



Hunters as Stewards for Wildlife Conservation

Evaluating the relationship between hunting and the protection of wildlife
in North America based on social, ecological, and economic aspects

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Abstract

Historical accomplishments in protecting and restoring wildlife populations ever since the extinction crisis in the mid-1800s demonstrate the role of hunters to be substantial for the protection of North American wildlife. Nevertheless, in the context of wildlife protection today, hunting is a controversially discussed topic. Hunters are often seen as the antagonists of conservationists while fundamental decisions on wildlife management are guided by one of the worldwide most successful conservation models based on regulated hunting: *The North American Model of Wildlife Conservation*. Addressing this controversy, our work evaluates the role of hunters as stewards for wildlife by collating their multifaceted contributions to conservation based on social, ecological, and economic aspects. Accordingly, this narrative literature review is based on a diversity of application-oriented research related to hunting, conservation, and wildlife stewardship in North America.

With regards to social aspects, for many recreational hunters connecting to nature and learning about wildlife prevails the simple shooting and removing of an animal from its habitat. A deep appreciation for the hunting experience results in a considerable number of individuals who frequently volunteer in conservation projects, contributing their time, expertise, and financial resources for the benefit of wildlife.

When viewed from an ecological perspective, hunter-supported organizations have helped to conquer the greatest current threat to wildlife by acquiring, restoring, and securing key habitats all over North America that are essential for the survival of wildlife populations and entire species.

Moreover, the ever-growing hunting industry accounts for a substantial contribution to the North American economy, and wildlife conservation is mainly financed by revenues generated by hunting-related activities, hunt clubs, and funding based on the user pay - user benefit model.

However, unregulated hunting and counterproductive management can manipulate the development of wildlife populations and their habitats. Hence, besides direct inflictions of harm on individual animals, those aspects need to be considered as potential threats. Nevertheless, no alternative model has been shown to compete with the effectiveness of hunting, and the role of hunters as stewards for wildlife conservation yet proves to be irreplaceable.

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1 Introduction

Within the last decades, a clear separation between humans and nature becomes visible (Louv 2008). Due to the development of modern society people become increasingly alienated from their roots and a disconnect to their natural origins continues to evolve (Leopold 1986). Observing the critical evolvement of the growing distance to wild environments humans seem to have forgotten that for millennia their species has lived off the lands, gathered what mother nature provided, and hunted for the mere purpose of survival (Wilson 1993).

The shift from hunting for survival towards the insatiable demand for financial wealth generated by trading wild game caused a dramatic decline of wildlife populations in the North American prairies in the early nineteen-hundreds (Organ et al. 2010). In this historical development, the first conservation thought that was initiated by avid hunters was born, who in response brought to life the *North American Model of Wildlife Conservation* – the guidelines that govern contemporary conservation decisions in the United States and Canada (Organ et al. 2010). Ever since then, hunters have acted as wildlife stewards and their activities have been fundamental for conservation achievements (Holsman 2000; Mahoney & Jackson 2013; Heffelfinger et al. 2013).

Nevertheless, humans' relationship to wildlife today is influenced by their past experiences of early hunting (Arnett & Southwick 2015) and in times of species extinction, climate change, and resource exploitation the ideas about wildlife conservation are split. The increased conflict potential between hunters and anti-hunt movements has created a gap with opposing opinions about the relationship between hunting and conservation, fired up by the media promoting frightening stories of hunters brutally slaughtering animals (Knezevic 2009).

The acceptance and recognition of hunting as an essential part of wildlife conservation often turns into an ethical question (Loveridge et al. 2006) and different perceptions of adequate knowledge, values, and goals (Schusler & Decker 2002) aggravate the disagreement about the role of hunting in stewardship regards.

Perceiving hunting as the major threat to wildlife in modern times is one of the greatest misconceptions that is carried through this argument (Knezevic 2009). While the world is facing greater man-made challenges than ever before, in reality, it is the loss of habitat that plays a key role for the survival of wildlife, being responsible for the extinction of more species than all hunting combined (Bean 1999; Venter et al. 2006; Pennisi 2019).

On the contrary, hunters often consider themselves as conservationists (Knezevic 2009), contributing far more to the preservation of wildlife than what is required of them by the laws and regulations related to hunting activities (Heffelfinger et al. 2013; Arnett & Southwick 2015). In fact, the restoration of wildlife habitat after the extinction crisis in the late 19th century, maintenance of healthy wildlife populations and the creation of designated habitat for hunted and non-hunted species are greatly attributed to the social, ecological, and economic contributions of ethically motivated hunters (Organ et al. 2010; Heffelfinger et al. 2013; Mahoney & Jackson 2013).

This paper is written with the purpose to assess the role of hunters as stewards for wildlife by reviewing a diversity of application-oriented literature discussing controversial views about the impacts of hunting on the conservation of wildlife in North America, which in this context refers

to the United States and Canada. Initially, the history of humans as hunter-gatherers and the origin of North America's first conservation thought is explored. The definitions of stewardship and the North American Model of Wildlife Conservation are essential concepts to understand before social, ecological, and economic aspects of hunting related to the protection of wildlife are examined.

2 Theoretical Basis and Conceptual Framework

2.1 Humans, Wilderness, and Hunting

For centuries, humans depended on the skills that life in nature has taught them for survival (Wilson, 1993). Urbanization, technology (Pergams & Zaradic 2006; Pergams & Zaradic 2008), and social systems that are heading away from consciousness for their lands have increased the isolation between humans and wilderness (Leopold 1986: 261).

The biophilia hypothesis describes the innately emotional affiliation of humans with nature and other living organisms (Wilson 1993). For more than 99 % of human history, our species has lived as hunter-gatherers, deeply connected to the environment surrounding us. Yet, Wilson's theory suggests that even when humans are alienated from nature, this connection is genetically passed on from generation to generation. Thus, it comes with no surprise that a part deep within humans seeks to reconnect with their evolutionary roots (Causey 1992; Wilson 1993).

Modern generations grow up with an awareness of environmental challenges, but they are missing the physical contact and intimate connectedness to the wilderness that is essential to living in harmony with the natural environment (Louv 2008). In *A Sand County Almanac*, Leopold (1986) declares the absence of an intimate human-nature-connection to be a fundamental challenge to an ethical relationship with the lands, while the World Commission on Environment and Development (1987) considers ethical, moral, cultural, aesthetic, and scientific values essential for conservation.

