Minnesota Deer Population Goal Setting Packet

Southeast Minnesota 2014

Minnesota DNR – Wildlife Section, March 10, 2014

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Executive Summary

Between 2005 and 2007, Minnesota DNR used a public participation process to determine population goals for deer permit areas (DPAs) across the state. Goals for portions of the state were revisited in 2012. Goals for the remainder of the state will be revisited, using a similar public process, between 2014 and 2016. The new process will emphasize collecting public input (mail surveys, online questionnaires and public meetings) prior to convening stakeholder teams selected to represent the diversity of perspectives related to deer management. Stakeholder advisory teams will provide MN DNR direction regarding deer population goals in each permit area. In 2014, goals will be revisited for permit areas 341-349 in the "Southeast" goal-setting block. Population goal recommendations will advance for approval by the DNR Commissioner after a final public comment period. If necessary, any adjustments to team recommendations will be communicated to the team and public.

The Minnesota Deer Population Goal Setting Packet for Southeast Minnesota provides an overview of factors important in decisions about deer populations in Minnesota, starting with the mission of the Minnesota Department of Natural Resources. Sections on the history of deer hunting and management in Minnesota, deer population biology, social considerations, health concerns, Minnesota's deer management framework, deer population and harvest trends, and public perceptions are discussed.

Minnesota's deer population has fluctuated, at least since European settlement, primarily in response to land conversion, habitat changes, and human harvest. Minnesota's current deer population management framework evolved after the last closure of the deer season in 1971. The firearms season, which begins each year on the Saturday closest to November 6th, is the primary contributor to hunting-related mortality. As of 2013, a hunter may purchase up to three seasonal licenses (archery, firearm, and muzzleloader) and harvest up to five deer annually throughout the state, depending upon deer permit area (DPA) management strategies.

In addition to providing opportunities for outdoor recreation and the commercial use of natural resources, MN DNR is directed by mission to work with citizens to conserve and manage the state's natural resources. Natural resource management decisions, including those related to deer, must consider the various and often competing values and objectives that are central to this mission. MN DNR strives to manage deer populations in a manner that will provide quality recreational hunting opportunities, protect ecosystems, and minimize damage caused by deer.

Deer are important to the economy of Minnesota, particularly in rural regions where hunters typically travel to hunt deer during the firearms deer season. Deer hunting is highly valued in Minnesota, and revenues generated from deer hunting support many wildlife programs. There are more than 500,000 deer hunters in Minnesota; about 1 out of every 10 Minnesotans hunt

deer each year. There are many more Minnesotans who also enjoy observing deer. While arguably Minnesota's most popular game species, deer population management also requires consideration of potential conflicts, such as public safety (e.g., deer vehicle collisions), browsing impacts (on agriculture, natural habitats, and landscaping), and the risk of disease (for deer, people, and other species).

In Minnesota, deer population management occurs at various levels – from local habitat management to statewide laws, rules, and regulations. Minnesota's deer population goals have been focused on the desired direction (increase, remain the same, or decrease) and magnitude (e.g., moderate) of population change for each deer permit area (DPA); hunting is the primary method used to manage deer populations. To manage deer densities within target levels, MN DNR staff members consult on an annual basis to determine the hunting season management designation for each DPA. Information considered in this process includes population trend data, annual harvest statistics including hunter success rates, and recommendations from the deer population goal-setting process as well as public comments. With few exceptions, DNR deer management strategies have been successful in that nearly 80% of permit areas are now within target density range, indicating that the population goal (i.e. desired population trend) has been achieved. If deer population goals are revised, management strategies will be adapted to move the population toward new goal levels.

In the last decade, the estimated number of deer in Minnesota's deer population has stabilized near approximately 1 million deer. After the severe winters of 1996 and 1997, deer population numbers increased to a high of more than 1.1 million deer due to relatively mild winters and relatively low antlerless harvests. Following deer population goal setting during 2005-2007, deer densities in most DPAs were intentionally reduced and stabilized to current levels through harvest management strategies designed to meet those population goals. As a consequence of purposeful population reduction, Minnesota deer hunters harvested numbers of deer during the period 2003 – 2006 that are not sustainable over the long-term. High antlerless harvest rates, along with liberal bag limits contributed to high harvest numbers and the decline in the statewide deer population.

Following deer population goal setting in 2005, deer densities in southeast Minnesota were intentionally reduced and, in the last few years, have remained stable. Although populations can generally be considered stable, significant localized deer problems still exist and much attention has been focused on reducing agricultural damage. Annual harvests increased to peak levels in 2006 and 2007 and were about 21% higher than the 2000 harvest. In 2012, total harvest was 6% below that of 2000. Harvest densities vary by DPA and reflect habitat, population densities and goals, harvest management strategies, and hunting pressure.

During the fall and winter of 2012-13, MN DNR collected information, via mail surveys, on Southeast hunter (3A and 3B seasons) and landowner (>40 acre) perceptions about the current deer population and desires regarding future management. Survey recipients were selected randomly and provide a statistically representative sample of stakeholder opinions. Thus, these surveys differ from public input opportunities which may include some bias according to self-selection of interested parties. When asked about the current deer population, the most common response from both surveyed hunters and landowners was that the population was "about right". Almost half of the responding hunters indicated they were satisfied with the total number of deer they saw while hunting (41% were not satisfied and 10% were neutral). When asked about future management, the greatest proportion of responding hunters indicated that they would like to see an increase in the deer population while the greatest proportion of landowners (61% of whom were also hunters) indicated that the population level should not be changed. There were slight differences among landowner groups, with more large (more than 250 acres), southern landowners believing deer populations were too high, compared to small (40 – 80 acres), northern landowners. Southern landowners also believed populations should be lowered more significantly than northern landowners indicated. All landowners reported receiving some damage to their crops from deer, with damage most often reported by southern landowners who owned more than 250 acres. A majority of respondents reported negligible to minor damage.

Over the course of the next few months, deer population goals will be considered for southeast Minnesota. The process will include a review of applicable data, public input (online and meetings) during February and advisory team meetings during March. After final public comment, population goals will be finalized by MN DNR. Harvest management strategies to meet those goals will be implemented for the 2014 hunting season.

Minnesota DNR Mission Statement

The mission of the Minnesota Department of Natural Resources (MN DNR) is to work with citizens to conserve and manage the state's natural resources, to provide outdoor recreation opportunities, and to provide for commercial uses of natural resources in a way that creates a sustainable quality of life.

About the mission statement and deer management

MN DNR works to integrate and sustain the interdependent values of a healthy environment, a sustainable economy, and livable communities. MN DNR's integrated resource management strategy shares stewardship responsibility with citizens and partners to manage for multiple interests. Natural resource management decisions, including those related to deer, must consider the various and often competing values and objectives that are central to this mission. The MN DNR:

- protects the state's natural heritage by conserving the diversity of natural lands, waters, and fish and wildlife;
- manages natural lands such as forests, wetlands, and native prairies;
- maintains healthy populations of fish and wildlife;
- protects rare plant and animal communities throughout the state;
- manages the state's water resources, sustaining healthy waterways and ground water resources;
- provides access to enrich public outdoor recreational opportunities through a state outdoor recreation system; and
- supports natural resource-based economies in a manner consistent with sound natural resource conservation and management principles.

History of Minnesota Deer Hunting and Management

Historically, white-tailed deer in Minnesota existed throughout the wooded river valleys and woodlands of central and southern Minnesota (Figure 1). Hardwood forests comprised of maple, basswood, and oak were abundant in southeastern and central regions of Minnesota and white-tailed deer were likely common in these portions of the state as well. In northern Minnesota, deer were absent or rare; moose and caribou were the most abundant members of the deer family. The predominant forest landscape was comprised of extensive tracts of jack pine, and red and white pine, mixed with spruce-balsam and aspen-birch on the uplands and spruce, tamarack and white cedar on the lowlands.

European settlement of southern and central Minnesota during the mid- to late-1800's cleared forests for lumber and agriculture, which improved habitat quality for deer by creating new

openings. However, as agricultural land conversion expanded, habitat quantity declined and so did deer numbers. Market and subsistence hunting accelerated the population decline in deer numbers; by the 1880s deer were rare in many parts of Minnesota (Figure 2).

During the late 1800's, logging of the red and white pine forests and burning logging slash, as well as clearing land for farming, created new habitats for white-tailed deer in northern Minnesota. By 1920, white-tailed deer were common in northern forests but were rare in much of their former range (Figure 3).

The State of Minnesota attempted to manage deer numbers through regulated hunting as early as 1858 (Table 1). Deer hunting seasons were closed in Minnesota's farmland area in 1923 and remained closed until 1945. The first statewide, any-deer season occurred in 1946. Deer were more abundant in the north and a deer hunting focus and traditions developed in the northern forest, including the far northeastern counties. Over the past century, deer populations have fluctuated throughout the state in response to changing habitat, patterns of winter severity, and hunting harvest. These factors, especially the latter two, forced season closures in the early 1940s and in 1951. A statewide deer population crash occurred in the late 1960s, which prompted the last season closure in 1971.

An improved management framework by MN DNR evolved during the 1970s that permitted annual hunting, while allowing the statewide population to grow. While the hunting zones, season lengths, and opening dates have changed slightly over the years; today's seasonal framework generally reflects the system developed in the 1970s that centers on an opening firearm season on the Saturday closest to November 6th. A hunter may purchase a season license to take a buck, or to take an antlerless deer with an either-sex permit, in a "lottery" deer permit area (DPA). The either-sex permit quota depends on where the deer population is relative to the population goal, hunter success rates, and other mortality factors. Because demand for either-sex permits typically exceeded supply in most permit areas, a lottery preference system has been utilized since the early 1980s in order to equally distribute antlerless permits among hunters through time. Beginning in the 1990s, MN DNR allowed for issuance of additional either-sex permits (i.e., bonus permits) to help reduce deer populations in permit areas that exceed established goals. Beginning in 2003, permit areas were annually designated by wildlife managers as lottery, managed, and intensive. The latter two designations allowed the issuance of an either-sex license and purchase of one or up to four additional bonus permits, respectively. Hunter choice, a management strategy intermediate to lottery and managed harvest, was instituted in 2011 to allow hunters to take one deer of either sex in a permit area without making a lottery application. As of 2013, a hunter may purchase up to three seasonal licenses (archery, firearm, and muzzleloader) and harvest up to five deer annually throughout the state, depending upon DPA management strategies.

Minnesota's deer program has been a success story based on hunter numbers and deer harvests. Minnesota firearms deer hunter numbers (Figure 4) and firearms deer harvests (Figure 5) have grown tremendously over the past 95 years. More recently, MN DNR developed a public goal-setting process to better involve citizens in deer population decisions. The current framework has, for the last 40 years, brought stability to deer population management in Minnesota relative to previous decades, when liberal seasons were often followed by season closures. Population management through season structure and regulation, along with winter weather patterns, has been the most significant factor in growing and stabilizing both farmland and forest deer populations in the state during the past forty years.

Carrying Capacity and Deer Management

Carrying capacity

MN DNR strives to balance the birth and death rates within deer populations to protect ecosystems, to minimize damage caused by deer, and to provide quality recreational hunting opportunities. The maximum number of deer that can be supported in a given area is theoretically limited by habitat quality and climate. This population level is generally referred to as the "biological carrying capacity" (BCC) and represents the maximum number of animals that can be supported on a sustainable basis given a suite of biological factors. If deer populations exceed this threshold, habitat quality deteriorates and the amount of food for each deer (and other species that use deer habitat) is reduced. Consequently, deer numbers eventually decline in response to habitat degradation and the shortage of food. The BCC is useful because it establishes a benchmark to reference in deer herd management. However, BCC is difficult to determine because of the complexities of natural systems and the difficulty of accurately measuring variation in those systems. Usually, the BCC can only be determined after deer numbers have exceeded that threshold, resulting in poor habitat conditions, reduced body condition and fertility, and, eventually, a declining deer herd. Attempts to maintain deer at the apex of BCC are not realistic for the reasons articulated below.

Although the BCC is important to deer population dynamics, the "social carrying capacity" (SCC) is more relevant for managing Minnesota's deer populations. The SCC focuses on the impacts deer may have on people and the things people value; essentially, it is the maximum number of deer that humans will tolerate and is lower than the BCC. Negative impacts of deer that contribute to SCC include degraded natural ecosystems and associated impacts on wildlife species, deer-vehicle collisions, agricultural damage, and damage to residential landscaping. It is important to understand that neither the biological or social carrying capacity is fixed at a certain number of deer. Carrying capacities can be difficult to define because each varies with changes in local conditions. MN DNR wildlife managers attempt to manage deer populations

below both biological and social carrying capacities. This requires evaluation of a variety of sources of information including the ecological and economic impacts of deer across a large geographic area and the broad interests of stakeholders with interests in deer management.

Population growth

Deer herds increase annually through recruitment of young deer into the population. "Recruitment" is the number of fawns born in spring that survive into fall. Reproduction is a high priority for female deer and regardless of influences such as food resources, deer densities, or the numbers of bucks in the population, most adult does are bred every year. Although winters may be stressful, does rarely abort their fetuses even when they are severely malnourished. However, fawns born to mothers that were severely malnourished in winter have lower body weights and are more prone to mortality. All does that give birth to fawns produce milk of the same quality with the proper composition of nutrients. But, when does are in poor condition or cannot find adequate food to support lactation, they produce a lower volume of milk for their fawns. Malnourished fawns are more prone to be killed by predators or die of abandonment or disease, and recruitment is negatively impacted.

Density-dependent factors, such as food resources and cover, affect recruitment rates in white-tailed deer populations. Density dependence relates to the concept of BCC; there is only so much food and cover available to a deer population. The amount of food and cover available for each deer will decrease as deer numbers increase toward BCC and, as a result, the number of fawns recruited per doe will decrease. When food resources are limited, physical condition and adult deer survival also declines. Deer in poor physical condition will have lower body weights and bucks (particularly yearling males) will possess antlers with fewer points and smaller beam diameters. When food and cover resources are sufficient, deer densities have less of an effect on survival and reproduction, and recruitment is high. Harvest levels are maximized when deer densities are well below the BCC because fawn recruitment is maximized and mortality is minimized.

Understanding how deer herds respond to different levels of harvest is one of the most complex parts of managing deer populations. The size of the deer population in relation to BCC is a major consideration for managing deer harvest. As indicated above, when the population is at BCC, deer densities will be high but recruitment of fawns will be low and overwinter survival will be affected. This is an important concept to understand. To maintain a population at a particular level, mortality through hunting and other causes cannot exceed the number of deer recruited into the population. The population will decrease if the number of deer dying exceeds the number of deer recruited into the population. Conversely, the population will grow if fawn recruitment exceeds the number of deer that die. In order to maintain the population at a given level, low fawn recruitment when populations are very high or very low

means that fewer deer can be harvested. An optimum deer population level is one that is well below BCC, resulting in negligible competition for food resources, a maximum number of fawns produced per doe and, in turn, the maximum number of adult deer available for harvest by hunters. At this population level, deer management benefits the deer herd, recreational opportunities and ecosystem health.

Social Issues and Deer Management

Deer management must also balance social considerations, including conflicts with other land uses and human tolerance. The desires of farmers, foresters, ecologists or others who experience conflicts with deer and favor lower deer densities must be considered along with those of hunters, wildlife watchers, and others who may support higher deer densities.

Importance of deer to society

Deer are important to the economy of Minnesota, particularly in rural regions where hunters typically travel to hunt deer during the firearms deer season. Based on the 2011 National Survey of Fishing, Hunting, and Wildlife-Associated Recreation, the total annual economic impact of hunting in Minnesota exceeded $725 million and more than 85% of hunters in Minnesota hunt deer.

Deer hunting is highly valued in Minnesota, and revenues generated from deer hunting support many wildlife programs. Passage of the 1937 Federal Aid in Wildlife Restoration Act, which created the Pittman-Robertson Program, marked the beginning of wildlife management as we know it today. Pittman-Robertson dollars are a result of a federal excise tax on firearms and ammunition. These funds and revenues generated directly from deer hunting license sales are used to support a wide variety of wildlife-related activities including acquisition of conservation lands, management and research activities to benefit wildlife, natural resources education programs and law enforcement.

There are more than 500,000 deer hunters in Minnesota, which means that about 1 out of every 10 Minnesotans hunt deer each year. There are many more Minnesotans who also enjoy observing deer. The 2011 National Survey of Fishing, Hunting, and Wildlife-Associated Recreation estimated that more than 1.5 million people spent $621 million to observe, feed, or photograph wildlife in Minnesota during 2011. Though difficult to quantify, deer are a popular species among wildlife observers; thus, it is probably safe to assume that a good portion of those people spent time and money enjoying and observing deer.

