

# APR White Paper

Examining the implications of Antler Point Restrictions,  
Herd Age Structure and Communicable Disease,  
in Michigan's White-tailed Deer herd.

By

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## **Introduction**

In recent years there has been an increasing amount of research focusing on two communicable Cervid diseases that have become endemic in portions of the United States and Canada, Chronic Wasting Disease and Bovine Tuberculosis. Much of this research indicates compelling evidence of both an age and gender bias in the prevalence rates of deer affected by these diseases. Multiple studies indicate that male deer, particularly older male deer, are much more at risk for these diseases and show a significantly higher incidence rate of disease, when compared to female deer within the same herd. It is believed that the social behavior of male deer may be a significant factor contributing to this bias. It's also likely that the innate mechanism of yearling buck dispersal plays a role in contributing to the geographic spread of these diseases outside of established core areas. The finding of sex and age bias, in relation to these two communicable diseases, has important biological herd-management implications that should be taken into consideration when formulating public-policy, deer management regulations. Regulatory changes, such as the implementation of Antler Point Restrictions, which result in an older male age-structures and decreased harvest pressure on yearling bucks, could result in a potentially negative long term impact to the resource, should future outbreaks of either of these communicable diseases occur in Michigan. Conversely, it is possible that managing the resource for a younger male age structure and focusing harvest pressure on yearling males, could be an effective means of limiting the scope of potential outbreaks of these diseases and could contribute to controlling the geographic area affected by such outbreaks.

## **Overview of CWD and bTB**

### **Chronic Wasting Disease**

Chronic Wasting Disease (CWD) is a progressive, degenerative neurological disease, affecting deer and other Cervids, which is believed to be caused by a malformed brain protein called a prion. While other prion based diseases, which are known as transmissible spongiform encephalopathy's (TSE's), such as Scrapie in Sheep and Creutzfeldt-Jakob Disease in humans have been recognized for many decades, CWD and Bovine Spongiform Encephalopathy (commonly known as Mad Cow disease) are relative newcomers to the TSE spectrum. Like all TSE's, CWD is invariably fatal and no known cure exists. Deer exhibiting the symptoms of CWD were first noted in a Colorado research facility in 1967 and the disease was identified as a cervid TSE in 1978. Originally limited to mule deer populations in Colorado, CWD has subsequently spread to seventeen U.S. States and two Canadian Provinces. It has been identified in mule deer, white-tailed deer, elk, moose and red deer. Three primary mechanisms facilitating the spread of CWD have been identified, the importation and transportation of infected captive deer and elk, hunters from unaffected states bringing infected deer or elk carcasses and body parts back from CWD positive states and the natural migration of free ranging Cervids infected with the disease. In Michigan, there has been one case of a captive deer testing positive for CWD, which occurred in Kent County in 2008. Increased levels of monitoring and testing of free ranging animals in the immediate vicinity failed to show any evidence that CWD migrated into the free ranging deer population in Michigan. While it's never been confirmed how CWD was introduced into the Kent Co. facility, a likely hypothesis is that the contamination occurred through exposure to improperly disposed-of taxidermy residue from an on-site taxidermy operation on the deer farm, which had processed two deer that hunters had illegally transported from known CWD positive areas in Colorado and South Dakota.

It's likely that CWD will eventually be introduced into Michigan's free ranging deer population, probably during the next decade, if the natural progression of the spread of the disease continues in adjacent states, as it has for the last ten years or so. Since being discovered in Northern Illinois in 2002, CWD has continued to spread in a southerly direction, expanding southwards around 100 miles or so in the last ten years.

Deer affected with CWD have been found in Grundy County in Illinois, which is approx. 120 miles from Michigan's southern border. Riparian corridors (river systems) have been identified as playing a likely role in the spread of CWD. Incidence of CWD has been advancing steadily eastward from Colorado into Nebraska, via the Platte River corridor over the past decade. Yearling dispersal along riparian corridors poses a significant threat facilitating the spread of diseases like CWD and bTB outside of core areas.

*"The highest densities of white-tailed deer in the Midwest are often associated with riparian habitat; therefore, if transmission of CWD and other infectious diseases are affected by density-dependent functions, then spread of diseases in the Midwest will likely occur along river corridors. We found that adult males in the middle Missouri River Valley had a high degree of fidelity to their home range and temporary excursions and migratory movements occurred at low rates and distances traveled were short. Such movements would be unlikely to contribute to rapid expansion of infectious diseases. Yearling males, however, dispersed at high rates and were capable of traveling long distances, representing the greatest risk for rapid spread of diseases. Our results showed that most yearling males that dispersed followed the river corridor and established adult ranges within the river valley."* **Movements of White-Tailed Deer in Riparian Habitat: Implications for Infectious Diseases** –Gregory M. Clements et. al., *The Journal of Wildlife Management*.

*"An equally disturbing result from an epidemic model constructed by Miller et al. (2000) was that CWD could be sustained in cervid populations for decades and may have been spreading eastward along the North and South Platte rivers for over a decade. River bottom habitat is abundant throughout eastern and western South Dakota; seasonal movements of mule and white-tailed deer occupying the central river breaks region of South Dakota was described by Grassel (2000) as being highly variable. It is possible that white-tailed deer occupying river bottom habitats throughout South Dakota could aid in accelerating the spread of CWD in the future to regions of the state that presently harbor uninfected mule deer and elk populations."* **Prevalence of Chronic Wasting Disease and Bovine Tuberculosis in Free-Ranging Deer and Elk in South Dakota** – Christopher N. Jaques et. al. – *Digital Commons@University of Nebraska*

The Kankakee River watershed runs west to east, from Grundy Co. Illinois, where CWD was found in 2010, through northern Indiana to southern Michigan. This watershed provides a likely conduit for CWD positive deer traveling along the river into southern Michigan, at some point in the future.



Figure 1. - Kankakee River Watershed

The potential also exists for CWD spreading to Michigan's Upper Peninsula, at some point in the future, as well. In 2012, a CWD positive deer was identified near Shell Lake, Wisconsin, which is approx. 100 miles from the border of Michigan's Upper Peninsula. The extent of the outbreak in that vicinity has not yet been determined, it's possible that it will be limited in scope but if the disease becomes endemic in northern Wisconsin, as it has become in southern Wisconsin over the last ten years, then it's almost inevitable that it will spread to Michigan's Upper Peninsula at some point in the future. Whether by the natural migration of free ranging deer or through the illegal importation of hunter killed or captive Cervids, the likelihood that CWD is a disease that will impact the free ranging deer and elk herd in Michigan at some point in the future, is substantial.

### **Bovine Tuberculosis**

Bovine Tuberculosis (bTB) was initially found in a single free ranging deer in Michigan's northeast Lower Peninsula in 1975 but at the time it was thought to be an isolated incident, since prior to that time bTB had never become established in free ranging deer populations in this country. A second bTB positive deer was found in the same general area of the NELP in 1994. After the second positive deer was found, extensive testing was conducted and other bTB positive deer were discovered in the immediate vicinity. Subsequent years of testing established that bTB was endemic in a four county area in the northeastern Lower Peninsula of Michigan. This area was historically known as "Club Country", due to the many private hunting clubs which were

located in those counties. Many of these clubs had a long history of supplemental feeding of deer during the winter and artificially sustaining herd density numbers far above the natural carrying capacity of the available habitat of that area, which generally is rather poor. As long ago as the 1930's, this area was identified as a "problem" area by the Michigan DNR, so it's not surprising that the first known incidence of Bovine Tuberculosis becoming established in free ranging deer, in this country, occurred in an area previously identified as being grossly over-populated, with poor native habitat. Winter feeding on a massive scale, as well as stored cattle feed that was readily exposed to free ranging deer, has most likely contributed to the sustained outbreak of bTB in this area. Despite a disease management program that includes a total ban on baiting and the supplemental winter feeding of deer, a large increase in the availability of antlerless permits to decrease the density of the herd in that area and changes in "best practice" methods of storing animal feed to prevent contact by wild deer, efforts to eradicate the disease have proved unsuccessful.

