Effects of Wolves and Other Predators on Farms in Wisconsin: Beyond Verified Losses

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<u>Introduction</u>

With the recolonization of gray wolves *(Canis lupus)* across the Western Great Lake States (Minnesota, Michigan, and Wisconsin) there has been a concomitant increase in livestock depredations caused by wolves (Mech 1998, Ruid et al. 2005, Treves et al. 2002, USDA 2006, Wydeven et al. 2006). Wolf populations in Wisconsin have grown from 25 in late winter 1980 to 465 in late winter 2006 with their range expanding both towards the east and south across the state. These wolf populations fluctuate during the year and perhaps double soon after pups are born in the spring, but decline to lower levels in fall and winter due to pup and adult mortalities. The official wolf count made at the end of winter thus represents the lowest number of wolves on the landscape in the annual cycle, and number of wolves that livestock could be exposed to would be higher during most of the year. With the growth of the wolf population there have been major increases in depredation on livestock, especially toward the later 1990s and into the 2000s (Treves et al 2002, Ruid et al. 2005, Wydeven et al. 2006). The majority of the livestock losses have been calves with over a half a million dollars paid to livestock, hunters, and pet owners since 1985 (Jurewicz 2007 pers. comm.). It is also worth noting that research on risk perception suggest that people focus on maximal events, not average losses, and this helps explain why so many livestock producers are anxious and may consider costly measures despite low 'average' losses (Naughton-Treves 2003).

Traditionally assessments of the economic impact of livestock operations due to predators have focused on direct losses from predation. However, there have been concerns from livestock producers in this region about the economic impacts related to factors other than the direct losses of animals killed by wolves. The very threat of depredation by wolves on livestock can be stressful to farmers (Fritts et al. 2003). Shelton (2004) reported that livestock producers have increased costs associated with efforts to prevent predation which may include night confinement, improved fencing, early weaning, choice of grazing area, or increased feeding costs from a loss of grazing acreage.

Though there is not definitive research supporting the following, it is plausible that other impacts predators may have on livestock production include abortions from the stress of being harassed by predators, disease transmission, decreased weight gain from increased vigilance by livestock living near predators, potential reduction in meat quality from stress, and emotional stress placed on livestock producers concerned about depredations.

In the remainder of this report we explore the effects of wolf and other predators on farms. We examine the literature for these effects on livestock and other aspects of the farms. We also discuss relevant anecdotal information on the effects of wolf and predator presence on farms. Lastly, recommendations for future research to measure the effects of wolf presence on farms and how such data should be used in managing wolf populations and livestock are shared.

Wolf Range and Depredations

Most wolf depredations in Wisconsin occurred especially along the agricultural /forest fringe at the southern edge of Zone 1 and northern edge of Zone 3, as well in some agricultural patches south and west of Ashland, and east of Superior in Zone 1. These areas with higher depredation rates have mostly been colonized by wolves since about 2000. In 2005, Zone 1 had 86% of the wolves in the state, Zone 2 had 10%, and Zone 3 had 4%. Distribution of the 25 farms with depredation in 2005 included 72 % in Zone 1, 4% in zone 2, and 24 % in Zone 3 (Wydeven and Wiedenhoeft 2005). Thus, depredation did not occur in proportion to where wolves occurred, but were more frequent in areas with higher presence of agriculture and livestock.

Total verified wolf depredations in Wisconsin from 1976 though 2005 included 5 horses killed, 1 horse injured, 50 sheep killed, 184 cattle killed, 7 cattle injured, 38 deer killed, 264 poultry killed, 99 dogs killed and 30 dogs injured (Wydeven et al. 2006). Depredations were relatively uncommon prior to the mid 1990s, but became a fairly regular activity after the population had reached 150 wolves. Numbers of farms with depredations on domestic animals averaged 2.8 farms annually in the 1990s, but increased to mean of 14.0 farms annually between 2000 and 2005. By 2005, the number of farms with depredation had grown to 25, and between 2001 and 2005, 54 farms had at least 1 verified livestock depredation. This highly uneven distribution of costs and benefits of wolf recovery is a fundamental challenge to wildlife managers. Private insurance is problematic in cases where most producers have minimal risk and a few have high or chronic risk. No insurance company would want to cover this risk in such a situation (Daniel Rondeau, Economist, pers. Comm.., Wildlife Society Forum on Compensation, Anchorage, Alaska).

