AN INDEPENDENT REVIEW OF BRITISH COLUMBIA'S URBAN DEER MANAGEMENT

USING A CASE STUDY APPROACH, HOW MUCH IS SCIENCE-BASED? HOW EFFECTIVE WERE RECENT CULLS?

"Seeing through the thickets"

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DISCLAIMER

The independent scientific conclusions documented herein are entirely our own based on an exhaustive case study review of five recent municipal deer management/cull initiatives in British Columbia, information obtained from the province and a scientific literature review. In particular we have had to often rely on annual deer management reports and other information done specifically for each community studied. This was generally a very complex and at times disparate and not always accurate data base and we have done our best to sift through a multitude of deer reports and other data to make some sense of each deer cull situation. We take full responsibility for any errors or omission on our part but no responsibility for any errors within the data and references that sometimes had to be accepted at face value. Where necessary we have relied on my own professional judgment and opinion.

While the best efforts have been made to ensure the accuracy and validity of this review, no liability is assumed with respect to the use or application of the information contained herein.

TABLE OF CONTENTS

ABSTRACT

We examined the science and overall effectiveness of urban deer population reductions carried out by five British Columbia municipal governments between 2010 and 2016: Oak Bay near Victoria, where 11 coastal black-tailed deer were culled in 2015; and four communities in the East Kootenays: Elkford, Invermere, Cranbrook, and Kimberley, where a total of 438 mostly mule deer were removed (378 through trap-and-kill, 60 through translocation). We looked at all data available, including municipal deer counts, numbers removed lethally or non-lethally by translocation, other mortalities (e.g., vehicle collisions), deer-people conflict complaints, provincial oversight documents, scientific literature, population dynamics, ecology and behaviour of the different deer species/types involved, and other information sources. We found that very little science had been used in the design of the cull programs (reproductive and mortality rates of urban deer numbers, potential rates of immigration and emigration in and out of the subject communities). The municipal databases available, such as annual deer reports, counts, and deer-people conflict/traffic collision information was very sporadic and often subjectively interpreted. Monitoring the results of the various culls was often not done or not done at a credible scientific level.

By examining the deer counts and conflict data (some of which, we concluded, had questionable reliability), we found that there may have been some short-term effectiveness resulting from the culls, but little or no evidence of long-term value. In Elkford, even a high lethal cull of 66% of the over-wintering deer did not result in a reduced count the following fall. The data suggest that deer removed were replaced within a year or two by the rebound effect (increased reproduction and immigration). While we did not do a full-cost accounting, we concluded deer culling is an expensive activity having questionable results, a conclusion supported by a number of urban deer studies reported in peer-reviewed journals. The review for Oak Bay found very little science was used in their urban deer conflict reduction program, including no baseline information on types and locations of conflicts and population numbers to justify the 2015 Clover trap-bolt gun cull of 11 deer at a cost of $16,000.

While an East Kootenay non-lethal deer capture-and-translocation program in 2016 was more rigorously designed and monitored (through radio-collared deer), the overall results are as questionable as the lethal culls for the same reasons (urban deer population rebound effect, etc.). Other non-lethal options put forward by some communities (fencing municipal boundary, sharp-shooters, hazing with dogs) were not pursued. We did not examine these options but they should be more seriously considered along with all other options.

For the District of Oak Bay, and other urban environments in BC where deer-people conflicts are occurring, long term research, monitoring, and dedicated resources need to be put in place. Baseline research on urban deer numbers, population dynamics (reproduction, survival rates, mortality), diet, behaviour (herding, etc.), home ranges, habituation, response to aversion techniques, immigration and emigration, landscape migration patterns, and other factors are needed to enable sound adaptive management of urban deer populations to a level where conflicts with people and vehicle collisions are kept to a minimum. Acquiring baseline data of what, where, why, and how many wildlife-people conflicts are occurring is also an important first requirement to enable comprehensive and effective management planning. Keeping the data updated to identify trends in habitat availability and wildlife population levels will help ensure that British Columbians and visitors can enjoy wildlife in and near our communities.

INTRODUCTION

In May 2016, McCrory Wildlife Services was commissioned by Animal Alliance of Canada to carry out an independent review of how much science was being applied in the approaches being used by the government of British Columbia and some municipal governments to deal with urban deer-people conflicts. Additionally, where lethal culls and translocation removals were being conducted, how effective were these measures in addressing the fundamental concerns regarding urban deer?

We decided that the best approach would be for a biologist team to work together to do a Stage 1 review using case studies of Oak Bay (adjacent to Victoria), and four municipalities in BC's East Kootenays (Kimberley, Cranbrook, Invermere, and Elkford). In the process, we began to look closely at other approaches used in other jurisdictions to reduce urban ungulate-people conflicts in order to help us determine what scientific practices may be the most successful for urban deer management in BC. We called this Stage 2, but it is not part of this Stage 1 report other than to touch on non-lethal approaches, such as the 2016 East Kootenay mule deer translocation project. We feel a much more in-depth review of approaches used elsewhere in North America and other countries would be worthwhile.

THE STUDY TEAM

Wayne McCrory is a registered professional biologist with considerable field and background research involving ungulates in western Canada, including coastal black-tailed deer, elk, mountain goats, Dall's sheep, bighorn sheep, barren-ground caribou, deer, moose, and others. He previously did a mammal inventory in Yoho National Park that reviewed highway-ungulate mortality data and other ungulate-people conflicts with a particular focus on the town herd of elk. He also worked with Parks Canada on methods to reduce mountain goat traffic mortality at the east snowsheds in Glacier National Park, which included implementation of a 70 km/hr speed reduction zone that is still in place today. He has extensive experience in wildlife conflict research and the design of human-wildlife conflict plans and their implementation and monitoring.

Maggie Paquet has been a biological researcher, writer, and editor for the past 35 years. Her past work includes the comprehensive reports, *Stone's Sheep of the Northern Rockies: The Effects of Access*, *Toward A Mountain Caribou Management Strategy for British Columbia*, and *Conservation of Grizzly Bears in British Columbia: Background Report*, as well as a variety of BC government brochures, including *Caribou in BC* and *Black Bears in BC*.

Both McCrory and Paquet also have a large amount of scientific expertise in developing bear hazard studies and bear-people conflict prevention plans for a large number of municipalities under the province's science-based Bear Smart program.

Sadie Parr is a wildlife researcher who provides outreach and public education on ways to coexist with wildlife. Most of her recent work focuses on large carnivores. She is involved in research projects on wolves, coyotes, grizzly bears, and wolverines. Previously, Parr acted as the Bear Aware Community Coordinator for Golden BC, providing public education on conflict reduction, attractant management, and an assessment of Golden's bear travel corridors, attractants, and conflicts with people to facilitate adaptive management. Parr is the author of Wolf Awareness' booklet titled *Ranchers Guide to Coexistence with Carnivores*.

STUDY APPROACH

Background reviews were done by examining key documents, including annual deer reports done by municipalities that were available online. We also reviewed all relevant reports done by or for the province. A literature review of relevant published papers and reports on urban deer was carried out. Representatives of municipal governments and others involved with the subject deer culls were contacted for fact-checking and for information that might not have been available from other sources. Maggie Paquet carried out the background case study of Oak Bay (near Victoria) and Sadie Parr carried out the initial background data assemblage for each of the four East Kootenay communities. The reviews were done under the direction of senior biologist Wayne McCrory.

REPORT FORMAT & NOTE ON TERMINOLOGY USED

Format

Due to a large volume of relevant background information, the baseline databases we put together for each of the five case study municipalities are included in the Appendices. For Oak Bay, Maggie Paquet prepared a standalone technical report that is in Appendix 1. Appendices 2-5 are for each of the four East Kootenay communities reviewed. All of this information is summarized in the section on GENERAL FINDINGS AND RECOMMENDATIONS.

Special note on the use of the following terms for urban deer: resident, transient, migratory, and emigration and immigration

Throughout some of the urban deer committee reports cited in this document, other background information, and in some of our interpretation, we have used a number of common terms to loosely describe the perceived status of urban deer, such as resident, transient, and migratory without, insofar as we are aware, any studies that quantify or prove these terms to be valid for the circumstances described. For example, what may be considered "resident" deer may in fact be seasonal residents that move in and out of urban settings to adjacent natural winter or summer range. Some deer may be passing through an urban development (transient) as part of their historic migration patterns between winter and summer natural ranges, or vice-versa. "Immigration" loosely refers to deer moving from adjacent areas into an urban area, and "emigration" refers to deer moving back out. Until BC conducts detailed research on the diet, movements, reproduction/mortality, behavioural modifications, and home range requirements of a number of our urban deer populations, we really won't understand all of the parameters that are required to proactively address management situations where some sort of problem mitigation measures are considered politically necessary. A classic example is an extensive radio-telemetry study of white-tailed deer in a suburb of Rochester, New York by Porter et al. (2004), which discovered that 8% of the female cohort "emigrated" and dispersed out of the urban area annually and, even with the major cause of mortality being deer-vehicle collisions, there was a 68% survival rate of urban deer. Population modeling showed that culling would still have to reduce annual survival to 58% for just under ecological carrying capacity of the suburban deer area, and 42% to keep the population at one-half carrying capacity.

GENERAL FINDINGS AND RECOMMENDATIONS

DEVELOPMENT OF BC'S URBAN DEER MANAGEMENT PROGRAM

In 2010, due to increasing concerns and complaints about urban deer being made by various municipal governments, the Ministry of Environment commissioned a report titled *British Columbia urban ungulate conflict analysis* (Hesse 2010). One of the conclusions was that:

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

Hesse also reviewed case studies in Magrath, Alberta (controlled quota hunt report) and Sidney Island, British Columbia (capture-and-euthanize project), as well as in Helena, Montana (capture-and-euthanize project). Hesse (2010) provided a summary of urban ungulate issues for some communities. While identifying significant information gaps, the Hesse report provided what could be considered a fair scientific background review and some evidence-based standards embedded in management recommendations for municipalities to follow, should they implement urban deer management/control programs. As a result, and with the assistance of the Ministry of Forests, Lands, and Natural Resource Operations (MFLNRO) at both the Victoria and East Kootenay levels, the District of Oak Bay and four communities in the East Kootenays (Kimberley, Invermere, Cranbrook, and Elkford) subsequently began urban deer management programs that, on the surface, were guided by local committees. In all instances, the local government councils elected to move forward with lethal cull programs modelled after one carried out in Helena, Montana.

On April 18 and 19, 2012, the Columbia Mountains Institute of Applied Ecology convened a conference in Cranbrook on urban wildlife challenges and management and published the proceedings, which are available online. We reviewed the proceedings and found they included a number of very informative presentations relevant to urban deer issues that have, unfortunately, largely been ignored in the five urban deer case studies we reviewed.

The proceedings report (Columbia Mountains Institute of Applied Ecology 2012) includes an excellent presentation by Harris and Kuzyk (2012) on the ecology, herd behaviour, and reproduction of mule deer and white-tailed deer as it pertains to urban deer situations. Subsequently, in our five case study reviews, we found no evidence where herd/social behaviour and, in particular, reproduction rates (annual increments/total mortality) were factors adequately included where culls were implemented.

At the Cranbrook conference, Hall (2012) provided a critical review of the Ministry of Environment's British Columbia Urban Ungulate Conflict Analysis Summary for Municipalities (2010). We are in agreement with his findings, which also went largely ignored by provincial biologists in charge of the urban deer management program. According to Hall, the provincial ungulate conflict analysis:

> *…summarizes the current state of urban wildlife conflict management in different jurisdictions throughout North America, describes the legal context for urban wildlife management in BC, and recommends management options for communities to consider. However, these guidelines fail to demonstrate an integral way of solving conflicts at the community-level using a formal and structured approach to solving*

> *these types of problems. Even the Ministry of Environment's Urban Ungulate Conflict Analysis Summary (2010) report perpetuates this myth by recommending communities 'get at the root cause.' In fact, there is no such thing as a single root cause to any problem, and relying on paradigms such as this typically leads to failure for problem solvers. The Ministry's Urban Ungulate Conflict Analysis report (2010) perpetuates the pitfall of judging solutions by their* [financial] *cost (i.e., 'expensive option') in absence of a comparison against the total cost of a defined problem, the risks associated with its recurrence, and the options available to a community to amortize the cost over an acceptable period of time.*

The next political stage of policy development/implementation of urban deer management in BC occurred in January 2015, when an urban deer workshop was delivered through collaboration with the provincial government and the Union of BC Municipalities (UBCM) at Richmond, BC.

The workshop decreed the establishment of a Provincial Urban Deer Advisory Committee (PUDAC), the purpose of which would be to *provide consistent and authoritative support to all local governments in BC that contend with urban deer conflict* (Provincial Urban Deer Committee Terms of Reference - FNR-2015-53558). PUDAC involves the collaboration of provincial government staff with local municipalities and other shareholders, and will provide funds for managing urban deer. Per the program plan for the Provincial Urban Deer Operational Cost Share Program, M*FLNRO will provide up to $100,000 in cost-share funding per year.* The funds are to be used to help communities with approved deer management plans and defray costs of managing urban deer populations *through culling, capture, and research in an effort to mitigate risks and negative impacts to communities (people) where urban deer are an issue* (NRS1407 Government Transfer – Shared Cost Agreement # SCA 16FHQ275-01 – SCHEDULE A– SERVICES). An application and standardised project plan is required to be submitted by local governments for PUDAC evaluation and approval.

The annual $100,000 funding provided by MFLNRO was stipulated to be for use by local municipalities in the following ways:

- Operational Activities: direct management activities (e. g., trap-and-kill programs), research trials, anti-deer structures (e. g., fencing or cattle guards)
- Equipment purchase (e. g., traps)
- Development of communications materials that can be used province-wide

The program plan for the Provincial Urban Deer Operational Cost Share Program states that *Culling operations in the interior of BC will be supported at a rate of $200.00 for each deer that is culled*. In BC coastal areas, $300 will be provided by MFLNRO for each deer killed. *The support is intended to cover approximately 50% of the operational costs associated with culling. Cost-share management activities will be capped at $20,000 per local government per year.*

The plan for this cost-share program does not specify the species of deer for the financial subsidy, nor is a target demographic outlined (e.g., adult does), however, it is possible that these objectives may be listed within an individual municipality's plan it submits to access the required permit and request provincial funds *(*Program Plan for the Provincial Urban Deer Operational Cost Share Program -FNR-2015-53558). For each municipal project, the requirements for standardized monitoring and reporting (as established by the provincial government) must also be fulfilled.

A most interesting document is the province's response to the UBCM workshop's extensive recommendations (dated Sept. 23, 2015 and found online at: http://www.ubcm.ca/assets/Resolutions~and~Policy/Policy/Environment/Provincial%20Response%20to%20UBCM%20Urban%20Deer%20Recommendations.pdf). This document is a must-read for anyone hoping to understand the complex bureaucratic structure, politics, guidelines, and legislative rules and restrictions concerning lethal and non-lethal options involved.

The funding objectives for 2016/2017 appear to have modified to include First Nations and to allow for research projects. Again, this funding is available from the joint UBCM/province Urban Deer Cost Share Program to *help local governments or First Nations with up to $100,000 to address urban deer management challenges through operational or research projects.* The Program *is intended to support 'shovel ready' projects that are consistent with community-based planning processes.* There is a list of guidelines including that if it is a research project it must be *scientifically rigorous* (http://www.ubcm.ca/EN/meta/news/news-archive/2016-archive/urban-deer-management-funding-applications-now-available.html).

Given the past history of the BC urban deer management program, where our conclusions are that very little scientific rigour was applied to background justification concerning the efficacy of lethal control programs as well as in quantifying the results with a sound database and credible evaluation process, one has to ask: What scientific oversight will there be for the new joint UBCM/provincial Urban Deer Cost Share Program? Who will have that oversight responsibility?

SUMMARY OF FIVE CASE STUDY REVIEWS

1. Deer-People Conflict in the District of Oak Bay, BC

In 2015, Oak Bay was the first municipality in southwestern BC (on southern Vancouver Island) to implement a lethal coastal black-tailed deer cull in an attempt to address a relatively high level of deer-people conflicts, including expensive costs related to traffic collisions with "resident" deer (see footnote 5 on p. 33 of this report)). Using equipment and experienced personnel from the East Kootenay deer cull program, 11 deer were culled in Oak Bay in February 2015 at a cost of $16,000 ($1,455 per deer). Further efforts at population reduction are in the planning stages.

Ecological Context for Oak Bay

The district municipality of Oak Bay is one of 13 municipalities in the Capital Regional District (CRD), which is a local government administrative district encompassing the southern tip of Vancouver Island and the southern Gulf Islands. The CRD area is within the natural range of the Columbia black-tailed deer subspecies (*Odocoileus hemionus columbianus*), a small coastal subspecies of black-tailed deer adapted to surviving in Pacific coastal rainforests. Under natural conditions in the wilds, the black-tailed deer forms a vital and vibrant part of the intricate wolf-deer predator-prey system of coastal temperate rainforests that has existed for thousands of years.

The high reproductive capacity of coastal black-tailed deer and their ability to recover from catastrophic population crashes in the wilds is relevant background information for urban deer conflict reduction programs that, among other biological characteristics of the species, appears to have been overlooked in Oak Bay's attempt to reduce or eliminate their urban deer population. According to a coastal black-tailed deer report (McCrory et al. 2003), the high reproductive capacity of the species has, under favourable conditions, led to high densities on Vancouver Island of 15-20 deer/sq km. Densities are considerably lower where less productive second-growth forest plantations have replaced the more productive original old-growth forest ecosystems. Probably as a result of extensive clearcut logging, black-tailed deer have also undergone a significant population decline from former times. Estimates from the 1980s showed the population at 150,000-300,000 (McNay and Davies 1985), but in 2011, their numbers were down to an estimated 44,000 to 65,000 animals (http://www.env.gov.bc.ca/fw//wildlife/management-issues/docs/2011_BC_Provincial_Ungulate_Numbers.pdf).

In wetter coastal regions, old-growth winter range is critical to survival during severe and prolonged winters that appear to occur every 17-18 years historically, although climate change may unpredictably alter this situation. On Vancouver Island, where most of the old-growth forests have been depleted, severe winters have resulted in catastrophic population declines. One study estimated that 100,000 black-tailed deer died during the severe winter of 1968-1969.

The CRD is within the generally warmer and drier coastal Garry oak-Douglas fir ecosystem, where deer numbers would not be so influenced by severe winter conditions. **Nonetheless, our point is that even with catastrophic population declines, coastal black-tailed deer have a high level of reproductive capacity to quickly recover their numbers under favourable habitat and other conditions, such as what may be experienced by urban deer populations, namely, fewer predators and sustainable anthropogenic food sources, including gardens, lawns, landscape plants, fruit trees, garbage, and agricultural crops.**

Unfortunately, we have no background biological information on urban black-tailed deer (such as for urban diet and reproductive rates that might be gained from an urban deer telemetry study) to help us fully understand the ecological and deer social/behavioural conditions as to why coastal black-tailed deer have recently colonized the CRD after what appears to be a long period of being locally extirpated from colonial times; or why their numbers have expanded to be highly problematic in places like Oak Bay, when across Georgia Strait on the lower mainland in similarly favourable urban residential areas in West Vancouver and North Vancouver (where McCrory and Paquet have done extensive Bear Smart bear habitat/hazard studies) bordering wild deer habitats, the same deer species have not become seriously problematic.

From the outside, Oak Bay appears to be very favourable urban deer habitat, which includes the lack of wild predators. Oak Bay is a seaside residential community. According to one source, Oak Bay has a *large proportion of single-family dwellings, some with substantial gardens and landscaping,* [likely resulting in] *conditions that favour an influx of black-tailed deer to take-up residence*. However, what do they eat compared to their wild diet, how fast do they reproduce, and how much does their urban diet and lifestyle influence their reproductive rate? How much do they move in and out of other adjacent jurisdictions or are first attracted from wild areas to agricultural crops bordering the residential areas? These are all stark, unanswered questions that need to be addressed if long-term solutions are ever to be found.

Summary of Maggie Paquet's November 2016 Oak Bay Case Study

The case study showed that by 2014, black-tailed deer numbers within this urban residential community had reached high but undetermined population levels and a high level of deer-people conflict complaints and costly vehicle collisions, despite a fairly high unnatural mortality rate that included vehicle collision kills. **The review found very little science was used in the Oak Bay urban deer conflict reduction program, including no attempt to acquire baseline information on types and locations of conflicts and deer population numbers to justify the 2015 controversial Clover trap-bolt gun cull of 11 deer at a cost of $16,000.**

Paquet's comprehensive review found the answer was NO to each of the following sets of questions:

1. *Was the process leading to the decision to conduct the cull transparent? Were Oak Bay residents fully consulted and given adequate opportunity to contribute to the decision-making process?*
2. *Was the Oak Bay deer-people conflict situation scientifically assessed and was science used as the basis for a population reduction strategy? What prior facts are needed to support a decision to implement a "capture-and-euthanise" cull to manage deer in an urban setting?*
3. *Were the causes of the conflicts thoroughly known and acted on before a cull was decided on and subsequently conducted?*
4. *Were acceptable levels of alternative conflict-reduction options undertaken by Oak Bay prior to deciding to do the cull? Were all the conflict-reduction options fully employed, and their results analysed and publicly reported on prior to carrying out the cull?*
5. *Was the cull in Oak Bay effective in reducing the deer population? Did the cull reduce deer-people conflicts in Oak Bay?*

Oak Bay did, however, take some small steps in the right direction. Prior to the cull in 2014, the municipality passed a bylaw to increase the fine for feeding deer from $100 to $300, and another to increase allowable fence heights for residential side and back yards. Oak Bay also acquired speed sign equipment from ICBC that was placed in high collision areas to alert drivers to reduce their speed. This action was somewhat augmented by residents putting up their own homemade signs urging deer awareness and speed reduction. On the downside, Paquet could find no data to support any level of enforcement activity for these measures. Oak Bay also conducted a survey that had limited value, in part because it was lacking in objectivity and because its distribution was uneven. There was also no way to determine if individual respondents had made more than one response.