Deer-vehicle collisions

Deer-vehicle collisions (DVCs) are a major concern throughout much of the United States, accounting for human injury and death, damage to vehicles, and waste of deer as a wildlife

resource. According to the Minnesota Department of Public Safety, DVCs resulted in 5 fatalities and 342 reported injuries in Minnesota during 2012. State Farm Insurance estimated that 1.23 million deer-vehicle incidents occurred nationwide from July 2011 through June 2012, and the average cost of damage of these incidents was $3,305. For the same year, State Farm Insurance projected the occurrence of over 41,000 DVCs in Minnesota, ranking the state 8th in the country for likelihood of a DVC.

Most states have attempted to minimize DVCs through a variety of techniques, including deer-crossing signs, modified speed limits, highway lighting, roadside fencing, over- or underpasses, habitat alteration, deer hazing, driver awareness programs, and reflective devices. However, most methods designed to reduce deer-vehicle collisions have been proven ineffective, including deer crossing signs. Proper deer management, improving visibility along roadways, managing the speed of vehicles, and educating residents about the seasonal risks of deer-vehicle collisions are important. During May and early June when fawns are born, female deer are more mobile and are susceptible to deer-vehicle collisions. Likewise, in late October through November, bucks are actively chasing does for breeding purposes, and motorists should be especially alert.

Agriculture

Minnesota's agricultural industry accounts for approximately 14% of the state's income and employment. The U.S. Department of Agriculture estimated that wildlife caused $944 million in damage to agriculture during 2001; with increasing commodity prices, the cost of damage has risen in recent years. Since many agricultural plants are preferred forage for deer, deer are responsible for a substantial proportion of these damages. Minimizing damage caused by deer is an important consideration in managing deer populations in Minnesota. MN DNR has an animal damage program with staff committed to minimizing human-wildlife conflicts. In many DPAs in Minnesota, deer are managed at or near population goals annually. However, complaints of deer damage from agricultural producers do occur in localized areas and may occur at any deer density. Complaints of depredation by deer in Minnesota include consumption of forage stored for livestock and damage to specialty crops such as produce, row crops including corn and soybeans, and commercial forest stands.

MN DNR does not compensate farmers financially for crop damage caused by deer. Wildlife managers are available to work cooperatively with agricultural producers to develop strategies to reduce deer damage and improve deer population management. By excluding deer from stored forage, the damage can be effectively eliminated. Farmers who enter into a Cooperative Damage Management Agreement with MN DNR are eligible to receive material assistance from the State, including installation of exclusion fencing. Sound and visual deterrents and taste and smell repellents have proven ineffective for reducing deer damage in most agricultural settings.

Typically, agricultural fields are too large in area to deploy these strategies effectively. Therefore, to minimize damage to standing crops in Minnesota, localized population management techniques (including hunting and shooting permits) are used to decrease deer numbers where they are causing damage. If sport-hunting is utilized to the fullest extent and damage is still excessive, MN DNR may issue shooting permits to agricultural producers to harvest deer outside of hunting seasons. In addition, a pilot program was instituted in 2012 in southeastern Minnesota, which allows the use of depredation permits allocated to specific properties where deer damage is occurring. Depredation permits allow increased bag limits for private sport-hunters to harvest additional antlerless deer during regular hunting seasons. MN DNR is committed to working with agricultural producers, and strategies to reduce deer damage will continue to be adapted to be effective with changing agricultural practices.

Habitats

Deer can have a major impact on the natural habitats they use. Deer feeding habits and their preferences for certain plants change the structure and composition of plant communities over time. Because they are large herbivores, white-tailed deer are highly effective at altering habitat due to their energetic requirements and high reproductive potential. For example, high deer densities can cause drastic declines in the number of species of forest plants, the abundance of those species, and overall forest structure. Deer browsing may also reduce food sources, cover, and nesting sites for a variety of other wildlife species. Such alterations influence the number of species of birds, mammals, reptiles, and amphibians that can use habitats degraded by deer.

As the number of deer increase, plants that are preferentially consumed become less abundant and may disappear altogether. However, other plants have developed a tolerance to high levels of deer browsing and those plants may out-compete more desirable plants for resources. For example, Pennsylvania sedge, which is not eaten by deer, may form dense mats on the forest floor inhibiting the growth of other plants. Likewise, common buckthorn, which is a non-native species introduced to Minnesota in the 1800s for residential hedges, is not preferred browse for deer. Buckthorn forms dense stands in the forest understory that inhibits growth of other plants by blocking sunlight and depleting available soil nutrients.

Many of the tree species that have commercial value are also preferred forage for deer, which can result in revenue losses due to over-browsing. Deer browsing can kill trees or hinder their growth; both scenarios may result in significant economic losses. According to a 2011 MN DNR analysis, the state's forest products manufacturing and related sectors directly contributed $3 billion value-added to the Minnesota economy. As of 2012, over eight million acres (roughly half) of forests in Minnesota were certified for sustainable forest management through a voluntary third-party process. In 2005, a forest certification audit noted that deer browse in

certain areas of the state was contributing to regeneration failures as well as possible loss of other plant species. Continued certification of MN DNR's forest lands required demonstration by MN DNR that deer population targets were consistent with ecosystem health goals. While there is a natural assumption that deer damage to natural vegetation is related to high deer densities, in some situations damage can occur even where deer population size is not considered high. Foresters and land managers also have a variety of non-lethal techniques available to reduce deer damage such as adjusting silvicultural techniques to reduce damage (e.g., natural versus artificial regeneration), protecting seedlings (e.g. by retaining coarse woody debris, bud-capping or using tree shelters), and incorporating browsing risk into landscape-level planning.

Landscaping

In urban and suburban areas, deer damage to landscape plants, ornamental trees, and gardens costs homeowners millions of dollars. There is a wide range of monetary estimates of deer damage to landscaping. This can be attributed to variations in the costs of landscaping in different residential neighborhoods and personal preferences of homeowners. In some neighborhoods, individual homeowners have reported deer damage to ornamental plants exceeding $10,000 annually. Homeowners can also employ a variety of non-lethal techniques to reduce deer damage to landscaping including use of alternative plants less palatable to deer, taste and smell repellents, harassment, and fencing. At higher densities, only fencing secured to the ground and 10 feet in height will be effective at reducing deer damage. However, fencing can be expensive and unsightly. Management of deer in urban areas through harvest or permitted removal is critical to minimize risks to the public and to keep deer numbers in balance with remaining natural habitats.

Diseases and Health Concerns

Monitoring and management of deer diseases

The risks of deer-related disease for deer, people, other wildlife, and domestic animals are an important consideration in deer management. Since 2002, DNR has spent approximately $6 million on surveillance and management of CWD and over $4 million on the eradication of TB in Minnesota's deer.

Despite their close association with humans, white-tailed deer pose few direct disease risks to humans or livestock. Most diseases known to be found in deer occur naturally and are endemic to the U.S. Because of the significance of CWD and TB, and the human health implications of Lyme disease to deer management in Minnesota, summaries about these diseases are provided below. Some other diseases are a management concern for MN DNR or are commonly

mentioned diseases of interest to stakeholders. Detailed case histories of CWD and TB in Minnesota and descriptions of other diseases of concern are provided in Appendix 1.

Chronic Wasting Disease

Chronic Wasting Disease (CWD) is a fatal transmissible spongiform encephalopathy (TSE) caused by abnormal proteins and is known to infect members of the deer family including mule deer, white-tailed deer, elk, red deer, and moose. TSEs are diseases which are capable of being spread animal-to-animal (transmissible) and result in holes in brain tissue (spongiform) that lead to a progressive neurological condition resulting in death.

CWD is spread in free-ranging deer through contact with bodily secretions including saliva, feces, and urine and infected soils and plants in the environment. No treatment exists, and population management strategies for controlling CWD involve drastic deer population reductions in localized areas to reduce transmission of the disease. There is no evidence to date that CWD is a zoonotic disease, which may be transmitted to humans, but this possibility cannot be ruled out.

In 2002, MN DNR began surveillance for CWD in free-ranging white-tailed deer after CWD was found in free-ranging white-tailed deer in Wisconsin in February 2002. Subsequently, CWD was found in a Minnesota domestic elk in August 2002. In November 2010, an archery hunter harvested a CWD-positive, free-ranging, adult female white-tailed deer near Pine Island two miles from an Olmsted County elk farm where CWD was found in 2009. Given this first discovery of CWD in Minnesota's wild deer herd, the MN DNR implemented its CWD response plan in January 2011, which included establishment of a 306-square mile CWD Management Zone, designated DPA 602. Deer harvest was intensified in DPA 602 to reduce the risk CWD transmission and testing of all adult deer harvested in the zone was mandatory. To date, MN DNR has tested more than 40,000 deer, including more than 4,000 deer in the CWD management zone, and the single case near Pine Island was the only wild deer found to be CWD positive as of December 31, 2013. Because no CWD-positive deer were found during the 2013 deer season, the borders of the CWD Management Zone, DPA 602, will be dissolved and CWD-related restrictions will be lifted.

MN DNR will continue to be proactive in surveillance for CWD in wild deer. If CWD-positive deer are detected in the future, the CWD Response Plan will be implemented in localized areas as necessary to minimize the risk of disease transmission and spread. The CWD response plan is on the DNR website and can be found at the following address, http://files.dnr.state.mn.us/fish_wildlife/wildlife/disease/cwd/cwdresponseplan.pdf.

Bovine Tuberculosis

Bovine Tuberculosis (TB) is caused by bacteria of the species *Mycobacterium bovis*. While domestic in origin, many animal species can harbor TB including non-cattle domestic animals, wildlife, and humans. TB was once common in cattle and swine in the U.S. until a cooperative effort started in 1917 by federal and state governments and the livestock industry made significant progress toward eradicating the disease. TB is still sporadically detected in U.S. cattle herds, and its discovery imposes costly trade restrictions, testing, and culling of suspect herds. Prior to the discovery of widespread infection of TB in wild white-tailed deer in northern Michigan, cases of TB-infected white-tailed deer were rare. TB is spread through nasal or oral discharges, and there is evidence that the disease may be transmitted through consumption of contaminated feeds by cattle and deer. Once established in a wildlife population, TB can be difficult to control and eradicate. TB progressively causes animals to become emaciated, debilitated, and severe respiratory infection causes labored breathing.

TB was detected on a northwest Minnesota cattle farm in 2005. The disease was subsequently found in a total of 12 cattle operations and 27 individual free-ranging white-tailed deer. Testing showed that both deer and cattle had the same strain of TB, which was consistent with a strain of TB found in cattle in the southwestern U.S. and Mexico. The Minnesota Board of Animal Health led efforts to eradicate the disease in Minnesota's cattle and MN DNR initiated a response plan that included intensified deer harvest and testing in the area. From 2005 – 2012, MN DNR tested a total of 10,667 white-tailed deer for TB. No new infections have been detected in either cattle or deer since 2009. Minnesota cattle producers regained TB-free accreditation in 2011. While MN DNR is unable to declare the local deer herd entirely disease-free, the surveillance efforts were aimed at TB detection of prevalence more than 0.5% with 99% confidence. These efforts provided solid evidence that TB is no longer within these detectable levels in the deer population. Consequently, efforts to monitor for TB in the state have been suspended.

Lyme disease and tick-borne illnesses

Lyme disease is the most commonly reported vector-borne illness of humans in the U.S. According to the Minnesota Department of Health, the number of Lyme disease cases has increased dramatically since the 1990s. The disease is caused by spirochete bacteria and is transmitted to people via the black-legged tick, which is also known as the deer tick. In Minnesota, black-legged ticks also transmit other tick-related illnesses including babesiosis, human anaplasmosis, human ehrlichiosis, and a strain of Powassan virus.

Lyme disease is most commonly transmitted to humans when the infected ticks are nymphs during the spring, which are carried by a variety of small mammals and ground-dwelling birds. White-tailed deer are the primary reservoir hosts of the adult black-legged tick and the exact

relationship between deer densities and Lyme disease infection rates is not clearly understood. Reducing deer numbers has been ineffective in preventing Lyme disease because deer are not the only reservoir for the disease and do not transmit the disease directly to humans or other deer.

Managing Deer Populations in Minnesota

Scales of deer management

Deer population management in Minnesota occurs at various scales. Most harvest-related laws, rules, and regulations are applied statewide. MN DNR also reports annual harvests and population estimates at the statewide level. However, few management decisions are made at this broad level due to differences in land use, climate, topography, human population and hunter densities, and habitat differences throughout the state.

Differences in deer populations and management can also be interpreted and understood according to ecological landscape features. The State of Minnesota uses an Ecological Classification System (ECS) that separates the state into progressively smaller and similar landscape units based upon biotic and environmental factors (e.g., climate, soils, and vegetation). For example, Minnesota's forest deer population model closely reflects the Laurentian Mixed Forest at the ECS province level (Fig. 6). Habitat management activities, which influence deer densities, are implemented on a smaller scale based on subsection plans and more local landscape features.

Finally, deer population management decisions and strategies are implemented at regional and local scales that reflect both ecological and administrative boundaries. For example, the length of Minnesota's firearm deer hunting season varies statewide by zone (Figure 7) as a result of factors including differences in deer vulnerability and habitat, hunting pressure, and land ownership. The finest scale of deer population management occurs at the Deer Permit Area (DPA) level. In general, DPAs are the finest scale at which populations can be estimated and monitored (Figure 8). At the DPA level, deer populations are estimated through simulation modeling and the number of deer that can be harvested while maintaining the population near the population goal is determined. Consequently, either-sex permit quotas are allocated by DPA.

Managing deer harvest

Hunting is the primary method used to manage deer populations in Minnesota. Population goals for each DPA were developed through a stakeholder-based process administered by MN DNR between 2005 – 2007. To manage deer densities within target levels, MN DNR area managers, the big game program leader, and wildlife researchers consult on an annual basis to determine the management designation and the number of either-sex permits offered for each

DPA. The information considered in this process includes population trend data, annual harvest statistics including hunter success rates, and recommendations from the deer population goal-setting process as well as hunter comments and deer damage complaints. When deer population goals are revised for DPAs, management strategies are adapted to move the population toward new goal levels.

MN DNR wildlife researchers conduct population modeling to understand historical deer herd dynamics, predict population sizes, and explore the impacts of various hunting regulations on population size and age structure. Two deer population models were developed for Minnesota; both have been used for about 25 years. One model was tailored for the forested region where estimating mortality associated with winter weather is important. The other model was developed for the farmland region where high hunting mortality and high productivity of female deer occur. Both models are accounting-type models where the balance of deer changes each year due to "withdrawals" which reflect mortality from various sources and accumulated "interest" which represents fawns recruited into the population. The models keep track of the number of deer in each sex and age category (e.g., adult males).

Vital statistics used in the models, including rates of reproduction and non-hunting mortality, are obtained through research studies or from the primary scientific literature. Harvest data are obtained through mandatory hunter-registered deer, which are reported as an adult male, adult female, fawn male, or fawn female and these data are tallied for each DPA in Minnesota. The population models estimate average deer density within DPAs annually. Because simulated population estimates may "drift" away from actual deer densities as model input errors accumulate over time, MN DNR periodically recalibrates the starting population of models with independent deer population estimates and population reconstruction using harvest data. Where habitat and snow conditions allow, aerial surveys by helicopter are used to estimate deer for model recalibration purposes in the forest transition zone. Other data are used to recalibrate models in the farmland and forest zones. With periodic recalibration, simulation modeling has been demonstrated to perform as well as annual surveys and is much more cost-effective.

Goals and goal setting process

Current Population Goals

Deer population goal setting was conducted over a 3-year period (2005 – 2007) throughout Minnesota. Previous to this project, deer population goals were established at the local level by area wildlife managers; similar information was considered and public input, while informal, was incorporated into decisions. Beginning in 2005, the goal-setting process was specifically designed to enable public participation from a broad spectrum of interested stakeholders in a consistent manner, statewide.

DPAs were consolidated into 15 blocks loosely aligned along the ecological classification system (Figure 9). A round-table, goal-setting process was advertised by MN DNR; stakeholder teams for each block were formed using self-nominations submitted by interested individuals or organizations as well as input from local wildlife staff. For each block, a group of up to 20 individuals was selected based on their ability to best represent the local constituency and issues related to deer in their area. Teams met twice over a one-month period and provided guidance to DNR on deer population direction. DNR then solicited public input via an online presentation and survey. Final population recommendations were adjusted somewhat to reflect public comment, when necessary, and approved by the MN DNR Commissioner's office at the end of each process. The final goals for each permit area were articulated as a desired population trend (i.e., increase, decrease, remain the same) and the associated percent change in deer densities.

In total, nearly one-half of the permit areas were slated for a population reduction (Table 2, Figure 10). The DPAs where population reductions were recommended were in northern, central, and southeast Minnesota. Conversely, recommendations were made to increase populations in 40% of permit areas, which were mostly associated with the farmland regions of western, southern, and southwest Minnesota.