Prior to 2005, all depredations on livestock and poultry occurred in northern Wisconsin (Zone 1 and northern portions of Zone 3). In 2005 a farm in the Central Forest (Zone 2) lost two calves, the first livestock depredation for that region. Total farms for 16 counties with wolf packs (2002) in northern Wisconsin was 6445 farms (USDA, NASS, 2002 Census of Agriculture Profile), thus the 53 farms with wolf depredation represent about 0.8 % of farms in the region. Although this would suggest that the total number of farms with wolf depredation is relatively low, not all the farms had livestock that would be at risk to depredation (i.e. confinement operations), and most farms were outside of wolf range. Thus, a small number of farms received most of the wolf depredation losses.

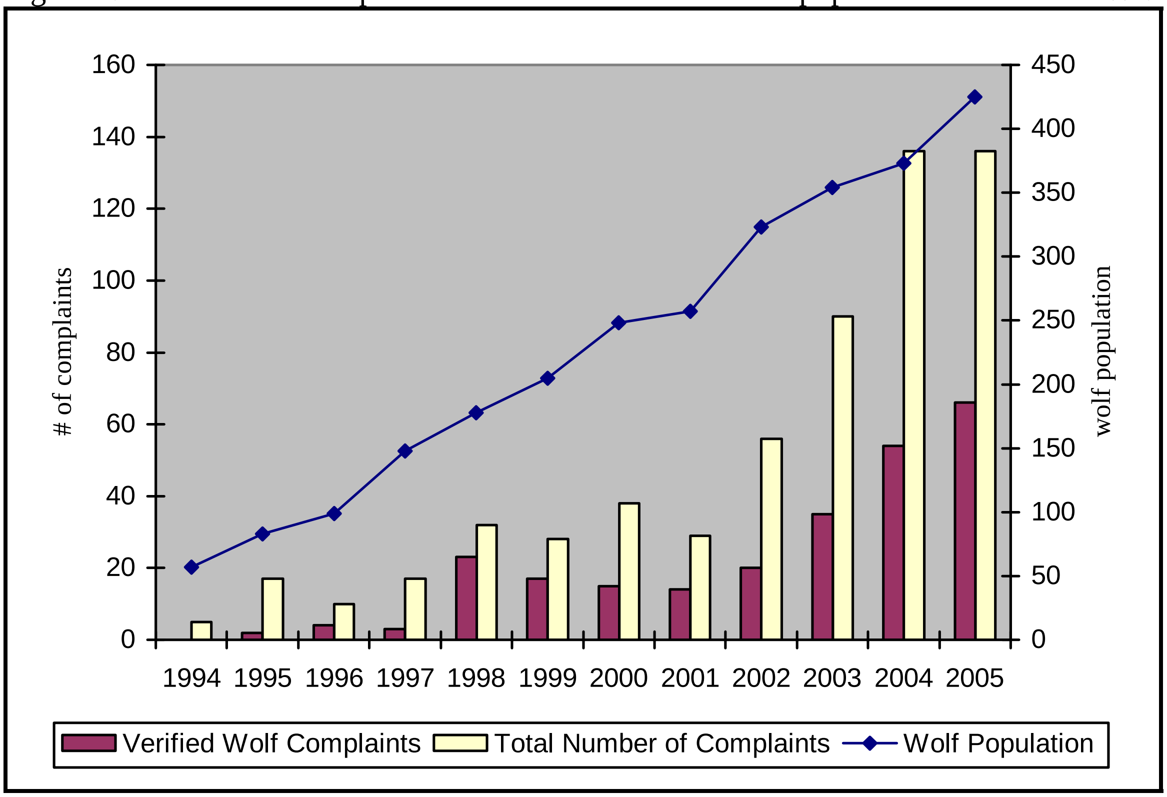
Zone 1 has an average deer goal of 19 deer per square mile, but goals varied much by deer management units, and actual deer populations have generally been above goals in recent years. Between 2001 and 2005, the average deer density for zone 1 varied from 22 to 30 deer per square mile of deer range, but individual deer management units varied from 8 to 49 deer per square mile of deer range. Zone 2 had an average goal of 27 deer per square mile of deer range, but between 2001 and 2005 varied from 29 to 35 deer per square mile of deer range for the zone, and individual deer management units ranged from 24 to 38 deer per square mile of deer range. Higher prey base and lower wolf numbers, may have been part of the reason for less wolf depredation in zone 2. High deer density or other wild ungulates near farms are sometimes a factor in increased probability of wolf depredation on cattle (Bradley and Pletscher 2005, Treves et al. 2004). On the other hand, Fritts et al. (1992) found higher rates of wolf depredation on livestock following declines in the deer herd, but even with deer densities as low as < 4 deer per square mile wild prey continued to be the most important food for wolves living near livestock in northwest Minnesota (Chavez and Gese 2005). Apparently concentration of deer and other wild ungulates near livestock can bring wolves in more regular contact and increase depredation rate on livestock, but overall healthy population levels of wild ungulates probably reduces depredation on livestock.