The Paquet case study recommended the following:

> *For the District of Oak Bay, and elsewhere in urban environments in BC where deer-people conflicts are occurring, long term/ongoing research, monitoring, and dedicated resources need to be put in place to enable adaptive management of deer populations to a level where conflicts with people are kept to a minimum.*
>
> *Acquiring baseline data of what, where, why, and how many wildlife-people conflicts are occurring is the first requirement to enable comprehensive and effective management planning. Keeping the data updated to enable identifying trends in habitat availability and wildlife population levels will go a long way to ensuring that British Columbians and visitors can enjoy the presence of wildlife in and near our communities.*

Other General Commentary and Relevant Context Related to Oak Bay's Cull

The urban deer management and conflict situation in British Columbia has some obvious parallels with the province's Bear Smart program in that, despite the province having a fiduciary responsibility under the Wildlife Act to manage wildlife, even on private lands, and the resources and expertise to fund and conduct baseline research for wildlife-urban problem situations, as with the Bear Smart program in 2012, it downloaded the Oak Bay urban deer conflict problem almost entirely onto municipal governments. The only difference is that prior to downloading the Bear Smart program onto municipal and regional governments and NGOs in 2012, the province had conducted a credible background biological study of the root causes of bear-people conflicts and had also funded, for some years, a program to assist local governments to gather sound biological information to develop local science-based bear-people conflict prevention plans tailored to each community; as well, there was a 50% cost-sharing program for some bear-proofing (all of this ended in 2012).

Other than the Hesse (2010) science report and the $300/deer killed in coastal communities (see p. 8 above re PUDAC), there was no funding for communities to develop science-based and tested urban deer conflict mitigation plans and programs; rather, government left it up to the communities to be guided by local "urban deer committees," most of which had very little to no scientific expertise. The committees were given limited input from provincial biologists and the provincial veterinarian. Thus Oak Bay, under considerable political public pressure from a vocal segment of the constituency to "do something," and without adequate biological oversight and scientific information, had to rely on advice from a non-science-based ad hoc advisory committee with periodic input from provincial biologists. In other words, places like Oak Bay were forced to

try to resolve or reduce their challenging urban deer conflicts without adequate scientific studies, biological expertise, and other resources.

Obvious biological parameters not considered by Oak Bay in their cull decision included a general lack of knowledge of their urban deer population numbers; deer population input factors including reproduction, herd increment potential, and existing mortality factors; and an ignorance of the obvious phenomenon of the immigration of deer into Oak Bay from adjacent urban deer populations once a "sink" or deer population hole was created by the cull measure. Thus, the Oak Bay cull in February 2015 not only generated a large amount of public controversy and legitimised questions about its humaneness and deer population effectiveness, but only recently did we learn the cull of 11 deer cost $16,000, or $1,455 per animal. This amount of money would have supported much of the costs of a two-year graduate level research program on urban deer diet, ecology, movements, and behavioural adaptations to urban habitats to better guide future effective management of Oak Bay's urban deer.

Also, according to Paquet's report, prior to the 2015 cull, 49 dead deer were found in Oak Bay between 1 September 2013 and 19 October 2014, with about half killed by vehicles. In 2014, 29 deer were killed by traffic up to September of that year. In other words, and not knowing how many deer are actually found in Oak Bay, prior to the cull, there already was what appeared to a high level of human-caused mortality to the urban deer population. What difference did the cull make then? We don't know, but apparently not much, as the second post-cull count done six months after the cull counted 55 deer. This must be considered not a total count but a sampling of the Oak Bay population. Given the high mortality factors documented for the previous two years (49 found dead and 11 culled) as a sampling of overall mortality, it appears likely that the Oak Bay black-tailed deer population has a high level of reproductive resiliency and survival, almost certainly aided by immigration from adjacent areas. Better knowledge and understanding of the population dynamics of Oak Bay's urban deer could have aided the community in its decision whether or not to carry out a cull.

Another significant research gap is related to not knowing the diet of urban deer and what are their preferred habitats compared to adjacent wild areas? In other words, what are the main food attractants and habitat preferences in places like Oak Bay? If we fence deer out of people's gardens, will they still obtain most of their annual dietary needs from residential lawns, golf courses, urban parks, and other green spaces? We have the attractant information to design programs to mitigate urban bear-people conflicts, but without knowing more specifically what food and habitat preferences attract wild deer into becoming urban deer, how can we address the urban deer situation over the long term?

These considerations only underscore the need for adequate scientific research on urban deer ecology and behaviour in order to support an evidence-based approach to support any further efforts to proactively address the urban deer conflict issues in Oak Bay and elsewhere.

2. Case studies of deer-people problems in four municipalities in BC's East Kootenay region

Summary of urban deer management reviews and control programs by the four communities

In the East Kootenays, considered a mecca for BC ungulate populations due to very productive wintering habitats in the Rocky Mountain Trench, four communities (Kimberley, Cranbrook, Invermere, and Elkford) implemented urban deer management programs between 2010-2016. The communities had obtained some support funding for population control (lethal and non-lethal) from the province based on a number of criteria arising from the Hesse (2010) report.

Our review looked closely at how these four East Kootenay communities implemented and monitored the effectiveness of both lethal and non-lethal (translocation) management of urban deer (mule and white-tailed) using a case study approach to evaluate how evidence-based information was used in their management programs and how effective, from an objective scientific perspective, were these management programs (See Appendices 2-5).

In each case, in order to qualify for provincial support and permits for lethal culls and later for possible funding support, each of the four communities implemented all or most of the following criteria:

- pass a bylaw to prohibit feeding of deer
- create an urban deer management committee
- survey residents regarding urban deer and their management
- count deer numbers within city limits

A circa 2010 urban "deer invasion"?

A review of annual reports by the urban deer committees for these communities indicates, from anecdotal observations and COS complaint data, including numbers of aggressive deer and injured deer killed, that at some time from about 2000, urban deer numbers increased over the decade so that in 2010 problems and conflicts had escalated such that when a poll was conducted in each community, the majority of residents supported population controls in the form of lethal culls. While the evidence for this urban deer "invasion" is not adequately quantified, the claim appears to have some validity. What is missing from any review is why this happened, what conditions suddenly made formerly nearly deer-free municipal areas so attractive for wild deer to take up residence and breed and rear their young? Why has this not happened in many other BC communities adjacent to deer habitats and migration corridors?

Lethal and non-lethal cull programs, mostly for mule deer

In 2011, Cranbrook was the first BC municipality to receive a provincial permit to capture and kill deer inside its city limits, in many senses acting as a pilot-project or prototype for other communities. Clover traps and bolt guns were provided by the province. The three other East Kootenay municipalities soon followed suit. From 2011-2016, depending on the community, our review of what appears to be nearly complete kill data records kept by the municipalities shows that a total of 378, mostly mule deer, were removed by trap-and-kill programs.

In 2016, as a result of a workshop, the communities underwent a transition to an experimental non-lethal approach involving live-capture and translocation of deer to wild areas, including doing

some radio-telemetry monitoring. This resulted in 29 mule deer being radio-collared of a total of the 60 mule deer translocated: 20 in Kimberly, 13 in Invermere, 12 in Cranbrook, and 15 in Elkford. A more scientific approach was used, including a background review on methods and viability used elsewhere, and contracting the work out to a biological consulting firm. This included more science-based monitoring and reporting. However, as noted elsewhere, no effort was made to correlate the number of mule deer translocated from each community to the overall population dynamics of each community's habituated deer population in order to assess if the end results could turn out to be negated by deer rebound and immigration as noted for lethal control.

Counting the translocated deer, a total of 438 urban deer were removed from the four East Kootenay communities between 2011 and 2016.

The community breakdown was as follows:

1. District of Kimberley (Appendix 2): Early in 2012, had the largest annual cull (99 mule deer) of any community. Overall, a minimum of 110 mule deer were killed from 2012 to 2015; 20 mule deer were also translocated in 2016, for a total of 130 mule deer removed.
2. District of Invermere (Appendix 3): Cull data may be incomplete. Minimum of 54 mule deer killed from 2012 to 2016; 13 mule deer translocated in 2016, for a total removal of 67 mule deer.
3. City of Cranbrook (Appendix 4): over six winters, from 2011-2016, Cranbrook killed a total of 176 deer (158 mule deer and 18 white-tailed deer); 12 mule deer were also translocated in 2016 for a total removal of 188 deer.
4. District of Elkford (Appendix 5): 38 mule deer were killed in 2014, information is lacking for 2015, and 15 mule deer were translocated in 2016 for a total removal of 53 mule deer removed.

Monitoring of effectiveness of sporadic population reduction programs; sorely lacking scientific quantification

Supporting evidence for this section, and as highlighted in our case study reviews in the relevant appendices, is cut-and-pasted following this section.

Our review shows that the four East Kootenay municipalities were very successful with support from the province in removing a large number (438) of mule deer over a five-year period, mostly by lethal means. However, we found that credible monitoring of the results was very sporadic and sorely lacking in verifiability or duplication. Some municipalities had their urban deer committees produce a number of annual reports, but these were generally lacking in scientific rigour; even when claiming success that may be accurate in the short term, claims were not sufficiently quantified to be reliable.

While some data kept were somewhat useful for monitoring deer control results, means to monitor effectiveness were largely deficient in all of following action areas that could have been used in combination to at least crudely assess cull effectiveness:

1. As noted previously, we found no evidence where herd/social behaviour and in particular reproduction rates (annual increments/total mortality) combined with immigration were factored into control measures.

2. Mortality due to vehicle collisions and other causes were not factored into a population analysis related to the cull removal programs.
3. All municipalities passed no-feeding deer bylaws prior to the lethal culls, but, aside from Kimberley, little to no monitoring appears to have been done on bylaw enforcement and incident reduction that might have translated to helping reduce deer habitation in urban areas, depending on available urban deer habitat carrying capacity. Even vehicle-deer collisions could be reduced. For example, McCance et al. (2015) found that white-tailed deer-vehicle collisions occurred more frequently near suburban areas in Winnipeg where people provided food for deer, and recommended a ban on feeding them.
4. In some instances, COS complaint data-were useful in monitoring the number of aggressive urban deer complaints and injured deer killed before and after culls, but the value of the data overall was limited in nature.
5. Annual deer counts were done on a sporadic basis in all four communities, with some attempts made at being more systematic, but count data biases and relationship to actual numbers were not discussed. Count data, accepted at face value, was useful in some cases to determine effectiveness of culls for the short term; unfortunately, annual counts were not kept up and not even done after some culls, so any long term value of the culls was difficult to determine (with the exception of Kimberley).
6. Targeting culls in urban areas with higher aggressive deer complaints or just targeting the individual aggressive deer likely has some value, but monitoring of results was very poor.
7. Data on deer injured or killed by vehicles as a crude means to measure population levels and cull effectiveness could be extrapolated from some of the COs complaint files, as well as those from the RCMP, but was hardly used to help determine cull effectiveness.

Using what deer count and other available data, the evidence is strong that even the highest lethal cull of 99 mule deer done by Kimberley in 2012, combined with injured and other deer killed by COs (representing nearly half of the hypothetical Kimberley urban deer population based on a pre-cull count), only had short term benefits; a count some years later indicated the same high numbers as pre-cull. This is likely the result of population rebound and immigration, as pointed out in the Ministry's 2010 report by Hesse. She raised concern not only about immigration following a deer cull to vacant urban habitat and unused resources, but over the reproductive rebound effect of a deer population as they compensate for mortality with access to more resources citing: *Porter et al. (2004) reported that both pregnancy rates and number of fetuses/pregnant females increased for adults, yearlings and fawns over the term of a 6-year period culling program.* This was also pointed out by Sinclair et al. (2006): *The reduced density, therefore, generates a potential increase that will become manifest if the control or harvesting is terminated.*

Our conclusion on the lack of valid longer term effectiveness of the East Kootenay deer culls is supported by in-depth studies done elsewhere and reported in peer-reviewed journals that obviously have been ignored by those who designed, funded, and implemented the East Kootenay culls. For example, results from an extensive radio-telemetry study of white-tailed deer in a suburb of Rochester, New York by Porter et al. (2004) found that even with the major cause of mortality being deer-automobile collisions, there was a 68% survival rate. Even with 8% of female deer dispersing out of the suburban study area (i.e., a loss to the urban population),

population modeling showed that culling would still have to reduce annual survival to 58% for just under ecological carrying capacity of the suburban deer area and 42% to keep the population at one-half carrying capacity.

Key Points from each of the Four East Kootenay Case Studies

City of Kimberley (Appendix 2):

1. The Kimberley Urban Deer Advisory Committee provided a number of fairly well-documented reports to Council between 2011-2013, but we could not locate any annual reports after that, which somewhat restricted our evaluation from 2013 onward.
2. As with other East Kootenay community case studies, circumstantial and anecdotal evidence suggest that increases in urban deer numbers and conflicts occurred from about 2000-2010, possibly reaching a state of socio-ecological crisis about 2010 or, alternatively, reaching a point where political pressure to do something was finally brokered with the provincial government.
3. Kimberley has made more of an effort to research and promote more non-conventional approaches, such as a controlled deer hunt within the city, as well as a one-day experimental aversive conditioning trial using trained dogs.
4. As with our other case studies, we found a more political than scientific approach in response to a very real community problem fraught with opposing views and internecine conflicts over whether having the deer in town was good or bad, and whether there are scientifically better approaches to addressing the underlying causes of the urban deer phenomenon and the fundamental conflict issues.
5. While Kimberley was the first community in the East Kootenays to pass a no-feeding deer bylaw in 2007, unfortunately for our own review, the Kimberley annual reports provided no data on how much the no-feeding bylaw was enforced and to quantify what success it has had in reducing deer numbers and complaints. The only information is that by 2013 there are "less human placed attractants" and "intentional feeding of deer is almost non-existent." One of the continuing problems in Kimberley is that deer dig into garbage bags left curbside on garbage day (Kimberley Urban Deer Advisory Committee 2013).
6. All claims of success of the large lethal cull have some validity in part because Kimberley had the largest cull early in 2012, compared to any other BC municipality that was using trap-and-kill methods. Of a total pre-cull count of 242, some 41% (N = 100) were killed. Another 20 were recorded by the COS to have been killed in 2011 (2 aggressive and 18 from injuries), meaning that known human-caused deer mortality in 2011 and early 2012 was about half of what might be considered to be the total population (assuming the count data is accurate, which is questionable). It is thus not surprising that the conflict/complaint rate decreased (while cougar complaints doubled for reasons that are not explained) after the cull. However, after the cull, the lack of annual reports after the February 2013 report on 2012 activities and the apparent lack of annual counts after that, make it impossible to determine the longer-term impacts of such a large mule deer cull.

District of Invermere (Appendix 3):

1. The Invermere deer committee recommended that the District's deer population be reduced to a maximum of 50 animals by 2014 or earlier. They also recommended that sharpshooting be investigated. For a long term solution, they recommended the District review the possibility of a perimeter fence along municipal boundaries (District of Invermere 2011). The terminology used by the province for fencing and other like structures, such as cattleguards, is "strategic anti-deer infrastructure." This proposal appeared to have some merit, but we were unable to locate where there had been any follow up on the Invermere anti-deer fence infrastructure proposal.
2. Evaluation of Invermere's lethal and non-lethal deer control program was difficult due to the somewhat scattered, unavailable, and/or incomplete database. Unlike Cranbrook's detailed annual reports, Invermere produced an annual report in 2011 and another in 2015 (Prosser 2015). One thing is obvious, if the urban deer counts represent a somewhat reliable sampling of urban deer numbers, the counts remained more or less in the same range from 2012 to 2014, suggesting the number of deer was not decreasing as a result of the 2012 cull, keeping in mind that the small number removed (19) would likely be exceeded the following year by reproduction. However, it is also noted from the COS data (Table 2) that 14 injured deer were destroyed by COS in 2012, and 13 in 2013, but how this factored into the control program was not apparently taken into account.
3. The count of 165 deer in 2014 was over three times the goal set by the deer committee to reduce numbers to 50 by 2014. In 2015, the focus of the 26 mule deer culls was determined to be in areas where the most aggressive deer complaints were generated (Prosser 2015). Since we have no complaint data for 2015-2016, we have no idea if this led to any reduction in aggressive deer encounters. This sort of scattered, incomplete database underscores the sloppy and inconsistent monitoring of Invermere's lethal cull program, thereby questioning the costs, community conflicts involved, and the efficacy of their deer reduction program.
4. In 2016, a total of 22 deer were removed by lethal and non-lethal means. No data were available for the number of deer killed from other sources such as by collisions with vehicles. It remains to be seen if the last removal program proved effective, but we are not optimistic. Other than short term benefits, it is doubtful that any lasting effects will result from the combined lethal and non-lethal approach conducted in 2016.
5. We have no comprehensive database prior to 2011 that confirms the claim that urban deer numbers increased since that time and that some form of a "deer invasion," occurred in Invermere. Increases in aggressive deer complaints and injured deer destroyed by COS for Invermere between 2005 and 2014 do strongly support this contention. If true, the underlying causative factors for this increase in deer becoming habituated to living in an urban setting have never been studied (as with our other case study areas) and, until this happens, we may not arrive at a long-term solution to such a complex socio-ecological wildlife problem.

To conclude, Invermere has not kept a consistent nor reliable monitoring database to properly evaluate the effectiveness of their urban deer control program. Given that Invermere is within a large area of prime ungulate winter range and that the district provides suitable habitat to apparently support up to 200 or more (mostly) urban mule deer, lethal and non-lethal control measures are not likely to be a long term solution due to what appears to be likely immigration from adjoining viable deer habitat, and compensatory reproductive increases by urban deer that survive the cull processes.

City of Cranbrook (Appendix 4):

1. At the outset, Cranbrook passed a bylaw in 2010 to prohibit the feeding of deer. The bylaw has an escalating fine schedule; however, the penalties are not substantial: $100 for first offense, $200 for the second, $500 for the third. No analytical attempt was made in the annual reports as to how well the bylaw was enforced and whether this reduced deer numbers/complaints.
2. Unlike our analysis of urban deer control measures in Oak Bay, where there was some limited data on vehicle collisions and other deer mortality causes available, we could not find similar information specifically for Cranbrook (other than three aggressive deer killed) that would have assisted our review of the effects of lethal control measures combined with other unnatural mortality causes for the Cranbrook urban deer population. Unfortunately, mortality data provided in the joint Cranbrook-MFLNRO reports on injured deer destroyed by COs and the RCMP between 2004-2015, covered a much larger area than Cranbrook; no attempt was thus made by the authors of Cranbrook's annual deer control reports to separate out the injured deer destroyed data for the city, which may have been relevant to the discussion. Essentially, this negated any potential for us to use overall mortality data as one approach to evaluate the effectiveness of the Cranbrook cull program.
3. Accepting that the annual deer counts are a reasonable approximation of Cranbrook's resident deer population, Table 1 in Zettel and Teske (2016) shows an average count of 113 mule and white-tailed deer annually from 2010 to 2015. Over the six counts between 2010 and 2015, an average of 82.3 mule deer were counted. The data show no consistent declining trend in numbers after the first cull was initiated in 2011 (starting in 2011, the counts were 101, 121, 96, 120, 104 and 137 deer respectively). In fact, the highest count (N=137) was recorded in November 2015, after four years of culling a total of 176 deer. While Zettel and Teske (2016) concluded that "the lethal removal of deer (cull and injured deer destroyed) is slowing the increase of the urban deer population," this may possibly be true, but they have no pre-control data to prove this, nor do they account for immigration and population rebound. What is clear, if the annual counts are any indication, is that the lethal cull program is not reducing the Cranbook urban deer population, which was the main stated objective of the cull program in the first place. The data also suggest that immigration and population rebound are likely factors negating or even nullifying the removal of the 176 deer by contributing to deer increases. The lethal cull data also call into question what value, other than a very short term benefit, the 2016 translocation program would have.
4. The authors attribute the dramatic increase in urban deer numbers to the following factors: "presumably because residential areas offer protection from predators, and because they provide an abundance of food, including unnatural food that the public are feeding to deer. Urban sprawl is also contributing to this trend." Some of this is likely true, but none of it has been studied and quantified.

District of Elkford (Appendix 5):

1. There was very little technical information available to evaluate Elkford's urban deer management program. From 2010 on, the District appeared to loosely follow the general pattern prescribed by the province, or shall we say "jumped through the hoops" in order for the local government to get support and other funding to address their deer concerns.
2. If the annual counts are at all reliable and consistently done, the numbers show a declining trend from a high average of 103 deer in 2011 to 59, or almost half, on October 24, 2014 prior to the culling of 38 mule deer. If the population was shown to be declining, one well may wonder why the controversial cull was initiated in 2014. However, the lethal removal of 38 deer (65% of the deer previously counted) in January 2014 did not appear to affect the estimated population size as a total of 61 deer were counted nearly one year later on November 14, 2015. The data also suggest counts are either considerably underestimating total population numbers, inaccurate or there was a high immigration to replace the 2014 culled deer combined with a rebound effect of increased reproduction.
3. As part of the East Kootenay Urban Mule Deer Translocation Trial project initiated in February 2016, 15 mule deer were translocated from Elkford between March 8 and 10, 2016 (Adams 2016). How this might have affected the local population is unknown since we have no data on follow up counts, but if our review of the general lack of effectiveness of the Elkford lethal removal in 2014 is any indication, the non-lethal removal is not likely to have had any appreciable impact.

Overall, one can only conclude from this case study that there is little biology or wildlife science involved in the decision to undertake lethal population control. The approaches being used are driven by the province's deer management funding criteria and are obviously not proving to be scientifically sound or offer a long-term sustainable solution. Even a high cull of 66% of the 2014 over-wintering deer count did not result in a reduced deer count the following fall.

