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Cervid Disease Research at the National Wildlife Research Center

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ABSTRACT: The realized and perceived threats of cervid diseases have immense implications for federal and state wildlife management agencies, captive cervid ranchers, hunters, and businesses and economies that rely on recreation associated with deer and elk. Therefore, the spread of diseases, primarily chronic wasting disease and bovine tuberculosis, in wild and captive cervids is of great concern. Research is paramount to closing information gaps associated with all aspects of cervid diseases. The Wildlife Disease Research Program of the USDA APHIS WS National Wildlife Research Center is engaged in considerable research on cervid diseases. Efforts focus on disease epidemiology, cervid ecology, and methods to reduce disease prevalence and transmission. Here we share results of recently completed studies, provide updates for ongoing studies, and share plans for upcoming research.

KEY WORDS: *Cervus elaphus*, deer, disease, elk, fencing, frightening device, *Odocoileus hemionus*, *Odocoileus virginianus*, wildlife damage management

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INTRODUCTION

The United States Department of Agriculture, Animal Health and Plant Inspection Service, Wildlife Services, National Wildlife Research Center (NWRC) has a long record of conducting research associated with ungulate damage, including disease. Ungulate populations continue to increase (VerCauteren 2003), and the need for effective non-lethal means to reduce the wide array of problems caused by deer is ever-increasing (DeNicola et al. 2000). Problems include disease transmission to livestock and captive wildlife, consumption of agricultural and natural resources, collisions with vehicles, and other types of damage. With the recent emergence and reemergence of diseases associated with cervids, NWRC has stepped up research efforts to understand, manage, and eliminate disease in wild and domestic ungulates.

The primary diseases and species being addressed are chronic wasting disease (CWD) and bovine tuberculosis (TB) in elk (*Cervus elaphus*), mule deer (*Odocoileus hemionus*), and white-tailed deer (*O. virginianus*). Chronic wasting disease is an emerging infectious neurological disease of North American cervids. The presence of CWD in an increasing number of western and midwestern states and provinces has generated concern about potential impacts on cervid populations and health risks to humans and domestic animals.

Congress has provided the NWRC funding to develop methods to manage CWD and TB. The NWRC is uniquely qualified to address research questions pertaining to disease transmission among wild cervids and at the interface between wild and domestic cervids. With the close relationship between USDA APHIS Veterinary Services (VS), the information, knowledge, and tools developed will be efficiently used and implemented. Scientists at NWRC have expertise related to cervid ecology, research, and management, and our efforts include applied and basic studies. Our ongoing, long-term studies will enable us to address and answer questions related to disease spread through cervid populations and across landscapes in a minimal amount of time. Further, as the research branch of USDA APHIS Wildlife Services (WS), NWRC has disease specialists and other field personnel available to aid in disease surveillance and research efforts across the country.

BARRIER METHODS

In recent years, NWRC scientists and collaborators have made substantial progress in the development of barrier methods to reduce disease transmission and other types of damage associated with cervids. Our barrier evaluations have focused on three categories: frightening devices, fences, and biological management.

Frightening Devices

Related to frightening devices, the body of research we are producing through a systematic approach to research has advanced the science of managing wildlife through psychological stimuli. The first step of the research process is to conduct an extensive literature review. We began by assimilating, synthesizing, and interpreting the existing literature, which led to two reviews on frightening devices (Gilsdorf et al. 2003, VerCauteren et al. *In Press*) and one on color vision in deer (to understand the potential role of colored laser light in frightening deer, VerCauteren and Pipas 2003). These efforts aided us in determining the state of science and how to advance knowledge by developing research questions that were sound and meaningful.

Our first studies evaluated existing technologies that are used commonly as deer frightening devices (propane exploders and electronic guards) (Gilsdorf et al. 2004a) or marketed as such, but had not previously been objectively tested. We also evaluated ruby lasers, a new technology that has been proven to be effective on many bird species (Blackwell et al. 2002), but not deer (VerCauteren et al. 2003). Ruby lasers were ineffective, though evaluations

with lasers of shorter wavelengths have merit and are planned. At this point it was clear that new, innovative, effective frightening devices were needed and we continued work with that goal in mind. Our most promising efforts required the development of animal-activated devices that stimulated the senses of vision and hearing. We adapted recently developed infrared detection technology (from high-tech security systems) to trigger our devices only when deer, not other wildlife, approached the protected resource. Though bio-acoustics (deer distress and alarm vocalizations) did not perform well (Gilsdorf et al. 2004b), a pop-up effigy accompanied with frightening sounds (30 digital recordings, one randomly-chosen recording played each time the device was triggered) performed quite well (Beringer et al. 2003). The device represents a major scientific advancement in the technology of frightening devices. A second generation of this device appeared to reduce coyote predation on sheep (VerCauteren et al. 2004b). The third-generation device has been turned over to private industry for commercial production and is expected to be available to WS and others in summer 2004. The new, commercially available product will be the state-of-the-science frightening device and holds promise for many species and damage situations.

