



Environment and Natural Resources Trust Fund (ENRTF) M.L. 2017 LCCMR Work Plan

Date of Submission: October 15, 2019
Date of Next Status Update Report: April 15, 2020
Date of Work Plan Approval: January 11, 2018
Project Completion Date: 06/30/2020
Does this submission include an amendment request? Yes

PROJECT TITLE: Deer movement related to potential CWD prion transmission

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Location: Fillmore, Houston, Mower, Olmsted, Winona. Southeastern Minnesota will be impacted by the study.

Total ENRTF Project Budget:	ENRTF Appropriation:	\$449,557
	Amount Spent:	\$353,427
	Balance:	\$96,130

Legal Citation: M.L. 2015, Chp. 76, Sec. 2, Subd. 10 - Emerging Issues Account as extended M. L. 2017, Chap. 96, Sec. 2, Subd. 18 as extended M.L. 2018, Chp. 214, Art. 4, Sec. 2, Subd. 20 as extended by M.L. 2019, First Special Session, Chp. 4, Art. 2, Sec. 2, Subd. 19

Appropriation Language:

\$1,000,000 the first year is from the trust fund to an emerging issues account authorized in Minnesota Statutes, section 116P.08, subdivision 4, paragraph (d)

M. L. 2017, Chap. 96, Sec. 2, Subd. 18. Carryforward; Extension

- (a) The availability of the appropriations for the following projects are extended to June 30, 2018:
(8) Laws 2015, chapter 76, section 2, subdivision 10, Emerging Issues Account.

M.L. 2018, Cho. 214, Art. 4, Sec. 2, Subd. 20. Carryforward; Extension

- (a) The availability of the appropriations for the following projects are extended to June 30, 2019:
(9) Laws 2015, chapter 76, section 2, subdivision 10, Emerging Issues Account.

M.L. 2019, First Special Session, Chp. 4, Art. 2, Sec. 2, Subd. 19, Subd. 19 Carryforward; Extension
(a) The availability of the appropriations for the following projects is extended to June 30, 2020:
(4) Laws 2015, chapter 76, section 2, subdivision 10, Emerging Issues Account;

I. PROJECT TITLE: Deer movement related to potential CWD prion transmission

II. PROJECT STATEMENT:

In November 2016, MNDNR discovered chronic wasting disease (CWD) in wild white-tailed deer of southeastern Minnesota. In total, 11 positives were found in two spatial clusters approximately 5 miles apart (Figure 1 – see part IX), which motivates research to 1) understand potential pathways of CWD landscape spread, and 2) increase our likelihood of managing the outbreak in this and other areas. We propose to study deer movement ecology as it relates to potential prion transmission in southeastern Minnesota in and around the newly established disease management zone (DPA 603) (Figure 2 – see part IX). From September 2016 through March 2017, 4,142 deer were sampled for CWD, and the data suggests we have discovered the disease in the early stage of the outbreak. This timing offers the best chance of management success because once the disease becomes established, it will be difficult if not impossible to completely eliminate CWD from the deer population. A growing body of research suggests that in the long-term, CWD causes deer population decline and has the potential to cross species barriers.

We received ENRTF Emerging Issues funding (M.L. 2015, Chp. 76, Sec. 2, Subd. 10) which will allow the Minnesota Department of Natural Resources (MNDNR) to purchase GPS collars and acquire satellite data downloads, supplies, and a contract for helicopter captures of 115 white-tailed deer (*Odocoileus virginianus*) in March 2018, 64 deer in February 2019, and 90 deer in January 2020. Wild deer are most efficiently captured during winter because they tend to form herds that are more easily encountered, as compared to other seasons. Ideally, at least one year of data will be needed for a basic understanding of seasonal movements (assuming that weather patterns in 2018 fall under what is considered to be typical). With the addition of \$99,557 from the LCCMR Emerging Issues fund, we will be able to extend the study another year and be able to provide a better understanding of deer dispersal patterns in the study area. This information will provide the basis for guiding future CWD surveillance and management activities in the region.

As infected and non-infected deer interact and move across the landscape, they transmit infectious prions through direct contact with other deer or indirectly through environmental deposition. Limited information exists about deer contact rates and their relationship to transmission rates, especially in areas recently infected. The presumed main driver of spatial spread among wild deer is movement. Currently, there is no research that demonstrates the extent to which potentially infected deer move across the landscape and interact with each other in southeastern Minnesota.

Deer behavior and movements vary by biological and environmental conditions, along with deer population demographics and social structure. Two types of movement likely facilitate disease spread across the landscape, recurrent seasonal movements and one-time dispersal or foray events. The most substantial long-distance movements involve dispersal from birth to adult ranges, most likely to occur in 1-year-old deer. Because deer densities can be altered by management actions, a better understanding of both deer density and movement tendencies related to density will enhance our ability to effectively manage disease risk in the Minnesota deer population. The importance of this research is underscored by the increased risk of disease spread from Wisconsin and Iowa, and our findings will help the MNDNR understand those risk factors as well.

Project objectives:

- 1) Document dispersal patterns and estimate movements of juvenile (\approx 1 year old) males and females, and adult males ($>$ 2 year old)**

Deer will be fitted with Global Positioning System (GPS) collars to obtain multiple locations on a daily basis. We will determine movement patterns and activity ranges of deer during biologically critical time periods of the year; namely spring, fall, and winter. We will focus on juvenile deer because they are the most likely to disperse to new areas and adult males because they are three times more likely to be infected than other sex or age classes.

2) CWD spatial pathways mapping to inform future surveillance and management

We will use GPS location data to evaluate how movement propensities of deer are correlated with landscape characteristics and deer densities in the study area. This will be used to create a predictive deer movement map, which will inform future surveillance and probable pathways of spatial CWD spread.

3) Determination of cause-specific mortality

The GPS collar technology will permit detection of likely mortalities, and we will estimate cause-specific mortality rates by generalized categories (e.g., harvested, vehicle collision, predation) and incorporate those estimates into population models to improve accuracy and understanding of deer population dynamics in southeastern Minnesota.

III. OVERALL PROJECT STATUS UPDATES:

Amendment request (11/17/2017):

Our bid for helicopter capture of our sample of 115 white-tailed deer was quoted (Hells Canyon Helicopters) for less than we budgeted for, leaving approximately \$52,000.00 remaining in our capture budget for activity 1. In addition, our quote for satellite data download (activity 1) was quoted as \$35,063.50 from the selected company Lotek. Our original budget was \$57,500.00, which leaves \$17,521.50 in this line item. Our quote for GPS collars from Lotek (activity 1), was \$4,915.00 above our budgeted cost of \$172,500.00. We would like to transfer \$4915.00 from the satellite data budget to cover the collar costs, and add an additional \$3000.00 for possible extra shipping costs. This leaves \$66,521.50 extra remaining in the helicopter capture and satellite data line items. We request permission to use this additional funding to hire a 50% unclassified FTE (Natural Resource Specialist I) dedicated to all field efforts, landowner communications, and data management. Specifically, we are considering a period of hire starting December 2017 and extending through June 2019 (19 months). The cost of the specialist will be \$43,000 (\$2263/month), with a dedicated truck costing \$10,415.50 (0.55/mile with 230 miles/week for 82.33 weeks), field supplies costing \$1000, and travel expenses including lodging and food allowance costing \$12,103. As a consequence of our request, we ask permission to extend the period over which we can spend these funds through June 30, 2019.

Amendment approved by LCCMR on 1/11/18; extension contingent on Legislative approval.

Amendment request (01/19/2018):

With the addition of \$99,557.00 from the LCCMR Emerging Issues account (M.L. 2015, Chp. 76, Sec. 2, Subd. 10), we have modified our work plan to incorporate another year of capture and deployment of Lotek LiteTrack TL330 expandable GPS Iridium collars on 33 juvenile male deer in the study area (Year 1: \$177,415 Year 2: \$48,807). These funds will also cover the cost of an additional year of data download fees (year 1: \$35,063.50, Year 2: \$35,063.50), the cost of helicopter capture through Hells Canyon Helicopters Inc. (Year 1: \$40,000 Year 2: \$11,478.39), the cost of a DNR-owned spotter fixed-wing aircraft to ensure project safety and adherence to study design (Year 1: \$12,000 Year 2: \$7,200), a 25% unclassified FTE Natural Resource Specialist I (Year 1 50% FTE: \$43,000.64 Year 2: 25% FTE: \$13,579.15), travel expenses for this FTE (Year 1 50% FTE: \$12,208.83 Year 2: 25% FTE: \$4,209.54), and expenses for DNR staff assisting in capture during the 2nd year capture period not to exceed 5 days (Year 1: 3,580 Year 2: \$1,660). Please note that we amended the fixed-wing aircraft spotter plane cost to reflect accurate fees for its use from \$250.00 per hour to \$300.00 per hour, and this change has been

incorporated into the budget. Also, in order to balance the budget, we reduced some of the expenses built into the previous approved 1/11/18 budget.