While prevalence rates have been reduced, it appears that the disease will continue to exist at some level in the free ranging deer herd for the foreseeable future. It's been determined that White-Tailed deer serve as the primary reservoir species for bTB in that area. The relevant consequence of bTB in this area has been the impact that it has had on the dairy and beef cattle industry in northern Michigan. 55 cattle herds have been depopulated, due to becoming infected with Bovine Tuberculosis, at a cost of tens of millions of dollars to both farmers and taxpayers. A major consequence was the loss of bTB free status in Michigan's cattle herd, which has had a substantial negative economic impact on agriculture in Michigan. As prevalence rates in the deer herd came down and after testing indicated that the outbreak was primarily contained within a four county core area in the NELP, the State of Michigan was able to negotiate an agreement with the USDA that created multiple zones within the state, allowing the UP and 58 counties in the Lower Peninsula, to regain bTB free status, which facilitates the export of cattle for finishing and sale outside of the state. The remaining counties within the lower peninsula, outside of the core bTB area, were granted modified accredited advanced status (MAAZ), which has less strict restrictions imposed on the export and transport of cattle both within and outside of those zones, than the core area, which is classified as the modified accredited zone (MAZ). In the last several years, several

additional counties adjacent to the core area were able to move from the restricted classification to the modified advanced accredited zone, which allows more freedom of movement and economic opportunity than is afforded farmers in counties in the immediate bTB zone. Currently, “at-risk” areas include the 4 county core bTB area MAZ (modified accredited zone) and the MAAZ (modified accredited advanced zone) comprised of 7 counties which border the MAZ and which has had several dairy & cattle herds test positive for bTB in recent years. There are approx. 1,220 cattle and dairy herds in the MAZ & MAAZ. It is vital to the economic livelihood of many farmers and conversely to the economies of many areas in northern Michigan, that bTB prevalence rates within the free ranging deer herd, which appears to be the primary mechanism involved in spreading bTB to cattle operations in that area, remain at low or non-existent levels. Over the last decade and a half, USDA, MDA and the MDNR have spent over \$200 million dollars on funding related to bovine tuberculosis in Michigan, including \$1.5 million dollars allocated last year by USDA, to be used to subsidize the implementation of risk reduction measures for northern Michigan farmers, intended to lower the frequency of incidental contact between deer, cattle and cattle feed. Implementing deer hunting regulatory changes that have the potential to increase prevalence rates in those same areas of northern Michigan would seem to make little sense from a public policy standpoint and has the potential to subvert the efforts made by USDA and northern Michigan farmers, in their quest to lower the potential for disease transmission to their herds.

## **Prevalence Rates**

One characteristic that these two diseases seem to share in common is a gender and age bias regarding the prevalence rate found in different portions of the herd. Research indicates that older males have a significantly higher potential for having these diseases and males in general have a higher incidence rate than females do.

According to the Michigan DNR, mature bucks are 4 -11 times more likely to test positive for bTB than are does. Clearly, there is more than just age driving incidence rates for communicable disease, as mature does have a significantly lower rate of disease than mature bucks within the same age class do. This sex bias has been found with both bTB and CWD.

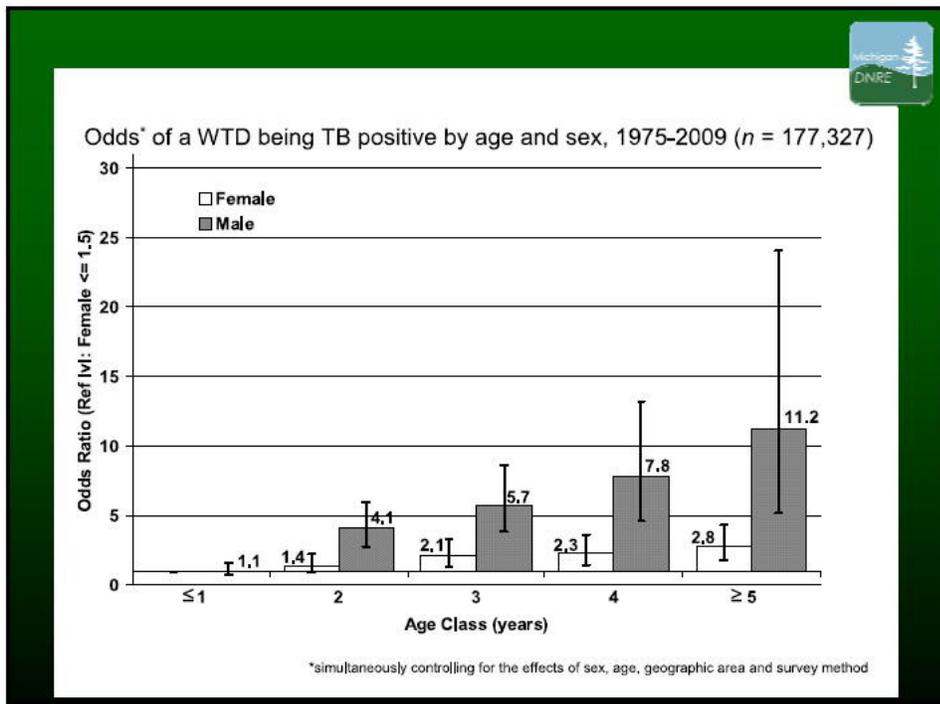


Figure 2 - Gender and age class prevalence rates of bTB

*“What we’ve observed is that as bucks get older, they’re much more likely than does to carry TB,” said DNRE deer and elk program leader Brent Rudolph. “By the time a buck reaches 5 ½ years old, it’s 12 times more likely than a 1 ½ year-old doe to have TB, while a 5 ½ year-old doe is only three times as likely.”.....“Does tend to stay with their mothers and form matriarchal groups, so they don’t interact much with strange deer,” explained Rudolph. “But bucks socialize with other deer much more frequently, such as when they spar with other bucks and breed does.”* **Michigan implements antler restrictions in the TB zone** – Darren Warner – NRAHuntersRights.org 8/12/10

Similar sex and age bias has been found to be present in deer infected with CWD and bTB by researchers in Wisconsin and Colorado, as indicated in the following citations;

### Wisconsin

*“Our results show that the probability of infection increased with age and that adult males were more likely to be infected than adult females. .... The increase in male prevalence with age is nearly twice the increase found in females. We concluded that CWD is not randomly distributed among deer and that differential transmission among sex and age classes is likely driving the observed patterns in disease prevalence.”* - **Demographic patterns and harvest vulnerability of chronic wasting disease infected white-tailed deer in Wisconsin.** Daniel A. Greer et. al. *The Journal of wildlife management*

*"Analysis of the sex and age composition of positive deer has shown that very few fawns are infected; only 10 out of more than 7,500 tested. Disease prevalence increases with age and the rate of increase is faster in males than in females. Only 2-3% of yearling females and males from the core area have tested positive for CWD. This increased to 4% of females and 10% of males for deer 3 years old or older." - **Controlling Chronic Wasting Disease in Wisconsin.** Robert E. Rolley - Wisconsin Department of Natural Resources Bureau of wildlife management and integrated science services.*

