Minnesota's Disease Status Report to the Midwest Fish and Wildlife Health Committee

Chronic Wasting Disease

Minnesota Department of Natural Resources (MNDNR) began chronic wasting disease (CWD) surveillance in 2002 following the state's first detection of CWD on a captive cervid farm. Following an initial three-year statewide surveillance, MNDNR adopted a risk-based response strategy to conduct intense, concentrated surveillance in high-risk CWD areas. In 2019, MNDNR conducted hunter-harvested surveillance around three known positive captive cervid farms and an outbreak in wild deer. To date, there have been 88 CWD-positive wild deer in six counties: Crow Wing, Dakota, Fillmore, Houston, Olmsted, and Winona. Three of the four outbreaks that included wild deer were within a few miles of a CWD-positive cervid farm in Olmsted, Winona, and Crow Wing counties. Since 2002, 10 captive cervids farms have been infected with CWD in the state.

Starting in 2016, MNDNR has been working to manage an ongoing outbreak of CWD in wild deer in the southeast, was first discovered began in Fillmore and now cases have also been found in county Houston and Winona counties. For fall 2019, surveillance was conducted in three areas of the state in response to CWD-positive cervid farms or detections in wild deer: central, north central, and southeast surveillance areas. For central, fall 2019 marked the third year of precautionary surveillance around a depopulated CWD-positive cervid farm. In the southeast, CWD Management and Control Zones were created in response to the increasing number of positive wild deer in Fillmore county, a depopulated positive cervid farm in Winona, new cases of CWD in wild deer found within a mile of the Winona farm, and the encroaching positive wild deer in Wisconsin and Iowa. Finally, a new CWD Management Zone was created in north-central Minnesota, Crow Wing County, where a CWD-positive cervid farm remained in business for several years and eventually led to the discovery of a positive wild deer found dead a half mile of the farm's fences. CWD Management Zones were created to allow MNDNR to impose mandatory testing requirements for all adult deer and enforce carcass movement restrictions to prevent the disease from spreading to new areas. The CWD Control Zone was created as a buffer to implement carcass movement restrictions, along with less restrictive mandatory testing requirements.

Fall 2019 surveillance included the incorporation of an inaugural dumpster program for all CWD Management and Control Zones, as mandated by state legislature. While the program was intended to be marketed similar to Wisconsin's Adopt-A-Dumpster program, most of the funding

came from within MNDNR, although several deer groups made donations. This dumpster program enabled hunters to quarter their deer and dispose of carcasses within the CWD Management and Control zones, allowing them to abide by carcass movement restrictions. Dumpsters, tables, and quartering tripods were available in select locations starting with archery season and expanded during the firearms season when most hunters are afield. The program was a roaring success, with more than 200 tons of deer parts brought to certified landfills, costing MNDNR and their partners $170,000. Very few issues came up during the first year of the dumpster program; notably, dumpsters were not used as dumping grounds for other non-target waste items, which was a concern from several parties. In the north central, Crow Wing County Landfill took additional steps to mitigate potential disease spread and worked with MNDNR and Minnesota Pollution Control Agency (MPCA) to utilize an incinerator for all deer waste for the CWD Management Zone in that region. The taxidermist program in all CWD surveillance areas was ramped up with cooperating taxidermists collecting hunter data, lymph nodes, muscle, and a tooth for $15/animal (mostly adult male deer). In previous years, taxidermists had produced a couple hundred samples per season, but this year taxidermists collected over 1,400 samples, which yielded four CWD-positive results.

Surveillance and staffing efforts in 2019 included 22 newly renovated self-service sampling stations (Figure 1) available to hunters throughout all of archery and muzzleloader seasons in north central and southeast CWD Management and Control Zones. DNR staff visited these stations three times per week to collect deer heads for sampling and lab shipment. During the firearm seasons, DNR employees (mostly wildlife with some fisheries staff) and students staffed 31 sampling stations daily. DNR staff worked 213 shifts, ranging 2-5 days in duration, while students from four universities filled 244 weekend shifts.

Figure 1. Self-service sampling station available to hunters when stations were not staffed by DNR employees. A 4’ x 4’ map with TRS locations was attached to the face of the plywood with plexiglass. Tags with detachable receipts were found in the toolbox, along with zip ties and garbage bags for affixing the hunter’s information to the deer’s ear. Heads were deposited by the hunter in the waterproof barrel and picked up by MNDNR staff three days a week for sampling.

Between July 1, 2019 through March 27, 2020, 18,543 deer were tested with 36 CWD-positive detections (Figure 2). During just the fall hunter-harvested surveillance, 17,717 deer were tested: 544 deer in the central with no new detections, 3,966 deer in the north-central with no new detections, and 13,207 deer in the southeast with 26 CWD-positive detections. In the southeast, additional management actions were taken over the winter including landowner shooting permits and USDA agency culling; these efforts yielded 37 deer tested with no detections and 463 deer tested with 7 CWD-positive detections, respectively. Opportunistic sampling of symptomatic deer occurs year-round across the state; 356 opportunistic deer were tested with three positive detections (two found dead in Fillmore and Houston counties and one reported sick animal from Dakota county). Finally, two new positive CWD-captive cervid farms were announced over the winter in Douglas and Pine counties.