<u>Wolf Complaints in WI</u>

The number of wolf complaints reported to WS and the WDNR has shown an increasing trend at the same time that the State wolf population has increased (Willging and Wydeven 1997, Treves et al. 2002, Figure 1). One of the likely reasons for recent increases in wolf conflicts relates to the fact that the areas of suitable remote forested habitat are occupied by wolves, and much of the recent wolf population expansion is into agricultural areas at the edge of the northern forest or agriculture areas within the northern forest (Figure 2). Opportunities for wolf-human interactions, including conflicts, are higher in these agricultural areas. In 1994 WS and the WDNR received 5 wolf complaints; in 2005 there were 136 wolf complaints which is a 27 fold increase over 1994. In 1995 there were 2 verified complaints compared to 66 in 2005, Figure 1. Verified wolf complaints were therefore 49% of the total wolf complaints received in 2005. The remaining 51% were either not verifiable or determined to be other predators. The same effort and resources are expended to investigate verified and non-verified complaints.

The 1999 Wisconsin Wolf Management Plan has a management of goal of 350 wolves for Wisconsin. In 2002 when the minimum wolf population estimate was 323 wolves, there were 9 farms that had a livestock depredation. In 2005, there were a minimum of 425 wolves in Wisconsin and 25 farms had livestock depredations. From 2002 to 2005 the wolf population increased by 32% while farms with livestock depredation increased 178%. Continued wolf recolonization in fragmented habitats containing livestock production will continue to increase the number of farms that have verified wolf depredations and detrimental non-predation impacts.

Figure 1. Annual wolf complaints and annual minimum wolf population estimates in WI.



Missing Livestock

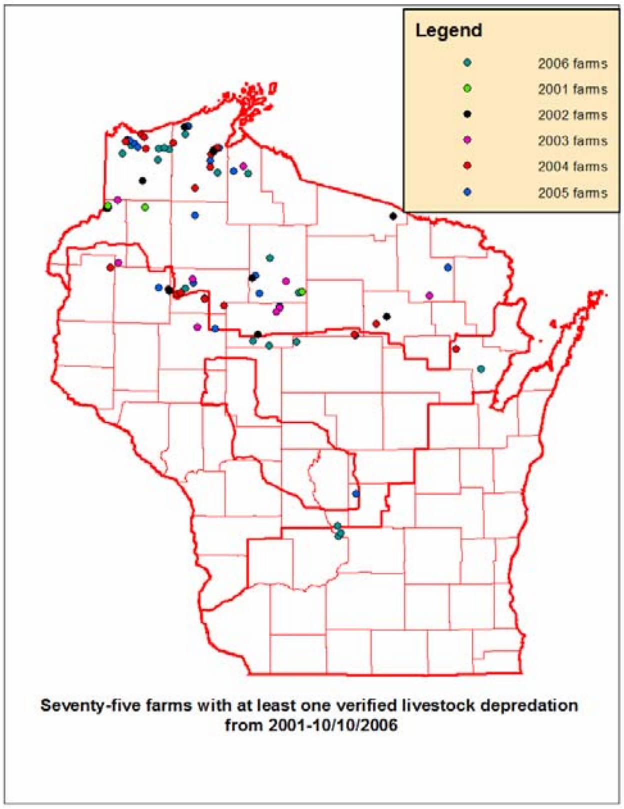
Livestock depredations nationally or on a state level are usually insignificant when compared to total livestock production or losses to disease or other factors;

