences on gun-deer lapse according to average strength of influence (measured on a 4-point scale where 1 is minor influence and 4 is very high influence).

Order		Mean Rating
1	I am not comfortable hunting on public land because of other hunters.	1.84
2	I do not see enough deer in the area(s) I hunt.	1.81
3	I think my chances of seeing deer are poor.	1.71
4	I no longer enjoy gun-deer hunting like I once did.	1.70
5	I see too few deer compared to the past.	1.65
6	I think there are a lack of decent bucks in the area(s) that I hunt.	1.64
7	It seems to me there are too few deer to make it worth hunting on public land.	1.54
8	I cannot afford private land (e.g. lease fees, property tax, etc.)	1.43
9	I think predators are taking too many deer.	1.39
10	I have a hard time getting time off from work during the gun season.	1.29
24	I prefer deer hunting during the archery season now.	0.87
34	All of the deer being taken by crossbow users negatively impacts my chances during the 9-day gun-deer season.	0.69
45	All of the deer being taken by compound archers negatively impacts my chances during the 9-day gun-deer season.	0.55

**Table 9.** Mean ranking and frequency of top three influences on major drivers of gun hunter lapse in 2017 and 2018.

Categories of Reasons for Lapse	Mean Rank	% Ranking in Top 3 Reasons for Lapse (Out of 8 Categories)		
		1st	2nd	3rd
Life & family priorities	2.8	40	17	11
Not enough deer	3.7	15	21	16
I lost interest/enjoy other things more	4.3	13	14	16
Lack of access to hunting land	4.7	15	12	12
Frustrated by deer management (rules and seasons)	4.7	9	12	10
Lack of hunting companions/group	4.9	7	11	15
Costs too much to go	5.0	4	8	15
CWD concerns	5.6	3	5	8

Finally, we tried to develop a bit more clarity on the underlying factors that contribute to purchasing lapses by asking respondents to *rank the importance* of eight broad categories. These categories were intended to be umbrella “catch-all” categories to distill importance and followed the major headings of the list of rated items described above. In this ranking exercise, life and family priorities clearly emerged as the leading source of gun-hunter drop out (Table 9). Four in 10 respondents ranked this as their top reason for not buying a license. Discontent with deer numbers was the second leading cause. Loss of interest, lack of land access, and frustration with deer management made up a second tier of most influential factors in gun hunter lapse (Table 9).

## **Key Findings**

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- *Most of those (64%) who had discontinued buying a gun deer license for the past two years had not purchased an archery license or a crossbow license in the past five seasons according to their questionnaire responses.*
  - *From 2014 to 2018, the annual participation rates for purchasing an archery license declined from 24 to 13 percent among the lapsed gun hunters, while crossbow license purchases increased from three to six percent in the past two seasons.*
  - *We found that two percent of lapsed gun hunters began using a crossbow in the past two seasons and three percent picked up a vertical bow. In both cases, a preference to hunt during the archery season appears to be a relatively strong influence on gun hunting lapse.*
  - *The self-reports of lapsed gun hunters support previous data mining conducted by the department (see previous section and Dhuey and Wallenfang 2019) which found erosion of gun license buyers is predominately occurring among single-season hunters who are not substituting their participation during archery season with either weapon type in significant numbers.*
  - *Lapse among gun deer hunters is being driven by an array of interacting factors which include shifting family and life priorities, dissatisfaction with deer encounters, and a general loss of interest.*
-



# STUDY # 3: Measuring Deer Hunter Motivations

## Literature Review

The recent observations of and related dialogue about the increase in crossbow license sales have raised some questions about **why** people chose to hunt deer with different weapon types. While there have been dozens of studies spanning five decades detailing hunter motivations and satisfactions, very few have looked specifically at weapon type, and with virtually none pertaining to motivations to pick-up crossbows. Studies on crossbows have addressed opinions about whether they should be allowed and have generally showed most hunters in other states supporting their legalization (Laubner and Brown 2000, Palmer 2007, Kandoth and Garris 2008, Frawley and Rudolph 2013).

Research literature examining why people hunt has generally synthesized a diverse list of potential motivations into four broad categories: 1) spending time in nature/outdoors, 2) spending leisure time with friends and family, 3) obtaining wild game (i.e. food), and 4) sport/achievement. These categories were first noted by Decker and Connelly (1980) and built on the work of Kellert (1978). Individual deer hunters usually have multiple motivations for hunting and their motivation profiles tend to change with experience and age (Hammitt et al. 1990, Norton 2008).

Responsive Management, a private research firm that studies public opinion on natural resource issues, has tracked the percentage of hunters whose primary motivations fit the four-category typology described above. The most recent polling in 2013 suggested that sport and food were the most prevalent dominant motivations for adults, and that prevalence of those motivated by food has increased slightly since 2006 (Responsive Management 2006, 2013). This body of research tends to paint hunter motivations in broad brush strokes that do not shed much light on why people would choose to pick up a particular weapon type to pursue game.

Prior to development of compound bows, most people who wanted to hunt deer did so with guns. Historically, archery hunters were a small subset of hunters who used primitive stick bows and were largely motivated by challenge, solitude, and a love for the equipment (Ditchkoff et al. 1996, Willging 2008). As compound technology was developed and marketed in the 1970s, some gun hunters took up archery hunting because it offered a longer season (i.e. more opportunity), solitude (i.e. nature) and for others, more challenge to harvesting a deer at closer range (i.e. achievement) or an additional chance to put venison in the freezer (Responsive Management 1996, Responsive Management and AMMO 2000, Fleegle 2015, Black et al. 2018). The later motivation may have been initially an important draw to archery given the “any deer” tag availability in an era where antlerless tags were issued conservatively (Willging 2008). For certain deer control hunts, archery gear has also allowed hunters to access areas where guns are not authorized; in those cases, an added benefit becomes hunting areas with high deer densities (e.g., Weckel et al. 2011). Research has shown that gun hunters tend to have stronger



social and food motivations than do archery hunters (Miller and Graefe 2001, Black et al 2018). Archery hunters tend to have stronger sport/achievement and nature motivations.

Certainly, those adopting crossbows—regardless of their past participation in gun and/archery seasons—may be doing so because it allows an opportunity to fulfill any of the four major goal motivations. One of the more pertinent studies on the issue of why people hunt with crossbows comes from an in-house survey conducted in 2017. Dhuey and Wallenfang (2018) surveyed nearly 6,000 Wisconsin hunters with authorizations to hunt during the 2017 bow season and compared the effort, harvest success, satisfactions, and motivations of individuals hunting under different license types. The results corroborate harvest registration data in that those who used crossbows had a slightly higher success rate than those who hunted exclusively with vertical bows. There were no differences in satisfaction ratings (Dhuey and Wallenfang 2018).

Dhuey and Wallenfang (2018) also explored motivations for hunting by license type in a couple of ways. First, respondents were asked to rank seven factors that contribute to a quality hunt. Comparing the mean rankings shows no difference in order of importance of factors between archery and crossbow license holders (Table 10). Further, comparing the mean rank scores of license holders of each of seven factors reveals no substantive differences. Second, they also compared both groups on a list of motivations for why respondents participated in the bow season in 2017. Again, archery-only and crossbow-only hunters were very similar in motivations as shown in Table 11 which displays the top five most frequently cited checked items.

**Table 10.** Mean rankings on a scale of 1-7 of factors that contribute to a quality hunt.

	Archery-only	Crossbow-only
Seeing deer	2.4	2.5
Seeing bucks	3.1	3.2
Opportunity to shoot a deer	3.4	3.2
Spending time with family and friends	3.7	3.8
Not seeing other hunters	4.5	4.3
Harvesting a deer	4.5	4.1
Weather	5.0	4.7

**Table 11.** Response frequencies for top-five motivations to participate.

	Archery-only	Crossbow-only
Timing of the rut	16%	16%
Solitude	12%	12%
Chance to harvest a buck	11%	12%
Season length	8%	10%
Weather	8%	13%

Another study that is informative comes from Michigan where crossbows were allowed during their archery season beginning in 2010 (Frawley and Rudolph 2013). They completed a study in 2013 of crossbow users and found three out of four agreed that, compared with compound bows, crossbows: 1) were easier to use, 2) took less time to become proficient, 3) were more accurate, and 4) made hunters more confident they could harvest a deer using a crossbow than with other types of bows. About 50 percent of crossbow hunters agreed that using crossbows allowed them to hunt more often, and that they would not hunt during the bow season if crossbows could not be used. Less than 30 percent of crossbow hunters stated they used crossbows because it was either more satisfying or more challenging to hunt with crossbows than other types of bows. These results tend to support the notion that crossbows enable more hunting opportunities for people limited by time and/or physical limitations (e.g., strength, injury, age, etc.) to participate during the bow season.

One major deficiency in the hunter motivation literature is the failure to isolate the importance and allure of pursuing bucks (i.e. antlers), although it could be considered a particular type of achievement motivation. Our own survey work has documented that most deer hunters would prefer to shoot a buck over an antlerless deer (Petchenik 2003).

Although the stigma associated with the word “trophy” suppresses hunter willingness to admit it on surveys, contemporary hunter behavior indicates a growing preference among all deer hunters to shoot larger bucks. The percentage of hunters who report passing up shots at legal bucks in hopes of a bigger one during a season has more than doubled over the past three decades, coinciding with the rise in number of bow hunting participants (QDMA 2019). Dhuey and Wallenfang’s (2018) work described above shows that archery and crossbows hunters are equally motivated to see bucks and pursue them during the rut when they tend to be most vulnerable. Nowadays, about one in three bucks harvested each fall in Wisconsin is taken during bow season. That was true before crossbows were available to all hunters in the state and it remains true now (Dhuey 2018). In the parlance of wildlife management terms, mortality from crossbows is compensatory, not additive *at the current rate of crossbow participation*. Lapsed bow hunters reactivating because of crossbows and those expanding into the sport from gun hunting may have different motivations, or they may both share a desire to hunt bucks during the rut, in nicer weather, with less competition, and using a weapon that requires less time to master and is easier to shoot.

## ***Survey Methods***

In addition to reviewing past work on hunting motivations, we also undertook a primary research project to explicitly examine hunter motivations by preferred weapon type in the Wisconsin context. An online survey (Appendix C) was launched on July 14, 2014 with email invitations sent to 7,000 hunters. Follow-up emails were sent to individuals who had not completed the survey every four days until 6 August, totaling six contacts. The final contact informed recruits of the survey closing date of 12 August.

To ensure that the three weapon types identified by the NRB were adequately represented a stratified approach to sampling was used. Given that any individual hunter could use all three weapon types in a given season, 1,000 hunters with email addresses were selected for each combination of weapon authorizations that could be purchased. Because of the equal distribution of strata within our sample, hunters did not have equal likelihood of being selected, and therefore did not represent the same number of hunters in the larger population. For example, while each respondent who held authorizations for both archery and crossbow equipment constituted one out of about 13 such hunters in the population; respondents who held only a gun license represented approximately 880 gun-only hunters in Wisconsin. Given an overall response rate of 34%, an assessment for non-response bias was conducted, and found differences in gender and age distribution between those who completed the survey and those who did not. The results thus presented are based on data that was weighted to correct the distribution of license holders as well as the age and gender distribution of hunters in our data to more accurately represent the true population of hunters in Wisconsin.

## ***Results***

### **Weapon Preferences**

Respondents were asked to indicate their preferred weapon from the seven weapon types listed previously (Table 12). These responses were then aggregated to group respondents into vertical bow (25%), crossbow (11%), and gun (64%) hunters to align with the current license structure for Wisconsin.

**Table 12.** Distribution of most preferred weapons used by Wisconsin deer hunters.

	Unweighted data		Weighted to reflect the population	
	N	Percent	Weighted Percent	Weighted Percent (Aggregated)
<b>Recurve or Long Bow</b>	28	1%	<1%	25%
<b>Compound Bow</b>	741	37%	25%	
<b>Crossbow</b>	647	32%	11%	11%
<b>Rifle</b>	519	26%	57%	64%
<b>Shotgun</b>	39	2%	5%	
<b>Muzzleloader</b>	18	1%	1%	
<b>Handgun</b>	6	<1%	1%	

While weapon preference was, understandably, associated with the weapon authorities purchased in 2018, these relationships were not consistent across weapon types (Table 13). For example, while 84 percent of those who said they preferred to use a firearm purchased only a firearm authorization (gun or sports license), the majority of those who preferred a vertical bow (59%) and crossbow (54%) purchased authorizations for both their preferred weapon type and also a gun license. Indeed, approximately three quarters of hunters who prefer a vertical bow or crossbow held licenses for two or more weapons in 2018. Because hunters preferred weapon types do not necessarily match the weapon indicated in by their license type, we differentiate groups of hunters based on weapon preference by using the terms vertical bow and firearm rather than the license terminology of archery and gun.

Looking at the same data by weapon authority provides additional insights (Table 14). While single license holders can be expected to purchase the authority that corresponds with their preferred weapon, the distribution of weapon preferences among purchasers of multiple authorities suggests that weapon preference is a nuanced topic. For example, most (81%) of those who purchased an archery license and a gun license indicated their preferred to use a vertical bow, whereas those who purchased either an archery and crossbow license or a crossbow and gun license were much more evenly split. These findings suggest that when looking at license purchases, in addition to the common conception of bow hunters, crossbow hunters and gun hunters, three additional types of hunters should be considered. The first of these are “string hunters”, i.e. hunters who eschew firearms but hunt with vertical or crossbow. The second type comprises “trigger hunters”, i.e. those who eschew vertical bows in favor of firearm or crossbow, and finally a third type are “deer hunters” who use any weapon.

**Table 13.** Distribution of weapon authorities held by hunters by most preferred weapon type. ( $\chi^2=1636.6$ ;  $p<0.001$ ).

		Preferred weapon type		
		Vertical Bow	Crossbow	Firearm
Weapon Authorities held in 2018	Archery Only	12%	1%	<1%
	Crossbow Only	1%	18%	1%
	Archery and Crossbow	1%	4%	<1%
	Gun Only*	17%	5%	<b>84%</b>
	Gun and Archery	<b>59%</b>	3%	5%
	Gun and Crossbow	2%	<b>54%</b>	9%
	Gun, Crossbow and Archery	9%	16%	2%
	Total	100%	100%	100%

\* Hunters may use a crossbow or archery equipment during the gun season under the “lesser weapon rule.”

**Table 14.** Distribution of weapon preferences held by weapon type authorizations purchased. ( $\chi^2=1636.6$ ;  $p<0.001$ ).

		Preferred weapon type			Total
		Vertical Bow	Crossbow	Firearm	
Weapon Authorities held in 2018	Archery Only	<b>93%</b>	2%	6%	100%
	Crossbow Only	5%	<b>83%</b>	12%	100%
	Archery and Crossbow	<b>43%</b>	<b>50%</b>	7%	100%
	Gun Only	7%	1%	<b>92%</b>	100%
	Gun and Archery	<b>81%</b>	2%	17%	100%
	Gun and Crossbow	4%	<b>51%</b>	<b>45%</b>	100%
	Gun, Crossbow and Archery	<b>42%</b>	<b>33%</b>	25%	100%

To get a better picture of hunters who prefer vertical bow, crossbow, or gun, we compared distributions of gender and avidity across these groups.<sup>3</sup> Overall, vertical bow hunters were more likely to be male (94%) than were the other two groups (90%; Table 15). We asked respondents to self-identify their level of avidity (Table 16). Five classifications were available ranging from “I have hunted but do not consider myself a hunter” to “I consider myself an avid hunter.” Hunters who indicated they prefer vertical bows were twice as likely to self-identify as avid (68%) as were those who preferred firearms (34%). Crossbow preferring hunters were in the middle (62%).

**Table 15.** Gender distribution of preferred weapon type.

Preferred weapon	Female	Male
Vertical Bow	6%	94%
Crossbow	10%	90%
Firearm	11%	90%

**Table 16.** Distributions of self-identified avidity groups across hunters with different weapon type preferences ( $\chi^2=139.6$ ;  $p<0.001$ ).

Preferred weapon	I have hunted but do not consider myself a hunter	I used to consider myself a hunter but no longer do so	I consider myself a novice hunter	I consider myself a casual hunter	I consider myself an avid hunter
Vertical Bow	<1%	2. %	3%	27%	68%
Crossbow	1%	2%	3%	32%	62%
Firearm	<1%	2%	6%	58%	34%

<sup>3</sup> While these preferences do not infer exclusive use of one of these weapon type, for convenience, I refer to these groups as vertical bow hunters, crossbow hunters and firearm hunters in this report.



## Motivations

After review of the peer-reviewed literature on hunting motivations and additional insights gained from pretesting with Wisconsin deer hunters in two focus groups, 23 hunting motivations were assessed in this study (Table 17). Respondents were randomly assigned to one of two groups in this assessment. Approximately half of respondents were asked to rate the importance of each motive on a five-point scale ranging from not at all important (1) to very important (5). The other half were provided a type of ranking exercise wherein they selected the most and least important motive from experimentally designed subsets of the 23 motives. These two approaches each have their strengths and weaknesses from an analytical perspective but corroborate each other to provide a holistic picture of what motivates hunters who prefer each weapon type.

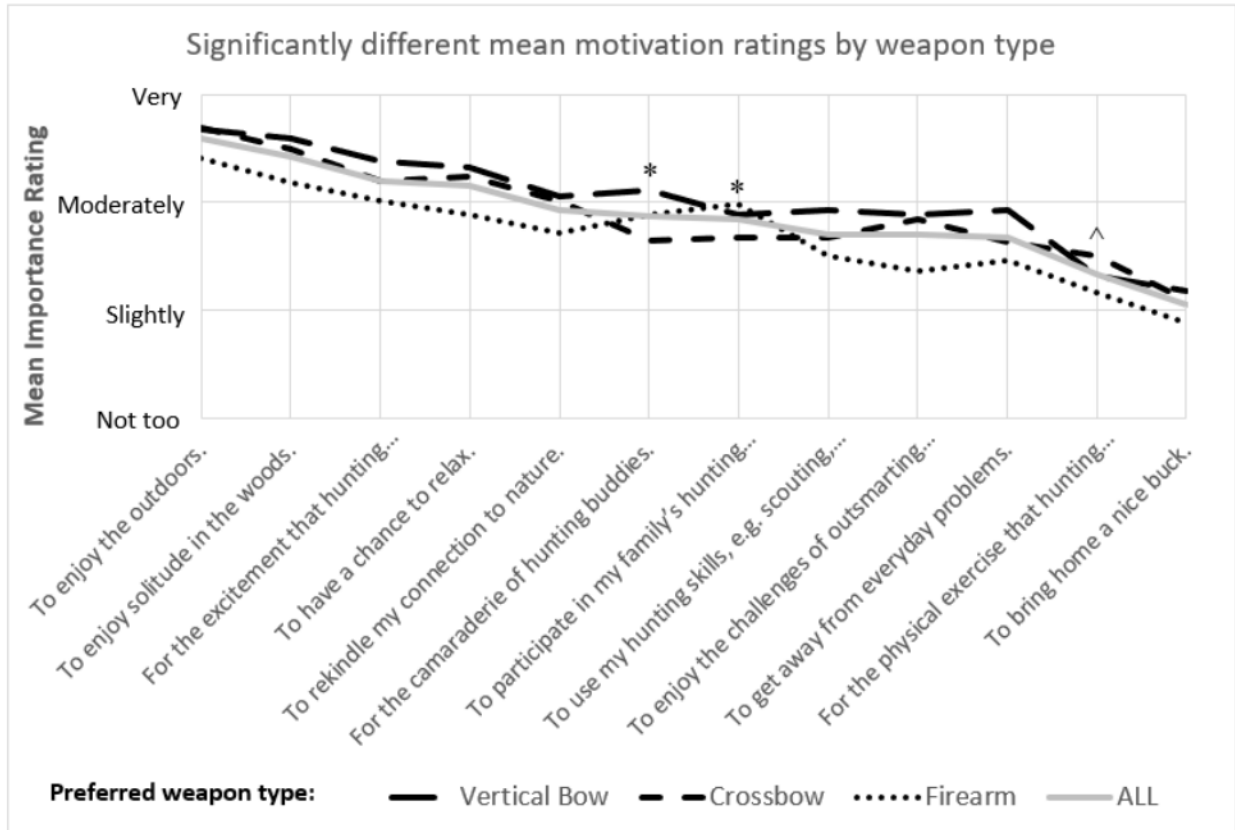
## Importance Rating

Importance rating (Table 17) tasks have been used since the 1970s for the assessment of hunter motivations. By rating individual motivations independently, this approach aligns with the concept of multiple satisfactions, which acknowledges that hunters can simultaneously hold many reasons that they hunt. Interpreting the results of this approach is also intuitive. On our five-point scale, a mean value between four and five indicates that on average a motive is moderately to very important. On the other hand, this approach may not adequately differentiate the motives of different groups in a meaningful way. For example, “To enjoy the outdoors” is a motivation whose means differ among the three weapon groups identified in this study, with hunters who prefer to use a firearm giving this motive a significantly lower average importance rating than did those who prefer vertical bow or crossbow (Table 17, Figure 9). That said, this motivation received the highest mean rating for all groups. In other words, while the difference is significant statistically, it is not really substantive. Another limitation of rating each motivation individually is that differences among groups may reflect differences in avidity. Simply put, more avid hunters are more motivated to hunt—for any reason. Of 12 motivations that showed statistically significant differences, hunters who prefer firearms gave significantly lower mean ratings than those who prefer crossbow or vertical bow on eight motivations. Only one motivation rated more highly for firearm hunters than another group, where they placed significantly more importance on participating in family hunting traditions than did crossbow-preferring hunters. Hunters preferring crossbows were more motivated than firearm hunters by the physical exercise of hunting and were similar to vertical bow hunters on all other motives except for the camaraderie of hunting buddies (Table 17, Figure 9).

**Table 17.** Average importance rating for 23 possible motivations for deer hunting across hunters with different weapon type preferences. The rating scale comprised five points where 1=not at all important, 2=not too important, 3=slightly important, 4=moderately important, and 5=very important. (Motivation items are presented in order of descending importance averaged across all groups. Homogeneous subsets are indicated by superscript letters.)