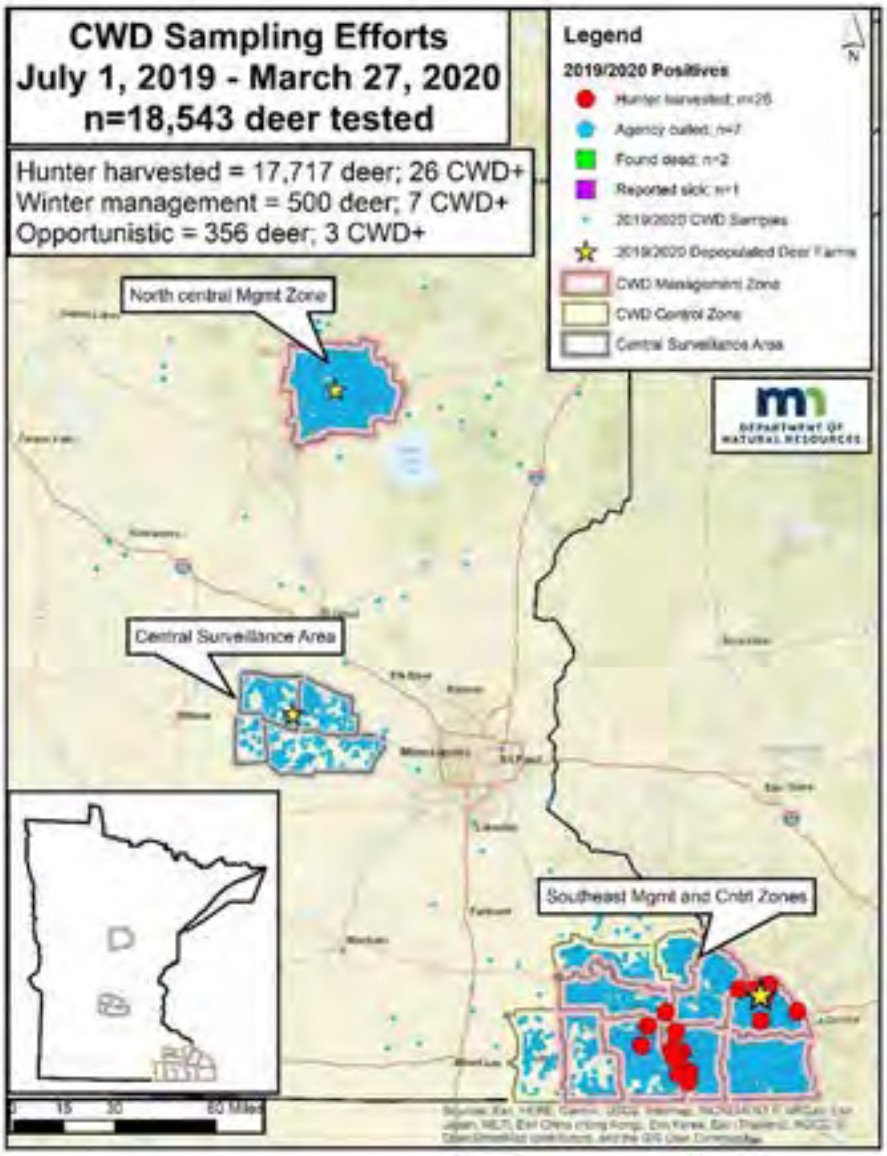

Figure 2. CWD samples collected July 1, 2019 through March 27, 2020. This map depicts fall hunter-harvested surveillance, winter management, and opportunistic deer sampled for CWD.

While there were several successes during the 2019 CWD surveillance season, including no detections in the central or north central surveillance areas, the announcement of two new CWD positive cervid farms and a positive wild deer found over 100 miles from the nearest CWD surveillance areas means that surveillance efforts will increase for fall 2020 (Figure 3).

Figure 3. Proposed surveillance for fall 2020, including Southeast Management and Control Zones, North central DPA 604 Management Zone, and new surveillance for Douglas, Pine, and Dakota

New surveillance for 2020 will include surveillance around the 2 new CWD-positive deer farms in Douglas and Pine counties. The CWD-positive wild deer in Dakota county (reported sick by a member of the public) will lead to the creation of a new CWD Management Zone with mandatory testing and carcass movement restrictions.

To protect the health of the herd, carcass import restrictions remain in place, preventing the movement of whole carcasses of any cervid from outside the state past MN boundaries. In addition, feeding and attractant bans are in place for 31 of 82 counties in Minnesota, and will soon be expanded to include Dakota county and its surrounding counties.

GPS collar study of movement dynamics of white-tailed deer and potential prion transmission in southeastern Minnesota

This study aims to better understand dispersal, movement patterns, and survival of white-tailed deer (*Odocoileus virginianus*) in southeastern Minnesota, particularly in and around the southeast Minnesota CWD Management Zone covering Houston, Fillmore, Olmsted, and Winona Counties (Figure 3). We are using the deer movement data to understand potential routes of disease spread via wild deer movements and thus inform management options. In addition, GPS collars include mortality sensors that alert us when a collared deer has died. We respond as soon as possible to mortality alerts (typically within 24-48 hours) to determine cause of death. Currently, we are in the process of using mortality information to quantify survival and cause-specific mortality.