Current Status

Several significant changes to deer management have occurred since the completion of the goal setting effort. Specifically,

- The 4A (2 day) and 4B (4 day) seasons were eliminated and the permit areas were placed into a 9-day continuous 2A season structure.
- Bovine TB was discovered in northwest Minnesota and a new permit area was created (DPA 101) for disease management. At the same time, northwest permit areas were also realigned along habitat lines.
- Numerous forest permit areas in Zone 1 and Zone 2 were realigned along public/private land boundaries and to separate the moose range.
- A moose management plan established a maximum deer density (10 deer mi^2) for deer permit areas in the primary moose range (NE Minnesota).
- CWD was discovered in a wild deer near Pine Island, Minnesota and a new permit area was created (DPA 602) for disease management in the Southeast.

With few exceptions, DNR deer management strategies have been successful in that nearly 80% of permit areas are now within target density range, indicating that the population goal (i.e. desired population trend to increase, decrease, or remain the same) has been achieved (Table 3; Figure 11).

Deer Population and Harvest Trends

Statewide population trends

In the last decade, the estimated number of deer in Minnesota's deer population has stabilized near approximately 1 million deer (Figure 12). Deer population increases over the past few decades were influenced by relatively mild winter weather; the average statewide winter severity index (WSI) value has declined each decade since the 1970s (Figure 13). The population increase also reflects the lower antlerless deer quotas in the 1970s and 1980s, and again following the severe winters of 1996 and 1997, when deer populations were lower and the goal was to increase deer numbers, especially in the northern forest.

After the severe winters of 1996 and 1997, deer population numbers increased to a high of more than 1.1 million deer due to relatively mild winters and relatively low antlerless harvests.

Following deer population goal setting during 2005-2007, deer densities in most DPAs were intentionally reduced and stabilized to current levels through harvest management strategies designed to meet those population goals.

The impact winter weather has on deer population numbers is most apparent in Minnesota's northern forested region (Figure 14). About half of Minnesota's deer population is in the forested region so the statewide population estimate declines when the forested region's population declines.

Deer numbers are relatively stable in Minnesota's farmland region (Figure 15). Winter weather has less impact on farmland deer because these deer are in better physical condition when winter begins due to a virtually unlimited food bank. Further, most of Minnesota's farmland is located in southern Minnesota where winter weather is comparatively mild. However, management of deer numbers in the farmland region is primarily limited by winter habitat availability and conflicts with agricultural producers.

Some of the highest deer densities in the state can be found In Minnesota's transition zone, where farmland shifts to forest. In many of these habitats, abundant food and cover, combined with relatively mild weather, allow deer to be managed at greater numbers compared to other regions in the state.

Between 2000 and 2005, deer numbers were increasing at a greater rate in the forested portion of the state than in the farmland region (Figure 16). After population goals were established, the deer population decreased in the forested portion of the state (where most permit areas were slated for reductions) but remained fairly stable in the farmland (where most permit areas were slated for increases).

Statewide harvest trends[1]

Prior to the last goal setting effort, the statewide deer harvest was on a generally increasing trend from 1977 through 2003 (Figure 5). Beginning in the 2003 deer season, DNR staff recognized that populations were at historic size and that, although goal setting had not formally begun, management changes needed to be made to lower densities across much of Minnesota. Consequently, several deer management changes were instituted that provided for increased recreational opportunity and more liberal bag limits. As a consequence of this purposeful population reduction, Minnesota deer hunters harvested numbers of deer during the period 2003 – 2006 that would not be sustainable over the long-term. High antlerless harvest rates, along with liberal bag limits contributed to high harvest numbers and the decline in the statewide deer population.

The harvest ratio of antlered/antlerless deer has also changed over time. The number of antlered deer harvested annually exceeded antlerless harvest ten out of 14 times from 1977-1990 (Figure 17). In contrast, statewide buck harvests exceeded antlerless harvest only six out 14 times from 1990-2003. Since 2003, statewide buck harvests exceeded antlerless harvest four out of 10 times (through 2013). This shift in antlerless harvest is a reflection of higher deer populations and the increased availability of antlerless permits designed to decrease total deer populations.

Southeast Minnesota population trends

Deer populations in southeast Minnesota were very stable during the 1990s until the early 2000s when deer densities increased almost 15% (Figure 18). Following deer population goal setting in 2005, deer densities were intentionally reduced and, in the last few years, have remained stable. Although populations can generally be considered stable (or at goal), significant localized deer problems still exist and much attention has been focused on reducing agricultural damage.

Southeast Minnesota harvest trends

Total numerical harvests have fluctuated over the past decade as a result of management to reduce densities to align with population goals (Table 5). Annual harvests increased to peak levels in 2006 and 2007 and were about 12% higher than the 2000 harvest (Figure 19). In 2013, total harvest was almost 20% below that of 2000.

Over the same period, numerical buck harvests stayed within 20% of the 2000 buck harvest with the exception of 2010, 2011 and 2013 (Figure 20) following implementation of antler point restrictions. In 2010, an antler point restriction that protected more than two-thirds of yearling

[1] Final 2013 harvest data and 2014 population estimates were not available at the time of this report.

males was implemented in southeastern Minnesota (300-series only) and the buck harvest dropped considerably. in 2013, the buck harvest in southeastern Minnesota (300-series and permit area 602) was 27% that of 2000. Antlerless harvest has consistently exceeded buck harvest in southeastern Minnesota (Figure 21), reflecting 53-69% of the total annual harvest. In 2013, antlerless deer comprised 61% of the total harvest.

Harvest densities vary by DPA and reflect habitat, population densities and goals, harvest management strategies, and hunting pressure (Figure 22).

Antler point restrictions

Beginning with the 2010 deer season, an antler-point restriction (APR) regulation was implemented in all eleven 300-level DPAs in southeast Minnesota during all seasons. This regulation, which defined a legal buck as having at least 4 points on one antler, was expected to protect more than two-thirds of yearling bucks in the population, and increase the number of bucks at least 2.5 years old in the harvest. Youth hunters (10-17 years old) were exempt from this regulation and could legally take any antlered buck. In addition, cross-tagging for bucks was prohibited (i.e., hunters cannot shoot and tag bucks for each other), although cross-tagging for antlerless deer remained legal.

Based upon deer registration data, buck harvest decreased below the 5-year average by 35% in 2010, 28% in 2011, and 17% in 2012. Also, whereas the percentage of bucks 1.5 years old in the buck harvest averaged 42% from 2005-2009, yearling bucks comprised only 22%, 19%, and 19% of the buck harvest during 2010, 2011, and 2012, respectively. Therefore, the antler-point restriction successfully protected the majority of yearling bucks. Hunter support for the APR increased from 49% in 2010 to 60% in 2012. Based upon these results, MNDNR recommended continuing APR regulations during the 2013 hunting season.

Public Surveys 2012-2013

MN DNR periodically conducts stakeholder surveys to collect information about public desires and opinions regarding specific natural resource management issues. Survey recipients are selected randomly and provide a statistically representative sample of stakeholder opinions. Thus, these surveys differ from annual public input opportunities which may include some bias according to self-selection of interested parties. In 2012-2013, both landowners and hunters in southeastern Minnesota were surveyed; the resulting information provides a basis for the 2014 deer population goal setting process.

3A/3B hunter surveys

After the 2012 deer season, MN DNR surveyed hunters about deer hunting in southeast Minnesota. Specifically, the purpose of this study was to better understand deer hunting

participation in southeastern Minnesota, along with opinions about deer management. Surveys were sent to 2,000 individuals who purchased a 2012 Minnesota firearm deer hunting license and indicated they intended to hunt in southeastern Minnesota during the 3A season, and 2,000 individuals who purchased a 2012 Minnesota firearm deer hunting license and indicated they intended to hunt in southeastern Minnesota during the 3B season. A total of 1,108 full-length 3A surveys and 1,018 full-length 3B surveys were returned.

Nearly all responding hunters, from both seasons, (98%) participated in the 2012 firearm deer hunting season, hunting an average of nearly 5 days during each season (both seasons are 9 days). About half of hunters did all their hunting on private land that they did not own or lease.

Hunter perceptions about deer populations

Just less than half of the hunter survey respondents from both 3A and 3B indicated that there were fewer deer than 5 years ago, with a third or more indicating the same number, and just over 10% indicating more deer (Table 4). Nearly half of hunter survey respondents indicated that the deer population was about right, with about 40% indicating it was too low, and less than 10% saying too high. Over a third of hunters wanted no change in the deer population in the area they hunted with nearly half wanting an increase. Hunters generally seem to feel that there are the same or more mature bucks in the areas they hunt compared to 5 years ago.

Hunter satisfaction

Respondents to the hunter survey were asked to indicate whether they heard about or saw legal bucks, their satisfaction with the number of legal bucks, quality of bucks, total number of deer and total number of antlerless deer. Almost half (49%) of responding hunters indicated they were satisfied with the total number of deer they saw while hunting (41% were not satisfied and 10% were neutral); over half (53%) were satisfied with the total number of antlerless deer they observed. Fewer hunters (40%) were satisfied with the number of legal bucks observed; 48% of hunters indicated dissatisfaction with the number of legal bucks observed although most (62%) indicated they saw legal bucks while hunting. More hunters (46%) were satisfied than dissatisfied (38%) with the quality of bucks observed. Season 3A hunters were more satisfied than 3B hunters with the quantity and quality of bucks.

Respondents were asked to rate the importance of 21 experiences to their satisfaction with the 2012 deer season. Responses were generally similar, with the most important experiences being enjoying nature and the outdoors, good behavior among other deer hunters, getting away from crowds of people, and hunting with family. 3A hunters rated five items significantly higher than 3B hunters did: (a) thinking about personal values, (b) seeing lots of bucks, (c) getting information about hunting seasons, (d) harvesting a large buck, and (e) being on my

own. 3B hunters rated three items significantly higher than 3A hunters did: (a) hunting with friends, (b) harvesting any deer for meat, (c) getting food for my family.

Southeast landowner survey

During the fall of 2012, MN DNR implemented a landowner survey to better understand private landowners' perspectives on crop damage, deer hunting and deer management, and land use patterns in southeastern Minnesota (Goodhue, Wabasha, Winona, and Houston counties). Private landowners who owned a minimum of 40 acres were identified as the population of interest. The survey was divided into 6 groups – north (Goodhue/Wabasha)/south (Houston/Winona) and parcel size, 40-80 acres, 81-250 acres, and more than 250 acres. Private landowners play a key role in controlling hunter access to deer populations. Understanding landowner perspectives helps MN DNR to design hunting regulations and develop landowner programs in southeastern Minnesota that resolve deer problems, yet sustain populations on the landscape. Over 2,300 landowners responded to the survey.

Landowner perceptions about deer populations

The greatest proportion of landowners (41%) indicated deer populations were at about the same level as 5 years ago. Respondents were also asked to characterize deer population around their property and surrounding area as too high, about right, or too low. Overall, the greatest proportion of respondents (48%) indicated that deer population around their property and surrounding area was about right (Table 4). There were slight differences among groups, with large (more than 250 acres), south landowners believing deer populations were too high (45%), compared to only 18% of small (40 – 80 acres), north landowners believing populations were too high. Landowners were also asked to identify the level deer populations should be managed on their property. The greatest proportion of respondents (44%) in all six groups indicated that the level of the deer population should not be changed, with nearly a quarter of respondents indicating an interest in reducing the population. Similar trends were observed for each group with large, south landowners believing populations should be lowered more than any other group.

Crop Damage

All landowners reported receiving some damage to their crops from deer (62%), with damage most often reported by south landowners who owned more than 250 acres (85%). A majority of respondents reported negligible to minor damage (53%). A majority (58%) also reported about the same amount of damage as five years ago. Interestingly, landowners also reported damage from other animals including raccoons (79%), turkeys (63%), and various rodents (58%).

Hunting on Private Land

Most property (88%) in southeastern Minnesota was reported as being hunted. Among

respondents who allowed hunting on their property, respondents across the six strata most commonly provided hunting access to friends or neighbors (77%), family members (74%), and strangers who ask permission (21%). Although a high proportion of lands are hunted by someone, DNR still has concerns about the land that is not hunted because those lands can serve as deer refuges.

Perspectives on Hunting

In total, 61% of respondents indicated they hunted deer and more than two-thirds (68%) agreed that hunting is a tradition in their family and that hunting will keep deer from being overabundant. A large majority of respondents (80%) disagreed with the statement "I am opposed to deer hunting in general." Following rules is also important as 72% of landowners would be more likely to allow hunting on their property if people followed the rules the landowner established. Also, 71% agreed that they would be more likely to allow or continue to allow other people to hunt deer on their property if they knew that the hunters were safe and ethical.

Leasing and land access

Only 4% of landowners indicated their property was leased for hunting, the majority of those people (91%) used leases to control who has access to their property. Other reasons for leasing included earning extra money for the property, using to better manage their property, and improving control over the type of deer harvested. About half (51%) neither agreed nor disagreed that they feel pressure from their neighbors who lease their property. Nearly half reported they were managing their property for mature bucks (47%).

With respect to posting, a majority of landowners (60%) do not post their property. By group, small (40 – 80 acres), south landowners (51%) were most likely to post; whereas, medium (81 – 250 acres), north landowners were least likely to post their property (32%). The top 5 reasons for posting were, controlling who uses the land, eliminating trespass, liability concerns, human safety, and reducing property damage.

Tables and Figures

Table 1. General frameworks for Minnesota's firearms deer seasons, 1858-Present

Years	Length	Opening Dates	Limit
1858-63	5 Mo.	Sept. 1	None
1865-73	5 Mo.	Aug. 1	None
1874-86	2.5 Mo.	Oct. 1	None
1887-92	1 Mo.	Nov. 1	None
1893-94	19 Days	Nov. 1	None
1895-96	20 Days	Nov. 1	5/License
1897-98	22 Days	Oct. 25	5/License
1899-1900	21 Days	Nov. 1	5/License
1901-04	21 Days	Nov. 10	3/License
1905-14	21 Days	Nov. 10	2/License
1915-18	21 Days	Nov. 10	1/License
1919-20	22 Days	Nov. 15	1/License
1921-44[a]	5-11 Days	Nov. 10-21	1/License
1945-58[b]	1-9 Days	Nov. 8-20	1/License
1959-69	9 days	Nov. 7-13	1/License
1970	2 days	Nov. 14	1/License
1971	Closed		
1972-1976	5-17 days	Nov. 1	1/License
1977-1984	16 days	Nov. 3-10	1/License
1985-1992	16 days	Nov. 3-9	Up to 2 deer with bonus permit
1993-2013	16 days	Nov. 3-9	Up to 5 deer with bonus permit

[a] Season closed every other year from 1923 to 1931, closed again 1935, 1939, 1941

[b] Season closed 1950

Table 2. Recommendations for deer population direction from the goal setting process, 2005-2007.

Recommendation	N	Percent	Percent of area with goals in this direction
Inc 50%	8	6%	40%
Inc 25%	36	29%	
Inc 10%	7	6%	
Stabilize	15	12%	12%
Dec 10%	14	11%	48%
Dec 25%	40	32%	
Dec 33%	4	3%	
Dec 50%	2	2%	
Total	126		

Table 3. Percentage of deer permit areas at, above, or below goal in 2013.

Status	N	Percent
At Goal	93	79%
Above Goal	3	2.5%
Below Goal	22	19%
NA[1]	11	
Total	129	

Note: areas are determined to be "at goal" if they are within the target density range (+/- 10% except at very low densities).

[1] *Three permit areas have no established population goals (601 – Metro; 101 – TB zone; 602 – CWD Zone). Eight permit areas do not have current density estimates (114, 224, 235, 199, 238, 251, 287, and 344).*

Table 4. Landowner and hunter deer population perceptions and desires, southeastern Minnesota 2012-2013.

