Baiting and feeding of deer in Wisconsin – Update 2008

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Executive summary
Since the discovery of Chronic Wasting Disease (CWD) in Wisconsin and Bovine Tuberculosis (TB) in Michigan and Minnesota, the controversy surrounding baiting and feeding deer in Wisconsin has grown. Although contrasting views on the ethics of baiting and feeding are vigorously debated in the hunting community, recent scientific data regarding the presence and distribution of CWD in Wisconsin, and deer population management needs unequivocally require ending deer baiting and feeding. In the past two years, the case for prohibiting baiting and feeding in Wisconsin has been strengthened by additional research into deer disease transmission and the behavioral responses of deer to the repeated placement of small volumes of food.

CWD and TB are transmitted through deer to deer contact and concentrations of deer are likely to favor the transmission of infectious agents. CWD is also transmitted through exposure to a contaminated environment and TB is transmissible from contaminated food and feed sites (Whipple and Palmer 2000). Baiting and feeding cause unnatural concentrations of deer and their activity likely increasing the risk of disease infection and spread. Repeated use of feeding and baiting areas poses a long term risk of disease transmission.

Baiting and feeding practices likely alter deer movement patterns as well as increase the carrying capacity for deer in Wisconsin. These factors complicate deer management in several ways. First, if deer are not moving as much as they historically have or if they are not moving during hunting hours, they are not vulnerable to harvest (the primary tool for deer management). Second, increasing deer carrying capacity through the artificial and repeated placement of food increases deer production and survival while mitigating the limiting effects of a harsh winter. A third factor is the effect on deer distribution. Deer are often drawn by artificial feed into residential clusters or posted property where firearm discharge is unwelcome or access restricted. The resulting patchy distribution of deer often causes hunters to question population estimates and to resist herd reduction efforts.

Deer impact forest composition and structure statewide. Artificially high deer populations supported by baiting and feeding magnify the breadth and depth of deer impacts. In some areas, forest regeneration of all but a few species (e.g. spruce and fir) cannot be maintained without expensive protection measures. Some hardwood forests managed under uneven-aged forestry systems do not contain any successful regeneration of desirable species less than 10-15 years old. In some areas with very high deer populations, even red pine plantations, generally considered unpalatable, are being severely browsed. Foresters have identified deer as a leading statewide barrier to successful regeneration. Overabundant deer populations can cause widespread damage to vegetation, local extirpation of plant species, alteration of habitat for other wildlife species, and reduced biological diversity.

From an agricultural perspective, the discovery of TB in the dairy state would result in the dairy and beef industry losing its TB free status. This would cost producers an estimated $1.9 million in annual testing costs alone. Michigan estimates that TB has cost its producers $121 million over 10 years. TB distribution in Michigan is linked to the distribution of deer feeding. Public costs (those covered by state taxpayers) would include testing suspect herds, euthanizing infected herds and disposing of carcasses, paying indemnities for producers, and disinfecting the property.

History
The history of deer baiting in Wisconsin is not very well documented. It appears there was always some level of baiting, particularly in the middle-north forested region, prior to the late 1980s. This low level of activity was probably due to the perception that baiting was illegal. Growing awareness that baiting was legal in the late 1980s and early 1990s is believed to have resulted in a sudden increase in baiting. A survey of Wisconsin deer hunters following the 1992 hunting season revealed that 75% of hunters who baited had been hunting with bait for less than 5 years (84% had hunted deer for more than 6 years; Petchenik 1993).

The same survey also found that statewide during the 1992 gun season, 17% of gun deer hunters reported using bait. However, the frequency of baiting was greater in the north, where 24% of the gun deer hunters reported using bait. A 1999 Wisconsin Department of Natural Resources (WDNR) survey of Wisconsin gun deer hunters found that 16% reportedly used bait (Dhuey and McCaffery 1999). A similar survey of bowhunters found that 34% of archers used bait in 1997 (Dhuey 1998). These are self-reported figures and may be biased low due to public controversy surrounding deer baiting.