As of April 15 2020, we continue to monitor 29 animals (19 females and 10 males) collared in 2019. All animals collared in 2018 either have collars that are no longer transmitting data (n=46) or have died (n=49). To date, 82 study deer have died, with sources of mortality including hunter harvest (n=34), capture-related issues (n=15), underlying health condition (n=10), vehicle collision (n=10), indeterminate (n=6), agency culling (n=4), and predation (n=3). The underlying health condition categorization includes a suite of comorbidities that preclude simple assignment including bacterial infection, trauma to extremities, emaciation, organ damage or anomaly, internal hemorrhaging, and acidosis. When carcass and mortality scene evidence was not sufficient to assign causality, we categorized cause of death as indeterminate.

From September through December 2019, we expected most of the fawns from the February 2019 cohort to have established an adult home range. During fall, deer may leave their home ranges to make excursions or expand their home ranges (males) as they search for mating opportunities with females. We found that fall home ranges were larger than summer home ranges for deer collared in 2018 and 2019. Home range size varied greatly among individual deer, but generally increased between summer and fall. Home ranges of females more than doubled in size, from an average of 1.37 km^2 (± 1.54 km^2 standard deviation [SD]) during the

summer (n = 47) to an average of 3.35 km^2 (± 4.46 SD; n=42) during the fall. Males also expanded their adult home ranges from an average of 1.88 km^2 (± 2.24 km^2 SD n=56) to an average of 4.29 km^2 (± 3.73 km^2 SD; n =53). Expansion of home ranges during the fall likely represents increased movement by males in search of mating opportunities and, potentially, matched movement from females as they also seek males.

From Feb. 09-12, 2020, we captured and collared additional 52 deer: 29 female fawns and 23 male fawns (Figure 4). We carried out capture operations across 132,113 acres of private (n=62,696 ac) and public (n=69,251 ac) lands in southeastern Minnesota. This area of Minnesota is primarily privately-owned, and capture success was largely dependent on developing positive relationships with 193 landowners.

During the capture period, two male fawns and two female fawn were able to kick off their collars just after initial collar fitting, but we were able to retrieve collars for redeployment on other animals. As of April 15, 2020, we are monitoring 29 does and 19 bucks from the third year cohort. We recorded four mortalities from the 2020 cohort, and suspect that two of these animals died from capture myopathy based on necropsy evidence at the UMN Veterinary Diagnostic Lab and the other two apparently were killed by predators. There have been no collar failures to date from the 2020 cohort.

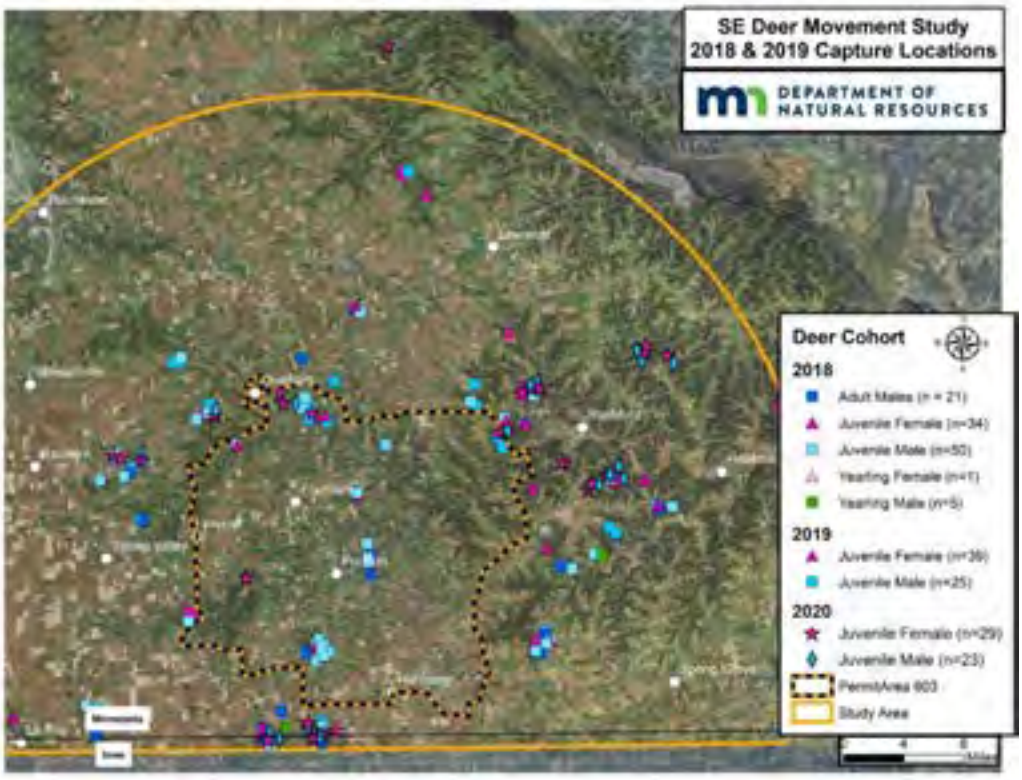

Figure 4. Spatial distribution of deer captured and GPS-collared during the three capture seasons between 2018 and 2020 in the study area, southeastern Minnesota.

