



Wisconsin Wolf Management Plan

October 27, 1999

Wisconsin Department of Natural Resources



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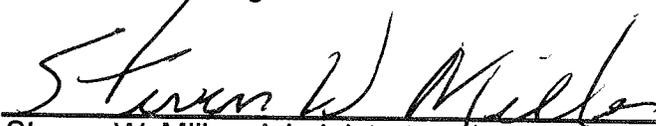
Wisconsin Wolf Management Plan

Compiled by the Wisconsin Wolf Advisory Committee
for the
Division of Land of the Wisconsin Department of Natural Resources

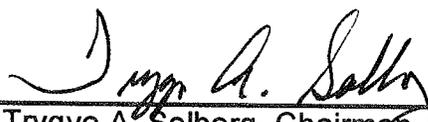
This plan outlines the long term management of wolves in Wisconsin. The plan was presented to the Wisconsin Natural Resources Board for its approval at Hayward, WI., on August 24, 1999 and revised at the Board's direction for its meeting in Madison on October 27, 1999.

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WISCONSIN WOLF MANAGEMENT PLAN EXECUTIVE SUMMARY

by the
WISCONSIN WOLF ADVISORY COMMITTEE

The Wisconsin Wolf Advisory Committee reports to the Bureau of Endangered Resources Director and Division of Lands, Land Leadership Team of the Department of Natural Resources. Plans prepared by the Wolf Advisory Committee are subject to approval of the Natural Resources Board

The gray wolf returned to Wisconsin in the mid-1970's and was listed as a state endangered species in 1975. A state recovery plan, initiated in 1989, set a goal for reclassifying the wolf from state endangered to threatened once the population remained at 80 or more wolves for 3 consecutive years. By 1999, the population had increased to 197 wolves, and had been at 80 or more since 1995. Therefore the Wisconsin DNR, has reclassified wolves from endangered to threatened, and developed this plan to manage wolves as a threatened and eventually as a delisted species. Efforts have also begun to federally reclassify or delist the gray wolf by the U.S. Fish & Wildlife Service.

This plan will delist the wolf from state threatened to a nonlisted, nongame species when the wolf population reaches 250 animals based on late winter count across the state in areas outside Indian reservations. A management goal of 350 is recommended.

Fourteen strategies were developed for managing wolves. These include:

1. managing wolves in 4 different management zones;
2. intensely monitoring wolf populations through threatened status and delisted status;
3. monitoring wolf health;
4. cooperatively managing wolf habitat;
5. controlling nuisance wolves and reimbursing landowners for losses caused by wolves;
6. promoting public education about wolves;
7. establishing regulations for adequate legal protection of threatened and delisted wolves;

8. encouraging interagency cooperation;
9. establishing a system for program guidance;
10. encouraging programs for volunteer assistance on wolf conservation;
11. recommending future research needs;
12. regulating wolf-dog hybrids and captive wolves
13. establish a protocol for handling wolf specimens;
14. encouraging reasonable ecotourism of wolves and their habitats.

Four zones will be used to manage wolves (Figure 8). Management actions will vary according to wolf population status (Table 1).

Zone 1 consists of Northern Forest deer management units and Menominee County. Limited lethal control would be allowed on problem wolves, but generally lethal control would not be exercised on wolves inhabiting large blocks of public land in areas of suitable wolf habitat.

Zone 2 includes Central Forest deer management units. Limited control would be allowed for handling nuisance wolves, but lethal control would normally not be conducted on large blocks of public land.

Zone 3 consists of areas south of Zone 1 and surrounding Zone 2. Protection would be provided for dispersing wolves, but more liberal control would be allowed for handling nuisance wolves.

Zone 4 represents areas with little or no wolf habitat where liberal control would be allowed on problem wolves.

Wolf population and health monitoring would remain intense for the foreseeable future and will include radio-telemetry tracking, wolf howl surveys, and track surveys. Management activities for Wisconsin's wolf population shall be based on a late winter count.

Cooperative management of wolf habitat will continue to be recommended for a threatened and delisted wolf population in suitable habitat. Habitat management would include access management, vegetation management, protecting corridor habitat, and protecting den and rendezvous sites. Management of wolf packs living within Native American reservation boundaries will be coordinated with tribal governments.

Depredation control activity will focus on preventive methods, while also providing adequate control of nuisance wolves. Once wolves are reclassified as federally threatened, wolves that are verified habitual killers of livestock, may be euthanized. Lethal wolf control activity will not be carried out generally in large blocks of public land in areas of suitable wolf habitat. Once wolves are state and federally delisted, euthanization of depredating wolves may be permitted by landowners or occupants on their private land. Proactive depredation control may be used by government trappers in areas with historical wolf problems after the population level of 350 has been exceeded.

Public education about wolves will continue to be an important strategy of wolf conservation in Wisconsin. Education will involve preparation of special education material, work with cooperating organizations to promote education on wolves, provide special training on wolf management to agency personnel, and continue agency presentations on wolves. The efforts will emphasize the positive aspects of wolves to Wisconsin's forest ecosystems.

Specific regulations will need to be developed for wolves listed as threatened or delisted. Regulations will focus on maintaining a high level of protection, even for a delisted wolf population.

Cooperation among various federal, state, county, local and tribal governments will be an important aspect of future wolf conservation in Wisconsin. A Wisconsin DNR Wolf Advisory Committee will continue to incorporate a diverse group of individuals to address policy and management concerns.

The Wolf Advisory Committee will annually review wolf management in Wisconsin with a citizen stakeholder group. Policy or management changes will be recommended to the Department of Natural Resources Land Leadership Team for Natural Resource Board approval. A public review of the plan and management goals will be conducted every five years by the Department of Natural Resources.

Volunteer programs will be used to provide education on wolves and assist with wolf population surveys.

Research will continue to be used to address management concerns as wolf populations increase and emphasis will be on developing accurate and economical survey techniques, as well as continued evaluation of future impacts on wolf populations and their habitats.

Legislative authorization will be sought to restrict ownership of hybrids and to obtain authority to control free-roaming wolf-dog hybrids.

Wolf Management costs will increase from a base level of \$130,000 yearly at approximately 10% per year from a base year of 1997-98, for the next five years; this does not include depredation costs. License fees from hunting, fishing or trapping will be used for wolf management only if the species is open for public harvest. Full reimbursement should be made to owners who have lost pets or livestock to wolves; normal costs are estimated at \$20,000 to \$40,000 per year when wolves have reached management goals. The cost of removing depredating wolves and either translocating them to suitable habitat or euthanizing them is estimated at \$15,000 to \$30,000 per year. Therefore the total cost of wolf management activities is estimated at from \$165,000 to \$200,000 per year.

By its nature, the gray wolf interests not only traditional hunters, but many persons who are interested in nature viewing, photography, hiking and nature study. As an apex species, the management of wolves impacts other forest species. It is appropriate for funding for wolf management to come from alternative funding sources, instead of traditional license fees, or strictly from endangered resources funding.

New funding sources need to be identified to provide the Department of Natural Resources the resources to continue reimbursement at fair market value for losses and to maintain a sufficient depredation response program, as well as maintaining sufficient monitoring of the wolf population.

Table 1. Management actions as prescribed by the DNR wolf plan for specific zones
(See details in text)

STATE LISTING AND ALLOWED MANAGEMENT OPTIONS

MANAGEMENT ACTION	Endangered <80 wolves	Threatened Status (80-250 wolves)				Nongame Protected Status (250-350 wolves)				Nongame or Furbearer Status (350 plus wolves)			
		ZONE 1	ZONE 2	ZONE 3	ZONE 4	ZONE 1	ZONE 2	ZONE 3	ZONE 4	ZONE 1	ZONE 2	ZONE 3	ZONE 4
		STATEWIDE	1	2	3	4	1	2	3	4	1	2	3
Depredation: USDA live trap and translocate	yes	yes	yes	no	no	yes	yes	yes	no	yes	yes	no	no
Confirmed depredation: USDA live trap and euthanize *	no	yes**	yes	yes	yes	yes**	yes	yes	yes	yes**	yes	yes	yes
Depredation: government trapper proactive control***	no	no	no	no	no	no	no	no	yes	yes**	yes	yes	yes
USDA/DNR/Law Enforcement euthanize nuisance wolves*	no	yes**	yes	yes	yes	yes**	yes	yes	yes	yes**	yes	yes	yes
Depredation: Private Citizen: Lethal control by permit***	no	no	no	no	no	yes	yes	yes	yes	yes	yes	yes	yes
Depredation: Landowner may kill wolf attacking stock or pets on private land***	no	no	no	no	no	yes	yes	yes	yes	yes	yes	yes	yes
Public Harvest**	no	no	no	no	no	no	no	no	no	yes	yes	yes	unlikely
Coyote hunting closure during firearm deer season	yes in part	yes	no	no	no	yes	no	no	no	yes	no	no	no

* Federal downlisting to threatened status must first occur before these actions can take place.

** Lethal Controls would rarely be authorized on large blocks of public land in areas of primary wolf habitat

*** Federal delisting must first occur before these actions can take place.

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I. INTRODUCTION

The gray wolf (*Canis lupus*) was listed as a Federally Endangered Species in 1967 by the U.S. Fish and Wildlife Service (USFWS), and was again listed in 1974 under provisions of the 1973 Endangered Species Act. All gray wolves in the lower 48 states were considered Endangered by the U.S. Government. In 1978 wolves in Minnesota were upgraded to threatened status.

The Wisconsin Department of Natural Resources (WDNR) listed the state population as Endangered in 1975, as wolves began to recolonize the state after being extirpated for 15 or more years. A recovery plan for Wisconsin wolves was initiated in 1989, and its goal of 80-plus wolves for the state was first achieved in 1995.

The State of Wisconsin downlisted wolves to state threatened in 1999. The federal downlisting process to reduce wolves from endangered to threatened will be initiated in 1999 and should be completed in 2000. Federal delisting from both the endangered and threatened lists should begin in 2000 and be completed within two years. Because Wisconsin's gray wolf population has recovered from an endangered status, guidelines need to be developed for managing wolves as a threatened species and eventually as a nonlisted species. This plan provides guidelines for managing wolves in Wisconsin for the next 10 to 15 years. These guidelines provide a conservation strategy for

maintaining a healthy viable population of gray wolves in the state, and contribute toward national recovery, while addressing problems that may occur with wolf depredation on livestock or pets.

The WDNR is directed by State Statute 29.605 (formerly s.29.415) to implement programs "directed at conserving, protecting, restoring and propagating selected state endangered and threatened species to the maximum extent practicable". This management plan provides the guidelines for managing a threatened wolf population, supply criteria for delisting wolves as no longer in jeopardy of extirpation, and provide a conservation plan for managing a delisted wolf population.

This management plan is based on state listing of endangered, threatened, or delisted wolves in Wisconsin. Mention in the plan of listing criteria and management actions will only refer to state listing, unless specifically called "federal" listing. Although the management actions in this plan are related to state listing, in some cases, federal downlisting or delisting will also need to occur before the management actions take place. Therefore although state listing criteria may be met, in some situations, it may be necessary for federal actions to take place before certain activities are permitted.

Across the State of Wisconsin are numerous Indian Nations which have management authority on tribal lands. While wolves are federally listed, tribes are required to follow federal guidelines, but once federally delisted, wolves will be managed independently on tribal lands. Portions of northern Wisconsin also consist of lands ceded from the various Chippewa bands who reserved hunting and gathering rights on these lands. Management actions proposed for this region will require cooperation with the tribes, including considerations of public harvest.

II. HISTORY OF WOLVES IN WISCONSIN AND PUBLIC ATTITUDES

Wolves occurred throughout Wisconsin prior to settlement (<1832) (Jackson 1961, Thiel 1993). Estimates of presettlement numbers vary, with the more credible being 3,000-5,000 (Wydeven 1993, Jackson 1961).

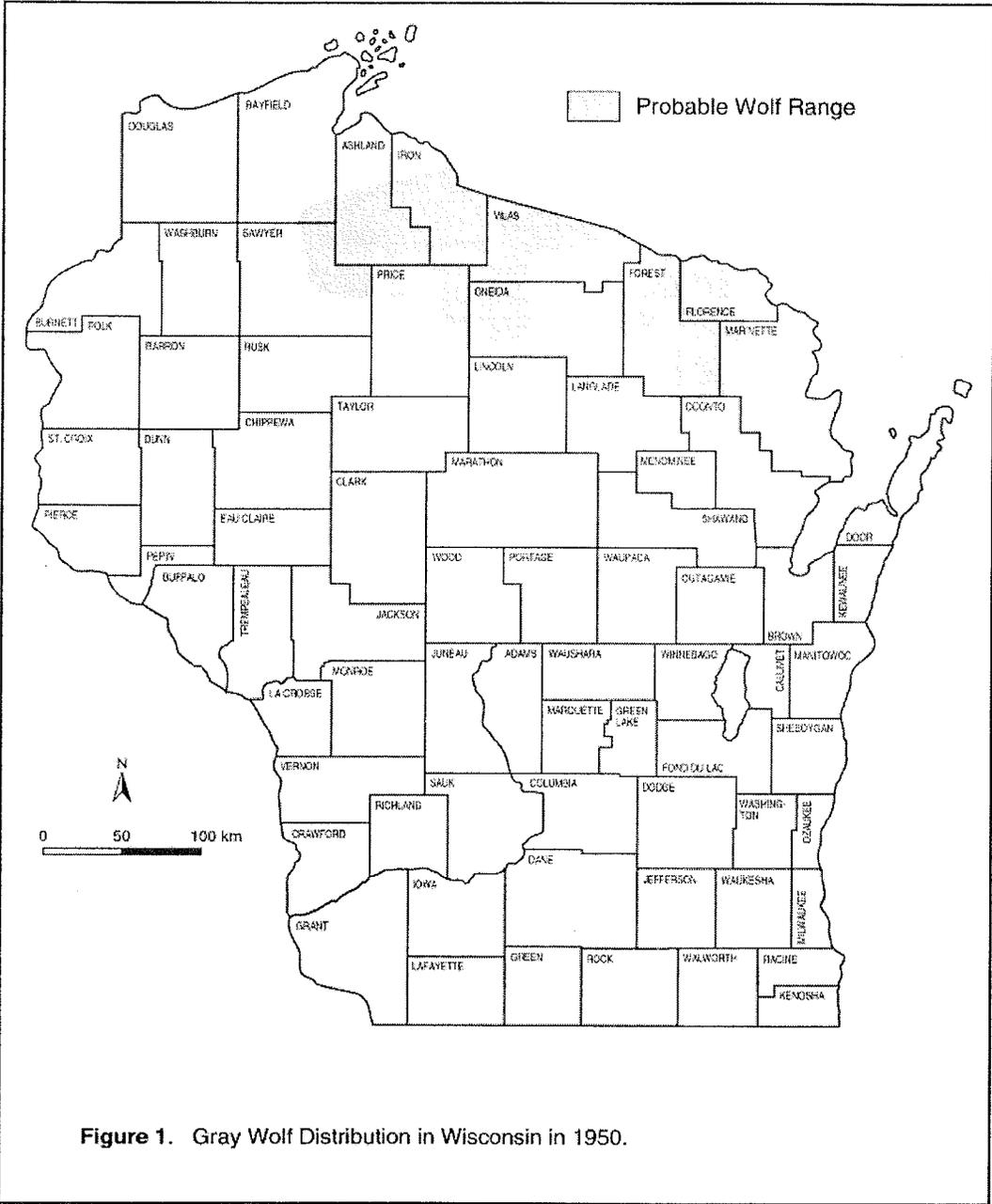
Prior to settlement, five species of ungulate were found in Wisconsin: bison, elk, moose, caribou and white-tailed deer (Schorger 1942, Scott 1939). All five species were potential prey for wolves (Mech 1970). Indeed, fur traders in the Wisconsin-Minnesota region between 1770 and 1830 documented wolf predation on bison and deer (Thiel 1993). By 1880, deer were the only wild ungulate species remaining in viable numbers within the state (Scott 1939).

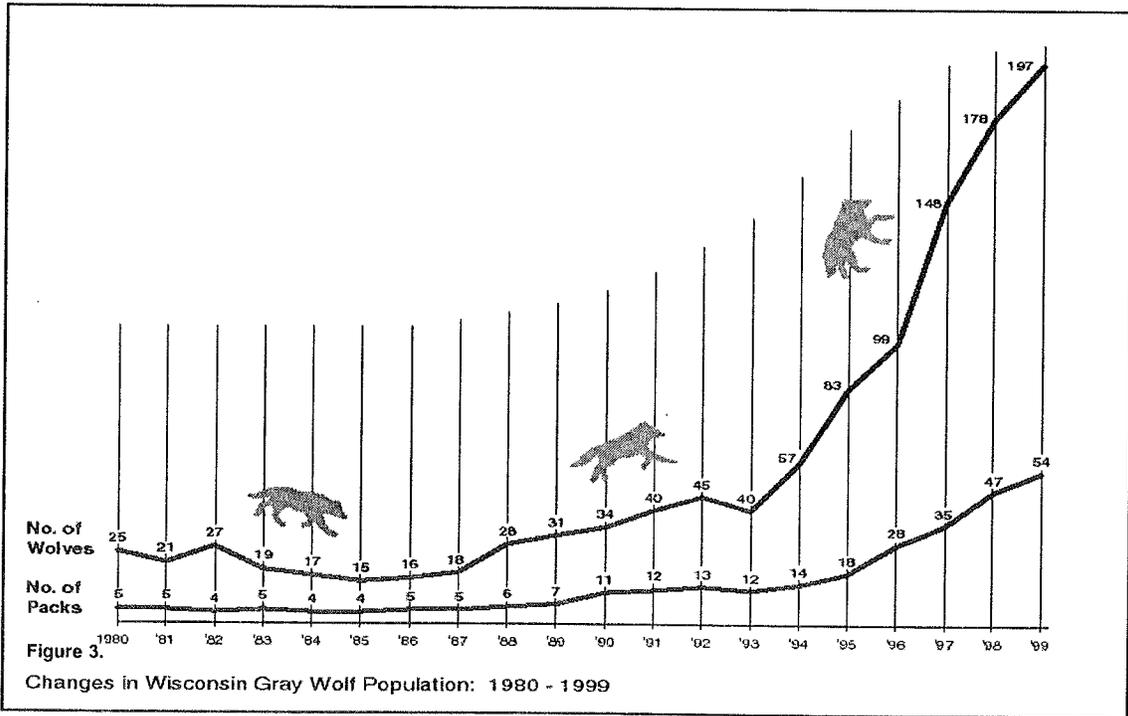
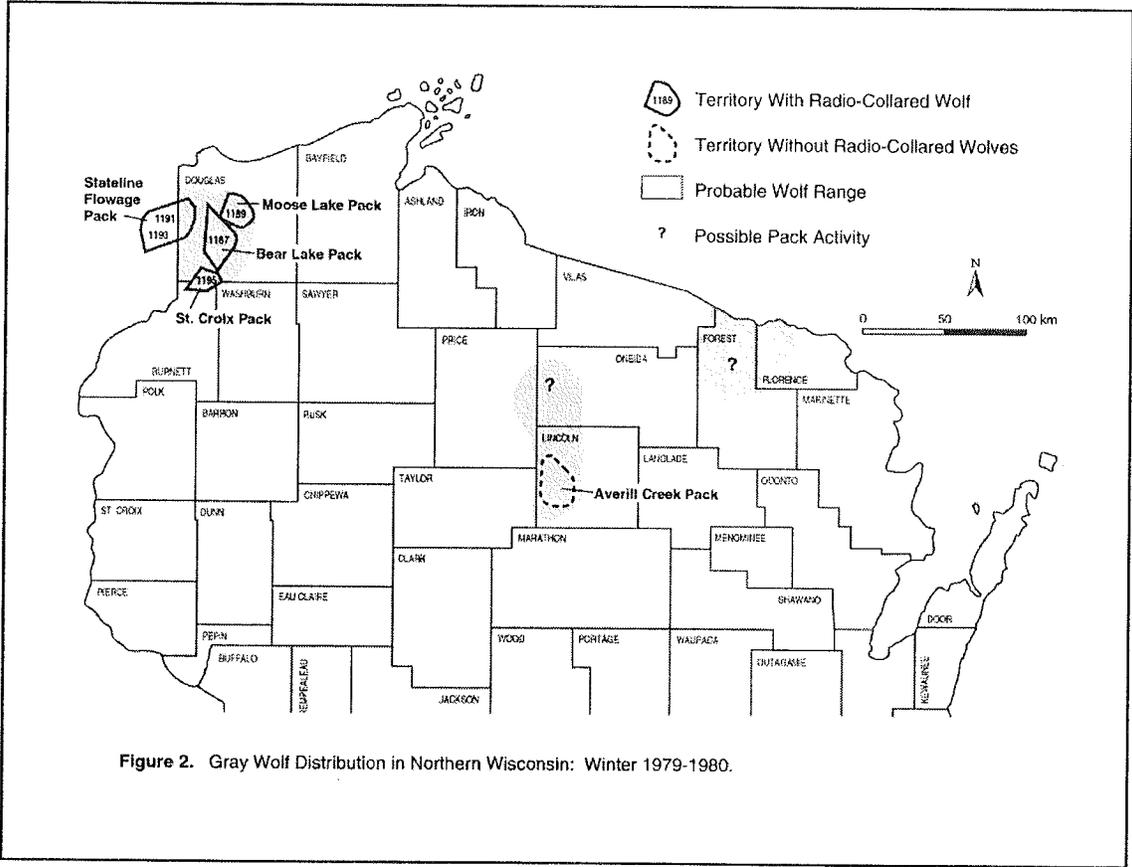
Native Americans occupying Wisconsin at the time of European contact revered wolves as

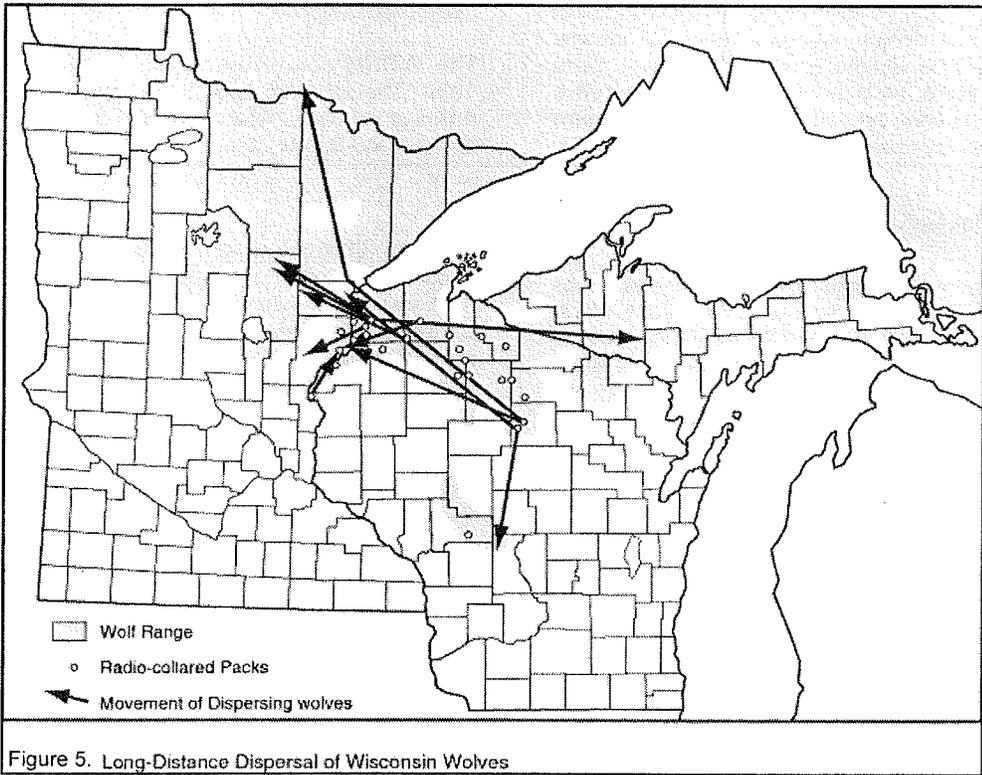
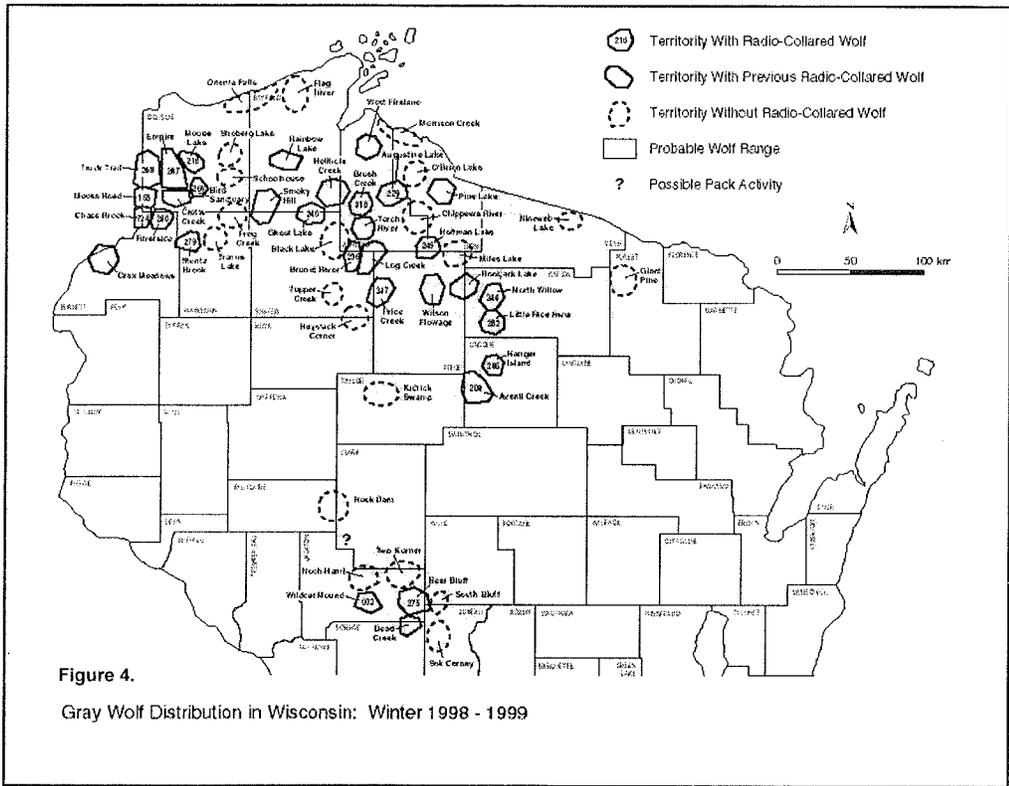
evidenced by their prominent role in culture and spiritual beliefs. Early fur traders were generally indifferent to the presence of wolves because they posed no threat, and were not considered valuable furbearers (Thiel 1993). Negative attitudes towards wolves prevailed among Europeans who settled in the Territory in the late 1830's. After the end of the Civil War, wolves were perceived as a menace to livestock, and in response, the state legislature instituted a bounty in 1865 (Thiel 1993).