LITERATURE CITED OR CONSULTED

Note: the following list encompasses all the case study reports discussed previously and detailed in the following appendices.

2015 FOI-FLNRO, 2016, 61775P1. Communication between Wildlife Biologist Ian Adams and Animal Alliance Director Liz White; email exchange [14?] March 2016.

Adams, Ian. 2016. East Kootenay Urban Deer Translocation Trial September 2016 Update. Vast Resource Solutions. Unpublished.

BC Deer Protection Coalition Society (BCDPS Update 2014-03-03: Kimberley slaughter has ended. http://www.bcdeer.org/kimberley-deer-slaughter. Accessed 7 July 2016.

BC Ministry of Environment. 2005. Approved Ungulate Winter Ranges -Kootenay U-4-008, 1:300,000. http://www.env.gov.bc.ca/wld/frpa/uwr/approved_uwr.html. Accessed December 2016.

BC Ministry of Environment. 2010. British Columbia Urban Ungulate Conflict Analysis Summary Report for Municipalities, 64 pages. Available at: http://www.env.gov.bc.ca/cos/info/ wildlife_human_interaction/UrbanUngulatesSum maryReportFINALJune21-2010.pdf (As of Jan 2017, no longer accessible).

BC Ministry of Environment, Ungulate Count 2011. (See black-tailed deer numbers for Vancouver Island and Mule deer numbers for the Kootenays. http://www.env.gov.bc.ca/fw/wildlife/management-issues/docs/2011_BC Provincial_Ungulate_Numbers.pdf.

BC Ministry of Environment, Ungulate Count 2014. (See black-tailed deer numbers for Vancouver Island and Mule deer numbers for the Kootenays. http://www.env.gov.bc.ca/fw/wildlife/management-issues/docs/2014_Provincial%20Ungulate%20Numbers%20Oct%2030_Final.pdf.

BC Ministry of Forests, Lands and Natural Resource Operations. 2014. Urban deer management in BC: Factsheet; Ministry of Forests, Lands and Natural Resource Operations, Factsheets /ministries/forests-lands-and-natural-resource-operations/factsheets/factsheet-urban-deer-management-in-bc.html.

BC SPCA Provincial Office. Letter to Oak Bay Mayor and Council, June 28, 2013 (accessed online 26 August 2016).

BC Wildsafe. 2016. BC Wildsafe Online Wildlife Alert Reporting Program. [Online Available at https://wildsafebc.com/warp/. [Accessed 15 November 2016].

Blood, D.A. 2000. Mule and Black-tailed Deer in British Columbia: Ecology, Conservation and Management. Retrieved from the British Columbia Ministry of Environment, Lands and Parks website: http://www.env.gov.bc.ca/wld/documents/muledeer.pdf.

Capital Regional District, August 2012. Regional Deer Management Strategy. CRD Citizens' Advisory Group, Victoria, BC.

Columbia Mountains Institute of Applied Ecology. 2012. Urban Wildlife: Challenges and Management. April 18-19. Cranbrook, British Columbia. http://cmiae.org/wp-content/uploads/Urban-wildlife-summary-2012.pdf. Accessed December 15, 2016.

CRD Regional Deer Management Strategy Implementation. Report to Planning, Transportation and Protective Services Committee. Meeting of Wednesday, July 24, 2013. https://www.crd.bc.ca/project/regional-deer-management-strategy. Accessed online 29 Aug 2016.

CRD Regional Deer Management Strategy Terms of Reference. March 8, 2012, pp. 11.

Davis, H., D. Wellwood, and L. Ciarniello. 2002. "Bear Smart" Community program: Background Report. BC Ministry of Water, Land and Air Protection. Victoria.

District of Elkford. 2014. News release. Deer cull – final update. http://www.elkford.ca/include/ get.php?nodeid=1002. Accessed December 28, 2016.

District of Elkford. 2017. Regular Council Meeting Agenda, 9 January 2017; p. 13. https://elkford.civicweb.net/filepro/documents/47303?preview=47306. Accessed 9 Jan 2017.

District of Invermere. 2011. Deer Feeding and Wildlife Attractants Bylaw, No. 1426, 2011.

District of Invermere. 2011. Meeting Minutes. Minutes of the Special Council held on August 3, 2011.

District of Invermere. 2011. Urban Deer Management Committee Final Report and Recommendations. July 2011. https://invermere.civicweb.net/document/11088. Accessed December 27, 2016.

District of Invermere. 2014. Meeting Minutes. Minutes of the Regular Council held on February 11, 2014.

District of Invermere. 2015. Meeting Minutes. Minutes of the Regular Council held on February 24, 2015.

District of Oak Bay. Lessons Learned: Resulting from the District of Oak Bay's Participation in the Capital Regional District Deer Management Strategy Urban Pilot Project, 30 April 2016; pp. 1-12.

Fyten. B. 2012. Urban elk management in Banff National Park. Presentation. Columbia Mountains Institute of Applied Ecology. 2012. Urban Wildlife: Challenges and Management. April 18-19. Cranbrook, BC. http://cmiae.org/wp-content/uploads/Urban-wildlife-summary-2012.pdf. Accessed December 15, 2016.

Glinz, G. 2011. Managing for the Future. An analysis of the contributing factors to deer habituation in the City of Kimberley and a series of recommendations to mitigate the deer/human conflicts. City of Kimberley Urban Deer Advisory Committee, Kimberley, BC, Canada.

Hall. M. 2012. British Columbia's urban wildlife conflict imperative. Presentation. Columbia Mountains Institute of Applied Ecology. 2012. Urban Wildlife: Challenges and Management. April 18-19. Cranbrook, BC. http://cmiae.org/wp-content/uploads/Urban-wildlife-summary-2012.pdf. Accessed December 15, 2016.

Harris, B. and G. Kuzyk. 2012. Biology of mule deer and white-tailed deer: Implications for management of urban deer. Presentation. Columbia Mountains Institute of Applied Ecology. 2012. Urban Wildlife: Challenges and Management. April 18-19. Cranbrook, British Columbia. http://cmiae.org/wp-content/uploads/Urban-wildlife-summary-2012.pdf. Accessed December 15, 2016.

Hello BC. 2016. Invermere-Destination BC. [ONLINE] Available at: http://www.hellobc.com/invermere.aspx?utm_source=msn&utm_medium=cpc&utm_term=district%20of%20invermere&utm_content=%21acq%21v2%2117567899639-3832016520-575461083&utm_campaign=Kootenay+Rockies+-+CA-BC. [Accessed 8 December 2016].

Hesse, G. 2010. British Columbia Urban Ungulate Conflict Analysis. Ministry of Environment. Available at http://www2.gov.bc.ca/assets/gov/environment/plants-animals-and-ecosystems/wildlife-wildlife-habitat/staying-safe-around-wildlife/urbanungulatesconflictanalysisfinaljuly5-2010.pdf.

Hesse, Gayle. March 2010. British Columbia Urban Ungulate Conflict Analysis: Summary Report for Municipalities. BC Environment Ministry, pp. 62.

Indiana Division of Fish & Wildlife. (no date). *Urban Deer Technical Guide*. pp. 32 (accessed online 25 August 2016).

Kerr, R., I. Teske, A. Mulholland. 2012. Kimberley Urban Deer Management Annual Report 2011. Ministry of Forests, Lands and Natural Resource Operations and City of Kimberley. https://kimberley.civicweb.net/document/1617. Accessed 12 July 2016.

Kimberley Urban Deer Advisory Committee. 2012. Recommendations report. Managing for the future. Gary Glinz, chairperson. June 2012. https://kimberley.civicweb.net/filepro/documents/1604?preview=1605. Accessed December 29, 2016.

Kimberley Urban Deer Advisory Committee. 2012. Urban deer management strategy. http://www.city.kimberley.bc.ca/siteengine/activepage.asp.

Kimberley Urban Deer Advisory Committee. 2013. Report on demonstration of using dogs for aversive conditioning of urban Deer in the City Of Kimberley. https://kimberley.civicweb.net/filepro/documents/1604?preview=10947. Accessed 12 July 2016.

Kimberley Urban Deer Advisory Committee. 2013. Report to City Council. February 25, 2013. https://kimberley.civicweb.net/filepro/documents/1604?preview=1605. Accessed December 29, 2016.

Kimberley Urban Deer Management Advisory Committee. 2011. Urban deer committee report. https://kimberley.civicweb.net/filepro/documents/1604?preview=1605. Accessed December 29, 2016.

Kloppers, EL, CC St. Clair, TE Hurd, 2005. Predator-Resembling Aversive Conditioning for Managing Habituated Wildlife*, Ecology and Society* 10(1):31 [www.ecologyandsociety.org/vol10/iss1/rt31] accessed online 25 August 2016.

Massei, G., D. Cowan, and D. Eckery. 2014. Novel Management Methods: Immunocontraception and Other Fertility Control Tools. USDA National Wildlife Research Center-Staff Publications Paper 1675, pp. 28.

McCance, E. 2009. Resident opinions concerning urban deer management in the Greater Winnipeg Area, Manitoba, Canada. M.Env thesis, University of Manitoba (Canada), 2009, 200 pages; AAT MR53067 Order this thesis from: http://proquest.umi.com/pqdlink?did=1919661251&Fmt=7&clientI%20d=79356&RQT=309&VName=PQD.

McCance, E., R. K. Baydack, D.J. Walker and D.N. Leask. 2015. Spatial and temporal analysis of factors associated with urban deer-vehicle collisions. Human–Wildlife Interactions 9(1):119–131, Spring 2015. http://www.berrymaninstitute.org/files/uploads/pdf/journal/spring2015/McCanceEtAlSpring2015HWI.pdf. Accessed January 6, 2017.

McCance, Erin, 2014: "Understanding White-tailed Deer and Management," Living with Wildlife Conference, Toronto. Video presentation (https://www.youtube.com/watch?v=jChucXn4H6c (accessed online 26 August 2016).

McCrory, W.P., P. Paquet, and B. Cross. 2003. Assessing conservation values for gray wolf and Sitka deer - BC central coast rainforest. Report to the Valhalla Wilderness Society, New Denver, BC.

McNay, R.S. and R. Davies. 1985. Interactions between black-tailed deer and intensive forestry management: problem analysis. Integrated wildlife intensive forestry research. A cooperative project between Ministry of Environment and Forests. IWIFR-22. Ministry of Forests, Research Branch EP-923. Ministry of Environment, Wildlife Bulletin B-38. Victoria. BC. http://www.env.gov.bc.ca/wld/documents/techpub/b38.pdf. Accessed December 31, 2016.

Memo to Oak Bay Mayor and Council from the District's CAO. 14 October 2014. Update-CRD Regional Deer Management Strategy--Oak Bay Pilot, (includes numerous attachments from various BC government ministries and agencies; e.g. Forests, Environment, Conservation Officer Service), pp. 21. (Found at www.oakbay.ca/ accessed online 25 August 2016).

Michigan State Forest Management Plan (Draft). 2008. D.L. Price, Editor. State of Michigan Department of Natural Resources, Lansing Michigan, pp. 294 (www.michigan.gov/dnr/ accessed online 25 August 2016.

National Park Service, US Department of the Interior. 2015. Review of Ungulate Fertility Control in the National Park Service: Outcomes and Recommendations from an Internal Workshop, February 2012, pp. 110. (accessed online 25 August 2016).

Plant, L., C. Andrews and S, Denback. 2010. Tourism Planning Workshop Report – Kimberley BC. Tourism BC. https://kimberley.civicweb.net/filepro/documents/567?preview=1278. Accessed 5 December 2016.

Porter, W. F., H. B. Underwood. and J. L. Woodward. 2004. Movement behavior, dispersal, and the potential for localized management of deer in a suburban environment. Journal of Wildlife Management, 68(2):247-256. 2004. http://www.bioone.org/doi/full/10.2193/0022-541X%282004%29068%5B0247%3AMBDATP%5D2.0.CO%3B2. Accessed January 6, 2017.

Program Plan for the Provincial Urban Deer Operational Cost Share Program - FNR-2015-53558. UBCM. www.ubcm.ca/…/Urban Deer Program Application Guide. 25 Oct. 2016. Accessed online 8 Jan 2017.

Prosser, C. 2015. Invermere Urban Deer 2015 Annual Report. http://docs.openinfo.gov.bc.ca/Response_Package_FNR-2015-53558.pdf. Accessed December 28, 2016.

Schwantje, Helen, Dr., provincial wildlife veterinarian. "Urban Deer Population Control--Direct Methods" presented at an Urban Deer Workshop January 12-13, 2015, Ministry of Forests, Lands and Natural Resource Operations.

Sinclair, A.R.E., J.M. Fryxell and G. Caughley. 2006. Wildlife Ecology, Conservation and Management. 2nd ed. Malden, MA, USA: Blackwell Publishing, pp. 355-357. https://moodle.ufsc.br/mod/resource/view.php?id=437142. Accessed January 6, 2017.

Urban Wildlife Management Advisory Committee, 2016. Meeting Minutes. February 15. District of Elkford.

Urban Wildlife Management Advisory Committee. 2015. Meeting Minutes. November 24. District of Elkford.

VerCauteren, Kurt C., John A. Shivik, and Michael J. Lavelle. Efficacy of an Animal-Activated Frightening Device on Urban Elk and Mule Deer: Peer reviewed work. Source: *Wildlife Society Bulletin*, Vol. 33, No. 4 (Winter 2005), pp. 1282-1287 (accessed online 25 August 2016).

Webber, K., A. Denis, E. Kristiansesn, W. Tanner, and K. Ramsay. 2013. *UVic Black-tailed Deer Management Plan*. University of Victoria, ES 341, pp. 51.

White, Liz, and Barry Kent MacKay. June 2012. Developing a Progressive Non-lethal Human/Deer Conflict Resolution Strategy for British Columbia. Animal Alliance of Canada and Born Free USA, pp. 34.

Wiggers, E. P. 2011. The Evolution of an urban deer-management program through 15 Years. Wildlife Society Bulletin 35(3), Ecology and management of deer in developed landscapes (September 2011), pp. 137-141. https://www.jstor.org/stable/wildsocibull2011.35.3.137?seq=1#page_scan_tab_contents. Accessed January 6, 2017.

Zettel, C. and B. Whetham, 2011. Section *8.* Urban deer management in Cranbrook. Columbia Mountains Institute of Applied Ecology 2012 Conference. pp. 44-51.

Zettel, C., and I. Teske. 2012. City of Cranbrook and Province of British Columbia. Urban Deer Management Annual Report 2011. Prepared by City of Cranbrook and Irene Teske, Ministry of Forests, Lands and Natural Resource Operations (MFLRNO). http://docs.cranbrook.ca/downloads/urban_deer/2011-Urban-Deer-Managment-Annual-Report.pdf. Accessed December 27, 2016.

Zettel, C., and I. Teske. 2015. City of Cranbrook Urban Deer Management Annual Report 2015. Prepared City of Cranbrook and Irene Teske, Ministry of Forests, Lands and Natural Resource Operations (MFLRNO). Accessed December 27, 2016.

Zettel, C., and I. Teske. 2016. City of Cranbrook Urban Deer Management Annual Report 2015/2016. City of Cranbrook and Ministry of Forests, Lands and Natural Resource Operations (MFLRNO). Accessed December 27, 2016.

Zettel, C., and B. Whetham. 2012. Section 8. Urban deer management in Cranbrook. Report on Conference: Urban Wildlife—Challenges and Management. Columbia Mountains Institute of Applied Ecology, April 18-19, 2012. Cranbrook, British Columbia, Canada. docs.cranbrook.ca/downloads/urban.../2015-2016-Urban-Deer-Annual-Report.pdf, accessed December 27, 2016.

Media articles

Poop in parks is the newest deer issue *posted* Sep 18, 2014 *at* 1:00 PM
http://www.oakbaynews.com/news/275649021.html

Group seeking to observe deer cull *posted* Dec 26, 2014 *at* 7:00 AM
http://www.oakbaynews.com/opinion/letters/286583741.html

Mayor says deer cull only option available *posted* Jan 20, 2015 *at* 4:00 PM
http://www.oakbaynews.com/news/289077781.html

Oak Bay secures permit for deer cull *posted* Jan 29, 2015 *at* 6:00 PM
http://www.oakbaynews.com/news/290135211.html

Deer cull creates a community divided *posted* Feb 5, 2015 *at* 12:00 PM
http://www.oakbaynews.com/opinion/290842021.html

Oak Bay takes province to task over deer control *posted* Feb 12, 2015 *at* 2:00 PM
http://www.oakbaynews.com/news/291579261.html

Letter: Check the facts on deer position *posted* May 9, 2016 *at* 4:00 PM
http://www.oakbaynews.com/opinion/letters/378719981.html

Letter: Many options available for deer management *posted* Jun 16, 2016 *at* 3:00 PM
http://www.oakbaynews.com/opinion/letters/383347011.html

Letter: Many questions from resident survey *posted* Oct 14, 2016 *at* 11:00 AM
http://www.oakbaynews.com/opinion/letters/397117291.html

Online resources

https://www.crd.bc.ca/about/news/2015/03/10/crd-urban-deer-management-pilot-project-concludes-in-oak-bay (accessed online 29 August 2016).

http://www.oakbaynews.com/news/306061231.html (accessed 26 August 2016).

http://www.spca.bc.ca/animal-issues/wildlife/issues/urban-deer.html (accessed 26 August 2016).

http://www.timescolonist.com/opinion/op-ed/comment-scientific-approach-could-make-us-a-leader-on-deer-1.2171928 (accessed 26 August 2016).

https://www.crd.bc.ca/project/regional-deer-management-strategy (accessed online 24 October 2016)

https://www.esquimalt.ca/news-events/news/township-asking-input-deer-activity-through-survey (accessed online 31 October 2015)

APPENDIX 1

DEER-PEOPLE CONFLICT IN THE DISTRICT OF OAK BAY, BC A CASE STUDY

November 2016

For
Animal Alliance of Canada
and
McCrory Wildlife Services
By
Maggie M. Paquet, Biologist/Researcher

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About the Author

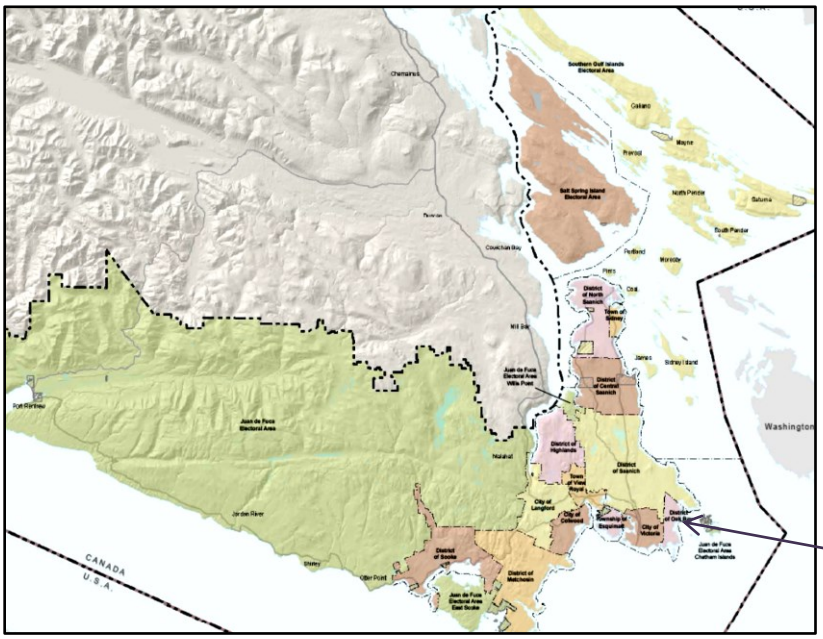
Maggie Paquet is a biologist, researcher, and writer whose past work includes writing or co-writing (with Wayne McCrory) numerous bear hazard assessments and bear-people conflict management plans (for Whistler, Port Alberni, Lions Bay, District of North Vancouver, City of Coquitlam, Municipal District of Squamish, Upper Slocan Valley, Sunshine Coast Regional District), as well as the comprehensive reports, *Stone's Sheep of the Northern Rockies: The Effects of Access*, *Toward A Mountain Caribou Management Strategy for British Columbia*, and *Conservation of Grizzly Bears in British Columbia: Background Report*, as well as a variety of BC government brochures, including *Caribou in British Columbia* and *Black Bears in British Columbia*.

Cover photo: Derek Vallintine (used with permission, found on BC SPCA website: www.spca.bc.ca/animal-issues/wildlife/issues/urban-deer.html)

TABLE OF CONTENTS

INTRODUCTION

As early as 2011, it was becoming apparent that many areas—agricultural, rural, and urban—in the Capital Regional District (CRD) of southeastern Vancouver Island (see Map 1) were experiencing increased conflicts with black-tailed deer (*Odocoileus hemionus columbianus*). BC's Ministry of Environment (MOE) and Ministry of Forests, Lands, and Natural Resource Operations (FLNRO) urged the CRD to develop a Regional Deer Management Strategy[1, 2] for the Capital Region.



Map 1. Capital Regional District (www.crd.bc.ca)

A Citizens' Advisory Group (CAG), augmented by an Expert Resources Working Group (ERWG), was established by the CRD in April 2012. The group set about to evaluate the various management options available. One of the CRD municipalities, the District of Oak Bay (Map 2) was represented on the advisory group. Oak Bay citizens had expressed concerns about conflicts with deer, including collisions with vehicles, deer damaging public and private gardens, and aggression towards people and pets. After some degree of public consultation, the municipality decided that a cull was their best option and, on 27 January 2015, Oak Bay obtained a Wildlife Act permit from the provincial government (FLNRO) for a pilot project to conduct a cull.[3] None of the other municipalities in the CRD had organised a cull to date, which is why this review focuses on Oak Bay.