Perception of deer population around property (or area hunted) and surrounding areas					
	n	Too high	About right	Too low	Don't know
Landowners	2003	28%	48%	14%	9.4%
Hunters	2101	6.0%	49%	40%	8.3%
3A Hunters	1084	4.8%	50%	41%	4.6%
3B Hunters	1025	8.1%	46%	39%	6.4%

Desired direction for deer population management								
	n	Decrease 50%	Decrease 25%	Decrease 10%	No change	Increase 10%	Increase 25%	Increase 50%
Landowners	2119	9.0%	13%	11%	44%	12%	8.2%	3.6%
Hunters	2080	2.8%	5.3%	6.8%	37%	21%	20%	7.1%
3A Hunters	1073	2.4%	4.9%	7.2%	36%	21%	20%	7.9%
3B Hunters	1016	3.5%	6.0%	6.1%	38%	21%	20%	5.7%

Table 5. 3A/3B Firearms Harvest 2000-2013

				Harvest											
	Hunters			3A	3A	3B	3B	Total	Total		Success		% Antlered		
Year	3A	3B	Total	Buck	A-less[1]	Buck	A-less	Buck	A-less	Total	3A	3B	3A	3B	3A/3B
2000	18,468	25,175	43,643	5,971	357	2,824	10,894	8,795	11,251	20,046	34%	54%	94%	21%	44%
2001	18,056	23,644	41,700	5,176	348	2,445	7,758	7,621	8,106	15,727	31%	43%	94%	24%	48%
2002	16,784	20,246	37,030	5,000	321	1,825	7,087	6,825	7,408	14,233	32%	44%	94%	20%	48%
2003	16,978	22,118	39,096	5,103	1,002	2,750	8,260	7,853	9,262	17,115	36%	50%	84%	25%	46%
2004	17,992	22,135	40,127	5,008	1,316	3,067	7,853	8,075	9,169	17,244	35%	49%	79%	28%	47%
2005	18,454	20,685	39,139	5,440	2,424	2,840	8,252	8,280	10,676	18,956	43%	54%	69%	26%	44%
2006	20,405	19,803	40,208	5,492	3,521	3,007	7,702	8,499	11,223	19,722	44%	54%	61%	28%	43%
2007	21,190	18,427	39,617	5,766	3,600	2,881	6,764	8,647	10,364	19,475	44%	52%	62%	30%	45%
2008	21,492	18,907	40,399	4,947	3,224	2,215	6,315	7,162	9,539	17,085	38%	45%	61%	26%	43%
2009	22,873	17,405	40,278	5,729	4,602	1,890	4,945	7,619	9,547	17,706	45%	39%	55%	28%	44%
2010	23,053	14,820	37,873	3,894	4,864	1,021	4,664	4,915	9,528	14,669	38%	38%	44%	18%	34%
2011*	24,051	13,617	39,437	4,053	4,796	886	3,553	4,939	8,349	14,448	37%	33%	46%	20%	37%
2012*	25,210	13,099	40,220	4,578	4,235	1,256	3,566	5,834	7,801	14,864	35%	37%	52%	26%	43%
2013*	25,235	12,408	39,589	4,211	4,133	867	3,292	5,078	7,425	13,848	33%	34%	50%	21%	41%
Average	20,732	18,749	39,883	5,026	2,767	2,127	6,493	7,153	9,261	16,796	37%	45%	68%	24%	43%

**Only "Total" records include 602 data for 2011-2013;*

[1] *"A-less" indicates antlerless*

3A

Hunters: 20732 +/- 1571
Buck Harvest: 5026 +/- 339
Antlerless Harvest: 2767 +/- 923

3B

Hunters: 18749 +/- 2110
Buck Harvest: 2127 +/- 435
Antlerless Harvest: 6493 +/- 1164

602

Hunters: 1875 +/- 94
Buck Harvest: 479 +/- 25
Antlerless Harvest: 765 +/- 79

Figure 1. Range map of cervids (deer, elk, moose, and caribou) in Minnesota prior to European settlement.

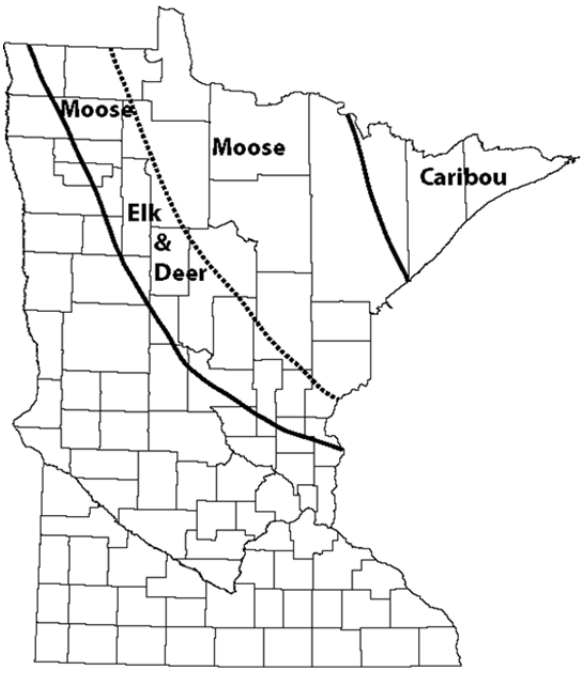

Figure 2. Range map of deer family members in Minnesota around 1880.

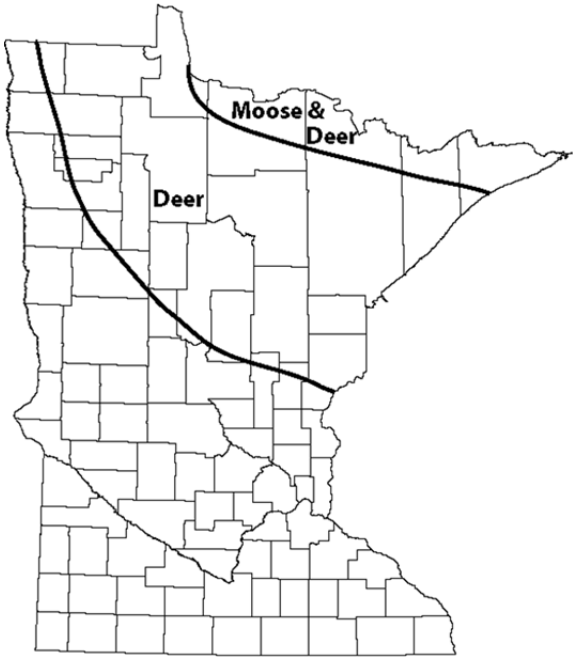

Figure 3. Range map of deer family members in Minnesota around 1920.

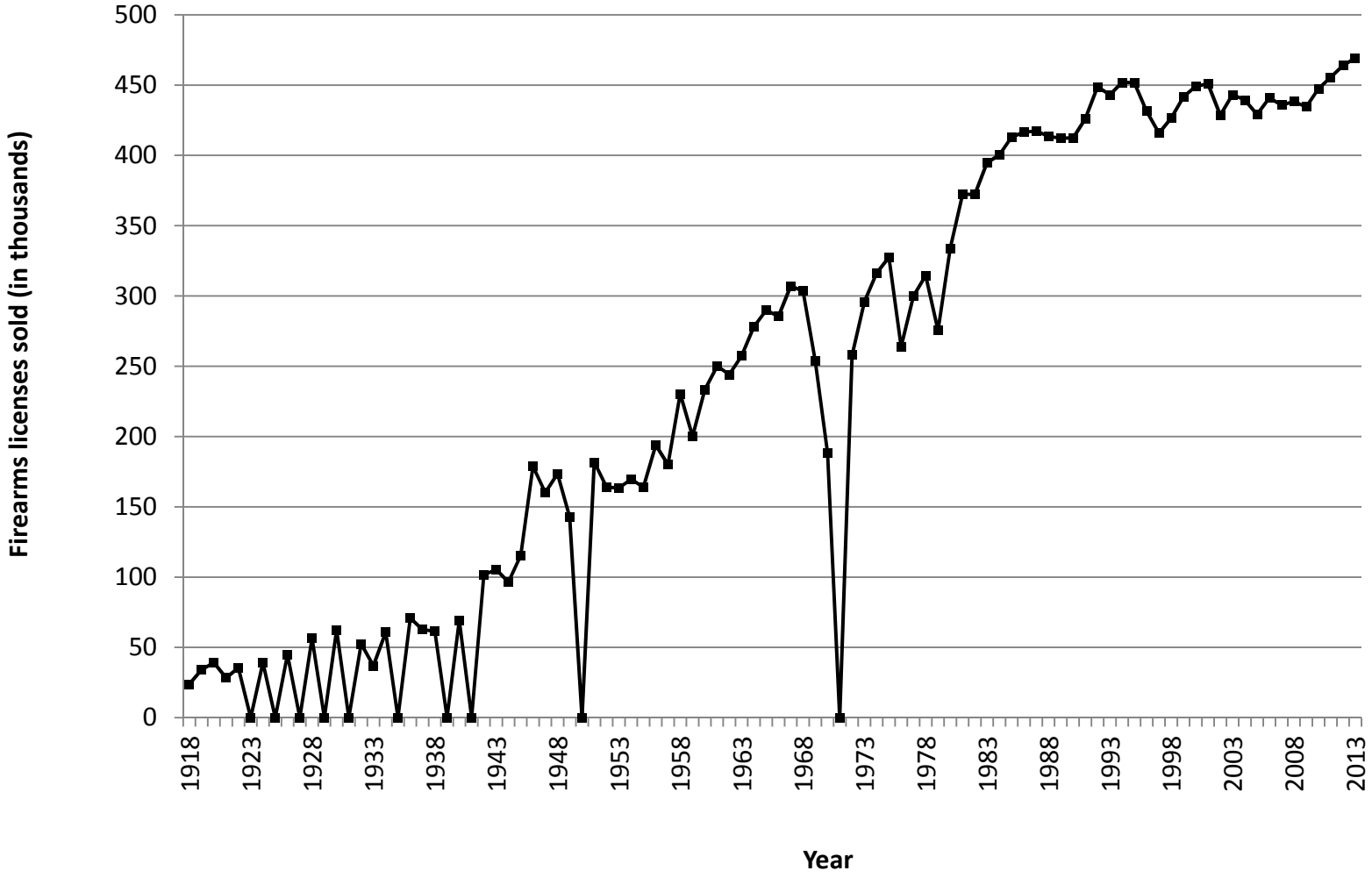

Figure 4. Minnesota firearm license sales between 1918 and 2013.

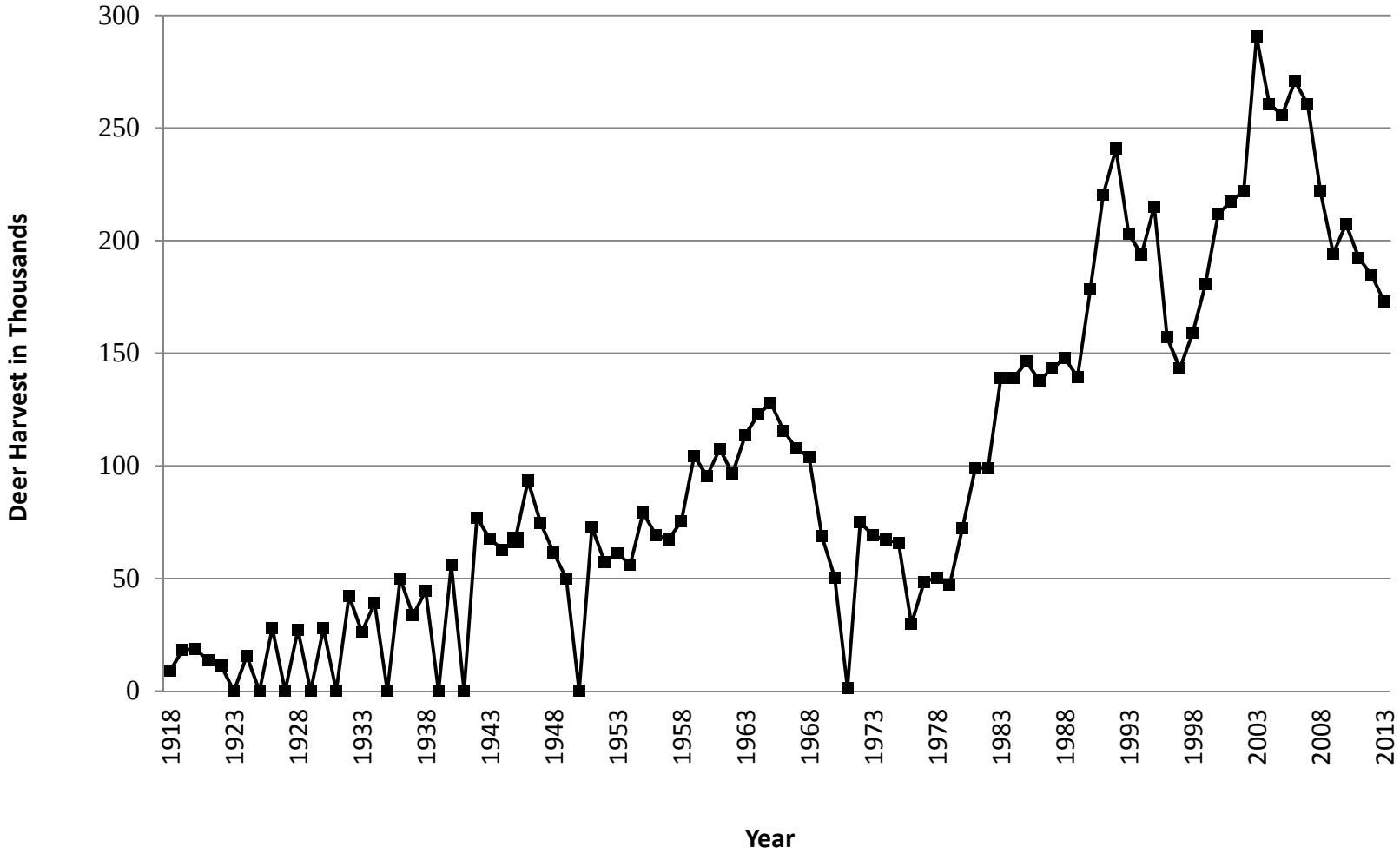

Figure 5. Minnesota deer harvest between 1918 and 2013.