Motive	Preferred weapon	Weighted N	Mean	Std. Error	Sig.
To enjoy the outdoors.	Vertical Bow <sup>b</sup>	233	4.68	0.04	<0.001
	Firearm <sup>a</sup>	596	4.41	0.04	
	Crossbow <sup>b</sup>	106	4.69	0.05	
To enjoy solitude in the woods.	Vertical Bow <sup>b</sup>	232	4.59	0.05	<0.001
	Firearm <sup>a</sup>	600	4.19	0.04	
	Crossbow <sup>b</sup>	107	4.49	0.07	
For the excitement that hunting provides.	Vertical Bow <sup>b</sup>	232	4.38	0.06	<0.001
	Firearm <sup>a</sup>	599	4.01	0.04	
	Crossbow <sup>ab</sup>	106	4.20	0.09	
To have a chance to relax.	Vertical Bow <sup>b</sup>	233	4.33	0.06	<0.001
	Firearm <sup>a</sup>	599	3.89	0.04	
	Crossbow <sup>b</sup>	106	4.24	0.08	
To see deer or deer sign.	Vertical Bow	233	4.15	0.06	NS
	Firearm	603	3.98	0.04	
	Crossbow	107	4.09	0.10	
To bring home venison to eat.	Vertical Bow	233	4.01	0.07	NS
	Firearm	600	3.95	0.05	
	Crossbow	105	4.04	0.10	
To rekindle my connection to nature.	Vertical Bow <sup>b</sup>	233	4.05	0.07	<0.001
	Firearm <sup>a</sup>	603	3.72	0.05	
	Crossbow <sup>b</sup>	106	4.01	0.10	
For the camaraderie of hunting buddies.	Vertical Bow <sup>b</sup>	233	4.11	0.08	0.004
	Firearm <sup>ab</sup>	600	3.88	0.05	
	Crossbow <sup>a</sup>	106	3.64	0.13	
To participate in my family's hunting tradition.	Vertical Bow <sup>ab</sup>	233	3.89	0.09	0.046
	Firearm <sup>b</sup>	603	3.98	0.05	
	Crossbow <sup>a</sup>	106	3.67	0.14	
To be actively involved in wildlife conservation.	Vertical Bow	233	3.91	0.07	NS
	Firearm	603	3.73	0.04	
	Crossbow	107	3.82	0.10	
To be a part of Wisconsin's hunting tradition.	Vertical Bow	233	3.78	0.08	NS
	Firearm	599	3.71	0.05	
	Crossbow	106	3.72	0.12	
To use my hunting skills, e.g., scouting, stalking or tracking.	Vertical Bow <sup>b</sup>	232	3.93	0.07	<0.001
	Firearm <sup>a</sup>	603	3.50	0.04	
	Crossbow <sup>a</sup>	106	3.67	0.10	
To enjoy the challenges of outsmarting a deer.	Vertical Bow <sup>b</sup>	233	3.89	0.08	<0.001
	Firearm <sup>a</sup>	600	3.36	0.05	
	Crossbow <sup>b</sup>	107	3.84	0.10	

Motive	Preferred weapon	Weighted N	Mean	Std. Error	Sig.
To get away from everyday problems.	Vertical Bow <sup>b</sup>	233	3.93	0.08	<0.001
	Firearm <sup>a</sup>	599	3.46	0.05	
	Crossbow <sup>a</sup>	107	3.63	0.13	
For the sense of accomplishment from a successful hunt.	Vertical Bow	233	3.67	0.08	NS
	Firearm	602	3.56	0.05	
	Crossbow	105	3.78	0.10	
To pass on my hunting knowledge to another hunter.	Vertical Bow	232	3.72	0.08	NS
	Firearm	599	3.48	0.05	
	Crossbow	106	3.63	0.12	
To contribute to managing the deer herd.	Vertical Bow	232	3.62	0.07	NS
	Firearm	603	3.55	0.04	
	Crossbow	106	3.66	0.11	
To use my hunting equipment.	Vertical Bow	233	3.26	0.08	NS
	Firearm	603	3.34	0.05	
	Crossbow	106	3.42	0.12	
For the physical exercise that hunting provides.	Vertical Bow <sup>ab</sup>	233	3.32	0.08	0.013
	Firearm <sup>a</sup>	603	3.17	0.05	
	Crossbow <sup>b</sup>	105	3.50	0.11	
To get a shot at a deer.	Vertical Bow	229	3.31	0.08	NS
	Firearm	596	3.24	0.05	
	Crossbow	106	3.30	0.11	
To bring home a nice buck.	Vertical Bow <sup>b</sup>	233	3.18	0.08	0.005
	Firearm <sup>a</sup>	596	2.88	0.05	
	Crossbow <sup>ab</sup>	106	3.10	0.12	
To learn from another hunter.	Vertical Bow	233	3.07	0.09	NS
	Firearm	603	2.90	0.05	
	Crossbow	106	2.81	0.13	
To provide meat for people other than my immediate family.	Vertical Bow	233	2.64	0.08	NS
	Firearm	602	2.58	0.05	
	Crossbow	106	2.76	0.13	



**Figure 9.** Mean hunting motivation importance ratings that show statistically significant differences among hunters who prefer vertical bow, crossbow, and firearm hunting. \* indicates motivations where firearm hunters are not lowest. ^ indicates motivations where vertical bow hunters are not highest.

### Best-Worst Scaling

The other half of respondents were asked to complete a best-worst scaling task. Each respondent was presented with four questions that were randomly selected from a bank of 46 questions, each of which included four of the above motivation items according to an experimental design. In each question, the respondent's task was to select the single most important motive from the list as well as the single least important motive. These responses were then put into a discrete choice model to predict hunters' most important motivations as a function of the motives that were available to them. While the outcome of this task is like a ranking exercise, limiting responses to only the top and bottom items in the list eases the response burden for participants, and while only partial information is collected from each participant, the aggregate models are quite robust.

This best-worst approach is well suited for differentiating among groups of respondents, as it focuses on the relative importance of each motive rather than attempting to place it on an absolute scale. Thus, for each group, it emphasizes which motives are most or least important, rather than describing them as “very” or “moderately” important. This difference addresses the issue of avidity influencing the motivation ratings above, because the output of the model provides a percent likelihood that each motive will be considered the most important. In other words, for each group, the likelihoods that any single motivation will be selected add up to 100%. These results are presented in Table 19.

There are many similarities between the order in which some motives appear between the rating and scaling tasks. For example, enjoying the outdoors is both the highest rated and the most likely to be selected as the most important motive (Figure 10). The results of the model however, do highlight some key differences among hunters that prefer vertical bows, crossbows, and firearms that are less apparent in the ratings. Based on the model, it becomes apparent that vertical bow hunters tend to be more motivated by elements of the hunting experience related to skill, challenge, excitement, and solitude, while firearm hunters are more motivated by bringing home venison, participating in family tradition, and the camaraderie of hunting buddies, corroborating findings from our literature review. Crossbow hunters, most of whom came to prefer that weapon type from a vertical bow or firearm hunting background, tend to fall between the other two groups, sharing similarities with one or other depending on the motivation. That said, crossbow hunters are slightly more likely to indicate that enjoying the outdoors or the feeling of accomplishment of a successful hunt are their primary motives. These differences, however, are not as dramatic as those that seem to define the other two groups.

### **Factors Influencing Preferred Weapon Choice**

Another series of questions focused on factors that influenced the weapon type that a hunter might prefer. Rather than addressing the research question of why crossbow hunters (for example) hunt deer, these questions address the question of why some deer hunters prefer a crossbow, vertical bow or firearm.

The first of these questions focused on characteristics of the weapon types themselves (Table 18). No differences were found in the importance of the accuracy of the weapon. Simply put, all hunters consider weapon accuracy to be quite important. Other weapon characteristics, however, did differ in their importance among the three hunter groups. While the effective range of the weapon was more important to gun hunters, vertical bow and crossbow hunters placed more importance on the weight of the weapon. Crossbow hunters, on average, rated the cost of the weapon (both the initial purchase cost as well as the maintenance cost) to be more important than did gun and vertical bow hunters. In keeping with their higher motivations to use their hunting skills, vertical bow hunters placed more importance on the amount of practice/skill required to become proficient than did the other groups.

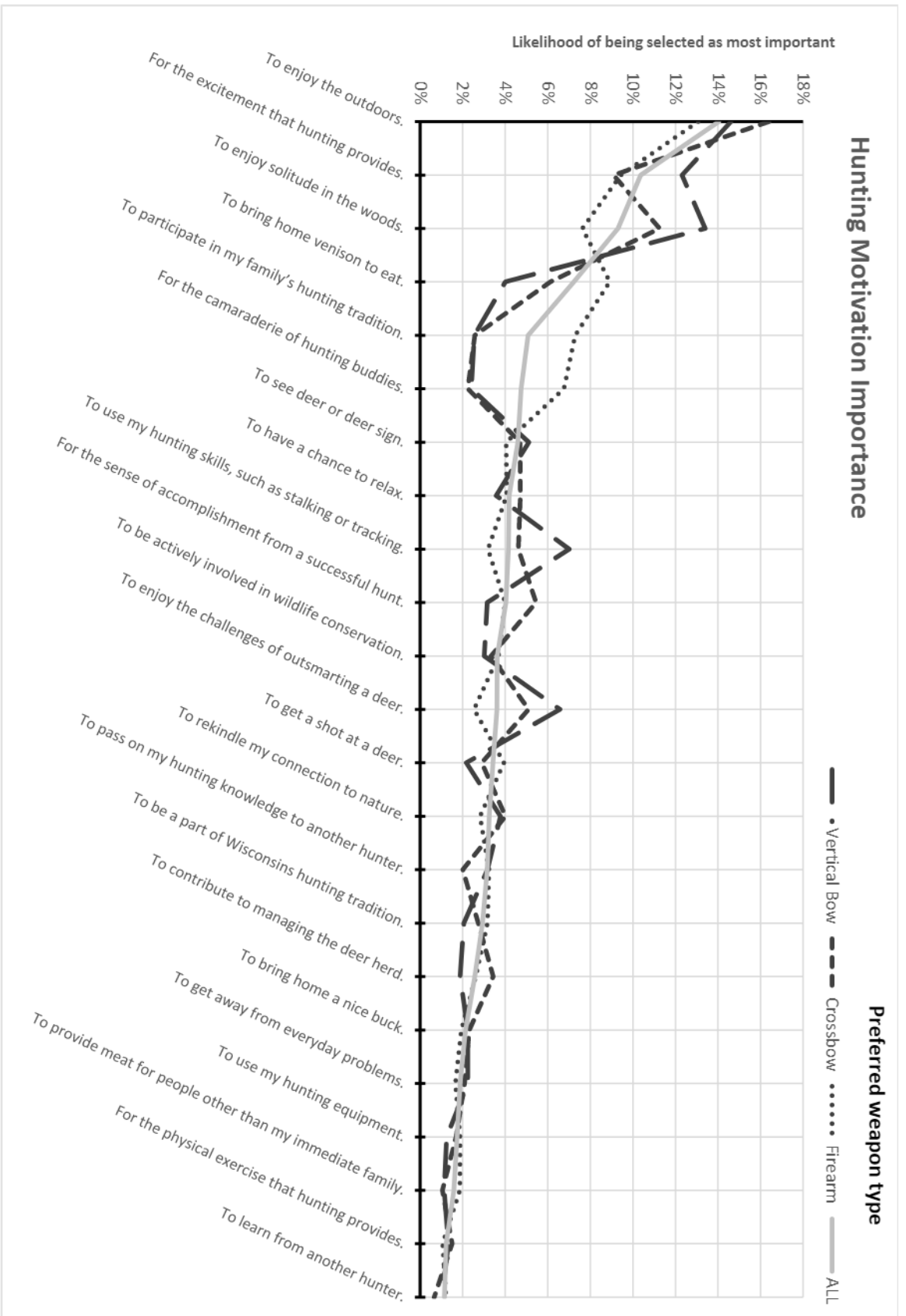
Another question focused on aspects related to harvesting a deer (Table 19). No significant differences were found in the importance of decreasing the chance of wounding a deer, increasing chances of successfully harvesting a deer, or having opportunities to harvest more than one deer. Differences were found, however in the chances of harvesting a buck, with firearm hunters placing more importance than crossbow hunters on this factor. Vertical bow hunters placed more importance on increasing chances of seeing deer than did the other groups.

**Table 18.** Average importance rating of weapon characteristics influencing choice of most preferred weapon type across hunters. The rating scale comprised five points where 1=not at all important, 2=not too important, 3=slightly important, 4=moderately important, and 5=very important. Homogeneous subsets are indicated by superscript letters and cell shading.

	Preferred weapon type	Weighted N	Mean	Std. Error	Sig.
<b>The accuracy of the weapon.</b>	Vertical Bow	390	4.67	0.04	NS
	Crossbow	178	4.78	0.04	
	Firearm	1002	4.67	0.03	
<b>The effective range of the weapon.</b>	Vertical Bow <sup>a</sup>	390	4.07	0.06	<0.001
	Crossbow <sup>a</sup>	178	4.18	0.08	
	Firearm <sup>b</sup>	1003	4.39	0.03	
<b>The weight of the weapon.</b>	Vertical Bow <sup>b</sup>	388	3.57	0.06	<0.001
	Crossbow <sup>b</sup>	178	3.60	0.09	
	Firearm <sup>a</sup>	981	3.29	0.04	
<b>The cost of the initial purchase of the weapon.</b>	Vertical Bow <sup>a</sup>	390	3.03	0.06	0.004
	Crossbow <sup>b</sup>	179	3.30	0.08	
	Firearm <sup>a</sup>	1001	2.97	0.04	
<b>The cost to maintain and use the weapon (e.g., ammunition, parts).</b>	Vertical Bow <sup>a</sup>	390	2.75	0.06	0.006
	Crossbow <sup>b</sup>	178	3.09	0.09	
	Firearm <sup>a</sup>	996	2.82	0.04	
<b>The amount of practice/skill required to become proficient.</b>	Vertical Bow <sup>b</sup>	389	4.26	0.05	<0.001
	Crossbow <sup>a</sup>	179	3.85	0.08	
	Firearm <sup>a</sup>	1005	3.71	0.04	



Figure 10. Likelihood that a motivation item will be ranked as most important across weapon preference groups.



**Table 19.** Average importance rating of aspects of harvesting a deer that may influence choice of most preferred weapon type across hunters. Homogeneous subsets are indicated by superscript letters and cell shading.

	Preferred weapon type	Weighted N	Mean	Std. Error	Sig.
Decreasing my chance of wounding a deer.	Vertical Bow	390	4.48	0.05	NS
	Crossbow	179	4.63	0.06	
	Firearm	996	4.53	0.03	
Increasing my chance of harvesting a buck.	Vertical Bow <sup>ab</sup>	390	3.58	0.07	0.018
	Crossbow <sup>a</sup>	179	3.48	0.10	
	Firearm <sup>b</sup>	996	3.74	0.04	
Increasing my chance of seeing deer while hunting.	Vertical Bow <sup>b</sup>	390	3.67	0.07	<0.001
	Crossbow <sup>a</sup>	177	3.05	0.11	
	Firearm <sup>a</sup>	995	3.17	0.04	
Increasing my chance of successfully harvesting a deer.	Vertical Bow	390	4.03	0.06	NS
	Crossbow	179	4.09	0.08	
	Firearm	996	4.23	0.03	
Having opportunities to harvest more than one deer.	Vertical Bow	390	2.53	0.07	NS
	Crossbow	179	2.55	0.10	
	Firearm	998	2.61	0.04	

More differences among hunter groups were found in the importance of different social considerations in selection of their preferred weapon (Table 20). In all, hunters who prefer crossbows placed less importance on social considerations than did vertical bow or firearm hunters. Firearm hunters placed the most importance on the influence of their mentor, while vertical bow hunters rated the influence of hunters they admire as well as their hunting buddies as more important.

Seasonal considerations also differed based on weapon preference (Table 21). Crossbow preferring hunters placed less importance on almost all seasonal factor than the other groups, including access to private hunting land during the season, and availability of time off from work or school. Vertical bow hunters placed more importance than others on the likelihood of encountering other hunters, corroborating their motivation to experience solitude. They also placed more importance on temperature conditions than the other groups, while firearm hunters, on average, gave temperatures less importance.

**Table 20.** Average importance rating of social considerations that may influence choice of most preferred weapon type across hunters. (Homogeneous subsets are indicated by superscript letters and cell shading.)

	Preferred weapon type	Weighted N	Mean	Std. Error	Sig.
I like this weapon type for introducing someone to hunting.	Vertical Bow <sup>b</sup>	390	3.01	0.07	0.036
	Crossbow <sup>a</sup>	179	2.70	0.10	
	Firearm <sup>b</sup>	999	2.92	0.04	
I was taught to use this weapon type by my mentor.	Vertical Bow <sup>b</sup>	390	2.82	0.08	<0.001
	Crossbow <sup>a</sup>	179	1.70	0.08	
	Firearm <sup>c</sup>	1005	3.23	0.05	
The hunters I admire most use this weapon type.	Vertical Bow <sup>c</sup>	390	2.59	0.08	<0.001
	Crossbow <sup>a</sup>	179	1.56	0.07	
	Firearm <sup>b</sup>	1005	2.34	0.04	
My hunting buddies use this weapon type.	Vertical Bow <sup>c</sup>	390	2.61	0.07	<0.001
	Crossbow <sup>a</sup>	179	1.67	0.08	
	Firearm <sup>b</sup>	1005	2.20	0.04	

**Table 21.** Average importance rating of seasonal considerations that may influence choice of most preferred weapon type across hunters. Homogeneous subsets are indicated by superscript letters and cell shading.

	Preferred weapon type	Weighted N	Mean	Std. Error	Sig.
Access to private hunting land during this weapon's season.	Vertical Bow <sup>b</sup>	389	3.33	0.08	<0.001
	Crossbow <sup>a</sup>	179	2.73	0.12	
	Firearm <sup>b</sup>	1005	3.08	0.05	
Availability of time off from work/school to hunt during this weapon's season.	Vertical Bow <sup>c</sup>	390	3.55	0.07	<0.001
	Crossbow <sup>a</sup>	179	2.92	0.12	
	Firearm <sup>b</sup>	1005	3.18	0.05	
Likelihood of encountering other hunters during this weapon's season.	Vertical Bow <sup>b</sup>	387	3.17	0.07	<0.001
	Crossbow <sup>a</sup>	178	2.57	0.11	
	Firearm <sup>a</sup>	1002	2.68	0.04	
The temperature conditions expected during this weapon's season.	Vertical Bow <sup>c</sup>	389	3.27	0.07	<0.001
	Crossbow <sup>b</sup>	179	3.02	0.10	
	Firearm <sup>a</sup>	1005	2.72	0.04	
The precipitation/snow conditions expected during this weapon's season.	Vertical Bow	390	2.80	0.07	NS
	Crossbow	178	2.74	0.10	
	Firearm	1005	2.82	0.04	

Finally, two statements were designed to capture some personal factors that might influence hunters preferred weapon type (Table 22). Firearm hunters were most likely to give higher importance to having always used that weapon type, while hunters that prefer crossbows placed the lowest importance on this factor. In contrast, crossbow hunters placed significantly more importance on not being able to use another weapon type for personal reasons including injury or felony conviction.

**Table 22.** Average importance rating personal considerations that may influence choice of most preferred weapon type across hunters. Homogeneous subsets are indicated by superscript letters and cell shading.

	Preferred weapon type	Weighted N	Mean	Std. Error	Sig.
It is what I have always used.	Vertical Bow <sup>b</sup>	385	3.17	0.07	<0.001
	Crossbow <sup>a</sup>	176	1.99	0.10	
	Firearm <sup>c</sup>	990	3.47	0.04	
I am not able to use another weapon type for personal reasons (e.g., strength required, personal injury, or felony conviction)	Vertical Bow <sup>a</sup>	382	1.45	0.05	<0.001
	Crossbow <sup>b</sup>	175	3.05	0.13	
	Firearm <sup>a</sup>	955	1.36	0.03	

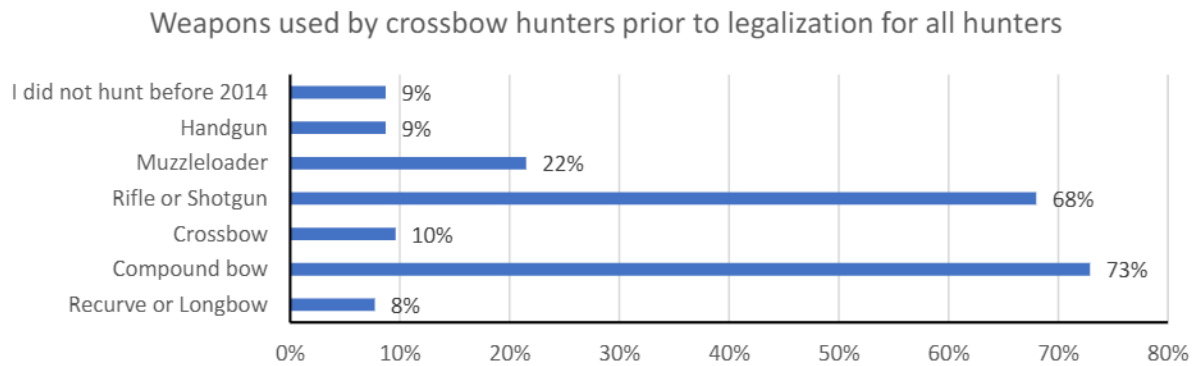
### Hunters Who Prefer Crossbows

Hunters who prefer the crossbow received an additional section of the questionnaire whose aim was to better understand the reasons they use that weapon. Because the analysis of this section is descriptive, and does not involve comparison to the other groups, the data is *presented without weighting* to reflect the proportion of the population who prefers this weapon type relative to other weapon types. This is done to ensure that standard errors reported reflect the true sample size for this group rather than the total sample of the survey.

Most hunters who prefer crossbow, perhaps unsurprisingly, began using this weapon after it was legalized for all hunters in 2014; however, about 16 percent used crossbows prior to 2014 due to either disability or age (Table 23), no different than Dhuey and Rees (2013) found in their survey of bowhunters in 2013. Only nine percent did not hunt prior to 2014, with the majority of the rest having either gun experience, archery experience, or both when the all-inclusive crossbow season began (Figure 11).