2.2 The Historical Context of Hunting and Conservation

Conservation has not been a notion until the late-mid 19th century as wildlife was abundant, roaming the prairies of North America (Brown 2010). With the industrial revolution around 1860, people started moving to the cities, and the market for meat, fur, and skin of bison, elk, and other big game increased dramatically. To meet the rising demand, poachers relentlessly exploited the lands of their wildlife for the once abundant species to be a step away from extinction (Organ et al. 2010: 23).

The urban life offered more time and financial resources for townsmen, and hunting was no longer necessary for securing a financial profit, but rather an activity for leisure and recreation (Organ et al. 2010: 24). Simultaneously, the drastic decline of wildlife initiated a conservation ethic (Mahoney 2007 in Organ et al. 2010: 23) that transformed hunting into a 'sport', pursuing honorable moral standards and enhancing conservation (Heffelfinger et al. 2013; Mahoney & Jackson 2013). This inevitably sparked a conflict between the market hunters, and the recreational hunters from the cities, who wanted to see wildlife roaming the landscapes rather than being sold as meat and fur (Mahoney & Jackson 2013). To protect wildlife, recreational hunters founded the first hunting

clubs and demanded regulations and laws that would restrict exploitation. A prominent supporter of the conservation movement was former U.S. president Theodor Roosevelt as an avid sport hunter himself, who also promoted the value of hunting for connecting people with the wilderness (Mahoney & Jackson 2013). Together with George Bird Grinnell, Roosevelt founded the Boone and Crockett Club in the late 19th century to “take charge of all matters pertaining to the enactment and carrying out of game and fish laws” (Reiger 1975 in Organ et al. 2010: 24) after only 540 bison remained in the entire country (Brown 2010: 29). The Boone and Crockett Club was a cornerstone for developing the North American Model of Wildlife Conservation, which has been profoundly influencing wildlife management in the United States and Canada ever since it was initiated (Organ et al. 2010).

2.3 The North American Model of Wildlife Conservation

The North American Model of Wildlife Conservation (the North American Model) provides fundamental guidelines for the management of wildlife and their habitat in North America. Organ et al. (2012: viii) define the North American Model as “a set of principles that, collectively applied, has led to the form, function, and successes of wildlife conservation and management in the United States and Canada”.

First articulated in 1995, the North American Model is based on regulated hunting and has deep social and ecological roots (Organ et al. 2010; Organ et al. 2012). The historical context of hunting and conservation reveals that it was the avid sports hunters who first established ethical standards (Mahoney & Jackson 2013: 455) and promoted a sustainable harvest of wildlife after species vanished from the once abundant prairies (Organ et al. 2010; Mahoney & Jackson 2013). Hunting clubs and conservation initiatives suggested laws and restrictions that have shaped the seven fundamental principles of the North American Model (Organ et al. 2012: 1) Wildlife resources as a public trust; 2) Markets for game are eliminated; 3) Allocation of wildlife is by law (laws determine access to wildlife); 4) Wildlife can be killed only for a legitimate purpose; 5) Wildlife is considered an international resource; 6) Science is the proper tool to discharge wildlife policy; 7) Democracy of hunting is standard (Organ et al. 2012: viii f.). These principles govern the management of traditional game and other species and their habitats (Organ et al. 2012), each of them a cornerstone for one of the most complex and effective infrastructures for conservation worldwide (Mahoney & Jackson 2013).

The principles of the North American Model have only been officially articulated by Valerius Geist in 2001 (Organ et al. 2012), nevertheless, they had been applied for decades, proving resilience to social and ecological changes that occurred over the past 100 years (Mahoney & Jackson 2013). Even though it has no direct legal power (Wikipedia Contributors n.d.), this model for conservation is still successful and widely accepted (Mahoney & Jackson 2013).

Purchased lands for habitat protection, execution of regulations, volunteer efforts, and financial contributions – largely supported by the communities of hunters and anglers – have enabled hunted and non-hunted species to thrive and prove the North American Model to be a substantial tool for managing wildlife (Organ et al. 2010; Organ et al. 2012; Heffelfinger et al. 2013).

2.4 Conservation and Stewardship

To evaluate the role of hunting in the conservation and stewardship of wildlife, it is important to understand the concept of the term.

Leopold (1986: 243) defines conservation as “a state of harmony between men and land”, that “viewed in its entirety, is the slow and laborious unfolding of a new relationship between people and land.” (Leopold 1940: 6 in Meine 2010: 15 f.).

Dixon et al. (1995: 42 f.) suggest that “Stewardship is the moral obligation to care for the environment and the actions undertaken to provide that care. Stewardship implies the existence of an ethic of personal responsibility, an ethic of behavior based on reverence for the earth and a sense of obligation to future generations. To effectively care for the environment, individuals must use resources wisely and efficiently, in part by placing self-imposed limits on personal consumption and altering personal expectations, habits and values.”

Considering the historical context and the definitions of conservation and stewardship, social, ecological, and economic impacts of hunting on wildlife and their habitat in North America will be further evaluated.

3 Methods

This narrative literature review (Galvan & Galvan 2017) is based on English sources acquired online by searches in the open web, but mostly on the scientific search engine Google Scholar. For our research, keywords like ‘hunters’, ‘hunting’ or ‘sports shooting’ were either combined with ‘conservation’ or ‘stewards’ and ‘stewardship’ or the different dimensions of ‘social’, ‘ecological’ or ‘economic’ either ‘impacts’ or ‘benefits’, connected by words like ‘and’, ‘of’, ‘in’ or ‘by’, if connected at all. Moreover, search terms like ‘North America’, ‘Canada’, and ‘United States’ or ‘US’ were used to narrow down the results to the geographically relevant regions.

In the further process, while reading the first papers, we found that it was most helpful to use a pyramid scheme and resort to the bibliographies denoted in the literature of the most useful papers of our first searches in Google Scholar. Later on, with the need for more detailed information on particular parts of the paper or specific topics, we would go back to Google Scholar using more specific keywords like ‘The North American Model of Wildlife Conservation’ or ‘financial support of conservation programs by hunting’ to find the information missing. During the process, the search function within pdfs helped find additional information on specific topics in already gripped papers.

