MANAGING BOVINE TUBERCULOSIS IN WHITE-TAILED DEER IN NORTHWESTERN MINNESOTA: A 2007 PROGRESS REPORT

Michelle Carstensen[1], David Pauly, Michael DonCarlos, and Lou Cornicelli

SUMMARY OF FINDINGS

Bovine tuberculosis (TB), first discovered in 2005, has now been found in 11 cattle operations in northwestern Minnesota. To date, all of the infected cattle herds have been depopulated and the Board of Animal Health (BAH) has continued an investigation of herds in the area as well as conducted a statewide surveillance effort. The strain has been identified as one that is consistent with bovine TB found in cattle in the southwestern United States and Mexico. In November 2007, the Minnesota Department of Natural Resources (MNDNR) conducted bovine TB surveillance of hunter-harvested white-tailed deer (*Odocoileus virginianus*) within a 15-mile radius of the infected farms. Results indicated that 5 of the 1,085 deer tested positive for bovine TB; estimated disease prevalence of 0.46% (SE=0.2%). All infected deer were harvested within 5 miles of Skime, Minnesota, which is in close proximity to 7 of the infected livestock operations. In response to additional deer found infected with bovine TB since 2005, the MNDNR also conducted a targeted deer removal operation during winter 2007, using sharpshooters from the United States Department of Agriculture (USDA) Wildlife Services. An additional 488 deer were removed through this project, yielding 6 more cases of infected deer. Further, a recreational feeding ban, covering 4,000 mi^2 in northwestern MN, was instituted in November 2006 to help reduce the risk of deer to deer transmission of the disease and enforcement officers have been working to stop illegal feeding activities. Also, in 2006, the Minnesota State Legislature passed an initiative that allocated $54,000 to deer-proof fencing materials for livestock producers within 5 miles of a previously infected farm; MNDNR erected 15 fences on 11 cattle premises during summer 2007. The findings of additional infection in cattle herds as well as the deer has resulted in the downgrading of Minnesota's bovine TB status to "modified accredited", which has increasing testing requirement for cattle statewide. The MNDNR will continue to conduct hunter-harvested surveillance in fall 2008 to monitor infection in the local deer population, and consider the continuation of aggressive management actions (e.g., sharpshooting deer in key locations) to address concerns of deer becoming a potential disease reservoir.

INTRODUCTION

Bovine tuberculosis is an infectious disease that is caused by the bacterium *Mycobacterium bovis (M. bovis)*. Bovine TB primarily affects cattle, however, other animals may become infected. Bovine TB was first discovered in 5 cattle operations in northwestern Minnesota in 2005. Since that time, 2 additional herds were found infected in 2006, and 4 more in 2007; resulting in further reduction of the state's bovine TB accreditation to modified accredited in early 2008. To date, 18 wild deer have been found infected with the disease in northwestern MN. Although bovine TB was once relatively common in U.S cattle, it has historically been a very rare disease in wild deer. Prior to 1994, only 8 wild white-tailed and mule deer (*Odocoileus hemionus)* had been reported with bovine TB in North America. In 1995, bovine TB was detected in wild deer in Michigan. Though deer in Michigan do serve as a reservoir of bovine TB, conditions in northwestern Minnesota are different. Minnesota has no history of tuberculosis infection in deer or other wildlife, and the *M. bovis* strain isolated from the infected Minnesota herd does not match that found in Michigan. Also, there are much lower deer densities in the area of the infected herds than in the affected areas of Michigan. Further, unlike Michigan, Minnesota does not allow baiting, which artificially congregates deer and increases the likelihood of disease transmission.