however, the impact to individual producers can be substantial (Breck and Meier 2004, Shelton 2004). And the political tolerance for depredation losses is lower (Naughton-Treves 2003). Shelton (2004) suggested that the value of depredated livestock from predators is the “tip of the iceberg” concerning the actual costs that predators impose on livestock producers. One such challenge relates to livestock carcasses that may be completely consumed or removed from the damage location resulting in missing livestock or non-verified losses. Bruscino and Cleveland (2004) state that the Wyoming Game and Fish Commission have long recognized the fact that not all livestock depredated by large carnivores are detected by producers or government agencies involved in livestock depredation management. Bjorge and Gunson (1985) in Alberta suggested that cattle dying from predation are less likely to be detected than cattle dying from other causes, and they estimated that wolves caused 41% of cattle mortality during the summer grazing season. Oakleaf et al. (2003) on mountainous terrain in Idaho, reported that producers had a detection rate of 1:8 for calves depredated by wolves, but 1:11.5 for calves dying from other causes, thus lower detection for other mortalities; wolf predation represented 34 % of calf mortality during the summer grazing period. We speculate detection rates are likely to be higher in the Midwest due to the fewer acres required to support grazing livestock as well as smaller herd sizes and more intensive management, but missing livestock losses due to wolves and other predators continue to be problematic for some producers. Thus, a missing livestock policy is in place in Wisconsin to compensate livestock operations for these losses given they meet the terms stated in within the policy guidelines (Wisconsin Administrative Code NR 12.54 (2)(c)).

Missing livestock on Wisconsin livestock operations has been an issue in some cases investigated by WS and DNR personnel. The following occurred in 2004 on a cow/calf operation in northern Wisconsin that has a chronic history of wolf depredations: Wildlife Services verified wolves depredated one calf, classified two additional calves as probably depredated by wolves (they were missing with wolf signs present throughout the grazing area), and there were three additional calves that were determined to be missing because of wolf predation. This producer had 32 calves during the reported grazing season; the loss of calves on this farm from wolf predation was 19%. The producer was compensated for full market value of the animals; however, there was no compensation for time spent searching for missing animals or the increased anxiety of knowing wolves were present on the property causing damage. Another example of missing livestock in WI occurred on May 18, 2005. A farmer in Price County contacted WI WS to report he saw a wolf in his calving pasture and discovered a calf which he assumed was depredated by wolves. WI WS staff investigated the complaint. Upon arriving the farmer reported a wolf had returned to the pasture where the calf was depredated and dragged the carcass into a nearby swamp. WI WS staff was able to follow the drag trail several hundred yards and locate the calf carcass which had been depredated by wolves. There were wolf tracks clearly visible in the drag trail. Had the farmer not been vigilant, he may not have known the calf was depredated by wolves. This occurred in a 40 acre pasture adjacent to his house suggesting that movement of animals closer to human dwellings is not a guaranteed solution for preventing depredations.

To address the issue of compensating livestock producers for missing calves, the WI DNR promulgated administrative code to pay for missing calves (NR 12.54 (2) (c). This code specifies provisions producers must comply with to be eligible for missing calf compensation.

Figure 2. Farms in Wisconsin that have had at least one verified livestock (cattle, sheep, domestic fowl, and horses) depredation from 2001-2006.



Stress

The regular presence of wolves in close proximity to livestock may result in a chronic stress situation for the domestic animals. Many infectious diseases result from a combination of viral and bacterial infections and are brought on by stress (Faries and Adams 1997). Stress can result in increased susceptibility to disease and weight loss, reduction in the value of the meat, and interfere with reproduction (Fanatico 1999). Stress prior to slaughter is thought to be a contributor to "dark-cutters," meat which is of unacceptable color not being the normal bright cherry red but rather almost purple. Dark-cutters are discounted severely because these meat products are difficult to sell (Fanatico 1999).

In addition, the stress of being repeatedly chased/harassed by predators can cause cattle to abort, calve early or give birth to a weak calf (Dr. Gregory Palmquist, personal communication). Repeated harassment by predators may alter livestock behavior and increase operational costs. Cattle may become difficult to handle, cow dogs may become ineffective for herding, cows that lose calves to wolves may have spoiled teats and have to be culled, livestock may be chased through fences, constant harassment may result in decisions to move livestock to different pastures, and cows may not rebreed the following season (Howery and DeLiberto, 2004).