**Table 23.** Frequency of years in which hunters first adopted the use of a crossbow.

	Percent
Before 2014	16%
2014	18%
2015	20%
2016	16%
2017	14%
2018	16%



**Figure 11.** Distribution of weapons used to hunt deer in Wisconsin before crossbows became legal for all hunters in 2014.

Hunters who preferred crossbows were asked to rate their level of agreement with nine statements describing possible reasons why they started using a crossbow (Table 24). The majority of crossbow hunters agreed that they started using a crossbow because they wanted to try something new (51%) and because they were not able to use a vertical bow (50%). Hunting during the rut (27%) and not being able to use a firearm (11%) were the reasons that received the least agreement.

**Table 24.** Agreement ratings with statements related to first adoption of crossbow for deer hunting. Calculated means are based on a scale where 1=strongly disagree, 2=somewhat disagree, 3=neither agree nor disagree, 4=somewhat agree, 5=strongly agree. Individuals who expressed “no opinion” were excluded from the calculation of the mean.

	Strongly disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Strongly agree	No opinion
I started using a crossbow because I wanted to try out something new.	19%	8%	18%	29%	22%	4%
I started using a crossbow because I was not able use a vertical bow.	27%	9%	10%	14%	36%	4%
I wanted to be able to hunt earlier in the season.	22%	11%	20%	14%	22%	7%
I started using a crossbow to increase my chances of harvesting a buck.	27%	7%	21%	20%	21%	4%
I thought it would be more exciting to harvest a deer than with other weapon types.	21%	10%	33%	18%	9%	9%
I thought It would be more satisfying to harvest a deer than with other weapon types.	21%	10%	33%	17%	10%	9%
I was not confident that I could successfully harvest a deer using other weapon types.	34%	9%	16%	17%	21%	4%
I started using a crossbow to be able to hunt during the rut.	34%	7%	25%	16%	13%	7%
I started using a crossbow because I was not able to use a firearm.	67%	5%	12%	4%	8%	5%

We then asked crossbow hunters about their continued use of crossbows by asking them to rate their level of agreement with a series of statements outlining various potential reasons to keep using one (Table 25). Most of these hunters agreed that they are more confident that they won't wound a deer when using a crossbow (73%) and that they can successfully harvest a deer with a crossbow (53%). They also agree that they enjoy using a crossbow more than hunting with a firearm (60%). A plurality of crossbow hunters agreed that they enjoy it more than hunting with a vertical bow (44%). A plurality also agreed that they continued to use a crossbow to increase their chance of getting a buck (46%) or to hunt during the rut (37%), although for these statements more than 20% indicated that they neither agreed nor disagreed. While a plurality of crossbow hunters agreed that they continued to use a crossbow because they could not use a vertical bow (45%), a small minority agreed that they used one because they could no longer use a firearm (10%).



**Table 25.** Agreement with statements related to continued use of crossbows for deer hunting. Calculated means are based on a scale where 1=strongly disagree, 2=somewhat disagree, 3=neither agree nor disagree, 4=somewhat agree, 5=strongly agree. Individuals who expressed “no opinion” were excluded from the calculation of the mean.

	Strongly disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Strongly agree	No opinion
I am more confident that I won't wound a deer when I use a crossbow.	7%	6%	12%	30%	45%	3%
I use a crossbow because I enjoy it more than hunting deer with a firearm.	11%	5%	18%	22%	37%	6%
I am more confident that I can successfully harvest a deer using a crossbow than any other weapon type.	16%	11%	18%	28%	25%	3%
I use a crossbow because I enjoy it more than hunting deer with a vertical bow.	17%	10%	23%	18%	27%	7%
I continue to use a crossbow because I have invested in the equipment.	18%	7%	21%	24%	21%	5%
I continue to use a crossbow because I am not able use a vertical bow.	30%	6%	12%	14%	33%	5%
I continue using a crossbow because it increases my chances of harvesting a buck.	25%	6%	21%	27%	19%	3%
I am more likely to kill all the deer that I want during the season if I use a crossbow.	27%	8%	21%	21%	19%	5%
It is more exciting to harvest a deer than with other weapon types.	20%	11%	30%	19%	15%	6%
I continue to use a crossbow because it allows me to hunt the rut.	27%	6%	26%	19%	18%	5%
It is more satisfying to harvest a deer than with other weapon types.	20%	9%	32%	19%	13%	7%
I continue to use a crossbow because I am not able to use a firearm.	64%	4%	14%	2%	8%	8%

## Key Findings

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- *Different weapons are associated with certain strategies for hunting deer, whether it be driving deer, stalking, or sitting stationary. Depending on the weapon used, hunters also choose spots that differ in the distance at which one can see a deer.*
  - *The maximum range at which hunters reported they would take a shot at a deer also differed; but no significant difference was found in the reported maximum ranges for crossbow and archery tackle.*
  - *Archery hunters tend to be more avid deer hunters than are crossbow hunters and gun hunters. Gun hunters tend to be the most casual.*
  - *Gun hunters are the most likely of the three groups to rank venison, camaraderie of hunting buddies, or participating in family tradition as the most important reasons for hunting.*
  - *Archers are the most likely to rank aspects of hunting related to skill, challenge, and solitude as the most important.*
  - *Crossbow hunters are most likely to rank the sense of accomplishment that comes with a successful hunt as the most important reason to hunt.*
  - *When choosing their preferred weapon, crossbows place the least importance on improving their chances of getting a buck. Gun hunters place the most importance on this aspect.*
  - *Half of those who prefer crossbows agreed that they started using a crossbow because they could not use a vertical bow. Only 10 percent agreed they started using a crossbow because they could not use a gun.*
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# STUDY # 4: Review of Crossbow Use in Other States

## Methods

We conducted key informant interviews with staff from state natural resources agencies in 19 states (Figure 12). The interviews typically involved each state’s principal deer biologist or the agency’s wildlife surveys specialist. Informants were questioned about the methodologies and considerations in the establishment of crossbows as a legal weapon in their state, who their crossbow users are, and the effects that the addition of crossbows may have had on the state’s deer herd. Most interviews were performed by telephone and all those who were contacted were asked a series of standardized questions (Appendix D). In a few cases, states shared online resources with reports relevant to the conversation and these are included in the reference section.

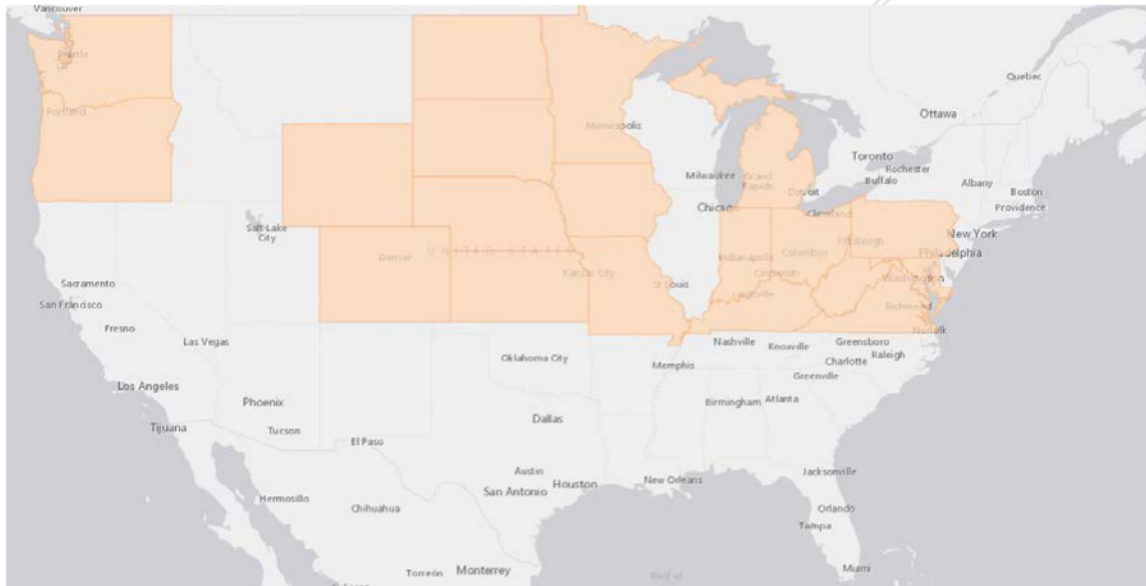


Figure 12. States surveyed regarding crossbow use.

## Crossbow Season Establishment and Changes

The states surveyed had various forms of crossbow use, from full inclusion in the archery season for several decades to those that did not allow crossbows to be used in their state. Initiation of crossbows as a legal weapon in most states started in the state legislature or with the state’s natural resources board or commission that oversees hunting related issues. Indiana and Kentucky were the only states that specified the inclusion of crossbows was initiated by their game and fish departments. Most states interviewed have allowed the use of a crossbow for less than 10 years. Kentucky, Ohio, and Wyoming have allowed crossbow use for 40 or more

years (Table 26). Most informants stated their agencies were crossbow neutral or in favor of the establishment of crossbows for use during the archery season. All states that have allowed crossbows went through public review of their rules prior to implementation of crossbow use. Interviewees mentioned that opposition to legalized crossbow hunting was confined to their states' vertical bowhunters association; none of the states interviewed mentioned any gun hunting groups being opposing the use of crossbows in their states. Proponents were often legislators, commission members, or groups of individuals with no identifiable associations.

**Table 26.** Number of years since allowing some amount of crossbow use during the bow portion of the deer season. Does not include years where physically challenged hunters could obtain permits/permission for use.

5 or less years	6-10 years	11-39 years	40 or more years	Requiring special use permits or forbidden during bow season
Minnesota <sup>1</sup>	Indiana	Maryland	Kentucky	Colorado
Missouri	Iowa <sup>2</sup>	Nebraska	Ohio	North Dakota
West Virginia	Kansas	Pennsylvania	Wyoming	South Dakota
	Michigan	Virginia		Oregon
	Wisconsin			Washington

<sup>1</sup> 60 or older

<sup>2</sup> 70 or older residents, restricted to antlerless only during bow season

Informants in states that did not allow crossbow use, or only allowed their use with a special permit, stated various reasons for not allowing all hunters to use them. Colorado does not consider them to be primitive weapons and restricts their use to the gun season. North Dakota and South Dakota have seen increases in archery hunters and harvest in recent years, particularly for mule deer, and are concerned about perceived overcrowding on public land and the effects on the number of gun licenses that can be issued as reasons for not allowing all to use crossbows. Washington and Oregon staff stated that concerns of archery user groups and lack of support for crossbows as reasons for not allowing crossbow use by all hunters.

Like Wisconsin, most states that allow the use of crossbows allow them to be used statewide during the entire bow season. Only Michigan (crossbows are not allowed for all users during the late bow season in the Upper Peninsula) and Virginia (four counties are archery only, no guns or crossbows) had areas where crossbow use was restricted differently than in other areas of the state.

Specific to user restrictions, Iowa (age 70 or older) and Minnesota (age 60 and older) have an age restriction on crossbow use, with Iowan crossbow users also being restricted to residents harvesting antlerless deer during the bow season. Kentucky limits crossbow use to disabled

hunters, those age 15 or younger, and those with a special use permit for the first two weeks of the bow season, but otherwise crossbow use is allowed for the remainder of the bow season.

For the states that allow crossbow use for all hunters, all states allowed the taking of antlered and antlerless deer with appropriate authorizations. No state surveyed has ever made any changes to crossbow use that has made their legal period shorter or more restrictive. All states have either made no changes to the original rule or expanded the use of crossbows (Table 27).

**Table 27.** Changes to crossbow seasons in states that allow crossbow use without a special permit.

State	Changes Since Inception
Indiana	None
Iowa	None
Kansas	No changes, all archery equipment is tied together, and change would affect both. No changes proposed.
Kentucky	Expanded -- 2006-2018: October 1 through the third weekend of October then again after gun season until Dec. 31. Expanded -- 2019: expanded to third Sat in Sept. through MLK day (added 47 days) still 2 weeks shorter than archery season
Maryland	Less restrictive -- 4 weeks in urban archery zone, then full inclusion in urban archery zones, then full inclusion statewide
Michigan	First years required hunters to get a free crossbow stamp from the Michigan DNR before crossbow hunting, this requirement was removed 3-5 years later.
Minnesota	None
Missouri	None
Nebraska	Changes to weapon specifications
Ohio	Less restrictive -- 2 weeks at the end of the archery season at the start, full inclusion in 1982.
Pennsylvania	None
Virginia	Separate licenses for archery and crossbow from 2005 through 2014. Dropped after 2014, deemed unnecessary
West Virginia	None
Wyoming	Changes to weapon specifications

## ***Hunter Demographics and License Sales***

No states that we contacted had analyzed “where their crossbow hunters came from,” but it was the perception of those interviewed that crossbow participants were not new to hunting. Instead, informants believed that crossbow users were primarily archery and/or gun hunters adding weapon(s) used or switching their preference of weapon choice. Participation of hunters using crossbows has been on the rise in states that have allowed their use—with Michigan, Ohio, Pennsylvania, Virginia, and West Virginia stating that crossbow users made up about 50 percent or more of their bow hunters or harvest. Most states have not determined if the addition of crossbows had any influence on their state’s overall deer license sales. Indiana and Kansas were the only two states that mentioned that crossbows may have caused an increase in license sales but did not have license sales data readily available. The interviewee from Ohio strongly believed that the addition of crossbows has slowed the loss of hunters since their inclusion as a legal weapon. Most other states mentioned that deer license sales have been on a long-term decline or did not have specific data on the effect of crossbows on license sales. Many states do not sell season- or weapon-specific licenses, but instead sell a permit for the harvest of an antlered and/or antlerless deer which is then valid for whatever weapon type is legal at that time of the year. Because of this fact, it made it impossible to measure any effects that crossbows may have had on overall license sales or a hunter’s willingness to purchase multiple licenses in these states.

## ***Crossbow Success Rates***

Many states either do not monitor hunter success rates by weapon type or have not collected the harvest or license sales information that would allow them to do so. There were a few states that we surveyed that did have recent data on weapon specific success, they were Ohio, Maryland, and Missouri. These three states showed similar results to Wisconsin with crossbows having higher success rates than archers (Table 28). Michigan too had shown that crossbow hunters were more successful than archery hunters during the early years of their crossbow season establishment (Frawley and Rudolph 2013). Michigan no longer collects that information and had no recent data (recent rule changes make comparisons to previous data unacceptable). The only state that tries to allocate harvest numbers proportionally is Washington, where they review and adjust season lengths every three years to balance the overall harvest percentages among weapon types with license sales.



**Table 28.** Success rates for all deer types by bow and crossbow.

State	Year	Bow Success Rate	Crossbow Success Rate	Difference (Crossbow-Vertical)
Ohio	2012-13	21.1	18.8	-2.3
Ohio	2015-16	19.6	21.7	2.1
Ohio	2018-19	21.3	28.1	6.8
Maryland <sup>1</sup>	2016-17	24.4	32.2	7.8
Missouri <sup>2</sup>	2016	31.8	34.4	2.6
Missouri <sup>2</sup>	2017	31.0	36.0	5.0
Wisconsin <sup>3</sup>	2014	23.0	29.9	6.9
Wisconsin <sup>3</sup>	2015	23.9	30.4	6.5
Wisconsin <sup>3</sup>	2016	23.6	32.0	8.4
Wisconsin <sup>3</sup>	2017	23.4	33.3	10.2
Wisconsin <sup>3</sup>	2018	22.5	30.9	8.4

<sup>1</sup>Antlered deer success rate

<sup>2</sup>Compound bows only

<sup>3</sup>Excludes Conservation Patron and upgrade license holders

Most states surveyed thought that there was little impact on established seasons and/or traditions with the addition of crossbows as a legal weapon (Table 29). All states with all-inclusive crossbow seasons said that “hunters’ willingness to bag deer” was unaffected by the inclusion of crossbows.

### **Biological Impacts**

Parsing out the impacts of the addition of crossbows on the total deer harvest in states that allow the use of crossbows is difficult. While some states did mention the addition of crossbows may have increased deer harvest, it was difficult to determine if the addition of crossbows was the sole cause. Annual fluctuations in deer and hunter numbers, permit levels, environmental and weather conditions were also mentioned as having potential for explaining changes in harvest levels. In general, states felt that the addition of crossbows had only a minor affect or “none at all” on the overall deer harvest. No state mentioned having a large change in deer harvest that could be attributed to crossbows in either a positive or negative way.

Crossbows’ effect on buck harvest was also not clear as many states sell permit(s) for the harvest of antlered deer but are not tied to a specific weapon type. No interviewee mentioned any measurable changes in the statewide buck harvest pre- and post-implementation of the legal use of crossbows during archery season. The same could be said for the timing of the buck harvest. While not all states that allowed the use of crossbows could measure the timing of the buck harvest, none mentioned that the timing of the buck harvest was causing concern with their gun hunters. But unlike Wisconsin, some states are a “one-buck” state or allow the use of

guns during some portion of the rut. States surveyed had varying amounts of antlered deer harvest allowed per hunter per year. Most states collected information about the age structure of animals harvested only during the gun season to maximize workforce efficiencies, so there is little data on age at harvest for either vertical or crossbow hunters. Most states said the addition of crossbows did not have any measurable biological impact on the state's deer herd. Staff from Indiana and Maryland both mentioned that crossbow harvest had a positive impact in that it allowed hunters to control deer in areas where gun discharge may be restricted.

**Table 29.** *Suggested impacts of crossbows on established traditions and or seasons.*

State	Traditions
Colorado	NA
Indiana	Older hunters who may have been opposed to crossbows, switched to crossbows when they became legal. Allows hunters who didn't like to hunt with a gun to be able to use crossbows to stay in deer hunting
Iowa	None
Kansas	Somewhat -- people that were only rifle hunters before may have switched to crossbows to be able to hunt a longer season. This may have affected "opening day" culture for gun hunters.
Kentucky	Very little impact -- it has grown slowly, no sharp jumps in harvest, can't measure as effects as there is no separate license.
Maryland	No measurable effects. Long term shift from guns to bow hunting especially in urban zones. Made bow discharge and set-back rules less restrictive to increase deer kill in urban areas
Michigan	More deer killed in bow season with crossbow than vertical bow, shift in weapon preference from vertical to crossbow.
Minnesota	None
Missouri	None
Nebraska	None
North Dakota	NA
Ohio	Did not add a season just an additional tool. Divided hunters in the state at first, now accepted tool by Ohio Bowhunters Association.
Oregon	NA
Pennsylvania	May be fewer hunters hunting in buck-only portion of the gun season as more people may have used buck tag in the bow season. Hard to measure.
South Dakota	NA
Virginia	More people are hunting deer in October than were before the inclusion.
Washington	NA
West Virginia	No impacts
Wyoming	No impacts

## ***Wounding Loss***

Three states surveyed had recent information on wounding rates and shot distances by vertical bow and crossbow users. A 2016 archery deer hunter survey in Missouri found that compound bow users hit a deer and failed to recover it 12 percent of the time, while crossbow users had a failed to recover rate of nine percent. Similarly, Missouri compound users reported missing a deer on 23 percent of their shots, while crossbow users missed 20 percent of their shots (Keller et al. 2018).

A survey of bow deer hunters in Ohio from the 2014-15 deer season showed a wounding rate of 19 percent and a miss rate of 31 percent for compound users, while crossbow users had a wounding rate of 19 percent and miss rate of 26 percent. Ohio additionally showed little difference in hunters hit rate on deer for both compound bow and crossbow users as the distance of their shots increased (Ohio Department of Natural Resources Division of Wildlife).

Wisconsin's survey of bow hunters in 2017 showed similar results to other states. We found one in 10 bow hunters admitted to wounding a deer—the same rate among both crossbow and compound users. Of hunters that took a shot at a deer during the season, again there was no difference in the values reported by compound bows or crossbows. Both users averaged 1.4 shots per season.

Research in Iowa from 1976-1979, during the early stages of compound bow use by hunters in that state, showed a crippling rate that varied between 13 and 17 percent over the four-year period. Hunters that used traditional archery equipment (recurves) had a crippling rate of 10-15 percent over the same time (Gladfelter et al. 1983). While compound bow use and technology have certainly expanded since this research was conducted. These data may give some historical perspective on wounding rates of compound bow users during the early years of expanded use.

Respondents to the 2018-2019 "Indiana After Hunt Survey" were asked to select a category of distances that best reflected the maximum range they would expect to kill a deer (either buck or doe) with one shot. Crossbows and compound bows fell into similar categories with maximum range being from 30 to 50 yards for over 93 percent of respondents. No respondents for either compound bow or crossbow mentioned 100 yards as a maximum distance (Caudell, personal communication).

## ***State-Specific Questions***

**Iowa:** Increasing requests by hunters to allow the use of crossbows in Iowa led the state to allow the use of crossbows for all resident hunters for the appropriate deer type they are permitted for during the late muzzleloader portion of the deer season. They also allowed the use of crossbows for residents 70 years or older during the bow portion of the season but restrict these hunters to antlerless deer. This was part of a larger weapon use liberalization for

deer hunters in Iowa in 2013. Public response from Iowa hunters suggested this was an appropriate use of crossbows in the state.

**Maryland:** There have been two wounding rate studies conducted at the Naval Support Facility, Indian Head, MD. The two studies comparing compound bows to crossbows were performed from 1989 to 2012 and authored by M. Andy Pedersen, senior engineer, Research and Development Department, Naval Explosive Ordnance Disposal Technology Division. He found no statistical difference in the users wounding rates of hunters at the Naval facility between weapon types; both having a wounding rate of 18 percent. Experience did make a difference in that hunters that had harvested the most deer had a lower wounding rate than hunters who had killed fewer deer (Pedersen et al. 2008). The second study looked at the use of fixed and mechanical broadheads in both weapon types. They found that the use of mechanical broadheads improved the deer recovery rates for both compound bow and crossbow users over their counterparts who used fixed blade broadheads (Pedersen et al. 2014).