Most of the papers we found to be relevant to our review were journal articles and internet documents. Additionally, we used information from personal communication with Andre Kuerbis from BC Trophy Mountain Outfitters in Canada. Furthermore, it is to be noted that the figures in US-Dollar (USD) used in this review were transferred directly from the data of the respective scientific literature without adjustments to account for inflation.

4 Results

4.1 Social Aspects

4.1.1 The Influence of Hunting on Society and Individuals

The close relationship to nature, which has been omnipresent throughout human evolution, keeps fading as humans have detached from primitive chores that were linked to survival such as hunting (Causey 1992; Peterson et al. 2010). Successively, hunting transformed into a recreational activity that reminds society of their dependency on nature (Peterson et al. 2010), allowing humans to observe the natural lifecycles of their environment (Causey 1992: 144). Beyond the recreational value, hunting can be a spiritual experience that fosters a deep connection to the cultural heritage and promotes reverence for life (Komppula & Gartner 2013). Hence, a hunter's experience often is far more meaningful than the conquest of an animal. Hunting has the potential to foster a deep connection to wilderness, increasing appreciation for nature, and sparking the desire in individuals to conserve that which they value (Holsman 2000; Heffelfinger et al. 2013).

4.1.2 The Hunter's Education

For around 13.7 million Americans, hunting provides a unique connection to wilderness and nature and the hunters' contributions are fundamental for a social-economic support system to conserve wildlife and their habitats in North America (Arnett & Southwick 2015).

Between dedicated educational programs (Heffelfinger et al. 2013) and the hunting act itself, the hunter gains a fundamental knowledge about landscapes, wildlife, and their habitat (Arnett & Southwick 2015). According to Causey (1992: 144), "the skilled hunter's ecological knowledge is holistic and realistic (...). Whereas ecologists study systems from without, examining and analyzing from a perspective necessarily distanced from their subjects, dedicated hunters live and learn from within." Hunters learn to cultivate reverence, respect, and appreciation for wildlife by engaging in the lifecycles of nature (Causey 1992). This attitude is fundamental for adapting ethical hunting standards while promoting a sustainable harvest of wildlife (Causey 1992; Mahoney & Jackson 2013).

Education on responsible behaviors enhances conservation efforts and is essential for maintaining the reputation of hunting to secure public support (Heffelfinger et al. 2013). Therefore, North America has established a large network of volunteers arranging educational programs on wildlife management, ethics, hunting techniques, and firearms safety, training around 650,000 responsible hunters each year (Wayne East, IHEA, personal communication, 2010 in Heffelfinger et al. 2013: 407). Consequently, education and practical exposure are likely to enhance the awareness of wildlife concerns and encourage responsible hunting.

4.1.3 Collective Stewardship

Though many restrictions and laws regulate hunting activities to protect wildlife (Leopold 1986), hunters often devote themselves to considerable conservation efforts (Heffelfinger et al. 2013). The countless organizations dedicated to the protection of wildlife, many of them founded and supported by avid hunters (Organ et al. 2012), confirm the stewardship role of hunters by actively supporting the well-being of wildlife and their habitat.

While many recreational hunters frequently volunteer for local conservation projects – such as population surveys, habitat improvement, and educational programs – they connect with local wildlife managers who regularly seek the advice of experienced hunters for strengthening wildlife policies and management (Heffelfinger et al. 2013; Arnett & Southwick 2015). In that case, hunters and wildlife managers get to share their knowledge, values, ethical standpoints, and personal motivations (Arnett & Southwick 2015: 736). Consequently, the deepening of a social connection between the hunter and the wildlife manager can enhance the overall stewardship efforts in a particular area.

4.1.4 The Personal Experience

Reflecting on the evolvement of hunting in the society, today's hunters primarily seek the 'experience' of hunting – the mental and physical challenges, meaningful interactions with families and friends, and a deeper connection to nature (Komppula & Gartner 2013; Arnett & Southwick 2015). While immersing themselves in the wilderness, hunters intimately get to know the species, habitats, and landscapes and consequently gain a deeper understanding of nature's complex interconnectedness (Arnett & Southwick 2015). Some hunters even state that the mere process of observing wildlife and 'scouting' for an animal has become one of the most enjoyable parts of their overall experience (Komppula & Gartner 2013: 173).

Stedman et al. (1993: 22) state that hunting “allows humans to gain reverence for nature” while recreating an environment comparable to our wild cultural heritage (Leopold 1966 in Stedman et al. 1993: 9). Causey (1992: 144 f.) suggests that “Hunters celebrate their evolutionary heritage and stubbornly refuse to be stripped of their atavistic urges – they refuse to be sterilized by modern culture and thus finally separated from nature.” Likewise, Causey (1992: 144) emphasizes that an ethical relationship of hunters with wildlife is based on appreciation, humility, and respect for nature. Those ethical and cultural values are often shared with individuals preferring non-consumptive activities related to wilderness and nature (Peterson 2004). Consequently, the modern hunters' mindset reflects a deep appreciation for our natural heritage, sincere interest in wildlife, and reverence for our natural environment, that to Peterson (2004) is of primary importance compared to the goal of harvesting an animal.

Research proposes different categories for classifying the personal goals of hunting (Stedman et al. 1993). The Six Stages of a Hunter model, for instance, suggests that the interests, goals, and skills of a recreational hunter evolve with increasing experience throughout the stages: 1) Shooting Stage; 2) Limiting-out Stage; 3) Trophy Stage; 4) Method Stage; 5) Sportsman Stage; 6) 'Give-back' Stage (BC Trophy Mountain Outfitters n. d.). Stages one to three predominantly revolve around the shooting act and the trophy, whereas in stage four the interest shifts towards hunting as a process. In the 'Sportsman Stage' and the 'Give-back Stage', the priority for hunters lays in the experience itself, the connection with wildlife and wilderness, giving back to nature and knowledge transfer to promote responsible hunting (BC Trophy Mountain Outfitters n. d.).

The development through these six stages indicates that recreational hunting – through skill acquisition, outdoor experience, and intimate connection to nature – raises awareness for the environment and evokes the hunter's interest in the protection of wildlife and their habitat. In summary, it can be concluded that the overall hunting experience is likely to have a positive impact on a hunter's mindset that transforms its relationship to nature, promoting stewardship, responsible behavior, and personal contributions to wildlife conservation.