Wolves were exterminated from southern Wisconsin during the 1880's (Schorger 1953). The last wolf in central Wisconsin was killed in Waushara County in 1914 (Thiel 1993). By 1930, wolves were restricted to less than a dozen counties in northern Wisconsin. By this time, sport hunters also favored a bounty on wolves because wolves were considered unwanted competitors for deer (Flader 1974, Thiel 1993).

The wolf population declined from an estimated 150 in 1930 to less than 50 by 1950 (Thiel 1993). Wolf range was also reduced to less than 10% of the state (Figure 1). The last wolf packs in Wisconsin disappeared by 1956-57,







just when the state legislature removed the timber wolf from the bounty. The last Wisconsin wolves were killed in 1958 and 1959 (Thiel 1993).

Between 1960 and 1975 the wolf was considered extirpated in Wisconsin (Thiel 1978). In 1973 wolves were afforded the protection of the federal Endangered Species Act. The Minnesota wolf population began expanding (Thiel and Ream 1995). In winter 1974-75, a wolf pack was discovered in the border area between Wisconsin and Minnesota south of Duluth-Superior (Thiel 1993). By 1980, five wolf packs were found in Wisconsin: four in Douglas County near the Minnesota border, and the other in Lincoln County (Figure 2)(Thiel 1993, Wydeven et al. 1995).

An intensive wolf monitoring program was instituted by the WDNR and the USFWS in 1979. During the 1980's wolf numbers fluctuated between a low of 15 animals (1985) to a high of 31 (1989) (Wydeven et al. 1995). High mortality rates (greater than 35% annually) were caused primarily by humans, with gunshot the leading cause of death (Wydeven et al. 1995).

Attitudinal surveys of deer hunters conducted in the early 1980's indicated that as many as 20% of Wisconsin gun-deer hunters in Douglas and Lincoln Counties harbored negative attitudes towards wolves (Knight 1985). In general, most (69%) of northern hunters believed wolves should not be eliminated from Wisconsin. Generally farmers, as a group, were less supportive of wolf recovery, and 50% of farmers in northern Wisconsin opposed wolf recovery in the 1980s.

III. WOLF BIOLOGY AND ECOLOGY

The gray wolf, Canis lupus, also known as "timber wolf", originally occurred across North America, Europe and Asia (Nowak 1995). Coyotes, Canis latrans, are sometimes called "brush wolves" but are not true wolves.

Wisconsin's wolves were formerly classified as the subspecies, Canis lupus lycaon (Eastern timber wolf) when the 1989 Timber Wolf Recovery Plan was approved (WDNR 1989). Recently the number of subspecies of the gray wolf has been reduced from 24 to 5 (Nowak 1995). The revised classification places all wolves in the Great Lakes Region west of Sault Ste. Marie, Michigan with the subspecies Canis lupus nubilus (Great Plains Wolf). For the purpose of this management plan, we will refer only to the species, Canis lupus.

(Nelson & Franson, 1988) Recently surveys found that in 1997, 78% of hunters felt protection of wolves and other predators was important, and that only 20% opposed increasing the wolf population (See appendix H).

In 1986, the WDNR created a Wolf Recovery Team to develop a state wolf recovery plan. Public input was a critical factor in developing a plan that would lead to the successful recovery of wolves. The Wisconsin Wolf Recovery Plan was approved by WDNR in 1989, and has been the template, guiding managers in decisions that affect wolf recovery in Wisconsin (WDNR 1989, Thiel and Valen 1995). The plan's goals were to:

- 1) support a minimum of 80 wolves for a minimum of 3 consecutive years;
- 2) reclassify the wolf as state threatened;
- 3) contribute to federal downlisting of the wolf to threatened in the Great Lakes Region.

The recovery goal of 80 wolves was first achieved in 1995 when 83-86 wolves were counted. By 1999, the population was up to 197-203 wolves (Figure 3), distributed in 54 territories in 20 northern and central Wisconsin Counties (Figure 4). A Wisconsin Wolf Advisory Committee was formed in 1992 to oversee wolf recovery in Wisconsin, and develop a Wolf Management Plan with criteria for reclassification. The Wolf Advisory Committee conducted a public review of the Wolf Recovery Plan in 1994, and found public support for continued wolf recovery. The Wolf Advisory Committee began work on development of a new Wolf Management Plan in 1996.

The WDNR downlisted wolves to state threatened in 1999. The USFWS has announced plans to federally downlist wolves in Wisconsin and plans to complete the process in 2000 or 2001.

Physical Characteristics: Gray wolves resemble large dogs but usually have longer legs, larger feet, and a narrower chest (Banfield 1974). Their tail is straight rather than curving upward, and their head appears more massive due to wide tufts of hair that project down and outward from below the ears (Mech 1970). Adult males captured in Wisconsin averaged 77 pounds (57-102 pounds) and adult females averaged 62 pounds (46-75 pounds)(Wydeven et al 1995). They are 4.5 to 6.5 feet long from tail tip to nose tip and stand 28-34 inches at the shoulder. Pelt color seldom varies from a grizzled gray/brown, but at least 2 black individuals have been recently observed in Wisconsin.

Social System: Wolves live in family groups called "packs" that consist of a dominant breeding pair ("alphas"), and generally surviving offspring from the previous year, and the current year's pups (Mech 1970). Occasionally older offspring remain with the pack or an

unrelated adult wolf may be a member. Pack size in Wisconsin ranges from 2-10 wolves and averaged 4.3 wolves during the 1996-97 winter (Wydeven and Cervantes 1997). Each family group occupies an exclusive territory of 20-160 square miles, averaging 70 square miles in Wisconsin (Wydeven et al. 1995). Territories rarely overlap and are defended against other wolves (Peters and Mech 1975).

Yearling wolves normally disperse from their natal packs, usually during October-January, to seek a mate and their own territory. Adult dispersal has also been noted (Fritts and Mech 1981). Dispersers may travel up to 500 miles in less than 10 months (Fritts 1983). Wisconsin wolves dispersed an average of 71 miles from natal territories and have traveled 300 miles (Figure 5) (Wydeven et al. 1995).

Reproduction: Wolves are sexually mature at 22 months but generally only the alpha male and female breed (Mech 1970). The alpha pair normally inhibit sexual contact between other mature members (Packard et al. 1983). Breeding takes place between late January to early March, and gestation is 60-63 days. Pups (4-8) are born in early to mid April (Fuller 1989). The pups are kept at a den site for 6 to 8 weeks. By mid June the pups are moved to rendezvous sites where they stay while adults search for food. Throughout summer, wolves utilize 2-3 rendezvous sites (Fuller 1995). In September and October, when the pups become large enough to travel with the adults, rendezvous sites are vacated and the pack moves as a single unit throughout its territory.

Mortality: Keith (1983) found that wolf populations declined when annual mortality rates of wolves greater than 6 months exceeded 30-40%. Wydeven et al. (1995) reported that average annual mortality rates for Wisconsin wolves greater than one year old decreased from 39% during 1979-85 to 18% during 1986-92.

Wolves are susceptible to diseases, predation, human persecution, starvation, and accidents. Human-caused deaths declined from 72% in 1979-85 to 22% in 1986-92. In recent years (1993-1996) 50% of wolf mortality was caused by humans, and over 25% of mortality was caused by vehicle collisions (WDNR files). Mortality rates for wolves 1 year old or older continues to be less than 20% annually.

Diseases such as canine distemper, canine parvovirus, Lyme disease, and blastomycosis have been observed in Wisconsin wolves. Wydeven et al. (1995) felt that canine parvovirus negatively impacted Wisconsin's wolf population during 1982-86. Parasites observed in Wisconsin wolves include protozoans and intestinal worms, ticks, mites, lice,

and heartworm (Mech et al. 1985, Archer et al. 1986, Thiel, unpubl. data). Mange has been observed frequently in Wisconsin wolves since 1992, and has been diagnosed as the primary cause of death for at least nine wolves in the past 5-6 years. In 1992 and 1993, 58% of wolves handled by WDNR had signs of mange, but this has declined to 15% in recent years (WDNR files).

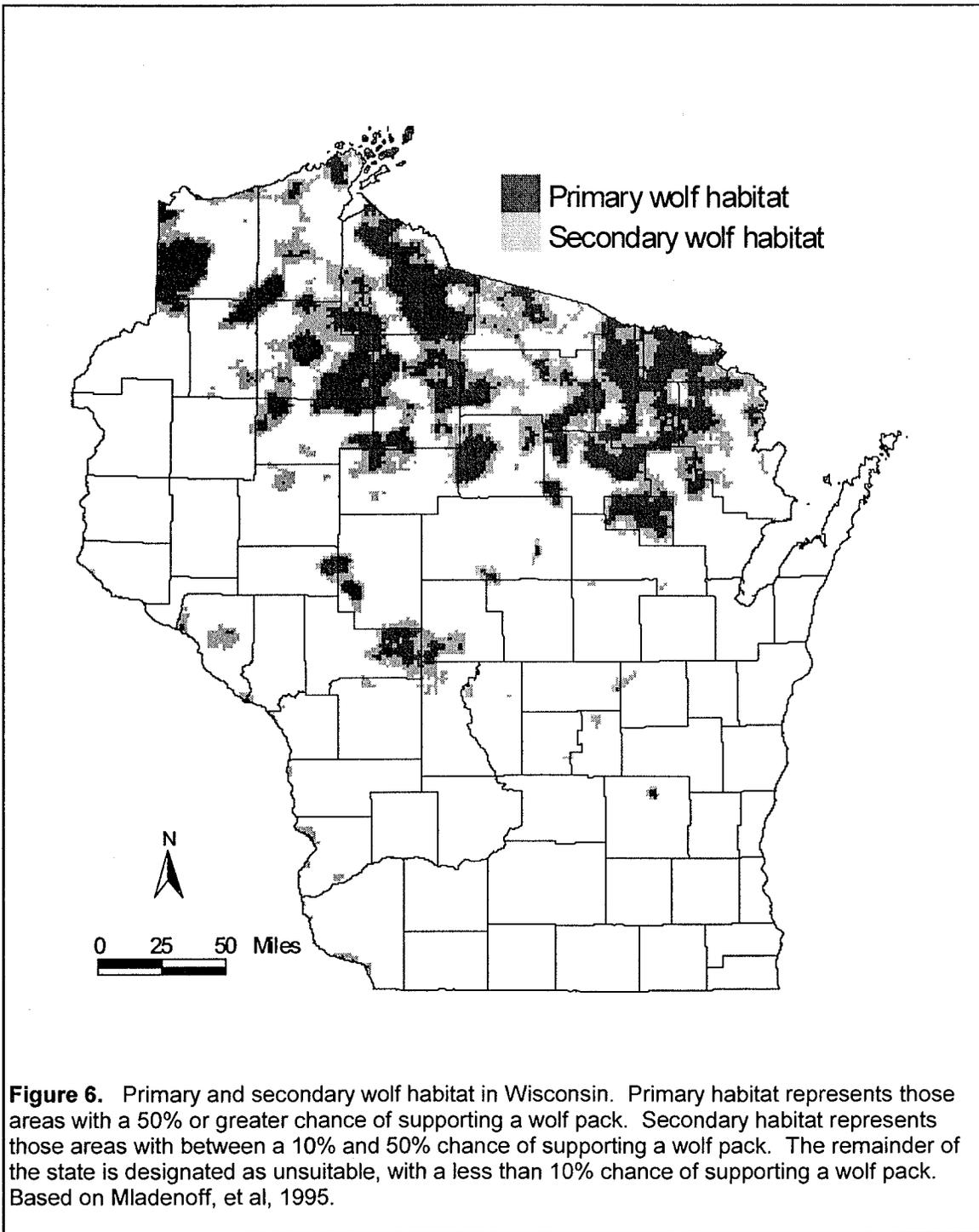
Food Habits: In the 1940's, deer occurred in 97% of 435 wolf scats found in Wisconsin, at a time when deer populations were very high and beaver numbers were low (Thompson 1952). Deer comprised 55% of scats collected between 1980 and 1982 and analyzed by Mandernack (1983). Beaver comprised 16% and snowshoe hare 10% in his analysis. Miscellaneous items accounted for the remainder. Some wolves have also killed domestic animals in Wisconsin in recent years (Appendix A).

Habitat Requirements: Wolves are adaptable and can survive on large landscapes with adequate prey populations and low rates of human persecution (Fuller 1995). Pack territories are typically 70 square miles (average pack territory size) and contain low human densities, limited public accessibility, and minimal livestock production (Thiel 1985, Mech 1986, Fuller 1995). Fuller (1995) suggested that clusters of 2-3 packs (areas of 200 square miles) represents the minimal number of packs necessary to support a viable population. The large land requirements of wolves can conflict with human use of those lands. Examples of direct conflict over land use by humans include livestock production, urban areas, and intensive recreational activities. Conflicts may also arise anywhere people have the opportunity to encounter wolves either accidentally or intentionally.

Keith (1983) and Fuller (1989) found that over 90% of the variation in wolf densities could be accounted for by variation in prey populations. In northeast Minnesota, Mech (1986) and Nelson and Mech (1986) reported a density of 1 wolf per 17 square miles in an area with deer densities of about one deer per square mile, but moose and beaver also occurred in this area. In north-central Minnesota, wolf densities of 1 wolf per 10-13 square miles were found in an area supporting 10-26 deer per square mile (Fuller 1989, Fuller 1990). Average deer density in deer management units comprising Wisconsin's Northern Forest, which includes most of Wisconsin's wolf range, was 22 deer per square mile during the 1996-97 winter and density of wolves in 2,200 square miles of wolf range was 1 wolf per 15 square miles (Wydeven and Cervantes 1997). Prey abundance should not be a limiting factor in Wisconsin.

Mladenoff et al. (1995) estimated that approximately 5,700 square miles of suitable wolf habitat exists in Northern Wisconsin and that it is highly fragmented.

13 They suggested that human-caused mortalities and



continued habitat loss due to human development could reverse wolf population trends in a fragmented region such as Wisconsin. An update of

this analysis shows 5,812 mi² of primary wolf habitat , 5,015 mi² of secondary habitat, and 45,252 mi² of unsuitable habitat on a statewide basis (Figure 6).

IV. MANAGEMENT GOAL AND CRITERIA FOR DETERMINING ENDANGERED, THREATENED OR DELISTED STATUS

The Wisconsin DNR proposes to delist wolves as neither state endangered or threatened when a late winter count of 250 wolves are achieved outside of Native American reservations in the state. At the delisted level, landowner control on nuisance or problem wolves can occur, and control can be expanded for law-enforcement officers. The state population management goal would be a late winter count of 350 outside of Native American reservations. At the management goal, proactive depredation control by government agents can be authorized.

A. Background

The Wisconsin Wolf Advisory Committee spent a great deal of time developing the delisting level and establishing a population management goal. Four major factors were considered in the development of the population goals:

1. The goal needed to meet or exceed federal recovery criteria.
2. The goal must represent a population level that can be supported by the available habitat.
3. The goal needed to be compatible with existing information on gray wolf population viability analysis.
4. The population goal needed to be socially tolerated to avoid development of strong negative attitudes toward wolves

The U.S. Fish and Wildlife Service (1992) Recovery Plan for wolves in the eastern U.S. recommended maintaining a minimum of 100 wolves in Wisconsin and Michigan to federally delist wolves in the region. Since the Wisconsin – Michigan population was located within 100 miles of the much larger Minnesota population (2450 wolves in 1998), 100 wolves was considered adequate for maintaining a regional viable population. The same plan recommended that if a second wolf population in the eastern U.S. was more than 100 miles from the Minnesota wolf population, it should consist of at least 200 wolves. Therefore, 100 wolves in Wisconsin and Michigan represents

the bare minimum level at which federal delisting can be considered for the region. The wolf population in Wisconsin needs to avoid approaching this level to prevent wolves from becoming relisted as Federally Endangered or Threatened.

A second concern was an assessment of the potential habitat base in Wisconsin. Studies done in Wisconsin using a Geographic Information System (GIS) with known pack territories, showed that 5812 mi² of land had a high probability of being settled by wolf packs (Mladenoff et. al. 1995, Appendix C). As many as 300 to 500 wolves could occur on the most suitable habitat at full occupancy (Mladenoff et. al. 1997, Appendix C). If wolves also occupied secondary or marginal habitat, possibly 500 to 800 wolves could occur in the state. On the other hand, if wolves are unable to fully occupy the most suitable habitat, and few occupy marginal habitat, the potential population could be considerably less than 500. Based on this assessment, 500 wolves occurring on about 6000 mi² of suitable habitat seemed to be a reasonable estimate of the potential carrying capacity of wolves in Wisconsin. Therefore, in the first draft of the wolf plan, an upper limit of 500

Table 2. Wisconsin Wolf Listing/Delisting Criteria

<u>Wolf Population</u>	<u>State Listing</u>	<u>Federal Listing</u>
less than 80	Endangered	Endangered
80 or more for 3 yrs.	Threatened	Threatened
100 plus for five years Wisconsin and Michigan	Threatened	Delisted
250 wolves for 1 year.	Delisted	Delisted
Decline to less than 250 for 3 yrs.	Reclassify as Threatened	Delisted
Decline to less than 80 for 1 yr.	Reclassify as Endangered	Not Specified

wolves was established for Wisconsin. Because of concerns expressed by many on the first draft, the figure was modified to a management goal of 350. The management goal represented the minimum level at which a full array of population control activities could occur including pro-active depredation control and the possibility of public harvest.

Long term viability of the Wisconsin wolf population was a third concern addressed by the Wisconsin Wolf Advisory Committee. Fritts and Carbyn (1995) conducted an extensive review of wolf population viability analysis, and determined that although no one really knows the minimum viable population of wolves, it appears that 100 or more wolves would be needed to maintain viability in isolation. Others have suggested that as many as 500 wolves may be necessary for long-term viability in isolation (Soule 1980). Haight et al. (1998) determined by modeling, that 16 wolf territories could maintain long-term survival in disjunct populations if immigration was adequate and portions of the population are highly protected; Haight et al. (1998) considered packs to average 4-8 wolves, or an overall average of about 6 wolves. Thus, the 16 territories would represent about 96 wolves, and with an average 15% loners, would consist of about 110 wolves. Therefore, Haight et al. (1998) would further support the idea that about 100 wolves could maintain viability if adequately connected to other populations. Thus, the literature seemed to suggest that about 100 wolves would be adequate if highly connected, but if isolated, populations may need to be at levels of 200 to 500 wolves to maintain long-term viability.

We further examined population viability analysis by conducting analysis of the Wisconsin population (Appendix B). Population viability analysis provides a useful way of looking at the dynamics of a wildlife population, but needs to be cautiously interpreted and should not be used by itself to set management goals (Bessinger and Westphal 1998, Reed et al. 1998). When examining varying levels of reproduction, environmental variability, and catastrophes, risk of extinction or relisting as endangered were often fairly high at 100 animals. But at populations of 200 or more animals, risk of extinction or relisting declined drastically, and the risks for 300 to 500 animals were similar and relatively low for most categories. The analysis was done on an isolated population to provide a conservative estimate of animals needed for long-term viability if exchange of wolves among the Great Lakes population declines in the future. Based on this analysis, a population between 200 to 300 seemed appropriate for delisting wolves in Wisconsin.

The fourth area of concern that needed to be ad-

ressed in developing a population goal is the social intolerance of wolves that may develop at a high population level. Habitat modeling, literature reviews, and population viability analysis provide somewhat systematic means for determining viable levels and potential populations for state wolves, but determining levels of social tolerance is more subjective. The Wolf Advisory Committee settled on a management goal of 350 wolves as a reasonable first attempt at assessment of social tolerance. The 350 level was intended to be the minimum level at which proactive control and public harvest would occur. This management goal falls about half way between the delisting level (250 wolves) and the perceived biological carrying capacity (500 wolves) for the state. During the review of the second draft of the wolf plan, of persons commenting on the population goal, 38% supported the goal, 38% felt it was too low, and 24% felt it was too high. Therefore, the goal seemed to be a reasonable compromise between population capacity, minimum level of viability, and public acceptance.

B. Delisting and Relisting Criteria

Delisting and relisting criteria for Wisconsin wolves are shown in table 2 and figure 7. Table 2 also illustrates federal listing criteria. State reclassification from endangered to threatened occurred in 1999. The state delisting level may be achieved within 2 more years and the management goal could be achieved in 5 years (Figure 7). Federal criteria for downlisting to threatened were achieved in 1997 and the downlisting process may be finalized in 2000. The federal delisting process will probably begin in 2000 and should be completed sometime in 2001 or 2002.

Some management proposed under state delisting will not be possible until federal delisting also occurs. Federal reclassification from endangered to threatened will allow DNR and USDA-WS to kill wolves causing depredation to livestock and pets. Total federal delisting will be required before the following can occur: lethal control by landowners; and proactive control by government trappers and public harvest.

V. WOLF MANAGEMENT STRATEGIES

A. Wolf Management Zones

Zone management is frequently recommended as part of wolf recovery plans and management plans (Mech 1995) and the establishment of protective areas helps assure long-term survival of small, disjunct wolf populations (Haight et al., 1998). The Federal Recovery Plan for the Eastern Timber Wolf provides 5 different zones for managing wolves in Minnesota (U.S. Fish and Wildlife Service 1992). Fritts (1990, 1993) suggested 3 levels of zone management for wolves in the Yellowstone Ecosystem. Fritts (1990) indicated that normally only 3 zone levels would be needed for wolf management to avoid unnecessary confusion. On the other hand, the

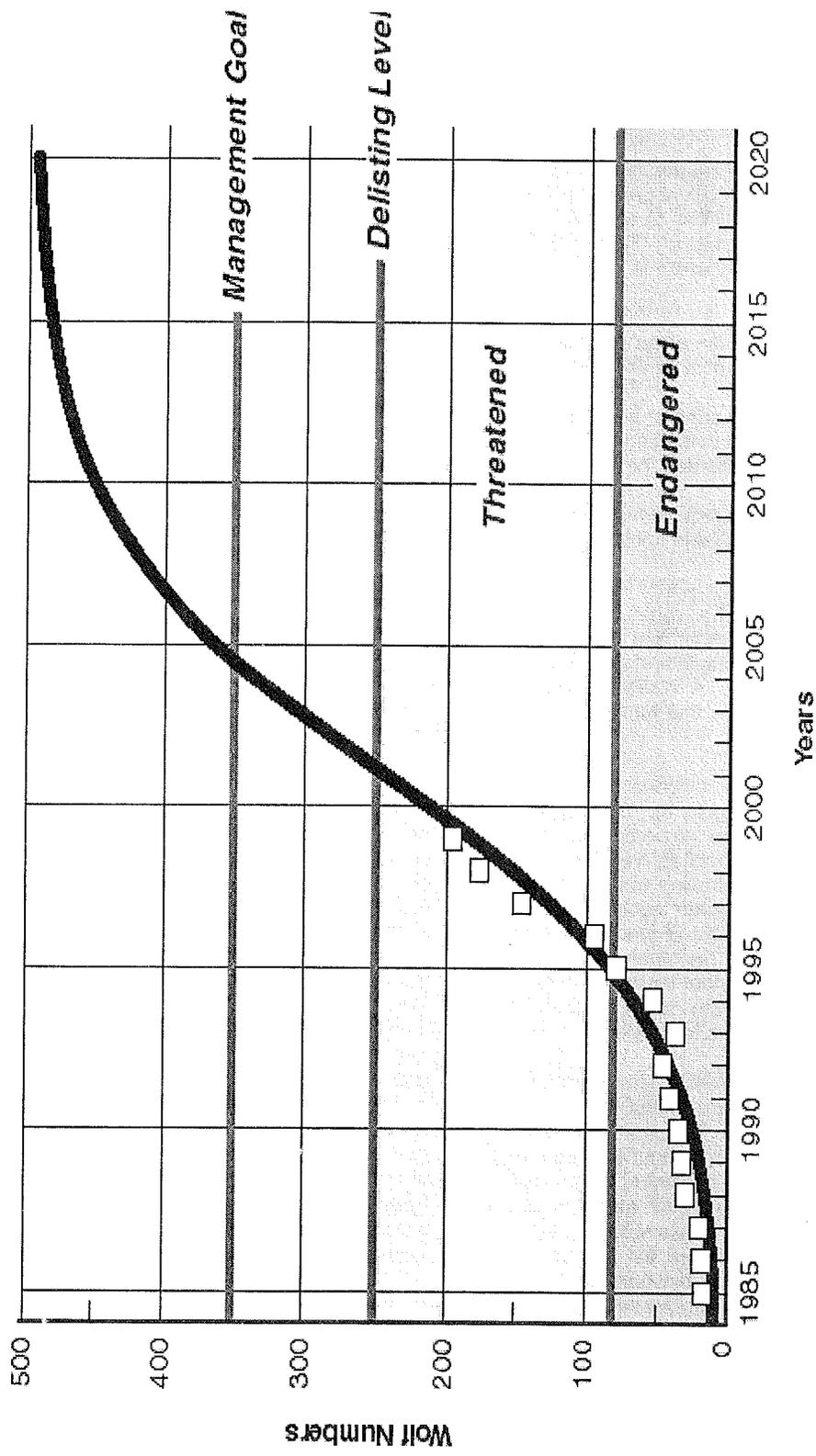


Figure 7: Wisconsin Wolf Population Growth if Carrying Capacity is 500 Wolves

Alaska Board of Game adopted a strategy for wolf management in 1991 that incorporated 7 zones, ranging from Zone 1 (Full Protection) to Zone 7 (High Use/Intensive Management) (Anonymous 1992).