Oak Bay's cull proceeded over a 16-day period in February 2015. During that time, 11 deer (7 males and 4 females) were trapped in modified Clover traps and killed with bolt guns. It was a highly controversial action that polarised the community. The foremost points of contention centred around the degree of scientific justification for the cull, if the decision to do a cull was premature, and if the cull was carried out humanely.

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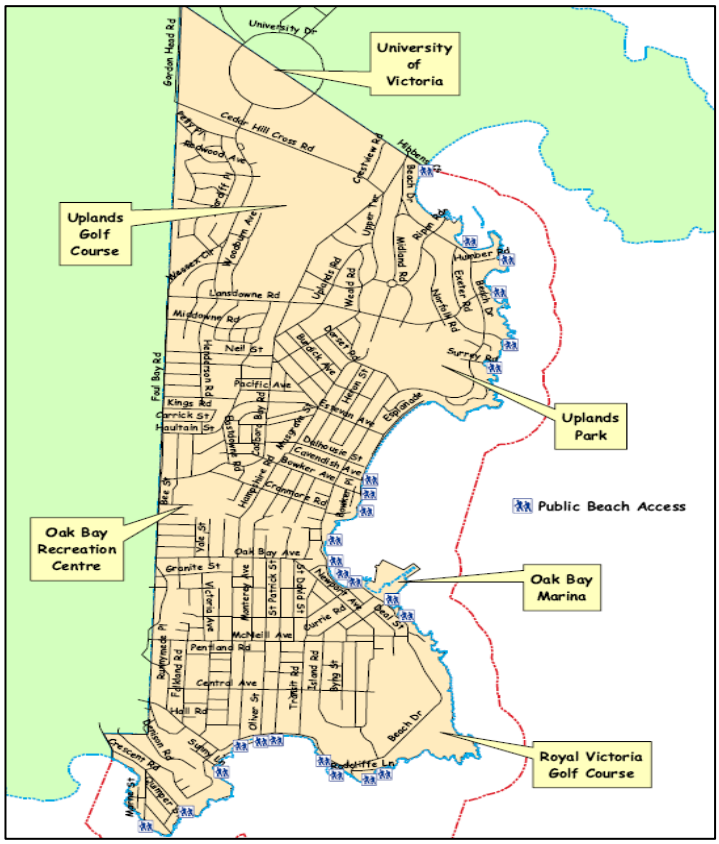
[1] *Lessons Learned: Resulting from the District of Oak Bay's Participation in the Capital Regional District Deer Management Strategy Urban Pilot Project*, 30 April 2015, p. 2

[2] *Regional Deer Management Strategy*, Capital Regional District and Citizens' Advisory Group, August 2012.

[3] Memo to Oak Bay Mayor and Council from Helen Koning, CAO, dated 11 May 2015.



Map 2. Oak Bay. The light green area on the left is the City of Victoria and that on the top is the District of Saanich (https://www.oakbay.ca/explore-oak-bay/getting-around/community-maps**).**

The cull raised many questions about how much science was used in the decision-making process, implementation, and monitoring. Such questions included:

- What factors contributed to the apparent increase in a resident deer population?
- What habitat and other attractant features led to wild deer becoming habituated to urban development and become seasonal or full-time resident deer?
- What facts are needed to support a decision to implement a "capture-and-euthanise" cull for managing deer in an urban setting?
- Did Oak Bay establish a baseline determination of the causes, types, and locations of conflicts, and were these mapped out and analysed over time?
- Did Oak Bay have a reliable estimate of the black-tailed deer population in the municipality, and were the numbers sufficient to justify a cull?
- Were acceptable levels of alternative non-lethal conflict-reduction management options undertaken by Oak Bay prior to deciding to do the cull?
- Did the cull solve the problems? Will a temporary removal, such as a cull, result in a long-term solution or does this create a population sink-source situation where more wild deer move in from outside the area to fill a temporary vacuum?

This case study examines the circumstances and conditions of the Oak Bay cull and attempts to address the above questions.

Methodology

- Reviewed documents and reports to and from Oak Bay Council, CRD, BC government (BC Environment, FLNRO), ICBC, and public health authorities
- Reviewed minutes of CRD Citizens Advisory Group (CAG) weekly to bimonthly meeting minutes from May 2012 through August 2015 (on CRD website)[4]
- Reviewed scientific reports on deer population science and the effects of various [deer] population- and conflict-reduction methods
- Reviewed numerous media articles
- Reviewed reports and comments by residents, farmers, First Nations, animal welfare NGOs
- Conducted online searches of deer management practices and tools (including immunocontraceptive vaccines and culls) in other parts of Canada and the USA
- Telephone interviews with some of the people directly involved in the Oak Bay issue

CONFLICTS--CAUSES AND SOLUTIONS

The kinds of conflicts experienced by Oak Bay residents (and elsewhere in the CRD) were typical of those that have developed between deer and people in some urban areas throughout British Columbia and elsewhere in North America. A typical human response pattern appears where residents and visitors initially react favourably to seeing deer in their communities. However, the novelty wears off for some residents when they have negative experiences, such as those listed below, all of which were occurring in Oak Bay.

- Deer eating or otherwise damaging public and private landscaping plants
- Deer eating and/or damaging private (residents') gardens (vegetables, fruits, trees)
- Deer scaring people, being aggressive, occasionally injuring people or pets
- Fear that deer may spread disease, including bacteriological illnesses caused by feces in public and private properties, and Lyme disease (from black-legged ticks)
- Fear that deer will attract predators (primarily cougars, less so wolves and bears)

In addition to the above, deer-vehicle collisions, causing property damage and injuries, were costing people and putting demands on local police and other government agencies. For example, "in BC, collisions with deer make up about 76% of wildlife accidents every year" (Hesse 2010). Deer-related car accidents in Victoria increased from 35 in 2000 to more than 100 in 2010, raising the collision cost to nearly $3,000 per vehicle in 2007.[5]

Residents looked to their provincial and local governments to do something about these problems. Initially, people were told that wildlife conflicts are under the jurisdiction of the provincial government (BC Wildlife Act). When people have problems with wildlife in BC, they generally contact the BC Conservation Officer Service (COS). However, the BC government told the CRD that there were not enough resources in the COS to deal with all the deer-related concerns and, most importantly, that since these conflicts were occurring in the CRD's jurisdictions, the CRD was responsible and should develop its own deer management strategy.

[4] www.crd.bc.ca/deermanagement
[5] *UVic Black-tailed Deer Management Plan*, 2013, p. 14

They added that the appropriate provincial ministries would help by providing technical advice and equipment, and by issuing any necessary permits.

Potential Causes of Conflicts

The CRD set up a Citizens' Advisory Group (CAG), which had the support of CRD staff and an Expert Resources Working Group (ERWG), and which included representation from the following groups:

- Ministry of Agriculture
- Ministry of Forests, Lands and Natural Resource Operations (represented by at least two biologists with deer management experience [Kim Brunt and Helen Schwantje]).
- Peninsula Agriculture Commission
- Society for the Prevention of Cruelty to Animals (BCSPCA-Chief Science Officer Sara DuBois)
- First Nations representatives
- Parks Canada biologist

The purpose of the CAG was described as follows: "… to identify, evaluate, and recommend options to mitigate deer-human conflicts over short and long terms." The goal of the process was "to mitigate deer-human conflicts in the region pertaining to agricultural impacts (as a priority), public health and safety, and ornamental gardens."[6] The CAG looked at some of the possible reasons for the stated increase in deer-people conflicts. Some of the questions they needed answers to included the following:

- Has the number of deer in the CRD increased, and if so, why and to what extent? What is the population estimate for the area? How many deer are in Oak Bay?
- Has there been a general or widespread loss of deer habitat due to human population growth and development (loss/alteration in areas inside and outside of the CRD such as by residential, recreational, commercial, agricultural, and industrial expansion; logging in watersheds outside of the urban/rural areas, etc.)?
- Are people in urban areas deliberately feeding deer?
- Are people in urban areas inadvertently feeding deer (birdfeeders, gardens, landscaping plants)?
- Are deer coming into urban areas to escape predators?

Potential Solutions

The initial request to the provincial government resulted in advice to the CRD to develop a deer management strategy for the entire region, including agricultural, rural, and urban areas, and this became the first task of the CAG. Along with advice from the ERWG, the CAG provided the various jurisdictions in the CRD, including the District of Oak Bay, with a range of recommendations and information on the options each could implement that had the potential to reduce deer-people conflicts. Among the very first was a recommendation to develop a communication and public consultation strategy, including a survey to determine a baseline—or informed starting point—for each of the conflict types, the specific locations where they were occurring, and what would be the acceptable solutions for each community (whether urban, rural, or agricultural). However, none of these recommendations were achieved.

[6] *Regional Deer Management Strategy*, August 2012, p. 2-3

The range of deer-human conflict reduction options, all of which are in the *BC Urban Ungulate Conflict Analysis*[7], include the following:

- Lethal control (including expanded bow and rifle hunting seasons, sharpshooting, a cull by the capture-and-euthanise method)
- Immunocontraception and sterilisation (or other non-lethal population control programs)
- Hazing with dogs, and with dogs and people together
- Use of frightening devices (sounds, water, flashing lights, etc.)
- Tranquilise & relocate
- Widespread public education programs
- Bylaws prohibiting feeding deer (deliberate and inadvertent)
- Signage and reduced speed limits on targeted streets and roads
- Increase driver education on avoidance of collisions with wildlife
- Redesign some streets/roads to mitigate collisions with deer
- Increase/extend rights-of-way by brushing to increase visibility of deer and to help keep deer away from road edges
- Use of deer repellents
- Increase municipal and/or residential fencing
- Planting species deer don't feed on
- "Luring" deer away from human-habituated areas (a) by planting deer foods in remote areas, and (b) by enhancing deer habitat outside of urban areas
- Preserve/restore natural deer habitats

The CAG realised from the outset that it had "a lack of scientific evidence" both on the causes of the conflicts and on which conflict-reduction solutions best matched the causes, and had to rely on anecdotal evidence and professional opinion in many cases. In particular, "Statistical information was lacking for the exact number of deer within the CRD…"[8]

The CAG was informed that some of the options would not likely be approved by the provincial government for a variety of reasons. For example, tranquilise & relocate required more resources than were available, as well as being too risky for the deer, both because of the stress involved in being tranquilised and moved, and because of the problems associated with finding a suitable location for moving the deer. Another option, immunocontraception and sterilisation, was not approved by Health Canada, in part because the drugs for contraception were not available in Canada and because sterilisation was very expensive and had high risks for the deer. Some of the options, such as planting deer foods in remote areas, were not appropriate actions for a highly urbanised area, and hazing with dogs was also considered not to be appropriate (under the Wildlife Act, it is illegal in BC, although specially trained dogs are used in some permitted bear aversion control programs).

[7] Hesse, G. 2010. *British Columbia Urban Ungulate Conflict Analysis: Summary Report for Municipalities*. BC Ministry of Environment, p.
[8] *Ibid*. preamble.

ACTIONS TAKEN

The Terms of Reference of the CRD's March 2012 *Regional Deer Management Strategy* stated the objectives as follows:

- Assess the impact of deer on agricultural crops.
- Assess public health and safety concerns related to deer-auto collisions and risk of aggressive deer-human or deer-pet interaction or transmission of disease.
- Assess level of deer encroachment on private urban residential properties resulting in vegetative loss and increased exposure to risk of deer aggression.
- Engage citizens, government/private/non-profit experts, First Nations, and farmers in preparing an action-oriented deer management strategy.
- Gain public and local/provincial government support for the implementation of the resulting strategy.

While taking note of the lack of available scientific information, the CRD undertook to develop a *Regional Deer Management Strategy* (published in August 2012) "to reduce human-deer conflicts in rural and urban areas." One of its early actions was to set up a communications method whereby residents could submit their comments and opinions to the CAG. They used this method to conduct a series of "online feedback forms" for each of the conflict-reduction management options listed on the previous page.

The comments received were from agricultural, rural, and urban areas throughout the CRD and not just from Oak Bay. Given the size of the human population in the CRD (over 377,000, of which 18,015 live in Oak Bay), the online feedback form garnered relatively few responses; many from people who were angry or frustrated about having to deal with deer on their farms or in their neighbourhoods. Some residents had technical problems with the online forms, others had difficulty with the wording of the questions.

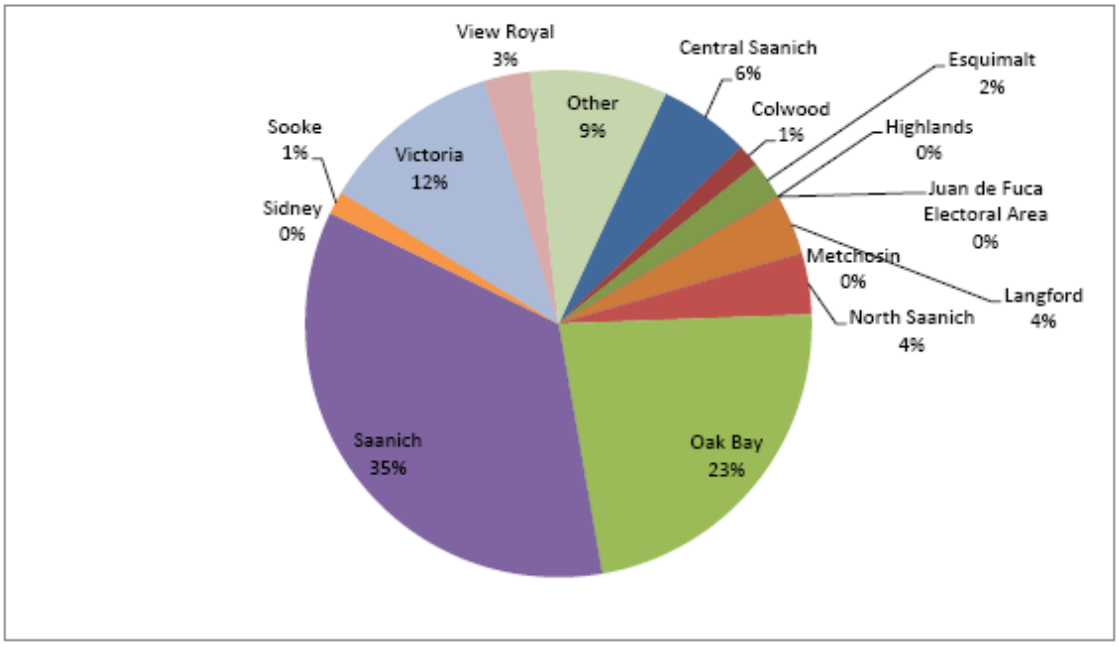
While the numbers of responses were tallied and organised according to conflict-reduction option and area within the CRD, it was not a scientifically designed survey of the wider community. Neither was its distribution method sufficient to get feedback from a representative sample of the whole community since "notification of the feedback forms…was sent to any email address that had submitted [*comments or questions*] to the deermanagement@crd.bc.ca email address.[9] Compared to the human populations living in each of the area categories, the number of responses for each option was very small, certainly not large or representative enough on which to base a decision to conduct a cull.

There were 206 responses to the online feedback form for the Capture-and-Euthanise management option (received by 18 July 2012). In response to *Question 1. Please indicate the Municipality or Electoral Area where you reside*, the breakdown for all areas within the CRD is shown in the pie chart below. (Question 2 asked if the respondent represented commercial agriculture, of which 9% answered in the affirmative.) Question 3 on the public feedback form was: *To what extent do you agree or disagree with the application of the evaluation criteria to the Capture-and-Euthanise management option?* Looking at these two pie charts, it appears that roughly 47 people from Oak Bay responded to Question 3 (23% of 206). Of those, it is impossible to determine how many of them agreed or disagreed with the Capture-and-Euthanise management option.[10]

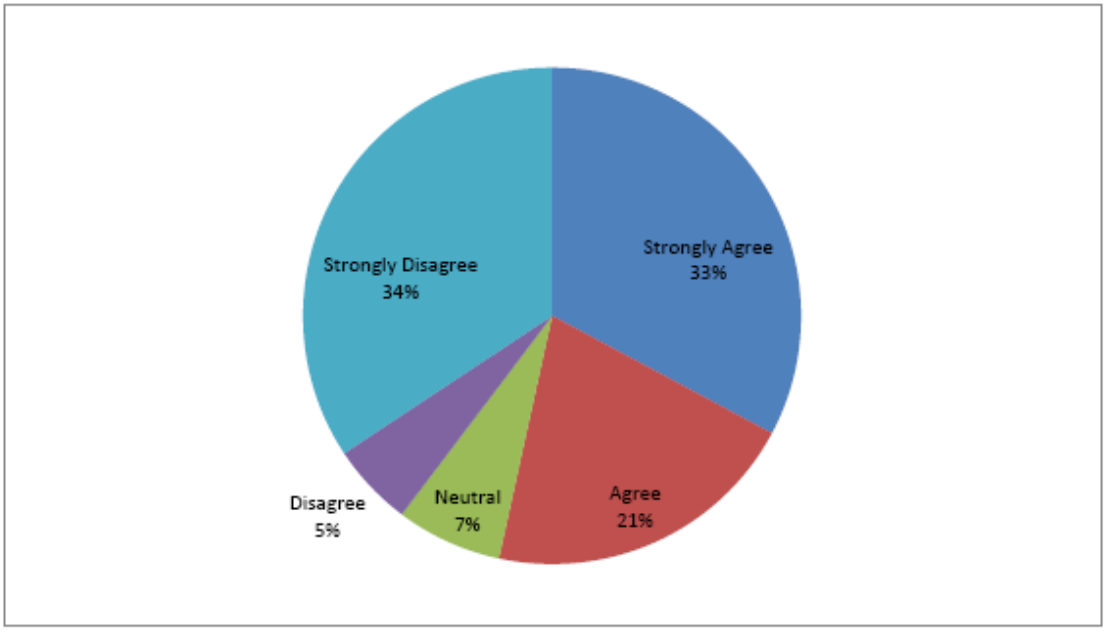
[9] CRD-CAG meeting notes, 27 June 2012

[10] All forms and results are found on the CRD's website under "Projects & Initiatives" at www.crd.bc.ca

1. **Please indicate the Municipality or Electoral Area where you reside.**



3. **To what extent do you agree or disagree with the application of the Evaluation Criteria to the Capture and Euthanize management option below?**



Individual comments (most with no indication of where in the CRD the respondent lived) were collected and reported back to the CAG. Some people commented that "if it were bears or cougars, there would be no hesitation" in killing them. It was fairly easy to determine if comments were being made by farmers, whose livelihoods were being affected by damage caused by deer, but there were a number of comments from people on both sides of the issue. Some comments were short and to the point: "Disagree 100% with the capture and kill option." "Quit talking. Just get rid of the deer!" Others expressed sadness that the deer would be killed, but admitted they had become a problem, particularly with aggressive behaviour that many felt was too dangerous to allow in residential areas, or they were concerned about the possibility of disease either from feces on lawns or black-legged ticks increasing the likelihood of getting Lyme disease. A few asked for the scientific rationale for a cull, rather than contraception or sterilisation.

Many people stated their concerns about the lack of clarity in the wording of the questions with such comments as:

- "The language you are using here is clumsy and confusing. Please consider less committee-type talk and more direct questioning to ascertain public opinion."
- "I find this survey very ambiguous and difficult to understand."
- "I'm not sure I understand what you are asking in this question."
- "I had to indicate 'neutral' as I did not understand the question. This survey is confusing and a frightening example of obfuscation."

At the June 5, 2012 CAG meeting, BC senior wildlife biologist Kim Brunt gave a presentation on doing a deer population inventory and the potential problems and limitations of doing a count in an urban area. One of the challenges involved the high habitat variability in urban areas compared to the relative uniformity in a forest. Part of his presentation is copied below:

CONCERNS WITH CONDUCTING AN URBAN DEER INVENTORY

- *Deer populations in the urban/rural environment will be highly variable by area, neighbourhood, or even individual block within a neighbourhood due to high variability in habitat suitability*
- *There is no standardized inventory methodology available for use in the urban environment*
- *Any count would only generate an index – with very wide confidence intervals – not an estimate of the actual population*
- *Past experience has noted that there are very serious concerns in the use of volunteers conducting deer inventory work*
- *Any inventory with any possibility of defensibility would be very labour and $ expensive to carry out, and would require numerous years of data to detect trends – if a reliable/defensible method could even be identified*

For all of the above reasons, any inventory work carried out would not be considered scientifically defensible, and therefore subject to intense criticism as to its reliability.

<u>RECOMMENDATION</u>: Use metrics of the problem – not the deer population – to identify areas of priority concern and to measure results of treatment.

The above reference to "metrics" refers to documenting the number of deer-vehicle collisions, the number of deer carcasses removed by Oak Bay municipal staff, the initial deer count undertaken in spring 2014, and the post-cull count done in fall 2015.

On January 12-13, 2015, provincial veterinarian and member of the ERWG, Dr. Helen Schwantje, gave a presentation at an urban deer workshop. Titled "Urban Deer Population Control—Direct Methods," she highlighted the fact that no single population reduction method is effective; rather, there should be a range of solutions conducted in tandem that together will "find balance among animal welfare, human safety, capacity, method effectiveness, and cost and acceptability."