4.2 Ecological Aspects

4.2.1 Habitat Protection

Without a doubt, mankind is currently facing a decline of species worldwide (He & Hubbell 2011). The discussion about the impact of hunting on wildlife often disregards that it is not the regulated harvest of animals that endangers species (Knezevic 2009). Instead, the increasing loss of habitat, greatly attributed to external factors unrelated to hunting, evolved to be the greatest threat to wildlife today (Bean 1999; Venter et al. 2006; Pennisi 2019).

In contrary to the misconception that hunting represents a major risk for wild animals, recent studies demonstrate that managed wildlife harvest creates a sustainable balance between a species and its natural environment (Patterson 2009 in Heffelfinger et al. 2013) and in some cases is the only way to preserve populations (Loveridge et al. 2006). Moreover, the territory that is improved with the intention to protect a certain population often benefits other species that share the same habitat, which may enhance the overall biodiversity in turn (Arnett & Southwick 2015).

Conservation experts declare habitat protection as the cornerstone for the protection of wildlife and suggest that a well-managed habitat is fundamental for the viability of populations, the gene pool of a species, and sustainable population sizes (Hobbs & Swift 1985; Organ et al. 2012). With the once abundant species vanishing from the North American prairies in the late 19th century, recreational hunters were the pioneers who cared for sustainable harvest (Mahoney & Jackson 2013) and realized the necessity to create the first wildlife refuges (among them Carroll's Island Club 1832, Gunpowder River in Maryland; Trefethen 1975 in Organ et al. 2012: 3) in response to the dramatic decline of population numbers. Later, the Boone and Crockett Club – founded by conservation-motivated hunters – requested a public network for protecting game habitat (Organ et al. 2012). Ever since then, hunting clubs and conservation initiatives have acquired large areas of land all over the continent to restore populations of endangered species and secure key wildlife habitats for the future (Heffelfinger et al. 2013). The conservation organization Ducks Unlimited alone, for instance, has acquired 10 million acres of habitat to protect waterfowl in the United States (Ducks Unlimited 2004 in Loveridge et al. 2006). Jackson (1996: 7) states that in addition, U.S. hunters dedicate over 1 billion USD annually to secure wildlife habitat. Moreover, the revenue generated by the sales of licenses, taxes, and equipment for hunting and fishing allowed states and provinces to attain essential wildlife habitats on a public level (Heffelfinger et al. 2013).

Overall, habitat protection in North America has been an incomparable achievement in wildlife conservation that is greatly attributed to the stewardship initiatives of hunters and demonstrates the potential of hunting to improve the overall condition of natural environments beyond the benefits for wildlife.

4.2.2 Population Management

Wildlife management in North America was born in the hands of hunters during the extinction crisis in the late 19th century (Organ et al. 2010) and up to this day, hunting remains essential for managing wildlife populations considering financial contributions and the execution of management goals (Heffelfinger et al. 2013).

Based on research, observations, and expertise, often supported by the intimate engagement of hunters, a reasonable harvest ratio for populations is determined by wildlife agencies (Heffelfinger

et al. 2013). Besides, the quality of a habitat defines the carrying capacity of a specific territory and guides decisions on population management (Hobbs & Swift 1985).

Decisions on wildlife management require close monitoring of populations (Heffelfinger et al. 2013). Naturally, species that are hunted are observed with the closest attention, nevertheless, non-hunted species benefit from monitoring when the overall condition of habitats is evaluated to ensure the sustainable use of resources. Moreover, the intense watching of hunted species benefits the research that is conducted on non-hunted species by allowing a wider field of focus (Heffelfinger et al. 2013).

Besides the financial contributions, hunters frequently support wildlife researchers by gathering data in the field that are required for conservation projects (Heffelfinger et al. 2013). This may be in form of submitting questionnaires that document relevant parameters related to the hunt, such as the number of individuals that have been taken, their body weight, condition, location, and sex and age ratio. It is no exception that hunters spare no efforts to share information with wildlife managers to enhance conservation efforts (Heffelfinger et al. 2013: 409).

Inefficient wildlife management can lead to a detrimental density of animals within habitats (Heffelfinger et al. 2013), negatively impacting populations of large mammals through resource-based competitive behaviors resulting in a decline of survival rates (Dusek et al. 1989). Taking a proportionate number of individuals from overabundant populations, in turn, increases the potential for reproduction and greater viability (Dusek et al. 1989).

Without the necessary hunting pressure and in correlation with changes in their environment, deer populations have grown to new heights since the 1960s (McShea et al. 1997 in Côté et al. 2004). A decrease in hunting activity and the loss of natural predators across North America have contributed to increasing deer populations (Côté et al. 2004). The different forms of damage caused by the overabundance of deer can be versatile and range from damage for agriculture and forestry over road accidents to the spread of diseases, such as chronic wasting disease, bovine tuberculosis, and Lyme disease which can be transmitted onto other species and populations with devastating consequences (Vercauteren et al. 2006). Hence, maintaining populations at a suitable level while respecting the regulations and guidelines for sustainable harvest is a major role of hunters in wildlife stewardship and conservation (Heffelfinger et al. 2013).

The absence of wildlife management prior to the late 19th century caused a historical collapse of nearly all wildlife populations on the North American continent (Organ et al. 2010). Driving several species close to extinction, populations needed to be stabilized and recover from this unparalleled mass exploitation (Mahoney & Jackson 2013). Subsequently, the establishment of the North American Model of Wildlife Conservation has greatly impacted restoration efforts for the once abundant wildlife populations with unparalleled success (Heffelfinger et al. 2013; Mahoney & Jackson 2013). The diversity of hunting-related contributions allowed key species such as Canada geese (*Branta canadensis*), white-tailed deer (*Odocoileus virginianus*), pronghorn (*Antilocapra americana*), bighorn sheep (*Ovis canadensis*), and turkeys (*Meleagris gallopavo*) to thrive after they had almost vanished. Moreover, those achievements have drawn attention to protecting species that are not hunted but whose viability is critically at risk (Heffelfinger et al. 2013: 405).

Up to this day, no other conservation strategy has been shown to match the effectiveness of hunting when it comes to the enhancement of wildlife populations and the preservation of essential

habitat for hunted as well as non-hunted species (Heffelfinger et al. 2013). Considering the hunters' intimate involvement in population management, from financial support to on-the-ground execution, their role as stewards for wildlife proves yet to be irreplaceable.