In Wisconsin, attempts to sustain overabundant deer populations via artificial feeding programs were initiated during the winter of 1934-35. As is often the case, public reaction to deer starvation is typically characterized by a strong desire to provide artificial feed for starving deer rather than to reduce deer densities to the carrying capacity of the range. Unfortunately, previous experiences of other states are seldom used to guide subsequent deer feeding programs. A notable exception to this general rule was Michigan's steadfast refusal to initiate artificial deer feeding as a part of their game management program (Dahlberg and Guettinger 1956). In 1951, the Michigan Department of Conservation stated that "artificial feeding has been tried over and over again in a dozen states. It's record is 100% bad. It has never worked because the underlying principles are wrong. It has no part in scientific deer management and should be forgotten once and for all (Anonymous 1951)."

The Department of Natural Resources has the public trust responsibility for regulating deer baiting and feeding subject to the limitations in State Statute 29.336. In response to the discovery of CWD in Wisconsin in 2002, the Department, through emergency Administrative Code procedures, placed a statewide prohibition on deer baiting and feeding. In 2003, the Department promulgated a permanent Administrative Code that prohibited deer baiting and feeding. During legislative review of Administrative Code, the Assembly Natural Resources Committee and the Joint Committee on Review of Administrative Rules (JCRAR) objected to the Agency's rule. The JCRAR introduced a bill that made baiting and feeding of deer legal by state statute, and limited the Agency's authority to regulate the practices. The state Assembly and Senate passed the bill and it became law in 2003.

The law allows the DNR to prohibit deer baiting and feeding in counties where CWD has been detected and in counties adjacent to counties where CWD has been detected. Currently, deer baiting and feeding are prohibited in 26 counties and most major conservation groups in the state support prohibiting these practices statewide.

Ethics
Ethics are a continuum of principles and practices by which hunters self-regulate. Ethical arguments have been waged over baiting and feeding in Wisconsin since at least 1990. A Michigan DNR report (Witcomb 1999) also indicated that the controversy among hunters was initially driven primarily by their perceptions of hunting ethics and only recently became a

biological issue as a result of disease concerns. Further, in their ethical arguments of baiting and feeding of deer, Brown and Cooper (2006) suggested that feeding is part of the domestication process that may subsequently lead to increasing desires for private ownership of wildlife. Likewise, Ortega y Gassett (1995) noted that baiting adds to the advantages of hunters over the hunted and consequently may decrease hunter satisfaction and increase concerns of anti-hunters and the non-hunting public. Brown and Cooper (2006) also suggested that on a "Hunter-Shooter" continuum, baiting and feeding practices have contributed to a sharp increase in the number of "shooters" in recent years. Equally disturbing is that shooters have little or no knowledge of deer biology or behavior, have limited hunting skills, and participate for the kill rather than the hunt (Brown and Cooper 2006). Although ethics discussions are interesting philosophically, their relevance to the issue of deer baiting and feeding pales in light of the numerous biological reasons to prohibit the practices.

Disease management

Chronic Wasting Disease is of immediate concern in Wisconsin due to discovery of the disease in the state in 2002. The route of CWD transmission among free-ranging deer remains uncertain (Grear et al. 2006), however, feces and saliva are the most likely sources of prion transmission (Sigurdson et al. 1999). High concentrations of prions at the surface of the tongues of infected animals further implicates saliva as a source of prion shedding and infection of other animals (Bessen et al. 2005). The presence of prions in saliva and oral transmission of CWD through saliva were confirmed by Mathiason et al. (2006). was confirmed by Mathiason et al. (2006). Deliberate eating of feces by deer has been reported while studying food habits of semi-tame deer (Bauer 1977, Shedd 1981). Fecal pellets also may be ingested incidental to feeding (Thompson et al. 2008). It is very likely that CWD will spread more efficiently in higher concentrations of deer. In general, high population densities of deer favor the transmission of infectious agents (Davidson and Doster 1997). Baiting and feeding cause unnatural concentrations of deer increasing the risk of disease infection and spread. In response to the discovery of CWD in a captive deer herd in September 2008, the state of Michigan banned deer baiting and feeding in the entire Lowever Peninsula.

Indirect (environmental) transmission of CWD also is efficient. It was previously known that "highly" contaminated sites could transmit CWD to healthy animals (Williams et al. 2002). Subsequent experience suggests that CWD transmission can occur in more subtly contaminated environments. Several mule deer in one enclosure contracted CWD within a year and transmission is believed to have come from excreta deposited more than 2 years earlier. In another enclosure, deer were infected from decomposed carcasses after nearly 2 years (Miller and Wild 2004).