White-nose Syndrome, WNS

White-nose Syndrome (WNS), caused by the fungus *Pseduogymnoascus destructans* (*Pd*), was identified in Minnesota in the winter of 2011/2012. As of fall 2019, WNS has been documented in fifteen counties in Minnesota (Figure 5). Few hibernacula remain negative for *Pd* and WNS is now considered widespread in Minnesota. Minnesota is home to four hibernating bat species including, the Big brown bat (*Eptesicus fuscus*), Little brown bat (*Myotis lucifugus*), Northern long-eared bat (*Myotis septentrionalis*), and Tricolored bat (*Perimyotis subflavus*). WNS can cause significant bat mortality in winter months, and has been readily observed in Minnesota. During the winters of 2016-2019, substantial bat mortality was observed in two of the state's largest hibernacula, Soudan Underground Mine in St. Louis County and Mystery Cave in Fillmore County.

Winter hibernacula surveys in 2018-2019 were conducted at eight locations to evaluate the presence of WNS. Of those eight hibernacula, Mystery Cave, Soudan Underground Mine and Robinson's Ice Cave have been monitored regularly since winter 2011/2012 and provide the best timeline for the appearance of WNS to Minnesota and the subsequent decline in hibernating bats. Counts during winter 2018-2019 season found a 90% decline at Soudan Underground Mine and a 94% decline at Mystery Cave from the highest counts pre-WNS/*Pd.*

Acoustic monitoring in addition to hibernacula studies occurred at the two entrances of Mystery Cave to document patterns of winter activity and spring emergence from February to April 2019. Beginning winter 2018, full spectrum detectors were used in place of zero-cross detectors to capture high quality call data for species identification. Despite the ability to capture more bat calls, both entrances experienced lower winter activity than previous years. This likely reflects the 94% decline observed during winter counts of Mystery Cave in March 2019. Summer acoustic surveys were conducted at five locations distributed throughout the state and staff documented continued decreases statewide in relative call frequency among *Myotis spp.* In addition to summer acoustic surveys, summer colony counts conducted in 2019 at Historic Forestville/Mystery Cave State Park showed an 87% decrease from the highest counts in 2016.

Summer roost site identification and monitoring occurs across the state. These structures may include outbuildings, bat boxes and barns. To determine species, nine sites were visited and emergence surveys were conducted with ultrasonic acoustic detectors for species identification. Counts occurred twice during the mating season (May/July) at most roosts. Species determination was based on both the call files and guano characteristics at the site.

MNDNR is working on a variety of ongoing research projects with University of Minnesota and USGS National Wildlife Health Center, including analysis of microbes in hibernacula as biocontrols, submitting guano samples for the USGS National Wildlife Health Center's Guano Project, and field trials of a vaccine for WNS.

In an effort to reduce the human spread of WNS, public tours of the MNDNR operated Soudan Underground Mine and Mystery Cave begin with a brief lesson about the disease and what precautions should be taken.. Visitors are required to walk across decontamination mats before and after tours. Likewise, visitors are advised not to wear the same clothing, footwear, or gear when visiting other caves or mines where bats may be present. Multiple washings in a standard washing machine will not provide sufficient decontamination. Tours will continue at the Soudan Underground Mine and Mystery Cave, and MNDNR will continue to follow recommended national decontamination protocols to prevent human transport of fungal spores. The MNDNR urges owners of private caves to learn about WNS and take similar visitor precautions.

In areas where WNS is known to be present, residents have contacted MNDNR with reports of seeing fewer bats. These residents have also noted increases in insects such as mosquitoes. A reporting system allows Minnesota residents to report unusual bat activity (https://www.dnr.state.mn.us/reportbats/index.html).