4.3 Economic Aspects

Hunting represents an American tradition, crossing racial and ethnic, geographic, and congressional boundaries, regardless of social and economic status (Southwick Associates 2002). Embodying an essential part of human culture since early times, hunting generates substantial contributions to the North American economy on state and regional levels (Loveridge et al. 2006; Duda et al. 2010).

4.3.1 The Economic Relevance of Wildlife Population Management

Conover et al. (1995) found that for any wildlife species or population both the positive and the negative values for society need to be taken into account. Especially economic losses, accidents, and diseases caused by wildlife create substantial problems. As the most serious negative monetary values of deer Conover (1997) lists and elucidates damage to households, deer-vehicle collisions, wildlife diseases, zoonoses, and damage to agricultural and timber productivity. The loss of productivity of timber results from deer browsing, as it either kills trees or stunts their growth which leads to longer tree generations before they can be commercially used (Conover 1997). The losses landowners are experiencing are good examples of externalities, as these landowners are not eligible for compensation from deer hunters for agricultural damage caused by large deer populations (Conover 1997).

U.S. white-tailed deer populations generated 19.7 billion USD in one year in benefits, including meat value, hunter expenditures, hunting-related recreation and recreation unrelated to hunting, however, negative values of deer were not included (Langenau et al. 1984 in Conover et al. 1995: 412).

In the year considered, the financial detriments of deer populations included 1 billion USD in automobile repair bills, moreover 211 fatalities and 29,000 injuries from about 726,000 traffic collisions, about 10,000 cases of Lyme disease, and over 367 million USD in damage to timber and undetermined damage to agricultural crops (Langenau et al. 1984 in Conover et al. 1995: 412). The overall net value of deer populations for society cannot be quantified exactly as no exact value could be placed on the loss of human life or health (Conover et al. 1995: 412). Conover (1997: 300) further concludes that it remains difficult to obtain a consensus about the management of deer populations because of the heterogeneous distribution of benefits and liabilities of this resource among individuals of the society.

4.3.2 Conservation Funding

Since the beginning of wildlife management, funds generated by hunting-related activities have been a major financial support for conservation efforts in North America (Loveridge et al. 2006; Organ et al. 2012). With the introduction of the North American Model of Wildlife Conservation, a complex and unique funding system has evolved that, according to Organ et al. (2012: 9), "typically is characterized as a user-pay, user-benefit model. (...) License and permit fees, a motor boat fuels tax, and excise taxes on hunting shooting sports and angling products provide dedicated funding for habitat conservation, harvest management, research, restoration, and monitoring

initiatives by state agencies”. In fact, the funds generated from hunters’ activities add up to sponsor between 60 and 90 % of the fish and wildlife agencies’ financial resources (U.S. Fish and Wildlife Service unpublished data in Organ et al. 2012: 9). Jackson (1996) attributes the increase of wildlife populations after the historical decline in the late 19th century to conservation programs that have been financed by hunting and were initiated even prior to the adoption of the U.S. Endangered Species Act and the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES).

An average of 75 % of all revenue devoted to conservation in North America is funded by the sales of hunting and fishing licenses and the excise tax on hunting, fishing, and shooting equipment (Jackson 1996; Scott et al. 1999 in Heffelfinger et al. 2013). Occasionally, there are additional funds added to the base funds of wildlife agencies, for example by lottery sources, state income tax, and special stamps, which are only effective because of the well-established agency infrastructure (Heffelfinger et al. 2013: 404 f.). According to Heffelfinger et al. (2013: 405), “the agencies most effective in conserving all resources (...), are those with a solid financial foundation provided by the well-regulated consumption of a few wildlife species.”

4.3.3 Organizations and Institutions

Even though the majority of conservation funding is derived by the user-pay, user-benefit model, many hunters contribute their time and money in the form of voluntary work, monetary support, or the donation of private land (Heffelfinger et al. 2013) to dedicated organizations such as Ducks Unlimited, National Wildlife Turkey Federation, Pheasants Forever, Rocky Mountain Elk Foundation, Quail Unlimited, Ruffed Grouse Society and The Nature Conservancy (Organ et al. 2012: 9). Southwick Associates (2012: 8) state that sports hunters “contribute nearly 8 million USD a day that goes to support wildlife agencies and conservation”.

For instance, a local hunt guide outfitter in British Columbia, Canada, donates a value of 5,000 USD each year to subdivisions or corporations of organizations referred to as ‘chapters’ (Safari Club International n. d.), supporting the Wild Sheep Foundation (national chapter, 5 regional chapters), Safari Club International (national chapter, 15 regional chapters), Dallas Safari Club (national chapter, 2 regional chapters), Rocky Mountain Elk Foundation (3 regional chapters), Wildlife and Habitat Improvement of Nevada and the Guide Outfitter Association of British Columbia, adding up to a total contribution of 150,000 USD annually (Kuerbis 2020). The same outfitter contributes a fee of 200 USD per sold hunt to the Wilderness Stewardship Foundation, a local conservation organization, amounting to 8,000 USD for 40 hunters every year (Kuerbis 2020).

In 2003, the relatively large wildfowl organization Ducks Unlimited alone raised 140 million USD, spending almost 80 % on conservation efforts (Loveridge et al. 2006: 228). Three years later in 2006, they increased their funds to 160 million USD, dedicating the same proportion to the preservation of wildlife, while that same year around 280 million USD have been given to North American conservation organizations in total (Poole 2007 in Knezevic 2009: 13).

The largest conservation group for hunters, however, is Safari Club International (SCI), with a dimension around 40 times greater than comparable organizations (Jackson 1996). The concept of SCI is based on hunters’ payments that are reinvested in wildlife conservation, adding up to large amounts considering the recruitment of over 5,000 new members each year (Jackson 1996: 8).