Thompson et al. (2008) assessed the potential for direct and indirect transmission of infectious disease (CWD) for different feeding quantities and methods based on deer use and behavior patterns at experimental feeding sites and natural feeding areas. In their Wisconsin study, deer spent more time foraging at bait piles than elsewhere and spent more time in close proximity to other deer at bait piles. They noted unusually large groups of deer at bait sites. Obviously, deer concentrated their use and spent more time where bait was present, all of which increased the risk of disease transmission. This project further explored the use of a limited amount of bait (the two gallon law) and concluded that while limiting the amount of bait used could limit the amount of feed individual deer consumed, it did not limit deer use of the site. These findings underscore concerns about potential disease contamination and transmission at sites where feed is repeatedly replaced and deer are habituated to revisit. Further, Miller and Williams (2003) found that horizontal transmission of CWD was "remarkably efficient" and warned against concentrating

deer in captivity or by artificial feeding; baiting and feeding cause unnatural concentrations of deer increasing the risk of disease infection and spread.

CWD prevalence was nearly twice as common (10% vs. 6%) near residential developments in Colorado when compared to undeveloped areas suggesting anthropogenic influences (Farnsworth et al. 2005). Possible mechanisms for higher infection rates included "artificial feeding around residences that concentrate deer at a few points on the landscape." Supporting their concern was evidence from Miller and Wild (2004) indicating that CWD can be transmitted via exposure to live infected animals or to environments contaminated with excreta or carcasses from infected animals. A Florida study also found that feeding significantly increased deer density, distribution, and group size near households that were feeding deer (Peterson et al. 2005).

Feeding site density is correlated with TB frequency in deer. Previous studies have confirmed that TB bacteria will live outside in frozen condition for up to 16 weeks (Whipple and Palmer 2000). Recent studies have linked the density of feeding sites with the frequency of TB infection among deer in Michigan (Hickling 2002, Miller and Williams 2003, Hickling et al. 2004). Modeling by Hickling (2002) suggests that TB incidence may not be spreading under current deer herd management (herd reduction and reduced feeding). However, projections indicate that Michigan is unlikely to achieve their goal of TB eradication among wild deer unless there is greater support from stakeholders for more aggressive deer herd reduction and for banning provision of artificial foods (Hickling 2002).

Evidence indicates that there is little or no natural resistance to CWD among deer (Williams et al. 2002) and that very high infection rates (>70% of adults) have been documented in captive situations (Edwards ranch NE, Hall Farm in Portage Co WI, 89% in a study by Miller and Williams 2003). The latter authors state directly that “concentrating deer in captivity or by feeding them artificially may facilitate transmission.” Disease establishment elsewhere in Wisconsin remains a major concern. A statewide prohibition of baiting and feeding of deer is one proactive measure that can be taken to reduce the likelihood of disease outbreak and transmission.

Deer population management

Baiting and feeding deer has the potential to increase the carrying capacity for deer in Wisconsin. On average, deer need about 5,000 calories (kcals) per day – the equivalent of about 3 pounds of corn. The cumulative amount of energy being placed in the environment by baiting and feeding deer has not been quantified in Wisconsin. However, DNR questionnaire surveys have shown that 17% of gun- and up to 40% of archeryhunters admit using bait (Dhuey 1998, Dhuey and McCaffery 1999). There is no estimate on the quantity of bait placed by Wisconsin hunters. But, Michigan hunters self-reported placing 13.1 million bushels of bait in 1991 when there was no quantity restriction (Michigan DNR 1992). [A biased implication here as WI hunters no doubt placed much less.]

There are approximately 550,000 rural households in Wisconsin. There is no estimate of the proportion of households that feed deer, nor is there an estimate of the average quantity placed per household. However, any resident that would feed 2 gallons per day during a 150-day winter would place a ton of feed. If they were to feed 2 gallons per day year-round the cumulative quantity would be 2.5 ton per site. At the height (1950- 51) of State sponsored winter feeding of deer, only 1,131 tons of food were distributed (Dahlberg and Guettinger 1956:183).

