Stratus Consulting

Potential Economic Impacts of Chronic Wasting Disease on Ontario's Economy

Final Report

Prepared for:

Chronic Wasting Disease Task Force
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Contents

Exhibits

Acronyms

AIB	Animal Industry Board
APHIS	Animal and Plant Health Inspection Service
AWMDA	Alberta White-tail and Mule Deer Association
BC	Boone and Crockett
BRD	Biological Resources Discipline
BSE	bovine spongiform encephalopathy
CCC	Commodity Credit Corporation
CDOW	Colorado Division of Wildlife
CFIA	Canadian Food Inspection Agency
CPI	consumer price index
CS	consumer surplus
CVC	Canadian Venison Council
CVM	contingent valuation method
CWD	chronic wasting disease
CWDTF	Chronic Wasting Disease Task Force
DAU	data analysis unit
DNR	Department of Natural Resources (specify state)
DOI	Department of the Interior
DWR	Division of Wildlife Resources (specify state)
GDP	gross domestic product
GFP	South Dakota Department of Game, Fish and Parks
GMUs	game management units
IHC	immuohistochemistry
IHZ	Intensive Harvest Zone
MZ	Management Zone
NAEBA	North American Elk Breeders Association
NCPIC	National CWD Plan Implementation Committee
NCTC	National Conservation Training Center
NVSL	National Veterinary Service Laboratory
NWF	National Wildlife Federation

NWHC	National Wildlife Health Center
NWT	Northwest Territory
OARSC	Ontario Animal Research and Services Committee
ODWC	Oklahoma Department of Wildlife Conservation
OMAF	Ontario Ministry of Agriculture and Food
OMNR	Ontario Ministry of Natural Resources
RP	revealed preference
SAFRR	Saskatchewan Agriculture, Food and Rural Revitalization
SCWDS	Southeastern Cooperative Wildlife Disease Study
SEIM	Socio-Economic Impact Model
SP	stated preference
TB	tuberculosis
TCM	travel cost method
TSE	transmissible spongiform encephalopathy
USDA	U.S. Department of Agriculture
USDOI	U.S. Department of the Interior
USGS	U.S. Geological Survey
WGFD	Wyoming Game and Fish Department
WHO	World Health Organization
WTP	willingness to pay

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Any remaining errors are our own.

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Executive Summary

This economic analysis was prepared as part of a planning effort to anticipate the potential spread of chronic wasting disease (CWD) into Ontario. Our analysis focuses on primary economic impacts of the disease on free-roaming deer and captive deer and elk, as well as secondary impacts on other sectors of the Ontario economy.

As of 2002, there were approximately 29,910 captive deer and elk on farms in Ontario, including slightly more than 4,000 elk and white-tailed deer (both species are known to be susceptible to CWD). The total number of deer hunters in Ontario has averaged around 155,000 resident and non-resident deer hunters in the last 4 years. Non-resident hunters account for roughly 2% of this total.

If cervid farmers reduce production or if hunters stop hunting (or hunt less often), all involved will suffer losses. In addition, they will spend less, creating a ripple effect throughout the Ontario economy. Exhibit S.1 summarises the five impact scenarios we modelled in this analysis and the economic impacts resulting from each.

Other estimates of economic impacts from CWD, some of which could not be quantified at this time, include:

- The impact of a 25% reduction in hunting efforts by aboriginal hunters could be more than CA$1.5 million a year.
- Licence revenues would decline by between CA$260,000 and CA$1,330,000 a year.
- Surveillance costs are about CA$800,000 per year. Should captive animals need to be eradicated, compensation payments to owners could amount to several millions of dollars under plausible scenarios. Because other costs of response and control will depend on choices made when an outbreak occurs, we could not estimate them here.

As Exhibit S.1 dramatises, discovery of CWD in Ontario could easily lead to tens of millions of dollars in economic losses. Consequently, substantial efforts to keep CWD out of Ontario are likely to be economically justified.

Exhibit S.1. Social-economic impact model results for CWD detection in cervids in Ontario (reductions in thousands, 2003$)

	Scenario A	Scenario B	Scenario C	Scenario D	Scenario E
Activity	**Farming**	**Farming**	**Farming**	**Hunting**	**Hunting**
Impact scenario	**25% reduction in elk/WTD[a] deer farming**	**100% reduction in elk/WTD deer farming**	**25% reduction in elk/all deer farming**	**5% reduction in hunter effort**	**25% reduction in hunter effort**
Initial expenditure reduction	1,334	5,341	11,167	2,234	11,169
Economic impacts modelled from SEIM					
Value added	1,387	5,557	11,678	2,361	11,804
Wages and salaries	750	3,004	6,311	1,406	7,029
Employment (person-years)	31	123	257	44	220
Total tax impacts	363	1,456	3,044	714	3,572
Imports into Ontario	383	1,534	3,193	646	2,732
Reduction in hunter welfare					
Reduced consumer surplus	na	na	na	19,000	31,676

a. WTD = white-tailed deer.
na = Not applicable.

1. Introduction

1.1 Purpose

The report is being prepared in anticipation of the potential spread of chronic wasting disease (CWD) into Ontario, as part of an overall scheme to eradicate or control CWD should it be detected in Ontario. This analysis focuses on primary economic impacts of the disease on free-roaming cervids, captive cervids[1] (farmed deer and elk), tourism, agriculture, agribusiness, and food and food service industries, as well as secondary impacts on other affected sectors of the Ontario economy. This report was jointly commissioned by the Ontario Ministry of Agriculture and Food (OMAF) and the Ontario Ministry of Natural Resources (OMNR).

In this assessment, we considered compensation issues, surveillance (voluntary versus mandatory), disease control, costs beyond disease control, disposal, benefits of managing CWD, lost opportunity costs, and impact on government revenues. We also reviewed impacts experienced in other jurisdictions. The executive summary of this document will form the economic impact section of Ontario's Chronic Wasting Disease Surveillance and Response Plan. The entire report will be included as an appendix to this plan.

1.2 Outline

Chapter 2 provides background on CWD throughout Canada and the United States and federal, provincial and state efforts to control the disease. In Chapter 3, we give information on previous studies of the economic impacts of CWD. Chapter 4 gives an overview of captive cervids in Ontario, and, using available information sources on the economics of deer and elk farming, develops the background for the economic analysis of the potential impact of CWD in Ontario. Chapter 5 contains an overview of issues surrounding wild cervids (focussing on hunting) in Ontario, and uses available information sources on the economics of deer hunting to develop the background for the economic analysis of CWD's potential impact in Ontario. In Chapter 6, we present the economic analysis using various scenarios of impacts on captive and wild cervids, as well as other potentially related economic impacts. Conclusions are included in Chapter 7. Appendix A summarises information from the provinces and states we contacted on the economic impacts of CWD in their jurisdictions. Appendix B is an annotated bibliography of previous economic studies, and Appendix C contains information on an informal survey we

1. We use (1) "captive cervids" synonymously with "farmed cervids," and (2) we use "wild cervids" synonymously with "free-ranging cervids."

conducted on CWD's economic impacts on the farmed cervid industry at the state and provincial level. Appendix D includes the survey instrument discussed in Appendix C.

2. Background

2.1 Chronic Wasting Disease

CWD is a naturally occurring transmissible spongiform encephalopathy (TSE) found in native North American deer (*Odocoileus* spp.) and North American elk (or wapiti; *Cervus elaphus nelsoni*).[1] Pathological forms of prions, which are microscopic proteins, apparently cause CWD and other TSE diseases. Deer and elk affected with CWD show progressive loss of body condition accompanied by behavioural changes. In the later stages of disease, emaciation, excessive salivation, increased drinking and urination, stumbling, trembling, and depression may precede death. The clinical course of CWD appears to be progressive and irreversible, ultimately leading to the death of affected animals. There is no current scientific evidence to indicate that CWD can affect humans. Nevertheless, because of the uncertainty about how it is transmitted, World Health Organization (WHO) experts do advise that humans not consume any part of any deer or elk that is known to be infected with CWD. WHO also suggests that people avoid consuming certain specified risk tissues of any deer or elk — whether known to be infected or not — including tissues from the brain, spinal cord, eyes, spleen, tonsils, and lymph nodes, because the infectious prions tend to congregate in these tissues.

CWD in deer was first recognised in the 1960s in captive deer held in wildlife research facilities in Fort Collins, Colorado. The disease was recognised as a TSE in the late 1970s. Evidence suggests that infected deer and elk transmit the disease through animal-to-animal contact. It also appears that CWD may be transmitted through contamination of water and feed by saliva, urine, and feces. Artificial feeding of deer and elk may therefore compound the problem (e.g., by increasing animal-animal interactions), helping to explain the rate of infection in some deer populations in farm and research concentrations.

Cases of CWD have been detected since 1996 in farmed or captive elk and deer herds from Colorado, Montana, Nebraska, Oklahoma, Kansas, Minnesota, Wisconsin, and South Dakota, as well as from Saskatchewan and Alberta. CWD has been diagnosed in wild populations in Wyoming, Colorado, Nebraska, South Dakota, Wisconsin, Illinois, New Mexico, and Utah, as well as in Saskatchewan. Exhibit 2.1 shows the geographic distribution of CWD and occurrences in captive and wild populations.

1. Wapiti and elk are the same. In general, we use elk unless a source specifically refers to wapiti.

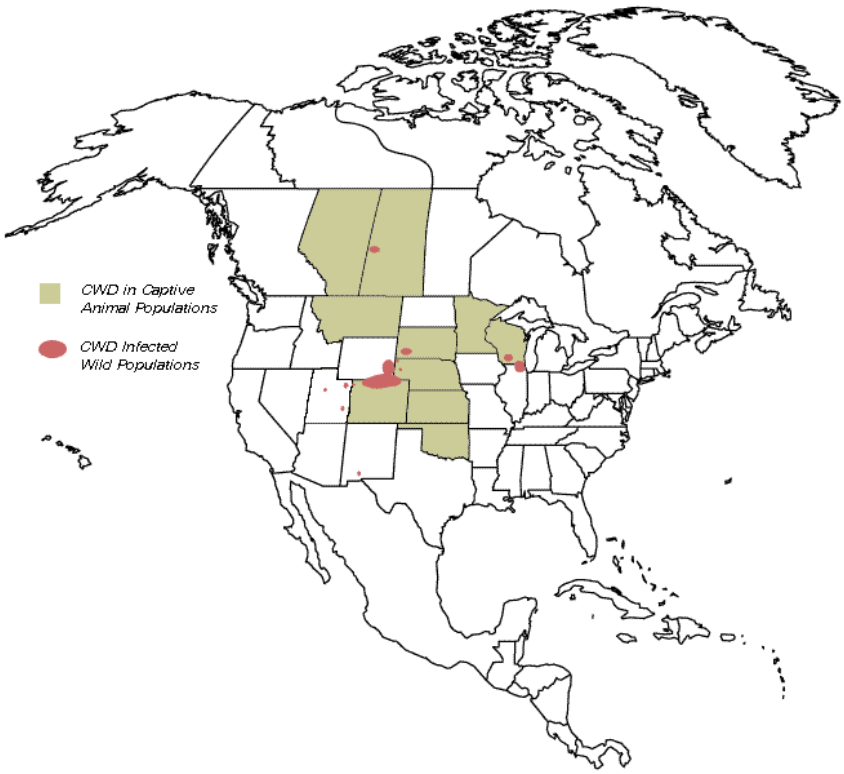

Exhibit 2.1. Occurrences of CWD.

Source: National Wildlife Health Center (NWHC, 2003).

2.2 Provincial and State Efforts to Control CWD

Many millions of dollars have been spent in Canada and the United States in efforts to understand, control and eradicate CWD. These costs include costs associated with research, surveillance and monitoring, diagnostic testing, technology, depopulation and compensation, disposal, education, and information dissemination [National CWD Plan Implementation Committee (NCPIC), 2002a,b]. These costs mostly occur at the provincial or state and the federal level. Many agencies have stated that these funds come at the expense of decreased funding of other existing or planned programs.

2.2.1 Canada

Canada implemented a CWD eradication policy in October 2000, and official reportable disease status for CWD came into effect in April 2001. As a reportable disease under the Health of Animals Act, CWD falls under the jurisdiction of the Canadian Food Inspection Agency (CFIA), a federal government crown agency. CFIA is responsible for reportable disease eradication in farmed cervids in Canada. From the beginning of the eradication program in 2000 to August 2003, CFIA has destroyed 8,731 cervids and paid $35.9 million[2] in animal compensation and transportation and disposal fees. Compensation is paid for animals ordered destroyed under the Health of Animals Act. This figure does not include the cost to the agency of the program, which is estimated at approximately $3.5 million for sampling, testing, epidemiological investigation, record keeping, and policy development.

The provinces' roles vary from province to province depending on the level of their regulatory authority. Once a case of CWD is confirmed, the role of a province is to support the CFIA in applying control measures, including placing source farms under quarantine. A province must also make animal movement information available, conduct priority laboratory analysis, and keep the livestock industry and the public informed of the situation. To date, no farmed or free-ranging deer or elk in Ontario have been diagnosed with CWD (OMNR, 2002b).[3]

Another aspect of public cost is the provincial government's expenditure from agricultural ministries. Alberta, Saskatchewan, and Manitoba all have mandatory testing and surveillance for slaughtered cervids. To date Ontario producers have a voluntary CWD herd certification program administered by the CFIA and the Canadian Cervid Council.

2.2.2 United States

In 2002 a U.S. task force released a Plan for Assisting States, Federal Agencies, and Tribes in Managing Chronic Wasting Disease in Wild and Captive Cervids (NPCIC, 2002a). The task force's members included wildlife disease, wildlife management, and wildlife biology experts from the U.S. Department of Agriculture (USDA), the U.S. Department of the Interior (USDOI), and various state agencies and universities. This plan identifies actions needed to determine the extent of the disease, proposes management measures designed to prevent its spread, and serves

2. All dollar values for Canadian activities or reports are referenced in Canadian dollars. U.S. dollars have not been converted to CA$ except where specifically noted for purposes of analysis.

3. According to an OMNR biologist, one mule deer at the Toronto zoo was part of a group that appeared to have a wasting syndrome. No evidence was found to confirm the wasting syndrome and the herd died off and was not replaced. Similar symptoms have not been detected since. At present, there is no evidence that deer and elk in Ontario are infected with CWD.

as a blueprint for future activities. As a follow-up to the U.S. assistance plan, the NCPIC drafted the Implementation Document for Plan for Assisting States, Federal Agencies and Tribes in Managing Chronic Wasting Disease in Wild and Captive Cervids (NCPIC, 2002b). A team representing several states, the USDOI, and the USDA developed the implementation document with input from a variety of wildlife professionals. The document assigns responsibility for individual projects, identifies what the projects will accomplish to help address CWD, outlines costs, and identifies the appropriate time frame for completing the proposed projects (Ver Steeg, 2003).

In September 2001, the USDA began a CWD surveillance, depopulation, and indemnity program for affected farmed elk populations. In May 2002, the USDA and the USDOI formed a CWD joint working group to ensure a coordinated and cooperative federal approach to assisting states with CWD response efforts. The USDA financially assists states, federal agencies, and tribes in efforts to control the threat to elk and deer from CWD. USDA Secretary Veneman authorised the transfer of approximately US$15 million in USDA Commodity Credit Corporation (CCC) funds to implement CWD surveillance and indemnity programs in the United States. The funding is distributed through grants determined by a formula developed in conjunction with the International Association of Fish and Wildlife Agencies (USDA, 2003). The formula establishes three tiers of states and distributes money according to need. To apply for funding, each state must submit management and surveillance plans detailing how the funds will be spent. In April 2003, the USDA made an additional US$4 million in new funding available to assist state wildlife agencies in addressing CWD concerns.

“Tier 1” states have known occurrences of CWD in free-ranging cervids. “Tier 2” states are those states adjacent to Tier 1 states, or states with known CWD occurrences in farmed or captive cervids. All other states are considered “Tier 3.

Exhibit 2.2 shows states classified as Tier 1 or Tier 2, and indicates how certain Canadian provinces would be classified using this approach. Exhibit 2.2 also shows where CWD has been detected (wild elk, wild deer, and captive cervids); lists the number of captive cervid farms; and supplies a count of big game hunting days as an indication of the “exposure” of the jurisdiction to CWD.

As part of this research effort, Stratus Consulting conducted informal interviews with government employees and members of stakeholder groups in several of the Tier 1 and Tier 2 provinces and states to collect information on the impact of CWD by jurisdiction. Appendix A contains brief summaries of the information we obtained from these surveys. In related research, Stratus Consulting conducted an informal internet survey of agencies and groups with knowledge on the captive cervid industry in their jurisdiction. Appendix C presents a summary of results from this survey. In the sections that follow, we summarise this information with respect to wild

Exhibit 2.2. Provincial/state cervid information

	State/province has tested positive for CWD in:[a]			Number of deer/elk farms (2002)	CWD tier classification[b]	Big game hunting days[c,d]
	Wild deer	Wild elk	Captive elk or deer			
Canada						
Alberta			✓	858	2	811,742
Manitoba				95	2	380,323
Ontario				388	3	3,143,032
Saskatchewan	✓		✓	610	1	438,968
United States						
Arizona				2	2	860,000
Colorado	✓	✓	✓	835	1	1,634,000
Idaho				70	2	1,384,000
Illinois	✓			500	1	3,274,000
Indiana				263	2	2,696,000
Iowa				155	2	1,449,000
Kansas			✓	103	2	1,570,000
Kentucky				125	2	2,828,000
Michigan				980	2	6,532,000
Minnesota			✓	370	2	4,869,000
Missouri				325	2	4,591,000
Montana			✓	77	2	1,797,000
Nebraska	✓		✓	97	1	763,000
Nevada				0	2	169,000
New Mexico	✓			22	1	711,000
North Dakota				112	2	574,000
Oklahoma			✓	142	2	3,465,000
South Dakota	✓	✓	✓	73	1	534,000
Texas				500	2	8,868,000
Utah	✓			0	1	1,252,000
Wisconsin	✓		✓	950	1	7,505,000
Wyoming	✓	✓		1	1	1,001,000

a. Information from New Mexico Department of Game and Fish (2003).
b. 1 = has/has had free-roaming CWD; 2 = has/has had captive CWD or is adjacent to Tier 1; 3 = otherwise.
c. Hunting days for Canada are from 1996 and from the United States are 2001. Data for hunting levels by province were available for all hunting only. To estimate the number of big game hunting days, the total hunting days are multiplied by the portion of all Canadian hunting days that were spent big game hunting (58% = 7.4 million day/12.4 million days). These data are for hunting by residents of the province, not all hunting in the province. However, residents represent 95% of the hunting days.
d. These do not count hunting days by aboriginal hunters.

Sources: National Wildlife Federation (NWF, 2002); USDA (2003); USDOI (2001); Environment Canada (1999).

and captive cervids as an indication of CWD's impacts and of the efforts being undertaken to respond to the disease.

2.2.3 Wild cervids

Policies: In most jurisdictions, one agency appears to be responsible for wild cervids (usually a wildlife or natural resources department or agency) and a different agency is responsible for captive/farmed cervids (usually the agriculture department or agency). For the most part, these agencies are working cooperatively to address CWD issues including surveillance, testing, and eradication, although there appears to be some friction between wildlife and agriculture agencies in some jurisdictions where there is opposition to cervid farming. See Chronic Wasting Disease and Cervidae Regulations by State and Province for a complete list of state-by-state regulations [Michigan Department of Natural Resources (Michigan DNR), 2003].

Hunting: In several jurisdictions where CWD has been detected in either free-roaming or captive cervids, significant impacts on hunting levels have not been observed (e.g., in Saskatchewan, Colorado, Minnesota, Montana, and New Mexico). However, some areas have observed reduced hunter effort of 10% or more in apparent response to CWD in wild cervids entailing large economic impacts [e.g., $58 million to $83 million in 2002 in Wisconsin (Bishop, 2003)]. However, in other jurisdictions — where reduction in hunting area has been recorded in or near a CWD detection area — the number of licenses for the province or state have remained fairly steady overall (e.g., in Nebraska). In some jurisdictions where CWD has been detected in wild cervids, hunting is often encouraged and licenses are free in an attempt to eliminate herd populations (e.g., in Saskatchewan, Nebraska, and Wisconsin). In addition, several provinces and states accept deer samples for testing (sometimes at a nominal fee) from areas other than the CWD detection areas, to determine if CWD exists elsewhere in the jurisdiction (e.g., in Saskatchewan and Utah).

Surveillance/research: To detect the potential spread of CWD, several agencies are undertaking surveillance of wild elk or deer, even if CWD has not been detected in wild populations in their jurisdiction, or are surveying in areas outside those where CWD has been detected (e.g., in Alberta, Minnesota, and Utah). Some agencies have undertaken or sponsored surveys of hunters to determine what their reaction has been or would be to CWD. In general, hunters have indicated that they would react to CWD but there would likely not be a significant reduction in hunting unless CWD were extensive (i.e., infecting a significant portion of the deer or elk population in their hunting area; for example, in South Dakota and Wisconsin). Other jurisdictions are working with state or province universities to research CWD issues (e.g., Wyoming, Nebraska, and Saskatchewan).

Funding/expenditures: Several U.S. states are now undertaking CWD surveillance and control work using USDA funds. Exhibit 2.3 gives some general information collected from various state or provincial agencies on the cost of CWD programs in their jurisdictions. Because we have not attempted to collect detailed information on what the programs cover, we cannot make specific statements about unit costs for different measures. It is obvious from Exhibit 2.3, however, that CWD is imposing significant costs in many provinces and states, even in some areas where CWD has not been detected.

Exhibit 2.3. State or provincial CWD cost or expenditure information (wild cervids)

Agency	Year	Expenditures	Notes
Saskatchewan Environment	2002	$200,000	Saskatchewan Environment pays $23 for each test and Saskatchewan Agriculture, Food and Rural Revitalisation contributes $40. Saskatchewan Environment spent approximately $200,000 on CWD programs in 2002.
Alberta Fish and Wildlife Management Division	2002	$500,000	Estimated CWD costs in Alberta Fish and Wildlife Management Division including staff time.
Colorado Division of Wildlife (CDOW)	2002	More than $2 million	Sampling; price of meat processing refunded if the test is positive.
CDOW	2003	More than $3 million	Sampling; price of meat processing refunded if the test is positive.
Nebraska	2002 and 2003	Approximately $500,000/year	University of Nebraska researches deer movements in CWD area to see how the social behaviour of deer affects the spread of the disease.
New Mexico	2002	$150,000	Tested 800 deer and elk.
North Dakota	2002	na	Started Hunter-Harvested Surveillance in 2002. USDA money available in addition to some state money; money comes from new revenue sources but funds intended for other programs or emergency funds may have to be used if it becomes necessary.
Oklahoma Department of Wildlife Conservation	2003	na	USDA pays testing fees.
South Dakota Game, Fish and Parks	2003	$171,000	USDA grant.
South Dakota Game, Fish and Parks	2003	$17,864	Regional modelling study of hunter behaviour.
Utah Division of Wildlife Resources	2003	$58,000	Monitoring.

Exhibit 2.3. State or provincial CWD cost or expenditure information (wild cervids) (cont.)

Agency	Year	Expenditures	Notes
Wisconsin	2003-2004	$3 million	State budgets additional money for CWD; additional funds allocated for managing/regulating deer farms.
Wisconsin DNR	na	$12 million	Reallocated almost half of the total wildlife budget to fight CWD.
Wyoming	2003	na	Has increased the surveillance budget; has no compensation programs.

na = information not available.

2.2.4 Captive cervids

Policies: Most states and provinces have a lead agency (such as a department of agriculture) that is responsible for dealing with captive cervid issues such as CWD. Some provinces or states have considered or undertaken action to ban cervid farms (e.g., in Montana and Wyoming), largely in response to CWD concerns. Some jurisdictions have established surveillance areas near previously highly contaminated game farms (e.g., in Saskatchewan) and have implemented expanded fencing requirements (e.g., in Colorado). Many jurisdictions have some form of mandatory surveillance of cervid mortalities (usually at some specific age or older; for example, in Alberta, Colorado, and Montana). Several have significant restrictions or controls on the import or transport of cervids (e.g., in Alberta, Colorado, South Dakota, New Mexico, and North Dakota). Many of these same jurisdictions indicated that their cervid farmers have been negatively affected by the regulations of other jurisdictions (e.g., in Colorado and Montana). The detection of bovine spongiform encephalopathy (BSE) has had significant negative impacts on the deer and elk industries in Canada because of the temporary closure of borders to certain meat exports and because Korea has stopped the import of velvet.

Costs/expenditures: Exhibit 2.4 presents some state and provincial cost or expenditure information related to captive cervid CWD efforts.

In related work, Stratus Consulting undertook an informal survey of agencies and organisations in 24 states on the impacts of CWD to the captive cervid industry in their jurisdictions. This information is summarised in Appendix C.

Exhibit 2.4. State or provincial CWD cost or expenditure information (captive cervids)

Agency	Year	Expenditures	Notes
Alberta	2002	$750,000	Farming diagnostics surveillance program
Minnesota	2002	Almost $1 million	Surveillance, staffing, purchase of an incinerator ($70,000), and a media program including a half-hour television show (likely includes expenditures on wild cervid programs)
Montana	1999	$70,000	Depopulation of 85 animals
Montana	na	Close to $1 million	CWD management through mid-2003 (likely includes expenditures on wild cervid programs)

na = information not available.

3. Economic Impacts from CWD

The economic effects of CWD have had a negative impact on hunting and other activities associated with wild cervids, deer and elk farming, and governmental costs accruing from efforts to detect and control the disease. It may also have affected aboriginal peoples (see Section 6.4.1).

The main impacts from CWD in wild cervids are associated with hunting. If hunters stop hunting or hunt less often, they will spend less, which affects the businesses that serve them. These impacts can ripple through an economy, adding indirect effects to the total damages.

In many jurisdictions the cervid farming industry has faced higher costs of compliance with strict regulations related to controlling CWD or preventing the introduction of CWD. These regulations may include changes in farming practices (e.g., new fencing requirements), more stringent testing requirements, more rigorous regulations on transferring livestock and associated products, or trade sanctions (Horan and Wolf, 2003). For example, Colorado requires proof of 5 years of CWD-free status before a producer can import live cervids or cervid products to the state, and these imports must meet requirements in terms of inventory, reporting of sales and deaths, and submissions of all mortalities for CWD testing. In 2002, Colorado expanded fencing requirements to a double barrier, including electric fences.

3.1 Literature on Economics and Behavioural Impacts

A limited number of studies have undertaken economic analysis or behavioural studies of the impacts of CWD. Bishop (2003) developed a quantitative estimate of the economic impact of CWD in Wisconsin for 2002 and explored the range of likely losses in 2003. To estimate market (hunting-related expenditures) and non-market (consumer's surplus) losses to Wisconsin from the spread of CWD, Bishop applies the principles of benefits transfer. Bishop estimates market losses in 2002 from the existence of CWD in deer at $66 million (assuming a 12% reduction in hunting based on reduced licence sales compared to the 2001 baseline). During the 2002 hunting season, Wisconsin conducted a state-wide testing program and found that CWD was restricted to a relatively small area in the south central part of the state where it was originally discovered. Bishop expects this news to encourage more hunting in 2003. Anticipating a 6% to 10% reduction in hunting relative to baseline, he expects a reduction in deer hunter expenditures in 2003 of between $33 million and $55 million. However, most market losses will likely be counterbalanced by gains elsewhere in Wisconsin's economy (residents comprise more than 90% of the total hunters, and they will likely spend money elsewhere within the state). Therefore, the hunters themselves will bear the large share of losses attributed to CWD, in the form of non-market losses, in 2002 and 2003. These losses were estimated to range from $58 million to

$83 million in 2002 (assuming that each hunter's consumer's surplus was approximately $40 per day before CWD existed, a 12% reduction in hunter-days, and a 10% to 20% reduction in consumer's surplus of the remaining hunter-days). Using parallel assumptions but anticipating an increase in hunting in 2003 compared to the 2001 baseline, Bishop predicts that losses to hunters will amount to between $30 million and $53 million in that year. (At the time this report was prepared, 2003 figures on licence sales and the deer harvest were not yet available.) Bishop points out that data do not currently exist to estimate the impacts of CWD on deer viewing and deer and elk farming in Wisconsin.

Freeman (2002) estimated the economic impact of the captive elk industry in Colorado using IMPLAN to quantify the impacts. There were approximately 15,000 ranched elk in Colorado in 2001. Freeman concludes that the average annual elk industry output during the previous five years was $18.9 million (including only direct effects and value added). Because the majority of the value-added payments (wages and profits) in Colorado are made to people who reside in the region, this has a large impact on the regional economy. The IMPLAN model predicts that, for every dollar of output by the elk industry in Colorado, on average, $0.65 additional in indirect effects is created, and for every dollar of value added, on average, a second dollar of indirect effects is created. Elk ranching, then, adds about $30.65 million to total economic activity in Colorado, including both direct and indirect effects.