4.3.4 The Hunting Industry

Since 1965, in the USA alone the number of hunters interested in big game has risen by more than 6 million, for several decades with an average increase as high as 15,000 hunters per month (Jackson 1996: 8). In 1991, Jackson (1996: 8) estimated that in the United States around 1.6 million USD per hour is spent on sales related to hunting, subjected “to an 11 % tax under the Federal Aid in Wildlife Restoration Act (1937), which contributes directly to acquisition of habitat, research, conservation training and education and provision of access to hunting and recreational facilities” (U.S. Fish and Wildlife Service 1999 in Loveridge et al. 2006: 228), generating 11.8 billion USD in tax income and creating over 680,000 jobs (Southwick Associates 2012: 5). Equipment manufacturers, local stores, farmers, gas stations, hotels, and restaurants that hunters obtain goods and services from in turn redistribute their revenues to the economy and create a positive ripple effect (Southwick Associates 2002; Southwick Associates 2012). Considering the multiplier effects to the national spending by hunters of 27.1 billion USD, the value of the contributions to the gross domestic product (GDP) aggregates to 36 billion USD (Southwick Associates 2018).

In 2006 alone, 12.5 million U.S. hunters spent 24.7 billion USD on activities related to hunting (Heffelfinger et al. 2013: 404). By 2011, the revenue had grown to a total of 38.3 billion USD generated by now 13.7 million hunters (Southwick Associates 2012: 5). This drastic increase in the number of hunters and generated revenue proves the hunting industry to be an ever-growing market that is more resilient to economic changes than other comparable branches (Jackson 1996). Southwick Associates (2002: 3) state that even in times of economic recession and uncertainty over national security hunters seem to spend their time and money on shooting sports activities.

The Report *The Importance of Nature to Canadians: The Economic Significance of Nature-related Activities* published by the authority of the Minister of the Environment of Canada asserts that Canadians spent over 7.2 billion USD on outdoor activities in Canada in 1996 alone (Federal-Provincial-Territorial Task Force, 2000). According to a survey conducted by Statistics Canada with a representative sample of about 87,000 Canadians, aged 15 years and over, viewing, fishing, or hunting activities were part of the trips of half (48.7 %) of the 10.3 million persons engaging in nature-related activities in Canada in 1996. The publication further indicates that Canadians spent 823.8 million USD for hunting in the respective year, on average 692 USD per participant and 41 USD per day per participation, as 46.5 % of the 823.8 million USD accounted for hunting equipment, while the remaining amount went for trip-related expenses, such as transportation (20.2 %), food (12.1 %), accommodation (4.7 %) or other items as license fees and ammunition (16.5 %). The report further suggests a division of the expenditures into spending on hunting as the main activity, which totals 666.4 million USD, and hunting as the secondary activity, which averages out at about 157.4 million USD. Overall, 815 million USD were contributed to Canada's GDP by hunting expenditures, 14,200 jobs were sustained and 384 million USD in tax revenue were diverted towards all levels of governments (Federal-Provincial-Territorial Task Force, 2000).

In many cases, hunters are willing to pay high prices for a single trophy hunt (Table 1), varying for different species (Loveridge et al. 2006). For popular game hunts including the acquisition of a single ram, for example of the the California Bighorn Sheep (*Ovis canadensis*), prices can amount up to 200,000 USD (Marty 2002: 39).

Table 1: Examples of outfitter prices of guided hunts for individual species in British Columbia, Canada

Species	Price per Hunt (per person) (USD)
California bighorn sheep (3/4 curl)	55,000
California bighorn sheep (full curl)	40,000
Cougar (mountain lion)	16,000
Mountain goat	15,000
Canadian moose	14,000
Mule deer, white- or black-tailed	5,500
American black bear	5,500
Canadian lynx	5,500
Bobcat	5,500
Wolf	5,500
Grouse	5,500
Duck	5,500
Geese	5,500

(Source: Kuerbis 2020)

To compare the dimensions of economic contributions related to hunting, Southwick Associates (2012: 8) assemble that “hunting overall brought in more revenue (38.3 billion USD) than Google (37.9 billion USD) or Goldman Sachs Group (36.8 billion USD)”. Adding up the numbers of economical contributions, hunting proves to have an unmatched impact – direct and indirect – on wildlife stewardship on a national, regional, and local level, reaching back to the origins of conservation.

4.3.5 Game Markets and Law Enforcement

In retrospect to the history of hunting and conservation from an economic perspective, Mahoney & Jackson (2013: 5) recall that the decision to end commercial traffic for game products, like furs, feathers, leather, and meat, was difficult to conceive and enforce, as trade was vast and highly lucrative and financial incentives remained. Although some species, like the Carolina parakeet, have had already vanished, ending the unrestrained killing and selling of wildlife on supply markets still enabled a return of many hunted species from the brink of extinction (Mahoney & Jackson 2013). The process began rather slow but increasing public agitation called early wildlife stewards into action and by collective actions of both regional and national legislation the uncontrolled shooting of wildlife began to cease (Mahoney & Jackson 2013).

Only the Lacey Act of 1900, which was passed by the USA, met the requirement of legislation at a continental scale and has been essential for North America’s federal legislation to curb illicit traffic in wildlife products by prohibiting the transport of illegally taken wildlife across state borders (Mahoney & Jackson 2013: 451). Beyond the achievement of federal legislation, the novel conservation movement helped to reinforce inclusivity among formerly conflicting groups. The fight against the illicit market for bird plumage, for example, has created a “partnership between bird protectionists and the new class of American hunters known as ‘sportsmen’”, achieving visible progress for the conservation of wildlife (Mahoney & Jackson 2013: 452).

The Federal Aid in Wildlife Restoration Act has contributed over 7.2 billion USD to state conservation efforts since its beginning in 1937, therefore, Southwick Associates (2012) depict a great example for the accomplishments of hunting for the stewardship of wildlife with it. The respective funds were partly generated by license and permit sales as high as 796 million USD and 440 million USD in form of annual donations directly to conservation and sportsmen's organizations (Southwick Associates 2012).

Attributed to its effectiveness, the laws and guidelines of the North American Model of Wildlife Conservation have been widely accepted and adapted to manage wildlife in the United States and Canada (Mahoney & Jackson 2013). Considering that laws of this model are based on regulated hunting (Heffelfinger et al. 2013), it is no surprise that 50 % of hunters and anglers in North America stated to highly respect the work of law enforcement officers (Duda et al. 1998 in Heffelfinger et al. 2013), whose salaries are mainly funded by revenues related to hunting and angling (Heffelfinger et al. 2013: 9). Hence, law enforcement plays a key role in the management and conservation of wildlife by ensuring that hunting regulations are met and laws are being respected.

