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ECONOMIC IMPLICATIONS OF CHRONIC WASTING DISEASE

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Introduction

Chronic Wasting Disease (CWD) is a transmissible spongiform encephalopathy (TSE) that affects cervidae such as deer and elk. CWD was first observed in 1967 in the United States and has been found in free-ranging and/or farmed cervidae in several states and in two Canadian provinces. The disease is always fatal to infected animals and is characterized by progressive weight loss among other common symptoms. At this time, many questions remain about the cause and transmission of CWD. No relationship between CWD and other TSEs of animals or humans has been discovered thus far (APHIS, 2003).

The economic implications of this disease are manifested in a number of ways. The economic and policy issues are complicated by the nature of the industry; both wild and farmed animal populations and both private and public lands are involved. Government agencies incur costs in research, surveillance, and disease management activities. Countries may have trade restrictions imposed against entire industries due to an outbreak. Consumer demand may suffer temporary or permanent damage due to perceived risks of meat

products. Producers of farmed cervidae may have their herds quarantined, restricting sales and movements, or depopulated. Businesses and communities may lose revenue from decreases in cervid hunting and wildlife viewing, and participants in these activities lose recreational benefits.

Estimating the current or potential economic implications of CWD is difficult. Few scientific studies have been conducted to date on the economic effects of CWD. Economic research on related subjects or aspects of the issue might provide some insights, however. This report summarizes some relevant research and information that has been published to date and discusses how it applies to the economic issues surrounding CWD. Areas of discussion include effects of the disease on hunting, wildlife watching, agricultural land values, the farmed cervid industry, and the potential government indemnity liability. Among the economic issues not confronted directly include potential effects on consumer demand for meat, trade sanctions, the effectiveness of various policy alternatives or potential avenues to mitigate farm level financial risk.

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Hunter Participation, Spending and Recreational Benefits

Hunters value hunting for its recreational value and as a source of meat. Regional economies benefit from those who participate in hunting from expenditures on hunting gear and trips.

Hunting licenses support the operating budgets of state and federal wildlife management agencies. It can be expected that the uncertainty surrounding the prevalence, transmission method, and human health impacts of CWD will decrease the value of hunting to hunters and adversely affect their expenditures. Information is available on the participation and spending of big game hunters from the United States Departments of the Interior and Commerce. Research has also been conducted to estimate the expected decrease in spending and recreational benefit received by hunters due to CWD (Bishop, 2002).

The *National Survey of Fishing, Hunting, and Wildlife-Associated Recreation* collects data on the number of hunters targeting specific game, the number of days spent hunting, and the dollars spent for hunting trips and equipment. The survey classifies big game to include deer, elk, bear, wild turkey, and other big game. Results and data are reported nationwide as well as by state (<http://fa.r9.fws.gov/surveys/surveys.html>).

In the United States, a total of over 10.9 million recreators spent 153 million days hunting big game in 2001. The number of deer hunters in 2001 totaled almost 10.3 million or 94 percent of all big game hunters. Deer hunters spent a total of over 133 million days hunting, accounting for 87 percent of the total hunting-days for all big game. Eight percent of all big game hunters, 910,000 total, targeted elk. The elk hunters spent a total of 6.4 million days hunting or 4 percent of the total.

Almost 10 million big game hunters reported their hunting expenditures for the survey. These respondents spent over \$10 billion on equipment and trip-related expenses, averaging \$1,013 per respondent. The expenditure numbers were not provided for hunters by species of game.

Survey results for 1991, 1996, and 2001 are provided in Table 1 to enable a comparison across time. The number of total big game, deer, and elk hunters increased from 1991 to 1996 and then declined slightly in the 2001 results. The total number of hunting days and elk hunting days also followed this trend. The number of days spent hunting deer, however, increased for both

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The results for the nation do not indicate an overall decline in the number of hunters or expenditures over the decade from 1991 to 2001 as may be expected due to CWD. Therefore, these data suggest that the current nationwide effect of CWD on hunters is small, due to the possibility to substitute hunting activities away from affected locations or species. However, localized results for areas where CWD is endemic or where it has been detected may tell a distinctly different story. Participation and expenditures in these areas may be adversely affected.

For example, CWD was expected to have economic implications on Wisconsin's economy and to the recreational value of the state's 600,000 deer hunters in 2002 (Bishop, 2002). Using information drawn from the *1996 National Survey of Fishing, Hunting, and Wildlife Recreation: Wisconsin*, spending from hunting was expected to fall by \$48 million to \$96 million due to the disease. The number of deer hunters and hunter-days were projected to decrease by 10 to 20 percent during the 2002 hunting season. These numbers overestimate the impact on the economy as a whole since a large majority of the hunters are Wisconsin residents and would spend this income in other sectors. The portion of this loss attributed to nonresident hunters amounted to \$5 million to \$10 million, and this amount would represent the net loss to the state's economy.