Gigliotti (2003a, b, c) evaluated South Dakota hunters' perceptions of CWD and its risks. About 10% of Black Hills hunters, 7% of West River region hunters, and 6% of East River region hunters were "very" worried about CWD. An additional 53%, 49%, and 47%, respectively, were slightly or moderately worried about CWD. Concern would increase if one free-ranging CWD-positive deer were found in the area in which they normally hunt. The proportion of hunters who were very worried would increase to 22%, 22%, and 25% for the Black Hills, West River, and East River regions, respectively; and the proportion slightly or moderately worried would increase to 59%, 62%, and 61%, respectively. Along with an increase in concern would come a change in behaviour. About 4% of all hunters would stop hunting in the area, 7% would hunt but not eat the meat, and 46% would hunt but have the deer tested before eating the meat. About 30% would make no behavioural change. This risk-averting behaviour would increase as the number of CWD-positive deer increased.

Horan and Wolf (2003) formulate a general model of wildlife growth and disease transmission applied to the case of bovine tuberculosis (TB) among white-tailed deer in Michigan. This work represents a first step in understanding the economics of disease control in wildlife populations. The authors formulated a general model of wildlife growth and disease transmission and found that there are theoretical limitations to a harvesting strategy when harvests cannot be made selectively from the diseased population. Strategies to address disease prevalence may therefore need to focus on more than just the harvest, and can be particularly effective if they address disease transmission and mortality. From the study's numerical example of bovine TB in

Michigan deer populations, the authors determined that eradication of the disease is not likely to be optimal. Although the model was applied to the specific case of bovine TB in wild deer herds, the model and results are suggestive in terms of other wildlife disease problems. For other diseases, alternative environmental variables might be manipulated in ways that reduce disease transmission, and it is reasonable to believe that such actions might result in trade-offs in in situ productivity (e.g., if contact is somehow reduced, fertility might also be expected to decline). Horan and Wolf's model forms a theoretical foundation for analysing a range of wildlife disease problems, possibly including CWD.

Miller et al (2003) examined hunters' perceptions of CWD and its risks. These investigators sent 3,500 mail surveys to a randomly selected sample of deer hunters in Illinois. Although almost all hunters (96%) were aware of CWD in deer, the disease had little effect on hunter behaviour in Illinois in 2002: 82% of hunters hunted as usual, 9% said they hunted more, 5% said they hunted only healthy deer, 3% hunted less, and 1% hunted only large bucks. A higher percentage of hunters (7%) in counties where CWD was found reported hunting less because of CWD than in other counties. Most hunters (63%) did not anticipate changing their hunting behaviours in the upcoming season. However, 21% reported that they would "check how the deer was acting," 15% would hunt in CWD-free areas, and about 2% would not hunt or hunt a different location. We should note that at this time, CWD in wild deer is restricted to a very small part of Illinois.

Petchenik (2003) examined Wisconsin hunters' perceptions of CWD and its risks. If one free-ranging CWD-positive deer was found in the area where they normally hunt, about 1% of all hunters would stop hunting in the area, 6% would hunt but not eat the meat, and 44% would hunt but have the deer tested before eating the meat. About 44% would make no behavioural change. This risk-averting behaviour would increase as the number of CWD-positive deer increased. One-third of hunters who chose not to hunt in 2002 gave a CWD-related reason for stopping. Of hunters who continued to hunt, 38% were somewhat or very concerned about CWD. Only 4% of CWD-county hunters disposed of the deer because of CWD and 1% did so in non-CWD counties. Most hunters (68%) support further monitoring of CWD in Wisconsin. The majority of hunters did not support proposals for reducing or eradicating herds. Hunters would support a ban on deer baiting (64% in southern Wisconsin and 52% in northern Wisconsin). Almost all hunters paid some or a lot of attention to news about CWD.

Menard et al. (2003) use an input-output model to estimate the economic impacts of CWD in Tennessee, where the disease does not currently exist. Deer hunting occurs throughout rural areas in Tennessee; however, centres for deer hunting exist in western Tennessee. Assuming that hunter expenditures decreased by 15%, the study estimates that an outbreak of CWD in Tennessee would cause an estimated $46.3 million decline in direct total industry output, along with a loss of 892 jobs. Total economic losses are estimated at $98.0 million and at 1,459 jobs, including indirect as well as direct effects. The business types most affected by this decline include service stations, retail stores, hotels and lodging places, eating and drinking

establishments, real estate offices, food stores, wholesale trade entities, owner-occupied dwellings, banks, and state and local government agencies. These effects would result from less travel; fewer expenditures for food, lodging, equipment, and supplies; fewer licences sold; and the spill-over effects of these declines on the general economy.

3.2 Conclusions

The existing literature indicates that CWD has economic impacts in the area where it is detected as well as potential impacts outside the detection areas.

Because provincial and state cervid producers in Canada and the United States represent only a small fraction of the world market, they are, in general, price takers for their products (especially those that are shipped outside of their areas, such as velvet to Korea). The economic impact on captive cervid producers, then, is felt in the local economies where most of the income, employment, and expenditures occur.

Economic impacts from changes in hunting behaviour are also potentially significant. Surveys of hunters and records of hunter activities indicate that they are aware of and respond to the presence of CWD in wild deer and elk. A portion of the economic impact results from hunters spending less on hunting. These reductions in hunting expenditures are likely offset somewhat by increased expenditures on other activities or commodities (especially because most deer hunters hunt within their own state or province and the offsetting activities likely also occur in the same jurisdiction). Reduced hunting also leads to direct losses to hunters in terms of reduced welfare or consumer's surplus — the benefit they realise from hunting above and beyond what it actually costs them to go hunting.

4. Captive Cervids

4.1 Introduction

This chapter contains background information on the captive cervid (deer and elk farming) industry in Ontario, Canada.[1] To the extent possible, we characterise the economic status of the deer and elk industries separately, as they appear to face somewhat different cost structures and sources of demand, and are influenced by different economic forces.

There is no existing analysis of the deer or elk farming industries in Ontario. The information for this research is derived from existing sources on deer and elk farming in other areas and available statistical information. It is important to note that there is some inconsistency in data between different sources. In general, we have chosen to use the data that appear more reliable, more recent, or more applicable to conditions in Ontario.

4.2 Background

Deer farming has been traced back more than 2000 years in Europe and even farther in Asia (Saskatchewan Agriculture and Food, 2000; Canadian Cervid Council, 2003). Deer have been domesticated on all continents including Africa (Canadian Cervid Council, 2003). Elk were kept as livestock in Pennsylvania in the late 1800s (Thorleifson, 2003). Deer and elk farming became established in Canada in the 1960s, with significant industry growth in the 1980s (Canadian Cervid Council, 2003). In 1990 a meeting in Denver of 17 supporters of elk farming led to the establishment of the North American Elk Breeders Association (NAEBA). In 1992, the Canadian Venison Council (CVC) was formed with representatives of all the elk and deer farming associations in Canada (Thorleifson, 2003). The CVC eventually became the Canadian Cervid Council. The approximate value of the livestock plus the value of capital (e.g., facilities and fencing) on North American elk farms is estimated at more than US$1 billion (Thorleifson, 2003).

1. Because this report focuses primarily on farmed cervids held for the production of consumable products, we do not include information on cervids kept as pets or in zoos. Although it is possible that these could be sources of CWD, they are not considered separately in this analysis. There are approximately 40 zoos in Ontario with captive cervids [Ontario Animal Research and Services Committee (OARSC), 2001].

Internationally, different cervid species are raised depending on the climate and target markets as shown in Exhibit 4.1. New Zealand, China, and Russia account for more than 80% of the cervids in captive facilities. Deer farming has developed since the 1970s in New Zealand, which has become the largest producer of cervids in the world. As of 2002, 1.6 million deer were farmed in New Zealand — an increase of 34% from 1.2 million deer in 1994 and 14% from the 1.4 million reported in Exhibit 4.1. Statistics from New Zealand on farmed deer include red deer, fallow deer, and wapiti (elk).

Exhibit 4.1. World populations of farmed elk and deer, 1997

Country	Number of animals	Predominant breeds	Uses	1998 velvet antler (tonnes, green)
New Zealand	1,400,000	Red deer, elk, fallow deer	Venison, antler	350
China	1,000,000	Red deer, elk, sika	Antler	200
Russia	400,000	Elk, red deer, sika	Venison, antler	180
United States	250,000	Elk, red deer, fallow, others	Venison, antler	45
Australia	180,000	Elk, red deer, rusa, fallow	Venison, antler	10
Germany	150,000	Red and fallow deer	Venison	-
Korea	112,000	Elk, red deer, sika	Antler	40
Canada	98,000	Elk, red, fallow, white-tailed	Venison, antler	45
Mauritius	60,000	Rusa deer	Venison	-
England	30,000	Red and fallow deer	Venison	-
Eire (Ireland)	28,000	Red deer	Venison	-
Scotland	20,000	Red deer	Venison	-
Taiwan	36,000	Sika, sambar, red deer	Antler	15
Sweden	35,000	Red and fallow	Venison	-
Denmark	30,000	Red and fallow	Venison	-
France	30,000	Red and fallow	Venison	-
New Caledonia	20,000	Rusa	Venison, antler	1
Vietnam	15,000	Sika deer	Antler	5
Malaysia	15,000	Red, fallow, and rusa	Venison, antler	5
Thailand	5,000	Sambar and red deer	Venison, antler	2
Norway	1,000	Red deer	Venison	2
Totals	3,915,000			898

Source: Thorleifson, 2003. Table: World Populations of Farmed Elk and Deer, 1997.

4.3 Deer and Elk Farms in Canada and Ontario

With Canada accounting for about 5% of the world inventory, the country is likely a price taker for most products related to cervid production, except perhaps in very localised markets. Deer and elk have been raised on Ontario farms since the mid 1980s. Breeding stock, velvet antler, trophy animals, and venison are the major products. The number of deer and elk farms in the province of Ontario represents a very small portion of the total number of farms in the province — about 0.5% of the total number of farms in the province in 2001. Exhibit 4.2 gives preliminary 2002 counts of the number and types of deer and elk in the various provinces of Canada.[2]

Exhibit 4.2. Farmed deer in Canada by species and area (preliminary 2002)

Province	Elk	Red deer	Fallow deer	White-tailed deer	Other deer	Total farmed cervids	Number of farms
Ontario	3,200	18,600	6,700	910	500	29,910	280
Yukon and Northwest Territory (NWT)	120	0	0	0	10	130	5
British Columbia	0	0	4,450	0	200	4,650	53
Alberta	48,419	0	0	11,759	619	60,797	605
Saskatchewan	38,000	0	3,000	7,000	470	48,470	661
Manitoba	3,731	680	600	80	50	5,141	50
Quebec	2,400	14,800	2,960	5,000	400	25,560	697
Maritimes	275	2,260	10	500	0	3,045	44
Canada total	96,145	36,340	17,720	25,249	2,249	177,703	2,395
Ontario as % CA	3.3	51.2	37.8	3.6	22.2	16.8	11.7

Source: Agriculture and Agri-Food Canada (2003).

Data from Exhibit 4.2 (for 2002) suggest a significant growth in farmed deer and elk populations since 1997 (as shown in Exhibit 4.1). We use the 2002 data from Agriculture and Agri-Food Canada for our analysis, as this represents more recent estimates and provides provincial breakdowns.

2. Another source of statistical information on alternative livestock on Canadian farms is http://www.statcan.ca/english/freepub/23-502-XIE/free.htm. Accessed December 8, 2003.

As indicated by OMNR (2003), CWD is known to infect white-tailed deer, black-tailed deer, Rocky Mountain elk, and mule deer, but it is not known to infect either other ungulates such as moose, domestic livestock, red deer, and fallow deer. Consequently, we confine our primary impact analysis to elk, white-tailed deer, and the "other deer" as listed in Exhibit 4.2. We include a broader secondary analysis of the potential impact on red deer and fallow deer farming because of their association with deer production.

Based on Exhibit 4.2, Exhibit 4.3 gives the distribution of cervids in Ontario we consider in the economic analysis.

Exhibit 4.3. Distribution of farmed cervids in Ontario for economic analysis (preliminary 2002)

Ontario	Elk	Red deer	Fallow deer	White-tailed deer	Other deer	Total
Farmed cervids	3,200	18,600	6,700	910	500	29,910
Percent of farmed cervids in Ontario	10.7	62.2	22.4	3.0	1.7	100

Source: Agriculture and Agri-Food Canada (2003).

4.4 Economics of Elk and Deer Farms

CWD has an impact on the captive cervid industry in three ways: (1) as the demand for farmed deer/elk products is diminished (either because of reduced demand resulting from public perceptions of meat/food safety or because of an inability to access markets (border closures, import/export requirements); (2) as costs increase to meet regulations imposed in reaction to herds becoming infected (Horan and Wolf, 2003); or (3) as the price of breeding stock/live animals has decreased dramatically, the capital/net worth/equity of deer/elk farms has also eroded, and being able to access financing has become a very real program for the cervid farming industry. The primary products from deer and elk farms are venison (deer or elk meat), velvet antlers, trophy bucks, and hunting experiences (Westendorf and Altizio, 2000; Dyar, 2003).[3] Breeding stock can be considered a derived demand for elk and deer because the value of primary products drives the demand for breeding stock to increase herd size, improve herd quality, or start new operations. Elk, red deer, and elk–red deer hybrids can produce venison and velvet. Fallow deer are raised primarily for venison and white-tailed deer are farmed for breeding

3. The Ministry of Natural Resources does not allow hunting of farmed elk, white-tailed deer, elk-red deer hybrids, or bison, in Ontario. Hunting experiences and trophy bucks are of value as exports to provinces or states that allow stocked or captive hunting (e.g., Saskatchewan, Quebec, and some U.S. states).

and trophy hunting (Westendorf and Altizio, 2000). Each contributes to the economy in its own way.

- To produce venison, the livestock is slaughtered; the meat is cut, processed, and packaged; and the meat is then either sold to a distributor or wholesaler or sold direct at farm-gate, at farmers' markets, or in butcher, grocery, and speciality stores.

- Velvet antlers are harvested (cut off) yearly in June and July just before the antler begins the calcification (hardening) process. The velvet antlers are then either frozen while still fresh and marketed as a "green" antler, or dried at a processing plant and marketed as a "dry or further processed" antler (Saskatchewan Agriculture and Food, 2000).

- Trophy elk bulls and white-tailed deer bucks may be sold to ranches in other jurisdictions, where operators specialise in hunting preserves. Ontario's Fish and Wildlife Conservation Act does not permit the hunting in captivity of farmed animals such as elk and white-tailed deer. In Ontario, white-tailed deer are raised primarily as trophy animals for delivery to hunting preserves in other jurisdictions, with a secondary market in genetics. The legislation does not encompass imported species such as red deer, fallow deer, and wild boar (see definition of "farmed animal," Section 1.1, Fish and Wildlife Conservation Act, Province of Ontario, 1997), thus these species are not prohibited from being hunted. At age 3 or 4 white-tailed bucks are assessed for trophy potential [the Boone and Crockett (BC) score of their antlers] and then sold at their peak maturity.

- Breeding stock and sperm from bucks and bulls with superior genetics are sold to other producers and breeding programs.

Because there is no accurate or dedicated animal inventory system in Ontario, it is difficult to estimate growth in each of the different types of enterprises (OARSC, 2001). Until recently, the trend in the industry appeared to be toward larger animals, especially elk. This was in part because of the high prices breeding stock commanded, because of superior velvet antler yield and quality, and because of larger carcass size for age in animals marketed for venison (OMNR, 1998; OARSC, 2001). The fallow deer sector has regressed largely because of lower venison prices and smaller carcass size (economies of scale).

4.4.1 Elk economics

Several sources have examined different aspects of the economics of elk farming. We present some of this information to characterise the economics of elk farming for purposes of analysing the potential impact of CWD on elk farming in Ontario.

Exhibit 4.4 indicates historic prices for green velvet — one of the primary drivers of the elk production industry in Ontario. Current prices (summer 2003) were approximately $15 to $22 a pound. Prices were lower than they had been historically, driven largely by the closure of the Korean market because of concerns about CWD-infected animals in western Canada.

Exhibit 4.4. Historical velvet prices (CA$/lb)

Year	Price/lb
1980	90
1981	65
1982	50
1983	30
1984	40
1985	35
1986	50
1987	70
1988	60
1989	85
1990	90
1991	95
1992	40
1993	60
1994	90
1995	110
1996	100
1997	90
1998	25
1999	35
2000	45-60 (based on sources below)
2001	22
2002	22
2003	15-22

Source: 1980 through 1989 from Thorleifson, 1999. Table 7; 1990 through 1999 from OARSC, 2001. p. 30.; 2000 through 2003 from personal communication with Brian Tapscott (OMAF). Nixdorf (2003) indicates about $60 in 2000; 2003 from personal communication with Brian Tapscott (OMAF) and from current elk farmers in Ontario.

The document Elk Production: Economic and Production Information for Saskatchewan Producers (Saskatchewan Agriculture and Food, 2000) contains perhaps the most complete analysis of the economics of elk production in Canada. This analysis includes a thorough discussion of capital costs, operating costs, and revenues for elk operations in Saskatchewan and develops an "Elk Production Model" for examining profitability over time.

Capital

Exhibit 4.5 summarises information on capital costs for an elk enterprise — these costs obviously will vary depending on the size, location, and exact goals of the operation. Dollar values from Saskatchewan Agriculture and Food (2000) are in 2000 dollars. For the impact analysis in Chapter 6, we convert these to 2003 dollars.

Exhibit 4.5. Summary of the capital inputs of an elk enterprise

Capital inputs	Cost ($)
Land	100-400/acre
Pasture improvement	30/acre
Fence	10,400/mile
Handling facility	5,000-25,000
Hydraulic squeeze	5,000-10,000
Water trenching and other equipment	1,500-5,000
2 ton truck	10,000 (used)-30,000 (new)
Stock trailer	5,000-10,000
Tractor with loader	8,000-15,000
Freezer	700 (chest)-10,000 (walk-in) each
Breeding stock	Market price
Miscellaneous	Varies with the size of operation

Source: Table 7: Summary of the capital inputs of an elk enterprise (Saskatchewan Agriculture and Food, 2000).

Operating expenses

Exhibit 4.6 presents information from Saskatchewan Agriculture and Food (2000) on operating expenses in 2000 dollars. This information serves as the basis for the Elk Production Model. The model assumes an initial capital investment of $295,490, using costs listed in Exhibit 4.5, of which $125,000 is equity and the balance is financed over a 10-year period at 8% interest. Initial handling facilities and fences are developed and constructed in the first year with expansion occurring as required. Seventeen bred heifers, 15 heifer calves and a breeding bull are purchased in November of Year 1 and produce a calf crop in Year 2. One hundred and sixty acres of pastureland is purchased. Eighty acres are improved in Year 1 and 80 more acres are improved in Year 4.

Exhibit 4.6. Summary of annual operating inputs of elk enterprise

Operating inputs	Annual costs ($ unless otherwise specified)
Labour	50/head
Total feed cost per cow	136/head
Total feed cost per bull	154/head
Total feed cost yearling	96/head
Livestock/breeding stock purchases	Market price
Veterinary fees and supplies	30/cow; 25/yearling or bull
Repairs and maintenance	Varies with the size of the operation
Gas, fuel, and oil	15/head
Utilities	15/bull; 10/head for cows and yearlings
Insurance	7-10/100 value of breeding herd
Marketing and transportation	10/head
Death loss	5% for calves; 3% for all others
Game farm license	200/5 years, renewable 150/5 years
Property taxes	1-5/acre
Miscellaneous	Varies with the size of operation

Source: Table 11: Summary of the operating inputs of an elk enterprise (Saskatchewan Agriculture and Food, 2000).

Exhibit 4.7 details the expected variable costs over a 10-year period for this operation. We have included a final column that gives an average annual variable cost per animal for an elk operation of this size.

Exhibit 4.7. Project annual costs from the Elk Production Model

	Year											Average per animal[a]
Project annual costs ($)	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**10-year average**	
Wages	152	1,650	2,062	2,906	3,863	4,608	5,444	6,401	7,563	8,283	4,293	45.19
Benefit (14% H wage)	21	231	289	407	541	645	762	896	1,059	1,160	601	6.33
Grain	300	896	1,138	1,636	2,271	2,725	3,237	3,822	4,544	5,026	2,560	26.94
Hay	300	1,507	1,923	2,742	3,792	4,545	5,396	6,368	7,565	8,360	4,250	44.73
Supplements	60	1,377	1,856	2,518	3,512	4,202	4,988	5,887	6,984	7,733	3,912	41.18
Breeding stock	194,700	0	0	7,000	0	7,000	0	7,000	0	7,000	22,270	234.42
Vet. fees and supplies	200	910	1,163	1,589	2,094	2,490	2,937	3,448	4,063	4,440	2,333	24.56
Repairs and maint.	80	495	618	872	1,159	1,383	1,633	1,920	2,269	2,485	1,291	13.59
Gas, fuel, and oil	150	495	618	872	1,159	1,383	1,633	1,920	2,269	2,485	1,298	13.67
Utilities	50	335	417	620	874	1,053	1,254	1,483	1,768	1,962	982	10.33
Insurance	490	200	200	200	200	200	200	200	200	200	229	2.41
Mktg and transport	130	55	61	73	134	177	181	216	341	341	171	1.80
Death loss	0	5,841	6,602	7,489	9,599	11,116	13,068	15,131	17,590	18,506	10,494	110.47
Misc. expenses	300	700	700	700	700	700	700	700	700	700	660	6.95
Operating interest	14	588	706	1,185	1,196	1,689	1,657	2,216	2,277	2,747	1,428	15.03
Total variable costs	**196,948**	**15,280**	**18,353**	**30,807**	**31,095**	**43,917**	**43,090**	**57,609**	**59,193**	**71,430**	**56,772**	**597.60**
Property taxes	400	400	400	400	400	400	400	400	400	400	400	4.21
Principal payments	0	11,769	12,710	14,072	16,399	17,711	19,749	21,951	24,121	31,189	16,967	178.60
Interest payments	0	13,851	13,099	12,829	14,217	12,001	10,338	9,478	8,202	6,273	10,029	105.57
Total cash costs	**197,348**	**41,299**	**44,563**	**58,108**	**62,111**	**74,028**	**73,577**	**89,438**	**91,916**	**109,291**	**84,168**	**885.98**

a. 10-year average divided by 95.0 animals per year average (see Exhibit 4.8).

Source: Schedule 3A, variable costs, and Schedule 4 — projected cash costs (Saskatchewan Agriculture and Food, 2000).

The other cash costs (property taxes, principal payments, and interest payments) are the costs of capital and thus represent the annualization of long-term costs. These appear as "financial" costs here, but we will reallocate these to specific sectors for the impact analysis.

Exhibit 4.8 indicates the Elk Production Model assumptions about the elk inventory over the 10-year modelling period. We use the average over the final 9-year period (the first year assumes zero inventory) to derive per-head average variable costs for the impact analysis (see the final column of Exhibit 4.7).

Exhibit 4.8. Elk inventory schedule

	Year									9-year
	2	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**avg.**
Heifer calves	15	7	11	12	14	17	19	22	20	15.2
Exposed heifers	17	10	2	6	6	7	9	9	6	8.0
Herd cows	0	17	25	26	31	36	41	47	54	30.8
Bull calves	0	7	11	12	14	17	19	22	25	14.1
Velvet bulls (coming 2 yrs)	0	0	7	11	12	14	17	19	22	11.3
Velvet bulls (coming 3 yrs)	0	0	0	7	11	12	14	17	19	8.9
Velvet bulls (3+ yrs old)	0	0	0	0	1	3	7	12	16	4.3
Breeding bulls	1	1	1	2	2	3	3	4	4	2.3
Total	33	42	57	76	91	109	129	152	166	95.0

Source: Table 17: Schedule 2 — inventory schedule (Saskatchewan Agriculture and Food, 2000).

Income

Exhibit 4.9 gives the estimated elk product price list used in the Elk Production Model. Exhibit 4.4 showed historic velvet prices in dollars per pound, which is also a large driver of the value of elk and elk products.

As indicated in Table 19 in Saskatchewan Agriculture and Food (2000), the expected return on investment from the Elk Production Model averages to 16.24% over the first 10 years of production. Other calculations in the referenced work suggest nearly a 17% return to elk farming as indicated in the Elk Production Model. Whittlesey (2003) of the Ontario Elk Breeders Association suggests a 17.09% return to elk farming. For purposes of the economic impact analysis we assume a 17% return to elk farming to calculate producer surplus, however, after the analysis was conducted, it was learned that this is an overestimation of return in the 2004 market.

Exhibit 4.9. Estimated elk price list ($)

Bull calves, velvet[a]	1,000
Breeder potential	3,000-5,000
Heifer calves[a]	3,900
Exposed heifers	7,600
Yearling velvet bulls	1,800
Exposed cows	6,000
Trophy bulls	2,500-6,000[b]
Breeding bulls	7,000

a. Spring calves sold late in the fall.
b. Prices of trophy bulls vary greatly with their antler score.

Source: Table 14: Estimated elk price list (Saskatchewan Agriculture and Food, 2000).

4.4.2 Deer economics

The document White-Tailed Deer Financial and Production Information (Saskatchewan Agriculture and Food, 2003) contains the most complete analysis of the economics of white-tailed deer production in Canada. The report gives an overview of white-tailed deer management, along with the economics of starting and running an operation. The primary market in North America for white-tailed deer is trophy bucks. In addition to trophy stock, white-tailed deer products include (1) breeding stock and to a much lesser degree, (2) meat, and (3) velvet antler. The Saskatchewan Agriculture and Food (2003) analysis includes a thorough discussion of capital costs, operating costs, and revenues for deer operation in Saskatchewan and develops a deer production model for examining profitability over time.[4]

Capital

Capital assets required for a white-tailed deer enterprise include land, handling fences and facilities, equipment, and initial breeding stock. A white-tailed deer doe-fawn(s) unit requires approximately 0.4 acres of pasture (2.5 doe and doe-fawn units per acre of pasture).

4. While Saskatchewan Agriculture and Food (2003) doesn't use the terminology "deer production model" this largely parallels the model developed in Saskatchewan Agriculture and Food (2000) for elk.

White-tailed deer are excellent jumpers and can clear 6-foot fences with ease. Industry standards call for fences of at least 8 feet high at a cost of the perimeter fence of $11,700 per mile. If predators are a problem the perimeter fence can be equipped with an electric fence on the outside, at a cost of $292 per mile. Internal fences are 8 feet high and are made of 8-foot game fence at a cost of $10,276 per mile.

A typical handling facility (for loading and unloading, testing, vaccinating and/or quarantining, velvetting (antler removal), and tagging and weighing the white-tailed deer) includes a holding corral, crowding pens, and a drop-floor squeeze. The cost of constructing a handling facility with 10-foot high walls is approximately $10.55 per running foot. Minimal equipment is required to maintain a white-tailed deer operation. In most cases, producers with existing farms will have all the necessary equipment.

The model in the Saskatchewan Agriculture and Food report (2003) demonstrates the process that is required to build a deer enterprise based on a breeding herd of 50 does. This number of breeding animals is reached in Year 10 of the example. We assume that no additional animals will be purchased other than the initial breeding stock.

Exhibit 4.10 shows the projected capital investment necessary for a 50-doe white-tailed deer enterprise based on the assumptions outlined above.

Exhibit 4.10. Capital investment for a 50-doe white-tailed deer enterprise

Breeding stock	**# of head**	**Cost per head ($)**	**Total cost ($)**
Does	50	5,600	280,000
Replacement does	14	6,400	89,600
Bucks	5	4,500	22,500
Subtotal			392,100
Land	**Acres**	**Cost per acre**	
Pasture	160	250	40,000
Pasture development	119	30	3,570
Subtotal			43,570
Equipment, fence, and facilities	**Miles**	**Cost per mile**	
Fence	3	10,400	31,200
Handling system			14,900
Feed bins, feeders, watering			5,000
Squeeze			2,900
Scale			2,750
Subtotal			56,750
Total capital (50-doe enterprise)			**492,420**

Source: Table 8: "Capital Investment for a 50 Doe Whitetail Deer Enterprise" (Saskatchewan Agriculture and Food 2003).

Note that, using an 8% rate of interest (the rate used in the financial analysis), the total capital costs of $492,420 translate to $39,393.60 annualised costs of capital.

Operating expenses

Operating (cash) costs include wages, benefits, feed, salt and minerals, veterinary fees and supplies, repairs and maintenance, fuel and oil, utilities, insurance, marketing and transportation, property taxes, miscellaneous business costs, and interest on cash costs.

Estimated wages per head per year [including the owner's wage (or opportunity costs)] are $75 for breeding does and $27 for yearlings, breeding bucks, and trophy bucks. For hired labour, benefits are estimated at an additional 14% of the cost of wages including Canada pension plan and employment insurance contributions.

Feed expenses, depending on the nature of the operation, include pasture; hay, grain, and supplement requirements; salt and minerals (e.g., salt blocks supplied for each pasture at a cost of approximately $0.25 per deer); and water (e.g., $1,500 is budgeted for the installation of water lines and watering bowls).