The act of handling cattle (i.e. moving them to new pastures, administering vaccinations or tests, or shipment) is inherently stressful to some degree. Efficiently handling cattle in a way that keeps stress to a minimum is a practice most producers strive for. A handler acting like a quiet stalking predator who induces the cattle to bunch is much less stressful than chasing cattle like an attacking predator (Grandin et al. 2006). All handler movements must be at a slow walk and great care must be taken to never cause cattle to run or start milling/continued non-stopping movements (Grandin et al. 2006).

A good handler using low stress herding principles has to make movements which trigger the innate anti-predator "software" in the animal's brain. To keep stress very low only the first stages of the "program" are turned on. When a bunched group of cattle is moved to a new location they should all be headed in the same direction and walking quietly. They must not be bumping into each other or turning. If they start doing this, it is an indicator that the next step in the "program" is being turned on and the animals are getting ready for a predator attack. This will cause high stress (Grandin et al. 2006).

Howery and DeLiberto (2004) have suggested indirect effects of carnivores on livestock foraging behavior including reduced forage efficiency, greater time spent on vigilance, and possibly selection of poorer habitat and diet to avoid predators. Research on elk *(Cervus elaphus)* and bison (*Bison bison)* in Yellowstone showed that these ungulates did spend more time in vigilance and less at foraging after wolves were reintroduced , especially among cows with calves (Laundre et al. 2001, Wolff and Van Horn 2003). The impact of stress of reduced foraging efficiency could reduce weight gain and survival of ungulates. Wolves also have altered elk use of habitats in Yellowstone (Creel et al. 2005, Fortin et al. 2005), but that grazing pressure is being more evenly spread on the landscape and is reducing over-grazing and over-browsing in certain habitats (Gude et al.2006). Thus wolves may have reduced overall fitness of some animals, the overall effects to the ecosystem may be positive. Among domestic ungulates that have less flexibility to alter distribution and movements, effects of wolf predation could be more stressful.

Animal behavior factors, fear, increased aggression or difficulty in handling

Harassment by predators may cause livestock to become nervous or aggressive. Aggressive or nervous animals have no place on the farm because they may hurt humans and the other cattle that are around them. Not only are they dangerous but they will also stress other cattle and reduce their performance as well (Ellington, 2002).

Grazing animals are a prey species, and fear motivates them to escape from perceived danger (Grandin 1999). Fear based behavior is likely to be the main cause of accidents due to a horse kicking or a cow or steer becoming agitated in a chute; reducing fear improves both welfare and safety (Grandin 1999). Harassment by predators may result in agitated and reduce flight zones of cattle. Agriculture is a dangerous occupation and over a three-year period spanning the years of 2002-2004, cattle were responsible for killing 13 people in Wisconsin (http://www.wiscash.uwex.edu/Pages/StatisticsAndMisc Documents/FatalitiesReports/FatalitiesReports.htm).

Wolves that occupied a wildland–agricultural landscape matrix in northwest Minnesota, visited pastures 28% of 178 24-hour tracking sessions during the grazing season, but depredations on livestock occurred only 5 times (Chavez and Gese 2006). Therefore visitation to pastures does not necessarily mean wolves are attacking cattle, but normally wolves chase ungulates much more frequently than actual kills are made as part of the testing of the prey (MacNulty 2002). While wild ungulates are probably well adapted to being occasionally tested by predators, domestication and genetic selection for docility in livestock has likely resulted in animals more susceptible to increased stress from predator harassment.

Fence Maintenance and Repair

Cows may be stampeded through fences when wolves or other predators are actively harassing livestock. Such stampedes may injure cattle and cause additional time spent on fence repair. Regrouping cattle after they have been stampeded is difficult, time consuming and stressful to the animals, taking time and money away from other needs on the farm (Dr. Greg Palmquist, personal communication).

Wisconsin has state statutes for legal fencing requirements. These requirements do not keep predators from co-mingling with cattle. Recommendations for fencing systems that would keep predators from entering livestock areas are generally not economically viable (Dr. Jeff . Lehmkuhler, personal communication)

Increased Surveillance of Herds

Farmers who have experienced depredation by wolves or other predators often spend extra hours on herd surveillance in addition to the extra time dealing with the damage. They are probably out earlier in the morning, many times during the day and late into the evening checking on cattle. Many hours may be spent trying to locate missing animals or remains to qualify for compensation. Something else may suffer due to lack of attention since they cannot afford to hire extra help to get the extra work done. Such stress on farmers and farm families may affect the financial, psychological, and physical well-being of the whole farm (Dr. Gregory Palmquist, personal communication).

