British Columbia Urban Ungulate Conflict Analysis

BRITISH COLUMBIA
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Ministry of Environment

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Executive Summary

Deer, moose, elk, and bighorn sheep have a widespread distribution across British Columbia, providing significant public recreational opportunities and aesthetic enjoyment to BC residents. However, excellent habitat in residential areas and protection from hunters and predators has encouraged some ungulate populations to become urban dwellers. Increasing numbers of ungulates (primarily deer) living in urban areas has led to increased conflict with the human residents of those areas.

Conflicts between urban ungulates and municipal residents include damage to gardens and landscaping, high rates of ungulate vehicle collisions, aggressive behaviour towards humans, and potential transmission of disease from ungulates to humans and livestock. Across Canada, there are only a few cities where active urban ungulate management has been implemented. In 2004, Magrath, Alberta carried out a controlled hunt in the rural areas adjacent to the town to reduce the resident deer population. Winnipeg, Manitoba carried out a deer capture and relocation project in 1985, and Ottawa, Ontario implemented a deer vehicle collision public awareness campaign in 2006.

In BC, although moose and bighorn sheep cause occasional seasonal management issues, deer are the major urban ungulate management challenge. The municipalities with the greatest challenges are Princeton, Kimberley and Grand Forks. Princeton and Kimberley have resident populations of mule deer and aggressive incidents are becoming more frequent. Grand Forks has white-tailed deer, but no aggressive incidents have been noted to date. Meetings have been held with municipal governments in all three communities, and Kimberley has implemented a bylaw prohibiting deer feeding.

Urban ungulate populations are challenging to manage for biological, jurisdictional and social reasons. Deer are very adaptable to human altered environments, and thrive in urban areas. The overlapping roles and responsibilities of the municipal and provincial governments complicate management decisions. Further, the wide range of public opinion on the most appropriate management interventions presents a huge challenge, as the diversity of often opposing opinions makes for a controversial management project.

Many communities in the United States (where urban deer management has a longer history than in Canada), are undertaking community based, co-management processes, which are usually perceived to be more appropriate, efficient and equitable than traditional authoritative wildlife management approaches. Although these processes may take more time, they can result in greater stakeholder participation and satisfaction with urban wildlife management.

Urban ungulate management strategies should be focused on the reduction of conflicts and management of populations to an acceptable level, not the complete elimination of the conflict or herd. A comprehensive and integrated plan that incorporates aspects of many options is required to achieve the project objectives. Short term strategies may provide relief from symptoms, while long term plans

address population levels. Provincial and community resources plus property owner cooperation are needed to achieve measurable results.

Management options fall into four categories: conflict reduction, population reduction, fertility control, and administrative options. Conflict reduction options keep ungulates away from susceptible properties, minimize the damage that is sustained if animals do enter property and reduce human/ungulate conflict. Landscape design, careful plant selection, taking preventative measures early before patterns of behaviour are established, and using repellents and scaring devices can reduce, but not eliminate, ungulate damage. Fencing is the only viable option when damage cannot be tolerated.

Population reduction programs are ongoing activities, with an initial reduction phase, when a significant proportion of the population is removed at one time, and a maintenance phase, occurring after ungulate densities are reduced and when fewer individuals are removed. Community specific management decisions have to factor in the number of animals to be removed and at what intervals, the potential for increased reproductive productivity, and possible increased immigration due to less competition for habitat and resources. Capture and relocation of deer has not often been implemented across Canada and the United States due to concerns about animal mortality post release, however, in localized areas, and under special circumstances, it may be appropriate. Sharpshooting, capture and euthanization, and controlled public hunting have all been used in the United States to reduce ungulate populations.

Fertility control options are extremely limited because no fertility control drugs are approved for general use in ungulate populations in Canada, and only one drug is approved for use in the United States. Immunocontraceptive vaccines are the most promising fertility control method and have been approved for experimental research purposes. Ongoing, long-term research reporting on the efficacy of these drugs to reduce populations and maintain them at low enough levels to keep ungulate damage at acceptable levels is just starting to emerge. For the near future, most researchers suggest that populations be lowered using lethal control, and then, when proven practical, population levels can be maintained using fertility control.

Administrative options such as amending municipal bylaws and provincial regulations to permit lethal control options need to be implemented, and public education and formal project monitoring need to be ongoing before, during and after any management interventions.

When complaints caused by overabundant ungulates are increasing in numbers and severity, then conflict reduction options such as fencing, repellents, and aversive conditioning will not significantly reduce the numbers of complaints. Population reduction is needed to reduce the damage caused by overabundant ungulates. Once the population numbers are lowered, then damage is easier to manage with conflict reduction techniques. The method of population reduction and how often it needs to be carried out is dependent on the site specific circumstances in each community.

Introduction

Large herbivorous mammals – deer, moose, elk, bighorn sheep – are widespread in British Columbia, providing significant public recreational opportunities and aesthetic enjoyment to BC residents. However, excellent deer habitat in residential areas combined with protection from hunters and predators have encouraged populations of ungulates to become urban dwellers. Increasing numbers of ungulates living in urban areas has led to increased conflict with the human residents of those same areas.

BC is experiencing increased conflict with ungulate populations that have become habituated to living in urban environments. Solving ungulate conflicts will likely include: changing stakeholder attitudes or behaviours; developing community capacity to increase participation in management decisions; establishing measureable management objectives for each community; modifying deer behaviour; modifying human behaviour; reducing herd size; and amending provincial and municipal regulations to facilitate management interventions. No single technique will be universally appropriate. Complexities of deer management and limitations on available interventions make quick-fix solutions unlikely. Because both the positive and negative values associated with ungulates are so high, setting management goals and determining treatment options can be very difficult.

Those responsible for urban ungulate management decisions may have to strike a balance between the aesthetic and sentimental value of urban deer and the unwelcome interactions and costly property damage they cause. An unfortunate reality is that addressing the social conflicts caused by management interventions may be more difficult than managing the biological aspects of population reduction.

This report provides an overview of the reasons why ungulates are present in urban environments and summarizes the consequences of overabundance. Interviews with wildlife managers in other provinces and Canadian and American cities provide examples of urban ungulate management projects in other jurisdictions. Urban ungulate issues in BC are summarized by community. The biological, social and administrative challenges of managing urban ungulates, a discussion of why residents' opinions and values about wildlife need to be considered when developing urban wildlife management programs and how residents and communities in other jurisdictions have become involved in urban wildlife management programs are discussed. Management options for urban ungulates are reviewed, including discussions of efficacy, costs, human health and safety, animal humaneness, and project advantages and disadvantages. Finally, there are recommendations for the future as BC addresses urban ungulate management challenges.

Definitions

Biological carrying capacity (BCC) Ellingwood and Caturano (1988); Swihart *et al.* (1998)

Biological carrying capacity is defined as the number of ungulates in good physical condition that a parcel of land can support over an extended period of time. BCC is a function of the quality and quantity of forage and the availability of good winter habitat. Reproductive productivity causes populations to exceed BCC, unless the productivity is balanced by mortality. When population numbers approach or exceed BCC, habitat quality decreases with loss of native plant species, the herd physical condition declines, and the likelihood of winter mortality due to poor nutrition or disease increases.

Cultural carrying capacity (CCC) Ellingwood and Caturano (1988)

Cultural carrying capacity is defined as the maximum number of ungulates that can coexist compatibly with local human populations (Ellingwood and Spignesi 1985). CCC is a function of the sensitivity of the local human population to the presence of animals, and can be considerably lower than BCC. Sensitivity of humans to ungulates is dependent on local land use practices, local population density, and attitudes and priorities of humans. Excessive numbers of wildlife vehicle collisions, homeowner and gardener complaints, or reports of wildlife aggression indicate that CCC has been exceeded.

Wildlife acceptance capacity (WAC) Decker and Purdy (1988); Decker *et al.* (2001)

Wildlife acceptance capacity is defined as the wildlife species population level that is acceptable to a group. There can be several WACs in a community; for example, gardeners may have a lower WAC than wildlife enthusiasts.

Urban, rural, suburban, exurban, periurban

Common definitions for the terms *urban* or *rural* are based on population densities. For example, the 2001 Census Dictionary from Statistics Canada defines urban as “an area with a population of at least 1,000 and no fewer than 400 persons per square kilometer” and defines rural as “all territory outside urban areas.” All of Canada is therefore classed as either urban or rural. *Suburban* is not a term recognized by Statistics Canada, but is generally defined as the outlying residential district areas of a city.

Additional terms found in the scientific literature are *exurbia/exurban*, described as residential land use that occurs outside city limits where human population densities and average property size are intermediate between suburban and rural areas (Nielson 1992) and *periurban*, which is used to describe areas between the suburbs and the countryside.

For this report, rural refers to land outside municipal boundaries, and urban or suburban refers to all areas within the city or town boundaries, which may include:

- Commercial districts and properties
- Industrial districts and properties
- Residential properties (city lots) and larger properties (1 – 3 hectares)
- Vacant properties
- Railway yards
- School yards
- Cemeteries
- Airports
- City parks
- Greenbelts, wetlands, or areas managed for aesthetic or environmental purposes
- Land parcels reserved from development due to inaccessibility or inoperability

This report does not discuss ungulate management options for land used for commercial agriculture, even if this land does occur within municipal boundaries. Management of ungulate damage issues on agricultural properties within municipal boundaries or rural properties outside municipal boundaries may have different goals or management strategies than urban ungulate management.

Urban ungulate

Urban ungulates are hoofed, herbivorous mammals that live primarily in urban ecosystems. The majority of urban ungulate management issues involve deer, but in BC, cervid species such as moose and elk, and bovid species, such as bighorn sheep, are also found in urban areas.

Urban ecosystem Conover (2002)

Urban ecosystem is defined as a system influencing, and being influenced by, human attitudes, human behaviours, regulatory policies, and a sense of resource control throughout areas where humans live, recreate, and work at densely to moderately populated scales.

Attractants

The increases in urban ungulate populations (primarily deer) are a predictable consequence of human actions within municipalities. People have established greenways and parks, planted gardens and trees, eliminated natural predators, leashed and controlled dogs, enacted municipal bylaws to prohibit the discharge of firearms and deliberately fed the wildlife. The resultant habitat and protection that people have provided have enabled ungulate populations to not only survive, but thrive.

Excellent habitat

White-tailed deer and moose thrive on edge habitat. Human activities that fragment the natural environment create ideal habitat for these animals. Ravines, creek draws, natural areas, and wooded parks create natural bedding areas and cover, while golf courses, open park land, fertilized lawns and flowering or vegetable gardens provide ample and varied forage opportunities. Bighorn sheep, mule deer and black-tailed deer also find the combination of excellent habitat with abundant refuge areas highly attractive.

Lack of predators

A key factor in deer mortality is predation. Natural predation on adult deer in urban areas is almost non-existent, and the predation behaviour of medium sized predators such as coyotes that would normally prey on fawns in the wild is often significantly different in urban areas. With this key mortality factor reduced, the survival rate and subsequent population growth is greatly increased. Dog licensing bylaws, off leash restrictions and control of stray dogs contribute to the safety and subsequent habituation of urban ungulates. As a prey species, ungulates “know” where they are safe, and use and exploit the safety of urban environments to their advantage.

Wildlife feeding

Purposeful wildlife feeding where feeding stations are set up to attract and feed deer is another contributing factor to increasing deer populations. Well fed deer, particularly white-tailed deer, have very high reproductive rates. Deliberate wildlife feeding is very seldom done in urban areas for moose or elk.

Hunting restrictions

In natural environments, wildlife managers use regulated hunting to control ungulate populations and influence sex and age ratios. This management tool is not available for population control in municipalities where weapons discharge and hunting are prohibited.

Consequences of Overabundance

An overpopulation of ungulates can have serious consequences. As an animal population approaches the cultural carrying capacity (CCC) of an area, negative interactions between people and the animals begin to increase. A significant measure of a community's CCC for ungulates is the amount of damage that residents are willing to sustain without calling for animal management programs. Generally, long before the biological carrying capacity (BCC) is reached, the overabundant animals have worn out their welcome.

Conflicts between urban ungulates and municipal residents result in damage to gardens and landscaping, high rates of ungulate vehicle collisions, transmission of disease from ungulates to humans and livestock, and in some circumstances, instances of aggressive behaviour towards humans. There are occasional reports of ungulates causing property damage to structures if they become trapped in fenced yards or buildings, or fall into backyard swimming pools. In addition to the social and environmental costs of exceeding an area's BCC, browsing pressure and subsequent decline in habitat quality can lead to a decline in herd health, marked by decreased body weights, lowered reproductive rates, lowered winter survival, increased parasitism, and increased disease prevalence (Eve 1981).

Damage to gardens, landscape plantings, and community forests

Overabundant deer populations can negatively impact native plant communities and community forest ecosystems. Deer can eat 2 – 5 kilograms of forage per day, with severe consequences to the variety, composition and abundance of native plant communities, community forests, and forest bird species. In the most severe instances, a "browse line" is highly visible, beneath which there is little or no new vegetative growth due to over browsing. In urban areas, there are abundant, high quality food sources for ungulates - flower and vegetable gardens, ornamental plantings, fertilized lawns, fruit trees, and possibly even bird feeders during the winter (Kilpatrick and Spohr 2002).

Deer are selective feeders and forage on plants or plant parts with considerable discrimination. However, when deer are overabundant and hungry due to heavy competition for resources, they will eat almost any type of plant. There are primarily three kinds of deer damage: browsing of plant parts; antler rubbing on bark; and trampling of plants. Deer browsing can be recognized because, lacking upper incisors, they must jerk, tear or rip leaves and twigs from trees and shrubs with their molars, leaving a ragged edge, in contrast to rabbits or rodents, which generally leave a cleanly cut plant stalk. Annuals may be pulled out of the ground. Damage to large trees extends up to about 2 metres, the highest height to which the deer can reach. Smaller trees may be pushed over or the bark may be chewed through.

Ungulate vehicle collisions

Data on animals killed by collisions with vehicles within municipalities is not consistently collected, but in communities with high urban ungulate populations, there are generally high rates of vehicle collisions.

Provincially, deer vehicle collisions comprise about 76% of the total number of wildlife collisions each year and other ungulates species comprise about 12% of the total. In a typical year in BC, about 5 people are killed in wildlife vehicle collisions and a further 382 people are injured. In 2006, ICBC spent about $34 million CDN on 10,500 animal related collisions. The Ministry of Transportation and Infrastructure spends over $600,000 CDN on highway cleanup and carcass removal annually. Additional societal costs are incurred by police, emergency response teams, WorkSafe BC, hospitals, and employers. Wildlife collision costs per vehicle including property damage, accident investigation, animal value, and carcass removal/disposal were estimated from studies in the USA and Canada by Huijser *et al.* (2009) for deer ($2,913 2007 USD), elk ($5,397 2007 USD), and moose ($6,587 2007 USD). The addition of human injury and fatality costs raises these costs to $6,617 (2007) USD for deer, $17,483 (2007) USD for elk, and $30,760 (2007) USD for moose.

The Ministry of Transportation and Infrastructure records show that there are about 4,900 wildlife carcasses recovered each year, while a further 14,700 animals are hit and killed by vehicles but move away from the roads to die, and therefore are not recovered and included in the official counts.

Disease

When there are high densities of ungulates there are high densities of the organisms that live on them or in them. Diseases can be transmitted from ungulates to humans, from one ungulate species to another, and from livestock to ungulates and back.

Anthrax (cervids and bovids to humans)

Anthrax is a disease mainly of cattle, sheep and horses and is caused by bacteria found in the soil. The anthrax bacterium can be transmitted from bison and cervids to humans. Anthrax has been found in Wood Bison in the Northwest Territories and Alberta, but not in BC. Common methods of infection are through cuts, open sores, scratches, inhaling spores or eating under-cooked meat. It can be a skin, lung, or gastrointestinal infection, treatable by antibiotics. A severe lung infection can be fatal. The risk of human infection in the outdoors is extremely unlikely. References: Manitoba Conservation Wildlife Disease - Anthrax in Wildlife webpage; BC MOE (2006).

Bovine tuberculosis (Bovine TB) (livestock to wildlife to livestock)

Bovine TB is a contagious and communicable disease caused by a bacterium (*Mycobacterium bovis*). It affects cattle, bison, deer, elk, and goats. Bovine TB is caused by a different bacterium than human TB (*Mycobacterium tuberculosis*), and although highly unlikely, it can affect humans. Disease transmission usually requires frequent and extended exposure to respiratory secretions and coughing, and/or contact with infected urine, manure and saliva. In Manitoba, elk feeding on haystacks where cattle were

infected with bovine TB became infected. Bovine TB does not usually sustain itself in wild elk populations. In BC to date (2009), there have only been 3 cattle that have tested positive for bovine TB, and it is not found in free ranging wildlife populations in BC. References: Manitoba Conservation Wildlife Disease - Bovine Tuberculosis in Elk webpage.

Chronic Wasting Disease (CWD) (ungulate to ungulate)
CWD is a fatal disease of the central nervous system found in mule deer, white-tailed deer, elk and moose in North America. It is not found in cattle. It is an emerging infectious disease of increasing importance and has been diagnosed in captive and free-ranging cervids in 2 provinces. BC is considered to be at low risk for CWD because captive farming of native cervid species has never been permitted and imports of native cervid species into BC have been prohibited since 1991. There are substantial geographical and spatial barriers to animal movements and any potential disease transmission between areas of infection in eastern Alberta and BC.

CWD and related diseases (e.g. bovine spongiform encephalopathy in cattle and Creutzfeld-Jakob disease in humans) tend to be species specific and are not known to be transmitted naturally between other species of wildlife and livestock or humans. CWD can be transmitted between individuals of the same species, and although the method of infection is not well understood, it may involve nasal-oral pathways, urine or faeces and possible environmental contamination (Fischer and Lavelle undated). There is no strong evidence that CWD can be transmitted from cervids to humans (Belay *et al.* 2004; Schwantje 2006). References: Schwantje (2006).

Escherichia coli (E. coli) (deer to humans)
E. coli is a bacterium that is commonly found in the lower intestine of warm blooded animals. *E. coli* has been found in hunter harvested white-tailed deer faeces (0.25%: Renter *et al.* 2001; 0.3%: Dunn *et al*. 2004;) and in venison from white-tailed deer (Rabatsky-Ehr *et al.* 2002) and black-tailed deer (Keene *et al.* 1997). Infection through physical contact with faeces is usually only a concern where there are extremely high concentrations of deer faeces, such as at feeding stations.

Hemorrhagic diseases of deer (deer to humans)
These diseases are caused by epizootic hemorrhagic disease virus (EHDV) or blue tongue virus (BTV). Mule deer are more affected by these diseases than white-tailed deer. EHDV and BTV are extremely unlikely to affect humans.

Johne's disease (livestock to wildlife to livestock)
Johne's disease is a chronic, contagious bacterial disease that affects the small intestine of ruminants such as cattle, sheep, goats, elk, deer, mountain goats, bighorn sheep, antelope and bison. All ruminants are susceptible to Johne's disease. Infected animals shed large numbers of the bacteria (*Mycobacterium paratuberculosis*) in their faeces, leading to contamination of feed and water sources. The most common method of infection is the ingestion of bacteria via manure-contaminated udders, milk, water

or feed. Johne's disease can be transmitted from livestock to wildlife then back to livestock. References: Johne's Information Central website.

Parasites (wildlife to wildlife)
Transmission of parasites from deer to deer is generally a natural phenomenon with little consequence to the animal, but when conditions change, deer numbers increase beyond acceptable levels and suitable habitat becomes over utilized, the effect of parasite transmission and disease can be significant.

Tick Borne Diseases

Tick borne diseases are transmitted when a tick that is infected with bacteria bites a human. Three closely interrelated elements must be present in order for tick borne diseases to be transmitted: the bacteria, the ticks that can transmit them, and alternate hosts such as mice and deer that provide food for the ticks in their various life stages. Abundance and distribution of ticks are correlated with deer densities (Walter *et al.* 2002; Rand *et al.* 2004).

Lyme disease (ticks via deer to humans)
Deer ticks (*Ixodes* spp.) are responsible for transmitting the bacteria to humans in the northeastern and north-central United States, and on the Pacific Coast, the bacteria are transmitted to humans by the western black-legged tick. Deer are the primary host for the adult deer tick and are key to the reproductive success of the tick, however, reducing the incidence of Lyme disease is a complex issue, and cannot likely be achieved by a simple reduction in the deer population. Although dogs and cats can contract Lyme disease, there is no evidence that they can transmit the infection directly to humans. Pets however, can carry infected ticks into the home or yard. Fatalities from Lyme disease are rare. However, undiagnosed Lyme disease may develop into chronic disease that may be difficult to treat. The transmission of Lyme disease through over abundant deer populations is a serious concern in northeastern parts of the USA, but only of low to moderate concern in BC. White-tailed deer do not appear to suffer from the clinical signs of infection from the bacteria that causes Lyme disease. References: Public Health Agency of Canada website; Todar 2008.

Rocky Mountain Spotted Fever (ticks via deer to humans)
Rocky Mountain Spotted Fever (RMSF) is a severe tick-borne disease caused by *Rickettsia rickettsii.* The American dog tick (*Dermacentor variablis*) in the east and the Rocky Mountain wood tick (*D. andersoni*) in the west are the principal vectors for bacterial transmission. Hosts for the adult ticks are carnivores, deer and domestic animals, especially dogs. Although RMSF cases have been reported in Canada, the incidence cannot be obtained since RMSF is not a national notifiable disease. Serious complications may occur. The case fatality ratio can be as high as 20% to 30% for untreated patients and 3% to 4% for treated patients. References: Public Health Agency of Canada website; Conover (2002).

Ehrlichiosis (ticks via deer to humans)

Human ehrlichiosis has been recognized as an emerging tick-borne infectious disease since 1986. There are three forms of ehrlichiosis: human monocytic ehrlichiosis (HME); human granulocytic ehrlichiosis (HGE); and one other undefined human ehrlichiosis. The lone star tick (*Amblyomma americanum*), the blacklegged tick (*Ixodes scapularis),* and the western blacklegged tick (*Ixodes pacificus*) are known vectors of ehrlichiosis. As ehrlichiosis is not a national notifiable disease in Canada, the incidence is largely unknown. In the USA, the highest incidence rates of HME have been reported from southern and south central regions, and the highest incidence rates of HGE from north eastern and upper mid-western areas. Although most cases of ehrlichiosis are mild, complications can occur in about 10% to 20% of patients. The case fatality ratios can be as high as 5% for HME and 10% for HGE. References: Public Health Agency of Canada website; Centre for Disease and Prevention Control website.

Aggressive ungulate behaviour

Although there is limited information in the literature documenting ungulate aggression towards humans, in BC, Conservation Officers report that all species of ungulates – moose, elk, mule deer, and bison – have demonstrated aggressive behaviour towards humans in urban settings. Ungulate aggression (or aggressive defense postures) can occur in three general situations: 1) females reacting to a real or perceived threat to young (generally occurs in the spring); 2) male or female annoyed or harassed by dogs; and 3) males during the rut (late fall). Aggression can take the form of assuming alarm postures, snorting, standing on hind legs and flailing with front legs, charging, and charging with contact.

Geist (2007) states that habituated animals (those that develop a “psychological patience” with human presence and activities) can be much more dangerous than wild animals, because habituation is a state of tolerance for, and even an attraction to, humans and their environment. Some habituated animals go even further, accepting humans as equal social partners, with subsequent competition and dominance behaviours.

Repeated instances of aggressive behaviour can be the tipping point for determining that ungulate management is required in a community. Residents may be willing to endure a considerable amount of property damage commensurate with the pleasures of wildlife watching, but they are generally unwilling to tolerate aggressive incidents that threaten people. Further, depending on circumstances, Conservation Officers, having made the determination that an animal is aggressive or threatening towards humans, will attempt to identify and dispatch the animal.

Moose

A significant cause of moose aggression, in addition to those mentioned above, occurs when moose are in distress due to heavy tick infestations or starvation (generally occurring in late winter). High numbers of aggressive moose incidents, where moose had to be dispatched due to their behaviour and/or poor condition, were noted during years of heavy tick infestation by Conservation Officers from both the Peace and Omineca regions. Cow moose will also aggressively defend against real or perceived threats to their calves.

There is likely a difference in how rural and urban residents, even of northern cities, view moose transgression into the human environment. Partnow (1999) describes how rural Alaskans only supported lethal control of moose when moose were threatening humans, not when moose were simply present in human territory. In contrast, Anchorage residents claimed justifications for dispatching moose even when there was simply a potential threat, as evidenced by proximity to humans or trespass onto human property (e.g. non aggressive moose blocking a driveway) and when there was damage to human property such as trees and gardens. Anchorage moose have stomped two people to death (in 1993 and 1995) and are estimated to have killed or injured 50 to 100 dogs annually (ADF&G 1999).

In Prince George and area, even the presence of moose in urban environments is not well tolerated, likely because of the large size of these animals. This is supported by statements from Omineca Region Conservation Officer G. Van Spengen who said in his interview "There is less tolerance from people for moose. People think that they should report simply if the moose are present. There is an increased perception by people that there is a potential for trouble or that moose are a danger. It is the people's behaviour that causes the problem, not the moose behaviour."

Elk

Elk habituation and subsequent aggression towards humans has been documented in Canada's National Parks, where there are populations of habituated elk in close proximity to both residents and large numbers of tourists. To reduce elk-human conflicts in Banff National Park, Parks Canada (1999) recommends: 1) identification of elk displaying unacceptable aggression towards humans and their removal or destruction; 2) elk habituation management and aversive conditioning; 3) public education; 4) management of attractants; 5) restoring predator access; and 6) an overall reduction in elk numbers by capturing and relocating elk.

There are no BC communities which are currently experiencing conflict with aggressive elk in urban settings.

White-tailed deer and mule deer

Conover (2002) reports 5 to 10 people are killed annually in the USA by aggressive buck deer (not differentiated among deer species).

Grovenburg *et al.* (2009) documented white-tailed deer doe aggression towards humans during a neonate capture program, but in a natural environment, not an urban environment, in a situation where does perceived fawns as actively threatened. Hubbard and Nielsen (2009) reported on a series of white-tailed deer attacks on humans during the fawning seasons of 2005 and 2006 on a university campus in southern Illinois. Contributing factors may include fawning areas in close proximity to areas of high human use, a history of deer and humans in close proximity, and unusual stress in the deer population, particularly one doe who may have been responsible for several attacks.

Despite similarities in size and morphology between mule deer and white-tailed deer, mule deer are considered to be more actively defensive than white-tailed deer. Given the choice of fight or flight, white- tailed deer use flight as a survival strategy, compared to the propensity of mule deer to actively defend their young against predators. Lingle *et al.* (2007) report the tendency of mule deer to defend their own fawns, other non-related mule deer fawns, and even white-tailed deer fawns. Additionally, Lingle *et al.* (2005) found that mule deer are more likely to actively defend fawns against predators than white-tailed deer, which are more prone to flight as a survival strategy. Lingle *et al.* (2005) suggest that because mule deer tend to inhabit more open habitat than white-tailed deer, they rely more heavily on aggression as a defense against predators, rather than the flight or hiding behaviours common to white-tailed deer. When mule deer tendencies towards fight rather than flight are exercised in encounters with humans in an urban environment, mule deer may exhibit active defensive behaviours towards humans, often perceived and reported as aggression.

Nonetheless, whether intended to defend fawns or as unprovoked aggressive attacks, the result of the behaviour is the same. Human safety is threatened, deer are the cause, and lethal control of the threatening animal is often the result.

Incidents of aggression or aggressive defense towards humans by mule deer have been reported in Kimberley, Cranbrook and Princeton. No instances of white-tailed deer or black-tailed deer aggression towards humans were described during interviews for this report.

Canadian Overview

There is little published academic or grey literature regarding the management of urban ungulate populations in Canadian cities and towns. City officials and provincial wildlife managers were interviewed to provide their experiences with urban ungulates.

Calgary, Alberta: No action

The primary ungulate species in Calgary is white-tailed deer, but there are some mule deer also. The urban deer population in Calgary seems to be in balance with the vigourous urban coyote population. Within the city, there are also some bobcat, and the occasional cougar. In southwest Calgary, the population may be 300 to 400 deer in the winter. There is an elk population in adjacent rural areas.

Bow hunting is permitted in some outlying areas around Calgary. There is a new primitive weapons season: black powder weapons with low velocity and short distance range; archery; and shotgun with single projectiles.

Deer vehicle collisions in Calgary are frequent; anecdotally perhaps 2 or 3 times per week, however, there are no current management concerns or actions being undertaken regarding the urban deer population in Calgary.

Edmonton, Alberta: Develop wildlife passage guidelines

The City of Edmonton is currently developing Wildlife Management Guidelines and Wildlife Passage Guidelines.

A 2008 City Biodiversity Report indicates populations of primarily white-tailed deer, with some mule deer and some moose. Unpublished data from the University of Edmonton indicate most deer are congregated along the river and ravine areas.

Edmonton is a distinct Wildlife Management Unit, and bowhunting within the city limits is allowed in some cases.

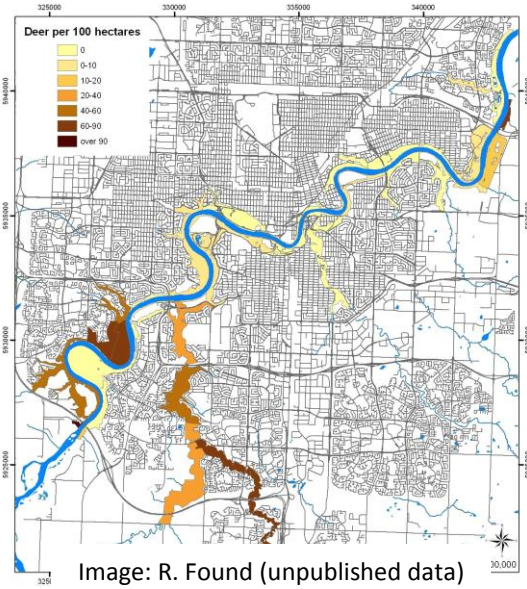

Image: R. Found (unpublished data)

Deer are not considered a major management challenge. The City of Edmonton Parks Branch does not receive many complaints regarding deer. There may be one complaint every other year about deer damage in gardens, plantings or landscaping. There are infrequent complaints regarding moose, and they have occasionally tranquilized and relocated moose that have wandered too far into the city.

Wildlife Passage Guidelines will focus on providing linkages and connectivity through developed areas, providing safe road crossing areas with breakouts or jump outs, and deterring deer from entering areas unsafe areas. The provincial ring road around Edmonton, Anthony Henday Drive, has incorporated several wildlife crossings, including one built at the intersection of the Whitemud Creek and Anthony Henday Drive.

Photo: David McKeown

There is an ongoing Urban Deer Location study, carried out by undergraduate students at the University of Alberta, Edmonton. The students trap and radio collar white tailed deer and monitor animal movements to study home range and impacts of new roads. There are no publishable results as yet, because the collared animals keep getting killed in vehicle collisions. Currently, there are only 2 white-tailed deer with collars.

Deer vehicle collisions do occur on urban roads. Data are collected by Animal Control Services, who pick up the carcasses. Deer vehicle collisions are not perceived by the general public as a concern.

Deer vehicle collision history (Animal Control Services, Edmonton)

	2006	2007	2008	2009 (to Aug 9)
# of deer carcasses recovered: >95% from vehicle collisions	113	141	78	39

Deer vehicle collision frequency

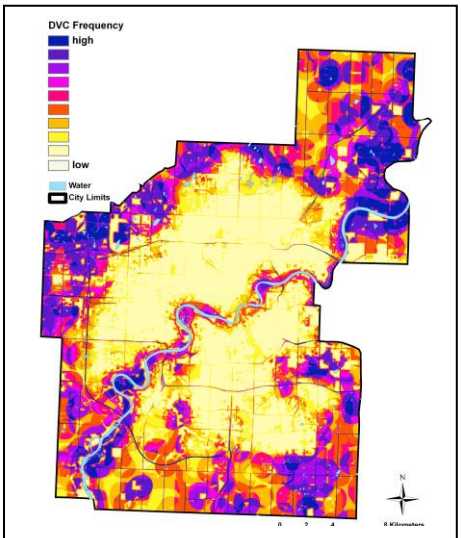

Image: R. Found (unpublished data)

Magrath, Alberta: Controlled quota hunt

(Information taken directly from the Magrath Quota Hunt January 8 – 31, 2004, Post Hunt Summary Report. 2004. Kim Morton and Lyle Lester. Fish & Wildlife Division, Ministry of Sustainable Resource Development).

In the summer of 2003, residents in Magrath began voicing their displeasure at what they felt were unusually high numbers of white-tailed deer living in and around their community. Deer were in parks, on roads and using gardens and ornamental vegetation as an alternate food source. The issue also was addressed several times by Enforcement Field Services (EFS), as officers responded to numerous complaints. The community's displeasure culminated in 83 residents signing a petition and delivering it to the local MLA in the fall of 2003.

EFS along with the Lethbridge Wildlife Management team began comparing deer numbers from past aerial surveys conducted in the area. Complaints to Fish & Wildlife and records of deer vehicle collisions were also summarized. While the overall population of white-tailed deer in adjacent survey blocks had fluctuated, it had slowly increased by approximately 30% over the last 10 years. More importantly, there was a shift in habitat use by deer in the area. The Magrath area numbers reflect that all deer were observed within approximately 2 miles of town. There was an increase from approximately 60 deer up to almost 300 (500% over 10 years). The white-tailed deer in the Magrath area were moving in closer to the community to take advantage of the permanent food sources (gardens, ornamentals and irrigated fields), the lack of predators and safety from hunters.

Lethbridge area Fish & Wildlife staff met with local governing bodies and the general public through a series of meetings from October to December. The Magrath public meetings were advertised by way of leaflets and posters. Special interest groups (i.e. Fish & Game) were specifically invited, as were all landowners within the hunt boundary. Word of mouth was also relied upon. During the meeting, attendees were provided survey forms to indicate their opinions regarding the quota hunt. Survey forms were also mailed out to all landowners within the proposed hunt boundary.

The outcome from the meetings indicated almost unanimous support for a quota hunt. Both levels of local government (town and county) were fully supportive of the proposal. Overall, support from community residents, landowners and the local government was very strong.

After consultation with town and county councils and Magrath residents, it was decided a quota hunt was an appropriate tool to use as part of the solution for dealing with the high deer densities in the area. Limited entry quota hunts are not a common management tool in Alberta. They are used to target a very specific population of animals, in a very specific geographic location that cannot be dealt with effectively during the regular season. A series of four 3-day hunts (Thurs., Fri. & Sat.) with 25 hunters participating in each was approved. All hunters were licensed to harvest 2 antlerless white-tail deer within a specific area.

Hunters applied for licenses in person, at the town office in Magrath on Jan. 5, 2004. They were required to have a valid WIN and signed permission for access from at least one landowner in the hunt area. Licenses were issued on a first come, first served basis, which increased the likelihood local hunters would be licensed and hunter success maximized. Successful applicants were not restricted to the lands they had written permission to access when applying. They were eligible to hunt all lands within the boundary, providing they had landowner permission. The requirement for written approval from at least one landowner within the hunt boundary was to ensure hunters applying were likely to purchase their license and participate in the hunt. All other hunting regulations applied as per the regular hunting season.

Once the hunt was approved, ads were placed in the Lethbridge Herald and in the Southern Sun Times, specifying hunt dates and how licenses would be made available to hunters. As well, local contacts (i.e. town CEO, local F&G) were notified and again word of mouth was utilized.

The limited entry, special quota hunt was held throughout the month of January, in a small geographic area around Magrath. Approximately 100 hunters harvested 164 antlerless white-tailed deer. Aerial surveys carried out shortly after the hunt indicated that while white-tailed deer numbers in the Magrath area remained high, but there was a reduction in the number of deer that were utilizing habitat in close proximity to Magrath. Residents of the community also report that the deer in and around town are more wary of people.

Additional points brought up in conversation with Kim Morton:

- A reduction in deer numbers was fully supported by local governments
- They had good historical population numbers
- Areas right adjacent to Magrath would not be first choice for hunters in the regular season, but for a quota hunt it was an additional opportunity to hunt, at a time of year when no other hunting opportunities were present
- Private landowners in the hunt area were largely in favour, and allowed access
- Because it was not during the regular season, it was possible to have more visible enforcement presence
- All hunters were required to attend a briefing session every morning
- Perhaps one-third to one-half of the Magrath deer population was removed
- In 2009, there appears to be an increase in deer related complaints and deer vehicle collisions

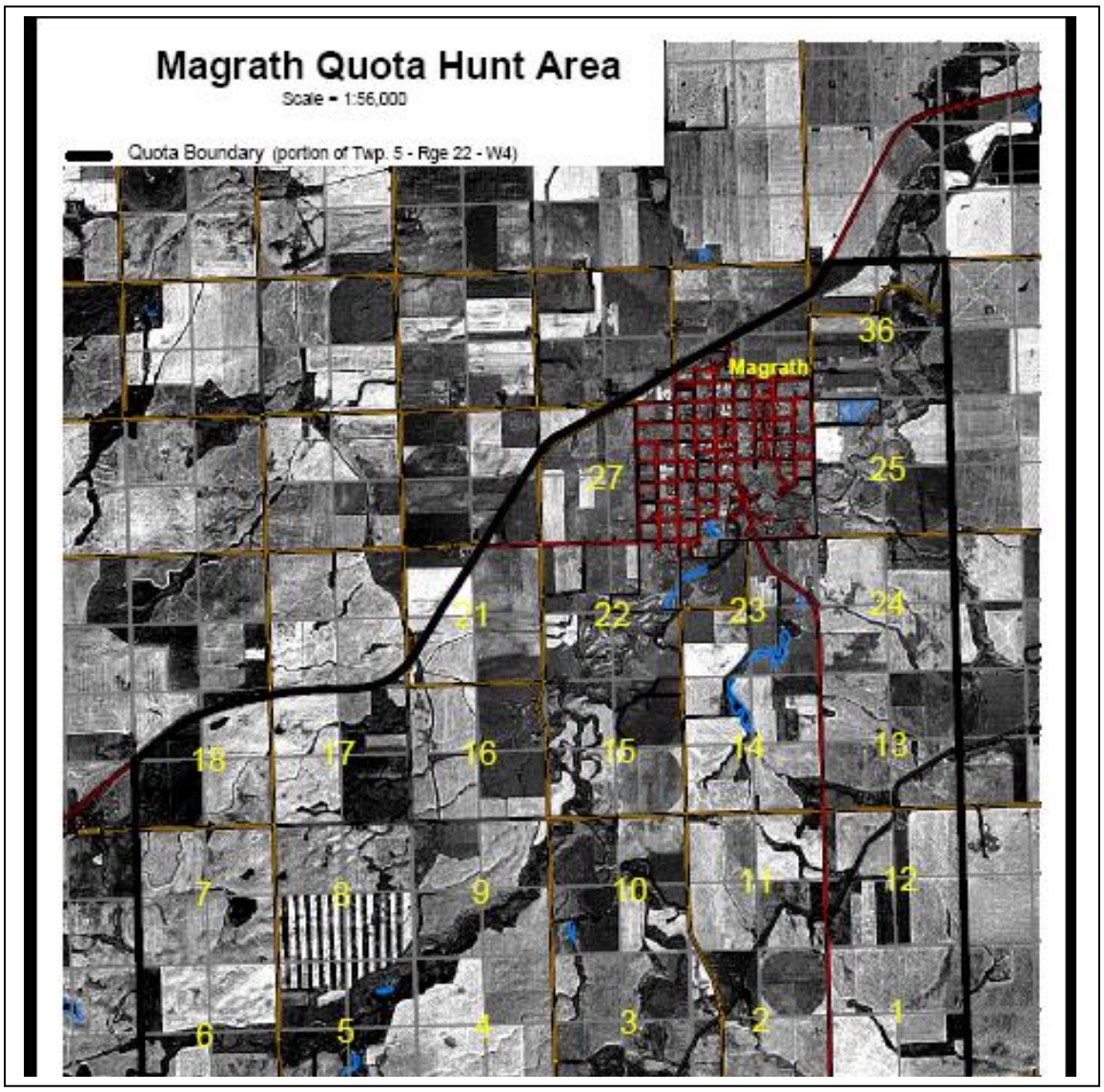

Image: Magrath Quota Hunt January 8 – 31, 2004, Post Hunt Summary Report. 2004. Kim Morton and Lyle Lester. Fish & Wildlife Division, Ministry of Sustainable Resource Development.

