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EXPLORING NEW TECHNOLOGIES FOR HUNTING

REVIEW AND RECOMMENDATIONS
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A white paper analyzing
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

Wyoming Game and Fish Department
Committee Members
Aaron Kerr
Dustin Shorma
Dustin Kirsch
Irah Leonetti
Tara Hodges
Nick Roberts
Jeff Short
Joe Sandrini

EXECUTIVE SUMMARY

Hunting equipment technology has advanced greatly over the past few decades and continues to expand at a rapid rate. This change in hunting technology has led to concerns from wildlife management professionals, the hunting public, legislators and other interested parties regarding maintenance of fair chase and ethical hunting practices. In August, 2017, a Wyoming Game and Fish Department committee was established to examine various pieces of high-tech equipment available for hunting and suggest ways to address them in relation to fair chase and ethical hunting. The committee was also tasked with looking at ways to analyze potential future technological developments within the same arena.

The assembled committee discussed and outlined the history of fair chase hunting and traditional hunting ethics in North America and developed a framework for examining certain technologies and where they fit into the spectrum of hunting tools, techniques, and tactics. The framework divides fair chase into two categories for consideration, one related to an animal's ability to avoid detection and the other concerned with the animal's ability to elude harvest if detected. The first category is subdivided into traditional and modern methods of detecting game, and the second is delineated by distances a hunter must stalk within to make a reasonable attempt at a quick and humane kill. The committee then evaluated several existing hunting technologies and discussed issues and concerns with them in terms of fair chase. These items included archery equipment, with a particular focus on crossbows and their recent advancements, including the need to maintain a primitive aspect to archery seasons; the advent of long-range firearms and their use in hunting; trail cameras, particularly those with capability to send photos or video to the user in real time; airbows, which are based on air gun frames but designed to shoot arrows; high powered and large caliber airguns; and firearms with computerized targeting and fire control systems, or "smart rifles." The committee also examined what other states have done in a regulatory fashion to address issues surrounding some of these advancements in hunting technology.

In consideration of the information attained and subsequent discussions, the committee provided several recommendations regarding a range of possible changes to Wyoming Game and Fish Commission Regulations to address the expansion of high-tech hunting gadgetry in relation to fair chase hunting and wounding loss. Appeals to wounding loss are often made to argue for or

against the legal use of certain hunting equipment and tactics, while little or no data exist to substantiate claims. The committee recommended areas for further research and harvest data collection including: quantifying wounding loss in various species as related to method of take; soliciting more information from hunters on wounding loss and methods of take; and surveying the public to quantify opinions related to hunting technologies.

INTRODUCTION

Technological advancement in the equipment available to hunters has increased their ability to detect game and circumvent an animal's ability to successfully elude harvest to levels not believed possible twenty years ago. For the most part, the effects of these advancements on harvest rates, including wounding loss, are unknown. This is due to the wide spectrum of adoption and use of what is available, the limited time frame some gadgetry has been available, and lack of research. However, there has been an increasing push from many quarters for wildlife management agencies to permit the latest weaponry and accouterments for legal hunting, often without serious thought employed, or data available to predict their impact on wildlife management and the broader cultural acceptance of hunting. This has resulted in concern about what should, or should not, be permitted in the hunting field, and under what conditions.

Not only are decisions based upon impacts to harvest success and wounding rates a concern for wildlife management agencies, but perhaps even more so is the need to maintain broad public acceptance of hunting by both consumptive and non-consumptive wildlife enthusiasts. After all, sport hunting is the primary population management tool employed by wildlife agencies. A 2017 Department of the Interior report noted about 40 percent of the United States' population 16 years old and older participated in wildlife-related activities during 2016 (USFWS, 2017). As reported by the Pittsburg Post-Gazette[1], a 2011 study by the National Shooting Sports Foundation found strong support of Americans for sport hunting finding, *"74 percent of those polled approve of legal hunting -- 42 percent strongly approve -- reflecting similar findings in Responsive Management surveys released in 1995, 2003 and 2006. Those results parallel other surveys gauging Americans' opinions on hunting issues, including 2003 and 2008 Gallup polls*

[1] http://www.post-gazette.com/sports/hunting-fishing/2011/12/11/National-survey-shows-continued-support-for-hunting-and-shooting-sports/stories/201112110233 accessed 11/06/2017

on animal rights that found a steady 75 percent of Americans "strongly opposed" or "somewhat opposed" banning all types of hunting." The strong public support of hunting exists even though the majority of the public does not hunt, less than 6 percent in 2011 (U.S. Dept. of the Interior, 2011). Therefore, maintaining approval of recreational hunting is vital to ensuring our primary wildlife management tool persists into the future.

When it comes to hunters, their support of harvest regulations is often contingent in part on maintaining or improving hunting opportunities, something that must be balanced against increased harvest success and wounding rates. For example, Wyoming's special archery seasons offer the opportunity for hunters to extend their time afield in pursuit of game by requiring methods of take assumed to reduce harvest and success rates in most cases. However, these seasons may result in increased relative wounding loss (South Dakota Department of Game, Fish and Parks, 2015).

On the other hand, non-consumptive wildlife enthusiasts and the majority of non-hunting public generally support hunting, but often cite caveats such as harvested meat being put to good use and hunting occurring in a humane and ethical fashion as prerequisites for their support. A good example of high-tech hunting that went beyond the pale for most people is the advent and subsequent widespread ban on internet hunting, wherein animals were identified and harvested remotely using computer-aided detection coupled with the sighting and firing of a gun. This amounted to a set of actions leading to a harvested game animal that completely removed the hunter from the field and isolated them entirely from directly engaging in the predator-prey dynamic. Thus, it can be argued that there is a certain ethos of hunting that should be maintained in order to provide continued public support of hunting by maintaining at some level the balance between hunter and hunted.

Also important in the discussion of what should be allowed in the hunting field is consideration of the historical ethos and tradition of hunting in Wyoming. Big game hunting is a traditional part of our state's culture. Consequently, the rapid advancement of technology affecting the hunt begs the question as to whether or not hunting in Wyoming should be constructed to maintain what it generally came to look like in the 20th Century, or allowed to evolve into something else a 20th Century hunter would not recognize. This was precisely the point made in a previous high-tech hunting committee's work (Ehlebracht, 2008), and drives much of the present concern

related to maintaining equal opportunity and fair chase in Wyoming. In the introduction to the 2008 committee's work, the following was stated:

> *The list of high-tech equipment available today is staggering. New products hit the market almost daily. All are designed to make it easier to get your game. They vary from simple items that have minimal or no impact, to inventions of unthinkable advancement… If we agree sports like hunting and fishing are "traditional" by definition, then it would follow there should be limits to protect that tradition. A good term to apply here is "fair chase." At some point, (harvest) success, and the quest for it, can lead us to cross the fair chase line… Allowing equipment that substitutes for skill and effort, we eventually end up needing to draw a line. Where do we draw that line?*

Similarly, several other efforts have been made by the Department to try and address the growing concern with technological advancements impacting traditional hunting in Wyoming. These included reviews of various use of artificial lighting systems used in conjunction with firearms and archery gear, and the use of drones to locate game (Choma, et al., 2015). The overall question that continues to be wrestled with is: Just because something is available to hunters, should it be allowed (even for physically disabled hunters), or does its use exceed what would be ethical in relation to fair chase or considered reasonable in relation to advantages in harvest success and wounding loss? Perhaps a better way to restate the dilemma is: To what extent should the State act to ensure the freedom to hunt in a manner that respects the tenets of North American Model of Wildlife Conservation and Wyoming's cultural heritage?

Considering continued advancements in hunting technology and the questions raised as to their impacts to fair chase and game management, the present high-tech committee was asked to look at the current situation in Wyoming and address the following:

- Provide a detailed analysis of the issues and concerns regarding fair chase and ethical hunting pertaining to advances in current and future hunting equipment technologies.
- Make recommendations on how to best address the changes in high tech hunting equipment pertaining to ethics and fair chase and, if necessary, draft language for new Commission regulations or legislation.
- Collect information, statutes and regulations from other states relative to high tech hunting equipment.

ISSUES AND CONCERNS REGARDING FAIR CHASE AND ETHICAL HUNTING

The situation described above by Ehlebracht (2008) has not changed, and arguably has become worse. In their discussion, the previous committee suggested there are two schools of thought relative to what is generally acceptable as methods and tactics for recreational harvest of fish and wildlife; with one school believing, *"the more high-tech, the better, (and)… those subscribing to this philosophy arguing that as long as it does not impact the resource or become a "management" issue, then it is acceptable,"* and opposing this view, *"tradition and heritage"* being the defining components of fair chase hunting (Ehlebracht, 2008).

Alternatively, we suggest that there exists a spectrum of personal judgment as to what constitutes fair chase, much of it conditioned upon the social and hunting history individuals have experienced. Consequently, there is far from consensus among hunters as to what fair chase is in relation to hunting methods, equipment and tactics. Ehlebracht (2008) recognized this, noting, "*Does that mean we should not address the 'ethical' aspects? Nobody likes laws or regulations that force ethics or morality, but the fact is not all people can be relied upon to limit themselves*." This statement reminds us that all laws are ultimately grounded in ethical and moral judgments, but not every person's concept of morality is equally viable and worthy of consideration.

Given the overall public support for humans to humanely harvest animals for legitimate purposes and the legal development of the public trust doctrine granting States the right and duty to manage wildlife, a range of options presents itself as to how to regulate fair chase hunting. The challenge is to do so in a manner that ensures human safety, fosters sound game management, and preserves the traditional ethos of hunting in Wyoming, while relying on sound reason and not personal whim.

With this background, one goal of the present committee's work has been to quantify the concept of fair chase in an objective manner consistent with Wyoming's system of wildlife management and the tradition of hunting in our State. We outline criteria in line with those sideboards that can be used to judge whether a given piece of equipment, method, or tactic used in the locating, stalking and taking of game is congruent with such. The use and recommended regulation of some specific equipment is also addressed. It is hoped more broadly that the committee's' findings can be used in the future to assess in a consistent manner new technologies not yet considered or invented.

FAIR CHASE

Wildlife management in Wyoming is underpinned by what has been termed The North American Model of Wildlife Conservation (Willms & Alexander 2014). This model was originally illuminated by Giest et al. (2001) and is comprised of seven tenets (Organ et al. 2012). Two of those tenets are directly applicable to the present discussion. First, "wildlife should only be killed for a legitimate reason," which has also be framed as "wildlife shall be taken by legal and ethical means;" and second, "the democracy of hunting" (Furtman 2015). These two principles essentially stipulate there should be equal opportunity under the law for citizens to pursue and harvest game, and that pursuit and harvest should be accomplished for acceptable purposes in an ethical manner.

The North American Model evolved organically and politically from a growing appreciation of the wildlife resource in North America as it became decimated by unregulated hunting in the mid 1800's (Organ et al. 2012). Two of the pioneering conservationists whose initial efforts eventually led to the model were Theodore Roosevelt and George Bird Grinnell. These men had witnessed in part the demise of the vast expanses of big game in North America and called for attitudinal and behavioral changes in the hunting public to ensure the immediate conservation and eventual perpetuation of game on the continent, together with the sport of hunting. Part of their efforts included developing and putting forward the ideal of "fair chase" in an effort to ensure public acceptance of hunting and the preservation of the self reliant pioneer spirit and outdoor skills (Organ et al. 2010, Organ et al. 2012).

Generally speaking, "fair chase" has been used by hunters to define an ethical approach to the taking of game animals. The earliest recorded use of the term can be found in the Boone and Crockett Club's constitution, adopted in February 1888.[2] In fact, the term "Fair Chase" is a registered trademark of the Boone and Crockett Club, and it is defined by the Club as *"the ethical, sportsmanlike, and lawful pursuit and taking of any free-ranging wild, native North American big game animal in a manner that does not give the hunter an improper advantage over such animals."*[3] At the heart of fair chase is the maintenance of a balance between predator and prey, such that the balance is not swung to an unethical extent in favor of the hunter. In

[2] https://en.wikipedia.org/wiki/Fair_chase accessed 09/05/2017

[3] https://www.boone-crockett.org/huntingEthics/ethics_fairchase.asp?area=huntingEthics accessed 09/05/2017

other words, game animals should have a reasonable chance of avoiding detection and if detected, eluding the hunter.