*"The rate of Chronic Wasting Disease infection in Wisconsin's white tailed deer herd increased last year. The Prevalence rate for adult bucks 2 1/2 years or older in the first epicenter of the outbreak, which covers mostly western Dane County and eastern Iowa County, increased from 10% in 2007 to 15.5 % last year according to figures released Tuesday by the Department of Natural Resources. The infection rate for yearling bucks increased from 3% to 6% during the same period." - **Prevalence of CWD jumps up,** Wisconsin News - August 2009*

## **Colorado**

*"Prevalence of CWD was higher for male mule deer for every age class except the 1–2 yr olds; for the 3- to 7-yr age classes, prevalence was 2.4-fold higher among males than among females, with differences being especially pronounced in the 5- to 6-yr age classes." - **Epidemiology of Chronic Wasting Disease in Free Ranging Mule Deer,** Michael W. Miller & Mary M. Conner – *Journal of Wildlife Diseases**

The causative factors behind the sex and age bias that is found in deer affected by these two diseases has not been conclusively documented but a primary factor that researchers are focusing on is the substantially different social behaviors that are exhibited by male and female deer.

*" In addition, EHD does not appear to affect older bucks more than other segments of deer populations, unlike bovine tuberculosis (bTB) and chronic wasting disease (CWD) in deer in limited areas in the United States and Canada. Although the factors responsible for higher bTB and CWD prevalence in older bucks have not been identified, they may be related to behavior." Dr. John Fischer - **Quality Whitetails** – QDMA - August 2008*

Female deer tend to limit their contact with other deer to tightly-knit family social groups, with relatively little interaction with males or with non-family group members, outside of the rut period that occurs during the fall. Females also tend to have smaller home ranges, which create less overlapping with territories inhabited by other non-family

group deer. Males, on the other hand, tend to have significantly larger home ranges and tend to cover much more territory, geographically speaking, and come into contact with greater numbers of deer, particularly during the fall rut period. Males tend to cluster together in loosely formed bachelor groups, the membership of which is constantly changing, during the winter, spring and summer seasons. It's believed that since each of the males within the group has a greater potential to cover more geographic territory, with larger home ranges and has increased levels of contact with non-family group deer, that the bachelor groups could have an amplifying effect on the transmission and spread of disease, that is not found within matriarchal family groups, which tend to be much more socially isolated.

There is also evidence that some of the social behaviors exhibited by bucks, particularly by mature bucks, could also play an important role in increasing the risk of the spread of communicable disease and could also offer some explanation regarding the higher prevalence rates found in males, particularly in older males. These social behaviors that occur during the fall breeding period are scraping, rubbing and licking. While the social mechanisms behind these activities are not clearly understood, it's believed that they serve as communication devices signaling a variety of information related to both the social hierarchy and the breeding process. Rubbing occurs as the blood supply to the "velvet", the skin covering growing antlers is cut off and the bucks tend to rub their antlers on tree trunks, to scrape off the outer covering of skin. Velvet has been shown to contain prions, in CWD infected deer. Rubbing behavior continues throughout the fall season, even after the velvet has been shed. As part of the rubbing process, glandular secretions are deposited on tree trunks. These secretions are frequently sniffed and licked by other deer, an activity which may also facilitate the transmission of disease. Scraping is a behavior where male deer scrape small indentations into the earth and deposit glandular secretions and urine on the scraped earth, as a means of chemically communicating with other deer. Often over the site of a scrape there is a branch called a licking branch, which bucks deposit saliva on, which is also thought to be a means of communicating with other deer.

Bodily fluids of infected deer, including saliva, urine and feces are known to be potential vectors for the transmission of both CWD and bTB. A Wisconsin study found that male deer engage in substantially higher amounts of social interaction related to scraping and

licking behavior than females do and that mature male deer engage in significantly greater amounts of those behaviors than yearling bucks and fawn males.

*“Therefore, if environmental contamination via saliva and urination are found to be important means of transmission, then scraping behavior may be a potential mechanism for the transmission of CWD. We found that males visited scrapes more frequently and spent more time at scrapes than females. There was also a difference in the frequency with which behaviors were performed by males and females, with males engaging in all of the behaviors more often than females. Thus CWD infected males would have a higher potential to deposit infectious prions into the environment and susceptible males would have a higher potential to expose themselves to CWD.” – **Scraping behavior as a potential means of Chronic Wasting Disease (CWD) transmission**, Michael Spellman – USGS - Wisconsin Cooperative Wildlife Research Unit.*

Included in the behavior commonly exhibited by male deer when making or visiting scrapes is depositing saliva, urine and feces, all materials that are believed to transmit CWD and bTB . Subsequent deer visiting the site come into contact with these materials. Also documented are increased amounts of feeding activity in the vicinity of scrapes, which has the potential for spreading the disease through increased levels of fecal ingestion, which has been shown to occur when deer feed.

Spelman’s study also found that among male deer, older bucks tended to exhibit significantly greater amounts of the high-risk behavior associated with scraping activity, than younger bucks.

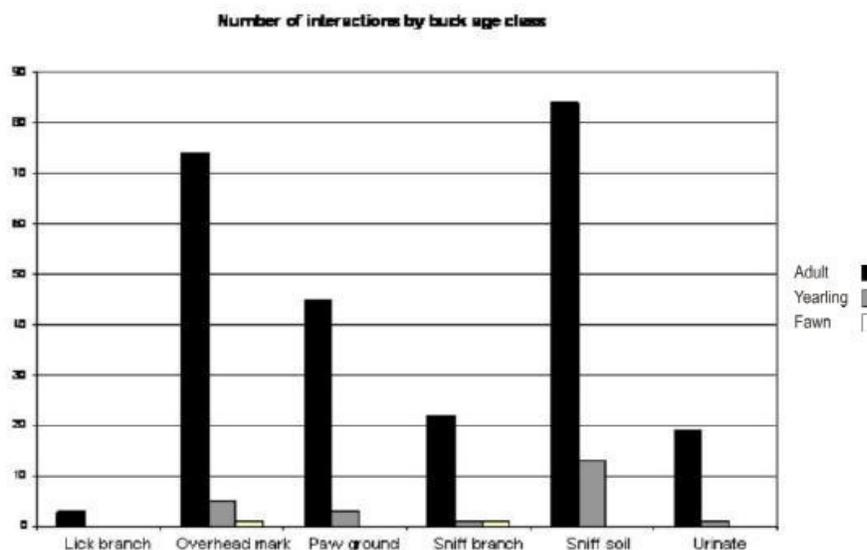


Figure 3 – Variance in male scrape activity

A study from Nebraska found similar results in terms of the substantially greater amounts of high-risk behavior exhibited by older males at scrapes.

*“We modeled Risk Values based on frequency of occurrence, duration, and Threat Values of each behavior, for contacting and transmitting CWD prions at scrapes. Adult males had the highest total Risk Values for contacting CWD prions (114.1) and shedding prions (59.4). The “grasp-lick branch” behavior had the highest Risk Value for adult males for both contacting and transmitting prions. Our study reveals a sex specific social behavior in male white-tailed deer that has the potential to spread chronic wasting disease between adult males in the population.”* **Scraping Behavior in Male White-tailed Deer as a Potential Means of Transmitting Chronic Wasting Disease** — Travis C. Kinsell University of Nebraska at Lincoln – Doctoral Thesis – 2010

The results of that study found a significant difference in the quantity of “high risk” scrape related behavior exhibited by the different age classes and genders. Adult bucks engaged in 50% more scrape related behavior than did yearling bucks and 68% more scrape related behavior than adult female deer. Adult bucks engaged in grasping/licking the lick branch 10 times more frequently than adult does, which may have particular significance, as saliva exchange is believed to be a primary conduit for the transmission of both CWD and bTB.