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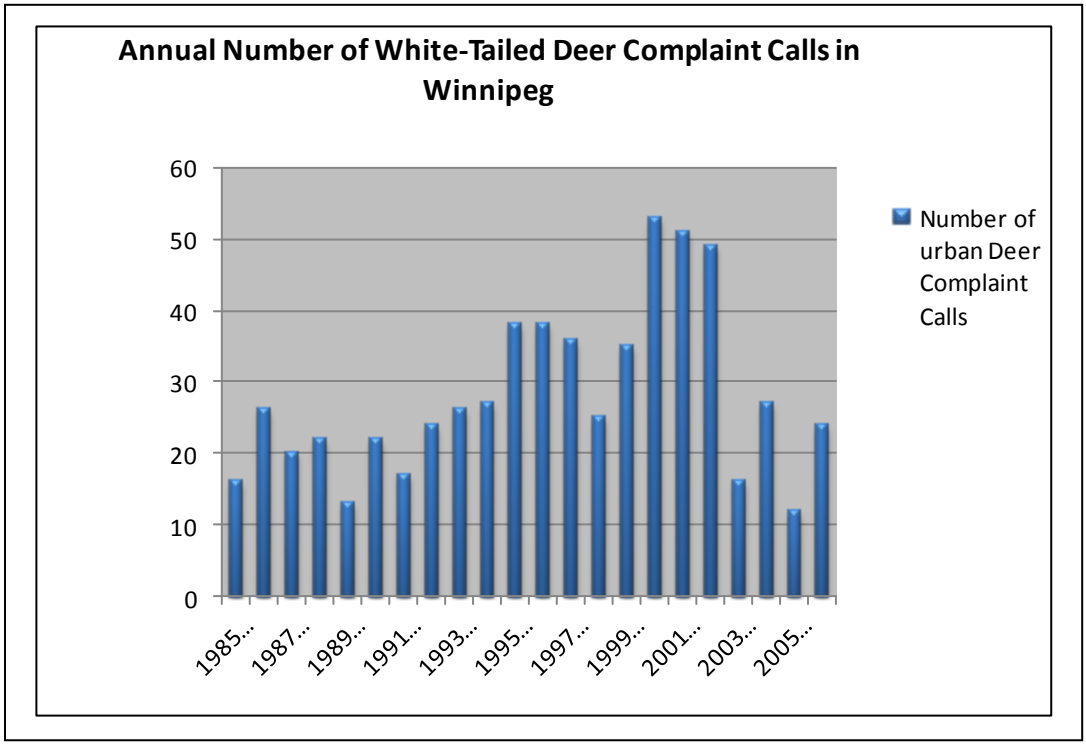
Winnipeg, MB: Capture and relocate

The Greater Winnipeg Area (GWA) has experienced a large urban white-tailed deer population growth and Manitoba Conservation has noted a significant increase in the number of complaint calls involving human-deer conflict over the last 20 years. The number of complaints peaked in 2000 to 2003, but has dropped off since then. Complaints generally involve damage to home or commercial gardens and deer vehicle collisions, with few calls involving aggressive deer.



Graph: McCance, E. (2009)

Over the past few years, heavy summer rains may have contributed to deer moving into the city to avoiding muddy, wet, agricultural fields, where grazing was poor.

There are no city bylaws in place preventing deer feeding. The Conservation Officers can ticket individuals for feeding deer, but the provincial legislation is weak, and it has to be demonstrated that the feeding is proving to be a safety concern for humans.

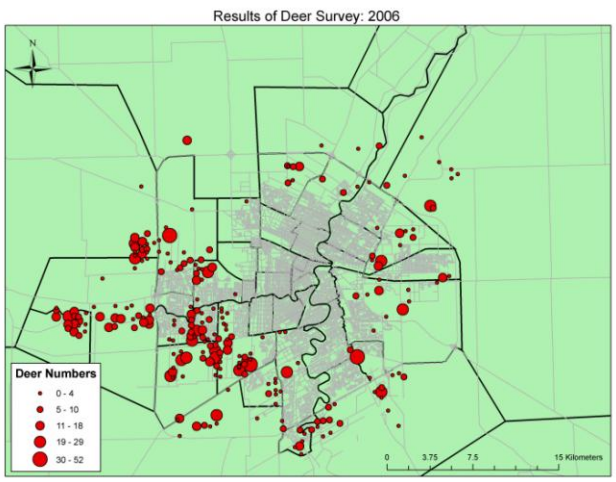
The number of deer vehicle collisions is increasing. In 2005, 2006, and 2007, there were 325, 433, and 424, respectively.

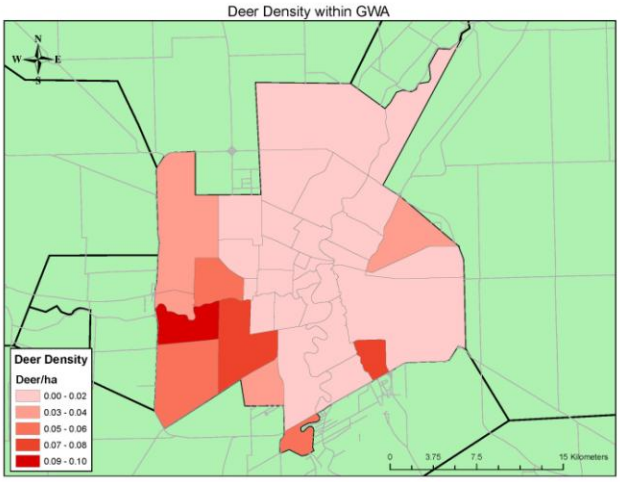
Manitoba Public Insurance carries out public awareness campaigns in the Winnipeg area to increase awareness of deer and reduce urban deer collisions. They have produced and implemented:

- radio, TV, and newspaper advertising
- community newspaper and seniors publications columns
- informational handouts
- online website tips
- annual news releases
- use of variable message signage in hot spot locations
- maps of high risk collision areas in Winnipeg and Manitoba

Image: Manitoba Public Insurance

An aerial survey conducted in 2006 by Manitoba Conservation estimated that there were approximately 1800 white-tailed deer within the city limits, and about half were concentrated in one geographic area of the city. A public opinion poll concerning deer management options was conducted in this neighbourhood in 2007. This is a resident white-tailed deer population, with little movement out of the city during the spring and summer.





Images from: McCance, E. (2009).

There are polarized views in the general public regarding deer management options. Three years ago it was identified there was a need for a strategy and Provincial MLAs organized two public meetings which 200 people attended.

The position of the City is that the province has jurisdiction over wild animals, deer complaints should go to the province, there are not many tools available in the city, and people look to the province for a solution. However, the City of Winnipeg has worked with Manitoba Conservation to prepare a draft management document to establish management options. This document is still under review and not available for general distribution at this time. The three main recommendations are:

1. Maintain the status quo
2. Continued public education
3. Herd reduction

Beginning in 1985, there was a 3 year project to trap white-tailed deer in Winnipeg and move them 60 miles south east. The target was to capture and relocate 300 does out of a population of +/- 1000. The project is discussed in Moran (1989).

- 283 white-tailed deer were removed over a three year period. Not all were does
- Four or five bait sites were established, and a drop net was used to capture the deer. 10 to 12 deer could be caught at once
- All deer were chemically immobilized
- 6 or 8 deer could be transported in a stock trailer at one time. The deer generally remained immobile during transport.
- There was 3.5% mortality (10 deer) during the capture/transport phase of the project
- All deer were ear tagged for future recognition purposes
- Approximately 20 deer were collared
- There was some supplemental feeding at the release site
- Less than 5 deer were recaptured back in Winnipeg
- Several deer moved long distances from the release site (>100 miles)
- Several were seen right at the release site in the years following the release
- There was no formal measurement of mortality post release, but there were lots of reported sightings of the tagged deer in the years following the relocation
- There was lots of volunteer labour involved in capture, transport and release
- Difficult to estimate costs due to high amounts of volunteer help, but may have been around $300/deer
- Winnipeg deer population after the project followed the wildlife agency expectations. There was an increase in deer numbers, but not a huge reproductive rebound. It bought them 15 years, until 08/09, when the situation again requires active management

In 2009, a public opinion survey of deer management options in Winnipeg was carried out for Manitoba Conservation and the Manitoba Wildlife Federation (McCance 2009). Conclusions and recommendations from this survey of 1182 residents were:

Conclusions

1. Greater Winnipeg Area (GWA) residents want an urban deer management plan
2. GWA residents substantially prefer non-lethal methods of management
3. GWA residents residing in high deer density areas, and GWA residents who have experienced direct human-deer conflict, show the highest support for lethal methods of action
4. Male and female GWA residents show significant statistical differences in relation to their acceptance of lethal methods of action, and the use of firearms within city limits
5. GWA residents believe residents and government together should create an urban deer management strategy

Recommendations

1. Establish a public education initiative
2. Integrate human dimensions work into the process of creating a management plan and continue human dimensions research
3. Create a management plan that is systematically revisited, adaptive and multidimensional
4. Prohibit deer feeding within the city limits
5. Increase road safety signage and barrier fencing/modifications on high collision prone roadways
6. Selectively cull injured deer to address residents concerns regarding deer well being
7. Create a city task force to address long term deer management planning

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Photo: Jim Hesse

Ottawa, Ontario: Deer vehicle collision mitigation

There was a functioning Urban Deer Management committee in Ottawa. It began in 1995, and met for approximately 8 years. The general feeling of the group was that a cull was needed, but the committee could not decide on how to bring this issue forward. The committee has not met since 2003.

In 2001, a number of the small municipalities surrounding Ottawa were amalgamated into the City of Ottawa, which meant that the City of Ottawa now contained an abundance of semi-rural land. Ottawa does have a regulated public bow hunt within the city limits, due to the inclusion of the surrounding semi-rural lands into the city boundary. The number of doe tags and the length of the season can be varied according to need.

No formal population estimates have been conducted. The deer population is primarily white-tailed deer. The primary damage complaints are the destruction of the natural ecological environment in the wooded rural areas of the city. The main comment from the public is requests for more deer vehicle warning signs.

In 2006, an aggressive public awareness campaign targeting deer collision awareness on city streets was launched. At a cost of $45,000, radio ads, TV ads, and street side billboards were launched. In high risk deer collision zones, on-street variable message boards were employed to show deer alert warning signs and a zero tolerance for speeders was enforced by police. Police handed out information cards to people they stopped. Local newspapers carried stories with area specific statistics and high risk locations. For 2007, 2008, and 2009, a less intensive campaign was maintained using only TV ads. A public evaluation phone survey was conducted (cost $5,000 CDN) asking if respondents if were aware of the campaign, if they knew the key message, and how did they hear of the message. The TV ads were found to have the most impact. Deer collision statistics are collected by the Police and forwarded to the Public Works Department. Partners in the awareness campaign were the Ontario Provincial Police, the Ontario Federation of Anglers and Hunters, the Ministry of Transportation of Ontario and the CAA.

Deer vehicle collision data was collected for two years pre and post awareness campaign.

	01 Jan 2004 to 31 Dec 2004	**01 Jan 2005 to 31 Dec 2005**	***Speeding Costs You…dearly!* Campaign introduced in Fall 2006**	**01 Jan 2007 to 31 Dec 2007**	**01 Jan 2008 to 31 Dec 2008**
Cost			$45,000	$20,000	$20,000
Deer vehicle collisions	919	909		731	624

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Photo: Jim Hesse

Sidney Island, BC: Capture and euthanize project

(Information taken directly from *Deer Management for Ecological Restoration on Sidney Island: A Prospectus,* December 2009, Deer Management Committee, Sallas Forest Strata Corporation.

European fallow deer (*Dama dama)* were introduced to Sidney Island near Victoria BC early in the last century, and have multiplied to an extent that they are severely damaging and disrupting the island's natural ecological systems. Various methods have been utilized in an attempt to manage the population. In 1981, the existing private land owner partnership organized both recreational hunting and commercial guided hunting in an effort to control the population. The provincial wildlife authorities issued permits to extend hunting seasons, relax bag limits and provide other regulatory accommodations. In the 1980's, the partnership also organized the live capture and shipment of large numbers of fallow deer for sale to deer farmers. Additionally, some hunting took place on the federal park lands, although currently, no recreational hunting is permitted in the park with the exception of aboriginal hunting, which removes about 20 deer/year.

Over the past 28 years, more than 11,000 fallow deer have been removed from the island. From 1994-2004, an average of 506 deer/year were removed, with the largest numbers taken by live capture for transfer to deer farms and in commercial, guided hunting. Both of these activities were terminated in 2002, the first because of the collapse of the deer farming industry, the second because of the pressures of increasing residential development which restricted hunting opportunities. Yet, this level of removal was nevertheless insufficient to reduce the population or slow population growth; indeed, the abundance of fallow deer has increased substantially over recent years. The conclusion is that any future level of removals will have to be considerably greater than in past years to prevent further population increases. Parks Canada and other experts have suggested a reduction of the deer population by 70% or more must happen before ecosystem recovery can take place.

The 82 private owners of most of the island lands, organized as the Sallas Forest Strata Corporation, have decided to launch a renewed, long-term effort to reduce and control the deer population to protect the forest environment from further degradation and to help restore the ecosystem. Because of the current size of the deer population, the Strata Corporation has decided that hunting is not a sufficient means of population control, and that both recreational hunting and live capturing and processing of deer on the island for production of venison products will be most effective.

The Strata Corporation identifies the following key objectives in their proposal:

- that deer are handled as humanely as possible, with minimum stress and threat of injury
- that reasonable efforts be made to ensure that deer removed be utilized for human consumption
- that sustainable recreational hunting opportunities are provided for property owners and guests

- that the plan and its implementation must be efficient in its demands on financial and managerial resources

The current deer population is estimated at ~2700 individuals, with an average density of 3 deer/ha, well above the density usually considered sustainable and several times the fallow deer density on other Gulf Islands.

In 2008, a new opportunity was presented by the development of a mobile abattoir, licensed to process red meat in BC. This facility also offered the significant advantage of avoiding the transport of live deer, which can be stressful to deer and costly for the operator. The Strata Corporation therefore constructed a new, high-quality deer barn and capturing facilities and contracted with the operator of the abattoir, Gate to Plate Food Services Inc., to bring it to Sidney Island.

In March 2009, 348 fallow deer were captured and dispatched. Only about half the deer delivered to the abattoir were deemed suitable for human consumption. While the meat inspector found little evidence of disease, the abattoir operator rejected many deer as unsuitable for marketable venison because of their poor, emaciated condition, bordering on starvation – a confirmation of their excessive numbers in relation to the island's biological carrying capacity. Nevertheless, this phase of the project succeeded in demonstrating the feasibility of capturing and processing large numbers of deer on the island.

The next phase was scheduled in late September and early October 2009. This timeframe resulted in a conspicuous improvement in the condition of the deer harvested, and a much larger proportion was utilized to produce venison for human consumption. Gate to Plate was again engaged, but only for its abattoir services. The Strata Corporation independently found a market for the venison, resulting in revenues sufficient to cover the abattoir cost and the immediate costs of the operation. The Sept/Oct 2009 phase removed 550 deer; plus the 348 taken in March 2009, and the 380 taken by hunters in winter 2008/2009, resulting in 1280 deer being removed from fall 2008 to fall 2009.

However, both capturing and processing of deer present challenges. One is the present dependence on a single capturing facility in a fixed location. Fallow deer are known to have small home ranges. This raises questions about the ability to access the deer beyond the immediate area surrounding the capturing pens. Will more facilities be needed or are there other solutions to this problem? Can this issue be addressed through the organization of hunting? Will it be necessary to mark, release and track animals to throw light on this issue? For the longer term, the most efficacious method of disposing of the deer as their numbers are reduced needs to be explored. The portable abattoir comes with substantial fixed costs and is viable only with a large number of deer of marketable size. As the deer population is reduced, other, smaller scale methods of disposal must be found, or once again, hunting alone will have to be relied upon.

In the meantime, it is important to continue the recent aggressive efforts to control and reduce the deer population. This is the most urgent part of this project and also the activity with which the Strata

Corporation has the most experience and competence. However, proceeding with population control adds pressure to initiate appropriate monitoring activities soon, in order to record the initial baseline conditions. Thus the monitoring facilities are expected to be in place and monitoring activities initiated in 2010.

Details of this project are contained in Appendix L.

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Provincial Overview

Most management plans for ungulates causing concern in British Columbia's urban environment are more than 20 years old, and contain few, if any, reference to challenges encountered or proposed solutions for managing these wildlife species in urban environments.

Cervid species such as moose, elk, and deer, as well as bovid species such as bighorn sheep, are found in urban areas in BC. Deer appear to be the species of most concern, not only because of their wide geographic distribution from the Kootenays to Vancouver Island to the Peace Region, but primarily due to their tendency to form resident populations in urban environments, rather than moose or elk, which may follow seasonal migratory patterns or only become involved in prolonged or serious interactions with humans under particular circumstances.

Moose, elk, black-tailed deer and mule deer populations are estimated to be stable to increasing, white-tailed deer populations are estimated to be increasing, and bighorn sheep populations are estimated to be stable in the southern regions, but possibly decreasing in the Cariboo and Peace regions.

BC Urban Ungulate Species: 2008 Pre-Season Population Estimates by Region and Sub Region

Region	MOOSE		ELK		BIGHORN SHEEP		BLACK-TAILED DEER		MULE DEER		WHITE-TAILED DEER	
	Number*	Trend	Number	Trend	Number	Trend	Number	Trend	Number	Trend	Number	Trend
Vancouver Island	<20	S	3.5 - 4.9K	S-I	0	n/a	45 – 60K	S-I	0	n/a	0	n/a
Lower Mainland	<100	S	0.8 - 1.2K	I	0	n/a	17 – 29K	S	3 – 5K	S	<30	S - I
Thompson	6 – 10K	I	<400	I	1.5 - 2.0K	S	0.5 - 1.0K	S-I	25 – 45K	I	2 – 3K	I
Kootenay	5.5 - 6.8K	S	27.0 - 33.5K	S-I	2.3 - 2.5K	S	0	n/a	24 – 48K	I	40 – 65K	I
Cariboo	20 – 28K	S	<250	I	<800	D	1 – 6K	S	15 – 30k	S-I	0.5 - 1.0K	I
Skeena	28 – 47K	S	<250	S-I	0	n/a	35 – 65k	S	4 – 6K	S	0.5 - 1.0K	I
Omineca	30 – 50K	S	<500	I	0	n/a	0	n/a	3 – 6K	I	0.5 - 1.0K	I
Peace	40 – 80K	D-I	15 – 35K	S-I	<150	D-S	0	n/a	6 – 12K	S	7 – 13K	I
Okanagan	2 – 3K	I	<900	S-I	1.0 - 1.2K	I	0	n/a	28 – 42k	S	31 – 44k	I

* Population numbers (K = 000s). Trends are estimates. I = increasing; D = deceasing; S = stable

Urban ungulate populations occur in most regions of BC, except for the Skeena and Cariboo regions.

Regional Comparisons

	Species present in urban areas and towns affected	Damage to gardens and landscaping?	Aggression towards people?	Public concern expressed?
Peace	Moose - Dawson Creek	Minimal	Yes	No
Omineca	Moose - Prince George	Minimal	Yes	No
Skeena	None noted	n/a	n/a	
Cariboo	None noted	n/a	n/a	Highway deer vehicle collision numbers
Okanagan	MD - Princeton WTD - Grand Forks WTD - Kaleden, Oyama	Yes	Yes - Princeton	Yes
Thompson	Bighorn sheep - Spences Bridge, Kamloops	Yes	No	Highway big horn sheep vehicle collision numbers
Kootenays	MD & WTD - Kimberley, Cranbrook Bighorn Sheep - Radium Hot Springs	Yes	Yes - Kimberley	Yes Highway big horn sheep vehicle collision numbers
Vancouver Island	BTD – Comox, Nanaimo, Victoria	Yes	No	Yes
Lower Mainland (Sunshine Coast)	Elk - Powell River, Squamish	unknown	unknown	Yes

After interviews with BC Ministry of Environment biologists, Conservation Officers, and municipal staff, the communities listed below appear to be the most severely affected by urban ungulate issues.

Community Comparisons

	Species of concern	Population in town	Complaints	DVCs	Aggression towards people?	Public concern?
Prince George	Moose	Not a resident population	+/- 200 complaints. In a bad year (ticks) ~30 moose dispatched	unknown	Yes, under severe tick and weather circumstances	No
Dawson Creek	Moose	Not a resident population	+/- 400 complaints. In a bad year (ticks) ~ 20-50 moose dispatched	unknown	Yes, under severe tick and weather circumstances	No
Princeton	Mule deer	~50+ (Spring 2009)	2 deer/yr dispatched for aggression 2/3 deer/yr dispatched for other reasons	unknown	Yes	Yes
Kimberley	Mule deer White-tailed deer are present but generally just outside the municipal boundaries	~120+ (Feb/Mar 2009) May be split between Marysville & Kimberley	~ 7 complaints of aggression per year. Also increased cougar sightings in town.	50 /year? Bylaw officer data needed	Yes	Yes
Grand Forks	White-tailed deer	~200 (Fall 2009)	unknown	~10/year WARS data	Yes	Yes
Comox	Black-tailed deer	unknown	unknown	30 dead deer/yr removed by works crews: may not all be dvc related	No	No
Powell River, Squamish	Elk – generally just outside the municipal boundaries	unknown	unknown	unknown	unknown	Yes

Princeton

From a spring 2009 population estimate, Princeton has an estimated mule deer population of 50+ individuals. Over the past 5 years, two does and fawns have been dispatched due to aggressive defense incidents. There was a considerable amount of deer feeding occurring 8 to 10 years ago, but with public education by the Conservation Officers, there is not much going on now. Princeton has a draft "no feeding" bylaw on the books but it has not been enacted, because there is no bylaw officer to enforce it.

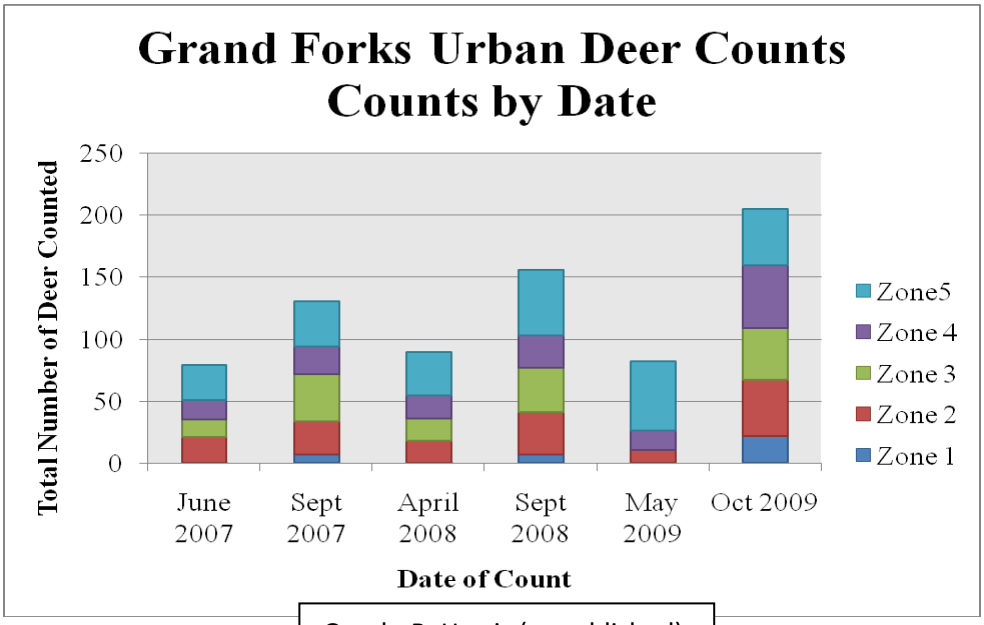
Kimberley

Kimberley appears to have the most severe urban ungulate management issues in BC. Kimberley has populations of both mule deer (120+) and white-tailed deer. The white-tailed deer appear to inhabit areas mostly on the outskirts of town and are quite wary and skittish of humans, but the mule deer are living right in the town, and are much more habituated. Public complaints are not simply about damage to property, but are about unprovoked attacks on leashed dogs walking with their owners. Complaints have been documented for 5 years. When complaints from the public begin to focus on issues of deer aggression and human safety, rather than property damage, implementing management options becomes a higher priority. Research has found that as the level of negative interactions with deer increases, people's tolerance for deer decreases. A "no feeding" bylaw has been enacted and is enforced.

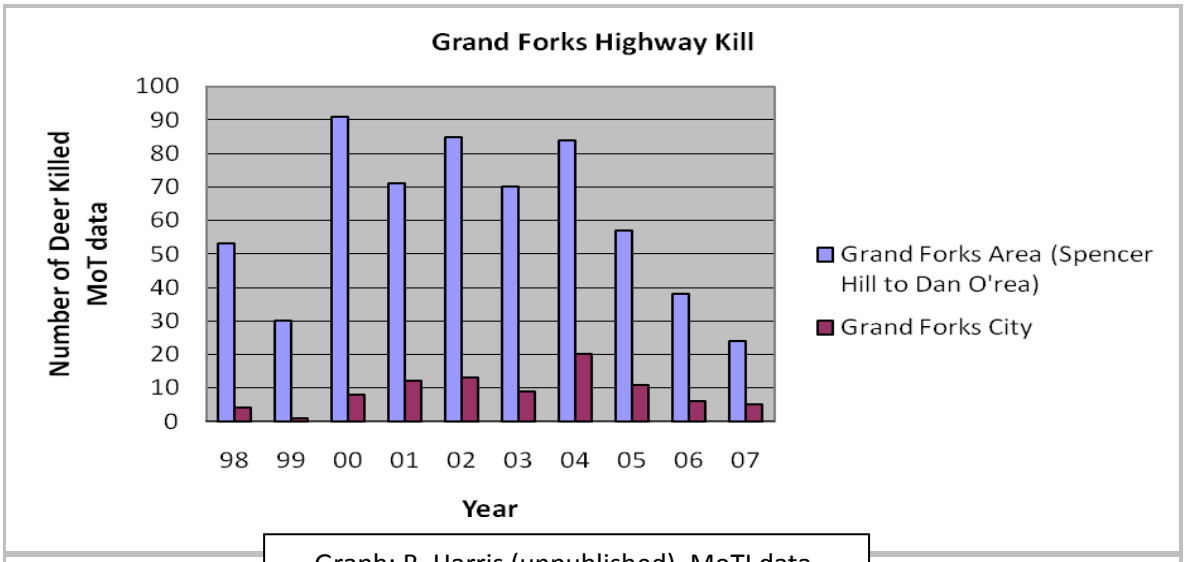
CO Stats Kimberley/Cranbrook	2005	2006	2007	2008	2009 (to July)
Cougar in town	2	7	8	10	
Human/pet attacks by deer	6	3	6	11	6
Attended injured deer	12	11	20	24	
Attended/destroyed deer (injured, caught in fences, dvcs)	9	10	23	35	
Attended/destroyed injured elk			1	2	

Grand Forks

Grand Forks has a white-tailed deer population living within the town limits. There are deer population estimates based on 3 years of spring and fall counts (see below) and there are 10 years of deer vehicle collision data (see below). These population estimates and vehicle collision numbers will help to support management actions. There are identified areas outside the community in which deer densities are low should a trap and relocate pilot project be considered.



Graph: B. Harris (unpublished).



Graph: B. Harris (unpublished). MoTI data.

Management Challenges

Ungulates in urban environments are challenging to manage for many reasons. Deer, particularly white-tailed deer, are superbly adapted to exploit urban resources and thrive in urban environments. While deer are thriving and populations are expanding, the jurisdictional wrangling of who is responsible for their management continues. Appropriate legislation, policy and procedures needs to be in place so responsibility, accountability and authority rest with the correct jurisdiction. Community residents have strongly held and varied opinions about what should happen with "their" deer. This diversity of often opposing opinions can make for a controversial management project, not favoured by managers. These factors compound the urban ungulate management challenge.

Deer adaptability

Deer will eat a wide variety of plant material, and in urban environments, there are abundant alternative food resources – shrubs, garden plants, succulent grasses and supplemental feed. The natural arid environment in southern BC cannot compete with the fertilized and watered vegetation of urban areas. White-tailed deer especially have a very high reproductive potential. In areas where resources are abundant, high reproductive rates and survival rates in offspring can increase populations almost exponentially. Deer easily develop a tolerance of urban disturbances including human presence, and the abundance of edge habitat provides a preferred habitat. Deer live longer in urban areas compared to rural areas as natural mortality factors are greatly reduced, but still include predation by dogs and coyotes, collisions with vehicles, malnutrition and disease. Regulated hunting and large predators are generally not found within municipal boundaries. Well-fed, healthy deer reproduce longer with a higher fertility rate, and live longer with little chance of either predation or being hunted. Fawns raised in urban environments learn both aggressive behaviour towards humans and pets as well as fence avoidance and crossing behaviours as part of their survival skill set, in addition to having foraging behaviours that are habituated to urban environments.

Jurisdictional responsibilities

One of the challenges in managing urban ungulates is "whose issue is it anyways?" Who is responsible for conducting population estimates, developing a plan, consulting with the public, or implementing recommended treatments?

Municipalities are contained within hunting management units, but overlaying the management unit are city or regional district bylaws that prohibit firearm discharge or bow and arrow hunting within municipal boundaries. This precludes the use of regulated hunting, which is the primary control method used by the Ministry of Environment to manage ungulate populations.

It is the responsibility of the municipality to determine the attitudes and opinions of their residents towards urban ungulate management. This generally means that a survey of public opinion must be

conducted. If the results indicate that a majority of residents favour action, then the city or the province has two paths forward. The provincial government or municipal government can assume the leadership and subsequent decision making role, or there can be a collaborative process with the formation of an urban ungulate management task force with representation from all stakeholders which has the responsibility to determine appropriate management actions for the community and make recommendations for action to the city and province. The province has the expertise and experience in managing wildlife, but the city has the issue.

In Canadian cities where urban ungulate management options have been implemented, the projects have generally been funded by the provincial governments. In Magrath Alberta, a quota hunt was largely funded provincially, although the town organized meetings and surveyed residents. In Winnipeg, Manitoba, a trap and relocate urban deer project was funded by the provincial government, with contributions of equipment from the city, and donations of volunteer time, feed and bait. In Ottawa Ontario, the city funded the deer vehicle collision reduction program entirely, with support from other agencies, although not from the Ministry of Natural Resources. In American cities, jurisdictional roles and responsibilities vary by state. Generally, projects are funded by municipalities, with technical advice and material support from state resource agencies.

Legislative concerns

There are provincial acts, regulations and policy that regulate wildlife management which are applicable to urban ungulates.

Feeding of Wildlife

Wildlife Act, R.S.B.C. 1996, c. 488

It is an offense under the *Wildlife Act* Sec. 33.1 to feed dangerous wildlife, but cervids are not classed as dangerous wildlife. Therefore, additional changes in law under the Community Charter needed to be made.

Community Charter S.B.C. 2003 c. 26

The *Community Charter* S.B.C. 2003 c. 26 sets out municipal powers and authorities, and also enables the *Spheres of Concurrent Jurisdiction – Environment and Wildlife Regulation* (BC Reg. 144/2004).

Spheres of Concurrent Jurisdiction – Environment and Wildlife Regulation (BC Reg. 144/2004).

Under Ministerial Order M 181, on July 31, 2008, the Minister of Environment amended *the Spheres of Concurrent Jurisdiction – Environment and Wildlife Regulation* (BC Reg. 144/2004). This amendment provided the appropriate authority to municipal governments to enact bylaws that would regulate, prohibit and impose requirements upon the feeding of cervids.

Wildlife–Human Conflict Prevention Strategy

The BC provincial government introduced the Wildlife Human Conflict Prevention Strategy in 2003. It states that reducing wildlife human conflicts is essential to protect human health and safety, maintain biodiversity and reduce wildlife-related property damage. The goal is to reduce wildlife human conflicts through prevention activities while maintaining BC's wildlife-rich diversity. The strategy sets out the guiding principles upon which wildlife human conflict will be managed.

Diverse public opinion

The goal of provincial wildlife management is shifting from maximizing wildlife populations and thereby maximizing recreational hunting opportunities to maximizing wildlife values for society, and society today has many diverse values, attitudes and beliefs that may conflict with wildlife management options traditionally preferred by managers. This results in a management challenge rooted in social values, ethical decisions and possibly legal issues rather than strict biological or ecological considerations.

As discussed by Decker *et al.* (2001) wildlife managers have traditionally contended that the rational application of biological data would lead to the correct resource decisions and provide the greatest good for the greatest number. Applying biological knowledge to a problem would achieve the desired biological effect. Since the health of the wildlife population would improve, the decision would be supported by all concerned. When the management objectives focus on commodity based values (game or fish) the stakeholders (trappers, hunters, fishers) could generally agree that rational decisions leading to healthier populations provided benefits for the public.

However, today, purely biological approaches are not sufficient because of enhanced sociological and political components in the management environment. Wildlife agencies now have a broader client base than the traditional consumptive users that must be included in the process. The value orientations of these new stakeholders are often not commodity based, and might include aesthetics, recreation or ecological diversity. People who represent a wide variety of views are legitimate stakeholders in the urban wildlife management process and may likely have concerns regarding traditional means of population management.

Wildlife managers generally focus on population level dynamics biology and ecology. However, in urban environments, it may be the individual animal or small social groups that require attention. A concern for the individual animal versus the whole herd is often what distinguishes groups of stakeholders from one another, and from the wildlife managers. Adding human dimensions study into the decision making process can help an agency understand the residents' concerns and correctly identify stakeholders.

Public relations concerns

One reason wildlife managers regard urban ungulate management as difficult is due to the perceived resistance of the public to a full range of management options (Decker and Locke 1996; Adams *et al.* 2006). Additional issues include agency image and credibility problems, conflicts between

recommended solutions and personal values of a diverse constituency, and public animosity towards regulatory agencies.

Human Dimensions of Urban Ungulate Management

In wildlife management, human dimensions refer to the study and understanding of the human considerations that may be involved in wildlife management decisions (Adams *et al.* 2006). Human dimensions information is important in managing urban wildlife because it helps to anticipate issues, makes management decisions more defensible, provides a scientific basis for action, demonstrates the agency is trying to be responsive to public concerns and is cost effective compared to after the fact results. Failure to engage the public early, honestly, and in an ongoing fashion is likely to increase the financial costs, the public's cynicism, frustration, and distrust (Decker *et al.* 2001).

Human reactions to wildlife include a broad spectrum of emotions and reactions (Decker *et al.* 2001; Lindsey and Adams 2006). Decker *et al.* (2001) describes how the attitudes towards wildlife and specific management alternatives are related to:

- *Personal experience with target species* – the most concerned or affected citizens are the ones who will most accept lethal control
- *Health and safety* – always ranked the highest concern - concerns about human toxicity of repellents, or accidents that might injure humans with capture nets, hunting or darting.
- *Effectiveness of options* – if the management technique will work and how quickly – most suburban residents have little experience with this type of management. Efficacy may be more importance to managers than citizens.
- *Cost of options* – personal costs – taxes – time to learn about management techniques - personal inconvenience when management techniques are implemented
- *Political support* – legality of treatments, liability issues
- *Humaneness and violence* – wildlife managers are concerned with sustainable population, but citizens may be concerned with individual animals

Conover (2002) describes and quantifies the public's differences in attitude towards wildlife, and notes that attitudes appear to be shifting from utilitarian toward moralistic and humanistic perspectives.

- *Negativistic* – People dislike animals – 37%
- *Neutralistic* – People avoid animals due to indifference – 37%
- *Humanistic* – People have very strong emotional ties to animals – 35%
- *Moralistic* – People are opposed to human exploitation of animals – 20%
- *Utilitarian* – People who are interested in the practical and economical uses of wildlife – 20%
- *Aesthetic* – People who enjoy wildlife art and photography – 15%
- *Naturalistic* - People who enjoy nature and outdoor recreation – 10%

This can be summarized as three broad dimensions of public attitudes towards wildlife: wildlife use, wildlife preservation and wildlife damage or nuisance tolerance (Fagerstone 2002).

Stakeholders are individuals or groups that have legal standing, political influence, sufficient moral claims connected to the situation, or power to block implementation of a decision (Adams *et al.* 2006). There are four major categories of stakeholders: government, non-governmental organizations, members of the academic community, and the general public. Traditional stakeholders tend to have shared management goals. Urban residents may have conflicting goals – one resident may wish to reduce deer vehicle collisions, and another may wish to enhance deer viewing opportunities.

Conover (2002) describes more specific categories of stakeholders, and notes that each stakeholder group will have its own wildlife acceptance capacity.

- *Farmers, ranchers, private landowners* – wildlife is publicly owned, but is dependent upon a land base that is privately owned
- *Hunters and trappers* – their idea of a healthy population may be higher than other stakeholders
- *Wildlife enthusiasts* – want healthy wildlife populations and they want habitat preserved
- *Animal welfare activists* – concerned with humane treatment of animals; oppose lethal control methods
- *Animal rights activists* – animals have the same moral rights as humans; may be more concerned with the individual animal, rather than the welfare of the population as a whole
- *Metropolitan residents* – prefer non lethal control, but if damage is perceived to be severe and chronic, their opinions may shift strongly
- *Rural residents* - more firsthand experience about animals, therefore generally more knowledgeable

The importance of understanding the factors that contribute to a community or stakeholder group's wildlife acceptance capacity is critical, because the call for management action is based on the public's tolerance for urban wildlife and any resultant damage. There is a considerable body of literature devoted to understanding and quantifying the public's attitudes towards urban wildlife and urban wildlife management strategies. These papers are listed in the References section - "Human dimensions of wildlife management".

In many communities where it has been decided that urban ungulate populations are too high, the resultant damage is unacceptable, and active management interventions must be considered, surveys of resident's opinions regarding damage, expenditures and the appropriateness of management actions have been undertaken. Appendix D lists resources that discuss public opinion survey methodology, provide examples of surveys, and report on the results of surveys measuring resident's responses to urban ungulate management projects.

Community Involvement in Urban Ungulate Management

Traditional wildlife management is generally administered province wide, through legislatively driven policies, with goals achieved through regulation and enforcement. Due to overlapping management jurisdictions and corresponding complexities in managing wildlife within an urban area, a more community based, collaborative management approach for urban deer issues is being undertaken in many American cities (where most organized urban ungulate [deer] management exists).

There are five recognized approaches to problem solving and decision making using public involvement (Adams *et al.* 2006). Each involves differing levels of responsibility and involvement of the wildlife management agency spread across a continuum of approaches ranging from total agency control to broad responsibility and decision making shared amongst stakeholders.

- *Expert authority* – top down, authoritative
- *Passive-receptive* – managers welcome input, but don't actively solicit input. Best organized stakeholders have the greatest influence. Decisions made by manager
- *Inquisitive* – proactive in gathering info. Manager decides whose interests have the greatest priority. Decisions still made by manager, but are better informed
- *Transactional* – managers work with interested parties to find acceptable objectives and actions. Interested parties may make binding decision within bounds set by agency. Consensus is sought. Managers are in charge of managing the process and have the role of deer management specialists and responsive public servants. Time consuming, resource intensive, costly.
- *Co-managerial* – more radical. Actually sharing decision-making by giving local communities greater responsibility for solving wildlife conflicts. Places more emphasis on providing biological and human dimensions expertise, training community participants, approving community produced management plans, certifying consultants, certifying community wildlife managers. Requires skilled management team.

If provincial agencies expect municipalities to share a large portion of the burden of urban ungulate management issues, the decision making has to be shared as well. In the USA, communities are sharing decision making, costs and responsibility for deer management under a variety of collaborative scenarios. There are many models of how co-management of urban deer issues can occur. Decker *et al.* (2004) compare and contrast the experiences of 10 communities in their attempts to manage urban deer. These models differ with respect to who makes the decisions and how the decisions are made, but in all co-management scenarios, there is a significant amount of involvement and representation from residents or elected representatives of the communities. Descriptions of six management models are drawn from Decker *et al.* (2004) and are provided as examples of how communities in the USA have handled their management challenges.

Community vote

This approach is characterized by a referendum in the community. This is common in states with a political structure that emphasizes local decision making. The wildlife agency is involved in knowledge creation and information transfer, but a community vote is needed to approve deer management actions. Local decision making rests with elected municipal leaders who use the results of the vote to decide whether or not to implement a proposed deer management proposal.

Environmental Impact Assessment (EIA)

This approach involves public engagement and comment associated with an EIA process to guide decision making. State deer managers evaluate proposed deer management actions in light of how those actions are likely to impact the fundamental management objectives of the state wildlife agency, and make decisions based on the fulfillment of these objectives.

Agency partnership

In this approach, a deer management committee comprised of wildlife agency staff, parks agency staff, non-government organizations, and area residents are vested with the authority to develop a plan. Residents are informed and offered opportunities to review and comment on draft management plans. There is ongoing communication and cooperation between agencies.

Community Association

The state wildlife agency interacts with a local community or homeowners' association, usually in response to a formal appeal for assistance. The agency provides information and expertise, and perhaps assistance with management interventions. The association assumes substantial management responsibilities, which may include problem assessment, and evaluation and implementation of management interventions.

