

EVALUATING MANAGEMENT STRATEGIES FOR CHRONIC WASTING DISEASE IN MICHIGAN WHITETAIL DEER

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Managing chronic wasting disease (CWD)—an always-fatal neurologic disease in whitetail deer, mule deer, elk, moose, and other members of the deer family—continues to challenge wildlife managers tasked with sustaining healthy and abundant deer herds. The disease continues to spread and is now found in wild deer in 31 U.S. states and four Canadian provinces. Wildlife agencies in western states, where the disease originated and has been spreading since the 1980s, report population declines in mule deer and elk. Despite best efforts by managers to prevent the introduction and spread of CWD, there are few instances where management was considered effective. One of these examples, however, is a local culling program conducted annually in northern Illinois, which has helped keep CWD at low levels since the early 2000s.

This persistent mystery surrounding the effective management of CWD drives our research at Michigan State University. With funding from the Michigan Department of Natural Resources (DNR), we built a simulation model to create wild deer populations infected with CWD and to assess how various management actions affect population and disease dynamics. Our goal was to produce a tool that can answer common questions state wildlife managers ask when faced with a new outbreak of CWD, such as: How many deer do we need to remove to stop or slow disease spread? Which areas should we target for deer removal to be most effective at reducing CWD? How soon do we need to implement management to make the biggest impact on the disease?

We built this model using data collected in real-time on GPS-collared deer in our study area of mid-Michigan—another study funded by the Michigan DNR and led by Boone and Crockett fellow Jonathan Trudeau. These location data revealed fine-scale movement and habitat use information, such as seasonal home range sizes and habitat preferences and dispersal rates, times, and distances for each age class and sex of Michigan deer, which we then applied to our simulated deer population. Although we simulate deer with behaviors and movements specific to mid-Michigan and model them on real geographic areas located in Michigan, we built our model to make it easy for wildlife managers in other states to add deer and landscape information specific to their state.

Once we had a model deer population that moved and interacted with each other and their environment similar to the real GPS-collared deer in our study area, we infected the virtual deer with CWD using disease data collected by CWD researchers and Midwest state agencies that report prevalence rates of CWD in their wild deer each year. With both the deer population and CWD performing as expected for CWD-infected deer populations in the Midwest, we began to assess various disease management strategies. These strategies were developed in close collaboration with wildlife managers and researchers at the Michigan DNR and wildlife biologists at the United States Department of Agriculture's Wildlife Services, which state agencies often hire to perform localized

LEFT: Noelle assisting with the capture and GPS-collaring of whitetail deer in mid-Michigan, a partner project led by Michigan State University and the Michigan Department of Natural Resources. They used a drop net to capture the deer. It is a huge net held up with a pole with bait placed in the center. There is a remote trigger to monitor the net from a distance and drop it once deer go under. They are able to capture multiple deer at once and it is fairly effective in agricultural fields during winter. **BELOW:** Two of the GPS-collared deer inhabiting the mid-Michigan study area which we collected movement and habitat use information to inform the CWD model.



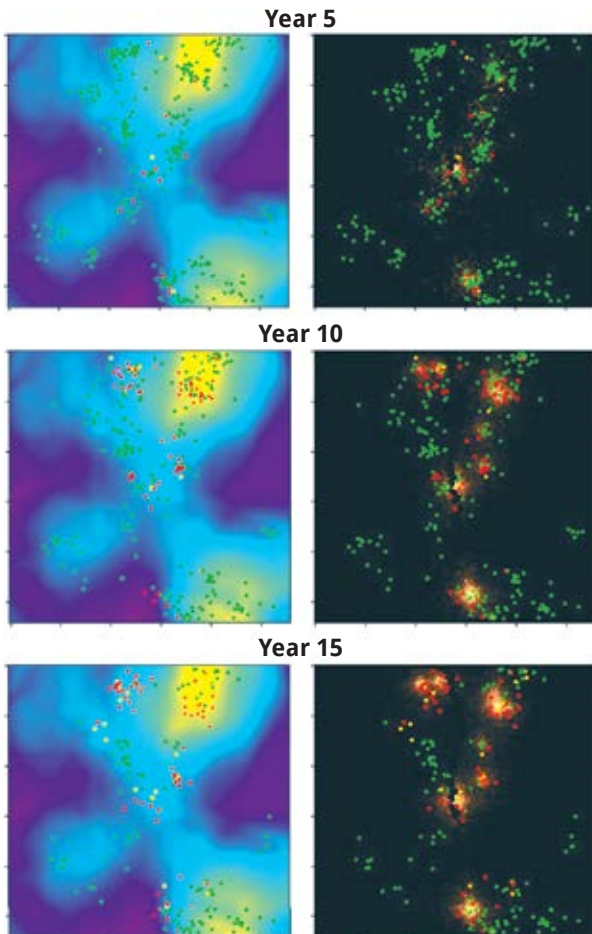
Although much about this disease remains unknown, we do know that CWD is too large of a threat to real, live deer populations to attempt to test management strategies in a trial-and-error fashion. Wildlife agencies must detect the disease early and act fast to have any chance of extinguishing the disease.

removal of deer. To make these management scenarios as realistic as possible, we asked our collaborators: How many deer do you remove in a single day? How many total deer do you remove by the end of the season? How do your deer removal efforts and success rates change over time?