In addition to a personal code of conduct, laws are necessary to regulate hunting. To be consistent, game laws should be based upon fair chase standards that at minimum ensure public safety, sustainable use of wildlife resources, and a standard of conduct the public will tolerate in a particular state, province, region, or country (Prosewitz 1994). This must be balanced with the sentiment that *"There are certain aspects of fair chase hunting that extend beyond written laws. For example, shooting at a running deer is not illegal, nor are there any laws regarding shooting at extremely long ranges with a firearm or bow. To those who believe in the responsibility to kill quickly and cleanly, taking such risky shots would be unethical. These are the personal choices of hunting that cannot and should not be regulated. A large part of the time-honored tradition of hunting has to do with the fact that sportsmen police themselves and others both within and beyond the rule of law."*[4] However, the advent and use of certain technologies can lead some into the temptation, or uninformed belief, that their effective and ethical killing range is greatly extended and contribute to errors in judgment when considering whether a shot should be taken or not.

Looking broadly at the concept of fair chase, it boils down to how much opportunity should be allowed to a game animal to avoid detection, and if detected, elude harvest (which includes becoming a wounding loss). In order to apply the tenets of the North American Model, regulators must consider some application of fair chase for the public as a whole. After all, when one moves very far beyond things like obvious affronts to equity in hunting opportunity or endangerment of human safety, they quickly find personal choices are required. However, because not everyone can be accounted to make choices that do the least harm to others and the wildlife resource, or do not offend the majority of public sentiment, some regulation is needed.

APPEALS TO WOUNDING LOSS

Arguments appealing to increased or decreased wounding loss are often proffered by opposing sides to garner support or rejection for some hunting technique or technology. A broad analysis of potential wounding loss relative to every hunting innovation is beyond the scope of this paper.

[4] https://en.wikipedia.org/wiki/Fair_chase accessed 09/06/2017

However, a serious examination of wounding loss relative to various hunting techniques needs to be considered. After all, wounding loss is part of hunting. It can affect game management, and without any data arguments appealing to wounding loss are pure conjecture.

There are some data available that can be considered in making appeals (pro or con) to wounding loss. For example, self reported wounding loss by both firearm and archery elk hunters in South Dakota indicates wounding loss of 47% of the total harvest for archery elk hunters, versus about 5% for firearm hunters (South Dakota Department of Game, Fish and Parks, 2015). Across the border in Wyoming, 1968 research reported by Garvice Roby in internal Game and Fish documents suggested wounding loss varied from 5% to 33% for white-tailed deer in the Black Hills, but was generally about 10% to 20% with the equipment used fifty years ago. In an undated "Harvest Summary of the Black Hills Two Deer Area" from this same time period, Eddie Burns and Duane Hyde report finding a wounding loss of 18% during the Black Hills deer season. More recently, a South Carolina study attempted to determine in part the effects of shot placement, differences in the effectiveness of various firearms and ammunition, and the distance of the shot taken (Ruth, 2013). This study found approximately 20 percent of the deer shot by hunters ran off and could not be found without the use of a dog (Ruth, 2013). As such, it appears wounding loss has not changed much with advancements in equipment, at least with respect to firearm hunting of white-tailed deer.

While the Department currently assumes 10% wounding loss for all harvested big game, this figure likely does not apply across species and methods of take. More research is needed, especially if appeals to increased or decreased wounding loss are to be substantiated in relation to advancements in hunting technology. Some suggested approaches to bridging this data gap include expanding the harvest survey questionnaire to include self-reported wounding loss along with method of take, and a research project specifically designed to determine wounding loss rates in various species, and perhaps in relation to method of take. In addition, a human dimension survey intended to gauge the types of equipment used by hunters in Wyoming, along with the percentages of hunters who rely on various technologies to extend their shooting range, would be beneficial to begin to make more objective decisions regarding use of technology and wounding loss adjustments to population models. Such a human dimension survey could also delve into assessing the general acceptability of methods of take for different seasons and species in Wyoming.

To help reduce wounding loss, we also recommend the passage of regulations extending the mandate for hunters to make a reasonable effort to determine if game has been wounded and retrieving wounded game beyond that presently incumbent only upon waterfowl hunters (Appendix 1). The following language, or something similar, could be used to amend Wyoming Game and Fish Commission Regulations Chapter 2, Section 13(b):

> (b) Wounding and Retrieving**:**
>
> **(i) Small Game, Game Birds and Migratory Game Birds:** No person shall wound or kill any **small game animal, game bird or** migratory game bird without making a reasonable effort to retrieve it and reduce it to possession.
>
> **(ii) Big and Trophy Game: No person who shoots at, wounds, or may have wounded a big or trophy game animal shall fail to make a reasonable attempt to locate said game animal suspected of injury and take it into their possession. If the hunter is unaware of the location of wildlife after shooting at it, failing to go immediately to the location of such wildlife when the shot was fired is not a reasonable attempt to locate game.**

A FAIR CHASE FRAMEWORK FOR REGULATING TECHNOLOGICAL ADVANCEMENTS

In considering the range of opinions and spectrum of personal ethics, it is very useful to begin by couching the concept of fair chase relative to the odds an animal has of avoiding harvest. Starting here, we suggest using this concept as a framework for regulating hunting in relation to technological advancements. Our proposed framework is based upon two separate, but related aspects of the hunt:

- **Detection:** How much opportunity is allowed a game animal to avoid detection by a hunter in the first place?
- **Eluding Harvest:** What is the potential for a game animal to successfully escape from a hunter once the hunter is aware of its presence? This facet can be further considered under two scenarios:
    1. A game animal is detected, but if not adequately stalked by the hunter, it will normally flee before it is within the range of the hunter's ability to kill it.
    2. A game animal is detected, but the hunter uses tools and techniques that allow them to make a reasonable attempt at harvest outside their quarry's normal flight zone, which is the area surrounding the animal that if encroached upon by a potential threat, the animal will exhibit alarm and escape behavior.

We begin with this structure and establish categories related to each in order to delineate objective criteria that can be used to evaluate fair chase in different hunting situations. Further, we limit the application by defining the sideboards based upon what has generally become the Wyoming big game hunting experience. This provides a tool to assess what methods should be used to detect and harvest game in fashions that respect human safety, foster population management, and are consistent with the Wyoming hunting ethos.

The goal of this approach is the maintenance of hunting equity over time (for example, between traditional archery gear users and crossbow hunters using the latest gear in a special archery season), while allowing generally acceptable methods of pursuit and harvest of game that do not offend the traditional balance between the hunter and hunted. While admittedly somewhat subjective in nature, our approach is grounded in the evolution of hunting methods and techniques. It allows consideration of the general hunting experiences for which people strive, along with the management ramifications associated with pursuit and take methodologies.

Detection: Examining how hunting has evolved, we can classify game detection methods and techniques broadly into two categories:

1. **Traditional Detection of Game**: This category requires the hunter to be "in the woods" to discover the presence of game. Hunters themselves, or in a party, use traditional scouting and hunting techniques (such as hiking and glassing) to locate their quarry and eventually position themselves for a shot. Electronic devices and communications are not generally used to aid in detecting and stalking game. Accessing hunt locations is normally done afoot, or in the saddle from a trailhead or location where the hunter's vehicle is parked. Some aspects of traditional detection include the following:

    - Does not circumvent an animal's ability to avoid detection in the first place.
    - Often puts the hunter at risk of being detected by their intended game.
    - Includes preseason scouting, and spot and stalk during hunting season in the field.
    - Hunters may rely on information communicated to them by other folks "in the woods," but not normally in real time by remote cameras or electronic communication.
    - Use of maps is common to find a place to hunt and aid in navigation. GPS systems may also be employed to find locations in which to hunt.

- Hunters may communicate using two-way radios or cell phones, but normally locate the game they intend to take through traditional scouting and hunting techniques and not via electronic communication.

- Use of off-road vehicles to access more remote hunting locations is fairly common, but restricted to open roads; and some hunters may try to locate game from a motor vehicle.

- Use of non-electronic game calls.

2. **Modern Detection of Game**: Use of tools and techniques may circumvent an animal's ability to avoid detection, allow a greater probability of detection without alarming an animal, or provide the ability for a hunter to "cover more ground" than a traditional hunter could. Some aspects of modern detection include the following:

    - Significantly reduces an animal's innate ability to avoid detection.

    - May significantly enhance a hunter's ability to avoid being detected themselves by their quarry.

    - Remote monitoring that allows 24-hour, seven and day a week coverage in the field, including detection in the dark. Maybe include use of single or multiple trail cameras. Cameras may or may not be synced in real time to personal electronic devices.

    - Real time, remote detection and notification, wherein a hunter is notified of an animal's presence someplace other than within range of the hunter's vision or hearing.

    - Use of drones or other aircraft to detect game.

    - Use of electronics in relation to finding a place to hunt and aiding in navigation (GPS, cell phone maps, Google Earth, etc.).

    - Electronic or radio communication between hunters in the field is common and may be used to coordinate actual stalking.

    - Contract scouting services solicited to find and keep track of a specific game animal over an extended period of time – outside of the services normally provided by a guide or outfitter.

    - Use of advanced off-road vehicles is common, and hunters may travel off established roads where the older generations of hunters were prohibited from doing so due to the types of vehicles in use.

    - Use of ultra-light aircraft or helicopters to access landlocked public lands.

    - Use of analog and digital electronic calls.

Eluding Harvest: In the evolution of hunting and wildlife management, we can delineate four categories related the probability of an animal avoiding being killed once it has been detected by a hunter:

1. **Short Range (maximum, ethical range less than 50 yards)**: The ability for a game animal to elude a hunter increases significantly at distances greater than 50 yards. Based upon the general need to be within this range to place a vital shot with arrow or bullet.
    a. **Hunting Ethos**: Hunters choosing to limit themselves to short range harvest generally appreciate a primitive hunting experience with ample opportunity to pursue game. The ethos of the hunt is often centered upon the overall hunting experience and connection to the outdoors to a relatively greater extent than the harvest or trophy. Some hunters may simply enjoy using primitive methods of take. Hunters choosing this category normally expect lower harvest success in return for more hunting opportunity and a greater bonding experience with the game they pursue and the habitats in which they find them.
    b. **Equipment:**
        i. Longbows, recurve bows, compound bows.
        ii. Depending upon loading, cocking, sighting, and firing mechanisms, may include some crossbows, percussion cap, and flintlock muzzleloaders.
        iii. Non-magnifying, or "open sights."
        iv. Binoculars, spotting scopes, rangefinders used to help find game and get within range, but none of these devices are directly linked to harvest implements.
    c. **Management Implications**:
        i. Increased season length and license issuance are possible due to lower average hunter success.
        ii. Wounding loss will normally exceed 10% due to primitive methods of take and must be considered in season structures.
2. **Mid-Range (maximum, ethical range less than 300 yards):** The ability for a game animal to elude a hunter increases significantly at distances greater than 300 yards. Based upon the general need to be within this range for the majority of hunters to reliably place a quick killing shot.
    a. **Hunting Ethos:** Hunting is about the overall experience. Generally consistent with using the tools and techniques that were developed for the most part in the 20th Century. Accurate and consistent shooting (depending upon method of take) beyond 300 yards in field conditions is not a reality for most hunters.
    b. **Equipment:**
        i. Everything from the short-range category.
        ii. Compound bows with "all the bells and whistles."
        iii. Most crossbows (including those with telescopic sights).

iv. Modern muzzleloaders (including in-line muzzleloaders and the use of telescopic sights on muzzleloaders).

v. Handguns, rifles and shotguns (often with telescopic sights).

vi. Rifle scopes with generally less than 10X magnification.

vii. Binoculars, spotting scopes, and rangefinders – but these are not connected directly to the hunting implement.

viii. Use of holdover and "Kentucky windage," including multiplex reticles rather than adjustable turret scopes.

ix. Real time weather data collection and calculations of ballistic performance are not normally made prior to taking a shot.

c. **Management Implications:** Traditional season dates, bag limits etc. apply, and wounding loss is currently assumed to be about 10%.