Livestock production typically is a small profit margin industry. This is especially true for the beef industry. Beef cow-calf operations on average made only $3.04/hd since 1980 (Cattle-Fax 2003). Further, according to the University of Minnesota FINBIN database, the average return to cow-calf producers spanning the years of 1993-2006 and representing 1,960 operation analyses was a loss of $42.75/hd (http://www.finbin.umn.edu). Based on this same dataset, it is reported that the average labor and management charge for these operations was $65.88/hd on an annual basis and represented 13% of the total cost of production. The reported estimated labor per cow on an annual basis was 9.65 hrs and equates to $7.11/hr in labor expenses. For the reported average herd size of 73 cows, nearly 2 hrs/day of labor was required. Increasing labor from more frequent surveillance of pastures will result in increased cost of production and reduced economic return (Dr. Jeff Lehmkuhler, personal communication.)

Limitations to moving cattle closer to barns or dwellings

Common recommendation for beef producers in areas experiencing wolf depredations is to move cattle closer to barns and human dwellings. This poses several problems. For one, it may increase risk of exposure to pathogens. For instance, it is widely accepted that post-partum cows and newborn calves should be moved to "clean" pastures as soon as possible following parturition (Dr. Jeff Lehmkuhler, personal communication). Recent research has shown that the prevalence of pathogens in the soil decreases as the distance from hay bale rings is increased (Lenehan et al. 2005). Further, many of the depredations occur during the grazing season. Since areas commonly experiencing depredations losses are classified as pastures dispersed between wooded areas, moving cattle closer to barns often require supplemental feeding. This may require feeding of the winter feed resources. Winter feed resources are the most costly feed inputs for cow-calf operations based upon Standardized Performance Analysis data. According to farm financial data from University of Minnesota, stored/purchased feed costs averaged $197.95/hd in comparison to $32.35 for grazed feedstuffs which included pasture and crop residues (http://www.finbin.umn.edu). Producers forced to move cattle closer to barns and feeding stored/harvested feedstuffs will result in lower financial returns for the operation (Dr. Jeff Lehmkuhler, personal communication).

Moving cattle too often results in increased stress, poorer performance and more sick cattle. Concentrating cattle in small areas may also increase the risk of food borne pathogens due to the increase in bacterial populations around the cattle and the immunosupression due to the stress of crowding (Dr. Gregory Palmquist, personal communication). The current recommendations to improve health in a cattle herd are to avoid overcrowding, rotate the cattle to fresh areas and avoid keeping them in the same areas year round (Dr. Gregory Palmquist, personal communication). Having to keep the cattle by the buildings to avoid predators is contrary to Best Management Practices for livestock production. Mech et al. (2000) assessed how different farm characteristics or husbandry practices affect the incidence of wolf depredation on 41 chronic farms and 41 matched farms without wolf depredations in Minnesota and concluded the type of husbandry practices were not different. The affects of carcass disposal were inconclusive. Size of farm, number of animals, and distance animals are from buildings were the only assessed factors that differed between chronic farms and farms without wolf depredations.

Abortions and Disease Transmission Concerns

The role wolves and other predators play in spread of diseases is complex. Wolves and other predators may reduce spread of diseases that potentially affect humans and ungulates (Ostfeld and Holt 2004, Packer et al. 2003, Stronen et al. 2007, and Wild et al. 2005). Yet, wolves and other wild canids may be infected by *Neospora* (Gordim et al.2004a), Leptospirosis (Khan et al. 1991), and bovine tuberculosis (Carbyn 1982, Bruning-Fann et al. 2001) potentially increasing risk of disease transmission to livestock. However, it is not clear if wolves play a role in the spread of these diseases, or if infection rates reflect feeding by wolves on infected animals and this is possibly producing a culling affect of removing infected animals from the wild ungulate population (Stronen et al. 2007).

The stress of being repeatedly chased can cause cattle to abort, calf early or give birth to a weak calf (Dr. Gregory Palmquist, personal communication). Another cause of abortions in cattle is *Neospora caninum* which is a protozoan parasite. *N. caninum* has been shown to be a large economic loss to the dairy and beef industry with infected animals being three to thirteen times more likely to abort than non-infected cattle (Hall et al., 2005 and Trees et al., 1999). Larson et al. (2004) modeled the potential economic losses of *N. caninum* for beef herds and three control strategies. These authors concluded that endemic infection lowered the economic return by 22% and 29% when rates of infection were 10% or 70% when testing the entire herd and culling offspring from seropositive dams as being the most economically feasible management.