In March 2014, Dr. Schwantje made a presentation to Oak Bay Council and provided information on the options for population reduction. She explained the limitations and challenges associated with immunocontraception and sterilisation, capture-tranquilise-relocate, targeted shooting/hunting, and with allowing natural predation by native predators. In the end, however, she said that the modified Clover trap-bolt gun cull method was the only one she could approve for an urban setting because of provincial and municipal laws and bylaws. A cull offered the "immediate reduction of numbers" of deer, and would allow the use of deer meat for human consumption. She further advised that "deer management is not just a one-time event, but that further monitoring and evaluating of human-deer conflict will be required for several years to come."[11] Dr. Schwantje's presentation informed the group that this method of reducing the number of urban deer had the following characteristics:

- Moderately labour-intensive
- Moderate cost
- Provincial permit required
- Access to licensed cut and wrap facility preferred
- Mandatory training in ethics and welfare, carcass inspection, and operation of Clover trap and bolt gun

This option for reducing the number of adult deer in Oak Bay was what the mayor and council decided on. A key part of the rationale for this decision was the fact that the number of deer killed by traffic and other causes in Oak Bay in 2014 (29 to the end of September) was "trending higher than in any previous year."[12]

Initiatives undertaken by the CRD included a public education campaign with the production of two brochures. How widespread these were distributed is unclear, but for its part, Oak Bay distributed them through the *Oak Bay News*. In 2014, Oak Bay passed two municipal bylaws; one to increase the fine for feeding deer from $100 to $300, and the other related to fence heights for residential side and back yards. Oak Bay also acquired speed sign equipment from ICBC that was placed in high collision areas to alert drivers to reduce their speed.[13]

DISCUSSION

To determine if the cull in Oak Bay was scientifically justified, this reviewer performed the following two tasks:

[11] Memo to Oak Bay Mayor and Council, 14 October 2014, www.oakbay.ca/
[12] *Ibid*.
[13] *Ibid*.

1. examined the available science for each of the potential conflict-reduction management options and compared the results with the activities that were carried out in Oak Bay;
2. reviewed all the available documentation on the CRD and District of Oak Bay websites, including local, regional, and provincial government memos and reports; minutes of the CAG meetings over 2+ years; presentations made by ERWG members (provincial biologist, provincial veterinarian, BCSPCA chief biologist, and others); collections of the online public response forms for each of the proposed management options and subsequent analysis by CRD and District of Oak Bay staff; and local media articles over a nearly three-year period.

A cull is a reactionary method of managing urban wildlife problems that addresses the consequences but not the causes of habituation. One of the causes is that urban deer lose their fear of humans and become comfortable around people. Kloppers et al. (2005) conducted research based on the assumption that habituation could be reversed by re-conditioning habituated wildlife (in this case elk) to respond to humans as predators, such as by hazing with dogs and/or with people and dogs together. This has limitations in dense urban areas and requires a place to haze the animals to that is safe for the wildlife, the people, and the dogs (such as not hazing toward a busy road). The researchers found that aversive conditioning did modify the behaviour of the elk by making them more wary of people and resulted in increased distances away from town boundaries.[14] In this respect, "teaching" deer in Oak Bay to be less comfortable in human use areas has some potential to reduce the number of deer becoming habituated to residential areas, thus also reducing the number and types of conflicts. However, the use of dogs to haze wildlife is not an approved practice in BC, other than specially trained dogs used for hazing bears in certain approved situations.[15]

The causes of the people-wildlife conflicts that are occurring in many areas in North America are varied and often complex. Solutions are also complex, not only because the science is complex, but so are our societies. They entail considerations based in science, economics, ethics, public safety, and other social concerns. The CRD's Regional Deer Management Strategy listed "social (or cultural) carrying capacity" as frequently as the environmental carrying capacity as an important indicator of the community's concern about deer-people conflicts. Economic, ethical, and other social considerations change over time and vary throughout the many societal groups in our communities.[16,17] The BCSPCA comments on this variation, stating:[18]

> *Many people oppose the concept of a cull outright on philosophical grounds, but the societal definition of what is 'humane' often differs from what can be enforced by law… the current culling of urban deer in BC for the purpose of conflict management does not equate to hunting or the removal of individual problem animals. Thus,* ***much more consideration of this issue is needed to find a balanced and evidence-based approach that is in the best interests of local residents and the deer*** (emphasis added).

In this context, it was important for Oak Bay officials to know what the community thought and felt about wildlife, especially when wildlife encroaches upon people's homes and into their

[14] Predator-Resembling Aversive Conditioning for Managing Habituated Wildlife, Kloppers, EL, CC St. Clair, TE Hurd, 2005, *Ecology and Society* 10(1):31 [www.ecologyandsociety.org/vol10/iss1/rt31]
[15] Wildlife Act {RSBC 1996] Chapter 488, s.78 A person commits an offence if the person causes or allows a dog to hunt or pursue (a) wildlife or an endangered species or threatened species, or (b) game, except in accordance with the regulations.
[16] http://www.ethicsweb.eu/node/122
[17] http://www.onlineethics.org/chapt1.aspx
[18] http://www.spca.bc.ca/animal-issues/wildlife/issues/urban-deer.html

neighbourhoods and streets. The fact that the cull in Oak Bay was so highly controversial points this out very clearly. People legitimately asked about the scientific basis for the cull, and they asked about the humaneness of the cull, if the District had put in place all the generally accepted conflict-reduction practices before the decision to do the cull was made, and about the transparency of the decision-making process.

Early on, the CAG developed 13 initial management criteria and 7 broader categories[19] into which the conflict-reduction options could be considered:

- Efficacy of reducing conflict in identified geographic areas
- Public acceptability
- Humaneness of management options
- Sustainability of management options
- Options that are most effectively monitored
- Legal and regulatory changes to bylaws, provincial statutes or regulations, licensing, education
- Timely implementation of options
- Alignment of options with CRD corporate strategic vision
- Authoritative limitations (implementation in different geographies)
- Public health considerations
- Cost
- Capacity to be grouped or paired with other options
- Jurisdictional barriers to implementation in specific geographic areas

The 7 broader categories:

- Effectiveness
- Feasibility
- Capability/capacity
- Cost/economic impact
- Time
- Support/enthusiasm
- Community factors (health, safety, and environment)

These criteria and categories clearly reflect the intention to manage the urban ungulate conflicts in a socially and scientifically acceptable manner. This is a valid consideration for a discussion on the Clover trap-bolt gun (capture-and-euthanise) deer cull that was carried out in Oak Bay in February 2015 because what is reported to have happened leaves many continuing to ask if the cull was justified, both from a taxpayer (value for money) viewpoint and scientifically.

[19] CAG meeting 12 June 2012

Were acceptable levels of alternative non-lethal conflict-reduction options undertaken by Oak Bay prior to deciding to do the cull?

To qualify for a permit to carry out the cull, the provincial government required Oak Bay to first implement as many of the conflict-reduction options as were appropriate for an urban area and that were economically feasible. Some conflict-reduction options are not allowed either in Canada (immunocontraception) or in British Columbia (hazing deer with dogs). Others are considered either too risky for the animals (tranquilise and relocate) or too risky to conduct in urban areas (hunting or sharpshooting). The options that are available, such as public education programs, passing bylaws to prohibit feeding deer, and reducing speed limits and street edge modifications to allow for greater visibility of deer, among others, are generally less expensive and more socially acceptable, but require targeted planning, widespread implementation, and consistent enforcement. My review indicates that these were only minimally carried out in Oak Bay prior to deciding to conduct a capture-and-euthanise cull.

Conflict reduction option	Done prior to deciding on cull
Lethal control by capture-euthanise method (cull)	
Immunocontraception and sterilisation (non-lethal control)	Methods not approved
Traditional hunting or targeted shooting/sharpshooting	Not appropriate in urban area
Hazing with dogs, and with dogs and people together	Not allowed in BC; also not appropriate in urban area
Use of frightening devices (sounds, water, flashing lights, etc.)	Not appropriate in urban area
Tranquilise & relocate	Too expensive & too risky for deer
Widespread public education programs	Limited, inadequate
Bylaws prohibiting feeding deer (deliberate and inadvertent)	Done, not strictly enforced
Signage and reduced speed limits on targeted streets and roads	Done, not enforced
Increase driver education on avoidance of collisions with wildlife	Not done
Redesign some streets/roads to mitigate collisions with deer	Not done
Increase/extend rights-of-way by brushing	Not done
Use of deer repellents	Limited amount, haphazard
Increase municipal and/or residential fencing	Not done
Planting species deer don't feed on	Limited amount, haphazard
"Luring" deer away from human-habituated areas (a) by planting deer foods in remote areas, and (b) by enhancing deer habitat outside of urban areas	Not appropriate in urban area
Preserve/restore natural deer habitats	Not appropriate in urban area

Was there a baseline determination of the types and locations of conflicts and the number (population) of black-tailed deer in the municipality to justify the cull?

Based on the available documentation, it does not appear that the decision to have a cull was put to a systematic measurement or analysis by the CRD or Oak Bay. For example, prior to conducting the cull, Oak Bay did not collect, map, and analyse the data needed to address all the conflicts—what caused each of them—at the specific locations where they occurred in order to target conflict-reduction efforts based on the various options put forward by the CRD's initial analysis. Also, a lengthy review of all the available documentation did not turn up a definitive

study of WHY black-tailed deer were becoming habituated to the urban areas in the CRD or Oak Bay, resulting in an increase in the number of resident deer compared to earlier times.

Oak Bay did, however, collect information (from their public works and police departments) on 49 dead deer found within the District between 1 September 2013 and 19 October 2014, including dates, locations, sex, age, and types of incidents. Just over half of them had been hit by vehicles, with the majority on three streets: Cadboro Bay Road, Henderson, and Cedar Hill X Road, yet little was done to reduce the number of collisions.[20] A small number of signs were put up to reduce speeds on the high-incidence streets, but there was no targeted enforcement of speed limits. Some of the other dead deer were thought to be orphaned fawns that likely starved, and some that were impaled on fences,[21] but there was no conclusive cause of mortality for the remainder.[22]

In spite of the challenges and limitations, two deer counts were done in Oak Bay—an initial count before the cull and a second count after the cull—both of which were requirements to obtain the permit from the FLNRO ministry. The first was done in June 2014 by CRD staff, volunteers, and the municipal animal control contractor. A detailed and time-consuming online search, as well as directed questions to individuals involved in the issue, revealed no exact information on the number of deer counted in Oak Bay in this first population estimation. Further, a memo to Oak Bay Mayor and Council (14 October 2014) stated: "While the count methodology would not stand up to scientific rigor, the methodology used was informed by the provincial wildlife branch…."

The second (post-cull) count was done over three weeks in late October and early November 2015, with the highest count being 55 deer. This was conducted by paid counters from the University of Victoria, Camosun College, Urban Wildlife Stewardship Society, and the CRD and is described as follows:

> *All the streets in Oak Bay were driven. Each route was alternately driven in each direction. The Victoria Golf Club was counted using optics (binoculars/spotting scope) and a golf cart. Four dawn and dusk counts were completed. Provincial staff interpret results for a driving count by considering the highest count of all the repetitions as the overall result. The high count was 55 deer. Of those, 14 were counted on the Victoria Golf Club grounds. The overall count is equivalent to finding one deer every two kilometers. Most animals appeared to be in good condition with few injuries observed. More females than males were observed: approximately 60% female and 40% male. As the initial count was done differently than the follow-up count, the results are not comparable. Also, the locations of the deer varied from one count to the next.*[23]

Was there an explicitly stated target goal/objective set for the cull in Oak Bay? If so, was it achieved?

The CRD's *Regional Deer Management Strategy* stated the primary outcome as "Reduce the deer population to **natural levels** [*emphasis added*] inside of settled areas and provide urban

[20] *Report: Black-tailed Deer Cull in Oak Bay*, B. MacKay and L. White, July 2015, pgs. 2-3
[21] https://www.oakbay.ca/municipal-hall/news/mayors-deer-update-message, 15 October 2014
[22] Personal communication, Jeff Weightman, 12 October 2016.
[23] https://www.crd.bc.ca/project/regional-deer-management-strategy

residents with measures to reduce deer-human conflicts to within the range of individual property owner tolerance levels."[24]

There was no science-based investigation or determination of what would be a "natural level" of deer in Oak Bay, just as there was no investigation of why the deer were becoming habituated to urban areas, as previously mentioned. Because the pre-cull population assessment wasn't conducted in a scientifically defensible way, there was no clear statement on how many deer there were in the municipality at the start of the pilot project.
Oak Bay's statements on its objectives for conducting the cull were simply to reduce the number of deer in the municipality so there would be fewer deer-people conflicts resulting in increased public safety. However, in its "Lessons Learned" report, dated 30 April 2015, the District states:[25]

> *Public safety **continues** to be an important lens in the evaluation as the real implications of deer-human conflicts **continue**. The issues of vehicle collisions, the biological carrying capacity of our environment, and the socio-economic carrying capacity of our residents (property damage, fencing costs, vehicle damage, veterinary bills, stress) all **continue***
> [emphasis added].

Were all the causes of the conflicts thoroughly known and explained to the public before the cull was decided upon and subsequently conducted?

Among the more successful non-lethal approaches to reducing wildlife-people conflicts are widespread public education and the passage of consistently enforced bylaws that modify human behaviour in ways that reduce the likelihood that wildlife (in this case, deer) become habituated to living in human settlements.[26]

Public education and outreach, as stated in the CRD's Regional Deer Management Strategy document,[27] was "considered as an overarching management option that will become increasingly effective, if paired with other options…Outcomes may include:

- Creating realistic expectations for achievable results
- Increasing appreciation for wildlife in appropriate settings
- Reducing undesirable human activity
- Broadening the public's knowledge of the range of concerns of all affected by deer habituation
- Increasing public understanding of deer management measures"

Based on many responses on the online comment forms before the cull was carried out, and on media articles after the cull, it does not appear that the public education efforts were very successful. Misunderstandings, accusations of political interference or bias, fear of deer aggression, and resentment and anger over property damage and other public safety issues are continuing problems in Oak Bay (and nearby). In a letter-to-the-editor in the *Oak Bay News* on May 9, 2016, the writer (a candidate in the previous municipal election) said:[28]

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[24] *Ibid*, p. 27
[25] Ibid. *Lessons Learned*, p. 5
[26] Davis, H. et al. 2002. "Bear Smart" Community Program: Background Report
[27] *Ibid*. p. 25
[28] http://www.oakbaynews.com/opinion/letters/378719981.html

I supported an option to re-visit and re-evaluate what I believed was a questionable, costly deer management pilot program through the CRD, one that would be potentially ineffective and divisive. I learned that to tackle the issue required regional coordination with Saanich and Victoria.

I pointed out that Oak Bay's lack of implementation of speed limit reduction on major traffic corridors, such as Cadboro Bay Road between Lansdowne and Cedar Hill X roads, and the absence of proper signage consistent with provincial government wildlife signage, were missed steps in the pilot program. I stressed that an absence of reliable scientific data on how many deer reside in Oak Bay and on their migration patterns was also a major gap in the pilot.

I believed then, as I do now, that without such scientific data collection, how could the municipality undertake an informed analysis of outcomes, to determine if the deer population was effectively reduced or managed and that Oak Bay taxpayers could be sure that the program was cost-effective…I stressed that Oak Bay's efforts to cull deer in isolation was sufficient cause to question the efficacy and common sense of this option.

What was the public perception of the cull as a method to reduce deer-people conflicts in Oak Bay? How were the locations for setting the Clover traps determined?

The completion of "the population reduction (cull) component of the Deer Management Strategy pilot project" was reported in a March 10, 2015 article in the *Oak Bay News*.[29] "Mayor Nils Jensen called the 15-day cull a success, with 11 deer removed as part of the CRD deer management strategy. 'The pilot project…wasn't about fixing a problem with a one-time cull.'" Because of incidents associated with culls carried out in the East Kootenay region, the modified Clover traps were placed on private properties in Oak Bay and generally in areas where there was a high degree of seclusion in order that the traps couldn't be seen by people unless they were either invited to be on the private property or were trespassing. To this, Mayor Jensen said, "We were, of course concerned about vandalism and criminal activity which was seen in Kimberley and Cranbrook areas, we were able to show it can be conducted without that." There was no information that the Clover traps had been located on properties where there were specific conflicts.

In the same article, BCSPCA chief science officer Sara DuBois said, "To say it's a success is really misleading. You're not addressing solutions that you claim to have with urban deer conflicts. If [you are] concerned about overpopulation, you worry about females. If you are concerned about vehicle areas, you trap around roads…They have no measures beyond political points here."

There was widespread concern about cruelty to the deer caused by the method of doing the cull (e.g., Clover trap-bolt gun), often exacerbated by attempts at secrecy by contractors and by some members of the local city council.

Another letter to the Oak Bay News, published on 10 Feb 2015, shortly after Oak Bay received its permit for the cull, focused on whether or not the cull would be as humane as the mayor and the provincial veterinarian said:

[29] http://www/oakbaynews.com/news/295769931.html

> *If this cull is as necessary and humane as Oak Bay Mayor Nils Jensen and Dr. Schwantje would have us believe, then why is the BC SPCA – the independent provincial authority on the humane treatment of animals – repeatedly expressing its strong opposition? In a Jan. 30 letter to the mayor, CEO Craig Daniell says "the proposed actions constitute an indiscriminate cull that is not a sustainable or evidence-based solution for managing deer in this area." The letter goes on to say that culls in other B.C. municipalities have not eliminated local human-deer conflicts, that the regional deer management strategy process that led to this decision is "fatally flawed," that residents of Oak Bay have not been appropriately consulted on their wishes and that the non-lethal conflict-reduction program has not been thorough. That's pretty damning, and it's all true.*
>
> *As for the method of culling, once a deer is caught in the clover trap, the trap is collapsed, a man throws his body weight onto the trapped animal while another man stuns the deer with a bolt shot into its head. The deer's throat is slit and the animal bleeds to death. Dr. Schwantje describes it as "a very quick process, in fact it's been done in under 30 seconds."*
>
> *It would be rare for an animal to bleed to death in 30 seconds. This is why the B.C. SPCA is warning Oak Bay that "bleeding out of a conscious animal is not considered humane or a generally accepted practice and is grounds for a cruelty investigation under the Prevention of Cruelty to Animals Act."*
>
> *In your story, Dr. Schwantje describes the Oak Bay deer cull as 'euthanasia.' The cull is not euthanasia; it is the inhumane and unnecessary slaughter for political gain and to satisfy a small but vocal number of residents.*[30]

In a letter-to-the-editor published in the *Oak Bay News* prior to the cull (on Dec 26, 2014), the writer states:[31]

> *The method chosen for this cull is highly controversial. The claim of a "rapidly expanding deer population" has not been substantiated by a scientific count, such as radio collaring and tracking movements of deer between municipalities.*
>
> *Some Oak Bay councillors have maintained that experts (unidentified) have assured them the clover trap/bolt gun kill is humane, with some claiming that this method is as humane as any abattoir kill. The use of the bolt gun in an abattoir is paired with an entirely different method of restraint than that depicted in the photographs on the DeerSafe website of the killing of a buck in 2010, where two men are restraining a 140- to 200-pound animal with the weight of their bodies. These are not the conditions of restraint for which the bolt gun was designed.*
>
> *I suggest that it would be in the best interests of the Oak Bay public if council members were to meet with those opposed to the upcoming cull to observe the clover trap/bolt gun kill by Oak Bay's chosen contractor.*
>
> *Given the ongoing controversy regarding the humaneness of this kill method, I hereby ask the council's permission to observe the clover trap/bolt gun kill, and invite councillors to attend as well.*

[30] http://www.oakbaynews.com/opinion/letters/291104941.html
[31] http://www.oakbaynews.com/opinion/letters/286583741.html

The BCSPCA did not support the cull.[32] In a June 2013 letter to the Oak Bay mayor and council, the provincial director of the BCSPCA said: "Using lethal control measures in Oak Bay is not a sustainable or evidence-based option for managing deer…for this area." Further, after commenting that the SPCA had been active in the "urban deer debate" for years, including being a member of the CRD's Expert Resource Working Group committee, he commented:

> *Oak Bay's deer problems are in part self-generated as a result of unlimited access to food resources through gardens and yards, as well as possible intentional feeding. Oak Bay's affirmative move towards a cull lacks the same scientific justification for lethal management … and given its proximity to other municipalities is bound to fail to achieve reduced deer interactions.*
>
> *Oak Bay has no means of accurately estimating a transient deer population, a population that moves in and out of adjacent municipalities by crossing the street. Decades of wildlife studies on culling activities show that removal of animals in such a transient system only creates a 'sink' territory for more animals to move into. An assumption that road kill trends correlate directly to increases in deer populations is scientifically dangerous and negligent. If there are specific individual deer that have demonstrated aggressive actions towards humans in Oak Bay, these individual animals should be treated like any other aggressive bear or cougar and removed by the Conservation Officer Service. However, an indiscriminate cull … which neglects considerations for gender and age class is unethical and contrary to generally accepted principles of wildlife management… The BCSPCA recognizes that* [Oak Bay residents] *demand some type of action…based on lessons learned from other North American cities dealing with this issue for the past 20 years, the proposed cull actions are not a scientifically-sound or sustainable solution. We encourage you to look at the current research of* [Dr.] *Erin McCance* [in Winnipeg] *… for the root causes of deer conflict and effective non-lethal management strategies… The BCSPCA strongly opposes the District of Oak Bay's cull proposal and encourages transparent and representative community consultation on the issue, the enforcement of existing bylaws, and regard for a more comprehensive management strategy including the implementation of non-lethal management actions and dedicated resources to measure their effectiveness. Oak Bay must aim to address the cause of the deer habituation rather than opt for a convenient, short-term action that will divide its citizens.*

A search for media coverage of the cull and associated activities in the CRD brought up dozens of articles and letters-to-the-editor, many by biologists and other professionals living in the region, who disputed the claims that (a) the cull was a necessary and effective method of reducing deer-people conflicts, (b) that there was scientific justification for the population control method conducted by the municipal District of Oak Bay (the cull), and (c) that the capture-and-euthanise method was humane.

No articles indicated the cull was successful, other than the few that contained unsubstantiated claims that it was. The municipal election in 2014 resulted in the election of local councillors who had publicly supported the cull. This was interpreted to mean that the mayor and council of Oak Bay had a mandate to carry out the cull. In such a divisive environment, it is impossible to state categorically that there was such a mandate. In any event, the purpose of this case study has

[32] http://www.spca.bc.ca/animal-issues/wildlife/issues/urban-deer.html

been to determine if there was scientific justification for the cull and if it resulted in reduced deer-people conflicts. The information herein clearly explains that there was no such scientific justification and, moreover, there has been no published evidence to indicate that there was a reduction in deer-people conflicts.