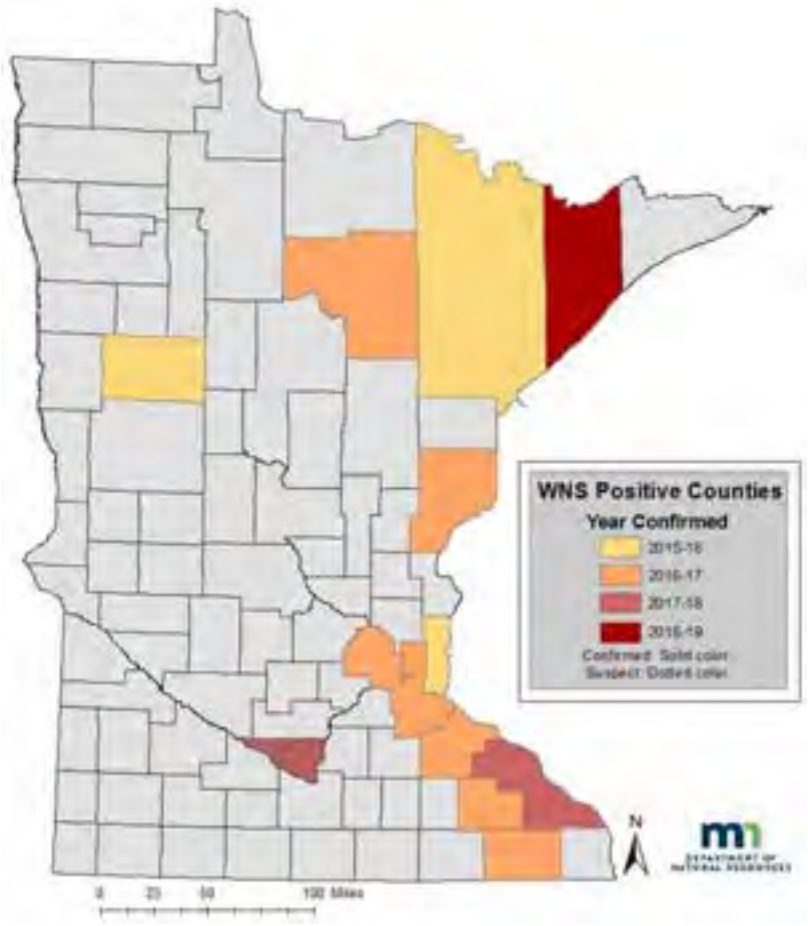

Figure 5: Minnesota counties positive for WNS as of Fall 2019

Neonicotinoid Exposure in White-Tailed Deer Project Update

Minnesota Department of Natural Resources (MNDNR) implemented a new pilot study to investigate white-tailed deer exposure to neonicotinoids. Neonicotinoid pesticides are insecticides applied through seed treatments, in foliar sprays, applied granularly to pastures, and injected into trees. They are most commonly used in agricultural practices but can also be found in some residential applications such as garden, turf, and animal uses. This project stemmed from an experiment out of South Dakota State University lead by Elise Berheim, wherein white-tailed deer were exposed to imadacloprid at varying levels via their water source. Upon testing, all deer, including the control group, had measurable levels of imidacloprid in the spleen. Further, as imidacloprid levels increased in the spleen, fawn survival, thyroxine levels, jawbone lengths, body weights, and organ weights all decreased. Archived samples from free-ranging deer in North Dakota were tested with the same procedures. Results showed imidacloprid levels were higher in wild deer when compared to the captive deer in their study.

To determine if Minnesota deer are exposed to neonicotinoids, MNDNR launched a project to collect spleens from hunter-harvested deer. In order to assess potential exposure across the state, each deer permit area was categorized based on the amount of cover crop (specifically corn, soybeans and wheat) per total area. Permit areas were placed into three categories, 0-33%, 33-66% and 66-85% crop cover. The goal was to collect 200 spleen samples from each category, with an additional 200 in the highest category (66-85%) for a total of 800 samples. Interested participants (hunters) signed up via a google form to receive a kit to collect spleens from deer they harvested. A total of 1,835 sampling kits were mailed to interested project participants. The kits included a sealable sample bag with attached label, a Ziploc bag to prevent leakage, a coin envelope for tooth collection, a cold pack, and a prepaid return shipping label and shipping box. The kit also included detailed instructions on where a spleen is located, how to remove it, and how to return the samples. In addition to the written instructions, we created a short video to identify the organ and demonstrate how to remove it from a white tailed deer. A link to this video was included in the instructions document.

Samples returned to the MNDNR office, were inventoried and frozen until the hunting season ended. After the hunting season, all samples were thawed to verify the correct tissue was collected and a subsample was taken as per lab specifications. A total of 798 samples were received through the hunter harvested process however, 24 samples were identified as non-spleen tissue. Additional samples were then collected from sick deer (n=2), as well as agency culled deer (n=28) to reach our goal of 800 (Figure 6). Samples were collected from almost every deer permit area in the state, but the majority of samples were collected from the lowest crop cover category (n=475, 59%) In addition to the samples collected from white-tailed deer, Minnesota elk hunters were asked to voluntarily provide a spleen sample from elk they harvested. We received 11 elk samples although three (3) were non-spleen tissue.