3. **Long Range (maximum, ethical range can be extended well beyond 300 yards to distances over 1,000 yards):** The use of certain equipment and techniques significantly increases the probability that once detected, an animal's ability to elude a hunter at under 1,000 yards may be significantly diminished. Being able to harvest an animal at such extended ranges often places the hunter outside the game's normal flight zone, while the hunter is still able to make a reasonable attempt at take.

   a. **Hunting Ethos:** The hunt can be centered on a variety of paradigms. For some it is about maximizing the odds of harvesting a truly outstanding trophy using all the tools available. For others, it is about the shooting experience, setting up and making a difficult shot with precision and accuracy. For some it is about maximizing harvest opportunity relative to effort given the amount of money and time they are able to invest. For others it is just a logical extension of hunting as technology advances and the latest in "revolutionary" or "game changing" technology becomes available.

   b. **Equipment used:**

      i. Some of the equipment from short and mid-range may be used.

      ii. Custom and factory firearms with precision machined parts with tight tolerances.

      iii. High quality range finders (reliably accurate at over 1000 yards).

      iv. Handheld weather measuring devices.

      v. Ballistic calculators

      vi. High magnification and illuminated "tactical" scopes (some exceeding 20X) using adjustable turrets to "dial in" a ballistic solution to a given shooting situation, such that the hunter can confidently hold dead on an animal at ranges in excess of 1,000 yards as ballistic compensations are taken into account to allow accurate shooting.

      vii. Mechanical shooting rests (including bipods and tripods).

      viii. Loaded and scoped rifles in excess of 10 pounds.

ix. Shooting systems wherein the "scope" acts as a rangefinder and condition sensor, automatically adjusting the reticle such that a hunter simply needs to "lock" on target and pull the trigger.

c. **Management Implications:**

i. Wounding loss at mid-ranges (200 to 400 yards may be reduced), but depending upon a hunter's experience and abilities may exceed 10% in situations where shots in excess of 400 yards are taken, or conditions significantly impact wind drift of bullets or terminal performance is compromised due to extended range given cartridge and bullet selection.

ii. Stricter bag limits or reduced license issuance may be warranted as hunter success rates climb and harvest pressure on "trophy" animals is focused and increased.

iii. Extreme range hunting compromises the hunter-prey relationship, as an animal can be harvested at distances where the prey's senses of sight, smell and sound are ineffective at alerting them to a hunter's presence. Such a tip in the balance of the hunter-hunted relationship could be a detriment to the long term acceptance of sport hunting.

4. **Special Management** – The intention of the hunt is to cull or significantly reduce a sub-population or remove specific, individual animals for the protection of human health and safety, property damage, radical population control, or disease management.

a. Essentially, this is the true "it doesn't matter how the game dies," scenario because the management goal is the requirement to have dead game. As such, methods and techniques not generally considered acceptable under fair chase standards or sport hunting may be used. Examples include baiting, spotlighting, or harvesting radio collared animals.

b. Provides for increased opportunity and relaxed regulation to increase the assurance of taking specifically targeted animals to protect or enhance public safety, reduce or prevent specific damage and depredations issues, reduce specific sub-populations, or monitor and control wildlife disease.

c. Some current examples: Goose conservation order; kill permits for deer damaging a plant nursery or a herd of depredating elk; chronic wasting disease mitigation through radical harvest; removal of trophy game in conflict with humans; authorization to kill rabbits near human dwellings during tularemia outbreaks; urban deer removal programs.

IMPLEMENTING THE FRAMEWORK

There is a wide spectrum of personal views as to what constitutes hunting and the ethics that should govern it. Failure to construct some sort of regulatory sideboards around these capitulates to allowing people to do whatever they think is "right." Such an abrogation of wildlife

management is what led to the widespread demise of wildlife on the North American Continent in the mid-1800's, and is not a tenable solution. Without sideboards on what constitutes a safe and ethical hunt, the sport quickly devolves into something that would likely not be palatable to the general, non-hunting public.

There remains, however, a viable continuum of what individual hunters may realistically expect from their hunt. Strict categories, while useful for analysis, can be of restricted utility if one desires to limit regulatory complexity and minimize unnecessary regulation. For example, many hunters spend a lot of time and effort in the field hunting specific trophy animals. Their use of trail cameras, precision rifles and other technology may significantly increase their odds of success. However, many of these hunters would argue they put more time and effort into their hunts than those who just pick up a crossbow and head out without much thought or practice to participate in a special archery season. Other hunters place voluntary limits on themselves by using primitive technology while simultaneously challenging themselves by hunting for specific trophy animals and pushing the limits of their skills and equipment. With the decline in hunting participation, there is also a need to emphasize opportunity without stepping over the line to allowing things that a solid critique would suggest not be allowed in the field.

RECOMMENDATIONS

Given the framework and sideboards presented, codification to preserve the categories strictly as presented represents a complex regulatory road that should not be traveled, in that a large number of new season structures with various legal methods of take would be needed. At the other extreme would be abrogating any regulation to sole reliance on expanded information and education campaigns aimed at schooling hunters on the limitations and proper use of old and new methods of take. Instead, we recommend an approach combining enhanced educational requirements, modest restrictions on legal methods of take that preserve Wyoming's hunting ethos, and an honest evaluation of archery seasons to recapture and re-institute a truly primitive weapon season. In addition, consideration could be given to expanded use of Type 0 or Type 9 licenses where local game managers and hunters believe seasons with special equipment and method of take limitations would afford increased opportunity and be substantially supported by the public. However, we are not advocating a large scale movement towards "choose your

weapon" seasons since the various methods of take and their vocal proponents seem to be expanding endlessly from atlatls and in-line muzzleloaders, to radically designed crossbows and large caliber air guns, to airbows and "smart rifles."

The recommendations presented below are intended to preserve the current hunting culture in Wyoming, while providing ample hunting opportunity (opportunity being defined as allowance of sufficient time in the field to secure a reasonable chance of harvesting an animal). Even with the suggestions presented, there are plenty of prospects to retain current season and license type structures. However, a few new regulations are needed to reduce wounding loss and technology creep (that is, maintain equity of hunting in some season structures such as special archery seasons), and preserve traditional hunting in Wyoming. We also address certain technologies and their potential use by disabled hunters, which should normally be prohibited to the general hunting public. Observations and recommendations related to new and old technologies are analyzed using the framework presented above and are listed in Tables 1 and 2. Additionally, there follow sections related to specific technologies to provide an expanded analysis and more detailed recommendations. Finally, we suggest statutory and regulatory changes that might be considered.

Tools, Techniques, and Tactics	**Traditional**	**Modern**
Allowable / Encouraged	• GPS units, binoculars, spotting scopes, range finders. • Walk or ride saddle mount from trailhead or parking area accessed by highway legal passenger vehicle to access game.	• GPS units, binoculars, spotting scopes, range finders. • Trail cameras not used in real time. • Use of ATV's and UTV's on open roads to access game. • Two-way radios and cellular telephones to stay in touch with other hunters but not coordinate stalking.
Allowable for physically disabled hunters	• Use of two way radios and cell phones to coordinate stalking of animals. • Use of ATV's and UTV's off open roads to locate game.	• Use of two way radios and cell phones to coordinate stalking of animals. • Use of paid services to locate specific animals to harvest – not to include traditional guide and outfitter services.

Restricted or Discouraged	• Use of two way radios and cell phones to coordinate stalking of animals. • Use of paid services to locate specific animals to harvest – not to include traditional guide and outfitter services. • Use of paid "game sitters" who locate specific animals and then stay with that animal for more than 8-hours waiting for the hunter to arrive. • Use of drones to locate game. • Hunting in fenced preserves	• Use of drones to locate game. • Hunting in fenced preserves • Use of paid "game sitters" who locate specific animals and then stay with that animal for more than 8-hours waiting for the hunter to arrive.
Possible Regulatory Solutions	• Prohibit trail cameras for hunting 8/1-12/31 • Prohibit real-time image transmitting from trail cameras	

Table 1. Comparison of Traditional and Modern Game Detection in Relation to Fair Chase Standards

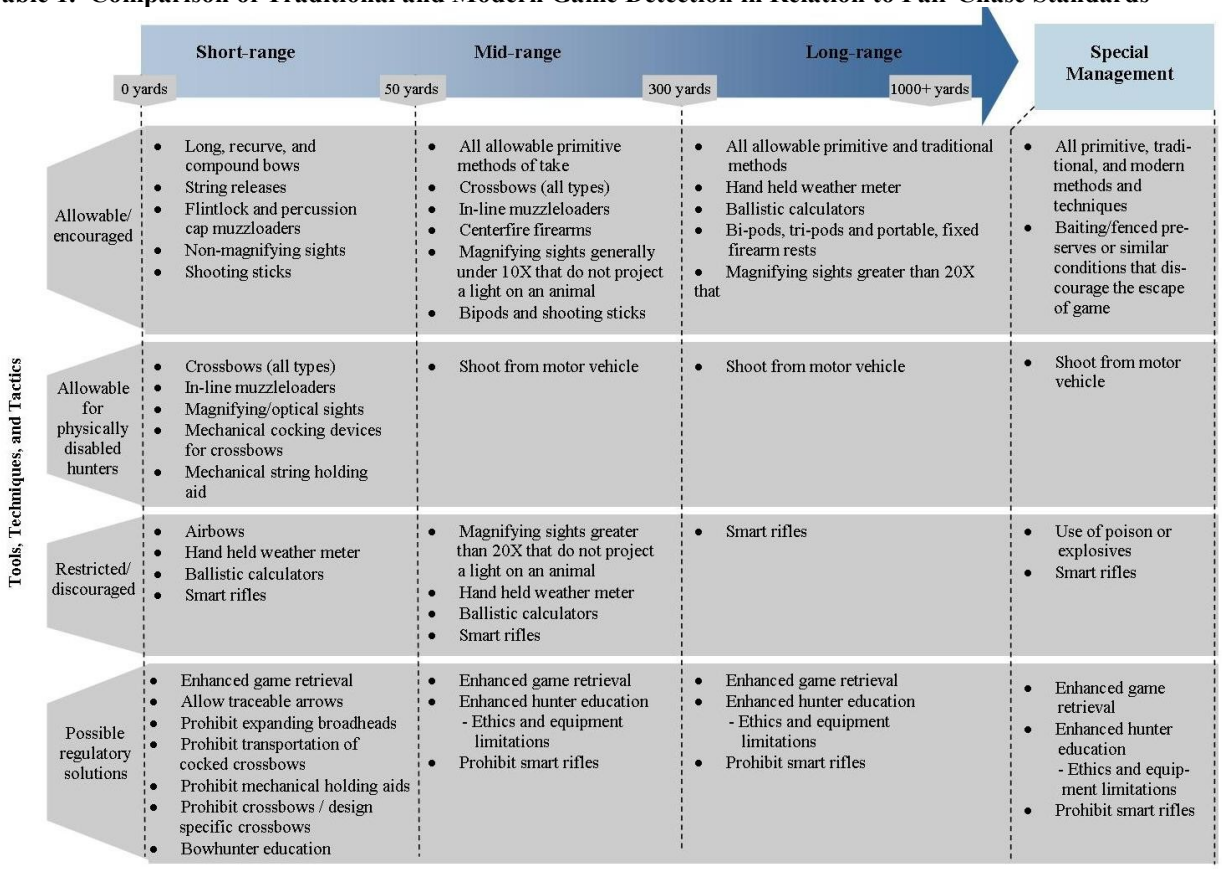


Table 2. Comparison of Short, Mid, and Long-Range Elusion of Harvest, including Special Management Framework, in Relation to Fair Chase Standards

Analysis and Discussion of Archery Hunting Equipment

The committee was tasked with conducting a detailed analysis of archery hunting equipment, including compound bows and crossbows, with specific attention to new crossbows such as the Ravin HeliCoil™.

History and Development of Technology

Mankind has used archery equipment for hunting and warfare since the Stone Age. Early bows and arrows were very crude, but that limitation was overcome by early man's ability to stalk within very close range of potential prey. This prehistoric challenge is the catalyst that draws many people into archery hunting today.

Archery gear underwent a very slow progression in advancement over most of human history. Until recent times, the technology used in archery equipment remained basically the same: a wooden stick or laminated wood or horn frame strung with a piece of sinew or natural fiber capable of launching a wooden shaft that was tipped with a stone or metal cutting edge. As archery technology progressed, new materials were found for use in limbs, arrows and points. New construction techniques were developed, moving from solid limb longbows to laminated recurves, but the overall effective range of the bow and arrow did not change drastically until the late 1960s.

In 1966, the invention of the compound bow revolutionized archery equipment. The compound bow used pulleys to give a mechanical advantage to the shooter and store energy from much stiffer bow limbs. It reduced holding weight by providing "let-off," allowing the shooter to draw much heavier poundage and hold a bow at full draw for longer times. This technology developed very quickly and the compound bow dominated archery hunting by the 1970s.

More recently, technology in the archery world has changed dramatically. Mechanical engineers are now using computers and programs to design lighter, faster, and more efficient bows. Modern materials like graphite, metal alloys, Spectra, Kevlar and carbon fiber are being used in the construction of bows, crossbows, arrows and bolts. Fiber optics, lasers, magnifying scopes and holographic sights are now available for archers to range and target quarry. Even lighted nocks, activated upon the release of the arrow, will illuminate that arrow's flight path from a bow.