Numerous ecological studies have shown that supplemental feeding of deer increases diet quality and quantity, which subsequently increases winter survival rates, population productivity, and hence rapid deer population growth (Brown and Cooper 2006). It can be expected that carrying

capacity for deer would increase as energy (food) was added to the system. Exploratory modeling that compared the 1980s with the 1990s suggests that the rise in baiting and feeding activity since 1991 contributed to increasing carrying capacity by a factor of 3-4 times in northern Wisconsin (Van Deelen, unpublished data). An impact of this magnitude from ad hoc baiting and feeding seems plausible when compared with results of 4 ad lib feeders on a square mile in the Cusino enclosure in Michigan. Here carrying capacity was believed to have been increased by a factor of 7-10 times (Ozoga and Verme 1982). Any rise in carrying capacity poses herd control difficulties and potential negative environmental impacts. Though disease risks are of greatest concern, degradation of habitat resulting from baiting and feeding deer has been documented throughout the U.S. and Canada (Brown 2004, Cattet 2004).

It is likely that the yearly and nearly ubiquitous availability of bait and feed is affecting, in part, deer production, survival, distribution and behavior. While some may view these impacts as favorable, most ecologists do not (Waller and Alverson 1997). Baiting and feeding are widely believed by non-baiting hunters to alter daily and geographic behavior of deer and to impair harvest opportunities. Skewed deer distribution also causes many hunters to question population estimates and to resist herd reduction efforts. This artificial energy is also believed to affect timely yarding and winter mortality which are part of the natural process for deer close to the northern limit of their range. Also, to the extent that this artificial energy elevates deer densities, it clearly impacts the distribution and abundance of other plant and animal species in the environment. Baiting and feeding appear to be confounding herd control efforts because deer behavior and distribution (and vulnerability to harvest) can be altered, and herd productivity and survival are likely artificially elevated.

Baiting and feeding causes unnatural concentration of deer

People use baiting and feeding to concentrate deer for enhanced individual hunter opportunity or viewing. In northern deer, seasonal concentration in deeryards is a well-known phenomenon (Blouch 1984). However, the potential for close animal-to-animal contact over a feed pile is fundamentally different than the contact yarded deer experience while foraging on natural food or at a food plot. Food sources in deer yards and food plots are widely distributed over a large area and they are not replaced. Moreover, browse is typically held aloft on the plant stem such that fecal and other contamination is less likely.

Garner (2001) demonstrated that, relative to natural forage, supplemental feeding caused reduced home range sizes, increased overlap of home ranges in space and time and dramatic concentrations of activity around feeding sites. Thompson et al. (2008) (see earlier discussion) replicated these conclusions in Wisconsin finding that large groups of deer spent more time close to feeding sites than at control sites. They also emphasized that limiting the amount of food or bait *does not* limit deer use or contact. There is no safe limit to deer feeding and baiting. Habituating deer to repeatedly return to feeding sites increases the probability of disease transmission as these sites become progressively contaminated with saliva, nasal droppings, urine, feces, and pathogens.

Deer hunting management

Over the past few years, wardens report that baiting and feeding for deer has grown to the point that it impacts the natural movement of deer which negatively impacts hunters' opportunity to harvest. Concerns also include influencing distribution of deer, cabin shooting, and conflict, particularly on public land (Stark 2006).

Illegal baiting and feeding was by far the most prevalent violation encountered by wardens during the past 3 gun deer gun seasons. The number of illegal baiting violations increased to 331, up

30% from the 2006 record of 254. The number of illegal feeding violations increased 82%, from 45 to 82.

In the southern 1/3 of Wisconsin, baiting and feeding have been prohibited since 2002 in an effort to affect the distribution and prevalence of Chronic Wasting Disease. Wardens reported baiting and feeding violations were up considerably in the Northern, Northeast and West Central Regions, but have decreased in the South Central and Southeast Regions (where baiting and feeding are prohibited). There has not been any effort or initiative to reinstate baiting and feeding in southern Wisconsin and hunter success has not been hampered by its prohibition. Moreover, a Wisconsin study found that baiting, as practiced by hunters, had little to no effect on final fall deer harvest totals (Van Deelen et al. 2006).

Baiting is often one of the contributing factors increasing the amount and intensity of conflict among hunters and landowners on both public and private property. Several years ago hunters reported that they saw more deer the year deer baiting and feeding was banned because deer reverted back to natural movement patterns. In talking to hunters, wardens have learned that baiting has created a widespread reactive response in the hunting community. Many hunters contacted would prefer not to bait, but feel they must bait to compete. Wardens also have reported an exponential increase in cabin shooting, a term used to describe situations where people place feed close to a dwelling, illuminate the feed with a light, and illegally shoot deer at night from the dwelling. Consequently, wardens are spending tremendous amounts of time on issues relating to baiting and feeding. This is time that could be spent elsewhere if baiting and feeding were not consuming a growing amount of the financial and human resources in the warden service.