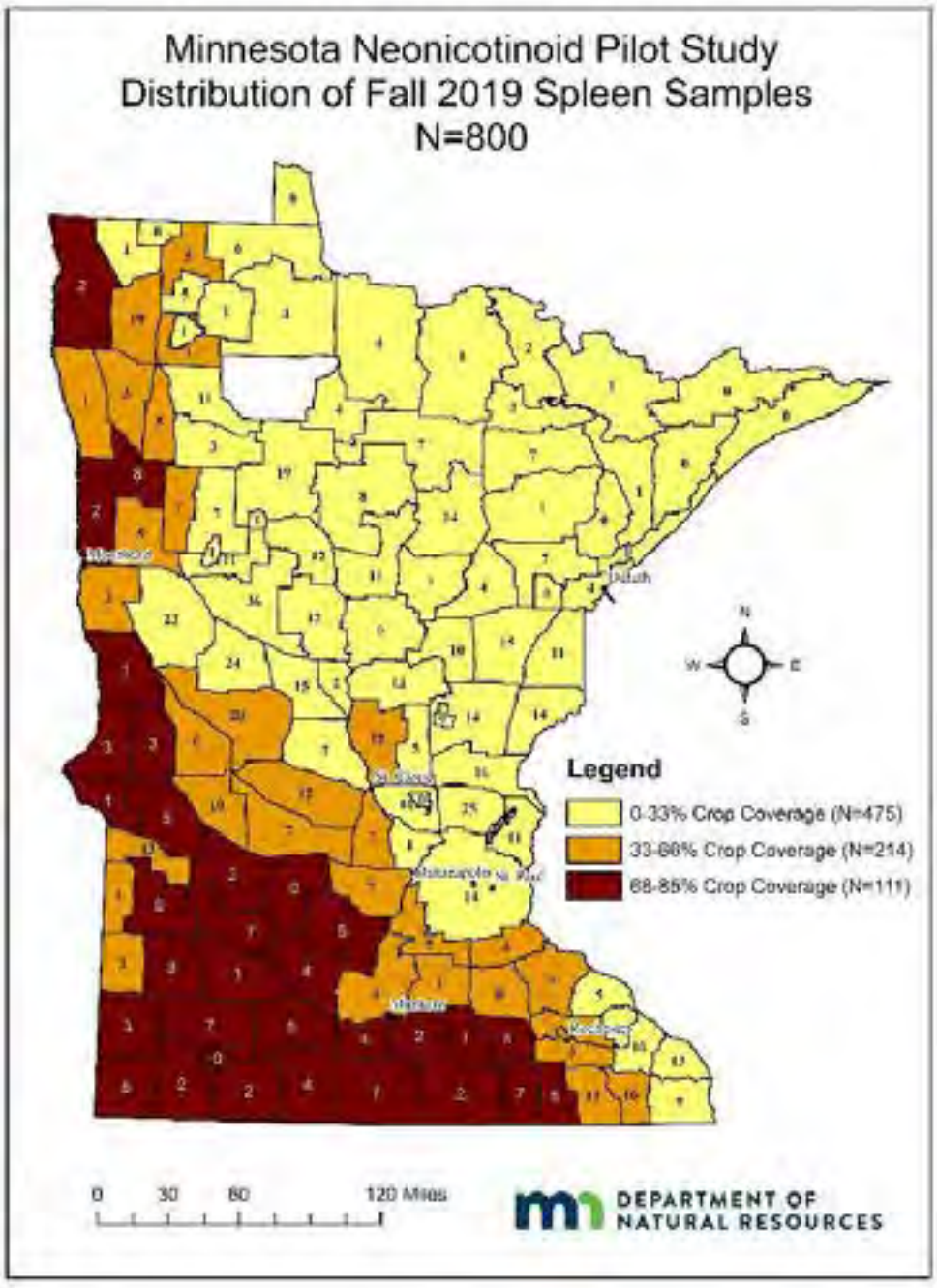

Figure 6. Number of spleen samples collected from hunter-harvested deer within deer permit areas of Minnesota for inclusion in the deer-neonic pilot project.

Spleen samples will be processed at the Ecdysis Foundation in Estelline, South Dakota where an ELISA test will be conducted to determine level of exposure. Sample results for these tests are expected to be returned in August. Tooth samples will be processed at Matson's Laboratory in Manhatten, Montana via cementum annuli; aging results are expected in June. Once all results are received, the data will be analyzed and a short summary will be created to distribute to all project participants. Additionally, participants that provided a spleen and tooth sample will receive the results of both neonicotinoid exposure and exact age for their individual deer or elk. Results from this study will help guide future research into potential effects of neonicotinoid on white-tailed deer population performance in Minnesota deer.

West Nile Virus in Minnesota's Ruffed Grouse

Minnesota participated in a collaborative, multi-state West Nile virus (WNV) study of ruffed grouse (*Bonasa umbellus*) in the Great Lakes region during 2018 and 2019. Cooperating hunters (n = 117) voluntarily collected 273 samples from birds harvested during the 2018 hunting season and 166 hunters collected samples from 317 ruffed grouse during the 2019 season (Figure 7). Blood on filter strips and hearts were submitted to the Southeastern Cooperative Wildlife Disease Study (SCWDS) at the University of Georgia to assess both 1) viral exposure as indicated by antibodies in blood, and 2) virus in hearts indicative of infection. Laboratory results indicated that 12.5% and 12.3% of birds were positive for antibodies to WNV or a flavivirus (most likely WNV rather than St Louis encephalitis virus, based on known WNV activity during the study period) in 2018 and 2019, respectively. However, virus was not isolated from hearts in either year, indicating that exposed birds were not infected at the time of collection. These findings indicate that Minnesota ruffed grouse are exposed to WNV. Some birds either mount a successful immune response without symptoms or develop symptoms and recover. However, any birds that might have succumbed to infection over the summer and did not survive were not available for sampling during the fall, so it is difficult to know how many birds might have been lost to WNV. Providing good ruffed grouse habitat that produces birds in good condition is our best management option for buffering ruffed grouse populations from WNV and other stressors.

Four grouse that were observed exhibiting abnormal behavior or had reduced muscle mass were turned in to MNDNR staff as suspected for WNV infection. Carcasses were brought for necropsy at the University of Minnesota's Veterinary Diagnostic Laboratory and screened for both WNV and Eastern Equine Encephalitis (EEE). All 4 birds were found positive for EEE and exhibited supporting histopathology to confirm the virus likely caused their morbity or mortality. These birds were found in Itasca (n=3) and Aiktin (n=1) counties this past fall.