**Minnesota:** In February 2018, members of the Minnesota Deer Hunters Association (MDHA) rejected a resolution calling for liberalized crossbow usage, including full access to the traditional archery season. The MDHA president offered the opinion that archers in Minnesota want to preserve their traditions of heavy preparation and relative seclusion in the woods. The heart of the archery season precedes the opening of the gun season. The vote may have been influenced by gun hunters who said too many bucks would be taken during the bow season if crossbow users were allowed to join. This was only brought forward and voted on by members of MDHA. This was not voted on by all of Minnesota's deer hunters nor brought forward by the Minnesota DNR. <http://www.startribune.com/deer-hunters-group-against-expanded-crossbow-season/475348873/>

**Michigan:** Crossbows are a legal weapon for all users statewide during the early portion of the bow season from October 1–November 14 and the gun deer season. The bow season resumes on December 1 and goes until January 1. During this late season, crossbow use in the Upper Peninsula is restricted to those that are disabled and hold a crossbow permit or special permit. This was part of the original rule package that allowed all hunters to use a crossbow in Michigan. This caveat was to address concerns from Upper Peninsula hunters to the Michigan Natural Resources Commission on what they believed were going to be substantial impacts on the deer herd during the late season. The Michigan DNR's deer management program staff do not have evidence to suggest this impact will occur. In 2014, Michigan changed license systems from customers purchasing a weapon-specific license to an animal-specific license. Michigan has had an overall decrease in license sales; however, it is difficult to determine the effect of weapon use on this decline.

**Kentucky:** Kentucky's early crossbow seasons were 10 to 11 days in length. They have only expanded crossbow opportunities in the state since, with the most recent changes occurring in 2019 when they moved up the starting date to the third Saturday in September (two weeks after the start of the archery season) and the season runs continuously to the end of archery

season (added 47 days). Hunters age 15 and younger may hunt the entire length of the bow season with a crossbow. The change was in response to hunter demand for expanded crossbow opportunities and little past or expected impact on the deer resource.

<https://kentucky.gov/Pages/Activity-stream.aspx?n=FishandWildlife&prId=399>

**Ohio:** The Ohio DNR deer management program administrator commented that “the addition of crossbows has helped sustain deer license sales in the state of Ohio. They have been a life preserver as we plug the hole in the license sales boat, they have only helped.” Most deer hunters in Ohio hunt with multiple weapon types: vertical bows, crossbows, and guns.

**Wyoming:** In 2017, the Wyoming Game and Fish Department produced *Exploring New Technologies for Hunting* (Kerr et al. 2017). This document was an analysis of the history of fair chase hunting and traditional hunting ethics in North America, a framework for examining certain technologies and where they fit into the spectrum of hunting tools, techniques, and tactics. In this white paper, they attempt to define fair chase parameters and make several recommendations for changes to deer hunting rules and lawful practices in Wyoming, one of which is to eliminate the use of crossbows during the bow season. This report was submitted to the Wyoming Game and Fish Commission for their consideration. The Wyoming Game and Fish Commission is currently not moving forward with any recommendations that affect crossbow use. <https://drive.google.com/drive/folders/1mKoC85I4OTPVWXbpj9JNCT8z0BJoNdYe>

## Key Findings

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- *Most states that allow crossbow use allow it statewide during the entire bow season.*
  - *States that did not allow crossbow use for all bow hunters, restricted their use because of concerns for crowding, overharvest, or appropriate weapon classification.*
  - *Most states' crossbow laws were initiated in their legislature or by their natural resources board or commission.*
  - *Opponents of crossbows have commonly been the states' organizations representing vertical bow hunting.*
  - *No state interviewed that allowed crossbow use has shortened its season or restricted crossbow use from the original law.*
  - *Crossbow use typically increased over the initial year then leveled off sometime in the future.*
  - *Few states measure weapon specific success rates. States that did showed higher success rates for crossbow users than archery users.*
  - *No states attempt to balance success rates by weapon type.*
  - *The addition of crossbows showed little impact on established seasons/traditions or hunters' willingness to bag deer.*
  - *Crossbows did not cause any change in total deer harvest*
  - *The addition of crossbow did not have any measurable biological impact on the states' deer herds.*
  - *In the states that measured deer wounding and/or hit rates, there was little difference between vertical bow and crossbow users.*
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# STUDY # 5: Review of Crossbow Technology and Safety

## ***Advances in Technology***

Internet research for reports on bow technology development over time revealed few useful summaries related to crossbow technology changes since 2014. Each year, however, many reputable outdoor recreation websites release comparative make and model reviews for newly released bows. For these reviews, manufacturers are invited to submit new models and bows are reviewed for speed, power (kinetic energy), accuracy, and handling. Both *Outdoor Life* and *Field and Stream* have used similar methods for evaluating and comparing bow models. We were able to use the reviews available at OutdoorLife.com and FieldandStream.com to evaluate changes in bows by comparing the measured metrics for bows released in 2014 against those for top makes and models released in 2019. For newly released 2019 models, manufacturer specifications were used when reviews were unavailable. We asked the Archery Trade Association to peer-review our work and their review confirmed the findings of our analysis. A synthesis of our comparisons follows.

## ***Crossbow Technology***

Comparisons of the top identified crossbows from 2014 and 2019 demonstrate that length and weight of crossbows has remained similar.

- Top models from 2014 range in length from 19.9 to 36.25 inches and weight between 6.2 and 8.4 lbs. without accessories.
- Top new models for 2019 range from 26 to 36 inches long, with some models now containing an adjustable stock option that provides a 2- to 3-inch length buffer, and weigh between 6.5 and 8 lbs. without accessories.

While power stroke (draw length in a vertical bow) has remained similar between 2014 and 2019 models, reverse limb designs and new construction materials have allowed for increases in draw weight and decreases in axle-to-axle width when fully cocked.

- Top 2014 crossbow models ranged in draw weight from 125 to 290 lbs. with most falling between 160 and 185 lbs. These models, when fully cocked, have an axle-to-axle width between 13.25 and 21.5 inches.
- New 2019 crossbow models range in draw weight from 185 to 340 lbs. Some new crossbows with exceptionally high draw weights, now have fully integrated (i.e. non-accessory) cocking systems that reduce draw weight down to 12 to 14 lbs. Some new 2019 model crossbows also have axle-to-axle widths as low as 5.75 to 9 inches when drawn.



Related to draw weight, new crossbow models have also seen an increase in arrow speed and force in ft.-lbs. kinetic energy (KE). Arrow speed and force vary depending on arrow weight used and advertised or reviewed speeds are typically the fastest potential for the bow with a light weight (350-400 grain) bolt that may not be suitable for all hunting applications.

- Using factory provided bolts, top new models from 2014 reached top speeds between 350 and 410 feet per second (fps.). At 20 yards, these bolts had peak forces ranging from 89.9 to 137.4 ft.-lbs. KE.
- New models releasing in 2019 have advertised top speeds between 370 and 480 fps. and the corresponding force of these bolts at point blank distance ranges from 130.6 to 191 ft.-lbs. KE.

Other recent crossbow innovations that impact accuracy are more difficult to measure since they are subject to user skill, to a degree. These include weight distribution away from the nose of the crossbow, more comfortable handling and firing (e.g., smoother trigger pull), and string technology that reduces vibration. For a skilled shooter these updates coupled with increased power have the potential to increase accurate shooting distances.

### ***Compound Bow Technology***

In addition to reviewing new crossbows each year, both *Outdoor Life* and *Field and Stream* completed thorough reviews of top new compound bows released in 2014 and 2019.

Typical length and weight of compound bows does not appear to have changed substantially since 2014.

- Top new models in 2014 ranged from 28 to 34.75 inches axle-to-axle and weighed between 3.8 and 4.5 lbs.
- Top new models in 2019 range in length from 30 to 33 inches and weigh between 3.9 and 4.6 lbs.

Top speeds advertised for new compound bows in 2014 and 2019 have also remained similar.

- New top compound bow models in 2014 advertised arrow speeds between 273 and 360 fps., depending on model and arrow weight.
- New top models in 2019 advertise top arrow speeds between 332 and 364 fps.

## ***Crossbow Safety***

Crossbows, like other weapons, deserve respect and attention to safety when handling. In Wisconsin there have been two hunting accidents reported, including one fatality. Both were self-inflicted. The Wisconsin hunter safety program does not include archery/crossbow content; however, crossbow use is covered in the bow hunting education course, and crossbow safety content has increased since 2014.

Another area of interest is the inclusion of air bows in the crossbow season. Air bows are currently legal in Wisconsin for small game, but not for wild turkeys, deer, black bear, or elk. Inclusion of air bows for deer in the crossbow season could be considered and warrants further discussion.

## ***Key Findings***

- *Innovation in the materials used to make crossbows as well as the overall structure and cocking systems have made crossbows easier to use, more powerful, and more accurate. There are, however, substantial differences between manufacturers as it relates to the tradeoffs between overall size, ease of cocking, power, and accuracy of a crossbow. Taking full advantage of these features is subject to user skill, to a degree.*
- *Since 2014 compound bows have not seen substantial changes in length, weight, or top advertised arrow speeds.*

## **STUDY # 6: Perceptions of Business Owners of Retail Impacts of Crossbows**

### ***Business Implications***

This section summarizes major themes that arose during interviews of Wisconsin archery and crossbow retailers. The interviews allowed us to gather insights from retailers regarding business changes and sales trends observed since 2014. The retailer interviews, used in conjunction with the previously summarized research activities, help inform ongoing discussions about how the authorization of crossbow use has affected deer hunting.

### ***Interview Process***

To ensure the business contacts were as comprehensive as possible, we identified four categories of businesses based on company size: large/national outdoor-based companies, large department stores that carry sporting goods, local hardware stores/sporting goods stores, and local archery shops. Additionally, we split the state into six regions (southwest, east, central, west, northeast, and northwest) to ensure business contacts were spread across Wisconsin. We contacted at least one business in each category in each region. In total, 29 businesses were contacted (five outdoor-based companies, six department stores, eight hardware/sporting goods stores, and 10 archery shops). Seventeen retailers responded to the request to interview, 10 of which were ultimately willing to participate in telephone interviews that followed a standardized line of questioning (Appendix E). None of the large department stores nor any of the hardware stores were interested in being interviewed.

Despite contacting a wide-range of archery and crossbow retailers across the state of Wisconsin, these interviews only captured insights from 10 businesses and should not be assumed to be comprehensive of all viewpoints for hunting gear retailers. Additionally, we made every effort to evaluate changes on deer-hunting business, but customers may purchase crossbows or archery tackle for uses other than deer hunting. The following summary of findings should only be considered as a general glimpse into how the full inclusion of the crossbow may be affecting archery and crossbow retailers. What follows is a summary of the major 'take-aways' or broader themes that emerged during the conversations with the 10 retailers interviewed.

### ***Observed Business Changes since 2014***

All Wisconsin businesses interviewed reported that the full inclusion of crossbows into the bow season has been good for business in general because the versatility and the user-friendliness of the crossbow has attracted new groups of people into their businesses and into deer hunting. The audiences noted as most interested in using crossbows were youth, women, and men who are new to hunting during the archery/crossbow season.

Other than an overall increase in crossbow sales, the “biggest boost” from the regulation change in 2014 has been the crossbow repair business. Crossbows have more power than a compound bow and hunters tend to maintain their crossbows less than a vertical bow—leading to the crossbows becoming worn out and breaking more often. Many archery shops reported still having multiple crossbows hanging on the wall waiting to be repaired.

Although crossbows have led to more customers in-store and a thriving crossbow repair business, one business owner also reported that crossbows “killed the used bow market.” Before 2014, archers would upgrade their bows and pass the used bows down to new hunters interested in getting into deer hunting during the archery season. Now, those new hunters just start out using a crossbow. Once introduced to a crossbow, some hunters (mostly women) tend to stick with the weapon, while others convert to a compound bow for the additional challenge of shooting once their skills and strength evolve. Two business owners believed that five years is not long enough to tell if hunters—specifically youth hunters—will switch to a compound bow if first introduced to bow hunting with a crossbow.

### ***Compound Bow Sales Trends since 2014***

Five of the 10 businesses reported no change in their compound bow sales, mainly citing that most hunters remain using a compound bow unless they encounter a physical reason to switch—such as if their shoulder “just can’t take it anymore.” All the stores interviewed reported that the customer demographic for compound bow sales has remained unchanged since 2014 and is comprised mostly of 20- to 40-year old men, but a significant following of women and youth hunters also opt for a compound bow. Additionally, businesses reported that many hunters will use both a compound bow and a crossbow. Many hunters opt to use a compound bow for target practice or for casual shooting, and only use their crossbow when hunting to ensure confidence in a killing shot. Some hunters continue to use a compound bow when hunting from a tree stand but use a crossbow if hunting from the ground or from a blind. If the hunter uses both a compound bow and a crossbow to deer hunt during the same time period, the crossbow may be the preferred weapon if the weather is cold and extra clothing layers affect the hunter’s ability to draw back the compound bow. One business owner likened the crossbow to when rifles could be used statewide in the Wisconsin gun-deer season in addition to the use of shotguns by saying crossbows are “just another tool.”

In contrast to those who reported no change, five other businesses reported a decrease in compound bow sales since 2014, a decrease mostly attributed to more youth hunters using a crossbow. According to these businesses, more youth crossbow sales translates into fewer compound bow sales. Because compound bows must be fitted to the individual and adjusted as the child grows, parents were purchasing a new compound bow about every four years. Now, one crossbow can be used by the entire family and replacement bows do not need to be purchased as the hunter grows in height or in strength. The reduction in the hunting age limit

may exacerbate this situation as young hunters come into the sport when they do not have enough strength to be successful using a compound bow.

### ***Crossbow Sales Trends since 2014***

All businesses reported an initial boom in crossbow sales during the first one to two years after the regulation change in 2014. More recently, crossbow sales have leveled out/stabilized. One business reported a decrease in crossbow sales in the last year, believing the drop is due to hunters not needing to update their crossbows as often as compound bows (because compound bows are fitted to individuals). This retailer also believes everyone already switched to a crossbow if they were interested. He suggests crossbow sales will be a “big letdown in the future,” but that his business’ compound bow sales to 20- to 40-year old men were still strong. The other nine businesses reported their crossbow sales are now either equal to or exceed compound bow sales. The versatility and user-friendliness of the crossbow leads to its popularity. Customers that gravitate towards crossbows tend to be youth, women, and men who are new to the bow season. Many business owners believe that including more women and youth in deer hunting has “revitalized Wisconsin’s hunting heritage.” But even “die-hard archers using compound bows who said they’d never switch to crossbows are switching” after encountering an injury or a decline in physical strength that prevents them from being successful with a compound bow. Most compound bow users tend to stick with the vertical bow unless they encounter a physical reason to switch, but one business owner said hunters who have been unsuccessful or have wounded one or more deer with a compound bow are deciding to switch to a crossbow—a switch that may ultimately lead to more hunter satisfaction through lower wounding rates.

Three businesses also mentioned that a few gun-only hunters have purchased a crossbow. These businesses do not feel that many gun hunters are completely lapsing from the gun-deer season, but that these hunters are instead using crossbows to be able to participate in both deer hunting seasons for the first time in their hunting careers.

Businesses reported the popularity of the crossbow with parents because the full inclusion of the crossbow now facilitates kids participating in the bow season with their parent(s). Since younger kids and teenagers can now actively participate in the bow season with their family members, business owners believe more youth are becoming involved in deer hunting which is ultimately beneficial for new hunter recruitment. A business owner also involved in mentoring youth hunts mentioned that shotguns and rifles have too much recoil for many young kids, and crossbows enable youth to get involved in hunting without experiencing unpleasant recoil or having to meet certain physical strength requirements to operate the weapon. Additionally, crossbows offer the versatility that some families or hunting groups need in order to continue hunting by decreasing the overall cost of equipment. Outfitting an entire family or hunting group with proper equipment can be expensive, and there are added costs if each bow needs to regularly be upgraded as the hunter grows physically. In contrast, one crossbow can be

purchased and used by the whole family or can be used by several members of the same hunting group. Specifically, one business owner said crossbows are purchased by hunting groups traveling out of state because one crossbow can be shared by all members in the event that a bow breaks while participating in the hunt.

In addition to crossbows opening the field to people that didn't have the physical strength to use a compound bow, a handful of business owners attributed the weapon's popularity to an overall generational switch and that overall, allowing crossbows to be used by all deer hunters during the bow season may lead to more hunter recruitment. Specifically, one business owner said, "We hear of attention spans getting shorter and shorter and that applies to hunting, too." He said, "Kids don't care what type of weapon they're using as long as they feel confident with it." Another store owner echoed this observation by saying that hunters are aging out of the sport, and that crossbows help recruit new hunters because crossbows are "easier to get into." Crossbows require less time and practice and are more forgiving than compound bows. Crossbow use has especially increased with youth hunters. A different business owner said, "Dads that vertical bow hunt will purchase a crossbow for their kid to use." Then the parents will monitor their kid until he or she develops the strength and skill level to begin using a compound bow. This specific business owner believed that hunters introduced first to crossbows would ultimately switch to compound bows for more of a challenge if their bow skills developed to that stage. Additionally, more women can hunt during the bow season through the use of crossbows. More participation from women may lead to more people being introduced to the sport through those women hunting with their spouses and children. A business owner said that "crossbows have twice the power and may be half the challenge [compared to archery tackle], but if that is what is needed to get more people out into the woods, then crossbows are a good thing."

### ***Additional Comments from Retailers***

Retailers shared a variety of perspectives and offered thoughts on a range of tangential topics. Most businesses agreed that crossbows have attracted new customers into their business and into deer hunting, but a few remain unsure about the future of deer hunting with the full inclusion of the crossbow into the archery-deer season. One business owner believed youth hunters should learn how to shoot using a vertical bow first because he believes shooting with a vertical bow creates a more skilled hunter. Other business owners shared concerns that youth hunters especially may stick with a crossbow if it is the first bow they are introduced to. These owners are concerned about the future sales of compound bows if young hunters continue to use crossbows. But two business owners also mentioned that since the crossbow regulation changed in 2014, it is still too early to know if hunters introduced to the crossbow will ultimately switch to a compound bow.

## Key Findings

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- *Retailers reported that the full inclusion of crossbows into the bow season has been good for business. Five of the 10 businesses reported no change in their compound bow sales.*
  - *All the stores interviewed reported that the customer demographic for compound bow sales has remained unchanged since 2014.*
  - *The audiences noted as most interested in using crossbows were youth, women, and men who are new to bow hunting.*
  - *Other than crossbow sales, the biggest revenue boost has come through crossbow repairs.*
  - *The used compound bow market may be suffering because new hunters are starting with a crossbow; crossbow hunters update their equipment less frequently than hunters using compound bows.*
  - *It is too early to determine if hunters that start with a crossbow will eventually change to use a compound bow with more experience.*
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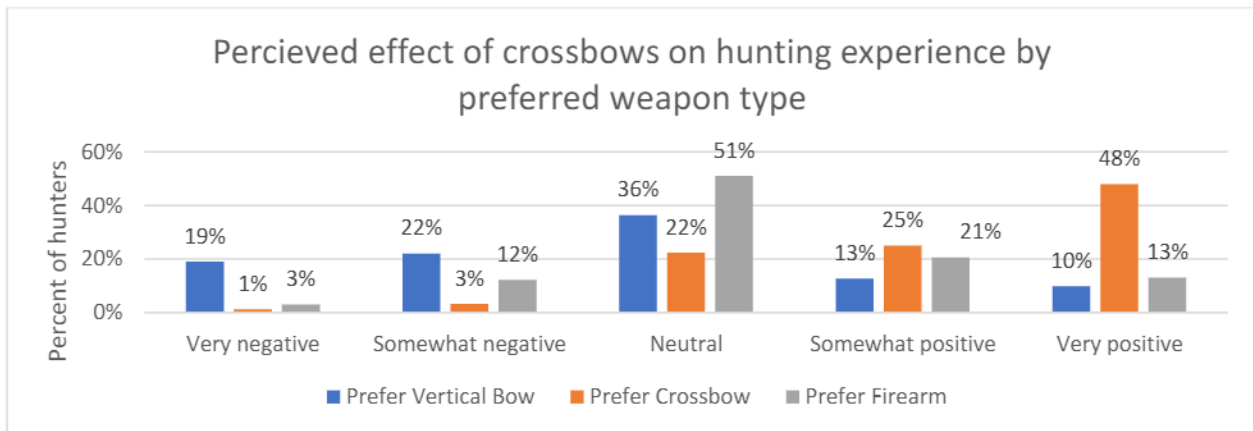


# DISCUSSION # 1: Deer Hunter Attitudes about an All-inclusive Crossbow Season

The following data were gathered from the Hunter Motivation and Lapsed Gun Hunter surveys described previously (Studies #2 and #3).

## The Effect of Making Crossbows Legal on Hunting Experiences

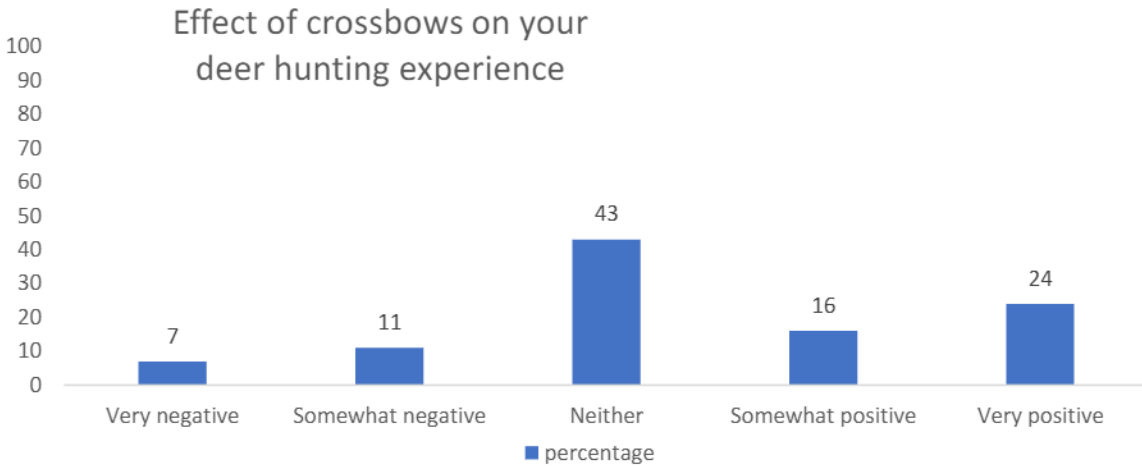
When asked their opinion on the effect of making crossbows legal for all hunters on their hunting experience (Figure 13), hunters who prefer crossbow, not surprisingly, were overwhelmingly positive (73%), with most of the remaining crossbow hunters expressing a neutral opinion on this statement (22%) and a small minority (5%) expressing a negative opinion. Firearm preferring hunters were much more neutral (51%) with a larger minority expressing a positive opinion (34%) than a negative one (15%). Vertical bow preferring hunters held the most negative opinion of crossbows (41%), with only 23% rating the overall influence as positive.