Amendment Approved by LCCMR 1/23/2018

Project Status as of April 15, 2018:

Deer Permit Area 603 Update: During the Fall 2017 hunt in the disease management zone (DPA 603), there were 1,183 hunter-harvested deer that were >1.5 years old and sampled for CWD. Of these, six additional animals were confirmed positive with CWD (5 males and 1 female), bringing the total number of wild deer confirmed with CWD to 17 since the 2016 outbreak began in southeastern Minnesota (Figure 3 – see part IX). Of particular concern are two CWD-positive detections in Forestville State Park, which may indicate westward expansion of the disease. MNDNR organized a taxidermist network to augment the check station CWD sampling effort and secured 33 samples from high-value animals (adult males) in DPA 603. Following the regular season hunt, the MNDNR also held a special late season hunt (Jan.6-14 2018) and issued landowner shooting permits (Feb.10-Mar.9 2018), which contributed approximately 300 additional samples for surveillance – all of which resulted in no CWD detected.

Project Update: We secured permissions to use 105,473 acres of property, consisting of private (67,924 ac) and public (37,549 ac) lands, for search and capture of white-tailed deer in southeastern MN (Figure 4 – see section IX). We could not have achieved our sampling goals without the enormous outpouring of support from private landowners in the study area (>200). From March 18-23, 2018, we captured 111 white-tailed deer (*Odocoileus virginianus*) in our study area (Figure 4 – see section IX). Of these 111 - one juvenile male was able to kick off its collar twice and escaped without being re-collared, and 1 adult male accidentally broke its neck upon being captured. Of the 109 deer captured with successfully deployed collars, three animals (2 juvenile males and 1 adult male) were able to kick their collars off within the first week, reducing our sample size to 106. Of these 106 collared deer, by April 15, 2018, nine deer have died. Mortality sources include suspected coyote predation (n=2), suspected vehicle collision (n=1), suspected disease (n=1), and suspected capture-related (4-5). Final necropsy results are still pending to confirm causes of mortality. This leaves 97 GPS-collared deer on the air that we are currently tracking and includes 44 juvenile males, 21 adult males, 31 juvenile females, and 1 adult female. Of the original 115 collars purchased from Lotek Inc., we returned three because of GPS malfunctioning issues, and are in the process of returning an additional 4 collars due to collar structural malfunctions prior to deployment in the field. As such, we are being re-invoiced by Lotek Inc., and have not spent any ENTRF Emerging Issues funding on collars yet. We have established databases for capturing updated movement and mortalities, and are monitoring all 97 GPS-collared animals daily. As a highlight of the initial movement information we have collected; we found that seven deer have traveled into Iowa, and it's not clear yet if they have established an adult range there. Of these seven deer, they include three juvenile males, one juvenile female, and three adult males. Although some animals have experienced mortality thus far, we will not have sufficient data for robust statistical analysis of survival until the next reporting period.

Project Status as of December 01, 2018:

Deer Permit Area 603 Update: As of November 30 2018 in the disease management zone (DPA 603), there were 1,196 hunter-harvested deer that were >1.5 years old and sampled for CWD. Of these, 1,085 samples were tested and CWD was not detected, 104 samples were tested with results still pending, and eight additional animals were confirmed positive with CWD (all males). In addition, two additional males were detected with CWD just outside DPA 603 (in DPA 347). Thus, the total number of wild deer confirmed with CWD in and around DPA 603 since 2016 is 27 with one additional suspect case pending confirmation (Figure 3 – see part IX). Of particular concern are the two CWD-positive detections outside of DPA 603 and an additional CWD-positive in Forestville State Park, which may indicate expansion of the disease. Two of the CWD-positive detections were deer found dead and another two were obtained from our taxidermist network (to augment the check station

CWD sampling effort). The MNDNR is currently planning for the next phase of CWD management actions in DPA 603.

Project Update: As of November 30 2018, of the original 109 collared and released deer, 30 are actively being monitored, 12 slipped free of their collars, 23 have died, and 44 collars were deactivated because of hardware malfunction. The deer currently being monitored include 11 juvenile females, 6 adult males, and 13 juvenile males. We have experienced significant technical problems with the GPS hardware; of the original 115 GPS collars purchased, 3 were immediately sent back to the manufacturer after failed initial testing, 44 had to be deactivated on animals in the field because of hardware failure, and the expansion mechanism (that allows for neck growth during the rut period) for 11 juvenile male collars failed and led to these collars falling off of deer. Of the 23 collared and released deer in the study that have died thus far, mortality sources include coyote predation (n=3), vehicle collision (n=3), disease (n=1), capture-related (n=5), and hunter harvest (n=11).

Despite technical difficulties with GPS collars, we have been able to discover interesting movement dynamics. Prior to the dispersal period between April and July 2018, we estimated the average winter home range size as 1.60 km² for juvenile females, 2.96 km² for adult males, and 2.28 km² for juvenile males. Preliminary assessment of dispersal suggests that dispersal probability of juvenile females (45%, n=20) was slightly greater than juvenile males (32%, n=31) in spring 2018, although this difference was not statistically significant ($p = 0.41$). The average apparent dispersal distance travelled was 28 km (n=9) and 16 km (n=10) for juvenile females and juvenile males, respectively. Interestingly, when two outliers are removed from juvenile female cohort (linear travel distances of 40 and 77 miles), the average apparent spring dispersal distance decreases to about 9km for juvenile females, which is more in accordance with our expectations.

The greatest linear travel distance for spring dispersal that we have recorded was a juvenile female that travelled from slightly southwest of Forestville State Park to just east of Cannon Falls. She is currently still on the air, and appears to have established an adult home range in the area. Approximately 10 of our collared deer either made forays or dispersed to northern Iowa. We have found that several of these deer have made back-and-forth movements between states.

Amendment Request (12/18/2018)

Given the technical difficulties we have experienced with our first release cohort of GPS-collared deer, the manufacturer, Lotek, is warranting at least 68 collars. As such, we do not have to use the remaining LCCMR Emerging Issues funding for purchase of our round 2 of collar releases. By the end of June 30, 2019, we expect to have approximately \$130,000 remaining in our account, and request a legislative extension until June 30 2020 to spend these allocated funds for the project. We have modified our work plan to incorporate a third year of capture and deployment of GPS Iridium collars for approximately 40 juvenile female and 40 juvenile male deer in the study area (Year 3: \$1500.00/collar x 80 collars = \$120,000). Any remaining funds available would be allocated to covering the cost of GPS data acquisition. As it stands, our sample sizes for GPS-collared are small relative to the objectives of the study. An additional year of capturing, collaring, and tracking deer in the study area will significantly influence our success in being able to draw stronger conclusions about patterns of deer movement in southeastern Minnesota, where CWD incidence in wild deer has increased. We could not have foreseen the problems we experienced with the current batch of GPS collars, and hope that LCCMR will grant us permission to extend the funding period for this project.

Amendment pending further LCCMR and legislative action as of **01/15/19**

Legislative extension signed into law **05/31/19**

Project Status as of May 1, 2019:

Deer Permit Area 603 (and surrounding areas) Update: At the close of the fall hunting seasons, MNDNR was able to test 4,373 deer for CWD in southeast MN and found 14 new cases, including 11 within DPA 603, 2 in DPA 347, and 1 in DPA 346. This increase in both CWD prevalence and spread prompted additional harvest and culling opportunities during winter (Jan-Mar) and 1,988 more deer were tested, bringing the total number of confirmed cases from fall 2016 to present to 50 (Figure 3 – see part IX). Of particular concern are the increasing number of CWD-positive detections outside of DPA 603, which will entail an expansion of CWD management efforts. The MNDNR is currently planning for the next phase of CWD management actions in southeastern Minnesota, as well as in north-central Minnesota where a CWD-positive wild deer was found in close proximity to a different CWD positive captive deer farm in Crow Wing County.

Project Update: As of April 19 2019, we are only able to monitor 14 animals (7 females and 7 males) from the original collared cohort of 109 deer. Of the 2018 capture group, 34 deer (8 females and 26 males) have died with mortality sources including agency-culled (n=4), vehicle collision (n=4), capture-related and unknown (12), and hunter harvest (n=14). A total of 73 collars had to be deactivated because of hardware failure (either collar expansion or internal electronics failure).

From September through December 2018, most of the fawns from the March 2018 release cohort were expected to have established an adult home range. Using data from the available deer in the study, we found that 36% of females (n=4/11) and 15% (n=4/26) of males underwent excursions (linear movements greater than 4 km) from their adult home range. On average, females traveled about 6 km and males traveled about 19 km. So, although females had a higher likelihood of making excursions from their home range, they traveled a shorter distance on average compared with males.

From Feb. 18-21, 2019, we captured and outfitted 64 additional deer with GPS collars: 39 female fawns and 25 male fawns (Figure 4 – see part IX). Ahead of our capture period, we secured permissions to access 115,259 acres of property, consisting of private (72,398 ac) and public (42,861ac) lands. This area of Minnesota is mostly held in private hands, and capture success was largely dependent on developing positive relationships with landowners and seeking their collaboration.

During the capture period, three male fawns and one female fawn were able to kick off their collars just after initial collar fitting, but we were able to retrieve them and redeploy on other animals. One female fawn accidentally broke its neck upon capture and we were able to donate the meat to the Share the Harvest program. As of April 19, 2019, 34 does and 23 bucks from the second year release cohort are actively being monitored, while five females and one male have died. We suspect that one of these animals died from capture myopathy based on necropsy evidence at the UMN Veterinary Diagnostic Lab. One male was able to kick off his collar within about a month following capture. There have been no collar failures to date from the second release cohort.