One of the primary questions in this study was whether changes to fine-scale deer removal practices could improve managers' chances of slowing or stopping disease spread. To begin to answer this, we implemented and assessed a suite of local deer removal techniques in the model, including ring culls of various sizes, which involves the removal of deer within a specified distance of a detected case of CWD, and more spatially-targeted removal methods, such as removing deer only located in areas with high-quality deer habitat with the assumption that deer are more likely to come into contact and spread the disease in those areas. Holding the modeled deer population and underlying landscape constant across scenarios, we then tracked CWD over time to identify the deer removal methods that could stamp out the disease or were more effective at slowing its spread.

Other ideas we are currently exploring with the model include how the environment and deer

Uninfected (green) and infected (orange and red) deer depicted as dots on a study area located in mid-Michigan at Year 5, 10, and 15 of a model simulation. The map on the left details the suitability of habitat for deer, with deer more likely to be located and use areas shaded light blue to yellow. The images on the right visualize where the disease agent, infectious mutated proteins or 'prions,' were deposited into the environment and where uninfected deer can then encounter them and become infected. The landscape changes from black to light brown in the model as prions are shed by infected deer and accumulate in each area.



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The mission of the Boone and Crockett Club University Programs is the development of a diverse community of high-impact wildlife conservation leaders.

MEET NOELLE

I was raised on the south side of Chicago. I went to college thinking I wanted to work in a wildlife conservation department within a large zoo—the extent of my knowledge about wildlife careers. During my undergraduate program at the University of Illinois, I joined the chronic wasting disease (CWD) lab and became interested in wildlife diseases and applied research. I stayed with the CWD lab for my master's degree to assess how a long-term deer management program affected deer habitat use and spatial structure in an important natural area with implications for potential disease spread. After my MS, I began my PhD at Michigan State University where the Boone and Crockett Quantitative Wildlife Center was initiating a multi-year CWD project. For my dissertation, I am evaluating effective management strategies for CWD in Michigan's free-ranging deer herds. My research interests focus on wildlife infectious diseases, wildlife policy, and wildlife management. In the future, I aim to make an impact on wildlife diseases and policy as a wildlife disease ecologist within a federal or state agency.

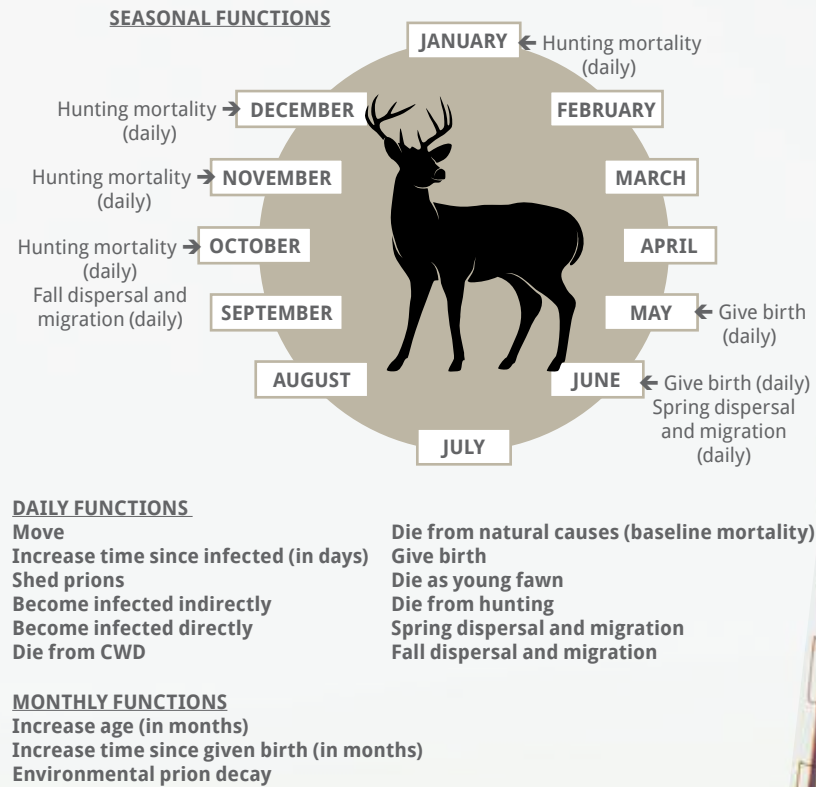


population, such as landscape type and deer density, affect management success; identifying the proportion of deer needing to be removed for disease eradication to be likely; and how variability in the implementation of management practices, such as deer removal and land access rates, affect management success. However, the possibilities of this model to answer questions asked by wildlife managers and allow them to make more informed management decisions go far beyond these initial assessments. The model can investigate CWD management strategies beyond localized deer removal, such as altered hunter-harvest rates and regulations on baiting and supplemental feeding.

Although much about this disease remains unknown, we do know that CWD is too large of a threat to real, live deer populations to attempt to test management strategies in a trial-and-error fashion. Wildlife agencies must detect the disease early and act fast to have any chance of extinguishing the disease. Once CWD becomes established in a wild deer herd, the chances of getting rid of the disease appear to be nearly zero. To better understand and predict the usefulness of management strategies for CWD, we provide wildlife agencies and researchers with a modeling tool where they can safely implement and investigate management scenarios for CWD in a virtual yet realistic environment. ■

A herd of whitetail deer feed in an agricultural field within the mid-Michigan study area. The deer that is farthest back in the photo is GPS-collared with ear tags after having previously been captured and fitted with a GPS collar by Noelle's MSU-MDNR field study.

LIFE AND DISEASE EVENTS EXPERIENCED BY SIMULATED WHITETAIL DEER EACH YEAR WITHIN THE MODEL



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