Presently domestic dogs and coyotes are the only two species that have been determined to be definitive hosts of *N. caninum* (Gondim et al. 2004b). Canids become infected by ingesting tissues (placenta, fetuses) contaminated with the organism. They then shed the organism in their feces. A cow grazing on a pasture contaminated with these feces can become infected with *N. caninum*. Once infected cows can pass the infection to their calves transplacentally (Dubey 2003).

It has been postulated that wolves are likely definitive hosts for *N. caninum* because of their phylogentic relationship to dogs and coyotes. Research in Minnesota is currently being conducted to determine if wolves are a definitive host of *N. caninum* (Bill Paul, personal communication). Gondim et al. (2004a) indicated that 39% (n = 164) of wolves from Minnesota and 11% of coyotes sampled from Utah, Colorado, and Illinois (n = 113) were sero-positive for *N. caninum*. Seroprevalence of *N. caninum* in wild canids is highly variable ranging from 0% (n = 221, Jakubek et al 2001) in red foxes in Sweden to 100% (n = 2, Patitucci et al. 2001) in Chiloe fox. Wild canids in Israel had a low seroprevalence and was not detected in 9 wolves, but the authors concluded the results could vary by region if wild canids were in areas in which they could feed on infected bovines (Steinman et al., 2006). The risk of pregnancy loss and abortions in cattle is increased with exposure to *N. caninum* (Dr. Jeff Lehmkuhler, personal communication).

The relationship between wild canids and the rate of transmission of *N. caninum* is unclear. Additional testing of wolves to determine if they are indeed definitive hosts of *N. caninum* and the rate of seroprevelence of coyotes, dogs, and wolves needs to defined for a particular geographic region before conclusions can be drawn regarding the importance of canids transmitting this disease to cattle (Gondim et al. 2004a).

Over all the impact of wolves on potential spread of disease is probably variable, although in some situation wolves may help reduce spread of disease by consuming infected animal, redistributing ungulates on the landscape, and reducing overall abundance of wild ungulates (Wild et al. 2005).

Presence of wolves or other predators in pastures likely increases activity of cattle and harassment often causes cattle to run. This increases heat stress during warm weather and risk of cold stress during cold periods from cattle that are sweated wet (Dr. Jeff Lehmkuhler, personal communication). Chebel et al. (2004) discovered that heat stress (>29 degrees Celsius) prior to artificial insemination resulted in lowered conception rates for high producing dairy cows. Dairy cows exposed to high heat index values during peri-implantation may have a greater risk of pregnancy loss (Garcia-Ispierto et al., 2006).

Recommended Research and Management Considerations

More research is needed to assess how wolves affect livestock and economic sustainability of farms in Wisconsin. Types of research that would be useful would include economical studies to compare farms with wolf depredation to farms without wolf depredation; studies of stress factors on cattle for farms with wolves and those without; comparisons should be made of fall calf weight, conception rate and birth rates among cattle exposed to wolf depredation and those not exposed; measure of behavioral changes should be assessed when calf mortalities occur to compare herd behavior among cattle exposed to wolf depredation and those losing calves from other mortalities; more research is needed to better understand Neospora and possible role of wolves in the spread of the disease; sociological surveys should be done in wolf range to determine how wolves affect the farm families by comparing farm families exposed to wolf depredation verse those not exposed to wolf depredation.

Having a better understanding of the impacts of wolf presence on farms will assist with recommendations regarding management of livestock co-habitating with wolves. Understanding how/if livestock producers change their management due to the presence of wolves over the long term would be important not just for Wisconsin, but also other areas trying to balance the rights of local citizens with broader agendas to restore wildlife. Knowledge of wolf impacts can be used for future considerations of wolf/ agricultural zones, or planning wolf control areas. Improved understanding of cattle behavioral factors to indicate stress on cattle or likely wolf harassment may be useful for planning of preventative trapping efforts or the issuing of special permits to farmers. Improved knowledge of overall economical losses would allow better assessments of reasonable levels of reimbursements for known and probable losses, as well as terms for compensation.

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