Advancements in archery-related technology have been fast and furious. The effective range and accuracy of compound bows has essentially doubled since the 1970s, and compound bow technology plateaued in the early 2000s. Small improvements are still being made, but it is widely felt that manufacturers have gotten very close to reaching the maximum capability of this type of equipment, as inherent arrow performance is compromised at velocities greater than those currently being realized.

For the purpose of this discussion we classify archery equipment into two basic types of bows:

Upright bows are a handheld device where the user holds the bow in one hand and draws the string with the other. Arrows are fired by pulling back the string while holding or nocking the arrow onto the string and holding the bow at full draw with one's strength. The energy held in the limbs is transferred to the arrow by the string when it is released.

Crossbows utilize a stock with limbs attached. Either by physical or mechanical pulling, the string is drawn and mechanically held by the bow at full draw. The bow can be left at full draw indefinitely until the archer is ready to fire, usually by pulling a trigger. This will release the string and fire the bolt, which is the crossbow equivalent of an arrow. Primitive crossbows did not have much trajectory advantage over upright bows due to their shorter limbs, and sighting mechanisms were similarly limited. However, the advent of compound bow technology has also revolutionized crossbow design. Historically, crossbows lagged behind upright bows in advancement due to lower popularity. This was largely due to many states not allowing their use for hunting during archery seasons. As restrictions on crossbow use have waned, advancements in terminal performance of crossbows have surpassed upright bows, since the shooter is not required to draw the crossbow or hold it at draw. These advantages have allowed for radical advancement of the weapon, and the development and use of magnifying scopes designed specifically for crossbows have greatly extended the crossbow shooter's effective range. New crossbow models are coming out regularly and some, like the Ravin HeliCoil™ advertise range and accuracy similar to rifles (Appendix 2). The ceiling for this technology is likely yet to be reached.

What were once limited-range weapons requiring an advanced level of skill are now being used right out of the box by hunters with limited practice to accurately hit targets in excess of 70 yards

in the case of compound bows and 100 yards or more for crossbows. How does the advent of modern technology and equipment affect big game hunting seasons designed to be used with primitive weapons? Do these modern weapon types still fit within a short range weapon season framework, or have we reached the point managers need to limit the use of some types of archery gear in order to preserve what archery seasons were originally envisioned to entail and designed to accomplish?

Issues and Concerns Related to Archery Equipment

1. Fair chase and our approach

The philosophy of fair chase was largely developed in the early 1900s. By this time most hunters had moved well past using archery equipment. Firearms were the dominant tool for hunters in the field at that time. Archery equipment use for sport hunting did not make a strong resurgence until the 1970s and 1980s following the limited exploits of earlier archery pioneers such as Saxton Pope, Arthur Young and Fred Bear. At that time, many states started providing special archery seasons and popularity of the sport grew rapidly. With this is mind, modern upright bows or crossbows would still easily fall under the tenets of fair chase as we have defined for eluding harvest at 50 yards or less. These are still short-ranged weapons compared to the firearms being used even in the early 1900s and require the hunter to stalk well within the ranges that animals can effectively evade predation by hunters. However, many of the advanced crossbows and their attendant sighting systems have extended hunter's effective ranges to 100 yards or more, making them more comparable to mid-range hunting implements as defined above.

2. Human Safety

Archery equipment properly used is not generally considered to be a human safety concern. In fact, many areas with high human population densities require hunting be done with archery equipment to reduce safety concerns associated with errant projectiles. There is a concern that hunters traveling with cocked and loaded crossbows are a safety risk. Many crossbows are difficult to cock and cannot be decocked without firing, so hunters using them often leave them cocked during all phases of the hunt. Department personnel have witnessed many instances of hunters during special archery and type 9 seasons driving ATV's with cocked and loaded

crossbows between their arms; and it is not uncommon at all to encounter hunters driving around in pickups or utility vehicles with cocked and loaded crossbows in the seat next to them.

Implications Related to Game Management

1. Opportunity

Archery hunts are often utilized to provide more hunter opportunity. This is due to historically lower hunter harvest success rates for archery hunters. Archery seasons are commonly longer in duration than equivalent firearms seasons and in many instances provide opportunity at times when animals are more vulnerable to harvest, such as during the rut. Harvest success rates have likely risen from increased effort during archery hunts and the use of more advanced archery equipment. In some areas, archery bull elk hunter success has risen to or surpassed rifle success due to high hunter effort, the ability to call bulls in the rut into close range, and the increased length of the season. If archery success continues to rise due to advances in equipment, opportunity provided by those seasons will have to be reduced, or more stringent limitations put on legal gear.

2. Season structure

Wyoming uses a few different ways to structure archery hunts. We offer limited quota archery only (type 9) licenses in a limited number of areas. The remaining limited quota and general hunting seasons all have special archery only seasons available to hunters. These special seasons allow hunters to use legal archery equipment to hunt during late summer and early fall with the purchase of an archery license, but also return to hunt later during the regular firearm season if they were unsuccessful. Crossbows are currently considered archery equipment and are legal during archery only and special archery seasons. Archery hunters can also use legal archery equipment during the regular hunting seasons.

3. Harvest

Harvest rates vary greatly for archery hunts. This is largely affected by the species hunted, timing of the hunt, stalking terrain, etc. For example, hunting bull elk in the rut can be very effective with a bow in forested habitats with good populations of elk, such as in the Bighorn Mountains or Black Hills. Conversely, hunters pursuing mule deer with a bow in September

amongst very open environments with low deer densities can have very low success rates, such as in the Red Desert.

4. Wounding loss

Wounding loss in archery hunting is a common concern. Archery hunting has often carried with it the stigma of high wounding rates. Some of this is attributable to the visibility of a wounded animal with an arrow protruding from it in more densely populated areas, or when people find a carcass with an arrow in it. It is very difficult to quantitatively measure average wounding loss rates with any weapon type. There have been some hunter survey results and anecdotal evidence suggesting it is higher in archery hunting than in rifle hunting. A case may also be made that it is much harder to see evidence of rifle wounding loss than that of archery. An archery wounding shot will often leave a visible arrow as evidence in an animal where a bullet will not. Rifle hunts typically occur right after archery hunts so large numbers of rifle hunters are in the field to witness the effects of archery seasons. There are no seasons after rifle hunts to allow the same for those animals wounded by rifle shots. Many bad archery hits are assumed to cause wounding loss, but in many circumstances the animal will survive a hit with an arrow in a non vital area.

It is a credible concern that as archery equipment technology advances there is a potential for more hunters to take longer shots and wounding loss may increase. However, as with any harvest method, hunters will push the limits of their effective range regardless of the equipment used. As recommended above, it would be prudent to improve our knowledge of archery equipment effectiveness and wounding loss through more research.

Wyoming Hunting Ethos and the Spectrum of Use by Hunters / Hunter Opinions

Archery hunting has become a valued part of hunting culture in Wyoming. Many hunters appreciate the extended time afield these hunts provide and hunt with both archery equipment and firearms. Other hunters have resolved themselves to only hunt with archery equipment to further their experience of the hunt. There has been much division in the archery hunting public over the last 30 years. There is a varied set of ethics on what archery hunting really is. Should compound bows be allowed, or should archery season remain a more primitive, traditional hunt with longbows and recurves? Should crossbows be allowed during archery seasons? Hunters taking up archery equipment are often looking for a particular experience in the field and many

have strong opinions about what should be allowed during those seasons. As an agency, we need to further investigate what hunters want from those seasons and what those hunters' opinions are; then respond by structuring hunting seasons and allowable methods of take in a fashion that best fosters public safety, sustainable use of wildlife resources, and a standard of conduct most of the public expects and will tolerate.

Applicable Statutes and Regulations from Other States

There is great variation in archery laws between individual states. Those with high densities of whitetail deer appear to have very liberal archery laws, while western states with a variety of big game species have more conservative archery laws.

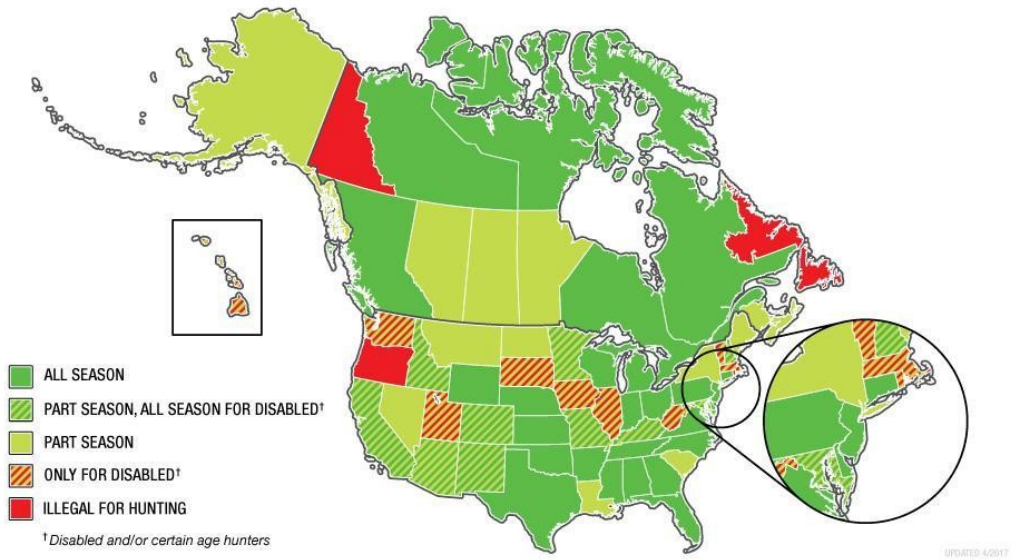
The majority of state archery hunting laws focus on several categories:

- Crossbow Allowance and Use
- Minimum Draw Weights (how many pounds to pull a bow string) and Maximum Let Off (the percentage of the draw weight you hold at full draw)
- Bowhunter Education Courses
- Broadheads (Fixed vs Expandable, Construction Material and Cutting Diameter)
- Draw Locks
- Sights and Scopes

Many of these laws are intended to make sure archery hunters use the right equipment to make clean, humane kills (draw weight, education courses, and broad head size and cutting diameter are examples). However, several laws are intended to keep archery hunting a "primitive" way to hunt. By regulating the type of weapon used, the type of sight used on that weapon, and the way that weapon is fired (using physical strength vs. elastic energy held by a mechanical device) lawmakers have made it clear that bow hunting should be a difficult endeavor, as it was a thousand years ago for our ancestors.

The center of debate regarding archery laws concerns the use of crossbows. Generally speaking, most states allow some use of crossbows as a legal means to take big game animals. While only a handful of states and provinces completely ban their use, most allow them to be used during

archery or any weapon seasons (see map below). The map below shows states in green as allowing crossbow use during the regular or special archery season. The cross hatched green/lime green states allow crossbows to be used during archery season by disabled hunters or during an any weapon season by everyone else. The lime green states allow crossbows to be used only during a certain portion of the season (for most, this is during the any weapon or rifle season). The cross hatched red/lime green states allow crossbow use by disabled or youth hunters only, and the red states completely ban their use. There does seem to be a correlation between states with free ranging elk populations and the legality of using crossbows during archery seasons. Most of these states do not allow the use of a crossbow except by qualified disabled hunters.



Examining the laws regarding crossbow use by states surrounding Wyoming, it becomes clear that Wyoming is the exception to the rule by allowing their use.

	Allows Crossbows during Archery Season	Allows Crossbows during Rifle Season	Allows Disabled Hunters to use during Archery Season

Wyoming	Yes	Yes	Yes
Colorado	No	Yes	Yes
Utah	No	Yes	Yes
Idaho	No	Yes	Yes
Montana	No	Yes	No
South Dakota	No	Yes	Yes
Nebraska	Yes since 2011	Yes	Yes

Colorado, Utah, Idaho, Montana and South Dakota all allow crossbow use by disabled hunters during archery season but prohibit their use unless it is during an any weapon or rifle season. Nebraska is the only neighboring state that allows crossbow use during archery season by someone other than a disabled hunter.

Wyoming laws concerning the use of crossbows are as follows:

WYOMING GAME AND FISH COMMISSION

CHAPTER 32

REGULATION GOVERNING FIREARM CARTRIDGES AND ARCHERY EQUIPMENT

Section 3. Definition. For the purpose of this regulation, definitions shall be as set forth in Title 23, Wyoming Statutes, and the Commission also adopts the following definition:

(a) "Archery Equipment" means crossbows, longbows, recurve bows, compound bows**,** arrows and bolts.