CONCLUSIONS

The questions this case study examined are:

- What factors contributed to the apparent increase in a resident deer population?
- What habitat and other attractant features led to wild deer becoming habituated to urban development and become seasonal or full-time resident deer?
- What facts are needed to support a decision to implement a "capture-and-euthanise" cull for managing deer in an urban setting?
- Did Oak Bay establish a baseline determination of the causes, types, and locations of conflicts, and were these mapped out and analysed over time?
- Did Oak Bay have a reliable estimate of the black-tailed deer population in the municipality, and were the numbers sufficient to justify a cull?
- Were acceptable levels of alternative non-lethal conflict-reduction management options undertaken by Oak Bay prior to deciding to do the cull?
- Did the cull solve the problems? Will a temporary removal, such as a cull, result in a long-term solution or does this create a population sink-source situation where more wild deer move in from outside the area to fill a temporary vacuum?

The following is a summary of the answers based on the available information, reports, interviews, research, media articles, and minutes of meetings.

1. **Was the process leading to the decision to conduct the cull transparent? Were Oak Bay residents fully consulted and given adequate opportunity to contribute to the decision-making process?**

   No. One of the provincial government's first recommendations was for the CRD to develop a communication and public consultation strategy, including a survey to determine a baseline—or informed starting point—for each of the conflict types, the specific locations where they were occurring, and what would be the acceptable solutions for each community. However, neither of these recommendations was achieved. A scientifically designed survey distributed to every household in Oak Bay—or at least a statistically significant sample—was never done. A good communication strategy could have helped inform the public, as well as the local government agencies involved and possibly prevented the divisiveness and confusion that plagued the issue before, during, and after the cull was conducted.

2. **Was the Oak Bay deer-people conflict situation scientifically assessed and was science used as the basis for a population reduction strategy? What prior facts are needed to support a decision to implement a "capture-and-euthanise" cull to manage deer in an urban setting?**

No. First and foremost, there needs to be a baseline determination of the types and locations of conflicts. There also needs to be an assessment of the black-tailed deer population in the municipality. There was no scientifically accepted count of the number of deer in Oak Bay prior to conducting the cull, nor was there any scientific research to explain why black-tailed deer had become habituated to the city.

3. **Were the causes of the conflicts thoroughly known and acted on before a cull was decided on and subsequently conducted?**

   No. This is covered herein on pages 10-13.

4. **Were acceptable levels of alternative conflict-reduction options undertaken by Oak Bay prior to deciding to do the cull? Were all the conflict-reduction options fully employed, and their results analysed and publicly reported on prior to carrying out the cull?**

   No. See pages 11-13 herein.

5. **Was the cull in Oak Bay effective in reducing the deer population? Did the cull reduce deer-people conflicts in Oak Bay?**

   No, and no. In the year prior to the cull, 49 deer were killed by traffic, starvation, accidents involving fences, and other unknown causes of mortality. This high level of mortality without a cull during a one-year period and just prior to an organised cull of 11 deer using the modified Clover traps, resulted in a mortality rate of over four times the organised cull.

As recently as 26 October 2016, there was an incident in Oak Bay where a buck injured a small dog that was on its own lawn by stomping on its legs.[33] On 24 October 2016, in adjacent Victoria, an over-200 lb buck attacked a woman who was jogging with her dog and knocked her to the ground.[34]

Upon review, it could be argued that Oak Bay's decision to conduct the cull was premature. There had not been sufficient prior research into nearly every parameter—scientific and social—to justify carrying out a cull, nor had there been sufficient levels of non-lethal conflict-reduction methods employed to support the decision to conduct the cull.

Is there a long-term solution?

The CRD Board accepted the following recommendation at its August 12, 2015 meeting: "Continue to manage wildlife services, as necessary, at an operational level by various line departments, and **not** [*emphasis added*] establish an ongoing service for deer."[35] It appears, therefore, that for the time being there are no dedicated deer-people conflict reduction activities going on within the CRD. The exception to this is a new process scheduled to begin in Esquimalt, another municipality within the CRD, located immediately west of Victoria.

For the District of Oak Bay, and elsewhere in urban environments in BC where deer-people conflicts are occurring, long term/ongoing research, monitoring, and dedicated resources need to be put in place to enable adaptive management of deer populations to a level where conflicts with people are kept to a minimum.

[33] http://www.ctvnews.ca/canada/buck-wild-2-dog-owners-attacked-by-deer-in-b-c-1.3131851
[34] www.cheknews.ca/deer-attacks-woman-dog-first-reported-attack-greater-victoria-235228
[35] https://www.crd.bc.ca/project/regional-deer-management-strategy

Acquiring baseline data of what, where, why, and how many wildlife-people conflicts are occurring is the first requirement to enable comprehensive and effective management planning. Keeping the data updated to enable identifying trends in habitat availability and wildlife population levels will go a long way to ensuring that British Columbians and visitors can enjoy the presence of wildlife in and near our communities.

For the CRD, where the larger and more populated municipalities are adjacent to each other, it would be advantageous to develop an ongoing coordinated regional deer management strategy that encompasses consistent conflict-reduction options simultaneously throughout all the urban areas. Urban deer move in and out of political jurisdictions, but can affect the entire region.

Compared to long-time densely populated places in eastern Canada and the US, BC is relatively recently realising it must deal with people-wildlife conflicts in ways that are effective and that are acceptable to people, and to principles of wildlife management and conservation. There will be no one set of solutions applicable to all communities or regions within the province.

A literature review on the subjects of urban deer, deer-people conflicts, and the various management options for reducing deer-people conflicts points to the likelihood that both non-lethal and lethal deer population reduction methods may need to be employed at various stages in a region's deer management plan activities.

Any deer management method is likely to be controversial:

> *Deer and deer management may be some of the most controversial topics city leaders encounter due to the polarizing opinions that deer raise with members of the community. Many individuals believe community residents must adapt to the presence of deer and live together peacefully. Others are vocal in their disdain for deer and want their numbers drastically decreased by any means possible. Both parties are often unrelenting in their values, and there are no management alternatives available that both parties find unanimously favorable… Deer overabundance is often a reflection of human values rather than biological thresholds…communities struggle with the task of selecting a publicly acceptable management strategy to safely and effectively reduce deer populations.*[36]

This doesn't mean that there can't be socially and biologically acceptable and effective long term solutions to the problems associated with urban deer. Most, however, will require people to modify their own behaviours and, to a certain extent, their beliefs about what are the optimal levels of wildlife activities in their neighbourhoods. Just as with BC's Bear Smart program[37], which requires people to learn how to better deal with their garbage, fruit trees, and other attractants and behaviours (e.g., not running and screaming at the sight of a bear, keeping dogs on leash when walking in bear country, etc.), an effective urban deer management plan will focus on how to convince residents—with science—that there are clear behaviours they can adopt to reduce conflicts with deer.

Consistent, widespread public education and engagement goes a long way to helping reduce conflicts with wildlife, and increases public safety. For her Master of Environment thesis, *Resident Opinions Concerning Urban Deer Management in the Greater Winnipeg Area, Manitoba, Canada*, Erin McCance (2009) mailed 4,000 questionnaires to randomly selected

[36] *Urban Deer Technical Guide*, Indiana Division of Fish & Wildlife, Department of Natural Resources, pp. 3-4.

[37] Davis et al, 2002, *"Bear Smart" Community program: Background Report*.

residents to "investigate residents' opinions and tolerances…and to assess residents' preferences concerning potential urban deer management strategies." She found that there was a "preference both for non-lethal methods of action and for resident involvement in the creation of management plans…[suggesting] how human dimensions, along with biological and ecological information, might be incorporated into potential urban deer management decisions." This approach helps to plan for a successful urban deer management strategy by engaging community members in decision-making, thereby reducing community divisiveness.

> *...although biological and ecological data will always be essential in effective wildlife management, inevitably wildlife management is a human activity with human-defined goals and objectives. The effectiveness of long-term successful urban wildlife management action will depend on the ability of managers to integrate the biological, ecological, and human dimensions of wildlife management.*[38]

Assessing the cultural (social) carrying capacity is an increasingly important component of developing an urban wildlife management plan that, along with a well-directed communications plan and widespread public education, can help to set the stage for a long-term solution to the problems that arise when wildlife exceeds the biological carrying capacity in urban areas.[39]

[38] McCance, 2009, p. 3
[39] *Ibid*, pp. 4-54

APPENDIX 2. BACKGROUND URBAN DEER CASE STUDY REVIEW FOR CITY OF KIMBERLEY BC. Wayne McCrory and Sadie Parr January 2017.

The *Kimberley Urban Deer Management Annual Report for 2011* (Kerr et al. 2012) provides the background for the urban deer control program implemented by this municipality. As with the other East Kootenay communities we have reviewed, Kimberley's program was an outgrowth of Hesse's (2010) provincial review of ungulate conflicts and mitigation recommendations for urban areas. Kerr et al. (2012) provide the standard description of why the program was initiated:

> *Several communities in southern British Columbia have identified increasing numbers of human-deer conflicts. Deer numbers have increased dramatically in these areas, presumably because residential areas offer protection from predators and an abundance of food, including non-natural food that the public are feeding to deer. Urban sprawl is also contributing to this trend as more deer habitat is converted into residential areas. This is more than an animal nuisance issue, as increasing vehicle collisions and human conflicts with deer are impacting public safety.*
>
> *While deer are not classified as dangerous wildlife by the province, they can act aggressively to protect themselves or their fawns from perceived threats from dogs or humans. Deer aggression has been escalating in several BC and Alberta communities with high densities of urban deer. In the last few years, mule deer attacking dogs has become a fairly common occurrence in some southern communities. In some cases, this aggressive behaviour has escalated to threats towards human safety with deer chasing baby strollers, tourists, and local residents without dogs.*

The aggressive behaviour mentioned refers to mule deer. As in other communities, Kerr et al. (2012) identify what work Kimberley did in 2010 and 2011 to implement the recommendations in the Hesse (2010) adopted by government. This includes Kimberley having "passed and enforced a bylaw to prohibit feeding deer, created an urban deer management committee, surveyed residents on urban deer and their management, and counted deer numbers within city limits." In fact, Kimberley was the first community in the Kootenay region to adopt and enforce a no-feeding bylaw in 2006 (Kimberley Urban Deer Management Advisory Committee 2011).

In 2011, the Kimberley Urban Deer Management Committee submitted their proposed management plan to the Kimberley council. One recommendation was that deer are **a natural and permanent part of the Kimberley community**. Council dismissed the committee's recommendation for a controlled community hunt to reduce mule deer numbers and the city subsequently obtained a provincial permit for a trap-and-kill cull.

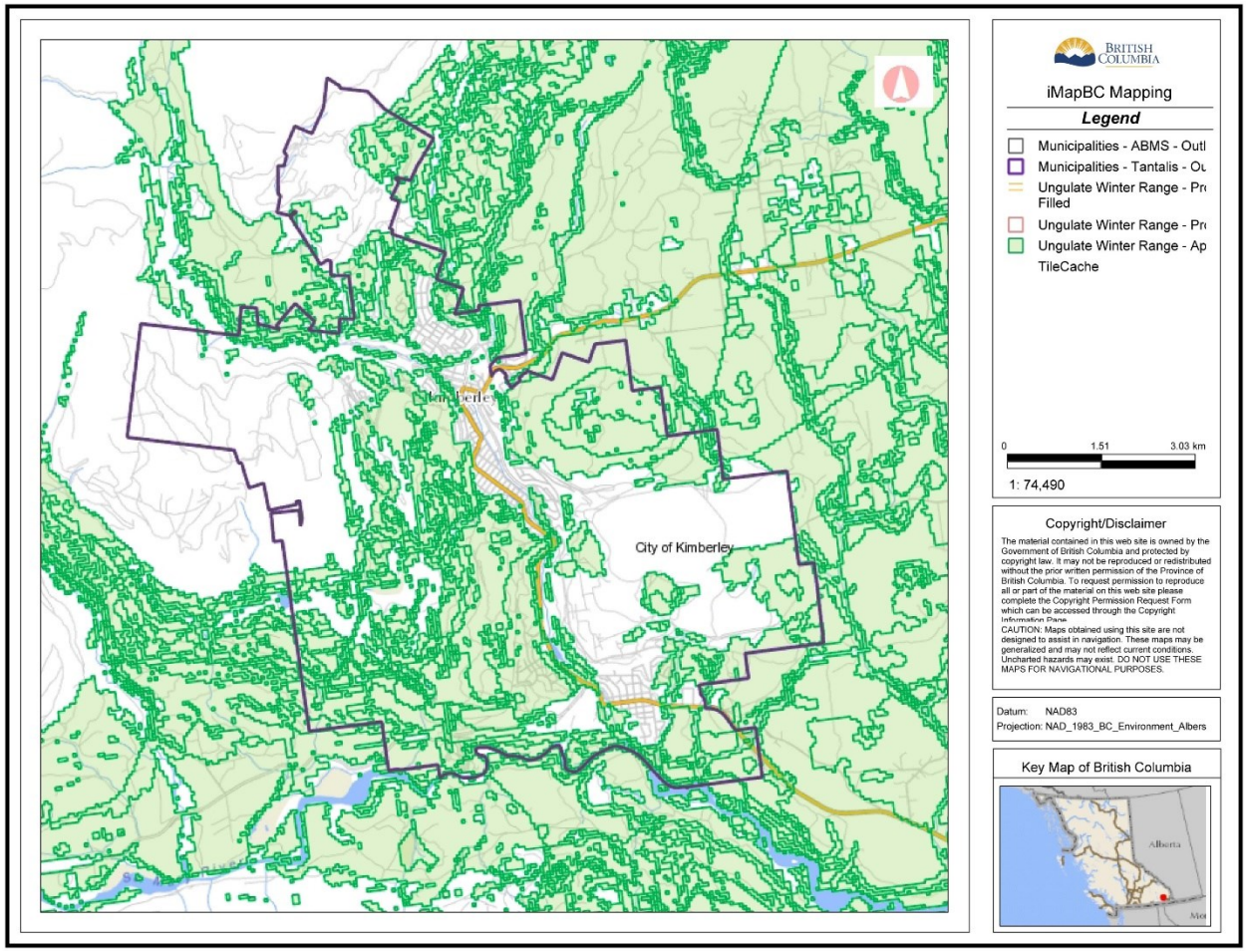
In 2010, a public survey on the urban deer issue was done by the city, using the Hesse (2010) survey question examples. According to Kerr et al. (2012):

> *The comprehensive survey was mailed to 3,123 Kimberley residents of which 1,018 responded. The results were provided to council in September 2010: 83% of respondents were concerned about deer population in Kimberley; 81% were concerned about deer aggression in Kimberley; 72% wanted greater than 30% decrease in deer population in Kimberley. Other concerns included damage to plantings (19%), deer aggression towards humans (17%), deer/vehicle collisions (16%), deer aggression towards pets (16%), and overpopulation of the herd (15%). The survey indicated that approximately $650,000 has been spent by residents over the past five years dealing with deer-related damage.*

Early in 2012, a total of 99 mule deer were killed using Clover traps and bolt guns (Kerr et al. (2012): Another kill of 11 mule deer was done in 2014 (Sadie Parr pers. comm. data Source not confirmed). We are unsure of the other years in between, or if any deer were killed in 2015. In 2016, the cull program switched to 20 deer translocated as a result of a regional buy-in to a non-lethal pilot project.

Evaluation of Kimberley's urban deer conflict mitigation program 2010-2016

The Kimberley Urban Deer Advisory Committee provided a number of fairly well-documented reports to Council between 2011-2013, but we could not locate any annual reports after that, which somewhat restricted our evaluation from 2013 onward. These are available online at: https://kimberley.civicweb.net/filepro/documents/1604?preview=10947.



We were not able to access an ungulate winter range map for the Kimberley area, but it would appear that Kimberley is similar to the other East Kootenay communities that are having urban deer problems in that it is within known historical seasonal deer habitats and movement or migration corridors (see map above). **As with other East Kootenay community case studies, circumstantial and anecdotal evidence suggest that increases in urban deer numbers and conflicts occurred from about 2000-2010, possibly reaching a socio-ecological crisis state about 2010 or, alternatively, reaching a point where political pressure to do something was finally brokered with the provincial government.**

Similar to Cranbrook, Kimberley made a concerted effort to evaluate the urban deer conflict situation, design a management program with some science behind it, and do a monitoring/ evaluation process through fairly credible reports done almost annually. Unlike other communities, **Kimberley has made more of an effort to research and promote more non-conventional approaches, such as a controlled deer hunt within the city, as well as a one-day experimental aversive conditioning trial using trained dogs.**

However, as with the other community case studies we examined for our report, Kimberley also proceeded linearly along the same path by following the provincially set format that then allowed them to eventually obtain equipment and support funding for a lethal cull program. No more in-depth questions were asked, nor was more thorough consideration given to the fact that if the goal was to maintain Kimberley's urban deer population as a permanent and "natural" part of the community (urban deer are no longer considered to be "natural"), would the community then be committing to costly annual culls or translocations to attempt to keep the urban population under "control" in order to try to reduce citizens' complaints and the probable periodic high costs of vehicle damage from deer collisions, damage to gardens, landscaping, fruit trees, and so on? **In other words, as with our other case studies, we find a not very scientific but rather more political control "hype" happening in response to a very real community problem fraught with opposing views and internecine conflicts over whether having deer in town is good or bad for the town** (the presence of wildlife can benefit tourism and, conversely, a lethal cull can have the opposite effect)**, and whether there are scientifically better approaches to addressing the underlying causes of the urban deer phenomenon and the fundamental conflict issues.**

How effective was the Kimberley mule deer control program in reducing deer numbers and, proportionately, conflict/problem rates? It was hard to tell since Kimberley had the highest lethal cull (100 mule deer) of any of the studied communities in 2012 (about 41% of the estimated population, based on the pre-cull count), and this resulted in fewer deer counted later (although actual count data were not provided for 2012/2013) and, after this, Kimberley appeared to do no counts or, if they did, they were not made available.

While Kimberley was the first community in the East Kootenays to pass a no-feeding deer bylaw in 2016, unfortunately for our review, the Kimberley reports provide no data on how much the no-feeding bylaw was enforced or to quantify what success it has had with such goals in reducing deer numbers and complaints. The only information is that by 2013 there were "less human placed attractants" and "intentional feeding of deer is almost non existent". One of the continuing problems in Kimberley is that deer dig into garbage bags left curbside on garbage day (Kimberley Urban Deer Advisory Committee. 2013).

Evidence does indicate that, as with the other East Kootenay urban deer conflict communities, the numbers of habituated town deer and associated problems appeared to escalate from at least from 2004 to 2011. One annual report suggests numbers actually increased from 1996 (Kimberley Urban Deer Management Advisory Committee 2011). As per Hesse's British Columbia Urban Ungulate Conflict Analysis report (2010), public complaints about urban deer within Kimberley included damage to property and complaints about unprovoked deer attacks on leashed dogs walking with their owners. Hesse verified this with a summary of five years of complaint statistics from the Conservation Officer Service (COS) between 2005-2009. Her report cited an average of seven complaints made to the COS in each year for Kimberley. The report also indicated the following:

- increased cougar sightings in town
- an estimate of 50 deer-vehicle collisions/year
- an increasing trend in number of deer injured and attended to by COS between 2005 and 2008

Our review of the COS records does indicate that aggressive deer complaints increased from 2 in 2004 to 34 in 2011. In addition, a total of six aggressive deer were killed by COs and this only occurred in 2010-2011. Injured deer destroyed, presumably mostly from vehicle collisions, also increased over time to 10-13 annually in 2007-2009 and then dropped to only 2 in 2010, but increased dramatically to 18 in 2011 (Kimberley Urban Deer Management Report 2011, table 1 on following page). These numbers, if accurate, support the contention that urban deer numbers increased in Kimberley from 2004. During this time, Kimberley has also seen an increase in tourism and development of infrastructure, including nature trails. Kimberley offers golfing and alpine and cross-country skiing in habitat that is sought after and used by both people and deer. In 2010, a 30 km trail between Cranbrook and Kimberley was opened to the public and promoted as part of a range of trail opportunities. In essence, there has been an increase in trail development and usership that likely has also led to a corresponding increase in human-deer encounters in addition to what appears to have been an increase in the number of urban deer within the municipality itself.

The following table shows that cougar complaints nearly doubled to 26 in the period 2004 to 2012, and aggressive deer complaints, while at a low of 2 in 2004, had risen to 33 in 2011, then were significantly reduced to 20 in 2012, about the same as in 2010. Two aggressive deer were destroyed, while the number of injured deer destroyed increased to 18.

Table 1. Complaints and action taken by COS regarding cougar and deer in Kimberley

Kimberley	2004	2005	2006	2007	2008	2009	2010	2011	2012
Cougar complaints	14	1	6	7	17	10	4	12	26
Cougar action taken	1	0	0	1	3	1	0	2	1
Aggressive deer complaints	2	3	3	3	7	11	19	33	20
Aggressive deer destroyed	0	0	0	0	0	0	4	2	1
Injured deer destroyed	3	5	6	13	10	10	2	18	11

*Data includes Kimberley, Marysville, Meadowbrook

Deer counts have been conducted using volunteers and dividing the city into different subareas. According to Kerr et al. (2012), in 2010, Kimberley had a high density of mule deer (20 mule deer/(km^2) based on a count of 200 within city limits. In November 2011, a total of 242 mule deer were counted prior to the cull of 100 mule deer in January and February 2012. While the 2012 Kimberley Urban Deer Advisory Committee report (2013) does not provide count data for 2012 to early 2013, it indicates a "marked decrease" of deer counts from the previous two years and that there are "close to less than half the deer in Kimberley than there was in 2011." It also

states that "this decrease is largely due to the deer cull in 2012, but also to a number of other factors such as natural mortality and human behaviour modifications (i.e., that intentional feeding of deer became "almost non-existent"). As evidence of the success of the cull, a graph showed the continued rise of complaints to the COS about aggressive deer, which peaked at 34 in 2011 prior to the cull, and then decreased to 20 in 2012.