Citizen action

Both public and private stakeholders are involved in the formation of a grassroots citizen group supported by professionals with technical expertise. Wildlife agency staff generally participate in the group, but act primarily as technical advisors. These citizen groups can vary with respect to decision-making responsibilities. Some function as working groups without direct connections to local decision makers, and some are advisory groups with decision making authority for their communities.

Citizen-agency partnership

In this approach, a co-management agreement is formed between a state wildlife agency and a local land management authority (municipality, airport, regional district), for the purpose of managing deer populations. The wildlife agency provides technical assistance and support in developing a management plan, designates the areas in question as a special management zone, and authorizes the use of approved alternative management techniques. The local land management authority assumes

responsibility for documenting damage, implementing the management actions and recording results. State wildlife managers play an important advisory role from problem assessment to evaluation of outcomes.

In general, community based, co-management processes are usually perceived to be more appropriate, efficient and equitable than traditional authoritative wildlife management approaches. Although these processes may take more time, they may result in greater stakeholder investment in and satisfaction with deer management (DeNicola *et al.* 2000). The community scale is appropriate because deer impacts may vary by neighbourhood and successes or failures are readily apparent at the local level.

An assumption in collaborative decision making is that stakeholders have the capacity to engage effectively and efficiently in the decision–making process (Lauber and Knuth 2000). Raik *et al.* (2004) defined capacity in three ways: institutional capacity (municipalities/government agencies; able to offer funding, materials and partnerships); community capacity (neighbourhoods, informal groups; able to offer a sense of common purpose and shared values); and individual capacity (individual residents; able to offer leadership and analytical skills). Important dimensions of capacity for collaboration include partnership, credibility, funding, relationships, common purpose, knowledge, and local leadership. Most important is the stakeholder knowledge about the wildlife issue (or willingness to learn) and leadership arising from the community (Raik *et al.* 2006). Although capacity may not be present at the beginning of the process, educational programs can be built into the collaborative management process. Wildlife managers are well poised to organize and increase knowledge through education and to cultivate the development of leadership within the community.

DeNicola *et al.* (2000) offer the following suggestions for the development and implementation of a generalized urban deer management committee. Successful committees need to have: relevant stakeholder representation; an external trained facilitator; accurate and complete biological data; a survey of community attitudes; and technical support from wildlife management agencies. Responsibilities of a committee usually include:

- setting goals and objectives
- reviewing pertinent biology
- examining management options
- selecting appropriate management techniques that are biologically feasible and socially acceptable
- identifying funding sources and staff sources
- coordinating dissemination of information and results to the community and media
- evaluating results
- revising goals and objectives as needed as part of an adaptive management program

To fulfill these responsibilities, an urban deer management committee will need to address the following questions (Fagerstone *et al.* 2002):

- Who has the authority over a group of animals?
- Why are we doing this?
- What is it that we want to achieve?
- Where do we want to go?
- Can we get there?
- How do we get there?
- Will we know when we have arrived?
- What are the disadvantages or penalties?
- What are the benefits to be gained?
- Will the benefits exceed the penalties?

An urban deer management committee will need to consider the following types of information to develop their plans (Adams *et al.* 2006):

- factors contributing to the over abundant population
- population estimates
- population annual rate of increase and projected growth with and without any intervention
- documentation of property, agricultural, or natural resource damage, as well as human health and safety concerns
- legal ramifications or jurisdictional issues – city ordinances, provincial and federal laws
- identified or suspected ecological, economic, sociological and political consequences

To decide upon management options, Adams *et al.* (2006) identifies that the difficult part for urban deer management committees are decisions whether to:

- avoid the issue altogether – proactive management of new property development
- get at the root cause – analyse the factors that have contributed to the situation
- attack the symptoms – reactive strategy to the issue – applied as a triage approach – applied in the most troublesome areas
    - clean up the mess – deer vehicle collision mitigation
    - cull the herd
    - relocate (move the animals)
    - fence the animals out
    - use behaviour modification – aversion or frightening methods
    - apply fertility control (no drugs approved for operational use in Canada to date [2009])
- do nothing – live and let die

Urban ungulate management strategies should be focused on the reduction of conflicts and management of populations to an acceptable level, not the complete elimination of the conflict or herd. It is critical to clearly define ungulate management goals and measureable response variables prior to the project implementation so that outcomes can be evaluated objectively. In order to monitor a project outcome, baseline data is needed – roadkill numbers, vegetative damage reports, number of

homeowner complaints - to determine accurately the effects of management actions and evaluate effectiveness.

In an analysis of 6 communities undertaking collaborative, community based deer management, Raik *et al.* (2004) summarized the criteria that stakeholders used to assess both the success of the collaborative decision making processes and the community-based deer management programs that were implemented. Although some of these criteria are specific to an implemented archery program in an area where Lyme disease was a strong motivation for action, most of the criteria can be used to measure the success of any generalized urban ungulate management project.

Criteria used by stakeholders to judge the success of community based, collaborative decision making processes and the resulting deer management plans (Excerpted from Raik *et al.* 2004)

Process	Environmental outcome	Socioeconomic outcome	Impact outcome	Management performance
• Peaceful, collaborative process • Public input into decisions • Assimilation of all interests in the decision • Diverse representation on committee • Fair stakeholder involvement • Divisive controversy avoided • Decision is a compromise	• Decreased tick population • Improved deer herd health • Improved forest regeneration • Decreased predator population • Decreased deer population • Vegetation is protected • Decrease in road side deer carcasses	• Increased hunting opportunities • Positive public reaction to the program • Good communication between public and elected officials • Decease in controversy about the issue	Decrease in: • Vehicle collisions • Lyme disease • Property damage • Shrub damage • Crop damage • Aggressive deer encounters • Complaints from the public • Increase in human health	• No complaints about the hunting program • Wildlife agency says deer population is under control • Increase in deer harvest • Safe and effective hunting program • Genuine attempt to implement non-lethal options • Successful implementation of an adaptive management plan • Plan based on scientific fact • Balance between safety and the environment

Many of the criteria used to measure success are derived from the experiences and expectations of the public. Community support for any deer management action requires considerable public education. Decker *et al.* (2001) suggests that an effective public education program will ensure that actions and programs are coordinated to:

- Define clear and achievable objectives
- Attend to the key components (audience, message content, message channel, perception of source) of the persuasion process
- Regularly evaluate the program effectiveness by systematically documenting success and failure
- Adjust the program in response to the evaluative information

Photo: Roy V. Rea

Management Options at a Glance

Conflict Reduction Options

Hazing and frightening techniques
Fencing
Repellents
Landscaping alternatives
Artificial feeding and baiting
Ungulate vehicle collision mitigation

Population Reduction Options

Capture and relocate
Capture and euthanize
Controlled public hunting
Sharpshooting
Natural predator introduction

Fertility Control Options

Surgical sterilization
Synthetic steroid hormones
Immunocontraception
Contragestation

Administrative Options

Status Quo
Monitoring
Amend Municipal Bylaws
Amend Provincial statutes and regulations
Public education

Management Options

The complexities of urban ungulate management mean that there are no easy answers or quick fix solutions. No single technique or strategy will work on its own because management options are not mutually exclusive. A comprehensive and integrated plan that incorporates aspects of many options is required to achieve the project objectives. Short term strategies may provide relief from symptoms, while long term plans address population levels. Provincial and community resources plus property owner cooperation are needed.

When developing management plans, there are many practical considerations that need to be weighed. These variables must be considered to determine the feasibility of potential management options:

- Ungulate population size, density, distribution and relative herd health
- Percentage of the target population to be removed
- Approachability of individual animals
- Time of year when conflicts occur
- Probable effectiveness and duration of treatment options
- Incremental difficulty (and costs) of treating animals after the initial stages
- Alternative food resources
- Techniques permitted by province, municipality and landholder
- Total management area
- Human population, distribution, activity patterns and housing density
- Access – private vs public; road networks
- Multi-year projects and available budgets over successive years
- Conflicting social and public concerns
- Firearms or hunting restrictions
- Safety and liability
- Cost

Measureable objectives (population level objectives or damage level objectives) and recommended control options should be determined with stakeholder input and made available to the general public prior to management interventions being undertaken. Management actions should be transparent and readily available for media coverage. Field personnel should be well informed and comfortable with discussing all aspects of the project. Pre and post project monitoring is critical to demonstrating project success.

The following section discusses urban ungulate management options with references to the scientific literature where appropriate. A comparative table of population reduction options is included at the end of the “Population Reduction Options” section. A condensed summary of all management options is contained in a separate document titled *British Columbia Urban Ungulate Conflict Analysis: Summary Report for Municipalities*, March 2010.

Conflict Reduction Options

Conflict reduction options are based on keeping ungulates away from susceptible properties, minimizing the damage that is sustained if animals do enter property and reducing negative interactions between ungulates and people. For most people there is a balance between wanting to see and enjoy the presence of some ungulates and sustaining some small amount of damage due to browsing. Once that balance is disturbed, and damage sustained by property owners exceeds some level, either animal behaviour or human behaviour must be changed in order to reduce conflict.

Although ungulates can cause a great deal of damage, their aesthetic values make them an important and valued species, which cannot be casually dealt with when they cause conflicts. Ungulate damage control is both a social and political issue, and biologically and logistically difficult to treat. Conflict reduction options are usually exercised by individual property owners, or occasionally by municipalities. They are generally not implemented at a scale of operation suitable for provincial management.

Conover (2002) suggests that animal behaviour can be changed in several ways: use of fear provoking stimuli; use of chemical repellents; diversion to different resources; physical exclusion from the resource; or an alteration of the resource so it is less palatable to wildlife. There are a variety of techniques that can help to minimize deer damage. Landscape design and careful selection and placement of plants, the planting of native varieties, taking preventative measures early before patterns of behaviour are established, and the use of repellent and scaring devices can all be used to reduce ungulate damage to gardens and landscaping. None of these will eliminate damage completely. In situations when browsing cannot be tolerated, fencing is the only option. Varying all of these devices and strategies and using them in combination helps to reduce ungulate damage.

Photo: Jim Hesse

Hazing and Frightening Techniques

Definition

Frightening techniques to reduce damage by ungulates include the use of auditory, visual or other sensory clues to frighten animals from specific areas. Hazing is the undertaking of deliberate and active measures to keep ungulates from becoming habituated to human presence and activities.

Description

Ungulates, like many animals, are afraid of new and unfamiliar things. Many devices have been suggested and used to exploit this fear in order to frighten deer away from both agricultural crops and urban plantings. Visual frightening devices may use scarecrow-like devices, strobe lights or balloons activated at random intervals. Auditory devices include sirens, fireworks, gunfire, cracker shells, bangers, propane cannons or gas exploders. Some of these devices, including water sprinklers, may be activated through motion sensor detectors, making their actions less predictable. Other low tech suggestions include using suspended strips of tinfoil, suspended CDs, wind chimes and radios set to all night talk shows.

The presence of dogs in an area can provide a deterrent for ungulates, if the dog is the right size and temperament, and is outside during the hours of highest animal activity. There are “invisible fence” systems which use a radio transmitter, a copper wire and a special dog collar with receivers. The collar, when activated by the underground wire, first transmits an audible signal, then a small harmless shock to the dog. The dog must be trained to heed the signals.

Once animal movements and behaviour become established they are difficult to break, so actions must be taken early when damage is first detected. Animals can quickly become habituated to these sights and sounds, so a combination of techniques is most effective and moving the locations of the devices frequently is also beneficial.

An observation of ungulate behaviour in urban environment is that the vast majority of interactions with humans are benign. In order to restore more normal or natural fear reactions in ungulates, the vast majority of interactions should be stressful or negative (C. Cassady St. Clair *pers. comm*). To implement this in urban areas would mean the involvement of police officers, city employees and bylaw enforcement officers, and may involve a considerable amount of staff time and resources.

The deliberate hazing of ungulates to reduce their habituation to humans is a complex undertaking. Any activities must be undertaken in a “humane and ethical manner with the highest regard for the animal’s welfare” (Parks Canada 2000). Aversive conditioning is intended to “educate” ungulates to associate humans and urban environments with an aversive stimulus. Following an avoidance response away from

humans, the ungulates prevent the unpleasant experience of the negative stimulus. The "reward" for such a conditioned response is decreased anxiety in a secure environment (Hadley 1981).

Parks Canada has undertaken elk aversive conditioning projects in Banff National Park. The negative stimuli used in Banff included: smell and taste repellents; acoustic repellents such as screamer and cracker shells; hazing with dogs; use of 12 gauge rubber slugs, 37 mm nylon baton round and 12 gauge rubber buckshot; and ground personnel on horseback or using noisemakers. Kloppers *et al.* (2005) report on an elk aversive conditioning project in Banff National Park that used either humans or dogs to create simulated predator-chase sequences. Three response variables were measured: flight distance response; proportion of time spent in vigilance postures; and distance between elk locations and the town boundary. Both the flight distance response and the average distance from the town boundaries increased, demonstrating that it is possible to at least temporarily modify some aspects of habituated elk behaviour.

As part of the City of Helena Urban Deer Management Plan (2007), one option suggested was that of an intensive deer tracking and aversive conditioning project. Selected people would be trained to remotely mark deer with paintballs, colour-coded by city zone. Three potential benefits were described:

1. The movement of deer between zones could be tracked with a citizen science on-line data base, thus providing a better understanding about deer behaviour and movement, where deer are concentrated, and seasonal distribution. This could lead to customized application of other management options in different zones of the city.
2. Deer may be inclined to change their behaviour and may try to avoid people.
3. People would become much more aware of deer, leading to active involvement and enhanced learning including: how to successfully live with deer; how to successfully landscape; how to recognize assertive behaviour in deer and taker proper precautions; an understanding of the basic biological elements of deer population change.

The paint wears off in a matter of weeks or months, so deer marking events might occur for a week long period every month. Regular marking is necessary to gain timely information about seasonal habitat use and movement. Training for citizens would include: hunter training; urban certification; shooting proficiency; historical perspectives about wildlife conservation and wildlife as a part of the culture and heritage; safe and responsible use of paintball guns or slingshots in an urban environment; training about private property restrictions; clean up of errant paint; record keeping of locations, dates, number of marked deer; and legal age and/or parent's permission.

This option has not been implemented in Helena to date (2009).

Efficacy

Frightening devices can be effective if applied early, but animals become quickly habituated. Best results come from the use of a variety of techniques and locations.

Various frightening devices to protect against deer damage have been tested on agricultural crops. Green and blue lasers are reported as ineffective for dispersing deer at night (VerCauteren *et al.* 2006). The Critter Gitter™ is ineffective at reducing damage to baited sites (VerCauteren *et al.* 2005). Sound cues and shock treatments failed to prevent deer foraging activities (Gallagher and Prince 2003). Infra red detection of deer and activation of recorded deer distress and alarm calls failed to deter deer damage (Gilsdorf *et al.* 2004).

Logistical constraints

Frightening devices are labour intensive to set up and maintain in an effective rotation. Devices relying on auditory disturbances may not be appropriate in urban areas. The use of frightening devices is practiced at the homeowner level, or possibly for municipal plantings and gardens. This is not an option that can be implemented by the provincial government.

Legal issues

There are no legal issues associated with this option. Hazing ungulates using dogs is prohibited.

Permit requirements

There are no permitting issues associated with this option.

Cost

The cost of frightening devices for use in urban areas by private property owners would be low to moderate.

Human health and safety concerns

There are no concerns associated with this option.

Humaneness

There is minor stress on the animal associated with hazing activities.

Advantages

- May be effective under certain circumstances for residential property owners

Disadvantages

- No reduction in ungulate populations
- Animals can quickly become habituated
- Neighbours may be disturbed
- Difficult to modify animal behaviour once established

Fencing

Definition

Fences exclude (or contain) animals by providing a physical barrier, a psychological barrier (through aversive conditioning) or a combination of both (VerCauteren *et al*. 2006).

Description

Some fences, such as a woven-wire fence, provide a physical barrier through which the animal cannot pass over, through or under. Conversely, a 2-strand electric ply-tape fence provides a minimal physical barrier but acts as a psychological barrier through the delivery of a negative stimulus (shock) upon contact. Fences are best employed as part of an integrated ungulate management program.

For home or municipal gardens where no incursions are tolerated, a fence must be of good quality, high (taking into account snowpack), specifically designed for the area, and installed with care and precision in order to be effective.

There are several variables to consider when determining appropriate fence structures. These include the desired level and duration of protection, ability of the animal to penetrate various designs, animal motivation to penetrate, behavioural characteristics of the animal, and economics.

Fencing Considerations

Physical capabilities. Ungulates, particularly deer, are adept at jumping barriers and can also manoeuver through or under poorly constructed fences. Deer have been recorded passing through openings as narrow as 19 cm (Feldhammer *et al.* 1986 in VerCauteren *et al.* 1996.)

Motivating factors. Food, predators, seasonal movement, separation from family or social group may all contribute to an animal's ability to penetrate a fence. When food is abundant and competition minimal, animals will be less motivated to penetrate a barrier (DeNicola *et al.* 2000).

Behaviour. Individual animals that have learned how to penetrate a fence can educate others by their behaviour, and conversely, learned behaviour may be beneficial in educating others to respect an electric fence.

Economics. The cost of a fence relative to the potential savings must be weighed. A less expensive fence may require more maintenance and may not last as long as a more expensive fence. Although all fences require maintenance, inexpensive fences like the baited electric fence require additional maintenance in the continued application of attractants or repellents.

Permanent fencing

Wire mesh. A common design for wildlife exclusion is 2.4 m or 3.0 m wire mesh fence. It is available in many forms including: woven-wire, chain link, welded wire, "v" mesh, and rigid mesh. Woven wire fence costs more than welded wire, but it is more durable and more effective at following contours of the land.

Modified woven-wire mesh. Existing woven-wire mesh fence can be modified by installing multiple strands of high-tensile wire or wire mesh on outriggers or extensions above the existing fence.

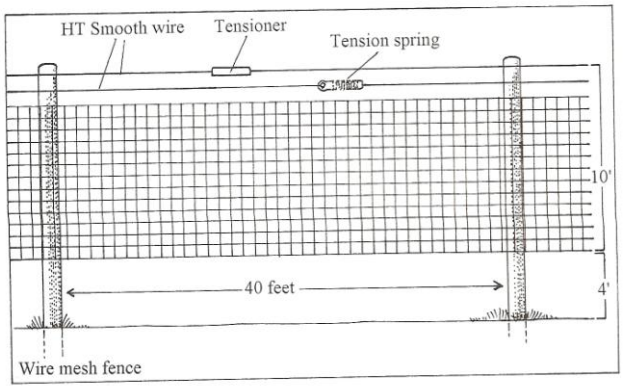


Diagram excerpted from Loewer (2003)

Slanted wire-mesh fence. This fence style deters jumping based on its 3 dimensional appearance because it requires a long and high jump to clear it. Wire mesh that is 1.8 metres tall and installed at 45 degrees angle to the ground results in a barrier that is ~1.3 m tall and 1.35 m wide. The wider area is more labour intensive to keep weed free.

Barbed wire fence. These fences are traditionally used to contain livestock, and have also been used to protect stored livestock feed from ungulate depredation. There is a possibility of animals becoming entangled in this type of fence.

Electric fencing. Electric fences rely on behavioural conditioning of the animal to avoid the fence by administering a shock when the animal makes contact with the fence. For successful animal control, a minimum charge of 3,000 volts should be used on high-tensile wire and poly-type materials. Electric fences can be configured as an all-positive system, or as a positive/negative system.

The all-positive system has a positive charge running through all the wires with the soil acting to ground and complete the circuit when an animal contacts the wire. The animal need only touch 1 wire while touching the fence to receive a shock.

A positive/negative return system is a configuration that alternates positive and negatively charged wires. To complete the circuit and receive a shock, either a positive and negative wire, or a positive wire and the ground must be contacted simultaneously. Benefits of this system include decreased chance of vegetation shorting the system, ability to shock an animal not in contact with the ground (i.e. jumping), and fewer problems associated with poor soil conductivity.

High-tensile electric fence. This fence design incorporates stretched 12.5-ga high-tensile wire electrified with a high-voltage energizer. A 6 to 8 wire, 1.5 m. high configuration with alternating positive and negative high-tensile wires is both a physical and psychological barrier and is commonly used in deer management. There is less sag in the wires, so the posts can be further apart.

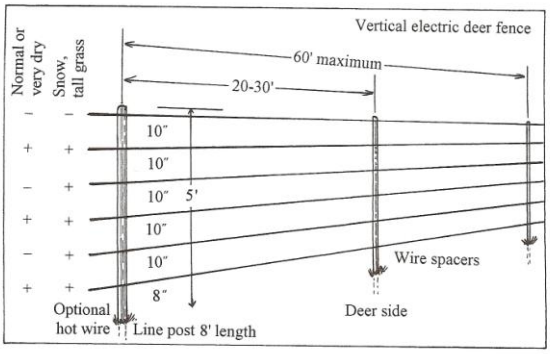


Diagram excerpted from Loewer (2003)

Other fence designs include the offset fence and the slanted multi-strand fence. The offset fence is 2 simple electric fences set up parallel to each other with wires at staggered heights. This does not need to be as tall as a single fence.

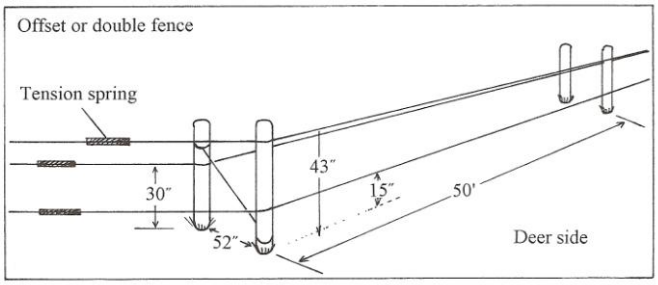


Diagram excerpted from Loewer (2003)

A fence charger (powered 12 volt battery) sends out a short pulse of power approximately once per second.

High-tensile electric fences may not offer the same level of protections as wired-mesh fences of comparable heights, but they are less expensive.

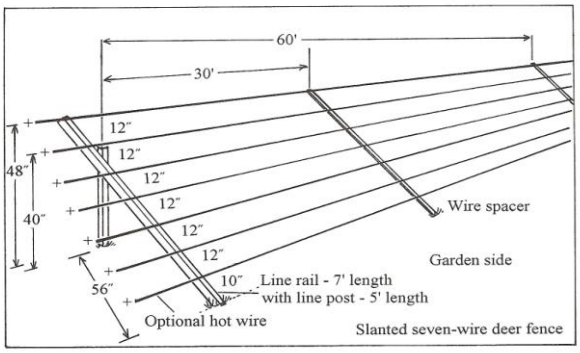


Diagram excerpted from Loewer (2003)

Semi-permanent/temporary fencing

Polytape, polyrope or polymesh fences. Polytape and polyrope fences incorporate conductive wires into synthetic ropes or wires. The materials are durable, easy to work with and cost is comparable to traditional electric fences. They are highly visible, which may reduce animal/fence collisions.

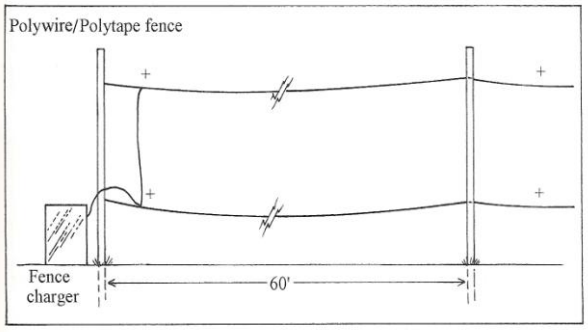


Diagram excerpted from Loewer (2003)

Attractant/repellent-laced fences.
Polytape and polyrope fences have an increased surface area on the fence strands, and attractants or repellents can be applied to these strands. Thinned peanut butter applied directly to the wires or on flags at the height of a deer's nose is effective, inexpensive and easy. The use of attractants increases effectiveness by encouraging animals to touch the fence and receive the shock on the nose, which is more painful than against the skin. The use of repellents in the same fashion has shown promise but has not been rigourously tested.

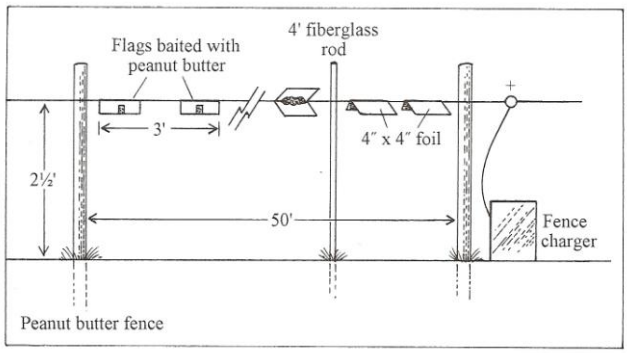


Diagram excerpted from Loewer (2003)

Electric spider fence. This is a relatively new fencing concept that combines multi-wire electric fencing technology with medium cost and good exclusion capability. This five-wire fence is 48 inches tall and uses a 17-gauge wire that is not under high tension. The only driven posts are the corners, and intermediate fiberglass posts are used periodically to maintain wire spacing and height. The minimal wire tension is increased or decreased by wrappings on the Spider G-Spring at the gate opening system. Because there are few driven posts and low tension, the fence is only semi permanent and much cheaper to construct than conventional high-tension systems. Baiting with peanut butter flags, described above, is essential to make this fence effective. Properly maintained, this fence has a life expectancy of about 10 to 12 years. Cost, excluding labour, ranges from $0.35 to $0.40 per linear foot.

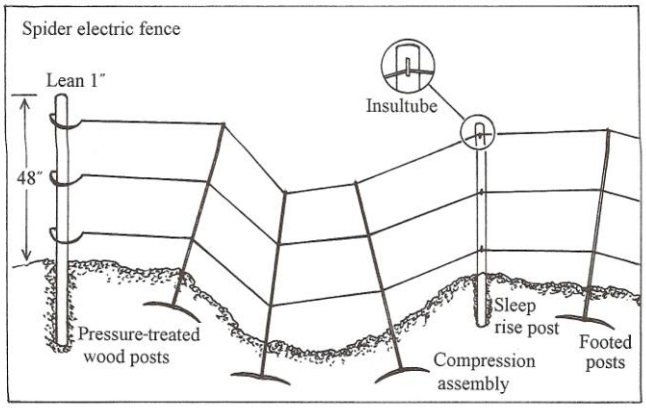


Diagram excerpted from Loewer (2003)

Gates. Fences are only as effective as the gates that offer access to the inside of the fence. Cattle guards provide one method of restricting intrusions but may be expensive or impractical for urban areas. Seamans and Helon (2008) evaluated the use of an electrified mat placed across fence openings and reported that bait site intrusions were reduced by 95%, offering a possible solution for urban settings.

Individual fencing. Individual wire cages, plastic tubes, tree wraps, and bud caps can be used to protect plantings of particular value in a home garden.

Logistical constraints

Fence planning involves considerations of the level of protection required, whether light or heavy animal pressure is expected, area size and topography, visual aesthetics and costs. The fence must extend underground or completely touch the ground in order to exclude deer.

Legal issues

Municipalities may have bylaws that prohibit the use of electric fences.

Permit requirements

There are no permitting issues associated with this option.

Cost and Efficacy

Fence type	Cost/m**	Height (m)	Efficacy (%)	Longevity (yrs)	Maintenance
Woven wire	10-15	2.4	90-99	30-40	Low
Welded wire	10-15	2.4	90-99	20-30	Low
Chain link	>20	2.4	90-99	30-40	Low
Poly. Mesh	15-20	2.4	90-99	10-20	Medium
Poly. rope 9	5-10	1.82	70-80	15-25	High
Mod W.W. 3 HT[a]	5-10	2.4	80-90	20-30	Medium
Poly. Snow[b]	5-10	2.12	80-90	15-25	Medium
Offset HT	2-5	1.05	60-70	20-30	High
Slanted 7 HT[c]	2-5	1.5	70-80	20-30	High
Penn St. 5 HT	2-5	1.12	70-80	20-30	High
Ply. Tape 2[d]	<2	0.9	60-40	5-15	High
Baited electric	<2	1.12	80-90	10-20	High

** 2006 USD Excerpted from VerCauteren *et al.* 2006.

[a] Modified woven-wire fence with 3 strands of high tensile wire

[b] Polypropylene snow fence

[c] Slanted 7-strand high-tensile wire

[d] Two-strand poly-tape

Human health and safety concerns

Electric fences are supplied with high voltage charges that provide regularly timed pulses (45-60 per minute) followed by a relatively long period without current, allowing people or pets time to free themselves from accidental contact with the fence.

Humaneness

Fencing is a humane management option.

Advantages

- Many fencing options available
- Can effectively prevent ungulate damage
- Long term solution if permanent fencing is used
- One of the few effective options for landowners
- Existing fences can usually be retrofitted with either high-tensile electric wires or several strands of barbed wire.

Disadvantages

- Can be expensive
- Addresses only site specific issues
- Environmental, personal and aesthetic considerations restrict use
- Does not reduce ungulate population
- Electric fencing may suffer from seasonal problems associated with poor grounding due to heavy snows and dry soil conditions
- Electric fencing not suitable for areas of frequent human contact
- Site shifting may occur as animals move to other areas with easier access

Photo: Jim Hesse

Repellents

Definition

Area repellents are behaviour modifying substances that create a chemical barrier which animals will not cross, or products that permeate an area to be protected from ungulate browsing with an odour that causes animals to avoid the area. Contact repellents are behaviour modifying substances that are topically applied or attached directly to a plant in order to reduce their palatability or to induce pain or fear in the animal (Trent *et al.* 2001).

Description

Repellents are designed to persuade ungulates to eat something other than the treated or protected food source, so they function best when alternate food sources are readily available and when they are used on plants of general low palatability and preference.

Repellents have four modes of action: fear, conditioned aversion, pain and taste and can be classified as odour based or taste based. Odour based repellents generally out-perform taste based repellents. Repellents can be spread throughout an area or applied to the plant.

Fear inducing repellents give off sulfurous odours that mimic predator scents. Examples include products containing rotten eggs, soap, predator urine, blood meal, and other animal parts. These products can be applied directly to plants or placed in bags and suspended in the areas requiring protection. The advantage of odour based products is that animals realize the plant or area is treated as they approach, so the plant remains undamaged. Putrescent egg solids are the active ingredient in several odour based, fear inducing repellents (e.g. Deer-Away) that have been shown to be effective (Wagner and Nolte 2001). Blood meal is the active ingredient in Plantskydd, which has also been shown to be effective (Wagner and Nolte 2001). These types of products have generally performed well and are often used a standard for comparing other active ingredients (DeNicola *et al.* 2000). Hinder is an odour based repellent containing ammonium soaps of higher fatty acids, and is one of the few products registered for use on edible plants.

Conditioned aversion is an avoidance response that occurs when the animal associates the treated item with nausea or gastrointestinal distress. Thiram is a fungicide that induces a taste based conditioned aversion and is most often sprayed or painted on the bark of dormant trees and shrubs. Efficacy is generally limited because animals must be trained to avoid these materials and damage during training can be extensive.

Pain inducing repellents affect the trigeminal receptors in the mucous membranes of the eyes, nose, mouth and throat. These products are sprayed or dusted on the foliage. An example is capsaicin, the active ingredient in hot peppers. The disadvantage of taste based products is that the plant must be browsed in order for the repellent affect to take place. Products based on capsaicin include Miller's Hot

Sauce and Deer-Off. Pain inducing repellents are generally less effective than odour based repellents, perhaps because active ingredient concentrations are too low (Trent *et al.* 2001; Wagner and Nolte 2001).

Taste based repellents generally include a bittering agent that renders the treated plant unpalatable. These types of repellents are the least effective (Wagner and Nolte 2001), as herbivores appear to be indifferent to bitter taste (Trent *et al.* 2001).

Home-remedy repellents such as placing small bags of human hair or suspending bars of tallow-based soap in areas requiring protection may deter deer if pressure is low. Small bags of coyote hair, tested by Seamans *et al.* (2002), did reduce deer intrusions into a test bait site, and may be effective for small discrete areas.

Repellents will rarely stop antler rubbing and will not eliminate browsing. If browsing cannot be tolerated at all, then fencing or barriers are the only option.

Refer to Appendix G for a list of various types of repellent products and contact websites.

Efficacy

Trent *et al.* (2001) report on a field trial of 20 repellent products intended to protect *Thuja plicata* seedlings. Their findings include:

- Topical repellents generally perform better than area repellents
- Fear inducing repellents performed better than the other types of repellents
- The most effective repellents emitted sulfurous odours
- Repellents containing decaying animal proteins, such as egg or slaughterhouse waste appeared to be the most effective
- The most effective products were, in order, Deer Away Big Game Repellent powder, Plantskydd, Deerbuster's Sachet and Bye Bye Deer Sachets
- Get Away Deer and Rabbit Repellent failed to protect seedlings during this test
- None of the products provided complete protection

Repellents are most effective when used during periods of good weather, in high concentrations, in small areas and for short term problems. The effectiveness of repellents is variable from year to year, and from site to site. Efficacy is negatively correlated with deer density. Repellents may achieve desired results under moderate deer browsing pressure, but under severe pressure they become ineffective. Changing repellents frequently may increase effectiveness.

Logistical constraints

Repellents require multiple applications (every 2 to 5 weeks) over a growing season to protect new shoots. The products may have label application or use restrictions. Treatment must start early in the growing season to try and modify behaviour before animals become habituated. The application of repellents is practiced at the homeowner level, or for municipal plantings and gardens. This is not an option that can be implemented by the provincial government.

Legal issues

There are no legal issues associated with this option.

Permit requirements

There are no permitting issues associated with this option.

Cost

Repeated applications are costly.

Human health and safety concerns

There are no concerns associated with this option.

Humaneness

Repellents are a humane option.

Advantages

- May be effective under certain circumstances for residential property owners

Disadvantages

- No reduction in ungulate populations
- Not effective in areas experiencing heavy deer pressure
- Require frequent applications to continually protect new growing shoots
- May be washed off by rain
- Can be used effectively only in mild weather
- Site shifting may occur as ungulates move to untreated areas
- Repeated applications are time consuming and effective
- Results are unpredictable

Landscaping Alternatives

Definition

Altering urban landscaping practices and plant selection in favour of less palatable plants in an effort to reduce ungulate browsing

Description

Ungulate preferences for specific plants depends upon several factors: the animals' nutritional needs; its previous feeding experiences; plant palatability; time of year; and the availability of wild forage. Almost all of the literature discusses deer preferences for plantings. When deer populations are low and food is abundant, deer select their most preferred food. When deer population increase and food becomes scarce, there are few plants that deer will not eat. A large deer population creates competition for food, causing deer to eat many plants that they normally would avoid. Planting less desirable plants around homes and in gardens may reduce the likelihood of damage, but in areas of high deer densities, almost all plants are at risk (Washington Department of Fish and Wildlife 2004; Kilpatrick and LaBonte 2007).

Information on suggested plants for landscaping in urban areas with high deer populations can be found in the References sections "Community/state/provincial recommendations for residents" and "Resistant plants, landscaping options and damage assessment" plus Appendix E: Urban Ungulate Management Websites.

Efficacy

Certain plants can be more or less palatable to deer depending on time of year, individual plant health and overall deer pressure, however fertilized and watered plantings are generally very attractive to deer and it is difficult to prevent browsing unless physical or chemical barriers are imposed.

Logistical constraints

This is practiced at the homeowner level or for municipal plantings and gardens. This is not an option that can be implemented by the provincial government.

Legal issues

There are no legal issues associated with this option.

Permit requirements

There are no permitting issues associated with this option.

Cost

The costs of plants and landscaping are borne largely by the property owner and replacement costs can be expensive. Residential damage caused by deer to urban landscaping has been estimated at over $250 million (2002) USD/year in the United States (Conover 2002).

Human health and safety concerns

There are no concerns associated with this option.

Humaneness

This is a humane option.

Advantages

- May be effective for residential property owners
- Lots of information is available on preferred and non-preferred browse plants for deer

Disadvantages

- No reduction in ungulate population
- Site shifting may occur as animals move to other areas with easier access
- Only really effective in areas where there is low to moderate browsing pressure
- If deer are motivated, they will eat almost anything
- Deer adapt well to nearly all human-modified environments, except fully developed, downtown commercial areas devoid of all woodland and vegetative covers.
- Can be quite labour intensive, and may not prove to be effective

Photo: Jim Hesse

Artificial Feeding and Baiting

Definition

Artificial feeding is the placing of natural or artificial food into the environment to supplement natural food sources. Emergency feeding is the provision of food when natural food sources become inaccessible or severely restricted; winter feeding is the provision of food to offset reduced food availability caused by severe winter conditions of snow cover and depth; and intercept feeding is the provision of food in a preventative effort to reduce damage to agricultural crops, livestock or timber. Baiting is the provision of food or other attractants to attract wildlife to a specific site to aid in shooting, vaccinations, poisoning or capture of the animals (Dunkley and Cattet 2003).

As a management option employed by wildlife agencies, artificial feeding in urban environments would be used as an intercept method, to draw ungulates away from urban food sources. This option has been considered, but never recommended or implemented in Canada or the USA as a management option for urban ungulates. In BC, artificial feeding of wildlife is not practiced, and hunting over bait is not permitted.

In urban environments, the general public may provide food to ungulates for a variety of reasons: to enhance viewing opportunities, to mitigate against severe winter conditions for their "favoured" animals, to provide food for smaller, weaker, or injured animals that are perceived as requiring help, or to provide alternate sources of food so that ungulates will not browse on garden or landscape plantings.

Artificial feeding of urban ungulates is strongly discouraged by Canadian and USA wildlife management agencies. Feeding can lead to increased ungulate populations far above what the "natural" environment can support, decreased wariness and increased habituation of ungulates, collapse of home ranges, increased possibility of disease spread, and possible starvation if food sources are abruptly cut off or if the animal's digestive system cannot switch efficiently from one food source to another.

Baiting is an integral part of other management options such as sharpshooting or capture of live animals. In these management situations, the ecological and social considerations of feeding wildlife are not applicable.

Efficacy

Baiting effectively attracts ungulates to areas where management interventions can be undertaken.

Logistical constraints

Sufficient amounts and type of bait need to be provided to maintain animal use of a bait site.

Legal issues

In BC, artificial feeding of wildlife is not practiced, and hunting over bait is not permitted.

Permit requirements

Permits may be required for management options that require baiting.

Cost

Bait cost is a minimal component of sharpshooting or capture projects.

Human health and safety concerns

There are no concerns associated with this option.

Humaneness

Whether artificial feeding is practiced on large or small scale, there are ethical considerations around the domestication of wildlife and the increasing dependence of the wildlife on artificial feed, which could lead to starvation if the artificial food supply is cut off.

Advantages

- Bait sites facilitate management options such as sharpshooting over bait, trap and relocate or trap and euthanize
- Spatial changes of deer in response to baiting include collapse of home range and core areas around bait sites which helps to shift areas of use to locations where management options could be undertaken safely and efficiently (Williams and DeNicola 2000)

Disadvantages

- If artificial feeding is used, population levels are sustained at higher capacity than the natural environment can support; may lead to starvation if feeding stops abruptly
- Areas around bait sites can quickly become degraded from heavy use; exotic plant species may be introduced
- Crowding around bait stations may lead to fighting and injury
- Non-target species may consume bait
- Artificial feeding may contribute to the spread of bovine tuberculosis in deer, CWD in deer and elk, and brucellosis in elk and bison
- Carbohydrate overload may occur if deer diet changes abruptly. Because their digestive systems cannot adjust to the new food source, deer may starve although it appears that there is abundant food available.

Ungulate Vehicle Collision Mitigation

Definition

Ungulate vehicle collision mitigation is the implementation of a variety of techniques to address factors responsible for ungulate vehicle collisions caused by overabundant populations in urban areas.

Description

Mitigation for wildlife collisions can take a variety of forms, either directed towards changing the behaviour of the driving public (signs, public awareness, speed reduction) or the behaviour of the wildlife species (fences, wildlife crossings, roadside brushing, repellents). The frequency of deer vehicle collisions is often used as an indicator of deer damage in a community and can be the prime motivator for communities seeking solutions to overpopulation.

Occasionally urban ungulates, particularly moose, pose a danger to motorists while they are attempting to avoid capture by Conservation Officers, or after darting and prior to immobilization, when their movements are erratic and unpredictable.

Legal issues

Speed limit reduction and wildlife warning sign location on provincial highways is a complex process. Speed limit changes involve legislated regulations.

Permit requirements

Permits are not required for any of the techniques listed.

Human health and safety concerns

There are no concerns associated with this option.