Section 6. Archery equipment that is legal for the taking of big or trophy game animals.

(a) For the taking of antelope, bighorn sheep, black bear, deer, mountain goat, mountain lion, or gray wolf where designated as a trophy game animal, a hunter shall use a longbow, recurve bow or compound bow of not less than forty (40) pounds draw weight and an arrow equipped with a fixed or expanding point broadhead that when fully expanded cannot pass through a seven-eighths (7/8) inch solid ring.

(b) For the taking of elk, grizzly bear or moose, a hunter shall use a longbow, recurve bow or compound bow of not less than fifty (50) pounds draw weight and an arrow equipped with a fixed or expanding point broadhead that when fully expanded cannot pass through a seven-eighths (7/8) inch solid ring.

(c) For the taking of any big or trophy game animal with a crossbow, a hunter shall use a crossbow having a peak draw weight of at least ninety (90) pounds and a bolt of at least sixteen

(16) inches in length equipped with a fixed or expanding point broadhead that when fully expanded cannot pass through a seven-eighths (7/8) inch solid ring.

Recommendations

With evolving advancements in the construction, function, and ability of new archery equipment, holding ourselves to the belief that special archery and archery only seasons are meant to be used by primitive weapons is going to take some tweaking of Game and Fish Commission Regulations to even the playing field. There are several potential changes that could ensure we stay true to this standard.

1. Change Chapter 32 of Wyoming Game & Fish Regulation to prohibit the use of crossbows during archery only and special archery seasons, except for use by hunters with qualifying disabilities.

    - Rationale - The technology and development of new crossbows gives their users an unfair advantage over upright bows in the taking of big game. By eliminating them as a legal means, everyone (except qualified disabled hunters) would have to use a physically manipulated long, compound, or recurve bow to hunt and harvest big game animals.

2. Change Chapter 32 of Wyoming Game & Fish Regulation to prohibit the use of magnifying optics and holographic sights on all archery equipment, except for use by hunters with qualifying disabilities.

    - Rationale – Regulation will still allow for the use of crossbows as a legal means of archery hunting equipment. However, crossbow hunters would have to use generally the same style of pins and natural light available as other archery hunters, putting everyone on the same playing field - one limited by the natural capacities of the human eye.

3. Change Wyoming Statute WS§23-2-106 to require bowhunter education, to read:

    (a) Except as provided in subsection (c) of this section, no person born on or after January 1, 1966, may take any wildlife by the use of firearms *or archery equipment* on land other than that of his own family, unless the person possesses or can demonstrate they have obtained a certificate of competency and safety in the use and handling of firearms *or archery equipment* as provided by subsection (b) of this section.

    (b) The department shall institute and coordinate a statewide course of instruction in safety and competency in handling firearms *and archery equipment*.

- Rationale - Wyoming does not require archery hunters to take any kind of educational or safety course prior to heading into the field. This would hopefully benefit the sport by teaching bow hunter ethics, an appreciation for the limitations of the equipment, and ultimately result in reduced wounding loss.

4. Change Chapter 2 of Wyoming Game & Fish Regulation to require shot follow up (see above).

    - Rationale – Achieve a reduction in wounding loss and make hunters think twice about taking unethical and long shots, instilling a culture of responsible shot choice.

5. Change Chapter 2 of Wyoming Game & Fish Regulation to prohibit the transportation of a cocked crossbow.

    - Rationale – Use regulation to help reduce safety concerns about cocked crossbows in vehicles and reduce the occurrence of road hunting with crossbows. Also level the playing field somewhat with upright bow hunters who must draw their bows undetected by game.

6. Change Chapter 32 of Wyoming Game & Fish Regulation to prohibit design-specific advancements in crossbow technology.

    - Rationale – Use regulation to restrict the use of crossbows featuring advanced technology and keep them in the realm of short-range weapons.

7. Change Chapter 32 of Wyoming Game & Fish Regulation to prohibit all mechanical holding aids which hold an upright bow at full draw.

    - Rationale – Holding aids allow a compound bow to be held at full draw indefinitely prior to taking a shot, so the user is not dependent on physical strength to do so, effectively making them somewhat similar to a crossbow.

8. Change Chapter 32 of Wyoming Game & Fish Regulation to allow use of traceable arrow technology.

    - Rationale – Allow new technology to help with animal recovery and reduce wounding loss.

9. Change Chapter 32 of Wyoming Game & Fish Regulation to prohibit the use of expanding point broadheads for taking big and trophy game animals.

    - Rationale- Expanding point broadheads allow an arrow to fly at a higher rate of speed, increasing the effective range and making bow hunting a less primitive sport.

    - Rationale- Anecdotal evidence and interviews with hunters in the field suggests that expanding point broadheads, when used on larger big game animals like elk,

moose, and mule deer, do not expand reliably or have blades break off when they strike these animals, conceivably contributing to more wounding loss.

Analysis and Discussion of Long Range Hunting Equipment

The committee was tasked with conducting an analysis of long range hunting equipment, including firearms and other technology.

Background

Hunters have used firearms to harvest game animals for several centuries. During this time, the equipment used has changed greatly and will continue to evolve in the future. Advances in firearm design, sighting devices, ammunition and the willingness of hunters to embrace new technology has enabled hunters to harvest game at increasingly greater distances. Because of recent advances in technology and media coverage, long range shooting and hunting have become more popular in the last decade. Some of the technology that has enabled hunters to take game at increasingly long distances include:

Long range rifles

Rifle technology and accuracy has advanced greatly in the last decade to the point where most new factory produced rifles will shoot close to one minute of angle (MOA), a precision level of approximately one-inch groups at 100 yards. It wasn't too long ago a shooter needed to spend hundreds of dollars at a gunsmith to get a factory rifle to shoot that well. Long range shooters expect a lot out of rifles they shoot, and will have work done to them and add accessories to make them as accurate as possible. Expectations of 0.5 MOA or less is commonly required of rifles used to shoot at ranges in excess of three or four hundred yards. Most rifles used to shoot long range are built with a heavy barrel and a stock that is bedded (or precisely fitted) to the action. These rifles commonly have parts machined to extremely tight tolerances to make them as accurate as possible.

Long range scopes

A shot from a long range rifle can only reliably hit what the shooter can see and effectively aim at. Scope technology has advanced in tandem with rifle technology. A long range scope will be of high and often variable magnification, typically have a 30mm or larger tube, and external turrets that can be used to quickly adjust the reticle for a given shooting situation. Other scopes have complex reticles that aid the shooter in correcting for bullet drop and wind drift by allowing precise holdover and windage compensation, and are often times illuminated.

Modern scopes use the latest technology in lens coatings to give the shooter the clearest view of the target possible and provide reliable, repeatable adjustments to correct the path of the bullet to ensure precision at long ranges. Because of the need for precision in these scopes a very sturdy mount to attach it to the rifle is a must. Long range shooters expect to pay as much or more for their scope as they did for the rifle they plan to mount it on.

Other optics

Another optic used by long range shooters is a laser range finder that can range soft and hard targets to the ranges at which they expect to shoot. Advances in laser range finder technology allow for the accurate ranging of targets past 1000 yards, effective ranging distance being only limited by the amount of money a hunter is willing to spend. To identify their target, long range shooters also use a quality pair of binoculars and a spotting scope. These optics have also benefitted from the advances in lens coating and construction realized in rifle scopes in the last decade.

Handheld or pocket weather meters

Being able to precisely measure wind velocity and other environmental metrics such as temperature, relative humidity, altitude, and density altitude are vital to finding an accurate firing solution in long range shooting. Most long range shooters use an anemometer, often coupled to other weather measuring instruments, to measure these metrics so that a shooter can input them into a ballistic calculator or cell phone application in order to accurately calculate bullet drop and wind drift at a given range.

Ballistic calculator

A long range shooter will need some form of ballistic calculator that can take the information on bullet velocity, shape, weight and drag (ballistic coefficient), along with range and

environmental factors to calculate a firing solution to compensate for bullet drop, wind drift, and other factors that affect bullet flight. In the past, these were as simple as a table of precalculated solutions, or involved using a handheld calculator. Today, this has evolved into a standalone device, which completes all of the calculations for the shooter. Shooters can also purchase applications for their cell phone to calculate firing solutions which are extremely accurate. Other manufactures have incorporated ballistic calculators into their devices such as chronographs, handheld weather meters, and anemometers. Having one device that accomplishes several tasks is a great advantage to the long range shooter.

Tripod and bipod

Accurate long range shooting requires a shooter to shoot from a very stable shooting position. Many shooters shoot from the prone position using a bipod mounted toward the front of their rifles. Tripods have been increasingly popular in recent years, with some manufacturers building tripods specifically for long range shooting. These tripods are often constructed of carbon fiber, have a ball head for easy adjustment and a quick release mechanism that allows the shooter to easily attach their rifle to the ball head.

Local manufactures, products, schools

The Best of the West and Gunwerks are two examples of local Wyoming companies that manufacture and market long range shooting optics and firearms for hunting and use on the range. The following are a few of many products marketed specifically as firearms/optics for hunting game animals.

MountianX by Gunwerks: Functional Range: 900 yards, 9.9 pounds, $6,550.00 https://www.gunwerks.com/store/rifles

Helios by Gunwerks: Functional Range: 750 yards, 7.9 pounds, $5750.00 https://www.gunwerks.com/store/rifles

Mountain Hunter by Best of the West: 1000 yards range, 8 pounds, Huskemaw long range optics, $5995.00**,** http://www.thebestofthewest.net/products.html

Signature series carbon by Best of the West: Range: 1000 yards, 8.3 pounds, Huskemaw long range optics $8995.00, http://www.thebestofthewest.net/products.html

The National Rifle Association (NRA) and many manufactures of long range shooting optics and firearms offer classes designed to train a student how to use their equipment and be a successful long range shooter. These two to three day courses are available for a cost ranging from $1000 to $1900.

Issues and Concerns Related to Long Range Hunting

For the purpose of this document, long range hunters are considered as those who use specialized equipment that allows them to shoot with precision and accuracy in excess of 400 yards. Through analysis of this issue, it has become apparent that an individual's perception and personal definition of long range hunting influences their concerns related to the topic. This document attempts to evaluate long range hunting technology, which differs from hunters who

take unethical shots at long distances. Advances in long range hunting technology are not necessarily driving unethical behavior in some hunters, but may contribute to a false sense of ability in an unpracticed or under-practiced marksman.

The popularity of long range shooting and hunting has significantly increased in the last ten years due in part to publicity of technology and techniques presented through hunting shows and other media. Because this technology has become increasingly more mainstream, there is concern many average hunters have the perception that if they purchase the latest hi-tech equipment, they will be able to make accurate long range shots as advertized by the manufacturer or media. In reality, it takes a great deal of practice to make accurate shots at long range, even when using the best technology available.

There is also a perception that long range hunting increases wounding loss of game, however, there is little data available to support or deny this claim. In any given hunting scenario, shooting outside of a hunter's personal limitations could potentially lead to an increase in wounding loss. In addition, there is concern that many hunters taking a long range shot are unwilling to physically inspect the site of the potential kill to see if an animal was hit or if the shooter missed.

Fair Chase and the Ethics of Long Range Hunting

There are varying opinions about long range hunting and whether or not it falls within the realm of fair chase or is an ethical way to harvest a game animal. Those opposed to this method of hunting do not consider it fair chase because the hunter is making a shot at a distance beyond which the animal would normally try to escape. Proponents of long range hunting counter that long range shooting in and of itself does not violate the ideal of fair chase. This is because while the animal's ability to detect the hunter and decide to escape may be compromised, the difficulty of making a clean and effective kill shot increases greatly at longer ranges as well. At any rate, the ultimate goal of most hunters is to be undetected no matter the distance from the animal being hunted.

Ethical long range hunting is dependent on the individual hunter. What may be an unethical shot for one hunter may not be for another. Ethical hunters are aware of and respect their limitations.

Long range hunting is not necessarily unethical, but it is agreed by most that it is unethical to attempt any shot outside the ability of the hunter and their equipment.

As long range shooting continues to increase in popularity, it will be important to gauge the public's perception and evaluate if long range hunting pushes the envelope of fair chase too far for the majority of the public. However, strictly regulating it as an activity will be difficult, if not impossible. Sound hunter education and perhaps regulations that instill a sense of responsibility in hunters to choose their shots wisely and follow up on them is likely where any solution lies.

Human Safety

Human safety is always a consideration when hunting afield with high powered rifles. Those hunting big game animals with a firearm in Wyoming are required to wear hunter orange in order to be visible to other hunters. Long range shooters, as any other shooters, need to make certain of their target and what lies beyond.