The purpose of zone management is to vary management depending on potential wolf habitat and the possibilities of conflicts between wolves and humans. Fritts (1993) listed 3 assumptions inherent in zone management for wolves:

- 1) Wolves belong in some areas and not others because of potential conflicts with humans.
- 2) Adequate habitat to support a viable population should exist in the zone(s) where the species is afforded the most protection.
- 3) The species should receive high priority in the areas of most suitable habitat.

Generally the fewer the zones, the more simplified the management and greater the understanding by the public and agency personnel (Fritts 1990). A disadvantage to fewer zones is that less fine tuning of management is possible.

The WDNR will utilize 4 zones to manage wolves in the state (Figure 8). Such a system provides maximum protection in most portions of suitable habitat, yet allows a flexible system for controlling wolves in less suitable areas where higher levels of conflict are likely to occur. The characteristics of the 4 zones under this management system are listed below. On tribal lands, tribal governments will determine management of wolves once the species is delisted.

Zone 1 Northern Forest: This zone consists of 18,384 square miles within the Northern Forest Deer Management Units and Menominee County. About 634 square miles of Zone 1 would consist of Indian reservations that have unique management systems and in many cases would provide additional protective areas for wolves. Zone 1 could support an estimated 300-500 wolves. Habitat consists mainly of forest and contains relatively little farm land or urban area. The zone includes 90% of the states' favorable (primary) wolf habitat. Reimbursement for losses and perhaps payments for abatement practices would be provided. Depredation controls would in-

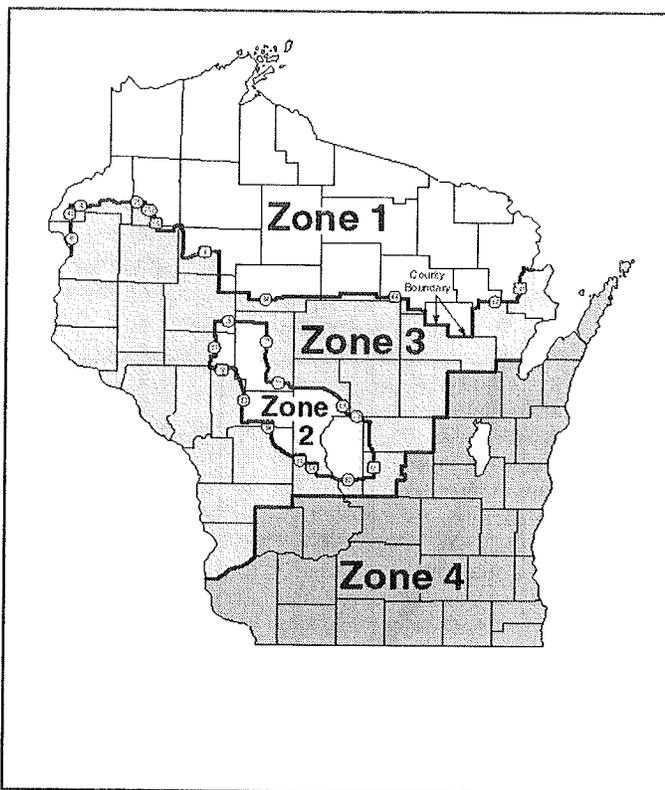


Fig. 8. Wisconsin Wolf Management Zones

clude livetrapping and translocation if suitable habitat exists, or euthanization of depredating wolves. Agents of the USDA-Wildlife Services; Department of Natural Resources and law enforcement agencies could euthanize nuisance animals within 0.5 miles of depredation sites. Normally lethal control would not be authorized on or adjacent to large blocks of public land in suitable wolf habitat. Wolf habitat maintenance would be encouraged on suitable portions of public lands by access management, protection of den and rendezvous sites, and forest management to support adequate prey populations. An existing coyote hunting closure during the deer firearm season would remain in effect for Zone 1. This would be an acreage reduction from the existing coyote closure area of 44% of the state to 33% of the state.

Following state delisting control of depredating wolves could be done by landowners /occupants acting on private land under WDNR permit; they also will be allowed to kill wolves in the act of attacking pets or livestock on their land. If the management population is exceeded, proactive trapping by government trappers may occur in areas with chronic wolf depredation problems.

Zone 2 - Central Forest Zone: This zone consists of 4,521 square miles in the Central Forest Deer

Management Units. The area is capable of sustaining approximately 20-40 wolves. Wolf habitat maintenance would be encouraged on suitable portions of public lands by access management, protection of den and rendezvous sites, and management for younger forests to support prey population. No major change in management would be required in this zone as the wolf is delisted. The wolf population would be allowed to fluctuate with the deer population. Deer populations are primarily impacted by hunter harvest, and winter severity. Reimbursement for losses and perhaps payments for abatement practices could be provided. Depredation controls would include livetrapping and translocation if suitable habitat exists and euthanization of wolves within 0.5 mile of a depredation site. Agents of the USDA-Wildlife Services; Department of Natural Resources and law enforcement agencies could euthanize nuisance animals. No coyote closed area is being proposed for this zone.

Following state delisting control of depredating wolves could be done by landowners /occupants acting on private land under WDNR permit; they also will be allowed to kill wolves in the act of attacking pets or livestock on their land. If the population exceeds 350, proactive trapping by government trappers may occur in areas with ongoing wolf problems.

Zone 3 - Wolf Buffer Area: This zone represents areas having very limited habitat for packs to colonize, but probably contains patches of suitable dispersal habitat that connects the north and central management zones. The zone covers about 18,000 mi² including the mixed forest/farming areas of central Wisconsin and the rugged Coulee country of western Wisconsin (counties are 20% to 60% forested). Most of the area has less than a 10% chance of being occupied by wolf packs, but some of the rugged bluff country or bottom land areas along the Mississippi River have greater than 25% chance of being occupied by wolf packs. Generally less than 20 wolves are likely to occur in this zone. Because of the importance of maintaining genetic diversity in the Central Forest wolf population, some level of protection will be provided for dispersing wolves in this area. Unless these wolves cause problems, they will not be controlled. Wolves that do become depredators on livestock or pets will be vigorously controlled. Trapping by government agents can be conducted up to 5 miles from depredating sites. Wolf packs that establish may be allowed to persist, but if depredation occurs the whole pack may be removed.

Following state delisting, control of depredating or nuisance wolves could also be done by the landowners /occupants on their land with WDNR permits; in addition the landowners / occupants would be allowed to kill wolves in the act of depre-

ation on their land. Proactive trapping by USDA-Wildlife Services would be considered if the wolf population builds up in an area and causes chronic problems after the wolf population exceeds 350.

Zone 4 -- This zone represents areas that have almost no opportunity for colonization by wolf packs. Wolves entering this zone have a high probability of conflicting with people. This zone would include southern and eastern counties that have less than 20% wildlands and would include all the urban areas across the state. The zone would cover about 16,000 mi². Few wolves are likely to occur in this area. Although non-depredating wolves that avoid areas of human or livestock concentration can receive some level of protection, any wolf or wolf-like animal that lacks fear of people and readily approaches pets, livestock or people should be captured or controlled. Many of the wolf-like animals that would be controlled under such circumstances would probably be free roaming wolf-dog hybrids. Along with federal and state trappers, local law enforcement and animal control officers will be allowed to control nuisance wolf-like animals in this zone.

Following state delisting, landowners or occupants could be granted WDNR permits to kill wolves or wolf-like animals on their land and would be allowed to kill wolves in the act of attacking pets or livestock on their land. Proactive control by government agents could begin once delisting has occurred at the state population level of 250, unlike other zones where the proactive control would not occur until a management goal of 350 is reached.

B. Population Monitoring and Management

1. Population Monitoring

Accurate counts are necessary to determine if wolves are attaining management goals. Radio tracking of collared individuals is the most precise way to monitor wolf populations (Mech 1974). By observing collared wolves with other pack members, complete counts can be made of wolf packs in winter (Mech 1974). One or two radioed animals per pack enables biologists to monitor whole packs. However, the presence of a collared wolf is not always a guarantee that the whole pack will be monitored. Sometimes collared wolves disperse prior to winter, or a pack may occur in dense conifer cover where few observations are possible. Snow tracking can be used to estimate pack size (Thiel and Welch 1981, Wydeven et al. 1996). Counting wolves by snow tracking is less precise than observing wolves from the air, but is useful for assessing wolf numbers, especially if done in conjunction with radio telemetry. The tracks of a wolf pack need to be observed several times over a winter to get an accurate count.

Howling surveys are useful for determining summer home sites for wolves and pup production (Harrington and Mech 1982). These surveys are done mainly from July to October. Although howling surveys rarely allow opportunity for precise counts, the technique allows as-

assessment of relative numbers and helps separate packs.

Since 1979, the Wisconsin DNR has surveyed the state wolf population using the techniques described above. Wolf live-trapping has been performed during each spring and summer (approximately May 1 to September 15), and 3-17 wolves were caught and radio-collared each year. Wolves were located by airplane 1-2 times per week and remained on the air from 1 week to 4 or more years. Normally about 15-20% of the population was captured each year and 30-40% of the population had active transmitting collars during the year. During the winter about 50-60% of packs had at least one collared wolf. Usually 2 crews, each consisting of 2-3 people, conducted live trapping each year.

It requires 10-12 days to trap each wolf. Radio collars placed on wolves cost about \$350 and it normally costs about \$300 to locate all the collared wolves using aerial surveys. It costs about \$1,000-1,500 to capture each wolf. Live-trapping and radio-tracking is the most precise system for monitoring wolves, but is expensive.

Snow tracking has been used to supplement telemetry data on wolves. Most winters, 2,500 - 3,000 miles of survey were conducted in suitable habitat. These surveys normally proceed at about 4-5 miles per hour thus representing 500-750 hours of track surveys.

During summers, howling surveys are conducted in pack territories across the state to determine pup production. These surveys take about 100 hours to complete.

Monitoring efforts need to expand with population growth for the foreseeable future. Federal funds for monitoring will be eliminated 5 years after federal delisting. The WDNR will survey wolves at current rates of monitoring for the next five years and will incorporate information from other surveys to supplement and enhance wolf population information. Efforts will be made to more thoroughly gather reports of wolf observations by the general public.

Existing and potential surveys that could help assess wolf abundance include:

- 1) Furbearer winter track counts, consisting of 2 ten-mile segments per county of snow covered roads that are examined for furbearer abundance each winter by wildlife managers.
- 2) Annual reports of observations by DNR field people on selected state mammals.
- 3) Marten surveys done by Endangered Resources and Science Service personnel by snow tracking 100-300 miles in the Chequamegon and Nicolet National Forest.

4) Wolf reports by the general public and agency personnel (rare mammal reports) will be collected, investigated, placed in a data file and used to guide winter and summer DNR surveys.

5) Bow hunter surveys of wildlife observations by bow hunters.

6) Reports from USDA Wildlife Services on depredating wolves.

7) Additional population modeling may be possible in the future using indices from other surveys, as well as information from road kill and depredation controlled wolves.

8) Occasional statewide population counts may be done similar to Minnesota where field people are asked to assess areas occupied by wolves and the population estimated is based on known densities, pack size and other parameters of the wolf population (Fuller et al. 1992).

A volunteer carnivore track survey was initiated by the WDNR in fall 1995 (Wydeven et al. 1996). Surveyors were asked to conduct 3 or more surveys of 20 - 30 miles each on snow covered roads in each of the 123 survey blocks (200 square miles each). In 1996, 32 of 46 (67%) surveys were returned for assigned survey blocks, and in 1997, 37 of 51 (75%) blocks were surveyed. Surveyors in 1997 conducted 3,317 miles of survey, averaging 90 miles and 4.7 surveys per block. Volunteer surveyors were very close to WDNR estimates of wolf numbers in 1996, but much less in 1997, probably due to poor tracking conditions. Once the volunteer tracking program has been adequately tested and refined, it may also be used as a monitoring tool, and be turned over to a volunteer organizations such as the Timber Wolf Alliance (TWA) and Timber Wolf Information Network (TWIN).

General recommendations for wolf population monitoring under threatened status and as a delisted population are described below.

Threatened and Delisted Status — Live-trapping of wolves and radio-tracking will continue. As the wolf population increases, the percentage of wolves captured and radio-collared each year will decline. Emphasis would be on collaring packs in new areas, core areas, Central Forest Areas, or in research projects where special funding is available. Other packs would be monitored mostly by snow tracking and summer howling surveys. Greater reliance would be on tracking and howling surveys conducted by volunteers. Other WDNR surveys would also be used more extensively for comparing wolf abundance with track and telemetry surveys. Meetings will be conducted each spring with agency wolf surveyors and members of the general public to determine the overwinter wolf population.

2. Population Management

The Wolf Advisory Committee believes population growth will be slowed by actions listed in this plan, including take by USDA-Wildlife Services related to depredation, control by law enforcement officers, and the take by private landowners of wolves in an act of depredating, or landowner control by permit in chronic problem areas.

USDA-WS will be allowed to use lethal control as soon as federal reclassification occurs. Landowner control throughout the state and proactive control by government agents in Zone 4 can occur when the wolf population exceeds 250. Such control actions, along with normal mortality, will impact overall population growth. If the population exceeds 350, proactive depredation control by government trappers will be allowed in all four zones and public harvest can be considered.

Threatened Status --- Only wolves causing depredations on pets or livestock would be euthanized while wolves are classified as threatened. All depredation control activity would be conducted by WDNR or USDA-WS. Under special circumstances, authorization to control nuisance wolf-like animals can be given to local law enforcement or animal control officers in urban areas. Landowner control would not be considered while wolves are listed as threatened.

Delisted status – Once delisted, the gray wolf would be classified as a “protected nongame species” (similar to the badger) . Most control activity would continue to be done by WDNR or USDA - WS personnel. Within Zone 4 and urban areas, local law enforcement officers and animal control officers could be authorized by WDNR permit to control wolf-like nuisance animals that are free-roaming in urban areas. Control in these type of situations should be flexible and be based on animal behavior. Most wolf-like animals that would be controlled in these situations would probably be wolf-dog hybrids or captive raised wolves.

Once wolves are delisted landowners/occupants may be issued permits to kill nuisance wolves on their land. Landowners/occupants would also be allowed to shoot wolves in the act of attacking pets or livestock on their land, with the requirement that a Conservation Warden must be contacted within 24 hours. All wolves killed by landowners must be turned over to the State.

Proactive control by government trappers would be used by the WDNR to control the wolf population once the management goal of 350 is achieved. This would consist of lethal controls in areas with a history of depredation problems, or areas with a high probability of wolf-human conflicts. Such control would have the effect of slowing or perhaps stabilizing the growth of the wolf population.

A public harvest can be considered if other control activities do not adequately maintain the population near the 350 goal. All other control activities such as government trappers, law enforcement officer controls, and landowner controls will first be used to attempt to maintain the population at this goal. The Wisconsin State Legislature would have to approve authority for a controlled public harvest of wolves.

The development of legislation that would allow a limited public harvest of wolves would require extensive public interaction as part of the process. Harvest by private citizens is controversial, but the taking of wolves in a recovered population is consistent with the management of other furbearers in the state of Wisconsin. Any public harvest would be closely monitored to ensure that the population does not decline below the management objective of 350 wolves. The Wisconsin Department of Natural Resources adheres to the principles of adaptive management, and the Wisconsin Wolf Management Plan will be periodically reviewed, and adapted to meet changing biological and social conditions.

C. Wolf Health Monitoring

Health monitoring is necessary to assess impact of diseases and parasites on the wolf population. Health monitoring includes collection and analysis of biological samples from live-captured wolves, analysis of wolf scats, and necropsies of dead wolves found in the field. While federally listed as endangered/ threatened, biological samples of live captured wolves and analysis of scats will be conducted by WDNR, and wolf necropsies will be conducted by the National Wildlife Health Lab in Madison. When federal delisting occurs, all health monitoring will be the responsibility of WDNR.

Intensive health monitoring will continue while wolves are listed as a state endangered or threatened species. Live-captured wolves will be tested for diseases, physiological condition and parasites. Ideally about 10% of a population of 100 wolves should be examined, but as the population continues to increase, the percentage of the population live-captured will decline. In recent years 12 to 17 wolves were captured annually. Wolf scats will be collected to monitor canine viruses and parasite levels. Dead wolves will be necropsied to determine cause of death, physical condition and disease status. .

Following state delisting, live-trapping will continue, but the percentage of the population captured each year will decline. Periodic scat analyses will be done to test for diseases and parasite loads. WDNR will continue to examine dead wolves. Special research studies may occasionally be done on wolves and these should include health monitoring. Wolf health monitoring should be part of the capture protocol of all live-capture studies of any wild wolves in Wisconsin, and should be carefully coordinated with WDNR wildlife health specialists.

D. Habitat Management

1. Potential and Favorable Wolf Habitat

Based on computer models, Wisconsin contains large tracts of potential wolf habitat (Mladenoff et al. 1995, 1997, Appendix C). The variables used to determine what makes up potential habitat include human population density, prey (deer) density, road density, vegetation cover, spatial landscape pattern, and land ownership. Of these, density of improved roads and complexity of spatial pattern are most important. Wolves have selected areas that are most remote from human influence, and with the least amount of landscape pattern (e.g. least amount of agricultural land, lakes, and other separate land cover patches). Based on these findings, there are currently 5,812 mi² (15,052 km²) of favorable wolf habitat in Wisconsin (Figure 6). Favorable (primary) habitat is defined as areas that have a greater than 50% probability of being occupied by wolf packs. Most of this favorable (primary) wolf habitat is located on public land, especially county forests, followed by national forests, and private industrial forests (Mladenoff et al. 1995 Appendix C). Wolves have naturally expanded into Wisconsin and have better defined what favorable habitat is to them by currently occupying 2,200 mi² (5,700 km²), most of which is also within the areas identified as favorable through computer models (Figure 6).

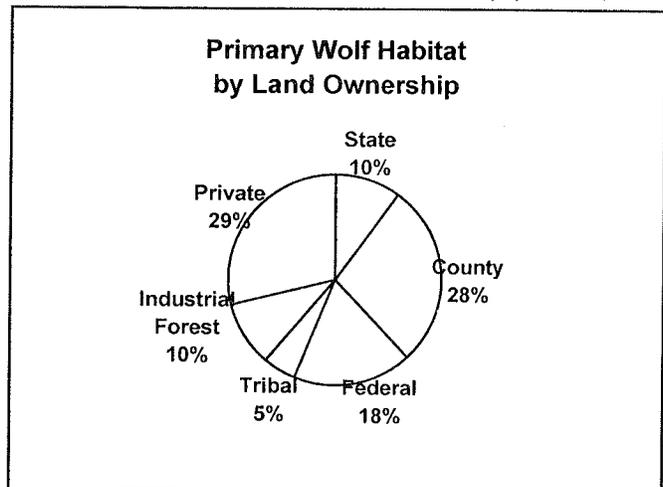
The Wolf Advisory Committee will facilitate cooperative habitat management efforts with land agencies and industrial forest and private land owners, especially in the 5,812 mi² of the most favorable habitat (Mladenoff 1995, Appendix C). Habitat management should include efforts at access management, corridor protection, vegetation management, and den site protection. Such habitat management should continue for wolf populations listed as threatened or delisted.

2. Access Management

Wolf populations are affected by human caused mortality (see Appendix F). Motorized access, and the level of human use on such access, has been shown to be a key factor in establishing and maintaining wolf populations (Thiel, 1985; Mech et al. 1988). These studies suggest that wolves exist primarily in areas with less than, or up to, one linear mile of open improved road per square mile (0.6 km/km²). Mladenoff et al. (1995) showed that road densities within pack territories were lower, averaging 0.37 mi/mi² (0.23 km/km²). The expanding wolf population in the Lake States, however, has shown

increased tolerance for slightly higher road densities in recent years (WDNR unpubl. data; per comm. Bill Berg, MN DNR).

Access management is important for many economic, social, and biological reasons. Managing the amount, type and level of public motorized access is recommended for Zone 1 and 2. Access management can include avoidance of new road construction, using temporary or winter-only roads, closure of existing roads not needed for management or public access with gates berms or large rocks, and road obliteration. Emphasis in access management should be on maintaining existing low road densities in areas of suitable habitat. Access management may help reduce maintenance costs, provide remote recreational experiences, and may benefit certain wildlife including bear, marten, bobcat, moose, goshawk, and spruce grouse. In deciding upon an access management program, variables such as administrative controls, economic and recreational land use, human population demographics, ownership patterns, atti-



tudes of the local population towards wolves, and historic trends in wolf mortality need to be taken into account.

Low standard roads (the ones that are not shown on county maps, including Forest Service class D roads), off-road motorized vehicle trails (including all-terrain vehicles and dirt bike areas), and open areas, are access situations not adequately addressed in the Wisconsin Wolf Recovery Plan. Low road density correlates well with wolf colonization because road density is directly related to levels of human access. Impacts associated with open areas where off-road vehicles are not restricted to trails, and the occurrence of low standard roads are difficult to measure, but probably have similar effects on wildlife species such as wolves. Development of low quality roads or trails for motorized vehicles should receive thorough review when being proposed in areas with suitable wolf habitat.

3. Vegetation Management

Wolves require deer, beaver and other prey to survive. Deer are generally most abundant in early successional forests. Historically, disturbances such as windstorms and fires created this vegetation condition, but in recent times timber harvest and other forest management practices have provided this habitat. Beaver are especially fond of aspen for food. Aspen, jack pine, and regenerating forests of all types are preferred by deer. Oak is important to deer in central Wisconsin, and seasonally throughout the state for its periodic acorn crop. Dense conifer cover such as hemlock, cedar and mixed conifer swamps are important as winter thermal cover for deer. Small grassy upland forest openings are important components of deer summer range. Wolf pack territories have a higher proportion of mixed conifer-hardwood forest and forested wetlands than non-pack areas (Mladenoff et al. 1995). Wolf territory size tends to increase as local deer populations decrease, and territory size decreases when deer numbers increase (Wydeven et al. 1995).

An ecosystem management approach to forest management on public and private land will balance considerations for wolves with other forest species. Young forests provide summer habitat for deer and mature conifer forests provide wintering areas. Young forests provide higher populations of prey, and large blocks of forest with a low density of roads provide seclusion for wolves.

4. Habitat Linkages and Corridors

Wisconsin is more fragmented with roads, towns, and open agricultural land than is northern Minnesota and the Upper Peninsula of Michigan. To maintain a wolf population in Wisconsin, it is important to provide forested habitat linkages and corridors for wolf dispersal to and from Minnesota and Michigan, as well as within Wisconsin. Forested blocks of land that connect wolf habitats across Wisconsin should be maintained. The WDNR will encourage private landowners, tribal governments and public land agencies to cooperatively manage corridor habitats. Protection of corridor habitat should be a factor in considering acquisition of public land for other conservation purposes.

5. Den and Rendezvous Site Management

Wolf pups are born in dens in April and remain there until mid to late June. Dens may be excavated in the ground, or may be hollow logs and stumps, old beaver lodges, or rock caves. Wolf pups are moved to rendezvous sites in mid or late June which are used until late Sep-

tember or early October when wolves begin their nomadic hunting period of fall and winter. Rendezvous sites often consist of grassy areas or sedge meadows near beaver ponds or forest streams, often near dense conifer cover.

Active den sites and rendezvous sites in areas of suitable wolf habitat need protection. Areas within 330 feet (100m) should receive total protection from tree harvest, and areas within 0.5 miles (0.8km) would be recommended for protection from disturbance such as logging from March 1 to July 31. These recommendations would generally serve as policies on public land, and be encouraged on private land in areas of suitable wolf habitat. Den and rendezvous site protection should be included even after wolves are delisted. Wildlife biologists responsible for designating such sites, and foresters will be encouraged to cooperate to manage logging operations to protect wolves during forestry projects. Normally only one or two den sites would be affected within a 50-square mile area.

6. The Role of Wilderness and other Forest Reserves

Federal wilderness (69 mi², 5 areas), state wilderness (50 mi²) and other non-timber managed forest reserves with limited or no motorized access contribute to wolf habitat in that they provide refuge areas where wolves are not subject to high human disturbances. Although designated wilderness areas are used by wolves, experience in Wisconsin and other areas of the Great Lakes have shown that managed forests with adequate access management also provide suitable wolf habitat. Therefore it is not necessary to designate areas as wilderness for the benefit of wolves.

E. Wolf Depredation Management

Wolf depredation management is one of the most sensitive segments of this Wolf Management Plan. WDNR is charged with protecting and maintaining a viable population of wolves in the state, but also must protect the interests of people who suffer losses due to wolf depredation.

Wolves occasionally kill livestock, poultry, and pets. Although wolf depredation is not anticipated to impact a significant portion of the livestock growers, poultry producers, and pet owners, it can bring hardship to individuals. Minnesota currently has more than 2,000 wolves but fewer than 1% of the farms in wolf range experience wolf depredation problems.

WDNR paid \$55,575 in wolf damage compensation claims for 45 calves, 11 sheep, 140 turkeys, and 36 dogs during 1976-98. (See Appendix A.) Depredation on dogs represented 76% of reimbursement payments provided by WDNR. Only 0.4% of the farms in the current wolf range have experienced wolf depredation problems. Through 1998, six wolves have been translocated as a result of depredations.

Reclassifying wolves from federally and state endangered to threatened status will provide an option to euthanizing

depredating wolves. Under threatened status only government agents would euthanize wolves. Once wolves are delisted, permits may be issued by WDNR to enable private landowners to take depredating wolves. Public comments in autumn 1996 revealed concerns about killing wolves, particularly through public harvests. Other comments strongly supported public harvest. Most who supported euthanizing depredating wolves felt this should only be done by government professionals. Many urged educational programs and preventive efforts by livestock producers to minimize depredation losses. There was strong support for continued damage compensation programs.

1. Depredation Management Plan

The objective of the wolf depredation program is to minimize depredations and compensate people for their losses. Euthanization is listed a depredation management option statewide, but depredation management will focus on prevention and mitigation rather than wolf removal. The Department will work with the livestock industry to develop guidelines for preventing or minimizing wolf depredations. Wolf removal without adequate prevention and mitigation, will likely result in large annual expenditures of time and money.

2. Verification Procedures

Quick, uniform, and accurate verification of wolf depredation is critical. Previous experience has shown that the majority of wolf complaints turn out to be non-wolf problems when properly investigated. Immediate response to complaints by qualified people is necessary to reasonably determine cause of death.