Advantages

- Implementation of effective techniques can reduce wildlife vehicle collisions

Disadvantages

- Effective mitigation can be expensive
- Jurisdictional issues between MOE, MOTI and municipalities may restrict action

Ungulate vehicle collision mitigation can be undertaken with a variety of techniques.

	Efficacy	Cost to implement	Responsible agency	Comments and constraints
Deer whistles	Ineffective	Minimal	General public	Independent research does not support use
In-vehicle technologies	Unknown	Expensive	General public	Expensive to purchase, no independent research
Roadway lighting	Limited	Moderate	Municipalities, province	May be effective in specialized circumstances
Speed limit reduction	Effective	Minimal	Municipalities, province	Difficult to implement and enforce
De - Icing alternatives	Limited	Moderate	Municipalities, province	Logistically difficult to implement
Wildlife warning signs	Limited	Minimal	Municipalities, province	Need to reflect seasonal risk and use non-traditional designs
Wildlife reflectors	Ineffective	Moderate	Province	Independent research does not support use
Repellents	Unknown	Moderate	Province	Logistically complex to implement
Public education	Effective in focused markets	Moderate	Municipalities, province, ICBC, wildlife organizations	Due diligence to the public requires notification of areas where wildlife hazards exist
Right of way brushing	Effective	Moderate	Municipalities, province	Needs to be carried out in midseason to prevent resprouting
Exclusionary fencing	Effective	Expensive	Province	Expensive, restricts natural travel patterns unless implemented with crossing structures
Wildlife crossings	Effective	Expensive	Province	Expensive, needs to be implemented with fencing to direct animal movement
Roadway planning and design	Effective	Moderate	Municipalities and province	Can be incorporated into already existing processes

Population Reduction Options

Population control programs generally have two phases; the initial reduction phase when a significant proportion of the population is removed at one time and the maintenance phase, occurring after ungulate densities are reduced and when fewer individuals are removed. Any method of population reduction will be an ongoing activity. Population control interventions may occur annually or after several years have passed depending on the circumstances. Wildlife managers, municipalities and residents need to expect and be committed to long term efforts. The goals of population reduction programs should be to reduce populations so that conflict and damage levels are brought within acceptable levels, not to eradicate a population or herd.

Except for capturing and removing ungulates to other locations, population reduction means the removal of animals from an area by killing them. Killing animals is controversial because there are conflicting social attitudes and perceptions around animals and people's roles and responsibilities towards them. Any program involving population reduction will generate at best, lively and provocative discussion, and at worst, vigorous public protest and controversy.

The difference between hunting and culling is an important consideration in the discussion about urban ungulate management. Hunting is a philosophical concept based on the ideas of sportsmanship, fair chase and utilization of the target animal by the hunter. Culling is the act of removing specific animals, in a specific place, to meet specific objectives such as changes in population composition or the alteration of population densities to meet a required target. Hunting is a maintenance activity designed to remove a sustainable harvest surplus, while culling is a more deliberate effort to reduce population numbers when circumstances merit a response. In an urban ungulate management plan, one of the objectives will be to reduce ungulate populations. If hunting is used to achieve that objective, many of the fair chase concepts associated with a more traditional hunting experience will not be satisfied. It is a "hunt" only in the fact that the animal is harvested and utilized, sometimes for food banks.

For many urban residents, hunting and the use of firearms or archery equipment is not a comfortable or familiar activity around their homes or property. People who reject hunting in urban areas may not necessarily oppose hunting in a philosophical context; they may just see it as an incompatible land use. It may not necessarily be the lethal aspect of hunting, but the public perceptions of humaneness and safety that preclude its use (Shissler 2007).

Another concept important to the decisions around population reduction is the length of time that people are willing to wait before they see a reduction in deer damage. Kilpatrick *et al.* (2007) reported in a survey of opinions about population reduction methods, most residents were willing to wait 3 to 5 years to see the desired reduction in populations if there were no associated costs to them. As costs increased, homeowners' willingness to wait for noticeable results declined.

Once population reduction projects are to be implemented, the question remains of how many animals should be removed from the population and at what intervals. There are three circumstances:

1. *Pilot project* - a limited number of animals is removed in order to test the efficiency of the desired methods and to provide enough operational information to determine the cost and feasibility of proceeding with a larger scale project.
2. *Steady state management* - a predetermined number of animals is removed, bringing the herd to a density where damage levels are acceptable. This density is maintained annually.
3. *Pulsing or cyclical management* - a significant proportion of the herd is removed in the first intervention, and then interventions stop for an interval of some years until the herd population rebuilds, not to its original densities, but to a level where it is cost effective and economies of scale are sufficient to warrant another removal.

The use of pulsing methods versus steady state management has been discussed by Rondeau and Conrad (2003) and Jordan *et al.* (1995). Rondeau and Conrad (2003) offer a theoretical discussion modeled on the results of deer removal projects in Irondequoit, New York and Jordan *et al.* (1995) report on the results of a sharpshooting project in North Oaks, Minnesota.

Steady state management has several advantages. Personnel remain trained and experienced with no learning curves as would be expected after a few years of absence from an activity. Budgets can be confidently planned for on a year to year basis, rather than on more *ad hoc* basis. There is less opportunity for complaints from residents who may suffer damage in the "off" years of a cyclical treatment plan. If there is strong community opposition, a break in activities could mean re-opening the debate every few years when interventions are needed.

Cyclical interventions may be appropriate when fixed set-up costs form a high proportion of the project cost, when animals are in a well-defined and controlled area, and when population levels and ease of removal are inversely correlated. For example, it is more efficient to overcome operational challenges based on population density (being able to attract a sufficient number of animals to bait stations) every few years when the populations are at a high level, rather than try to overcome them every year when population densities are moderate.

Jordan *et al.* (1995) discuss the challenges of knowing when to initiate population control interventions. Urban ungulate control programs are most often designed around: 1) determining an animal population and density estimate; 2) determining a more "appropriate" population density; and 3) calculating the number of individuals to be removed to achieve the desired density. Another way to approach the problem is focused less on population density than on animal caused damage. Rather than setting a fixed population density as a goal, communities could use other criteria such as levels of damage to gardens or the natural environment, or numbers of ungulate vehicle collisions. When these damage indicators reach a certain level, then community tolerance has been exceeded, and control methods can be applied.

Changes in the number and composition of ungulate populations are dynamic and occur as the result of a multitude of factors, including birth and death rates, immigration and emigration. Most literature on deer biology and behaviour in urban environments reports on white-tailed deer studies. Generally accepted precepts as summarized by DeNicola *et al.* (2000) include: deer are organized into matrilineal groups where related females are accompanied by their immediate offspring; female deer typically remain in their natal range, establishing ranges adjacent to and overlapping with their home range, whereas males disperse more widely and expand their home range during the rut; and females tend to have compact home ranges and move little between the seasons especially in urban areas, particularly if sufficient habitat diversity exists in the home range. This strong home range fidelity and the importance of social groups mean that effective management can be carried out in localized areas.

The timing of population reduction is discussed by Conover (2002). If animals are removed that would have died before the next breeding season, then the lethal control may have little or no impact. This is termed *compensatory mortality control* and simply replaces natural mortality. If the animals removed are different from those who would have died anyways, then *additive mortality control* has been achieved. There are natural "bottlenecks" in population dynamics; periods of natural mortality, such as winter. Mortality that occurs before winter is compensatory – there are only enough resources for some, not all, to survive the winter. Population reduction has more effect when used after the population has passed through the bottleneck, in late winter or early spring.

When discussing population reduction as a management intervention, there is concern about the reproductive rebound effect, which can happen when an animal population quickly takes advantage of resources freed up by a population reduction program and rapidly builds up to pre-reduction levels. White-tailed deer are particularly noted for their reproductive fecundity, so the concern is that a reproductive rebound will quickly negate any population reduction achieved by the population reduction program. Porter *et al.* (2004) reported that both pregnancy rates and number of fetuses/pregnant female increased for adults, yearlings and fawns over the term of a 6 year period culling program.

Another concern is that there will be increased immigration into an area that has been depopulated due to the newly available habitat and resources. Responses of white-tailed deer to sharpshooting and controlled hunting have been reported by Williams *et al.* (2008). Behaviours of hunted deer were directly affected by the human threat, while behavioural changes of deer subjected to sharpshooting were linked to the reduction in population and changes in social groups. Hunted deer increased mean home ranges during removal, while deer exposed to sharpshooting did not. However, McNulty *et al.* (1997) reported that removal of small social groups of white-tailed deer in New York created a low density deer area that persisted for several years, therefore adjacent deer philopatry may assist with management in small localized areas such as urban parks. This is supported by Oyer *at al.* (2004) who reported that the localized removal of white-tailed deer social groups created persistent areas of low deer density for at least 5 years.

Capture and relocate

Definition

The capture, transport and release of free-ranging, wild animals, primarily for conservation or ecological reasons, in (to) a location different from which they came, but where the species may presently occur or historically have occurred naturally (Nielson 1988).

BC Ministry of Environment policies and procedures for translocations of wildlife

The BC Ministry of Environment has both policy and procedures in place to regulate the capture and relocation of wildlife and non-native species. Both the 2001 policy and the 1984 procedures were under revision during 2005, but the amendments have not been finalized.

Policy

Translocation of Wildlife and Non-Native Species 4-7-13.02. Effective Date: May 29, 2001.

Procedure

Introductions and Transplants of Wildlife (Wild Birds and Mammals) 4-7-13.02. Effective Date: October 4, 1984.

Policy Statement

It is the policy of the British Columbia Ministry of Environment to:

1. Ensure that translocations are both justifiable and likely to succeed, and the scientific community can learn from each initiative, whether successful or not.
2. Minimize the risk of adverse side effects that may occur as a result of translocations.
3. Consider the welfare of animals involved in translocations.

Under the policy, *translocation* is defined as the "deliberate and mediated movement of wild or captive-bred individuals or populations including reintroduction, reinforcement or supplementation, conservation or benign introductions, and introduction of non-natives…" and under the procedures, *transplant* is defined as the "means to remove an animal from one location and to introduce it into another location where it now occurs or has occurred with the province of British Columbia."

Description

Ungulates are trapped, netted and/or remotely immobilized with tranquilizers via darts and then relocated. Ungulates may be captured by a variety of techniques:

- Net gunning from a helicopter
- Use of a helicopter or people to herd animals into a stationary drive net
- Use of stationary drop nets

- Use of rocket nets
- Use of net guns
- Remote immobilization drugs via darts
- Use of corral traps
- Use of Clover traps - collapsible netted cage traps (originally designed by Clover 1954; 1956, and modified to pivot at the corners and collapse by McCullough 1975)
- Use of Stephenson box traps – solid sided

Some capture techniques involve pre-baiting to attract and condition the animal to the capture site, and then baiting the trap or net site to facilitate capture. Traps can be remotely monitored with cameras, fitted with telemetry devices (VerCauteren *et al.* 1997) or checked frequently to ensure quick treatment after capture. After capture, the animal is generally restrained and blindfolded, and sometimes chemically immobilized. Subsequently, the animal may be subject to a variety of procedures: marking; tagging; collaring; collection of biological data or samples; preparation for transport; or even euthanasia.

With an experienced crew, time from reaching the trap until the deer is restrained is <5 seconds, and tagging or collaring can be completed in 3 minutes (VerCauteren *et al.* 1997).

Peterson *et al.* (2003) reports time to immobilization for Key-deer as < 1 minute, and time to blindfold, collar and collect biological samples was 5-15 minutes.

White-tailed deer were captured with a drop net, restrained, blindfolded, sedated, ear tagged and fitted with motion-sensitive radio transmitters for relocation with a mean processing time of 16 minutes (Beringer *et al.* 2004).

After helicopter pursuit (<3 minutes) and net gun capture in a rural Texas environment, white-tailed deer were restrained, untangled from the net, blindfolded, measured, and ear tagged with an average processing time of 5.9 minutes (Webb *et al.* 2007).

For transport, the animal may or may not be crated and then trucked, trailered or barged to the release site. During transport, deer should not be overcrowded (<5 individuals should be transported together) and kept in the dark. A padded horse trailer may be a suitable transport vehicle. Antlers should be removed from bucks or they should be transported separately (DeNicola *et al.* 2000). Beringer *et al.* (2004) transported deer in a darkened stock trailer to the release site.

Efficacy

Trapping and relocating ungulates may be appropriate for some limited situations; where local management expertise exists, small social groups can be targeted and particularly where public opinion is strongly in favour of non-lethal options and must be appeased. It can reduce population numbers and it poses little risk to the public, both of which are typical project goals. However, if one of the objectives

in choosing a capture and relocate method of population control was to avoid animal mortality, then that goal is not likely to be achieved. Methods that may reduce mortality during capture, transport and release are described both in the literature and in practical experience. However, mortality following release cannot be mitigated for, and can be substantial.

Conover (2002) states "Translocation is not a panacea – effectiveness varies widely and so does the cost. The minimum benefit is public relations – it is socially acceptable."

Logistical constraints

Due to increased capture wariness, it is easier to capture the first 10% of the target population than the last 10%.

Mortality rates for ungulates increase if capture is carried out at excessively high or low temperatures, because some drugs inhibit the animal's ability to maintain its body temperature, therefore animals should only be tranquilized under certain weather conditions.

There may be perceived or actual liability concerning translocated animals. What if a translocated animal is involved in a vehicle collision and someone is killed? Or, what if a translocated animal subsequently damage crops or ornamentals in the new location?

It is often difficult to identify suitable sites for release. An ideal site capable of absorbing relocated deer would be where deer numbers are lower than carrying capacity, public demand for deer is high, and there are few potential issues. Unfortunately, such sites are rare. Many suitable locations are already at or near carrying capacity.

Health risks for target animals

Michigan DNR (2000) has compiled summaries of mortality rates for some common capture techniques and mortality rates following specified timeframes of release for relocated deer. These tables provide excellent summaries for projects carried out prior to 2000 and are located at the end of this section.

Capture mortality. To relocate an animal, it must first be captured. A varying percentage of individual animals may be injured or killed during the capture process depending upon:

- Species
- Capture technique
- Number of animals caught per trapping attempt
- Handling protocol and handling time
- Use of drugs
- Capture crew experience and number of members per capture crew
- Season and meteorological condition
- Animal condition prior to capture

Capture mortality may be linked to whether or not capture and restraint or remote chemical immobilization was used. Additionally, captured animals may develop capture myopathy after release. In ungulates, this syndrome is characterized by depression, muscular stiffness, lack of coordination, paralysis, metabolic acidosis, and death (Montané *et al.* 2002) brought on by the intense muscle activity, fear and stress experienced during pursuit and capture. Translocation of the animal increases the stress on the animal, therefore rendering it more susceptible to capture myopathy.

Michigan DNR (2000) reported capture mortality rates from 0 to 48%. Highest mortality rates were associated with dart guns (13.6-25%) or rocket nets (23.5-48%), and lowest capture mortality was associated with box traps (0-7.6%), and clover traps (0-7.2%). *See comparative table at the end of this section.*

Peterson *et al.* (2003) evaluated capture methods for urban white-tailed deer and summarized mortality rate results for projects from 1954-2003. Capture mortality associated with box traps, drop nets, Clover traps, rocket nets and darting was highly variable (0-33.3%). Corral traps and oral sedatives were associated with high mortality, 13.9% and 22.2%, respectively. Mortality associated with drive nets and net guns was 0-3.6%. Studies using chemical immobilization, tranquilizers, or sedatives post capture, typically resulted in higher mortality than those using physical restraint only. *See comparative table at the end of this section.*

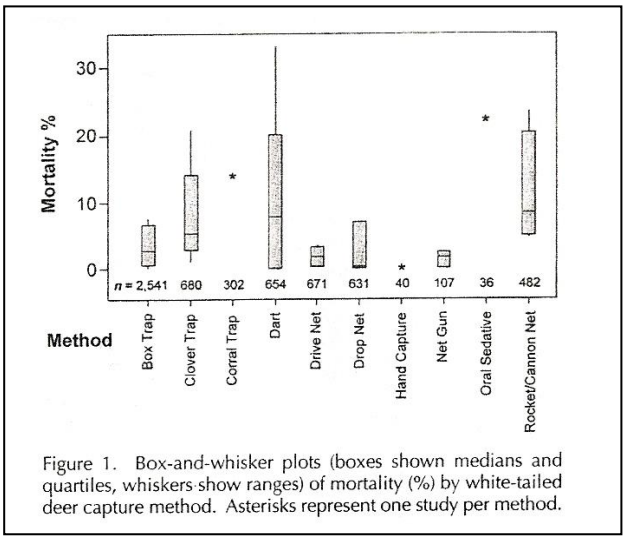


Figure 1. Box-and-whisker plots (boxes shown medians and quartiles, whiskers show ranges) of mortality (%) by white-tailed deer capture method. Asterisks represent one study per method.

Peterson *et al.* (2003)

Peterson *et al.* (2003) recommends the use of a modified drop net or drive net as most appropriate for use in urban settings, as although they may be more labour intensive than other methods, they result in nearly 0% mortality, and thus are perceived favourably by the public. Hand capture (holding bait in the hand and enticing the animal close enough to be caught by hand) was also used successfully for 40 Key deer (does up to 38 kg and bucks up 45 kg), who were accustomed to hand feeding.

Survival at release site. Survival rates of translocated ungulates (almost all studies report on white-tailed deer) are often low. Animals captured in urban areas and relocated to rural areas encounter many unfamiliar challenges in addition to any physical challenges resulting from the capture and relocation process. They may be more susceptible to mortality due to difficulties with finding food or shelter, adjusting to new forage, finding suitable winter habitat, unfamiliarity with the release area, and their prior habituation to humans. Relocated deer may fail to recognize the mortality agents that they had not been exposed to in their urban settings – predators, hunters, or unfamiliar roads. Relocated deer may be more vulnerable to hunting and poaching due to observed reduced flight distances compared to resident deer (Beringer *et al.* 2004). Relocated deer may be in poor condition pre-transfer, due to high deer densities and subsequent strong competition for resources caused by the population exceeding the carrying capacity.

Michigan DNR (2000) reported mortalities rates within one year of release ranging from 43%-85%.

Conover (2002) reports relocated deer mortality rate of 47% compared to 12% of resident deer in the Adirondacks, but also reports no difference in mortality rates of relocated deer in Kentucky with a mortality rate for both relocated and resident deer of 25% within 8 months.

O'Bryan and McCullough (1985) report relocations in California, New Mexico, and Florida resulted in 85%, 55%, and 56% mortality respectively, from 4 to 15 months later, where normal mortality was 28%.

Rongstad and McCabe (1984) report delayed mortality of relocated deer as high as 26%.

Jones and Witham (1990) in Cromwell *et al.* (1999) report white-tailed deer mortality rates for relocated does at 66%, compared to 27% for resident adults in Chicago, Illinois.

Cromwell *et al.* (1999) report captured and relocated white-tailed deer had greater mortality rates (47.9%) and incurred more capture related deaths than control deer (24.5%) in the 3 months following relocation.

Beringer *et al.* (2004) report 29% mortality of relocated deer attributed to capture myopathy, with 20% dying in the first 30 days post release, with a caveat that researchers exercised a high degree of diligence in recovering dead animals. Annual survival rates for relocated deer were 30% compared to 69% for resident deer at the capture site.

Dispersal from release site and/or return to capture site. Conover (2002) recommends a guideline of 5 to 10 times the width of the animal's home range as an appropriate separation distance of the capture site from the release site. In general, large herbivores stay close to the release sites although a few individuals may travel long distances. The following travel distances following release were noted in Conover (2002):

- White-tailed deer: 3 km in Illinois; 2-5 km in Illinois; 23 km in New York

- White-tailed deer: half released at the site of capture – these dispersed; half released elsewhere – these stayed put
- Black-tailed deer: 9 km in California
- Moose: translocated from Ontario to Michigan – 22 of 29 settled within 20 km; one travelled 290 km in the direction of its capture

Rogers (1988) says that most animals stay within 30 km of the release site. Adults are more likely to return to the release site than juveniles or sub-adults, who may be in the process of dispersing and establishing their own home range when captured.

Jones *et al.* (1997) report a post release travel distance of 23.5 km.

Beringer *et al.* (2004) report females as having the greatest range of movements away from the release site (3.83-54 kms). Of 14 release groups, 11 groups had deer that appeared to travel together for at least 2-3 months post release. A release distance of at least 60 km from the capture site is recommended.

A soft release program, where animals are kept in pens for a period after transfer, may be appropriate for some species, and has been carried out with Wood Bison in BC. This may increase the likelihood that the animal will remain in the area.

Effects on non target animals

Competition between relocated deer and resident deer. If the release site is already at or near the carrying capacity, then the translocated animals will likely be the ones to perish because of their inability to find food or avoid danger as successfully as residents. Residents will usually win any territorial battles due to site dominance (the home field advantage). Resident deer may be more determined to defend than non-residents are to attack. There will also be competition for food and shelter resources between resident and relocated deer. Predator-prey equilibrium could be disturbed.

Disease. There are two disease risks associated with animal relocation. The possibility exists that:

1. Animals will carry new diseases into the destination ecosystem that will cause harm to the destination ecosystem, or
2. Animals being moved will encounter new diseases in the destination ecosystem and will be harmed by these new diseases.

Some diseases arise more commonly in high deer density areas and are less frequent in low deer density areas (Eve 1982, in Michigan DNR 2000) and can be attributed to poor nutrition, stress, and increased number of animal to animal contacts in the higher density areas (Davidson 1981, in Michigan DNR 2000). Parasites that have deer as hosts may be spread to new areas by relocation of deer.

However, health and disease risks can be minimized by careful selection of both target populations and release sites and restricting movement of animals to within the same Ministry of Environment region.

Population genetics. Caution must be exercised so that transplanted animals are still within their subspecies range. Martinez *et al.* (1997) report on a case in Mexico where translocated white-tailed deer were larger than resident deer, thus posing difficulties for resident deer in maintaining a proportionate number of matings and resident does encountered difficulty during parturition.

Legal issues

Individuals undertaking capture and relocation projects must have the authority to do so in accordance with all provincial legislation.

Permit requirements

A permit is required if capture being conducted by a person not employed by Ministry of Environment. Authorized Ministry of Environment staff may capture animals without a permit.

Any relocation of deer needs approval from the federal Canadian Food Inspection Agency due to concerns with disease transfer.

Movement of animals within Ministry of Environment's regions is not restricted. Movement of animals between regions requires the approval from the Ministry of Environment Wildlife Veterinarian.

Cost

The costs of capturing and relocating ungulates vary with technique. Personnel costs (generally >60% of project costs as discussed in fertility control section) include staff time required for pre-baiting, locating and relocating traps, and actual capture or specialized darting. Equipment costs could include tranquilizers, guns, traps, bait, pens, trailers, and transportation. Capture costs will be lowest when:

- Animal densities are high
- Animals have not been previously trapped
- Any individual animal is the target – not a specific individual animal, gender or age class

Michigan DNR (2000) summarized 8 studies utilizing a variety of capture and transport techniques and involving 1,224 white-tailed deer at an average cost of ~$352 USD/animal. The costs are not adjusted for inflation and all studies were conducted prior to 2000.

Conover (2002) reported direct project capture costs of $412 USD/deer in Wisconsin and Montana FWP (2004) reported $431 - $800 US/deer for projects in New York, New Hampshire and California for studies conducted prior to 2002.

VerCauteren *et al.* (1997) reported costs ranging from $97-$637 USD/deer with an average of ~$350 US/deer for projects ranging taking place from 1984 to 1995.

Beringer *et al.* (2004), for a 1997-1998 project, reports a cost of $387 USD/deer, including volunteer time and travel. The use of volunteer labour saved over $2500 USD.

Canadian capture and relocate projects

Comparable Canadian projects to capture and relocate ungulates enabling cost, effort and success comparisons were not found in the literature. The results of one project, taking place in the mid 1980's involving the capture and relocation of white-tailed deer from Winnipeg, MB, to a rural area 60 miles southeast of Winnipeg, were reported anecdotally in an interview with Tom Moran, Manitoba Conservation biologist, and are fully discussed in Moran (1989). The full interview results are contained in the Canadian overview section of this report and summarized here.

Four or 5 bait sites were established, and a drop net was used to capture 300 deer. All deer were chemically immobilized. Six or 8 deer were transported together in a stock trailer. There was <5% mortality during the capture and transport phase. All deer were ear tagged. Approximately 20 deer were collared. There was some supplemental feeding at the release site. Less than 5 deer were recaptured back in Winnipeg. Several deer moved long distances from the release site (>100 miles). Several were seen right at the release site in the years following the release. There was no formal measurement of mortality post release, but there were many reported sightings of the tagged deer in the years following the relocation. It is difficult to estimate costs due to high amounts of volunteer help, but it may have been around $300 (1985) CDN/deer. The Winnipeg deer population after the project followed management expectations. There was an increase in deer numbers, but not a huge reproductive rebound. It bought them 15 years (until 08/09), when the situation again requires active management.

Human health and safety concerns

Techniques used to capture deer may be dangerous to humans or other animals, including pets, which may inadvertently encounter a trap or net. The propellants used to fire rocket nets are explosive and must be stored and used with appropriate precautions. Controlled access to treatment areas may be required during certain capture techniques. Chemicals used to immobilize ungulates can be dangerous to both people and ungulates, and have strict handling and storage protocols. Darts carrying immobilization drugs can be lost if a target is missed or they are deflected during the shot. Both the risk of accidental encounters with capture equipment and treatment drugs can be minimized to an acceptable level. There is a small risk of human injury during capture activities.

Ungulates treated with immobilizing drugs cannot be consumed by humans so animals must be ear tagged prior to release, and in some cases, treatment and release must be coordinated so as not to conflict with active hunting seasons, or release sites must not incorporate areas with free hunting.

Humaneness

As stated by Conover (2002), the biological realities of capture and relocation are quite different from the public's perception of "they lived happily ever after, just somewhere else."

Capture and relocation can be extremely stressful for the animal, animals can suffer capture related injuries and mortality, capture myopathy causing debilitation and death, and incur high incidental mortality rates following release.

Advantages

- Perceived by the public as a humane option, therefore has some public relations value
- Ungulate population and related damage is reduced
- May instill wariness in remaining animals, possibly reducing aggressive incidents
- May be of value for control of small social groups under special circumstances, where localized management expertise exists
- May be useful in 3 situations
    1. Where an individual animal is valuable
    2. When the population is below carrying capacity at the release site
    3. When the public relations values override other factors.

Disadvantages

- Not as humane as the public might think; not necessarily a non-lethal management option
- High ungulate mortality rates may occur, both during capture and following release
- Ungulates subject to capture and relocations are susceptible to capture myopathy; a significant mortality factor
- Expensive
- Requires substantial financial and logistical commitments of trained personnel and equipment to ensure human and animal safety
- Disrupts resident ungulates and may increase disease spread, initiate or exacerbate other land use conflicts, or disturb existing predator-prey balance
- Ungulates habituated to urban environments may seek out comparable residential locations from which they came
- Few skilled contractors available, requires significant investment of Ministry staff time

Table 1. Published mortality rates for some common deer capture techniques (Table adapted from Virginia Dept. of Game and Inland Fisheries 1998).

Method	Number Captured	Mortality (%)	Reference
Corral Trap	260	16.2	Hawkins et al. 1967
Box Trap	47	0.0	Hawkins et al. 1967
Box Trap	2,035	2.1	Palmer et al. 1980
Box Trap	85	7.6	Peery 1969
Drop Net	175	7.4	Conner et al. 1987
Dart Gun	44	13.6	Palmer et al. 1980
Dart Gun	60	25.0	Hawkins et al. 1967
Dart Gun	6	25.0	Ishmael and Rongstad 1984
Rocket Net	17	23.5	Palmer et al. 1980
Rocket Net	9 (control)	25.0	Cromwell et al. 1999
Rocket Net	10 (relocated)	48.0	Cromwell et al. 1999
Clover Trap	2	0.0	Ishmael and Rongstad 1984
Drive Net	5	0.0	Ishmael and Rongstad 1984
Combination of Several Methods	215	5.6	Mayer et al. 1995
Combination of Several Methods	29	6.9	Mayer et al. 1995
Rocket Net and Clover Trap	902	7.2	Beringer et al. 1999

Table 2. Published mortality rates for relocated deer (Table adapted from Virginia Dept. of Game and Inland Fisheries 1998).

Number Translocated	Time Frame	Mortality (%)	Reference
27	Within 3 months	85.2	McCullough et al. 1997
203	Within 1 year	85.0	O'Bryan and McCullough 1985
310	Within 1 year	43.0	Ishmael et al. 1995*b*
10	Within 1 year	49.0	Cromwell et al. 1999
19	Within 4 months	67.0	Florida Game and Freshwater Fish Comm. 1983
17	Within 1 year	47.0	Jones et al. 1997
28	≤ 502 days	68.0	Hawkins and Montgomery 1969
13	Within 1 year	62.0	McCall et al. 1988
11	Within 1 year	45.0	Diehl 1988
35	248 days	25.0	Pais 1987
12 (adults)	Within 1 year	66.0	Jones and Witham 1990
10 (fawns)	Within 1 year	56.0	Jones and Witham 1990

Table excerpted from Michigan DNR (2000)

Table 1. Summary of capture methods used for white-tailed deer, 1954–2002.

Category Capture method	Number captured	Mortality (%)	Post-capture monitoring	Chemical immobilization[a]	Reference
Passive, staffed					
Hand capture	40	0.0	Yes	No	This study
Drive net	144	2.1	Yes	No	Silvy et al. 1975
Drive net	28	3.6	No	No	DeYoung 1988
Drive net	430	1.4	Yes	No	Sullivan et al. 1991
Drive net	69	0.0	Yes	No	This study
Drop net	292	0.3	No	No	Ramsey 1968
Drop net	175	6.9	Yes	0.5 mg/kg xylazine	Conner et al. 1987
Drop net	164	0.0	Yes	No	This study
Passive, unstaffed					
Box trap (Stephenson)	47	0.0	No	No[b]	Hawkins et al. 1967
Box trap (Cohick)	92	7.6	Yes	No	Peery 1968
Box trap (Stephenson)	2,035	2.1	No	No	Palmer et al. 1980
Box trap (Stephenson)	367	3.3	Yes	1 mg/kg ketamine 1 mg/kg xylazine	Haulton et al. 2001
Clover trap	115	0.9	No	No	Clover 1954
Clover trap	254	4.7	Yes	No	Fuller 1990
Clover trap	115	5.2	Yes	No	Beringer et al. 1996
Clover trap	167	7.2	Yes	00-400 mg ketamine[c] 50 mg xylazine	DelGiudice 2001
Clover Trap	29	20.7	Yes	1 mg/kg ketamine 1 mg/kg xylazine	Haulton et al. 2001
Corral Trap	302	13.9	No	No[d]	Hawkins et al. 1967
Explosives mandatory					
Rocket-cannon net	33	6.1[e]	No	No	Hawkins et al. 1968
Rocket-cannon net	17	23.5	No	50-100 mg promazine	Palmer et al. 1980
Rocket-cannon net	300	10.3	Yes	No	Beringer et al. 1996
Rocket-cannon net	132	4.6	Yes	1 mg/kg ketamine 1 mg/kg xylazine	Haulton et al. 2001
Net Gun	42	2.4	No	No	DeYoung 1988
Net Gun	63	1.6[f]	Yes	300-400 mg ketamine[c] 50 mg xylazine	DelGiudice 2001
Net Gun	2	0	Yes	No	This study
Chemical immobilization					
Crossbow	83	15.7	No	nicotine alkaloids	Hawkins et al. 1967
Dart Gun	75	20.0	No	nicotine alkaloids	Hawkins et al. 1967
Dart Gun	44	13.6	No	≈9 mg succinylcholine chloride	Palmer et al. 1980
Dart Gun	23	0.0	Yes	200 mg ketamine[g] 70 mg xylazine	DeNicola and Swihart 1997
Dart Gun	31	0.0	Yes	280 mg ketamine 225 mg xylazine	Kilpatrick et al. 1997
Dart Gun	51	2.0	Yes	≈13.3 mg/kg ketamine ≈2.7 mg/kg xylazine	Haulton et al. 2001
Dart Gun	7	0.0	Yes	≈5.5 mg/kg ketamine ≈1.1 mg/kg xylazine	This study
Longbow	63	33.3	No	nicotine alkaloids	Hawkins et al. 1967
Oral Sedative	36	22.2	No	valium	Hawkins et al. 1967

[a] This category includes neuromuscular blocking drugs, general anesthetics, and/or tranquilizers/sedatives used after capture with nonchemical techniques.

[b] Used nicotine alkaloid injection on 1 adult male.

[c] Used 50 mg xylazine and 200 mg ketamine for fawns.

[d] Used nicotine alkaloid injections on adult males with 26.8% mortality.

[e] Both deer held >1.5 hours before release.

[f] This doe found tangled in a barbed wire fence.

[g] Used 35 mg xylazine and 100 mg ketamine for deer weighing <45 kg.

Table excerpted from Petersen *et al.* (2003)

Capture and Euthanize

Definition

The capture and subsequent euthanization of ungulates, using a penetrating bolt gun or firearm

Description

Ungulates are trapped, netted or tranquilized and then killed. For capture and euthanize projects ungulates may be captured by a variety of techniques:

- Use of stationary drop net
- Use of rocket nets
- Use of net guns
- Use of Clover traps - Collapsible netted cage traps (originally designed by Clover 1954; 1956, and modified to pivot at the corners and collapse by McCullough 1975)
- Remote immobilization drugs via darts

Some capture techniques involve pre-baiting to attract and condition the animal to the capture site, and then baiting the trap or net site to facilitate capture. Traps can be remotely monitored with cameras, fitted with telemetry devices (VerCauteren 1997) or checked frequently to ensure quick treatment after capture. Netting will capture multiple deer at a time and Clover traps capture individual deer, or occasionally a doe and fawn together. After capture, the animal is restrained and killed either by a penetrating captive bolt gun or other firearm shot to the brain, or may be shot without initial restraint.

With an experienced crew, time from reaching the trap until the deer is restrained can be between 5 and 60 seconds (VerCauteren *et al.* 1997; Peterson *et al.* 2003; Appendix A Helena case study).

Alternately, animals can be injected by tranquilizer darts, via remote delivery. It takes about 4 to 6 minutes for the tranquilizer to become effective during which time the animal may continue to feed and move. Wildlife professionals have no control over where an animal might move, and may require permission of land owners to come onto private land and retrieve a darted animal. When the animal succumbs to the tranquilizer, it is tracked and euthanized.

For more detailed methodologies on capture and euthanize projects:

1. Jordan *et al.* (1995) report on a combined sharpshooting and trap-and-shoot project occurring from 1980-1983 and 1990-1993.
2. Appendix A of this report contains a detailed case study of a trap and euthanize project in Helena, Montana, carried out in 2008 and 2009.
3. The Canadian Overview section of this report and Appendix L contains a summary of a capture and euthanize project on Sidney Island, BC, carried out in 2008 and 2009.

Efficacy

The capture and relocation of ungulates is more expensive, more time-consuming and less efficient than other lethal control methods because of the capture component. It is an effective option when there are very high ungulate densities and therefore attraction and trapping is easier, when there are individual ungulates identified as frequent causes of conflict, or when firearms discharge or hunting is not permitted or appropriate.

Logistical constraints

Trapping may be more difficult as the project goes on, and the animals become educated to the traps.

Trap locations need to be discreet. Owner permission will be required for trap placement on private land. The traps may be subject to vandalism if located on public land.

Pre-project planning is required for field dressing, carcass transportation, meat hide processing, food bank storage and distribution.

There is a balance between the number of traps set and the time required to visit and euthanize animals.

Heavy snow or freezing rain may cause trip mechanisms in a Clover trap to accidentally release or fail. Best success was right before or after heavy storms. Mild winter weather had the least success (Jordan *et al.* 1995).

Tranquilizing and euthanizing may require adjacent landowners' permission to retrieve animals.

Legal issues

Individuals undertaking capture and relocation projects must have the authority to do so in accordance with all provincial legislation.

Permit requirements

A permit is required if capture being conducted by a non-government Government staff may capture animals without a permit.

Cost

The costs of capturing ungulates vary with technique. Personnel costs generally account for >60% of project costs (see capture and relocate section and fertility control section). In addition to the staff time required for pre-baiting, locating and relocating traps, the equipment costs include guns, traps, and bait. Security costs may need to be included in project costs.

Capture costs will be lowest when:

- Animal densities are high
- Animals have not been previously trapped
- Any individual animal is the target – not a specific individual animal, gender or age class

Costs reported for a Clover trap and euthanize project in Helena, Montana, as reported in Appendix A were $250 (2009) USD/deer. Creacy (2006) estimates costs of $150-500 (2006) USD/deer.

Human health and safety concerns

Techniques used to capture deer may be dangerous to humans or other animals, including pets, which may inadvertently encounter a trap or net. The propellants used to fire rocket nets are explosive and must be stored and used with appropriate precautions. Controlled access to treatment areas may be required during certain capture techniques. The risk of accidental encounters with capture equipment can be minimized to an acceptable level.

Humaneness

The use of a drop net to capture animals prior to killing is viewed as less humane than the use of a Clover trap because of the time interval between netting and euthanization when the animal may struggle. In a Clover trap, animals remain fairly calm with minimal stress until the last few seconds when humans are sighted. Capture and euthanize is considered less humane than sharpshooting due to the capture component.

Advantages

- Ungulate population is reduced
- May instill wariness in remaining deer, possibly reducing aggressive incidents
- Meat can be donated to charities
- Use of a bolt gun may be permitted in areas where no firearms discharge is permitted
- Suitable for areas where sharpshooting is not feasible

Disadvantages

- Controversial
- May shift damage to areas where hunting is not permitted or where damage was previously low due to low deer densities
- Deer may become educated to the bait and net technique; less so with a Clover trap where only one deer at a time is captured.
- Expensive due to the trapping component

Controlled Public Hunting

Definition

Traditional public hunting is the search for, attraction, stalking, pursuit, shooting at and killing of wildlife for food or recreation (or the attempt to carry out any of these activities) by licensed individuals who are abiding by provincial hunting regulations and using legal firearms or archery equipment. In BC, the land base is divided into administrative management units (MUs) covering both crown and private land, where regulations regarding weapons, timing, species and bag limits vary by MU.

Controlled public hunting is a term used to describe the application of legal and regulated hunting in combination with more stringent controls or restrictions as specified by a private land owner or the elected officials responsible for land management on the area where the hunt is to be conducted (DeNicola *et al.* 2000). Controlled hunting may limit hunters to a modified season which is usually more restrictive in terms of hunter density, methods of take, and size of huntable area and may also provide incentives for antlerless harvest and hunter participation.

The Magrath Quota Hunt (Appendix K) is a Canadian example of a rural (although right up to the town limits) controlled hunt carried out under the existing hunting regulations, but with stricter controls. Citations for papers describing other urban hunting projects, using both firearms and archery equipment, are contained in the References section of this report under "Lethal Control". These papers report in detail on: changes in deer home-range size; shifts in deer core-are use; fidelity to deer home ranges; effectiveness of different controlled hunt designs; discussions of archery efficacy; residents' responses to lethal control projects; comparison of hunt strategies; residents willing to wait for results or willingness to pay for lethal control action; comparisons between 4 lethal control methods; sharpshooting programs; initial reduction and long term maintenance of white-tailed deer herd using controlled hunting; and comparisons of sharpshooting over bait, controlled hunts and opportunistic sharpshooting.

The use of hunting as an ungulate management tool for free ranging herds on crown lands is well understood and practiced by wildlife managers, however, the goals and objectives of urban ungulate management are very different from traditional ungulate management. For example, urban ungulate management reflects an increased focus on individual animals or small social groups versus large population management or herd dynamics. Goals in urban hunting may be to maximize antlerless deer removal as the most effective way to reduce populations rather than provide opportunities for large bucks which may be the emphasis in traditional hunting. Target population densities in urban areas may be different from conventional management standards in more natural environments. Success may be measured in terms of reduction in landowner complaints or reduced numbers of ungulate vehicle collisions rather than simply the maintenance of healthy and self sustaining ungulate populations. The

primary objective of population reduction may come at the expense of the "fair chase" element associated with a more traditional hunting experience.

In areas where local laws permit and the physical layout is appropriate, many jurisdictions have concluded that traditional public hunting in urban areas is effective, economical, efficient and acceptable (Kansas Wildlife & Parks 2001; Montana Fish Wildlife & Parks 2004; Northeast Deer Technical Committee 2008).

In areas proposed for urban hunting, there will be a substantial human population and related developments (buildings, houses, schools, parks, commercial areas) with many associated safety concerns and considerations. Traditional public hunting, as prescribed in the provincial hunting regulations, may not have sufficient controls to mitigate the public safety concerns. Controlled hunts offer an option of utilizing the benefits of hunting in a more rigorously managed way, thereby addressing both residents' safety concerns and achieving management goals.