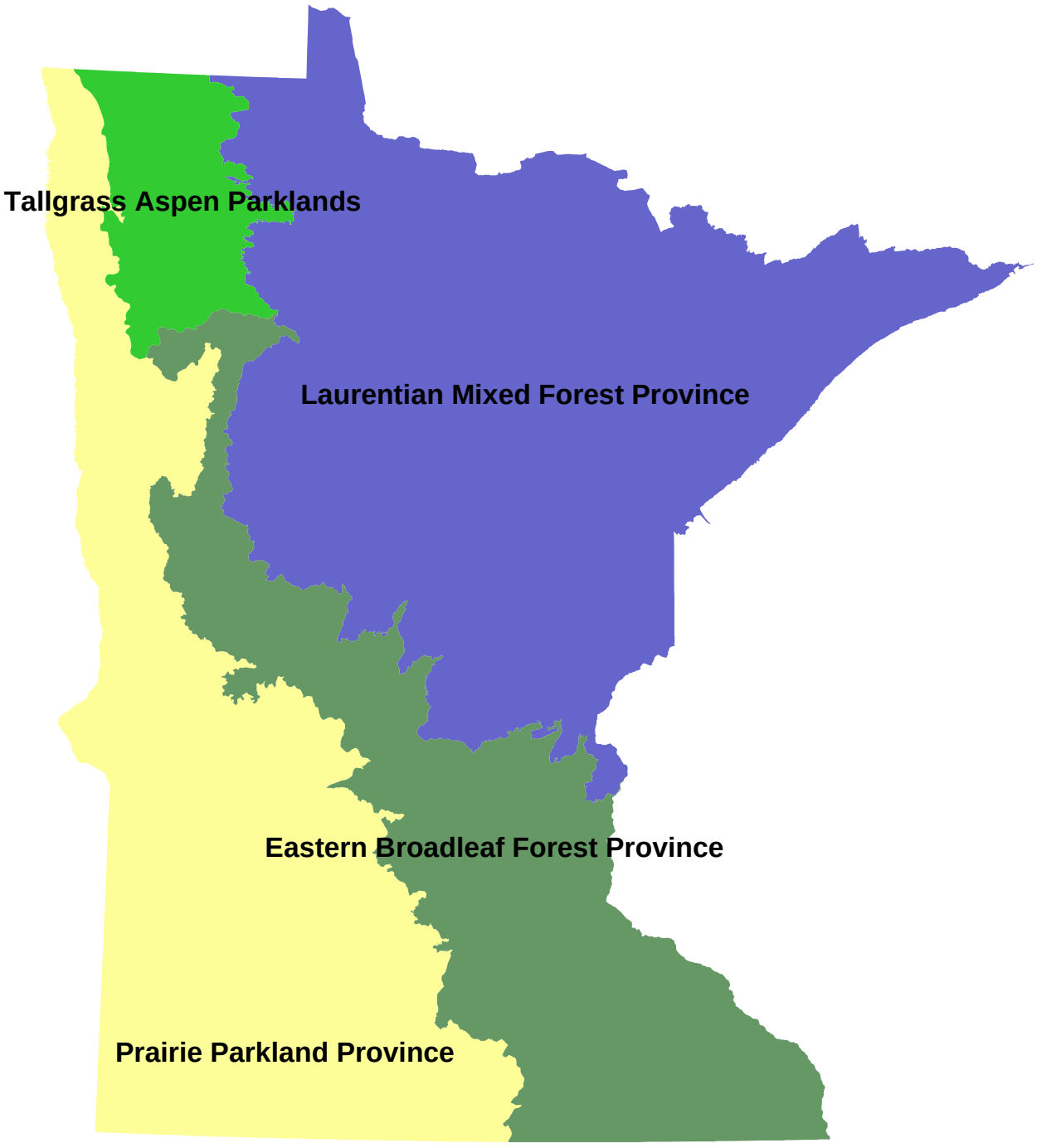

Figure 6. Ecological provinces in Minnesota

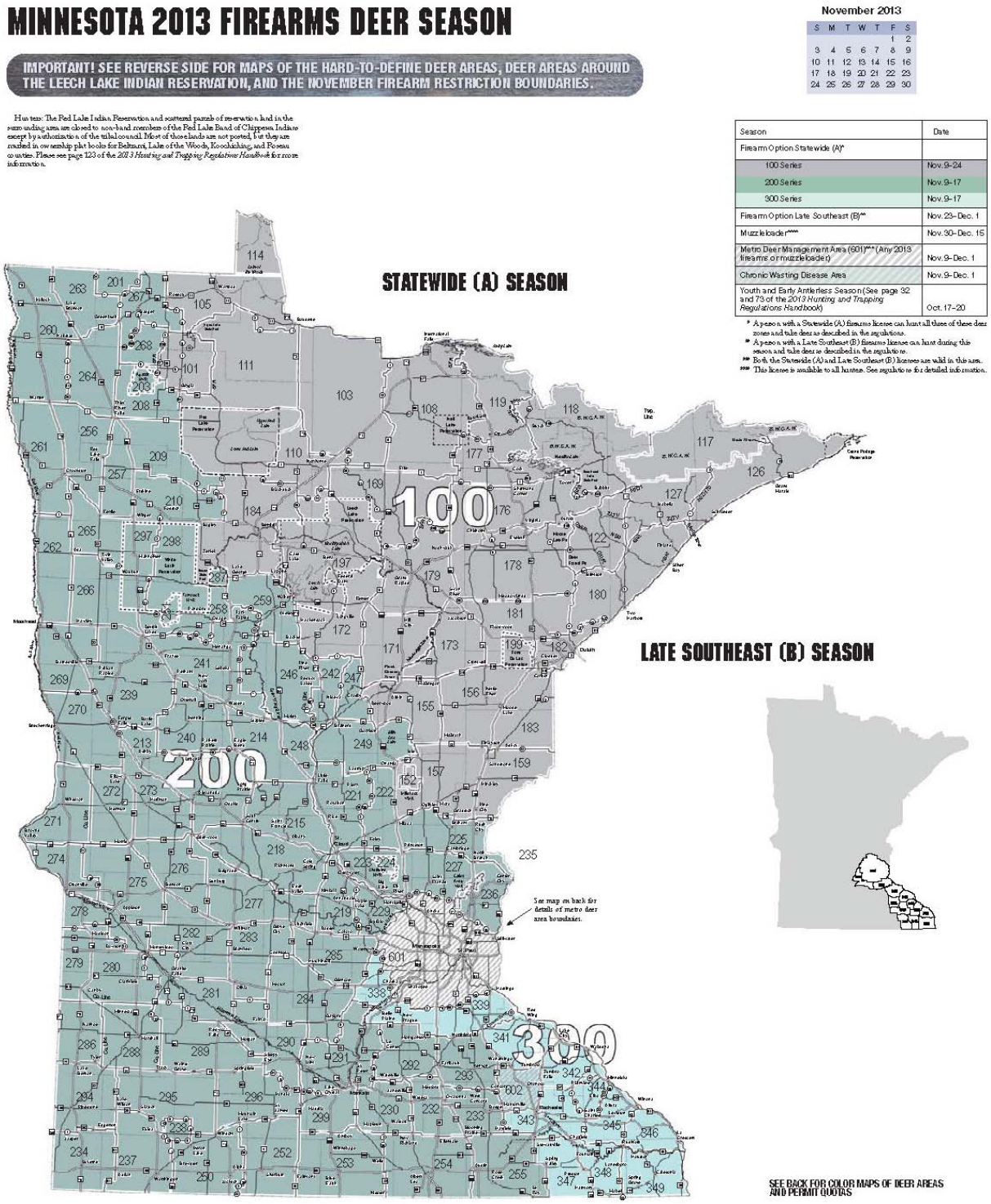

Figure 7. Deer Season Zone Map, 2013. Dates for the firearm season differ by deer management zone. In 2013, the season was held November 9-24 (100-series) and Nov. 9-17 (200- and 300-series). The 300-series also has a late (3B) season which ran from Nov. 25 to December 1.

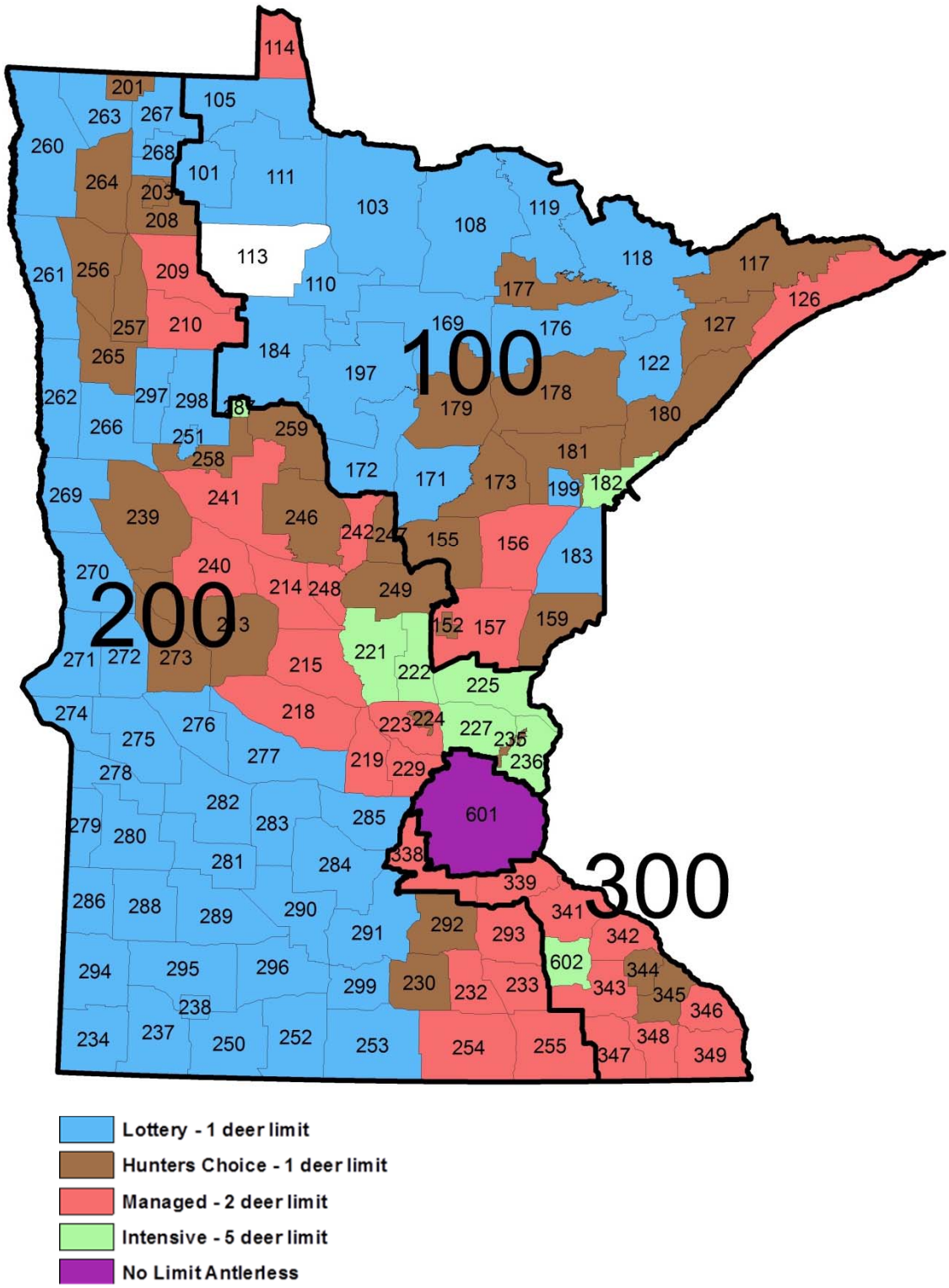

Figure 8. Minnesota deer management zones, permit areas and harvest management Strategies, 2013