- A. Upon receipt of a possible wolf depredation complaint, WDNR will immediately notify USDA-WS agents responsible for investigating complaints.
- B. USDA-WS will contact the complainant by phone within 24 hours and make an onsite inspection within 48 hours of receipt of the complaint if it appears to be legitimate.
- C. USDA-WS will classify the complaint under one of the following categories:
 1. Confirmed Depredation. Clear evidence that wolves were responsible for the depredation, such as a carcass present with bite marks and associated hemorrhaging, wolf tracks in the immediate vicinity or other wolf sign.
 2. Probable Depredation. Carcass missing or inconclusive but presence of good evidence such as kill site, blood trails, wolf tracks and scat in the immediate vicinity
 3. Confirmed Non-Wolf Depredation. Conclusive evidence that something other than a wolf killed the animal. Wolf-dog hybrids and wolves that appear to have been raised in captivity. will be treated as domestic animals.

4. Unconfirmed Depredation. Any depredation or livestock loss that does not meet the above criteria. This could be missing animals, animals that died of other causes, and even animals killed by wolves but unconfirmed because of lack of evidence.

The first two categories, "Confirmed" and "Probable" are the only ones that will warrant further action. If the investigating USDA-WS agent classifies a depredation complaint as "Confirmed Non-wolf Depredation" or "Unconfirmed Depredation", no further action will be taken except that the incident will be recorded and, if the depredation is determined to be caused by wild animals other than wolves, USDA-WS will provide the appropriate assistance.

3. Control Response Options

Five control response options are available to resolve confirmed or probable depredations. (Table 3a and 3b) The depredation management program will use a combination of these options as appropriate depending upon the individual situation. These include:

1. Technical assistance to help prevent/minimize problems,
2. Compensation for losses caused by wolves.
3. Livetrapping and translocation of wolves causing problems.
4. Trapping and euthanization of depredating wolves by government agent.
5. Landowners /occupants may be allowed to kill depredating wolves by DNR permit after delisting has occurred. They would also allowed to shoot wolves attacking pets or livestock on their land.

Under cases of "Confirmed Depredation" or "Probable Depredation", the local WDNR Wildlife Biologist, the WDNR Regional Wildlife Expert, and USDA-WS will jointly determine appropriate management activities using the following criteria:

- A. Technical assistance will be provided in all Wolf Zones. These may suitable include abatement materials or practices. This may also include development of a depredation prevention plan for the farmer and recommendations for increased abatement measures which would be cost-shared by WDNR.
- B. Compensation will be provided in all Wolf Zones for verified and probable losses of domestic animals to wolves. The present compensation program is funded through Endangered Resources revenues, but following delisting, compensation for damage done by gray wolves may no longer be available. The WDNR is seeking sources for

funding the compensation program . The Mammalian ecologist will notify possible claimants of the findings of USDA-WS within 7 days of receiving verbal notification that a wolf kill has occurred. The Madison Office of the WDNR will respond to a claimant within 14 days, either affirming the claim and initiating processing, or seeking additional justification for the claim. Farmers must follow any technical assistance recommendations to remain eligible for com-

pensation payments. Damage appraisals will continue to be performed by USDA-WS to provide accurate, timely and fair compensation for losses.

C. Translocation -Depredating wolves may be translocated from Zones 1,2 and 3. Translocation may be effective in some situations, but success will vary depending on the trapping history of a problem wolf. Eventually translocations may be limited as the number of suitable

Table 3a. Depredation Management Options by Management Zones For a Threatened Wolf Population in Wisconsin (80-250 wolves)				
Possible Depredation Control Activity	Zone 1	Zone 2	Zone 3	Zone 4
Technical Assistance and Compensation	allowed	allowed	allowed	allowed
Translocation of Wolves	allowed	allowed	allowed	not allowed
Euthanize Wolves (USDA-Wildlife Services)	allowed*	allowed	allowed	allowed
Private Landowner Control	not allowed	not allowed	not allowed	not allowed

Table 3b. Depredation Management Options by Management Zones For a Delisted Wolf Population in Wisconsin (250+wolves)				
Possible Depredation Control Activity	Zone 1	Zone 2	Zone 3	Zone 4
Technical Assistance and Compensation	allowed	allowed	allowed	allowed
Translocation of Wolves	allowed	allowed	allowed	not allowed
Euthanize Wolves (USDA-Wildlife Services)	allowed*	allowed	allowed	allowed
Private Landowner Control	allowed	allowed	allowed	allowed

* Lethal Control will rarely be used on large blocks of public land.

release sites are occupied by wolves. Identification of release sites and agreements with appropriate land owners/ managers must be done before translocation efforts can be initiated.

- D. Euthanization – Some wolves may be euthanized in the future due to conflicts with humans. This option can be used when:
- 1) there have been significant documented, confirmed losses at a site,
 - 2) the producer has a signed depredation management plan for the property and follows abatement/ husbandry recommendations,
 - 3) the USDA-WS Depredation Specialist recommends euthanasia, and the WDNR approves.
 - 4) wolf-dog hybrids will be euthanized in any zone where they are captured at depredation sites.

Initiation of translocation and/or euthanization efforts will depend upon the Wolf Management Zone in which the depredation problem occurs and the status (threatened or delisted) of the wolf population. Guidelines for each Wolf Zone are as follows:

1. Zone 1 —On large blocks of public land in primary wolf habitat, euthanization of wolves will not normally occur.
2. Zones 1 and 2 - While wolves are state threatened, trapping efforts will be initiated only in cases with repeated depredation problems. Trapping will be limited to areas within 0.5 miles of the confirmed depredation site. Wolves will be translocated or euthanized. After wolves have been state delisted, landowner /occupant control with DNR permit will be allowed at depredation sites on their property which have had a history of recurring problems.
3. Zone 3- While wolves are state threatened trapping efforts will be limited to repeated depredation problems and to areas within 5.0 miles of the depredation site. Wolves will be translocated or euthanized. After wolves have been state delisted, private landowner control will be allowed with DNR permit to control wolves on their property.
4. Zone 4 - While wolves are state threatened live trapping will be done on any wolf causing depredation with no limits from depredation sites on trapping. Such wolves will normally be euthanized. After wolves have been state delisted, proactive trapping may take place, local law enforcement officers may be allowed to kill wolves, and private land owners or their agents may be given permits to kill depredating wolves.

F. Wolf Education Programs

Public education about wolves was a major factor in the success of wolf recovery in Wisconsin. Education emphasized greater acceptance of wolves, and have reduced unfounded fears and myths. Education about wolves will continue to be important in future wolf management, with more focus on ways to live with wolves,

needs for wolf control activity, and needs for more of an understanding of the role of wolves in forest ecosystems. Educational information will also be needed to explain the reclassification and delisting process to the general public as wolves pass through threatened and delisted status.

A multifaceted and multi-agency approach will be used to encourage wolf education in Wisconsin. Some of the major education steps are listed below.

1. Develop Special Education Materials

- a. The current (1996) edition of the "Timber Wolf Life Tracks" publication will be updated about every 5 years or when major changes in status or population occur.
- b. A pamphlet will be developed between WDNR and USDA-WS on means for livestock owners to reduce or avoid depredation problems by wolves and other predators.
- c. A booklet will be prepared that explains Wisconsin wolf management to general audiences.
- d. Periodically write and publish news releases and articles on Wisconsin wolves for state newspapers, magazines, and others include the "Wisconsin Natural Resources Magazine".
- e. Incorporate information on wolf identification, protection, and trap release methods in hunting and trapping pamphlets, and incorporate wolf identification/ecology information into hunter and trapper education courses.
- f. Incorporate wolf information on the WDNR's Web Page (www.dnr.state.wi.us)

2. Work with other organizations

WDNR will continue to work with other organizations to promote wolf education including: Timber Wolf Alliance (TWA), Timber Wolf Information Network (TWIN), International Wolf Center, and other organizations involved in promoting wolf education. The WDNR will provide a person to serve on the advisory committee for TWA, provide training at TWA workshops, review and edit educational material for TWA, and help TWA promote the annual "Wolf Awareness Week". The WDNR will assist TWIN with workshops when requested and provide survey information for TWIN to use in developing educational materials. Periodic updates on Wisconsin wolf status and management will be provided to the International Wolf Center.

WDNR will assist other wolf organizations, schools, colleges, and educational organization to teach members about wolves and assist in developing wolf education material.

3. Provide Special Training

As wolf populations continue to expand, and wolf management becomes more decentralized, there will be more of a need to teach others about wolf management including WDNR wildlife biologists and technicians, other WDNR field workers, other agency personnel and tribal natural resources personnel. Education on wolf management would include: identification of wolves and wolf sign, methods of determining local wolf populations, methods of trapping and releasing wolves, procedures for wolf habitat management, and means for reducing wolf depredation problems. The WDNR will develop and conduct such programs to teach others about wolves. Other programs in which WDNR wolf program personnel will be involved would include training for USDA-WIS trappers, and track training for WDNR, Great Lakes Indian Fish and Wildlife Commission (GLIFWC), tribal natural resource personnel, Forest Service, and other agency personnel conducting furbearer and carnivore surveys. WDNR wolf program personnel will assist in the training of university personnel conducting wolf studies on methods of trapping, handling and monitoring of wolves.

4. Provide general wolf presentations

The WDNR wolf program coordinator will continue to provide presentations to the general public on Wisconsin wolves, as will others working on the wolf program. But as wolves become delisted and wolf management becomes more decentralized, no one individual will be as intensely involved with the wolf program. Therefore the need to give wolf presentations should be shared more broadly with other WDNR wildlife biologists, park naturalists, other agency biologists, and trained volunteers.

G. Law Enforcement

Strict legal protection has been a key in the improved status of wolves in Wisconsin and the Great Lakes region. In Wisconsin, important factors in the increase of wolves has been the closing of coyote hunting across the northern half of the state during the firearm deer hunting season, increased fines for killing of endangered species, and vigorous investigation of illegal killing of wolves. Changes and potential regulations necessary for reclassified and delisted wolf populations are listed below:

1. Threatened Status Regulations

- a) The term "threatened species" needs to be added to Wisconsin Stats. 29.65 (civil actions for damage caused by law violations), and 29.9965 (wild animal protection assessments). These statutes would set the value of an illegal killed wolf at \$875, the value

set for all endangered species, but currently not including threatened species. This amount would be added to the penalty for illegal killing of a wolf upon conviction.

- b) Penalties for killing threatened species remains the same as for endangered species, that being (Wisconsin Stats. 29.605 (formerly ss 29.415 (5) (a) (1):) **Unintentional violations** would be subject to a fine of \$500 to \$2,000 and 1 year loss of hunting privileges. **Intentional violations** would be subject to a fine of \$2,000 to \$5,000 or up to 9 months in prison, or both, and loss of hunting privileges for 3 years.
- c) A state endangered or threatened species permit would be required for possessing of captive wolves.
- d) Coyote-closed zones during the gun-deer season would be modified to cover Zone 1 (Figure 8), and would reduce areas with restricted coyote hunting from 44% to 33% of the state.
- e) While wolves remain federally listed as endangered or threatened, all law enforcement work will be coordinated with the USFWS. Decisions as to whether to prosecute violations as state or federal will be made by federal and state wardens in consultation with the local district attorney. Generally, federal violations carry much heavier fines and longer periods of imprisonment.

2. Delisting Regulations

- a) The wolf should be added to the animal list in Wisconsin Stats. 29.65 (1) (6) and 29.9965 (1) (6) (2). It would be added to moose, elk, fisher, prairie chicken, and sandhill crane as animals valued at \$262.00 for illegal kills.
- b) The wolf should be added to the list of species for which unlawful hunting would result in a "forfeiture of not less than \$1,000 nor more than \$2,000 and revocation of hunting privileges for 3 to 5 years" which currently exists for moose, elk, bear, and deer.
- c) Additional regulations should be added to Wisconsin Statutes Chapter 29 making it illegal to possess either wolf or wolf-dog hybrids in captivity without obtaining a permit from the WDNR. Legislative authority should be sought for Conservation Wardens to destroy free-roaming wolf-dog hybrids.
- d) Wolves would be added to Wisconsin Administrative Code NR 10.02 (1) as a "protected

wild animal".

- e) A coyote-closed zone would be maintained during the gun-deer season only in Zone 1.
- f) Investigations of illegal killing of wolves would be done by Wisconsin Conservation Wardens or Tribal Wardens, and federal involvement would not occur unless transport of illegally killed wolves crosses state lines.
- g) Wolf dens would be included under the category of regulations against disturbing or molesting in Wisconsin Administrative Code under NR 10.13(2) and create a new subparagraph "(d) Molest or disturb any gray wolf den".

H. Inter-Agency Cooperation/Coordination

Achieving the objectives of this plan requires the continued involvement and cooperation among many agencies, private individuals and organizations. The WDNR will continue to mesh its objectives with the USFWS Recovery Plan (1992), Minnesota DNR, Michigan DNR, Wisconsin counties, industrial forests owners, Native American Nations, and other concerned agencies and organizations.

In 1992 a Wisconsin Wolf Advisory Committee was formed similar to other species advisory committees coordinated by the WDNR. The Wolf Advisory Committee is charged with reviewing and making recommendations on policies and management procedures affecting wolves. The current management plan was developed by the Wolf Advisory Committee. Advisory committee membership includes WDNR, USFWS, U.S. Forest Service, GLIFWC, County Forests, University of Wisconsin-Stevens Point, USDA-WS, and Wisconsin Conservation Congress. The committee will continue to meet regularly once the plan is approved to review and monitor progress. Committee meetings are open to the general public and other agencies.

Since 1989 Great Lakes Wolf Stewards (an informal group of state, U.S. Fish & Wildlife Service and U.S. Forest Service biologists working with wolves) has met during most years to discuss wolf management issues affecting the Great Lakes region. This group consists of representatives from various agencies and private organizations from Michigan, Minnesota, and Wisconsin. The "GIS Analysis of Wolf Habitat in the Great Lakes Region" (Mlandenoff et al. 1995) and "Guidelines for Wolf Management in the Great Lakes Region" (Fuller 1995) are two products that resulted from these meetings. The WDNR will continue to promote, support and occasionally sponsor Great Lakes Wolf Stewards meeting.

The chair of the Wisconsin Wolf Advisory Committee and the U.S. Forest Service representative also serve

on the Federal recovery team for the eastern population of gray wolves in the U.S. This committee is reviewing the 1992 recovery plan to determine if reclassification and delisting criteria are being met. The Wisconsin members serve on the federal recovery team with members from Michigan, Minnesota, Wisconsin Chippewa tribes, and the National Park Service. This committee will finalize recommendations for federal delisting in close cooperation with the states.

Once wolves are state delisted, the Wisconsin Wolf Advisory Committee will meet at least annually to review wolf management in the state. Wisconsin biologists will meet periodically with biologists from Michigan and Minnesota to coordinate wolf management especially maintenance of habitat corridors that connect wolves across the three states.

I. Program Guidance and Oversight

A Wolf Advisory Committee will continue to oversee state wolf management in Wisconsin. The Wisconsin Wolf Advisory Committee reports to the Bureau of Endangered Resources and Wildlife Management and Division of Lands, Land Leadership Team of the Department of Natural Resources. Plans prepared by the Wolf Advisory Committee are subject to approval of the Natural Resources Board. The chairperson of the wolf advisory committee will be the coordinator for wolf management activity in the state. Composition of the Wisconsin Wolf Advisory Committee (DNR Wolf Technical Committee) may include the following:

- a) The chairperson should be the mammalian ecologist in the WDNR Bureau of Endangered Resources .
- b) WDNR wildlife biologists from regions that have wolves,
- c) WDNR wildlife education specialist,
- d) WDNR wildlife depredation specialist,
- e) WDNR wildlife health specialist,
- f) WDNR conservation warden,
- g) USDA-WS,
- h) USFWS biologist,
- i) USFS biologist,
- j) Tribal biologists,
- k) WDNR mammalian research ecologist,
- l) WDNR public affairs manager,
- m) Conservation Congress representative,
- n) County Forest Administrator,
- o) WDNR Furbearer Ecologist, and
- p) GLIFWC biologist
- Q) WDNR, BER Staff Biologist

The DNR will also create a stakeholders group that will include agencies, organizations, and other members of the general public interested in wolf management (Appendix D). The Wolf Advisory Com-

mittee should meet at least once per year with the stakeholders group to assess the state wolf population, assess wolf management zones, review depredation control activities, assess impact of educational activities, review problems and determine needs for new policies or management procedures. The stakeholder group will provide a balanced spectrum of publics concerned about wolves. Other public involvement techniques also will be used to encourage all persons who are interested in wolves to participate in discussions. All interested people should have a chance to make their viewpoints known. Annually the Wolf Advisory Committee (technical group) will make a written report to the public. At 5 year intervals, a thorough review should be made of the state wolf population status, and a public review should be made to assess concerns and support of wolf management.

J. Volunteer Programs

Many people have volunteered for wolf recovery efforts since the development of the Wisconsin Wolf Recovery Program in the 1980's. Volunteers have assisted in education programs, population monitoring, and financial donations to wolf management. Such efforts have expanded levels of wolf recovery work, provided additional funding, and helped foster citizens that are very committed to wolf recovery. As the wolf population expands, and are reclassified to threatened and eventually delisted, greater reliance will be placed on volunteers to conduct wolf conservation activity.

Timber Wolf Alliance (TWA) was formed in 1987 as a means for involving private citizens into Wisconsin wolf recovery efforts. The Sigurd Olson Environmental Institute out of Northland College, Ashland, Wisconsin sponsors TWA, in a similar fashion as it has sponsored Loon Watch, a successful program for volunteer monitoring of loon populations in the Great Lakes. TWA has developed a speakers bureau of volunteers that give wolf talks and assist at wolf education programs at sports shows and other events. TWA also has an Adopt a Pack program which provides education to groups and donates part of those proceeds from the program to DNR wolf population monitoring efforts.

Students of Northland College and UW-Stevens Point have monitored wolves. Students monitor wolves through snow tracking, howl surveys, and radio-tracking. Programs such as these can continue, and could expand to include universities, technical college and high schools.

Timber Wolf Information Network (TWIN) was formed in 1990 to encourage wolf recovery through wolf education programs. TWIN provides a wolf

ecology course through which many people have been taught about wolves. TWIN also has an Adopt a Pack program to teach schools and youth groups about wolves and encourage wolf research. Volunteers trained through TWIN's workshops have assisted on wolf population monitoring efforts in the state.

The WDNR initiated a volunteer tracking program in 1995, to use trained volunteers to search for wolves in winter and assess abundance of other medium and large carnivores in Wisconsin. Forested portions of north and central Wisconsin were delineated into 123 survey blocks averaging 200 square miles each. Volunteers are requested to conduct 3 or more good snowtracking surveys, covering about 30 miles each of snow-covered roads on their survey block each winter.

Opportunities for volunteers to work directly with WDNR wolf workers are limited, therefore WDNR will continue to work with other organizations and develop the volunteer tracking program. The WDNR will continue to search for other opportunities for volunteer involvement.

Work with volunteers will also be important in developing methods for preventing depredation and providing factual information to members of the public about wolf behavior. It may be desirable to enlist a volunteer organization to fund wolf depredation claims once delisting occurs and WDNR endangered species funds are no longer available.

K. Wolf Research Needs

The WDNR has been monitoring the status of the wolf population in the state since 1979. Emphasis has been placed on determining population status, pack sizes and distribution, mortality rates and factors, productivity, rates of recolonization, dispersal behavior, and disease/health status. More intensive research was initiated in 1992 in extreme northwestern Wisconsin to determine the impacts of highway expansion on resident and dispersing wolves near U.S. Highway 53. Results of these efforts have provided excellent data for tracking the progress of Wisconsin's recovering wolf population.

Reclassifying of wolves from "Endangered" to "Threatened" status, and hopefully down to "Protected" status in the future will require additional research to safeguard the wolf population and develop/evaluate future wolf management practices. Future wolf research needs include:

- 1) Development of reliable, but more economical wolf census techniques to accurately document numbers and distribution.
- 2) Re-measurement of public attitudes towards wolves and recovery in the state to define reason-

able wolf population goals and acceptable wolf habitat.

- 3) Identification of wolf travel corridors and development of appropriate management practices for travel corridors to allow continued interchange of wolves among Minnesota, Wisconsin, and Michigan.
- 4) Development of a model that can predict potential den and rendezvous sites within suitable wolf habitat so these areas can be protected from human disturbance.
- 5) Continued health monitoring to identify factors causing low pup survival and to document any future outbreaks of diseases or parasites that may have significant negative impacts on the wolf population.
- 6) Development of policy/procedures for handling depredating wolves and explore possibilities to minimize depredation problems.
- 7) Identification of factors apparently limiting wolf colonization in northeastern Wisconsin
- 8) Conducting special long-term research on wolf ecology, population growth, and depredation concerns in central Wisconsin.
- 9) Documentation of the impacts of future wolf populations on deer, beaver, coyote and other wildlife within wolf range.
- 10) Conduct research on non-lethal means of reducing wolf depredation and thoroughly examine the ecology of depredating wolves.
- 11) Developing models that estimate the state wolf population using existing survey and population data, as well as identifying needs for additional surveys. Use modeling to further examine viability of the state wolf population.

Availability of funding and personnel will determine the rate at which these research needs will be met. Other research priorities may arise with changes in wolf populations, human development, and land management practices. Some research would be conducted by WDNR, universities and other cooperators. Attempts will be made to secure outside funding to allow more thorough research than possible under current funding.

L. Wolf-Dog Hybrids and Captive Wolves

A wolf-dog hybrid is the offspring of the mating of a wolf (*Canis lupus*) with a domestic dog (*Canis familiaris*). Normally these are bred in captivity because wild wolves rarely breed with dogs. These animals have rapidly grown in popularity in the late 1980's and 1990's, and seem to be the pet of choice for a growing segment of the public that wants a pet that is different, intelligent, semi-wild, and independent. The characteristics of wolf/dog hybrids make them highly desirable to some people, but also highly unpredictable. Estimates of the number of privately owned hybrids in this

country run as high as 400,000 (Hope 1994).

The normal "predatory behaviors" of wild predators like the gray wolf have been lost in most domestic dogs. However, in hybrids these instincts are present to varying degrees, yet the animals commonly lack a fear of humans.

Attacks, maulings, dismemberment's and deaths caused by wolf/dog hybrids have received national media attention. Four children are known to have been killed by hybrids between 1981 and 1988. The death of a four year old in Florida in August of 1988 seemed to heighten media attention on this subject. In this case a publicly trusted institution--an animal shelter--featured a hybrid as the "pet of the week". Two hours after the animal had been brought to it's adoptive home, it killed the neighbor's child. The shelter paid a \$425,000 settlement to the boy's family. This tragedy set a national precedent for animal shelters/agencies: wolf/dog hybrids are to be put down or returned to their original owner, but are not to be adopted out to an uneducated, unsuspecting public.

This precedent makes it very difficult for distressed owners of unmanageable adult wolf/dog hybrids to find a "good home" for the animal they still love but just can't live with anymore. There are numerous wolf and wolf/dog hybrid shelters throughout the country, however, space is limited and such shelters are often filled. Unfortunately for the animals and the reputation of wild wolves, many overwhelmed hybrid owners resort to "setting their wolf free" when they cannot find a suitable home for them. These freed hybrids however lack the hunting skills and pack structure needed to survive by hunting wild prey. When these animals become hungry, they instinctively return to humans for food, invariably get into trouble, and often are shot to death by local enforcement officers. There have been twenty-one cases of free-roaming wolf/dog hybrids in Wisconsin between 1989 and 1998. (see Appendix G).

Free-roaming hybrids, and the problems they cause give wild wolves a bad reputation. Wildlife biologists may spend an extensive amount of time attempting to identify wolf-dog hybrids, document problems, and attempt to rectify such problems, which diverts time and expenses from management of wild wolves.

Wildlife biologists are concerned about escaped or released wolf/dog hybrids interbreeding with wild wolves--diluting the gene pool with the instincts and behaviors of domestic dogs (Hope 1994). Dog genes in a wolf population may reduce long term viability and increase rates of livestock depredation.

Attacks on humans by captive wolves and wolf/dog hybrids will continue to contribute to a negative image of wolves to the public. Additionally, released/escaped hybrids have the potential of destroying the genetic purity and hence, the legal status, of wild wolves in Wisconsin.

Possession of pure wolves is presently allowed only by WDNR permit. While this species is listed as Endangered or Threatened the WDNR Bureau of Endangered Resources is responsible for issuing such permits. These permits can only be issued for "zoological, educational, or scientific purposes or for propagation for preservation purposes" (s.29.604 WI Stats.). The possession of wolves will continue to be highly regulated following delisting. The WDNR will promulgate specific Administrative Rules to ensure this.

Possession of wolf/dog hybrids also needs to be regulated due to their potential impact on wild, free ranging wolves. The WDNR will seek statutory authority to regulate the ownership of these animals in the state. Twenty-five other states presently regulate the possession of these animals; these regulations range from simple registration to a total prohibition of possession.

Free-roaming wolf-dog hybrids trapped at depredation sites will be euthanized unless collars provide the identification of an owner. The owner of such an animal may be responsible for the cost of depredations. Legislative authority will be sought to allow Wisconsin Conservation Wardens to destroy free-roaming wolf-dog hybrids. Local law enforcement officers may kill animals which cause a substantial risk or threat to human life by attack or aggressive behavior.

M. Wolf Specimen Management

To date wolf carcasses found in the wild have been necropsied (examined) to determine cause of death and health status. While wolves were listed as endangered, the DNR policy was to have all wolf carcasses studied by the National Wildlife Health Lab in Madison, Wisconsin. Eventually all became specimens at research institutions, with most wolf specimens deposited at the University of Wisconsin - Zoology Museum in Madison. With reclassification and eventual delisting, the management of wolf specimens will be modified. The Wisconsin Wolf Advisory Committee developed guidelines for managing wolf specimens under threatened and delisted classification.

1. Wolf Specimen Management - Threatened

With reclassification to threatened, research, population monitoring and health evaluations of dead wolves found in the wild will remain the top

priority. Additional wolf carcasses will be made available as euthanasia of depredating wolves become possible, and accidental mortality caused by vehicle collisions increases. All wolf carcasses will be necropsied (examined) by the National Wildlife Health Lab, and specimens will be turned over to interested research museums when there is an identified need and use for such specimens. If specimen remain available after research needs have been met, the second priority for use of wolf carcasses would be for education purposes and Native American cultural and religious purposes. Such carcasses can be made available to tribal governments, nature centers, state parks, wolf education organizations, WDNR and other agency offices. Carcasses would not be available for private ownership.