Amendment Request as of (05/01/2019)

We had \$11,237 in surplus funds left over from the Professional/Technical/Service Contracts budget item MNDNR Law Enforcement (please see associated budget update Excel file). We request to shift these funds to our Helicopter captures budget item to pay off the remaining balance of \$9932, as we did not expect this deficit (we incurred more expense than anticipated because of weather-related delays and extra time needed to capture and collar the desired sex ratio of deer in our second year of the study). In addition, we request to shift \$657 from MNDNR Law Enforcement to the GPS collars line item (Equipment) and \$648 to the capture crew travel expenses line item so that this balance can be paid off as well.

Amendment Approved by LCCMR **05/10/19**.

Project Status as of October 15, 2019:

Deer Permit Area 603 (and surrounding areas) Update: The total number of confirmed cases of CWD in wild deer in southeast Minnesota from fall 2016 to present remains at 50 (Figure 3 – see part IX). Given MNDNR concern about the increasing number of CWD-positive detections outside of DPA 603, there has been considerable revision in our management strategy and expansion of CWD management efforts (Figure 5 – see part IX). Deer Permit Area (DPA) 603 has officially been dissolved, and seven DPAs (643, 645, 646, 647, 648, 649, and 655) have been re-designated as the South East CWD Management Zone. Surrounding this Management Zone, there are three newly designated DPAs (255, 343, and 344) as the South East CWD Control Zone. These new zones were established to liberalize harvest regulations and achieve three goals: (1) increase harvest of CWD positive deer to reduce disease prevalence, (2) reduce overall deer density to lower the number of susceptible deer on the landscape, and (3) reduce emigration from the area and mitigate disease spread across the landscape. To further reduce the risks of disease spread through movement of potentially infected carcasses, there are carcass movement restrictions in both CWD Management and Control Zones. The MNDNR has also created an Adopt-A-Dumpster program whose purpose is to facilitate collection of deer carcass waste and reduce the risk of CWD-positive carcass remains staying on the landscape where infectious prions may persist or be spread by scavengers.

Project Update: As of October 3 2019, we are monitoring 63 animals (35 females and 28 males) with nine from the first release cohort of 2018 and 54 from the second release cohort in 2019.

To date, there have been 46 known mortalities of GPS collared deer, which include 17 females and 29 males. The sources of mortality include hunter harvest (n=14), vehicle collision (n=6), agency-culled (n=4), poor health (n=6), unknown cause (n=4), and capture-related issues (12). A total of 81 collars have been deactivated because of hardware failure (either collar expansion or internal electronics failure). Due to these failures, we were (are) not able to document the fates of these animals, and our recorded mortalities likely underestimate the true number of collared deer that have died in the field.

Prior to the spring dispersal period between April 15 and July 15 2019, the average winter home range size of fawns captured in February 2019 was similar to fawns captured in 2018 at 1.84 km² for females and 2.65 km² for males. During the spring dispersal period of 2019, female deer had a higher than expected apparent dispersal probability (44%, n=15/34), although it was comparable with males (46%, n=10/22). These proportions were not appreciably different than estimates from 2018. The median dispersal distance travelled was 10.1 km (n=15) and 11.2 km (n=10) for females and males, respectively. These estimates align almost exactly with estimates from 2018 when females and males traveled a median distance of 12 km and 12.5 km, respectively. Given our small sample sizes and non-normal distribution of dispersal distances, we choose to use the median (as opposed to mean) as a measure of central tendency. Such non-normality causes extreme outliers (which we have) to skew distance distributions, artificially inflating the mean.

Of the fawns captured and collared in 2019, we found that two males and one female have apparently dispersed to Iowa, although it is not clear yet if they have established an adult range in that state. We saw similar movements from several animals in the 2018 release cohort that appeared to be seasonal movements between Minnesota winter and Iowa summer ranges. The longest linear movement we have recorded for a dispersing female yearling in 2019 was 29 miles, and for dispersing yearling males, it was about 50 miles.

We are planning for additional capture and GPS-collaring of 90 fawns (45 female and 45 male) in late January/early February 2020 in the study area. We are in the process of bidding for an aerial wildlife capture company who will conduct the actual deer captures, and are firming up logistical plans for the upcoming capture season. We are also in the process of contacting and updating existing landowner collaborators who have given us permission to access their properties for deer captures. Given the South East CWD Management Zone has expanded, we will expand the scope of our study area to include more of Winona and Houston Counties (Figure

6 – see section IX). This will also entail contacting additional landowners to secure permission to access more properties for deer capture and collaring efforts.

Amendment Request as of (10/15/2019)

We would like to shift \$20,533 from the Professional/Technical/Service Contracts budget item for Lotek Wireless GPS data (please see associated budget update in 2019-10-15 Budget.xlsx) into the Equipment/Tools/Supplies budget line towards purchasing our new order of GPS collars scheduled for release on 90 fawns in our study area in January 2020. As previously reported, we experienced substantial failures of our first year collars (n=80) after they were deployed in the field. Losing so many collars resulted in much less money spent for our GPS data budget item than expected, and there is no way we will be able to spend the remainder of the current budget allocation of \$70,127 for GPS data collection. Likewise, we would like to shift \$25,417 from the Personnel budget item for the 50% FTE Natural Resource Specialist position into the Equipment/Tools/Supplies budget line towards purchasing our new order of GPS collars (with revised remaining balance of \$58,964). Again, with the substantial failure of first year GPS collars (n=80), the field efforts required for the Specialist were reduced and resulted in budget savings for this line item. Given the level of effort we expect will be required for the Specialist, we have revised our Activity 1 budget accordingly. These budget modifications will ensure that we make the most efficient use of the valuable Emerging Issues Account funds that we were awarded for this project.

Project Status as of April 15, 2020:

Overall Project Outcomes and Results:

IV. PROJECT ACTIVITIES AND OUTCOMES:

ACTIVITY 1: Capture, placement of GPS collars on deer, and collection of daily movements

Description: We will capture two age classes of deer (fawns and adults) and fit them with iridium GPS collars, which assign spatial location from multiple satellites. We will set GPS collars to collect multiple daily locations of deer for up to two years. We will estimate annual home ranges, seasonal home ranges, and dispersal patterns of both yearling (fawns will transition to the yearling age class around June) and adult deer. Collar technology is advanced enough so that collars can be reprogrammed seasonally to identify precise movements from natal range and temporary/permanent emigration to new areas.

Summary Budget Information for Activity 1:

ENRTF Budget: \$ 449,557
Amount Spent: \$ 353,427
Balance: \$ 96,130

Outcome	Completion Date
1. Capture and GPS-collar 90 white-tailed deer fawns (60 male/30 female) and 25 adult male white-tailed deer.	03/31/2018
2. Capture and GPS-collar 64 white-tailed deer; 32 female and 32 male fawns	03/31/2019
3. Capture and GPS-collar 80 white-tailed deer; 40 female and 40 male fawns	03/31/2020

Activity 1 Status as of April 15, 2018: From March 18-23, 2018, we captured 111 white-tailed deer (*Odocoileus virginianus*) in our study area in southeastern MN (Figure 4 – see section IX). Of these 111 - one juvenile male was able to kick off its collar twice and escaped without being re-collared, and 1 adult male accidentally broke its neck upon being captured. Of the 109 deer captured with successfully deployed collars, three animals (2 juvenile males and 1 adult male) were able to kick their collars off within the first week reducing our sample size

to 106. Of these 106 collared deer, by April 15, 2018, nine deer have died. Mortality sources include suspected coyote predation (n=2), suspected vehicle collision (n=1), suspected disease (n=1), and suspected capture-related (4-5). Final necropsy results are still pending to confirm causes of mortality. This leaves 97 GPS-collared deer on the air that we are currently tracking and includes 44 juvenile males, 21 adult males, 31 juvenile females, and 1 adult female. As a highlight of the initial movement information we have collected; we found that seven deer have traveled into Iowa, and it's not clear yet if they have established an adult range there. Of these seven deer, they include three juvenile males, one juvenile female, and three adult males.

Activity 1 Status as of December 01, 2018: We have been planning for additional capture of 32 juvenile female and 30 juvenile male deer in late January 2019 in the study area. We have contracted with a new aerial wildlife capture company (Quicksilver), and are making plans for the upcoming capture season.

To address the hardware failures we have experienced with the first cohort of collars, we have changed the model of GPS collar that we are using for female deer. The model chosen, Lotek Iridium 420, has a proven track record of success with deer collared for movement ecology research in Wisconsin. For juvenile male collars, the GPS hardware of collars has been updated by the manufacturer.

Since the start of archery season on September 15, 2018 we have been able to visually inspect the wear of 12 different collars on deer in this study. Of these, 10 (5 adult males, 3 juvenile males, and 2 juvenile females) were shot by a hunter, 1 (juvenile male) died in a vehicle collision, and 1 (juvenile female) was found dead by the public. While the wear around the necks of juvenile females was normal, we found that the collar fit on 3 of 5 adult males was very tight and caused lacerations and skin infection. Similarly, the collar fit for one of the juvenile males was very tight and caused skin damage and infection. A second juvenile male at some point must have stepped-through its collar causing a very tight collar fit around the neck and under the front armpit – this caused skin laceration and infection in the animal's armpit area. The vehicle killed juvenile male had normal collar wear, but the collar was noted as being quite high on the neck. This recently acquired information is cause for concern for the design of the male collars in the study.