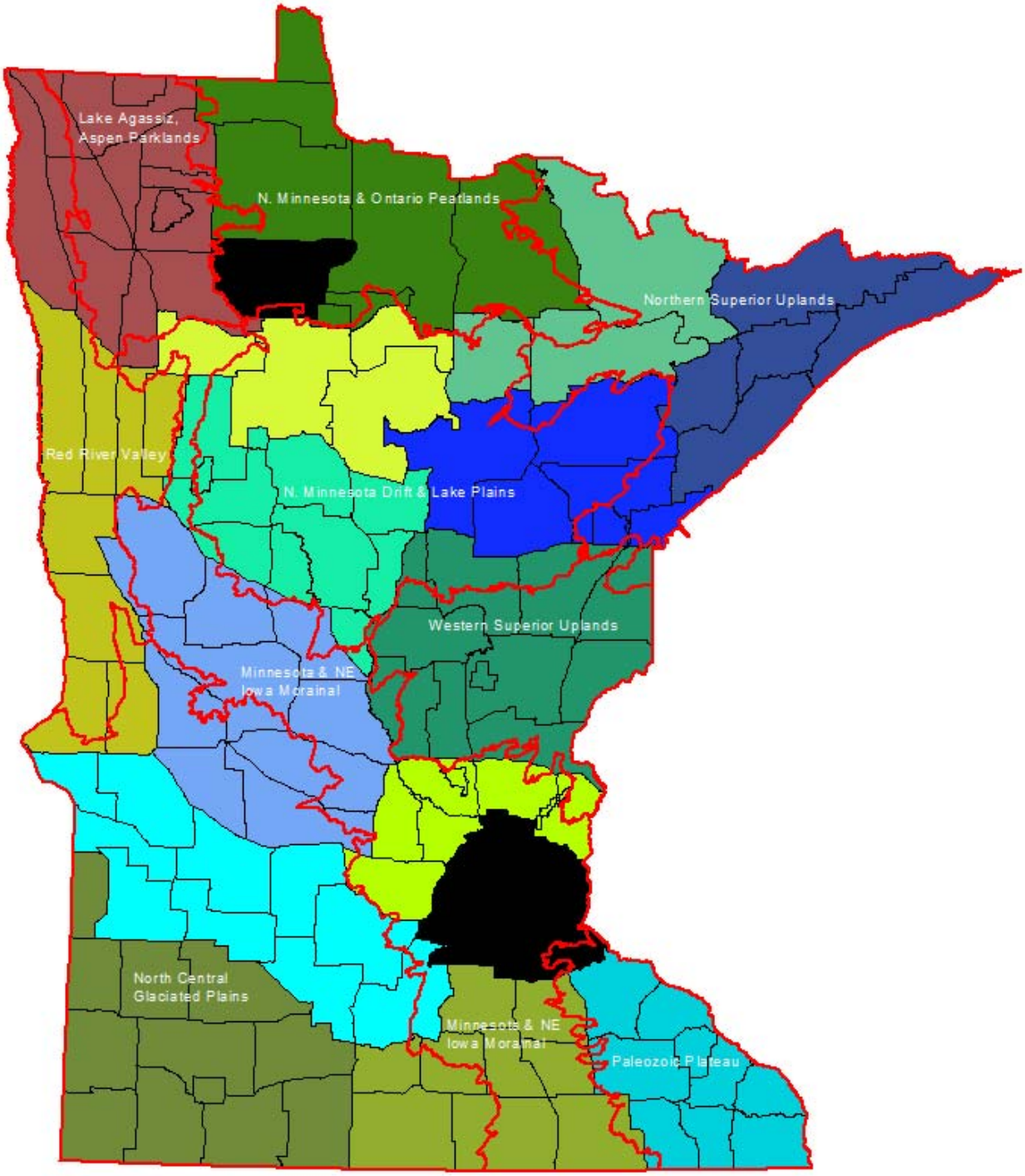

Figure 9. Goal setting blocks and ECS subsections, 2005-2007

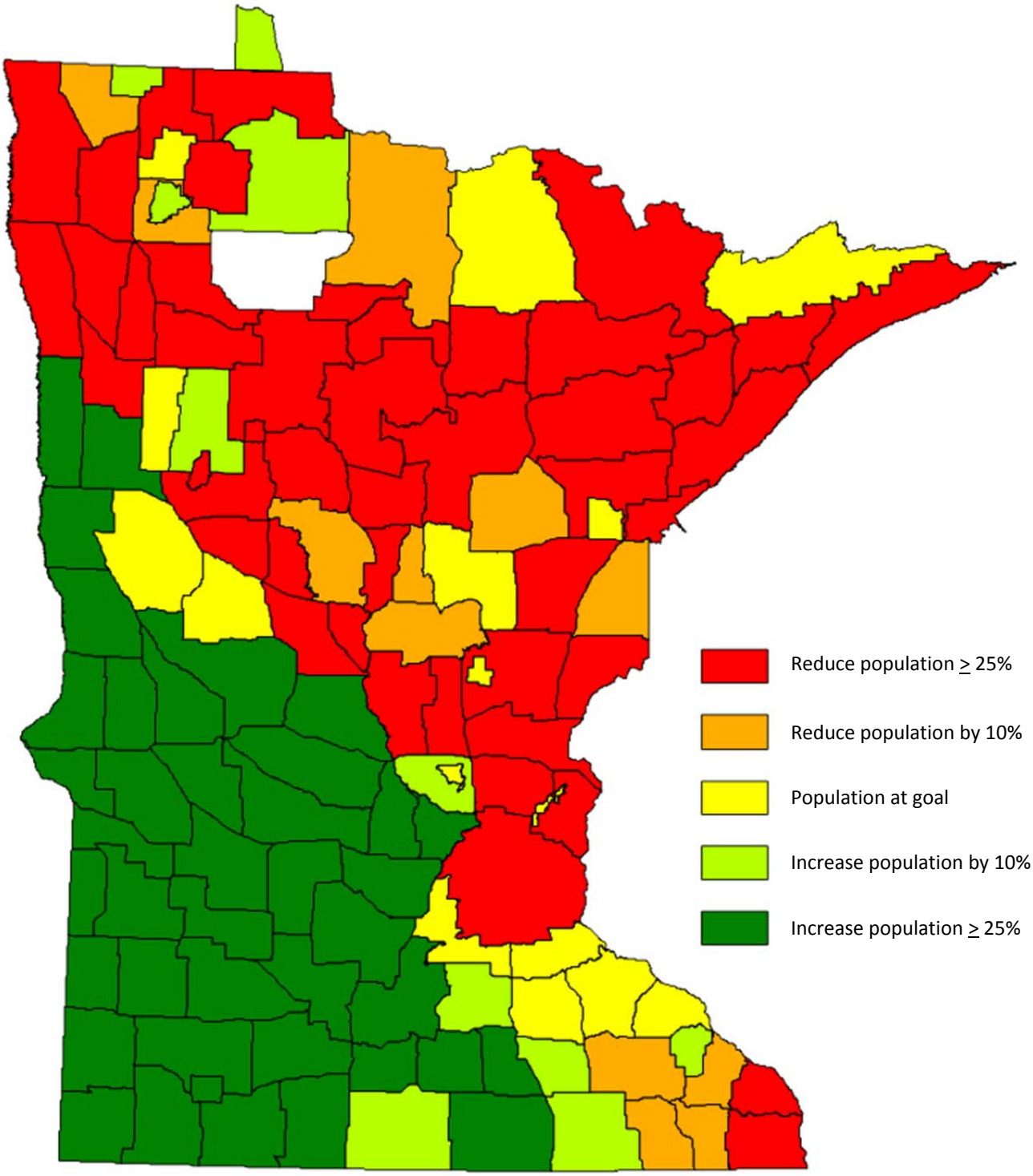

Figure 10. Final goal setting recommendations by permit area, 2005-2007

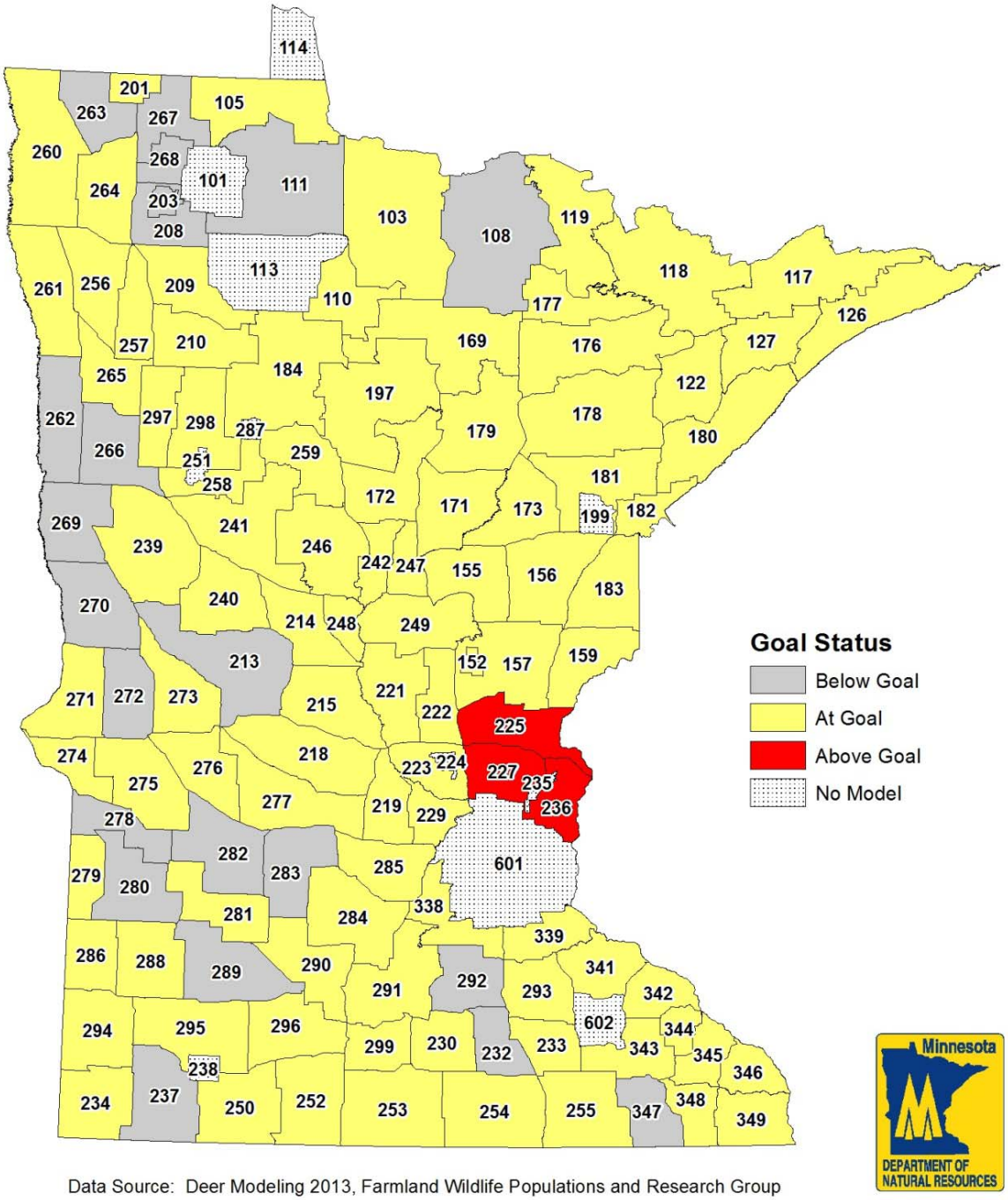

Figure 11. Deer population goal status, 2013

Note: areas are determined to be "at goal" if they are within the target density range (+/- 10% density estimate except at very low densities). Three permit areas have no established population goals (601 – Metro; 101 – TB zone; 602 – CWD Zone).

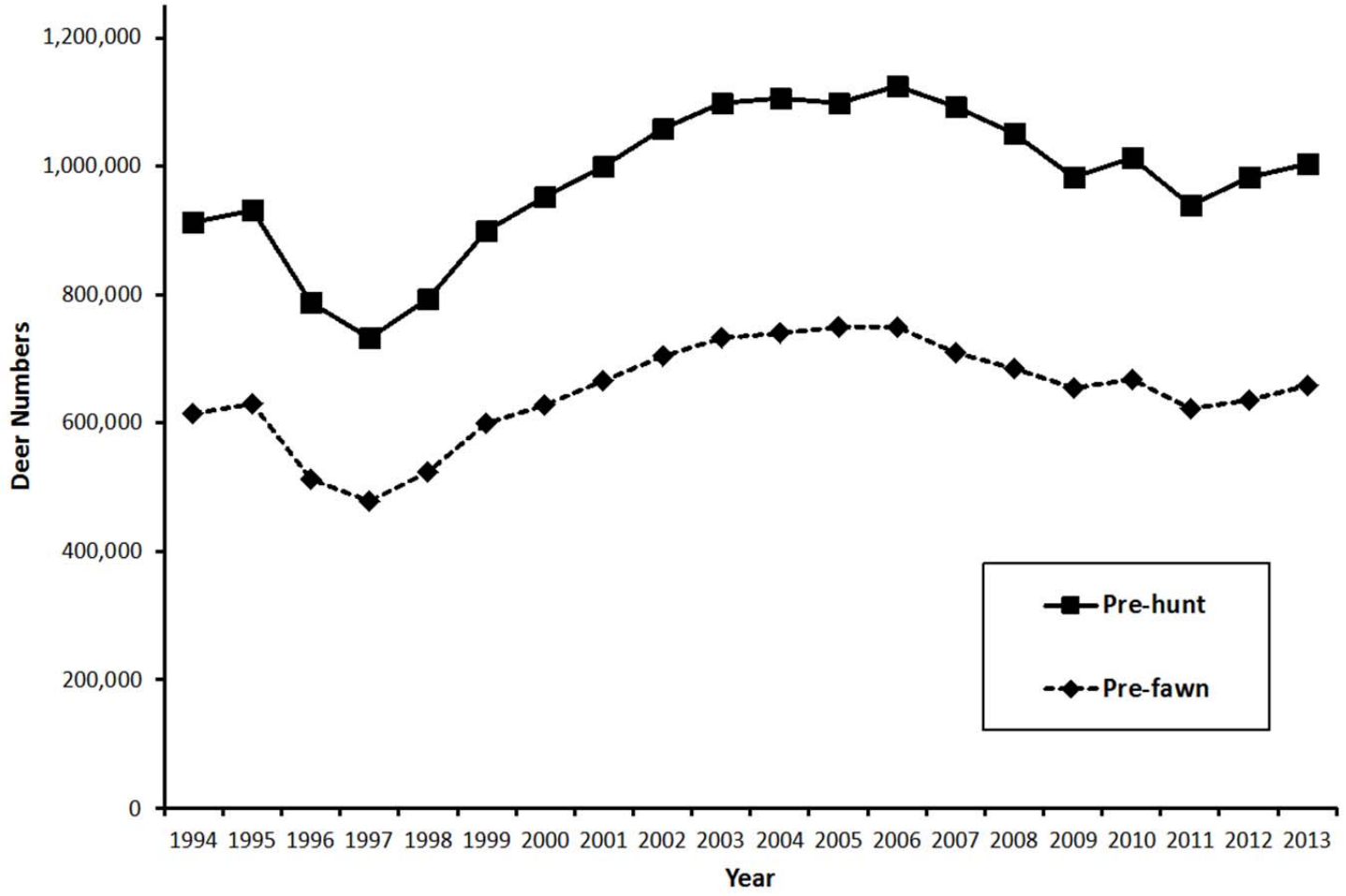

Figure 12. Statewide deer population estimates, 1994-2013

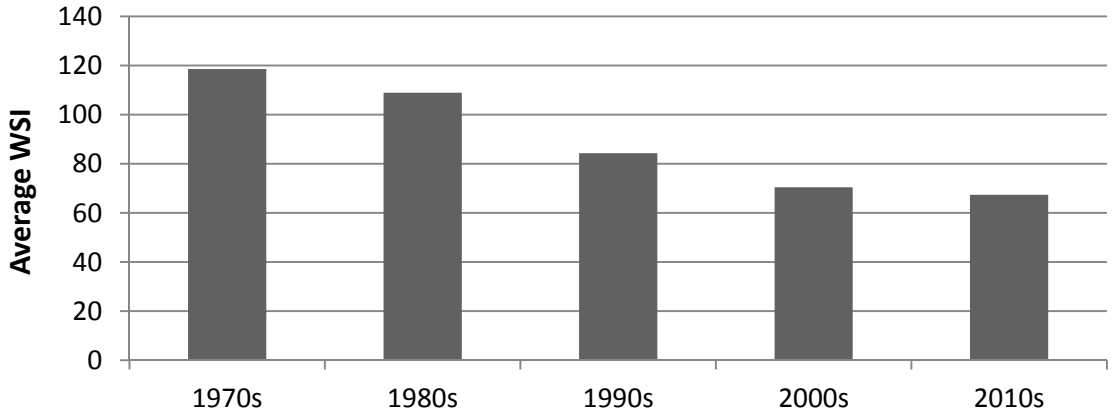

Figure 13. Average Minnesota winter severity index (WSI), statewide

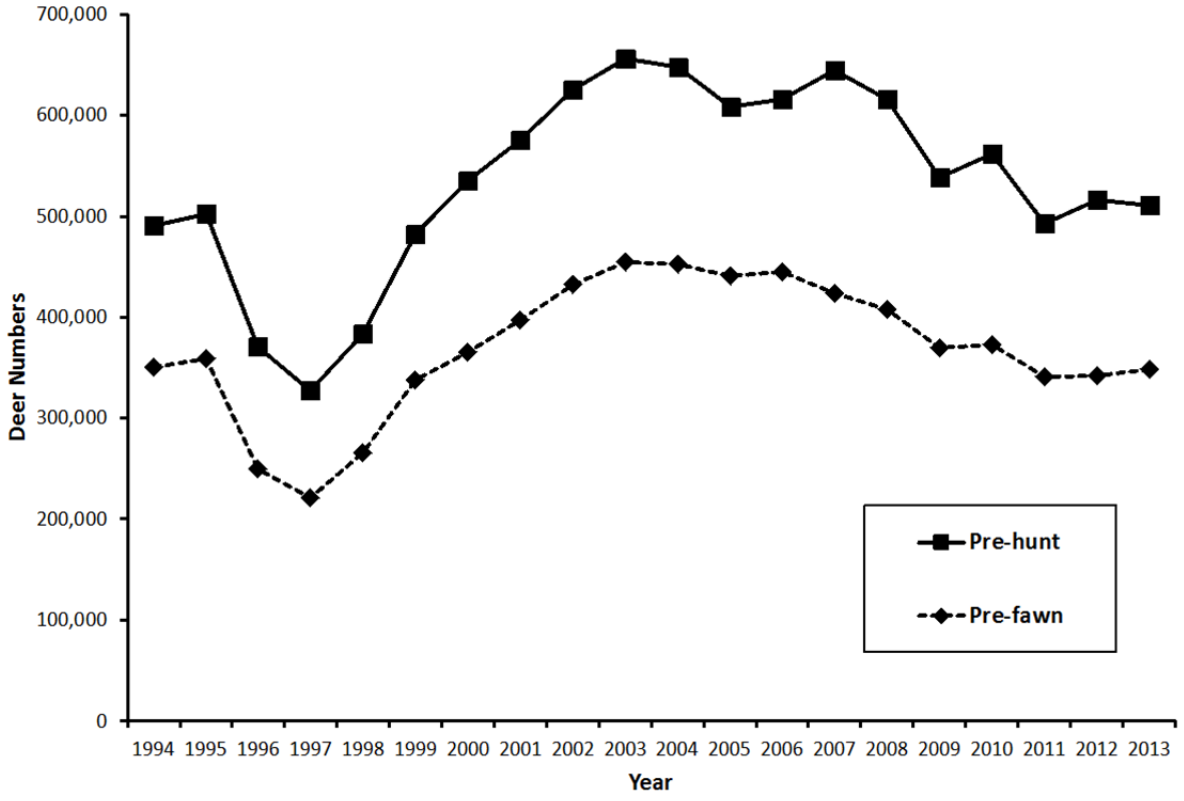

Figure 14. Forest deer population estimates, 1994-2013

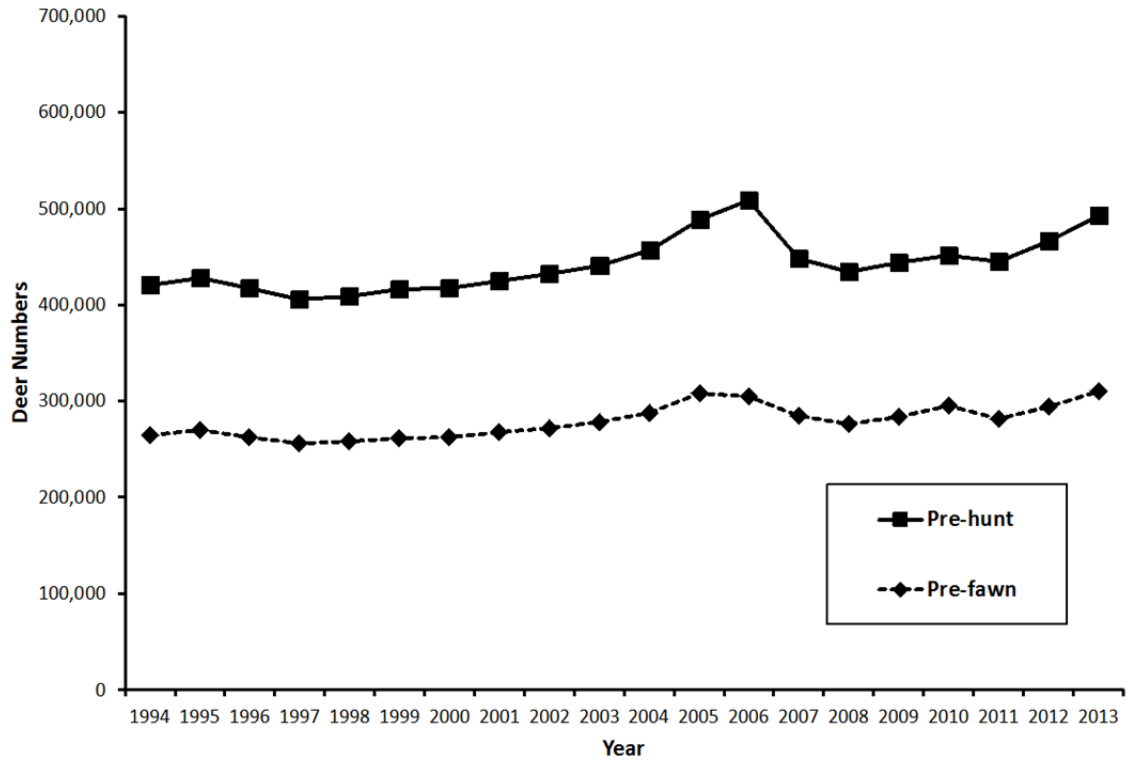

Figure 15. Farmland deer population estimates, 1994-2013

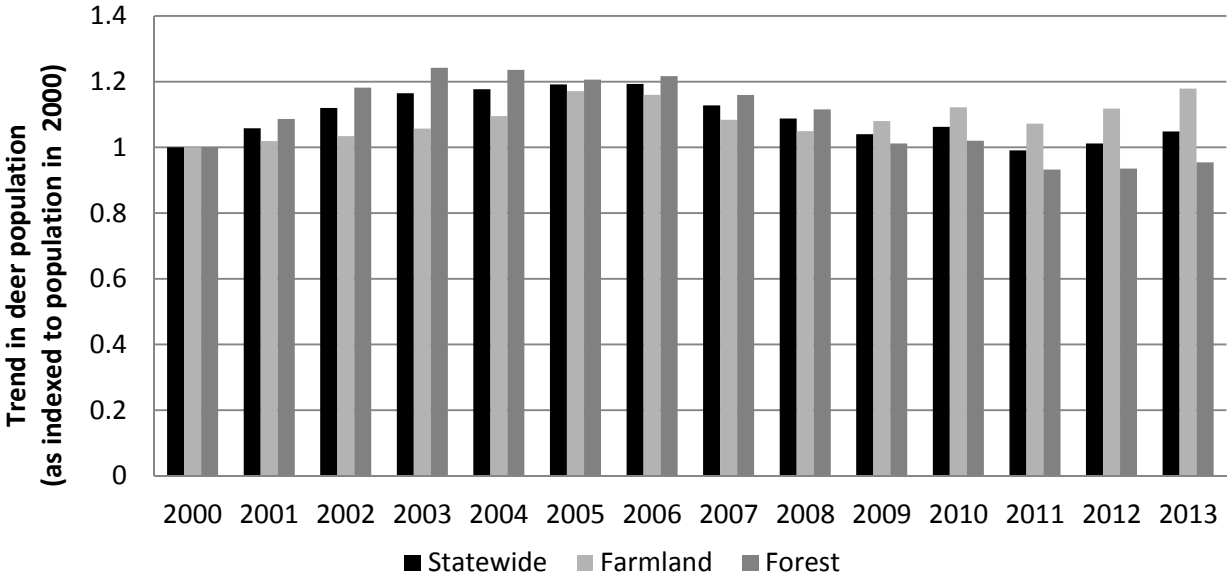

Figure 16. Statewide population trends, 2000-2013. Each bar represents how the annual population estimate compared to the population in 2000. For example, the statewide population estimate in 2013 was 5% higher than the 2000 population estimate**.**