Urban hunting versus rural hunting

Although urban ungulates are more habituated than their wild cousins, ungulates are a prey species, and will quickly learn when they are being hunted rather than being viewed for pleasure. This means that hunting in urban areas may provide a different degree of hunter success than what might be expected. Incentives to stimulate interest in urban hunting and restrictions on hunting activities may both be required to meet the management challenges associated with urban hunting.

Hunters wishing to participate in urban hunts may be expected to: pass shooting proficiency tests; undergo extra safety training; attend pre-hunt seminars; agree to pre-hunt interviews; meet mandatory check-in and check-out requirements; meet residency requirements; have a specified number of years of hunting experience; and be required to register any specialized equipment (Kilpatrick *et al.* 2004; Creacy 2006; Kilpatrick and LaBonte 2007; Williams *et al.* 2008). An example of a pre-hunt interview and hunter screening is provided in Kilpatrick *et al.* (2002).

Designing management strategies for urban hunts may include a variety of options or incentives such as: inviting each homeowner in the treatment zone to participate; providing an opportunity to earn a bonus additional either sex tag (includes a buck harvest) by the prior harvest of 2 (or 3) antlerless deer; offering a 2 deer either sex bag limit; higher or unlimited bag limits; providing an opportunity to harvest additional antlerless deer if the meat is donated to a food bank; providing for special opportunities to youth or disabled people; or the opportunity to enter a lottery if only a designated number of hunters is allowed (Kilpatrick *et al.* 2002; Kilpatrick *et al.* 2004; Creacy 2006, Kilpatrick and LaBonte 2007; Williams *et al.* 2008).

Changes to the hunt design itself may include: designated hunting areas or hunting lanes; extending the season; restrictions for weekdays or weekends; hunting in short intense bursts (2 days) followed by

periods of inactivity (5 days); restricted hunting hours; high hunter densities; use of crossbows outside of archery seasons; use of archery only; use of elevated blinds only; allowing hunting from elevated stands; allowing hunting over bait; or restricting locations where field dressing occurs (Kilpatrick *et al.* 2002; Kilpatrick *et al.* 2004; Creacy 2006, Kilpatrick and LaBonte 2007; Williams *et al.* 2008).

Some of these changes appear to increase the odds in favour of the hunter and may even appear unsportsmanlike - for example hunting over bait, which improves harvest opportunities by increasing the hunter's ability to position the deer for better shot placement, shooting safety and hunter success. Kilpatrick *et al.* (2002) describes a combined shotgun-archery hunt, where 92% of the local deer herd was removed by shooting from elevated tree stands placed so that no patch of cover remained unoccupied by hunters. Hunters, wildlife managers and community residents need to remember that the management objectives of an urban hunt generally include the removal of as many antlerless deer as possible, and may not necessarily include any or all of the elements of a fair chase hunt.

Hunters may need to be educated on hunting strategies to ensure that wariness among remaining ungulates is not substantially increased during the hunt, thus making their ultimate removal more difficult. This includes definitions of when to harvest given proximity of other animals to the target individual and ammunition restrictions (2 or 3 rounds/tag) that force clean shot opportunities (Williams *et al.* 2008).

In some jurisdictions there is a requirement to physically tag each dead animal prior to the next shot. With this requirement, it is impossible to shoot all the animals present in a group, even if they remained unalarmed after the first shot. The concept of tagging after shooting is rooted in the ethos of hunting, fair chase and the equitable sharing of game amongst all hunters, which are not necessarily important factors in urban hunts (Shissler 2007).

Requirements to wear fluorescent orange safety gear in urban areas deters some hunters as they feel very conspicuous in urban environments, which decreases their hunting experience (Shissler 2007).

Hunter densities may be higher in urban controlled hunts than rural hunts. Because of the differences in hunter comfort levels, hunt guidelines and hunter densities must be made clear to hunters during the hunter selection process (Kilpatrick *et al.* 2002).

Population demographics of urban deer are different from populations of hunted deer which may also impact hunt strategies. DeNicola *et al.* (2008) report on studies of urban deer demographics in 3 communities and found that sex and age structures are fairly uniform and predictable. There were consistent findings of 60% females and 40% males in urban unhunted populations. These deer populations were comprised of ~40% yearling and adult females, ~20% yearling and adult males and ~40% fawns. In hunted deer populations, adult female to adult male ratios of 3:1 or even 6:1 may occur due to removal of bucks through hunting (VerCauteren and Hygnstrom 2000).

Description

Traditional hunting methods of location, pursuit, and shooting of ungulates is carried out using firearms (rifles or shotguns) or archery equipment (traditional bows, compound bows and crossbows). Methods to enhance hunter success may be used such as hunting over bait or hunting from elevated stands.

Equipment

Urban hunting may be implemented through the use of both firearms and archery equipment, or may be restricted to one or the other. Traditional archery uses a recurve or long bow, and modern archery equipment consists of a compound bow or crossbow. Using firearms is more efficient, but may not be practical in all situations.

Firearms

Where legal, rifles are the preferred weapon, but in some areas the use of shotguns rather than high velocity rifles may be more appropriate due to the more limited effective range of the weapon (Kilpatrick *et al.* 2002). Shotguns equipped with rifled gun barrels and rifle sights or scopes can help ensure more accurate shot placement and efficiency. Shotguns with slugs should be used (DeNicola *et al.* 2000). Noise suppression for rifles is critical because all deer in a group can be removed without allowing any to escape and become more educated. Muzzle loading rifles of .44 calibre or larger do not lend themselves to urban hunting. The limitations of one shot, the time and movement required for reloading and the smoke and odour associated with black powder and back powder substitutes all contribute to increasing education of ungulates to hunters.

Archery

The use of archery in urban hunting provides a relatively discreet, non-disruptive and silent way to implement a population reduction. It may be perceived as safer because of the limited shooting range and the tendency to shoot from elevated blinds thus ensuring a safe backdrop to the shot (DeNicola *et al.* 2000). In areas where firearms discharge is not permitted, it may be the only option available. Individual animals are less vulnerable to archery equipment and are more likely to learn avoidance behaviours through exposure to archers due to increased movement, reduced range and inability to remove all animals in a group at once (Shissler 2007).

Archery is less efficient at reducing ungulate density than firearms because of the lower success rate (Creacy 2006). Seasons may need to be longer to accomplish the same amount of population reduction. Archery hunters are among the most skilled hunters who have deliberately chosen archery to increase the hunting challenges, but archery equipment is less efficient. Animals at 50 metres are out of reach for archery equipment, but not for firearms. Kilpatrick and LaBonte (2007) discuss the technological advantages of crossbows over traditional archery equipment, including scopes, mechanical releases, and pre drawn arrows that are mechanically held. Crossbows are more powerful than traditional bows, resulting in greater arrow speed and slightly greater effective range. These advantages may increase hunter efficiency through increased range, accuracy and precision of arrow placement.

Archery is perceived to have higher wounding rates and increased travel time and distance (up to 100 metres) by ungulates before they succumb to their injuries (Kilpatrick and Walter 1999; DeNicola *et al.* 2000). Pedersen *et al.* (2008) report on wounding rates using modern compound bow and crossbow archery equipment over an 8 year period. During this period, 908 deer were shot and 746 deer were recovered, corresponding to an 18% wounding rate and ~1 deer recovered for every 1.4 shots taken. Wounding rates of 17% (Kilpatrick and Walter 1999) and 14% (Suchy *et al.* 2002) have been reported using modern equipment. Reports prior to 1987 do not reflect material and design improvements characteristic of modern archery improvements.

Efficacy

Hunting is an effective way to reduce ungulate population numbers, where hunter participation is adequate and access to land can be assured, but there are constraints which impact the efficacy of urban hunting as a management tool. If the population reduction is effective and populations decrease: hunters may not see enough animals to want to continue; fawn recruitment could increase quickly; hunter success drops thus lowering hunter participation; and people who see less animals may advocate for the program to stop even if damage levels are still the same. In urban areas there are often frequent pockets of ground that are "off limits" to hunters, thus offering refuge for ungulates, and the animals may become quickly educated to hunter presence, hampering future management efforts for targeted populations (Kilpatrick *et al.* 2004; Shissler 2007; Williams *et al.* 2008).

Kilpatrick *et al.* (2002) report that gun hunters removed deer with 38% less effort than archers with a combined removal rate of 4.5 deer/day. High hunter densities, issuance of unlimited antlerless tags and active disturbance of cover contributed to the success of this hunt.

Kilpatrick and Labonte (2003) report that where deer densities were reduced by 25%, residents experienced a 24% reduction in damage, and where deer densities were reduced by 92%, residents experienced a 47% decrease in damage.

To increase hunt efficacy, Kilpatrick and Lima (1999) and Kilpatrick *et al.* (2002), in an archery only hunt and a combined shotgun-archery hunt, recommend using a series of short intense hunt periods separated by periods of no hunting in order to decrease deer responses to hunting pressure and increase vulnerability during the hunt.

As part of a 3 year deer removal program, Doerr *et al.* (2001) report no substantial changes in the deer population until the third year when there was a 46% drop in deer numbers, but report that vehicle collisions declined after the second year.

Logistical constraints

Appropriate safety zones for gun hunters and archery need to be maintained, entailing planning considering property sizes and layouts. Some areas will need to be closed to the public during hunts.

DeNicola *et al.* (2000) report that when lethal control is used, there is always the potential for intervention or interference by activist groups. Sites may need to be assessed and patrolled to minimize ingress by protestors, and costs for security should be factored into project costs.

Access to private land restricts the amount of available land that can be included in an urban hunt. Kilpatrick *et al.* (2007) discuss ways that hunters could increase their access to private land including completing a certified safety course, offering to field dress deer off-property, and expressing a willingness to address landowner concerns relative to where, when and how hunting may occur.

Legal issues

Municipal and provincial regulations governing hunting would have to be amended prior to implementation of hunting in urban areas.

Permit requirements

Appropriate permitting would need to be developed prior to implementation of hunting in urban areas.

Cost

Hunting is generally considered cost effective because hunters provide much of the labour for animal removal with little public expenditure. Costs incurred are mostly administrative, and small revenues may accrue through license fees. Project security costs, if required, should be factored into project planning.

- Creacy (2006) reports estimated costs of $75 to $100 USD per hunted deer for support staff wages, administration and equipment.
- Morton and Lester (2004) estimated that for the Magrath AB quota hunt, additional costs above and beyond normal area operating costs were incurred for gas, equipment, advertising and personnel expenses at a cost of ~$3100 or $19 (2004) CDN/deer.
- Doerr *et al.* (2001) reports costs for a controlled hunt as $117 (1994) USD/deer.
- DeNicola *et al.* 1997 reports costs/deer for controlled hunts of $160 (1996) USD; $622 (1994) USD; and $200 (1995) USD.

Human health and safety concerns

Required hunter training and proficiency skill tests may help to relieve safety concerns.

Kilpatrick *et al.* (2002) and Kilpatrick and LaBonte (2003) report that no hunting accidents have occurred in urban deer hunts in the United States with hunter densities ranging from 2.9-11.2 hunters/km^2.

Kilpatrick and LaBonte (2003), reporting on surveys of a community pre and post shotgun-archery hunt, indicate that 2 out of every 3 residents who did not support hunting as a management option before the hunt, indicated afterward that they would support further hunts in their community. These residents

indicated that support for hunting increased because the hunt was safe and effective, and residents' negative perceptions about an urban hunt were not supported by the reality.

In a 3 year program utilizing sharpshooters and controlled hunting to remove ~1400 deer, Doerr *et al.* (2001) reported no accidents or human injuries.

Humaneness

This is difficult to assess. Many people object to recreational sport hunting because it involves killing a sentient animal. Even the best-placed shot to the head resulting in instantaneous death may be considered inhumane to someone who believes that an animal has the right to live. In any hunting situation there is a risk of animals suffering from stress induced pursuit and poorly placed shots resulting in wounding and subsequent escape. Hunting could be considered as the least humane of all the lethal population control options because of the potential for wounding.

Advantages

- Effective at population reduction
- Efficient if using firearms, slightly less if using archery equipment
- Flexible and prescriptive option. Details of how, when, where, by whom, and how many can be adjusted according to localized management needs.
- Specifications can be restricted or liberalized to influence effect on ungulate populations or address public concerns
- Hunting can increase animal wariness and decrease habituation, possibly leading to less animal damage
- Season requirements – timing, days, length of season, and bag limit – can all controlled
- Opportunity for meat to be utilized by hunters or be donated to a food bank

Disadvantages

- Strong public concerns over safety
- Controversial
- Limited hunter access to private lands restricts efficacy
- By its very nature, increases animal wariness making future removal difficult
- May shift damage to areas where hunting is not permitted or where damage was previously low due to low deer densities
- Some lost recreational opportunities for non hunters if recreational areas are closed due to hunting

Sharpshooting

Definition

The systematic culling of ungulates by trained and authorized personnel at multiple pre approved and prepared bait sites during the day or night. Suppressed small calibre rifles are preferred but crossbows with a minimum peak draw of 50 pounds can be used where firearms discharge is not permitted. Protocols specify under what conditions a shot can be taken, ensuring no misplaced shots and that animals are dispatched with a single well placed shot to the head or spine.

Sharpshooting has been successfully used to address small scale deer overabundance issues in a variety of urban situations in the USA (Jones and Witham 1995; McAninch 1995; DeNicola *et al.* 2000; Kilpatrick and LaBonte 2007). Significant numbers of deer can be effectively and discreetly removed in one night (DeNicola *et al.* 2000; Shissler 2007). A variety of techniques can be used to maximize safety, humaneness, discretion, and efficiency (DeNicola *et al.* 2000). Sharpshooting can be employed in areas where there is insufficient undeveloped land for controlled hunting. Projects can be implemented with little disturbance to local residents if sound suppressed firearms are used. Properly designed sharpshooting projects can be efficient, safe for humans and effective (Shissler 2007).

Description

Variables in a sharpshooting project include: types of weapons used; shot specific protocols; selectively removing females if desired; day or night shooting; and use of spotlights or night vision goggles.

Using bait sites to facilitate sharpshooting projects means that shooting areas can be well defined, controlled and blocked off for safety considerations. Bait sites are selected to maximize efficiency and safety at a density of ~2 bait sites/km^2. Approximately 3 weeks are required for deer to pattern well on bait sites. Whole kernel or shell corn is used at ~0.5 to 1.0 kg/deer per site, or an amount sufficient so that most is consumed by the next visit. Different sites will use different amounts. Bait should be spread around the area, not piled. The site should be visited once every 3 days until the sites are well used and then visited every other day. Baiting should be as inconspicuous as possible (Shissler 2007 and DeNicola *et al.* 2008) and continued until deer are well patterned onto the bait site.

Shooting takes place from stopped vehicles, elevated locations, tree stands, or ground blinds, and during the day or at night. Shots are taken only when there is a known earthen backstop, either through topography or the shooters' relative elevation. Shots are taken only when there are no humans in the zone. Shots are not taken unless clear brain or spine shots can be achieved. Deer are shot on a first opportunity basis with antlerless deer being the first priority. Deer are not removed in the bush, at random locations or while moving. There are several specialized weapon systems available, based upon maximum shooting range, acceptable noise, proximity to homes, and deer abundance (White Buffalo 2009). Small caliber centre fire rifles are most effective, and are safe under controlled conditions.

Unhunted urban deer are very naïve to gunshots and reluctant to flee from a bait site, increasing their vulnerability and the efficiency and effectiveness of sharpshooting (DeNicola *et al.* 2008). The challenge is to continually remove deer without educating those that remain, rendering them less vulnerable. To prevent education and to maintain deer naïve behaviour, it is important to take only shooting opportunities when all animals present at a bait station can be removed at one time (Shissler 2007).

Prior to management actions, suburban deer are quite easy to approach and deer that do not readily exhibit alarm behaviour can be effectively and efficiently managed. Sharpshooting is difficult to implement after a public hunt, as deer are much more wary and subsequent techniques like tree stands are compromised (White Buffalo 2009).

The efficiency of sharpshooting projects can be increased with the selection of sharpshooters based on experience, efficiency and training (Doerr *et al.* 2001; Creacy 2006). If contractors are used, caution should be exercised in the manner of payment. Payments should not be based on simply a time and per deer removed basis, as a quick removal of many deer in an improper way could educate remaining deer making the next phase of the project more difficult. Rather, contracts should be multi-year and payments tied to successful achievement of quantitative deer program goals and an independent compliance and effectiveness monitoring program (Shissler 2007). Carcasses should be processed in closed facilities and the meat is generally donated to local charities for distribution.

For detailed descriptions of sharpshooting projects refer to Doerr *et al.* (2001); DeNicola and Williams (2008); DeNicola *et al.* (2008). An example of sharpshooting protocols is provided on the White Buffalo Inc. website <http://www.whitebuffaloinc.org/Sharpshooting%20Protocol.pdf>.

Efficacy

Sharpshooting is an effective localized tool. DeNicola *et al.* (2008) report on a project where up to 90% of a deer population was removed in one year. DeNicola and Williams (2008) report on sharpshooting projects in 3 locations where deer populations were reduced by 76%, 72% and 54% and deer vehicle collisions were reduced by 78%, 75%, and 49% respectively.

Logistical constraints

Appropriate safety zones for shooters and archery need to be maintained, entailing planning considering property sizes and layouts. Some areas will need to be closed to the public during hunts.

DeNicola *et al.* (2000) report that when lethal control methods are used, there is always the potential for intervention or interference by activist groups. Sites may need to be assessed and patrolled to minimize ingress by protestors, and costs for security should be factored into project costs.

Sharpshooting projects with short and specific removal periods are easier to disrupt by objectors.

Legal issues

Individuals undertaking sharpshooting projects must have the authority to do so in accordance with all provincial legislation.

Permit requirements

Appropriate permitting would need to be developed prior to use of sharpshooting.

Cost

Staff time required for implementation and monitoring adds to project costs

- Shissler (2007) reports costs of $100 to $350 (2007) USD/deer using contractors.
- White Buffalo (2009) reports $150 to $400 (2009) USD/deer.
- Hickman (2004) reports costs of $100 to $600 (2003) USD/deer for projects in New Jersey (including butchering of the meat).

Human health and safety concerns

Human safety is ensured by shooting only when there is a known earthen backstop created through the shooters' relative elevation or topography and a clear line of vision.

Hickman (2004) reports no injuries across the USA attributable to sharpshooting projects.

In a 3 year program utilizing sharpshooters and controlled hunting to remove ~1400 deer, Doerr *et al.* (2001) reported no accidents or human injuries.

Humaneness

This is difficult to assess. Many people object to any activity that involves killing a sentient animal. Even the best-placed shot to the head resulting in instantaneous death may be considered inhumane to someone who believes that an animal has the right to live. In any shooting situation there is a risk of animals suffering from poorly placed shots resulting in wounding and subsequent escape. Sharpshooting can be considered more humane than hunting because of the strict protocols regarding shot placement and timing which should result in much less wounding or escape.

Advantages

- Very structured option – can be implemented under strict protocols
- Opportunity for uniformed staff, such as Parks Officers or Conservation Officers, to implement these interventions therefore they may be perceived as safer by the public
- Can use tools not normally authorized in hunts, such as bait or spotlights to improve efficiency
- Quick
- Effective at population reduction
- Efficient

- Flexible and prescriptive option. Details of how, when, where, by whom, and how many can be adjusted according to localized management needs.
- Specifications can be restricted or liberalized to influence effect on animal populations or address public concerns
- Opportunity for meat to be donated to a food bank
- Little disturbance to local residents if sound suppressed firearms are used

Disadvantages

- Strong public concerns over safety
- Controversial
- In areas where hunting could occur, sharpshooting could be a source of conflict if hunters felt their access to a resource was denied
- May shift damage to areas where sharpshooting is not permitted or where damage was previously low due to low ungulate densities
- Some lost recreational opportunities for the general public if recreational areas are closed due to sharpshooting

Comparisons of cost and efficiency for various lethal control or capture and relocation projects

	Deer removed	Total person hrs	Person hrs per deer	Kms driven	Bait costs	Equipment costs	Cost /deer (1983 USD)
Shooting over bait	34	458	13.5	2642	$105	$360.00	$73.95
Dart gun	6	123	20.5	1610		$395.75	$179.05
Drive net	5	395	78.9	1264		$994.00	$523.02
Fence net	3	77	25.7	402			$112.79
Clover trap (5)	2	88	43.9	2074	$31.50	$492.00	$569.77
Rocket Net	0	51		732	$33.60	$1100.00	

Excerpted from Ishmael and Rongstad (1984) Capture techniques included relocation costs. Shooter wages = $3.95/hr

	Hunting effort (hrs)	# deer harvested	Person hrs per deer	Deer harvest rate (deer/hr)	Cost/deer (1993 USD)
Controlled hunting (larger parks)	7115	230	30.9	0.03	$117
Sharpshooting (urban)	890	645	1.4	0.47	$194
Opportunistic sharpshooting	997	355	2.8	0.23	$121
Sharpshooting (regional park)	744	212	3.5	0.49	$355

Excerpted from Doerr *et al.* 2001. Sharpshooting was carried out by uniformed officers; either police, Conservation Officers, or Park Rangers. Costs included shooter wages, admin wages, bait, equipment.

	Days of effort (in the first 2 yrs of project)	# deer killed	# deer killed per day
Iowa City, Iowa	31	700	22.5
Princeton, New Jersey	42	625	14.9
Solon, Ohio	77	1002	13.0

Excerpted from DeNicola and Williams (2008). Deer were removed by sharpshooting over bait.

Natural Predator Reintroduction

Definition

The reintroduction of natural predators into urban environments as a means of controlling ungulate populations and minimizing human involvement in urban ungulate management

Description

This option is intended to restore natural ungulate predators to an area in an attempt to re-establish the equilibrium in a predator-prey environment, and may be suggested by stakeholders and the general public as a more "natural" way to control overabundant ungulate populations.

A complement of effective predators can maintain ungulate population stability in natural environments. However, predator-prey relationships are highly variable and complex and tend to stabilize populations at relatively high densities. Wolves and cougars are efficient deer predators, but not likely to be tolerated in urban areas. Coyotes, lynx/bobcats and bears are potential deer predators. They are opportunistic and capitalize on specific periods of deer vulnerability, but none of these predators have demonstrated a consistent ability to control deer populations. In ecosystems where coyotes, lynx/bobcats and bear are present, both deer BCC and deer CCC are often exceeded.

Coyote populations have increased dramatically and their range has expanded often simultaneously with deer. Coyotes are the only medium sized predator species whose presence may be considered marginally tolerable by humans in urban ecosystems. Both coyotes and deer can exceed CCC in the same urban ecosystem, therefore demonstrating that coyote predation alone cannot control urban deer populations. Additionally, coyotes in high numbers may themselves be of concern to urban residents.

Predator reintroduction has been discussed (but never approved or implemented), in Kansas Department of Wildlife & Parks (2001); Hickman (2004); Creacy (2006); and Northeast Deer Technical Committee (2008).

Efficacy

Unknown – never implemented.

Logistical constraints

Appropriate predator densities and safe release locations are difficult to predict.

Legal issues

There are potential liability issues should reintroduced predators cause damage or human injury.

Permit requirements

Permits would likely be required for the capture and relocation of any predator species.

Cost

Unknown – never implemented.

Human health and safety concerns

Increased predator numbers would pose safety concerns for humans and pets.

Humaneness

This option may be perceived by the public as humane because it is more “natural”.

Advantages

- Potential for the conflict to be managed without human intervention
- May be perceived as more “natural”

Disadvantages

- Unproven
- Safety concerns for humans and pets
- For predator populations to have a noticeable effect, the populations would be too high for human or pet safety
- Impractical
- High human densities preclude suitable habitat for large predators

Fertility Control

Definition

The use of a contraceptive drug, vaccine, or sterilization to reduce the fertility rate of a population so that it is less than or equal to its mortality rate

From the perspective of population dynamics, infertility agents are best suited for management of short lived fecund populations such as small birds and rodents (Nielsen *et al.* 1997; Dolbeer 1998; Fagerstone *et al.* 2006), however, there is an active field of academic research on contraception for long lived species. Most of the academic literature on fertility control in ungulates concentrates on white-tailed deer, although there are some studies on black-tailed deer, elk and bison. It is important to distinguish between applying fertility control methods to ungulates in captive studies, versus small enclosed herds, versus achieving fertility control in the routine management of free-ranging ungulate populations.

Achieving fertility control in captive deer or in small scale field experiments may or may not be an accurate predictor of the success of fertility control at the population level in a free-ranging deer herd (Warren 2000, Rutberg *et al*. 2004, Merrill *et al.* 2006; Gionfriddo *et al*. 2009).

Maintaining large free-ranging populations with contraception may be accomplished with a long lasting contraceptive, and reducing the overall population numbers can be difficult but potentially achievable over time. Rutberg and Naugle (2008) report on the long term population effect of a PZP vaccine used in Gaithersburg, Maryland, and Fire Island National Seashore, New York, which demonstrate 27% and 58% population density declines, over 5 and 9 years respectively. They conclude that depending upon vaccine efficacy, accessibility of deer, and site-specific birth, death and immigration/emigration rates, a contraception program can significantly reduce population size in a free ranging population.

Description

There are four potential methods of fertility control for urban ungulate populations.

1. **Surgical sterilization**

   This requires individual animal capture and administration of drugs and surgery. It is expensive, labour intensive, highly stressful for the animal and is a mostly impractical treatment option, which might only be considered if there were specific management objectives for a particular individual or for a closed population. There is one well documented study in the literature (Mathews *et al.* 2005).

2. **Synthetic steroid hormones**

   This treatment requires oral exposure to synthetic hormones (progestins and estrogens) at frequent (daily or weekly) intervals (similar to the human birth control pill) thereby preventing ovulation. The possibility of consumption of hormone-treated bait by non-target

animals poses a concern. No drugs utilizing this treatment have been approved for routine operational use either in Canada or in the USA.

3. **Immunocontraception**

   This treatment relies on the administration of a vaccine that prevents conception by causing the immune system to initiate antibody production against proteins and hormones essential for conception. It has been the most widely researched fertility control treatment method for long lived mammals. Immunizations against Porcine Zona Pellucida and Gonadotropin-Releasing Hormone have been used to successfully control reproduction in ungulates. There are three main formulations of immunocontraceptive drugs:

   GonaCon™ vaccine. This was developed by United States Department of Agriculture (USDA), Animal Plant Health Inspection Services (APHIS), Wildlife Services Program, National Wildlife Research Centre. In September 2009, GonaCon™ was registered for routine operational use in white-tailed deer in the USA under the Environmental Protection Agency. It remains unregistered in Canada.

   PZP vaccine. This was developed by the University of California, Davis, California; the Science and Conservation Center, Billings, Montana; and the Humane Society of the United States. This drug is not registered for routine operational use either in Canada or the USA.

   SpayVac™ PZP vaccine. This was developed by TerraMar Environmental Research Ltd., Sidney, BC; ImmunoVaccine Technologies Inc., Halifax, NS; and Dalhousie University, Halifax, NS. This drug is not registered for routine operational use either in Canada or the USA.

4. **Contragestation**

   In this treatment, does are remotely injected with the contraceptive agent via biobullet delivered from a modified air rifle. This treatment interferes with implantation of the fertilized egg and/or causes abortion of an already implanted fetus. Late-term fetal abortion and fetal cannibalism, although not uncommon in untreated herds, would likely be offensive to the public. No drugs utilizing this treatment have been approved for routine operational use either in Canada or in the USA.

Fertility control to address wildlife disease transmission

Disease transmission can be a function of wildlife population density. Fertility control methods which lower population numbers and also reduces or eliminates reproductive behaviour (only GonaCon™ to date) could be used to minimize contact between individuals, therefore lessening disease transmission by traditional oral, pulmonary, venereal and nasal routes. A disadvantage is that there can be an influx of healthy animals back into the diseased population, with subsequent quick population rebounds, negating any initial population reduction.

Species and diseases where this technique may have potential include brucellosis control in elk and bison; bovine TB control in white-tailed deer, elk and bison; and chronic wasting disease in white-tailed deer (Miller *et al.* 2004; Killian *et al.* 2007; Killian *et al.* 2009).

Efficacy

Contraception has been achieved in the following species under a variety of conditions; captive animals, small enclosed herds and free ranging herds.

	WTD	BTD	Fallow deer	Elk	Domestic sheep	Bison	Feral horses
GonaCon™	yes	yes		yes		yes	yes
PZP vaccine	yes			yes	yes		yes
SpayVac™ PZP	yes	yes	yes				

However, achieving fertility control in a population, as opposed to achieving contraceptive control in individual animals, is much more complex and is dependent upon whether the population is open or closed, the initial population size, sex ratios, age structure, proportion of females to be treated, incidence of non-responders among treated does, increased survival of treated does, and estimated fertility and mortality rates (Gionfriddo *et al.* 2009).

Determining efficacy in a population firstly requires the establishment of treatment goals. For a fertility control program these goals might include: 1) significantly reduced (or even zero) population growth; 2) a reduction in total population numbers; and 3) establishing a target population figure. Using immunocontraceptive drugs, these goals may be achievable, but the length of time required for such strategies to achieve adequate control may be considerable. In the meantime, if no other management options are taken to reduce the population density, ungulate-caused damage continues at the same level. Consequently, many researchers conclude that reducing the size of a deer population to an acceptable level is more effectively achieved through culling first, and then maintaining the population at the desired level through contraception (Hobbs *et al.* 2000; Conover 2002; Gionfriddo *et al.* 2009).

Logistical constraints

Contraceptive products for use in free ranging wildlife populations must be practical to use, safe for the treated animal, and present little risk to humans, non-target animals and the environment. Despite great advancements, there are still many technical, biological, economic, health and legal issues to be overcome prior to wide field use.

Rudolph *et al.* (2000) have documented cost and effort to capture and administer PZP vaccine to deer, showing that significant effort (cost and time) is required. Repeated exposure to capture increases animal wariness, making it very difficult to treat the sufficiently high proportion of a herd required for successful population control. If remote delivery is possible, development of longer-range darting technologies should increase injection efficiency (Rutberg *et al.* 2004).

Population level studies are ongoing to determine what proportion of a free ranging herd must be treated to achieve a significant population effect. Depending on herd health, population density, and project goals, estimates range from 50% to 90% of reproductive does (>1 year of age) in a population

must be treated to meet project goals (Swihart and DeNicola 1995; Hobbs *et al.* 2000; Rudolph *et al.* 2000; Walter *et al.* 2002).

New, untreated immigrants to the area may quickly lessen the fertility control program effectiveness.

Regulatory requirements for fertility control drugs use under experimental protocols state that each animal must be marked to identify that the animal is not fit for human consumption. This marking requirement increases the operational complexity of a fertility control project.

Licensing for operational use - immunocontraception

USA. A recent agreement between the Food and Drug Administration and the Environmental Protection Agency (EPA) in the United States has changed the regulatory authority of animal contraceptives. Reproductive inhibitors for use in wildlife and feral animals are now regulated under the EPA. GonaCon™ was registered for routine operational use in white-tailed deer in the USA in September 2009. The GonaCon™ product label requires annual injections if sterility is desired for >1 year. The label requires hand injection, so deer must still be captured, although ear tagging is no longer required.

PZP vaccine and SpayVac™ vaccine remain unregistered, and approval for experimental use must be obtained on a case by case basis.

Canada. Fertility control drugs for use in wildlife populations in Canada must be registered and approved through the Veterinary Drugs Directorate of Health Canada. Currently, there are no fertility control drugs approved for use in ungulates, nor are there any new drug submissions pending.

It is possible for a fertility control drug that is approved in another jurisdiction (e.g. USA) to be approved for use on an experimental basis in Canada using an Emergency Drug Release application or an Experimental Study Certificate application to the Veterinary Drugs Directorate. Several ungulate fertility control research projects in BC have had the SpayVac™ vaccine approved for use in this manner.

TerraMar Environmental Research Ltd., located in Sidney, BC, has worked on the development of the SpayVac™ vaccine, which has been tested on fallow deer and black-tailed deer in Canada and white-tailed deer in the USA. Registration efforts for SpayVac™ are concentrated in the USA, and directly primarily towards use with wild horses. Registration for use in deer populations may be subsequently "tagged on" to a registration for horses.

Cost

The cost of the immunocontraceptive vaccine itself is relatively in expensive ($24/dose/deer: Walter *et al.* 2002; $50/deer: Locke *et al.* 2007). The main cost of a fertility control project is associated with the cost of capture and vaccine administration, particularly if the animal is to be marked for future identification or non consumption. Should the marking/identification requirement be lifted, these

treatment costs will be considerably reduced. However, for drugs that require a booster injection, it still may be necessary to mark treated deer, differentiating them from untreated deer still requiring injection.

Walter *et al.* (2002) reported on costs for a two shot spring-fall protocol to treat 30 white-tailed deer for 2 years. Labour for capture and handling of individual animals for treatment and marking comprised the majority of the project costs (64%), with the remainder comprised of supplies (13%), equipment (11%), lodging (9%), and travel (3%) for a total cost of $33,833. The cost was $1,128 (1999) USD/deer. Locke *et al.* (2007) reported costs for capture and single shot vaccination of white-tailed deer at $350 (2004) USD/deer.

Human health and safety concerns

Human health and safety concerns are minimized due to regulatory approvals necessary prior to use and strict protocols for field use. The major concerns are accidental exposure to the vaccine via a lost or poorly aimed dart, and consumption of meat from a treated animal. However, both of the PZP vaccines, the GonaCon™ vaccine and the antibodies produced are simple proteins, and are broken down into harmless amino acids in the gastrointestinal tract when consumed; therefore there is no accumulation in the food chain. The adjuvant used to enhance the vaccine's reproductive effects is also studied and approved as part of the new drug registration process. Synthetic steroid hormones which have the potential to accumulate in the food chain and could have secondary effects on humans need to have treatment withdrawal time guidelines established prior to human consumption.

Humaneness

Because fertility control works by decreasing birth rates rather than by increasing mortality rates, it is perceived by the public as more humane and morally acceptable than lethal population control methods.

Application of immunocontraceptives via dart gun is the most practical form of application to be used for a free ranging herd. Some studies have found minor lesions or granulomas at the dart or injection site, but this method of application is generally viewed as stress free for the animal with no adverse health effects of the treatment on the treated individual (Miller *et al.* 2001; Killian *et al.* 2006; Gionfriddo *et al.* 2009; Miller *et al.* 2009).

Risks to non-target animals

Dart, injection or biobullet delivery systems pose low risk of exposure for non-target species. Current regulatory approvals and field protocols do limit the risk of accidental exposure. Synthetic steroid hormones administered in oral baits, have a higher risk of unintentional ingestion by non-target animals. Some steroidal compounds can accumulate in body tissues and could have a secondary effect on predators.

Health effects on target animals

	PZP vaccine or SpayVac™ vaccine	GonaCon™ vaccine
Duration of contraceptive effect	WTD – contraception rates of 80% over 5-7 years (Miller *et al.* 2009) Single dose formulation is available. Other formulations may require booster injections.	WTD – efficacy of 80-100% for up to 5 years (Killian *et al*. 2008) Single dose formulation is available. Other formulations may require booster injections. Label requires annual doses.
Reversibility	Reversible when antibody levels decline	Reversible when antibody levels decline
Delivery method	Hand injection, darting, biobullet	Hand injection, darting, biobullet
Behaviour	If the female does not become pregnant, she will undergo repeated estrous cycles, resulting in extended breeding seasons, increased mating activity, and increased deer movements across the landscape, with subsequent increased physiological stress, which may be somewhat negated by lack of pregnancy.	Affects breeding and social behaviour by reducing sexual activity of both sexes Aggression in male ungulates may be reduced, due to immunological castration. Social hierarchy of treated population during the breeding season may be different than untreated populations, but during the non breeding season it may be the same.
Reproductive behaviour	Increases the number of times an animal comes into estrus; breeding season is prolonged, with increased risk of late summer or autumn births.	Does do not come into estrous in the fall Bucks exhibit early antler loss, retention of velvet, absence of antler hardening, abnormally small antler growth, smaller testes and reduced neck musculature
Toxicity	No information found	Accidental revaccination study (3 injections 2 weeks apart) did not pose a serious threat to health (Killian *et al.* 2006)
Animal health	No injection site reactions (Miller *et al.* 2009) No pathological changes resulting from PZP immunization (Miller *et al.* 2001)	No significant contraindications or toxic effects, aside from granulomata formation at injection site (Killian *et al.* 2006; Gionfriddo *et al.* 2009) Bucks not recommended for treatment (Killian *et al.* 2006; Curtis *et al.* 2008)
Increase in home range or DVC due to increased movements over the landscape	No evidence that PZP treatment affected dvc rates (Rutberg *et al.* 2004) WTD females demonstrate high fidelity to their home range (Rutberg *et al.* 2004) Range and movements of PZP treated WTD does were slightly larger than control does, but not significantly different (Hernandez *et al.* 2006) PZP treated does did not differ in risk of death from dvcs compared to control does (Rutberg and Naugle 2008)	No concerns raised

Advantages

- Ungulate birth rate is reduced
- Popular concept, favoured by public, perceived as humane
- Is a rapidly advancing technology, which may prove useful in the future

Disadvantages

- There are no fertility control drugs currently approved by Health Canada for routine operational use in Canada. Site specific approval is required for experimental use. In the USA, GonaCon™ is approved for use in white-tailed deer, but PZP vaccine and SpayVac™ vaccine are not approved for routine operational use.
- Expensive treatment due to high costs for capture and identification requirements
- Time and effort required to treat sufficient individuals to achieve the desired population control reduces the cost efficiency of the treatment
- Does not address the problems/damage caused by the population at its existing level
- Relies on natural mortality causes (disease, predation, vehicle collisions, and emigration) which are generally reduced in an sheltered, urban population, to achieve a reduction in the original population
- Under the best circumstances, there would be a time lag of several years (if ever) before population numbers and impacts would be reduced to any noticeable level
- Successful control is contingent on repeated treatments of large proportion (70-90% of female animals)
- Some fertility control drugs require an initial treatment and a booster treatment thereafter
- Although long term research results are beginning to be published, most methods are still unproven at the population level
- The state of fertility control technology lags far behind public expectations for this technique to be a reasonable alternative to lethal control

Major hurdles include:

- Development of cost effective delivery systems and effective products
- Public and natural resource agencies acceptance of this technique
- Commercialization of vaccines or baits
- Government approval
- More research into population level efficacy

Summary of Population Reduction and Fertility Control Options

Method	General Public Safety	Animal Humaneness	Efficacy	Relative Cost	Social Factors	Legal Issues
Trap and relocate Ungulates are baited, trapped and moved outside the city	Possibility of people or pets encountering traps, nets or unused/lost darts containing chemicals	High stress resulting from capture and relocation High mortality after release (BC experience with elk and Manitoba experience with WTD does not show high mortality after release)	Population and damage will be reduced Animal wariness may increase with each subsequent trapping effort	Expensive due to high cost of animal capture, transport, possible collaring and subsequent tracking Reported costs range from $352 USD/deer (2000) to $800 USD/deer (2002)	Generally favoured by the public Not controversial	Non-government staff require a permit to handle/possess/ transport wildlife Government staff require approvals from Region or Branch for relocation projects
Trap and euthanize Ungulates are baited, trapped and dispatched with bolt guns by COs, police or contractors	Possibility of people or pets encountering traps, nets or unused/lost darts containing chemicals	High stress resulting from capture Stress duration is short, with a goal of painless and quick death	Population and damage will be reduced Animal wariness may increase with each subsequent trapping effort	Expensive due to high cost of animal capture. $250 USD/deer (2009 Helena, MT) Moderate labour costs if COs or police are used, expensive if contracted out	Generally not favoured by the public Controversial	Non-government staff require a permit to handle/possess/ transport wildlife Government staff require approvals from Region or Branch for trap and euthanize projects
Sharpshooting Ungulates are baited, and shot by COs, police, or contractors	Possibility of collateral human injury during the process, however strict shooting protocols would be in place	Possibility of poor shot placement and subsequent animal injury and suffering, however strict shooting protocols are in place	Population and damage will be reduced	Moderate if COs or police are used, expensive if contracted out Reported costs range from $150 - $400 USD/deer (2009)	Generally not favoured by the public Controversial	Need for change to city bylaws to allow discharge of weapons

Method	General Public Safety	Animal Humaneness	Efficacy	Relative Cost	Social Factors	Legal Issues
Controlled public hunting Ungulates are shot by recreational bow hunters or rifle hunters that have received enhanced training	Possibility of collateral human injury during the process	Possibility of poor shot placement and subsequent animal injury and suffering	With good hunter success, population and damage will be reduced	Inexpensive, perhaps some small revenue accrues due to license purchase Reported costs range from $20 CDN/deer (2004) to $200 USD/deer (1995)	Generally not favoured by the public Controversial	Need for enhanced monitoring of hunters Need for change to city bylaws to allow discharge of weapons and hunting. Need for change to hunting regulations
Fertility control Ungulates are baited, trapped, ear tagged, and contraceptives administered by dart or hand injection	Animals must be tagged to prevent human consumption or repeat treatments Possibility of people or pets encountering traps, nets or unused/lost darts containing chemicals	High stress resulting from capture, tagging, or injections; minor stress from darting	Proven effective at reducing fertility in individuals Very slow to achieve population reduction in free ranging populations, therefore damage is ongoing	Expensive due to high cost of animal capture and possible annual treatment Capture/single shot vaccination project costs reported as $350 USD/deer (2004) Drug cost is inexpensive ($24-$50/dose/deer)	Generally favoured by the public Somewhat controversial	No drugs licensed for operational use in Canada; permits required for scientific trials GonaCon™ registered in USA for WTD; state approval must be obtained prior to treatment

Administrative Options

Status Quo

"No action" can be considered as a possible management action, and means that no new management interventions would be undertaken. Current response protocols for complaints and damage would be maintained. In an undisturbed environment, ungulate populations grow until they reach the upper population limits that the habitat can support. With few limits on habitat resources, and almost non-existent predation, urban ungulates are living in an artificially created habitat. Further, humans have altered landscapes, manipulated plant communities, displaced large predators, eliminated many native species, and introduced numerous exotic species. Adopting a "hands off" management policy will not return urban areas to more "natural" ecosystems.