We place very high value on each animal's well-being in our study and we seek to minimize stress and discomfort that they may experience. In order to protect juvenile male deer in future collar deployments, we have made significant changes to the design of the collars that allow more flexibility in the expansion material, and increase the overall collar circumference by 12%. Furthermore, we are working with the collar manufacturer to attach both a timed release drop-off mechanism (at a pre-defined time in the future the collar will drop off of the animal) and a line-of-sight drop-off mechanism (can be triggered with line-of-sight to an animal from an aircraft) to collars. These mechanisms increase assurance that if there is any indication of collar expansion problems, we can track and release collars from study animals. There is a chance the manufacturer will not be able to produce these juvenile male collars in time for our late January 2019 capture and collar period. If this is the case, we will not be deploying collars on juvenile males in January.

Activity 1 Status as of May 01, 2019: From Feb. 18-21, 2019, we captured and outfitted 64 additional deer with Iridium GPS collars: 39 female fawns and 25 male fawns (Figure 4 – see part IX). Ahead of our capture period, we secured permissions to access 115,259 acres of property, consisting of private (72,398 ac) and public (42,861ac) lands – over 180 mi². Most of our study area is held in private hands, and like the first year, our capture success was largely dependent on developing positive relationships with landowners and seeking their collaboration. We spoke with and secured permission to access the private properties of 224 landowning families in the study area. During the capture period, three male fawns and one female fawn were able to kick off their collars just after initial collar fitting, and thankfully we were able to retrieve them and redeploy those collars on other animals. One female fawn accidentally broke its neck upon capture, and we were able to donate the meat from this animal to the Share the Harvest donation program. As of April 19, 2019, 34 does and 23 bucks from the second year release cohort are actively being monitored, while five females and one male have died. One animal

was suspected to have died due to capture myopathy based on examination at the UMN Veterinary Diagnostic Lab. One other male was able to kick its collar off within about a month of capture.

For all 64 collars, we had the collar manufacturer (Lotek) install timed-release drop-off mechanisms, which after 130 weeks (2.5 years) will cause the collars to fall off of the animals. At that time, any remaining collars can be retrieved and potentially re-furbished. In addition, for male collars, we included a line-of-sight mechanism that permits the collars to be detached remotely with a special hand-held receiver and line of sight to the animal (within 200m). We added this feature on male collars because male necks expand and contract with season, and during the rut when their necks largest in diameter, there is a risk that collars could be too tight if the expansion mechanism fails. If during the rut when hunters are in the field and may come across collared deer with suspected tight collar issues, we can make efforts to locate and remotely release these collars from deer in the welfare interest of the animal.

Due to hardware problems, we experienced with the first release cohort in March 2018, the manufacturer (Lotek) warranted 73 collars and provided us with replacements at no cost. The manufacturer made modifications to on-board software, corrected quality-control issues with production of the collars, and modified the expansion design of male collars (by our direction and input) to improve performance of the equipment. There have been no collar failures to date from the second release cohort, which so far suggests that the modifications made to improve the collar performance have been successful.

Activity 1 Status as of October 15, 2019: As of October 7 2019, we have experienced one confirmed GPS-collar failure of the 64 deer released with collars in 2019; this collar is under warranty and will be replaced by the manufacturer (Lotek Wireless Inc.). This situation is much improved compared to the first generation of GPS collars that we released, of which about 70% failed due to collar expansion or hardware problems. We are actively monitoring 63 GPS-collared deer, 54 (32 females and 22 males) released in 2019 and 9 (3 females and 6 males) released in 2018.

We are planning for additional capture and GPS-collaring of 90 fawns (45 female and 45 male) in late January/early February 2020 in the study area. We are in the process of bidding for an aerial wildlife capture company who will conduct the actual deer captures, and are firming up logistical plans for the upcoming capture season. We are also in the process of contacting and updating existing landowner collaborators who have given us permission to access their properties for deer captures. Given the South East CWD Management Zone has expanded, we will expand the scope of our study area to include more of Winona and Houston Counties (Figure 6 – see section IX).

Activity 1 Status as of April 15, 2020:

Final Report Summary:

ACTIVITY 2: CWD spatial pathways mapping to inform future surveillance and management

Description: We will quantify GIS land cover data, temporal covariates, and deer density and demographic information for southeastern Minnesota in order to temporally relate deer resource use and movement tendencies with landscape features and population demographics. We will produce a deer movement propensity map stratified by age and sex cohort, which will be used in directing future CWD surveillance and management efforts. This work is being completed as part of MNDNR's in-kind services to be applied to the project with other funds, as listed in Section VI. B.

Summary Budget Information for Activity 2:

ENRTF Budget: \$ 0
Amount Spent: \$ 0
Balance: \$ 0

Outcome	Completion Date
1. Collect and characterize relevant GIS data	03/31/2018
2. Estimate activity ranges and dispersal probabilities with deer location data. Construct a CWD spatial pathway map based on year 1 data.	06/30/2019
3. Estimate activity ranges and dispersal probabilities with deer location data. Construct a CWD spatial pathway map based on year 2 data.	06/30/2020
4. Report findings in research summaries and prepare peer-reviewed publications	10/31/2020

Activity 2 Status as of April 15, 2018: We are in the process of collecting and characterizing relevant GIS data layers to use in our characterization of spatial heterogeneity on the landscape. This process is organic and evolving and we seek to use the most recently updated and spatially fine-scale GIS coverages available.

Activity 2 Status as of December 01, 2018: As of November 26, 2018, we have amassed over 130,000 records of deer location data. Prior to the dispersal period between April and July 2018, we estimated the average winter home range size as 1.60 km² for juvenile females, 2.96 km² for adult males, and 2.28 km² for juvenile males. These winter home range estimates align with our expectations of deer activity at this time of year. Contrary to our expectations, juvenile female deer had higher apparent dispersal probability (40%, n=20) than juvenile males (28%, n=29) in spring 2018, although this difference was not statistically significant ($p = 0.41$). The average apparent dispersal distance travelled was 30.4 km (n=8) and 14.6 km (n=8) for juvenile females and juvenile males, respectively. Interestingly, when two outliers are removed from juvenile female cohort (linear travel distances of 40 and 77 miles), the average apparent spring dispersal distance decreases to about 10km for juvenile females, which is more in accordance with our expectations. Although sample sizes for apparent dispersing animals was small (n=16), more formal analyses of spring dispersal is pending. The data also suggests that only 17% of our adult male sample underwent appreciable foray movements (n=2). Approximately ten (several animals had less than three locations just inside the border of Iowa that may represent GPS error) of our collared deer either made forays or dispersed to northern Iowa. We have found that several of these deer have made back-and-forth movements between states.

Activity 2 Status as of May 1, 2019: From September through December 2018, we expected most of the fawns from the March 2018 release cohort to have set up an adult home range. Using data from the available deer in the study (n=37), we found that 36% of females (n=4/11) and 15% (n=4/26) of males underwent excursions (linear movements greater than 4 km) from their adult home range. On average, females traveled about 6 km and males traveled about 19 km. Although females had a higher likelihood of making excursions from their home range, they traveled a shorter distance on average compared with males. About two-thirds of animals that underwent excursions made some form of return movement to their adult home range. Two of the four males that underwent excursions traveled south into Iowa during spring 2018 and returned to their capture locations in late August/September 2018. These movements may reflect some type of seasonal migratory behavior and we need additional data to draw firmer conclusions about these movement patterns.

Activity 2 Status as of October 15, 2019: As of October 7, 2019, we have amassed over 450,000 records of deer location data from all of our collared animals. Prior to the spring dispersal period between April 15 and July 15 2019, the average winter home range size of fawns captured in February 2019 was similar to fawns captured in 2018 at 1.84 km² for females and 2.65 km² for males. During the spring dispersal period of 2019, female deer had a higher than expected apparent dispersal probability (44%, n=15/34), although it was comparable with males (46%, n=10/22). These proportions were not appreciably different than estimates from 2018. The median dispersal distance travelled was 10.1 km (n=15) and 11.2 km (n=10) for females and males, respectively. These estimates align almost exactly with estimates from 2018 when females and males traveled a median distance of 12 km and 12.5 km, respectively. Given our small sample sizes and non-normal distribution of dispersal distances, we choose to use the median (as opposed to mean) as a measure of central tendency. Such

non-normality causes extreme outliers (which we have) to skew distance distributions, artificially inflating the mean.

Of the fawns captured and collared in 2019, we found that two males and one female have apparently dispersed to Iowa, although it is not clear yet if they have established an adult range in that state. We saw similar movements from several animals in the 2018 release cohort that appeared to be seasonal movements between Minnesota winter and Iowa summer ranges. The longest linear movement we have recorded for a dispersing female yearling in 2019 was 29 miles, and for dispersing yearling males, it was about 50 miles.

Activity 2 Status as of April 15, 2020:

Final Report Summary:

ACTIVITY 3: Determination of cause-specific mortality

Description: The GPS collar technology will permit detection of likely mortalities, and we will estimate cause-specific mortality rates by generalized categories (e.g., harvested, vehicle collision, depredation) and incorporate those estimates into population models to improve accuracy and understanding of deer population dynamics in southeastern Minnesota. This work is being completed as part of MNDNR’s in-kind services to be applied to the project with other funds, as listed in Section VI. B.