[1] Corresponding author e-mail: michelle.carstensen@dnr.state.mn.us

Bovine TB is a progressive, chronic disease. It is spread primarily through the exchange of respiratory secretions between infected and uninfected animals. This transmission usually happens when animals are in close contact with each other. Animals may also become infected with bovine TB by ingesting the bacteria from eating contaminated feed. It can take months to years from time of infection to the development of clinical signs. The lymph nodes in the animal's head usually show infection first and as the disease progresses, lesions (yellow or tan, pea-sized nodules) will begin to develop on the surface of the lungs and chest cavity. In severely infected deer, lesions can usually be found throughout the animal's entire body. Hunters do not always readily recognize small lesions in deer, as they may not be visible when field dressing deer. In fact, most infected deer appear healthy. In Michigan, only 42% of the bovine TB positive deer had lesions in the chest cavity or lungs that would be recognized as unusual by most deer hunters. While it is possible to transmit bovine TB from animals to people, the likelihood is extremely rare. Most human tuberculosis is caused by the bacteria *M. tuberculosis*, which is spread from person to person and rarely infects animals.

METHODS

A fall Surveillance Zone was developed that encompassed a 15-mile radius around Skime, Salol, and Grygla, Minnesota centering on the locations of the infected livestock operations (Figure 1). A sampling goal was determined to ensure 95% confidence of detecting the disease if prevalent in >1% of the deer population. Given the large geographic area and abundance of deer, the goal was to collect approximately 1,000 samples from hunter-harvested deer within the Surveillance Zone.

At the registration stations, hunters were asked to voluntarily submit lymph node (LN) samples for bovine TB testing. Hunter information was recorded, including the hunter's name, address, telephone number, MNDNR number, and location of kill. Maps were provided to assist the hunters in identifying the location (Township, Range, Section, and Quarter-section) of the kill. Cooperating hunters were entered into a gun raffle and given a Cooperator's patch.

Tissue collection procedures included a visual inspection of the chest cavity of the hunter-killed deer. Six cranial Lens (parotid, submandibular, and retropharyngeal) were visually inspected for presence of lesions and extracted for further testing. Samples were submitted to the Veterinary Diagnostic Laboratory (VDL) at the University of Minnesota for histological examination and acid-fast staining. All samples were then pooled in groups of 5 and sent to the National Veterinary Services Laboratories (NVSL) in Ames, IA for culture. Any suspect carcasses (e.g., obvious lesions in chest cavity or head) were confiscated at the registration stations and the hunter was issued a replacement deer license at no charge. Suspect carcasses were transported in their entirety to the VDL for further testing.

Additionally, MNDNR implemented efforts to further reduce deer numbers in the post-hunting season in the bovine 140-mi^2 TB-infected Core Area, through the use of sharpshooters. During winter 2006-2007, sharpshooter-harvested deer were transported intact to a central processing facility at Thief Lake Wildlife Management Area. Sample collection and handling was similar to that described above. Carcasses were salvaged for venison and available to the public.

Prior to the start of the winter 2006-2007 sharpshooting effort, MNDNR conducted an aerial survey of the bovine TB Management Zone and Core Area to assess deer numbers and distribution (Figure 2). This information was used to guide sharpshooting activities and estimate the percentage of deer removed from the area.

RESULTS AND DISCUSSION

In winter 2006-2007, we collected 488 samples from sharpshooter-harvested deer in the bovine TB Core Area (Figure 3). This included 219 adult (>2.5 years old) females, 30 adult males, 38 yearling (1.5 years old) females, 34 yearling males, 82 female fawns (0.5 year old), and 85 male fawns. We identified 6 deer as "suspects," meaning they had obvious lesions in

the lungs or chest cavity that were consistent with clinical signs of bovine TB. All of these deer were shot in the same general location in the southwestern part of the Core Area, which is a traditional deer-wintering area on state land. It is unknown whether these suspects are migratory deer and moved into this wintering area from their spring-summer-fall ranges elsewhere in the Core Area, or are resident deer. Given the population estimate of 923 ± 150 deer within the Core Area, we have removed approximately 42-63% of this deer population. Lastly, deer that were removed through this project were salvaged for venison. Thief Lake staff distributed 451 deer to interested folks from the local area as well as greater distances, including the Twin Cities.