**Figure 13.** The effect of making crossbows available to all hunters under the current season structure on your deer hunting experience

## Attitudes toward Crossbows among Lapsed Gun Deer Hunters

We asked lapsed gun hunters what effect, if any, the legalization of crossbows for everyone had on their deer hunting experience. Most respondents told us the effect on them was neither positive nor negative (Figure 14). Overall, a higher percentage of lapsed gun hunters were positive (40%) about crossbow than were negative (18%). The distribution of this general measure of attitudes mirrors what we heard during focus group testing.



**Figure 14.** Effect of crossbow on your deer hunting experience among lapsed gun hunters.

As can be expected, one’s evaluation of the impact of crossbows on personal deer hunting experience differed significantly depending on types of weapons that an individual had previously used (Table 30). Those who had only used a gun to hunt deer in the previous five years were mostly neutral (48%) and positive (40%). Lapsed gun hunters who also used vertical bows (and not crossbows) in the previous 5 years were a little more divided: most were neutral (38%), 32 percent said they had positive impacts and 29 percent rated crossbows negatively. Finally, those who had hunted with crossbows were very positive about the impact the legalization of the weapon had on their deer hunting experience.

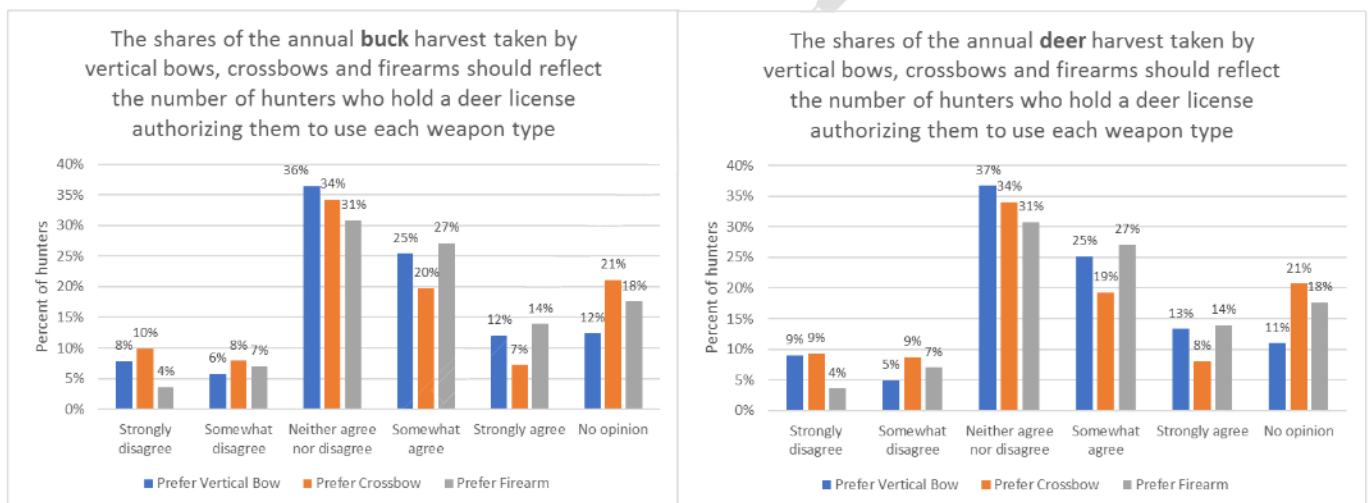
**Table 30.** A comparison in attitude toward crossbow legalization based on participation by weapon type.

By License Type Held in Past 5 Seasons	% Who Responded...					X <sup>2</sup>
	Very negative	Somewhat negative	Neither	Somewhat positive	Very positive	
Gun only	5	7	48	16	24	
Gun and Archery	12	17	39	16	16	X <sup>2</sup> =186.9
Gun and Crossbow	3	4	18	14	63	Sig=0.001

Attitudes about crossbow impact on deer hunting were not statistically different between genders or among age categories of respondents.

### Allocating Deer Harvest by Weapon Type

Two questions in the survey touched on the topic of fairness by asking hunters to rate their agreement that the shares of the annual buck harvest (or total deer harvest) taken by archers, crossbows and guns should reflect the number of hunters who hold a deer license authorizing them to use each weapon type (Figure 15). Overall, among all three groups, mean agreement tended to skew towards agreeing with these statements, although crossbow users had significantly lower mean agreement rating than did both other groups for total deer harvest and archery hunters for buck harvest. Nearly half of each group, however expressed either no opinion or a neutral opinion on these questions, with less than half of all hunters expressing agreement. Interestingly, hunters did not differentiate between buck harvest and overall harvest.



**Figure 15.** Attitudes among hunters that the shares of the annual harvest taken by archers, crossbows and guns should reflect the number of hunters who hold a deer license authorizing them to use each weapon type based on weapon type preference.

## **Key Findings**

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- *Those who prefer crossbow overwhelming rate the effect of making the weapon legal for all as having a positive effect on their hunting experience. Gun hunters tended to be more indifferent, however, with a slight skew to the positive. Archery hunters skewed slightly more negative.*
  - *All three groups tended to agree that the shares of annual deer harvests taken by archery, crossbows, and guns should reflect the number of hunters who hold a deer license authorizing them to use each weapon type.*
-

## DISCUSSION # 2: Crossbow Season and Redistributing Buck Harvest

### *License and Season Simplification*

The NRB asked if the current system of multiple licenses and upgrades is confusing and if there are opportunities to simplify it while giving all deer hunters a similar outdoor experience. Available data from surveys conducted for this report, as well as a large body of literature, strongly suggest that deer hunters are seeking varied experiences, not the same experience, from their time spent in the woods. For example, one hunter may be purely motivated to get venison for the freezer and another may be purely motivated to harvest a big buck. The second hunter type may pass up multiple opportunities to shoot a deer, while the first takes the first shot available to him or her. If we assume that these two types comprise the same number of hunters, at the end of the season, the meat hunters will appear to be more successful at getting a deer, even though the trophy hunters had just as many opportunities (or possibly more) to get a deer—they just passed them up in hopes of a bigger buck. On the other hand, the trophy hunters may appear more successful in the buck harvest, but the buck harvest may not be relevant to the meat hunter. So, measuring success at providing a “similar outdoor experience” for all deer hunters is difficult and varies with hunter motivations.

Further, previous research in Wisconsin has determined that most hunters want one or two deer a year for personal consumption (Holsman and Petchenik 2006). Dual season hunters who fill their freezer during archery season—regardless of weapon type—may be less motivated to fill an additional gun tag thus “voluntarily” reducing the average success rate among gun hunters. We do not have data available to quantify the extent to which hunter effort and selectivity are influencing harvest trends, but we believe they are important factors and likely different in different seasons.

The current license system allows hunters to purchase an archery or crossbow license and the option to purchase a \$3.00 upgrade to also use the weapon (archery or crossbow) not identified in the primary license purchase. If the upgrade is purchased, only one buck may be harvested. After the initial learning curve, this license system has caught on with Wisconsin deer hunters and questions to the Wisconsin DNR on this topic have reduced over time.

One option would be to eliminate the “upgrade” opportunity and have standalone archery, crossbow, and gun licenses. From a license revenue perspective, if hunter participation rates remain the same in archery and crossbow hunting, then this would increase license revenue. However, some hunters may not want to spend the additional money to purchase both licenses and may decide to purchase just one. This would result in a loss of revenue from the current process since these hunters will no longer have the option to purchase the \$3.00 upgrade.

Alternatively, further simplification could involve hunters purchasing one deer hunting license with a limit on the number of bucks (only one may be taken with gun) and does. Hunters could

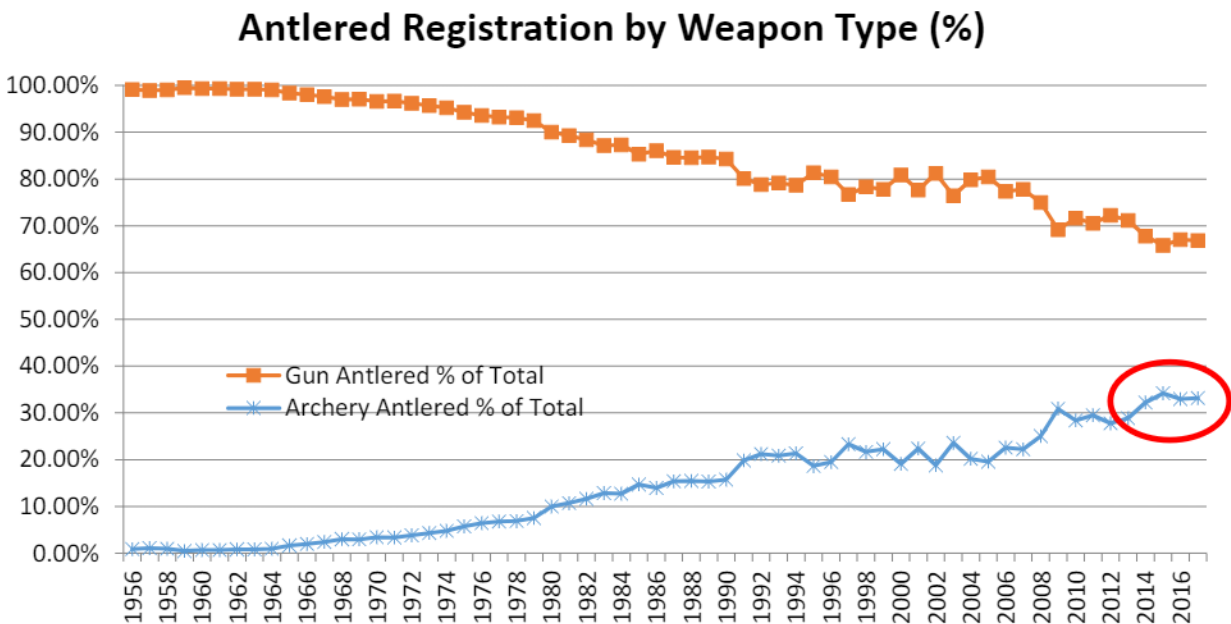


choose their weapon of choice during the legal open season for that weapon. This, however, would make it difficult for the department to track individual license sales (gun, archery, crossbow) as we have in the past and may result in a loss of revenue (some hunters buying one license instead of two) if license fees were raised accordingly.

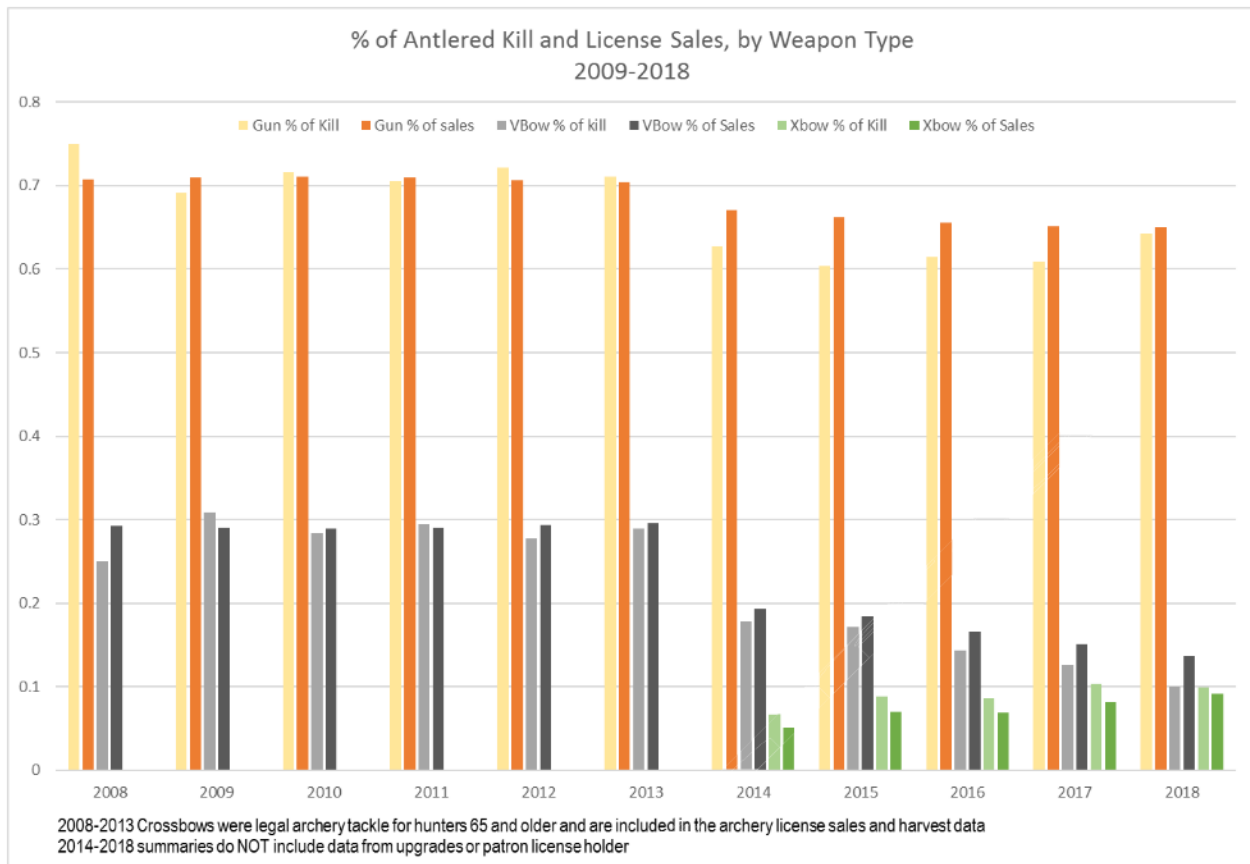
### ***Buck Harvest Allocation among Seasons***

An area of discussion with Wisconsin’s current crossbow season is the increasing trend in the number of bucks harvested during the breeding season and prior to the traditional nine-day gun deer season providing fewer bucks available to gun-only hunters. The increasing trend in buck harvest occurring prior to the nine-day gun season has been occurring since the late 1970s with advancing technology in compound bows (Figure 16). The all-inclusive crossbow season has accelerated this trend in recent years. It has been suggested that season structure and bag limits could be set to allocate buck harvest numbers proportional to the number of each type of weapon-specific deer hunting license sold.

A dictionary definition of “fair” is “marked by impartiality and honesty; free from self-interest, prejudice, or favoritism.” Using this definition, a season structure that is “fair” with the allotment of bucks would be if the percentage of total buck kill is close to the percentage of total license sales. For example, if gun hunters make up 60% of deer license sales, then gun hunters would harvest 60% of the total antlered bucks harvested. We reviewed data from before and after full inclusion of the crossbow season for the last several decades (Figure 17).



**Figure 16.** Trends in buck harvest, 1956-2018.



**Figure 17.** Percent of buck kill compared to percent of license sales for gun, archery, and crossbow licenses in Wisconsin, 2008-2018.

For the six years prior to the fully inclusive crossbow season, gun hunters average about +1% difference between their percent of the buck harvest and their percent of license sales and archery hunters averaged about -1% difference. During these six years, crossbows were legal archery equipment for hunters ages 65 and over and we could not distinguish between archery and compound licenses and/or harvest.

For the five seasons since the fully inclusive crossbow season, gun hunters average about -3.8% difference between their percent of the buck harvest and their percent of license sales and archery hunters averaged about -2.2% difference. Crossbow hunters average about +1.6% difference between their percent of the buck harvest and their percent of license sales. Not surprisingly, both gun hunters and archery hunters saw a drop in the percent of buck harvest relative to the number of licenses sold. The observed differences between gun, archery, and crossbow percentages, however, are slight and may not be simply corrected with adjustment to season lengths and bag limits.



The difference between percent buck harvest by gun hunters and gun hunting licenses sold for four decades are provided below. These figures point to a trend that Wisconsin and many other states have seen for the past several decades, specifically lower contribution from the gun hunters to the overall buck harvest, a trend that began before crossbows became legal bow equipment in Wisconsin.

- During the 1970's this difference averaged +12.6%
- During the 1980's this difference averaged +10%
- During the 1990's this difference average +5.1%
- During the 2000's this difference averaged +5.6%

These trends suggest that currently, the allocation of buck harvest among the license types available is "fairer" than it has been historically.

### ***Hunting Season Structure***

Hunting season structure and bag limit are two factors that can be adjusted to attempt to provide equal access to the buck resource. Hunting during late October and early November is important to many Wisconsin hunters. This period of the fall is when rutting bucks and hunters are most active, and when a significant percentage of the buck harvest occurs. It would make the most sense to adjust season dates for individual weapons during this time period to have the most significant impact on the buck harvest. Any alternative that reduces hunting opportunity at this time of the year, however, will present challenges and frustrations for archery and crossbow hunters who normally focus their limited days afield during this period.

Figure 17 suggests crossbow hunters are killing a slightly higher percentage of bucks relative to their percentage of license sales. The same cannot be said for gun and archery hunters. Reducing crossbow hunting opportunities during the rutting period may result in more bucks available for harvest by archery and gun hunters. However, 2018 license data indicate that 88% of crossbow license buyers also purchased a gun hunting license. We have not seen a change in the number of hunters that harvest two bucks per year since the all-inclusive crossbow season was implemented in 2014. The hunters most likely to be impacted by a reduction in crossbow hunting opportunity are those that harvest one buck per year with either a gun or crossbow. Provided that information, a reduction in crossbow hunting opportunity during the rutting period may not be a concern among these gun hunters since they are likely to harvest one buck regardless of weapon type. The result is a dead buck, whether it was killed with a crossbow or gun, however, and the buck can only be killed once so reducing hunting opportunity during a preferred time of year to be in the woods may not be justified.

For the archery hunter, reducing crossbow hunting opportunity during the rutting period may result in more bucks available for harvest during that time and prior to the nine-day gun deer hunting season. In addition, a reduced or later start to the crossbow season may incentivize

archery hunters to purchase a crossbow license upgrade to use a more efficient weapon if they have been unsuccessful with a vertical bow.

It is difficult to predict how hunter participation, and buck harvest could be impacted through the implementation of a reduced crossbow season during the rutting period. It may simply be that reduced season length results in a shift in the timing of when bucks get killed while having unpredictable impacts on the total buck harvest by weapon type.

### ***One Buck Bag Limit***

Another factor that has been suggested for adjustment to shift opportunity to harvest bucks is limiting the annual number of bucks a hunter can harvest. The idea would be that all hunters, regardless of season participation and weapon use, license purchase, or effort, would be restricted to the same number of bucks, within the legal season dates for all their weapon choices. Season dates and regulations vary by state, however, the number of bucks allowed under normal hunting seasons is either one or two (Table 31).

Wisconsin currently allows deer hunters to harvest two bucks, one with a gun license and one with an archery/crossbow license. Fewer than 11,000 hunters harvest a buck with both firearm and “bow” annually, and this has not changed significantly over the past decade.

Consideration of a one buck season resulted in the following list of pros and cons.

#### Pros:

- Could potentially eliminate the perception of competition between archery, crossbow, and gun hunters as all hunters would be allowed to kill one buck.
- Could potentially reduce total buck harvest by 9,000 to 11,000 bucks each year. This estimate represents the annual range of bucks that are killed by hunters as their second buck.
  - May increase overall hunter success rates on bucks by allowing more individuals to harvest one that was “saved” from being someone else’s second buck. However, given how few hunters currently harvest a second buck, this increase is likely to be marginal.
  - If harvest of mature bucks is a desired outcome, bucks not killed as a second buck could potentially get one year older.
- May increase antlerless harvest as hunters that want a second deer for venison may be less selective when choosing to shoot an antlerless deer.

#### Cons:

- It would invalidate the current *buck harvest total / buck harvest rate* as an index to the population, making population modeling more difficult
- It would violate one of the assumptions of the sex-age-kill (SAK) model and make comparisons to the previous 40+ years of data impossible. Significant investments would need to be made to validate the change in buck harvest for use in the SAK model.

- It may not alleviate the issue of perceived fairness regarding access to bucks prior to the nine-day gun season because archery and crossbow hunters would still have the first opportunity to hunt bucks.
- It could reduce the antlerless harvest during the nine-day gun season if the 40,000 archery and crossbow hunters that killed a buck prior to the gun season elect not to hunt during the gun season because they cannot harvest a buck.
- If the ~40,000 hunters who killed a buck prior to the nine-day gun season elect not to hunt during the gun season, there could be a loss of license sales revenue of over \$1 million.
- Eighty percent of deer range in Wisconsin is under private ownership, so buck harvest is likely already being “regulated” on properties that want to manage deer in that manner.
- Many counties have a management objective to reduce or maintain the deer herd. The 9,000-11,000 bucks not harvested, plus deer that might have been killed by hunters electing not to hunt the gun season, suggests that Wisconsin’s deer habitat would have to support more deer through the year causing damage to forests, other habitat, and planted crops where deer may already be overabundant.
- Bucks have higher incidence of chronic wasting disease (CWD) than does. Reducing buck harvest in areas of CWD may increase prevalence and aid in spreading CWD.