Efficacy

Damage still continues across the municipality unless other management options undertaken.

Logistical constraints

There are no logistical concerns associated with this option.

Legal issues and Permit requirements

There are no permitting concerns associated with this option.

Cost

No additional costs incurred by the municipality, but additional costs likely to be incurred by residents.

Human health and safety concerns

There are no concerns associated with this option.

Humaneness

There are no concerns associated with this option.

Advantages

- Generally gradual escalations of damage and costs

Disadvantages

- Both ungulate numbers and negative impacts increase

Implement Project Monitoring

Management goals and measureable responses need to be established prior to the project implementation so that outcomes can be evaluated objectively. In order to monitor a project outcome, baseline data is needed as well as project monitoring during and after management options are implemented. Population data, standardized reporting of complaints and vehicle collisions, documentation (age, sex, health) of any animal removed, and vegetative browse damage assessments in open areas and enclosed plots can all help to determine the effects of management actions and evaluate effectiveness.

Efficacy

Properly monitored projects provide useful results and allow for adaptive management practices as projects proceed.

Logistical constraints

It may be challenging to establish consistent reporting from all agencies involved.

Legal issues

There are no concerns associated with this option.

Permit requirements

There are no permitting concerns associated with this option.

Cost

Some administrative and operational costs will be incurred to implement ongoing project monitoring.

Human health and safety concerns

There are no concerns associated with this option.

Humaneness

There are no concerns associated with this option.

Advantages

- Monitoring will provide information to measure project outcomes.

Disadvantages

- There are no disadvantages to monitoring.

Amend Municipal Bylaws

Municipalities bear the brunt of citizen complaints regarding overabundant urban ungulate populations. Garden and landscaping damage, ungulate vehicle collisions on residential streets, and instances of ungulate aggression are the symptoms of an urban ungulate population that is exceeding its cultural carrying capacity. Municipalities can implement bylaws that complement and enhance more active ungulate population interventions. Ordinances that restrict the feeding or sheltering of ungulates within municipal limits can be implemented. Ordinances that regulate land-use can be developed to include wildlife corridors, green space considerations and riparian zone protection in future development applications. Bylaws that limit the type or amount of certain landscaping plants could be considered. Finally, bylaws regulating the discharge of weapons and hunting may be revisited to allow select use of these tools for urban ungulate control.

Ban ungulate feeding

Many people enjoy feeding ungulates (usually deer) particularly in the winter when conditions may be harsh for animals. However, feeding contributes to artificially high population levels. Supplemental feeding can enhance deer reproductive rates, enhance winter survival, contribute to the collapse of home range size, encourage deer to congregate, and increase the habituation of animals to humans. Education and regulation may help to reduce the number of people who feed ungulates, but wildlife feeding bylaws may be difficult to enforce. A concerted effort is required from the community, law enforcement, and wildlife agencies to discourage this practice.

Regulate land use or types of landscaping plants

Urban landscapes contribute to habitat fragmentation and reduced connectivity for wildlife movement. By requiring ecologically informed land use and development practices through municipal bylaws, ungulate habitat and connectivity corridors may be improved, thus reducing ungulate pressure in both newly developed and previously developed areas. Multifunctional green corridors may allow urban landscapes to be porous to ungulates, rather than attracting them and then habituating them to stay in urban areas. Greenways must be wide enough and complex in vegetative structure in order to retain ungulates within their boundaries. Alternate vegetation selection and management with respect to ungulate palatability may reduce ungulate preference for cultivated plantings and encourage them to move on in search of more natural forage opportunities.

Regulate weapon possession, weapon use and hunting

Communities commonly have local bylaws that regulate, within municipal limits: the discharge of weapons; the possession of weapons commonly used in hunting (firearms and archery equipment); and/or hunting activities. These types of ordinances were frequently written when resident populations of deer in urban areas were almost non-existent, and may not reflect the present needs of a community. Where necessary and appropriate, existing bylaws could be revised to include:

- provisions authorizing the use or possession of particular types of weapons needed under special circumstances
- restrictions on the types of equipment allowed
- restrictions on the techniques that may be used
- provisions authorizing specific individuals to use specific type of weapons during ungulate control activities.

One option for amending municipal bylaws to accommodate deer population control activities is suggested by the Kansas Department of Wildlife & Parks (2001). They list various options for amending municipal bylaws to permit state authorized deer control activities within municipal boundaries. The main consideration is that "deer population control permits" (whatever form these may take - likely different in each jurisdiction) are issued by the state. Consultation and determination of appropriate management action for control of the deer population in question occurs according to existing State policy and procedures, prior to the issuance of a deer control permit. A "weapons permit" (whatever form this may take - likely different in each jurisdiction), with clauses appropriate to the situation, is issued through the municipality, to the individual or company in possession of the deer population control permit.

Efficacy

Damage still continues across the municipality unless other, more active management options are undertaken. The efficacy of a *Ban Ungulate Feeding* bylaw may be limited without corresponding efforts at public education and may contribute to reducing deer congregation in localized areas.

Logistical constraints

Municipality may need increased enforcement capacity if additional bylaws are enacted. A *Ban Ungulate Feeding* bylaw may be difficult to enforce.

Legal issues

Any changes to municipal bylaws require compatibility with existing provincial legislation.

Permit requirements

Regulate weapon possession, weapon use and hunting bylaws would increase permitting at the municipal level, and may require increased capacity or training.

Cost

Little direct or additional costs to the municipality would be incurred, except a potential increase in bylaw enforcement requirements.

Human health and safety concerns

Ban Ungulate Feeding bylaws will not reduce the incidents of wildlife aggression or ungulate collision rates. *Regulate weapon possession, weapon use and hunting* bylaws increases the theoretical potential of increased human harm due to increased firearm use.

Humaneness

Regulate weapon possession, weapon use and hunting bylaws could theoretically increase animal suffering if lethal population control options were poorly monitored.

Advantages

- Revising bylaws has minimal cost to municipality
- *Ban Ungulate Feeding* bylaws likely would reduce animal habituation

Disadvantages

- Despite bylaw changes, damage likely to continues across the municipality
- Bylaw enforcement may be problematic
- *Regulate Land Use* bylaws may impose additional burdens on developers or property owners
- *Ban Ungulate Feeding* and/or *Regulate Land Use* bylaws may shift damage as property owners implement changes or wildlife feeding patterns stop or change
- *Regulate weapon possession, weapon use and hunting* bylaws likely to be controversial
- A *Ban Ungulate Feeding* bylaw may be unpopular with residents

Amend Provincial statutes and regulations

The Ministry of Environment has both authority and responsibility to manage ungulate populations. Regulated hunting is the primary management tool, through manipulation of herd age and sex ratios. Although municipalities are contained within hunting management units, bylaws restricting weapons discharge mean hunting cannot be implemented without regulatory changes from all jurisdictions. Changes to provincial hunting regulations or related provincial wildlife management legislation, regulations, policies or procedures would likely focus on providing opportunities for herd reduction in urban areas through lethal control.

Since traditional hunting methods may be inappropriate for urban areas, and hunters may be more reluctant to hunt in urban areas, creativity and incentives may be necessary to design a successful urban hunt. Some of the options suggested by DeNicola *et al*. (1997), Doerr *et al.* (2001), and Kilpatrick *et al.* (2004; 2007) include: longer seasons; Sunday hunting; restrictions to weekday hunts only; the use of bait; increased bag limits; quota hunts; earn 1 bonus buck tag by harvesting 3 antlerless deer; allowing for culling as opposed to hunting; inclusion of either sex seasons; inclusion of archery seasons – with or without crossbows; ability to harvest bonus deer if meat donated to the food bank; and lowered tag costs for antlerless hunts. Additional factors to consider would be required special training, proficiency tests, and residency requirements for urban hunters.

In small localized urban areas, management strategies and subsequent regulations can be adjusted to account for size of harvest, sex composition through bag limits, antlerless permits, season type, season timing, season length, number of permits, land access policies and other considerations (Northeast Deer Technical Committee 2008).

Efficacy

Regulatory changes to liberalize hunting regulations and implement population reduction options will result in decreased damage.

Logistical constraints

The general provincial decline in hunter recruitment, hunter unwillingness to shoot antlerless deer and lack of access to private lands for hunting will all make it difficult to administer urban hunting programs with sufficient success.

Legal issues

There will be considerable change required to hunting regulations to permit urban hunting programs.

Permit requirements

Appropriate permits would need to be developed if urban hunting allowed.

Cost

Low increase in administrative and enforcement costs, offset by small revenues from tag sales.

Human health and safety concerns

There have been no human safety incidents reported in any urban deer hunts that have occurred in US cities (Helena Urban Wildlife Task Force 2007).

Humaneness

Regulatory changes to liberalize hunting regulations in order to implement herd reduction options will likely be considered as a controversial and inhumane way to manage deer overabundance.

Advantages

- Regulatory changes liberalizing hunting regulations to implement herd reduction options offers an efficient and expedient way to control overabundant ungulates.

Disadvantages

- Regulatory changes liberalizing hunting regulations to implement herd reduction options are likely to be very controversial.

Public Education

Public education covers many aspects of urban ungulate management and should be carried out by all agencies involved in managing the issue. Public education imparts two kinds of information – information about the process (ongoing activities, timing, funding, who is involved) and knowledge about the issue (unbiased and accurate information about urban ungulate biology, ecology, behaviour, management and potential interventions). The public will often seek out knowledge from people or communities with differing viewpoints and experiences than wildlife managers. It is important for wildlife managers to provide advice on where to go to get credible information and how to distinguish biased information from unbiased information. Learning by doing and getting people involved in the process is more successful than passive listening; simply distributing information to citizens may not be sufficient.

Materials needed for public education	**Places to distribute information**
Brochures FAQ sheets Posters Standardized power point presentation Display Boards	Agency websites City and Regional District meetings Civic clubs Neighbourhood associations and community halls Veterinarians offices Animal rehabilitation centers Community functions
People to talk to	**Methods for public education**
Outdoors writers for newspapers Veterinarians Animal rehabilitation centers Animal control and public works departments Garden clubs Municipal and Regional district staff	News releases Radio public service announcements Through CORE program Submitted newspaper articles Hunting and Fishing Regulations and similar publications

Decker *et al.* (2001) and Conover (2002) suggest that public education can change human attitudes or behaviours and complement other active management interventions by:

- Increasing tolerance of ungulates and ungulate conflicts through informational programs that explain why ungulate/human interactions are increasing and what can be done about them
- Creating realistic expectations about ungulate management or achievable results for population levels through communication programs explaining key concepts (biological carrying capacity, limits on population controls, predator-prey relationships)
- Increasing appreciation for wildlife through youth stewardship education programs

- Increasing desirable human activity associated with urban ungulates through information programs on feed/do not feed and appropriate backyard plantings
- Reducing undesirable human activity associated with ungulates through proper wildlife collision signage
- Improving public understanding of other stakeholder's concerns through informational meetings

Efficacy

Damage will still continue across the municipality unless other management options are undertaken.

Logistical constraints

It is difficult to reach all interested parties and time consuming to talk to groups and people.

Legal issues

There are no concerns associated with this option.

Permit requirements

There are no permitting concerns associated with this option.

Cost

Staff time to prepare and disseminate materials will be required.

Human health and safety concerns

There are no concerns associated with this option.

Humaneness

There are no concerns associated with this option.

Advantages

- Keeping the public informed of the process, the issues and the management options to be undertaken can contribute to the success of a project.

Disadvantages

- There are no disadvantages associated with this option.

Recommendations

In communities where ungulate management challenges exist, preparation and planning must start as soon as possible. Animals are not going to stop reproducing because of the global economic downturn, provincial government budget cutbacks, staff workload, or Ministry priorities. Like any other issue, the longer the delay between the admission that an issue exists and taking action on that issue, the bigger that issue will become. However, there are steps that can be taken in preparation for the management decisions that will be needed in the future.

Public education

Develop a number of "canned" newspaper articles or radio ads that can be contributed to the media or made available to the public in other ways. The municipality can be involved in distributing this information, for example in tax notices or utility bills. The public needs to be educated about many aspects of ungulate management prior to the implementation of any urban ungulate programs.

Topics could include:

- Biological carrying capacity vs cultural carrying capacity vs wildlife acceptance capacity – how many deer are too many deer?
- What wildlife are present in the area?
- Why it is a bad idea to feed deer or other wildlife?
- Bear/deer aware tips – managing composts, fruit and other attractants
- Who decides if a specific animal presents a management challenge? And who has the authority to deal with that animal?
- Can ungulates be successfully trapped and moved?
- Is there really such a thing as birth control for deer?
- Do deer carry diseases?
- Lyme disease/tick information
- Costs of deer vehicle collisions
- Deer vehicle collision prevention techniques

Community capacity

Identify the people and organizations in the community who would be suitable and able to be a participant in an ungulate management task force and begin preliminary conversations with them.

Keep the MLA briefed

The MLA will be the first stop for people who disagree with any decisions on ungulate management. Make sure the MLA's staff have information early in the process, and know what the plan is to address the issues.

Cultivate relationships with the media

An ungulate management program can be won or lost in the media, so involve them early. Invite the media to every meeting, and if they don't come, send them a summary. Take them along on population counts, damage estimates, and when an animal has to be dispatched because it has stomped a dog or frightened a child. Ungulate management cannot be a closed process. It needs to be as open as possible. This is perhaps counter intuitive and difficult to accomplish as government employees, and it is where a community based ungulate management task force can play an important role.

Gather data

Identify the sources of data on ungulate human interactions and set up systems within and outside MOE to gather the data consistently. Baseline data will be needed to support management decisions before any ungulate management program can be implemented.

Data Sources

- Government: Highways maintenance contractors, Ministry of Transportation and Infrastructure, Conservation Officers
- Municipality: public works crews, bylaw officials, parks department, receptionist at the municipal office
- Federal: RCMP, Parks Canada
- NGO: BC Wildlife Federation clubs, trappers, guides or other similar organizations
- Private: independent biologists or wildlife experts

Data

- Numbers of deer killed in deer vehicle collisions on city streets or on adjacent highways.
- Numbers of complaints received: deer damage to gardens, properties
- Number of complaints received: deer aggression
- Numbers of deer attended by Conservation Officers for other reasons – caught in fences, trapped in yards etc and the outcomes
- Population estimates and other parameters, including population health
- Population health
- Any associated increase in cougars or coyotes in urban areas

Prepare for intensive public scrutiny

Urban ungulate management can be very different from many other wildlife management projects that have been undertaken. People who may or may not have ever seen a deer in its natural environment, or at best, may have seen one by the side of the road, will have an opinion on what should be done with "their" deer. These people will demand to have their opinions heard and not only heard, but acted upon. The management actions are going to be taken in full view of the community. There may be public

meetings or municipal council meetings to attend. However, other cities have managed to deal with their deer issues and it can be done.

What is the best control method?

There is no one best method to address the issue of overabundant urban ungulates. The situation in each community will dictate what management interventions can be implemented. A management program that integrates many components of ungulate management will be most successful. An integrated program will require action by all stakeholders: the provincial government, the municipal government, and the general public.

What is clear is that if the complaints caused by ungulate damage are increasing in numbers and severity, then conflict reduction options such as fencing, repellents, and aversive conditioning will not significantly reduce the numbers of complaints. A reduction in the population is needed to reduce the damage caused by overabundant ungulates. Once the population numbers are lowered, then damage is easier to manage with conflict reduction techniques. Population reduction methods are not generally going to be popular with the majority of the public, but are the only way to have a measureable impact on damage levels in the community. The method of population reduction and how often it needs to be carried out is dependent on the site specific circumstances in each community.

Photo: John Gomes / Anchorage Alaska

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Appendix A Urban Deer Management Case Study: Helena, Montana

Summary

Beginning in 1996, the City of Helena experienced an increase in the numbers of urban deer and associated deer-human conflicts. These issues resulted in public safety concerns, property and landscaping damage, and concern for deer welfare. Resident tolerance for deer decreased as deer populations and subsequent damage increased. There was increasing public frustration and constant public pressure.

From conversations with Bob Habeck and Matthew Cohn, Urban Wildlife Task Force member and co-chair, respectively, and Mike Korn, Assistant Chief of Enforcement for the Montana Fish, Wildlife & Parks agency, a tipping point seemed to be reached when deer began to interfere with the free movement of the public. One particular example was mentioned: a boy delivering newspapers was trapped under a vehicle by an aggressive deer. Also, small dogs had been attacked and stomped by both does defending fawns, and bucks during the rut.

Helena Urban Deer (White-tailed and Mule deer) Reports 2003-2008

Year	Dead or Injured	Other Complaints	Total	Vehicle Collisions
2003	86	17	103	16
2004	77	22	99	30
2005	127	55	182	31
2006	193	48	241	30
2007	216	43	293	34
2008	246	85	363	32

Montana Fish, Wildlife & Parks Urban Deer (White-tailed and Mule deer) Reports 2003-2006

Year	Dead or Injured	Other Complaints	Total
2004	58	15	73
2005	73	76	149
2006	96	66	162

Although State legislation passed in 2003 allowed for communities to develop and implement local programs for urban wildlife, it took 2 years of increasing public concern and constant public pressure before the Helena City Commission created an Urban Wildlife Task Force in 2006, which was then charged with evaluating the condition of the urban deer herd and recommending deer management actions.

The Task Force met 29 times, held 2 public meetings, and compiled the *"City of Helena Urban Deer Management Plan – Findings and Recommendations of the Helena Urban Wildlife Task Force*" after one

year of operation. The Deer Management Plan summarized all processes, technical information and administrative actions that the Task Force used to develop management recommendations to present to the City Commission. The Task Force:

- Researched other jurisdictions that were developing deer management plans
- Researched state and municipal legislation and ordinances that impact urban deer management
- Researched current response practices of the state and municipal agencies involved in urban deer complaints
- Compiled historical state and municipal agency summaries of urban deer complaints
- Conducted a telephone survey of citizen's opinions of urban deer and deer management (approximate cost $7,000 USD)
- Conducted a deer inventory study (approximate cost $6,000 USD)
- Researched historical population levels of deer in and around Helena
- Hosted 2 Town Hall meetings
- Solicited public input from citizens
- Developed a master communication plan for knowledge transfer to the public, Helena officials, and to identify and track future activities and deadlines
- Administered a "Quality of Life" survey to citizens, in response to concerns expressed from public comments

Following a nine month information gathering process, the Task Force began to consider five key questions.

1. Are the health and/or safety risks to people and urban deer significant enough to be considered a problem?
2. Are urban deer management actions necessary, or not?
3. Has Helena reached its social carrying capacity for deer, or not?
4. Should Helena reduce its deer population, or not?
5. Should Helena establish a permanent Urban Wildlife Advisory Committee?

The Task Force identified a wide array of urban deer management options, and based on diverse and extensive evaluation of technical information, literature review, expert testimony, and professional judgment, and accounting for economies of scale, effects on deer, budgeting, legality, and logistics, identified the following options as suitable for immediate or future use within the City Limits.

1. Maintain current management actions
2. Public education and outreach
3. Landscaping/repellents/barriers
4. Zoning/ordinances/laws
5. Capture and transfer
6. Capture and euthanize
7. Fertility/sterilization
8. Professional wildlife removal

9. Certified urban hunting
10. Deer tracking and aversive conditioning

The Task Force used the following criteria to evaluate, compare and convey the intensity of their position for each management option. Each criterion was scaled as high, medium and low and assigned points based on the scaling; high=5, medium=3, low=1. Each Task Force member assessed each option and assigned a scale value for each criterion. Criterion scale values were totaled, and the management options were ranked according to the scale point totals.

1. Social/political
    a. High – not controversial
    b. Medium – somewhat controversial
    c. Low - controversial
2. Human health and safety
    a. High - supports health and safety
    b. Medium – somewhat supports health and safety
    c. Low – compromises human health and safety
3. Cost to implement
    a. High – cost effective
    b. Medium – somewhat cost effective
    c. Low – not cost effective
4. Conflict resolution
    a. High - reduces conflict
    b. Medium - partially reduces conflict
    c. Low - does not reduce conflict
5. Biological Integrity
    a. High – supports healthy deer and habitat
    b. Low – somewhat supports healthy deer and habitat
    c. Low - compromises healthy deer and habitat

The following urban deer management options were recommended (final scores shown in brackets):

1. Professional wildlife removal (187)
2. Public education and outreach (173)
3. Certified urban hunting (156)
4. Capture and euthanize (145)
5. Zoning/ordinances/laws (145)
6. Landscaping/repellents/barriers (141)
7. Deer tracking and aversive conditioning (123)
8. Fertility/sterilization (119)

Maintaining current management actions and capture and transfer were not recommended as appropriate management options for Helena.

The Task Force then determined a deer population objective for Helena. The Deer Management Plan:

1. Described the methodology used to derive the population estimate
2. Applied the methodology to three scenarios (differing parameters and mortality rates) for the urban deer population of Helena
3. Established a deer population density objective of 25 deer per square mile

Helena is geographically divided into seven City Commission Districts. For each District, a management action strategy was developed, incorporating both immediate (within one year) and future actions to be undertaken. Each of the eight recommended management options was evaluated and assigned a numerical rank by each Task Force member, according to its suitability for use in each District, taking into account how the residents of each district had responded to the public opinion survey questions regarding lethal control measures. The ranking system applied to each management option was:

- High=5; strongly support management option for use in this District
- Medium=3; support management option for use in this District
- Low=1; do not support management option in this District

The final management matrix allowed the Task Force to determine management options, ranked by suitability, to be implemented in each geographical area of the city.

Additionally, the Task Force recommended, due to the complex and ongoing activities that would be required to successfully manage the urban deer in Helena, that an adaptive management strategy be applied to evaluate the effectiveness of all management options and to consider future inclusion, exclusion or transition of all appropriate management options.

The Deer Management Plan for Helena recommended that ongoing activities should include:

1. Continued monitoring to ensure the Deer Management Plan is meeting its objectives
2. Evaluating the assumptions used in the population density estimate
3. Conducting an annual deer population inventory
4. Collection of social data such as the number of citizen complaints, deer vehicle collisions, and State or municipal response records
5. Evaluation of operational costs for any management options implemented
6. Distribution of any harvested meat to local food banks

Issue Timeline

Date	Activity
2003	House Bill 249 (7-31-4110 MCA – restriction of Wildlife) enacted to allow local governments, in cooperation with Montana Fish, Wildlife and Parks, to develop and implement local programs in an attempt to manage urban wildlife for public health and safety reasons
2004	
Sept 2004	State of Montana, Fish, Wildlife and Parks publishes *"Findings and Recommendations of the Urban Wildlife Working Group"* which establishes the need to address increasing populations of wildlife, primarily white-tailed deer and mule deer, in urban areas
2005	City Commission passes City ordinance prohibiting feeding of deer within city limits
2006	
Feb 13, 2006	City Commission approved resolution to enact the Helena Urban Wildlife Task Force
Feb 15, 2006	City advertises for Task Force members through an application process
Mar 13, 2006	City Commission appoints Task Force members selected through application
June 29, 2006	Task Force elects a subcommittee to handle public affairs and information distribution
Sept 21, 2006	Deer population inventory bid submitted
Oct 20, 2006	Public opinion survey submitted to Task Force for review and comment
Nov 8, 2006	Public opinion survey field test
Dec 12, 2006	Public opinion survey completed
Dec 17, 2006	Deer population inventory begins
2007	
Jan 1, 2007	Public opinion survey draft report completed
Jan 12, 2007	Task Force Meeting #20: Review and selection of eligible deer management options
Jan 23, 2007	Deer population inventory results complete
Jan 25, 2007	Town Hall Meeting #1: facilitated discussion of options with the public
Jan 31, 2007	Deer population inventory final report submitted. 700 deer, with a density ranging from 9 to 82 deer/sq mile. Population could exceed 1800 by 2010 if no action taken
Feb 14, 2007	Town Hall Meeting #2: facilitated discussion of options with the public
Mar 1, 2007	Task Force Meeting #27: review and propose when and where control actions should be implemented
Mar 8, 2007	Task Force to finalize "Management Matrix"
Mar 22, 2007	Task Force to finalize draft Plan content
Apr 9, 2007	Task Force submitted *"City of Helena Urban Deer Management Plan – Findings and Recommendations of the Helena Urban Wildlife Task Force"* with appendices to the City Commission
Aug 2007	Helena submits request to State Fish, Wildlife & Parks Commission for approval of the deer reduction plan
Nov 2007	Montana Fish, Wildlife & Parks (FWP) Commission approved Helena's request to remove 50 deer from Dec 15, 2007 through May 1, 2008

2008	
Apr 2008	FWP approved request to amend removal period to Aug 15, 2008 through Mar 31, 2009
May 7, 2008	Environmental Assessment on the City of Helena Deer Reduction Plan is released for public comment
July 25, 2008	Environmental Assessment Decision Notice for Helena Deer Reduction Plan released. Project approved Aug 15, 2008 through Mar 31, 2009, as a pilot project.
Aug 2008	Pilot Project for Deer Removal Phase 1 begins Clover trap field tested
Sept 8 to Sept 14, 2008	Pre-baiting of select sites began
Sept 15, 2008	Traps checked and 3 deer caught: State Fish, Wildlife & Parks attended for three nights to approve the process
Sept 15 to Oct 30, 2008	Traps were set 35 times during this period 50 deer killed: 32 does, 18 bucks. 35 fawns released & 13 deer escaped the traps
Dec 2008	Helena requests approval from FWP Commission for continuation of deer removal pilot project: 150 deer proposed for removal; different areas of the city targeted, methods amended slightly, different time of year for treatment; different deer age classes involved
Dec 16, 2008	Environmental Assessment on the City of Helena Deer Reduction Plan is released for public comment
2009	
Jan 13, 2009	Environmental Assessment Decision Notice for Helena Deer Reduction Plan released. Project approved as a pilot project
Jan 15 to Feb 2, 2009	Pilot Project for Deer Removal Phase 2 Repair old traps, build new traps, select sites for traps. Stronger netting was used
Feb 3 to Mar 31, 2009	Traps were set for 43 days during this time. Only one day when no deer were caught; most deer caught in one night was 8. Fawns were killed during Phase 2. 150 deer killed: 103 does, 47 bucks. 6 deer escaped the traps
Mar 8, 2009	Public notice placed in local paper with update on the project, resulting in landowner calls who wanted the traps in their area.
June 8, 2009	Report on Phase 1 and Phase 2 presented to City Commission. City Commission directed the City Manager to proceed with a permanent, on-going deer removal project using methods established in Phase 1 and 2.
Sept 9, 2009	Environmental Assessment on the City of Helena Deer Reduction Plan is released for public comment 150 deer proposed for removal during 2009/2010 Approval sought from Nov 13, 2009 through Dec 31, 2019 unless the City's plan requires re-evaluations and re-approval City expected to report annually to FWP
Oct 5, 2009	White Buffalo Inc., hired to conduct a deer population survey and conduct deer population modeling
Nov 12, 2009	FWP Commission meeting

Helena Deer Reduction Project Summary, utilizing a trap and euthanize method

The pilot project was implemented by the Helena Police Department. Phase 1 was conducted Sept 15 to Oct 30, 2008, and Phase 2 was conducted Feb 3 to Mar 31, 2009. The Police Department researched methods carried out in other jurisdictions and then developed their own procedures. Six traps were employed in Phase 1 and 12 traps in Phase 2. Traps were set on most nights, with the exception of Sundays, giving the officers a day of rest.

Traps were located almost exclusively on private lands, in residential yards. Landowners signed a release form authorizing officers to be on their property, and advising them that their lawn may incur some damage from the trap or the deer. Generally, the response was that the deer cause more damage than a trap or net ever could. Neighbours within eyesight of the proposed trapping locations were consulted, and if there were any objections then that proposed location was not used. One trap was set at or near the waste transfer site, and one trap was set up near the golf course, next to a park with high public use.

In Phase 1 captured fawns were released, and in Phase 2 captured fawns were killed. The reasons for fawn release in Phase 1 were that fawns would provide little meat with the same processing costs, officers may find it difficult to dispatch small fawns and the public would be less likely to accept killing of fawns. After Phase 1, the recommendations from the Police Department were that if trapping was carried out in the winter months, the fawns should be dispatched as well. Most spring fawns were of almost mature size, and they reasoned that it was counterintuitive to the project objectives to release them. When a fawn was captured it still required the same time and effort to set and bait the trap and release the fawn with no gain to project objectives. The fawn also occupied a trap and made it inaccessible for a mature deer. 35 fawns were captured during Phase 1 and if they had been dispatched, Phase 1 could have been completed after approximately 19 days instead of 35.

Clover traps were used to capture the animals. The traps were baited with cob, a mixture of barley, corn, oats and molasses, and supplemented with cut up apples. The bait was placed about 8:00 - 9:00 pm each evening. In Phase 1 the traps were pre-baited for one week prior to capture. The traps consist of a rectangular pipe frame covered with heavy netting. There is a sliding mesh or netting door at one end. The bait was placed at the far end of the trap. A trip line runs through the bait and up to a snap trap or trip mechanism. The snap trap holds the door open by trapping the door rope. When the deer makes contact with the trip line, the snap trap releases the door rope and the door closes, trapping the deer inside.

The traps were checked about one hour prior to sunrise. If an animal was found in the trap, the frame and net were collapsed down onto the animal to restrict its movements, and then the animal was dispatched on site using a bolt gun. Bolt guns are used in the food processing industry, and the mechanism fires a steel bolt directly into the brain of the animal, causing instant brain death. The time the officers reached the trap until the animal was dispatched was timed at 18 seconds.

If a trap failed to catch a deer it was moved to another location where a landowner had requested a trap.

During the day, all traps were closed and the food pan was left out to increase deer familiarity and habituation. Clover traps are designed to capture only one animal at a time. Infrequently, a doe and fawn were captured together.

The carcasses were removed to a Fish, Wildlife & Parks facility to be cleaned, dressed and stored. During Phase 2, each deer head was removed and tagged, and subsequently checked by the FWP biologist for age, abnormal growths, and disease. When five or more carcasses accumulated (during Phase 1) and 15 to 20 carcasses accumulated (during Phase 2), they were taken to a local butcher, processed into deer burger, and the meat donated to the Helena Food Share for distribution to needy families. The butcher processed the meat at a reduced price. Helena Food Share paid for the processing through its regular donations.

Helena Police Department made a concerted effort for the process to be open and transparent. Notices were placed in the paper advising that the project was ongoing, and local media, both newspaper and TV, were invited to travel with and attend trap sites with the officers. The officer in charge of the project, Mark Lerum, Assistant Police Chief (retired), felt strongly that the donation of meat to Helena Food Share, and the inclusion of the media in the process was helpful in gaining the public support for this project.

Lessons learned: Phase 1

- Need heavy duty frame and netting (967 lb) to restrain large mule deer, and prevent escapes. In Phase 1, 13 deer escaped; in Phase 2, with heavier netting, only 3 deer escaped.
- 2 people are required to move equipment, set up and collapse traps, secure the deer and then move the dead deer.
- Some deer did carry ticks, and officers were bitten by ticks. Officers did wear clothing that limited skin exposure and heavy gloves.
- Some minor injuries were sustained by officers. One officer required stitches for a finger pinched during the collapse of a trap; several officers sustained sprained fingers caused by deer movements in the trap; several minor cuts were sustained by officers; one officer suffered sore ribs from contact with a stake when securing a deer. Antlers on bucks can be dangerous, but trapping during the winter months reduces this.
- Deer appeared to be easily attracted to the bait, and not nearly as wary as wild deer.
- The process is relatively quiet. Rarely did a resident or neighbor see or hear the officers as the trap was collapsed on the deer and it was dispatched with the bolt gun.
- Trapping may be more efficient if carried out to take advantage of the feeding habits of the deer, which appear to be feeding less at night and more in the hours just prior to and after sunrise. Often times, the deer would bed down during the night and not start moving until just

before dawn. Dispatching prior to sunrise was done as a means of carrying out the project as discreetly as possible, but if locations were carefully chosen, it could still be kept out of view although conducted during the early daylight hours.

- It is important to be able to clean the trapping locations of any blood. All of the landowners made water and garden hoses available to the officers. During winter months water may not be available and cleanup may be more difficult. Blood stained snow may sometimes be difficult to remove.
- The location used to dress and clean the deer needs to be easily washed down with water – again, this may be a problem in the winter.
- The grass and turf in the area of the trap can be damaged by deer hooves. All landowners were made aware of this problem and all stated they were not concerned.
- Note: During Phase 1 when 50 deer were killed, an additional 40 deer were either killed by collisions with vehicles, removed by FWP for aggressive behaviour towards people or dogs, impaled on fences or from other unknown causes.

Lesson learned: Phase 2

- Winter trapping: When the ground is frozen the stakes hold the traps well, but when the ground thaws and softens, the traps did not hold as well.
- If it is snowing hard or the temperature is below zero, it is best not to trap because:
    - Snow ruins the bait and the trigger devices will trip due to heavy snow load
    - Deer are not moving around and feeding as much
    - Cleanup at the trap site and the processing site was difficult due to lack of water
- After a heavy snowfall is over, deer are hungry and active.
- Deer movement is increased during a full moon or close to it.
- Traps near deer trails are more successful than yard traps.
- Trapping 150 deer in 8 weeks is possible but demanding.
- Lack of antlers in the winter did make bucks less dangerous, and they appeared to be less aggressive towards the officers.
- Sharpshooting could potentially be a faster way to remove the deer, but deer are frequenting urban properties that are close together, making sharpshooting dangerous for the public.
- Helena Food Share received 4,499 lbs of meat from 150 deer at a cost of $5,962. This included skinning, butchering, processing into burger and adding suet.

The cost expended out of the Urban Wildlife Project Fund budget for both Phase 1 and 2 was $36,885. This includes salary, electricity for the cooler, fuel, bolt gun and accessories, use of storage shed, dumpster charges, winch for vehicle, purchase and shipping costs for nets and traps, and trap maintenance. Additionally, during Phase 1, approximately $13,000 was expended out of Police Department salary funds for research and set up time, and regular officer operational time on the project. Total cost was approximately $49,885. For 200 deer, this works out to $249.33/deer.

Images of the clover traps used in Helena, Montana, 2008 and 2009

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Documents

Findings and Recommendations of the Urban Wildlife Working Group. September 2004. Prepared by Montana Fish, Wildlife, & Parks, Helena, MT, USA.

Urban Deer Management Plan, Findings and Recommendations of the Helena Urban Wildlife Task Force. April 2007. Submitted to the City of Helena City Commission, Helena, MT, USA. (includes Appendices A to T).

Environmental Assessment, City of Helena Deer Reduction Plan (May 2008) and Environmental Assessment Decision Notice (July 2008), prepared by Montana Fish, Wildlife & Parks.

Environmental Assessment, City of Helena Deer Reduction Plan (Dec 2008) and Environmental Assessment Decision Notice (Jan 2009), prepared by Montana Fish, Wildlife & Parks.

Environmental Assessment City of Helena Urban Deer Management Plan (Sept 2009), prepared by Montana Fish, Wildlife & Parks.

City of Helena Deer Reduction Pilot Program September 15, 2008 – October 30, 2008. Prepared by Troy McGee, Helena Chief of Police, submitted to Tim Burton, Helena City Manager. November 7, 2008.

City of Helena Deer Reduction Project Phase Two. Prepared by Troy McGee, Helena Chief of Police, submitted to Tim Burton, Helena City Manager. May 28, 2009.

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Interview Summaries

Bob Habeck, Urban Wildlife Task Force member

- Began in 2000; there was drought and not much forage in the wild
- Danger posed to dogs and children by does protecting fawns in the spring and aggressive bucks in the fall
- Public frustration and constant public pressure
- Yes, there was a tipping point - Boy chased under a car by a deer
- Deer interfering with free movement of the public
- State “owns” the deer. They can delegate authority to cities to manage them in urban areas, but they will continue to review plans for process and content, and take additional public comment
- Over time, opposition has waned
- Task Force concentrated on developing a thorough and comprehensive process, so that opposition could not be directed towards the process
- There are quantifiable difference in complaints per and post treatment. DVCs are down.
- The idea was to take another census, and every 3 years or so do a census to see if deer approaching the set limits
- Continue to look at nonlethal methods, primarily fertility control

Mike Korn, Assistant Chief of Enforcement, Montana FWP

- Boy chased under a vehicle by a deer
- Dogs injured and killed by both does and bucks
- Mule deer are the issue
- Jurisdictional conflicts between city and state
- Aggression was perhaps 15 to 20% of complaints
- Helena is a progressive town with a large environmentally conscious public
- Strong tradition of hunting in Helena
- Statute says city can go ahead if state has reviewed and approved the plan. Because needed an EA to review and approve, the process was delayed a bit
- Will not approve trap and relocate due to disease spread (CWD); disease starts in city and moved to wilder populations, higher post move mortality due to habituation

Matthew Cohn, Urban Wildlife Task Force co-chair

- Increasing mule deer populations over 10 years
- More dvcs, more injured animals, animals have lost their fear of humans – can get within 6 feet of them
- Tipping points - newsboy attack, dogs stomped
- Took 2 years to get to the point where the city decided it needed a task force
- There is still public opposition voiced in the paper
- Meat given to Helena Food Share is a strong positive
- Helena is a "Garden of Eden in a desert environment" very attractive for deer
- Need community involvement and openness
- There continues to be some public opposition, letters to the paper etc.
- Once a plan was developed, positive action could be taken
- Distribution of meat to Helena Food Share was a strong positive for the project
- Continue to look at fertility control as an option, but even if biologically/operationally feasible at some point, it may be cost prohibitive.
- The current budget of $30,000 seems to be an acceptable level of public expenditure.

Mark Lerum, Asst. Chief of Police (retired), Deer Reduction Project Coordinator

- Information from this interview is contained in the Helena Deer Reduction Project Summary, above

Jenny Sika, Wildlife Biologist, Montana FWP

- Population survey just completed with White Buffalo and Tony DeNicola (Oct 2009)
- Modeling still being completed, but deer population likely still above target densities
- Some deer are likely residents, and some do move in during the winter
- Certainly the social tolerance for deer has been exceeded

- Less negative public comments received during the comment period for current EA
- Current EA may cover the next 10 years – City still has to advise of planned projects but full EA not required for approval
- No trap avoidance behaviours noticed in remaining deer
- Montana will not consider trap and relocate – high mortality, parasites, disease, high deer populations elsewhere
- Lots of benefits aside from actual deer damage reduction – relationship/capacity building between City and State, more knowledge about urban deer and greater expertise in urban deer management
- Other cities in Montana looking forward to results

Appendix B Translocations of Wildlife and Non-Native Species – BC Policy

4-7-13.02

Translocations of Wildlife and Non-Native Species

• *Effective Date:* May 29, 2001

This Policy Replaces:

October 4, 1984 Policy on Introduction and Transplants of Wild Birds and Mammals.

Staff, organizations Directly Affected:

Wildlife Management Staff
Regional Directors
Conservation Organizations.

POLICY STATEMENT:

It is the policy of the ministry to:

1. ensure that translocations are both justifiable and likely to succeed, and the scientific community can learn from each initiative, whether successful or not.

2. minimize the risk of adverse side effects that may occur as a result of translocations.

3. consider the welfare of animals involved in translocations.

4. prevent the translocation of non-native species for the purpose of:

(a) establishing populations in locations where they do not presently occur;

(b) re-establishing populations; or

(c) supplementing existing populations.

Definitions:

"Native Species" — all species of wildlife known to naturally occur, or to have naturally occurred, within their known historical natural ranges in British Columbia.