In fall 2007, we collected 1,085 samples from hunter-harvested deer; this includes 4 whole carcasses that were confiscated from hunters due to the presence of suspicious lesions in the chest cavity or lymph nodes. All of these deer were confirmed positive for the disease by NVSL. An additional positive deer was detected that did not have obvious lesions in the chest cavity, but was part of a pool of 5 deer that were cultured positive for *M. bovis*. Upon re-examination of the lymph nodes from these 5 individual deer, microscopic lesions were found in one set of lymph nodes, and this deer was confirmed positive upon reculture. All 5 confirmed TB-positive deer were harvested approximately 5 miles from Skime, Minnesota (Figure 4). The apparent prevalence of this disease (0.46 ± 0.2%) and the geographic distribution of infected deer remain unchanged from the previous 2 years. The strain of bovine TB from the infected deer matched the strain isolated from the infected cattle herds in the Surveillance Zone and was consistent with bovine TB strains commonly found in the southwestern U.S. and Mexico.

The proximity of the infected deer to infected cattle herds, the strain type, and the fact that disease prevalence (<0.5%) is low, supports our theory that this disease spilled-over from cattle to wild deer in this area of the state. To date, we have sampled 3,085 deer in the bovine TB Surveillance Zone since 2005, and a total of 18 confirmed culture-positive deer. Further, all deer found infected to date would have been alive in 2005, when the initial detection of bovine TB in cattle occurred.

In November 2006, a ban on recreational feeding of deer and elk was instituted over a 4,000mi^2 area to help reduce the risk of disease transmission among deer and between deer and livestock (Figure 5). During a February 2007 enforcement flight, 29 illegal feeding sites were identified on 22 properties within the Bovine TB Management Zone; enforcement officers investigated all cases and illegal activities were stopped. Enforcement officers continue to enforce this rule and compliance is thought to be very high within the Bovine TB Management Zone.

Further, the Minnesota State Legislature passed a $54,000 funding initiative in 2006 that increased the amount of deer-proof fencing materials that can be provided by the MNDNR to cattle producers within 5 miles of a bovine TB-infected herd. The intent of this legislation is to protect stored feed from deer depredation and reduce the risk of deer to deer or deer to cattle transmission of the disease. The program allowed for up to $5,000 of deer-proof fencing materials per qualified livestock producer. During the summer of 2007, MNDNR erected 15 deer-proof fences on 11 cattle premises.

The presence of bovine TB in additional cattle herds and wild deer in Minnesota has led the USDA to further demote the state's bovine TB status from "modified accredited advanced" to "modified accredited"; resulting in mandatory testing of cattle and restrictions on cattle movements statewide. As part of the requirements to regain TB-Free accreditation, USDA required BAH to test 1,500 cattle herds statewide for the disease. By the end of 2007, BAH had completed this requirement, testing 1,596 herds, and did not find infection outside the endemic area in northwestern Minnesota. The MNDNR is committed to assisting the BAH in regaining Minnesota's TB-Free status as soon as possible. To accomplish this, the MNDNR will continue to conduct surveillance in 2008 and beyond.