Veterinary services and supplies will be $7 per fawn and $20 per yearling and mature animal per year.

Exhibit 4.11 shows the projected annual costs for this model. The final column shows average annual costs, assuming an annual average inventory of 40.9 animals from Exhibit 4.12.

Exhibit 4.12 shows the inventory projections for the model over the first 10 years of the operation. The final column indicates the 10-year average with a total animal (does and bucks) average of 40.9 animals.

Breeding stock purchases, property taxes, principal payments, interest payments, and operating interest total $40,510. At an 8% rate of interest, this represents an expense of capital of $506,375, very close to the total capital $492,420 (see Exhibit 4.10).

Saskatchewan Agriculture and Food (2003) for the white-tailed deer production model categorises non-variable cash costs somewhat differently than Saskatchewan Agriculture and Food (2000) does for the Elk Production Model. This does not matter for this analysis because we are focussing on average total expenditures and treating non-variable cash costs as payment to capital (i.e., non-variable cash costs are included in the final analysis the same way regardless of how they were treated in the production models).

Exhibit 4.11. White-tailed deer projected annual costs

	Year											Average per animal[a]
Projected annual costs ($)	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**10-year average**	
Wages	500	1,975	3,364	4,009	4,851	5,936	6,904	7,774	8,154	8,252	5,172	126.45
Benefit (14% of wages)	70	277	471	561	679	831	967	1,088	1,142	1,155	724	17.70
Grain or prepared feed	1,020	2,992	4,854	5,989	7,524	9,273	10,734	11,939	12,619	12,794	7,974	194.96
Hay	404	1,039	1,622	1,987	2,485	3,044	3,522	3,893	4,097	4,127	2,622	64.11
Salt and minerals	3	9	15	18	22	28	32	36	38	39	24	0.59
Veterinary fees and supplies	198	774	1,254	1,529	1,899	2,330	2,700	3,006	3165	3200	2,006	49.03
Ear tags	13	26	30	35	44	51	58	60	61	57	44	1.06
Corral cleaning	80	89	156	192	239	296	344	388	411	420	262	6.39
Utilities	48	108	173	200	234	281	328	366	380	379	250	6.11
Insurance	4,535	0	0	0	0	0	0	0	0	0	454	11.09
Marketing and transportation	0	554	823	995	1,232	1,495	1,729	1,894	1,979	1,973	1,267	30.99
Total variable costs	**6,870**	**7,841**	**12,764**	**15,516**	**19,209**	**23,564**	**27,316**	**30,444**	**32,046**	**32,397**	**20,797**	**508.48**
Breeding stock purchases	68,400	68,400	4,180	9,747	14,747	14,010	13,309	12,644	12,011	11,411	22,886	560
Repairs and maintenance	393	601	601	601	601	759	759	899	1,108	1,108	743	18
Gas, fuel, and oil	300	300	400	500	500	600	600	600	600	600	500	12
Property taxes	480	480	480	480	480	480	480	480	480	480	480	12
Principal payments	0	4,632	6,728	7,267	7,848	8,476	9,430	10,185	11,296	16573	8,244	202
Interest payments	0	6,273	13,155	13,020	9,945	6,173	4,892	4,138	3,667	3563	6,483	158
Miscellaneous	200	300	300	300	300	300	300	300	300	300	290	7
Operating interest	3,066	3,553	1,544	1,897	2,145	2,174	2,283	2,388	2,460	2657	2,417	59
Total other cash costs	**72,839**	**84,539**	**27,388**	**33,812**	**36,566**	**32,972**	**32,053**	**31,634**	**31,922**	**36,692**	**42,042**	**1,028**
Total costs	**79,709**	**92,380**	**40,152**	**49,328**	**55,775**	**56,536**	**59,369**	**62,078**	**63,968**	**69,089**	**62,838**	**1,536**

a. 10-year average divided by 40.9 animals per year average (see Exhibit 4.12).

Source: Saskatchewan Agriculture and Food (2003).

Exhibit 4.12. Projected white tailed deer inventory

End-of-year inventory	1	2	3	4	5	6	7	8	9	10	10-year average
Does	10	22	26	29	35	41	48	51	51	49	36.2
Breeding bucks	1	2	5	4	5	6	6	6	7	5	4.7
Average	**11**	**24**	**31**	**33**	**40**	**47**	**54**	**57**	**58**	**54**	**40.9**

Source: Schedule 2 — projected livestock inventory (Saskatchewan Agriculture and Food, 2003).

Income

The analysis assumes that the main source of revenue is from the sale of breeding stock with minor additional revenue from the sale of trophy bucks, velvet antler, and meat. The projected income is for an established 50-doe deer enterprise and is based on five assumptions: (1) the breeding herd consists of 50 bred does; (2) initially 50% of the does are retained as breeding stock, with 50% of the bred yearling does sold; (3) 50% of the buck fawns are sold as breeding stock, with the remainder raised as trophy bucks; (4) market prices are as shown in Exhibit 4.13; and (5) it will take 10 years to establish a breeding herd of 50 does and obtain this level of income.

Exhibit 4.13. Animal type (age) average price ($)

Hunt/trophy bucks (3½+ years)	4,500
Mature breeding bucks (2½+ years)	4,500
Yearling bucks (18 months)	3,500
Buck fawns (5-7 months)	1,700
Cull bucks (for meat; 6½ years)	400
Mature breeding doe (2½+ years)	5,600
Cull doe (for meat; 12½ years)	280
Yearling doe (bred; 18 months)	6,400
Yearling doe (for meat; 18 months)	130
Doe fawn (5-7 months)	3,200

Source: Table 13: Estimated prices of Saskatchewan white-tailed deer, 1999. The meat price is based on $3.20/lb dressed weight for cull breeding stock. Trophy bucks may range from a low of $1,500 to a high exceeding $6,000 depending on antler score. The average value of $4,500 is used strictly for illustration purposes (Saskatchewan Agriculture and Food, 2003).

We do not have current (2003) prices for deer products, but indications are that prices are currently depressed because of the closure of the international markets resulting from the potential detection of CWD and BSE in Canada. Based on the literature on deer farming economics and discussions with deer farmers in Ontario during the summer of 2003, we use a 10% return on deer farming for the economic impact analysis.

4.5 Information to be Used for Impact Analysis

Exhibit 4.14 summarises the information that will be used in modelling the potential impact of CWD in Ontario.

Exhibit 4.14. Assumptions for impact analysis for elk and deer farming in Ontario

	Elk	Deer (white-tailed and others)	Red deer[a]	Fallow deer[b]
Number of animals	3,200	1,410	18,600	6,700
Animals per farm	95.0	40.9	95.0	40.9
Number of farms	34	35	196	164
Annual operating costs (per animal; $)	885	1,536	443	1,536
Margin (%)	17	10	17	10
Profit (per animal; $)	150	154	75	154
Revenues (per animal; $)	1,035	1,690	518	1,690

a. We treat red deer as approximately one-half of an elk.
b. We treat fallow deer as equivalent to white-tailed deer. However, based on information we received after the analysis was conducted, the price of fallow deer breeding stock is lower than for white-tailed deer, and thus the assumptions used for the impact analysis may lead to an overestimation for fallow deer results.

The economic impact of CWD on the Ontario economy is undertaken using the Socio-Economic Impact Model (SEIM) run by OMNR. This model is an input-output model developed specifically to explore the impact of natural resource decision making in Ontario. Policy decisions enter the model as changes in expenditures in each of 34 specific industrial sectors. This model is described in more detail in Chapter 6. Exhibit 4.15 shows how we have allocated changes in expenditures in the deer and elk industry by SEIM sector for impact analysis.

Exhibit 4.15. Allocation of expenditures by SEIM category

Expense	Per animal		SEIM categorisation
	Elk[a]	White-tailed deer[b]	
Wages	45.19	126.45	Agriculture
Benefit (14% of wages)	6.33	17.70	Agriculture
Grain or prepared feed	26.94	194.96	Agriculture
Hay	44.73	64.11	Agriculture
Veterinary fees and supplies	24.56	49.03	Operating, office, laboratory, and food
Breeding stock purchases	234.42	559.56	Agriculture
Utilities	10.33	6.11	Communications, electricity, power, and gas
Insurance	2.41	11.09	Other financial, real estate, and insurance
Marketing and transportation	1.80	30.99	Transportation and storage
Repairs and maintenance	13.59	18.17	Other services (personal and household)
Gas, fuel, and oil	13.67	12.22	Refined petroleum and coal products
Salt and minerals	nc	0.59	Agriculture
Ear tags	nc	1.06	Agriculture
Corral cleaning	nc	6.39	Agriculture
Death loss	110.47	nc	Agriculture
Supplements	41.18	nc	Operating, office, laboratory, and food
Miscellaneous	6.95	7.09	Wholesale and retail trade
Direct cash expenditures	**582.57**	**1,105.52**	
Property taxes	4.21	11.74	Indirect cash expenditures are reallocated to specific industries below.
Principal payments	178.60	201.55	
Interest payments	105.57	158.50	
Operating interest	15.03	59.09	
Indirect cash expenditures	**303.40**	**430.88**	
Total costs per animal	**885.97**	**1,536.40**	
Reallocation of indirect cash expenditures[c]			
65%	197.21	280.07	Agriculture
15%	45.51	64.63	Construction
10%	30.34	43.09	Other financial, real estate, insurance
5%	15.17	21.54	Miscellaneous manufacturing
5%	15.17	21.54	Operating, office, laboratory, and food
100%	**303.40**	**430.88**	**Total**

a. From Exhibit 4.7.
b. From Exhibit 4.11.
c. These allocations are subjective estimates of the allocation of capital expenditures by SEIM sector.
nc = not calculated (this category not readily equivalent to the expenditures identified in the other production model).

Costs for white-tailed deer production are higher than costs for elk production. This is due to higher fencing standards; higher slaughter costs (per animal) relative to meat yield (per kg); and the fact that deer do not use pasture or hay very fully, and thus, have to be supplemented with concentrates or grains year round.

Indirect cash expenditures represent payments to capital in the production models. To use this information in the SEIM impact analysis, we reallocate these cash flows to specific sectors roughly in relation to the distribution of capital expenses from the original investment in the production effort. For instance, because the majority of the expenditures in setting up the operation involve expenditures in agriculture (e.g., livestock, facilities, etc.), we allocate 65% of the capital costs to the agriculture sector.

Exhibit 4.16 summarises how we allocated the expenditures shown in Exhibit 4.15 among sectors in the SEIM model on a per-animal basis.

Exhibit 4.16. Allocation by sector of variable costs for SEIM impact analysis (2000$)

		Costs per head ($)	
Sector #	Sector	Elk	White-tailed deer
1	Agriculture	665.29	1,250.89
2	Fishing	0.00	0.00
3	Forestry	0.00	0.00
4	Mining	0.00	0.00
5	Food and beverage	0.00	0.00
6	Rubber and plastic	0.00	0.00
7	Textile industry	0.00	0.00
8	Knitting mills and clothing	0.00	0.00
9	Wood industries	0.00	0.00
10	Furniture and fixtures	0.00	0.00
11	Paper and allied products	0.00	0.00
12	Printing and publishing	0.00	0.00
13	Primary metals	0.00	0.00
14	Fabricated metal products	0.00	0.00
15	Machinery	0.00	0.00
16	Transportation equipment	0.00	0.00
17	Electrical and electronic	0.00	0.00
18	Non-metallic mineral products	0.00	0.00
19	Refined petroleum and coal products	13.67	12.22

Exhibit 4.16. Allocation by sector of variable costs for SEIM impact analysis (2000$) (cont.)

Sector #	Sector	Costs per head ($)	
		Elk	Deer
20	Chemical and chemical products	0.00	0.00
21	Miscellaneous manufacturing	15.17	21.54
22	Construction	45.51	64.63
23	Transportation and storage	1.80	30.99
24	Communication, electricity, power, and gas	10.33	6.11
25	Wholesale and retail trade	6.95	7.09
26	Other financial, real estate, and insurance	32.75	54.18
27	Business and computer services	0.00	0.00
28	Education and health services	0.00	0.00
29	Accommodation services	0.00	0.00
30	Other services (personal and household)	13.59	18.17
31	Operating, office, laboratory, and food	80.91	70.58
32	Travel and advertising	0.00	0.00
33	Transportation margins	0.00	0.00
34	Owner-occupied housing	0.00	0.00
	Total	**885.97**	**1,536.40**

Exhibit 4.17 gives the input for the SEIM analysis for three impact scenarios for farmed cervids. The first two scenarios project 25% and 100% impacts on the elk and white-tailed deer industries. The third scenario projects a 25% impact on all cervids in Ontario including red deer and fallow deer (species that have so far not been shown to be susceptible to CWD but that may still be affected because trade restrictions related to CWD will likely encompass *all* farmed cervids, but these species may not experience the disease control costs).

4.6 Conclusion

Elk and deer farming in Ontario is subject to potential economic impacts should CWD be detected in farmed elk or deer in Ontario. Although only elk and white-tailed deer could be infected with CWD, impacts may also be felt on other farmed cervid operations (e.g., fallow deer and red deer). We have chosen a range of potential impacts on the industry for illustrative purposes because it is impossible to determine in advance when, where, or how CWD may be detected and the precise impact the discovery of CWD would have on the industry.

Exhibit 4.17. Input to SEIM for impact scenarios for farmed cervids (2000$)[a]

	Costs per head		Elk	WTD deer		Impacts		Red deer[b]	Fallow deer[c]		Impacts
Sector	Elk	Deer	3,200	1,410	Total	25%	100%	18,600	6,700	Total	25%
Agriculture	665	1,250	2,128,943	1,763,759	3,892,702	973,000	3,893,000	6,187,242	23,266,608	33,346,553	8,337,000
Fishing	0.00	0.00	0	0	0	0	0	0	0	0	0
Forestry	0.00	0.00	0	0	0	0	0	0	0	0	0
Mining	0.00	0.00	0	0	0	0	0	0	0	0	0
Food and beverage	0.00	0.00	0	0	0	0	0	0	0	0	0
Rubber and plastic	0.00	0.00	0	0	0	0	0	0	0	0	0
Textile industry	0.00	0.00	0	0	0	0	0	0	0	0	0
Knitting mills and clothing	0.00	0.00	0	0	0	0	0	0	0	0	0
Wood industries	0.00	0.00	0	0	0	0	0	0	0	0	0
Furniture and fixtures	0.00	0.00	0	0	0	0	0	0	0	0	0
Paper and allied products	0.00	0.00	0	0	0	0	0	0	0	0	0
Printing and publishing	0.00	0.00	0	0	0	0	0	0	0	0	0
Primary metals	0.00	0.00	0	0	0	0	0	0	0	0	0
Fabricated metal products	0.00	0.00	0	0	0	0	0	0	0	0	0
Machinery	0.00	0.00	0	0	0	0	0	0	0	0	0
Transportation equipment	0.00	0.00	0	0	0	0	0	0	0	0	0
Electrical and electronic	0.00	0.00	0	0	0	0	0	0	0	0	0
Non-metallic mineral products	0.00	0.00	0	0	0	0	0	0	0	0	0
Refined petroleum and coal	13.67	12.22	43,736	17,237	60,973	15,000	61,000	127,107	227,384	415,463	104,000
Chemicals and chemical products	0.00	0.00	0	0	0	0	0	0	0	0	0

Exhibit 4.17. Input to SEIM for impact scenarios for farmed cervids (2000$) (cont.)[a]

	Costs per head		Elk	WTD deer		Impacts		Red deer[b]	Fallow deer[c]		Impacts
Sector	Elk	Deer	3,200	1,410	Total	25%	100%	18,600	6,700	Total	25%
Misc. manufacturing	15.17	21.54	48,545	30,377	78,921	20,000	79,000	141,083	400,714	620,718	155,000
Construction	45.51	64.63	145,634	91,130	236,764	59,000	237,000	423,249	1,202,142	1,862,155	466,000
Transportation and storage	1.80	30.99	5,757	43,693	49,449	12,000	49,000	16,730	576,373	642,552	161,000
Communications, electricity, power, and gas	10.33	6.11	33,064	8,608	41,673	10,000	42,000	96,093	113,556	251,322	63,000
Wholesale and retail trade	6.95	7.09	22,232	9,998	32,229	8,000	32,000	64,611	131,883	228,722	57,000
Other financial, real estate, and insurance	32.75	54.18	104,803	76,388	181,191	45,000	181,000	304,584	1,007,665	1,493,440	373,000
Business and computer	0.00	0.00	0	0	0	0	0	0	0	0	0
Education and health services	0.00	0.00	0	0	0	0	0	0	0	0	0
Accommodation services	0.00	0.00	0	0	0	0	0	0	0	0	0
Other services (personal and household)	13.59	18.17	43,500	25,614	69,114	17,000	69,000	126,421	337,892	533,428	133,000
Operating, office, laboratory, and food	80.91	70.58	258,906	99,515	358,421	90,000	358,000	752,445	1,312,751	2,423,617	606,000
Travel and advertising	0.00	0.00	0	0	0	0	0	0	0	0	0
Transportation margins	0.00	0.00	0	0	0	0	0	0	0	0	0
Owner-occupied housing	0.00	0.00	0	0	0	0	0	0	0	0	0
Total	**885**	**1,536**	**2,835,119**	**2,166,318**	**5,001,438**	**1,249,000**	**5,001,000**	**8,239,565**	**28,576,967**	**41,817,970**	**10,455,000**

a. Values will be converted to 2003$ in Chapter 6.
b. 50% of elk.
c. Same as white-tailed deer (see footnote to Exhibit 4.14 for expanded discussion).

The impacts would involve reductions in expenditures by elk and deer farmers as they reduced their output, which would then affect other industries. To examine these impacts, we will implement the SEIM model. The impacts would also include direct losses of income (consumer's surplus) to elk and deer producers, which are also discussed in Chapter 6. For purposes of the economic impact analysis, we have not modelled a crossover effect to the elk and deer industry should CWD be detected in wild elk or deer in Ontario (or vice versa).

5. Wild Cervids

This chapter contains background information on wild cervids in Ontario, deer hunting in Ontario, and potential economic impacts of CWD on hunting in Ontario.

5.1 Ontario Elk and Deer Habitat and Populations

Elk were native to much of southern Ontario but were extirpated in the late 1800s because of the combined effects of over-harvesting and loss of habitat. There have been several attempts to restore elk to the province, the most recent being in the 1930's and 1940's. Unfortunately, most of these animals were subsequently killed due to unfounded concerns that they were passing a parasite (giant liver fluke) on to cattle. However, two small herds of elk managed to survive in the Burwash/French River area. In 1996 it was estimated that these two herds numbered about 60 animals in total (Cambrian College, 2004). An elk restoration project began in the winter of 1998 and as of 2001, Ontario's elk population was close to 500 (OMNR, 2001a). Elk introductions were halted in 2001 because of concerns about the potential introduction of CWD.

Native white-tailed deer, on the other hand, have a large population in Ontario, and the second largest in Canada (second to Saskatchewan). The wild white-tailed deer population in Ontario is estimated at 350,000 animals. Ontario has an abundance of deer habitat: of the 1,076,395 square kilometres of land in Ontario (Ontario Fact Sheet, 2003a), approximately 123,185 km^2 are identified as suitable as deer habitat. Deer are found in the southern portion of the province as far north as Sault Ste. Marie and North Bay, in northwestern Ontario from Thunder Bay to Red Lake, and in parts of northeastern Ontario near Timmins. Deer in southeastern and central Ontario migrate between summer (densities 1.4 to 7.0 deer/km^2) and winter ranges (densities 8.5 to 46.3 deer/km^2).

OMNR has indicated that high deer populations in some areas (e.g., Lanark County) are contributing to agricultural crop damage to area farmers, and to the high numbers of deer/vehicle collisions in recent years (OMNR, 2003). Numerous factors affect the abundance of the deer populations, including winter severity, land use, habitat, and the availability of areas for hunting.

5.2 Deer Hunting Effort in Ontario

The total number of deer hunters in Ontario has been fairly constant through the past decade. This has averaged 155,485 resident and non-resident hunters a year over the last 4 years. The number of non-resident deer hunters has tripled, but still constitutes a mere 2% of total licences

sold in 2002/2003. Exhibit 5.1 presents statistics on hunter effort in Ontario from 1999 through 2002 for resident and non-resident hunters.

Exhibit 5.1. Deer hunter effort in Ontario

	Non-resident		Resident		
Year	Number of days hunted	Percent of total	Number of days hunted	Percent of total	Total[a]
1999	11,934	1.2	992,446	98.8	1,004,381
2000	15,798	1.5	1,033,051	98.5	1,048,849
2001	19,278	2.3	815,945	97.7	835,223
2002	21,331	1.8	1,185,950	98.2	1,207,280
Average	**17,085**	**1.7**	**1,006,848**	**98.3**	**1,023,933**

a. May not total due to rounding.

Source: Deer Hunting Summaries 1999-2002. OMNR, 2003.

For purposes of the economic analysis, we use the 4-year average of hunter days in Ontario. Although potentially important differences in economic impact may exist between the different regions of Ontario (e.g., the northwest portion of the province may be disproportionately affected if non-resident hunters reduced effort in Ontario), we do not have sufficient data to examine this quantitatively at this time.

5.3 Economic Impacts of CWD on Hunting in Ontario

We analyse the impact of CWD on hunting in two areas: (1) expenditures and (2) willingness to pay.

5.3.1 Hunter expenditures

In general, the literature indicates that, at least for the area where CWD is found to occur, the presence of CWD may reduce the value of the hunting experience to the hunter. Detection of the disease may also reduce overall hunting participation, which will reduce sales of hunting licences and spending on hunting-related goods and services (see Chapter 3).

Legg (1995) estimated deer hunting in Ontario in 1993 to sustain 1,670 person-years of employment and contribute $90.0 million to gross provincial income. This amount comprises an initial expenditure of $56.9 million, plus indirect and induced impacts. Legg (1995) also examined tax revenues and licence fees and found that tax revenues as a result of deer hunting

activities totalled $32.7 million ($18.3 million federal, $10.5 million provincial, and $3.9 million local) and revenue from the sale of deer hunting licences totalled an additional $3.6 million.

The average Canadian hunter in Ontario spent $639 during the year, or $37 per day (1996$) of participation (Environment Canada, 1999). All big game hunters thus spent about $116.3 million in Ontario in 1996 ($37 × 3,143,032 big game hunting days). Deer hunting contributes a significant portion of this amount. Exhibit 5.2 shows the distribution of all hunting-related expenditures in the province of Ontario in 1996. This information is used in this analysis to allocate reductions in hunting expenditure by industrial sector for economic impact analysis.

Exhibit 5.2. 1996 distribution of hunting expenditures for all hunting (Ontario)[a]

Category of expenditure	Million$	%
Accommodation	13.2	6.6
Transportation	45.0	22.4
Food	28.4	14.2
Equipment	64.1	32.0
Other items[b]	49.8	24.8
Total[c]	200.6	100
Average per year ($)	639	
Average per day ($)	37	

a. Federal-Provincial-Territorial Task Force on the Importance of Nature to Canadians. 2000. Table 14: Expenditures on nature-related activities by Ontario participants in 1996, by type and activity.
b. Includes items such as licences, entry fees, guide fees, souvenirs, books, magazines, film and photographic services, equipment rental and repairs, batteries, and special items for hunting (ammunition and dog maintenance).
c. May not total because of rounding.

In 1997, deer hunters spent an estimated $58.5 million on items directly related to deer hunting. Of the $58.5 million, resident hunters accounted for approximately 98% ($57.3 million; OMNR, 2002c).

In 2001, deer hunter expenditures in Ontario were $97.7 million, with resident hunters spending $93.2 million of this total (OMNR, 2001b). On average, each deer harvested resulted in about $1,381 of direct expenditures in Ontario's economy. The average expenditure per deer harvested for non-residents was $3,378. The average non-resident expenditure per deer harvested was 2.45 times the resident expenditure. We use this ratio to allocate non-resident/resident expenditures for the impact analysis.

5.3.2 Deer hunting licences

Ontario residents must have a hunting version "Outdoors Card" before they can purchase a hunting licence or tag. Tags and game seals are considered to be part of the licence. Licence fees are in effect until December 31, 2003 (including the goods and services tax). Resident licence tags to hunt deer for 2003 are $33.00; farmer licence tags to hunt deer are $20; non-resident licence to hunt deer (antlered deer only) are $165; and a non-resident export permit for deer is $35 (2003 Hunting Regulations Summary). The province of Ontario (through the OMNR) received revenue from the sale of deer hunting licences in fiscal 1993/1994 of $3.6 million (Legg, 1995). In fiscal 1997/1998, the OMNR collected $3.8 million in revenue for deer licences and $161,150 in export permits (this includes deer, moose, and bear) (OMNR 2002a). Exhibit 5.3 shows that in fiscal 2001/2002, OMNR collected revenue totalling $5.3 million from the sale of licences and permits associated with deer hunting. About 88% of those revenues were generated by the sale of resident hunting licences.

Exhibit 5.3. Deer licence revenue, 2001/2002 fiscal year ($)

Resident deer licence	4,700,433
Resident farmer deer licence	86,447
Non-resident deer licence	418,913
Second deer tag	128,310
Total	**5,334,103**

Source: personal communication, Jennifer Backler (OMNR), November 4, 2003.

5.3.3 Willingness to pay for hunting

Economic value of hunting

Hunters have shown that they value hunting at levels greater than what they have to pay to hunt (e.g., in the form of licence fees). A large body of literature has examined what value hunters place on hunting. The total value of hunting has two components: (1) what people actually pay to hunt (e.g., equipment and licence fees); and (2) what they would be willing to pay over and above what they actually pay. The first component of value consists of the expenditures incurred. However, because cost is typically an underestimate of value, there is a second component of value that requires more explanation. Consumers purchase products in the marketplace because they are better off with the products than they were with the money needed to obtain the products (or whatever else they would have purchased with the money). If that were not true, goods and

services would not be exchanged in the marketplace. Similarly, hunting costs money and time, and hunters would not undertake hunting trips unless the visits yielded net benefits. Those net benefits are referred to by economists as consumer surplus (CS), and can be measured as willingness to pay (WTP). WTP captures the total value (costs plus CS) of hunting to a hunter.

Several studies have examined what hunters are willing to pay to hunt for big game in Canada and the United States. Typically, two types of valuation methods are used in the literature: (1) revealed preference (RP) methods such as the travel cost method (TCM), which use observed recreational behaviour to infer values; and (2) stated preference (SP) methods such as the contingent valuation method (CVM), which ask people to state their values or their willingness to trade off different resource commodities. TCM estimates of value are based on the assumption that the price paid to travel to a site is the implicit value of that site. Even though no fee may be imposed on the use of a (recreation) resource, costs are associated with accessing that resource, such as the cost in fuel and mechanical maintenance of a vehicle, as well as the time spent travelling. CVM is a direct means of measuring the CS through the elicitation of a WTP value for the use of a resource. The CVM employs a number of techniques to elicit valuation responses including a bidding "game," the use of a payment card, open-ended questions, and closed-ended questions. Carson et al. (1996) demonstrated that estimates-of-use values from the TCM and the CVM do not vary substantially on average.

Summary of literature

Rosenberger and Loomis (2001) conducted an extensive literature review of valuation studies for outdoor recreation. Exhibit 5.4 displays the studies these two investigators identified as having dealt with deer hunting, the CS values that were found for deer hunting, the location of the study, and the valuation method used (TCM or CVM). At the low end of the range is a value for deer hunting in Michigan of $13.70 per hunter per day (Feltus and Langenau, 1984, converted to 2002 Canadian dollars), and at the high end of the range is a U.S. national value of $301.20 (Balkan and Kahn, 1988, converted to 2002 Canadian dollars). The average value from this review is $93.95 (2002 Canadian dollars) per hunter per day and the median is $77.43 per hunter per day (2002 Canadian dollars) or $78.65 per hunter per day (2003 Canadian dollars).

5.4 Information for Impact Analysis Scenarios

Exhibit 5.5 summarises the information from above that will be used in the economic impact analysis scenarios for impacts on hunting.

Exhibit 5.4. CS values for deer hunting

Citation	CS (US$ per hunter per day with year of value in parentheses)	CS (US$2002 per hunter per day)[a]	CS (CA$2002 per hunter per day)[b]	Study area	Method
Balkan and Kahn (1988)	104.30 (1980)	227.71	301.20	National	TCM
Brooks (1988)	54.55 (1985)	91.20	120.70	Montana	TCM
Capel and Pandey (1972)	7.04 (1968)	36.39	48.16	Manitoba	TCM
Creel and Loomis (1990, 1992)	70.07 (1987)	110.96	146.84	California	TCM
Donnelly and Nelson (1986)	26.86 (1983)	48.52	64.21	Idaho	TCM
Donnelly and Nelson (1986)	19.18 (1983)	34.64	45.84	Idaho	CVM
Duffield and Neher (1990)	61.40 (1988)	93.37	123.50	Montana	CVM
Feltus and Langenau (1984)	2.84 (1974)	10.36	13.70	Michigan	TCM
Loomis et al. (1989)	36.96 (1987)	58.53	77.43	California	CVM
Loomis et al. (1989)	13.18 (1987)	20.87	27.61	California	TCM
Wilman (1984)	33.69 (1980)	73.55	97.29	Intermountain area	TCM
Median			77.43		
Average			93.95		

a. Values converted to US$2002 using the consumer price index from http://data.bls.gov/cgi-bin/cpicalc.pl.
b. Values converted to CA$2002 using the exchange rate as of November 7, 2003 (CA$1.32318 per US$1.00).