**Table 31.** Antlered deer harvest allowed per hunter per year.

<b>Controlled by permit or variable from year to year</b>	<b>1 per hunter</b>	<b>2 or more per hunter</b>
Colorado, North Dakota, South Dakota, Oregon, Washington, Wyoming	Indiana, Kansas, Kentucky, Ohio, Pennsylvania,	Iowa, Maryland, Michigan <sup>1</sup> , Minnesota, Missouri, Nebraska, Virginia, West Virginia, Wisconsin

<sup>1</sup> Can vary by license type purchased

## Key Findings

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- *In the five years with a crossbow season, both gun hunters and archery hunters saw a drop in the percent of buck harvest relative to their license sales contribution compared to before a crossbow season.*
  - *Although differences are slight, gun and archery hunters are harvesting fewer bucks relative to their license sales contribution and crossbow hunters are harvesting more.*
  - *Reducing crossbow hunter access to bucks during the rutting period may equalize these differences; however, crossbow hunters may simply adjust their timing and effort to harvest the same number of bucks.*
  - *Most crossbow hunters are also gun hunters and they typically harvest one buck per year. Adjusting the crossbow season would not protect bucks that these hunters could harvest with either weapon.*
  - *A one-buck bag limit could have negative implications for license sales, herd control, and chronic wasting disease management.*
-

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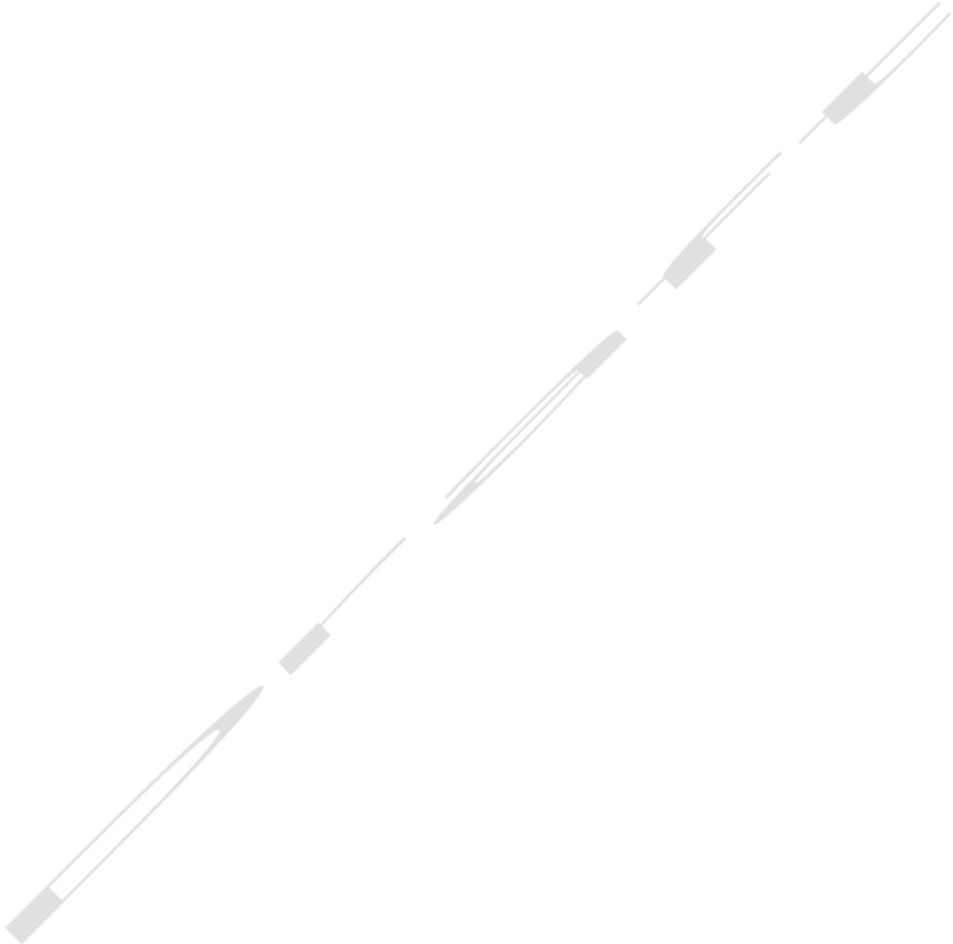


## Index

The lines of inquiry for this evaluation were guided by 21 research questions provided by NRB members in their request for information from Wisconsin DNR staff. Those questions are provided in the Index below along with the studies undertaken to obtain answers.

<b>NRB Research Questions</b>	<b>Where Addressed</b>
Why do people gun hunt?	Study #3, Study #2
Why do people bow hunt?	Study #3
Why do people crossbow hunt?	Study #3
How many previously licensed archers converted to crossbow?	Study #1
How many previously licensed gun hunters converted to crossbow?	Study #1, Study #2
How many crossbow hunters quit hunting with a gun or bow?	Study #1
How many shooting incidents with crossbows? Any fatalities?	Study #5
Did a crossbow segment get added to hunter safety as suggested in year 1?	Study #5
How would we best structure seasons to maximize participation and be fair in the allotment of game (bucks) yet still provide a reason to be a bowhunter, a reason to be a crossbow hunter, a reason to be a gun hunter, and a reason to be a muzzleloader hunter?	Study #3, Study #3, Discussion # 1
Would it make sense to incorporate airbows in the next crossbow season and get ahead of the next technology advancement?	Study #5
How much have crossbows advanced in the just the 5 years Wisconsin has had a season?	Study #5
What does a one buck season look like?	Discussion #2
We should be aware of the Maryland study on wounding comparison between compounds and crossbows.	Study #4
We would like to see a nice clean graph of license sales five years prior to crossbow season and 5 years after	Study #1
We would like to know why Michigan changed crossbow season in the UP to 55 and older and shut down the late season.	Study #4
Why did Kentucky shorten the crossbow season?	Study #4
Why is Wyoming Fish and Game considering shortening the crossbow season?	Study #4
Why are more states than have, not included crossbows in the archery season?	Study #4
Why did Minnesota reject full inclusion last year?	Study #4
We should know if Ohio has seen significant changes in deer licenses sales over time.	Study #4
Why does Iowa only allow crossbows during their primitive weapon season (muzzleloader) with antlerless tags only?	Study #4

# Appendix A- Original DNR Analysis of Weapon Use



# *A Summary of* **Weapon Use by Wisconsin Deer Hunters 2014 – 2017**

(3/22/18)

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Hunter Success by Authority Type for Antlered Deer: 2014 –	93
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**Bureau of Wildlife Management**  
**March 22, 2018**

In 2013, the Wisconsin State Legislature passed laws that created a separate crossbow hunting season and crossbow deer hunting license. In addition, rules were created that allowed all hunters (not just disabled or those over the age of 65) to use a crossbow during the open deer hunting season starting in 2014.

The following report summarizes a variety of outcomes as a result of firearm, archery (in some graphs referred to as bow or vertical bow), and crossbow use during the 2014-2017 deer seasons.

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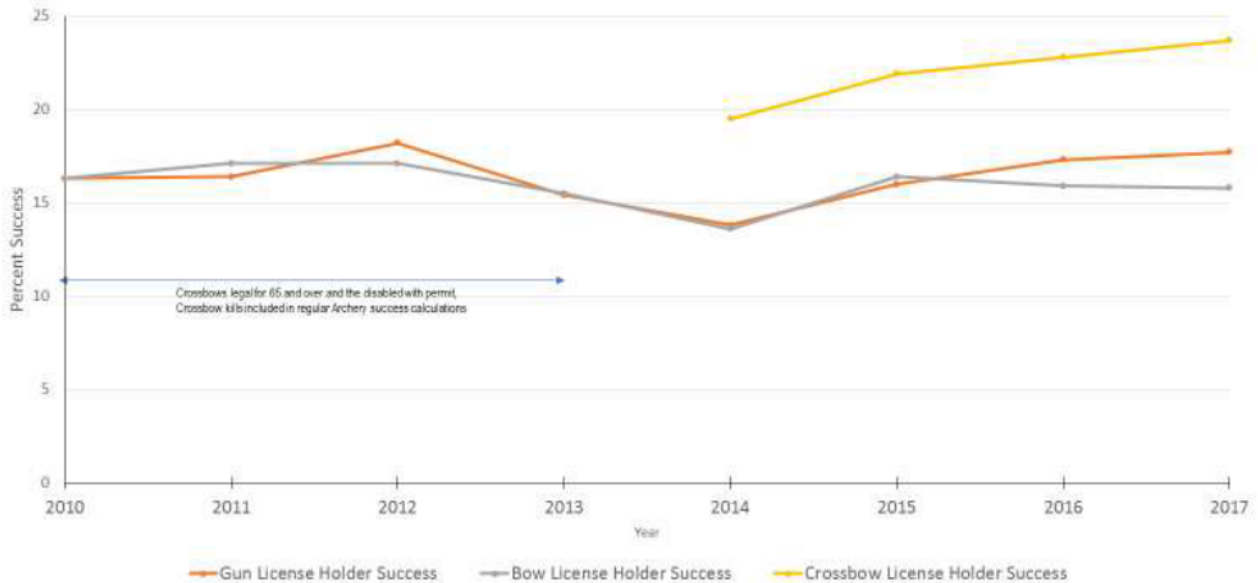
## Hunter Success by Authority Type for Antlered Deer: 2014-2017

Note: PAT means Conservation Patron license holder

Hunter Success by Authority (Antlered)			
2014	No. of hunters that killed an antlered deer by authority (only counted once if they harvested +1)	No. of hunters with authority (no duplicates in Crossbow or Archery upgrades)	Hunter Success <sup>1</sup>
UPGRADE	4,533	23,077	19.6%
ARCHERY	22,056	161,991	13.6%
CROSSBOW	8,336	42,788	19.5%
GUN	77,428	562,218	13.8%
PAT	11,228	47,561	23.6%
Hunter Success by Authority (Antlered)			
2015	No. of hunters that killed an antlered deer by authority (only counted once if they harvested +1)	No. of hunters with authority (no duplicates in Crossbow or Archery upgrades)	Hunter Success <sup>1</sup>
UPGRADE	5,049	22,389	22.6%
ARCHERY	25,671	156,374	16.4%
CROSSBOW	13,156	59,967	21.9%
GUN	90,170	564,228	16.0%
PAT	15,356	48,937	31.4%
Hunter Success by Authority (Antlered)			
2016	No. of hunters that killed an antlered deer by authority (only counted once if they harvested +1)	No. of hunters with authority (no duplicates in Crossbow or Archery upgrades)	Hunter Success <sup>1</sup>
UPGRADE	8,225	39,925	20.6%
ARCHERY	22,050	138,581	15.9%
CROSSBOW	13,244	58,049	22.8%
GUN	94,879	548,488	17.3%
PAT	15,880	51,374	30.9%
Hunter Success by Authority (Antlered)			
2017	No. of hunters that killed an antlered deer by authority (only counted once if they harvested +1)	No. of hunters with authority (no duplicates in Crossbow or Archery upgrades)	Hunter Success <sup>1</sup>
UPGRADE	9,028	42,695	21.1%
ARCHERY	19,645	125,151	15.8%
CROSSBOW	16,096	67,960	23.7%
GUN	95,093	536,557	17.7%
PAT	16,251	53,101	30.6%

<sup>1</sup> Not corrected for nonparticipation

Antlered Deer Harvest Success by License Type  
2010-2017<sup>1</sup>



- <sup>1</sup>Patron License sales and harvest data are NOT included under any weapon type success rate
- <sup>1</sup>Hunters that purchased an upgrade to use both a bow and crossbow are NOT included in the calculations from 2014-2017
- <sup>1</sup>Hunters that harvested multiple deer with a single weapon type are only counted once.

The above tables and graph summarize total deer hunting authority (license) sales and the number of hunters that harvest an antlered deer, by weapon type, during the 2014-2017 deer seasons. Crossbow users have the highest success rate of all weapon types.

A few important notes regarding the data presented:

- These figures are not corrected for non-participation, so actual success rates are probably higher for all weapon types.
- The all-inclusive Conservation Patron license success rates are for all deer harvested (gun, archery, and crossbow) by these license holders, as they have authority to hunt with all three weapons. However, these same hunters do not have to claim any weapon type that they will use while hunting at the time of purchase.



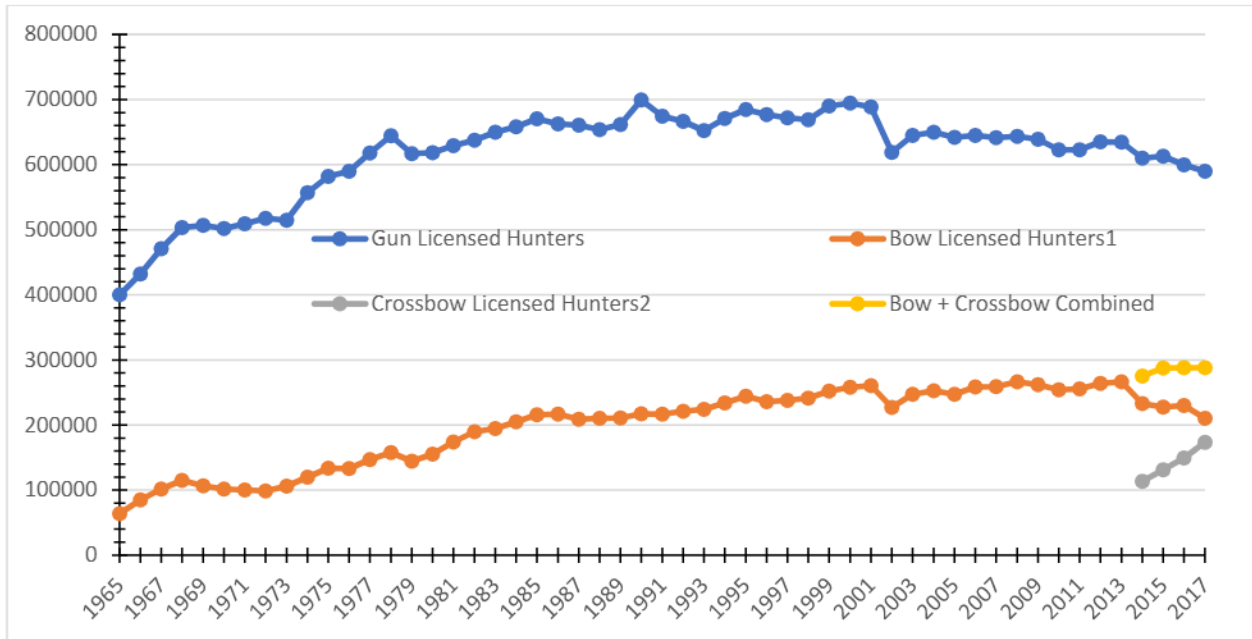
**Total Deer Hunting Authorities: 1999-2017**



The above graph shows total deer hunting by any authority (license) that allows the taking of a deer including archery deer, crossbow deer, upgrades, Conservation Patron, and gun licenses as well as the total number of individuals that purchased a license.

Wisconsin has averaged about 650,000 individual deer hunters purchasing 800,000 authorities and spending about 7.5 million days afield for the past 10+ years. The number of individuals purchasing deer hunting authorities has been on a long-term decline for several years at about 0.25-1.5% per year. However, the total number of deer authorities has been stable to increasing, indicating that more hunters are purchasing a license to hunt with another weapon type. This trend has been occurring for several decades.

**License Sales by Weapon Type: 1965-2017**

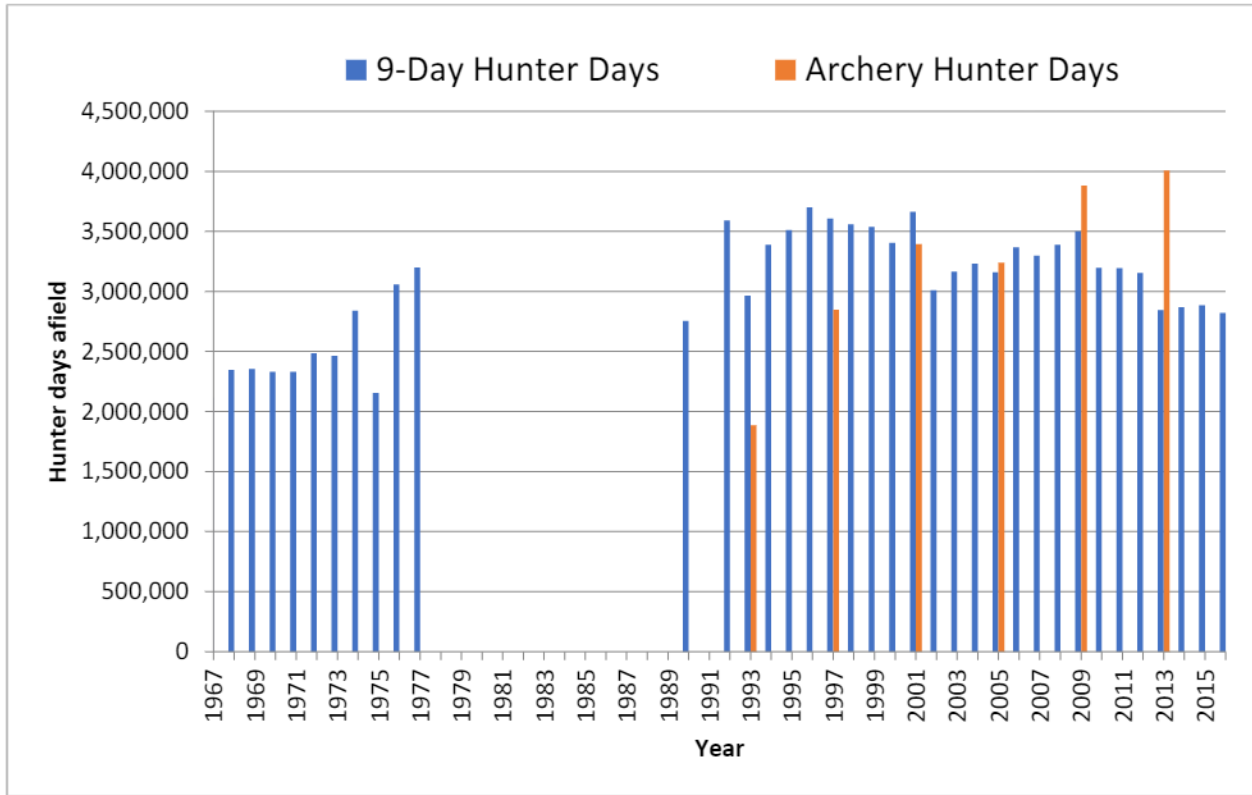


The figure above shows the trend in total license sales by license type starting in 1965 when individual archery license sales (labeled as “bow”) began.

- 2014-17 Archery and Crossbow license sales figures BOTH contain Conservation Patron and upgrade license sales
- Conservation Patron and upgrades are counted twice because they cannot be separated in either group as Conservation Patron hunters do not have to declare a weapon type
- There was a 13,000 loss in gun hunters between 2015 and 2016
- There was a similar 13,000 increase in archery/crossbow hunters between 2014 and 2015.

Downward trends in individual deer hunters began in the late 1990’s. Nationally, it is well documented that the hunting population is aging and hunters are falling out at a faster rate than recruitment of new hunters is occurring. Wisconsin appears to be retaining and recruiting hunters at a faster rate than most other states as our rate of decline is less than the national average.

**Hunter Days Afield: Archery/Crossbow vs. 9-day Gun**



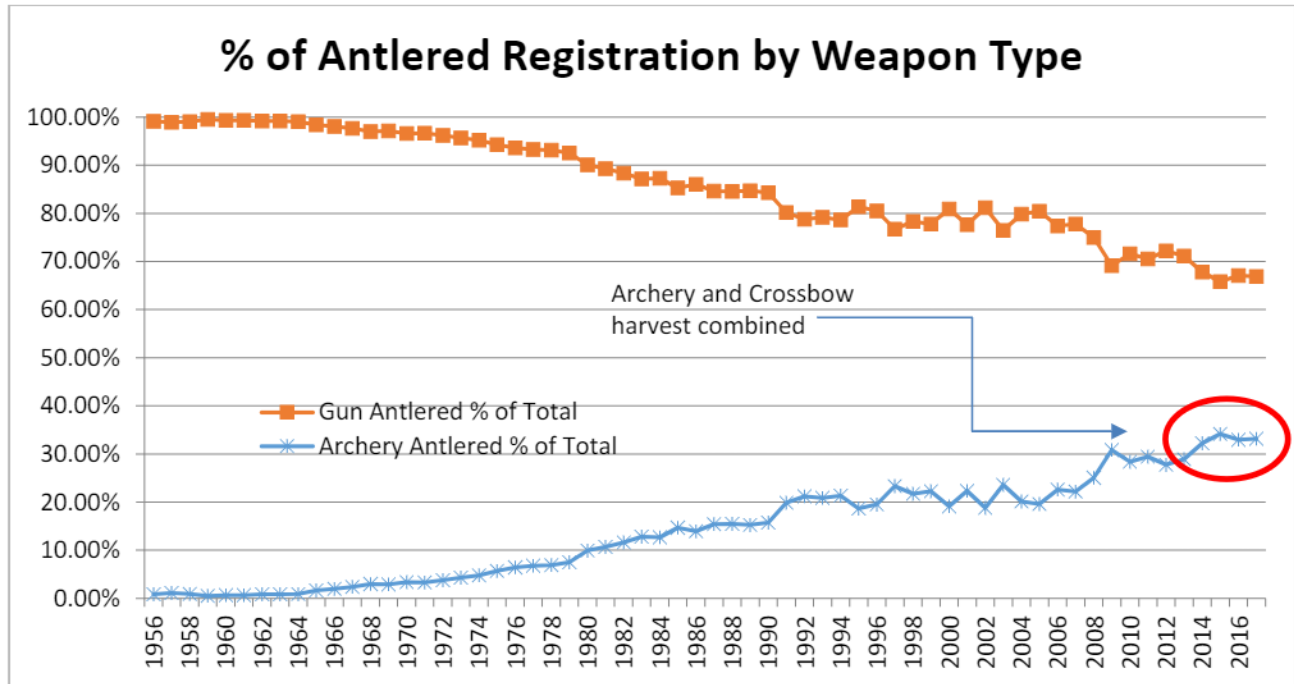
The above graphic shows the number of days annually spent afield by Wisconsin gun hunters during the 9-day gun season compared to those hunting with archery/crossbow. The graphic is built using information collected from the annual 9-day gun hunter questionnaire, and the 4-year archery questionnaire. Each survey is mailed to approximately 10,000 hunters randomly selected from all license buyers of that type during survey years. Only days afield during the 9-day season are accounted for in this survey, so days gun hunters spend during the youth, muzzleloader, December antlerless, and the holiday hunt are not accounted for.