Table 4-4: Percent occurrence of scrape-related behaviors by white-tailed deer at DeSoto National Wildlife Refuge in eastern Nebraska and western Iowa, 2005-2006.

Percent Occurrence of Interactions <sup>a</sup>				
Behavior	Adult male	Yearling male	Adult female	Fawn
Smell branch	64.7% <sup>b</sup>	60.4% <sup>b</sup>	42.3% <sup>d</sup>	22.5% <sup>e</sup>
Smell scrape	61.1% <sup>b</sup>	66.3% <sup>bc</sup>	72.7% <sup>c</sup>	76.1% <sup>c</sup>
Grasp-lick branch	44.2% <sup>b</sup>	30.7% <sup>c</sup>	4.3% <sup>d</sup>	7.2% <sup>d</sup>
Scrape	36.8% <sup>b</sup>	7.7% <sup>c</sup>	0.0% <sup>d</sup>	0.0% <sup>d</sup>
Pre-orbital mark	28.8% <sup>b</sup>	16.6% <sup>c</sup>	1.8% <sup>d</sup>	1.0% <sup>d</sup>
Rub-urinate	20.8% <sup>b</sup>	3.8% <sup>c</sup>	0.3% <sup>d</sup>	0.0% <sup>d</sup>
Graze	14.4% <sup>b</sup>	16.2% <sup>b</sup>	19.3% <sup>b</sup>	17.2% <sup>b</sup>
Urinate	5.9% <sup>b</sup>	8.4% <sup>b</sup>	0.9% <sup>d</sup>	1.0% <sup>d</sup>
Defecate	5.7% <sup>b</sup>	6.3% <sup>b</sup>	4.3% <sup>b</sup>	5.3% <sup>b</sup>
Other branch	3.1% <sup>b</sup>	0.9% <sup>c</sup>	0.3% <sup>c</sup>	1.0% <sup>bc</sup>
Flehmen	0.4% <sup>b</sup>	0.0% <sup>b*</sup>	0.0% <sup>b*</sup>	0.0% <sup>b*</sup>
<b>Total interactions</b>	<b>866</b>	<b>427</b>	<b>326</b>	<b>209</b>

Figure 4 - Differences in scrape related behavior by sex and age class

Multiple studies have documented the ability of bTB bacillus remaining viable for extended periods of time, sometimes as long as 6 weeks, even when exposed to a variety of climactic conditions. (Whipple & Palmer) (Fine et al.) Prions have been shown capable of remaining infective in soil for extended periods of time, potentially decades.



Figure 5 - frequency and concentration of scrape locations

This graphic shows the frequency and locations of scrapes identified on one particular property, in the study mentioned above by Kinsell. Over 100 scrapes were located within the study area, during just one fall rut period. The study showed that the mean number of unique adult bucks visiting individual scrapes was 5.1 and that some scrapes were visited by as many as 15 different adult bucks. Many of these bucks would return to the same scrapes 30 or 40 times during the course of the lead up to the rut. If each of those 100 scrapes was visited by 5 unique bucks and each visit included just one “high risk” action that could potentially transmit disease, such as sniffing or licking and each of those bucks returned to those scrapes just 20 times over the course of the rut, over 10,000 potential transmission contacts would occur, just on this single property, if a percentage of the bucks engaging in those activities were infected with either CWD or bTB. This clearly illustrates the increased risk for disease transmission that occurs with an increased buck age structure and a resulting increase in the frequency of such social behaviors.

*“Disease transmission may be facilitated at scrapes due to multiple males using the same scrape and then going on to interact with other scrapes across the landscape. Prevalence of CWD increases with age in white-tailed deer (Gear et al., 2006; Osnas et al., 2009), therefore, dominant and post-dominant males are the most likely to be infected with the disease. These males may interact with several different scrapes in a small area, and contaminate those scrapes with CWD. Younger males may subsequently interact with those scrapes and become infected, spreading the disease to more scrapes across a larger area as they roam about the landscape.”* Travis C. Kinsell **Scraping Behavior in Male White-tailed Deer as a Potential Means of Transmitting Chronic Wasting Disease** — University of Nebraska at Lincoln – Doctoral Thesis – 2010

In addition to increased amounts of scraping activity being related to greater numbers of older bucks in the populations, a number of biologists have noted similar increases in rubbing activity, correlated with greater numbers of older bucks in the population, which is one of the outcomes resulting from APR's.

**Dr. Karl Miller** - *"The number of rubs on any piece of property is influenced by a number of factors. In our studies, we have recorded rub densities that range from less than 500 rubs/mi<sup>2</sup> to over 3,000 rubs/mi<sup>2</sup>. Obviously, one would expect that deer density (or at least buck density) will have a major influence on the number of rubs made on an area. However, while our studies have indicated that density has an impact, it is not a direct relationship. Rather, we have found that the number of rubs is more directly correlated with the density of older bucks (2.5+ year old) in the population. Researcher John Ozoga found similar results in his studies in Michigan. John's studies revealed that younger bucks make fewer than half as many rubs as did mature bucks, and that they tended to start rubbing much later in the fall."*

*"If we acknowledge that yearling bucks make approximately 50 percent as many rubs as older bucks, our data suggests that on some area, older bucks may be making more than 1200 rubs during the roughly 90 day rubbing period. That translated to about 15 rubs per day!"*

**Kip Adams** - *"A buck's age can play a role as older bucks tend to rub more than younger animals."*

*"The relative abundance of rubs and scrapes on a given area is directly related to the density of mature bucks, and areas with mature bucks can have 10 times as many rubs as areas without them."*

**John Ozoga** - *"Research findings suggest that older, dominant bucks rub more than younger subordinates,"*

*"The researchers recorded buck rub densities ranging from 474 to 1,502 per sq. mile and they found rub density closely related to the number of bucks older than 2.5 years old in the population. That is, older bucks produced far more rubs than younger bucks."*

*"On healthy deer ranges, rub densities can vary from a couple hundred to nearly 5,000 per square mile and are closely related to the number of older bucks in the population. Even a fairly large number of young bucks may make few total rubs relative to what a couple of older bucks in the same area can produce."*

**Bryan Kinkel** - *"Rub densities and rubbed tree size are greatly influenced by herd dynamics and buck age structure; i.e. competition between bucks. Buck population plays a role, but it doesn't play as important a role as most hunters would assume. Over a 10 year period, in my rub density and distribution study (the largest study of its kind that I know of), we measured an increase in rub density from around 500 rubs per square mile at the beginning of the study to rub densities approaching 6,000 rubs per square mile by the end of the project. Although buck population did increase during the study, certainly not anything like the 12-fold increase in rub densities measured. The big difference was herd dynamics. The local deer population went from an unbalanced herd with few older bucks (and no mature bucks) to a very balanced herd sexually and age structure-wise, including an adequate percentage of mature bucks. It was the much increased competition between bucks (especially older to mature bucks) that drove the very high rub densities at the end of the project."*

**Dr. Grant Woods** - *"We have found a correlation between the number of rubs and the number of older bucks in an area. The better the age structure of a herd, the more rubs and signposts*

*that appear. On one of our management projects in Tennessee, we started out noticing about 700 rubs per square mile, or 1.1 per acre. After five years of good herd management, it increased to an amazing 5,000 rubs per square mile, or 7.8 per acre."*

The greater amounts of social interaction that occur during scraping, licking, rubbing and sparring with other bucks probably all play a role in driving the higher prevalence rates that are exhibited by older male deer. Regulations that increase the buck age structure in the herd will also result in a substantial increase in the frequency of these higher risk social behaviors occurring, which in turn could lead to an increase in the rate of disease transmission, as well as an increase in the number of deer who are exposed to disease, due to adult bucks having a significantly larger average home range than does.