Exhibit 5.5. Information for impact analysis scenarios

	Total number of days hunting[a]	Average total expenditures per day ($1996)[b]	Average total expenditures per day ($2003)[c]	Total expenditures (2003$)	CS per day (2003$)	Total CS (2003$)
Resident	1,006,848	37.00	42.60	42,895,704	78.65	79,189,491
Non-resident	17,085	90.50	104.21	1,780,479	0[d]	0[d]
Total	**1,023,933**			**44,676,183**		**79,189,491**

a. From Exhibit 5.1.
b. Totals to be allocated to sector by the final column in Exhibit 5.2.
c. Source: Price indices from Bank of Canada (2003).
d. WTP for non-residents is set to zero because this is a loss outside of the province and is generally not within the decision-making concern of the provincial authorities.

No one knows how hunter responses to CWD in wild deer will affect hunting behaviour over a number of years. Our survey of states and provinces showed wide variation in the perceived response of hunters to CWD. In some places, such as Colorado, there has been little or no perceived effect. In Wisconsin, where an aggressive strategy of control was initiated almost immediately after CWD was verified and where the disease has received a great deal of attention in the media, deer hunting apparently dropped by 12% in the first hunting season after CWD was discovered in Wisconsin (2002), but it is expected to recover somewhat in 2003. For purposes of the analysis here, we estimate impact scenarios based on assumed declines in hunting of 5% and 25%, which brackets Wisconsin's experience.

Based on Exhibit 5.2, Exhibit 5.6 presents the distribution of hunting expenditures for all hunting expenditures and for the two CWD impact scenarios (5% and 25% reduction in hunting days).

Exhibit 5.6. Distribution of hunting expenditures for CWD impact analysis

Category of expenditure[a]	SEIM sector	Allocation percent[a]	Total expenditures (2003$)	Impact of 5% reduction	Impact of 25% reduction
Accommodation	Accommodation services	6.6	2,948,628	147,431	737,157
Transportation	Transportation and storage	22.4	10,007,465	500,373	2,501,866
Food	Operating, office, laboratory, and food	14.2	6,344,018	317,201	1,586,004
Equipment	Wholesale and retail trade	32.0	14,296,379	714,819	3,574,095
Other items	Wholesale and retail trade	24.8	11,079,693	553,985	2,769,923
Total		100.0	44,676,183	2,233,809	11,169,046

a. See Exhibit 5.2.

Exhibit 5.7 shows the allocation by sector of costs for SEIM impact analysis in $2003 for the 5% and 25% hunter reductions.

Exhibit 5.7. Allocation by sector of costs for SEIM impact analysis ($2003)

Sector	Impact of 5% reduction	Impact of 25% reduction
1 Agriculture	0	0
2 Fishing	0	0
3 Forestry	0	0
4 Mining	0	0

Exhibit 5.7. Allocation by sector of costs for SEIM impact analysis ($2003) (cont.)

Sector	Impact of 5% reduction	Impact of 25% reduction
5 Food and beverage	0	0
6 Rubber and plastic	0	0
7 Textile industry	0	0
8 Knitting mills and clothing	0	0
9 Wood industries	0	0
10 Furniture and fixtures	0	0
11 Paper and allied products	0	0
12 Printing and publishing	0	0
13 Primary metals	0	0
14 Fabricated metal products	0	0
15 Machinery	0	0
16 Transportation equipment	0	0
17 Electrical and electronic	0	0
18 Non-metallic mineral products	0	0
19 Refined petroleum and coal products	0	0
20 Chemical and chemical products	0	0
21 Miscellaneous manufacturing	0	0
22 Construction	0	0
23 Transportation and storage	500,373	2,501,866
24 Communications, electricity, power, and gas	0	0
25 Wholesale and retail trade	1,268,804	6,344,018
26 Other financial, real estate, and insurance	0	0
27 Business and computer services	0	0
28 Education and health services	0	0
29 Accommodation services	147,431	737,157
30 Other services (personal and household)	0	0
31 Operating, office, laboratory, and food	317,201	1,586,004
32 Travel and advertising	0	0
33 Transportation margins	0	0
34 Owner-occupied housing	0	0
Total	2,233,809	11,169,046

5.5 Conclusion

We have chosen an upper bound (25%) and lower bound (5%) on possible hunter responses to the potential detection of CWD in Ontario. It seems unlikely that there would be a significantly greater reduction in hunting effort unless CWD occurred over a large number of areas, spurring an intensive media response.

We have not modelled the temporal path of possible adjustments to CWD. Based on discussions with individuals in several states, it seems likely that any initial reduction in hunter days would diminish over time as individuals became more informed about CWD, where it occurred, how to detect it, and what to do with deer potentially infected with CWD.

It is also important to note that for purposes of the impact analysis we have not reallocated in-province resident expenditures. It is highly likely that a significant portion of resident hunter expenditures would be spent in the province on alternative activities or commodities and thus would not be a loss to the economy. In this sense, this analysis accounts only for the negative impact of reduced hunting and not for the positive impact of the counterbalancing positive impacts that would follow as resident hunters reallocate their expenditures to other sectors of the Ontario economy.

6. Economic Analysis

6.1 Introduction

In this chapter we present the primary analysis we conducted to examine the economic impact of potentially detecting CWD in Ontario. As in previous chapters, we examine impacts based largely on whether CWD is detected in captive or wild cervids.

Given the available resources, we are unable to develop an impact analysis at the sub-provincial level at this time. Note that there may be disproportionately large impacts on some regions within the province compared to the impacts in other areas. In particular, we suspect that relatively larger impacts may be seen in rural areas where deer and elk are farmed or hunted compared to more urban areas.

In Section 6.2 we discuss economic impacts from potential CWD detection in captive deer or elk. In Section 6.3 we consider economic impacts from potential CWD detection in wild deer or elk. In Section 6.4 we present a range of impacts of interest in planning for potential CWD detection in Ontario. This includes impacts resulting from changes in wildlife viewing and hunting licence purchases, as well as impacts on aboriginal groups and costs of surveillance, control, and compensation. Because of limited resources and the limited availability of economic information on some groups, much of this discussion is necessarily more qualitative than quantitative. Section 6.5 concludes and briefly outlines some of the potential omissions, biases, and uncertainties in this analysis.

6.2 Impacts from Potential Detection of CWD in Captive Cervids

6.2.1 Scenarios

We will discuss three scenarios of the potential detection of CWD in captive cervids. As outlined in Exhibit 6.1, Scenarios A and B examine low and high impacts on elk and white-tailed deer farming, respectively, as these species are the species in which CWD has been diagnosed in other jurisdictions. Scenario C looks at a broader low-impact scenario including elk, white-tailed deer, and other farmed cervids (lower risk species of contracting CWD). These scenarios should provide a reasonable understanding of the upper and lower bounds of economic impacts of potential CWD detection in Ontario.

Exhibit 6.1. Scenarios for potential CWD detection in captive cervids in Ontario

Scenario	Impact level	Impact scenarios
Scenario A	Low impact	25% reduction in elk/WTD[a] deer farming
Scenario B	High impact	100% reduction in elk/WTD deer farming
Scenario C	Broader low impact	25% reduction in elk/all deer farming

a. WTD = white-tailed deer.

The economic impact of CWD on the Ontario economy is undertaken in part using the SEIM run by the OMNR.[1] This model is an input-output model developed specifically to explore the impact of natural resource decision making in Ontario. Input-output modelling has been applied to national, provincial, and regional economies to evaluate infrastructure investment policies, tax policies, and policies to address other economic problems. Such models are based on the economy's production process (i.e., outputs are a function of certain inputs). They describe transactions between a given economy and the "world" outside the economy.

Exhibit 6.2 shows the scenarios for captive cervid impact analysis from Exhibit 4.16 adjusted to 2003 Canadian dollars for input in the SEIM model. Each scenario assumes a reduction in total revenues of cervid farms as a result of CWD. As farms lose revenues, owners would spend less in the various sectors of the Ontario economy, especially those most closely related to cervid farming. We estimated these reductions in expenditure by sector as shown in the exhibit. For example, if all deer and elk farming ceases, as in the second scenario, the loss in revenues of those farms is estimated to be more than $5.3 million. If this were to occur, deer and elk farmers would no longer spend the amounts shown in various sectors. Impacts enter the model, then, as changes in expenditures in each of 34 specific industrial sectors. Sectors modelled with no change in initial expenditures are not shown in Exhibit 6.2.

6.2.2 Economic impacts from the farmed cervid sector

6.2.2.1 Value added

"Value added" measures the total gain in economic activity resulting from production of goods or services. Changes in the value-added measure are a good indicator of changes in net economic activity because only the net incremental value is summed at each transaction to avoid double counting. Value added is the most appropriate measure of the impact of an industry on an economy, and is defined as payments made to workers, interest, profits, and indirect business

1. OMNR and Econometric Research Limited supplied output from the SEIM model. All input into and output from SEIM in reported in CA$.

Exhibit 6.2. Input to SEIM for impact scenarios for captive cervids (2003$)

Sector	Scenario A 25% of elk and white-tailed deer	Scenario B 100% of elk and white-tailed deer	Scenario C 25% of elk and all deer
1 Agriculture	1,039,225.30	4,157,969.26	8,904,441.23
19 Refined petroleum and coal	16,020.95	65,151.84	111,078.55
21 Miscellaneous manufacturing.	21,361.26	84,376.98	165,549.77
22 Construction	63,015.72	253,130.93	497,717.36
23 Transportation and storage	12,816.76	52,335.09	171,958.14
24 Communications, electricity, power, and gas	10,680.63	44,858.65	67,287.97
25 Wholesale and retail trade	8,544.50	34,178.02	60,879.59
26 Other financial, real estate, and insurance	48,062.84	193,319.40	398,387.50
30 Other services	18,157.07	73,696.35	142,052.38
31 Operations, office, laboratory, and food	96,125.67	382,366.55	647,246.18
Total	1,334,010.69	5,341,383.06	11,166,598.67

From: Exhibit 4.16: Input to SEIM for Impact Scenarios for Captive Cervids (converted to 2003$) October 2003 CPI divided by October 2000 CPI = 122.4/114.6 = 1.068063.

Source: Canadian CPI Inflation Factor: 1.068 from October 2000 to October 2003. (http://www.bankofcanada.ca/en/cpi.htm accessed December 16, 2003).

taxes. Exhibit 6.3 shows how much the contribution of deer and elk farming to the Ontario economy would be reduced under the three scenarios, measured in terms of value added. We should emphasise that these represent *reductions* in value added.

Exhibit 6.3. Value-added impacts (2003$)

	Scenario A	Scenario B	Scenario C
Change in initial expenditure	$1,334,008	$5,341,383	$11,166,598
Value added			
Direct effects	$143,092	$576,257	$1,187,182
Indirect and induced effects	$1,244,297	$4,980,506	$10,490,629
Total effects on value added	$1,387,389	$5,556,763	$11,677,811
Multiplier	1.04	1.04	1.05

The "change in initial expenditure" is the change in total expenditures of deer and elk farms as depicted in Exhibit 6.2. Reduced expenditures mean reduced value added from the cervid farms themselves and from the businesses where they would have spent the money. The estimated reduction in value added in this first round is shown as "direct effects" in the exhibit. Direct effects, however, are not the end of the story. As businesses suffer the direct effects, they will spend less in other businesses in the economy, reducing value added there. These are the "indirect effects." As reduced direct and indirect effects accumulate, households throughout the economy will have less money to spend, which affects the total value added throughout the economy through "induced effects." Direct, indirect, and induced effects are combined to result in "total effects on value added." The multiplier summarises the total effects on value added per dollar of reduced initial expenditure. For example, if CWD resulted in a 25% loss of expenditures by white-tailed deer and elk farms — the scenario represented in the first column of figures — the estimated reduction in total expenditure would be slightly more than $1.33 million. Using the SEIM model of the Ontario economy, this is estimated to result in a total reduction in value added of almost $1.4 million, implying a multiplier of 1.04.

6.2.2.2 Wages, salaries, and employment impacts

Exhibit 6.4 shows the reductions in wages, salaries, and employment under the three farmed cervid impact scenarios.

Exhibit 6.4. Wages, salaries, and employment impacts

	Scenario A	Scenario B	Scenario C
Wages and salaries			
Direct	$80,821	$325,365	$675,284
Indirect and induced	$669,273	$2,678,894	$5,635,658
Total	$750,094	$3,004,259	$6,310,942
Employment (person-years)			
Direct	4.1	16.6	31.7
Indirect and induced	26.6	106.3	225.2
Total	30.7	122.9	256.9
Multiplier	7.49	7.4	8.1

The most extreme scenario shows that CWD could result in wage and salary losses of up to $6.31 million for the Ontario economy as a whole. This would translate into slightly more than 250 jobs (person-years of employment). Most of these jobs would be lost through the indirect and induced effects of CWD. Smaller effects would be felt under the other scenarios.

6.2.2.3 Taxes

Exhibit 6.5 shows the impacts on federal, provincial, and local tax receipts as a result of the potential CWD detection in farmed cervids under the three scenarios. Changes in taxes are the value of federal, provincial, and local taxes (including sales, property, and income taxes) throughout the economy resulting from changes in deer and elk farm activities. We have not attempted to analyse the full fiscal impact of these changes in terms of how government entities would respond to changes in their revenues. Again, note that these represent decreases in taxes collected and as such would need to be made up by alternative tax collections, borrowing, or reductions in government programs.

Exhibit 6.5. Federal, provincial, and local tax impacts

	Scenario A	Scenario B	Scenario C
Federal	$192,551	$771,220	$1,615,135
Provincial	$139,772	$559,863	$1,169,596
Local	$31,134	$124,742	$258,988
Total	$363,457	$1,455,825	$3,043,719

6.2.2.4 Imports

The decrease in economic activity as a result of the potential CWD detection in Ontario would also result in decreased demand for imported goods and services from other provinces and countries. Exhibit 6.6 indicates the reductions in imports into Ontario as a result of CWD under the three farmed cervid scenarios.

Exhibit 6.6. Changes in imports into Ontario

	Scenario A	Scenario B	Scenario C
From other provinces	$121,607	$486,771	$1,019,851
From other countries	$261,605	$1,046,902	$2,173,131
Total	$383,212	$1,533,673	$3,192,982

6.2.3 Lost producer profits (alternative partial value-added measure)

As explained earlier, value added is defined as payments industries make to workers, interest, profits, and indirect business taxes. As Exhibit 4.13 showed, the profit per animal is modelled as 17% for elk and red deer and as 10% for all other deer. Using the assumptions of the number of animals and the profit per animal, Exhibit 6.7 shows the calculation of the loss of profit to the elk and deer farming industry under the three scenarios.

Exhibit 6.7. Calculation of loss of elk and deer farming producer surplus

	Elk	White-tailed deer	Red deer	Fallow deer	Total loss of producer surplus
Number of animals	3,200	1,410	18,600	6,700	NA
Profit (per animal) (2003$)	$160.20	$164.47	$80.10	$164.47	
Total profit (2003$)	$512,640	$231,906	$1,489,860	$1,101,962	
Scenario A	$128,168	$57,980	$0	$0	$186,147
Scenario B	$512,670	$231,919	$0	$0	$744,589
Scenario C	$128,168	$57,980	$372,487	$275,507	$834,141

These represent a measure similar to that of the direct impacts from Exhibit 6.3 and are calculated only as a confirmation of the magnitude of impacts on deer and elk farmers as a result of the potential detection of CWD in Ontario. These estimates are well in line with those derived from the SEIM model of direct value added (as shown in Exhibit 6.3).

6.3 Impacts from Potential Detection of CWD in Wild Cervids

6.3.1 Scenarios

In this section, we discuss two scenarios of the potential detection of CWD in free-ranging cervids: a low-impact scenario (5% reduction in hunting effort) and a high-impact scenario (25% reduction in hunting efforts). We modelled these scenarios as a reduction in expenditures made in Ontario by hunters (both resident and non-resident, Exhibit 6.8). To the extent that these expenditures are transferred to other activities within the province, the economic impact in the province will be lessened. Because the majority of Ontario hunters are residents, we would expect that most of the modelled reductions in expenditures would be transferred to other activities within the province. These scenarios should yield a reasonable understanding of the lower and upper bounds of economic impacts of potential CWD detection in free-ranging cervids in Ontario.

Exhibit 6.8. Scenarios for potential CWD detection in wild cervids in Ontario

Scenario	Impact level	Impact scenarios
Scenario D	Low impact	5% reduction in hunting effort
Scenario E	High impact	25% reduction in hunting effort

As for the captive cervid analysis, the analysis of the economic impact of potential CWD detection in wild cervids on the Ontario economy is undertaken in part using the SEIM. Exhibit 6.9 shows the scenarios for wild cervid impact analysis from Exhibit 5.7 for input in the SEIM model. Impacts enter the model as changes in expenditures in each of 8 sectors determined by the historical distribution of hunting expenditures used in the SEIM model.

Exhibit 6.9. Input to SEIM for impact scenarios for wild cervids (2003$)

Allocated into expenditure sectors	Scenario D Impact: 5% reduction	Scenario E Impact: 25% reduction
Accommodations		
Meals and beverages		
Groceries		
Gas and oil		
Transportation		
Retail		
Equipment		
Other		
Total	$2,233,809.00	$11,169,046.00

6.3.2 Economic impacts from the wild cervid sector

6.3.2.1 Value added

Exhibit 6.10 shows the reductions in value added under the two scenarios. Remember that these represent *reductions* in value added resulting from reduced hunting activity.

Exhibit 6.10 shows that, given the assumptions of the analysis, the loss in value added as a result of potentially detecting CWD in wild deer in Ontario has an upper bound of about $11.8 million.

Exhibit 6.10. Value-added impacts

	Scenario D	Scenario E
Change in initial expenditure	$2,233,809	$11,169,046
Value added		
Direct	$498,231	$2,491,156
Indirect and induced	$1,862,516	$9,312,583
Total	$2,360,747	$11,803,739
Multiplier	1.06	1.06

6.3.2.2 Wages, salaries, and employment impacts

Exhibit 6.11 indicates the reductions in wages, salaries, and employment under the two wild cervid impact scenarios. The exhibit shows that, under what we have taken as a worst-case scenario (Scenario E, 25% reduction), CWD would result in losses of wages and salaries of roughly $7 million. This translates into about 220 jobs, measured in terms of person-years of employment.

Exhibit 6.11. Wages, salaries, and employment impacts

	Scenario D	Scenario E
Wages and salaries		
Direct	$316,380	$1,581,900
Indirect and induced	$1,089,474	$5,447,367
Total	$1,405,854	$7,029,267
Employment (person-years)		
Direct	14.3	71.3
Indirect and induced	29.7	148.9
Total	44.0	220.2
Multiplier	3.08	3.09

6.3.2.3 Taxes

Exhibit 6.12 shows the impacts on federal, provincial, and local tax receipts as a result of potential CWD detection in free-ranging cervids under the two scenarios. Changes in taxes are the value of federal, provincial, and local taxes (including sales, property, and income taxes) throughout the economy resulting from changes in hunting-related activities. We have not attempted to analyse the full fiscal impact of these changes in terms of how government entities would respond to changes in their revenues. Again note that these represent decreases in taxes collected and would need to be made up by alternative tax collections, borrowing, or government program reductions.

Exhibit 6.12. Federal, provincial, and local tax impacts

	Scenario D	Scenario E
Federal	$403,513	$2,017,563
Provincial	$246,407	$1,232,036
Local	$64,427	$322,134
Total	$714,347	$3,571,733

6.3.2.4 Imports

The decrease in economic activity as a result of potential CWD detection in free-ranging cervids in Ontario would also result in decreased demand for imported goods and services from other provinces and countries. Exhibit 6.13 indicates the reductions in imports into Ontario as a result of CWD under the two free-ranging cervid scenarios.

Exhibit 6.13. Changes in imports into Ontario

	Scenario D	Scenario E
From other provinces	$181,062	$405,308
From other countries	$465,406	$2,327,030
Total	$646,468	$2,732,338

6.3.3 Lost consumer surplus (lost WTP)

Exhibit 6.14 shows the calculation of consumer surplus losses under the two scenarios. We calculated a total loss of consumer surplus for those individuals who choose to not hunt altogether. We also calculated a loss of 20% of consumer surplus for those individuals who choose to continue hunting but will lose some benefit as a result of CWD potentially being found in the wild deer population. We have not calculated a reduction in WTP for non-residents because this “damage” occurs outside of the province.

Exhibit 6.14. Loss consumer surplus from CWD (2003$)

	Total number of resident hunting days	WTP per day	Total WTP	Reduction in WTP
Resident	1,006,848	$78.65	$79,189,491	
5% Reduction	956,506	$62.92[a]	$60,183,332	$19,006,159
25% Reduction	755,136	$62.92[a]	$47,513,157	$31,676,334

a. 80% of WTP without CWD.

The loss in social welfare of hunters under the high-impact scenario is more than $30 million. This is a true loss of social welfare that would not be made up by any reallocation of hunting effort to other activities in the province. The welfare loss to hunters thus represents a significant and large socio-economic impact of the potential detection of CWD in Ontario.

6.4 Other Impacts

6.4.1 Aboriginal hunting values

For aboriginal hunters and communities, big game hunting is an important subsistence-food source as well as an important cultural activity. The existence of a healthy big game population on traditional lands may be important to the cultural health of the community.

A study by Haener et al. (2001) indicates that moose hunting is economically important to Canadian aboriginal hunters in northern Saskatchewan. These investigators found that a decrease in the moose population (25% fewer moose harvested in the region) would lead to a $300 to $1425 loss in value per hunter per year. The loss was estimated as lowest ($300) for elder hunters, largely because they were assumed to have no opportunity cost to their time. The authors note that a more accurate representation of the opportunity cost of time in this non-traditional economic community should be explored in further research. The $300 to $1425 range fits well with their estimated cost to replace the meat that would be lost to the community ($800/per hunter/year). As mentioned above, however, the hunting activity for aboriginal hunters serves as more than simply a source of nutrition.

Aboriginal people may make up a substantial proportion of total hunting days, especially in western Canada, even though they do not make up a large proportion of the population. Exhibit 6.15 shows the incidence of aboriginal population in Ontario and Canada according to the 2001 Census.

Exhibit 6.15. Ontario aboriginal population (2001 census)

Selected characteristics	Ontario	Canada
Total aboriginal identity population	188,310	976,310
Total non-aboriginal population	11,097,235	28,662,725
Percent aboriginal	1.67%	3.29%

Source: Statistics Canada (2003).

At this time reliable data on hunting effort by aboriginal people in Ontario are not available. As a thought experiment, we can calculate a potential economic impact as follows. Information from OMNR indicates that, in 2002, there were 152,983 resident deer hunters (OMNR, 2002a) out of the 11,097,235 population of Ontario, for a hunter incidence of 1.38%. If we assume that the hunter incidence in aboriginal people is twice that of non-aboriginal people, the aboriginal hunter incidence rate becomes 2.76%. Of the 188,310 members of the aboriginal population reported in Exhibit 6.15, this represents 5,192 aboriginal deer hunters. Using the lower bound value estimate from Haener et al. (2001) of $300 per hunter, the impact of a 25% reduction on aboriginal hunters would be $1,557,590 a year. We use the lower bound estimate from Haener et al (2001) because that study dealt with moose hunting, whereas CWD would affect deer hunting.

6.4.2 Wildlife viewing

As stated in OMNR's Significant Wildlife Habitat Technical Guide (OMNR, 2000, p. 67), "In many parts of Ontario, deer provide high numbers of recreational opportunities, both for viewing and for hunting. Revenue generated from these opportunities is not only important to the local economy, but to the province as a whole."

As shown in Exhibit 6.16, more than $400 million is spent annually in Ontario on wildlife viewing. Based on these data, more than 1.5 million individuals participated in wildlife viewing in Ontario in 1996, spending an average of 16 days per individual engaged in this activity.

As shown in Exhibit 6.16, these expenditures involved equipment, transportation, food, and accommodation. Although we do not have specific economic impact data for Ontario, as shown in Exhibit 6.17, wildlife viewing expenditures generated $1.3 billion in gross domestic product (GDP) for Canada as a whole.[2] Some 22,300 jobs were supported and governments received

2. It is our understanding that more detailed province level data is available in published format. This was not available prior to completion of this analysis but could be considered in future work to better document potential impacts in Ontario.

Exhibit 6.16. Expenditures for wildlife viewing in Ontario[a]

Category of expenditure	Million $	% of total
Accommodation	28.1	6.8
Transportation	58.7	14.3
Food	36.2	8.8
Equipment	287.9	70.0
Total	410.9	100.0[b]
Average yearly	$263	
Average daily	$16	

a. Environment Canada (2003a).
b. Does not total because of rounding.

Exhibit 6.17. Economic impacts of nature-related activity in Canada in 1996

		Economic impacts		
Nature-related activity	Expenditures (million$)	GDP	Government revenue from taxes	Number of jobs sustained
Outdoor activities in nature areas	$7,246.7	$7,145.2	$3,365.1	124,200
Wildlife viewing	$1,301.8	$1,285.2	$605.3	22,300
Recreational fishing	$1,934.9	$1,908.6	$898.9	33,200
Hunting	$823.8	$815.2	$383.9	14,200

Source: Environment Canada (2003b).

more than $605 million in tax revenues. This suggests that wildlife viewing, taken as a whole, has a larger economic impact in Canada, and thus likely in Ontario as well, than hunting.

Determining the economic impact on wildlife viewing in Ontario, if CWD were found, would require answers to several questions, including:

- What portion of the wildlife population is affected?
- How much of wildlife viewing is related to viewing deer (and elk) in Ontario?
- How do people react to the presence of CWD in wildlife populations; how would their viewing behaviour change?

- How much would wildlife viewing expenditures decrease with changes in viewing habits?

- To what extent would these expenditures be transferred to other activities within the province?

We do not currently have the information or resources to reliably assess the potential economic impact of CWD on wildlife viewing in Ontario, but the overall economic importance of wildlife viewing in Canada suggests that this might be a topic to further research. As a thought experiment to suggest the potential magnitude of impacts from CWD, we present the following calculation. The $410.9 million spent on wildlife viewing in Ontario represents 31.6% of the $1,301.8 million reported for all of Canada in Exhibit 6.17. Applying this percentage to the economic impacts from wildlife viewing reported for all of Canada in Exhibit 6.17, Exhibit 6.18 shows a calculation of the economic impacts of wildlife viewing in Ontario, including the generation of more than $400 million in GDP, $190 million in tax revenues, and 7,000 jobs. The bottom row of the exhibit presents the estimated economic impact of a 1% reduction in wildlife viewing activity in response to CWD being found in Ontario.

Exhibit 6.18. Calculation of economic impacts of wildlife viewing in Ontario

		Economic impacts		
Wildlife viewing	**Expenditures (million$)**	**GDP**	**Government revenue from taxes**	**Number of jobs sustained**
All Canada	$1,301.8	$1,285.2	$605.3	22,300
Ontario	$410.9	$405.7[a]	$191.1[a]	7,039[a]
Economic impacts of 1% reduction in wildlife viewing in Ontario		$4.1	$1.9	70

a. Based on ratio of expenditures in Ontario to all Canada.

Based on experience elsewhere, CWD affects relatively few deer in a population at any given point of time. Consequently, the effects of deer viewing directly associated with CWD are likely to be small. However, if Ontario were to follow the lead of states such as Wisconsin and engage in herd reduction as a CWD control strategy, viewable numbers of deer in affected areas could decline substantially because of population reductions and the tendency of heavily hunted deer to seek cover and reduce activity during daylight hours. CWD if detected in Ontario, then, could have a significant adverse economic effect on wildlife viewing.

6.4.3 Deer hunting licence revenue

Of potential concern to the OMNR is the impact on deer licence revenues in the event of potential CWD detection in Ontario. Exhibit 6.19 shows information from Chapter 5 on the revenue collected from deer licences in the 2001/2002 fiscal year. Exhibit 6.19 shows 5% and 25% reductions in deer licence revenues parallel to the reductions in hunting effort modelled for Scenario D (5%) and Scenario E (25%).