Wolves found dead in the field should be collected by wildlife biologists, wildlife technicians or conservation wardens and placed in WDNR freezers until arrangements can be made to ship the carcasses to Madison. Any wolves euthanized by USDA-Wildlife Service will also be turned over to WDNR for necropsies. All carcasses should be tagged, and labeled with all pertinent information kept with each carcass. The WDNR regional wildlife expert should be notified of all wolf carcasses found in his/her region. The wildlife expert will coordinate shipment, necropsies, and eventual designation of specimens. Regional wildlife experts will keep lists of organizations interested in receiving carcasses, and will coordinate distribution of carcasses. Reports will be submitted at the end of each year to WDNR - Endangered Resources by regional wildlife experts on carcasses collected, and final disposition of each. Any wolf suspected of being killed illegally will be held for conservation wardens until legal investigation and prosecution are completed.

2. Wolf Specimen Management - Delisted

When wolves are no longer listed as threatened or endangered in Wisconsin, ownership of wolf carcasses can be broadened. Wolf carcasses would be available from depredation control activities, natural mortality, illegal kills, and accidents.

Research will continue to be an important priority, but will require a research proposal identifying needs and anticipated results, and such proposals would need WDNR and/or tribal approval. A portion of carcasses collected each year may be requested by WDNR-Wildlife Health specialist to evaluate health status, and all skinned carcasses may be requested most years. Following research and health monitoring, wolf education

and Native American cultural use would be the next priority for ownership of wolf carcasses. Skins and skulls would be made available for Native American tribal governments, schools, nature centers, state parks, WDNR and other agency offices, tribal centers, and wolf education organizations. Wolf specimens could be turned over to private individuals if specimens are not needed for above purposes. No carcasses should be provided to landowners conducting control on their land, or to persons involved in accidental killing of wolves. Dead canids suspected of being wolf-dog hybrids, but which appear to be mostly wolf, should be treated as wolves for the purpose of wolf specimen management.

Regional wildlife experts will coordinate wolf specimen management in each WDNR region. The wildlife experts will maintain lists of organizations and individuals interested in receiving specimens, and will determine disposition of carcasses. Annual reports will be submitted to WDNR Endangered Resources on carcasses collected and handled in each region, including biological information and final disposition of carcasses.

N. Ecotourism

Ecotourism has developed in recent years as a means for obtaining financial benefits from natural ecosystems and wild animals, while also encouraging protection of wildlands (Hunter 1996). Ecotourism at times can be a double-edged sword; it may encourage protection and conservation of biological diversity, but at times could cause disturbance of wild animals and disruption of their habitats. Guidelines and occasional regulations may be necessary to prevent or minimize negative affects of ecotourism.

Wolves can at times contribute to ecotourism. In Ely, Minnesota, tourist visits to the International Wolf Center provide a \$3 million annual impact to the local economy (Mech 1996). Ecotourism dealing with wolves is not likely to be as profitable in Wisconsin, but there are means that ecotourism involving wolves could impact local economies. Howling sessions could potentially be conducted by tour guides across portions of northern Wisconsin. Tours of wolf territories to search for wolf sign could be done during winter months. Snowmobiling and ATV tours of wolf territories have been suggested for the Minocqua area. Volunteer or paid naturalist at resorts could include wolf programs and tours of wolf territories. Naturalist programs by WDNR, Forest Service or National Park Service could attract tourist use of surrounding areas by providing wolf programs. Persons attending wolf workshops at Drummond and Tomahawk, make use of restaurants, taverns, gas stations and convenient stores in the local areas.

Ecotourism could also potentially have negative im-

pacts on wolves in Wisconsin. Excessive howling sessions could cause abandonment of preferred rendezvous sites, and perhaps displace wolves to less suitable areas. Disturbance of den areas may cause premature abandonment of den sites, and may expose pups to mortality; wolf pup mortality is already fairly high in Wisconsin.

The Timber Wolf Alliance and Timber Wolf Information have developed guidelines for minimizing impact from howl surveys on wolves. These guidelines include: avoid howling during the denning period in April-June, limit howls in specific territories to once per week or less, avoid repeated howlings at individual wolf packs, and refrain from visiting rendezvous sites. Similar guidelines would be recommended to others planning to conduct wolf howls in Wisconsin.

Encouragement will be made to groups conducting wolf tours or howl sessions to minimize impact on wolves, avoid certain portions of wolf territories, and refrain from excessive visits to wolf areas. It would also be recommended to any groups conducting such tours that these be conducted by individuals knowledgeable in wolf ecology and behavior. It may be necessary in the future to regulate wolf tours done for profit, in a fashion similar to existing guide permits.

VI. WOLF MANAGEMENT BUDGET

Expenditures for the Wisconsin wolf recovery program by fiscal year are shown in the Table 4 below. A total of \$ 1,547,333 (\$1,139,225 federal, \$408,148 state funds) was spent on wolf recovery efforts since 1979 (Table 4). Since 1990, when a recovery plan became effective program expenditures have averaged \$ 115,326 per year during the past eight fiscal years (i.e. 1990-1998); Federal funds accounted for 77%, state funds 23%.

Federal funds have come from the U.S. Fish and Wildlife Service (source: Federal Endangered Spe-

cies Act, Pittman-Robertson Wildlife Restoration Act) and from the U.S. Forest Service. State funds have come from the Wisconsin Endangered Resources Fund (ie the check-off on Wisconsin income tax forms and Endangered Resources License Plate funds), donations from The Timber Wolf Alliance and gifts from the public.

The Wisconsin Endangered Resources Fund pays for all damages done by state listed (endangered/threatened) species in addition to partially funding the wolf recovery program. Between 1984 and 1998, \$55,575 has been paid to compensate people for losses due to wolves. Compensation payments are not included in the tables below.

Table 4.

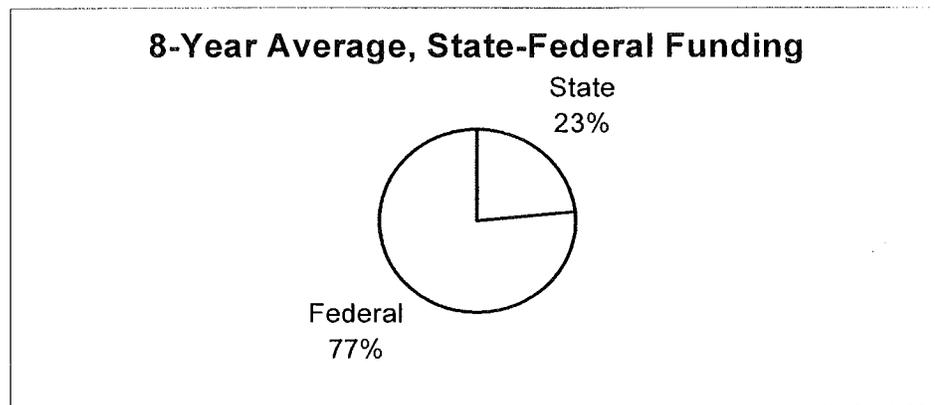
WI Timber Wolf Recovery Program Expenditures			
Year	State	Federal	Total
1979-80	\$5,000	\$15,000	\$20,000
1980-81	\$5,425	\$16,275	\$21,700
1981-82	\$7,734	\$35,000	\$42,734
1982-83	\$13,013	\$35,200	\$48,213
1983-84	\$27,905	\$51,440	\$79,345
1984-85	\$11,804	\$28,125	\$39,929
1985-86	\$23,625	\$60,600	\$84,225
1986-87	\$44,129	\$56,305	\$100,434
1987-88	\$14,864	\$62,592	\$77,456
1988-89	\$23,888	\$18,069	\$41,957
1989-90	\$20,411	\$48,319	\$68,730
1990-91	\$15,508	\$95,198	\$110,706
1991-92	\$25,769	\$67,443	\$93,212
1992-93	\$38,651	\$58,893	\$97,544
1993-94	\$19,006	\$68,893	\$87,899
1994-95	\$19,404	\$91,265	\$110,669
1995-96	\$30,819	\$112,119	\$142,938
1996-97	\$29,909	\$120,450	\$150,359
1997-98	\$31,284	\$98,039	\$129,323
PROJECT			
TOTAL:	\$408,148	\$1,139,225	\$1,547,373
YEARLY	State	Federal	
AVERAGE:	\$21,481	\$59,959	\$81,441

It is anticipated that wolf management will cost approximately \$130,000 in state fiscal year 1999-2000 and increase about 10% per year each year thereafter.

Approximately one-third of the project costs are for the salary of the wolf program coordinator and about \$42,000 are costs involving radio-telemetry surveys. Five years after wolves are federally delisted, Section 6 Endangered Species funds will no longer be available. In recent years Section 6 funds have normally ranged from \$20,000 to \$40,000 and Forest Service monies have ranged from \$6,000 to \$12,000. Pittman-Robertson Wildlife Restoration funds would still be available for wolf conservation work, but less may be available due to competition with other endangered species and wildlife management projects. Some Forest Service funds may continue to be available.

and 24% for other losses. The average livestock loss yearly was \$781. Livestock losses have increased in recent years and between 1995-1998 average payments on livestock have been \$ 2,800 per year. Generally about \$17,000 are available annually in the Endangered Species Depredation Fund. The majority of this money has been spent recently on payment for depredation of dogs.

Once wolves are state delisted, this fund may no longer be available for damage caused by wolves. The costs of depredation on livestock and pets is pro-



Currently monitoring costs are: radio-telemetry \$40,000 to \$45,000 annually, snow track surveys at \$15,000 annually and howl surveys at about \$5,000 annually. These costs will probably increase as wolves expand across more of Wisconsin. Monitoring must keep up with wolf population as it increases so adequate information is available to make sound decisions about wolf management in Wisconsin.

jected to be about \$20,000 to \$40,000. The cost of USDA-Wildlife Services investigating, assessing and controlling depredation is \$15,000 to \$30,000. The total cost for depredation control is therefore likely to be \$35,000 to \$70,000 annually. New funds need to be provided for the WDNR is to continue reimbursing livestock and pet owners for losses.

Wolf depredation costs have averaged \$3,970 annually since 1984. Of that amount 76% was for dogs

The total cost for wolf management will be approximately \$165,000 to \$200,000 annually including all management activities and depredation controls.

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VIII. Glossary

Abatement - Techniques for reducing risk of depredation by creating exclusions, establishing barriers, or using scare methods. Abatement practices that may be used to reduce wolf depredation would include fences, guard dogs, scare devices and other techniques.

Access - Refers to the ability of humans to penetrate an area and is usually measured by roads per square mile.

Carrying Capacity – The population at which a population stabilizes (births=deaths) with its environment; This is generally referred to as biological carrying capacity. The maximum population level tolerated by people is called the sociological carrying capacity and is usually considered less than biologically carrying capacity. The estimated biologically carrying capacity of wolves in Wisconsin was estimated at 300-500 in areas of primary wolf habitat but could be 50% or more higher if wolves readily occupy secondary habitat.

Critical Habitat -Term used in the Federal Endangered Act whereby certain areas are defined as critical to the survival of a species. Such a classification may restrict land use activity within designated areas. No areas in Wisconsin have been classified as critical habitat for timber wolves by the Federal Government.

Delisting - Refers to the act of removing a species from both endangered and threatened species classification. The act of delisting does not mean a species is no longer protected. Delisting federally indicates that a species no longer has Federal Endangered Species protection, but would fall under state management and protection authority.

Depredation - Refers to predation on domestic animals or animals that a predator would not normally encounter or kill in natural habitat.

Endangered - Federal designation of the term "endangered species" means any species which is in danger of extinction throughout all or a significant portion of its range." [Federal Code 16USC SS 1532 (6)].

State designation of endangered species means "any species whose continued existence as a viable component of this state's wild animals or wild plants is determined by the Department to be in jeopardy on the basis of scientific evidence. [Wisconsin Statute 29.604].

Favorable Habitat – As used in GIS analysis of potential wolf habitat (Mladenoff et al. 1995), refers to areas that have a 50% or greater probability of being settled by wolf packs. Such areas may also be called suitable habitat or primary wolf habitat. Areas of favorable wolf habitat have less than 0.7 mile of road per square mile, less than 10 people per square mile, and consists of over 90% forest or wildlands.

GIS -Geographic Information System - This is computer mapping that allows for comparison of multiple landscape features and allows the comparison of landscapes with occurrence of animal or plant species.

GLIFWC - Great Lakes Indian Fish and Wildlife Commission; this agency conducts wildlife and fisheries management activity for the Chippewa tribes in the ceded territories of Minnesota, Wisconsin and Michigan.

International Wolf Center - A wolf educational organization located in Ely, Minnesota that promotes wolf education for worldwide wolf conservation activity.

Livestock - Any domesticated animal owned and raised as stock; or pen-raised animals raised on licensed game farm operations.

National Wildlife Health Lab - Facility formerly with the U.S. Fish and Wildlife Service and now in the National Geological Survey in the U.S. Department of the Interior. The Madison, WI., health lab conducts research on wildlife diseases affecting migratory birds, federally endangered and threatened species, and other wildlife species of national concern.

Necropsy – an examination of an animal body after death to determine cause of death or character and changes produced by disease.

Pets - Any domesticated animal not raised as stock.

Potential Habitat-Habitat that is likely to be occupied in the future and includes mainly those areas that have a 50% or greater probability to be occupied.

Predation - Refers to the act of killing by predators for food. Predation usually is used to refer to predators killing normal prey species, whereas killing of domestic animals is referred to as depredation.

Primary Habitat- (See Favorable Habitat)

Proactive Depredation Control - Control activity conducted on predators before verified depredation has occurred, or control activity used before verification has occurred in the current season. Such activity would occur in areas of unsuitable habitat with high probability of depredations or conflict. Control activity would refer to euthanizing or translocation of potential depredators.

Reclassification -Refers to the act of changing listing from endangered to threatened, the delisting of species as neither endangered or threatened, or the relisting of species as endangered or threatened.

Roads - Generally this includes any travelways used by motorized vehicles. In GIS habitat analysis, roads refers to travelways that are driveable by 2-wheel drive vehicles on a year-round basis. Low quality roads may also have some impact on wolf habitat, but are often more difficult to accurately measure and assess.

Secondary Habitat - Areas providing food and cover for wolves of a quality that would have a 10% to 50% probability of being settled by wolf packs as defined by Mladenoff, et. al. (1995)

Species - Organisms that are capable of interbreeding and is designated by a binomial term in Latin. The species designation of timber wolf or gray wolf is Canis lupus.

Subspecies -A grouping of organisms that differ from other members of their species by color, size or various morphological features; also referred to as race. Wolves in Wisconsin had been referred to as the Eastern timber wolf Canis lupus lycaon, but have recently been reclassified to the Great Plains wolf Canis lupus nubilus. The specific subspecies classification is not critical for determining wolf conservation needs.

Threatened - Wisconsin's designation of threatened species is "any species of wild animal or wild plant which appears likely within the foreseeable future on the basis of scientific evidence to become endangered" (Wisconsin Statutes Sec. 29.604 2)). Federal designation of threatened species is "likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range" (Federal Code 16USCSS1532(20)).

TWA - Timber Wolf Alliance - Wolf education organization working out of the Sigurd Olson Environmental Institute, Northland College in Ashland Wisconsin.

TWIN -Timber Wolf Information Network - Wolf education organization that is independently operated by volunteers out of Waupaca, Wisconsin.

USDA-WS -U.S. Department of Agriculture, Animal and Plant Health Inspection Service, Wildlife Service - The Federal agency responsible for dealing with problems caused by wildlife species, especially in agricultural situations; formerly known as Animal Damage Control (ADC). The WDNR contracts USDA-WS to assist wildlife management controlling depredating wildlife in the state including problems caused by bear, beaver, geese, plus timber wolf and other endangered species.

USFWS - U.S. Fish and Wildlife Service - The Federal agency in charge of programs on federally endangered and threatened species, as well as managing migratory birds and species having national significance.

Wilderness -Land under federal and state statutes that are set aside to maintain these areas in primitive condition and are closed to any timber harvest or mechanized equipment.

Wildland - Land covered mainly by native vegetation and does not include agricultural, urban, or industrial areas.

WDNR -Wisconsin Department of Natural Resources - the state agency responsible for wildlife and fisheries conservation, including responsibility for managing state endangered and threatened species.

Wisconsin Wolf Advisory Committee - Wisconsin DNR sponsored committee responsible for proposing and evaluating policy and management programs for the state wolf population.

APPENDIX A

Wolf Depredation 1976-1998

By
Robert C. Willging, Adrian P. Wydeven,
Randy L. Jurewicz, and Kelly A. Thiel.

Depredation by wolves on livestock or pets has been a rare event since the return of wolves to Wisconsin in the mid 1970's. These depredations will continue to be infrequent events, but will increase somewhat as the wolf population expands.

Wolf depredations have generally been handled by U. S. Fish and Wildlife Service (USFWS), Wisconsin DNR (WDNR), or USDA-Wildlife Service. Complaints were generally investigated by USFWS and WDNR in the 1970's and 1980's, and since 1990 have mostly been investigated by USDA-W.S. The WDNR has provided payments for losses caused by state endangered and threatened species since 1984, using moneys from the Endangered Resources Check-Off Funds. Live trapping of depredating wolves has been done by WDNR and USDA-W.S. Under federal endangered status, euthanizing of depredating wolves was not allowed in Wisconsin, and live-captured wolves were relocated from depredating sites.

Table A2 lists all known cases of wolf depredation on pets and livestock in Wisconsin from 1976 through 1998. Most of these cases represent confirmed depredations, but a few also represent probable depredation where strong circumstantial evidence existed of wolf depredation. Fifty-four cases of wolf depredation occurred in Wisconsin during the 23 year period including 45 calves, 11 sheep, 140 turkeys, and 27 dogs killed and 9 dogs injured. (See Table A1) Payments on wolf depredations totaled \$55,574.91 including \$13,269.75 payments on livestock and \$42,305.16 payments on dogs. Depredation on dogs represented 76% of reimbursement payments provided by the WDNR.

During the 23 year period at least 130 wolf complaints were investigated by agency personnel, but only 54 were confirmed as probable wolf depredation. Many depredations were caused by coyotes or other animals. Depredations occurred on livestock and poultry on 19 different farms in northern Wisconsin. Wolf depredation on livestock occurred on 7 farms in Douglas County, two in Burnett, one in Oneida, three in Price, two in Taylor, one in Washburn, one in Bayfield and one in Rusk counties. The 14 counties of northern Wisconsin that included wolf pack territories in the period 1990-1998, contained 4,900 farms with 167,200 cattle and 4,400

sheep. Therefore wolf depredation has affected only 0.4% of farms in the area. Live trapping was used on 7 occasions and 6 wolves were translocated from farms (4 long distance moves of 40+ miles and 2 local relocation of less than 10 miles).

Thirty-six cases of depredation on dogs were documented in Wisconsin including death of 27 dogs and injury on 9 dogs. Of these 36 dogs, 28 were attacked while being used for hunting or training on predators, 4 for hunting hares, 2 were non-hunting dogs roaming in wildland areas and 2 were attacked near homesteads.

Seventeen dog depredations occurred while hunting or training on bear. Most wolf attacks occurred on free-roaming dogs. Many wolf attacks occurred when dogs approached den, rendezvous sites, or kills (prey) being defended by wolves.

Some expansion of wolf depredation will likely occur in the future. Once wolves are reclassified to a federally threatened species, euthanization of depredating wolves will be permitted in Wisconsin. Generally only wolves that are habitual depredators on livestock would be euthanized. New funds will need to be located to provide reimbursement payments for wolf depredation on livestock and pets once wolves are delisted in Wisconsin.

Hunter education may be necessary to reduce wolf depredation on dogs. Hunters need to become familiarized with wolf sign, and avoid sending hounds into areas where wolf activity is concentrated. Careful documentation needs to be made of wolf depredations on dogs so that circumstances under which such depredations occur can be better understood and recommendations for reducing losses can be developed.

Table A1.			
Total Wolf Depredation on Pets and Livestock			
Time Period: 1976-1998			
Animals Lost	Number of Farms/Homesites		Payments
Calves Killed	45	14	\$11,600.00
Calves Injured	1	1	\$9.75
Sheep Killed	11	3	\$584.00
Turkeys Killed	140	1	\$1,076.00
Chickens Killed	2	1	\$0.00
Dogs Killed	27	1*	\$41,000.00
Dogs Injured	9	1*	\$1,305.16
Deer Killed	4+	1	Pending
Total:			\$55,574.91

APPENDIX B

Wolf Viability Analysis

By Robert E. Rolley, Adrian P. Wydeven,
Ronald N. Schultz, Richard T. Thiel and
Bruce E. Kohn.

Population Viability Analysis (PVA) is the estimation of extinction probabilities by analyses that incorporate identifiable threats to population survival into models of the extinction process (Lacy, R. C. 1993. VORTEX: a computer simulation model for population viability analysis. *Wildlife Research* 20:45-65). The extinction process involves both deterministic processes (eg. over-harvest, habitat destruction, competition or predation from introduced species) and stochastic processes (random variation of demographic and genetic events and the effect of environmental variation on demographic and genetic events).

Stochastic processes are especially important for small populations. Demographic variation is the normal variation in the population's birth and death rates, and sex ratio caused by random differences among individuals. For example, in extremely small populations, it is possible through random chance for all offspring born during one generation to be of one sex. Variation in environmental conditions (eg. periodic favorable or severe weather conditions) often cause variation in reproduction and survival rates. In addition, rare catastrophic events, such as disease epidemics, fires, or floods, can greatly affect small populations. Lastly, small populations can be affected by the loss of genetic variation through genetic drift and inbreeding.

Computer simulation modelling provides a tool for exploring the viability of populations subjected to many complex, interacting deterministic and stochastic processes. We used the VORTEX simulation model (Lacy, R. C., K. A. Hughes, and P. S. Miller. 1995. VORTEX: a stochastic simulation of the extinction process. Version 7 User's Manual. IUCN/SSC Conservation Breeding Specialist Group, Apple Valley, MN, USA.) to estimate the viability of the gray wolf population in Wisconsin. VORTEX is an individual-based model that simulates birth and death processes as discrete, sequential events, with probabilistic outcomes. The model generates random numbers to determine whether individual animals live or die and the number of progeny produced by each female each year. The model can simulate inbreeding depression as a decrease in viability of inbred animals.

Model Inputs and Assumptions

We modeled the Wisconsin wolf population as a single interbreeding population with no ingress from or egress to other populations. Based on observed

litter sizes in Wisconsin, as well as literature records, we assumed a mean litter size of 5.3 pups/litter and the sex ratio at birth of 50:50. We further assumed a Poisson distribution of litter sizes, with a maximum of 11 pups. We assumed that the proportion of females breeding was density dependent. However, due to uncertainty of the proportion of females breeding, we evaluated two possible reproductive scenarios. In the high reproduction scenario, we assumed the age of first breeding was 2 years, 90% of females bred when population size was low, and 60% of females bred when the population was at biological carrying capacity. In the low reproduction scenario, we assumed the age of first breeding was 3 years, 80% of females bred when population size was low, and 50% of females bred when the population was at biological carrying capacity. Based on the observed survival rates of radio-collared wolves in Wisconsin, we assumed mean annual pup mortality was 70%, mean annual mortality of yearling and adult females was 16%, and mean annual mortality of yearling and adult males was 30%.

Based on 17 annual estimates, we estimated the standard deviation (SD) of pup mortality was approximately 10%. However, data were not available to estimate the effect of environmental variability on adult mortality rates or the proportion of females producing pups. We believe it is likely that environmental variation has a greater effect on pup survival than on adult survival or the proportion of females breeding. Due to the uncertainty of the effects of environmental variation on survival and reproductive rates, we evaluated 3 scenarios. In the low environmental variation scenario, we assumed the SD in the percentage of females producing was 2%, the SD of pup survival was 5%, and the SD of adult survival was 3%. In the moderate environmental variation scenario, we assumed the SD in the percentage of females producing was 4%, the SD of pup survival was 10%, and the SD of adult survival was 6%. In the high environmental variation scenario, we assumed the SD in the percentage of females producing was 6%, the SD of pup survival was 15%, and the SD of adult survival was 12%. We assumed that variation in survival was concordant with variation in reproduction, i.e., years of poor reproduction were associated with years of poor survival and years of good reproduction were associated with years of good survival.

Few data are available to estimate the frequency of catastrophic events in wolf populations. The Wisconsin wolf population has experienced 2 epidemics during the past 17 years. To assess the effect of catastrophic events on the viability of wolf populations we evaluated 3 scenarios. We simulated population trends assuming a 0, 5, and 10% probability of a catastrophic event per year. We as-

sumed that a catastrophic event reduced both reproduction and survival by 50%.

We assessed the effect of initial population size on viability by simulating trends with initial populations of 100, 200, 300, 400, and 500 wolves. The age distribution of starting populations were set to reflect stable age distributions based on the reproduction and survival rates.

In the initial series of analyses we assumed a biological carrying capacity (BCC) of 500 wolves and that BCC was stable over time. Whenever simulated populations exceed the biological carrying capacity, additional mortality was imposed to reduce the population back to carrying capacity. For each of the 90 combinations of the 2 reproductive, 3 environmental variation, 3 catastrophic event, and 5 initial scenarios we calculated 100 iterations of simulated population change over 100 years. We estimated the probability of extinction (PE) as the proportion of the 100 iterations in which the number of individuals of one sex declined to 0. In addition, we estimated the probability of relisting (PR) wolves as endangered as the proportion of the 100 iterations that declined to less than 80 individuals at least once during the 100-year simulations. In all simulations, we assumed that the population was not harvested or augmented. We did not attempt to simulate the effect of inbreeding depression in these analyses.

We conducted a second series of simulations to assess the effect of managing the population at a level below that of the assumed BCC of 500. For these analyses, we assumed a cultural carrying capacity (CCC) of 300. Because the hypothetical CCC was lower than the BCC set by food availability, we assumed that the percentage of females breeding when the population was at CCC only declined to 80% in the high reproduction scenario and to 70% in the low reproduction scenario. In these analyses, we used initial population sizes of 100, 200, and 300 wolves; assumed a 5% probability of catastrophe; and evaluated the 2 reproduction and 3 environmental variability scenarios described above.