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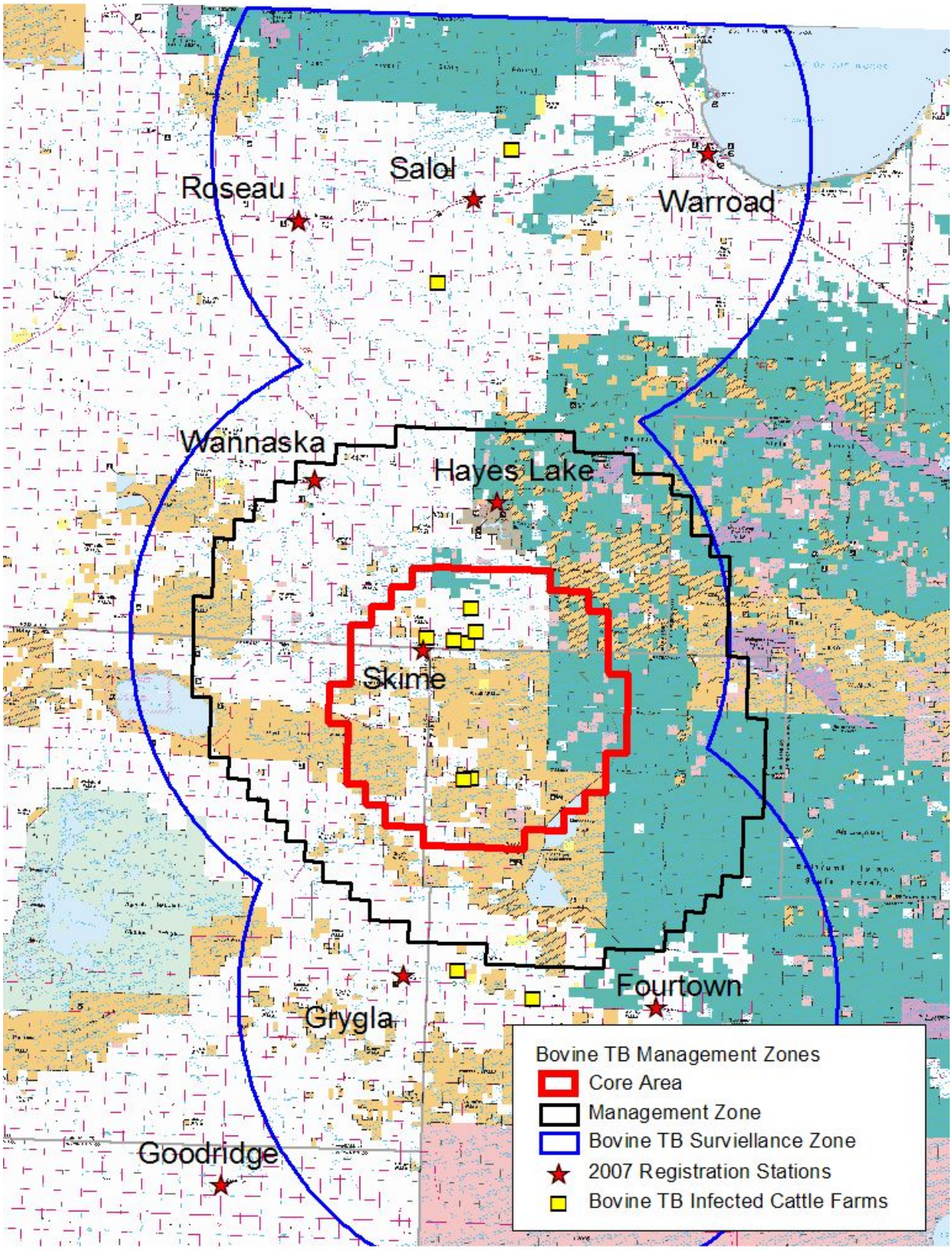


Figure 1. Locations of deer registration stations for sampling hunter-harvested deer for bovine tuberculosis during fall 2007.