Food plots

The Department does not promote food plots as an acceptable deer management practice for many of the same privatization, ethical, and human conflict issues identified above. Additionally, planting food plots can have the same effect of providing additional (and unnecessary) energy as a bait site or feeding station, however that effect is for a more limited time (food is not replaced) and spread geographically over a greater area. As a result deer to deer contact and local site contamination is less likely to occur at a food plot than at a bait site or feeding station thus significantly reducing the risk of disease transmission at a food plot.

Ecological impact of deer

Forestry

Deer impact forest composition and structure statewide. Artificially high deer populations supported by baiting and feeding magnify the breadth and depth of deer impacts. Overabundant deer populations affect valuable treess, shrubs, and flowers. In some areas, foresters are unable to regenerate preferred tree species following logging operations due to deer overbrowsing on tree seedlings. Long-term overpopulation of white-tailed deer and a ubiquitous ground cover of Pennsylvania sedge have dramatically reduced or eliminated regeneration of commercially important northern hardwood species on approximately 35,000 acres of forestland owned by International Paper Company (IP) located in the southern Upper Peninsula of Michigan and northern Wisconsin (Proceedings of the Michigan Society of American Foresters 2005).
Some hardwood forests managed under uneven-aged silvicultural systems do not contain any successful regeneration of desirable species less than 10-15 years old. In some areas with overabundant deer populations, even red pine plantations, generally considered unpalatable, are being severely browsed. Foresters have identified deer as the number one statewide barrier to successful forest regeneration and have reported substantial problems where deer populations exceed 20-25 deer per square mile of deer range. Consequently, overabundant deer populations

can cause widespread damage to vegetation, local extirpation of plant species, alteration of habitat for other wildlife species, and reduced biological diversity.

High deer populations and over browsing of forests in Wisconsin has drawn the attention of forest certification auditors. Observations during a recently completed 2008 field audit on Wisconsin's County Forest system led to the following recommendation from the lead Forest Stewardship Council (FSC) field auditor; "The Wisconsin County Forest Program in cooperation with WDNR should take additional measures to reduce the deer population to levels where ecosystem health is not compromised by deer browse. " Observations by forest certification auditors include: "Deer browse in certain areas of the State is contributing to regeneration failures of desired species. Wisconsin County Forest Program is to be commended for its attempts to influence the legislature regarding deer harvest goals and policy, however, deer population numbers and impacts to regeneration remain problematic".

During a field visit in Bayfield County the forest certification auditor observed a site where the county had conducted an oak shelterwood cut in 2006 retaining 50 sq ft of basal area. The sale was 47 acres in size and the county fenced 29 acres. The auditor called the difference between the fenced and unfenced areas "dramatic". The auditor went on to say that this demonstration provided a "compelling case that a forest with ˜35 deer per sq mile (which is over 70% above goal) is severely impacted."

Aldo Leopold warned of the threats to forests from overabundant deer in the 1930s and 1940s, and subsequent research (e.g., Côté et al. 2004; Rooney 2001; Rooney and Waller 2003; Horsley et al. 1983) has confirmed a host of direct and indirect ecological effects which accumulate over time. Tremblay (2005) summarized these effects as follows:

> *"By foraging selectively, deer affect the growth and survival of many herb, shrub, and tree species, modifying patterns of relative abundance and vegetation dynamics. Cascading effects on other species extend to insects, birds, and other mammals. In forests, sustained overbrowsing reduces plant cover and diversity, alters nutrient and carbon cycling, and redirects succession to shift future overstory composition. Many of these simplified alternative states appear to be stable and difficult to reverse."*

Tremblay's last observation is particularly troublesome; i.e., reducing deer density does not guarantee that their ecological effects can be reversed. High deer populations can therefore directly threaten long-term forest sustainability (Proceedings of the Michigan Society of American Foresters 2005).