Results

Most simulated populations increased rapidly from the initial size to BCC and fluctuated around BCC, occasionally decreasing due to unfavorable environmental conditions or catastrophic events. Within the range evaluated, initial population size had little effect on the probability of extinction (Tables B1-B6). Averaging across reproductive levels, environmental variability, and the probability of catastrophic events, PE for initial populations of 100 was 0.086, compared to 0.061 for initial populations of 500. In contrast, initial population size did effect the probability that simulated populations would decline below 80 wolves and be relisted as endangered. Mean PR

decreased from 0.48 for initial populations of 100 to 0.31 for initial populations of 500.

The probability of catastrophic events greatly affected the probability of extinction. When the probability of catastrophic events was 0, PE was less than or equal to 0.02 for all initial population sizes in all reproduction and environmental variability scenarios evaluated. When the probability of catastrophes was 0.05, PE was less than 0.05 for all initial population sizes in the low and moderate environmental variability scenarios, regardless of reproduction. When environmental variability was high and the probability of catastrophe was 5%, PE was 0.05-0.09 in the high reproduction simulations and 0.09-0.20 in the low reproduction simulations. When the probability of catastrophe was 10%, PE increased markedly as environmental variability increased.

Probability of extinction differ among the 3 levels of environmental variability. Mean PE was 0.013 for low environmental variability, 0.036 for moderate environmental variability, and 0.153 for high environmental variability. The effect of environmental variability differed among levels of reproduction and probability of catastrophes. The increase in PE as environmental variability increased was 2 times greater for low levels of reproduction than for high levels of reproduction. Similarly, the increase in PE as environmental variability increased was markedly greater when the chance of catastrophic events was 10% than when the chance of catastrophes was lower. The proportion of females breeding affected the probability of extinction. Mean PE under the high reproduction scenario was 0.04, compared to 0.09 under the low reproduction scenario. The effect of reproduction differed depending on levels of environmental variation and the probability of catastrophe. The difference in PE between reproductive levels was substantially greater with the high environmental variation scenarios than with the low environmental variation scenarios. Likewise, increasing the probability of catastrophe increased the difference in PE between the two levels of reproduction.

With low to moderate environmental variability and probability of catastrophe less than or equal to 0.05, less than 5% of the simulated populations when extinct (Tables B1,B2,B4, and B5). However, with a 5% chance of catastrophe, the proportion of simulated populations that declined below 80 wolves varied from 0.02 to 0.38 (mean = 0.15) in the low to moderate environmental variation scenarios. The risk of extinction and relisting increased considerably under the high environmental variability and 10% chance of catastrophe scenarios.

Managing wolves at a hypothetical cultural carrying capacity of 300 instead of allowing the population reach a biological carrying capacity of 500 had little

effect on the risk of extinction (Tables B7 and B8). However, managing for a lower population approximately doubled the proportion of simulated populations that declining below 80 individuals under the low and moderate environmental variability scenarios. Virtually all simulated populations declined below 80 individuals in the high environmental variability scenarios.

Discussion

PVA is a process of assembling all available demographic information, explicitly incorporating what we do know into an overall model, and evaluating the impact of what we do not know on the predictions from the model. Computer simulation modeling is a tool that permits estimation of the approximate probability of population extinction, and facilitates testing of various hypotheses about the viability of small populations. The estimates and predictions are only as good as the data and assumptions input to the model. Because many population processes are stochastic, a PVA can never specify what will happen to a population. Instead, PVA forecasts the likely effects of those factors incorporated into the model.

An essential component of PVA is sensitivity testing, evaluating ranges of plausible values for uncertain parameters to determine the effects of uncertainty on model predictions. Our analyses suggest that estimates of the probability of extinction and relisting are very sensitive to uncertainty about environmental variation and the probability of catastrophes.

PVA is, by definition, an assessment of the probability of persistence of a population over some specified number of years. However, prevention of extinction is only the first step for effective conservation of a species. Management goals may need to be greater than simply preventing extinction if wolves are to be functional members of Wisconsin's biological communities.

In these analyses, we assumed no ingress to determine viable levels for a Wisconsin wolf population that would be independent of wolf populations in adjacent states. We had included ingress in some preliminary analyses,

but by definition, a population with constant ingress would never go extinct. Therefore, we believed that including ingress in the model provided little useful information on long-term viability.

The main objective of the management plan is to ensure that wolves will not have to be relisted or endangered. Our current (1999) population estimate is 197 to 203 wolves. This PVA suggests that a population of 300 to 500 wolves would have a high probability of persisting for 100 years under most of the scenarios evaluated. However, given the information currently available, we cannot exclude the possibility that a population of 300 to 500 wolves may decline to the point that relisting as endangered will be necessary in the future. In fact, with only moderate environmental variability and a 5 percent chance of catastrophic events 10 to 40 percent of simulated population declined below 80 wolves.

Given the effect of uncertainties on model predictions, this PVA should be viewed as a component of an adaptive management process. In adaptive management, the lack of knowledge adequate to predict with certainty the best course of action is acknowledged, management actions are designed in such a way that monitoring will generate new understanding and refinement of the model, and corrective adjustments to management plans are made whenever accumulated data suggest that the present course is inadequate to achieve the goals and a better strategy exists.

Our uncertainty about the magnitude of environmental variation and the frequency and severity of catastrophic events emphasizes the importance of continued monitoring of the Wisconsin gray wolf population to insure its long-term persistence. As additional information becomes available, the model can be revised, and if necessary corrective management can be implemented.

Table B1. Effect of initial population size and probability of catastrophic event on estimated probability of extinction and relisting for a hypothetical gray wolf population during 100 years assuming a biological carrying capacity of 500, low environmental variability and high reproduction.

Initial popul. size	Probability of catastrophic event					
	0		0.05		0.1	
	Extinct.	Relist.	Extinct.	Relist.	Extinct.	Relist.
100	0	0	0	0.24	0.01	0.53
200	0	0	0	0.07	0.02	0.3
300	0	0	0	0.03	0.01	0.35
400	0	0	0	0.02	0.03	0.29
500	0	0	0	0.04	0.03	0.28

Table B2. Effect of initial population size and probability of catastrophic event on estimated probability of extinction and relisting for a hypothetical gray wolf population during 100 years assuming a biological carrying capacity of 500, moderate environmental variability and high reproduction.

Initial popul. size	Probability of catastrophic event					
	0		0.05		0.1	
	Extinct.	Relist.	Extinct.	Relist.	Extinct.	Relist.
100	0	0.03	0.01	0.23	0.08	0.64
200	0	0	0	0.08	0.02	0.48
300	0	0	0	0.14	0.01	0.53
400	0	0	0	0.07	0.05	0.49
500	0	0	0	0.12	0.05	0.45

Table B3. Effect of initial population size and probability of catastrophic event on estimated probability of extinction and relisting for a hypothetical gray wolf population during 100 years assuming a biological carrying capacity of 500, high environmental variability and high reproduction.

Initial popul. size	Probability of catastrophic event					
	0		0.05		0.1	
	Extinct.	Relist.	Extinct.	Relist.	Extinct.	Relist.
100	0	0.44	0.09	0.74	0.28	0.92
200	0.02	0.23	0.05	0.64	0.26	0.85
300	0.01	0.18	0.05	0.47	0.24	0.87
400	0.01	0.14	0.05	0.44	0.23	0.89
500	0.01	0.11	0.06	0.49	0.2	0.8

Table B4. Effect of initial population size and probability of catastrophic event on estimated probability of extinction and relisting for a hypothetical gray wolf population during 100 years assuming a biological carrying capacity of 500, low environmental variability and low reproduction.

Initial popul. size	Probability of catastrophic event					
	0		0.05		0.1	
	Extinct.	Relist.	Extinct.	Relist.	Extinct.	Relist.
100	0	0	0.01	0.38	0.07	0.81
200	0	0	0	0.18	0.07	0.51
300	0	0	0	0.09	0.07	0.56
400	0	0	0	0.14	0.02	0.63
500	0	0	0	0.11	0.05	0.46

Table B5. Effect of initial population size and probability of catastrophic event on estimated probability of extinction and relisting for a hypothetical gray wolf population during 100 years assuming a biological carrying capacity of 500, moderate environmental variability and low reproduction.

Initial popul. size	Probability of catastrophic event					
	0		0.05		0.1	
	Extinct.	Relist.	Extinct.	Relist.	Extinct.	Relist.
100	0	0.04	0.04	0.36	0.19	0.91
200	0	0	0.01	0.21	0.17	0.75
300	0	0	0.01	0.21	0.15	0.71
400	0	0	0.01	0.15	0.13	0.6
500	0	0	0.01	0.2	0.15	0.69

Table B6. Effect of initial population size and probability of catastrophic event on estimated probability of extinction and relisting for a hypothetical gray wolf population during 100 years assuming a biological carrying capacity of 500, high environmental variability and low reproduction.

Initial popul. size	Probability of catastrophic event					
	0		0.05		0.1	
	Extinct.	Relist.	Extinct.	Relist.	Extinct.	Relist.
100	0.01	0.54	0.2	0.85	0.56	0.98
200	0.01	0.36	0.12	0.7	0.43	0.99
300	0	0.22	0.09	0.75	0.53	0.99
400	0.02	0.25	0.12	0.74	0.41	0.95
500	0	0.19	0.12	0.67	0.41	0.94

Table B7. Effect of initial population size and environmental variability on estimated probability of extinction and relisting for a hypothetical gray wolf population during 100 years assuming a cultural carrying capacity of 300, a 0.05 probability of catastrophic event, and high reproduction.

Initial popul. size	Environmental variability					
	Low		Moderate		High	
	Extinct.	Relist.	Extinct.	Relist.	Extinct.	Relist.
100	0	0.39	0	0.4	0.08	0.91
200	0	0.16	0.01	0.36	0.08	0.84
300	0	0.15	0.01	0.32	0.09	0.85

Table B8. Effect of initial population size and environmental variability on estimated probability of extinction and relisting for a hypothetical gray wolf population during 100 years assuming a cultural carrying capacity of 300, a 0.05 probability of catastrophic event, and low reproduction.

Initial popul. size	Environmental variability					
	Low		Moderate		High	
	Extinct.	Relist.	Extinct.	Relist.	Extinct.	Relist.
100	0.02	0.5	0	0.56	0.21	0.97
200	0	0.4	0.01	0.4	0.16	0.9
300	0.01	0.33	0.01	0.36	0.11	0.87

APPENDIX C

GIS Evaluation of Wolf Habitat and Potential Populations in the Great Lakes States

by Adrian P. Wydeven, David J. Mladenoff, Theodore A. Sickley and Robert G. Haight

A geographical information system or GIS is a computer mapping system that allows researchers or managers to examine various layers of landscape simultaneously. By examining various landscape features, biologists can determine why a species occurs in a specific location.

Gray wolves lend themselves well to examining of their habitat selection using GIS. Wolf packs occupy fairly discrete areas that are maintained as territories, and represents the breeding potential of a wolf population. In the Great Lakes region wolves normally occupy territories that cover 20 to 120 square miles. By discerning the characteristics of suitable pack habitat (breeding habitat), we can determine the extent of area that wolves can occupy, and the size of a wolf population that an area can support.

GIS was used recently to determine the type of landscape features that packs occupy in Wisconsin and the adjacent states of Michigan, and Minnesota (Mladenoff et al 1995, 1999). Additionally, work was done to determine how many wolves could occur in Wisconsin and Michigan (Mladenoff et al 1997).

Various landscape features were initially examined in 14 wolf territories that were monitored by the Wisconsin DNR using radio-collared wolves during 1980-1992. These known territories were compared to 14 random areas the size of wolf territories scattered across northern Wisconsin. Wolf territories were also compared to the overall landscape of northern Wisconsin. Landscape features that were examined included human population density, prey (deer) density, road density, land cover, land ownership, and several spatial indices. An additional 23 new packs were examined in an update of the analysis (Mladenoff et al. 1999).

Table C1 illustrates some of the important features of wolf habitat in Wisconsin. In general the aver-

Landscape Features	Wolf Pack Habitat Mean Value	Wolf Pack Habitat 90% Cut-off Level	Northern Wisconsin Mean Value
Land Cover			
Urban area	0%	---	1%
Agricultural and open land	2%	<7.5%	21%
Total forest	93%	---	73%
<i>Upland forest</i>	68%	---	59%
<i>Lowland forest</i>	25%	---	14%
Marsh or bog	4%	---	2%
Water	1%	---	4%
Land Ownership			
Public lands	70%	---	27%
Private industrial forest	10%	---	5%
Other private lands	21%	<50%	66%
Density			
Roads Density	0.4 mi/mi ²	<1.0 mi/mi ²	1.1 mi/mi ²
Human Density	4.0 persons/mi ²	<10.8 persons/mi ²	11.3 persons/mi ²
Deer Density	22.2 deer/mi ²	---	21.3 deer/mi ²

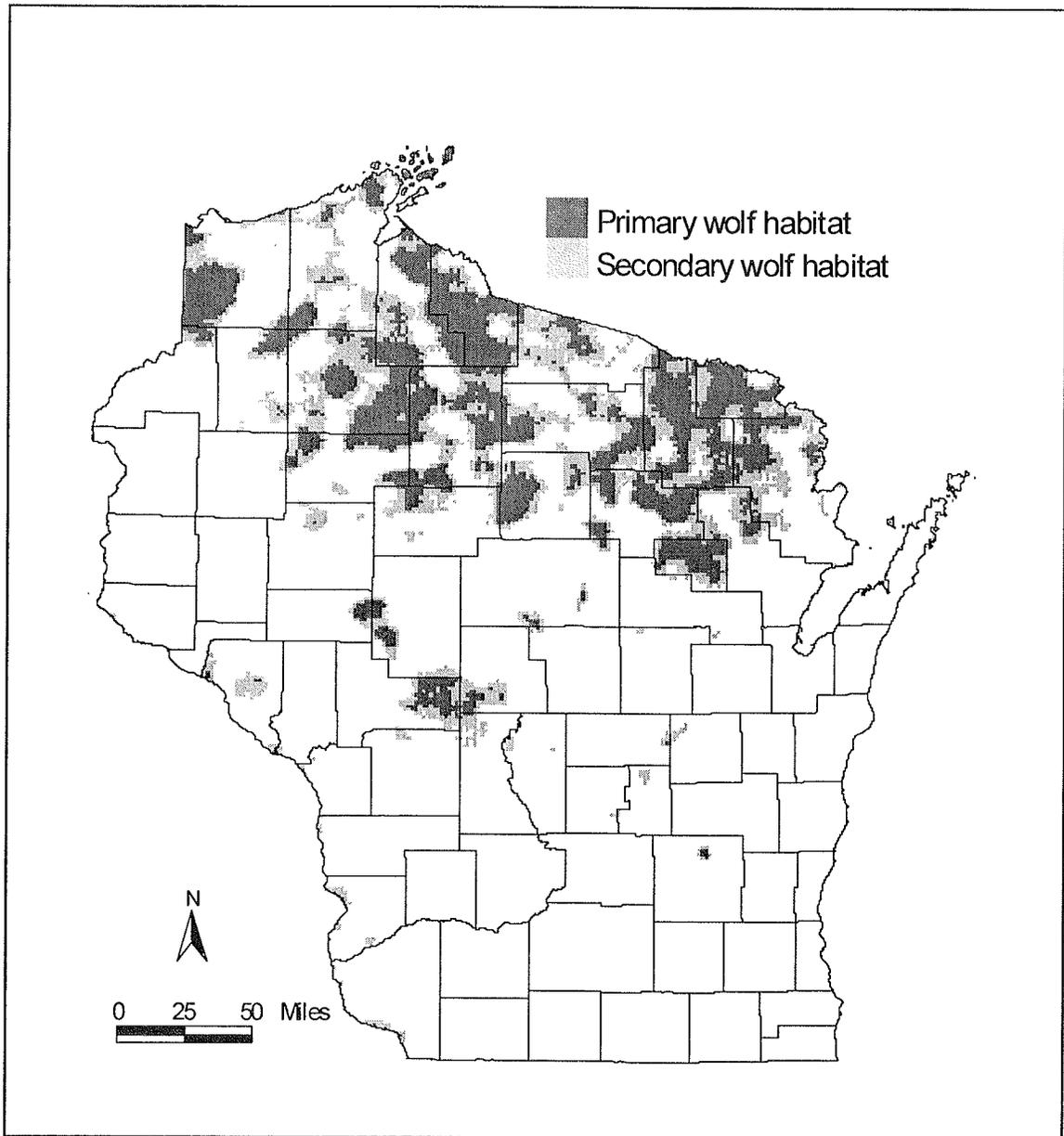


Figure C1.

Primary and secondary wolf habitat in Wisconsin. Primary habitat represents those areas with a 50% or greater chance of supporting a wolf pack. Secondary habitat represents those areas with between a 10% and 50% chance of supporting a wolf pack. The remainder of the state is designated as unsuitable, with a less than 10% chance of supporting a wolf pack. The map shows 5,812 square miles of primary wolf habitat and 5,015 miles of secondary habitat state-wide. There are 45,252 square miles which are considered unsuitable habitat. (Graphic by Ted Sickley, Department of Forest Ecology & Management and Land Information and Computer Graphics Facility, University of Wisconsin-Madison based on Mladenoff et al, 1995)

age wolf territory contained no urban land, very little farmland, and was 93% forest. Nearly 30% of an average territory was in wetlands, especially conifer swamps and bogs, compared to only 16% overall for northern Wisconsin.

Wolf territories consisted mainly of public and industrial forest land (80%), even though these areas cover only about 1/3 of northern Wisconsin. Wolf pack areas had about 1/3 the road density and human population density of northern Wisconsin in general.

Road density was the best predictor of suitable wolf habitat, as had been found by Thiel (1985) and others. Areas that contain less than 0.7 miles of road per square mile have a 50% chance or greater of being settled by wolf packs if adequate space and prey are available. Blocks of land with less or equal to 0.7 miles/mile² was considered suitable wolf habitat for management purposes. Land with more than 1 mile of road/mile² is least suitable and has less than 10% chance of being settled by wolf packs. An update of the GIS analysis confirms that road densities continue to be good predictors of suitable habitat in Wisconsin (Mladenoff et al. 1999).

Although road density is an important indicator of good wolf habitat, wolves do not have an aversion to roads. Wolves readily travel down roads for hunting and dispersing, especially dirt and gravel roads. The reason road density is important to wolf habitat, is because higher road densities equate to higher risks of vehicle collisions or illegal kills. In recent years vehicle collisions have become almost as high a mortality factor as illegal killing in Wisconsin. During an 8 month period in 1994-95, 5 wolves died in central Wisconsin due to vehicle collisions.

Area of potential wolf habitat in northern Wisconsin are illustrated in Table C2. A total of 5,739 square

miles have greater than 50% probability of being settled by wolf packs and are listed as primary wolf habitat in Table 2. The majority of the primary habitat (71%) occurs on public land or industrial forest land. Land that has a 10 to 50% probability of being settled by wolf packs is listed as secondary wolf habitat and covers 4,704 square miles; slightly over half the secondary habitat occurs on private land (Table C2). About 12,393 square miles of northern Wisconsin appears to be poorly suited as wolf habitat, and most unsuitable habitat occurs on private land. Some of the areas of less suitable habitat may be occupied by wolf packs if these areas occur close to areas of suitable habitat. Landscapes that are not likely to be settled by wolf packs, may still have potential for dispersing wolves, especially in forested habitats near existing packs.

The initial analysis we conducted on potential wolf habitat examined about 23,000 square miles of northern Wisconsin, but did not examine land in central Wisconsin (Mladenoff et al. 1995). In fall 1994 a wolf pack was verified in central Wisconsin, therefore GIS analysis was conducted for the remainder of Wisconsin in spring 1996. A small area of favorable wolf habitat was identified in central Wisconsin (207 square miles) and included the three wolf territories located in the region in 1996. No other sizeable areas of primary or secondary potential habitat occur in the state, but a few small scattered parcels of secondary habitat exist in central and western Wisconsin. The chance of wolves settling into these small parcels is remote, but these areas may be used by dispersing wolves.

The potential wolf population for Wisconsin and Michigan were determined by Mladenoff et al. (1997) using two methods. A habitat based estimate used the average territory size (69 mi²) average sized pack (4.1 wolves), average space between territories

WOLF HABITAT CLASSES	DENSITY OF ROADS	AREAS LISTED IN SQUARE MILES					
		<i>State</i>	<i>County</i>	<i>Federal</i>	<i>Tribal</i>	<i>Industrial Forest</i>	<i>Private</i>
Primary Wolf Habitat (>50% prob. class)	<0.7/mi ²	567(45%)	1623(51%)	1028(45%)	290(53%)	570(49%)	1661(12%)
Secondary Wolf Habitat (>10% to <50% prob. class)	<1.0/mi ²	286(23%)	784(25%)	821(36%)	172(31%)	220(19%)	2421(17%)
Unsuitable Wolf Habitat (<10% prob. class)	>1.0/mi ²	402(32%)	772(24%)	431(19%)	90(16%)	381(33%)	10,317(72%)
Total Land Area		1255	3179	2280	552	1171	14,399

(37%), and assumed 15% loners in the population within areas of primary wolf habitat. A wolf-prey based estimation developed by Fuller (1989) was also used to estimate the potential wolf population within primary wolf habitat, based on abundance of deer.

Table C3 illustrates estimated potential wolf population of 380 and 462 by the two methods. The habitat area based estimate is probably the more reliable projection of the potential population, because it has a more narrow confidence interval, and the prey based projection includes estimates of wolf densities that are higher than any mainland densities reported for wolves in the Great Lakes region. Therefore a reasonable estimation would be a potential wolf population of 300-500 wolves in northern Wisconsin, and 600-1000 wolves in Michigan.

The populations projections made by Mladenoff et al (1997) includes only potential habitat in northern Wisconsin. Based on the size of suitable habitat and wolf densities in other areas of Wisconsin, central Wisconsin could support an additional 20-40 wolves. More research is necessary to better assess habitat and wolf population potential in central Wisconsin.

Figure C1 shows the state-wide potential habitat as calculated following the study. It shows 5,812 square miles of primary habitat and 5,015 square miles of secondary habitat in Wisconsin. Our potential wolf population was based on full occupancy of primary habitat, but if secondary habitat were also fully occupied, the potential wolf population could be 50% higher or more. Behavioral adaptations by wolves and greater acceptance by humans could allow for a considerably higher population. Conversely, if wolves are less accepted by people, and are unable to fully occupy even primary habitat, then the potential wolf population could be lower.

These results suggest that Wisconsin and Michigan

could support far more than the goal of 100 for both states for federal delisting as neither endangered nor threatened. The current (1999) population for both states of about 370 wolves, already far exceeds the goal. The GIS results of delineating suitable habitat and potential populations will be very useful for future management planning for the Great Lakes States. The GIS data will provide an important bench mark for evaluating the success of wolf recovery in the Great Lakes region.

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Table C3. Potential Wolf Population for Wisconsin and Michigan as Determined by Two Methods.

	Wisconsin Estimate	90% Confident Interval	Michigan Estimate	90% Confident Interval
Habitat Area Model	380	324-461	751	641-911
Prey Based Model	462	262-662	969	581-1357

restoration in altered ecosystems: A spatial landscape project of wolf population recovery. *Bio-science* vol. 47(1):21-31.

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Appendix D
Citizen Involvement in Development of the Wolf Management Plan.
By David A. Weitz and Adrian P. Wydeven

The Wisconsin Department of Natural Resources (DNR) began work in 1996 to develop a new wolf management plan for the state. The initial effort by the Wisconsin Wolf Advisory Committee was directed at obtaining public opinion on ideas, issues, and concerns of wolf management in Wisconsin.

Initial Issue and Concern Identification

From October 15, 1996 to October 17, 1996 ten public forums were conducted across the state to obtain public opinions. (Sites were at Florence, Superior, Milwaukee, Park Falls, Madison, Stevens Point, Black River Falls, Rice Lake, Rhinelander and Green Bay). A total of 228 people attended the forums. Verbal comments were made by 122 of those in attendance. In addition 98 written and email comments were received during later weeks. Notifications of the forums along with information on the DNR Wolf Management Planning effort were sent to 1,200 media outlets and individuals throughout Wisconsin. Additionally copies of a "White Paper" on wolf management was sent to a list of about 800 individuals and groups who had expressed some interest in development of the original Wolf Recovery Plan in Wisconsin.

Both verbal material and written (including email) comments showed extremely strong concern for the welfare of the wolves in Wisconsin. A variety of comments centered around concern that 80 wolves is not enough to provide a stable population that justifies reclassification from endangered to threatened status. Several persons asked that any management plan incorporate a "trigger" mechanism that would automatically reclassify the timber wolf as endangered if wolf numbers dropped below a specific number.

Not all people agreed that reclassification should occur and some stated they'd be opposed to any change in the status of the wolf. Others favored reclassification but after population numbers are larger than 80 wolves. At least one person suggested simply getting out of wolf management entirely.

The strongest single recommendation was that education about wolves continue with strong funding. Those responding in the forums and in writing showed real concern for the possible lack of adequate funding for educational efforts and some sug-

gested methods of raising dollars for wolf monitoring, education and management.

In general people indicated support for some type of wolf population control at a future time but disagreed on the number of wolves that should exist in Wisconsin. While some thought hunters should be allowed to take wolves, and one person suggested using volunteers to control depredating wolves, in general most who discussed the issue felt that only Department of Natural Resources professionals should control wolf numbers.