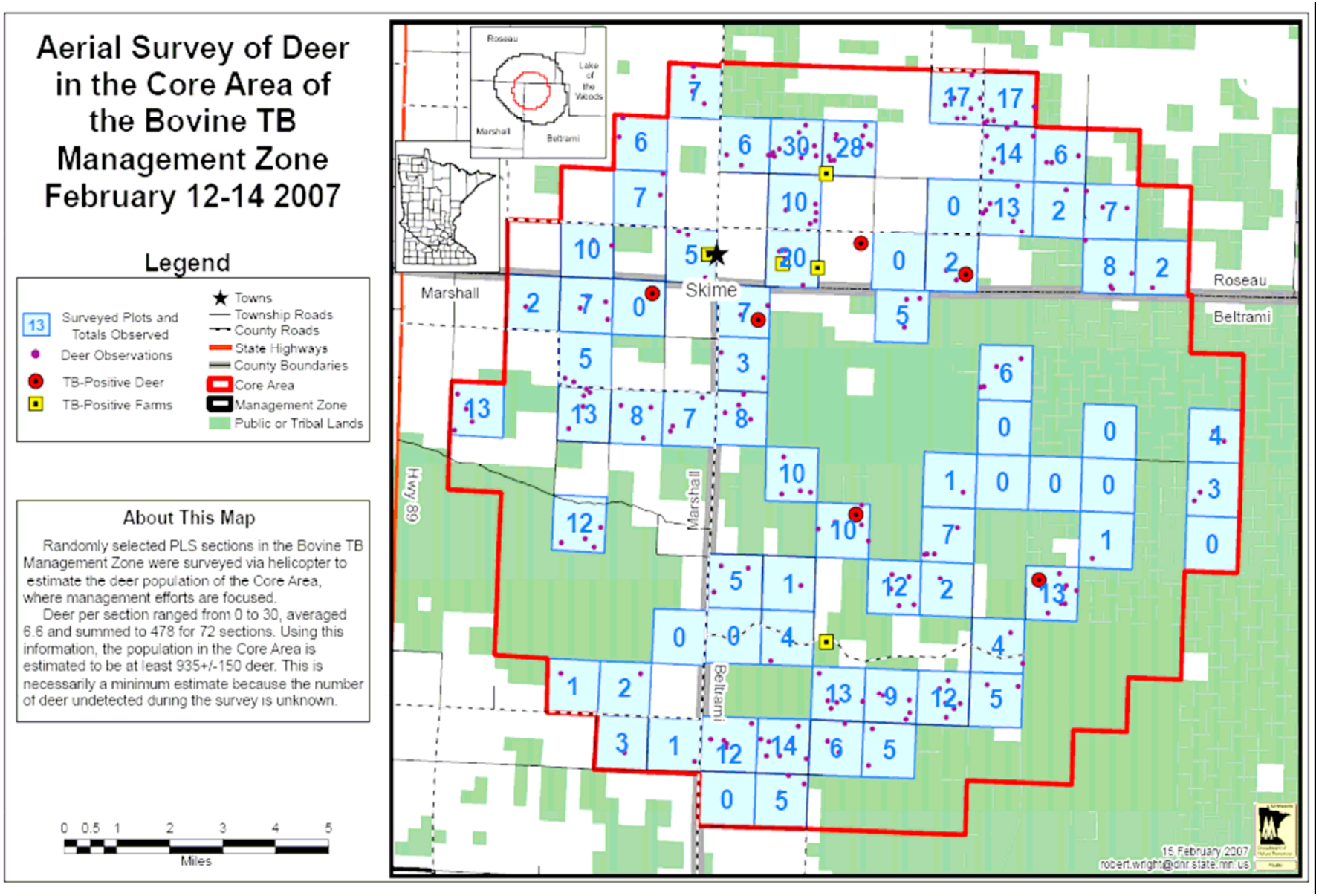


Figure 2. Results of aerial white-tailed deer survey of the bovine TB Core Area in February 2007.