### **Yearling Buck Dispersal**

Yearling buck dispersal is an innate behavior exhibited by a majority of younger male deer, in which they leave their natal range, which is inhabited by their mothers and female siblings and relocate to other areas prior to establishing their own adult home ranges. Roughly 50% to 75% of yearling (1.5 year old) males disperse sometime between the ages of one and two. In contrast, female yearlings disperse from their natal range much less frequently, only about 15% of the time. Female offspring tend to assimilate into matriarchal family groups of females and fawns and establish home ranges within the same general area that they were born in. The underlying biological basis of the buck dispersal mechanism is undoubtedly designed to create genetic diversity within the herd. There can be a wide variance in the distances that younger bucks disperse before establishing permanent home ranges. Much of that variance is dependent on herd densities and the availability of quality habitat. A Maryland study found that 70% of younger bucks dispersed an average of 3.7 miles from their place of birth, although, in that study, one yearling buck was found to have dispersed 36 miles from where it was born. (*Rosenberry et. al. **Population effects of white tail deer dispersal**, Wildlife Society Bulletin*) In a Nebraska study, two whitetail deer were found to have dispersed 125 and 137 miles respectively (Richard P. Smith, ***Deer Hunting***). While this is certainly not the norm, it raises the possibility that outlier dispersants could

potentially have a significant impact on spreading communicable diseases substantial distances from where disease may be established in a core area.

*“Differences in movement and dispersal between male and female white tailed deer may also be a significant component of CWD distribution across the landscape, especially in areas where animals do not show seasonal migrations. Between 50% to 80% of yearling males disperse distances of 10 to 30KM, depending on habitat characteristics. (Long et. Al. 2005), whereas less than 20% of females disperse (Rosenberry et. al. 1999) Infected yearling males are therefore more likely to spread CWD into new areas” Michael R. Hutchings - **Management of Disease in Wild Mammals***

While yearling bucks tend to have lower incidence of disease than mature bucks do, they are not immune. 21% of the antlered bucks that tested positive for bTB in Michigan, since 2002, have been yearlings.

*“In applied ecology, the study of dispersal is fundamental to understanding such problems as the spread of diseases, invasions of exotic species, and escape of genetically modified organisms (Bullock et al. 2002a). Dispersal has been suggested as a primary means of spreading disease among populations, and dispersal distance is an important parameter in many mammalian disease spread models” Duane R. Diefenbach, et. al. **Modeling Distribution of Dispersal Distances in Male White-Tailed Deer** - Journal of Wildlife Management*

Protecting yearling bucks has the practical impact of increasing the number of bucks that leave one area and relocate to other areas, which in turn increases the potential for spreading disease from one area and relocating it to another area, thus exposing greater overall numbers of deer to disease. Focusing harvest pressure on yearling bucks, results in a younger overall herd age structure and is an effective means of limiting the potentially negative impact that yearling dispersal may have, on increasing the spread of communicable disease.

The benefit of maintaining a young herd age structure is apparently not lost on the recently appointed “Deer czar” in Wisconsin, who made the following comment in regards to the finding of a CWD positive deer in Northern Wisconsin, 200 miles from where any previous CWD infected deer had been found.

*“State deer trustee James Kroll has recommended an aggressive hunt to keep the deer population young as a means of reducing chronic wasting disease in a deer population, without*

*trying to eliminate the population entirely.” Joe Knight – **DNR announces CWD measures for Northwestern Wisconsin**, Leader Telegram of Eau Claire 4/24/12*

A similar recommendation was made regarding management strategies designed to limit yearling buck dispersals along riparian corridors;

*“Our results showed that most yearling males that dispersed followed the river corridor and established adult ranges within the river valley. This tendency may be strategically useful in controlling the spread of diseases from infected source populations. Management efforts in riparian habitats could be maximized by targeting male fawns and yearling males for removal in areas within or immediately adjacent to the river valley.” **Movements of White-Tailed Deer in Riparian Habitat: Implications for Infectious Diseases** –Gregory M. Clements et. al., *The Journal of Wildlife Management*.*

A Wisconsin study made a similar recommendation for targeting yearling bucks as a means of disease risk mitigation;

*Although yearling males have low chronic wasting disease prevalence rates, they may be infected before dispersal due to variable incubation times. Managers should increase yearling male harvest and consider removing young males in areas of higher forest edge. **White-Tailed Deer Movements in a Chronic Wasting Disease Area in South-Central Wisconsin** – Lesa h. Skuldt et .al, *The Journal of Wildlife Management*.*

Clearly, regulations that protect increased numbers of yearling bucks may be counter-productive to efforts intended to decrease the overall prevalence of communicable disease and limit it's spread.

## **Overview of APR's in Michigan**

Antler Point Restrictions or APR's, also referred to in Michigan as “QDM” restrictions, are regulations that define which antlered male deer are legal for harvest based on the number of antler “points” that are present on their antlers. Currently, the state imposes antler restrictions on each of the two tags available in the combo license, the first being a minimum 3" restriction on the "unrestricted" license and a 4 point on one side restriction on the "restricted" license. The 3" restriction is the delineation between what is legally considered an antlered deer and an antlerless deer, which may include female deer, male fawns, sub 3" yearling bucks and mature bucks that have shed their antlers.

In 1998, the Natural Resources Commission set up a process that would allow for stakeholder driven QDM/APR initiatives. This decision was based partly on the conclusion that there was no substantive biological impact resulting from APR's. The feeling was that since it was based on the social desire of hunters to be able to harvest older and larger antlered bucks, that it should be determined by the preferences of a super-majority of hunters in a given area.

The wildlife division of the Department of Natural Resources has repeatedly stated that there is no tangible biological benefit that results from the imposition of antler restrictions resulting from these stakeholder initiatives.

*"There is no scientific evidence that antler point restriction and quality deer management is in fact a better way to manage a herd. The deer are just as healthy now as they would be if we went to a quality deer management," (Ashley Hippler, Deer Program Biologist MDNR) **Antler Restrictions Proposed Across Northern Michigan** – Petoskey News – 5/17/12*

Over the last decade there have been a number of "QDM" initiatives which provide stakeholder groups the opportunity to suggest and promote mandatory antler restrictions, if two thirds of a sample pool of hunters who hunt in a given DMU, agree to support said restrictions. The restrictions in these initiatives have ranged from a 2 point minimum "no-spike" rule, to 3 points on a side to 4 points on a side for the "unrestricted" tag in the combo license. Some of the initiatives have passed, some have failed, some have been extended after an initial five year period and some have failed to gain enough support to be extended after five years. In the past, most of these initiatives have been for just one DMU or sometimes 2 or 3 DMU's, in areas where hunter populations are fairly low. There is currently a 12 county APR initiative under way in the northwest Lower Peninsula.

### **Impact of APR's on herd structure**

While there have been minor variations in the results of different APR programs historically, most have two common results that have significant implications in relation to communicable disease concerns. Those common results are increased numbers of older bucks in the herd, commonly referred to as an advanced buck age structure and increased protection of yearling bucks. Since age is one of the contributing factors to antler development, it's not surprising that instituting harvest restrictions based on antler

points would have these results. As previously mentioned, there is currently as APR initiative underway in Michigan's northwest Lower Peninsula, which would expand the antler restrictions that have been in place since 2003 in Leelanau County, to 12 other NWLP counties. Examination of herd demographics in Leelanau County both prior to and under APR's, provides some insight into what changes APR's may cause within the herd structure.