This graph indicates there is an increase in archery days spent afield as compared to gun hunting days afield which has generally been declining since the late 1990's. Over the evaluation period identified, Wisconsin's bow hunters have experienced increased season lengths as well as increased hunter participation, while hunter surveys indicate gun hunters during the 9-day gun season experienced lower hunter days due to hunter losses as well as additional gun-deer seasons when to hunt and kill a deer. 2017 will be the first time that the bow survey will be conducted to account for "full inclusion" of crossbow seasons in determining hunter days spent afield for "archers", but this data is not yet available.

In general, Wisconsin deer hunters spend approximately 7.5 million days afield each year. In the past, this figure was dominated by gun hunters, but has changed over time. Since the 2009

survey, more days afield are spent during the bow season. While overall effort has not changed, WHEN hunters spend time outdoors has over that last several decades.

**Percentage of Antlered Deer Registration by Weapon Type**



The above graphic shows the percent of antlered deer registered by weapon type over the past 60+ years. Archery and crossbow harvest data are combined from 2014-2017.

During the past 60 years, there has been a gradual shift in how and when antlered deer are killed. In the last decade, about 30% or more of the total antlered deer harvest occurred using archery or crossbow. The percentage of archery/crossbow antlered harvest began to accelerate in the 1980s. The two most likely influences on this trend occurred shortly after compound bows became popular and hunting from an elevated platform became legal. On an overall population or statewide scale, when deer are being harvested has been influenced by these factors however the overall antlered deer harvest does not appear to be influenced by weapon type.

Despite weapon popularity or season changes over time, these lines will likely cross sometime in the future.

**Percentage of Hunters Killing Multiple Antlered Deer**

2011-13

% Antlered Hunter Bag by Authority Type (Frequency) 2013		
# of Bucks Harvested	GUN & VBOW	PATRON
0	68.8% (127,545)	71.7% (33,371)
1	27.3% (50,587)	24.7% (11,499)
2	3.8% (7,072)	3.4% (1,589)

% Antlered Hunter Bag by Authority Type (Frequency) 2012		
# of Bucks Harvested	GUN & VBOW	PATRON
0	65.1% (120,059)	68.0% (33,371)
1	30.0% (55,367)	27.5% (12,384)
2	4.7% (8,599)	4.2% (1,881)

% Antlered Hunter Bag by Authority Type (Frequency) 2011		
# of Bucks Harvested	GUN & VBOW	PATRON
0	66.9% (117,142)	70.3% (32,233)
1	28.5% (49,963)	25.6% (11,720)
2	4.4% (7,740)	4.0% (1,811)

Does not include Conservation Patron license holders

2014-17

% Antlered Hunter Bag by Authority Type (Frequency) 2017			
# of Bucks Harvested	GUN & XBOW	GUN & VBOW	PATRON
0	61.5% (36,905)	67.3% (88,458)	69.4% (36,853)
1	32.7% (19,622)	28.8% (37,821)	26.7% (14,203)
2	5.8% (3,512)	3.9% (5,119)	3.9% (2,045)

% Antlered Hunter Bag by Authority Type (Frequency) 2016			
# of Bucks Harvested	GUN & XBOW	GUN & VBOW	PATRON
0	62.2% (31,200)	67.1% (92,399)	69.1% (35,494)
1	32.1% (16,205)	25.8% (30,999)	26.9% (13,508)
2	5.6% (2,822)	3.9% (5,390)	4.0% (2,072)

% Antlered Hunter Bag by Authority Type (Frequency) 2015			
# of Bucks Harvested	GUN & XBOW	GUN & VBOW	PATRON
0	63.9% (33,875)	67.4% (97,447)	68.6% (33,581)
1	31.1% (16,400)	26.6% (41,126)	27.4% (13,425)
2	5.0% (2,645)	3.8% (5,480)	3.9% (1,925)

% Antlered Hunter Bag by Authority Type (Frequency) 2014			
# of Bucks Harvested	GUN & XBOW	GUN & VBOW	PATRON
0	64.1% (24,898)	68.7% (102,739)	70.6% (33,592)
1	30.3% (11,756)	27.1% (40,659)	25.2% (11,997)
2	5.5% (2,147)	3.9% (5,861)	3.8% (1,819)

The above graphic shows the percentage of hunters who registered an antlered deer with both gun and archery/crossbow during the 2011-2017 deer seasons. Prior to 2014, the percentage of hunters doing so were less than 5%, generally around 3.5% and has remained fairly similar since 2014. The actual number of hunters bagging 2 bucks is relatively small when compared to the overall number of deer hunters (around 10,000 hunters annually).

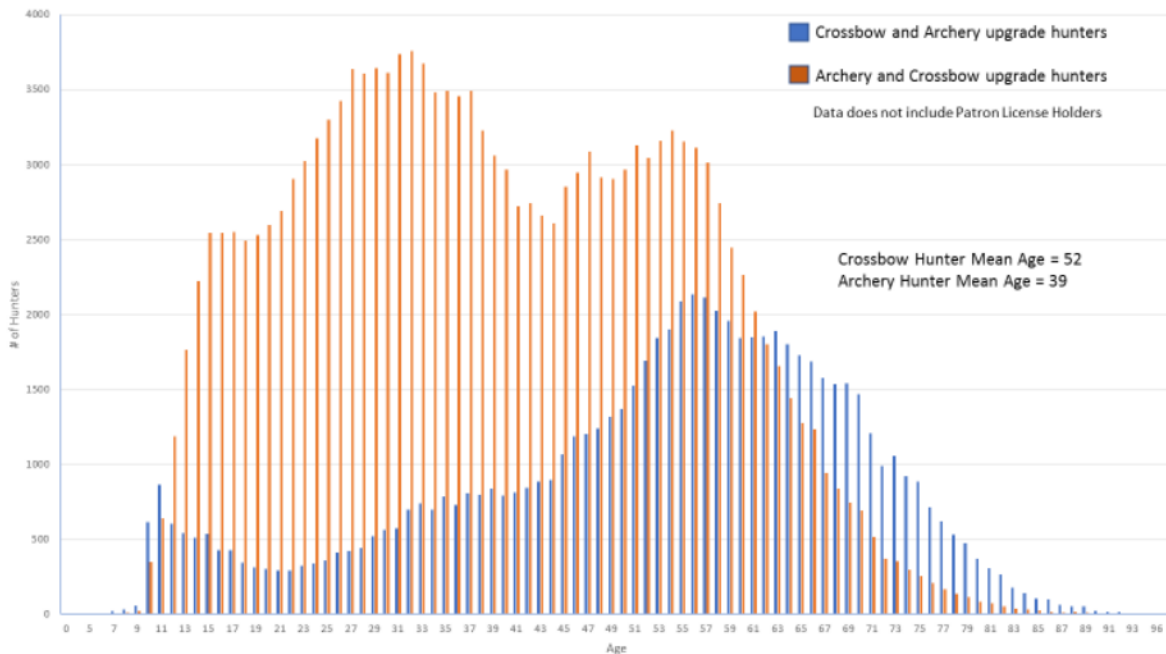
One commonly stated concern is that hunters that use both a crossbow and gun are bagging two bucks at a higher rate than those hunting archery equipment and gun. Data indicates that there is approximately a 1-2% difference between the two groups. In addition, 41.6% of the hunters that held a crossbow license and a gun license bagged 2 antlered deer at least once since 2005 while 47% of hunters that held just a vertical bow and a gun license bagged 2 antlered deer at least once since 2005.

**Percentage of Total Harvest on Public Lands: 2014-2017**

	2014	2015	2016	2017
Crossbow	12.4%	12.4%	13.1%	13.9%
Archery	13.9%	14.1%	14.4%	15.6%
All Weapons	12.6%	12.9%	13.5%	14.5%

The above table shows the percentage of deer harvest occurring on public lands by weapon types during the 2014-2017 hunting seasons. Comparing weapon types, there are minimal differences in public land harvest rates. With most of the state in private ownership (85%), the majority of deer hunting occurs on private land where permission is required, leaving the decision of the weapon type used to harvest a deer up to the landowners/leasees.

**Age Frequency of Crossbow and Archery Hunters: 2017**



The above graph shows the number of hunters comparing archery vs. crossbow. Currently crossbow license buyers are older than archery hunters with an average age of 52 years old compared to 39 years old for archery hunters. Based on the graph above, the opportunity to use crossbows may be allowing more hunters to be retained and re-engaged in deer hunting later in life.



## **Appendix B - Lapsed Gun Hunter Questionnaire**



## LAPSED GUN-DEER HUNTER QUESTIONNAIRE 2019

### FOR STARTERS

1. Sometimes, there is a clear and primary reason to explain why you didn't purchase a gun-deer hunting license in the past couple of years. Below are four statements that describe some of these situations.

If **ANY** of the four statements apply to your situation, check the box  and return the questionnaire now. (We do not need to know which ones.)

- ❖ I AM ON MILITARY DEPLOYMENT.
- ❖ I MOVED OUT OF STATE.
- ❖ I HAVE A FELONY CONVICTION.
- ❖ A HEALTH ISSUE OR INJURY PREVENTS ME FROM HUNTING NOW



## LAST TIME YOU BOUGHT A GUN-DEER LICENSE

For the opening set of questions, please think about the last time you purchased a Wisconsin gun-deer hunting license. According to our license records that was in 2016.

1. Which Wisconsin county did you gun-deer hunt last time? (If you hunted in more than one county, please pick the county where you hunted most).

2. Which statement best describes where you gun-deer hunted the last time? *Check one.*

- Exclusively on public land
- Mostly on public land/ some on private land
- About equal time on public and private land
- Mostly on private land/ some on public land
- Exclusively on private land

3. How many others went gun-deer hunting with you the last time?

If you hunted alone, write Zero:


4. Did you personally harvest a deer with a gun? *Check one.*


- Yes
- No
- Don't remember


**Directions:**


People can decide not to purchase a gun-deer hunting license in any given year for a variety of reasons related to their available time, quality of opportunities, family obligations, availability of hunting partners, and many others. We have put together a series of questions that seek to understand the reasons that you have not purchased a gun-deer hunting license in recent years.


- Please check the box in PART A if the factor listed applies to your situation or is “true for you”.
- If you check the box in PART A, then proceed to Part B in that row.
- If you **DID NOT** check the box in Part A, then **SKIP PART B**, and proceed to the next row.

1. LIFE & FAMILY PRIORITIES	Part A	If true, then answer Part B	What degree of influence did this item have on your decision not to buy a gun-deer license?				
	This is true for me ✓		No Influence	Minor influence	Moderate influence	High influence	Very high influence
I have young children.	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I lost or changed jobs.	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I am busy with school during gun-deer season.	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Being with my kids is a priority at this stage of my life.	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I have a hard time getting time off from work during the gun season.	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I have been taking care of a family member who is ill.	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I moved in the past two years.	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I have been introducing or mentoring someone else into gun-deer hunting.	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>


<b>2. OPPORTUNITIES TO SEE &amp; SHOOT DEER</b>	Part A	If true, then answer Part B	Part B What degree of influence did this item have on your decision not to buy a gun-deer license?				
	This is true for me ✓		No Influence	Minor influence	Moderate influence	High influence	Very high influence
I think my chances of seeing deer are poor.	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I do not see enough deer in the area(s) I hunt.	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I see too few deer compared to the past.	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I think there are a lack of decent bucks in the area(s) that I hunt.	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I think predators are taking too many deer.	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
It seems to me there are too few deer to make it worth hunting on public land.	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

<b>3. COSTS OF PARTICIPATION</b>	Part A	If true, then answer Part B	Part B What degree of influence did this item have on your decision not to buy a gun-deer license?				
	This is true for me ✓		No Influence	Minor influence	Moderate influence	High influence	Very high influence
The price of a gun-deer hunting license is too high for me.	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Travel costs makes gun-deer hunting too expensive for me.	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I cannot afford the equipment it takes to gun-deer hunt.	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
When I add it all up, gun-deer hunting costs more than the amount of fun it provides.	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I cannot afford private land (e.g., lease fees, property tax, etc.)	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Deer processing fees are expensive for me.	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

4) ACCESS TO HUNTING LAND	Part A	If true, then answer Part B	Part B What degree of influence did this item have on your decision not to buy a gun-deer license?				
	This is true for me ✓		No Influence	Minor influence	Moderate influence	High influence	Very high influence
I lost access to private land (e.g., land was sold, or permission withdrawn).	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I am not comfortable hunting on public land because of other hunters.	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
The land I prefer to hunt is too far away.	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Places I used to gun-deer hunt are now posted or gated off.	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
The area I hunt has been developed or subdivided.	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I do not have permission to gun-deer hunt anywhere on private land.	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

5. CHRONIC WASTING DISEASE (CWD)	Part A	If true, then answer Part B	Part B What degree of influence did this item have on your decision not to buy a gun-deer license?				
	This is true for me ✓		No Influence	Minor influence	Moderate influence	High influence	Very high influence
CWD is present in the area where I gun-deer hunt.	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I have shot a deer that has tested positive for CWD in the past.	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I worry about the safety of eating venison from a CWD-positive deer.	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
My spouse worries about the safety of eating venison from a CWD-positive deer.	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I do not want the hassle of having to get my deer tested.	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I am not sure how to dispose of a CWD-positive deer.	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>



6. DEER MANAGEMENT (rules and seasons)	Part A	If true, then answer Part B	Part B What degree of influence did this item have on your decision not to buy a gun-deer license?				
	This is true for me ✓		No Influence	Minor influence	Moderate influence	High influence	Very high influence
The gun-deer regulations are too confusing to me.	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Online and phone-in registration has been a hassle for me.	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I am not able to get antlerless tags for the area where I hunt.	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
All the deer being taken by crossbow users negatively impacts my chances during the 9-day season.	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
All the deer being taken by compound archers negatively impacts my chances during the 9-day season.	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I do not like the separation of antlerless permits for public and private lands.	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I am concerned for my safety knowing that young kids (under 12) are handling firearms in the woods.	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I know of other hunters who are not registering their deer under the new system.	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I am not allowed to use bait where I want.	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
The youth deer season negatively impacts my chances during the 9-day season.	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I only need to buy a gun license if I have filled my archery/crossbow tags.	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

7. CHANGING or LOST INTEREST	Part A	If true, then answer Part B	Part B What degree of influence did this item have on your decision not to buy a gun-deer license?				
	This is true for me ✓		No Influence	Minor influence	Moderate influence	High influence	Very high influence
I no longer enjoy gun-deer hunting like I once did.	<input type="checkbox"/>	➔	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I prefer other outdoor activities to gun-deer hunting.	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I don't like being out in the cold.	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I choose to deer hunt in another state.	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I'd rather spend my free time doing other things.	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I prefer deer hunting during the archery season now.	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

8. HUNTING COMPANIONS	Part A	If true, then answer Part B	Part B What degree of influence did this item have on your decision not to buy a gun-deer license?				
	This is true for me ✓		No Influence	Minor influence	Moderate influence	High influence	Very high influence
One or more of my hunting partners have stopped hunting in WI.	<input type="checkbox"/>	➔	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
There are others in my family that can put venison in the freezer.	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I miss that no one gathers at registration stations anymore.	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
My kids are not interested in gun-deer hunting.	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
People who introduced me into deer hunting have passed on or are too old to go.	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I do not have anyone to go gun-deer hunting with.	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I have better ways now to stay connected with friends and family than going deer hunting together.	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

9. We just had you consider 8 different categories of potential reasons that people who have hunted in the past may decide not to participate.



We would like you to **RANK ORDER** them from 1 to 8, where “1” represents the most important reason you did not buy a gun-deer hunting license, “2” would be the second most important reason, “3” is the third, and so forth. **Use each number only once.**

- \_\_\_\_\_ Life & family priorities
- \_\_\_\_\_ Not enough deer
- \_\_\_\_\_ Costs too much to go
- \_\_\_\_\_ CWD concerns
- \_\_\_\_\_ Lack of access to hunting land
- \_\_\_\_\_ Frustrated by deer management (rules & seasons)
- \_\_\_\_\_ I lost interest/ enjoy other things more
- \_\_\_\_\_ Lack of hunting companions/group

## SOME BACKGROUND QUESTIONS

1. At which time of life did you start gun-deer hunting? *Check one.*

- As a young child (12 and younger)
- As a teenager (13-19)
- As an adult

2. Who introduced you to gun-deer hunting? *Check one.*

- Father
- Spouse
- In-laws
- Other family member
- Friend
- Other: \_\_\_\_\_

3. There are many reasons that people deer hunt. When it comes to gun-deer hunting, how important are the following potential reasons for you to hunt?

	Not-at-all Important	Not too Important	Slightly Important	Moderately Important	Very Important
For the camaraderie of hunting buddies.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
For the excitement that hunting provides.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
For the physical exercise that hunting provides.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
For the sense of accomplishment from a successful hunt.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
To be a part of Wisconsin's hunting tradition.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
To be actively involved in wildlife conservation.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
To bring home a nice buck.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
To bring home venison to eat.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
To contribute to managing the deer herd.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
To enjoy solitude in the woods.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
To enjoy the challenges of outsmarting a deer.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
To enjoy the outdoors.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
To get a shot at a deer.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
To get away from everyday problems.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
To have a chance to relax.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
To learn from another hunter.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
To participate in my family's hunting tradition.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
To pass on my hunting knowledge to another hunter.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
To provide meat for people other than my immediate family.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
To rekindle my connection to nature.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
To see deer or deer sign.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
To use my hunting equipment.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

4. To what extent do you agree or disagree with the following statements about how **gun-deer hunting** fits into your lifestyle? *Check one for each.*

	Strongly agree	Somewhat agree	Neither agree nor disagree	Somewhat disagree	Strongly disagree
Most of my friends are in some way connected to gun-deer hunting.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I would rather go gun-deer hunting than do most anything else.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I exert considerable effort to be successful at gun-deer hunting whenever I have a tag.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Others who know me would tell you that gun-deer hunting is a big part of who I am.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I like to gun-deer hunt as a way to participate in the conservation of wildlife.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
If I stopped gun-deer hunting an important part of my life would be missing.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I have invested a lot of money to be able to hunt.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Gun-deer hunting has always been big in my family.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

**AND FINALLY...**

1. Overall, how would you rate the effect of making crossbows available to all hunters in Wisconsin under the current season structure on your deer hunting experience? *Check one.*

- Very Negative
- Somewhat Negative
- Neither Positive nor Negative
- Somewhat Positive
- Very Positive

2. Have you bought an archery or crossbow license in Wisconsin at any time in the past five years?

- Yes  
 No >>> If Not, please skip to the last page.

3. Please indicate which weapon type(s) you have used in the past five years during the archery season. *Check all that apply.*

<u>Year</u>	<u><i>I hunted with a vertical bow</i></u>	<u><i>I hunted with a crossbow</i></u>
2018	<input type="checkbox"/>	<input type="checkbox"/>
2017	<input type="checkbox"/>	<input type="checkbox"/>
2016	<input type="checkbox"/>	<input type="checkbox"/>
2015	<input type="checkbox"/>	<input type="checkbox"/>
2014	<input type="checkbox"/>	<input type="checkbox"/>

4. To what extent do you agree or disagree with the following statements about how **archery-deer hunting** fits into your lifestyle? *Check one for each.*

	Strongly agree	Somewhat agree	Neither agree nor disagree	Somewhat disagree	Strongly disagree
Most of my friends are in some way connected to archery deer hunting.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I would rather go deer hunting with a vertical bow than do most anything else.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I exert considerable effort to be successful at archery hunting whenever I have a tag.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Others who know me would tell you that archery hunting is a big part of who I am.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I like to archery-deer hunt as a way to participate in the conservation of wildlife.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

**THANK YOU FOR YOUR PARTICIPATION IN THIS STUDY!**

Do you have any comments about deer hunting that you would like to share?

This publication is available upon request in alternate formats for visually impaired persons. Please contact Robert Holsman at (608) 264-8592 to request an alternate format.

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## **Appendix C - Hunter Motivation Study Questionnaire**



## Weapon type and the deer hunting experience

### Experience during the 2018 Deer Season?

\* 1. Which of the following weapon types did you hunt with during the 2018 Deer Season? (Check all that apply)

- Recurve or Longbow
- Compound Bow
- Crossbow
- Rifle
- Shotgun
- Muzzleloader
- Handgun
- None of the above

Note: Skip logic was used to show participants only the pages that correspond to their selected weapons.



## Weapon type and the deer hunting experience

Using a recurve or longbow in 2018.

- \* 2. Approximately how many days during the 2018 Deer Season did you use a **recurve or longbow**? (please count all days even if you hunted for only a short time.)

- \* 3. Thinking about your favorite spot that you hunted in the 2018 season using a **recurve or longbow**, what is the maximum distance you...  
... could have seen a deer in yards?

... would take a shot at a deer with that weapon type in yards?

4. Which of the following strategies did you use while deer hunting with a **recurve or longbow** during the 2018 deer season? (*check all that apply*)

- Hunting while scouting/stalking.
- Participating in a deer drive with other hunters.
- Hunting from an established position at ground level (e.g., in a blind.)
- Hunting from an elevated position (e.g., in a tree stand.)

- \* 5. How many deer did you harvest during the 2018 deer season with a **recurve or longbow**? (*please enter 0 if none.*)

Number of bucks

Number of antlerless deer



## Weapon type and the deer hunting experience

### Using a compound bow in 2018

- \* 6. Approximately how many days during the 2018 Deer Season did you use a **compound bow**? (please count all days even if you hunted for only a short time.)

- \* 7. Thinking about your favorite spot that you hunted in the 2018 season using a **compound bow**, what is the maximum distance you...  
... could have seen a deer in yards?

... would take a shot at a deer with that weapon type in yards?

8. Which of the following strategies did you use while deer hunting with a **compound bow** during the 2018 deer season? (check all that apply)

- Hunting while scouting/stalking.
- Participating in a deer drive with other hunters.
- Hunting from an established position at ground level (e.g., in a blind.)
- Hunting from an elevated position (e.g., in a tree stand.)