"Natural Range" — the area occupied by a species, usually for thousands of years, as a result of natural forces and influences like climate, moisture, fire, soils and species interactions.

"Non-native Species" — species of wildlife known not to occur, or not to have naturally occurred, indigenously in British Columbia, or species of wildlife that occur artificially in locations beyond their known historical natural ranges due to intentional or unintentional physical movement by humans.

"Translocation" — deliberate and mediated movement of wild or captive-bred individuals or populations including reintroduction, reinforcement/supplementation, conservation/benign introductions, and introduction of non-natives, as defined below:

"Reintroduction": an attempt to establish a species in an area which was once part of its indigenous range, but from which it has been extirpated or become extinct due to human causes. ("Re-establishment" is a synonym, but implies that the reintroduction has been successful).

"Reinforcement/Supplementation": addition of individuals to an existing population of conspecifics.

"Conservation/Benign Introductions": an attempt to establish a species, for the purpose of conservation, outside its recorded distribution but within an appropriate habitat and eco-geographical area. This is a feasible conservation tool only when there is no remaining area left within a species indigenous range.

"Introduction of Non-natives": the deliberate or unintentional introduction of a non-native species that is not of conservation concern to a location outside its eco-geographical area.

"Wildlife" — All flora and fauna; including fish, wildlife, plant species, plant communities, invertebrates, and ecosystems, occurring in British Columbia, as listed in the *Wildlife Act* and regulations.

Policy Cross-References:

Volume 4, Section 7, Subsection 13.02.

Other Cross-References:

Problem Wildlife Policy and Procedure (Volume 4, Section 7, Subsection 4.01)
Management of Problem Predators Procedure (Volume 4, Section 7, Subsection 4.01.1)
Possession of Live Wildlife Policy and Procedure (Volume 4, Section 7, Subsection 12.05
Wildlife Act
Permit Regulations; BC Reg 253/2000.

Reason for Policy:

Translocation can be a significant wildlife management method to manage for natural biodiversity or for species of concern within the province. The ability to participate in translocation programs is also vital to our international responsibility to conserve and enhance natural biodiversity and native populations throughout their historical range. This policy will ensure that translocation remains a viable management tool and that translocations:
— achieve their intended conservation benefit without causing adverse side-effects of greater impact;
— are both justifiable and likely to succeed;
— consider the welfare of animals involved;
— and prevent the translocation of non-native species.

Appendix C Introductions and Transplants of Wildlife (Wild Birds and Mammals) BC Procedures

Introductions and Transplants of Wildlife (Wild Birds and Mammals)

• *Effective Date:* October 4, 1984

The Procedure Replaces:

October 13, 1978 Policy on Introduction and Transplants of Wild Birds and Mammals.

Staff, Organizations Directly Affected:

Wildlife management staff
Regional Directors
Conservation Organizations.

Policy Cross-Reference:

Volume 4, Section 7, subsection 13.02.

Other Cross-References:

Wildlife Act, sections 22, 34, 38 & 11O(h)(w) I (aa)
B.C. Reg. 18/69, 141/69, 365/78 (Permit Regulations).

Purpose:

To establish the procedure to be followed when considering or approving proposals for introductions and transplants.

Definitions:

"Introduction" — means the act of bringing or having brought an animal into an area where it has not occurred previously.

"Transplant" — means to remove an animal from one location and to introduce it into another location where it now occurs or has occurred with the province of British Columbia.

"Wildlife" — means raptors, threatened species, endangered species, game and other species of vertebrates prescribed as wildlife, which are native to, or through introduction have permanently established themselves in, British Columbia.

"Foreign species" — means species of vertebrates known not to occur, or not to have historically occurred, indigenously in British Columbia.

"Native Species" — means species of vertebrates known to occur, or to have historically occurred, in British Columbia.

"Regional manager" — means a regional manager of the fisheries and wildlife programmes.

"Director" — means the director of the Wildlife Branch of the Ministry of Environment.

Procedure:

All proposals for introductions and transplants shall follow a process of application and review prior to approval or rejection, as set out below:

1. Applications

Applications from individuals or organizations (including staff of the Wildlife programme) for permits to transplant or introduce foreign or native species shall be made to the regional manager in whose region the transplant or introduction is being considered, and shall furnish the following information:

(a) name and address of applicant

(b) purpose of transplant or introduction

(c) species and age of animals considered for use

(d) stock origin, and primary and/or subsequent locations at which the proposed stock will be held

(e) method(s) of transport and proposed dates for introduction or transplant

(f) available infectious disease and/or parasite history of the source stock and any precautions to be taken to avoid introduction and spread of disease(s) (may require a veterinarian certificate of health)

(g) exact site of proposed release(s) marked on a map of the area showing ownership of release location and adjacent lands

(h) assessment of impact the introduction or transplant will have on wildlife, the habitat of wildlife, other resource interests, private property or public property (i.e. Highways , Forestry)

(i) a plan of future management of the animals including use and habitat enhancement responsibilities

(j) other forms of permission from other agencies or jurisdictions, including the approval of the agency providing the transplant stock.

2. Review

2.1 The regional review of transplant or introduction proposals shall be the responsibility of the regional manager. He shall ensure that approval is obtained from other agencies, particularly the agency responsible for land management on the release site. After review of the transplant proposal, the Regional Manager sends a copy of the proposal to the Director with regional recommendations except as noted in 3.1. below.

2.2 Applications for transplants of foreign species or of indigenous species to areas where they are not currently present are forwarded with regional recommendations by the Regional Manager to the Director for consideration. The regional recommendations are signed by the Regional Manager.

2.3 Review shall include consideration of the following:

(a) Does the introduction or transplant satisfy a specific commercial, recreational or biological need?

(b) Is the animal suitable for the habitat in which it will be released?

(c) Will the animal be deleterious to desirable species or cause deterioration of the ecosystem?

(d) Is the habitat suitable for the animal and who will ensure that suitability is maintained?

(e) Is habitat improvement necessary and, if so, who will implement it?

(f) Potential conflicts with present land uses (i.e. forestry, agriculture, urban/industrial expansion, transportation corridors, hydroelectric dams, mining, etc.).

(g) Views of interested public groups or individuals.

(h) Views of other resource or land management agencies.

(i) Plans for monitoring the success or failure of the proposed transplant or introduction.

(j) Source of funds and cost of proposed transplant or introduction.

3. Approval

3.1. The transplant of a native species within its current range is approved by the Regional Manager after he is satisfied that it is needed to meet regional wildlife objectives, except as noted

in 3.2 below. The Regional Manager ensures notice of approved transplants of native species are received by the Director at least one month prior to carrying out the transplant.

3.2 Proposals for introductions of foreign species, transplants of native species outside their present range, or where there are objections to a transplant, are reviewed by the Regional Manager and forwarded with his recommendations to the Director for consideration.

3.3 Where the Director approves an introduction or transplant, the Regional Manager may proceed.

3.4 Where the Director determines there are significant objections to a proposal it is discussed with the Minister.

3.5 Before *any* introduction or transplant is carried out, the Director informs the Minister.

Appendix D Literature containing information based on or about public opinion surveys

The following papers: 1) discuss methods to survey resident's opinions of urban ungulate management; 2) provide examples of public opinion surveys on urban ungulate management; or 3) report on survey results concerned with urban ungulate management.

Bowker, J. M., D. H. Newman, R. J. Warren, and D. W. Henderson. **2003. Estimating the economic value of lethal versus nonlethal deer control in suburban communities.** Society and Natural Resources 16:143-158.

Butler, J. S., J. Shanahan, and D. J. Decker. **2003. Public attitudes toward wildlife are changing: a trend analysis of New York residents.** Wildlife Society Bulletin 31(4):1027-1036.

Campbell, J. M., and K. J. Mackay. **2003. Attitudinal and normative influences on support for hunting as a wildlife management strategy.** Human Dimensions of Wildlife 8:181-197.

Decker, D. J., T. L. Brown, and W. F. Siemer. **2001. Chapter 18: Planning a Human Dimensions Study** *In* Human Dimensions of Wildlife in North America. The Wildlife Society, Bethesda, Maryland, USA.

Decker, D. J., and T. A. Gavin. **1987. Public attitudes toward a suburban deer herd.** Wildlife Society Bulletin 15:173-180.

Field, R. **2000. Wildlife damage in the suburbs: conflicts in a human-wildlife landscape.** Page 236 *in* The Ninth Wildlife Damage Management Conference Proceedings. M. C. Brittingham, J. Kays, and R. McPeake eds. 5-8 October, 2000, State College, Pennsylvania, USA.

Green, D., G. R. Askins, and P. D. West. **1997. Developing urban deer management plans: the need for public education.** Pages 95-103 *in* Proceedings of the Eighth Eastern Wildlife Damage Management Conference 8:95-103. Lincoln, Nebraska, USA.

Henderson, D. W., R. J. Warren, D. H. Newman, J. M. Bowker, J. S. Cromwell, and J. J. Jackson. **2000. Human perceptions before and after a 50% reduction in an urban deer herd's density.** Wildlife Society Bulletin 28(4):911-918.

Lauber, T. B., M. L. Anthony, and B. A. Knuth. **2001. Gender and ethical judgments about suburban deer management.** Society and Natural Resources 14:571-583.

Lauber, T. B., and B. A. Knuth. **2000. Suburban residents' criteria for evaluating contraception and other deer management techniques.** Human Dimensions of Wildlife 5(1): 1-17. DOI: 10.1080/10871200009359169

Lauber, T. B., and B. A. Knuth. **2000. Tailoring communication about suburban deer management to stakeholders' concerns.** HDRU Series No 00-8. Human Dimensions Research Unit, Department of Natural Resources, Cornell University.

Lauber, T. B., and B. A. Knuth. **2004. Effects of information on attitudes toward suburban deer management.** Wildlife Society Bulletin 32(3):322-331.

Loker, C. A., D. J. Decker, and S. J. Schwager. **1999. Social acceptability of wildlife management action in suburban areas: 3 cases from New York.** Wildlife Society Bulletin 27:152-159.

Mankin, P. C., R. E. Warner, and W. L. Anderson. **1999. Wildlife and the Illinois public: a benchmark study of attitudes and perceptions.** Wildlife Society Bulletin 27(2): 465-472.

McCance, E. **2009. Resident opinions concerning urban deer management in the Greater Winnipeg area, Manitoba, Canada.** Submitted to Manitoba Conservation and Manitoba Wildlife Federation.

Messmer, T. A., L. Cornicelli, D. J. Decker, and D. G. Hewitt. **1997. Stakeholder acceptance of urban deer management techniques.** Wildlife Society Bulletin 25(2):360-366.

Miller, C. A., and P. Shelton. **2000. Perceptions about white-tailed deer abundance and management among hunters and landowners in Illinois.** Pages 265-268 *in* Proceedings of the 9th Wildlife Damage Management Conference. M. Brittingham, J. Kays, and R. McPeake eds. 5-8 October 2000, State College, Pennsylvania, USA.

Siemer, W. F., D. J. Decker, M. D. Lowry, and J. E. Shanahan. **2000. The Islip deer initiative: a strategy for stakeholder involvement in deer management.** Pages247-264 *in* Proceedings of the 9th Wildlife Damage Management Conference. M. Brittingham, J. Kays, and R. McPeake eds. 5-8 October 2000, State College, Pennsylvania, USA.

Siemer, W. F., T. B. Lauber, L. C. Chase, D. J. Decker, R. J. McPeake, and C. A. Jacobsen. **2004. Deer/elk management actions in suburban environments: what will stakeholders accept?** Pages 228-237 *in* Proceedings of the 4th International Symposium on Urban Wildlife Conservation. W. W. Shaw, L. K. Harris, and L. Vandruff eds. 1-5 May 1999, Tuscon, Arizona, USA.

Stevens Point, Wisconsin. **Deer Opinion Survey**. Accessed October 15, 2009. http://www.uwsp.edu/wildlife/deer/Public%20Opinion.htm

Stout, R. J., D. J. Decker, B. A. Knuth, J. C. Proud, and D. H. Nelson. **1996. Comparison of three public-involvement approaches for stakeholder input into deer management decisions: a case study.** Wildlife Society Bulletin 24(2):312-317.

Stout, R. J., B. A. Knuth, and P. C. Curtis. **1997. Preferences of suburban landowners for deer management techniques: a step towards better communication.** Wildlife Society Bulletin 25(2):348-359.

Whittaker, D., M. J. Manfredo, P. J. Fix, R. Sinnott, S. Miller, and J. J. Vaske. **2001. Understanding beliefs and attitudes about an urban wildlife hunt near Anchorage, Alaska.** Wildlife Society Bulletin 29(4):1114-1124.

Winnipeg, Manitoba. Undated. **Survey of Charleswood neighbourhood residents regarding deer management.**

Appendix E Urban Ungulate Management Websites

Canada

British Columbia - Ungulate Conflicts
http://www.env.gov.bc.ca/cos/info/wildlife_human_interaction/docs/ungulates.html

Manitoba - Home Owners Guide to Living with White-tailed deer
http://www.manitoba.ca/conservation/wildlife/problem_wildlife/pdf/wtddeer_en.pdf

Manitoba - Living with Wildlife in Manitoba - Problem Species - White-tailed Deer
http://www.manitoba.ca/conservation/wildlife/problem_wildlife/wtd.html

New Brunswick - Don't feed winter deer!
http://www.gnb.ca/0078/DeerFeeding-e.asp

Nova Scotia - When White-Tailed Deer Become a Nuisance
http://www.gov.ns.ca/natr/wildlife/nuisance/deer.asp

Ontario, Upper Thames River Conservation Authority - Management Strategies: White-tailed Deer
http://www.thamesriver.on.ca/Wetlands_and_Natural_Areas/white-tailed_deer_mgmt_pg1.htm#WHY%20ARE%20THERE%20SO%20MANY%20DEER

Saskatchewan – Problem Wildlife – Dealing with deer and elk damage (primarily rural)
http://www.environment.gov.sk.ca/adx/aspx/adxGetMedia.aspx?DocID=302,301,254,94,88,Documents&MediaID=132&Filename=Deer+and+Elk+Damage.pdf&l=English

United States

Alaska - Anchorage - Hillside Hunt a Success (Urban Moose Hunt)
http://www.wc.adfg.state.ak.us/index.cfm?adfg=wildlife_news.view_article&issue_id=35&articles_id=194

Arkansas - National Sustainable Agriculture Information Service - Deer Control Options
http://attra.ncat.org/attra-pub/deercontrol.html#top

Connecticut - Deer Nuisance Problems
http://www.ct.gov/dep/cwp/view.asp?A=2723&Q=325938

Connecticut - Fairfield County Municipal Deer Management
http://www.deeralliance.com/index.php

Deer Management Resources – Links to State websites
http://www.deer-departed.com/deer-management.html

Game and Fish Magazine - Tactics for Urban Bowhunting
http://www.gameandfishmag.com/hunting/whitetail-deer-hunting/RA_0707_09/

Illinois - Living With Wildlife - White-tailed deer
http://web.extension.uiuc.edu/wildlife/directory_show.cfm?species=deer#wd-control

Indiana - Game and Fish Magazine - Bonus Urban Deer Zone Hunting
http://preview.indianagameandfish.com/hunting/whitetail-deer-hunting/IN_0905_02/index1.html

Iowa - City of Ames - Urban Deer Management
http://www.cityofames.org/police/UrbanDeerManagement/UrbanDeerManagement.htm

Maryland - Deer Damage Management Techniques
http://www.dnr.state.md.us/wildlife/ddmtintro.asp

Massachusetts – Living with Wildlife
http://www.mspca.org/site/DocServer/Keep_Deer_Away.pdf?docID=3286

Michigan - City of Grand Haven - Urban Deer Management
http://grandhaven.org/documents-and-forms/urban-deer-management/

Mississippi - Suburban & Urban Deer: Problems and Solutions
http://www.mdwfp.com/Level2/Wildlife/Game/Deer/Articles.asp?article=172

Missouri - Controlling Deer Damage
http://extension.missouri.edu/publications/DisplayPub.aspx?P=MP685#additional

Missouri - Humans and Deer: Living Together
http://mdc.mo.gov/areas/stlouis/wildlife/deer.htm

Montana - Wildlife Extension Program - Minimizing Deer Damage to Residential Plantings
http://www.animalrangeextension.montana.edu/articles/wildlife/deer_damage.htm

Montana - Urban Wildlife Subcommittee
http://www.ci.missoula.mt.us/index.aspx?NID=883

New Jersey - Community Based Deer Management
http://www.state.nj.us/dep/fgw/cbdmp.htm

New Jersey - Deer Management Program (includes community based deer management programs)
http://www.state.nj.us/dep/fgw/deerbrf.htm#cbdmp

New York - Reducing Deer Damage to Home Gardens and Landscape Plantings
http://www.dnr.cornell.edu/ext/chdp/Reducingdeerdamage.htm

New York, Ithaca - Cornell University - Urban Deer Management: Deer Nuisance and Disease
http://wildlifecontrol.info/deer/Pages/NuisanceDeerInformation.aspx

Ohio - Urban Deer Hunting: A 2005 Update
http://www.all-creatures.org/hope/DOE/4%20-%20Urban%20Deer%20Hunting%20In%20Ohio.htm

Oklahoma - Controlling Deer Damage: Ornamental and Garden Plants
http://pods.dasnr.okstate.edu/docushare/dsweb/Get/Document-1089/HLA-6427web.pdf

Pennsylvania - A Plan to Reduce Deer-Human Conflicts in Developed Areas
http://www.pgc.state.pa.us/pgc/cwp/view.asp?a=465&q=167793

Texas - Wildlife Resources - Deer Management within Suburban Areas
http://www.texashuntfish.com/app/wildlife-resources/20571/Deer-Management-Within-Suburban-Areas

USA - Deer Resistant Plants
http://www.deer-resistant-plants.com/

USDA Wildlife Services- Wildlife Damage Management - Animal Damage
http://lib.colostate.edu/research/agnic/animals/other.html

Washington - Living with Wildlife - Deer
http://wdfw.wa.gov/wlm/living/deer.htm#tips

Washington - Deer Management Links
http://gardening.wsu.edu/library/lpro020/lpro020.htm

Wisconsin - Deer Damage Management
http://www.extension.org/pages/Deer_Damage_Management

Wisconsin - Milwaukee County – Deer Management
http://www.county.milwaukee.gov/Deer9212.htm#taskforce

Wisconsin - Stevens Point - Urban Deer Management
http://stevenspoint.com/deer/index.htm

Deer Control Products

Deer-Busters - Deer Fencing, Deer Fence Products, Repellents
http://www.deerbusters.com/index.html

Deer-Departed - Ultimate Source of Solutions to Unwanted Deer
http://www.deer-departed.com/

Nuisance Deer Product Information
http://wildliferehabber.com/modules/wildlifesection/item.php?itemid=20

Wireless Deer Fence
http://www.deerdamagecontrolfence.com/

Say No to Deer Feeding

Maryland - Feeding Wildlife: You May Be Doing More Harm than Good
http://dnr.maryland.gov/wildlife/feedingwildlife.asp

New Brunswick - Don't feed winter deer!
http://www.gnb.ca/0078/DeerFeeding-e.asp

New Hampshire - Don't Deed the Deer
http://www.wildlife.state.nh.us/Wildlife/Wildlife_PDFs/More_harm_deer_brochure.pdf

Pennsylvania – Please don't feed the Deer
http://www.pgc.state.pa.us/pgc/lib/pgc/deer/pdf/feeding_deer.pdf

Virginia - Feeding Wildlife Food for Thought
http://www.dgif.virginia.gov/habitat/wild-in-the-woods/feeding-wildlife-food-for-thought.pdf

Western States - Supplemental Feeding - Just Say No
http://www.createstrat.com/muledeerinthewest/feeding.html

Wildlife or Deer Damage Workshops or Conferences

Deer Damage Management Workshop - Internet Centre for Wildlife Damage Management
http://icwdm.org/credits/deerdamagemanagement.asp#Program

Urban Wildlife Ecology & Management: An International Symposium on Urban Wildlife & the Environment
http://www.people.umass.edu/sdestef/urban_conference.html

Urban Wildlife Working Group of The Wildlife Society
http://www.rw.ttu.edu/urbwlf/

Miscellaneous

Deer Impacts BlogSpot
http://deerimpacts.blogspot.com/search/label/municipal%20deer

Deer Management Simulator
Developed for the National Park Service by Ken L. Risenhoover (Texas A&M University) and H. Brian Underwood (USGS) was specifically designed to assist natural resource specialists attempting to manage problems relating to overabundant ungulate populations
http://lutra.tamu.edu/dms/dms.htm

City of Grand Haven. **2008. Urban Deer Management Plan.** City of Grand Haven, Michigan, USA. Accessed September 23, 2009. http://grandhaven.org/documents-and-forms/urban-deer-management/

City of Town and Country. **2008. Report of the Deer Task Force. September 22, 2008.** City of Town and Country, Missouri, USA.

Creacy, G. **2006. Deer management within suburban areas.** Texas Parks and Wildlife. Austin, Texas, USA.

Helena Urban Wildlife Task Force. **2007. City of Helena urban deer management plan – findings and recommendations of the Helena urban wildlife task force.** Helena, Montana, USA.

Hickman, G. **2004. Findings and recommendations of the urban wildlife working group.** Montana Fish, Wildlife & Parks. Helena, Montana, USA.

Missouri Department of Conservation. **2008. MDC urban deer management guidelines.** Revised June 2008. Urban Deer Management Program of the Missouri Department of Conservation.

Ontario Ministry of Natural Resources. **2005. Strategy for preventing and managing human-deer conflicts in southern Ontario.** 20 pp.

Ontario Ministry of Natural Resources. **2006. Strategy for preventing and managing human-wildlife conflicts in Ontario**. 12 pp.

Pennsylvania Game Commission. **2006. A plan to reduce deer-human conflicts in developed areas.** Deer Management Section, Bureau of Wildlife Management, Pennsylvania Game Commission.

Pennsylvania Game Commission. **2006. Managing deer for healthy deer, healthy habitat and reduced deer-human conflicts for current and future generations.** Deer Management Section, Bureau of Wildlife Management, Pennsylvania Game Commission.

Pennsylvania Game Commission. **2008. A guide to deer management in developed areas of Pennsylvania.** Version 2.1. April 2008. Pennsylvania Game Commission's Deer Management Section.

Premo, D. B., and E. Rogers. **2002. Town of Amherst deer-vehicle accident management plan.** Prepared for Town of Amherst – Town Board. Amherst, New York, USA.

Shissler, B. **2007. Deer management plan for Lower Makefield Twp.** Natural Resources Consultants, Inc. Fort Hill, Pennsylvania, USA.

Yonker, C. A. **2008. Review of techniques for improving human-deer coexistence in and adjacent to the city of Fremont.** City Council Memorandum. January 8, 2008. Fremont, Michigan. USA.

Appendix G Repellent Product Websites

Becker Underwood Tree Guard®
www.beckerunderwood.com

Bobbex Inc.
www.bobbex.com

Bonide Products Shotgun®
www.bonideproducts.com

Brookstone Deer Repellents
www.brookstone.com

Carnivore urines
www.predatorpee.com

Deer Blocker®
www.pestproducts.com

Deer Stopper
http://www.messinawildlife.com/products/deer-repellent.php

Deer Busters Millers Hot Sauce® and Repellent Sachets
www.deer-busters.com

Deer No No®
www.deernono.com

Deer-Off®
www.deer-off.com

Durapel®
www.treeessentials.com

Hinder®
www.protectyourgarden.com

Hot Pepper Wax®
www.hotpepperwax.com

Liquid fence®
www.liquidfence.com

N.I.M.B.Y. Not In My Back Yard
www.nimby.com

Not Here Deer
www.notheredeer.com

Not Tonight Deer
www.nottonight.com

Outdoor Animal Repellents®
www.champion.com

Plant Pro-Tec®
www.plantprotec.com

Plantskydd®
www.treeworld.com

Repellex®
www.repellex.com

Romancing the Woods, Inc
www.rtw-inc.com

Ro-Pel®
www.ropel.com

Scare Wars®
www.reedjoseph.com

St Gabriel Laboratories
www.milkspore.com

Tree Guard®
www.bugpage.com

Havahart ®Deer Away®(developed by Weyerhauser)
http://www.havahart.com/ourbrands/deer-away

Capture techniques

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Appendix I BC Bylaw Examples Kimberley Prohibit Deer Feeding Bylaw 2296

CITY OF KIMBERLEY

PROVINCE OF BRITISH COLUMBIA **BYLAW NO. 2296**

A BYLAW OF THE CITY OF KIMBERLEY TO PROHIBIT FEEDING OF DEER.

The Municipal Council of the City of Kimberley, in open meeting assembled, enacts as follows:

1. Interpretation

1.1 This Bylaw may be cited as "Deer Feeding Bylaw No. 2296, 2006."

1.2 Words or phrases defined in the British Columbia *Interpretation Act*, the *Community Charter* or *Local Government Act* or any successor legislation, shall have the same meaning when used in this Bylaw unless otherwise defined in this Bylaw.

1.3 In this Bylaw:

"Bylaw Enforcement Officer" means a Peace Officer, as defined in the British Columbia *Interpretation Act*, and those persons designated by the City as Bylaw Enforcement Officers from time to time;

"City" means the City of Kimberley; and

"Feed" means to deliberately lay out food to attract deer.

1.4 In this Bylaw the singular includes the plural and the masculine includes the feminine gender.

1.5 The headings contained in this Bylaw are for convenience only and are not to be construed as defining, or in any way limiting, the scope or the intent of the provisions of this Bylaw.

1.6 If any portion of this Bylaw is for any reason held invalid by any court of competent jurisdiction, the invalid portion shall be severed and the severance shall not affect the validity of the remainder.

2. Prohibition

2.1 No person shall feed deer or cause deer to be fed.

2.2 No person shall permit deer to be fed on property he or she occupies as a permanent or semi-permanent place of residence.

3. Offence

3.1 Every person who contravenes or violates any provision of this Bylaw, or who suffers or permits any act or thing to be done in contravention or in violation of any provision of this Bylaw or who neglects to do or refrains from doing anything required to be done by any provision of this Bylaw, commits an offence and, upon conviction, shall be liable to a maximum fine of up to $500.00;

4. Inspection

4.1 The Bylaw Enforcement Officer is hereby authorized to enter on property for the purposes of inspecting and determining whether the provisions of this Bylaw are complied with.

5. Commencement

5.1 This Bylaw shall come into force and take effect from and after the date of the final passing thereof.

Read a first, second and third time on the 28th day of August, 2006.

Approved by the Minister of Environment on the 8th day of January, 2007.

"Chris Trumpy"

Adopted on the 22nd day of January, 2007.

"J. E. Ogilvie"
MAYOR

"G. Stratton"
CHIEF CORPORATE
ADMINISTRATION OFFICER

I HEREBY CERTIFY this to be a true and correct copy of the Original Bylaw No. 2296 "Deer Feeding Bylaw No. 2296, 2006" as passed by the Municipal Council of the City of Kimberley signed by the Mayor and Chief Corporate Administration Officer, sealed with the seal of the said City, and dated the 22nd day of January, 2007.

DATED at Kimberley, B.C. this 24th day of January, 2007.

_____

CHIEF CORPORATE ADMINISTRATION OFFICER

Appendix J BC Bylaw Examples Kelowna Discharge of Firearms Bylaw 9979

CITY OF KELOWNA

BYLAW NO. 9779

A Bylaw to Regulate the Discharge of Firearms Within the City of Kelowna

*****Pertinent sections to deer management and crop protection have been highlighted in bold*****

WHEREAS pursuant to the Community Charter the Council of the Municipality may by bylaw regulate and prohibit in relation to the discharge of firearms;

AND WHEREAS the Municipal Council of the City of Kelowna deems it advisable to regulate and prohibit the discharge of firearms within the boundaries of the said City of Kelowna;

NOW THEREFORE, the Municipal Council of the City of Kelowna, in open meeting assembled, enacts as follows:

Part 1 - Short Title

1.1 This bylaw may be cited for all purposes as the "Discharge of Firearms Bylaw No. 9779".

Part 2 - Definitions

2.1 "Chief of Police" includes the Officer in Charge of the Kelowna Detachment Royal Canadian Mounted Police or his designate.

2.2 "Farm" includes every parcel of land within a rural agricultural zone under the provisions of the City of Kelowna Zoning Bylaw No. 8000, as amended, which is cultivated or worked in a farming operation and which is over two (2) hectares in size.

2.3 "Farmer" includes every person who cultivates or works land in a farming operation on a Farm.

2.4 "Firearm" includes a rifle, pistol, shotgun, air gun, air rifle, air pistol or spring gun, but does not include a starting pistol in connection with an athletic event where blank ammunition is used.

2.5 "Highway" includes a street, road, lane, bridge, viaduct, highway right-of-way or any way open to use by the general public, but does not include a private right-of-way on private property.

Part 3 – Prohibition

3.1 No person shall discharge a Firearm within the limits of the City of Kelowna.

Part 4 - Exemptions

4.1 The provisions of Part 3 of this bylaw shall not apply to:

a) A Peace Officer, discharging a firearm in the lawful performance of his duty;

b) An employee of the City of Kelowna discharging a Firearm which fires only blank ammunition, in the lawful performance of his duty; and

c) Any person holding a valid permit, in the form attached hereto as Schedule "A", for the discharge of Firearms issued by the Chief of Police for:

(i) a pistol, rifle, trap and/or shooting range which has received prior approval from the City of Kelowna; or

(ii) the operation of a commercial slaughterhouse operation for the killing of animals within the said slaughterhouse operation; or

(iii) a fair, midway or other such event provided that the operator or operators of such event have received prior approval from the City of Kelowna; or

iv) a person who has received authorization, in writing, from the City of Kelowna Airport Manager, for the discharge of a firearm on any land owned or leased by the City of Kelowna at the Kelowna International Airport complex for the purpose of destroying animals or birds which may be or have become a hazard to aviation; or

(v) the discharge of a firearm by an employee or contractor of the City of Kelowna for the purpose of control of wildlife in a park; or

(vi) the discharge of a shotgun only, not using a single projectile, for a land owner or person acting on his/her authority on land over two (2) hectares in size for the protection of such land from animals or birds; or

(vii) the discharge of a rifle using a single projectile, for a Farmer or person acting on his/her authority, for the protection of crops, livestock or domestic animals (as defined in the Wildlife Act), which are grown or kept on the said Farm, providing the Farmer or person acting on his/her authority, can show the necessity for the use of the said rifle.

4.2 No person permitted to discharge a Firearm pursuant to subsection 4.1(c) of this Bylaw shall do so either:

(a) across, along or on a highway; or
(b) within 150m of any school building, school yard, public park, playground, church, workshop, place of business, dwelling house, Farm building, or other place where persons may be assembled or engaged in work of any kind, except as specifically authorized by the permit.

Part 5 - Insurance

5.1 No person shall be issued a Firearm permit pursuant to this bylaw unless he provides roof of coverage, prior to issuance of the permit, of a public liability and property damage insurance policy in the minimum amount of Five Million Dollars ($5,000,000.00) validated for the duration of the said Firearm permit.

5.2 No person shall be issued a Firearm permit pursuant to this bylaw until a firearm registration check and a criminal record check have been completed, and the Chief of Police is satisfied that the person is fit to be issued the permit based on those two checks.

Part 6 - Penalties

6.1 Every person who violates any of the provisions of this bylaw, or who suffers or permits any act or thing to be done in contravention or in violation of any of the provisions of this bylaw, or who neglects to do or refrains from doing anything required to be done by any of the provisions of this bylaw, is guilty of an offence under this bylaw, and liable to a penalty of not less than One Hundred Dollars ($100.00) and not more than Ten Thousand Dollars ($10,000.00) or liable to a term of incarceration for a period of not more than 90 days, or both.

Part 6 – General

6.1 Nothing contained in, nor permitted pursuant to, this Bylaw shall abrogate or relieve any obligation of any person pursuant to, nor any provision of, any applicable provincial or federal act or regulation with regard to the discharge of Firearms.

6.2 City of Kelowna Discharge of Firearms Bylaw No. 7418, together with all amendments, is hereby repealed.

Read a first, second and third time by the Municipal Council this 30th day of April, 2007.
Reconsidered, finally passed and adopted by the Municipal Council of the City of Kelowna this 7th day of May, 2007.

_____
Mayor

_____
City Clerk

CITY OF KELOWNA

BYLAW NO. 9779

SCHEDULE "A"

CITY OF KELOWNA

FIREARM PERMIT

Issued to: _____

(Name)

_____

(Address)

subject to the provisions of "Discharge of Firearms Bylaw No. 9779".

Purpose of Permit:

Firearm Permitted:

Conditions:

Permit Valid for Period _____ 19 _____ to _____19 _____

Issued: _____ 19 _____ _____

Officer-in-Charge, R.C.M.P.

Magrath Quota Hunt
January 8 – 31, 2004

Post-Hunt Summary

Kim Morton
Wildlife Management
Fish & Wildlife Division
Lethbridge, Alberta

Lyle Lester
Enforcement Field services
Fish & Wildlife Division
Cardston, Alberta

Table of Contents

This document is now page numbered as part of the overall Urban Ungulate Problem Analysis, British Columbia report, November 2009.

The original page numbers as shown in this Table of Contents do not apply.

APPENDICES

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Acknowledgments

Planning and preparation for the Magrath hunt would not have been possible without the record keeping and organizational skills of Leo Dube (Lethbridge Wildlife Management team), providing past survey data timely and in a useable format. He also completed numerous tasks preparing for the fieldwork related to the hunt.

The administrative staff in the district offices in Cardston and Lethbridge, as well as the Lethbridge area office met hundreds of Albertans through the weeks leading up to the hunt and during the hunt, as they called or came in to local offices. Paulette Shields, Cheryl Trapp and Terry Briggs handled hundreds of extra calls courteously and professionally, averting possible pitfalls by providing accurate information to the public. We also appreciate the ability of all three to maintain their sense of humor through it all.

Enforcement Field Services management supported the high degree of enforcement presence throughout the hunt. Thanks to officers Bob Machum, Egon Larson, Don English and Tyler Young for varying degrees of participation in the planning, setup and execution of the hunt.

Oriano Castelli (Resource Information Unit) provided excellent map products, from wall maps to the hunt boundary map handouts that were given to successful applicants.

Thanks to the councilors for the Town of Magrath and the town administrator, Ron Williams. The facilitation of the public meeting and the use of the town office for license issuing are appreciated.

Thanks to the many students from Lethbridge Community College that took time out to come and assist with deer head collection.

The many landowners within the hunt boundary are thanked for allowing hunters access to their land. Without the support of the landowners, the hunt could not have proceeded.

Thank-you to the residents of the town of Magrath. The quota hunt did put some added disturbance on your community for the month of January.

Executive Summary

- Residents, via petition sent to local MLA, raise issue of "too many deer" in Magrath.
- Staff driving through Magrath area after hunting season (Dec. 1, 2003) observed over 370 whitetail in 12-15 square miles.
- Past aerial survey information indicates an increase of approximately 30% over a 10-year period in survey block 108 E (Magrath area).
- Past aerial survey information indicates a shift in habitat use of whitetail deer with number of deer within 2 miles of town increasing from 50 to 300+ over the last 10 years.
- Cardston County and Magrath Town Councils both fully supportive to implementing a quota hunt in the Magrath area.
- Majority (80%) of residents and landowners support the implementation of a quota hunt.
- On Jan. 5, 2004, 108 people applied in person for 100 available licenses for the Magrath quota hunt. Hundreds of calls received at district offices throughout January enquiring about license availability.
- 95 of 100 licensed hunters participated in the hunt.
- 91 of 95 hunters participating harvested at least one antlerless whitetail deer.
- Approximately 175 whitetail deer were harvested as a result of the hunt.
- SRD costs directly related to the quota hunt: $3132.15
  575.5 man-hours
  975 phone calls/walk-ins
- Eight individuals were involved in 14 enforcement actions taken during the Magrath hunt: 7 prosecutions; 6 warnings and 1 'time to produce'.
- Media coverage escalated as the hunt progressed, with most coverage during Hunt 2 and Hunt 3. Most coverage was positive.

1.0 Introduction

Last summer (2003), residents in the community of Magrath began voicing their displeasure at what they felt were unusually high numbers of whitetail deer (*Odocoileus virginianus*) living in and around their community. Deer were in parks, on roads and using gardens and ornamental vegetation as an alternate food source. The issue also was addressed several times by Enforcement Field Services (EFS), as officers responded to numerous complaints. The community's displeasure culminated in 83 residents signing a petition to that effect and delivering it to the local MLA in the fall of 2003. Shortly after, EFS along with the Lethbridge Wildlife Management team began comparing deer numbers from past aerial surveys conducted in the area. Complaints to Fish & Wildlife and records of deer/vehicle collisions were also summarized. After a series of meetings with town and county councils and the residents of Magrath, it was decided a quota hunt was an appropriate tool to use as part of the solution for dealing with the high deer densities in the area.

A limited entry, special quota hunt was held throughout the month of January, in a small geographic area around the community of Magrath. In the end, approximately 100 hunters harvested 164 antlerless whitetail deer. Aerial surveys carried out shortly after the hunt indicated that while whitetail numbers in the Magrath area remain high, there was a reduction in the number of deer that were utilizing habitat in close proximity to Magrath. Residents of the community also report that the deer in and around town are more wary of people.

2.0 Background

A variety of information, both scientific and social, was used to determine how serious the problem of high whitetail deer densities was in the Magrath area. Fish & Wildlife officers and Wildlife management staff then discussed several possible tools to deal with the problem. The first step was to educate community members on what was attracting deer to their community. Information was provided to residents on how they could protect their property with fencing, ornamental plant selection and behavior modification techniques. It was also agreed that a late season quota hunt would reduce the local population to give residents respite as they took steps to protect their property.

Limited entry quota hunts are not a common management tool used in Alberta. Management of most populations is done through regular hunting seasons. Quota hunts and other late season hunts create additional workload and also carry additional expenses not usually budgeted for. As well, if not properly justified, they are seen as a knee-jerk reaction to a perceived problem. This then sets a poor precedent for dealing with ungulate problems across the province.

2.0.1 What is a quota Hunt?

The provincial Wildlife Act authorizes the Minister of Sustainable Resource Development the ability to establish and issue licenses for a quota hunt (Part 3, Sec. 15(1)) (Province of Alberta, 1999 A)[1]. The Wildlife Regulations (AB Regulations 143/97) further define the quota license and applicable conditions that can be applied to the licenses issued (Sec. 28 (2)(b) and Sec. 30(5)) (Province of Alberta, 1999 B)[2].

As a management tool, quota hunts are used to target a very specific population of animals, in a very specific geographic location. As outlined in the "Management Plan for Whitetail Deer in Alberta (EP – NRS, 1995)[3], a quota hunt allows wildlife managers to reduce populations that cannot be dealt with effectively during the regular season. When utilized, it is often in response to depredation issues, usually where the problem wildlife population has a 'safe area' protecting them from harvest during regular hunting seasons. There are examples in areas around provincial parks where ungulate populations thrive inside the parks, yet during adverse winter weather conditions, leave the park and utilize livestock feed as a supplementary food source. Other 'safe areas' include Federal lands (i.e. Suffield) or large tracts of privately owned land where hunting is not permitted (i.e. Deseret and McIntyre ranches, southern AB).

A quota hunt utilizes local hunters, the most effective tool to harvest ungulates. Meat from harvested animals is fully utilized, either by the hunters, or others the game is often donated to. Using hunters to harvest animals is more socially acceptable than other methods of organized, large scale herd reduction.

2.0.2 Why Hold a quota hunt?

After studying all information collected, it was decided a quota hunt was one of the tools necessary to deal with the problem. While the quota hunt allowed Wildlife Management to reduce unusually high local deer numbers, it was emphasized to Magrath residents that the long-term responsibility lay with them to protect their property. Residents with deer in their gardens were educated and encouraged on a variety of methods of protecting vegetation both in gardens and planted as ornamentals.