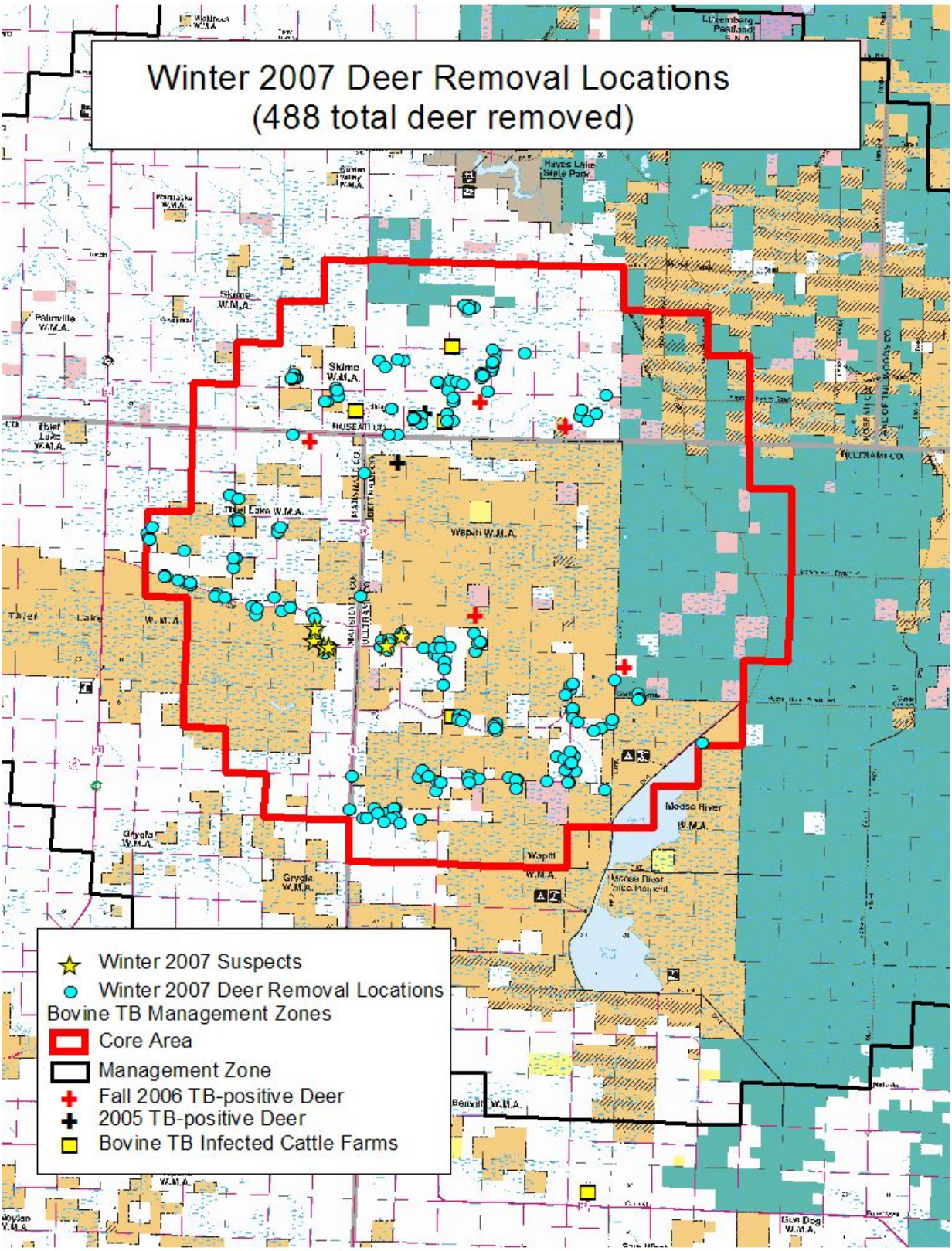


Figure 3. Locations of deer removed by USDA sharpshooters during February-April, 2007 within the bovine TB Core Area (delineated in red), a 140mi^2 area within bovine tuberculosis Management Zone (delineated in black).