Implications Related to Game Management

At this time, no data are available on wounding loss or hunter success rates specific to long range hunting. In the South Carolina study referenced above (Ruth, 2013) there was a statistically significant increase in missed shots at ranges in excess of 150 yards, but no data were presented relative to wounding rates at different ranges. If hunter success rates increase or an increase in wounding loss is detected due to new technology associated with long range shooting, decreased season length and license issuance may be necessary.

Applicable Statutes and Regulations from Other States

On Oct. 30, 2017 a survey was sent to the law enforcement chiefs of seventeen western US states asking the following questions:

1. Does your state regulate long range shooting/hunting? If so, please include any regulatory or statutory language in your response.

2. If your state does not regulate long range hunting/shooting at this time, are there concerns with this type of hunting/shooting and does your agency plan on addressing this in the future?

Of the 12 states that responded, 11 do not regulate long range hunting or shooting. One state regulates long range shooting by limiting the weight of any firearm used to take game to 16 pounds or less. One state responded that they are not concerned about long range hunting/shooting and three states responded that they are concerned about the issue.

Four states prohibit the use of "smart weapons" and one state requires hunters to go to where the animal was standing when it was shot if there is uncertainty as to the location of the animal after the shot(s). One state responded that state statute prohibits their department from regulating firearms or ammunition used to take game with some exceptions. Here are the specific responses:

Arizona
Arizona doesn't prohibit long range shooting, nor limit the use of "smart scopes." Arizona does not permit the use of smart rifle technology, however. Weapons that lock on a target and fire when conditions are right are not allowed under their Fair Chase review of the technology.

Colorado
Colorado does not regulate long range hunting or shooting. However, in 2003 the legislature added a subsection (c) to our "Pursuit of Wounded Game-Waste of Edible Game Wildlife" statute to try and somewhat address this situation of long range shooters not going to the location of the animal they shot at to check for wounded animals. [C.R.S. 33-6-119(1)(c) If the hunter is unaware of the location of wildlife after shooting at it failing to go immediately to the location of such wildlife when the shot was fired is not a reasonable attempt to locate game.]
There are ethical concerns with long range shooting and calling it hunting. Colorado would be interested in how other states are addressing this ethical issue through regulatory or statutory language. Colorado, thus far, has tried to use education to address this ethical issue.

Idaho
Idaho does regulate long range shooting/hunting. The topic comes up occasionally, but there are no plans to address it further. See regulation below:
Idaho Administrative Code
IDAPA 13.01.08 Rules Governing the Taking of Big Game Animals in the State of Idaho
410. UNLAWFUL METHODS OF TAKE
No person shall take big game animals as outlined in this section. (7-1-93)
01. Firearms. (7-1-93)
a. With any firearm that, in combination with a scope, sling, and/or any other attachments, weighs more than sixteen (16) pounds. (7-1-93)
b. With any shotgun using any shot smaller than double-aught (#00) buck. (7-1-93)
c. With any rimfire rifle, rimfire handgun or any muzzleloading handgun, EXCEPT for mountain lion and trapped gray wolf. (4-4-13)
d. With a fully automatic firearm. (10-26-94)
e. With any electronic device attached to, or incorporated in, the firearm (including handguns and shotguns) or scope; except scopes containing battery powered or tritium lighted reticles are allowed. (4-2-08)

01.a. was adopted to prevent the use of long range weapons and still does to an extent. However, we realize technology has changed such that long range weapons are being used that comply with this rule.

Montana
Montana does not regulate long range hunting/shooting. Fish, Wildlife and Parks is prohibited in regulating long range shooting rifles and have not had any serious talk of regulating long range shooting. Montana statute prohibits the Commission from regulating the use or possession of firearms, firearms accessories or ammunition used for hunting.

Nebraska
Nebraska does not currently regulate long range shooting. There haven't been any discussions or concerns expressed from the public or within the agency.

New Mexico
New Mexico does not regulate long range shooting/hunting. New Mexico does not plan to regulate long range shooting in the future. There is concern with the popularity of long range shooting and they don't want inexperienced shooters to take shots beyond their limitations. New Mexico plans to address this in education rather than by regulation at this time.

North Dakota
North Dakota does not regulate long range hunting/shooting at this time. No response was given for question 2.

Oklahoma
At this time Oklahoma has no regulations on long range shooting at game. Oklahoma has the normal laws against shooting from or across public roadways, transporting loaded firearms and requirement on the legal rifle calibers for hunting deer or big game in Oklahoma. Right now they are trying to focus on making our regulations simpler to understand and navigate so there isn't any movement towards any kind of limitation on the distance someone could harvest game. They just leave that up to the hunter's ethics in the field (which we know could be a problem) to decide if they should take the shot or not.

Oregon
While Oregon does not regulate long range hunting or shooting, they do have some regulations that limit technology. These regulations include prohibiting any sight which projects a beam of light to the target (this regulation prohibits any scope which has a built in rangefinder), prohibiting any computer assisted (internet) hunting, prohibiting smart guns, prohibiting scopes on muzzle loading firearms, prohibiting anything but a round ball for muzzleloaders and prohibiting rangefinders and mechanical broad heads in archery equipment.
Oregon does have concerns with long range hunting/shooting and long range shooting equipment. No current plans have been made for regulation changes which would directly regulate long range hunting.

South Dakota
No regulations or statutes in South Dakota pertaining to long range hunting or shooting. South Dakota hasn't experienced any issues and have no immediate plans, but understands how this could be an issue with some unscrupulous sports taking marginal shots.

Utah
Utah currently does not regulate long range shooting/hunting. They do prohibit the use of "smart guns" for taking big game as per the following rule:
R657-5-7. Prohibited Weapons.
(1) A person may not use any weapon or device to take big game other than those expressly permitted in this rule.
(2) A person may not use:
(a) a firearm capable of being fired fully automatic;
(b) any light enhancement device or aiming device that casts a visible beam of light; or
(c) a firearm equipped with a computerized targeting system that marks a target, calculates a firing solution and automatically discharges the firearm at a point calculated most likely to hit the acquired target.
(3) Nothing in this Section shall be construed as prohibiting laser range finding devices.
A couple of years ago Utah state tried to address high tech hunting equipment and sent out a survey to around 70,000 deer and elk hunters. They received over 20,000 responses back. See appendix A: Power Point that was presented to Utah's "Wildlife Board."
At the time, there had been a lot of complaints about hunters using large caliber rifles to shoot long distances so there was a question on the survey concerning this. In the end it was obvious Utah's hunters did not support the use of large calibers, but they discovered it was far more common to use fast, small caliber rifles for long distance shooting. The Wildlife Board decided to table any regulation to try and address the issue of shooting long distances to harvest big game and the issue has not come up since.
Utah's officers are starting to see more hunters using these long distance rifles in the field and they suspect they will be forced to look at the issue again in the future.

Washington
Washington does not regulate long range hunting or shooting. No answer was given for question two.

Recommendations

The committee has four recommendations related to long range hunting:

1. The committee recommends an educational approach to address this ethical issue rather than implementation of regulatory or statutory language. An educational approach would encourage hunters to recognize their personal limitations in a given hunting scenario in order to make ethical decisions. This approach could include creating materials to facilitate discussions in hunter education classes and/or partnering with manufacturers to encourage ethical decision making by long range hunters.

2. The committee recommends that a human dimension survey be conducted to gauge the tolerance/acceptance for long range shooting by the general hunting public.
3. The committee recommends that the harvest survey be modified in order to collect specific data on long range shooting and wounding loss in order to assess wounding loss rates and harvest success of long range hunters.
4. Similar to Colorado, the change recommended above to Game and Fish Commission Regulation Chapter 2 relating to wounding and retrieval could serve to allay some of the perceptions about wounding loss related long range hunting. It could also become a touchstone for hunter education in the realm of hunter responsibility and ethics.

Analysis and Discussion of Trail Cameras

The committee was tasked with conducting a detailed analysis of trail cameras used for hunting, including those that transmit images in real time to cell phones or other devices.

History and Development of Technology

Trail cameras have evolved and become commonplace in the last 15 years, to the point they are now widely use by hunters to help locate game animals in the field. Currently, there are numerous trail cameras produced by various manufacturers that provide real time transmission of images/video via cellular telephone, WIFI and mobile hotspot signals. This development has brought trail camera use to the forefront of wildlife management in relation to the potential for overharvest of trophy quality game animals and may have implications for overall herd management through possibly increased harvest success rates. Trail cameras are commonly used in the following manners:

1. Bear baits – Trail cameras allow hunters to judge size and numbers of bears frequenting bait sites. This allows hunters to evaluate and restrict their harvest to only large boars, which in turn reduces/prevents the harvest of smaller/young female bears with cubs. Trail cameras have also been successful in identifying grizzly bears in locations previously unknown to wildlife managers and possibly reducing human-bear conflicts.
2. Water holes – Hunters are known in other states to set trail cameras up at watering locations in arid habitats to track and locate large trophy class big game animals (elk, deer, antelope, bighorn sheep, etc.). This type of detection can substantially alter hunters' patterns to focus on only harvesting truly mature big game animals, which may not have been documented otherwise.
3. Trails, ground blinds and tree stands – Hunters commonly use trail cameras on trails which intersect for the purpose of documenting game densities in an area and aiding in

the placement of ground blinds and tree stands. This allows hunters to pattern wildlife and hone their hunting times and location, possibly increasing harvest rates of mature big and trophy game animals.

4. Security – Use of trail cameras is becoming commonplace for landowners and sportsmen for the sole purpose of documenting trespass violations, theft and destruction of private property by vandals.
5. Research – Trail cameras have become commonplace in wildlife management to document animal occurrence, migrations, and calving/fawning locations. The ability to identify and classify animals remotely reduces survey costs and expands effort, while limiting personnel exposure to hazardous backcountry and aerial work.

Issues and Concerns with Trail Cameras and Hunting

1. Fair chase and our approach

Throughout the course of their evolution, trail cameras have gained notoriety for their low price, availability, and capability of locating game previously undetected. Trail cameras increase the ability of hunters to focus harvest on trophy sized game animals. This is a result of hunters detecting and patterning game that would otherwise have only a small chance of being identified in the field by traditional hunting techniques. Strategically-placed trail cameras allow a hunter to document nearly every animal within a given area, day or night, without spending any time in the field other than what is required to maintain the cameras. Cameras with real time transmitting capabilities give a hunter the ability to monitor an area at all times and know when and where a given animal is available to be taken. This certainly increases the likelihood of detection for animals that are typically very secretive and difficult for hunters to find using traditional hunting methods.

2. Human Safety

Trail cameras placed on bear baits have been able to document grizzly bears in new locations unknown to wildlife managers and prevented possible conflicts with hunters and recreationalists alike. As mentioned above, they can also help reduce wildlife managers' exposure to hazardous working conditions.

Implications Related to Game Management

The use of trail cameras allows hunters to identify and pattern game animals prior to hunting them. Some modern trail cameras have the ability to transmit real time images/videos to hunters, allowing them to pursue specific game animals when they are known to be in specific locations.

This can result in increased hunting pressure on the trophy quality segments of big and trophy game populations, and has the potential to improve overall hunter success rates. Over time, it may be necessary to modify season structure and license issuance to reduce opportunity in areas where the trophy segment of a population has experienced overharvest.

Wyoming Hunting Ethos and the Spectrum of Use by Hunters / Hunter Opinions

Wyoming hunters have commonly used trail cameras since their inception for the convenience of documenting wildlife in the field, whether it is 100 yards from their residence or 15 miles into the backcountry. With the advent of real time transmission of images/videos from trail cameras, which can be purchased for as little as $250, issues related to wildlife management and fair chase have come more to the forefront. The following questions arise: Is it fair chase to have multiple cameras in the field with cellular capability texting and emailing images/videos of wildlife that comes within 60-150 feet of the device? If not considered fair chase, does such action effectively differ from hiring an outfitter to spend dozens of days scouting the same country and being much more intrusive in documenting the same wildlife?

There are several important considerations that must be made when deciding whether or not to regulate the use of trail cameras for hunting. Trail cameras with the ability to transmit images and video in real time to a hunter are most concerning from a fair chase standpoint. However, regulation of these specific trail cameras would be difficult to enforce. Most trail cameras are placed in an enclosed metal box with a lock. A search warrant is needed for law enforcement to access someone's locked camera and electronic surveillance equipment. In addition, a hunter who purchases a camera capable of transmitting real time images may or may not have enabled that feature of the camera. Doing so requires the camera to have significant WIFI or mobile hotspot signal strength for data transmission and the user must have purchased a wireless plan to allow for that transmission. In addition, law enforcement must determine if the camera is being used for hunting or some other legitimate purpose, such as security, research or simply watching wildlife with no intent to hunt them.