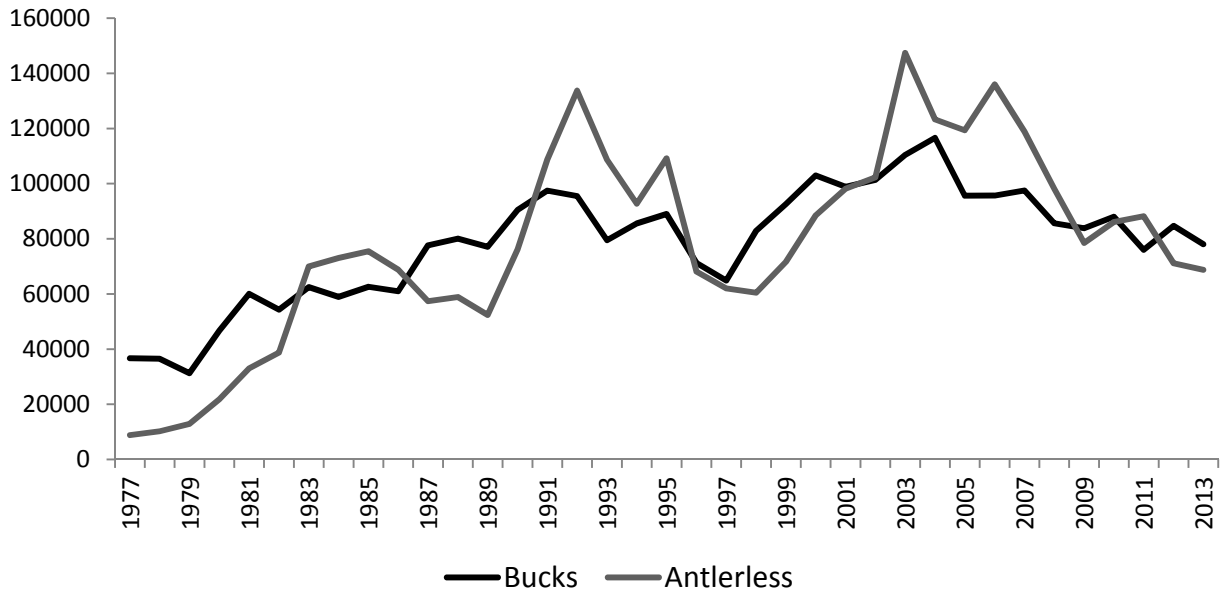

Figure 17. Minnesota firearms antlered and antlerless harvest 1977-2013.

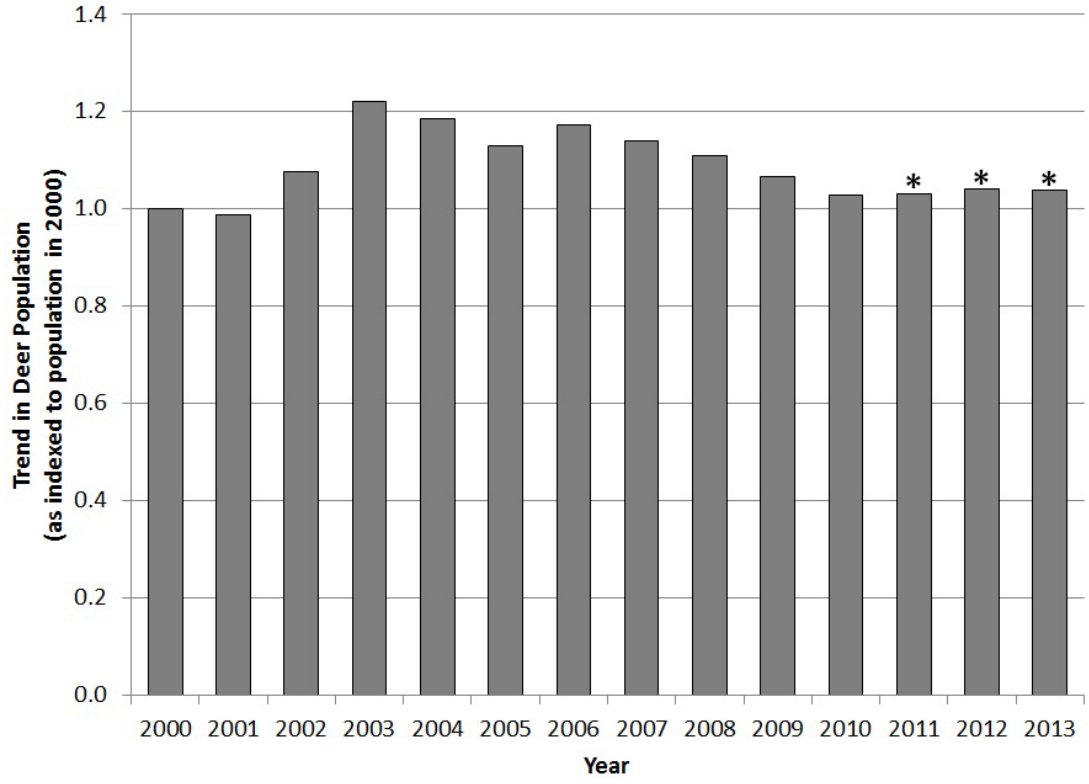

Figure 18. Southeast MN Population Trends, 2000-2013. Each bar represents how the annual population compared to the population in 2000. *Population estimates for 2011-2013 do not include estimates for deer in permit area 602.

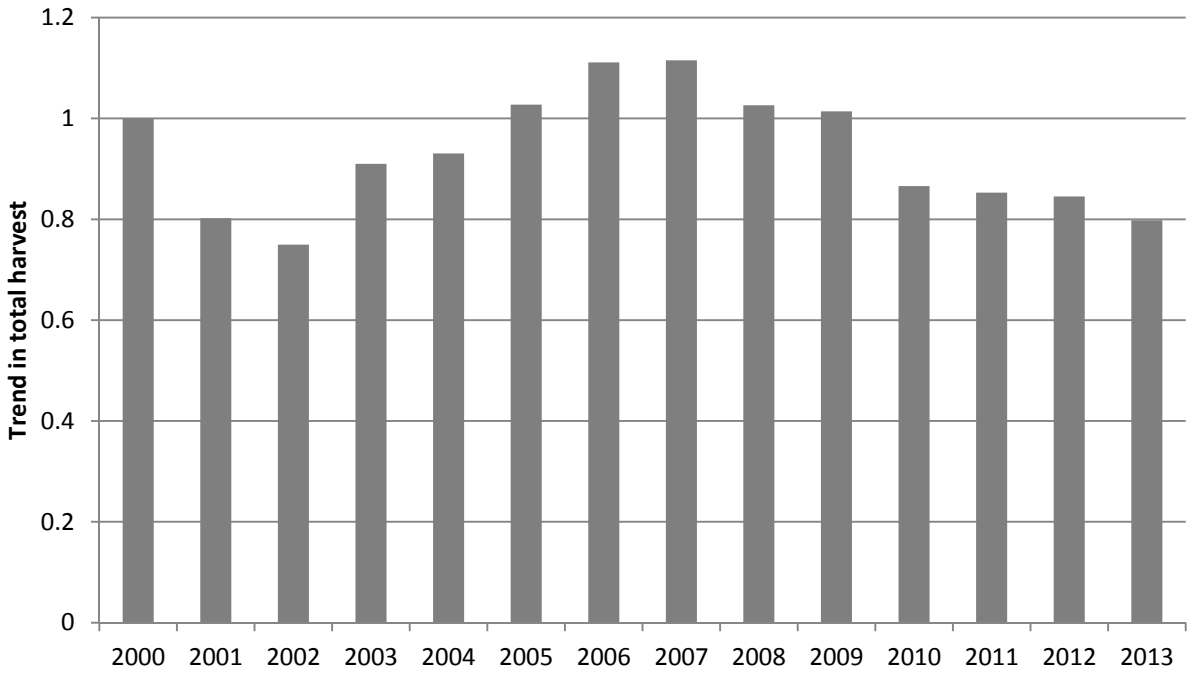

Figure 19. Trend in total harvest for the southeast region. Each bar represents how the total annual harvest compared to total harvest in 2000. For example, the total harvest in 2006 was about 11% higher than the 2000 harvest.

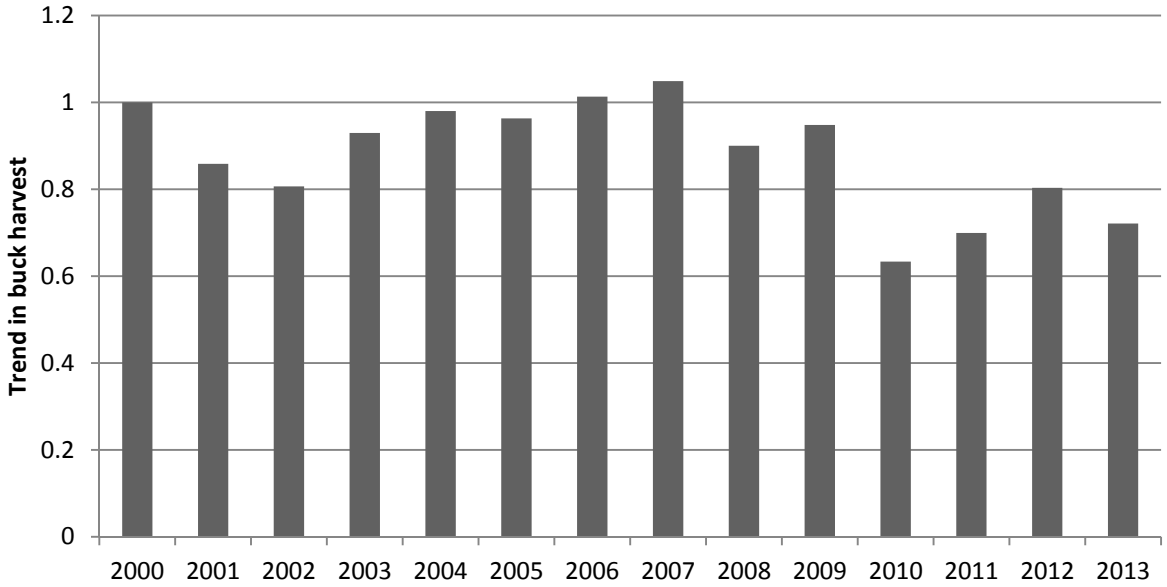

Figure 20. Buck harvest trend for the southeast region. Each bar represents how the annual buck harvest compared to buck harvest in 2000. For example, the buck harvest in 2007 was about 5% higher than the 2003 harvest.

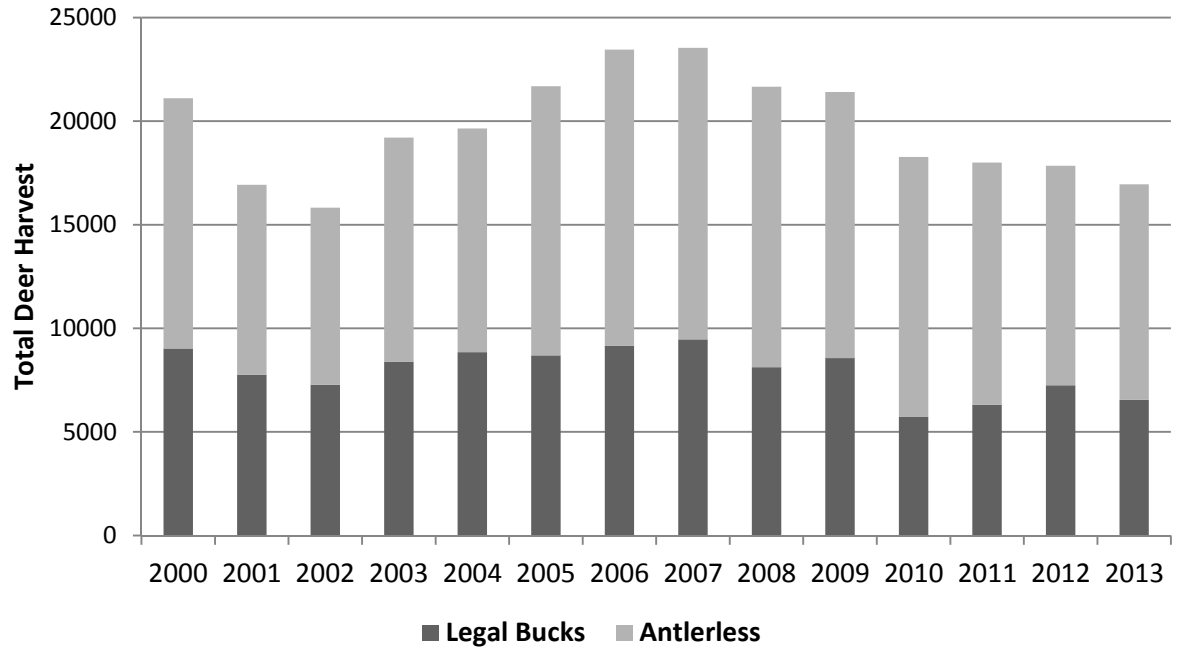

Figure 21. Antlered and Antlerless harvest in southeastern MN, 2000-2013.

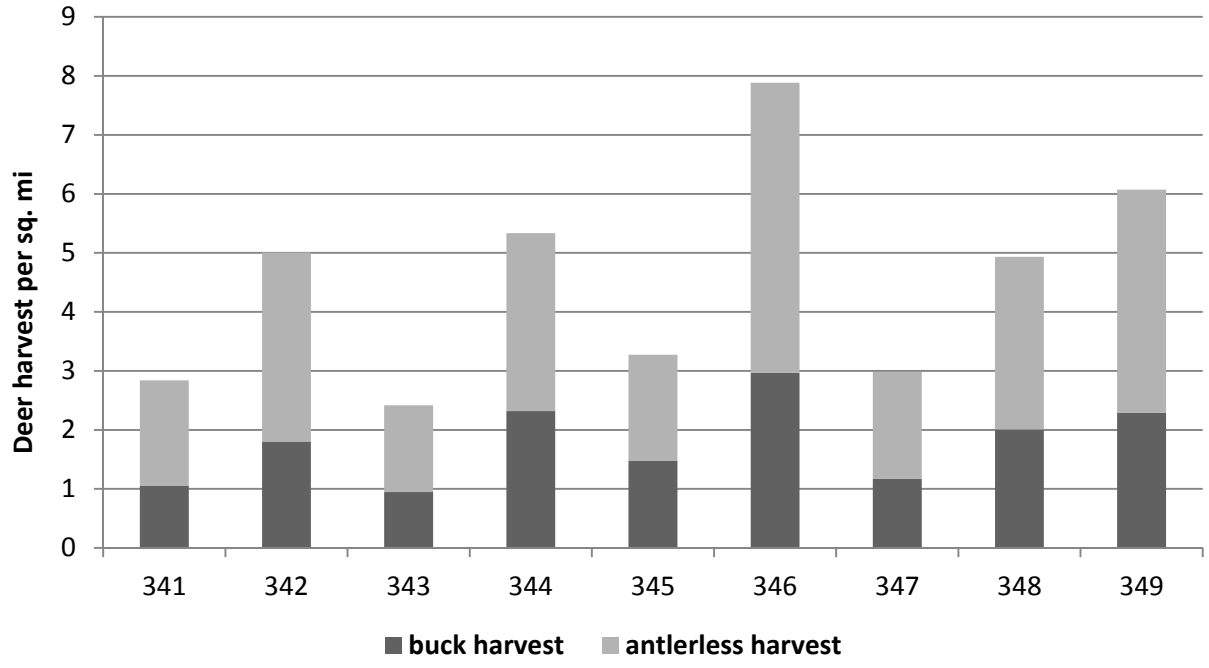

Figure 22. Total 2013 deer harvest per square mile in southeastern Minnesota, by permit area. Note: DPAs 344 and 345 were under a hunter choice (1 deer bag limit) strategy. The remaining PAs were under a managed (2 deer bag limit) strategy.

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Appendix A: Diseases and Health Concerns

Chronic Wasting Disease

Chronic Wasting Disease (CWD) is a fatal transmissible spongiform encephalopathy (TSE) known to infect members of the deer family including mule deer, white-tailed deer, elk, red deer, and moose. TSEs are diseases which are capable of being spread animal-to-animal (transmissible) and result in holes in brain tissue (spongiform) that lead to a progressive neurological condition resulting in death. CWD-infected animals are most commonly adults, but yearling deer may also be infected. As the disease progresses, CWD-infected animals lose weight as they eat less food over time and their body condition worsens. The behavior of infected deer changes, they interact less with other animals, become lethargic, have a tendency to keep their head lowered, have blank facial expressions, and may repetitively walk in patterns. They may drink, urinate and salivate excessively. Deer with other illnesses that occur more commonly (e.g., bacterial infections, hemorrhagic disease) may have similar symptoms.