In Pennsylvania, as in other eastern states, deer have increased in abundance since the 1920s. Likewise, negative deer impact has increased on tree regeneration, and on shrub and herbaceous vegetation survival. Pennsylvania forest certification is threatened by the lack of regeneration due to overbrowsing from deer. Browsing by white-tailed deer was identified as the most important biological impediment to sustainable forestry on a majority of 16 certification assessments conducted in the northeastern United States (Proceedings of the Michigan Society of American Foresters 2005).

<u>Specific forestry concerns include:</u>

1. <u>Failure of regeneration, resulting in unsustainable forest management.</u>
    - In a 2005 reforestation survey of practicing DNR foresters, deer browse was identified as the most significant barrier to successful artificial regeneration; 81% of respondents identified deer browse as a problem.

- Forest certification specifies regeneration standards. Deer browsing can result in regeneration failures that require corrective actions to maintain certification. These corrective actions can be expensive or infeasible, but if not implemented could result in the loss of certification.

2. Increased regeneration costs, through regeneration failure, repeated silvicultural treatments, and expensive protection of regeneration (e.g. fencing).
3. Reduced tree growth rates and productivity, through regeneration failure, unacceptable stocking of desired species, delayed establishment, and slower growth from repeated browsing.
4. Altered forest tree composition, through browsing preferences and impacts on regeneration. Some species are killed by browsing while others are placed at a competitive disadvantage. Examples:
    - Hemlock and white cedar: these historically predominant species are very susceptible to browsing, and regeneration is often reduced, resulting in a significant shift in ecosystem composition.
    - Maples, birches, and oaks: regeneration of these economically important species often is severely impacted, and can be eliminated under severe browsing pressure.
    - White pine: regeneration often is impacted, resulting in reduced growth and extended establishment period.
    - Red Pine: avoided at low deer populations with abundant food, but deer can cause significant damage when other food sources are lacking.
5. Altered composition of understory plant communities, through browsing. At high deer densities, seedling and herbaceous plants can be extirpated, leaving only barren ground, grasses, or ferns. Lilies and orchids are particularly vulnerable.
6. Altered composition of animal communities, through alteration of plant community composition and structure.

Deer herbivory in Wisconsin forests is causing economic and ecological losses by reducing tree survival and growth, and altering species and age class composition. The continued overabundance of deer can directly threaten the future of sustainable forestry. Research in Pennsylvania has shown that future economic impacts are avoidable, and that detrimental ecological impacts to forest plant and animal communities are preventable but only if action is taken to reduce deer numbers. The opportunity to reduce the economic and ecological effects is within reach if deer numbers are reduced in a timely and strategic manner.

Ecosystems

By the nineteenth century, natural historians recognized that overabundant deer could exclude certain plants from European landscapes (Watson 1983). Systematic studies of deer overabundance, however, did not occur until after the emergence of wildlife ecology, developed by Aldo Leopold. Based on his experiences with the dangers of deer overabundance, Leopold was the first to discuss threats posed by growing deer herds (Leopold 1933, Leopold et al. 1947). Leopold's warnings sparked an initial period of concern in the 1940s and 1950s, mainly in the midwestern United States, which prompted the construction of exclosures to demonstrate the influence of native deer on forest regeneration (Beals et al. 1960, Pimlott 1963, Stoeckler et al. 1957, Webb et al. 1956). Interest in deer impacts expanded in the 1970s, primarily in the Midwest and the Allegheny region of New York and Pennsylvania (Anderson and Loucks 1979, Behrend et al. 1970, Harlow and Downing 1970).

Seminal experiments on the population dynamics of white-tailed deer on the George Reserve in Michigan were conducted in the 1970s (McCullough 1979). The introduction of deer into a fenced area demonstrated that, because deer have such a high potential rate of increase, they can

easily overwhelm the carrying capacity of their environment and consequently have strong and persistent negative impacts on vegetation (McCullough 1979, 1997).

In North America, the study of deer impacts soon broadened to include birds (Casey and Hein 1983), interactions with weeds (Horsley and Marquis 1983), and long-term effects on forest composition (Frelich and Lorimer 1985) and sapling-bank diversity (Whitney 1984). By the late 1990s, impacts resulting from high deer densities were being tallied in review articles (Alverson et al. 1988; Gill 1992a, b; McShea and Rappole 1997a, b; Miller et al. 1992). Tilghman (1989) quantified direct effects of overbrowsing on regeneration of tree seedlings, wood shrubs, and herbaceous plants in hardwood forests in northwestern Pennsylvania while DeCalesta (1994) noted deer overbrowsing contributed to declines in species richness and abundance of canopy-nesting songbirds. To this end, high deer populations in northern Wisconsin (and elsewhere) artificially supported by baiting and feeding are ecologically troubling. Forest regeneration is negatively impacted by high deer populations and the forest industry will continue to be affected by wholesale type conversions of Wisconsin's forests.