It should be noted that the data available regarding the age class composition in individual counties in Michigan is somewhat limited. The Department of Natural Resources does not include age or antler point data in the statistical information gathered in the annual hunter survey. The limited data available is gathered at the voluntary check stations that the DNR uses for this purpose but the actual number of deer checked annually represents only a very small percentage of the deer harvested and the DNR has stated that the results are probably skewed towards larger and older animals, due to the voluntary nature of the data collection. Because check station availability varies widely from county to county, the value of comparisons between different counties is limited. This is not to say that there is not some valuable information to be gained from analyzing year to year changes that occur in individual counties, only that those changes may not be accurately representative of trends occurring in the actual harvest. Some of the estimates included in this paper are based on check station data and it needs to be stressed that the nature of this data may not accurately reflect the actual harvests that occur.

In Leelanau Co., prior to the imposition of APR's, approx. 60% of antlered bucks harvested were yearlings, 20% 2.5 year olds and 20% older bucks (3.5+years of age). This would indicate a herd with a younger average buck age structure, which is the result of heavy harvest pressure on the yearling age class. In contrast, during the 8 year APR period in Leelanau County, there was a substantial increase in the average age of harvested bucks. During that period, the percentage of yearling harvest fell to 35%, which would indicate an additional 25% of the previously harvested yearling age class survived to be able to disperse to other areas, the percentage of 2.5 year olds harvested increased to 27% while the percentage of older bucks harvested almost doubled, to 38%. This indicates a substantial shift in the average age of bucks within the herd.

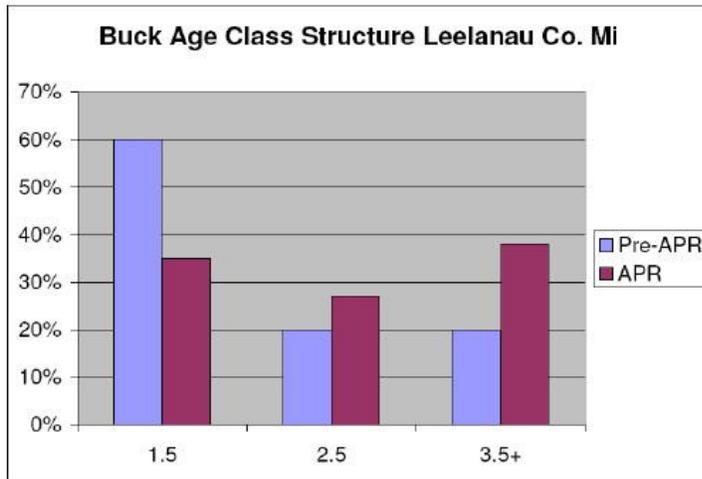


Figure 6 - Buck Age structure changes resulting from APR's

These results are not unique to the Leelanau Co. APR experiment, the results of a ten year study in Mississippi show results that are strikingly similar to what was found in Michigan.

### Change in Percent Harvest of Bucks

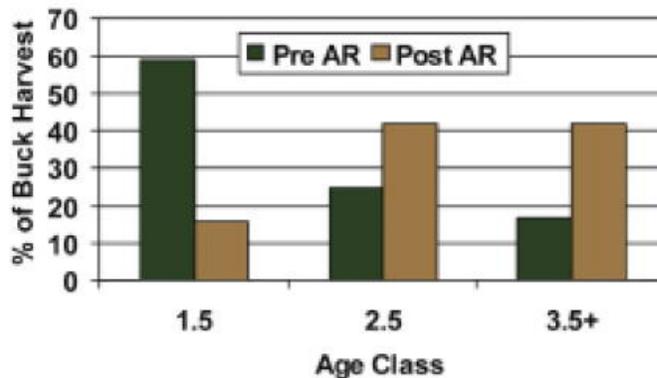


Figure 7 - Impact of APR's on age structure in Mississippi

In both of these examples and in virtually every other case where APR's have been introduced, there has been a substantial increase in the number of older bucks that are present in the herd and a substantial decrease in the harvest of yearling bucks.

### Non-Stakeholder initiated APR's

In 2009 the wildlife division of the Michigan DNR asked the NRC to implement a 3 pt. Minimum antler restriction in the NELP. This recommendation was one which had been originally made by a private group of landowners in the bTB zone who were

members of a “cooperative” that included some of the large private hunting clubs in the region. This cooperative was created for the purposes of promoting private land deer management practices based on the Quality Deer Management technique, which focuses on protecting yearling bucks and creating an advanced buck age structure in herds managed with these policies. The DNR has been working cooperatively with some of the clubs which were included in this cooperative for several years, gathering harvest data and conducting necropsies on the deer harvested by those clubs. The original efforts designed to combat bTB that were employed by the DNR, resulted in a substantial reduction in densities in the bTB zone and an accompanying decrease in the average prevalence rate within the herd but in recent years that downward trend had stopped, densities had begun to increase again and prevalence rates appeared to have reached a plateau or were increasing incrementally. As one of several recommendations for regulatory changes designed to reverse that trend and lower bTB prevalence rates, the wildlife division of the MDNR embraced part of the proposal that had been put forth by the private cooperative, specifically that a 3 pt. minimum antler requirement be imposed on bucks harvested within the bTB zone.

At the time, this recommendation surprised a lot of people involved in deer hunting and deer management in Michigan, since there did not seem to be any biological basis for promoting such a regulatory change. At least according to press reports, the stated purpose that was suggested by the DNR was that these APR regulations were intended to focus harvest pressure on older bucks, due to the fact that they have a much higher prevalence rate for bTB.

*“DNRE wildlife veterinarian Steve Schmitt said while the long range trends have reflected reductions in deer numbers and TB efforts have stalled over the last five years or more. “The older the deer is, the more likely it is to have TB and males are more likely to have TB than females.” Schmitt said. “A 5 ½ year old buck is 11 times more likely to have TB than a 1 ½ year old buck. If we could target those and remove more of them, that would be helpful to us. That’s what we are talking about, targeting older bucks. We realize that nobody passes up those older bucks but again, if we can harvest a few more of them.” – **DNRE Explains new TB recommendations** – Presque Isle County Advance 6/30/10*

Keith Charters, former Chairman of the Natural Resources Commission gave the following explanation for the proposed APR’s.

*"Charters says simply "one of the proposals is that we have horn restrictions of 3 points on a side, at least 3 points on a side, basically a 6 point buck." Essentially, it's a similar quality deer management standard that has been set up in other parts of the state to try and allow more bucks to grow nice racks..... Charters says according to the DNRE fish and wildlife division "the theory behind that is that the older bucks have the higher presence of TB. This would encourage more people to shoot the larger bucks and therefore reduce the prevalence rate."*  
*Marc Schollett – **Hunters Face Antler Restrictions?** – UpNorthLive.com 6/22/10*

What was confusing for many is that there is no apparent evidence that APR's focus harvest pressure on older bucks to the point that a net reduction occurs in the number of older bucks in the herd. While harvest of older bucks increases under APR's, it's because there are substantially greater numbers of older bucks in the herd available to be harvested, which results in a net increase in the number of older bucks present that have an increased likelihood to spread disease. In fact, the primary reason for the emergence and increasing popularity of the Quality Deer Management movement is the fact that many hunters who have the desire to harvest older and larger antlered bucks feel that traditional management systems are too effective in focusing harvest pressure on adult bucks, thus preventing significant numbers of them in the herd. It seemed counter-intuitive to suggest implementing a regulatory change that is normally designed to increase the total number of older bucks in the herd and which also allows increased numbers of yearling bucks to disperse, when both of those factors pose an increased level of risk for the transmission of disease.