CWD is the only TSE known to persist in free-ranging wildlife populations and the cause of the disease is believed to be abnormal proteins, called prions, which accumulate in brain tissue. CWD is spread in free-ranging deer through contact with bodily secretions including saliva, feces, and urine and infected soils and plants in the environment. The disease was first found in 1967 in a captive mule deer in the Colorado Division of Wildlife's Foothills Wildlife Research Facility in Fort Collins, Colorado. CWD is known to be endemic to parts of Colorado and Wyoming, where it has persisted more than 30 years in free-ranging deer. No treatment exists, and population management strategies for controlling CWD involve drastic deer population reductions in localized areas to reduce transmission of the disease. There is no evidence to date that CWD is a zoonotic disease, which may be transmitted to humans, but this possibility cannot be ruled out.

In 2002, MN DNR began surveillance for CWD in free-ranging white-tailed deer after CWD was found in free-ranging white-tailed deer in Wisconsin in 2001. CWD was first detected in Minnesota in 2002 in a captive elk farm near Aitkin. The entire herd was subsequently depopulated to reduce the risk of the disease spreading to free-ranging deer and no additional CWD-positive animals were found. A second farmed elk, which was part of a herd exposed to the CWD-positive Aitkin elk, tested positive after it was quarantined and killed for testing on a Stearns County farm in January 2003.

In 2006, a captive white-tailed deer in Lac qui Parle County was diagnosed as CWD positive. The deer and elk in that facility were depopulated and no additional CWD-positive animals were found. In 2009, a herd of more than 600 captive elk in Olmsted County was found to be infected with CWD, all animals in the herd were euthanized, and four elk tested positive for CWD.

In November 2010, an archery hunter harvested a CWD-positive, free-ranging, adult female white-tailed deer 2 miles from the aforementioned Olmsted County elk farm near Pine Island. Given this first discovery of CWD in Minnesota's wild deer herd, the MN DNR implemented its CWD response plan in January 2011, which included: 1) establishment of a 306-square mile CWD Management Zone, DPA 602; 2) monitoring of deer densities via aerial surveys in DPA 602; 3) reduction of deer densities within the zone through maximized hunting opportunities and government culling to reduce the risk of CWD transmission and to provide samples for additional disease surveillance; 4) a ban on deer feeding and mineral attractants in the 4-county area surrounding the harvest location of the CWD-positive deer; 5) mandatory registration of all deer harvested in the zone at an official CWD registration station; 6) submission of a sample for CWD testing from all adult deer harvested in the zone; and 6) the requirement that all deer that are tested for CWD must remain in the zone until a negative test result is reported.

To date, MN DNR has tested more than 40,000 deer, including more than 4,000 deer in the CWD management zone, and the single case near Pine Island was the only wild deer found to be CWD positive as of December 31, 2013. Because no CWD-positive deer were found during the 2013 deer season, the borders of the CWD Management Zone, DPA 602, will be dissolved and CWD-related restrictions will be lifted.

Due to the discovery of CWD near Shell Lake, Wisconsin in 2011, MN DNR conducted CWD surveillance during the fall 2012 firearm deer season in several DPAs along the border with Wisconsin. Of nearly 1,100 samples taken, no deer were positive for CWD and testing efforts were suspended in the area.

In 2012, a captive European red deer was found to be infected with CWD in a herd of approximately 400 animals in Ramsey County. This marked the first time CWD was discovered in this species. Also in 2012, USDA discontinued funding which was previously available to depopulate CWD-infected captive herds. Thus the Ramsey County herd was quarantined with no future plan in place to deal with the infection. The herd owners have voluntarily slaughtered approximately half the herd to date, and no new cases of the disease have been detected. Future plans for the remaining animals within this herd are uncertain. In 2012, CWD testing of wild white-tailed deer in the north metro area was initiated by MN DNR as a precautionary measure in response to the discovery of the infected captive red deer. Of the 154 samples collected, no deer were positive for CWD. Testing efforts in the north metro will continue in 2014.

MN DNR will continue to be proactive in surveillance for CWD in wild deer. If CWD-positive deer are detected in the future, the CWD Response Plan will be implemented in localized areas as necessary to minimize the risk of disease transmission and spread.

Bovine Tuberculosis

Bovine tuberculosis (TB) is caused by bacteria of the species *Mycobacterium bovis*. Many animal species may harbor TB including domestic animals, wildlife, and humans. TB was once common in cattle and swine in the U.S. until a cooperative effort started in 1917 by federal and state governments, and the livestock industry made significant progress toward eradicating the disease. TB is still detected in U.S. cattle herds, and its discovery imposes costly trade restrictions, testing, and culling of suspect herds.

Prior to the discovery of widespread infection of TB in wild white-tailed deer in northern Michigan, only eight cases of TB-infected deer were documented in North America. TB is spread through nasal or oral discharges, and there is evidence that the disease may be transmitted through consumption of contaminated feeds by cattle and deer. Cattle found to be infected with TB are typically culled rather than treated, and TB-suspect carcasses do not enter the food chain. Once established in a wildlife population, TB can be difficult to control and eradicate without significant population reductions. TB-infected animals may appear normal and healthy. TB is a chronic disease, which progressively causes animals to become emaciated, debilitated, and severe respiratory infection causes labored breathing.

TB was detected in a northwest Minnesota cattle farm in 2005. The disease was subsequently found in a total of 12 cattle operations and 27 individual free-ranging white-tailed deer. Testing showed that both deer and cattle had the same strain of TB, which was consistent with a strain of TB found in cattle in the southwestern United States and Mexico. The Minnesota Board of Animal Health led efforts to eradicate the disease in Minnesota's cattle, which included the depopulation of all infected herds, a buy-out program that removed 6,200 cattle from the infected area, and mandatory fencing of stored feeds on remaining farms. In an effort to reduce deer densities within the infected area and increase sampling for the disease, MN DNR initiated a response plan that included intensified deer harvest by hunters, landowners, and government sharpshooters. MN DNR tested a total of 10,667 white-tailed deer for TB in northwest Minnesota from 2005 to 2012. No new infections have been detected in either cattle or deer since 2009. Minnesota cattle producers regained TB-free accreditation in October 2011. However, some testing requirements remained on cattle herds within the endemic area until the infection in deer could be determined as nonexistent. While MN DNR is unable to declare the local deer herd entirely disease-free, the cumulative years of intensive surveillance efforts were aimed at TB detection of prevalence more than 0.5% with 99% confidence. These efforts provided solid evidence that TB is no longer within these detectable levels in the deer population. MN DNR has now suspended any future efforts to monitor for TB in the state.

Epizootic hemorrhagic disease

Epizootic hemorrhagic disease (EHD) is a naturally occurring virus in North America and is caused by one of ten types of the hemorrhagic or bluetongue viruses. EHD infects white-tailed deer, mule deer, elk, pronghorn, and domestic animals including sheep, cattle, and alpacas. White-tailed deer are most susceptible to EHD and it is considered the most infectious disease in white-tailed deer throughout the United States. In other species, such as elk, the animals are susceptible to infection but typically only develop mild clinical signs of the disease. EHD cannot be transmitted to humans. Most deer mortality from the disease occurs before archery season, but deer that are chronically afflicted may develop secondary infections and may not be suitable for consumption if they are harvested by hunters.

EHD is transmitted by the bite of the *Culicoides* midge, a small gnat, which is most abundant in late-summer and early fall. The virus begins to replicate in the deer after being infected, and the deer will get a significant fever within a week after being infected. The viral replication results in holes in the blood vessels and hemorrhaging. Hemorrhaging can happen throughout the body; it is especially apparent throughout the gastro-intestinal tract. The ears, eyelids, and tongue swell and eventually bleed. The hooves of the deer are sensitive to the disease and will often times slough off partially or entirely. Behaviorally, the deer may lose its fear of humans, lose its appetite, have labored breathing, become lethargic, and may have droopy ears. Often times, deer will stand in water or stay near water due to the fever associated with the disease. Some animals recover from EHD while others die within days or weeks.

Widespread outbreaks of EHD have been known since 1900. It occurs annually throughout the white-tail's range, but the impact varies geographically. EHD does not impact deer populations at the state level, but localized deer densities can be reduced substantially during outbreaks. Since mortality from EHD rarely exceeds 25%, deer populations can recover in as little as one year after an outbreak. Although common throughout the Midwest, no documented cases of EHD have occurred in Minnesota's wild deer[2]. In recent years, the range of EHD has been expanding northward, and all states bordering Minnesota have had widespread reports of EHD. In 2012, the Minnesota Board of Animal health reported that a cow in Brown County was infected with EHD; this was the first clinical case of the disease identified in any species in Minnesota. A second case was reported in a cow from Murray County in 2013. Therefore, it is likely that EHD will occur in Minnesota's deer population in the future.

Options for managing the disease are very limited. Vaccination of wild deer is not practical, and eliminating gnats from large geographic areas is not possible. Because the disease is not spread from animal to animal, EHD is considered "density-independent" and attempts to manage deer

[2] One report has been recorded nationally for Cook County, Minnesota. Documentation is not available.

numbers at lower population levels would not have any impact on the prevalence of the disease. If an outbreak of EHD occurred in Minnesota, management would be similar to actions taken in response to severe over-winter mortality in northern Minnesota. Staff would attempt to estimate the spatial extent of the disease and the impact it had on local deer numbers. Hunting regulations would be adjusted accordingly to prevent overharvest of deer from occurring in DPAs that were impacted by EHD.

Anaplasmosis

Anaplasmosis is an important disease of domestic cattle in North America caused by rickettsia bacteria. Infected cattle develop severe anemia, high fever, and jaundice followed by death or severe debilitation. Although white-tailed deer may carry the disease, deer are not clinically impacted by anaplasmosis. The disease is spread by the transfer of fresh blood by biting insects or other mechanical means such as needles or de-horning shears. The bacteria replicate in certain species of ticks. With the exception of areas of the western U.S. where deer are hosts to those species of ticks, deer are not considered to be reservoirs of the disease and are not important in its transmission.

Giant liver flukes

Giant liver flukes are a type of parasitic flatworm naturally found in white-tailed deer. White-tailed deer are considered the normal host for giant liver flukes, and usually tolerate fluke infestations without serious clinical illness. Other wild deer, including moose and elk, and domestic cattle and sheep may also be infected by giant liver flukes. The life cycle of giant liver flukes is rather complex, and requires aquatic snails as intermediate hosts. Eventually, animals ingest larval cysts of the flukes, the cysts break open in the host, and the larvae migrate to the liver where they develop into adult flukes. In white-tailed deer, adult flukes reside in the liver and shed eggs to continue the life cycle. Moose are not normal hosts for giant liver flukes and adult flukes eventually die in the moose liver; however, infestations may contribute to reduced condition and secondary infections in nutritionally stressed moose. In sheep, flukes migrate through the liver and typically kill the sheep before the life cycle of the fluke can be continued. In cattle, reactions in the liver prohibit eggs from leaving the animal and the life cycle of the flukes does not continue. Although giant liver fluke infestations in cattle are generally not serious, damage by flukes causes livers to be condemned at slaughter. Domestic cattle and sheep may also be infected by the common liver fluke, which is not found in deer. Livestock producers concerned about the role of wild deer in fluke infestations should work with their veterinarian to identify the species of flukes infecting their animals. If giant liver flukes are found to be the cause of infestation, livestock producers should take measures to keep deer separated from livestock and their feed. Control of snails may interrupt the life cycle and reduce the local abundance of flukes.

Johne's disease

Johne's disease is caused by slow-growing bacteria, which cause a progressive loss of body condition in cattle, sheep, goats, and deer. Johne's is transmitted through infected feces, and animals with Johne's often have chronic diarrhea. Johne's causes considerable economic losses to the cattle industry. However, reports of Johne's infection in wild deer are rare. Therefore, free-ranging wild deer are not believed to be important hosts for the disease.

Leptospirosis

Leptospirosis is a disease caused by spirochete bacteria. There are over 180 known varieties of this organism. The disease can infect a wide variety of mammals including domestic livestock, pets, humans, and wildlife. Although each variety may infect many different species, there are specific animals that are hosts thought to maintain and spread particular varieties of the disease. Some domestic species are primary reservoirs for certain varieties including cattle, dogs, pigs, and horses. Several wild mammals have been found to be primary reservoirs for individual varieties of Leptospirosis including raccoons, opossums, rats, and mice. Carrier animals have persistent infections of the urinary tract and contaminate the environment with bacteria in their urine. Most animals contract the disease by contact with urine-contaminated food, water, and other materials. Numerous studies have shown that white-tailed deer have a lower rate of Leptospirosis infection than domestic livestock, and naturally occurring clinical infection of the disease is rare in white-tailed deer. Therefore, deer are not considered to be important in maintaining and spreading leptospirosis to domestic livestock.

Lyme disease

Lyme disease is caused by spirochete bacteria and is transmitted to people via the black-legged tick, which is also known as the deer tick. Lyme disease is the most common vector-borne illness of humans in the U.S. If Lyme disease is left untreated during its early stages, it could lead to serious health problems including arthritis and various neurologic diseases. In Minnesota, black-legged ticks also transmit other tick-related illnesses including babesiosis, human anaplasmosis, human ehrlichiosis, and a strain of Powassan virus.

White-tailed deer are the primary reservoir hosts of the adult black-legged tick. Lyme disease is transmitted among ticks when uninfected ticks take blood from infected deer or other already-infected animals. The disease is most commonly transmitted to humans when the infected ticks are nymphs during the spring. The exact relationship between deer densities and Lyme disease infection rates is not clearly understood. Reducing deer numbers has been ineffective in preventing Lyme disease because deer are not the only reservoir for the disease and do not transmit the disease directly to other deer.

The Minnesota Department of Health reported that during the years 1996 through 2012 more than 17,000 tick-borne illnesses were reported in people, with Lyme disease confirmed in

12,935 of those cases. The reported rate of Lyme disease infection in Minnesota during 2012 was approximately 17.2 cases per 100,000 people. According to the Minnesota Department of Health, the number of Lyme disease cases has increased dramatically since the 1990s. A variety of factors, including increasing physician awareness, increasing infection rates in ticks, and expanding tick distribution may have led to this trend. People are encouraged to take preventive measures to avoid Lyme disease infection. Using approved repellents, avoiding brushy and grassy areas when possible, and conducting regular checks for ticks is recommended.

Meningeal worm ("Brain worm")

The meningeal worm, which is commonly referred to as "brain worm", is a nematode of the species *Parelaphostrongylus tenuis*. Meningeal worms may infect all members of the deer family as well as domestic sheep and goats. The meningeal worm is naturally occurring throughout the range of white-tailed deer. White-tailed deer are the definitive host for meningeal worms, and normally harbor the worms with few signs of disease. Occasionally, white-tailed deer will accumulate massive infections of meningeal worms and these deer will display neurological symptoms including incoordination and paralysis. The life cycle of meningeal worms is complex, involving snails and slugs as intermediate hosts, which harbor larvae, and white-tailed deer as the final host for adult worms. Animals become infected with the larvae when they inadvertently eat snails and slugs. When white-tailed deer ingest infective larvae, the larvae develop in the spinal cord and migrate to the brain as adult worms where they produce eggs that deer shed into the environment. Deer species other than white-tailed deer, including moose and elk, that consume larvae can suffer severe clinical illness and death. Where white-tailed deer populations overlap with moose in Minnesota, deer densities are managed at less than 10 deer per square mile to reduce the potential risk of meningeal worm infestations in moose. Meningeal worms are not a health risk to humans.

Appendix B: Programs that support deer management in Minnesota

In addition to local and regional wildlife managers, several programs and supporting staff are involved with deer management in Minnesota.

Populations and regulations program: Responsible for management of hunting seasons to maintain deer populations within established goals. Management tools associated with the populations and regulations program include establishment of deer seasons, bag limits, and seasonal hunting regulations.

Animal damage program: Works with landowners to reduce wildlife damage. Management tools associated with the depredation program include technical assistance, damage management abatement materials and animal removal. Animal removal via shooting or depredation permits is used to address local damage concerns.

Wildlife research program: Supports DNR operations with science-based information and recommendations. Deer management tools associated with the research program include population monitoring, evaluation of management techniques, surveys, and associated ecological research.

Wildlife health program: Monitors and protects the health of Minnesota's wildlife populations, with a focus on game species. The extent of work ranges from large-scale surveillance efforts to individual case investigations. Structured within the DNR's Wildlife Research Unit, the Wildlife Health Program also conducts research into current wildlife health issues.