Summary Budget Information for Activity 3:

ENRTF Budget: \$ 0
Amount Spent: \$ 0
Balance: \$ 0

Outcome	Completion Date
1. Estimate cause-specific mortality and describe factors related to mortality trends for year 1 data.	06/30/2019
2. Estimate cause-specific mortality and describe factors related to mortality trends for year 2 data.	06/30/2020
3. Report findings in research summaries and prepare peer-reviewed publications	10/31/2020

Activity 3 Status as of December 01, 2018: Of the original cohort of 109 deer released with GPS collars, 23 in the study have died thus far. Mortality sources include coyote predation (n=3), vehicle collision (n=3), disease (n=1), capture-related (5), and hunter harvest (n=11). Formalized cause-specific mortality estimates will be generated in early 2019.

Activity 3 Status as of May 1, 2019:

Of the 109 collared and released deer from the 2018 cohort, 34 that have died thus far and mortality sources include agency-culled (n=4), vehicle collision (n=4), capture-related and unknown (12), and hunter harvest (n=14).

Of the 64 collared and released deer from the 2019 cohort, six have died (five females and one male). Within about a month of capture, a male was able to kick its collar off. There is evidence that one female may have died due to capture myopathy.

Activity 3 Status as of October 15, 2019:

To date, there have been 46 known mortalities of GPS collared deer, which include 17 females and 29 males. The sources of mortality include hunter harvest (n=14), vehicle collision (n=6), agency-culled (n=4), poor health

(n=6), unknown cause (n=4), and capture-related issues (12). A total of 81 collars have been deactivated because of hardware failure (either collar expansion or internal electronics failure). Due to these failures, we were (are) not able to document the fates of these animals, and our recorded mortalities likely underestimate the true number of collared deer that have died in the field.

Activity 3 Status as of April 15, 2020:

Final Report Summary:

V. DISSEMINATION:

Description: The initial outlet for results from this project will likely be through an official MNDNR research summary that will be available on the DNR webpage after October 2018. The webpage to which the summary will be posted is: <http://dnr.state.mn.us/publications/wildlife/index.html>.

We will also prepare peer-reviewed manuscript(s) for publication based on this research. The scientific outlets may include Journal of Wildlife Management, Journal of Wildlife Diseases, Journal of Mammalogy, or PLoS One. Furthermore, there are likely to be press releases that report on the status of this project in popular media outlets.

Status as of April 15, 2018:

We have had considerable media coverage of this project thus far. A list of the various stories that have been published about this study include:

Newspaper Articles:

- Star Tribune – 10/17/2017 – *Minnesota to collar more than 100 wild deer with tracking devices to fine-tune its fight against CWD*
- Star Tribune – 12/12/2017 – *Minnesota DNR needs help to track deer movements in southeast area*
- Post Bulletin – 12/14/2017 – *DNR seeks landowners' help in deer study*
- Outdoor News – 02/12/2018 – *In Minnesota, southeast deer study set for kickoff*
- KBJR6 and WPTA21 – 03/12/2018 – *Minnesota DNR to start deer movement study to help against CWD*
- MNDNR Press Release – 03/12/2018 – *Deer movement study begins in southeastern Minnesota's CWD zone*
- Albert Lea Tribune – 03/12/2018 – *DNR begins deer movement study in Minnesota*
- 103.1 KFIL radio – 03/13/2018 – *Deer movement study begins in CWD zone of SE Minnesota*
- Austin Daily Herald – 03/14/2018 – *DNR will study area including Mower for CWD*
- Winona Post – 03/14/2018 – *Deer movement study begins in southeastern Minnesota's CWD zone*
- Post Bulletin – 03/14/2018 – *Outdoor notes: Deer study pushed back by at least one week*
- KWWL7 and KBJR6 News and WXOW – 03/18/2018 – *Helicopter aids in MN DNR movement study*
- Star Tribune – 03/21/2018 – *Helicopter crew netting deer in Fillmore County in state's fight against CWD*

TV Stories/Interviews:

- KIMT3 News – 03/14/2018 – *DNR research project aims to study CWD*
- WCCO4 News – 03/23/2018 – *Helicopter capture aims to track CWD, protect Minnesota's white-tailed deer*

Radio Interviews:

- KATE Radio (Albert Lea) – 03/16/2018 – 10-minute live segment on deer movement study
- The 4 Outdoorsmen on BOB 106 FM – 04/15/2018 – Interview on southeast deer movement study and other DNR initiatives

Status as of December 01, 2018: We completed an official MNDNR research summary of the project, which will be made available to the public on the DNR webpage. In addition, we built a dedicated webpage that outlines the deer movement study, provides periodic updates about our findings, and has links to movement maps that we created to show some of the interesting movements that some of our study deer have made. It can be viewed at: <https://www.dnr.state.mn.us/cwd/deer-movement-study.html>.

Without the support of private landowners in the study area to permit deer captures, this project would not be possible. We have been providing quarterly updates to the 200+ property owners that have graciously given us permission to capture deer for the study on their land. These quarterly updates include maps of movements from our study deer, highlights about novel information that we are gleaning, and upcoming plans for the study.

We have had considerable media coverage of this project thus far. A list of the various stories that have been published about this study since the last update in April 2018 include:

Newspaper/Online Articles:

- Rochester Post Bulletin – 07/26/2018 – Deer study yields stunning results
- Winona Post – 09/05/2018 – Growing threat: Chronic wasting disease in deer
- MPR – 08/16/2018 – Chronic wasting disease spread faster than expected
- Bluestem Prairie – 8/19/2018 – Will new research on deer movement prompt Minnesota legislature to act on CWD?

Status as of May 1, 2019:

We continue to update a dedicated webpage to the deer movement study located at <https://www.dnr.state.mn.us/cwd/deer-movement-study.html>. The page outlines the objectives of the study, provides statistics on movement parameters and updates about our findings, and has links to movement maps that we created to show some of the interesting movements that some of our study deer have made.

Without the support of private landowners in the study area to permit deer captures, this project would not be possible. We have been providing bi-annual updates to the 200+ property owners that have graciously given us permission to capture deer for the study on their land. We also provide updates to a large number of city, state, and federal colleagues that have provided support and are responsible for various resource management duties in the study area. These quarterly updates include maps of movements from our study deer, highlights about novel information that we are gleaning, and upcoming plans for the study.

We have had considerable media coverage of this project thus far. A list of the various stories that were published about this study and presentations since the last update in December 2018 include:

Newspaper/Online Articles:

- North American White-tail – 02/14/2019 – Tracking deer providing valuable CWD information
- Tri-County Record – 2/28/2019 – Rushford airport is home base for DNR deer study

Presentations:

- Minnesota Board of Animal Health Quarterly Board Meeting – 09/18/2018
- Minnesota Department of Natural Resources Round Table – 01/11/2019
- Midwest Association of Fish and Wildlife Agencies Health Committee – 4/24/2019

Status as of October 15, 2019:

We continue to update a dedicated webpage to the deer movement study located at <https://www.dnr.state.mn.us/cwd/deer-movement-study.html>. The page outlines the objectives of the study, provides statistics on movement parameters and updates about our findings, and has links to movement maps that we created to show some of the interesting movements that some of our study deer have made.

Without the support of private landowners in the study area to permit deer captures, this project would not be possible. We have been providing bi-annual updates to the 200+ property owners that have graciously given us permission to capture deer for the study on their land. We also provide updates to a large number of city, state, and federal colleagues that have provided support and are responsible for various resource management duties in the study area. These quarterly updates include maps of movements from our study deer, highlights about novel information that we are gleaning, and upcoming plans for the study.

Since our last update on May 1 2019, although we have had no additional media coverage to report regarding this project, we have had additional outreach opportunities to highlight this study. On May 5 2019, we gave an oral presentation on the deer movement study at a statewide DNR meeting to Division of Fish and Wildlife staff. We gave another oral presentation of the study (“Deer movement in Minnesota and the potential to spread chronic wasting disease”) at the international Wildlife Disease Association conference in Tahoe City, CA on August 8, 2019. In addition, we advertised the study with a poster at both the Minnesota State Fair between August 27 and September 7, 2019 and a Bell Museum Spotlight Science event focused on chronic wasting disease on September 14, 2019.

Status as of April 15, 2020:

Final Report Summary:

VI. PROJECT BUDGET SUMMARY:

A. Preliminary ENRTF Budget Overview:

***This section represents an overview of the preliminary budget at the start of the project. It will be reconciled with actual expenditures at the time of the final report.**

Budget Category	\$ Amount	Overview Explanation
Professional/Technical/Service Contracts:	\$ 157,500	1 contract with a wildlife helicopter capture company TBD through competitive bid for capturing and collaring deer; 1 contract with a GPS data collection and reporting service TBD through competitive bid – this may be combined as a package with a GPS collar vendor; 1 contract with a wildlife aerial survey company TBD through competitive bid to spot prospective deer herds for capture.
Equipment/Tools/Supplies:	\$ 180,418	GPS collars to be placed on white-tailed deer
Capture crew_expenses in MN:	\$ 6,538	Mileage, meals
Personnel (50% FTE):	\$ 43,000	Cost represents 19 months of hire.
50% FTE expenses:	\$ 23,518.50	Includes vehicle expense (\$0.55/mile at 230 miles/week for 83.33 weeks), field supplies, and travel expenses
Other:	\$ 13,462	Direct and necessary costs including Department support services (Human Resources, IT, Safety, Financial, Communications, and Planning)
TOTAL ENRTF BUDGET:	\$ 350,000	

Explanation of Use of Classified Staff: N/A

Explanation of Capital Expenditures Greater Than \$5,000: N/A

Total Number of Full-time Equivalent (FTE) Directly Funded with this ENRTF Appropriation: 0.5 for year 1 and 0.25 for year 2.