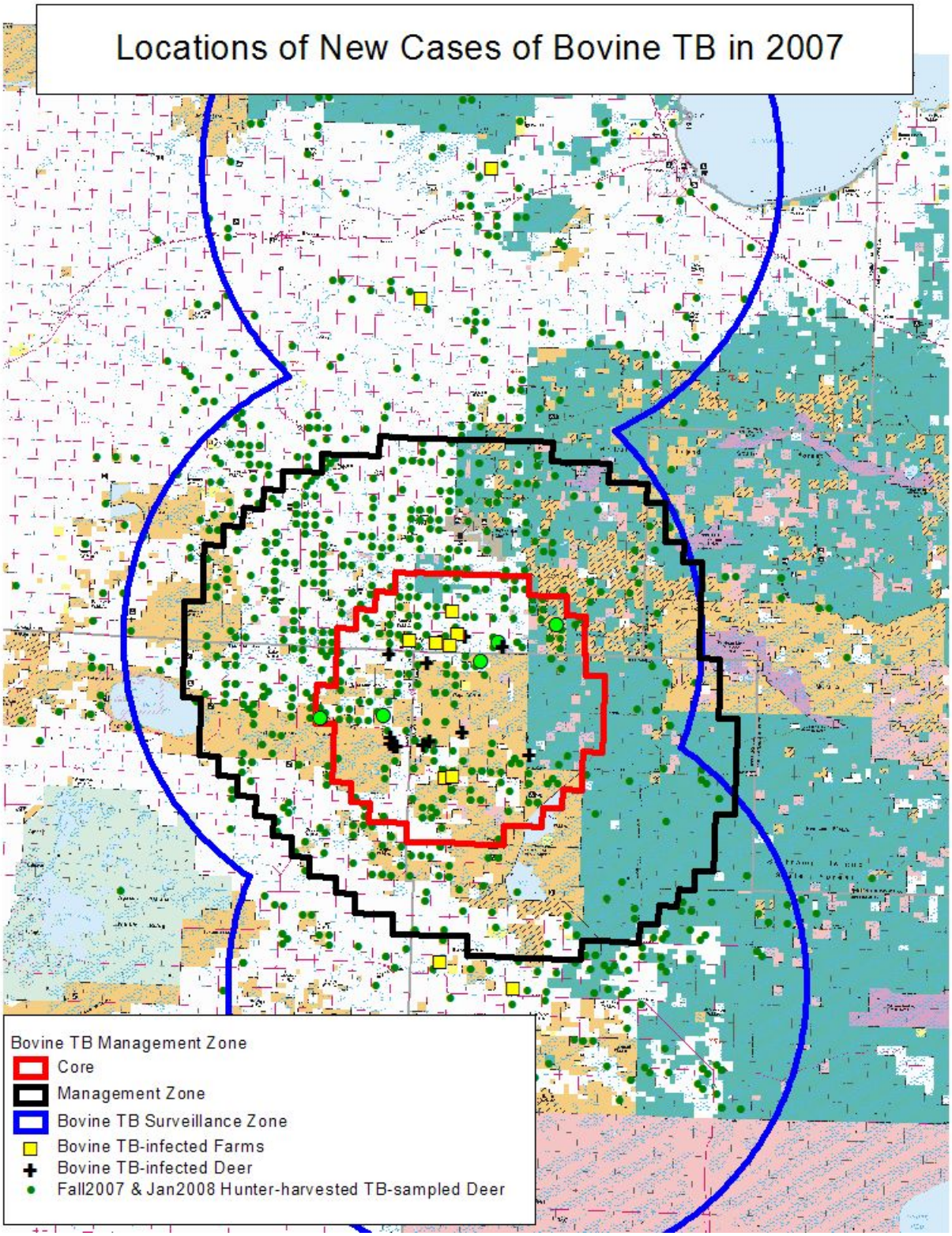
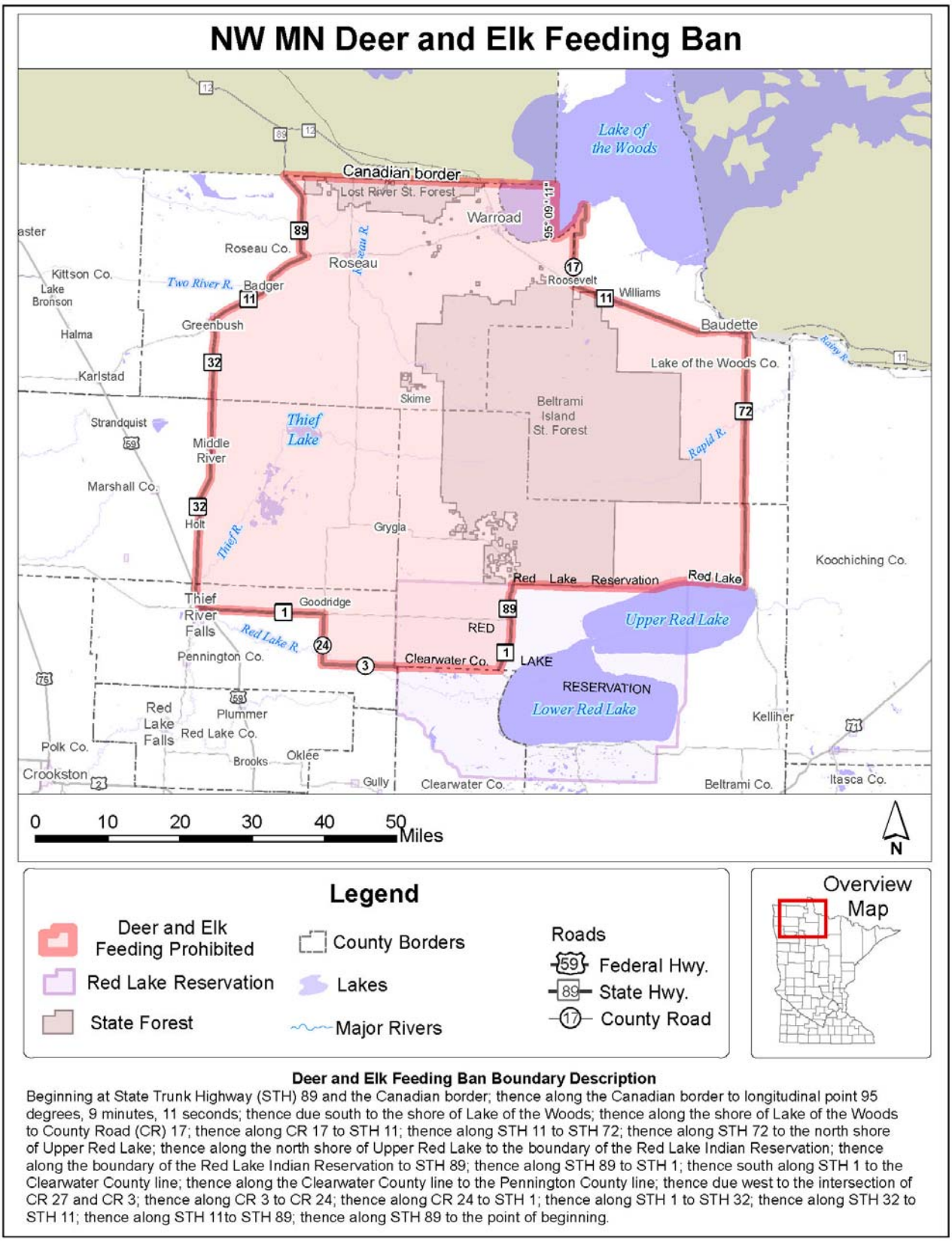