In an economic context, the role of hunters as wildlife stewards remains essential for conservation agencies, law enforcement as well as population management, as the latter is responsible for the damage control affecting industries like agriculture and forestry. The hunting industry in the United States and Canada with its financial contributions on regional, national, and continental levels proves to be vital for conservation funding and the North American economy overall.

5 Discussion

5.1 Threats to Wildlife Populations

Positions about the role of hunters in wildlife stewardship are split and the discussion often carries enormous potential for conflict (Knezevic 2009). Whether hunting is perceived as an important part of wildlife conservation is often turned into an ethical question with a focus on a hunter's personal motivation and the affliction of the game (Loveridge et al. 2006: 226 f.). Roth & Merz (1996) in Loveridge et al. (2006: 224) also argue that "when poorly regulated, hunting can be – and historically often has been – damaging to the target population, with dramatic examples of extinction and population decline".

As a matter of fact, hunting is a selective activity that inevitably impacts wildlife populations (Loveridge et al. 2006: 232). The personal motivation to acquire a decent trophy (BC Trophy Mountain Outfitters n. d.) can affect the genetic composition of a population by removing individuals of a desired phenotype, or, in extreme cases by managing populations with the goal to increase the development of trophy animals (Loveridge et al. 2006: 232). Few cases have been observed where hunters urged wildlife management to increase their success in harvesting fully grown game by reducing the overall takes, which would turn into a loss of financial resources generated by those hunts that support conservation efforts (Heffelfinger et al. 2013: 406).

Especially removing a high proportion of male individuals can potentially alter the evolutionary development of populations (Coltman et al. 2003; Heffelfinger et al. 2013). For instance, research on a brown bear (*Ursus arctos*) population in Alberta, Canada, has shown a decrease associated with

the harvest of mature male bears due to the killing of cubs by younger males (Wielgus & Bunnell 1994). In populations of the bighorn sheep (*Ovis canadensis*) a significant distinction between hunted and non-hunted rams has been observed by Coltman et al. (2003) during a 30-year study. In the same research, they concluded that unregulated trophy hunting may lead to lower weights and smaller horn sizes in sheep populations, decreasing their overall 'breeding values' (Coltman et al. 2003: 656). Comparably, Strickland et al. (2001) suggest that the hunter's preference for large antlers in white-tailed deer (*Odocoileus virginianus*) in combination with the protection of younger males may lead to a change in the average antler size of a population.

The results of different studies on the consequences of selective hunting suggest that there is a possibility that the gene pool of populations may be affected, yet not necessarily impacting biodiversity (Loveridge et al. 2006: 233). However, Loveridge et al. (2006: 224) conclude that "the impact of hunting on population dynamics can be complex and difficult to quantify."

5.2 Counterproductive Habitat Management

Heffelfinger et al. (2013) state that no other type of conservation has been proven to match the effectiveness of hunting to preserve habitat for hunted and non-hunted species. Among like-minded, hunters are often perceived as stewards for wildlife and their habitat, avidly supporting conservation matters (Holsman 2000). Yet others argue that habitat protection, for example in the case of the black duck (*Anas rubripes*), may even lower population sizes (Grandy 2003 in Loveridge et al. 2006: 231), counteracting the intention to raise the number of individuals. Nevertheless, the impact of hunting activities on wildlife highly depends on the response of different species (Loveridge et al. 2006). The grizzly bears (*Ursus arctos*) in the Yellowstone National Park, for instance, have shown a rather accepting behavior to hunting in their territory, actually moving closer to hunted areas to benefit from human waste (Ruth et al. 2003). Wolves (*Canis lupus*) did not change their behavior distinctively, whereas the cougar (*Puma concolor*) withdrew from its usual habitat (Ruth et al. 2003).

Harmful impacts on habitats managed by hunting can occur especially when numbers of species are kept high in favor of the hunters, creating an imbalance of ecosystems in a certain territory (Holsman 2000; Loveridge et al. 2006). Moreover, in some species the management of wildlife and their habitat through hunting has been evaluated as inefficient due to the decreasing hunter-game ratio, for example in controlling populations of white-tailed deer (*Odocoileus virginianus*) (Brown et al. 2000).

5.3 Inflictions of Harm on Wildlife

Direct inflictions of harm on wild game are often the focal point of the debate whether or not hunting is accepted in the context of conservation (Loveridge et al. 2006; Knezevic 2009). MacDonald et al. (2000) describe evidence of stress responses in hunted wildlife, especially when the animal is chased or being trapped. However, the instant killing of deer, for example, does not show the same amount of suffering for the individual (Harris 2017) which appears to represent a fairer method to hunt.

Loveridge et al. (2006) counter-argument examples of individual harm to the animal by presenting several studies showing that likewise, human activities that are not related to hunting can be

disturbing for wildlife, such as a high number of tourists observing animals from a close distance (Sorice et al. 2006). Surprisingly, even non-hunting conservation efforts that are meant to benefit individuals and populations have been observed by Mathews et al. (2005) to stand in conflict with the well-being of animals that have been reintroduced to the wilderness within a reintroduction program.

In the context of harm on wild game, hunters are often characterized as ego-motivated and selfish (Komppula & Gartner 2013) rather than being accepted as stewards for wildlife. Nonetheless, the hunter's efforts for preserving wildlife, regardless of the motivation, are enhancing hunted and non-hunted species in many cases. Likewise, the benefit of thriving species is not limited to the hunters. Other wildlife-related activities, such as wildlife viewing and photography, are based on abundant wildlife, however, often their contributions to the well-being of wildlife do not match those of hunters (Komppula & Gartner 2013). In some cases, such as the restoration of predators, hunters may not agree with projects that are relevant for a healthy population or an improvement of habitat for self-motivated reasons, but yet support the system that preserves wildlife overall (Heffelfinger et al. 2013). Hence, one can conclude that the overall benefit of selective hunting for hunted and non-hunted wildlife outweighs the possible threats and potentially harmful impacts on individual animals, populations, and habitats (Loveridge et al. 2006; Heffelfinger et al. 2013).