Total Number of Full-time Equivalent (FTE) Estimated to Be Funded through Contracts with this ENRTF Appropriation: N/A

B. Other Funds:

Source of Funds	\$ Amount Proposed	\$ Amount Spent	Use of Other Funds
In-kind services to be applied to project during project period			
Salary	\$ 76,000	\$ 134,281.67	MNDNR Wildlife Health Group and Farmland Populations and Research Group; multiple employees working on project management, field work, data analyses, reporting of results; 20% effort.
Mortality Diagnostics	\$ 2,000	\$ 2,250.00	Some mortalities retrieved with unknown or suspicious cause of death will be taken to the UMN Veterinary Diagnostic Lab for necropsy.
Disease Screening	\$ 5,000	\$ 0	Blood samples retrieved from study animals will be screened for a variety of infectious diseases.
MNDNR Funding*	\$ 330,000	\$ 6,108	These funds will be used to purchase additional GPS collars, pay for transmission fixes, staff salaries, supplies, and logistics.
TOTAL OTHER FUNDS:	\$ 413,000	\$ 142,639.67	

*Additional funding being provided by MNDNR for continuation of the study.

VII. PROJECT STRATEGY:

A. Project Partners:

Partners receiving ENRTF funding

Collaborator:

Kelsie LaSharr – MNDNR (25% FTE for the project)

Partners NOT receiving ENRTF funding

- Collaborators:
Michelle Carstensen – MNDNR
Lou Cornicelli – MNDNR
Ryan Tebo – MNDNR
Tyler Obermoller – MNDNR
Erik Hildebrand – MNDNR
Margaret Dexter – MNDNR
Todd Froberg – MNDNR

Andrew Norton – South Dakota Game, Fish, and Parks

- Please make note that Dr. Andrew Norton is no longer a co-Principal Investigator on this project.

B. Project Impact and Long-term Strategy:

This study will provide critical information on deer movements, which directly relates to CWD prion transmission to new areas. These data will inform future surveillance and management strategies related to white-tailed deer; a \$500,000,000 annual resource in Minnesota. In addition, we will collect survival information used to inform population models and guide management recommendations.

C. Funding History:

N/A

VIII. REPORTING REQUIREMENTS:

- The project is for 2.75 years, will begin on 10/01/2017, and end on 06/30/2020.
- Periodic project status update reports will be submitted April 15 and October 15 of each year.
- A final report and associated products will be submitted between August 15 and October 31, 2020.

IX. VISUAL COMPONENT or MAP(S): See attached maps below (Figures 1, 2, 3, 4, 5 and 6)

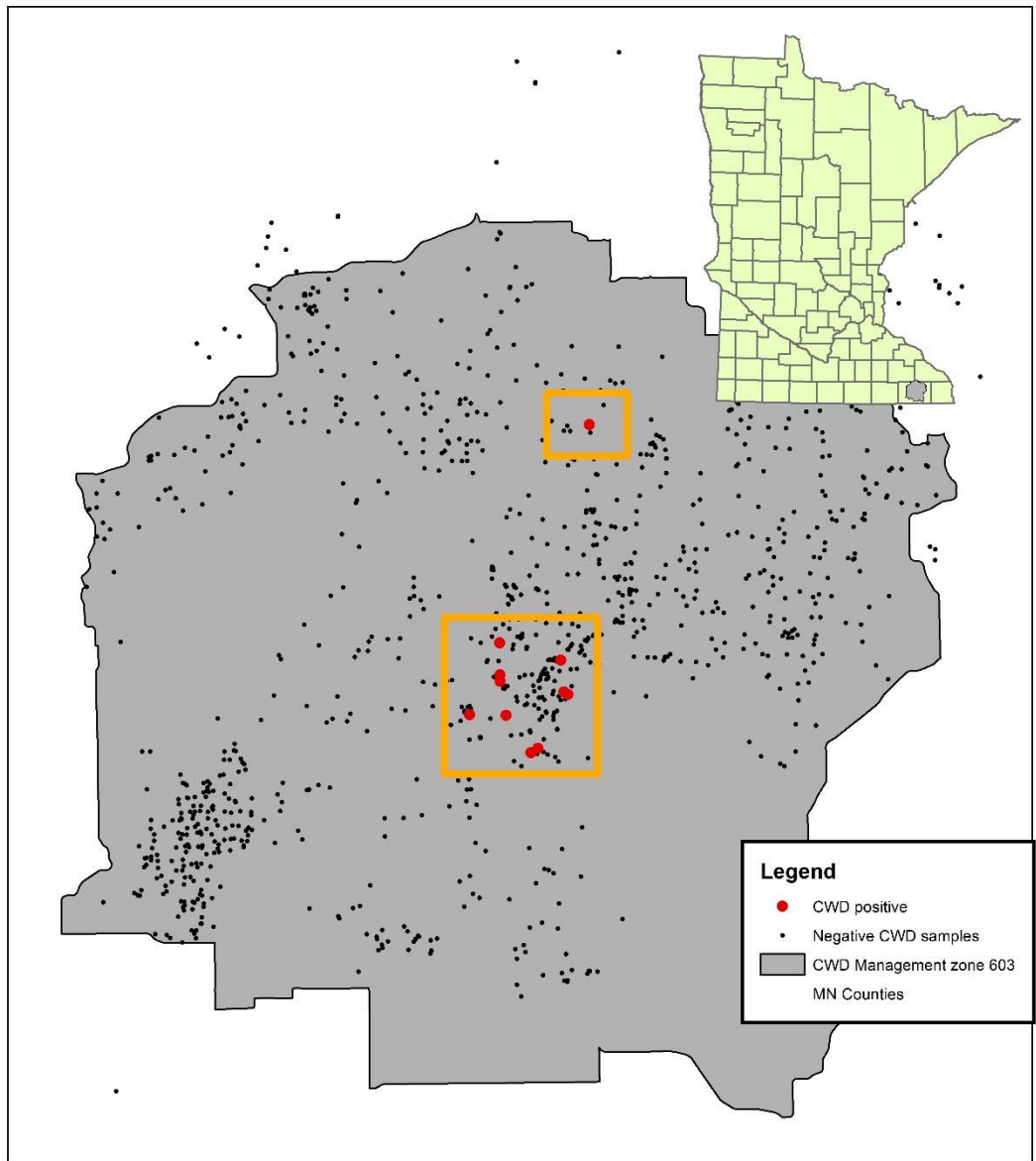


Figure 1. Chronic wasting disease management zone 603 established in fall 2016 in response to three CWD positive wild white-tailed deer detections. From September 2016 through March 2017 with additional efforts via a special hunt, landowner permits, and a USDA removal contract, a total of 11 CWD positive white-tailed deer were detected in zone 603.