The idea that antler restrictions could help reduce levels of disease prevalence was greeted with some skepticism by some.

*"During the question and answer portion of the presentation, George Perry, of Hubbard Lake, who said he's practiced his own form of antler restrictions for 25 years, said, "One of the things we have to do is separate antler restrictions and trophy bucks from TB." The more young bucks that are not harvested means more older bucks, and that "is going to bring more TB-infected deer into the mix." He added, "Science has not been provided to prove that this will work." He called the antler restrictions a "by gosh and by golly" effort."* **State Wildlife experts explain APR proposal** Tom Carney – Michigan Outdoor News 7/08/10

This skepticism was also shared by some deer management professionals around the country;

*“Michelle Carstensen is the wildlife health program coordinator for the Minnesota Department of Natural Resources, another state that’s dealt with TB in its herds (California and New Mexico have also found TB-positive deer). Carstensen questions whether aiming at older bucks will affect the TB rate. “The best way to reduce TB in deer is to just focus on taking as many deer as you can,” said Carstensen. “One way Minnesota has done this is to reduce the cost of doe permits and let hunters take as many as they want.”*

*Others point out that targeting older bucks through the use of APRs may prove counterproductive. “Studies have shown that yearling bucks are most likely to disperse and travel farther than older bucks, so if they have TB, they will spread it the most,” said former Michigan DNRE biologist John Ozoga. “By putting in APRs, I don’t see how you’re going to put more pressure on shooting older bucks in that area than you already have.”* **Michigan implements antler restrictions in the TB zone** – Darren Warner – [NRAHuntersRights.org](http://NRAHuntersRights.org) 8/12/10

The Natural Resources Commission elected not to implement the APR’s requested by the DNR and in 2010 instead decided to implement a variant known as “hunters choice” APR’s or the Lindquist rules, modeled after the APR’s that the NRC had implemented several years previously in the Upper Peninsula. These rules give hunters the option of either using one unrestricted buck tag annually or purchasing a combo license that has the same 3/4 antler restrictions that had been sought by the DNR. It’s a compromise designed to allow casual hunters to still be able to harvest one buck of their choice, while also affording some additional protection for yearling bucks resulting from those hunters who choose to be able to harvest two restricted bucks a year. Regardless of the practical implications of the hunter’s choice APR’s, the fact remains that the goals behind them are social in nature. While they may not present as great a potential for increasing the number of older bucks in the herd and as a result raising the potential risk for the transmission of disease, they still create a higher level of risk than would occur without these restrictions in place. The fact remains that there was no science supporting the implementation of these restrictions and there remains no biological benefit and a tangible potential biological detriment created by implementing these types of regulations, in areas where disease is known to be present, such as the NELP.

It’s troubling to note that two seasons after the “hunters choice” antler restrictions were put into place in the NELP, 3 bTB positive bucks were found in one of the counties, outside of the core bTB area, that was subject to those APR’s. Those 3 bucks, which

were all between 2.5 and 3.5 years old, may likely have been protected from being harvested as yearlings by the APR's that had been implemented. Because of the substantially higher prevalence rate exhibited by 2.5 and 3.5 year old bucks (4.3% and 5.7%) compared to the 1.4% found among the yearling buck age class, when the number of older deer is expanded, the likelihood of finding a TB positive deer increases substantially. Just to illustrate the impact that APR's can have on these age groups, in the 12 county NWLP area that is currently part of a QDM initiative, which has not been managed with APR's in the past, the 2.5 and 3.5 year old age classes make up 31% of the total antlered buck component of the herd, with the majority of the antlered bucks falling into the yearling age class (60%). Leelanau Co., which has had APR's in place for 9 years, has a dramatically older buck age structure. In Leelanau Co. the 2.5 and 3.5 year old age classes make up 60% of the antlered buck component of the herd, essentially double of what is found in counties that are not subjected to APR's. This graphic shows a comparison of what the estimated risk factor for bTB would be in the buck component of each herd if bTB was present, one managed with APR's and the other managed with traditional methods that focus harvest on the yearling age class.

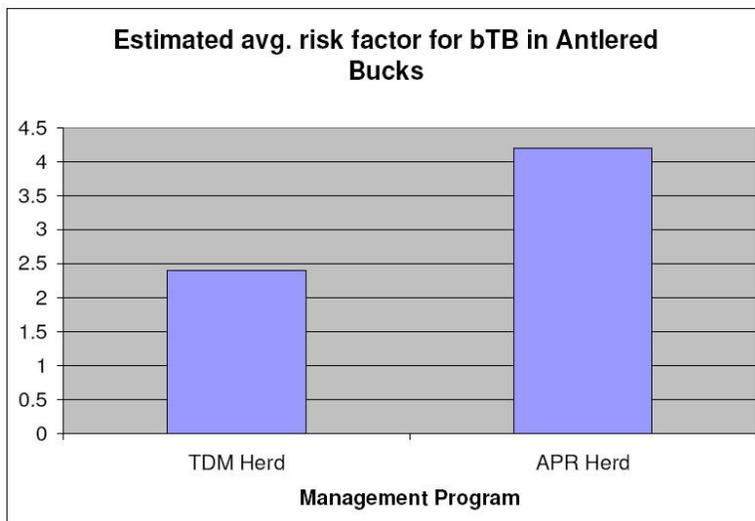


Figure 8 - Model showing comparison in est. prevalence rates

This graphic shows the impact that the higher male prevalence rate resulting from an advanced buck age structure would have on the adult population of a herd, at different sex ratios. One of the goals of most APR initiatives is to decrease the ratio of males to females in the herd. Sex ratios in most of the NLP are in the 2:1 range pre-hunting season and closer to 3.5:1 during the winter and spring.

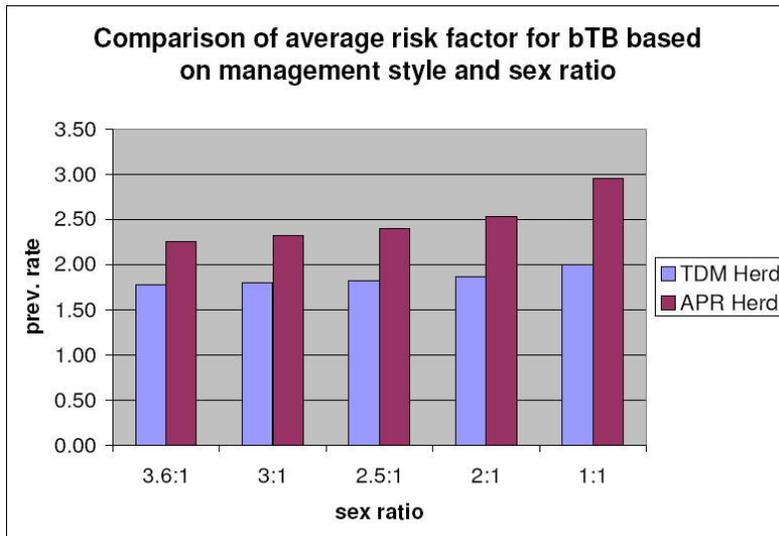


Figure 9 - Model showing impact of APR's on adult avg. prev. at different sex ratios.