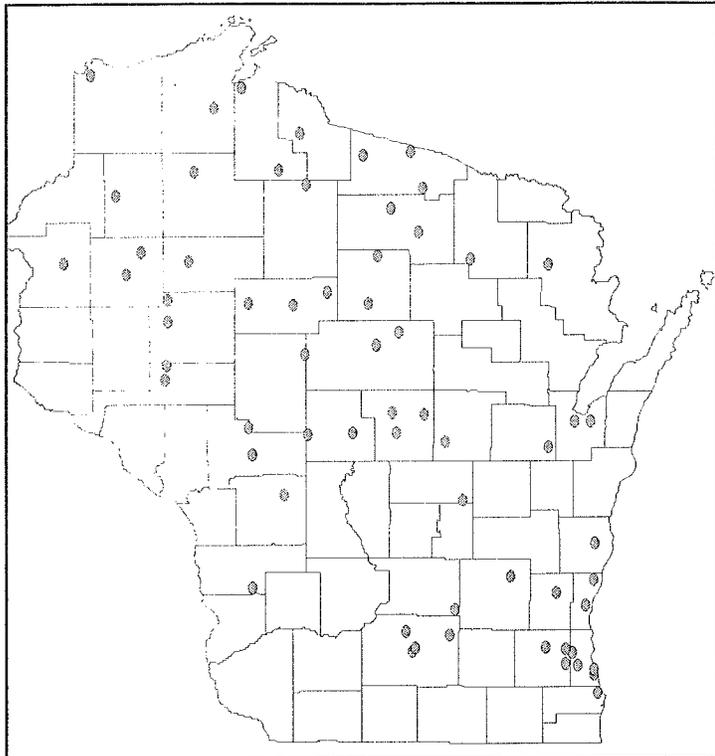


Figure D 1. The map shows the distribution of responses from within Wisconsin to Draft 1 of the Wolf Management Plan from zip-codes. Some responses were received via email and some from out-of-state.

Although there was some disagreement, there was general support for payment of damage to livestock and pet owners who lose animals to wolves. Some individuals suggested funding mechanisms including a call for private organizations to shoulder the cost.

While they represent a clear minority, some people did suggest that the state spend no further money on wolf management, and indicated they felt there was no reason to nurture wolf populations.

An issues report summarizing people's issues and concerns about wolf management was sent out in September, 1997. This report was sent to more than 1,000 persons and groups who have shown interest in the Wolf Management Plan for Wisconsin. It also was distributed in press release to about 1,200 outlets in Wisconsin.

Draft 1 Wolf Management Plan

The Wolf Advisory Committee began on a draft wolf management plan in fall, 1997. Draft 1 of the Wisconsin Wolf Management Plan was completed in spring, 1998 and sent out for public review in early May. More than 2,000 copies of the draft document were distributed. The draft plan was announced in a press release that went to more than 1,200 media outlets.

The 90-day review period allowed individuals or groups to comment on the Draft Wolf Management Plan. It helped the Department of Natural Resources Wolf Advisory Committee to clarify public attitudes and desires. In addition, it pointed the way toward the need to discuss issues not fully voiced in the first set of forums. A second set of forums was conducted from June 1 through 4, 1998, at Superior, Hayward, Rhinelander, Green Bay, Black River Falls, Stevens Point, Madison and Milwaukee. Staff from the Wolf Advisory Committee, especially Adrian Wydeven, explained the draft plan at meetings with interest groups including the Wisconsin Conservation Congress, Wisconsin Bear Hunters Association, at meetings with Chippewa Nation representatives, members of the HoChunk Nation, Menomonee Nation and Oneida Nation, the Sierra Club, University of Wisconsin Extension Livestock Specialist Richard Vathauer and a livestock association representative as well as many others. Numerous individuals received information over the phone, by mail, and by email. The concepts expressed in Draft 1 of the Wisconsin Wolf Management Plan were discussed by Wydeven and other Committee representatives on Wisconsin Public Radio, numerous commercial television and radio stations and in the print media.

During the second set of forums in, June 1998, an estimated 300 attended the sessions and 69 persons directly addressed the plan. During the review period 423 written comments were received including 173 individual comments, 40 individual letters from high school students at Kaukauna and 202 copies of form letters. Individuals letters were 46 percent supportive of the Draft 1 plan and 50 percent negative toward the Draft 1 plan. About 4 percent of respondents were neutral. Five of the organizations were supportive and three were negative. The committee received 193 copies of one form letter that expressed concern about wolf populations in Wisconsin. There were also 9 copies of another form

letter that indicated support for wolves.

Most of the 40 letters from Kaukauna High School were generally supportive but some expressed concern about wolf numbers.

Major issues that people brought to the attention of the Wolf Advisory Committee were:

Population level: The issue of greatest concern was the proposed wolf population goal of 300-500 wolves for the State of Wisconsin. Many people wanted to keep the wolf population at 100 or less. Often people had the misconception that the goal of 80 wolves established in the 1989 Wolf Recovery Plan was a maximum goal. That number was actually established as a minimum measure of success for the Wolf Recovery Plan. Others objected to any control on the wolf population, and recommended allowing wolves to stabilize with the prey populations. Although wolves can exist without any control in large wilderness parks in a highly developed state, such as Wisconsin, this isn't possible.

Based on these concerns in Draft 1 of the Management Plan the Wolf Committee recommended a reduction in Draft 2 of the state delisting goal from 300 animals for three years to 250 animals for one year. The committee also decided against a maximum goal of 500 wolves and, instead, proposed a minimum management goal of 350. Therefore at 350 wolves maximum efforts at population control could go into effect.

Livestock and Pet Depredation: Many people were concerned about protecting pets or livestock on their land. Therefore the Wolf Advisory Committee decided to recommend authority be provided to private citizens to kill wolves in the act of attacking pets on private land. The lowering of the delisting goals also would allow landowner control to begin somewhat sooner than envisioned in the Draft 1 plan. Additionally, the Wolf Committee has recommended continuing payments for pets lost to wolves once delisting has occurred.

Lethal Control of Wolves: A lot of concern was expressed that all public land (7,600 mi²) in the Northern Deer Management Units and in the Central Forest Deer Management Units were proposed to be closed to any lethal control activity under Draft 1 of the Wolf Management Plan. On the other hand, some people did not want any lethal control anywhere in Zone 1 of the original plan. (Northern and Central Wisconsin 23,000 mi²). The Wolf Advisory Committee decided that the Zone system needed to be modified to meet the concern of the public. In Draft 2 areas closed to all lethal control were reduced to large blocks of highly suitable wolf habitat (3,227 mi²). These Wolf

Core Areas consisted mostly of public land but also include some small isolated parcels of private land and industrial forest land. The Wolf Committee felt that the Wolf Core Areas would serve as a safety net against excessive control activities.

The Wolf Committee dropped the formal core areas from this final version of the Wolf Management Plan and, instead, included a flexible system whereby lethal control would rarely be conducted on large blocks of public land but avoided a total prohibition of lethal controls on such lands. As long as intense population monitoring is maintained more flexible controls can be allowed.

Central Forest Wolf Packs: A great deal of concern was expressed over wolves becoming established in the Central Forest. Many people were concerned about the potential impact of wolves on pets, livestock and deer. No livestock depredation has yet occurred and depredation on pets has been limited. The impact on deer is not significant. Still, because of the concerns expressed, the Wolf Advisory Committee decided to recommend treating the Central Forest as a zone separate from Zone 1. By special designation more attention could be focused on this zone, including focused education, research and more liberal control if necessary. The Central Forest Area would be treated as a more experimental population compared to the Northern Forest Zone (Zone 1), and would not have a coyote closure during the firearm gun season. Having different regulations in Zone 2 (Central Forest) would allow the Department of Natural Resources to evaluate the future needs of such regulations on Zone 1. Different regulations also allow for more flexible management of wolves in Central Wisconsin.

Wolf Monitoring: The Draft 1 Wolf Plan proposed significant reductions in wolf monitoring. Many people had concerns about the proposal to reduce wolf population monitoring once wolves were downlisted. People interested in keeping wolf numbers low were interested in maintaining intense monitoring to justify more intense control activities. Conversely, many people concerned about continued security for the wolf population want to be able to detect any declines in the population. Therefore the Wolf Advisory Committee is recommending continuing to maintain existing levels of intense population monitoring.

Native American Concerns: Members of the Menominee Nation wanted their reservation to be included in the Northern Forest Zone to promote wolf establishment in their area. The Wolf Advisory Committee therefore included the county in Zone 1. The Wolf Management Plan also expands the language referring to Native American reservations, ceded lands and tribal lands.

Coyote Hunting Closure: Some hunters were opposed to continued closure of coyote hunting during the firearm deer season in Wisconsin. Because the need for a coyote closed season has yet to be determined in Central Wisconsin, the final plan does not include expanding the coyote closed zone to Central Wisconsin. Also, the area closed to coyote hunting during the gun deer season would be reduced from 44 percent of the state to 33 percent of the state. Because the coyote closed zone had worked in the past to reduce illegal kill of wolves in Northern Wisconsin, Wolf Committee members did not feel complete removal of the closed area would be advisable, because it may introduce additional forms of mortality to wolves in the area.

Threats to Humans, Pets, Livestock: Many people were concerned that the wolf population would continue to grow to extremely high levels and pose threats to livestock, pets and humans. The Wolf Committee has increased the flexibility for Department of Natural Resources, USDA-Wildlife Services, and local law enforcement officers to control nuisance wolves, especially in areas of unsuitable habitat. This concern also points to the need for continued education about wolves to help alleviate people's fears.

Public Harvest of Wolves: Several hunters and trappers expressed interest in starting a public harvest of wolves as soon as possible. Some felt public harvest was needed to keep wolves at specific population goals. Others objected strongly to any public harvest of wolves, and only accepted lethal control by government agents. The Wolf Advisory Committee decided that it would be premature to recommend a hunting or trapping season structure at this time. Public acceptance of a wolf harvest appears low. At low population numbers a public harvest would not be scientifically sound. **Still, the time may come when a public harvest is wise. If the population exceeds 350 and if public tolerance of wolves is very low, then a public harvest will be considered. The committee did not feel it could adequately evaluate the attitudes of the people affected to determine "social carrying capacity" at this time.** Also, impacts from other mortalities would need to be carefully evaluated before a public harvest could be conducted.

Public Attitude Surveys: Several people expressed concern that scientific surveys of people's attitudes had not been conducted recently in Wisconsin. A recent survey of attitudes of people towards wolves and other endangered species is now listed in Appendix H of this document. Attitude surveys are listed as an important research priority.

Wolf Management Program Costs: The cost of wolf

management was of concern to some people. Although some felt no money should be spent on wolves many urged added funding. A large number of people urged that wolf monitoring be continued and that full payment for depredation of pets or livestock be continued. Adequate funding for education about wolves was a major emphasis of the responses to the initial set of forums which identified major issues. The respondents to the Draft 1 plan also emphasized the importance of education and adequate funding for educational activities, but to a lesser degree than experienced in the original forums. People also expressed concerns that dollars from hunting, fishing and trapping licenses not be used for non-game management purposes. The Wolf Advisory Committee has recommended, in this document, that the program be funded through general public revenues or alternate funding and not segregated dollars from hunting, fishing and trapping licenses sales.

Draft 2 Wolf Management Plan

Based on all the information that has been gathered, the Wisconsin Wolf Advisory Committee revised the plan. The Draft 2 plan incorporated some new ideas and was modified to meet the needs expressed by people at the public meetings and in other communications. It was to serve to guide cooperation with the Departments of Natural Resources in Minnesota and Michigan. The plan was developed with benefit of information from their wolf management experts.

A 45-day review period was conducted on the Second Draft of the Wolf Plan from March 19 to May 5, 1999 with an additional 10-day extension to May 15. There were 53 letters and 39 email messages received during the review period.

A discussion group with invited members representing a variety of viewpoints was conducted April 24 at Wausau to discuss the Draft 2 Wolf Management Plan. Those invited were from a variety of interest organizations but were asked to express their personal views and not state a specific formal interest group position statement. The people attending were members of the Sierra Club, Wisconsin Wildlife Federation, Wisconsin Bear Hunters Association, Wisconsin Conservation Congress, Timber Wolf Information Network, Great Lakes Fish & Wildlife Commission, Whittetails Unlimited, Wisconsin Bowhunters Association, Wisconsin Livestock Association, Wisconsin Chapter of The Wildlife Society, an industrial forester, Defenders of Wildlife, Timber Wolf Alliance and Wisconsin Commercial Deer and Elk Farmers Association. Others invited but not attending the wolf discussion group included members of the Menomonee Nation; Ho Chunk Nation; Bad River Band of Chippewa; Lac du Flambeau Band of Chippewa; Izaak Walton League and Indianhead Sheep Breeders Association.

Additionally wolf committee members met with individual groups including the Wisconsin Conservation Congress; Wisconsin Wildlife Federation; Wisconsin Bowhunters Association; Wisconsin Deer Farmers Association; Wisconsin Bear Hunters Association; Timber Wolf Alliance; Wisconsin Zoning Commissioners; County Forest Administrators; University of Wisconsin – Madison; University of Wisconsin – Marinette Center; St. Norbert College, DePere; Marathon County Farmers; Wisconsin Loggers Conference; and Madison Birdwatchers. Committee members also met with representatives of Polled Hereford associations and the Northern Wisconsin Beef Breeders Association.

In addition 1,200 media notices were sent out about the wolf plan and committee members were interviewed by many media people including Wisconsin Public Radio call-in programs; radio stations at LaCrosse, Eau Claire, Park Falls, Milwaukee, Madison, Sparta, Green Bay, Rhinelander and Duluth. Newspapers from Wausau, Minocqua, Eau Claire, Duluth, Madison, Abbotsford, LaCrosse, Marinette, Neillsville, Minneapolis, Grantsburg, and Ironwood, WI. carried information about the Draft 2 Wolf Management Plan. In addition, specialty publications such as Wisconsin Outdoor News, Wisconsin Outdoor Journal, Sports Afield, and Wolf Magazine sought and received information. Television stations from Eau Claire also aired news coverage about the Draft 2 Wolf Management Plan. In addition the Draft 2 plan was made available on the Department of Natural Resources' World Wide Web Site and also on the Timber Wolf Information Network World Wide Web Site.

Modifications made in Draft 3 of the wolf plan draft based on public input included the following:

1. Core Areas were dropped as a formal refuge system, but language was added to the text that lethal control activities would rarely be conducted on large blocks of public land in areas of suitable wolf habitat. A lot of concern was expressed that Core Areas would greatly restrict human activity although the intent of the Wolf Committee was only to create areas where no lethal control would occur. Wolf Committee members decided such decisions could be made on a more flexible case-by-case basis adding language that such control would rarely be recommended in areas of large blocks of public land.
2. The five-year moratorium on public harvest was dropped in favor delaying

consideration of public take until the wolf population reaches 350. At the population threshold of 350 a review of the need for public harvest and possible change in State Statutes to allow harvest would take place. Many people were concerned that the wolf population would grow very quickly without a chance for public harvest control. The Wolf Committee decided that the population level of 350 would not be likely to occur in less than four to five years. It will be necessary to review other control activities allowed under the Wolf Plan before a public harvest can be recommended. Before public harvest is possible, a citizen review process, including public hearings, Natural Resources Board approvals and Legislative approval would be necessary.

3. Further clarifications of Native American concerns were included in the Draft 2 Wolf Management Plan. Delisting (250 wolves) and management goals (350 wolves) are to be based on late winter counts outside of Indian Reservations in Wisconsin. The 1999 wolf count of 197-203 wolves included 6 wolves found on Indian reservations. Generally wolves on reservations are likely to represent less than 5 percent of the state wolf population.
4. Clarification was needed on wolf population goals and methods of counting wolves. The population statistics will be based on late winter count of the state wolf populations (outside Indian reservations) using the current system of population monitoring. The Wolf Committee agreed that a "Minnesota Type" survey should be conducted every few years to measure the possible extent of the wolf population, but that population goals would be based on the current survey system. The delisting goal of 250 wolves represented the level at which landowner controls could occur on wolves, and the management goal of 350 was the minimum level at which pro-active depredation control could occur, and when public harvest of wolves would be considered.

The Wolf Management Plan incorporates these concerns as well as updated information and includes minor editing changes. The Wolf Plan serves as an Environmental Analysis of Wolf Management in Wisconsin. A completed version of the Wolf Management Plan was prepared for approval by Department of Natural Resources Secretary George Meyer

and the Natural Resources Board.

Once approved, the Wolf Management Plan would guide wolf management in the State for the next 10 to 15 years. The Wolf Advisory Committee will review the wolf plan annually and conduct a public review of the plan every five years.

This plan also will serve as a document to Federal Recovery Efforts as assurance of wolf conservation in Wisconsin and set the stage for Federal reclassification and delisting. The plan will indicate how the State of Wisconsin will manage wolves once authority is completely returned to the State.

The March, 1999, revision of the Draft Wolf Management Plan served as an environmental Assessment.

If you are interested in the Environmental Analysis process you may contact:

James D. Pardee, WEPA Compliance Specialist, Environmental Analysis and Liaison Section, P.O. Box 7921, Madison, WI., 53703 Phone (608) 266-0426.

Draft 3 Wolf Management Plan

The third draft of the Wolf Management Plan was presented to the Wisconsin Natural Resources Board on August 25, 1999 in Hayward. Thirty-one persons spoke before the board about the plan. Seventeen of the people generally supported the plan although some recommended changes, and fourteen had major concerns about portions of the plan or objected to most of the plan. Major concerns included discussion that the management goal of 350 is too low to guarantee wolf population perpetuation in Wisconsin; that the management goal is too high and will cause increased depredation; that the Department of Natural Resources wolf counts are too low; and that depredation payments must be made promptly and at market rates when wolf damage occurs. Some individuals also disagreed with the plan because it did not contain a specific formula for wolf harvest. A distribution of responses by Zip Code is shown in Figure D2 and Figure D3.

Following the presentation of the wolf plan and public discussion, the Natural Resources Board deferred action until its October 27th meeting and instructed the Department staff to make four modifications to the plan:

- 1 Create a stakeholder group to advise the Department on wolf management.
- 2 Allow more citizen input on annual population surveys and census estimates.
- 3 Provide a more complete funding request within the plan that anticipates increasing costs of wolf management, and provide a prompt settlement

procedure for those who have lost pets or livestock to wolves.

- 4 Develop a detailed draft of procedures for a controlled public wolf harvest which will occur when the management goal of 350 is reached.

These additions were incorporated into the the fourth draft of the wolf plan and sent to the Natural Resources Board for its meeting on October 27, 1999 in Madison.

- 1 A new stakeholder group will be incorporated into the wolf management planning effort (ie program guidance and oversight (page 28 and Figure D-4)
- 2 With help from the stakeholder group greater efforts will be made to gather and incorporate citizen input into the wolf population surveys adding to the existing volunteer efforts (population monitoring page 19).
- 3 Funding requests for wolf management have been expanded to anticipate future increased costs (V Wolf Management Budget page 33). The depredation payment procedure (outlined on page 25) will assure claims are handled quickly. The ability of the Department to pay claims will be directly related to the adequacy of funding for that purpose. The Department will address this need in its 2001-2003 Budget Request.
- 4 Suggested Statutory changes and Administrative Rule additions to allow wolf hunting in Wisconsin were developed and were listed in Appendix J.

Draft 4 Wolf Management Plan

The fourth draft of the wolf plan was presented to the Natural Resources Board on October 27, 1999, in Madison. Although opportunity for additional public comment was not provided at this meeting, the Board received extensive written comment and much media coverage on the fourth draft of the wolf plan. Comments were mainly negative toward the concept of public hunting of wolves. At the October 27 meeting, the Wisconsin Natural Resources Board approved the fourth draft of the wolf management plan, with modification that Appendix J, the specifics of wolf hunting regulations, be removed from the plan. The Board also recommended that language be clarified in the depredation section of the plan, especially to clarify that landowners throughout the state would have the authority

to protect pets and livestock from wolves on their land. The material in Appendix J would be maintained as a separate document, that would be used to start the discussion of wolf hunting regulations once the need develops for such control.

SUMMARY

A series of strategies were used to seek public interest and opinion as the drafts of the Wisconsin Wolf Management Plan were prepared. The first set of forums was to identify major issues. Respondents largely indicated their concern that the wolf be adequately protected although some responses emphasized a fear that wolves pose problems and that wolf recovery in Wisconsin is not a good idea.

The second set of forums, conducted after publicity that outlined the major points of Draft 1, brought comments critical of the range of population management (300-500). Many respondents were concerned that wolves would affect their recreational opportunities such as use of snowmobiles and all terrain vehicles, deer hunting opportunities or threaten hounds used to hunt bear or coyotes.

A face-to-face discussion among individuals with varying opinions was used to obtain public input in Draft 2. The Draft 3 plan was the result of those discussions as well as written and verbal statements of others to the members of the wolf committee.

During the preparation of this document more than 300 public presentations, interviews, and speeches were made to groups and reporters throughout Wisconsin as well as in other states and to a Swedish conference on European wolf management. News releases and the Department Web page were used to provide information and seek public input for all drafts of the plan.

A stakeholder group was developed at the direction of the Board as a method of obtaining continuing public input at its August, 1999 meeting. Other citizen involvement techniques, such as mailings, news releases, assistance to teachers and citizen groups, also will be required as this plan is implemented. It will be essential for all persons who want to be involved with wolf management to be heard.

At its meeting on October 27, 1999 the Board approved the plan. It also directed staff to clarify landowner rights to protect stock and pets on their private property from wolf attack, and to remove the specifics of public harvest from the plan, but retain the information as a report for later study.

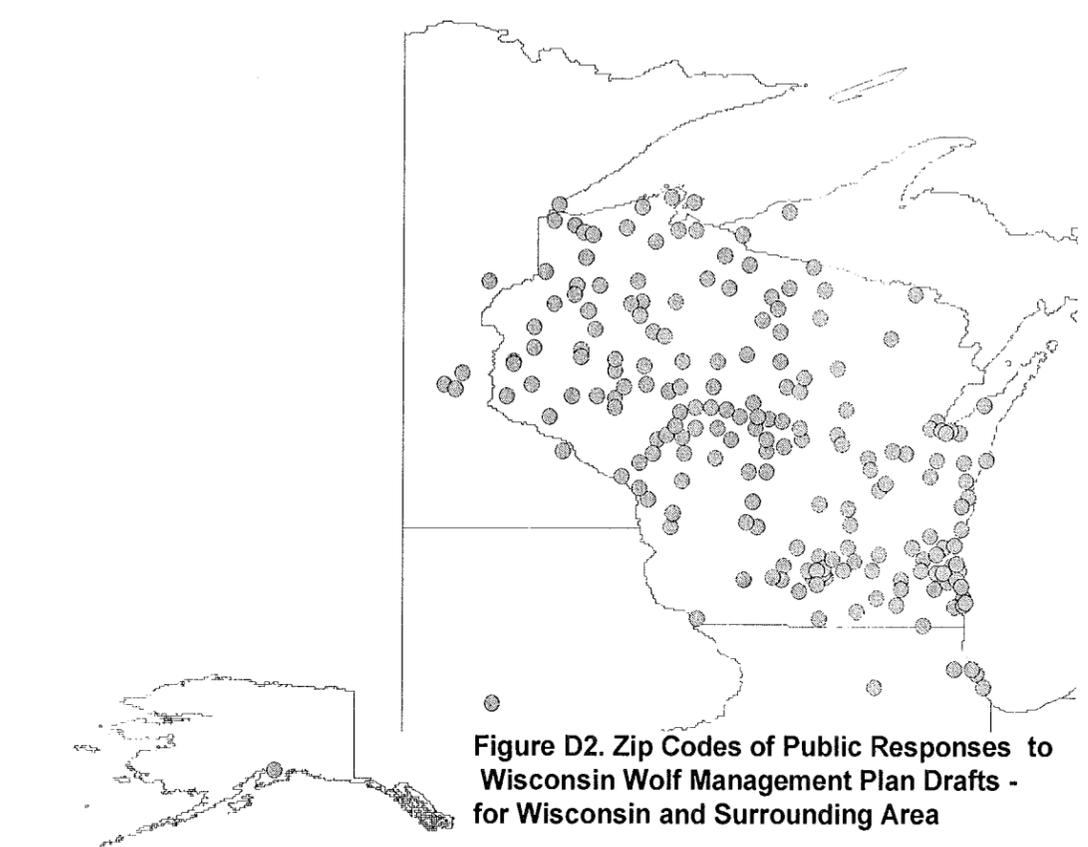


Figure D2. Zip Codes of Public Responses to Wisconsin Wolf Management Plan Drafts - for Wisconsin and Surrounding Area

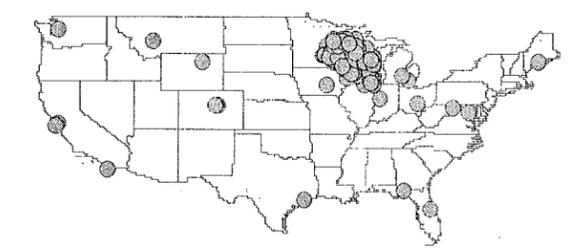


Figure D3. Zip Codes of Public Responses to Wolf Management Plan Drafts from Locations throughout the United States

Wisconsin Wolf Management Citizen Involvement Model

Wolf Advisory Committee
(resolves issues brought forward by Stakeholder Team and from other public input and makes recommendations to the WDNR Land Leadership Team.)