5.4 Alternatives to Hunting for Population Management

There are different approaches to dealing with deer damage in agriculture, forestry, through deer collisions with automobiles and the spread of diseases like chronic wasting disease (CWD), bovine tuberculosis, and Lyme disease (Vercauteren et al. 2006). In a survey with deer-fenced and non-deer fenced farms, the deer-fenced farm respondents stated that deer killing permits issued by state agencies were recognized as fairly effective but not nearly as efficient as deer exclusion fencing, while deer killing permits were perceived as more effective by the comparison group from non-deer-fenced farms (Isleib 1995). Mainly for farmers with high-value crops, like small fruits, Christmas trees, and orchards, deer exclusion fences remain essential for the survival of their business operations (Isleib 1995: 68). For both respondent groups combined, 77 % indicated that they hunt on their properties, and in 70 % of cases other people were allowed to deer hunt on their farms at no cost (Isleib 1995: 67). However, landowners remain to have mixed opinions on the effectiveness of hunting measures on their farms (Isleib 1995).

Deer exclusion fencing can be a reliable solution to deer damage, but the downsides need to be considered, too (Vercauteren et al. 2006). When single spaces are shielded from deer it naturally concentrates on other non-deer fenced habitats. This can potentially shift the problem instead of actually managing the abundance of deer overall, as happens when populations move to areas close to highways, increasing the risk of deer-vehicle-collisions (Vercauteren et al. 2006).

Concluding one could say that, in specific cases, the usage of deer exclusion fences can represent a necessary solution for landowners to protect their crops. Hunting as a measure to manage the overall abundance of deer populations, however, remains to be indispensable.

5.5 Alternatives to Hunting as a Conservation Tool

Sport hunting as an economic driving factor for conservation can be compared to other forms of land-use with benefits for conservation efforts and the economy, like agriculture, subsistence hunting, logging, and non-consumptive tourism (Loveridge et al. 2006: 234). For photographic tourism, as it is often compared to hunting, larger numbers of participants are necessary to achieve the same amount of profit as with hunting (Loveridge et al. 2006: 235), causing greater incidental environmental damage (Goodwin et al. 1998 in Loveridge et al. 2006: 235).

The public and the global conservation community still have not obligated themselves to finance the cost of conservation (Loveridge et al. 2006). Thus, it remains essential to create incentives for sustainable hunting, promoting a low impact on the environment while ensuring a high return on financial resources. According to Loveridge et al. (2006), other consumptive activities like agriculture, subsistence hunting, and logging tend to be considerably more damaging, negatively affecting wildlife populations and habitats. Based on their research, Organ et al. (2012: 23) predict that “without the political, social, and financial support of hunters and anglers, agencies will be severely challenged to be able to deliver effective conservation programs for all wildlife into the future.” In his paper from 1991, Heberlein already concluded “I am afraid that no serious funding and infrastructure from the non-consumptive user and often uninterested general public will replace [the funding from sport hunting]” (Heberlein 1991: 533).

6 Conclusion

The relationship between hunting, stewardship, and wildlife conservation is complex and cannot be labeled as either solely beneficial or adverse by assessing only one particular aspect. Rather, it is appropriate to evaluate different aspects from a social, ecological, and economic perspective to comprehend the greater context of hunting and wildlife.

The extinction of particular species that were popular in the U.S. and Canada throughout the 18th and 19th centuries can be attributed to voracious market hunters exploiting the once abundant prairies. Nevertheless, without this historical population decline, a hunting ethic that advocated for the prohibition of uncontrolled game slaughter might have never been born, and the laws and principles that are successfully guiding conservation and stewardship in North America today may have never been established.

One of the challenges to conservation and stewardship in modern times is the increasing alienation of societies from nature. Environmental awareness, intimate connection to the lands, and a deep appreciation for nature are fundamental to protect wildlife and its habitat. Hunting is an activity that allows humans to understand ecosystems in their complexity and experience the life and death cycles of nature. This consciousness for the natural environment can foster the desire to conserve what people value and depend on. If humans want to protect wildlife and their habitat in the future, society as a whole needs to cultivate reverence for the natural resources that they now seem to take for granted. Whether this is achieved through hunting or non-consumptive activities seems secondary in this context.

Contrary to the assumption that regulated hunting represents a severe threat to wildlife populations in modern times, the real challenge is a continuous loss of habitat, threatening the viability of all

species. The North American conservation system, with guidelines and laws based on regulated hunting, has achieved historical habitat improvements that can be greatly attributed to the initiative, contribution, and support from hunters. In some cases, using hunting to manage habitat can be counterproductive, depending on the species, their territory, and the quality of management. However, the positive effects on hunted and non-hunted wildlife populations mostly outweigh possible threats in the execution of appropriate wildlife management.

Likewise, inflictions of harm on individual animals highly depend on the hunting method, and regulations enforce a fair chase in most cases. Potential challenges for populations due to selective hunting, such as changes in gene pools and phenotypes, have been documented. Nevertheless, the consequences of selective forces vary between species and populations and need to be further evaluated.

The absence of population control can be detrimental to wildlife, habitats, and the economy. Therefore, an effective management strategy is an essential part of conservation and stewardship, so that negative effects of overabundant species can be controlled while maximizing positive effects. Up to this day, hunting represents the most effective tool to manage populations and no other strategy has shown to match the financial and executive role of hunters. However, indications of a decline in hunting activities such as waterfowl hunts (Vrtiska et al. 2013), demonstrate the need for an alternative support system to sustain wildlife management.

Revenues generated by hunting-related activities are vital for financing wildlife conservation and funding of wildlife agencies. Hunting organizations and the overall hunting industry generate a substantial amount of income that is dedicated to conservation efforts, directly through revenues generated by sales of licenses, equipment, and taxes, and indirectly by creating positive ripple effects that aid U.S. and Canadian economy, overall.

The legislation and enforcement of laws and guidelines like the Lacey Act, the Federal Aid in Wildlife Restoration Act, and the North American Model of Wildlife Conservation have been essential for the shift from the slaughter of wildlife for commercial trade towards conscious and sustainable hunting that has become one of the main pillars for wildlife conservation in North America.

In the 21st century, mankind is facing severe environmental challenges that are unrelated to hunting. Habitat loss, climate change, urbanization, and human separation from nature increase the need for collective stewardship. However, whether or not hunting is accepted as part of conservation often turns into an ethical question and the conflict between hunters and opponents prevents a joined conservation force.

While discussing ethical aspects, one should consider that without the social, ecological, and economic support of hunters, North America's well-established conservation system is on the brink. It is important to recognize the diverse role of hunting in the protection of wildlife, from personal to financial contributions, that has yet shown to be indispensable.

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