Fencing

Through a similar systematic research approach, we are also advancing our base of knowledge on cervid fencing. Our efforts with physical barriers are one step behind our related emphasis on psychological barriers and are leading to a series of publications. We routinely consult with personnel from WS, VS, and other agencies. After reading and assimilating the literature on ungulate fencing, it was clear that comparing across studies was inappropriate because of the myriad of factors that varied in study design, study rigor, animal density, and animal motivation to breach. Thus, our first need was to synthesize the literature (VerCauteren and Lavelle 2003, VerCauteren and Lavelle *In Press*, VerCauteren et al. 2004a). We also evaluated several different types and configurations of fences (e.g., Beringer et al 2003). To advance knowledge, we developed a dynamic simulation model, based on data from our reviews and evaluations, which can be customized by users to fit their unique situations. The model helps to determine the appropriate fence designs and includes a cost:benefit analyses incorporating significant variables (VerCauteren and Lavelle 2003). The model will be useful to WS, VS, other agencies and institutions, and producers for determining the best fence for controlling deer damage relative to the situation.

Biological Management

We recently evaluated the efficacy of livestock protection dogs for keeping deer and other wildlife, which are potentially infected with TB, from contacting cattle. The dogs were very effective and a second study, building on the first, is underway. These are the first studies to employ livestock protection animals for keeping potentially disease-infected herbivores from coming in contact with livestock. The concept is being accepted, and some landowners in the TB endemic area of Michigan are employing what are becoming commonly referred to as "TB dogs."

Other Efforts

We are also conducting a novel series of studies on ear tags and collars that deliver an electrical shock to deer when they attempt to enter a protected area (Nolte et al. 2003). The concept shows promise and our new technology will be applicable in some damage scenarios because it lends itself well to the matriarchal social structure found in deer and elk populations.

In addition to developing techniques and methods for abating damage and disease, the NWRC also conducts applied research to increase the knowledge base and expedite problem-solving. We have been evaluating the ecology of white-tailed deer along the Missouri River in eastern Nebraska and western Iowa for 14 years (VerCauteren 1993, 1998; VerCauteren and Hygnstrom 1994, 1998, 2002). The work in these areas continues and serves as the foundation of our current efforts. In this study area, we continue to build on a data set that includes information on the movements, home ranges, reproduction, mortality, and interactions of over 300 radio-marked deer. We traditionally focused on the female segment of the population, as females and their dependent offspring make up majority of the populations and are subsequently responsible for the majority of damage. More recently, we began putting equal emphasis on males to address differing roles in disease transmission between the sexes. Also, we just initiated a study on white-tailed and mule deer along the Platte River of western Nebraska, an area where CWD is endemic. In addition to learning about the ecology of both deer species in this area, we are determining prevalence and expansion rates of CWD. Data from both study areas will be used to develop models that will evaluate the potential for transmission of CWD along river systems and provide information on the means to manage CWD.

Other studies that are underway include:

- disease surveillance and mitigation in caribou and reindeer,
- evaluation of interactions and disease transmission between feral and domestic swine,
- evaluation of interactions and potential disease transmission routes between captive and wild cervids at fencelines,
- assessment of the roles that scavengers and predators play in the transmission of CWD,
- development of a rapid test to identify prions in biological and environmental samples, and
- development of enzymes for denaturing prions.

SUMMARY

Challenges associated with ungulates and the damage they cause, including disease concerns, continue to emerge. Scientists and collaborators with the NWRC have traditionally been at the forefront of these issues, and we continue to conduct research that is vital to providing the knowledge and tools needed to address challenges with cervid disease. The NWRC is continuing to maintain a leadership role associated with cervid

challenges with cervid disease. The NWRC is continuing to maintain a leadership role associated with cervid disease and we routinely advise, consult, and collaborate with others.

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