All of these claims of success from the large lethal cull in Kimberley have some validity in part because early in 2012 Kimberley had the largest trap-and-kill cull of all BC municipalities. Of a total pre-cull count of 242, some 41% (N = 100) were killed. Another 20 were recorded by the COS to have been killed in 2011 (2 aggressive and 18 from injuries), meaning that known human-caused deer mortality in 2011 and early 2012 was about one-half of what might be considered to be the total population (assuming the count data is accurate, which is questionable). It is thus not surprising that the problem/complaint rate decreased (while cougar complaints doubled for reasons that are not explained) after the cull. However, the lack of annual reports after the February 2013 report on 2012 activities and the apparent lack of annual counts after that, makes it impossible to determine the longer-term impacts of such a high mule deer cull.

The only other data we have pertains to the live capture and translocation of 16 mule deer in 2016. We have no other data, such as complaints, to evaluate the results of the non-lethal cull. The translocation project that involved Kimberley and other East Kootenay municipalities is addressed elsewhere in the report, as is Kimberley's experiment with hazing, using trained dogs.

Table 2. Summary of Kimberley's deer management program 2010-2016.

Year	Type of reduction program	Number of deer removed	Notes	Population count
2016	Translocation , preferential to females (tranquilized and radio-collared). ongoing education	20	1 mortality to darted deer	?
2015				?
March 2014	Trap and kill program	Lethal control 11 deer, captured in clover traps.	Intended to remove 30	?
2013		Tried one day hazing with dogs		?
2012	Trap and kill program initiated January 3 - Feb 4 -10 modified clover traps and Blits bolt gun	99 mule deer: (permit for 100) -65 female, 34 male -35 fawns and 64 adults (2015 FOI -FLNRO - 2016 - 61775P1) Provincial government spent approximately $16,200 on trapping related equipment , (plus personnel) The City of Kimberley spent $38, 454.84 on contractors, mileage, bait and meat processing.	All recorded as "good health"	?

2011	Permit received in November 2011 for lethal removal program	Began discussing trap and kill program after council dismissed the idea of a controlled hunt within city limits (Kimberley Urban Deer Management Urban Report 2011)	34 complaints of aggressive deer to COS compared to 2 in 2004 . (Kimberley Urban Deer Management Urban Report 2011)	Nov 10 high count within town limits = 242, 100% mule deer 56 fawns: 100 does 52 % does -Density = *24 deer/km2.*
2010				High count within town limits = 204 Nov. 25, 2010 (98% mule deer) *Density = 20 deer/km2.* 72 fawns : 100 does 47% does

Note: Helena, Montana being used as comparison in Kimberley Report (2011) and Hesse (2010). The recommended density for urban deer in Helena, Montana is 9.6 deer/km2.

APPENDIX 3. BACKGROUND URBAN DEER CASE STUDY REVIEW FOR INVERMERE BC. Wayne McCrory and Sadie Parr. January 2017.

As summarized in the District of Invermere's 2011 urban deer management committee final report and recommendations for 2010, in response to the province's widely circulated report on urban deer conflicts (Hesse 2010), the District of Invermere took the following steps:

- adoption and enforcement of no-feeding deer bylaw
- conducted and analyzed a survey of residents
- created an urban deer management committee
- began conducting deer population inventories

In January 2011, a survey on urban deer was sent to 1800 Invermere property owners and also made available online. A total of 285 completed surveys were returned with the following "main concerns" listed:

- damage to plants 67%
- aggression to pets 57%
- aggression to humans 78%
- concern about deer population 84%
- deer/vehicle collisions 47%
- wish to see a deer reduction 81%

Note that the survey methods may have provided an under-representation bias and subsequent inaccurate evaluation as fewer than 16% of the surveys were returned.

After a review of options, the Invermere urban deer committee recommended that a trap-and-cull program be initiated in fall 2011, and a deer relocation program be implemented the following spring. The committee also recommended that the District's deer population be reduced to a maximum of 50 animals by 2014 or earlier. They also recommended that sharpshooting be investigated as a possible means of reducing the deer population. As well, for a long term solution, they recommended the District review the possibility of a perimeter fence along municipal boundaries (District of Invermere 2011). It should be noted that the terminology used by the province for fencing and other like structures, such as cattleguards, is "strategic anti-deer infrastructure." We could find no information that there had been a follow-up on the fencing proposal.

The cull program using Clover traps and bolt guns became highly controversial when implemented in 2011 and led to a **Supreme Court injunction** and subsequent court case in 2012. Following this, Invermere obtained a permit from the province in October 2014 to kill up to 60 deer annually to March 2017.

Although the database is incomplete, Invermere killed at least 54 mule deer between 2012 and 2016, and also translocated 13 in 2016. The first kill was in late Feb-Mar 2012 involving 19 mule deer. The final of four winter counts just prior to the cull found 175 animals. No cull appeared to take place until 26 mule deer were killed between Jan 28-Feb 14, 2015, following a count of 165 deer the previous November. In 2016, 9 mule deer were destroyed in January and February followed by the translocation of 13 female mule deer in late February.

Deer counts were done by volunteers and exact methods for each year were not determined, although some inaccuracies, such as double-counting and missing some individuals, are to be expected. [In 2012, on behalf of an Invermere client group, I criticized the count method as being unreliable to justify a lethal cull]. Prosser (2015) indicated that the counts in 2014 were done by dividing the district into five survey units and counts in each unit were done at the same time to "prevent double-counting." Count results were 92 in 2010, 199 in 2011, four counts in the period Nov. 2012-Feb. 2013 averaged 182 deer per count, and in 2014, the count was 165 (160 mule deer, 5 white-tailed deer). Species data were not available for the other counts, but it was assumed that most were mule deer, as observation indicates, since they are usually the more common of the two species found in this area. No count data were located for 2015 and 2016.

Evaluation of Invermere's Urban Deer Conflict Mitigation Program 2010-2016

Evaluation of Invermere's lethal and non-lethal deer control program was difficult due to the somewhat scattered, unavailable, and/or incomplete database. Unlike Cranbrook's detailed annual reports, Invermere produced one in 2011 and another in 2015 (Prosser 2015). One thing is obvious, if the urban deer counts represent a fairly or somewhat reliable sampling of total urban deer numbers, the counts remained more or less in the same range from 2012 to 2014, suggesting the number of deer was not decreasing as a result of the 2012 cull keeping in mind that the small number removed (19) would likely be exceeded the following year by reproduction by the town herds. However, it is also to be noted from the COS data (Table 1) that 14 injured deer were destroyed by COS in 2012, and 13 in 2013, although how these figures factor into the control program is apparently not considered.

It is also noted that the count of 165 deer in 2014 is over three times the goal set by the deer committee to reduce numbers to 50 by 2014. In 2015, the focus of the 26 mule deer culled was determined to be in areas where complaints about the most aggressive deer were generated (Prosser 2015). Since we have no complaint data for 2015-2016, we have no idea if the cull led to any reduction in aggressive deer encounters. This sort of scattered, incomplete database underscores the sloppy and inconsistent monitoring of Invermere's deer lethal cull program, which questions its efficacy. (See Table 2 for a summary of Invermere's deer management program.)

In all, a total of 22 were removed in 2016 by lethal and non-lethal means. No data were available for the number of deer killed by other means, such as collisions with traffic. It thus remains to be seen if the last removal program proved to be effective, or even if it was perceived to be effective. Other than possible short term benefits, it is doubtful that any lasting effects will result from the combined lethal and non-lethal approach conducted in 2016.

We also have no comprehensive database prior to 2011 that confirms claims that deer numbers, or a "deer invasion," occurred in Invermere. Increases in aggressive deer complaints and injured deer destroyed by COS for Invermere between 2005 and 2014 (see table below) does strongly indicate this to be the case.

If so, the underlying causative factors for this change in the number of deer becoming habituated to living in an urban setting have never been studied (as with our other case study areas) and until this happens, we may not arrive at a long-term solution to such a complex socio-ecological wildlife problem.

Table 1. Invermere COS complaint data

COS complaint data summarized (Nov 30, 2014)

Invermere

	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Cougar complaints	23	5	11	13	10	1	9	6	8	8
Cougar action taken	1	0	0	0	0	0	0	0	0	1
Aggressive deer complaints	0	0	0	4	3	4	4	13	17*	8**
Aggressive deer destroyed	0	0	0	0	0	0	0	0	0	0
Injured deer destroyed	3	4	4	4	4	4	18	14	13	8

2004-2011 = COS data only for aggressive deer

2012 = COS and DOI data for aggressive deer

2013 = COS data only

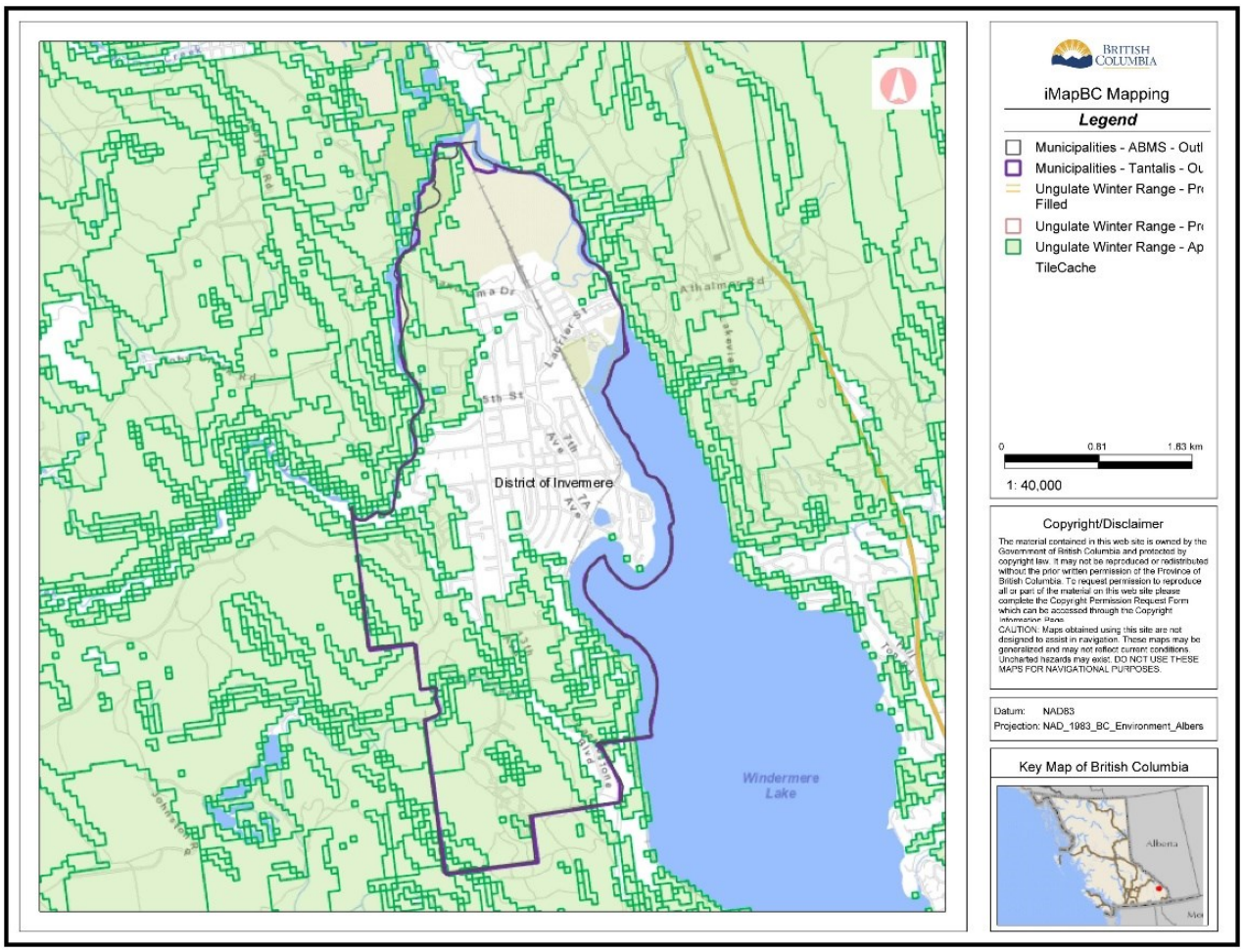
2014 = COS data only

*2013 = includes 2 injured dogs (both needed surgery), 1 boy knocked over and 1 man injured

**2014 =includes 3 injured dogs (2 required surgery)

The map below indicates that Invermere is within good ungulate winter range and other seasonal habitats, other than the lakeside. Some of these winter ranges occur within the district's boundaries. It also appears well-endowed with green spaces, including golf courses that would attract deer, although what available cover and food resources that fit the diet of mule deer and white-tailed deer has never been studied here and should be.

In conclusion, Invermere has not kept a consistent and reliable monitoring database to properly evaluate the effectiveness of their urban deer control program. Given that Invermere is in a large area of prime ungulate winter range, and the district provides suitable habitat to support up to 200 or more (mostly) urban mule deer, control measures, lethal and non-lethal, are not likely to be a long term solution due to immigration from wild deer and compensatory reproductive increases by the urban deer that survive the cull processes.



Ungulate Winter Range in Invermere and surrounding area.

Table 2. Summary of Invermere deer management program, 2010-2016.

Year and Pop'n count	Method/Actions	Cost/year	Duration	Monitoring?	Reference
2016 Missing data	TOTAL 21 REMOVED (9 lethally and 13 by translocation) TRAP AND KILL 9 mule deer destroyed • 6 adult female • 2 adult male • 1 juvenile female • all good health TRANSLOCATE 13 female mule deer translocated • all darted		January 19 - February 17 Year 2 of 3 year cull program February 22-24	Annual counts YES, radio-collars on 5	*FNR-2016-61776P1; Appendix D Record of Wildlife Hunted, trapped or killed Permit CB14-140587* Adams 2016
2015 Missing data	TRAP AND KILL -26 mule deer destroyed • 14 adult females • 6 adult males • 3 juvenile females • 3 juvenile males • all reported in good health except for 1 female adult, however the meat from her carcass went to the food bank 26/160 = 0.1625 or approximately 16.25% of the mule deer population destroyed -No white-tailed deer captured	-$5,520 spent on cull and equipment, used district staff instead of contractors $5,000 towards translocation project	January 28 - February 14 Beginning of 3 year program	Invermere Urban Deer 2015 Annual Report stated "No reported aggressive behaviour reported since kill".	*Appendix D - Record of Wildlife hunted, trapped or killed permit CB14-140587.* and Invermere Urban Deer 2015 Annual Report
2014 Nov 29 total deer count=165 white tailed =5 mule deer = 160 Ministry staff est. 25% deer pop'n not counted (poor weather)	-*BC permit allows Lethal control up to 60 deer/year. Permit allows removal by hunting, trapping or killing up to a combined annual total of 60 mule deer (or incidental white tailed deer) within municipal boundaries of Invermere -Mostly clover net and bolt gun used *Max deer that would be taken in this program would be 180 deer over 3 years (at 60 deer/year for 3 open seasons)	Max $30,000/year budgeted	*3 year permit= October 7 2014 - March 31 2017 *Year-round killing but capture only allowed Dec 1 - March 15 *trapping program length set for 3 annual cycles of 3.5 months between Dec. 1 - March 15 during the valid permit ->Invermere asked annual deer cull be permitted each year until Council decides not to proceed (no end in sight)	* Permit requires record-keeping of wildlife killed, location, method used, date, sex, age and health of deer killed.* Permit also requires annual urban deer counts within urbanized city limits to be conducted each year and sets out methodology	**BC Ministry of FLNRO Wildlife Act Permit CB14-140587 and* >Regular council minutes- Tuesday February 11, 2014 (Motions 1 and 2 - Deer Harvest Permits)
2013	No data?				

2012 November 17 = 220 November 12 = 148 November 10 = 185 February 4, = 175 **Note decrease in numbers as winter progresses.	TRAP AND KILL 19 mule deer destroyed • 14 adult females • 2 adult males • 1 juvenile female • 2 juvenile males • all good health all carcasses for "personal" use 19/175 = 0.1086 or approximately 10.9% of the estimated Invermere town population was destroyed Note that 175 was last count in February prior to beginning reductions		February 26 - March 1		
2011 deer count = 199 ; 19.5 deer/sq.km	- Committee decided to support trap and cull program next year. -Feeding and attractant by-laws enacted - Translocation considered among other options				
2010 November count = 92 deer Density 3.7/sq.km	Established no deer feeding bylaw				

APPENDIX 4. BACKGROUND URBAN DEER CASE STUDY REVIEW FOR CITY OF CRANBROOK BC. Wayne McCrory and Sadie Parr. January 2017

In 2011, Cranbrook received the first permit in BC to capture and kill urban-conditioned deer within city limits. Lethal culls were carried out from 2011 to 2016. Also in 2016, Cranbrook began participating with a number of other East Kootenay municipalities in a non-lethal mule deer translocation program.

The main objective of Cranbrook's control program was to "…reduce urban mule deer population levels and to improve human safety and decrease the number of aggressive deer conflicts and complaints" (Zettel and Teske 2016).

Cranbrook modelled its lethal deer-reduction program after a similar initiative in Helena, Montana in the United States, where close to 500 deer were removed from a 28 km^2 area around the state capital.

Prior to each of its culls, the City of Cranbrook obtained a provincial permit under BC's Wildlife Act to use Clover traps and bolt guns, which were provided by the province. Each permit specified the number of urban deer that could be killed during the period of the permit, allowing for mainly mule deer to be killed, with white-tailed deer included as an incidental species.

According to Zettel and Teske (2016), Cranbrook was one of four communities in the East Kootenay region that initiated urban deer control measures and met the criteria set out in Hesse's (2010) report, which included the following "administrative" methods of reducing deer-people conflicts:

- passing and enforcing a "no-deer feeding" bylaw
- creating an urban deer management committee
- carrying out a survey of residents on their thoughts regarding urban deer and their management
- annually inventorying deer numbers within city limits

At the outset, Cranbrook passed a bylaw in 2010 to prohibit the feeding of deer. The bylaw has an escalating fine schedule; however, the penalties are not substantial: $100 for first offense, $200 for the second, $500 for the third. No analytical attempt was made in the annual reports on how well the bylaw was enforced and whether this initiative reduced deer numbers/complaints.

Also in 2010, the city conducted a public opinion survey (Zettel and Whetham 2012). The results included the following, listed from highest to lowest concern:

- deer aggression towards humans 19.2%
- damage to vegetables, flowers, trees, shrubs, or other landscape plants 17.36%
- deer/vehicle collisions 16.8%
- deer aggression to pets 13.6%
- overpopulation of deer herd 13.5%
- human health risks from deer 9.7 %
- overall health and well being of deer herd 7.4%
- no concerns 2.3%

The survey results indicated that 62.5% of the respondents said they wanted to see a substantial decrease in the deer population by more than 40%. The survey also indicated that respondents were accepting of a capture-and-kill program (30.3% very acceptable and 31.1% acceptable), whereas 78.8 % of survey participants stated it was unnacceptable to "do nothing."

Another public survey was carried out for Cranbrook residents in 2014, of which 1,628 were completed online. As stated in a February 25, 2015 letter to Cranbrook's mayor and council from the BCSPCA, "This represents **less than 5% of Cranbrook residents** of the 19,364 community members." The BCSPCA letter also raised the concern that there was no verification of duplicate participation during the survey process. In fact, Dr. Sara Dubois of the BCSPCA repeatedly participated in the survey 10 times to show that anyone in Cranbrook, or elsewhere, could have done the same, indicating the survey methodology was flawed and not representative.

Regardless of the cautions that come along with interpreting survey results and participation, it is imperative to recognize that these opinion surveys are more indicative of a social carrying capacity rather than an ecological one.

In order to attempt to measure the results of their urban deer population control program, annual deer counts were conducted within the Cranbrook city limits (25 km^2 survey area). In addition, data were compiled on some types of, but not all, human/deer complaints made to the Conservation Officer Service (COS) between 2004 and 2015 (see Table 2 in Zettel and Teske 2016). Unfortunately, other than aggressive deer complaints, the database was not specific to the City of Cranbrook but rather for a large area between Jaffray and Moyie Lake (including Cranbrook).

Monitoring involved four technical reports (2011, 2013, 2015, and 2016) that were prepared in a partnership between the City and an MFLNRO biologist.

Evaluation of Cranbrook's Urban Deer Conflict Mitigation Program 2010-2016

Table 1 provides a general summary of Cranbrook's deer management and control activities from 2010-2016. Over six winters, from 2011-2016, Cranbrook killed a total of 176 deer (158 mule deer and 18 white-tailed deer); 12 mule deer were also translocated in 2016 for a total removal of 188 deer. **Unlike our analysis of urban deer control measures in Oak Bay, where there were some limited data on traffic and other deer mortality causes available, we could not find similar information specifically for the City Cranbrook that would have assisted our review of the effects of lethal control measures combined with other mortality causes for the Cranbrook urban (resident) deer population. Unfortunately, mortality data provided in the joint Cranbrook-MFLNRO reports on deer destroyed by COs and the RCMP covers a much larger area than Cranbrook; no attempt was thus made by the authors of Cranbrook's annual deer control reports to separate out the data for the city. Essentially, this negated any potential use of mortality/complaint data by us to try to evaluate the effectiveness of the Cranbrook cull program.**

In general, the annual deer reports are a more generalized presentation and summary of data with limited scientific rigour and lacking in a more in-depth academic approach. One crude measure of control success would be to compare the annual control kill data to the annual deer counts. This approach also has limitations since the annual reports make no effort to identify deer count survey biases (as identified by Hesse 2010).