Exhibit 6.19. Impacts on deer licence revenue

Type of licence	Deer licence revenue 2001/2002 fiscal year ($)[a]	Reduction scenario	
		Scenario D 5%	Scenario E 25%
Resident deer licence	$4,700,433	$235,022	$1,175,108
Resident farmer deer licence	$86,447	$4,322	$21,612
Non-resident deer licence	$418,913	$20,946	$104,728
Second deer tag	$128,310	$6,416	$32,078
Total	$5,334,103	$266,705	$1,333,526

a. See Exhibit 5.3.

OMNR operating expenses for 2002/2003 were $454 million, and projected operating expenses for the 2003/2004 fiscal year are $530 million (Ontario Ministry of Finance, 2003).[3]

Although the revenue losses indicated in Exhibit 6.19 do not represent a large portion of OMNR's operating expenses, reductions in hunting licence revenues may disproportionately affect programs earmarked to receive funding based on these revenues.

6.4.4 Cost of disease control

The costs of preparing for a potential CWD outbreak are under the control of decision-making agencies. This report covers a portion of the costs of planning and preparing for a potential outbreak. The actual costs for responding to and controlling a CWD outbreak will vary depending on when and where an outbreak occurs.

3. According to the Ministry of Finance's Annual Report and Consolidated Financial Statements, the OMNR had budgeted $493 million and had actual 2003 expenditures of $526 million.

Many millions of dollars have been spent in Canada and the United States in efforts to understand and control CWD. These costs include costs associated with research, surveillance and monitoring, diagnostic testing, technology, depopulation and compensation, disposal, education, and information dissemination (NCPIC, 2002b). These costs mostly occur at the provincial, state, and federal levels. Many state agencies have stated that these funds come at the expense of decreased funding of other existing or planned programs.

Exhibit 6.20, which is copied from Appendix C, summarises some of the responses to the captive cervid survey Stratus Consulting conducted via e-mail. As the exhibit suggests, there is a potentially significant range of expenditures depending on the presence of CWD and the nature of the jurisdiction's response.

Exhibit 6.20. CWD-related spending and allocations

	Total amount spent on CWD in 2003 (CA$2003)	% spent on surveillance	% spent on communication	% spent on eradication	% spent on prevention	% spent on control	% spent on compensation	% spent on other
Wisconsin	2.0 million	na	na	na	na	na	na	na
Alberta	1.5 million	na	na	na	na	na	na	na
Illinois	1.1 million	30	5	50	0	0	0	15
Utah	466,000-666,000	67	7	3	7	3	0	13
New Mexico	146,000	70	10	0	20	0	0	0
Nevada	126,000	89	7	0	3	0	0	0
Manitoba	109,000	95	5	0	0	0	0	0
Oklahoma	45,000	100	0	0	0	0	0	0

See Exhibit C.2 for a complete explanation of the information reproduced here.

In addition, here are some of the costs various provinces or states have incurred:

- In Alberta, costs in the wildlife branch including staff time were $500,000 for 2002. For farming, $750,000 was spent just for the diagnostics surveillance program.
- The CDOW does CWD testing for hunters for free and that agency spent more than US$2 million in 2002 for that service. In 2003, the CDW will spend more than US$3 million on the service.

In the sections that follow, we discuss potential costs of disease control based on the different phases of response: prevention, surveillance, control and eradication, recovery, and communication.

6.4.4.1 Prevention

Efforts proposed for the prevention of CWD in Ontario include 1) controlling the movement of cervids, 2) managing or restricting the use of certain foods for captive cervids, 3) certifying disease-free herds, 4) reducing or eliminating baiting, 5) controlling or eliminating the feeding and use or possession of natural attractants, and 6) managing data and information more rigorously. In general, these approaches involve costs for the regulating agency for implementation, monitoring, and enforcement, and impose costs on the producers for compliance with regulations.

The economic *benefits* of a proactive prevention plan are the potential avoided costs associated with an outbreak of CWD in Ontario. These benefits (avoided costs) would include those discussed earlier in terms of direct and indirect economic losses associated with the potential detection of CWD in captive or wild cervids, as well as the avoided costs discussed in the subsections that follow for control, eradication, recovery, and communication.

Voluntary certification

The objective of the CWD Voluntary Herd Certification Program is to give cervid farmers the opportunity to have their herds identified as "elite" with respect to CWD. Participation in the certification program is intended to extend assurances to potential animal purchasers that a purchase from a herd with the same level of certification has the same risk of being infected with CWD. The level of assurance of CWD freedom depends on the length of time the herd has been enrolled in the program. Any owner of elk or deer operations who agrees to comply with the provisions of the CWD Voluntary Herd Certification Program may enrol.

As indicated in responses to the captive cervid internet survey (see Appendix C), stricter regulations on cervid farming, including those that may be needed to satisfy voluntary certification requirements, may significantly increase costs. For instance, an analysis in Colorado suggested that elk farmers' costs would increase 42% or more if double fencing were required. Although we do not have the resources to derive quantitative estimates of the costs of CWD prevention, the regulating agencies would obviously expect to incur costs. In addition, operating costs would be expected to increase for elk and deer farmers (i.e., reduced profit margins) that attempt to meet the certification standards.

6.4.4.2 Surveillance

As stated in Ontario's Chronic Wasting Disease Surveillance and Response Plan (Chronic Wasting Disease Task Force (CWDTF, 2003a), Section 3.3.2, "The total estimated cost of complete surveillance in all 14 zones annually is approximately $800,000.[4] The actual annual cost will be determined by the amount of surveillance, and number of zones sampled, which will depend on allocated resources." This may represent an upper bound cost for a comprehensive annual surveillance program. Given the likely limited availability of funds, it seems likely that actual expenditures on surveillance will be lower in any given year with high-priority (higher risk) areas being surveyed earlier and more often than lower risk areas.

6.4.4.3 Control and eradication

Control and eradication costs would depend on where and when an outbreak occurred. The primary difference in deriving cost estimates would be whether the outbreak occurs in farmed or in free-ranging cervids. We have not developed control and eradication cost estimates for the scenarios used for the economic impact analysis presented earlier. However, based on experiences in other jurisdictions (especially in Colorado and Wisconsin), these costs would likely be on the order of millions of dollars a year and might extend over several years (especially if CWD becomes endemic in wild cervid populations).

Compensation (CFIA)

One component of costs for control and eradication in farmed herds would be compensation paid to farmers. The CFIA is responsible for eradicating reportable diseases in farmed cervids in Canada. Between the beginning of 2000 and August 2003, CFIA has destroyed 8,731 cervids and paid $35.9 million in animal compensation, transportation, and disposal fees. This figure does not include the program's cost to the agency, which is estimated at approximately $3.5 million for sampling, testing, epidemiological investigation, record keeping, and policy development.

Compensation is paid for animals ordered destroyed under the Health of Animals Act (Compensation for Destroyed Animals Regulations, 2000)**.** Exhibit 6.21 presents compensation cost information from CFIA from 2000 through the summer of 2003. The average compensation per animal is about $4,000.

4. CWDTF (2003a) indicates this cost as $600,000. We have been informed that this has since been revised to the $800,000 indicated here. Personal communication, Karen Laws, March 15, 2004.

Exhibit 6.21. Animal compensation and transportation and disposal fees for cervids

Year	Number of cervids	Compensation	Average per animal
2000-2001	2525	10,459,006.17	4,142.18
2001-2002	5428	22,659,867.00	4,174.63
2002-03	651	1,677,299.40	2,576.50
2003-2004 (through August 2003)	127	199,632.26	1,571.91
	8731	34,995,804.83	4,008.22

Source: Personal communication, Dr. Carolyn Inch, National Manager, Disease Control, CFIA, Ottawa, August 19, 2003.

Hypothesising a situation in which 25% of Ontario's WTD deer and elk would need to be destroyed. Using the figures from Exhibit 4.3, compensation costs would be on the order of $4.6 million.[5]

6.4.4.4 Recovery

As stated in Section 5.0 of Ontario's Chronic Wasting Disease Surveillance and Response Plan (CWDTF, 2003a),

> The agencies that make up the task force will judge the effectiveness of efforts to eradicate or control CWD. They will do this through continuous surveillance and harvest monitoring within the response zone during a recovery period of not less than 36 months. MNR will coordinate the surveillance, monitoring, and determination of disease-free status for free-ranging cervid populations. The CFIA will coordinate follow-up monitoring and surveillance of captive cervid facilities.

Costs of undertaking recovery operations will largely fall on the relevant task force agency. Although we currently do not have estimates of likely costs for such efforts, we recognise that they are likely to occur at least in part at the expense of other programs or operations normally undertaken by the relevant agency.

5. The total of farmed elk and white-tailed and other deer is 4,610, of which 25% would be 1,153 animals, times $4,008 each, equals 4,619,220.00. As noted previously, CWD has not been detected in red deer or fallow deer.

6.4.4.5 Communication

Plans for a CWD awareness campaign would involve informing stakeholders, the media, and the public about CWD. The goals would be to foster a reasonable knowledge of CWD and its potential threat to farmed and wild cervid health; to reinforce that there is no scientific evidence that CWD can be passed on to humans; and to maintain a source of CWD general information to which interested parties can refer before and after any potential incident of CWD in Ontario.

An extensive communication effort is also required in the event of a CWD outbreak. We did not estimate the costs of such communication efforts as part of this research. It seems likely, however, that the cost of communications in the event of a positive case would come at the expense of other programs and activities because a wide range of public officials would be involved in the response and communication efforts.

The results of a proactive communication effort and of well-executed "positive case communications" may be the difference between a significant reduction and a minor reduction in hunter effort. Although there is no specific basis for modelling the difference in impact of communication plans in Ontario, we suspect that the difference between the scenarios of 25% hunter effort reduction and 5% hunter effort reduction may suggest the potential benefits of a proactive communication plan. As discussed in Appendix A, Section A.20, of this report, "Cost Estimate for Implementation of U.S. National CWD Plan," the pre-detection portion of a comprehensive communication plan for the United States is likely to cost in the tens of thousands of dollars. It is difficult to anticipate the costs of "positive case communications" needs at this time, because they will depend on choices made once CWD is discovered.

7. Conclusions

7.1 Conclusions

We prepared this report in the event of the potential introduction of CWD into Ontario, as part of an overall planning effort to eradicate or control CWD should it be detected in the province. This analysis focuses on primary potential economic impacts of the disease in free-roaming deer and farmed deer and elk, as well as secondary impacts on other affected sectors of the Ontario economy. In this assessment, we considered compensation issues, surveillance (voluntary versus mandatory), costs beyond disease control, benefits of managing CWD, lost opportunity costs, and impacts on government revenues. To provide context for the analysis, we also reviewed impacts experienced in other jurisdictions.

Hunters and those engaging in other activities associated with wild cervids, farmers of deer and elk, and government agencies responsible for detecting and controlling the disease would likely feel the economic effects of CWD. It is also likely to affect aboriginal peoples. If cervid farmers reduce their production or if hunters stop hunting (or hunt less often), they will spend less, which affects the businesses and communities that serve them. These impacts would ripple through Ontario's economy, adding indirect effects to the total damages. To estimate the economic impact of CWD on the Ontario economy, we used the SEIM. Exhibit 7.1 summarises the five impact scenarios modelled in this economic analysis.

Exhibit 7.2 summarises the economic impacts for the five scenarios. In addition, the bottom row shows the estimated losses that hunters would experience; we estimated these separately from the analysis in the SEIM modelling.

Aboriginal hunting values

For aboriginal hunters and communities, big game hunting is an important subsistence-food source as well as an important cultural activity. Assuming that the hunter incidence in aboriginal people is twice that of non-aboriginal people, of the 188,310 members of the aboriginal population, this represents 5,192 aboriginal deer hunters. Using a lower bound value estimate from Haener et al. (2001) of the value of hunting to aboriginal hunters of $300 per year per hunter, the economic impact of a 25% reduction on aboriginal hunters would be more than $1.5 million a year.

Exhibit 7.1. Scenarios for economic impact analysis of potential CWD detection in cervids in Ontario

Scenario	Activity	Impact level	Impact scenarios
Scenario A	Farmed	Low impact	25% reduction in elk/WTD[a] deer farming
Scenario B	Farmed	High impact	100% reduction in elk/WTD deer farming
Scenario C	Farmed	Broader low impact	25% reduction in elk/all deer farming
Scenario D	Free-ranging	Low impact	5% reduction in hunter effort
Scenario E	Free-ranging	High impact	25% reduction in hunter effort

a WTD = white-tailed deer.

Exhibit 7.2. Summary of the economic impacts of potential CWD detection in cervids in Ontario (reductions in thousands of 2003$ or person-years of employment)

	Scenario A	Scenario B	Scenario C	Scenario D	Scenario E
Initial expenditure	$1,334	$5,341	$11,167	$2,234	$11,169
Value added	$1,387	$5,557	$11,678	$2,361	$11,804
Wages and salaries	$750	$3,004	$6,311	$1,406	$7,029
Employment (person-years)	31	123	257	44	220
Total tax impacts	$363	$1,456	$3,044	$714	$3,572
Imports into Ontario	$383	$1,534	$3,193	$646	$2,732
Hunter welfare (consumer surplus)	na	na	na	$19,000	$31,676

NA = Not applicable.

Wildlife viewing

Because more than $400 million dollars is spent annually in Ontario on wildlife viewing, this is likely to have a larger economic impact in Ontario than hunting. If Ontario were to engage in herd reduction in free-ranging cervids as a CWD control strategy, viewable numbers of deer in affected areas could decline substantially because of population reductions and the tendency of heavily hunted deer to seek cover and reduce activity during daylight hours. We can see that CWD in Ontario could have a significant adverse economic effect on wildlife viewing, although we lacked the data to estimate the potential magnitude.

Deer hunting licence revenue

Reductions in deer hunting licence sales were assumed to parallel to the reductions in hunting effort modelled for Scenario D (5%) and Scenario E (25%), which would imply reductions in licence revenues of more than $260,000 and $1,330,000 respectively. Reductions in hunting licence revenues may disproportionately affect programs earmarked to receive funding based on these revenues.

Cost of disease control

Decision-making agencies are responsible for the costs of preparing for a potential CWD outbreak. The actual costs for responding to and controlling a CWD outbreak will vary depending on when and where an outbreak occurs. Costs of disease control would occur during different phases of response: prevention, surveillance, control and eradication, recovery, and communication.

Prevention

Costs for the prevention of CWD being introduced into Ontario could include 1) controlling the movement of cervids, 2) managing or restricting the use of certain foods for captive cervids, 3) certifying disease-free herds, 4) reducing or eliminating baiting, 5) controlling or eliminating the feeding and use or possession of natural attractants, and 6) managing data and information more closely. The economic *benefits* of a proactive prevention plan are the avoided costs associated with an outbreak of CWD in Ontario. These costs include direct and indirect economic losses associated with the potential CWD detection in farmed or wild cervids, as well as the avoided costs for control, eradication, recovery, and communication. At this time we have no reliable information on the costs of CWD prevention and response strategies, although the experiences of other jurisdictions suggest that there is likely to be a substantial on-going cost to be borne by the agencies, industries, and individuals involved in CWD prevention efforts.

Surveillance

The total estimated annual cost of a complete surveillance program in Ontario free-ranging deer is $800,000, which is equivalent to about $124/animal tested. A revolving surveillance program — with higher risk areas being surveyed earlier and more often than lower risk areas — is more likely to be adapted depending on the availability of funds. It seems likely, then, that annual surveillance costs for only a portion of the province would be lower than the $800,000 required to survey the entire province in any given year.

Surveillance for CWD in captive cervids also represents a potentially significant cost. Enhanced surveillance for higher risk species includes testing on farm mortality and slaughtered animals. Assuming 4,610 total WTD and elk (high risk species) of which 40% are adults (i.e., greater than

16 months old which are higher risk age animals) with a 3% mortality rate, this represents an estimated 55 on farm mortalities annually. In addition about 461 WTD and elk would require testing at slaughter each year for a total of 516 animals. At $100 per animal this represents about $51,600/year. For enhanced surveillance for all cervid species, these numbers increase to 350 on farm mortality for adults and 3,000 total slaughter animals for a total of animals 3,350 a year. At $100 per animal this represents a cost of $335,000/year (estimate by Dr. Bob Wright and Brian Tapscott, OMAF; Brian Tapscott, personal communication, March 5, 2004).

Control and eradication

Control and eradication costs would depend on where and when an outbreak occurred and on what strategies federal and provincial decision makers decided to adopt in addressing the disease. Based on experiences in other jurisdictions (especially in Colorado and Wisconsin), these costs would likely be on the order of millions of dollars a year and might extend over several years (especially if CWD becomes endemic in wild cervid populations).

Compensation

The CFIA is responsible for eradicating reportable diseases in farmed cervids in Canada. Compensation cost information from CFIA from 2000 through the summer of 2003 indicates an average compensation per animal of about $4,000. Hypothesising a low impact situation in which 25% of Ontario's WTD deer and elk would need to be destroyed, compensation costs would be on the order of $4.6 million.

Recovery

Costs of undertaking recovery operations will largely fall on the relevant task force agency. These costs are likely to be incurred — at least in part — at the expense of other programs or operations normally undertaken by the relevant agency. Recovery costs are difficult to anticipate at this time and will depend on choices made once CWD is discovered

Communication

It seems likely that the cost of communications if CWD were to be detected (i.e., in the event of a positive case) would come at the expense of other programs and activities because a wide range of public officials would be involved in the response and communication efforts. The results of a proactive communication effort and a well-executed "positive case communication program may be the difference between a significant and a minor reduction in hunter effort. The difference between the scenarios of 25% hunter effort reduction and 5% hunter effort reduction may suggest the potential benefits of a proactive communication plan. As discussed in Appendix A of this report (Section A.20), "Cost Estimate for Implementation of U.S. National CWD Plan," the pre-detection portion of a comprehensive communication plan is likely to cost in the tens of

thousands of dollars. It is difficult to anticipate the costs of "positive case communications" needs at this time because they will depend on choices made if CWD were detected.

7.2 Omissions, Biases, and Uncertainties

Economic analysis entails a degree of uncertainty and invariably, some missing information. To recognise potential omissions, biases, and uncertainties, we briefly mention several issues that have arisen during this study. These issues could lead to changes in economic impact estimates or may be of concern to decision makers:

- Our analyses of economic impacts were based on scenarios that were developed by considering what is known about CWD in other jurisdictions, along with environmental conditions in Ontario. As such, they were designed to be suggestive of the range of possible outcomes rather than as definitive predictions of outcomes. Our results are designed to suggest plausible outcomes for planning purposes. In the event of an outbreak of CWD in Ontario, we would expect actual outcomes to be in the same ballpark as our estimates, but exact economic effects will depend on the specific details of the actual events and conditions specific to Ontario.

- Modelling of the economic impacts of CWD is necessarily an imprecise business. It depended on figures that were inexact and assumptions that are true only as approximations. Ontario's SEIM model must itself be inexact.

- Estimated consumer surplus losses from hunting were based on studies of hunting values done elsewhere and on plausible assumptions rather than on a study of hunting values in Ontario tailored to gauge CWD's impacts. We believe that they are suggestive of what is a stake with respect to CWD in deer, but they are necessarily imprecise.

- We have not attempted to closely examine temporal issues such as potential adjustments in hunting behaviour over time. It is likely that some hunters will find substitute hunting opportunities, meaning that the negative impacts on their well being will decline over time. Impacts of a continuing CWD presence on hunting may well decline over time as hunters learn to "live with" the disease.

- The analysis presented here was undertaken at the provincial level. Note that there may be regional or spatial issues within Ontario that could be important at a lower level of disaggregation. In particular, some small rural communities or regions may be disproportionately hurt by the impacts of CWD.

- In terms of numbers of farms and animals and actual economic structure, there is currently inherent uncertainty about deer and elk farming in Ontario (i.e., compared to Saskatchewan from which economic information was transferred and where there is a provincial regulatory system in place to quantify the inventory of farms and animals. No such provincial system is in place in Ontario).

- The analysis of economic impacts was made more difficult by the detection of BSE in Alberta and CWD in other Canadian provinces (Alberta and Saskatchewan) and the recent detection of BSE in the United States. Specifically, the analysis of economic impacts in Ontario should be based on baseline conditions in Ontario and elsewhere. With the detection of diseases in other jurisdictions and economic and political responses to those occurrences, the baseline for conditions in Ontario and elsewhere is constantly changing.

- Deer and elk farming are dynamic industries still under development in Ontario and elsewhere, which means that future baseline conditions with and without CWD are speculative. For the purpose of undertaking the economic analysis, we have implicitly assumed that current conditions will continue.

- If human health impacts of CWD were to be verified, the economic impacts of a CWD outbreak in Ontario would be likely to change drastically. At this time there is no evidence that CWD can be transferred to humans.

- The potential spread and impacts of CWD in wild populations is still uncertain. For instance, if CWD were found to spread significantly faster (or slower) under environmental conditions found in Ontario, the likely economic impacts could be significantly larger (or smaller).

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A. Province and State Information

Contact information is provided for a number of the individuals and agencies we interviewed or attempted to interview. The contact information provided includes: name, title, agency, mail address, and phone number, and email address, where readily available.

For each state/province we provide the information for that jurisdiction regarding whether they have had animals tested positive for CWD (wild deer, wild elk, or captive elk or deer), the number of deer and elk farms, their CWD tier classification and the number of big game hunting days for 2002. The check marks in the boxes for wild deer, wild elk, or captive elk or deer indicate that CWD has been detected in that population in that jurisdiction.

Government employees and members of stakeholders groups in several of the Tier 1 and Tier 2 provinces and states were interviewed, contacted, or surveyed to determine primarily if any economic impact studies had been conducted and to obtain overviews of state/provincial efforts to control CWD and levels of associated costs. The discussion here does not attempt to completely summarise each province or state's history with CWD: this type of information is often available on the province or state Web site, which are listed. The information summarised here attempts to reveal local issues related to potential economic impacts. Each subsection in this appendix begins with the names and contact information of the individuals who participated in our survey. Please note that the statements and assertions in the following summaries are largely based on verbal comments during telephone interviews. Because we have not attempted to verify some of this information, the assessment of conditions in the different states and provinces may be based on the subjective interpretations of the individuals interviewed.

If applicable, the CWD testing results from each locale are presented. Individual comments are then summarised.

A.1 Recent U.S. Federal Actions

The fiscal year 2004 U.S. Department of the Interior (USDOI) budget passed by the U.S. Congress included $4.2 million for CWD research allocated to the U.S. Geological Survey (USGS). This is a $1 million increase over the $3.2 million appropriation in 2003, and the budget includes a specified appropriation of $250,000 to establish a wildlife disease centre in Wisconsin. The USGS will utilise the funding to study the transmission pathways of the disease, as well as outbreak patterns and the disease's possible associations with landscape features.

The USDA's Animal and Plant Health Inspection Service (APHIS) published a proposed rule in the November 4, 2003, *Federal Register* titled "Bovine Spongiform Encephalopathy; Minimal Risk Regions and Importation of Commodities" related to the ruminant ban from Canada and other areas.

Region 8 of the U.S. Environmental Protection Agency established a panel of experts to establish recommendations for the disposal of deer and elk tissue infected with CWD (Nebraska Game and Parks, 2003).

A.2 Ontario

Ontario Ministry of Agriculture and Food

Web site: http://www.gov.on.ca/OMAF

- David Alves, Manager, Veterinary Science, OMAF, David.Alves@omaf.gov.on.ca
- Brian Tapscott, Alternative Livestock Specialist, OMAF, brian.tapscott@omaf.gov.on.ca.

Ontario Ministry of Natural Resources

Web site: http://www.mnr.gov.on.ca.

- Jennifer Backler, Resource Economist, OMNR, jennifer.backler@mnr.gov.on.ca
- Karen Laws, Wildlife Policy & Program Specialist, OMNR, karen.laws@mnr.gov.on.ca
- Barry Radford, Senior Communications Advisor/Planner, OMNR, (705) 755-1357, barry.radford@mnr.gov.on.ca.

	Tested positive for CWD in:			Number of deer/elk farms (2002)	CWD tier classification	Big game hunting days
	Wild deer	Wild elk	Captive elk or deer			
Ontario				388	3	3,143,032

A.3 Saskatchewan

Saskatchewan Environment and Resource

Web site: http://www.agr.gov.sk.ca/docs/livestock/elk_and_deer/herd_health/chronicwastingdisease.asp

- Dennis Sherratt, Director, Wildlife Branch, Saskatchewan Natural Resources, 3211 Albert Street, Regina, Saskatchewan S4S 5W6 Canada, (306) 787-2314
- Joe Warbeck, (306) 787-2464, jwarbeck@serm.gov.sk.ca.

	Tested positive for CWD in:			Number of deer/elk farms (2002)	CWD tier classification	Big game hunting days
	Wild deer	Wild elk	Captive elk or deer			
Saskatchewan	✓		✓	610	1	438,968

Wild: CWD has been detected in both free-roaming and captive cervids in Saskatchewan. Significant impacts on hunting levels have not yet been observed. However, there have been impacts from land use accessibility, which has been altered by CWD control programs. Three "herd reduction areas" have been established in a 4-mile radius around the centre point where contaminated free-roaming animals were found. Within the herd reduction areas, hunting is encouraged and licences are free in an attempt to eliminate herd populations. Four high-priority areas have also been established, which are bigger areas encompassing prime mule deer and white-tailed deer habitat near previously highly contaminated game farms. In the high- priority areas, hunting is also encouraged by allocating free hunting licences to hunters (and hunters are expected to submit samples of their kills for testing for CWD), in an attempt to detect the presence and prevalence of CWD in the wild. Deer samples are also accepted from other areas in the province to determine if CWD exists elsewhere in the province. Local businesses near these managed areas are experiencing somewhat of an economic boost with increased visitation to the area. At this time there is no evidence that the presence of CWD in wild cervids has any adverse impact on the outfitting industry in northern Saskatchewan. Saskatchewan Environment, which is responsible for free-roaming animals, shares testing costs with Saskatchewan Agriculture, Food and Rural Revitalization (SAFRR) for testing free-roaming cervids. For each test, Saskatchewan Environment pays $23 and SAFRR contributes $40. Testing is conducted at the University of Saskatchewan. In 2002, Saskatchewan Environment spent approximately $200,000 on the CWD program.

Captive: As described above, four high-priority areas were established. These are areas encompassing prime mule deer and white-tailed deer habitat near previously highly contaminated game farms, as identified by the CFIA. The CFIA is responsible for testing game farm animals.

A.4 Alberta

Alberta Fish and Wildlife Division

Web site: http://www3.gov.ab.ca/srd/fw/diseases/

- Ken Ambrock, Director, Fish and Wildlife Management Division, Natural Resources Service, Alberta Environment, Main Floor, South Petroleum Plaza, 9915-108 Street, Edmonton ALB T5K 2G8 Canada, (877) 944-0313
- Margo Pybus, Alberta Fish and Game, (780) 427-3462.

	Tested positive for CWD in:			Number of deer/elk farms (2002)	CWD tier classification	Big game hunting days
	Wild deer	Wild elk	Captive elk or deer			
Alberta			✓	858	2	811,742

Wild: In the fall of both 2000 and 2001, surveillance of wild elk and deer was conducted along Alberta's eastern border, and more than 600 animals tested negative. CWD has never been detected in wild elk and deer in Alberta (Government of Alberta, 2002). The number of hunting licences in Alberta has increased over the last few years. Any change in this trend may not capture the potential impact of CWD until 2003 hunting data are available. Hunters are concerned about CWD risks and might be hunting more moose, but this has not been documented. Notices were sent to hunters in some areas asking them to submit heads for testing. Costs in the wildlife branch — including staff time — were estimated at $500,000 for 2002.

Captive: Game farmers in Alberta are facing many serious challenges: drought, lack of pasture, lack of hay, and market affects from CWD (Korea no longer purchasing Canadian antler velvet). In addition, their meat market was never really established. The detection of BSE in one cow in May 2003 led to the closure of U.S. markets for live beef, dairy, and all ruminants (including deer/elk) and their products. Consequently, Alberta has not been able to market deer and elk and their products in the United States for some time. Alberta has had a moratorium on importing game farm cervids since 1988 in recognition of disease and parasite risk, but the province has allowed limited imports under restrictive protocols following rigorous risk assessments. Alberta

has also had a voluntary CWD surveillance program since October 1996. In 2002 Alberta announced the implementation of a mandatory CWD surveillance program. Elk and deer farmers are required to submit for CWD testing the heads from all farmed animals over 1 year of age that die or are slaughtered. As of December 31, 2002, testing of more than 9,114 wild and farmed elk and deer had detected only two cases of CWD in Alberta. For the cervid farming sector, $750,000 was spent just for the diagnostics surveillance program.