2.0.2.1 Social Support for hunt

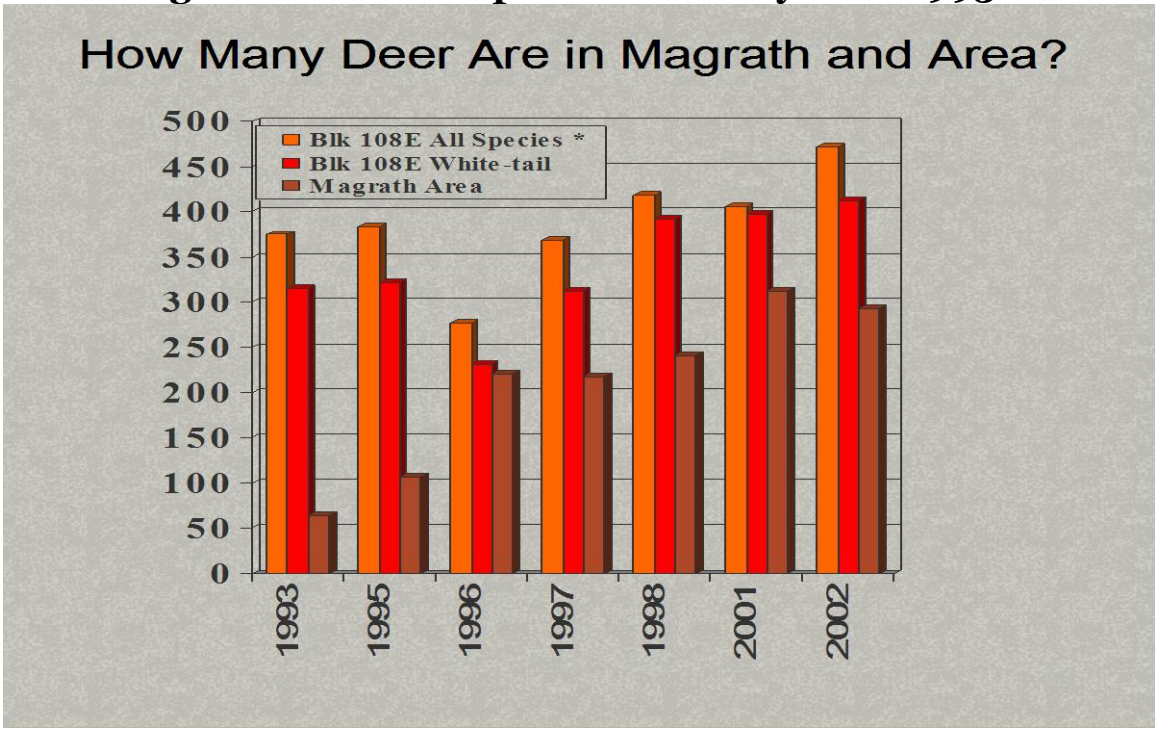
The Cardston District Fish &Wildlife office began responding to complaints of deer in yards and gardens through the summer of 2003. Magrath residents became more vocal as the summer went on. The frustration culminated in a public petition, signed by 83 members of the community, being delivered to local MLA Broyce Jacobs on September 12, 2003. The petition was then forwarded to the office of the Minister of Sustainable Resource Development (SRD). In response, Lethbridge area Fish & Wildlife staff met with local governing bodies and the general public through a series of meetings from October to December (Appendix A). The outcome from the meetings indicated almost unanimous support for a quota hunt. Both levels of local government (town and county) were fully supportive of the proposal. Overall, support from community residents, landowners and local governments was very strong.

2.0.2.2 Evidence supporting hunt

The community of Magrath happens to be situated along the bank of Pothole Creek within one of the ungulate aerial survey blocks. This allowed for a historical comparison of deer numbers over the past several years. Figure 1 outlines population trends for the past 10 years.

While the overall population of whitetail deer in survey block 108E has fluctuated, it has slowly increased by approximately 30% over the last 10 years. What is more important though, is the shift we have seen in habitat use by the whitetail deer in the area. The Magrath area numbers reflect all deer observed within approximately 2 miles of town. Here we have seen an increase from approximately 60 deer up to almost 300 (500% over 10 years). The whitetail deer in the Magrath area are moving in closer to the community to take advantage of the permanent food sources (gardens, ornamentals and irrigated fields), the lack of predators and safety from hunters.

Figure 1. Aerial Population Survey Data 1993-2002.



Along with the higher density of deer come other problems as well. The biggest problem is deer/vehicle collisions on our roadways. Volker Stevens (responsible for highway maintenance) reported having already removed over a dozen animals killed along portions of Hwy. 5 and Hwy. 62 in the Magrath area . During the month of December, at least another half a dozen were observed in the area by Fish & Wildlife staff.

The RCMP reported the following statistics:

- 2001 (4 months) -14 vehicle collisions
- 2002 (full year) -43 vehicle collisions
- 2003 (9 months) -18 vehicle collisions

These vehicle collisions were for portions of Hwy. 5 and Hwy. 62 as well. The 2003 statistics only included road kills up to September, but late fall and early winter are typically where they have the majority of vehicle/deer strikes reported.

All complaints received by the Fish & Wildlife district offices regarding wildlife are entered into the ENFOR system. Records indicate there have been 32 complaints in the Magrath area that were actioned by district Fish & Wildlife staff in the last two years.

3.0 Methods

3.0.1 Hunt Mechanics

While the goal of the proposed hunt is to reduce whitetail deer numbers in the Magrath area, it is important to maintain the safety of hunters and residents in the area and minimize the disturbance to landowners and residents. With the proposed hunt occurring in mid-winter, it is also important to limit the amount of disturbance the deer face so individual survivability and fawn survival in the spring is not compromised.

Fish & Wildlife staff decided on a series of four 3-day hunts (Thurs., Fri. & Sat.), with 25 hunters participating in each. All hunters licensed to legally harvest 2 antlerless whitetail deer, within a specific area (Appendix B).

Hunters applied for licences in person, at the town office in Magrath on Jan. 5, 2004. They were required to have a valid WIN and signed permission for access from at least one landowner in the hunt area. Licences were issued on a first come- first serve basis (Appendix C). This increased the likelihood local hunters would be licenced and hunter success maximized. Successful applicants were not restricted to the lands they had written access permission to when applying. They were eligible to hunt all lands within the boundary, providing they had landowner permission. The requirement for written approval from at least one landowner within the hunt boundary was to ensure hunters applying were likely to purchase their license and participate in the hunt.

All other hunting regulations applied as per the regular hunting season.

3.0.2 Public Involvement/Notification

The Magrath public meeting was advertised by way of leaflets distributed to all mailbox holders. Posters were placed throughout the community and at the town office. Special interest groups (i.e. Fish & Game) were specifically invited, as were all landowners within the hunt boundary. Word of mouth was also relied up on. During the meeting, attendees were provided survey forms (Appendix D) allowing them to indicate their opinions regarding the quota hunt. Survey forms were also mailed out to all landowners within the proposed hunt boundary.

Once the hunt was approved, ads were placed in the Lethbridge Herald and in the Southern Sun Times. These ads specified the dates of the hunt and how licenses would be made available to hunters. As well, local contacts (i.e. town CEO, local F&G) were notified and again word of mouth was utilized.

3.0.3 Hunt Data Collection

Information on several aspects of the hunt was collected to help determine success of the hunt, pitfalls encountered and to provide wildlife managers information for decision making with regards to future hunts.

3.0.3.1 Hunter Participation/Success

All hunters successful in their licence application were given survey forms (Appendix E), complete with a self-addressed envelope. The survey was to be completed at the end of their hunt and sent in the Lethbridge Wildlife Management.

One of the licence conditions was that hunters were required to submit the heads of all deer harvested. To facilitate this, we had staff (enforcement and wildlife) in the field at all times collecting heads. Fish & Wildlife Officers also kept field notes on all hunters that were checked in the field throughout the quota hunt. This provided information on hunter participation and success. As well, total number of deer harvested was obtained.

Once the hunt was complete, this information was confirmed via telephone calls to all hunters who records indicated had not participated or had not harvested an animal.

3.0.3.2 Biological Data Collection

Collection of deer heads in the field by staff provided the opportunity to also collect information on the harvested animals. Age (adult/fawn) and sex information was recorded at the time of head collection. Location harvested and date was also collected (Appendix F).

3.0.3.3 Disease Testing

Heads from mature animals were tagged and separated for the Chronic Wasting Disease Monitoring program. Heads were stored frozen and delivered to the Alberta Agriculture veterinary lab in Lethbridge for testing. Heads from fawns and livers from all animals were tagged and separated for delivery to the Lethbridge Research Center. When samples could be delivered fresh, Wildlife staff facilitated it. Most samples were stored frozen and delivered at a later date.

3.0.4 Administrative Cost - Data Collection

All staff taking part in the set up and execution of the quota hunt were asked to summarize effort and costs incurred.

Staff personal journals and time sheets provided an indication of hours spent on all aspects of the hunt. For administrative staff, there was no way to effectively capture that

information. For this reason, administrative staff was asked to summarize phone calls received and number of walk-ins occurring that were directly related to the hunt.

Staff expenses were obtained from claims submitted. Direct costs, such as advertising and equipment needed were obtained from purchasing records.

3.0.5 Hunter Compliance

The number of individual landholdings within the Quota Hunt Area was in excess of 90; as such the potential for Landowner/Hunter conflict was significant. This was the major considerations to spread the 100 hunters out over four separate seasons. Reducing the overall number of hunters would significantly reduce the possibility of negative hunter/landowner interactions and hunter/hunter interactions.

During meetings with municipal officials and residents of the area it was stressed that there would be a strong enforcement presence during the entire hunt. The enforcement approach agreed upon by Fish and Wildlife staff was the hunt would be allowed to unfold in the least intrusive manner, while maintaining a proactive enforcement approach. This was accomplished by employing the following enforcement actions:

- Officers conducted foot patrols in the Nature Reserve that lies within the town boundaries.
- Officers and biological staff conducted roving patrols to ensure compliance and maintain a high public profile.
- A fixed check station was set up and manned by biological staff, and occasionally officer staff, to provide the public with a known location where staff could be contacted as required during the hunt.
- Increased vehicle and foot patrols were conducted in a highly visible manner during closed times between seasons.
- Shifts for officer staff were staggered to provide coverage by two officers for most of the hunt. Additional officers were brought in to ensure adequate coverage existed during high use times.

4.0 Results

4.0.1 Hunt Mechanics

One hundred and eight hunters were present Monday, January 5, 2004 at the Magrath town office to apply for 100 licenses. All four hunts were filled and eight people were placed on an alternate list. All 100 hunters registered for the hunt successfully met all requirements and were issued a license to harvest two antlerless whitetail deer.

4.0.2 Public Notification

The short, but intensive public notification program carried out for the Magrath hunt culminated with approximately 60 people showing up for the evening public meeting. The group was made up of residents and landowners from the immediate area. The results of surveys completed by twelve attendees are summarized in Table 1. The high degree of support expressed (92%) was supported by almost all meeting attendees during an informal vote (show of hands). While the setting for the public meeting was not necessarily conducive to people speaking out about the hunt, most comments made and attitudes displayed indicate a high degree of support.

Table 1. Town Resident Survey Information

Question	Agree	Disagree
Too many deer?	11 (92%)	1 (8%)
Do you have problems with them?	10 (83%)	2 (17%)
Agree with the proposed hunt?	11 (92%)	1 (8%)

Total Respondents = 12

Without landowner support, hunters would not be able to access the targeted animals. There was a high degree of support (83%) from landowners to deal with the problem and to use a quota hunt as part of the solution. Twenty-three landowners completed surveys and returned them to our office. Results from the landowner mail-out survey are summarized in Table 2.

Table 2. Landowner Survey Information

Question	Agree	Disagree
Too Many Deer?	20 (87%)	3 (13%)
Will Allow Hunter Access?	19 (83%)	4 (17%)*

Total Respondents = 23

*One landowner indicated he only had 40 acres and was grazing sheep on it, so was unable to grant access. He did agree with the hunt though.

4.0.3 Hunt Data Collection

4.0.3.1 Hunter Participation/Success

The Magrath Quota hunt had a very high participation rate from licenced hunters. Of the 100 hunters licenced, 95 were out for at least one day of their eligible hunt. These 95 hunters shot and tagged 164 antlerless whitetail deer. Only 4 hunters participated in the hunt and were not successful in harvesting an animal. The majority of hunters (73/95 = 77%) were successful in harvesting two deer (Table 3).

Table 3. Hunter Participation and Harvest Success

HUNT	#Licenses	# Hunters	0 Deer	1 Deer	2 Deer
1	25	25	-	2	23
1	25	25	-	7	18
1	25	23	3	7	13
1	25	22	1	2	19
TOTALS	**100**	**95**	**4**	**18**	**73**

While all licensed hunters were provided with a mail in survey to be completed and submitted as a condition of the license, our office received only 45 surveys. The low compliance on surveys may be due in part to the presence of staff in the field, collecting heads and age/sex data at that time. Hunters may have concluded that we had the information we wanted and that the surveys were no longer necessary.

4.0.3.2 Biological Data

Age/sex information collected by staff was checked against returned hunter survey forms to determine age and sex composition of the harvest (Table 4).

Table 4. Age and Sex Composition of Harvested Animals

	ADULT		JUVENILE		UNKNOWN	
Hunt	M	F	M	F	M	F
1		20	16	11		1
2	1	21	13	7		1
3		21	9	3		
4		28	6	6		
Total	1	90	44	27		2 = 164
% Of Total	0.6%	54.9%	26.8%	16.5%		1.2%

Juveniles - Males 44/71=62% Females 27/71 = 38%

The adult harvest is slightly lower than the expected values during an antlerless hunt(64% - as derived from incisor age bar reports (EP – NRS, 1995)[3]), but there appears to be a selection for the larger male fawns compared to female fawns.

The lone adult male deer harvested was a mature buck that had already shed antlers by the time it was shot during the second hunt.

4.0.3.3 Disease Testing

Chronic Wasting Disease

Throughout the 4 hunts, 88 heads were collected from mature animals and submitted for testing. Results from all heads tested came back negative. To date, there have been no cases of CWD documented in wild ungulate populations in the province of Alberta (Appendix G).

Parasite Presence/Abundance

Fifty-nine heads and Approximately 60 livers were delivered to the Lethbridge Research Centre for sampling. The two parasites that were of interest were the genus Cephenemyia (nasal bot) and Fascioloides (liver fluke). Both species are known to occur in wild ungulates. In communication with Dr. Doug Calder (Agriculture and Agri-Food Canada), he indicated that nasal bot was present at low densities in several of the heads. Thirteen of 58 heads examined were positive for nasal bot, with an intensity ranging

from 1-8 (mean = 4.5) (Appendix G). These levels were well within the expected range in a wild ungulate population. Some data was also gathered on louse infestations during lab examinations of the deer heads. Two species were identified: Solenopotes ferrisi and Trichodectes spp.. However, final results were not available at the time the report was finalized. There are no results from liver tissue analysis yet.

4.0.4 Administrative Costs of Hunt

There were several costs associated with the Magrath quota hunt that were incurred over and above normal area operating costs. The total 'extra costs of the hunt were $3132.15. While gas was the largest expense, not all of the $1480 was directly related to the hunt (Table 5). Enforcement staff would have still been in the field occasionally during this time responding to public complaints. Advertising was also a large expense incurred because of the hunt.

Table 5. Magrath Quota Hunt Expenses

Employee	Meals	**Gas	Equipment	Advertising	Hosting
(W) Leo D.	166.75	200	45.45	-	-
(E) Lyle L.	160.00	500	-	-	-
(E) Bob M.	140.00	350	-	-	-
(W) Kim M.	174.00	300	126.16	708.46	104.83
(E) Don E.	17.00	70	-	-	-
(E) Egon L.	9.50	60	-	-	-
TOTALS	**$667.25**	**$1480**	**$171.61**	**$708.46**	**$104.83**

TOTAL EXPENSES...$3132.15

**Gas expenses are an estimate. Some portion of gas expenses for enforcement staff would have been incurred regardless, as the officers carried out normal duties.
(W) – Wildlife Management staff (E) – Enforcement Field Services Staff

The increased workload on staff associated with the quota hunt is also an important consideration when proposing such a hunt. Because of the proximity of the hunt area to the community and commitments to residents and landowners, staff was required to spend many hours in the planning and execution of the quota hunt. Table 6 outlines the extent of the added workload generated by the quota hunt. A total of 88.0 mandays were spent directly related to the Quota hunt. There was an increased interaction with the public both in the field and at the district and area offices also. In an attempt to capture the increased workload for staff with respect to the hunt, public interactions

(majority being phone calls) were estimated for the period leading up to the hunt, during the hunt and after the hunt (Table 7).

Table 6. Increased Workload From The Magrath Quota Hunt

Employee	Reg. Hrs.	O/T Hrs.	TOIL (equiv.)	Total Hrs.	Days
(W) Leo D.	72.50	25.50	43.50	98.00	13.50
(E) Lyle L.	108.75	28.50	47.25	137.50	19.00
(E) Bob M.	87.00	30.00	43.00	130.00	18.00
(W) Kim M.	206.50	28.50	53.25	235.00	32.00
(E) Don E.	7.25	3.25	5.50	10.50	1.50
(E) Egon L.	7.25	0.50	0.75	7.75	1.00
*H/Q Staff	21.75				3.00
TOTALS	**489.25**	**116.25**	**193.25**	**618.50**	**88.00**

Estimated 3 days for headquarters staff dealing with licence registration, briefing notes etc.

(W) – Wildlife Management staff (E) – Enforcement Field Services Staff

Paulette S. \ Cheryl T. > Terry B. / The three offices received many phone calls regarding the hunt. While there was no way to accurately capture hours worked by administrative staff, public interactions are captured in the Phone calls summary.

Table 7. Phone Call Summary

		Hunt			
Office	**Pre-hunt**	Calls	Walk-ins	**Post-hunt**	**Media**
Cheryl T. / Cardston Dist.	80	145	20	15	10
Paulette S. / Lethbridge Dist.	180	210	40	10	10
Terry B. / Lethbridge Reg.	-	75	-	10	-
*Lyle L. / Cardston Dist.	20	30	10	10	20**
Kim M. / Lethbridge Reg.	40	20	-	-	20**
TOTALS	**320**	**480**	**70**	**45**	**60**

TOTAL CALLS/WALK-INS…975.

* Most of the calls taken by Officer Lester were taken at his home in Magrath, many after hours.

** Most media interactions for Officer Lester and Kim M. involved phone or live camera interviews.

Although there were a large number of calls with respect to the quota hunt, they can be broken down into the following general categories:

1. Most callers were enquiring about the hunt (Is it on? How do I get a tag? Are there tags left?).
2. After the hunt received media coverage, several callers complained about not having known the hunt was on. As a result, they did not get a chance to get a license. While several commented on this (<5%), only a few callers were really upset (<1%).
3. 1 caller complained the hunt was doing nothing for the number of deer being hit on the highways in other areas of the province.

The Magrath Quota hunt received a surprisingly large amount of media coverage, ranging from local radio and newspapers to national television coverage (Appendix H).

4.0.5 Hunter Compliance

The hunt resulted in 14 Enforcement actions being taken, involving 8 individuals or an 8.25% non-compliance rate (Appendix I). Considering the significant enforcement presence in the relatively small hunt area, this is a fairly high non-compliance rate. Enforcement actions taken are summarized in Table 8. It is speculated that the level of non-compliance can be attributed to the deer being concentrated on a few key parcels of land, which concentrated the hunters. This crowding of hunters may have put pressure on some individuals to harvest a deer and resulted in poor ethical hunting behavior.

TABLE 8. Summary of Enforcement Actions During the Magrath Hunt

Total number of **Prosecutions**.....7
Total number of **Warnings**.....6
Total number of **Time To Produce**.....1
Total number of Enforcement Actions.....14

The hunt also produced 5 complaints of deer shot and left and 4 complaints of shot and wounded deer that were subsequently destroyed by Fish & Wildlife officers. There were additional complaints of deer that had been wounded but did not require officers to destroy them. The majority of shot & left deer occurred on the 17th of January. On this Saturday, very heavy fog moved in for the most of the day, often preventing any hunting from occurring. Deer that were shot, but moving well, evaded hunters in the fog.

Overall response from the community and sportsman to the level of compliance was very positive.

5.0 Discussion

Wildlife in urban settings has long been a problem for Fish & Wildlife staff. Typically, it involves coyotes, raccoons, rattlesnakes and other small animals. Occasionally a moose, deer or elk wanders in to a community and causes a rash of phone calls to the district office. The animal often makes it out of town on its own, or is escorted by enforcement staff. With urban centers spreading out and often located in or along areas of high quality wildlife habitat, larger animals are showing up more frequently in urban settings. In many cases, they are born, live and die within larger centers such as Calgary, Lethbridge or Edmonton.

This brings a new twist to wildlife management. Wild ungulate populations are generally managed for sustainability and a harvestable surplus. Recreational harvest provides managers with their primary tool in maintaining populations within socially/scientifically determined ranges. The movement of localized populations of many Alberta game species into or adjacent to urban centers takes away the effectiveness of this tool. Safety concerns as well as quality of hunt issues decrease the likelihood local populations, such as the whitetail deer near Magrath, are to be targeted by hunters during regular hunting seasons.

To effectively deal with this growing problem, the public needs to be informed about the problems associated with deer living in and around their communities. They also need to realize the part they play in encouraging or discouraging this type of behavior. At the public meeting held in Magrath, several residents admitted they had liked the deer at first when it was only one or two in their yard, many said they had even done things to encourage them. As the number of deer increased though, they began seeing them as a nuisance. This example illustrates the importance of educating the public on urban wildlife management. Providing this education/information will play a significant part in the development of future management plans for urban wildlife. To facilitate this public awareness, a series of newspaper articles were written by the District Officer and printed in the local newspaper in Magrath. These articles outlined why the deer were there, why they weren't leaving and what the town residents could do to keep them out of their yards. Information on fencing, deer deterrants and ornamental plant choices least preferred by deer was also made available at the town office and the local library. These proactive actions can forestall or completely remove the possibility of a quota hunt in urban areas.

A hunt of this nature impacts recreational hunters as well. In the Provincial Management Plan for Whitetail Deer, the assumption is made that hunters will selectively harvest the larger does over fawns during an antlerless hunt. While this was the case to some degree in the Magrath hunt, there was still a high proportion of the harvest made up by fawns. However, while the management plan assumes an equal split of fawn harvest between the sexes, this was not observed during the Magrath hunt. Almost two thirds of the fawn harvest was male. While this fits the assumption that hunters will select the larger animal, as male fawns were noticeably larger than female

fawns, it can have lasting effects. The impact of harvesting 44 male fawns during the hunt may result in a noticeable, localized reduction in bucks available over the next few hunting seasons. While this may reduce hunt quality and success to somewhat, whitetail bucks are on general season in WMU 110 and in the Magrath area, the whitetail population has surpassed the social carrying capacity.

The small geographical area of the hunt and the high harvest goal provided a unique opportunity to collect biological samples for testing. Heads of mature animals were submitted as part of the provincial CWD testing program. Magrath was outside the area of concern, but a large enough sample was collected to provide data for the area. Other samples collected were for research purposes rather than directly linked to current disease issues. The nasal bot, louse and fluke are all common parasites that are present in varying intensities in any wild ungulate populations.

6.0 Recommendations For Future Quota Hunts

1. The Magrath hunt was planned, approved and carried out in a very short time frame. For this reason, there were a few opportunities that were missed out on. The quota hunt offered an opportunity for students in the Wildlife Enforcement program at Lethbridge Community College to gain some hands on field experience. While several students did make it out, with more time to plan, that experience could have been enhanced.
2. Ensure consultation with municipal levels of government.
3. Consultation with public in open form on neutral ground, i.e. don't hold at Fish & Game Club House that will be attended primarily by Fish & Game Members.
4. Designate media contact person(s). This is very important to ensure the correct message is getting out to the public.
5. Have media information package (Can be same/similar to public information package).
6. At public meeting have neutral person chair meeting.
7. Provide self addressed stamped envelopes if you want survey results returned.
8. Ensure F&W staff that will participate in hunt are involved/attend information sessions and have access to the same/more information that the public and local municipal governments have access to.
9. Licences should be sold locally and offered for sale at a venue that insures good local participation.
10. Have hunters come in with signed access permission slips as a prerequisite to obtaining the hunting licence.
11. Have a strong Enforcement/F&W presence during the hunt.
12. Communicate to the public at large pre and post hunting season the reasons and results of the hunt.
13. Identify and strive to meet long-term goals in deer management to avoid the use of quota hunts if possible.
14. Continue to list the boundaries of the quota hunt area on the hunting licence itself.
15. Provide hunters with a clearly marked map/air photo of hunt area.
16. Contact landowners personally by mail with an information kit and a self addressed and stamped envelope to insure they have an opportunity to comment on the hunt.
17. Identify the specific goal(s) of the hunt and ensure the reasons for the hunt are simple, straight forward and consistently put forward at every opportunity.

References

1. Province of Alberta, 1999 A. **WILDLIFE ACT** – Statutes of Alberta, 1984, Chapter W-9.1 with amendments in force as of May 19, 1999. Queen's Printer, Edmonton, AB. 56 pp.

2. Province of Alberta, 1999B. **WILDLIFE ACT – WILDLIFE REGULATION** – Alberta Regulation 143/97 with amendments up to and including Alberta Regulation 68/99. Queen's Printer, Edmonton, AB. 271 pp.

3. Environmental Protection – Natural Resources Service, 1995. MANAGEMENT PLAN FOR WHITE-TAILED DEER IN ALBERTA. Wildlife Management Planning Series Number 11. (Pub. No. T/303). 142 pp.

Appendix A

Meetings with Local Civic Councils and the Public

Pre-Hunt Meetings

Oct. 15, 2004

Officer Lester attended Cardston County meeting to discuss wildlife related issues. Foremost were the county's concerns over the high number of deer in the Magrath and Welling area.

Nov. 10, 2004

Officer Lester and Kim Morton (Wildlife Management-Lethbridge Area) attended Cardston County meeting. Council was given a presentation on basic deer biology, population estimates for the area over the past 10 years and a list of potential options for dealing with ungulate problems in both urban and rural settings. Following the presentation, there was open discussion, during which, the council voiced its support for the possibility of a quota hunt in the area. A letter to that effect was received in the Cardston district office about 3 weeks later.

Nov. 25, 2004

Officer Lester, EFS Lethbridge Area Superintendent Dennis Palkun and Mr. Morton attended a meeting with the Magrath Town Council. They were given the same presentation as the M.D. council. It was once again stressed the problem would not be solved solely by a quota hunt, residents and council needed to take responsibility in protecting property. Open discussion was similar to that during the county council meeting, with town council unanimously supporting the possibility of a quota hunt in the area.

Dec. 4, 2004

Officer Lester and Mr. Morton hosted a public meeting in Magrath, with the County of Cardston providing a council member to chair the meeting. Other F&W staff in attendance was Cheryl Trapp (Cardston district) and Tyler Young (Lethbridge district). Fifty-five community members signed in at the meeting. Town residents and landowners were invited via flyers in mailboxes, letters, posters around town and word of mouth.

The presentation was given, with much more discussion following. While opinions varied on what should be expected by landowners, there were no dissenters when specifically asked about support for the idea of a quota hunt. Residents agreed that we should target as many deer as possible. After weighing many factors (i.e. disturbance to landowners, timing restrictions of late winter disturbance on animals) it was decided to target 200 antlerless whitetail deer. Other issues discussed were enforcement, effectiveness of different protective measures suggested, limits with respect to harassing wildlife when scaring them from private property and public safety in the event of a quota hunt.

Post-Hunt Meetings

March 23, 2004

Officer Lester and Kim Morton attended the regularly scheduled meeting of the town council. At this time, the results of the hunt were presented and questions were answered. Town council was thanked for assistance given during the hunt and the town manager was singled out for congratulations of his handling the local and national media.

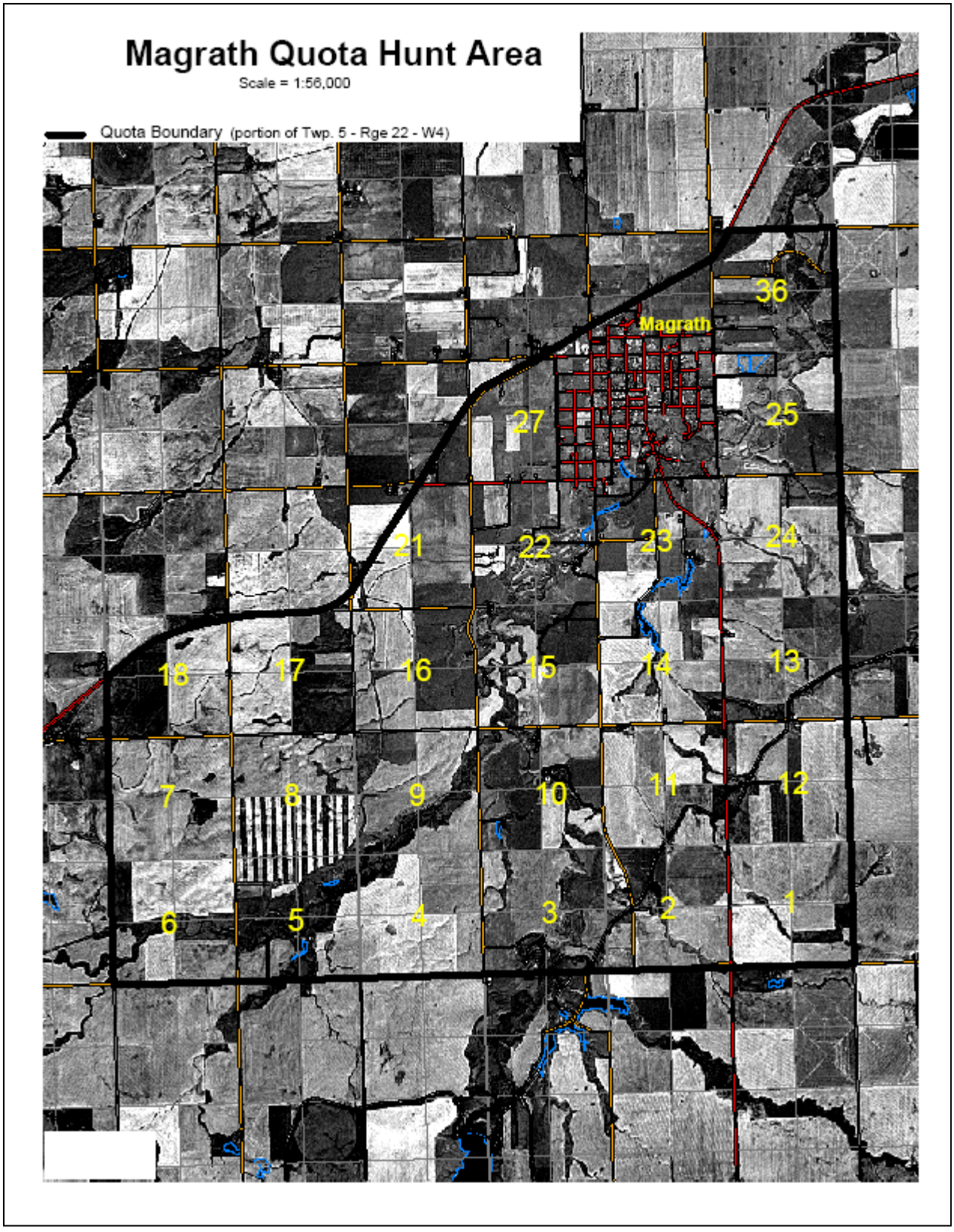
It was made clear that there would not be a similar hunt in the area, but that now the town and its residents would need to step up to their responsibility of protecting their property from deer damage. To this end, Officer Lester agreed to make information available at the town office and at the library for residents.

April 14, 2004

Officer Lester and Kim Morton attended the regularly scheduled meeting of the Cardston County council. At this time, the results of the hunt were presented and questions were answered. There were few questions and discussion soon turned to grizzly bears. Councillors were made aware of the availability of information regarding deer at several locations in Magrath.

Appendix B

Map of Quota Hunt Boundary


Magrath Quota Hunt Area
Scale = 1:56,000
Quota Boundary (portion of Twp. 5 - Rge 22 - W4)
Magrath
36
25
27
21
22
23
24
18
17
16
15
14
13
7
8
9
10
11
12
6
5
4
3
2
1

Appendix C

Hunter License Application Form

2003/2004 Quota Antlerless White-tailed Deer
Hunt in Magrath Area

Hunter Name (in full) _____ (please print)

Date of Birth _____

WIN _____

Phone No. During Day _____

Check off the applicable **one**

Hunt Season Dates
_____ Jan 8-10, 2004
_____ Jan 15-17, 2004
_____ Jan 22-24, 2004
_____ Jan 29-31, 2004

There are No Fees to be collected at the F &W Office.
The hunter will purchase his licence at one of the specified licence issuers the next day.

Date _____

Fish & Wildlife Signature _____
Lethbridge Fish and Wildlife Office

Fax completed form to: Licensing & Revenue Services
FAX: (780) 422-0266

2003/2004 Quota Antlerless White-tailed Deer
Hunt in Magrath Area

Hunter Name (in full) _____ (please print)
Date of Birth _____
WIN _____

Phone No. During Day _____

Check off the applicable **one**

Hunt Season Dates
_____ Jan 8-10, 2004
_____ Jan 15-17, 2004
_____ Jan 22-24, 2004
_____ Jan 29-31, 2004

There are No Fees to be collected at the F &W Office.
The hunter will purchase his licence at one of the specified licence issuers the next day.

Date _____

Fish & Wildlife Signature _____

Lethbridge Fish and Wildlife Office
Fax completed form to: Licensing & Revenue Services

FAX: (780) 422-0266

Appendix D

Landowner/Resident Survey Forms

This questionnaire is completely optional. We are soliciting the input of community members to determine how best to deal with the problems associated with the current deer population in and around the town of Magrath. Your cooperation is greatly appreciated.

1. Do you feel that there are too many deer in the Magrath area?

_____Yes _____No.

2. Have you had any problems with deer on your property?

_____Yes _____No.

3. Do you support the use of hunter as a method to reduce deer numbers?

_____Yes _____No.

4. Do you own land in Township 5 Range 22 – W4M in the area south of Highway #5 (Property within the town of Magrath does not apply)?

_____Yes (Please complete #5-7) _____No (You are done the survey).

5. Do you currently allow hunters access on your land during the regular hunting season?

_____Yes _____No.

6. Would you be willing to allow access for a limited number of hunters on your land for a quota hunt being held to reduce the number of deer in the Magrath area?

_____Yes _____No.

7. If you answered Yes to question #6, please list all lands that you hold title or disposition to.

LSD's_____(if applicable) ¼_____ Sec._____ Twsp_____ Rge._____

Appendix E

Hunter Harvest Survey Forms

As a successful applicant in the Magrath - WMU 108 Antlerless Quota hunt, you are required to complete the following questionnaire and mail it back to us in the enclosed, self-addressed envelope.

1. Did you hunt antlerless whitetail deer during the quota hunt?

_____Yes _____No.

2. How many days did you hunt?

_____1 _____2 _____3.

3. Were you successful in harvesting an antlerless whitetail(s)?

_____Yes _____No.

4. If yes, how many deer did you harvest?

_____1 _____2

5. If you answered yes to question #3, Please indicate the location of where you harvested your deer.

Deer 1: ¼_____Sec._____ Twsp_____ Rge._____

Deer 2: ¼_____Sec._____ Twsp_____ Rge._____

6. The purpose of the Antlerless quota hunt was to reduce deer numbers in a specific geographic area without impacting deer across the entire WMU? Providing recreational hunting opportunity was not the intent. With this in mind, do you feel, as a hunter, that you had an enjoyable hunting experience?

_____Yes _____No.

Recommendations to make future quota hunts better_____

_____

Appendix F

Field Data Collection Sheet

Magrath Quota Hunt - January, 2004
Data Collection for Antlerless Whitetail Deer

Hunter WIN #_____

Sex: Male_____ Female_____ Age: Adult_____ Fawn_____

Date shot: **(Check date that applies with corresponding hunt)**

HUNT 1	HUNT 2	HUNT 3	HUNT 4
Jan. 8_____	Jan. 15_____	Jan. 22_____	Jan. 29_____
Jan. 9_____	Jan. 16_____	Jan. 23_____	Jan. 30_____
Jan. 10_____	Jan. 17_____	Jan. 24_____	Jan. 31_____

Land location (down to ¼ section if possible – see hunt map)

_____1/4 _____sec. __5__twsp. __22__rge. W4M

Head collected? Yes_____ No_____ Liver Collected? Yes_____ No_____

Magrath Quota Hunt - January, 2004
Data Collection for Antlerless Whitetail Deer

Hunter WIN #_____

Sex: Male_____ Female_____ Age: Adult_____ Fawn_____

Date shot: **(Check date that applies with corresponding hunt)**

HUNT 1	HUNT 2	HUNT 3	HUNT 4
Jan. 8_____	Jan. 15_____	Jan. 22_____	Jan. 29_____
Jan. 9_____	Jan. 16_____	Jan. 23_____	Jan. 30_____
Jan. 10_____	Jan. 17_____	Jan. 24_____	Jan. 31_____

Land location (down to ¼ section if possible – see hunt map)

_____1/4 _____sec. __5__twsp. __22__rge. W4M

Head collected? Yes_____ No_____ Liver Collected? Yes_____ No____

Appendix G

Disease Testing Results

Appendix G was left blank.

Appendix H

MEDIA COVERAGE

During the second of the four hunts, CBC National from Calgary came out to cover the hunt. After they aired footage of the hunt that weekend (Jan. 17/18) on national news, the majority of the media calls were received. Most calls were received and interviews carried out during the third hunt.
The media coverage that Fish & Wildlife staff is aware of the hunt receiving has been listed below.

National

Media Agent	Media Type
CBC National	Television
CTV National	Television
National Post	Newspaper
CBC Country Canada	Television
TRAIN 48	Television

Provincial

Media Agent	Media Type
Calgary Herald	Newspaper
Calgary Sun	Radio
Alberta Outdoors	Magazine publication

Local

Media Agent	Media Type
Lethbridge Herald	Newspaper
Magrath News	Newspaper
Magrath/Raymond Commentator	Newspaper
Global (Lethbridge)	Television
CFRN (CTV Lethbridge)	Television

Appendix I

Enforcement Actions

TABLE I Prosecutions under the Wildlife Act by Section

Section 12 Contravene Terms And Conditions of License.....2
Section 25(1) Hunt Closed Season.....1
Section 52(1) Discharge Weapon Within 200 Yards Of Occupied Residence...2
Section 55(1) Unlawful Possession Of Wildlife.....2

Total Prosecutions.....7

TABLE II Warnings under the Wildlife Act by Section

Section 25(1) Hunt Closed Season.....1
Section 26(1) Fail To Carry License.....1
Section 33(1) Discharge Weapon From Vehicle.....2
Section 45(1)(b) Allow Dog To Pursue Big Game.....1
Section 51(1) Discharge Firearm Off Road.....1
Total Warnings.....6

TABLE III Time to Produce under the Wildlife Act

Section 26(1) Fail To Carry License.....1

Total Time to Produce.....1

Appendix L Sidney Island, BC, Capture and Euthanize Project

This account of the capture and euthanize method employed by the Sallas Forest Strata Corporation, was supplied by Paul McNally, Chair, Deer Management Committee, Sallas Forest Strata Corporation.

On Sidney Island, there is a large natural meadow and grazing area, of which a portion has been fenced, which is the initial staging area for the operation. There are 4 gates in the fence, which are left open most of the year, and the deer freely move in and out. Some weeks in advance of the capture operation, the gates and meadow area are baited with alfalfa. Then, during the night, when the deer are the quietest, the gates are closed. Hundreds of deer may be contained in this meadow at a time.

The deer do not herd easily, but 2 or 3 men on foot, moving very quietly and gently, can "work" large groups of the herd along the fence towards an open gate and an interim paddock area. The deer tend to run along the fence lines. The deer are kept in the interim paddock area for up to 8 or 10 days. They are provided with shade, food and water. They are generally very calm as long as there is very little presence of humans or dogs.

When sufficient numbers of deer are captured, the abattoir is brought in, and the deer are moved through a series of increasing narrow linear spaces, always maintaining a gentle and soft approach to the herding process. Because fallow deer very retain large racks, which can damage other deer during the herding process, bucks are removed by sharpshooting at this stage. The remaining deer are not alarmed by the shots, but may become nervous when carcasses are removed, and there is more movement in the paddock. Does and fawns ultimately end up in a small, absolutely dark shed, where they are in very close quarters. In this very dark area, they are very passive and immobile. One MoE or Parks Canada staff member moves quietly among the deer, and dispatches 4-6 animals with a bolt gun. This is the number of carcasses that the abattoir can process efficiently without undue handling delays.

In March 2009, 348 deer were captured and dispatched. Only about half the deer delivered to the abattoir were deemed suitable for human consumption, because of their poor, emaciated condition, bordering on starvation. Nevertheless, this phase of the project succeeded in demonstrating the feasibility of capturing and processing large numbers of deer on the island. The next phase took place in September and early October 2009 and removed 550 deer. This time of year resulted in a conspicuous improvement in the condition of the deer harvested, and a much larger proportion was utilized to produce venison. The Strata Corporation independently found a market for the venison, resulting in revenues sufficient to cover the abattoir cost and the immediate costs of the operation.

348 deer were removed March 2009, 550 deer were removed in fall 2009, 380 taken by hunters in winter 2008/2009, resulted in 1280 deer being removed from fall 2008 to fall 2009.