Accepting that the annual deer counts are a reasonable approximation of Cranbrook's resident deer population, Table 1 in Zettel and Teske (2016) shows an average count of 113 mule and white-tailed deer annually from 2010 to 2015. Over the six counts between 2010 and 2015, an average of 82.3 mule deer were counted. The data show no consistent declining trend in numbers after the first cull was initiated in 2011 (starting in 2011, the counts were 101, 121, 96, 120, 104 and 137 deer respectively). In fact, the highest count (N=137) was recorded in November 2015, after four years of culling 176 deer. Zettel and Teske (2016) concluded that "the lethal removal of deer (cull and injured deer destroyed) is slowing the increase of the urban deer population." This may possibly be true, but they have no pre-control data to prove the assertion; nor do they account for immigration and population rebound. What is clear, if the annual counts are any indication, is that the lethal cull program is not reducing the Cranbook urban deer population–which was the main stated objective of the cull program in the first place. The data also suggest that immigration and population rebound are likely parameters negating or even nullifying the removal of the 176 deer. The lethal cull data also call into question what value, other than a very short term actual benefit, the 2016 translocation program would have.

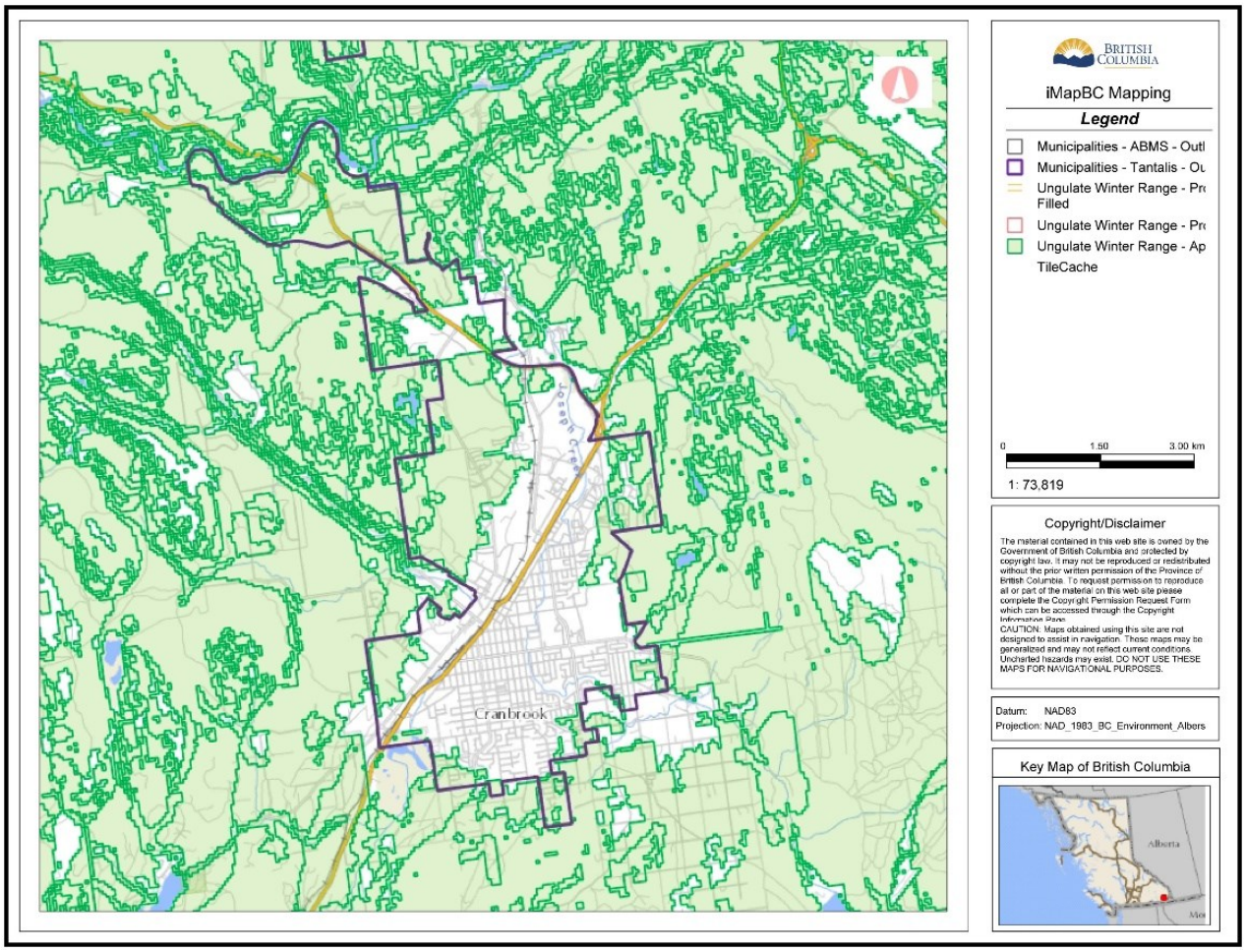
As noted previously, the database for urban deer complaints from 2004-2015 (Table 2 in Zettel and Teske 2016) was not a valid way to measure progress of the 2011-2016 deer control program by Cranbrook since (other than aggressive deer complaints) the information was from a much larger area than the city itself.

From a broader ecological perspective, and as with the other case studies in our review, there has been no attempt to scientifically determine more accurately when, how, and why deer numbers have apparently "burgeoned" in Cranbrook, as described in the first deer management report (Zettel and Teske 2012). The authors do state that aggressive deer complaints (mostly involving adult mule deer does) received from the COS increased from 0 in the period 2004 through 2009, to 1 in 2007, and up to 42 in 2011.

Although the authors attribute deer numbers increasing dramatically "presumably because residential areas offer protection from predators, and because they provide an abundance of food, including unnatural food that the public are feeding to deer. Urban sprawl is also contributing to this trend," but none of this has been studied and quantified. As shown on the following map (IMapBC), Cranbrook is surrounded by ungulate winter range (green polygons), including the peripheral areas of the municipal boundaries (purple), yet no attempt is made to study or explain why there appeared to be few urban deer and few conflicts previous to 2010, and then this changed.

Zettel and Teske (2016) indicate that the city of Cranbrook trap-and-cull program for urban deer has cost approximately $73,359 between 2011 and 2015, with 176 deer removed at an average cost of $417 per animal. It should be noted that this cost amounts does not include $15,000 of equipment (modified clover traps, bolt guns, etc.) purchased by the province in 2011, nor the costs of repairing or replacing vandalised and stolen traps over the years.

Zettel and Teske (2016) also indicate that Cranbrook spent an additional $6,100 on the translocation project to have 12 mule deer removed in 2015 at an average cost of $508 per animal.



Ungulate Winter Range in Cranbrook and near-surrounding area

Table 1. General summary of Cranbrook's deer management and control activities from 2010-2016

Year	Population Reduction Method	Number killed	Duration	Reference	Population
2016	Lethal control capture and kill, clover trap and bolt gun COST: $10, 374 total (included $4,000 from FLNRO) ALSO TRANSLOCATION (Cranbrook contributed $10,000)	29 deer killed - 22 mule deer - 7 white tailed 58.6% female take 12 deer translocated Total 41 deer removed.	= Feb 17 2016 Feb 16–Mar 10	2015 FOI - FLNRO - 2016 - 61775P1 Adams May 2016	
2015	Lethal control capture and kill , clover trap and bolt gun 30 mule deer killed out of 116 mule deer counted = 26 % of urban mule deer population COST: $5,187.00; March 2015 Council approved an additional $10,000 in funding towards the East Kootenay Mule Deer Translocation Trial (Cranbrook Urban Deer Management Annual Report 2015)	30 mule deer killed 63.3% female take	Jan 24 - March 3	2015 FOI - FLNRO - 2016 - 61775P1	Nov 2015 deer count 137 total: 116 mule and 21 white-tailed deer (Zettel and Teske 2016)

2014	Lethal control capture and kill , clover trap and bolt gun 49 mule deer killed out of 71 mule deer counted = 69 % of urban mule deer population killed Using cost estimate of $494/deer from Cranbrook's Urban Deer Report (2015/16), cost: $24,206 Cranbrook contributed $1,000 seed funds towards development of the East Kootenay Mule Deer Translocation Trial (Cranbrook Urban Deer Management Annual Report 2015)	49 mule deer killed 75.5% female take	Jan 6 - Feb 26	2015 FOI - FLNRO - 2016 - 61775P1	Dec 2014 deer count 104 total; 71 mule deer and 33 white-tailed deer
2013	Lethal control capture and kill , clover trap and bolt gun 24 mule deer killed out of 80 mule deer counted = 30% of local mule deer population killed 24 mule deer killed out of 120 total deer counted = 20% of total deer population killed Using cost estimate of $494/deer from Cranbrook's Urban Deer Report (2015/16),, cost: $11,856	24 mule deer killed 58.3% female take	February 9 - 27	2015 FOI - FLNRO - 2016 - 61775P1	November 2013 deer count 120 total; 80 mule and 40 white tail.)
2012	Lethal control capture and kill , clover trap and bolt gun *using count of 96 as it was later in the year, consistent with other counts 19 mule deer killed out of 57 mule deer counted = 33.33% of local mule deer population killed 19 mule deer killed out of 96 total deer counted = 19.79% of total deer population killed Using cost estimate of $494/deer from Cranbrook's Urban Deer Report (2015/16), cost: $9,386	19 deer killed All healthy	Feb 26 - March 13 2012	2015 FOI - FLNRO - 2016 - 61775P1	March 31 within the city limits = 121 deer counted. -74 mule deer -47 white-tailed. Data from count compiled by Ministry of FLNR wildlife biologist Irene Teske. Later in Nov 2012 count (Ref: excel file from Karen- ask source) a total 96 deer were counted; 57 mule and 39 white tailed.

2011	Lethal control capture and kill , clover trap and bolt gun -$15,000 of equipment purchased by province for pilot project -Council budgets $13,000 manpower Using Nov 2010 deer count from FLNRO files: 14 mule deer killed out of 82 mule deer counted = 17.07% of local mule deer population killed 25 deer (both types) killed out of 92 total deer counted = 27.17 % of total deer population killed Using cost estimate of $494/deer from Cranbrook's Urban Deer Report (2015/16), cost: $12,350	25 deer killed -14 mule -11 white tail All healthy 60% female take	Dec. 2 - 29, 2011	2015 FOI - FLNRO - 2016 - 61775P1	
2010	No feeding bylaw established Oct 2010 Began educational programs. September urban resident survey Idea of deer cull presented to council and approved. **Viral video of deer stomping dog			Report on Conference *Urban Wildlife: Challenges and Management Columbia Mountains Institute of Applied Ecology* 2012	92 total Nov 2010: -82 mule deer -10 white-tailed Density = 3.7 deer/sq km; only mule deer =3.3 /sq km. Another source reports 101 deer (96 mule and 5 white-tailed) Nov 2010
Total		**176**	**2 Dec 2011 to 17 Feb 2016**		

APPENDIX 5. BACKGROUND URBAN DEER CASE STUDY REVIEW FOR ELKFORD BC. Wayne McCrory and Sadie Parr. January 2017.

There was very little technical information available to evaluate Elkford's urban deer management program. From 2010 on, the District appeared to loosely follow the general pattern prescribed by the province, or shall we say "jumped through the hoops" in order for the local government to get support and other funding to address their deer concerns.

The following was obtained from a District of Elkford 2014 press release:

> *In 2010, after an increase in the number of complaints regarding the deer in our Community, Council directed that a survey be conducted to sense the pulse of the community on this urban deer issue. 433 Elkford residents responded and one of the directions was to establish a committee of citizens to examine the urban deer issue (73% supported this). The results of the survey also indicated that the community wished to see a reduction in the urban deer population – 70% wanted a moderate decrease of the herd by 30%-40%.*
>
> *A Citizen Committee was established in 2011 and held numerous public meetings, researched and investigated the issue, conducted deer population counts, and eventually made recommendations to Council. One of the recommendations was to apply to the Province for a permit to cull urban mule deer, and another recommendation was to establish an Urban Wildlife Management Advisory Committee. Council endorsed both of these recommendations.*
>
> *The Province, based on the research conducted by this committee and District staff, issued the District a permit to cull deer and to process the meat for donation to local food banks.*

Elkford thus became the fourth BC municipality to lethally cull deer starting in December 2014, when 38 mule deer were killed using the modified Clover trap-and-bolt gun method. Data from 2015 were not available since the District has not done any annual deer management reports, as has been done by Cranbrook. In 2016, 15 deer were translocated from within district limits, but we are unsure if lethal control was also used.

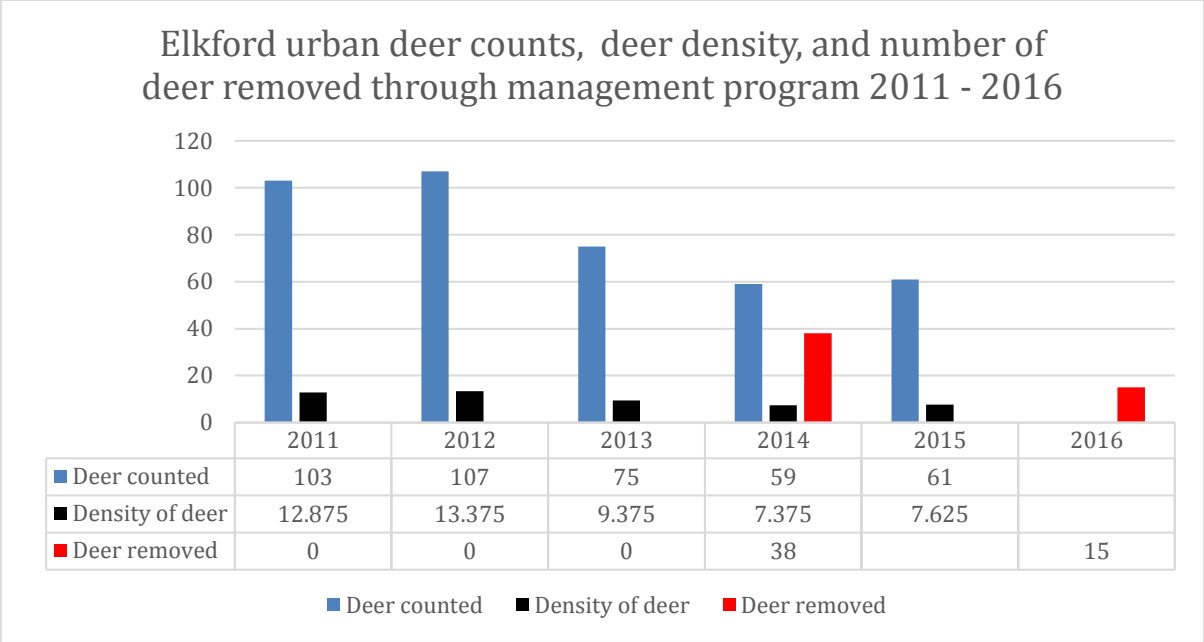
Prior to the 2014 cull, annual urban deer counts were done from 2011-2014 but methods were not available. No data were available as to species but it was assumed most or all were mule deer.

Evaluation of Elkford's Urban Deer Conflict Mitigation Program 2010-2016

If the annual counts are at all reliable and consistently done, the numbers show a declining trend from a high of an average of 103 deer in 2011 to a little over half on October 24, 2014 (N=59) prior to the culling of 38 mule deer. If the population was shown to be declining, one has to wonder why the controversial cull was initiated in 2014. However, the lethal removal of 38 deer (65% of the deer previously counted) in January 2014 did not appear to affect the population, as there were two deer more counted about a year later on November 14, 2015 (61) compared to the previous years pre-cull count on October 24, 2014 of 59. The data also suggest counts are either considerably underestimating total population numbers, are inaccurate, or there was a high immigration to replace the 2014 culled deer combined with a rebound effect of increased reproduction.

As part of the East Kootenay Urban Mule Deer Translocation Trial project initiated in February 2016, 15 mule deer were translocated from Elkford between March 8-10, 2016 (Adams 2016). How this might have affected the local population is unknown since we have no data on follow-up counts, but if the lethal removal in 2014 is any indication, the non-lethal removal is not likely to have had any appreciable impact other than perhaps very short term due to what appears to be the fact that, as with other East Kootenay municipalities, urban deer appear to be responding to control programs with population rebound and immigration; although this has not been studied and should be.

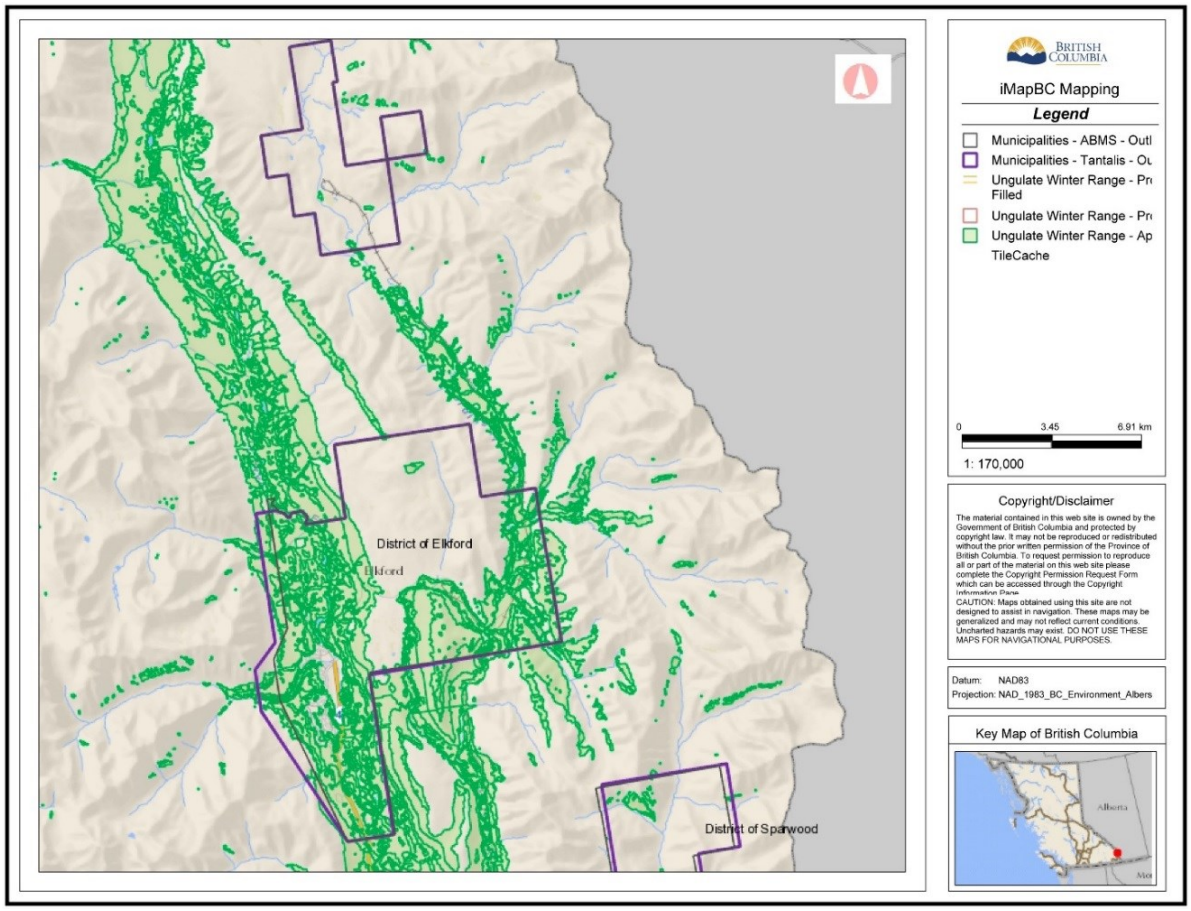
No complaint/aggressive deer or other mortality data, such as road kills or deer destroyed by COs, was obtained to complete our review. Also, there was no information available on the costs of the Elkford lethal and non-lethal culls.



	2011	2012	2013	2014	2015	2016
Deer counted	103	107	75	59	61	
Density of deer	12.875	13.375	9.375	7.375	7.625	
Deer removed	0	0	0	38		15

As per the map below, approximately three quarters of Elkford, the southern portion, is situated within ungulate winter range. The west side of the town limits appears to be within a strip of ungulate winter range, which may also be used as a wildlife movement corridor. This map confirms that Elkford has a good source population of wild deer to in-fill once deer numbers are reduced within the district by control measures.

Overall, one can only conclude from this case study that there is little biology or wildlife science involved in the decision to undertake lethal population control. The approaches being used are driven by the province's deer management funding criteria and are obviously not proving to be a scientifically sound or a long-term sustainable solution. Even a high cull of 66% of the over-wintering deer count did not result in a reduced deer count the following fall.



Ungulate winter range in Elkford & surrounding area

Table 1. Elkford urban deer management summary

Year	Population Reduction Method	Number removed	duration	Reference	Population
2016	15 mule deer translocated	15	Mar 8 - 10	Adams 2016	
2015	[data missing]			Urban Wildlife Management Advisory 2015	61 deer counted November 14, 2015
2014	Lethal control initiated: capture and kill, clover trap and bolt gun.	38 mule deer	Jan 6-22, 2014	Record of Wildlife hunted, trapped or killed Permit CB12-84109	59 deer counted Oct 24 NOTE: this is prior to winter die-off
2013				Dist. Elkford Council Mtg Agenda, 9 Jan 2017, p. 13	Total deer counted = 75
2012				Dist. Elkford Council Mtg Agenda, 9 Jan 2017, p. 13	Total deer counted = 107
2011				Adams 2016	Total deer counted = 103