- \* 9. How many deer did you harvest during the 2018 deer season with a **compound bow**? (please enter 0 if none.)

Number of bucks

Number of antlerless deer



## Weapon type and the deer hunting experience

### Using a crossbow in 2018

- \* 10. Approximately how many days during the 2018 Deer Season did you use a **crossbow**? (please count all days even if you hunted for only a short time.)

11. Thinking about your favorite spot that you hunted in the 2018 season using a **crossbow**, what is the maximum distance you...

... could have seen a deer in yards?

... would take a shot at a deer with that weapon type in yards?

12. Which of the following strategies did you use while deer hunting with a **crossbow** during the 2018 deer season? (*check all that apply*)

- Hunting while scouting/stalking.
- Participating in a deer drive with other hunters.
- Hunting from an established position at ground level (e.g., in a blind.)
- Hunting from an elevated position (e.g., in a tree stand.)

- \* 13. How many deer did you harvest during the 2018 deer season with a **crossbow**? (*please enter 0 if none.*)

Number of bucks

Number of antlerless deer



## Weapon type and the deer hunting experience

### Using a rifle in 2018

- \* 14. Approximately how many days during the 2018 Deer Season did you use a **rifle**? (please count all days even if you hunted for only a short time.)

- \* 15. Thinking about your favorite spot that you hunted in the 2018 season using a **rifle**, what is the maximum distance you ...  
... could have seen a deer in yards?

... would take a shot at a deer with that weapon type in yards?

16. Which of the following strategies did you use while deer hunting with a **rifle** during the 2018 deer season? (*check all that apply*)

- Hunting while scouting/stalking.
- Participating in a deer drive with other hunters.
- Hunting from an established position at ground level (e.g., in a blind.)
- Hunting from an elevated position (e.g., in a tree stand.)

- \* 17. How many deer did you harvest during the 2018 deer season with a **rifle**? (*please enter 0 if none.*)

Number of bucks

Number of antlerless deer



## Weapon type and the deer hunting experience

### Using a shotgun in 2018

- \* 18. Approximately how many days during the 2018 Deer Season did you use a **shotgun**? (please count all days even if you hunted for only a short time.)

- \* 19. Thinking about your favorite spot that you hunted in the 2018 season using a **shotgun**, what is the maximum distance you...

... could have seen a deer in yards?

... would take a shot at a deer with that weapon type in yards?

20. Which of the following strategies did you use while deer hunting with a **shotgun** during the 2018 deer season? (check all that apply)

- Hunting while scouting/stalking.
- Participating in a deer drive with other hunters.
- Hunting from an established position at ground level (e.g., in a blind.)
- Hunting from an elevated position (e.g., in a tree stand.)

- \* 21. How many deer did you harvest during the 2018 deer season with a **shotgun**? (please enter 0 if none.)

Number of bucks

Number of antlerless deer





## Weapon type and the deer hunting experience

### Using a muzzleloader in 2018

- \* 22. Approximately how many days during the 2018 Deer Season did you use a **muzzleloader**? (please count all days even if you hunted for only a short time.)

- \* 23. Thinking about your favorite spot that you hunted in the 2018 season using a **muzzleloader**, what is the maximum distance you...

... could have seen a deer in yards?

... would take a shot at a deer with that weapon type in yards?

24. Which of the following strategies did you use while deer hunting with a **muzzleloader** during the 2018 deer season? (check all that apply)

- Hunting while scouting/stalking.
- Participating in a deer drive with other hunters.
- Hunting from an established position at ground level (e.g., in a blind.)
- Hunting from an elevated position (e.g., in a tree stand.)

- \* 25. How many deer did you harvest during the 2018 deer season with a **muzzleloader**? (please enter 0 if none.)

Number of bucks

Number of antlerless deer



## Weapon type and the deer hunting experience

### Using a handgun in 2018

- \* 26. Approximately how many days during the 2018 Deer Season did you use a **handgun**? (please count all days even if you hunted for only a short time.)

- \* 27. Thinking about your favorite spot that you hunted in the 2018 season using a **handgun**, what is the maximum distance you...

... could have seen a deer in yards?

... would take a shot at a deer with that weapon type in yards?

28. Which of the following strategies did you use while deer hunting with a **handgun** during the 2018 deer season? (*check all that apply*)

- Hunting while scouting/stalking.
- Participating in a deer drive with other hunters.
- Hunting from an established position at ground level (e.g., in a blind.)
- Hunting from an elevated position (e.g., in a tree stand.)

- \* 29. How many deer did you harvest during the 2018 deer season with a **handgun**? (*please enter 0 if none.*)

Number of bucks

Number of antlerless deer

\* 30. There are many reasons that people deer hunt. How important are the following potential reasons for you to hunt?

	Not at all important	Not too important	Slightly important	Moderately important	Very important
For the camaraderie of hunting buddies.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
For the excitement that hunting provides.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
For the physical exercise that hunting provides.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
For the sense of accomplishment from a successful hunt.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
To be a part of Wisconsin's hunting tradition.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
To be actively involved in wildlife conservation.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
To bring home a nice buck.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
To bring home venison to eat.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
To contribute to managing the deer herd.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
To enjoy solitude in the woods.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
To enjoy the challenges of outsmarting a deer.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
To enjoy the outdoors.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
To get a shot at a deer.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
To get away from everyday problems.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
To have a chance to relax.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
To learn from another hunter.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
To participate in my family's hunting tradition.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
To pass on my hunting knowledge to another hunter.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
To provide meat for people other than my immediate family.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
To rekindle my connection to nature.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
To see deer or deer sign.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
To use my hunting equipment.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
To use my hunting skills, e.g. scouting, stalking or tracking.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>



## *Weapon type and the deer hunting experience*

### *Your Preferred Weapon*

\* 31. Which of the following weapons is currently your most preferred way to hunt deer?

(Select only one)

- Recurve or Long Bow
- Compound Bow
- Crossbow
- Rifle
- Shotgun
- Muzzleloader
- Handgun



## Weapon type and the deer hunting experience

### Your preferred weapon for deer hunting

\* 32. How important were each of the following weapon characteristics when choosing to use a {{ Q31 }} for deer hunting?

	Not-at-all important	Not too important	Slightly important	Moderately important	Very important
The accuracy of the weapon.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
The effective range of the weapon.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
The weight of the weapon.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
The cost of the initial purchase of the weapon.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
The cost to maintain and use the weapon (e.g., ammunition, parts).	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
The amount of practice/skill required to become proficient.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

\* 33. How important were each of the following expected hunting outcomes when choosing to use a {{ Q31 }} when you hunt?

	Not-at-all important	Not too important	Slightly important	Moderately important	Very important
Decreasing my chance of wounding a deer.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Increasing my chance of harvesting a buck.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Increasing my chance of seeing deer while hunting.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Increasing my chance of successfully harvesting a deer.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Having opportunities to harvest more than one deer.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

\* 34. How important were each of the following social influences for you to choose to use a {{ Q31 }} when you hunt?

	Not at all important	Not too important	Slightly important	Moderately important	Very important
I like this weapon type for introducing someone to hunting.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I was taught to use this weapon type by my mentor.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
The hunters I admire most use this weapon type.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
My hunting buddies use this weapon type.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

\* 35. How important were each of the following seasonal aspects for you to choose to use a {{ Q31 }} when you hunt?

	Not at all important	Not too important	Slightly important	Moderately important	Very important
Access to private hunting land during this weapon's season.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Availability of time off from work/school to hunt during this weapon's season.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Likelihood of encountering other hunters during this weapon's season.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
The temperature conditions expected during this weapon's season.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
The precipitation/snow conditions expected during this weapon's season.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

\* 36. How important were each of the following personal factors for you to choose to use a {{ Q31 }} when you hunt?

	Not at all important	Not too important	Slightly important	Moderately important	Very important
It is what I have always used.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I am not able to use another weapon type for personal reasons (e.g., strength required, personal injury, or felony conviction)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>



## Weapon type and the deer hunting experience

The next four questions present a few common reasons for deer hunting, and for each question we ask that you think back to the last time that you went deer hunting with a **Q31** and answer the following questions:

Which of the following four reasons listed was the ...

1. ...single **MOST IMPORTANT** aspect motivating your most recent **Q31** hunt?
2. ... single **LEAST IMPORTANT** aspect motivating your most recent **Q31** hunt?

*In some cases, choosing just one reason for each question may be difficult. In these cases, we ask that you do your best and select only one item. The combinations that you will be presented are selected at random, and your responses will be analyzed along with those of other participants whose combinations are different from yours.*

Note: Each participant was shown four questions that were randomly selected from a set of 46 possible questions that included experimentally designed combinations of motivations.





## Weapon type and the deer hunting experience

\* 37. Please indicate the single **MOST IMPORTANT** and the single **LEAST IMPORTANT** motivations of your **most recent {{ Q31 }}** hunt?

	MOST Important	LEAST Important
For the camaraderie of hunting buddies.	<input type="radio"/>	<input type="radio"/>
To have a chance to relax.	<input type="radio"/>	<input type="radio"/>
To bring home venison to eat.	<input type="radio"/>	<input type="radio"/>
To see deer or deer sign.	<input type="radio"/>	<input type="radio"/>

\* 38. Please indicate the single **MOST IMPORTANT** and the single **LEAST IMPORTANT** motivations of your **most recent {{ Q31 }}** hunt?

	MOST Important	LEAST Important
To be actively involved in wildlife conservation.	<input type="radio"/>	<input type="radio"/>
To be a part of Wisconsin's hunting tradition.	<input type="radio"/>	<input type="radio"/>
For the physical exercise that hunting provides.	<input type="radio"/>	<input type="radio"/>
To use my hunting equipment.	<input type="radio"/>	<input type="radio"/>



## Weapon type and the deer hunting experience

\* 39. Please indicate the single **MOST IMPORTANT** and the single **LEAST IMPORTANT** motivations of your **most recent {{ Q31 }}** hunt?

	MOST Important	LEAST Important
To pass on my hunting knowledge to another hunter.	<input type="radio"/>	<input type="radio"/>
For the physical exercise that hunting provides.	<input type="radio"/>	<input type="radio"/>
To enjoy solitude in the woods.	<input type="radio"/>	<input type="radio"/>
To use my hunting skills, e.g. scouting, stalking or tracking.	<input type="radio"/>	<input type="radio"/>

\* 40. Please indicate the single **MOST IMPORTANT** and the single **LEAST IMPORTANT** motivations of your **most recent {{ Q31 }}** hunt?

	MOST Important	LEAST Important
To rekindle my connection to nature.	<input type="radio"/>	<input type="radio"/>
For the camaraderie of hunting buddies.	<input type="radio"/>	<input type="radio"/>
To enjoy the challenges of outsmarting a deer.	<input type="radio"/>	<input type="radio"/>
To bring home a nice buck.	<input type="radio"/>	<input type="radio"/>



## Weapon type and the deer hunting experience

### Section 4: Using a crossbow

\* 83. The crossbow season was established in Wisconsin in 2014. If you hunted before 2014, which weapon types did you use? (Check all that apply)

- Recurve or Long Bow
- Compound Bow
- Crossbow (senior/disabled)
- Rifle or Shot Gun
- Muzzleloader
- Handgun
- I did not hunt before 2014

\* 84. In what year did you first start using a crossbow for deer hunting (in any state)?

\* 85. To what extent do you agree or disagree with the following statements about why you **started using a crossbow** for deer hunting?

	Strongly disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Strongly agree	No opinion
I thought it would be more exciting to harvest a deer than with other weapon types.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I thought It would be more satisfying to harvest a deer than with other weapon types.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I wanted to be able to hunt earlier in the season.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I was not confident that I could successfully harvest a deer using other weapon types.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I started using a crossbow because I was not able to use a firearm.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I started using a crossbow because I was not able use a vertical bow.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I started using a crossbow because I wanted to try out something new.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I started using a crossbow to be able to hunt during the rut.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I started using a crossbow to increase my chances of harvesting a buck.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

\* 86. To what extent do you agree or disagree with the following statements about why you **continue to use a crossbow** for deer hunting?

	Strongly disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Strongly agree	No opinion
It is more exciting to harvest a deer than with other weapon types.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
It is more satisfying to harvest a deer than with other weapon types.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I am more confident that I can successfully harvest a deer using a crossbow than any other weapon type.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I am more confident that I won't wound a deer when I use a crossbow.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I am more likely to kill all the deer that I want during the season if I use a crossbow.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I use a crossbow because I enjoy it more than hunting deer with a firearm.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I use a crossbow because I enjoy it more than hunting deer with a vertical bow.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I continue to use a crossbow because I am not able to use a firearm.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I continue to use a crossbow because I am not able use a vertical bow.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I continue to use a crossbow because I have invested in the equipment.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I continue using a crossbow because it increases my chances of harvesting a buck.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I continue to use a crossbow because it allows me to hunt the rut.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>



## Weapon type and the deer hunting experience

### Section 5: Opinions on hunting in recent years.

\* 87. In the last five years, there have been many changes to the way deer are managed in Wisconsin. To what extent do you agree or disagree with the following statements about how these changes have affected your deer hunting in Wisconsin?

	Strongly disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Strongly agree	No opinion
I spend more time hunting deer (across all deer seasons) than I did five years ago.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I am more likely to harvest at least one deer (across all deer seasons) than I was five years ago.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I am more likely to harvest at least one buck (across all deer seasons) than I was five years ago.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I am more likely to harvest a deer prior to the nine-day gun season than I was five years ago.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
In the last five years, deer hunting has become more fun.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
In the last five years, I have become more engaged in the deer management process.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
In the last five years, deer hunting has become too complicated and or confusing.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

\* 88. One of the changes that have occurred in the last five years is to allow the use of crossbows for all deer hunters. To what extent do you agree or disagree with the following statements about the use of crossbows for deer hunting?

	Strongly disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Strongly agree	No opinion
Being able to use a crossbow allows more people to take advantage of hunting opportunities.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Being able to use a crossbow allows older hunters to continue hunting.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Being able to use a crossbow allows disabled/injured hunters to participate in hunting.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Being able to use a crossbow is attracting new hunters that would not hunt otherwise.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Crossbows are a good way to introduce youth to hunting during the bow season.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Hunters using crossbows are making it harder for gun hunters to harvest a buck.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Hunters using crossbows are making it harder for vertical bow hunters to harvest a buck.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I am less likely to hunt with a firearm during the 9-day firearm season now that crossbows are legal to use for all hunters.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I am more likely to continue deer hunting in the future because crossbows have been made legal to use for all hunters.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Since crossbows have been made legal for all hunters, more hunters are harvesting at least one buck in a year.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Since crossbows have been made legal for all hunters, more hunters are harvesting multiple bucks in a year.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Since crossbows were made legal for all hunters in Wisconsin, the early bow season has become more crowded.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

\* 89. Overall, how would you rate the effect of making crossbows available to all hunters under the current season structure on your deer hunting experience?

Very negative	Somewhat negative	Neutral	Somewhat positive	Very positive
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

\* 90. To what extent do you agree or disagree that the shares of the annual deer harvest taken by vertical bows, crossbows and firearms should reflect the number of hunters who hold a deer license authorizing them to use each weapon type?

Strongly disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Strongly agree	No opinion
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>



\* 91. To what extent do you agree or disagree that the shares of the annual buck harvest taken by vertical bows, crossbows and firearms should reflect the number of hunters who hold a deer license authorizing them to use each weapon type?

Strongly disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Strongly agree	No opinion
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>



## Weapon type and the deer hunting experience

### Section 6: And finally, some background questions

\* 92. Which statement best describes you as a hunter?

- I have gone hunting but do not consider myself a hunter.
- I consider myself a novice hunter.
- I consider myself a casual hunter.
- I consider myself an avid hunter.
- I used to consider myself a hunter, but no longer do.

\* 93. How strongly do you agree or disagree with the following statements about the importance of hunting to your life?

	Strongly disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Strongly agree
If I stopped hunting an important part of my life would be missing.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Hunting is an annual tradition that has become important to me.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Participation in hunting is a large part of my life.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
It would be difficult to find a replacement activity for hunting that I would enjoy as much.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I plan my vacation time around hunting seasons.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I have invested a lot of money to be able to hunt	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Given the hunting skills/knowledge that I have developed, it is important I continue to hunt.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I spend a lot of time thinking and reading about hunting outside the season.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>



## *Weapon type and the deer hunting experience*

**Thank you for participating in our survey!**

94. If you have any other comments related to the topics covered in this survey, please enter them in the box below.

*When you are ready, please click the button marked "Done" to finalize and submit your responses.*

## Appendix D – State Agency Interview Questions

- How was your crossbow season initiated? (agency, legislature, NGO's)
  - What were the pros/cons?
  - Did your agency take a position on crossbows?
    - If so, what was the position?
  - Did your crossbow rule go through your legislature/board or commission/public review?
  - What changes or modifications have occurred since the original rule?
    - More or less restrictive on crossbow use?
    - Why were changes made?
  - If you don't have a crossbow season, why?
- What were your considerations for the establishment of a season?
  - Season length/structure/bag limits (1 buck per person per season)
  - Zones/inclusion/exclusion areas
  - Impacts on deer harvest
  - Impacts on buck harvest
  - Impacts on established seasons/traditions
  - Harvest tracking/separate account of harvest
  - Reasons for/against full inclusion in archery season
  - Does your state take into account efforts to balance harvest success rates or take by weapon type?
- Who are your crossbow hunters?
  - What license buyer/user group did they come from or were they new to hunting?
  - Did they add crossbows to their weapon(s) of choice or switch to crossbows?
    - Did they drop weapon types?
  - Change in participation rates in any of the other established seasons (archery, gun)
  - How have crossbow participation rates changed since the season inception?
  - Have you completed any studies to evaluate hunter satisfaction changes/differences between individuals using different weapon types?
  - Age structure or vertical versus crossbow users?
  - Have crossbows changed the total number of deer hunters in your state more/less?
    - Changed overall deer license sales
    - + or – effect on the number of 2 license buyers
  - What information, either scientific or anecdotal is your state hearing from hunters about crossbows being a legal weapon?
- Crossbows impact on the deer herd
  - Success rates by weapon type
  - Shot distance/wounding
  - Age of animals harvested/big buck being killed by crossbows

- Selectivity difference in deer types between weapon types
- Is there any + or – biological impact since the inception of crossbow season?
- Has the overall all bagging rate, number of deer hunters are willing to kill in a fall been affected by crossbow seasons?
- Are there more bucks being harvested prior to your firearm season start than before inclusion?
- What are hunters' perceptions of crossbows impact on the deer herd?
- State specific questions:
  - Maryland
    - Bow/crossbow wounding rate study. What were the results?
    - Can we cite/get a copy of the report
  - Michigan
    - Why did you change the season in the UP to 55 and older and not allow crossbows in the late season?
  - Kentucky
    - Why did you shorten the crossbow season?
  - Wyoming
    - Why are you recommending a shorter crossbow season?
    - Has there been significant changes in deer license sales due to crossbows?
  - Minnesota
    - Why was “full inclusion” rejected?
  - Ohio
    - Has there been significant changes in deer license sales due to crossbows?
  - Iowa
    - Why are crossbows only allowed in your “primitive weapon” season and restricted to antlerless only?
- Closing thoughts or comments on the impact of crossbows
  - Does your agency have any reports or documents we could cite on crossbow use?

## Appendix E - Interview Script for Retail Businesses

In Wisconsin, crossbows have been available for all hunters to use during the archery season of deer hunting since 2014. The DNR is working to understand how crossbows have impacted hunting participation as well as weapon choice for WI deer hunters. License sales gives us some information, but we thought asking businesses would be the best way to gauge the effect that crossbow availability may be having on hunter weapon preference.

To do this, we've contacted businesses around the state that sell crossbows. Today, I have some questions I'd like to discuss with you – the interview should take about 15-20 minutes. All information we talk about in this interview will be for internal use within the DNR. All information discussed today will be confidential and the resulting summary from my interviews will not include any business names.

1. What is your role in this business?
2. How long have you worked here? *(If less than 1-2 years, is there anyone else within your business that I would be able to talk to that may have more insight on long-term trends, like 4-5-year sales trends?)*
3. Crossbows have been available for all hunters to use during the archery season since 2014. The DNR is working to understand how crossbows have impacted hunting participation and weapon/season choice for WI deer hunters. **Thinking about your business from 2014 to the present, in general, have you experienced any changes with your deer-hunting business since crossbows were made available?**
4. Would you say your in-store **compound bow** sales have gone up, down, or stayed about the same since 2014?

What about online sales of compound bows?

5. What about trends for compound accessories? Up, down, about the same?
6. For weapons and accessories, **if compound bow sales are down**, have crossbow sales compensated for that difference?
7. Would you say your in-store **crossbow sales** have gone up, down, or stayed about the same since 2014?

What about online sales of crossbows?

8. What about trends for crossbow accessories? Up, down, about the same?
9. How do you feel technological innovations impact archery sales? That is, does improved quality/weight/power lead to less or more purchases over time from individuals?

Have you noticed if this is different for crossbows purchases vs. compound bow purchases?

10. Since 2014, what has been the overall trend (like age or hunting experience level) that you see in customers purchasing **compound bows**?

What about **crossbow** customers?

11. **(If the contact has experience to speak about prior to 2014) Now thinking about prior to the 2014 availability of crossbows to all hunters...** was the trend in customers (like age or hunting experience level) different for compound bows?

What about crossbows?

12. I'm going to switch directions from archery for just a moment. What change, if any, have you observed for the trend of your gun sales since 2014? Up, down, stayed the same?

13. If down, do you think the trend is attributed to crossbow sales?

Is there anything specific (such as what you've been hearing or noticing from customers) that leads you to relate the downward trend of gun sales to crossbows?

14. Do you have an archery league associated with your shop?

Yes                      No

Are crossbows allowed to participate? Has there been any changes in participation since the incorporation of crossbows?

15. Has any other wildlife management changes in the last 5 years had an impact on your sales?

Thank you so much for your time and willingness to participate in this interview. That concludes all the formal questions I have for you.

Is there anything else that you'd like to comment on or share with me today?