Recent research of plant communities in Wisconsin provides valuable information on changes in species composition over time and clues about the cause of these changes. The ecological impacts associated with deer herbivory on native plant communities are large and long term. Excess herbivory on palatable and browse-sensitive plant species can restructure native plant communities such that biodiversity is lost, species composition is altered, and vegetative structure is simplified. Numerous adverse effects of overabundant deer populations on plant species composition, regeneration and productivity (particularly on eastern hemlock, northern white cedar, Canada yew, yellow birch, and numerous herbaceous species) have been noted throughout northern Wisconsin and nearby areas of the Lake States since the early 1940s (Beals et al. 1960, Mladenoff and Stearns 1993, Rooney and Waller 2003, LeBouton 2005, Hurley and Flaspohler 2005). These cumulative impacts have contributed to ecological degradation of forested ecosystems (Stoeckeler et al. 1957, Waller and Alverson 1997, Rooney 2001) and economic losses have been observed in forestry regeneration projects across Wisconsin.

Although many plant species are negatively impacted by high deer populations, some benefit. Species that have benefitted from deer overbrowsing include both common native species and invading exotics. Decreasing species are mostly rarer native forbs that appear sensitive to desiccation, anthropogenic disturbance, and/or herbivory by white-tailed deer. The fact that the species that have increased are the ones that resist or tolerate deer herbivory while many of those that have decreased are sensitive to deer suggests that deer may be a key driver of the shifts we observe in these forests.

Agricultural Industry

An outbreak of Bovine Tuberculosis in wild deer would result in Wisconsin losing its TB-free status. Agriculture officials estimate that dropping from TB-free to TB-modified accredited advanced (that's a one-level drop on a five-level scale) would cost Wisconsin dairy and beef producers about $1.87 million in testing costs annually. The drop in status would mean that other states and nations would require each animal shipped to have a TB test, where they now are accepted in most places without being tested.

There are additional costs that producers would incur. Infected herds would not be sold and producers would have to feed cattle they'd ordinarily be shipping until the herd was depopulated, Post depopulation, there would be further downtime while cleaning and disinfection occurred. . Dairy plants may decide not to accept milk from quarantined farms due to perceived liability issues. Public costs would include testing suspect herds, euthanizing infected herds and disposing

of carcasses, paying indemnities for producers, and disinfecting the property. There may be loss of consumer confidence in Wisconsin dairy products and loss of markets overseas.

In Michigan, the projected cost to producers alone is $121 million over 10 years without accounting for costs to other segments of the industry or any multiplier effects. Minnesota is just beginning an economic analysis of what their TB outbreak has cost to date. That will be helpful to us in projecting costs if we found ourselves in a similar situation. Given Wisconsin's position as a leading milk producing state, we have more to lose than Minnesota or Michigan. Recently brucellosis in cattle herds in Montana and Wyoming has been linked to brucellosis in elk and bison in the Greater Yellowstone Area. Wyoming's infected herd has been directly linked to Wyoming elk feeding grounds.

Conclusion

This paper explored the history and ethics of deer baiting and feeding and evaluated the impacts and risks these practices bring to deer disease and population management, ecologcal conservation, and to the agricultural and forest industries in Wisconsin. Repeated use of baiting and feeding sites poses a long term risk of disease transmission. Baiting and feeding practices likely alter deer movement patterns as well as increase the carrying capacity for deer in Wisconsin. High deer populations are a leading statewide barrier to successful forest regeneration. Overabundant deer populations can cause widespread damage to vegetation, local extirpation of plant species, alteration of habitat for other wildlife species, and reduced biological diversity. Banning baiting and feeding statewide is not a single comprehensive solution to these challenges. However, baiting and feeding deer greatly exacerbate these challenges (and others) and confound public efforts to address them. Banning baiting and feeding deer is an easy and effective approach to mitigate the unnecessary complication and risks associated with these practices.

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