Applicable Statutes and Regulations from Other States

Montana

Motion-Tracking Devices and/or Camera Devices: It is illegal for a person, while hunting, to possess any electronic motion-tracking device or mechanism that is designed to track the motion

of a game animal and relay information on the animal's movement to the hunter. A radio tracking collar attached to a dog that is used by a hunter engaged in lawful hunting activities is not considered an illegal motion-tracking device.

Two-way Communication: Two-way electronic communication (radios, cell phones, text messages, etc.) may not be used to:

- hunt game animals or upland game birds, migratory birds or furbearers as defined in Montana law ("Hunt" means to "pursue, shoot, wound, kill, chase, lure, possess or capture"), or
- avoid game checking stations or FWP enforcement personnel, or to facilitate illegal activity.
- The rule does not prohibit the possession or use of two-way communication for safety or other legitimate purposes.

Utah

Utah has allowed trail cameras since 2012 and allows trail cameras to be placed in the following manners:

- Hunting is allowed on DNR land and it is not a designated special use zone. These "special use" zones would include trails, parking lots, buildings, beaches, toilet facilities, and campgrounds.
- Cameras show either the name and address or DNR customer identification number of the owner. This must be clearly visible without having to move or inspect the camera.
- Cameras may not cause damage to natural vegetation. Thus a camera that is installed with a screw into a tree would not be allowed on a tree, whereas a camera that is strapped onto a tree would be allowed.
- The placement is done at the risk of the camera owner. If someone steals or damages the camera the department will not be liable, and if DNR employees conduct habitat work (such as timber stand improvement, burning, etc.) and the camera is damaged the department will not be liable.
- The use of trail cameras is only on DNR-owned land, and does not include land leased from private landowners. There the landowner must give permission.

Idaho

Idaho has been considering the following regulation as of the 2017 legislative session:

IDAPA 13.01.08.410.UNLAWFUL METHODS OF TAKE. No person shall take big game animals as outlined in this section. (7-1-93)

- With any game camera or other electronic device capable of recording images used as an aid to take a big game animal during the same day or following day as the images were transmitted or the camera was visited in the field.
- With any device capable of recording and transmitting photographic or video wirelessly to a remote device such as a computer or smart phone, used as an aid to take a big game animal during the same day of transmission or the following day.
- With any electronic device, including, but not limited to, cellular phones, smart phones, satellite phones, 2-way radios, and GPS devices, used in any manner to communicate the location or approximate location of any big game animal to another person for the

purpose of aiding the take of that big game animal. Nothing in the rule shall be interpreted to preclude the use of such electronic devices for communication for other lawful purposes.

Nevada

Nevada considered the following regulation in 2016, but it is unknown of its submission into law. This regulation prohibits a person, during the period beginning August 1 and ending December 31 of each year, from locating or observing, or assisting another person in locating or observing, certain big game mammals for the purpose of hunting with the use of a trail camera, including, without limitation, any device that is not held or manually operated by a person and that is used to capture images or video using a heat or motion detector to trigger the device. This regulation also prohibits a person from placing a trail camera or such other device within 200 feet of a spring, water hole or artificial basin that is used by wildlife and collects, or is designed and constructed to collect, water.

Section 1. Chapter 503 of NAC is hereby amended by adding thereto a new section to read as follows:

Except as otherwise provided in this section, a person shall not, for the purpose of hunting, locate or observe, or assist another person to locate or observe, any big game mammal in a management unit described in NAC 504.210 during the period beginning August 1 and ending December 31 of each year with the use of a trail camera, including, without limitation, any device that is not held or manually operated by a person and that is used to capture images or video using a heat or motion detector to trigger the device.

1. A person shall not place any device described in subsection 1 within 200 feet of:
   (a) A spring;
   (b) A water hole; or
   (c) An artificial basin which is used by wildlife and collects, or is designed and constructed to collect, water.
2. Evidence of an act constituting a violation of this section includes, without limitation, any image or video of a big game mammal captured by any device described in subsection 1 that:
   (a) Is stored on the device; or
   (b) Has been transferred to a viewing device at another location.
3. The provisions of this section do not apply to a person who is acting within the scope of his or her official duties and who is:
   (a) An employee or authorized agent of this State;
   (b) An employee of a municipal or county government of this State; or
   (c) An employee of the Federal Government.

Recommendations

The following proposed regulatory language could be added to Wyoming Game and Fish Commission Regulation Chapter 2: *Except as otherwise provided in this section, a person shall not, for the purpose of hunting, locate or observe, or assist another person to locate or observe,*

any wildlife during the period beginning August 1 and ending December 31 of each year with the use of a trail camera, including, without limitation, any device that is not held or manually operated by a person and that is used to capture images or video using a heat or motion detector to trigger the device.

The provisions of this section do not apply to a person who is acting within the scope of his or her official duties and who is:

(a) An employee or authorized agent of this State;

(b) An employee of a municipal or county government of this State; or

(c) An employee of the Federal Government

Such a proposal could also be limited to prohibition of real-time transmission of images, although as mentioned above, regulatory enforcement would be difficult.

Analysis and Discussion of Air Powered Weapons

The committee was tasked with conducting a detailed analysis of additional emerging technologies for hunting. One of these, the Crosman Pioneer Airbow, was developed based on air rifle technology.

History and Development of Technology

Air powered weapons (air guns) have been around for hundreds of years and are generally designed to fire some type of metal projectile using compressed air or other gas, like CO2. Air guns of various calibers are allowed for hunting in several states, most commonly for small game species. A few states allow the use of large caliber air guns to take big game (Davis, 2017). The Crosman Corporation has been manufacturing CO2 powered airguns for decades, but recently developed and began marketing the Pioneer Airbow to archery hunters. The Pioneer Airbow is essentially an air rifle designed to fire an arrow at up to 450 feet per second and is advertized as being accurate at ranges out to 75 yards. The design of the airbow allows it to be cocked and de-cocked by a lever on the stock using two fingers. Information on the Crosman website states that the airbow is capable of firing 8 arrows in the time it takes to fire three from a traditional crossbow.

Issues and Concerns with Air Powered Weapons and Hunting

1. Fair chase and our approach

From a fair chase standpoint, most air guns, along with the Pioneer Airbow, fall within the category of other short-ranged weapons discussed above. To effectively use an air gun or airbow while hunting, the hunter must stalk well within ranges that allow animals to effectively evade predation by hunters. Most traditional air guns are between .177 and .25 caliber and would be unsuitable for taking big or trophy game animals, but are effective for small game. Recently, airguns firing up to .50 calibre projectiles have been developed, some delivering muzzle energies in excess of 500 foot pounds, and are legal for big game in some states. An example is the following, advertised on

https://www.airgundepot.com/airforce-texan-air-rifle-scope-combo.html

"Consider all the great things about the AirForce Texan: smooth side lever cocking, the world's most powerful production air rifle (500+ ft. lbs in .45 cal), surprisingly light, Lothar Walther barrel, and of course USA made (well? except the Lothar Walther barrel of course, which we're okay with since they're the best rifle barrels in the world!)."

Based on the advertised specifications of the airbow, its performance in the field is likely to be very similar to modern crossbows. While the airbow falls into our short-range category like archery equipment, it is clearly not archery equipment outside of the projectile it fires. Traditional archery equipment uses energy from a drawn string to launch an arrow, while an

airbow is simply an air gun that has been adapted to fire an arrow. It has handling characteristics in the field similar to those of firearms. While use of airbows may constitute fair chase in the sense of the hunting tactics and ranges involved, their possible use for hunting in Wyoming bears further scrutiny.

2. Human safety

Air guns and airbows pose a reduced risk to human safety, much like traditional archery equipment. As with crossbows and firearms, carrying a loaded and cocked air gun or airbow in a vehicle or while in the field prior to setting up for a shot could pose a safety risk, and they are quite capable of inflicting mortal wounds in a human.

Wyoming Hunting Ethos and the Spectrum of Use by Hunters/Hunter Opinions

Currently, airguns and airbows are not legal methods of take for most game animals in Wyoming. They do not fall into the definitions of firearms or archery equipment under Chapter 32 of the Wyoming Game and Fish Commission Regulations. These weapons are legal for hunting of predatory animals, blue and ruffed grouse, and small game species. To date, there has not been significant, galvanized interest from the public to allow air guns to be used for taking big or trophy game species, but there has been some interest in the use of airbows. The Department has received several inquiries from the hunting public regarding the legality of airbows for big game hunting during archery seasons. Some interest has also been expressed for allowing the use of airbows by disabled hunters during archery seasons. Many archery hunters in Wyoming are already opposed to the legality of crossbows during archery seasons and are unlikely to support adding airbows as legal weapons.

Applicable Statutes and Regulations from Other States

In 2016, the Department conducted a survey of state wildlife law enforcement chiefs asking the following questions:

1. Is the Crosman Pioneer Airbow or similar device legal for hunting in your state? If yes, for which species?
2. What are the legal requirements and/or definition of archery equipment (bow, crossbow, arrows and bolts) within your state?

3. Would the Crosman Airbow be classified as archery equipment or a firearm as it pertains to a hunting weapon?
4. Are airguns legal for hunting in your state? If yes, what are the specific requirements/specifications/limitations for an air gun to be considered a legal hunting weapon and what species may be taken with an air gun?

Of the 18 states that responded to the survey, none of them consider airbows to be legal archery equipment for hunting purposes. Several states define airbows as air guns and allow for their use in hunting some species. A handful of states include airbows and air guns with firearms for hunting purposes. No states responding to the survey allowed airbows to be used during archery only seasons.

Alabama

Alabama allows hunting with air powered guns and airbows fall into this category for use to hunt deer, feral hogs and small game during preliminary muzzle loader and air rifle seasons. They are not considered archery equipment or allowed during archery season.

Arkansas

Arkansas considers air guns and airbows to be firearms for hunting purposes and allows them to be used to take small game.

Colorado

Colorado does not allow airbows for hunting and does not consider them to be archery equipment or firearms for hunting purposes. Colorado does allow use of air guns firing a pellet .177 caliber or larger for certain small game species.

Connecticut

Connecticut does not consider the airbow to be archery equipment. It groups airguns with firearms, but air guns legal for hunting must use a single ball or pellet type projectile. Therfore, airbows are not legal for hunting.

Florida

Florida considers airbows to be air guns and allows their use for rabbits, squirrels and non-game animals.

Iowa

Iowa does not consider airbows to be firearms or archery equipment for hunting purposes. Airbows and air guns are legal for taking small game species.

Kansas

Kansas does not allow airbows for hunting and does not consider them to be firearms or archery equipment for hunting purposes. Pellet guns and BB guns are legal for the take of rabbits, hares and squirrels.

Louisiana

Louisiana does not allow airbows for hunting and does not consider them to be firearms or archery equipment for hunting purposes.

Maine

Maine does not allow airbows for hunting and does not consider them to be firearms or archery equipment. Air rifles firing pellets are legal for small game.

Montana

Montana does not allow airbows for hunting and does not consider them to be firearms or archery equipment for hunting purposes.

Nevada

Nevada does not consider airbows to be firearms or archery equipment for hunting purposes. They are allowed for the hunting of unprotected species such as coyotes.

North Carolina

North Carolina considers the airbow to be an air rifle and allows any species legal for hunting to be taken with an air rifle.

North Dakota

North Dakota considers the airbow an air rifle, which is not legal for hunting there.

Oregon

Oregon does not allow airbows for hunting and does not consider them to be firearms or archery equipment.

Tennessee

The airbow is not legal for hunting in Tennessee, which considers it to be a firearm along with air guns. Air guns .25 caliber or smaller may be used to take small game, furbearers and crows.

Utah

Utah does not allow airbows for hunting. They do not fit into the legal definition of firearms or archery equipment. Air guns may be used to take non-protected wildlife (coyotes and jackrabbits).

Vermont

Vermont does not allow airbows for hunting and does not consider them to be firearms or archery equipment.

Wisconsin

Wisconsin considers airbows to be air guns and allows them for the hunting of small game species.

In addition to Wyoming's survey, a biologist with the Florida Division of Hunting and Game Management conducted a nationwide survey of air gun and airbow hunting regulations in April, 2017. This survey found that eight states (AL, AK, AZ, MD, MI, MO, NE, VT) allow the hunting of big game with air guns and six states (AL, AK, AZ, MD, MO, NC) allow the hunting of big game with airbows (Davis, 2017). Several more states allow the hunting of small game species with both air guns and airbows.