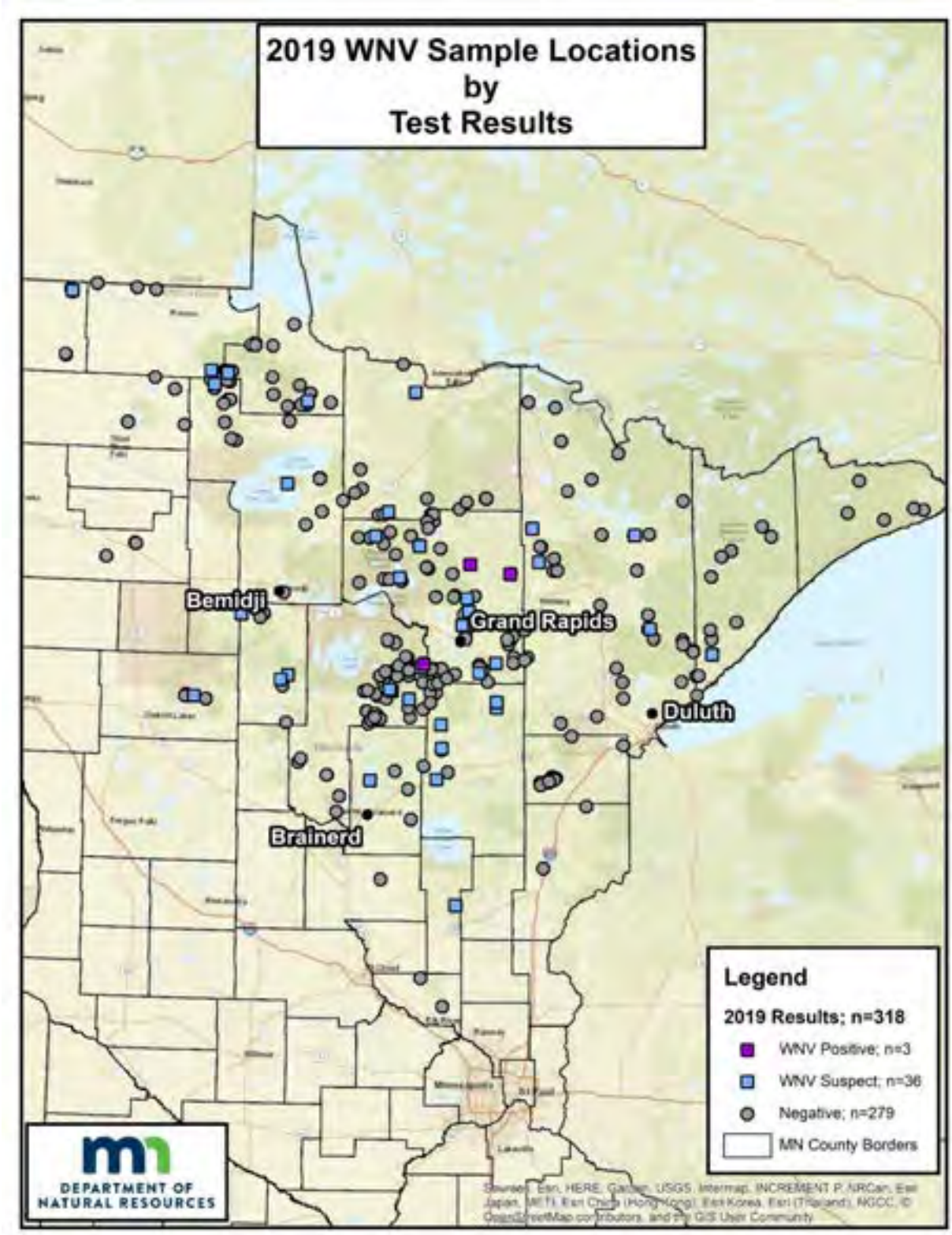

Figure 7. The distribution of hunter-harvested ruffed grouse samples in Minnesota during 2019, with samples indicated as West Nile virus (WNV) positive, flavivirus (WNV suspect) positive, or negative.

Epizootic Hemorrhagic Disease (EHD)

On Sept 3, 2019, Minnesota DNR received reports of multiple dead deer in Stearns County, in central Minnesota; most carcasses were too decayed for diagnostics except for 2 deer. Both were confirmed positive for EHD on Sept 11th, which is the first confirmed detection of this disease in Minnesota. Approximately 30 deer on 5 properties in the same area were reported and several additional spleens samples were submitted and confirmed to have EHD.

On Sept 5th, the Minnesota Board of Animal Health (BAH) reported the deaths of 2 farmed deer in a captive herd in Houston County, in southeastern Minnesota. Both animals were confirmed to have EHD-Serotype 2. Soon after, reports of dead wild deer were received on 16 properties involved >50 carcasses in Houston county. Spleens were sent in from several of the mortalities and EHD was again confirmed. Reported mortalities likely under estimate the deaths caused by EHD in these 2 counties, which likely involved ~200 deer.

Health assessments for free-ranging Elk in Northwest Minnesota from 2004-2019

From 2004-2019, we assessed the health of 220 free-ranging elk (*Cervus elaphus)* from northwestern Minnesota by screening hunter-harvested or opportunistic animals for a variety of diseases, parasites, and hepatic mineral levels. Hunters were provided a sampling kit and instructions for collecting samples of lung, liver, feces, blood, hair, ticks, and an incisor for aging. Sampled elk were then grouped as either *harvested* (*n*=173, 98 females, 75 males; including hunter-harvested (157), removed under shooting permit (12), and illegally poached (4) or *other* (*n*=47, 15 females, 32 males; including vehicle kills (3), sick (5), found dead (3), live-captures (22), agency-sponsored removals (12), and other (2). Elk were categorized by age class, including 3 calves (<1 year of age), 25 yearlings (1 year old), and 136 adults (mean age was 5.2; range was 2 to 16). Age results for 15 elk are still pending.