Study Area

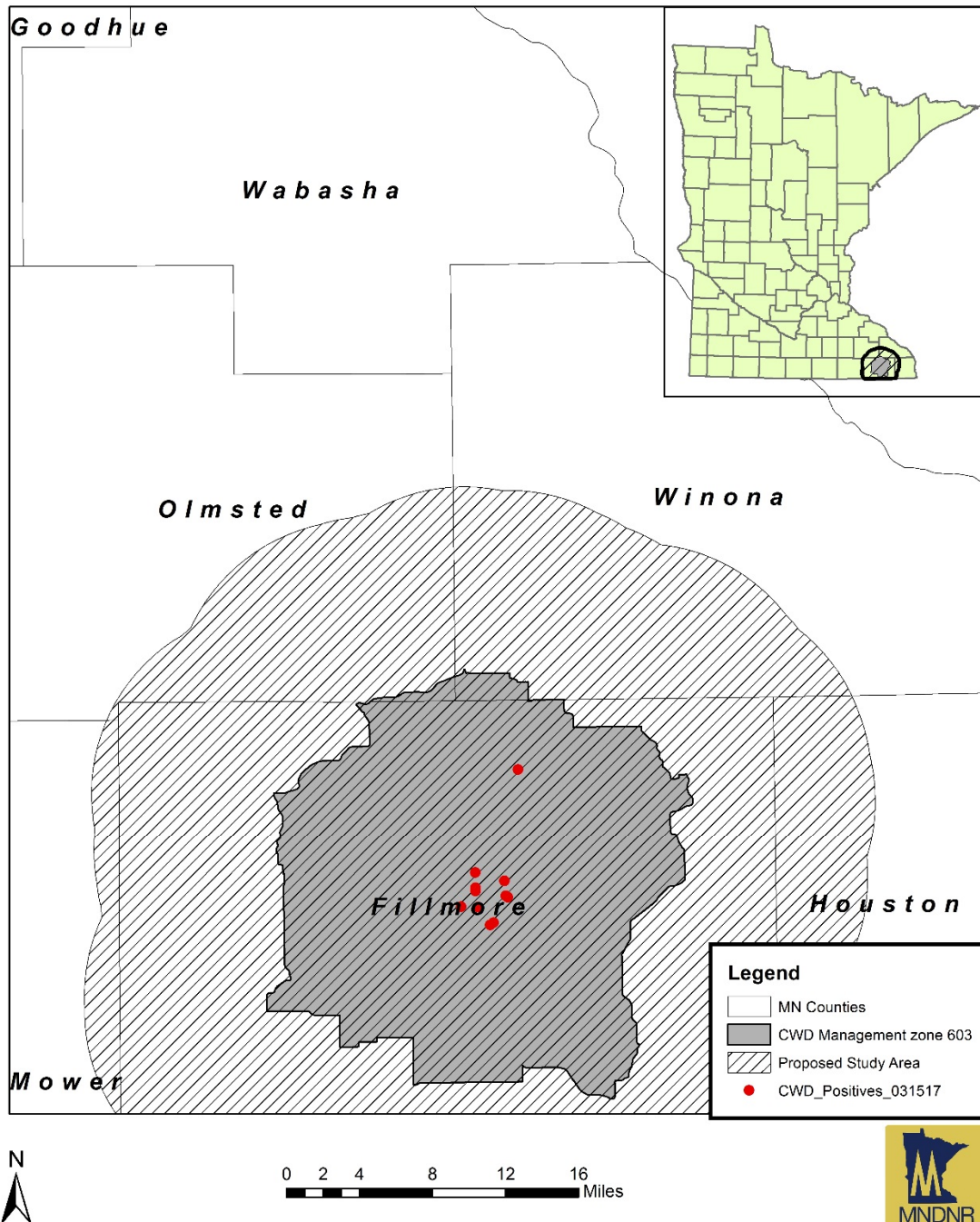


Figure 2. Proposed study area in and around the chronic wasting disease management zone (Deer Permit Area 603). This area is largely private land, so the final disposition of sampling locations for GPS collaring deer will depend on permissions we receive from cooperating landowners, weather patterns, and local scale landscape characteristics that facilitate helicopter capture of wild white-tailed deer.

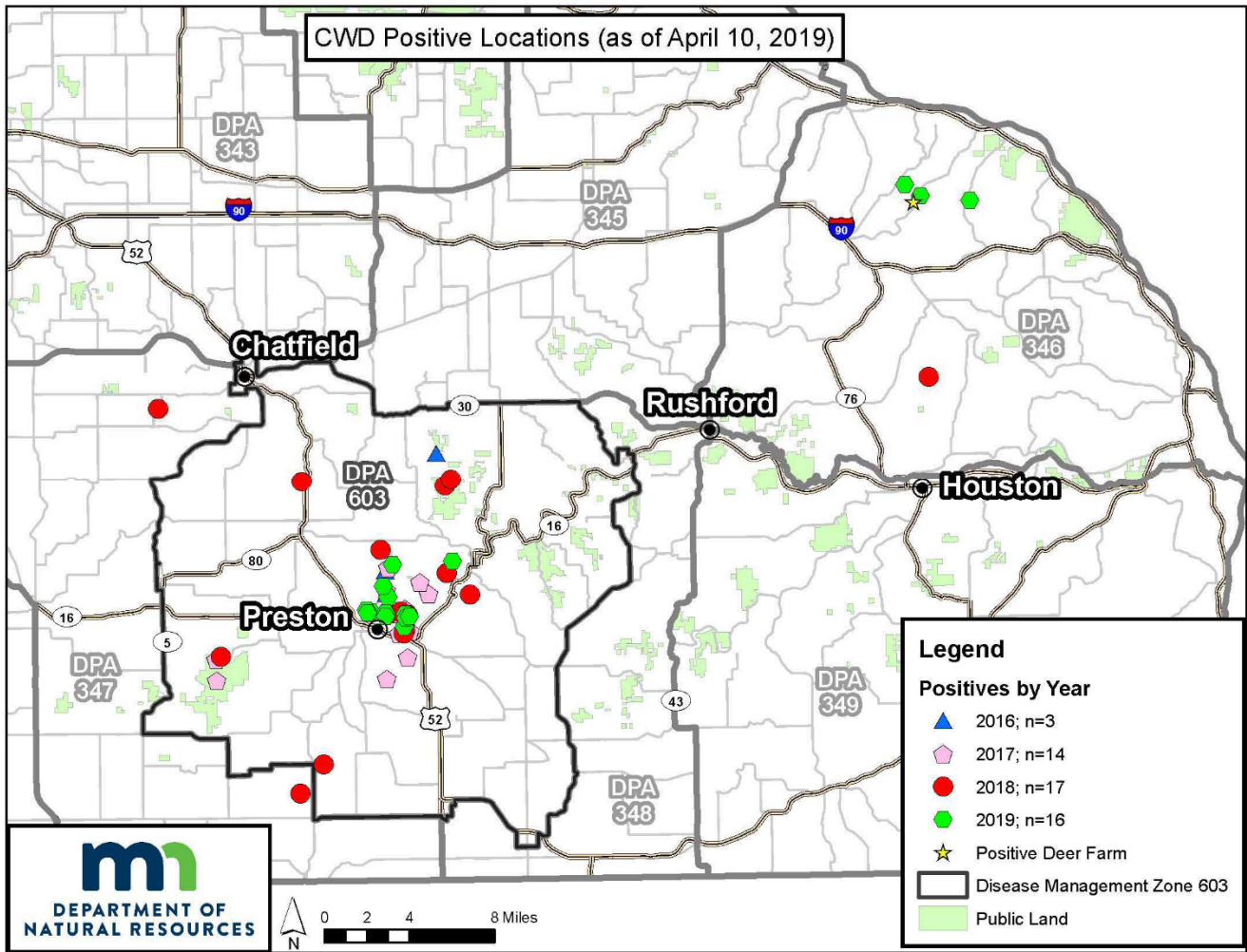


Figure 3. Spatial distribution of wild white-tailed deer confirmed with CWD infection in and around DPA 603 as of 04/10/19. Since 2016, there have been a total of 50 confirmed CWD-positive wild deer in southeastern Minnesota.

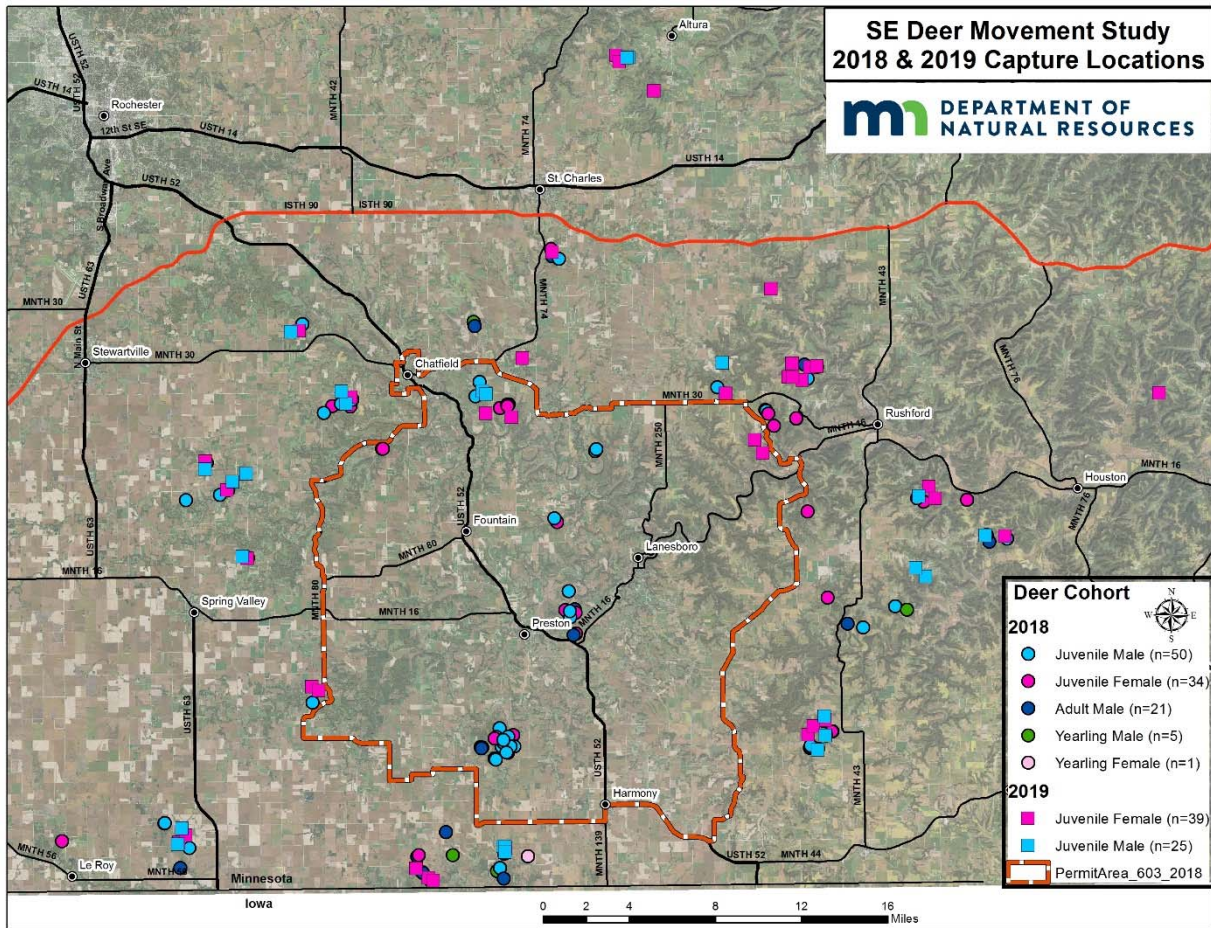


Figure 4. Spatial distribution of deer captured and collared during 2018 and 2019 in the study area. Points represent the locations where white-tailed deer were captured, collared with GPS units, and released in the study area centered on CWD management zone 603 in Fillmore County. Year one captures occurred from March 18-23, 2018 and year two captures occurred from February 18-21, 2019.