CWD also reduces the value of deer hunting to Wisconsin hunters. Deer hunters spent an average of \$900 to participate in the season, according to the 1996 survey. Economic principles suggest that the hunters must value the activity higher than the price of participating, by an amount called consumer surplus. Based on previous research, the value of consumer surplus was estimated at \$40 per day. The total consumer surplus over approximately 5 million hunting days would be \$200 million before the knowledge of CWD. The prevalence and uncertain risks surrounding the disease are

Table 1: Hunter Participation & Expenditures: The National Survey of Fishing, Hunting, and Wildlife-Associated Recreation (In 1000s except for Average Expenditures per Spender.)

	1991	1996	2001
Total Number of Big Game Hunters	10,745	11,288	10,911
--Deer	10,277	10,722	10,272
--Elk	682	959	910
Total Days of Hunting	128,411	153,784	153,191
--Deer	112,853	131,345	133,457
--Elk	5,048	7,174	6,402
Number Reporting Expenditures	10,506	10,805	9,962
Total Expenditures (nominal \$)	\$5,090,443	\$9,712,735	\$10,087,930
Average per Spender (nominal \$)	\$485	\$899	\$1,013

expected to reduce this amount due two types of impacts, a reduction in the number of hunting-days and a reduction in the quality of the remaining hunting-days. With a reduction in hunter-days of 10 to 20 percent and an assumed drop in the consumer surplus of \$10 to \$15, the total losses of recreational benefits to Wisconsin deer hunters in 2002 will range from \$68 million to \$105 million (Bishop, 2002).

The results of the analysis provide insight into the significance of the expected losses to hunting activities due to CWD. Although the economy as a whole will suffer relatively minor impacts, sectors of the economy providing goods and services to the hunters' needs may be strongly influenced. Deer and elk hunters may also lose much of the recreational benefit that they receive from the activity. The analysis assumed that no new evidence would indicate human health consequences of eating venison from deer infected with CWD, the possibility of disease transmission to animals other than deer or elk, or disease presence outside of the Mt. Horeb area in Wisconsin. If information became available invalidating these assumptions, the potential economic implications would be higher.

Wildlife Watching Participation and Expenditures

In addition to hunting, cervidae are enjoyed by wildlife viewers. The *National Survey of Fishing, Hunting, and Wildlife-Associated Recreation* collects data on the number of people participating in wildlife watching and their expenditures on the activity. Although data are not collected specifically for deer and elk, participation is presented in a category called "large mammals", which would include these animals. In 2001, over 66 million

people participated in wildlife watching, spending almost \$38.5 billion. Large mammals were the focus of almost 17.5 million residential participants and over 12 million nonresidential participants. Both residential and nonresidential large mammal watching participation declined in 2001 from 1996, while the total number of wildlife recreators increased (Table 2).

Expenditures on hunting and wildlife-watching activities are multiplied throughout many segments of the economy. The United States Fish and Wildlife Service (1998) estimated that the approximately \$29.2 billion spent on the activity in 1996 generated a total industrial output of \$85.4 billion supporting over 1 million jobs. Every \$1 directly spent on wildlife-watching actually produced \$2.92 of economic activity.

Wildlife viewing activities and expenditures significantly contribute to the economy. While participation in large mammal viewing has fallen from 1996 levels, total participation and expenditures have increased. With these blunt data and scale of analysis, it is difficult to impute why this segment is declining and if CWD has had any impact. However, it is reasonable to assume that, like hunting, CWD could adversely affect the recreational benefits of those who enjoy wildlife viewing.

Elk Habitat and Agricultural Land Values

Wildlife are found on public and on private lands. Wildlife can have a positive (e.g., hunting, photography, outfitting) or a negative (e.g., crop loss, disease risk, animal loss, human health risk) impact on the value of activities undertaken on private lands. One study indicates that agricultural land values in

Table 2: Wildlife Watching Participation and Expenditures: The National Survey of Fishing, Hunting, and Wildlife-Associated Recreation. (In 1000s except for Average Expenditures per Spender.)

	1996	2001
Total Wildlife Watching Participants	62,868	66,105
Total Residential ¹ Participants	60,751	62,928
Total Nonresidential ² Participants	23,652	21,823
Total Residential Observing Large Mammals	17,513	17,481
Total Nonresidential Observing, Photographing, or Feeding Large Land Mammals ³	13,152	12,226
Total Expenditures for Wildlife Watching	\$29,227,888	\$38,414,488
Average Expenditures per Spender	\$554	\$738

¹ Activities within 1 mile of home. ² Activities greater than 1 mile from home. ³ Deer, elk, bear, etc.

Wyoming are significantly impacted by the presence of elk habitat (Bastian et al., 2002). Statewide hedonic price models found that the acres of yearling elk habitat per deeded acre of land positively affected the appraised value of the land. The same models indicated that elk habitat in Western Wyoming negatively influenced the appraised value of the land.