A.5 Colorado

CDOW, Ft. Collins, (970) 472-4300

Web site: http://wildlife.state.co.us/CWD/index.asp

- Wayne Cunningham, State Veterinarian, (303) 239-4162
- Lee Lamb, USGS Biological Resources Discipline (BRD), Ft. Collins, (970) 226-9314
- Ray Christianson, Colorado Farm Bureau, (303) 749-7500
- Ron Walker, President of the Colorado Elk Breeders Association and President of the North American Elk Breeders Association, (719) 372-6872
- Dr. Barb Powers, Colorado State University, Diagnostic Lab Veterinarian, (970) 491-1281
- Tyler Baskfield, Public Information Specialist, CDOW, (303) 291-7468
- Mike Miller, Doctor of Veterinary Medicine, CDOW, (970) 472-4300
- Sandy Snider, Colorado Wool Growers Association, Executive Director, (303) 431-8310
- Dr. Marvin Hamann, Colorado Cattlemen's Association, Veterinarian, (303) 431-6422
- Barb Wilkenson and Benji Lemon, Colorado Cattlefeeders Association, (303) 457-2232
- Dr. Liz Chandler, Colorado Elk and Game Breeders Association, Veterinarian, (970) 984-3269
- Dr. Leesa McCue, Colorado Veterinary Medical Association, Veterinarian, (719) 775-9773

- John Pape, Colorado Department of Public Health and Environment, Epidemiologist, (303) 692-2628
- Kathy Green, CWD Disease Coordinator, (303) 291-7275
- Todd Molmsburey, CDOW Media, (303) 291-7410
- Colorado Wildlife Federation, (303) 987-0400.

	Tested positive for CWD in:			Number of deer/elk farms (2002)	CWD tier classification	Big game hunting days
	Wild deer	Wild elk	Captive elk or deer			
Colorado	✓	✓	✓	835	1	1,634,000

Wild: CWD was first detected in Colorado in the late 1970s. The state has not noticed a decrease in hunting in 2002, and state representatives report that it is partly because a strong testing system is in place and animals are tested with a rapid turnaround time. Exhibit A.1 shows the temporal trend of deer and elk hunters from 1949 through 2000. A simple statistical analysis of deer and elk hunter numbers did not indicate a significant change for either deer or elk hunters following the detection of CWD.

A 5-hour CWD test has been made and the testing kit costs around US$15. CDOW does free sampling for hunters and the agency spent more than US$2 million in 2002 for that service. In 2003, CDOW will spend more than US$3 million on the service. Colorado also refunds the price of meat processing if the test comes out positive.

To dilute CWD effects, the state recommends having a state-of-the-art testing system in place and having the agency that issues licences or controls hunting conduct an in-depth media campaign to explain all effects. Colorado sent letters to all people with tags where the disease was known to exist, along with literature on CWD, literature on how to process game, and other educational materials to minimise the scare factor.

CDOW reports that an additional 208 animals have tested positive for CWD as a result of the 2003 hunting season surveillance. Hunters submitted more than 15,000 animals for testing. The breakdown of positive results is 173 mule deer, 9 white-tailed deer, and 26 elk. As expected, most detections occurred in game management units (GMUs) where the disease was previously detected. However, cases were detected in nine new GMUs, and one new deer data analysis unit (DAU).

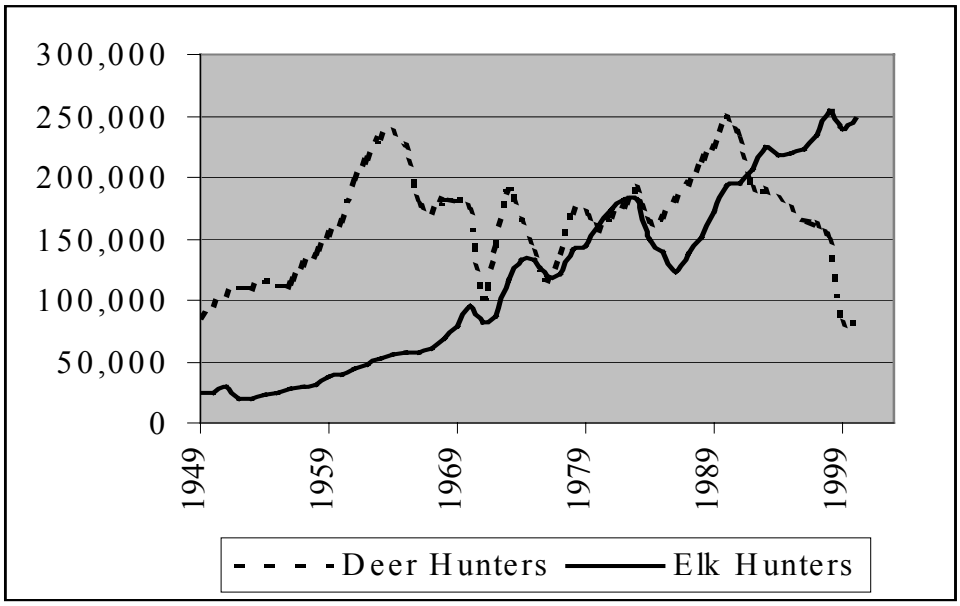

Exhibit A.1. Colorado deer and elk hunters by year: 1949-2000.

Source: Colorado Division of Wildlife, 2001.

Captive: Many other states have strict regulations that Colorado producers' deer and elk cannot comply with and this has had a significant economic impact in Colorado. Colorado has restrictions on their imports as well — the state requires proof of 5 years of CWD-free status. In addition, all imports must meet Colorado's requirements for maintaining inventory, reporting of sales and deaths, and submissions for CWD examinations. In 2002, Colorado expanded fencing requirements to a double barrier, including electric fences. The costs of meeting these requirements are very difficult on those farms that are already facing difficult economic times, and Colorado herds have been reduced by about 35% accordingly. Colorado has a mandatory surveillance program for all mortalities of 15 months or older.

Farmed populations went from a high of around 16,000 in 2001 to below 10,000 in 2003 because of the depopulation of herds that were not affected in the endemic areas in the northeast portion of the state. The USDA provided Colorado elk farmers with compensation based on the class of animal and age of animal. The average compensation was around US$1,850 per animal. Colorado also has a mandatory reporting of sales and death to monitor the movement of animals in and out of facilities. The state is also considering controlling water drainage to public lands. Many facilities have gone out of business without compensation and have sent their animals to slaughter or paid $250 per animal to have individual or small groups of animals removed.

Although these were outside the endemic area and were not infected, public perception and market conditions were such that the farmers could not sell their stock or afford to feed them.

A.6 Illinois

Illinois DNR

Web site: http://dnr.state.il.us/pubaffairs/2002/CWD.htm

- Illinois DNR, (217) 782-6302
- Craig Miller, Illinois craigm@imhs.uiuc.edu.

	Tested positive for CWD in:			Number of deer/elk farms (2002)	CWD tier classification	Big game hunting days
	Wild deer	Wild elk	Captive elk or deer			
Illinois	✓			500	1	3,274,000

Wild: A study by Miller et al. (2003) examined Illinois deer hunters' attitudes toward and understanding of CWD in white-tailed deer. The study found that 5% of hunters can be expected to drop out of deer hunting if CWD is found in the county next to or in the county where they hunt. The authors stated that the Illinois DNR has been reluctant to come out with statements about CWD for fear of causing panic. The report also shows that hunters are concerned about several disease-related issues (e.g., West Nile encephalitis and Lyme disease).

A.7 Michigan

Michigan DNR, (517) 373-2329; Wildlife Division (517) 373-1263

Web site: http://www.michigan.gov/dnr/1,1607,7-153-10370_12150-29070--,00.html

- Betsey Clark, Michigan DNR CWD Task Force, (517) 335-1185.

	Tested positive for CWD in:			Number of deer/elk farms (2002)	CWD tier classification	Big game hunting days
	Wild deer	Wild elk	Captive elk or deer			
Michigan				980	2	6,532,000

A.8 Minnesota

Minnesota DNR

Web site: http://www.dnr.state.mn.us/mammals/deer/cwd/index.html

- Mike Don Carlos, Minnesota DNR, (651) 296-6157.

	Tested positive for CWD in:			Number of deer/elk farms (2002)	CWD tier classification	Big game hunting days
	Wild deer	Wild elk	Captive elk or deer			
Minnesota			✓	370	2	4,869,000

Wild: There was a less than 5% decrease in deer hunters in Minnesota during 2002/2003, and it is believed that CWD is only one of the reasons for the decline. However, licence sales were at an all-time high because second-deer tags were made available.

In 2002 the Minnesota DNR collected approximately 5,000 samples after finding CWD in elk on two game farms. Tests in 2002 failed to detect CWD in the free-roaming population of deer. More than 400 DNR employees and volunteers collected samples at 135 check stations in the northwest, northeast, east-central, and west-central regions of the state. The agency indicated that it hopes to collect 13,000 deer for CWD testing during the 2003 hunting season. As an incentive, hunters who submitted their deer for testing during the Fall of 2003 had a chance to win one of about 20 rifles, shotguns, bows, and muzzleloaders donated by the Minnesota Deer Hunters Association, the Bluffland Whitetails Association, and various outdoor stores.

Captive: The Minnesota legislature made some changes that had significant impacts on farming. A report to the legislature on CWD is being prepared for early 2004, and this report will include details and dollar amounts related to CWD impacts. The state government of Minnesota estimates that almost US$1 million was spent on CWD last year for activities and items including surveillance, staffing, purchase of an incinerator (US$70,000), and a media program including a half-hour television show. The Minnesota Board of Animal Health is now the sole regulator of CWD in captive cervids.

A.9 Montana

Montana Department of Fish, Wildlife and Parks

Web site: http://www.fwp.state.mt.us/hunting/cwd.asp

- Tim Feldner, (406) 444-2535.

	Tested positive for CWD in:			Number of deer/elk farms (2002)	CWD tier classification	Big game hunting days
	Wild deer	Wild elk	Captive elk or deer			
Montana			✓	77	2	1,797,000

Wild: Montana has not detected CWD impacts on hunting, but the state has not yet found CWD in the wild.

Captive: There are approximately 80 game farms in Montana. Although some of these are hobbyists who simply enjoy owning elk but do not rely on them financially, a larger percentage has elk as a means to diversify their agricultural operations for potential income opportunities. Of the 83 licensed facilities in Montana in 2000, fewer than 10 relied on the fee for shooting the captive elk as the major part of their business.[1] CWD was detected on a Montana game farm in 1999.

All game farm animals over 16 months of age that die on game farms must be tested for CWD. By the summer of 2003, 3,000 farm animals had been tested since testing began in 1999 and all were negative for CWD (with the exception of the one game farm, where 9 CWD-positive animals out of 85 were diagnosed). Farmers in Montana have been economically affected by CWD. These impacts have been felt in part because most states have requirements stating that imported animals must come from a CWD program where animals have tested CWD-free for at least 5 years. Not many Montana farms have had an active CWD surveillance program for 5 years. The Korean ban on the import of velvet antlers in 2000 and the decrease in the number of new game farms being established have resulted in a drop in the market for elk and elk products.

1. It needs to be clarified whether these figures represent the pre-legislation scenario discussed in the following paragraphs.

In Montana, CWD was one driving force behind legislation passed in 2000. That legislation prohibited the issuance of new game farm licences in Montana, prohibited the transfer of existing farm licences, and prohibited the shooting of captive cervids (this was more because of hunter ethics than CWD concerns). These regulations have reduced the market for the sale of breeding stock to newly established facilities, which compounds the effect of market reduction resulting from interstate transport restrictions.

The Montana government has incurred large costs in controlling CWD. Testing began in 1996, and has become more intense since 1999 (3,000 samples have been tested since 1999). Montana has also incurred costs for depopulation efforts — in 1999, 85 animals were depopulated at a total cost of approximately $70,000. Overall, Montana has spent close to US$1 million on CWD management through mid-2003. In addition, the state government is considering purchasing an incinerator.

A.10 Nebraska

Nebraska Game and Parks Commission, Wildlife Division

Web site: http://www.ngpc.state.ne.us/wildlife/cwd/cwdinfo.html

- Bruce Morrison, Nebraska Game and Parks Commission, (402) 471-5430.

	Tested positive for CWD in:			Number of deer/elk farms (2002)	CWD tier classification	Big game hunting days
	Wild deer	Wild elk	Captive elk or deer			
Nebraska	✓		✓	97	1	763,000

Wild: Nebraska has been monitoring for CWD since 1997, but it was not detected until 2000. In the CWD area, deer permit sales were down approximately 9% in 2002, but state-wide deer permit sales were similar with sales from the previous years. In the past year, the Game and Parks Commission has undertaken two culling operations to assess the presence of the disease in Nebraska. In 2001, the commission's staff, after learning that a mule deer taken in Kimball County in the 2000 hunting season had tested positive for the disease, began a culling operation in Kimball County. Of 104 deer taken in that operation, one tested positive, bringing to two the number of wild deer in Nebraska testing positive — both in the extreme southwestern panhandle. Two additional deer taken in Kimball and Cheyenne counties during the 2001 hunting season tested positive for CWD. The University of Nebraska is researching movements of deer in CWD area to see how the social behaviour of deer affects the spread of the disease. CWD-related costs in 2002 and 2003 were approximately $500,000/year. Hunting regulations in the areas where

CWD has been found in wild populations have been liberalised to allow the sporting public to assist in the control of this disease. The commission is working with several other states, some federal agencies, and private non-governmental conservation organisations to develop a regional management plan for CWD and to encourage the U.S. Congress to allocate additional funding for research and monitoring. The commission is also cooperating with the USDA's Agricultural Research Service in research efforts to answer some of the questions about CWD.

Captive: The Nebraska Department of Agriculture regulates captive cervid farms. Sixteen captive cervid operations in Nebraska's panhandle were depopulated in 2002.

A.11 New Mexico

New Mexico Department of Game and Fish

Web site: http://www.gmfsh.state.nm.us/PageMill_TExt/Hunting/cwd.html

- Kerry Mower, New Mexico Department of Game and Fish, (505) 476-8080.

	Tested positive for CWD in:			Number of deer/elk farms (2002)	CWD tier classification	Big game hunting days
	Wild deer	Wild elk	Captive elk or deer			
New Mexico	✓			22	1	711,000

Wild: New Mexico has been watching for CWD for several years. Two deer tested positive for CWD in January 2003 during the muzzleloader hunt in the Organ Mountains; a total of six deer from the White Sands Missile Range area have tested positive since spring 2002. CWD was first documented in New Mexico in June 2002 in a wild deer at the missile range. Department biologists stepped up testing and surveillance of the disease following that incident, focusing on deer but testing elk tissues as well. No cases of CWD in *elk* have been documented in New Mexico to date (New Mexico Department of Game and Fish, 2003a).

The 2002 hunting season was the first during which the general public had an awareness of CWD, but New Mexico did not observe any significant decrease in the number of deer and elk hunting licences purchased. New Mexico has experienced a slight but steady decrease in overall numbers of hunters during the past 20 years, which is attributed to a cultural shift in which young people are not introduced to hunting and not raised in hunting families. New Mexico has only 1 year of hunting data since its discovery of CWD. When more years of data are generated, the state plans to examine the data to separate CWD impacts from the cultural shift.

Because some counties rely heavily on hunting in New Mexico, CWD has the potential to hurt the state's rural economies. U.S. Army officials are concerned because CWD occurs on Army land in a high-security area with housing units located among the deer carrying CWD. The Army is sharing some costs with the Department of Game and Fish, the New Mexico Livestock Board, and the USDA in Albuquerque.

New Mexico has monitoring and surveillance programs in place. In 2002, about 800 deer and elk were tested at a cost of about $150,000. The state is now working on a USDA grant for surveillance and monitoring. Because there is no state compensation program, all costs so far have been at the expense of other programs. No programs for disposal exist and carcasses are disposed of in the field. A few carcasses considered to be high risk have been taken to a laboratory in Albuquerque. Disposal and incineration is a top priority for new funds. Other agency programs are getting less funding because of funding for CWD.

Captive: CWD is having a severe impact on New Mexico elk producers. The state's 22 elk ranches are suffering because they are unable to import animals since the agency director declared a moratorium on importation. In 2003, the New Mexico Department of Game and Fish modified its ban on importing captive cervids. The new ban permits animals to be imported from areas where CWD has not occurred and only from facilities that have been testing all deaths for a period of 60 months. In 2003 elk producers are entering the third season without importing, which is considered a significant hardship. The fees for applying to import cervids have been substantially increased to cover the costs of research into CWD history of the proposed animals.

A.12 North Dakota

North Dakota Game and Fish Department

Web site: http://www.state.nd.us/gnf/info/cwd-q-and-a.html

- Bill Jensen, Game and Fish, (701) 328-6300
- Bruce Stillions, (701) 227-7431
- Roger Johnson, (701) 662-3671
- Jackie Ermer, (701) 654-7475 x 42.

	Tested positive for CWD in:			Number of deer/elk farms (2002)	CWD tier classification	Big game hunting days
	Wild deer	Wild elk	Captive elk or deer			
North Dakota				112	2	574,000

Wild: North Dakota does not have CWD and has not experienced any CWD impact on hunting. Hunters had concern in 2002 about CWD resulting mostly from inaccurate media coverage; however, a record number of deer licences were sold. Although North Dakota has not yet surveyed hunters about their responses to CWD, the state will be participating in a survey with several other states later in 2003/2004. North Dakota has conducted targeted surveillance since 1996 but just started hunter-harvested surveillance in 2002. Sampling started on a small scale. In 2003, the state plans to sample 1,500 deer with the aid of USDA money along with some state money. At this point, money is coming from new revenue sources but the state may have to use funds intended for other programs or emergency funding if it becomes necessary.

Captive: The farming industry has had 5 years of mandatory surveillance where all deer and elk mortalities have been tested. The agency is trying to educate the public and is developing a media program of brochures and information available on the Internet.

A.13 Oklahoma

Oklahoma Department of Wildlife Conservation (ODWC)

Web site: http://www.wildlifedepartment.com/cwd.htm

- Mike Shell, ODWC, (405) 521-2739.

	Tested positive for CWD in:			Number of deer/elk farms (2002)	CWD tier classification	Big game hunting days
	Wild deer	Wild elk	Captive elk or deer			
Oklahoma			✓	142	2	3,465,000

Wild: ODWC has been monitoring wild deer and elk since 1999, and the department collected more than 1,000 heads in 2002, all of which tested negative for CWD. No hunting impacts have been noticed. There was a slight decrease in licences sold last year but this was likely because hunters had purchased lifetime licences in previous years. ODWC cooperates on CWD with the Oklahoma Department of Agriculture, the USDA, and the State Department of Health. The agency does not have many costs aside from the personnel time for collecting heads, because the USDA pays the testing fees. This year the state received an USDA grant to cover the cost of CWD testing for up to 2,000 deer. ODWC developed a response plan, modelled after the plan developed and approved by the state of Texas. The plan includes a heavy information education component. ODWC communicates through magazines, its Web site, and news shows. The state has not yet mailed anything to hunters, but a handout is available at the check stations. A recent

survey showed the total economic impact from deer hunting in Oklahoma exceeded $600 million annually (ODWC, 2003).

Captive: In June 1998 CWD was diagnosed in a captive elk in Oklahoma. From 1996 to 1998, the Oklahoma herd received more than 80 elk from commercial sources in Montana and Idaho but the ranch had not dispersed animals to other places [Southeastern Cooperative Wildlife Disease Study (SCWDS), 1998].

A.14 South Dakota

South Dakota Department of Game, Fish and Parks (GFP)

Web site: http://www.state.sd.us/gfp/divisionwildlife/hunting/BigGame/CWD.htm

- Mike Kintigh, Steve Griffin, South Dakota GFP, (605) 773-3381, Animal Industry Board, (605) 773-3321
- Larry Gilotti, South Dakota, (605) 773-3381.

	Tested positive for CWD in:			Number of deer/elk farms (2002)	CWD tier classification	Big game hunting days
	Wild deer	Wild elk	Captive elk or deer			
South Dakota	✓	✓	✓	73	1	534,000

Wild: Beginning in 1997, GFP has conducted extensive efforts to determine if CWD was present in free-ranging deer and elk populations in the state. South Dakota has had a surveillance program in place since 1997 and recently received a USDA grant for $171,000. As of July 2003, a total of 3,859 wild deer and elk have been tested for CWD in South Dakota and 1 elk and 12 deer were found to have the disease. Joint management strategies for CWD are aimed at intensified surveillance to determine to what degree CWD occurs in free-roaming animals. GFP, in cooperation with South Dakota State University and Wind Cave National Park, tested hunter-harvested animals, road-killed animals, sick animals, and research animals starting in 1997. Emphasis was placed on testing elk and deer from areas near previously quarantined CWD private elk herd sites. Currently, GFP is evaluating strategies to increase the harvest of antler-less deer. CWD may work against this goal. The purpose of a survey given to deer hunters in 2002 was to determine how concerned hunters are about CWD given the low infection rate in South Dakota deer and elk populations and what impact CWD might have on future hunting behaviour. About 4% of the hunters said they would quit hunting if just one CWD-positive deer were found in their unit. If the CWD infection rate increases, GFP expects some changes in hunter

behaviour. Most hunters will continue to hunt but may be less inclined to harvest antler-less deer. The GFP may implement a CWD-testing process to maintain adequate harvest levels of antler-less deer under a scenario of higher CWD infection rates. Also, maintaining a high level of information to the hunters will help keep their levels of concern and worry at a level appropriate to the situation (South Dakota GFP, 2003). In addition GFP is undertaking a regional modelling study of hunter behaviour at a cost of $17,864 for 2003.

Captive: In South Dakota, CWD was first discovered in seven private captive elk herds during the winter of 1997-1998. The Animal Industry Board (AIB) established specific requirements after CWD was first diagnosed in these herds to prevent further introductions or recurrences in such herds. All captive herds that were infected or exposed have been depopulated, and a mandatory cervidae (deer and elk) CWD surveillance and control program for captive cervids has been implemented.

A.15 Utah

Utah Division of Wildlife Resources (DWR)

Web site: http://www.wildlife.utah.gov/hunting/biggame/cwd/

- Leslie McFarland, Utah DWR, (801) 560-4461.

	Tested positive for CWD in:			Number of deer/elk farms (2002)	CWD tier classification	Big game hunting days
	Wild deer	Wild elk	Captive elk or deer			
Utah	✓			0	1	1,252,000

Wild: The Utah DWR first began looking for CWD in 1998. Utah has detected two cases of CWD (in wild deer) to date, but agency representatives have not noticed a reduction in hunting. Utah will spend $58,000 in 2003 on monitoring. During the 2003 fall archery, muzzleloader, and rifle hunts, DWR staff collected 3,072 samples on 17 hunting units across Utah. Two deer sampled during the archery hunt tested positive for CWD. None of the deer sampled during the muzzleloader hunt tested positive. The latest finds bring to six the number of wild deer that have tested positive for CWD since the disease was first found in Utah in February 2003 (Utah DWR, 2003a). There is considerable concern that CWD will spread into additional Utah deer and elk populations. The Utah DWR will conduct random samplings of harvested deer and elk to check for the disease. The division is also considering implementing additional measures to inhibit the spread of the disease.

The Utah DWR has also taken measures to prohibit the import of deer and elk carcasses from known infection areas. The DWR has implemented an aggressive surveillance plan to target deer in specific units throughout the state. Testing strategies target deer and not elk, although the DWR will test any deer or elk exhibiting clinical symptoms of CWD. Hunters who harvest a deer outside of a CWD sampling unit and wish to have their deer or elk tested may do so at a cost of $25 by providing the head to the Utah State University Diagnostic Lab in Logan, Utah (Utah DWR, 2003b).

A.16 Wisconsin

Wisconsin DNR

Web site: http://www.dnr.state.wi.us/org/land/wildlife/whealth/issues/cwd/

- Jordan Petchenik, Wisconsin DNR, (608) 266-8523
- Paul Holtan, Editor of *WI DNR News*, Wisconsin DNR, PO Box 7921, Madison WI 53707, (608) 267-7517, paul.holtan@dnr.state.wi.us.

	Tested positive for CWD in:			Number of deer/elk farms (2002)	CWD tier classification	Big game hunting days
	Wild deer	Wild elk	Captive elk or deer			
Wisconsin	✓		✓	950	1	7,505,000

Wild and captive: Wisconsin passed a state budget that provides $3 million additional money for CWD for the next 2 years. Additional funds were allocated for managing and regulating deer farms. Wisconsin experienced a 10% drop in hunting licences from 2001 to 2002 but Wisconsin DNR representatives did not expect it to be as bad in 2003. Exhibit A.2 shows licence sales, revenues, and changes from 2001 to 2002. The state lost about US$2.9 million in licence revenues compared to the year before with more than one-third of this decrease coming from revenues generated by out-of-state hunters. The Wisconsin DNR reallocated US$12 million, which is almost half of the total wildlife budget, to fight CWD.

The Wisconsin DNR indicates that it has implemented a significant educational campaign to help people understand what steps Wisconsin is taking to manage CWD. In addition, the department did a little promoting of hunting in 2003. The Wisconsin DNR hired a person to do public affairs on CWD, but has not put more money into media. The Wisconsin DNR also prepared an environmental impact statement on CWD. Wisconsin has established special zones around areas where CWD

Exhibit A.2. Wisconsin licence sales, revenues, and changes from 2001 to 2002

Licence type	2002	2001	Change	Percent change	Change revenue ($)	Licence fee ($)
Resident patron	81,895	81,189	706	0.9	77,660.00	110.00
Resident sports	75,122	87,335	-12,213	-14.0	(525,159.00)	43.00
Resident gun	428,724	470,399	-41,675	-8.9	(833,500.00)	20.00
Resident archery	137,482	168,172	-30,690	-18.2	(613,800.00)	20.00
Non-resident patron	38	24	14	58.3	8,050.00	575.00
Non-resident sports	277	251	26	10.4	6,240.00	240.00
Non-resident gun	32,889	40,606	-7,717	-19.0	(1,041,795.00)	135.00
Non-resident archery	8,510	8,404	106	1.3	14,310.00	135.00
Totals	**764,937**	**856,380**	**-91,443**	**-10.7**	**(2,907,994.00)**	
Gun only	618,945	679,804	-60,859	-9.0		
Bow only	145,992	176,576	-30,584	-17.3		

Source: Thomas A. Heberlein, University of Wisconsin-Madison, personal communication, August 19, 2003.

has been detected in an effort to harvest more deer and reduce the prevalence of the disease. Two zones were established with different population and harvest goals for each. The Intensive Harvest Zone (IHZ) was placed around the area where deer were most likely to have CWD. The goal in this area is to reduce the population to zero. The Management Zone (MZ) is a buffer area placed around the IHZ. The goal in this area is to reduce the population to 10 deer per square mile.

A.17 Wyoming

Wyoming Game and Fish Department (307) 777-4600

Web site: http://gf.state.wy.us/services/education/cwd/index.asp

- Terry Kreeger, Veterinarian Services Supervisor, Wyoming Game and Fish, (307) 322-2571
- Dr. Beth Williams, Pathologist, University of Wyoming, (307) 742-6638
- Dr. James Logan, State Veterinarian, Wyoming Department of Agriculture, (307) 777-7515
- Larry Kruckenberg, Game and Fish Department, Special Assistant for Policy, 307-777-4539.

	Tested positive for CWD in:			Number of deer/elk farms (2002)	CWD tier classification	Big game hunting days
	Wild deer	Wild elk	Captive elk or deer			
Wyoming	✓	✓		1	1	1,001,000

Wild: Efforts in Wyoming related to CWD have generally focussed on understanding the disease in order to manage it. Wyoming Game and Fish Department (WGFD) is now taking some action to stop the spread by identifying new areas (other than the endemic area), where several more deer/elk (20-40) will be removed. If some of these are positive for CWD, the department will probably remove even more animals in an attempt to eradicate CWD in this particular locale or "hot spot." Wyoming has a state-wide voluntary testing by the Wyoming State Veterinary Laboratory. Wyoming Game and Fish collected and tested 2,200 deer and elk in 2002, and in 2003 will collect and test up to 6,000 cervids. The majority of tests are free to the public at check stations and meat processors, but people can also pay to have their animals tested and have the results sent to them. Wyoming has increased the surveillance budget and does not have any compensation programs. In 2002, out of 1,775 deer and 775 elk that were tested, 105 deer and 5 elk tested positive.

Captive: Elk or deer ranching is no longer permitted in Wyoming. Wyoming has one remaining elk ranch that was in existence before legislation that banned game ranching was passed, and it was allowed to continue.

A.18 Washington

- Jeff Koenings, Washington Department of Fish and Wildlife, (360) 902-2225.

A.19 International Association of Fish and Wildlife Agencies

- Gary Taylor, (202) 624-7890.

A.20 Cost Estimate for Implementation of U.S. National CWD Plan

In 2002 a plan for assisting states, federal agencies, and tribes in managing CWD in wild and captive cervids was released to the public (NCPIC, 2002a). The plan was developed by a team of professionals in the fields of wildlife health, wildlife management, wildlife biology, and livestock health. It represents the most current scientific knowledge on CWD and delineates actions recommended to address the ongoing effort to identify the extent of the disease and the

management actions needed to limit its spread. In October 2002, an implementation document (NCPIC, 2002b) was developed to provide information that conveys who is responsible for individual projects, what projects will accomplish to help address CWD, the cost, and project time frames (NCPIC, 2002b). The following information is summary information of cost estimates by focus area and action item.

Communications

Action Item 1: Production of material.