### APR's and Disease in other states

Other states which have faced outbreaks of communicable disease have elected to take a different approach than Michigan has, regarding APR's, in areas where disease is known to be present. In Minnesota, APR's were suspended as part of a DNR response plan to the finding of a CWD positive deer near Pine Island, MN, in 2011. The reason for the suspension of the APR's in that case was the belief that they may impede attempts to reduce deer densities in the area surrounding the location where the CWD positive deer were detected. *(Personal communication, Dr. Michelle Carstensen, MDNR)*

Missouri responded similarly in 2012, when they decided to suspend APR's that had been in place for the previous five years, in the area where CWD has been detected in five free ranging deer. Missouri Department of Conservation Biologist Jason Sumners indicated the reasoning behind the decision to make regulation changes in the CWD outbreak area;

*“According to Sumners, the reason for the regulation change is that management strategies such as antler-point restrictions, which protect yearling males and promote older bucks, have been found to increase prevalence rates and further spread the disease. Sumners explained that yearling and adult male deer have been found to exhibit CWD at much higher rates than yearling and adult females so a reduction in the number of male deer can help reduce the spread of CWD. He added that the movement of young male deer from their birth range in*

*search of territory and mates is also a way of expanding the distribution of CWD.” MDC online - Missouri Department of Conservation - MDC open house on CWD next steps June 2 in Macon County.*

In February of 2013, Pennsylvania announced the finding of 3 CWD positive deer in their free ranging deer population, in an area close to the border with Maryland, which has had a history of CWD in its free ranging herd. The CWD response plan in Pennsylvania, which was adopted in 2011, authorizes the Pennsylvania Game Commission to eliminate antler restrictions in established disease management areas, as part of risk mitigation efforts designed to limit the spread of CWD. If the PGC decides to do so, Pennsylvania will become the third state to suspend or rescind APR's in areas where communicable cervid diseases have been found.

## **Conclusions**

The primary motivation behind APR initiatives is the desire of some hunters to have the opportunity to harvest greater numbers of older bucks with larger antlers than are typically available in herds managed under more traditional management regulations. There is no biological benefit or any demonstrable change in the underlying health of herds that are managed for an older buck age structure, at least for Northern herds like we have in Michigan.

The lack of any biological benefit resulting from APR's was one of the reasons that the NRC decided to implement the stakeholder QDM initiative process. At the time that the NRC formulated this process, in 1998, very little was known about the potential disease implications that might result from managing herds for a specific gender and age distribution. Over a decade has passed since then and there is a great deal more scientific information available, that justifies a review and potentially a revision of previously enacted policies.

There is little reasonable debate about whether or not Antler Restrictions increase the number of older bucks in the herd. This is both intuitive (protect younger ones and they become older ones, as exemplified in “Let them go, so they can grow”, the catch phrase promulgated by QDMA) and it's been repeatedly demonstrated by the data generated by virtually every APR experiment that has been tried, whether on a state wide basis like Pennsylvania, a zone wide basis as has been employed in Missouri and

parts of Minnesota or in county wide experiments like the one that has occurred in Michigan's Leelanau County, The results are clear, APR's do in fact result in an increase in the number of older bucks in a herd and protect a greater number of yearlings from being harvested when they are 1.5 years old, allowing increased dispersal.

Increasing the number of older male deer in the herd, which collectively have a substantially higher incidence rate for communicable disease and who have significantly more social interaction with non-family group deer, substantially increases the risk potential for the spread of disease. Protecting yearling males, who have either recently dispersed or are in the process of dispersing outside of their natal range, significantly increases the potential for the spread of disease outside of established core areas.

Management strategies intended to limit the potential spread of communicable disease, while decreasing the average prevalence rate in a herd, should focus harvest pressure equally on male fawns and yearling bucks, as well as emphasizing the harvest of antlerless deer. A low density herd with a younger buck age structure should be the goal of herd management policies and regulations in areas where disease is present or is likely to be a factor.

The resulting increase in the potential for the spread of communicable disease is a tangible result of implementing APR's and one which has the potential to negatively impact both the free ranging deer herd itself but also the beef and dairy industry in the areas where these APR's are put into place. It would certainly seem that public deer management policy should err on the side of caution and take steps to try and minimize and mitigate any potential negative biological impacts that could result from the implementation of socially motivated regulations. Managing the herd for a younger overall buck age structure in areas where disease is known or suspected to be present would be a prudent and effective method of reducing the potential threat that is posed by communicable disease.

## Recommendations

Based on the substantial amount of scientific evidence that is available that documents the fact that older male deer have a significantly higher rate of both CWD and bTB and that an older male age structure creates a herd that has a greater potential for spreading these communicable diseases and the fact that APR regulations protect the component of the herd which has been demonstrated to have the greatest potential to travel the farthest outside of a core area, the following recommendations are suggested to mitigate the potentially negative impact resulting from APR's that might occur if and when CWD or bTB are found in areas of Michigan where they do not currently exist.

- 1) We recommended that the Natural Resources Commission amend the current CWD response plan and establish a similar regulatory "trigger" in regards to APR's, as is currently part of the baiting and feeding regulations in Michigan. That in the event CWD is found within in Michigan, a moratorium would be enacted on any APR's that are more restrictive than the 3" and 4 pt. restrictions currently included in the combo deer license regulations, that are in effect in any CWD containment zones that are established. The moratorium would be maintained for a minimum of three years from the date of enactment, subject to review after that time period, depending on the results of subsequent testing during the moratorium period.
- 2) That counties located in either the Modified Accredited Zone (MAZ) or within the Modified Accredited Advanced Zone (MAAZ) and any counties that have prior instances of bTB positive deer being found in the free ranging deer herd, be automatically excluded from any stakeholder driven "QDM" APR initiatives.
- 3) That the hunters choice APR's that were instituted by the NRC several years ago, in Michigan's bTB zone, be repealed and replaced with the standard 3" and 4 pt. restrictions that are currently part of the combo license regulations.

Enacting these recommendations would be consistent with managing the resource based on the best available science and would be a prudent and effective means of

limiting and containing the current disease situation that we face in Michigan, as well as an effective prophylactic means of limiting the potential impact and spread of any future incursions of communicable disease, that are likely to come to Michigan in the relatively near future. Ignoring the potentially negative biological consequences, that may result from socially driven regulatory changes, puts the resource at risk and also poses an unwarranted and unacceptable increase in risk to the economic viability of the beef and dairy industry in Northern Michigan, as well as the numerous ancillary businesses that are dependent on that industry.

One final note, the concerns that have been voiced in this paper and the recommendations that are entailed within it will be viewed by many, particularly by many QDM proponents, as being anti-APR or anti-QDM in nature. It is not our intent, nor should this paper be misconstrued to be an attack on APR's or the QDM philosophy. We would agree with the opinion offered by the DNR's wildlife division, that the goals of APR's are generally social in nature and that there are no significant biological impacts resulting from their implementation, either positive or negative. The exception to this statement is when APR's are applied to areas where disease is known to be present or that have had a previous history of communicable disease being present in the free ranging deer herd. Absent any current or previous disease concerns, we have no objection to the stakeholder initiative method of determining socially motivated regulations being used to implement such regulatory changes. Note that we have not included in our recommendations the suggestion that the stakeholder APR initiative process, as currently formulated by the NRC, be abandoned. Our concerns are focused on the potentially negative biological impact that may result from the implementation of APR's in areas where disease is known to be or has a history of being found in the free ranging deer population. In those scenarios, biological considerations should trump the social desires of hunters and the NRC should be making the required regulatory decisions based on the preponderance of sound and objective scientific information.