Recommendations

The committee does not recommend any changes to Wyoming statutes or regulations to allow air guns for the taking of big or trophy game, or for the use of airbows during a special archery season. Although referred to as "bows" for marketing purposes, airbows do not fit into the traditional definition of archery equipment, and there would likely be strong opposition from the archery hunting community for defining them as such. If the Commission is interested in allowing airbows for hunting big or trophy game in Wyoming, we recommend changing Chapter 32 to allow their use during regular hunting seasons only, including for disabled hunters. Existing archery technology, such as leverage gaining devices for cocking crossbows and draw locking devices for compound bows, offer opportunities for disabled hunters to use legal archery equipment during archery only seasons.

Analysis and Discussion of Smart Rifle Technology

The committee was tasked with conducting a detailed analysis of additional emerging technologies for hunting. One of these is the "smart rifle" developed and manufactured by TrackingPoint, Inc.

History and Development of Technology

TrackingPoint, Inc. has developed a scope which ranges, compensates and controls the firing system of a firearm. They have incorporated this technology into semi-automatic and bolt action rifles. The committee did not find any other manufacturers of "smart rifles" during our research, but there are likely to be more as this technology evolves. According to the TrackingPoint website, www.tracking-point.com, the company manufactures precision-guided firearms incorporating the same tracking and fire control systems found in advanced jet fighters. They advertise that their products allow shooters of any skill level to shoot better than the best shooters who ever lived. The scope on a TrackingPoint rifle contains built-in laser range finders and weather calculation instruments. It also has the ability to "lock on" to the target at ranges out to 1,200 yards, keeping the scope reticle aligned on the point of impact even if the rifle barrel is not on target. When the trigger is pulled by the shooter, the rifle will not fire until the rifle is properly aligned with the designated point of impact on the target, which may be moving. Although many of their products are geared for military use, TrackingPoint also has developed rifles marketed specifically to hunters. One such model is the Shadow Trax3 bolt action rifle, shown here.

TrackingPoint describes this rifle and its use this way on its website (www.tracking-point .com/shadowtrax3/).

Finally Get That Elusive Trophy!

Moving silently amongst the golden stands of quaking aspen, he appears and disappears through the heavy mist that blankets the mountainside. You've waited, watched and tracked him for the past two years, envisioning this very moment…will this be the year you finally get your trophy? Ensure that it is with the **NEW ShadowTrax3™** in .300WM from TrackingPoint™!

Built on a next-generation bolt-action platform, the ShadowTrax3 features a stainless steel Stiller action and 22″ Shilen barrel that shrug off everything Mother Nature can throw your way. Couple those with an optic that tracks targets, an onboard weather station, integrated laser ranger finder that automatically updates the ballistics data and a 1200 yd. lock range, and that big game trophy becomes a reality. The simplicity and reliability of the bolt-action platform coupled with TrackingPoint's patented lock-and-load precision guiding technology provides pinpoint accuracy and makes the ShadowTrax3 the most innovative bolt-action hunting rifle on the market today.

Issues and Concerns with Smart Rifles for Hunting

1. Fair chase and our approach

These rifle systems allow the hunter to designate a target and allow the scope/rifle system to track and decide when to fire the shot and take the animal. This weapon system falls into the long-range category in relation to an animal's ability to elude harvest once detected. The fire control system, which automatically calculates a firing solution and determines when to fire the rifle, removes a hunter's individual shooting skill from the equation. From that standpoint, the committee feels use of this technology falls outside of traditional fair chase hunting.

2. Human Safety

The committee did not identify concerns regarding human safety with this technology. These rifles are actually likely to be safer than traditional firearms by requiring the firearm to be properly aligned with a designated target prior to firing.

Wyoming Hunting Ethos and the Spectrum of Use by Hunters/Hunter Opinions

There is no current legislation or regulation which bans or restricts smart rifles for hunting in Wyoming. The Department does not have any data regarding hunter opinions on the use of these weapon systems for hunting. Many hunters are likely to be opposed to use of this technology for fair chase reasons, especially those who already limit themselves to more primitive weapons and hunting techniques. The high price point of these weapons also tends to discourage their use by the majority of the public. However, there is a segment of the hunting population that will use

any tool available, no matter the cost, to routinely harvest the biggest and best trophy animals they can find.

Applicable Statutes and Regulations from Other States

Idaho

Idaho Administrative Code

IDAPA 13.01.08 Rules Governing the Taking of Big Game Animals in the State of Idaho

410. UNLAWFUL METHODS OF TAKE

No person shall take big game animals as outlined in this section. (7-1-93)

***01. Firearms**. (7-1-93)*

***e.** With any electronic device attached to, or incorporated in, the firearm (including handguns and shotguns) or scope; except scopes containing battery powered or tritium lighted reticles are allowed. (4-2-08)*

Oregon

Oregon regulations say that when using centerfire weapons, it is illegal to use any sight which projects a beam to the target. This includes the beam of a laser rangefinder; therefore scopes that incorporate rangefinders (Burris Eliminator, etc.) are not legal.

Computer-assisted hunting (Internet hunting) is illegal. "Computer-assisted hunting" (Internet hunting) means the use of a computer or any other device, equipment, or software to remotely control the aiming and discharge of a firearm, bow, or any other weapon …..

These regulations, make long range hunting more difficult, and make the use of "Smart Guns" which use laser rangefinders and on-board computers illegal for game animals.

Utah

***R657-5-7. Prohibited Weapons**.*

(1) A person may not use any weapon or device to take big game other than those expressly permitted in this rule.
(2) A person may not use:
(a) a firearm capable of being fired fully automatic;
(b) any light enhancement device or aiming device that casts a visible beam of light; or
(c) a firearm equipped with a computerized targeting system that marks a target, calculates a firing solution and automatically discharges the firearm at a point calculated most likely to hit the acquired target.
(3) Nothing in this Section shall be construed as prohibiting laser range finding devices.

Recommendations

The committee recommends adding language to Chapter 32 of the Wyoming Game and Fish Commission Regulations to prohibit the use of smart weapon technology in the taking of game animals. We propose the following language: *For the take of game animals, no person shall use any firearm equipped with a computerized targeting system that marks a target, calculates a firing solution and automatically discharges the firearm at a point calculated most likely to hit the acquired target.* This language would continue to allow rifle scopes with built in laser range finders, but would not allow use of a scope with an integrated fire control system. Smart weapons would still be allowed for the taking of predatory animals.

CONCLUSION

The information presented in this report is by no means a complete evaluation and discussion of every piece of technology available for use by the hunting community. Rather, it focuses on technologies that currently generate controversy and debate when looked at in terms of fair chase hunting. It is hoped that the framework for analyzing technology presented by the committee serves as a useful tool for evaluating where new technology may fit in with traditional fair chase hunting in Wyoming. There is still much more research to be done, especially relating to the amount of wounding loss associated with various methods of hunting and overall public opinion regarding the use of various pieces of high-tech equipment. There will likely be heated debates among wildlife managers, the hunting public and others interested in wildlife about the merits of various technologies and their use in hunting. The recommendations presented in relation to specific technologies represent the consensus of the committee and provide for a range of possible solutions as to how these should be regulated in order to ensure that Wyoming maintains a fair chase ethic when it comes to the hunting of the state's wildlife resource.

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Appendix 1

WYOMING GAME AND FISH DEPARTMENT

5400 Bishop Blvd. Cheyenne, WY 82006

Phone: (307) 777-4600 Fax: (307) 777-4699

wgfd.wyo.gov

November 7, 2017

MEMORANDUM

TO: High Tech Equipment Committee

FROM: Nick Roberts, Evanston Game Warden

COPY TO: Dustin Shorma, Dustin Kirsch, Irah Leonetti, Tara Hodges, Joe Sandrini, Nick Roberts, Jeff Short, Doug Brimeyer, Scott Edberg, Mike Choma, Regional Wildlife Supervisors, Mike Ehlebracht, Bea Nicholas, File

SUBJECT: Game Retrieval Laws

This memorandum is written in regards to possible statutory or regulatory suggestions related to game animal retrieval laws. As part of the high tech equipment committee, one of the topics we were asked to review was a concern regarding long range shooting in hunting. In our discussions regarding the topic, one suggestion was to introduce an obligation to "follow up" any shots taken at an animal as a means to more responsible and ethical hunting practices. The following is a preliminary review of possible statutory or regulatory changes.

As with other hunting technology, modern rifles have evolved significantly. Advances in long range shooting have made some shooters effective at harvesting animals at distances to 1,000 yards, allowing for increased hunting success. Some would argue that harvesting an animal from those distances violates a fair chase ethic. Those advances have also broadened the perceived abilities of less effective shooters. Although hard data is not available, it is reasonable to expect wounding rates to increase as shooting distances increase. In an attempt to mitigate some of those concerns, we would propose a statutory or regulatory obligation for a hunter to follow up any shots taken at a game animal. The language used would seek to force a hunter to physically inspect the last known location of the animal they attempted to harvest for signs of a wounded animal or a carcass. If the hunter were to find signs of a wounded animal, they would then be obligated to make a reasonable effort to harvest the animal. If a carcass were found, the hunter would be obligated to salvage the meat. We believe this will create an increase in culpability when a hunter chooses to fire a weapon at a game animal. As an example, if a hunter chose to take a 1,000 yard shot at an animal across a canyon, they would then be obligated to make the effort to cross that canyon to "follow up" their shot. This disincentives long shots as a hunter will need to weigh the amount of effort they will need to put into following up their shot. Similarly, too often we see hunters take long shots at running animals and simply leave if the animal does not immediately fall dead. These are difficult, high risk shots and would presumably have higher wounding rates. If the hunter were obligated to spend the time following up those shots, they may choose to pass on that shot.

Presently, W.S. 23-3-303(a) states "**No person shall take and leave, abandon or allow any game bird, game fish, or game animal except trophy game animal, or edible portion, to intentionally or needlessly go to waste. No person shall knowingly possess any parts of a big game animal wasted as provided in this subsection.**" W.S. 23-3-303(b) states "**The failure of any person to properly dress and care for any big game animal killed by that person, and, if the carcass is reasonably accessible, within forty-eight (48) hours to take or transport the carcass to the camp of the person, and there properly care for the carcass, is prima facie evidence of a violation of subsection (a).**" This statute is valuable but does not address a scenario in which an animal is killed or wounded by a hunter who makes little or no attempt to finish or retrieve the animal. Legally, the hunter cannot be responsible for the care of a carcass they never found or attempted to find.

One possible statutory language change would be to add a section to 23-3-303 stating something to the effect, "No person shall attempt to kill any big game animal, small game animal, game bird or trophy game animal without making a reasonable attempt to discern if the animal was wounded, to retrieve the animal and to reduce the animal to possession." A separate violation code and bond amount could then be added that would fit the violation if no animal was actually killed. If an animal was killed and the hunter made no effort to "follow up" their shot, they could be charged with waste.

Chapter 2 section 2(bbb) of the Wyoming Game and Fish Commission (Commission) regulations defines "**waste**" as "**means to leave, abandon or allow any edible portion of meat from a big game animal, game bird, game fish or small game animal to become tainted, rotten or otherwise unfit for human consumption prior to processing at a person's home or at a processor**." Again, this definition addresses an animal that a hunter has found but fails make use of. It does not address the problem of a hunter not making a reasonable effort to find a dead or wounded animal.

Chapter 2 section 13(b) of the Commission regulations states "**Wounding and Retrieving. No person shall wound or kill any migratory game bird without making a reasonable effort to retrieve it and reduce it to possession.**" This is a common sense regulation that should not be restricted to migratory game birds only. We would propose adding all game animals (excluding game fish) to this regulation along with language that would require a hunter to follow up any shots taken at a game animal. The current language in this regulation is aimed at migratory game birds where a hunter would clearly know if a bird was wounded when it fell out of the sky. The same does not hold true for other game animals. The "reasonable effort" must include a search for signs of a wounded animal since they may not know that they wounded the animal. One possible amendment to the regulation could read, "Wounding and Retrieving. No person shall wound, take or attempt to take any big game animal, small game animal, game bird or trophy game animal without making a reasonable attempt to discern if the animal was wounded, to retrieve the animal and to reduce the animal to possession." This regulation change would require its own violation code and bond amount. If the hunter killed or wounded an animal but made no reasonable effort to retrieve it, this regulatory change would bolster an argument under W.S. 23-3-303(a) that the hunter ultimately wasted the animal.

Appendix 2


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