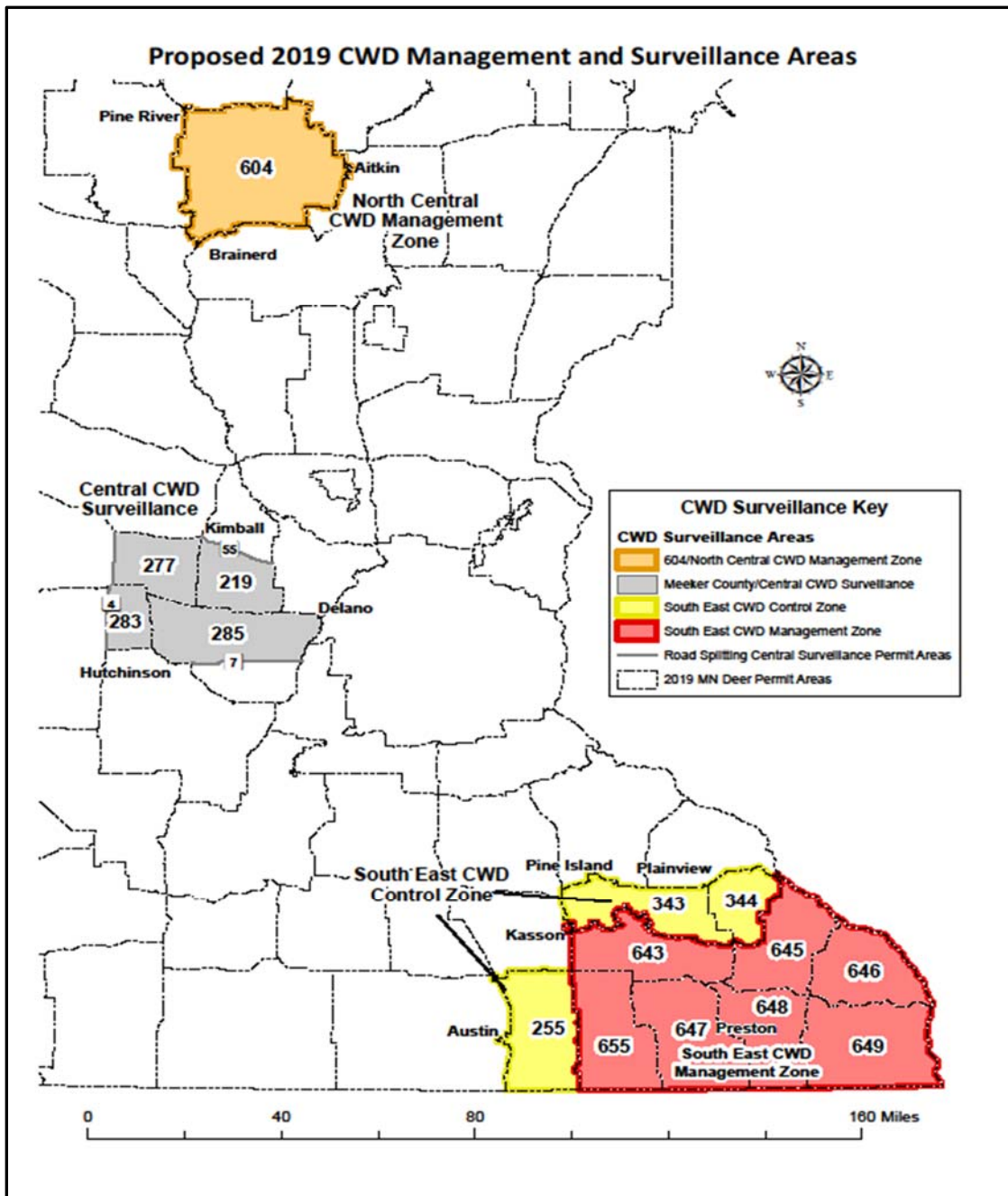


Figure 5. Changes to CWD Management and Surveillance areas for fall 2019. Deer Permit Area (DPA) 603 has been dissolved, and seven DPAs (643, 645, 646, 647, 648, 649, and 655) have been re-designated as the South East CWD Management Zone (red shaded area). Surrounding this management zone, there are three newly designated DPAs (255, 343, and 344) as the South East CWD Control Zone (yellow shaded area). These zones were established to liberalize harvest regulations and increase harvest of CWD positive deer, reduce overall deer density, and reduce the likelihood of disease spread across the landscape. In Meeker County centered on the captive cervid farm that was linked to the Crow Wing County CWD-positive captive cervid farm, is the Central CWD Surveillance Zone (DPAs 219, 277, 283, and 285). In Crow Wing County, the North Central CWD Management Zone was newly created surrounding the detection of a CWD-positive wild deer close to the location of the CWD-positive captive cervid farm.

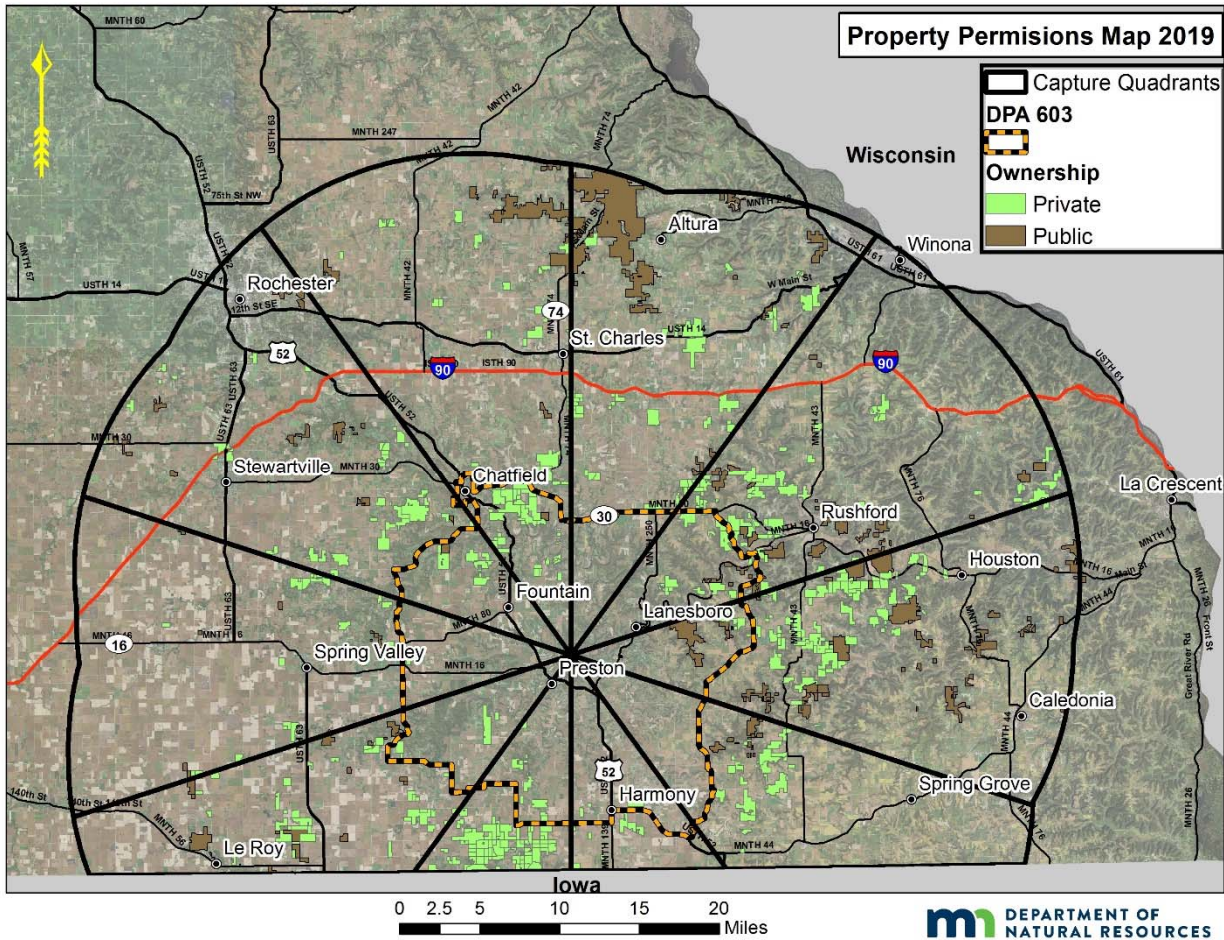


Figure 6. Spatial distribution of study area capture quadrants to be used as a basis for establishing the January/February 2020 deer capture goals in southeastern Minnesota. The target optimal capture distribution will be 4-5 female and 4-5 male white-tailed deer fawns captured per quadrant. We secured permissions to access 115,259 acres of property for 2019 captures, consisting of private (72,398 ac) and public (42,861ac) lands – over 180 mi² and plan to inquire with additional landowners to increase the available capture area.