Figure 4. Locations of white-tailed deer sampled for bovine tuberculosis in the Surveillance Zone in northwestern Minnesota, fall 2006. Deer found infected with the disease in 2007 are noted with large green circles, and black crosses correspond to infected deer from 2005-2006.



Deer and Elk Feeding Ban Boundary Description

Beginning at State Trunk Highway (STH) 89 and the Canadian border; thence along the Canadian border to longitudinal point 95 degrees, 9 minutes, 11 seconds; thence due south to the shore of Lake of the Woods; thence along the shore of Lake of the Woods to County Road (CR) 17; thence along CR 17 to STH 11; thence along STH 11 to STH 72; thence along STH 72 to the north shore of Upper Red Lake; thence along the north shore of Upper Red Lake to the boundary of the Red Lake Indian Reservation; thence along the boundary of the Red Lake Indian Reservation to STH 89; thence along STH 89 to STH 1; thence south along STH 1 to the Clearwater County line; thence along the Clearwater County line to the Pennington County line; thence due west to the intersection of CR 27 and CR 3; thence along CR 3 to CR 24; thence along CR 24 to STH 1; thence along STH 1 to STH 32; thence along STH 32 to STH 11; thence along STH 11to STH 89; thence along STH 89 to the point of beginning.

Figure 5. Area in northwestern Minnesota where recreational feeding of deer and elk was banned in November 2006, as a preventative measure to reduce risk of disease transmission.