Differences in statewide versus regional results may be explained by two factors. Western Wyoming has a large amount of public land, 81 percent of the region, which decreases the potential for receiving rents for fee hunting on private land. Elk also cause damage to private property such as fences and haystacks. The rest of the state has less public land and a lower population of elk, making fee hunting a more likely opportunity for landowners.

Although the research did not address CWD, it is possible that the presence and detection of CWD in free-ranging elk could affect how the elk habitat impacts the value of agricultural land. The demand for hunting may fall either due to changes in the quality of hunting or disease concerns, leaving fewer opportunities for landowners to offer fee hunting. In the event that CWD is later found to be transmissible to livestock or humans, land values may again be impacted.

Farmed Cervid Industry

The farmed cervid industry saw steady growth in the 1990s. In 1997, the captive deer herds in the United States had an estimated 83,270 animals valued at almost \$56.5 million and the stock of farmed cervidae continues to rise. Many different products (Table 3) can be produced from a farmed cervid operation. Total

revenues for 1997 amounted to \$1.9 million from venison, \$910,000 from velvet, used as a dietary supplement, and \$3 million from breeding stock (Coon et al., 2000).

Venison consumption in the United States has also grown from 1.2 million pounds in 1992 to over 3.1 million pounds in 1997. Only an estimated 640,300 pounds were produced in North America. Imports from New Zealand were the other main source (Coon et al., 2000).

CWD may present a challenge to the farmed cervid industry in several ways. Primarily, the disease threatens the health of the herds. The threat of spreading the disease to other areas, however, has caused restrictions on cervid imports into many states. This may impact the breeding stock market significantly. Information on state cervid import regulations can be found at <http://www.cwd-info.org/pdf/CWDRegstable011403.pdf>. Consumer perceptions about the safety of venison, because of or despite scientific evidence, could also impact demand for venison and other products.

Potential Government Indemnity Liability

As part of the efforts to eradicate CWD in the United States, the USDA Animal and Plant Health Inspection Service (APHIS) established animal health regulations (9 CFR Part 55) approving the payment of indemnity for the voluntary depopulation of infected captive cervid herds. Depopulation of affected animals reduces the risk of spreading the disease to other herds, and indemnity payments are made to encourage producer participation in the disease eradication program. The Federal indemnity payment will be made for 95 percent of the appraised value of the animals up to \$3,000 per animal.

Table 3: Products from Farmed Cervidae

	Deer	Elk
Major Products	Breeding Stock Meat (Venison) Hunt Bucks	Breeding Stock Semen Velvet Antler Meat (Venison) Hunt Bulls
Minor Products	Hard Antlers Deer Urine (Hunting aid) Velvet Antler (Dietary Supplement) Hides Tails Leg Sinews Antler Buttons	Hides Tails Leg Sinews Antler Buttons Ivories (Canine Teeth)
Source: (Coon et al., 2000)		

The total amount of federal indemnity (and associated expenses) spent to date on CWD is \$20,348,645 (APHIS, 2003).

The North American Elk Breeders Association (NAEBA) and the North American Deer Farmers Association (NADeFA) provided information to complete an analysis of the potential cost liability of this federal program. NAEBA estimated that approximately 2,300 farms had 110,000 elk with the number of elk per operation ranging from 10 on lifestyle farms to 700 on commercial operations. The value of each animal varies based on the type of animal and market conditions, but was estimated to be \$2,000 on average, although some animals may be worth up to \$5,000 each. The value of the U.S. farmed elk inventory was estimated to be \$220 million.

NADeFA estimated that approximately 2,000 farms had between 100,000 and 150,000 deer with the number of deer per operation, ranging from 5 on hobby farms to 3,000 on commercial operations. The value of each animal also varies and ranges from about \$375 for a fallow deer to \$4,000 for a wapiti deer, more commonly referred to as elk. The organization estimated the value of its members' 66,172 deer at \$111.6 million, making the average almost \$1,700 per head.

Disease spread models indicated that almost the entire captive elk inventory is at risk of contracting CWD. Captive deer have not contracted the disease unless the

animals have been in contact with positive captive elk. At the time the regulation was published, CWD positive or exposed elk numbered about 1,500 head in seven herds. At the indemnity rate of 95 percent of the average value of \$2,000, the federal government indemnity liability was estimated at \$2.85 million (9 CFR Part 55). This included only one percent of the total captive elk inventory. The potential liability for the entire inventory would reach approximately \$209 million.

Conclusions

Little direct information is available on the current and potential economic implications of CWD. The potential losses to the economy, hunting and wildlife-watching recreational benefits, farmed cervid industry, and government are significant. Other areas where information may be valuable in determining the economic impact of the disease include the costs of restricted interstate and international trade of farmed cervidae and the costs of research, regulatory enforcement, monitoring, and surveillance incurred by state and federal agencies.

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