Year 1: $50,000 (States)
Year 2: $25,000 (States)
Year 3: $25,000 (States)

Action Item 2: Events, training, and information distribution

Year 1: $30,000 ($5,000 states & $25,000 Department of the Interior (DOI) — National Conservation Training Center (NCTC)
Year 2: $30,000 ($5,000 states & $25,000 DOI - NCTC)
Year 3: $30,000 ($5,000 states & $25,000 DOI - NCTC)

Biennial CWD symposium

Year 1: $10,000 (To host state or tribal agency)
Year 2: $25,000 (To host state or tribal agency)
Year 3: $10,000 (To host state or tribal agency)

Scientific and technical information dissemination

Action item 1: Integrated information systems: Establish database to accommodate testing results as well as research, monitoring, and surveillance data from state, tribal, and federal agencies.

Year 1: $250,000 (DOI - USGS)
Year 2: $150,000 (DOI - USGS)
Year 3: $150,000 (DOI - USGS)

Develop a data import system to allow state, tribal, and federal agencies to enter their current and archival data.

Year 1: $200,000 (DOI - USGS)
Year 2: $200,000 (DOI - USGS)
Year 3: $300,000 (DOI - USGS)

Develop and/or provide resources for digitisation of location data for samples from both free-ranging and captive cervids that can be used with the system described above.

Year 1: $50,000 (States)
Year 2: $50,000 (States)
Year 3: $50,000 (States)

Maintain Web-based information system created in Action Item 1 above.

Year 1: $25,000 (DOI - USGS)
Year 2: $25,000 (DOI - USGS)
Year 3: $25,000 (DOI - USGS)

Diagnostics

Action item 1: Establish sufficient testing capacity.

Year 1: $1,500,000 [USDA - National Veterinary Service Laboratory (NVSL)]
Year 2: $600,000 (USDA - NVSL)
Year 3: $300,000 (USDA - NVSL)

Action item 3: Assure sample quality.

Year 1: $50,000 (DOI - NCTC).

Action item 4: Assist in validation and application of high-throughput screening tests.

Year 1: $100,000 (USDA - NVSL)
Year 2: $25,000 (USDA - NVSL)
Year 3: $25,000 (USDA - NVSL)

Disease management

Action item 1: Disease prevention: Entities without CWD should plan to prevent its introduction through movement restrictions.

Year 1: $25,000 (States)

B. Restrictions on baiting and feeding should be implemented.

Year 1: $25,000 (States)

Action item 2: Management techniques to eliminate, contain, and/or control CWD.

Year 1: $10,000,000 ($2,000,000 USDA - APHIS; $3,000,000 DOI; $5,000,000 States)
Year 2: $14,000,000 ($2,000,000 USDA - APHIS; $3,000,000 DOI; $9,000,000 States)
Year 3: $14,500,000 ($2,000,0000 USDA - APHIS; $3,000,000 DOI; $9,500,000 States)

Action item 4: Carcass disposal:

Year 1: $3,000,000 ($2,000,000 USDA - APHIS; $1,000,000 States)
Year 2: $1,000,000 (States)
Year 3: $500,000 (States)

Research

Action item 1: Improve existing diagnostic tests and develop a validated live animal test.

A. Develop tests that provide early detection of the disease.

Year 1: $2,000,000 (USDA - ARS)

B. Determine the feasibility of tests for environmental contamination.

Year 1: $2,000,000 (USDA - ARS)

Action item 2: Conduct research into the biology and pathology of CWD.

Year 1: $2,000,000 ($500,000 USDA-ARS; $700,000 DOI-USGS; $800,000 States)
Year 2: $2,000,000 ($500,000 USDA-ARS; $700,000 DOI-USGS; $800,000 States)
Year 3: $2,000,000 ($500,000 USDA-ARS; $700,000 DOI-USGS; $800,000 States)

Action item 3: Conduct research into disease management and host ecology.

For field epidemiological studies:

Year 1: $4,000,000 ($1,000,000 USDA-ARS; $2,000,000 DOI-USGS; $1,000,000 States)
Year 2: $5,000,000 ($1,000,000 USDA-ARS; $2,850,000 DOI-USGS; $1,150,000 States)
Year 3: $6,500,000 ($1,500,000 USDA-ARS; $3,000,000 DOI-USGS; $2,000,000 States)

For methods to inactivate CWD agent:

Year 1: $2,000,000 ($1,000,000 USDA-ARS; $1,000,000 States)
Year 2: $2,000,000 ($1,000,000 USDA-ARS; $1,000,000 States)
Year 3: $2,000,000 ($1,000,000 USDA-ARS; $1,000,000 States)

Action item 4: Conduct research into the human dimensions of CWD.

Year 1: $100,000 (States)
Year 2: $250,000 (States)
Year 3: $250,000 (States)

Surveillance

Action item 1: Determine best alternatives for sample collection and management and collection of samples.

A. Designing CWD surveillance programs

$20,000 has been funded by the USGS for the workshop.
$50,000 is needed by DOI-USGS to publish and distribute final products from the workshop.

B. Implementing CWD surveillance programs

Year 1: $14,850,000 ($2,000,000 USDA-APHIS; $1,500,000 DOI; $11,350,000 States)
Year 2: $10,000,000 ($1,000,000 USDA-APHIS; $2,000,000 DOI; $7,000,000 States)
Year 3: $5,000,000 ($1,000,000 USDA-APHIS; $2,000,000 DOI; $2,000,000 States)

Action item 2: Epidemiology

Year 1: $50,000 (States)
Year 2: $50,000 (States)
Year 3: $50,000 (States)

B. Annotated Bibliography

Bishop, R.C. 2003. The Economic Effects of Chronic Wasting Disease (CWD) in Wisconsin. University of Wisconsin — Madison. Agricultural and Applied Economics Staff Paper Series. Staff Paper No. 463. http://www.aae.wisc.edu/www/pub/sps/stpap463.pdf. Accessed December 22, 2003.

Type of study: Quantified estimation of economic impact of CWD on hunting in Wisconsin.

CWD details: Study examines economic impacts on hunting of CWD in deer in Wisconsin in 2002 and 2003. Both market and non-market impacts were estimated.

Description of study: The author applies the principles of benefits transfer to estimate market (hunting-related expenditures) and non-market (consumer's surplus) losses in Wisconsin from the spread of CWD to Wisconsin.

Conclusions/recommendations: From the point of view of the state as a whole, the author does not expect market losses to be large. Even though hunters have probably spent tens of million of dollars less on the sport, most hunters are Wisconsin residents and will simply spend the money elsewhere in the state. Bishop does emphasise that losses to rural areas could be important to them. He believes that the brunt of the economic impact of CWD in Wisconsin will fall on the deer hunters themselves in non-market impacts. Based on licence sales in 2002 and plausible assumptions, he estimates that those losses were probably in the $58 to $83 million range in 2002 and could be somewhat less in 2003, perhaps in the $30 to $53 million range.

Freeman, B. 2002. Colorado Elk Economic Impact Study. Carbondale, CO: Tangibles, LLC. March.

Type of study: Quantified estimation of the economic impact of the elk industry in Colorado.

CWD details: Study examines impacts of the elk industry in Colorado. The study uses IMPLAN to quantify the impacts.

Description of study: There were approximately 15,000 ranched elk in Colorado in 2001. Colorado's elk industry is the second largest in the United States, following Minnesota. Freeman ran various scenarios on the IMPLAN model and examined potential impacts, from changes in revenue from hunting and wildlife watching of elk to increased revenue percentages from meat production.

Conclusions/recommendations: The average annual elk industry output in the past 5 years is $18.9 million (including only direct effects and value added). Value added comprises four components: employee compensation, proprietary income, other property income, and indirect business taxes. The majority of the value-added payments (wages and profits) in Colorado are largely made to people who reside in the region, and have a large impact on the regional economy. For every dollar of output by the elk industry in Colorado, on average, an additional $0.65 is created, and for every dollar of value added, on average, a second dollar is created. The total output of the elk industry in Colorado, then, including all direct and indirect effects, is $30.65 million. Other non-quantified benefits include preserving natural landscapes (elk ranching maintains a landscape that is pleasing to residents and tourists); sustaining the ranching industry, which maintains a high quality of life for ranchers, retains 78% of the income in the Colorado economy, and deters urban sprawl (considered undesirable by many residents); preserving "open space," which reduces pollution; and supporting local veterinarians and their hospitals. In efforts to control the spread of CWD, Colorado elk ranchers have spent more than $6 million on fences and related materials in the past 5 years. The economic impacts of a change in revenue from hunting and wildlife watching of elk was predicted to be larger than an increase in revenue from increased meat production.

Gigliotti, L.M. 2002. Chronic Wasting Disease (CWD) — Public Opinion Survey. Pierre, SD: South Dakota Game, Fish and Parks. (Summarises Gigliotti 2003a, 2003b, and 2003c.)

Type of study: Quantified estimation of South Dakota hunters' perceptions of CWD and its risks.

CWD details: Study examines impacts of CWD presence in deer in South Dakota, given that there is a low rate of incidence. Hunters were surveyed in three regions: 1,776 hunters in the Black Hills (137 non-residents, 1,632 residents); 1,537 resident hunters in the West River region; and 1,781 resident hunters in the East River region. CWD has been found only in the West River region.

Description of study: Study reports hunters perceived risks and behaviour changes in response to CWD. No economic analysis or modelling of hunter behaviour was done.

Conclusions/recommendations: About 10% of Black Hills hunters, 7% of West River hunters, and 6% of East River hunters are "very" worried about CWD. An additional 53%, 49%, and 47%, respectively, are slightly or moderately worried about CWD. Concern would increase if one free-ranging CWD-positive deer were found in the area in which they normally hunt. If this were the case, the proportion of hunters who are very concerned would increase to 22%, 22%, and 25% for the Black Hills, West River, and East River regions, respectively, and the proportion slightly or moderately worried would increase to 59%, 62%, and 61%, respectively. Along with an increase in concern would come a change in behaviour — about 4% of all hunters would stop hunting in the area, 7% would hunt but not eat the meat, and 46% would hunt but

have the deer tested before eating the meat. Only about 30% would make no behavioural change. This risk-averting behaviour would increase as the number of CWD-positive deer increased. If 1% of deer in the area were found to be CWD positive, 6% would stop hunting, 10% would stop eating the meat, and 52% would have the meat tested first. If 5% of deer in the area were found to be CWD positive, 15% would stop hunting, 14% would stop eating the meat, and 51% would have the meat tested first.

Horan, R.D. and C. Wolf. 2003. The Economics of Managing Wildlife Disease. East Lansing, MI: Department of Agricultural Economics, Michigan State University. July 9.

Type of study: Formulation of a general model of wildlife growth and disease transmission applied to the case of bovine TB among white-tailed deer in Michigan.

CWD details (TB in this case): Because bovine TB is transmitted among and between white-tailed deer and dairy cows and captive cervids, the issue is an important concern in Michigan for its potential impact on livestock populations and productivity. Bovine TB was responsible for more livestock deaths than all other diseases combined at the turn of last century. Moreover, the presence of bovine TB among Michigan farms may lead to stringent regulations and trade restrictions. The USDA awarded Michigan accredited TB-free status in 1979. This important accreditation prevents other states from imposing trade restrictions on Michigan livestock and livestock products. But in the early to mid-1990s, signs of bovine TB started to re-emerge both in the wild deer population and also among some small farms. In fact, Michigan is the only known area in North America where bovine TB has become established in a wildlife population.

Description of study: This paper represents a first step in understanding the economics of disease control in wildlife populations. The authors formulated a general model of wildlife growth and disease transmission and found that there are limitations to a harvesting strategy when harvests cannot be made selectively from the diseased population. Strategies to address disease prevalence must therefore focus on more than just the harvest, and can be particularly effective if they address disease transmission and mortality.

Conclusions/recommendations: From the study's numerical example of bovine TB in Michigan deer populations, the authors determined that eradication of the disease is not likely to be optimal. It takes too long for the disease to dissipate naturally once supplemental feeding is halted, which is not surprising considering that it took 62 years to eliminate the disease in cattle herds under much more controlled conditions. It is also too difficult and costly to kill all the deer in the infected area, as managers in Michigan are currently discovering. Instead, it is optimal for the disease to remain endemic in the area at very low levels, with intermittent investments (via supplemental feeding) in in situ deer productivity. Of course an endemic disease is not always optimal. If marginal damages, feeding costs, and disease mortality, or all three, are large enough, it may be optimal to delay feeding-induced productivity enhancements in favour of disease

eradication. Although the model was applied to the specific case of bovine TB in deer herds, the model and results are likely to be applicable to other wildlife disease problems — even those problems where supplemental feeding is not an issue. Supplemental feeding decisions in the model represent the easiest method of controlling disease transmission for the Michigan case, and the control of disease transmissions would likely be a part of any wildlife disease management strategy. For other diseases, alternative environmental variables could be manipulated in ways that reduce disease transmission, and it is reasonable to believe that such actions might result in trade-offs in in situ productivity (e.g., if contact is somehow reduced, fertility might also be expected to decline).

Menard, J., K. Jensen, and B.C. English. 2003. Projected Economic Impacts of Chronic Wasting Disease (CWD) Outbreak in Tennessee. Agri-Industry Modeling & Analysis Group Industry Brief. Knoxville, TN: Department of Agricultural Economics, University of Tennessee. http://web.utk.edu/~aimag/pubs/CWD.pdf. Accessed December 10, 2003.

Type of study: Study used an input-output model to estimate economic impacts of CWD, assuming hunter expenditures were decreased by 15%.

CWD details: CWD does not currently exist in Tennessee; study estimates potential impacts should Tennessee experience an outbreak.

Summary description of study: The study found that an outbreak of CWD in Tennessee would cause an estimated $46.3-million decline in direct total industry output and a loss of 892 jobs. When the direct effects are combined with effects from decreased purchases from supplying industries and service providers and effects from fewer expenditures with income losses, the total economic losses are estimated at $98.0 million and 1,459 jobs. The businesses most affected by this decline include service stations, retail stores, hotels and lodging places, eating and drinking establishments, real estate offices, food stores, wholesale traders, owner-occupied dwellings, banks, and state and local government agencies. These effects would accrue from less travel and fewer expenditures for food, lodging, equipment, supplies, and licences, and from the spill over effects of these declines on the general economy.

Conclusions/recommendations: Deer hunting occurs throughout rural areas in Tennessee. However, centres for deer hunting exist in western Tennessee. The top rankings for deer harvest are held in counties in the upper and lower areas of western Tennessee. Therefore, it is likely that unless the outbreak were limited to another area of the state, these areas would experience much of the declines in expenditures on deer hunting activities.

Miller, C.A., C.B. Colligan, and L.K. Campbell. 2003. Hunter Perceptions of Chronic Wasting Disease in Illinois. Human Dimensions Research Program, Illinois Natural History Survey, Illinois Department of Natural Resources June 30. http://www.inhs.uiuc.edu/cwe/hd/Reports/PDFs/Deer%20Hunter/handgun%20report%20final.pdf. Accessed December 22, 2003.

Type of study: Quantified estimation of Illinois hunters' perceptions of CWD and its risks.

CWD details: Study examines impacts of CWD presence in deer in Illinois. Mail surveys (3,500) were sent to a randomly selected sample of firearm, archery, and muzzleloader deer hunters in Illinois. Response rate was 79% (2,683 mail surveys returned). For analysis, the investigators grouped the hunters by the type of county in which they hunted: (1) a CWD county, (2) adjacent to a CWD county, (3) two counties removed from a CWD county, and (4) all others.

Description of study: This study reports on hunters' knowledge of CWD, their perceived risks, and behaviour changes in response to the disease. No economic analysis or modelling of hunter behaviour was done.

Conclusions/recommendations: Almost all hunters (96%) were aware of CWD in deer. Of these, 79% had heard of CWD in Wisconsin, 77% in Illinois, and 46% in other states. Only 15% of Illinois hunters felt they had a moderate or high risk of becoming ill from CWD, compared to 38% for Lyme disease, 34% for West Nile encephalitis, and 32% for having a heart attack while hunting. More hunters (12%) were "undecided" about the risk of CWD than other potential risks. Less than 20% of hunters thought that CWD posed a risk to deer only. CWD had little effect on hunter behaviour in Illinois in 2002; 82% of hunters hunted as usual, 9% hunted more, 5% hunted only healthy deer, 3% hunted less, and 1% hunted large bucks. A higher percentage of hunters in CWD counties (7%) reported hunting less because of CWD than in other counties. Most hunters (63%) did not anticipate changing hunting behaviours in the upcoming season. However, 21% reported that they would "check how the deer was acting," 15% would hunt in CWD-free areas, and about 2% would not hunt or hunt a different location.

Petchenik, J. 2003. Chronic Wasting Disease in Wisconsin and the 2002 Hunting Season: Gun Deer Hunters' First Response. Madison, WI: Bureau of Integrated Science Services, Wisconsin DNR. April.

Type of study: Quantified estimation of Wisconsin hunters' perceptions of CWD and its risks.

CWD details: Study examines impacts of CWD in deer in Wisconsin, given that the areas affected were not known before the survey was administered. Mail surveys were sent to 2,100 resident gun deer hunters, with a response rate of 68%.

Description of study: This study reported on hunters' perceived risks and behaviour changes in response to CWD. No economic analysis or modelling of hunter behaviour was done.

Conclusions/recommendations: If one free-ranging CWD-positive deer were found in the area they normally hunt, about 1% of all hunters would stop hunting in the area, 6% would hunt but not eat the meat, and 44% would hunt but have the deer tested before eating the meat. About 44% would make no behavioural change. This risk-averting behaviour would increase as the number of CWD-positive deer increased. If 1% of deer in the area were found to be CWD positive, 5% would stop hunting the area, 6% would stop eating the meat, and 52% would have the meat tested first. If 5% of deer in the area were found to be CWD positive, 15% would stop hunting the area, 11% would stop eating the meat, and 53% would have the meat tested first. If 20% of deer in the area were found to be CWD positive, 21% would stop hunting the area, 15% would stop eating the meat, and 41% would have the meat tested first. Only 10% would not change their hunting behaviour if 20% of the deer tested positive for CWD. Other results include the following:

One-third of hunters who chose not to hunt in 2002 gave a CWD-related reason for stopping. Of hunters who continued to hunt, 38% were somewhat or very concerned about CWD, 38% were somewhat or very concerned about Lyme disease, 50% were somewhat or very concerned about getting shot by a member of another hunting party, and 31% were somewhat or very concerned about getting shot by a member of their own party.

Few hunters would be concerned about eating venison if the animal tested negative for CWD (11% in CWD counties and 7% in non-CWD counties); some hunters would be concerned about eating venison if the animal was not tested for CWD (36% in CWD counties and 25% in non-CWD counties); and most hunters would be concerned about eating venison if the animal tested positive for CWD (72% in both CWD counties and non-CWD counties).

Almost all hunters (94%) continued to hunt in their traditional hunting areas, and most (90%) processed the deer they bagged for eating. Only 4% of CWD-county hunters disposed of the deer because of CWD and 1% did so in non-CWD counties.

Most hunters (68%) supported further monitoring of CWD in Wisconsin, but no proposals for reducing or eradicating herds were supported by a majority of hunters. Hunters would support a ban on deer baiting (64% in southern Wisconsin and 52% in the north).

Almost all hunters paid some or a lot of attention to news about CWD. About 44% think the DNR is giving the appropriate amount of attention to the issue, 33% think it is giving too much, and 6% think it is giving too little. The average "grade" given to the DNR by survey respondents for its CWD management was B/C.

Williams, E.S., M.W. Miller, T.J. Kreeger, R.H. Kahn, and E.T. Thorne. 2002. Chronic Wasting Disease of Deer and Elk: A Review with Recommendations for Management. *Journal of Wildlife Management* 66(3):551-563.

Type of study: Examination of the history of CWD and programs for CWD management.

CWD details: Good overview of the development and spread of CWD and disease details.

Description of study: Constraints on options for controlling or eradicating CWD were found to be long incubation periods, subtle early clinical signs, absence of a practical antemortem diagnostic test, extremely resistant infectious agent, possible environmental contamination, and incomplete understanding of transmission. The control strategies stated in the study for farmed facilities are (1) prevention of CWD introduction, (2) quarantine, or (3) depopulation of CWD-affected herds. Controlling CWD is problematic. Managing CWD in free-ranging animals presents many challenges. Long-term active surveillance programs to monitor CWD distribution and prevalence have been instituted in the Wyoming-Colorado-Nebraska endemic area to determine the extent of the endemic area and to assist in evaluating both temporal changes and effects of management intervention. Established management programs focus on containing CWD and reducing its prevalence in localised areas. In Saskatchewan, northwest Nebraska, Wisconsin, and northwest Colorado, where CWD may not be endemic yet, eradication is the ultimate goal for CWD management. In contrast, wildlife managers in Colorado and Wyoming have refrained from committing to eradication because it appears unattainable in their endemic CWD situations. The authors give more CWD management options for free-ranging wildlife.

Conclusions/recommendations: To date in Canada, the magnitude of infection in farmed elk herds detected has cost the Canadian government more than $30 million in indemnity and clean-up funds. State and provincial animal health officials are developing guidelines for farmed herds with CWD. Implications for free-ranging populations of deer and elk may be even more significant. Agencies do not translocate deer and elk from CWD-endemic areas. Ongoing surveillance programs are expensive and draw resources from other wildlife management needs.

C. Captive Cervids Expert Survey

C.1 Introduction

Stratus Consulting conducted an on-line survey to learn more about the effects of CWD on the captive (i.e., farmed) elk and deer industries in the United States and Canada. Appendix D includes a copy of the survey. The survey was designed to supplement information on the captive cervid industry as discussed in Chapter 4 and to attempt to collect the most up-to-date information possible.

We sent a request to complete the survey to individuals in 25 states and provinces that have detected CWD in wild cervids (Tier 1), that border on Tier 1 states or provinces, or that have seen CWD in captive cervids (Tier 2). Recipients included individuals working with state or provincial agencies (either the state veterinary office or employees in the state or provincial agriculture department) and individuals who work in the industry or belong to elk or deer associations. To obtain perspectives on the impact of CWD from different public and private groups, we made multiple contacts with each state and province.

We e-mailed the survey invitation in the afternoon of December 15, 2003. As the survey is an online survey instrument, the survey invitation indicated the link to the website at which individuals could provide their responses. This appendix summarises results received up to the morning of December 22, 2003. Responses reported here are taken from 30 total respondents.

Some of the comments are reported verbatim and may represent personal opinions of respondents rather than the official positions of the states, agencies, or groups responding. While the survey was intended to collect factual information, the sensitivity of issues surrounding CWD led to some strong normative responses. We have included some of these comments in the report in order to indicate that not all issues surrounding CWD are "clear cut and factual."

Where costs or revenues are reported, dollars are expressed in either Canadian or U.S. dollars (as specified). When U.S. dollars were converted to Canadian, we used the consumer price index (CPI) from the U.S. Bureau of Labor Statistics CPI calculator Web site (http://data.bls.gov/cgi-bin/cpicalc.pl) to calculate the exchange rate as of December 22, 2003 (CA$1.33124 per US$1.00).

C.2 Respondents

Individuals from 17 states and provinces responded to the survey: Alberta, Manitoba, Saskatchewan, Arizona, Colorado, Idaho, Illinois, Kansas, Kentucky, Montana, Nebraska, New Mexico, Nevada, North Dakota, Oklahoma, Utah, and Wisconsin. Respondents represented the following government agencies:

- Alberta Agriculture, Food and Rural Development
- State of Arizona Department of Agriculture
- Kansas Department of Agriculture
- Kentucky Department of Agriculture
- Manitoba Agriculture, Food and Rural Initiatives
- New Mexico Department of Game and Fish
- Nevada Department of Agriculture
- New Mexico Department of Game and Fish
- Oklahoma Department of Agriculture
- Oklahoma Department of Wildlife Conservation
- Saskatchewan Agriculture, Food Rural Revitalization
- Utah Department of Agriculture and Food
- Utah Division of Wildlife
- Wisconsin Department of Agriculture Trade and Consumer Protection.

A few respondents represented the following non-governmental agencies:

- Alberta White-tail and Mule Deer Association (AWMDA)
- Colorado Elk Breeders Association
- Illinois Elk Breeders Association
- Illinois Deer Farmers Association
- North Dakota Elk Growers.

In the following sections of this appendix, we discuss survey results by state or province. We took all the information reported directly from the survey results and have not independently verified the data.

C.3 Alberta

Two individuals from Alberta responded to the survey: one from the AWMDA and one from Alberta Agriculture, Food and Rural Development. Alberta has 150 deer farms with about 12,000 deer, and 450 elk farms with roughly 46,000 to 50,000 elk. CWD has been detected in two farmed deer and in one farmed elk.[1]

Annual venison gross sales in Alberta are CA$1.2 million, and annual velvet sales are CA$1.0 million. Both respondents rated the economic losses to deer and elk farmers resulting from CWD as catastrophic (when asked if losses were "catastrophic," "large," "moderate," "small," or "none"). Alberta has lost more than 30 farms in the deer industry, and approximately 1,800 animals have been shot and buried.[2] The losses result from border closures to other provinces and to the United States, combined with increased costs of production. There are no prospects of accessing viable markets in the near future. One respondent claimed that "Many producers are in desperate financial straits. CWD and another disease, BSE, have totally devastated what should have been a CA$21 million dollar industry in 2003, if borders had not been affected. The deer and elk industry in 2008 would have been over CA$80 million per year, if borders had not been affected."

One respondent said that the agency with the primary responsibility for dealing with CWD in Alberta is the Canadian Food Inspection Agency; the other respondent reported that the responsibility is shared by wildlife and agricultural agencies (but did not give the names of the agencies). In 2003, CA$1.5 million was spent on CWD in Alberta.

Alberta Agriculture, Food and Rural Development pays for testing of captive and wild elk and deer. The estimated cost is CA$125 per animal. The current test used is immunohistochemistry (IHC), and approximately 8,000 to 9,000 animals have been tested to date (wild and domestic). Alberta also has a compensation program.[3]

When the respondents from Alberta were asked if they had any other comments, they made the following observations about the effects of CWD and BSE:

1. From respondents answers it is unclear whether this is the number of farms or number of animals affected.

2. It seems likely that this includes elk farms and elk, although the responses indicated deer.

3. It is uncertain based on responses received whether this is a provincial program or is actually the compensation program administered by the CFIA.

- "CWD/BSE has totally devastated a once lucrative industry. All decisions of the day seem to made more on politics and emotion than on science."

- "The effects of CWD in Alberta have been compounded by our single case of BSE last spring. Prior to the BSE case, certain (US) markets were still available to producers who could demonstrate the required level of surveillance. Our producers find it difficult to understand why, if CWD did not cause the border to be closed, a case of BSE should stop all movement."

C.4 Manitoba

Two individuals from Manitoba responded to the survey: both with the Manitoba Agriculture, Food and Rural Initiatives. Manitoba has 3 deer farms with about 250 deer, and about 70-100 elk farms with roughly 3,500-4,500 elk (the different individuals reported varying responses and the range of responses is reported here). CWD has not been detected in any captive or wild deer or elk in Manitoba.

Venison gross sales in Manitoba are CA$150,000 annually, velvet sales are CA$200,000 annually, and sales of breeding stock or semen are CA$20,000 annually. Both respondents rated the economic losses to deer and elk farmers resulting from CWD as catastrophic. Both individuals said that reliable estimates of the economic losses to the captive deer and elk industry are available, but did not report the exact numbers. Velvet in Manitoba is worth only about 50% of what it was a few years ago (CA$45 per pound to about CA$18-22 per pound in 2003). Five years ago, elk breeding stock was worth between CA$5,000 and CA$20,000 per animal. When Korea shut the borders to Canadian velvet, breeding stock plummeted and is now worth about CA$200 per animal. Also, regulatory costs are high.

One respondent said that further information on the Manitoba elk and deer industry is available at http://www.gov.mb.ca/agriculture/statistics/pdf/aac02s08.pdf, and reported that "this website does include deer but these are not considered farmed animals in Manitoba. Only elk can be game farmed under Department of Agriculture, Food and Rural Initiatives."

Respondents indicated that that the agency with the primary responsibility for dealing with CWD in Manitoba is the Canadian Food Inspection Agency; while Manitoba Agriculture, Food and Rural Initiatives also holds responsibility. In 2003, CA$108,800 was spent in Manitoba on CWD: CA$103,800 on surveillance and CA$5,000 on communication. Almost all of the surveillance money was spent on wildlife surveillance.

Manitoba Agriculture, Food and Rural Initiatives helps pay for testing of captive and wild elk and deer. Producers are responsible for getting the head or sample to the provincial laboratory, and the laboratory does the initial test processing at no charge (which costs the laboratory CA$45). Then, the producer pays for the cost of the IHC (CA$45), which is done at another lab. A slaughter subsidy is available to help pay this cost, and starting in 2004, the province pays all costs of the test (CA$90). However, the producer will still be responsible for getting samples to the provincial laboratory. Although IHC must be used for on-farm deaths, the rapid test called "Bio-Rad" has now been accepted by the Canadian Food Inspection Agency for the voluntary CWD National Standards Program for slaughter, wildlife surveillance, and herd reductions. Approximately 8,000 to 9,000 animals have been tested to date (wild and domestic).