Our results indicated exposure to eastern equine encephalitis (14%), West Nile virus (61%), malignant catarrhal fever (29%), anaplasmosis (15%), borreliosis (70%), bovine viral diarrhea virus 1 and 2 (9%), bovine herpes virus (5%), *Leptospira sp*., (12%) and parainfluenza virus 3 (34%). A variety of fecal parasites were also identified (including *Coccidia, Strongyle-type ova,* and *Moniezia*) in 22% of elk. Lung and liver tissue were cultured for bacterial infection; *Streptococcus sp.* was isolated from the lung of one individual and no isolations were found in liver samples. All elk were negative for *Mycobacterium paratuberculosis,* blue tongue virus, neospora, epizootic hemorrhagic disease, brucellosis, chronic wasting disease, and bovine tuberculosis.

Rabies

There were 12 cases of rabies reported by the Minnesota Department of Health from January 1, 2019 to August 1, 2019; information for the remainder of 2019 was not available. These included 4 skunks, 7 bats, and 1 fox (Figure 8).

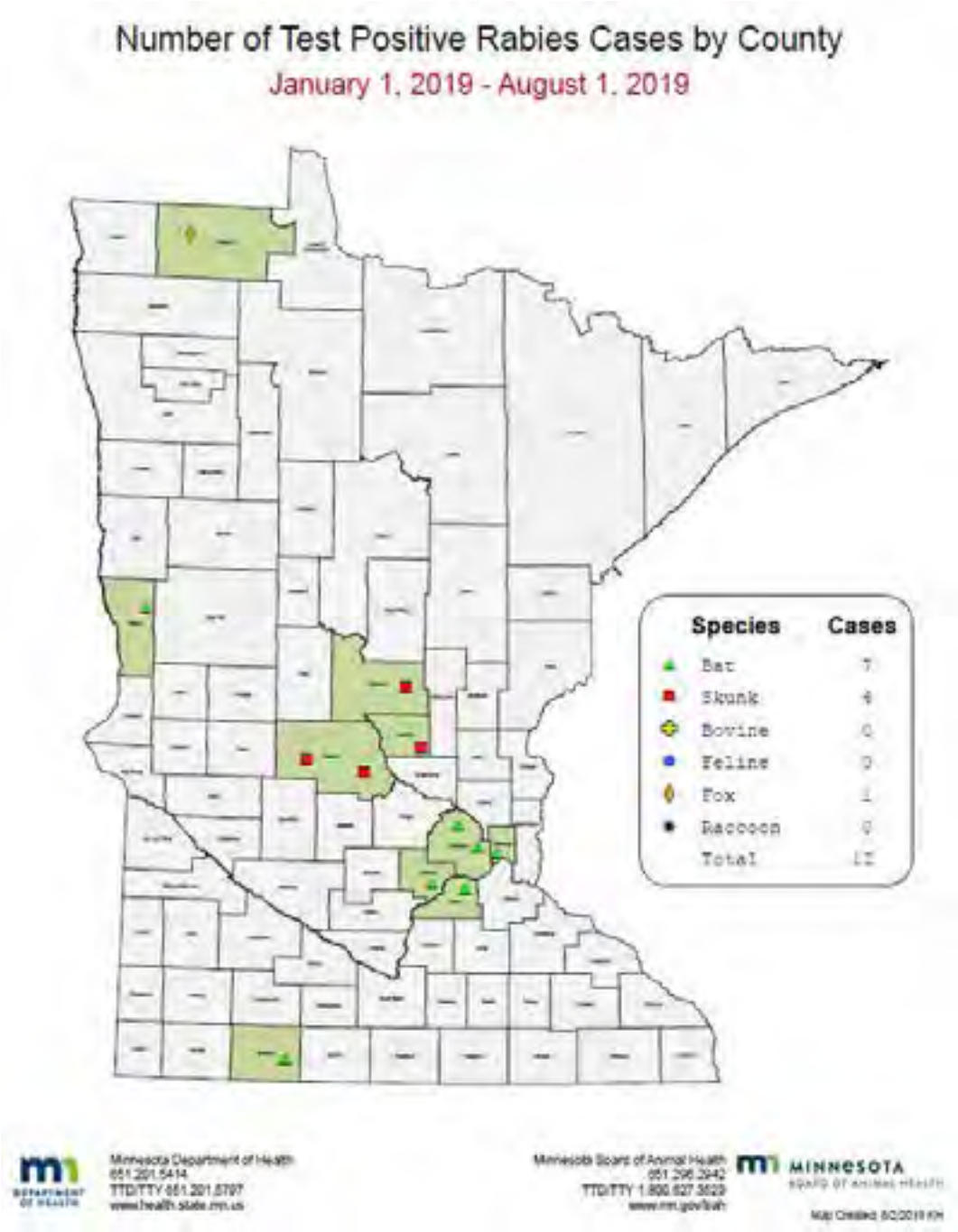

Figure 8. Cases of rabies (*n*=12) reported in Minnesota during Jan-Aug, 2019.