Manitoba does not have a compensation program, but does have a subsidy for testing because there is a legislative requirement to test animals slaughtered for food.

When the respondents from Manitoba were asked if they had any other comments, one said, "I should have mentioned that some producers are in such dire financial straits that they are considering doing large herd reductions on farm and burying the animals (possibility of approximately 500 in our province). I believe this may have already occurred in Saskatchewan and Alberta."

C.5 Saskatchewan

One survey respondent provided limited information in response to the survey. The respondent requested that some of this information not be used at this time due to uncertainty regarding information available at the time of the survey implementation. The respondent indicated that Saskatchewan has 150 deer farms with about 10,000 deer, and 400 elk farms with roughly 42,000 elk. CWD has been detected in 23 wild deer and 230 farmed elk.

C.6 Arizona

One respondent with the State of Arizona Department of Agriculture answered a few of the survey questions. The respondent said that Arizona has only two deer farms and has detected CWD in captive or wild cervids. The Arizona Department of Game and Fish is responsible for controlling CWD in the state, and the agency does have programs in place to address CWD.

The respondent from Arizona said that the captive deer and elk industry have experienced only small losses, primarily as a result of meeting export requirements. Also, there has been an impact from reduced demand for breeding stock.

The State of Arizona pays for testing of elk and deer and compensate farmers, but such programs are currently under design and review. The respondent from Arizona also said that import requirements and herd certification protocols are being developed for consistency in commerce.

C.7 Colorado

Two of the respondents were from Colorado: one with the Colorado Elk Breeders Association and the other a private veterinarian who does occasional work with the Colorado Elk Breeders Association.

Colorado has 2 deer farms (the number of deer was not specified) and between 80 and 110 elk farms with roughly 7,800 elk. CWD has been detected in almost 300 wild deer and 50 farmed elk. One respondent reported 46 cases of CWD in wild elk; the other reported 150 cases.[4]

The Colorado Department of Agriculture has the primary responsibility for dealing with CWD in the state, but the respondents did not report any spending information.

Venison gross sales in Colorado are US$1.1 million annually, velvet sales are US$515,000, and sales of breeding stock or semen are US$250,000.

One respondent rated the economic losses to deer and elk farmers resulting CWD as catastrophic, and the other rated the losses as large. One respondent said that economic losses total US$23 million, losses that accrue primarily from movement restrictions on Colorado elk from other states and from restrictions in regions within Colorado. Approximately 65 family-run farms have had to close and more were expected to fall in 2003. One respondent stated that "the impact is greatest because of the wild herds with CWD, and other states will not allow Colorado animals to go to their state for fear that Colorado captive elk might have CWD from the wild, no matter how long surveillance has been in operation."

The costs of CWD-related regulations also have an economic impact. A regulatory analysis by the Department of Agriculture showed that elk farmers' costs will increase by 42% to 76% (per animal) if the farmers are required to install double fences to control CWD.

One non-governmental Colorado respondent had the following political comment:

> The wild deer population on the eastern slope [of Colorado] have uncontrolled disease and the state is doing nothing of significance to solve the problem, but they continue to wage and win the battle of public opinion. In Colorado, the

4. It is unclear from responses whether this 150 is just elk or includes deer.

> Division of Wildlife is responsible for the vast majority of the CWD cases, yet they refuse responsibility for future containment of the disease.

Colorado does not pay for testing of captive elk and deer, but one respondent said that Colorado has a compensation program (but did not give details of the program).

C.8 Idaho

One individual from the Idaho Department of Agriculture responded to the survey. The state has no deer farms, but is home to about 120 elk farms with 3,000 elk. Idaho has not detected any cases of CWD, but the state does have a CWD program. The Idaho Department of Agriculture is responsible for controlling CWD.

Economic losses in Idaho from CWD have been small, but the value of the animals has been reduced, along with access to markets, because restrictions mandate that the animals cannot be sold or imported into or out of some states. The individual responding to the survey said that estimates of losses are available, but did not give a citation or estimate.

The State of Idaho does pay for testing of captive cervids for CWD. The Idaho Transportation Department sells automobile vanity license plates (displaying a graphic of an elk), and a portion of that fee is deposited annually into a fund for animal health. This law has been in place for 1 year and more than US$10,000 has been deposited. A local university laboratory tests animals for a slightly lower rate than they would normally charge. The state notified the Idaho Elk Breeders Association about the availability of funds and that the testing would be free if producers sent their samples to this lab. Once the funds are depleted for the year, the owners are responsible for the costs of testing their animals until the next annual deposit from the license plate fund is made.

C.9 Illinois

Two survey respondents were from Illinois: one from the Illinois Elk Breeders Association and one from the Illinois Deer Farmers Association. The Illinois Department of Agriculture is responsible for CWD in the state. In 2003, US$800,000 was spent on CWD in Illinois: 50% on eradication, 30% on surveillance, 15% on "other" (which the respondents reported as costs for administration, research, and travel), and 5% on communication.

Illinois has about 500 deer farms with 7,000 deer, and 60 elk farms with 1,500 elk. Eighteen cases of CWD have been seen in wild deer.

Venison gross sales in Illinois are US$500,000 annually, velvet sales are US$30,000, sales of breeding stock or semen are US$200,000, and urine sales are US$200,000. Also, one respondent commented that hunting, hard antler sales and trophies contribute an additional US$1 million annually.

Economic losses in Illinois from CWD were rated from large to catastrophic, primarily because of movement restrictions. Another issue that negatively affects the industry is the small number of harvest ranches and the growing need for them:

> Several deer farmers have been forced to harvest their own deer because they are unable to move their animals to other jurisdictions. Farmers are restricted in the movement to other jurisdictions and Illinois only has two ranches that are allowed to harvest deer. Efforts are being made to have more ranches open in Illinois, but are running into road blocks from the Illinois Department of Natural Resources (DNR). The Illinois Deer Farmers Association may seek a legal remedy on grounds that the Illinois DNR appears to be restricting free trade in Illinois.

One of the respondents reported that the political situation surrounding CWD has had large and negative economic effects:

> CWD is a disease of wild deer in Illinois. It is only the current vehicle used by conservation departments and special interest groups to eliminate this viable livestock industry. More farmed deer and elk will die of lightning strikes than will die from CWD. At first detection of the disease the farmed industry was blamed and continues to be blamed. Evidence is increasing that CWD was introduced to the state of Wisconsin by the University of Wisconsin, yet continual blaming of the captive industry has slowed or nearly stopped growth of new farms. Pressure by state agencies and special interest groups has resulted in a continued ban on North American velvet by Korea, this has depressed velvet prices to 25 cents on the dollar. State agencies have banned importation and ignored science in developing import protocols. Lack of Federal Uniform Methods and Rules has further slowed development of import protocols. Overall, the captive cervid industry is worth about 5% of the pre-CWD slander campaigns.

Illinois does pay for testing and "does not have a compensation program because the USDA (U.S. Department of Agriculture) has the compensation program." After the state collects the head (at an unspecified cost), the sample is run in the state laboratory (at a rough estimate of US$50 per sample, which is what the state charges hunters). The state collects and tests about 700 samples per year.

C.10 Kansas

Three individuals from Kansas responded to the survey: one from the Kansas Department of Agriculture. The affiliations of the other two respondents were not specified. Kansas has 35 deer farms with 1,000 deer, and 50 elk farms with 1,000 elk. Kansas has detected only one case of CWD in a farmed elk.

The respondents rated CWD-related economic losses in Kansas, primarily resulting from the reduction in the market value of the cervids, as moderate to large.

C.11 Kentucky

One individual from the Kentucky Department of Agriculture responded to the survey. Kentucky has detected no cases of CWD. The Kentucky Department of Agriculture is the controlling agency for CWD, but does not pay for any testing or offer other forms of compensation. The respondent said that the state has realised no economic losses from CWD.

C.12 Montana

Two individuals from Montana responded to the survey: one with the Department of Livestock, and the other from the Department of Fish, Wildlife and Parks. Montana has 76 elk farms with 3,740 elk. One individual reported that there is one deer farm in Montana, but did not specify how many deer were on the farm. Montana has detected nine cases of CWD in farmed elk.

One respondent rated the economic losses from CWD in Montana as small, but the other respondent rated them as large:

> CWD has limited the movement of farmed cervids into or out of Montana and has prevented the establishment of new farmed cervid enterprises, therefore reducing the sale of breeding stock to prospective new operators. Also, CWD may have had some effect on the farmed cervid meat market. One alternative livestock facility in Montana has been depopulated because of CWD. Should transmission of CWD to domestic livestock be proven, the economic consequences could be devastating to the state.

Montana does not pay for CWD testing, but the Montana Department of Livestock has an Alternative Livestock program, and the state veterinarian provides some assistance and support.

C.13 Nebraska

Two individuals from Nebraska responded to the survey: neither stated an affiliation. Nebraska has 3 deer farms with 218 deer, and 87 elk farms with 3,456 elk. Nebraska has had 82 CWD cases in farmed deer, 37 cases in wild deer, and 12 cases in farmed elk (for a total of 131 cases). The Nebraska Department of Agriculture is the state agency responsible for controlling CWD. The respondent rated economic losses as catastrophic, but did not answer any other survey questions.

C.14 Nevada

One individual from the Nevada Department of Agriculture responded to the survey. Nevada has two deer farms with 75 deer, and no elk farms. Nevada has not detected any cases of CWD. The Nevada Department of Agriculture is the state agency with CWD responsibilities. In 2003, US$95,000 was spent on CWD in Nevada: roughly 89% on surveillance, 7% on communication, and 3% on prevention. The state does pay for testing of captive cervids.

The economic losses from CWD in Nevada were rated as small, with the respondent commenting that "The small farmed deer industry has been impacted because of import requirements from other states for live animals."

C.15 New Mexico

One individual from the New Mexico Department of Game and Fish responded to the survey. New Mexico has 5 deer farms with 2,000 deer, and 20 elk farms with 10,000 elk. New Mexico has detected six cases of CWD in wild deer.

New Mexico spent US$110,000 on CWD in 2003: 70% on surveillance, 20% on prevention, and 10% on communication.

The economic losses from CWD in New Mexico were rated as moderate. "Most captive cervids are on large hunting parks who have been affected little if at all. Only a few small farms raise breeding stock, venison, or velvet. With the import moratorium, some of these small farms have probably experienced increased sales."

New Mexico offers a certification program to participating farms. The Department of Game and Fish works closely with farms and will test tissue samples if the owners request and surrender the proper tissues. The department has also "done some tonsil biopsy work for private farms."

C.16 North Dakota

One individual with the North Dakota Elk Growers Association responded to the survey. North Dakota has 90 elk farms with 2,500 elk (the respondent did not answer questions about deer farms). North Dakota has not detected any cases of CWD. The North Dakota Board of Animal Health is the state agency responsible for controlling CWD. North Dakota does not pay for animal testing.

The respondent rated the economic losses from CWD in North Dakota as large, citing the scare of CWD in other states and countries. The velvet market and the value of breeding stock have been drastically reduced. The only profitable elk product is the hunting market. In addition, the meat market is just getting started and is showing some good potential.

When asked for a final comment, the respondent said "I believe that CWD is something that we all have to learn to live with, like rabies etc. I feel that the media has made a huge deal about this and has damaged the ranched elk industry. I hope that there will be a turn around so that we can make some money to stay on our family farms."

C.17 Oklahoma

Two individuals from Oklahoma responded to the survey: one from the Oklahoma Department of Agriculture, Food and Forestry, and one from the Oklahoma Department of Wildlife Conservation. Oklahoma has 55 deer farms and 55 elk farms (the respondent did not give numbers of deer or elk on the farms). Oklahoma has detected only one case of CWD in a farmed elk.

The Oklahoma Department of Agriculture, Food and Forestry and the USDA-APHIS are responsible for controlling CWD programs in Oklahoma. In 2003, CA$45,000 was spent on CWD in the state. All of the funds were spent on surveillance.

The economic losses from CWD in Oklahoma were rated small to catastrophic by the respondents. One respondent said that, "The economic impact is not as much related to the CWD presence in Oklahoma as much as the general hysteria and non-scientific regulations states have placed on the movement of deer and elk." The other respondent commented that economic impacts would be larger among breeders that choose not to enrol in the Oklahoma Department of Agriculture CWD monitoring program.

C.18 Utah

Four individuals from Utah responded to the survey: one with the Utah Division of Wildlife, and one with the Utah Department of Agriculture and Food (the other two individuals did not give their affiliations). Utah has no deer farms, but has 46 elk farms with 2,084 elk. Ten cases of CWD have been detected in wild deer.

The Utah Department of Agriculture and Food and USDA-APHIS are responsible for controlling CWD in captive cervids in Utah. From US$350,000 to US$500,000 was spent in Utah in 2003 on CWD: 67% of which was spent on surveillance, 7% on prevention, 7% on communication, 3% on eradication, 3% on control, and 13% on "other." The respondent did not specify what measures are included in the other category.

Economic losses resulting from CWD have been moderate in Utah. The value in markets for breeding animals and velvet has dropped, and sources for herd additions are limited.

Utah does not pay for testing of captive cervids and does not have a compensation program. However, the Utah Department of Agriculture and Food has awarded a marketing grant to the Utah Elk Breeders to explore markets for venison.

C.19 Wisconsin

Two respondents from Wisconsin answered the survey: both with the Wisconsin Department of Agriculture, Trade and Consumer Protection. Wisconsin has between 450 and 800 deer farms containing 17,000 to 35,000 deer (the respondents gave widely varying estimates). Wisconsin has approximately 250 elk farms, containing 8,000 to 10,000 elk. Wisconsin has detected CWD in 11 farmed deer, 239 wild deer, and 1 farmed elk.

The respondents rated economic losses to the deer and elk farming industry as large to catastrophic. One respondent explained that Wisconsin is an export state for cervids and cervid genetics, and that losses have resulted from 1) breeding stock sales being shut down after other states banned cervids from Wisconsin; 2) velvet antler sales to Asian markets being lost; 3) meat sales to wholesale and retail customers being lost; and 4) breeding stock sales being reduced within the state. The respondent stated that "breeding stock values have dropped in excess of 50% and venison markets have declined even further. Additional costs have been incurred by farmers due to the costs of participating in the CWD monitoring program."

The Wisconsin Department of Agriculture, Trade and Consumer Protection is responsible for controlling CWD in captive cervids in the state. In 2003, US$6 million was spent on CWD in Wisconsin. This is the largest reported amount of spending in the states surveyed, but the

individual did not give any further details on the spending and how it was allocated. We believe that this individual was including expenditures to control CWD in wild deer. According to the State of Wisconsin's Legislative Audit Bureau, the figure should be roughly $2 million, and we use this figure in summarising the results.

C.20 Summary

This survey was designed to explore the magnitude of economic impacts that CWD has had on the captive cervid industries in various states and provinces. Eleven of the seventeen states or provinces included in this survey have detected at least one case of CWD, and almost all have experienced some sort of economic impact. In fact, one half of the states and provinces surveyed have experienced significant impacts to date, and solutions to the CWD problem are not readily evident.

Although deer and elk farming is not a sizeable industry in some states and provinces, annual venison sales alone contribute more than CA$1.4 million in Colorado, CA$1.2 million in Alberta, CA$643,000 in Illinois, and CA$150,000 in Manitoba. When sales from velvet, breeding stock or semen, and urine are included, revenues total CA$2.5 million in Colorado, CA$2.2 million in Alberta, CA$1.2 million in Illinois, and CA$370,000 in Manitoba. These revenue estimates are for 2002 or 2003. Several respondents stated that their revenue estimates would be much higher without the existence of CWD (e.g., one individual from Illinois said the current captive cervid industry is worth about 5% of the pre-CWD value, and another from Manitoba said that velvet is worth about 50% of the pre-CWD value).

Exhibit C.1 displays the number of deer and elk farms in each of the states and provinces and how many detected cases of CWD were reported. Alberta, Saskatchewan, Wisconsin, New Mexico, Illinois, and Colorado appear to have the largest numbers of captive cervids, and the highest numbers of CWD cases have been detected in Colorado, Saskatchewan, Wisconsin, and Nebraska.

All states and provinces indicated that they had some sort of CWD program. Reported spending ranged from US$45,000 (in Oklahoma) to US$2 million (in Wisconsin). Exhibit C.2 displays the CWD-related spending in the states and provinces in 2003, along with a breakdown of the costs where given. Most CWD-related costs were allocated to surveillance programs. Most respondents stated that their jurisdiction pays for all or part of testing costs (through subsidies and other programs), which range from CA$67 to CA$125 per sample. One state (Idaho) raises revenues for an assistance program through the sale of automobile vanity plates (raising $10,000 in 2002). Idaho was also able to have a university laboratory perform the testing at reduced rates.

Exhibit C.1. Reported numbers of deer and elk farms and detected cases of CWD[a,b]

	Deer farms	Total farmed deer	Elk farms	Total farmed elk	Cases of CWD in farmed deer	Cases of CWD in wild deer	Cases of CWD in farmed elk	Cases of CWD in wild elk
Alberta	150	12,000	450	46,000-50,000	2	0	1	0
Manitoba	3	250	69-98	3,500-4,500	0	0	0	0
Saskatchewan	150	10,000	400	42,000	0	23	230	0
Arizona	2	na	na	na	0	0	0	0
Colorado	2	na	80-100	7,800	288-300	50-56	46-150	0
Idaho	0	0	120	3,000	0	0	0	0
Illinois	447-500	7,000	60	1,500	0	18	0	0
Kansas	35	1,000	50	1,000	0	0	1	0
Kentucky	na	na	na	na	0	0	0	0
Montana	1	na	76	3,740	0	0	9	0
Nebraska	3	218	87	3,456	82	37	12	0
Nevada	2	75	0	0	0	0	0	0
New Mexico	5	2,000	20	10,000	0	6	0	0
North Dakota	na	na	90	2,500	0	0	0	0
Oklahoma	55	na	55	na	0	0	1	0
Utah	0	0	46	2,084	0	10	0	0
Wisconsin	450-797	17,000-35,000	250-264	8,000-10,000	11	239	1	0

na = not answered.
a. Numbers displayed here are those reported in the survey and have not been verified.
b. Ranges given reflect the range of estimates reported by different individuals for the same state.

Exhibit C.2. CWD-related spending and allocations[a]

	Total amount spent on CWD in 2003 (CA$2003)[b]	% spent on surveillance	% spent on communication	% spent on eradication	% spent on prevention	% spent on control	% spent on compensation	% spent on other
Wisconsin	2.0 million	na	na	na	na	na	na	na
Alberta	1.5 million	na	na	na	na	na	na	na
Illinois	1.1 million	30	5	50	0	0	0	15[d]
Utah	466,000-666,000[c]	67	7	3	7	3	0	13[e]
New Mexico	146,000	70	10	0	20	0	0	0
Nevada	126,000	89	7	0	3	0	0	0
Manitoba	109,000	95	5	0	0	0	0	0
Oklahoma	45,000	100	0	0	0	0	0	0

a. Numbers displayed here are those reported in the survey and have not been verified.
b. The question asked was "What was spent on CWD in total in your state or province in 2003?" and it was not specified if money spent in each state and province was state or provincial, federal, or combined funds.
c. Range given reflects the range of amounts reported by two different individuals, both reporting for Utah.
d. "Other" category for Illinois includes costs for administration, research, and travel.
e. The individual reporting this information for Utah did not state what measures are included in the other category.

Almost all individuals reported that their state or province had experienced some type of economic loss resulting from CWD. Exhibit C-3 reports economic losses, ranging from none, small, moderate, and large to catastrophic. For illustrative purposes, the exhibit also shows the total number of farmed cervids in each state and province, along with the total number of detected cases of CWD.

Individuals from Alberta, Manitoba, Nebraska, Colorado, Illinois, Wisconsin, and Oklahoma stated that economic losses in their state or province were catastrophic. In general, the larger economic losses are being experienced in the states that have relatively larger captive cervid industries, with greater numbers of detected cases of CWD. However, Alberta has detected only three cases of CWD, Manitoba and North Dakota have had no cases, and Oklahoma has had only one case.

The following list recaps the losses described in the specific state or province summaries:

- Alberta has lost more than 30 farms in the deer industry, and approximately 1,800 animals have been shot and buried. If borders had not been affected, the deer and elk industry should have worth CA$21 million in 2003, instead of CA$2.2 million.
- Velvet in Manitoba is only worth about 50% of what it was a few years ago (dropping from CA$45 to about CA$18-22 per pound). Five years ago, elk breeding stock was worth between CA$5,000 and CA$20,000 per animal. Because of lost access to Korean markets, breeding stock is now worth about CA$200 per head.
- Economic losses from CWD in Colorado have been estimated to total US$23 million. Approximately 65 family-run farms have had to close and more will fall in 2003. Elk farming costs will increase by 42% to 76% per animal if producers are required to install double fences.
- An individual from Illinois commented that loss of Korean markets has reduced velvet prices to 25 cents on the dollar, and that overall, the captive cervid industry is worth about 5% of the pre-CWD value.
- In Montana, one alternative livestock facility has been depopulated, and the economic consequences could be devastating to the state if transmission of CWD to domestic livestock is proven.
- In Wisconsin, breeding stock values have dropped in excess of 50% and venison markets have declined even further.

Economic losses were reported to result primarily from movement restrictions and strict import and export requirements (see Exhibit C.3). Increased regulatory costs, along with reduced demand and prices because of public perceptions, also negatively affected the captive cervid industry. Other impacts were also experienced from a small number of harvest ranches being permitted (in Illinois), from a lack of participation in the state monitoring program (in Oklahoma), and because of limited sources for herd additions (in Utah).

A few respondents stated that many of the economic losses stem from movement restrictions based on political reasons instead of science. Some respondents also noted that CWD-related regulations are the first disease regulations that have been largely formulated by wildlife agencies. These agencies may have different agendas than departments of agriculture, which have traditionally been responsible for regulating diseases. Some individuals also commented that the media has had a large negative effect on the captive cervid industry.

Exhibit C.3. Economic losses to the captive cervid industries from CWD[a,b]

	Total number of farmed cervids	Total number of cervids detected w/CWD	Reported economic losses from CWD	Comments on primary reason(s) for economic losses
Alberta	58,000-62,000	3	Catastrophic	Border closures to other provinces and to the United States, increased costs of production
Manitoba	3,750-4,500	0	Catastrophic	Closed access to Korean markets, high regulatory costs
Saskatchewan	52,000	253	na	na
Nebraska	3,674	131	Catastrophic	na
Colorado	7,800	390-500	Large to catastrophic	Movement restrictions, high regulatory costs
Illinois	8,500	18	Large to catastrophic	Movement restrictions, small number of harvest ranches, closed access to Korean markets
Wisconsin	25,000-45,000	251	Large to catastrophic	Ban from other states on cervids from Wisconsin, reduction in sales to Asian markets, regulatory costs
North Dakota	2,500	0	Large	Movement restrictions, negative perceptions given by the media
Kansas	2,000	1	Moderate to large	Reduction in market value of cervids
New Mexico	12,000	6	Moderate	Only a few farms affected
Oklahoma	na	1	Small to catastrophic	Public perceptions, movement restrictions, no participation in state monitoring program
Montana	3,740	9	Small to large	Movement restrictions, prevented establishment of new farmed cervid enterprises
Arizona	na	0	Small	Meeting export requirements, reduced demand for breeding stock
Idaho	3,000	0	Small	Reduced value of animals, movement restrictions
Nevada	75	0	Small	Import requirements from other states
Utah	2,084	10	None to moderate	Reduced value of breeding animals and velvet, limited sources for herd additions
Kentucky	na	0	none	na

na = not answered.
a. Information displayed here is as reported in the survey and has not been verified.
b. Ranges given reflect ranges of numbers reported by different individuals for the same state.

D. Captive Cervids Expert Survey Instrument

researchexec

Questionnaire View

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Stratus Consulting is helping the University of Wisconsin learn about the effects of chronic wasting disease (CWD) in your state or province. Please take a few minutes to fill out this online survey, which focuses on CWD impacts to captive cervids (deer or elk) and other related agricultural impacts. Your responses in this survey will be of significant help with this research. Thank you very much for your time.

We are interested in finding out about the impacts of CWD on the captive/farmed deer and elk industry. Are you familiar with this in your state?

- Yes
- No

Please enter the name, phone number, and email address of the person we could contact to complete this survey.

if Q1 = b skip to COMPLETION

Approximately how many of the following do you currently have in your state? (enter 0 if none, please leave blank if you do not know)

Number of deer farms	
Total number of farmed deer	
Numbers of elk farms	
Total number of farmed elk	

Has CWD ever been detected in any deer or elk in your state or province?

	CWD Detected	CWD NOT Detected	Don't Know
Farmed deer			
Wild deer			
Farmed elk			
Wild elk			

How many farmed deer have been detected with CWD in your state or province? (please leave blank if you do not know)

How many wild deer have been detected with CWD in your state or province? (please leave blank if you do not know)

How many farmed elk have been detected with CWD in your state or province? (please leave blank if you do not know)

How many wild elk have been detected with CWD in your state or province? (please leave blank if you do not know)

Please enter a name, phone number, and email address of a person we should contact who might know if your state has had any detected cases of CWD.

if Q57 = c AND Q58 = c AND Q59 = c AND Q60 = c skip to COMPLETION

What is the name of the agency with primary responsibility for dealing with, regulating, or controlling CWD in captive deer and elk in your state or province? (please leave blank if you don't know)

Does your state or province have any type of government program to address CWD in captive/farmed deer or elk?

- Yes
- No
- Don't Know

Do you know (even approximately) how much is being spent in your state on CWD in 2003 or any other year? (exact amount not necessary)

- Yes, I know what is being spent on CWD in 2003
- Yes, I know what was spent on CWD in a year other than 2003 (but I do not know what is being spent in 2003)
- No, I do not know how much was or is being spent on CWD in my state

What was spent on CWD in total in your state in 2003? (please give us your best estimate: local/state or province/federal monies combined)

For what year do you know CWD spending information?

What was spent on CWD in total in your state in that year? (please give us your best estimate: local/state or province/federal monies combined)

If possible, please breakdown the total cost you entered for the following categories (as either a percent of total or dollar amount). Please give your best estimate.

	Percent of Total Costs	Dollar Amount
prevention		
surveillance		
eradication		
control		
compensation		
communication		
other		

Please specify for what "other" category you specified in the previous question that your state has CWD costs:

Approximately how much are gross sales from the deer and elk farming industry per year in your state or province (by product, in dollar amounts)? (please enter zero when applicable, and leave blank if don't know)

	Dollar amount (please

	(please use numeric keys only with no "$", "." or ",")
venison	
velvet	
breeding stock or semen	
urine (for sale to hunters or other purposes)	
other	

Please specify what "other" product(s) you entered information for in the previous question:

In your judgment, on a scale of 1 to 5, please rate how large have the economic losses been to deer and elk farmers in your state as a result to CWD?

(1) No losses	(2) Small losses	(3) Moderate losses	(4) Large losses	(5) Catastrophic losses
○	○	○	○	○

Are there reliable estimates of the economic losses due to CWD in your state or province?

- ○ Yes
- ○ No
- ○ Don't know

In dollars, what are the economic losses to the captive elk and deer industry (in the most recent year for which information is available) from CWD in your state or province? (please leave blank if you don't know)

Please briefly describe in words the economic impact on the captive deer and elk industry due to CWD in your state or province.

Does your state or province pay for testing of captive elk or deer?

- ○ Yes
- ○ No
- ○ Don't know

Please provide a brief explanation of how much your state or province pays for testing captive deer or elk for CWD - either in total or per animal.

Does your state or province have a CWD compensation program for captive deer or elk that must be destroyed due to CWD?

- ○ Yes
- ○ No
- ○ Don't know

Please provide a brief explanation of how much your state or province pays for testing captive deer or elk for CWD - either in total or per animal.

Does your state or province have any other type of CWD program to assist or support farmers with CWD-related expenses?

- Yes
- No
- Don't know

Please provide a brief description of what other assistance program(s) your state or province has for farmers with CWD-related expenses.

Please list the names/citations of any available studies on the economic impacts of CWD in your state that you are aware of:

What is your name?

Please select your State or Province:

Please make a selection

What agency/organization are you with?

Would you be interested in obtaining a copy of our results from this survey?

- Yes
- No

Please provide an email address that you would like an electronic file sent to in 3 to 4 weeks:

Is there anyone else in your state/province that you are aware of that we could contact to obtain information on economic impacts? (please give name(s), telephone number(s) and email address(es))

Do you have any other comments on the economic impact of CWD on agriculture (either actual or potential)?

Do you have any other comments on the economic impact of CWD on agriculture (either actual or potential)?

Thank you for your time. Please click finish to exit the survey.
URL: thankYou.asp