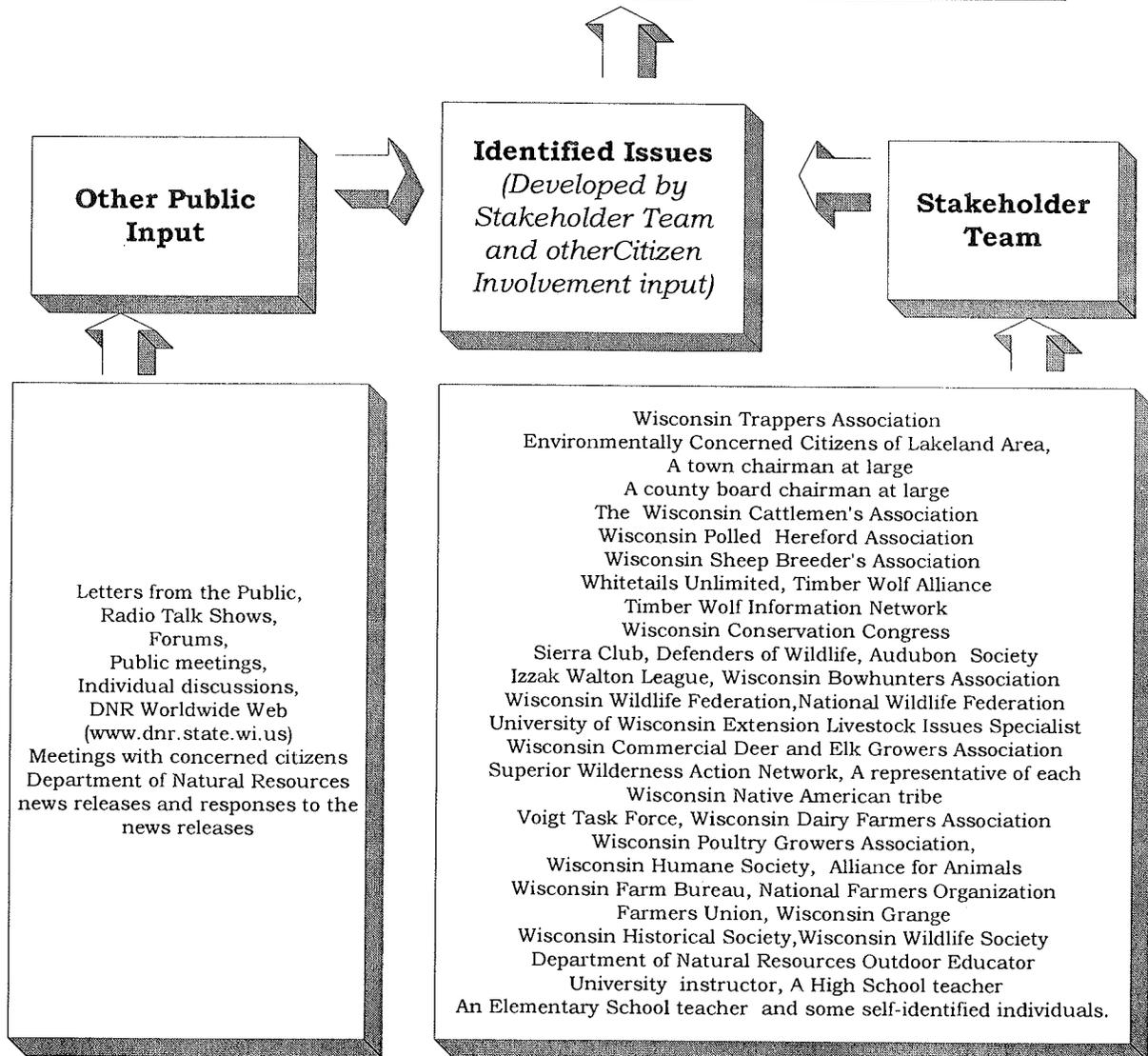


Figure D4. Citizen Involvement Model for Wolf Management in Wisconsin.

Appendix E
Impact of Wolves on Deer in Wisconsin.
by Ronald N. Schultz, Keith R. McCaffery,
and Adrian P. Wydeven

Many hunters continue to be concerned about the impact wolves may have on deer populations. During fall 1997, hunters became aware of the lower deer numbers across northern Wisconsin, and some blamed the deer decline on the increasing wolf population. The severe winters of 1995-1996 and 1996-1997 were the main factor that caused the deer decline across northern Wisconsin. Because such deer declines do create concerns over the impact of wolf predation, careful monitoring of wolf and deer populations will continue to be important aspects of management for both species.

Winter mortality is the main factor affecting deer numbers in northern Wisconsin (Figure E1). During winter 1995-96 as many as 170,000 deer died in northern Wisconsin due to harsh winter weather. In the 1996-97 winter, another 70,000 may have died. Winter Severity Indices correspond to severe winters and declines in the deer population.

There have been a few cases where wolves have limited ungulates (hooved mammals) to low population densities (Mech and Karns 1977; Gasaway et al. 1992). Generally such wolf impact would occur when ungulate populations are also stressed by severe winters, habitat deterioration, and/or overharvest. Fuller (1990) monitored a deer herd decline in Minnesota wolf range that went from 28 to 10 deer per square mile, but wolves accounted for only 10% of the deer mortality. Mech (1984) indicated that wolves rarely limit deer populations. Deer populations would normally need to be reduced to fewer than 3 deer/mi² for wolves to limit growth of the deer population (Mech 1984). Generally wolf predation is not a major mortality factor to deer populations until deer densities drop to fewer than 10 deer/mi² (Wydeven 1995). Deer densities of fewer than 10 deer/mi² occur infrequently in Wisconsin.

Wolves in the Great Lakes region normally consume 15-18 deer per wolf per year (Fuller 1995). At a rate of 18 deer per wolf pack per year an average Wisconsin wolf pack of four wolves on a 70-square mile territory would consume about 72 deer or about 1 deer per square mile. Wisconsin's wolf population in 1999 consisting of about 200 wolves probably consumed 3,000-3,600 deer. The total 1998 harvest within the central and northern forest zones where wolves occur, was 112,936 by firearm hunters, 29,266 by bow hunters and another 10,000 by motor vehicles.

Mortality due to wolves occurs year round, which is

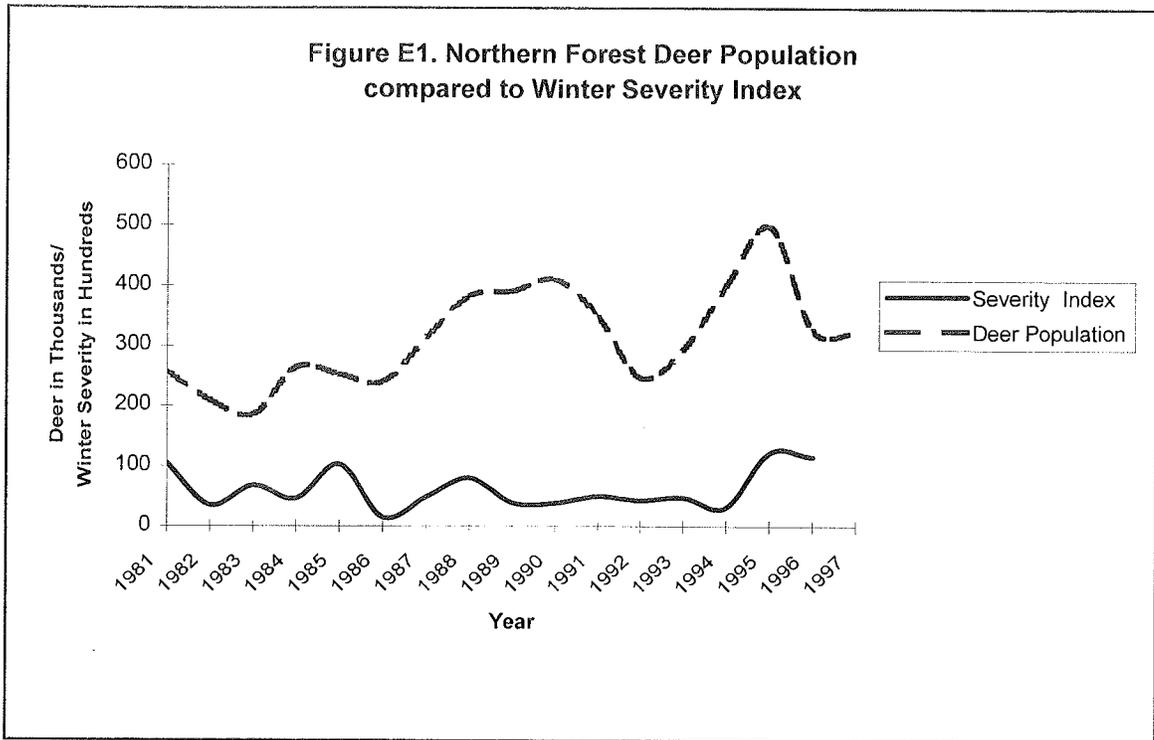
much different than hunting mortality that is compressed into one season and has less effect on herd dynamics and hunter opportunity, because some wolf predation is compensatory.

The projected potential wolf population in Wisconsin could be 300-500 wolves (Appendix C). At a rate of 18 deer per wolf year, wolves would annually remove 5,400-9,000 deer. This rate of wolf predation would occur across 6000+ square miles, therefore would consist of 0.9 to 1.5 deer per square mile. Deer population density over winter across this region would generally range from 10 to 25 deer per square mile

The overall deer population and deer density were compared for 4 deer management units with wolves, and 4 deer management units without wolves across northern Wisconsin (Table E2). Population fluctuations were relatively similar across deer management units with or without wolves. Deer density was slightly more in units without wolves than units with wolves, but the results were not statistically different (t-test $P > 0.10$). The over winter management goals for the units with wolves is 18.7 deer per square mile. The management goals for the units without wolves is 21.3 deer per square mile. These goal differences reflect habitat and climatic effects unrelated to wolves. It appears that habitat and climatic effects have greater impacts on deer population trends than wolf predation.

Furthermore, the average rate of herd increase from post-harvest to subsequent pre-harvest (1981-1997) was 1.33 for units without wolves and 1.31 for units with wolves. Thus recruitment (net increase in herd size) was similar in both sets of management units.

Overall it does not appear that wolves are likely to be a major mortality factor to deer in northern Wisconsin under current conditions, or in the near future. Even with a population of 500 wolves, annual predation of 9000 deer would represent only 2.6% of the overwinter population of 343,000 deer in the Northern Forest and Central Forest. The area has an average fall population of about 450,000. Much of the predation by wolves would probably compensate for other natural mortality because it occurs year-round. A large proportion of northern Wisconsin deer die from natural causes, which can vary drastically depending on severity of winter (Creed et al. 1984). Wolves would probably remove some of these animals that would die from other causes. A deer killed by wolves won't be killed by winter stress or other mortalities. Wolves may also displace other predators such as coyotes (Peterson 1995); under some circumstances coyote predation may have more of an impact on deer populations than wolves (Mech 1984). The current deer management system in Wisconsin adjusts antlerless deer harvest in individual deer manage-



ment units by limiting the number of hunter choice permits per unit (VanderZouwen and Warnke 1995). This system should be able to adequately adjust for the impacts of wolf predation in deer management units. Generally, wolf predation would have very limited impact on the number of hunter-choice permits issued, or the overall deer harvest within specific management units.

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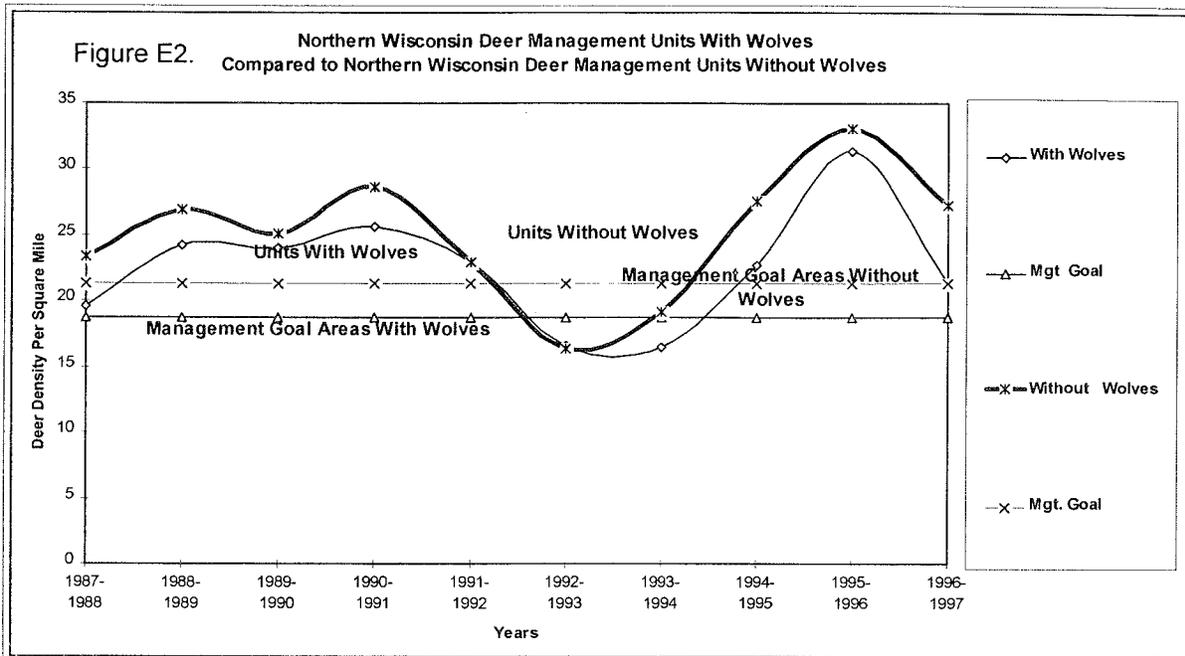


Table E1. Comparison of deer population densities in northern Wisconsin from 4 deer management units with wolves and 4 deer management units without wolves.

Deer Management Units with wolves (1473 sq. miles)			Deer Management Units without wolves (1536 sq. miles)			
Year	Wolf No.	Deer No.	Deer/mi ²	Wolf No.	Deer No.	Deer/mi ²
1987-1988	28	28,900	19.6	0	35,900	23.4
1988-1989	33	35,600	24.2	0	41,300	26.9
1989-1990	33	35,300	24.0	0	38,600	25.1
1990-1991	37	37,800	25.6	0	44,000	28.6
1991-1992	22	33,800	22.9	0	35,200	22.9
1992-1993	24	24,400	16.6	0	25,200	16.4
1993-1994	31	24,300	16.5	0	29,400	19.2
1994-1995	31	33,400	22.7	0	42,400	27.6
1995-1996	30	46,200	31.3	0	50,900	33.1
1996-1997	37	31,400	21.3	0	41,800	27.2
Average Density			22.5			25.0
Management Goal			18.7			21.3
Population Density Over Mgt. Goal			3.8			3.7

Appendix F
Wolf Health Monitoring
and Mortality Factors

by Kerry A. Beheler

Adrian P. Wydeven, and Richard P. Thiel

Disease testing and assessment of mortality factors has been a critical aspect of wolf monitoring in Wisconsin since 1981. Such examinations have been important for determining overall health of the wolf population and determining how various factors have affected wolf mortality.

Six diseases have been tested on wolf serum samples since 1981, and in the 1990's fecal samples were tested for parvovirus, and live capture wolves were assessed for probable mange (Table F1). Disease testing was conducted on 115 serum samples through 1996 for canine parvovirus (CPV), infectious canine hepatitis (ICH), canine distemper virus (CDV), heartworm (HTW), Lyme disease, and Blastomycosis. Most of the animals tested represented adults and yearlings, because few pups were captured during the spring-summer live trapping period. Test procedures changed during the monitoring period, therefore some difference in positive results may be due to varying test sensitivity. Positive results indicate that the animal was exposed to the disease, but not necessarily clinically infected. Rate of positive titer values indicate prevalence of various diseases in the wolf population, but not specifically the number of animals affected by the disease.

Canine parvovirus was tested on 94 wolf serum samples and 23 wolf scats. Overall results were near 50% positive for both tests. Positive test were more prevalent on samples in the 1980's than in the 1990's ($\chi^2 = 5.967$, $P < 0.025$ 1 d.f.). The high levels of positive testing corresponded with a period of population decline between 1982 to 1985 when the population declined 44% from 27 to 15 wolves. CPV was also considered a major factor in the decline of Isle Royale wolves between 1980 and 1982 (Peterson 1995). Mech and Goyal (1995) indicated that when 76% of adults tested positive, the wolf population would be expected to decline. Parvovirus probably mainly affect young pups by causing severe diarrhea leading to dehydration, but can also cause mortality in wolves 9 months old in the wild (Mech et al. 1997).

Lyme Disease tested positive in 48% of 69 wolf serum samples. The rate in Wisconsin is higher than most of Minnesota (Thiel et al. 1992). Lyme Disease has only been identified in wolves of the Great Lakes region. Although Lyme Disease has not been shown to cause specific mortality with wild wolves, it perhaps does have some subtle impacts on the wolf population. Annual pup survival has been estimated at only 30% in Wisconsin (WDNR files), and possibly Lyme Disease is a factor.

Sarcoptic mange was first identified in a Great Lakes wolf in 1991 (Wydeven et al. 1996). Although sarcoptic mites were difficult to retrieve from live-trapped wolves, several wolves showed external signs of mange including extensive hair loss (alopecia), darkened hairless skin, and flaky crusting skin. Since 1991 mange sign was detected on 27% of wolves, and was as high as 58% in 1992-1993. In 1993 a 11% decline was detected in the Wisconsin wolf population; Todd et al. (1981) indicate that population impact of mange is generally most severe during the second or third year of infestation. Although Wisconsin wolves continue to be infested with mange, it does not appear to have slowed population growth in recent years.

Only 1 of 33 wolves tested positive for Blastomycosis, although 2 others were "suspicious" (Thiel, unpublished data). One wolf was found to have died with Blastomycosis in Minnesota (Thiel et al. 1987).

Other positive disease test included 39% of 72 samples for infections canine hepatitis and 23% of 65 samples for canine distemper. These rates as with other disease test indicate exposure to antibodies, but not necessarily active disease status. Only one serum sample of positive heartworm infection was detected; this disease seems to be a rare disease among wild wolves in Wisconsin.

Table F2 illustrates mortality factors of 63 radio collared wolves found dead in the field from 1979 through 1998. Some of these wolves were no longer being actively monitored. Human's caused 61% of known wolf mortality, and more than half was caused by shooting. Disease caused half of natural mortality. During the early 1980's annual adult survival was only 61% and most mortality was caused by humans (Wydeven et al. 1995). In recent years annual adult survival has generally exceeded 80% and human-causes have been reduced to 50% of mortality. Shootings have declined in recent years, but vehicle collisions have increased and equal shooting mortality in the 1990's. Decrease in the illegal kill was probably due to educational efforts and increased law enforcement.

Although the Wisconsin wolf populations are affected by a variety of diseases and mortality factors, overall the wolf population seems relatively healthy and is showing good growth in recent years. Health monitoring will need to continue in the future to further assess impacts of disease on the wolf population, and to detect any new mortality factors that may affect wolves in the future.

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**Table F1. Disease testing of live-captured wolves in Wisconsin 1981-1996
(Positive Test/ Total Tested)**

YEAR	CPV Serum	CPV Feces	ICH	CDV	HW	Lyme	Blasto	Mange-like Condition
1981	5/6	---	---	---	---	---	---	---
1982	6/7	---	3/3	6/6	---	---	1/3	---
1983	4/5	---	2/5	0/5	---	---	---	---
1984	1/4	---	---	0/1	---	---	0/2	---
1985	4/5	---	0/1	---	---	---	0/5	---
1986	4/4	---	---	---	---	---	---	---
1987	---	---	---	---	---	---	0/2	---
1988	1/4	---	2/4	0/4	---	3/4	---	---
1989	---	---	---	---	---	3/4	---	---
1990	---	---	---	---	---	2/3	---	---
1991	5/12	---	5/12	1/1	1/11	8/12	0/12	2/11
1992	2/10	---	4/9	1/10	0/8	4/9	0/9	5/10
1993	0/6	2/4	0/6	1/6	0/7	3/6	---	6/9
1994	3/9	2/6	3/10	2/10	0/10	4/9	---	3/11
1995	7/13	4/7	4/13	1/13	0/13	2/13	---	2/16
1996	4/9	3/6	5/9	3/9	0/9	4/9	---	1/14
Total	46/94	11/23	28/72	15/65	1/58	33/69	1/33	19/71
+81-89	71%	---	54%	38%	---	75%	8%	---
+90-96	36%	48%	36%	18%	2%	44%	0%	27%

CPV = Canine Parvovirus

ICH = Infectious Canine Hepatitis

CDV = Canine Distemper Virus

HW = Heartworm

Lyme = Lyme Disease

Blasto = Blastomycosis

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Table F2.		
Mortality summary of radio-collared wolves from Wisconsin and adjacent areas of Minnesota, Oct., 1979 to Dec., 1998		
Cause of Death	Number	Percent Known Mortality
Human Caused:		
Capture Related	2	4%
Shooting	18	32%
Trapping	3	6%
Vehicle Collision	8	14%
Unknown Human Causes	4	7%
Total Human Caused	35	61%
Natural Causes:		
Birthing Complications	1	2%
Disease	11	19%
Killed by Other Wolves	6	12%
Unknown Natural Causes	3	5%
Total Natural Caused	22	39%
Total Known Mortality	57	100%
Unknown Mortality	6	
Total All Mortality	63	

Appendix G

WOLF-DOG HYBRID CASES IN WISCONSIN.

by Adrian P. Wydeven, Randy L. Jurewicz and Ronald N. Schultz

ing wild wolves, control actions have been applied very carefully. Once wolf populations are more secure, more liberal controls can be applied toward wolf-like animals that lack fear of people and occur in residential and farmland areas.

Twenty-one cases of free-roaming wolf-dog hybrid incidents involving Wisconsin DNR or USDA-WS occurred between July 1989 and 1998 (Figure G1 and Table G1).

These cases involved 44 different animals, including 14 wolf-dog hybrids that were shot, 3 accidentally killed (vehicle collisions), 12 live-captured and placed in captivity, and 9 disappeared or remained in the wild.

Livestock were verified killed/attacked by one group of hybrids in 1989, and possible depredation by a wolf-dog hybrid occurred in 1997. A wolf-dog hybrid was known to be free-roaming on a farm that had 9 calves killed and 21 missing. Although some calves were verified as probably killed by wolves, the presence of the wolf-dog hybrid complicated investigation/verification of losses.

Wolf-dog hybrids challenged or attacked dogs or humans in 8 cases, including 1 case of a hybrid biting a child. In at least two cases, female wolf-dog hybrids apparently bred with dogs, and one produced a pup in captivity.

Although most wolf-dog hybrids did not cause serious problems, the lack of fear of people and their pets posed real concerns. Agency dealings with wolf-dog hybrids consumed time and expense that could have been spent on wolf conservation.

Calls and reports of wolf-like animals initiated investigations by WDNR or USDA-WS and sometime involved lengthy attempts at live-capturing. Because of concerns for protect-

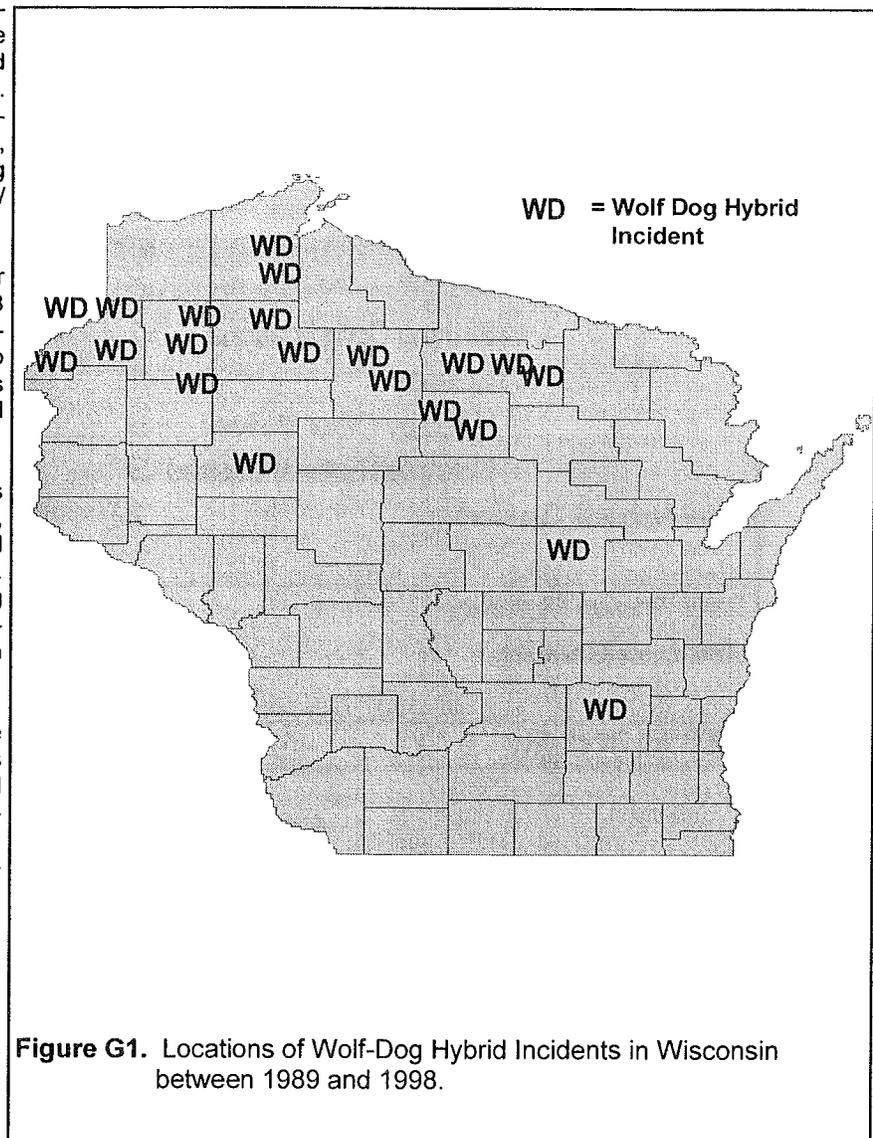


Table G1.

Free-roaming wolf-dog hybrid incidents/complaints in Wisconsin - July 1989 through December 1998

Date(s)	Year	Location	County	No.Sex/Age	Problems	Outcome
July-Aug	1989	Spooner,	Washburn	2A/1Y/7P	Killed 10 sheep, mauled 5 sheep	AM, AF and PM shot by landowner
August	1991	Stone Lake,	Washburn	1AM+1AF	Attacked dogs spilled garbage	Killed by sheriff's deputy
June	1992	Cable,	Bayfield	AF+2P	scavenging garbage	pups in USDA-WS trap killed by local person
Sept.	1992	Phillips,	Price	AF	close approach to people and pets	live captured by USDA-WS held by DNR cooperator
Feb. 14	1994	Clam Lake,	Sawyer	AF	found shot started investigation	dog food in stomach shooter not found
Mar.	1994	Drummond,	Bayfield	1AM/2YM	frightened people; stole pet food, challenged dogs	live capture DNR & USDA-WS placed on game farm
Apr.	1995	Brantwood,	Price	YM	visiting farm area concerned farmer	live capture by DNR placed on game farm.
May 5	1995	Chippewa Falls,	Chippewa	AM	road kill, started DNR investigation	necropsied. carcass to UW-Madison
Aug-Nov	1995	Minong,	Washburn	Unk. A	approached vehicle on road ate scraps	Observed for 4 months then disappeared
Feb-Mar	1995	Grantsburg,	Burnett	3PF	attacked dogs challenged person	two live captured, taken to Wildlife Sci. Center, MN; 1 shot#256
June 7	1996	Rhinelanders,	Oneida	AF+1P	bit child	AF shot, tested for rabies, negative; pup given to hybrid owner
May 3	1997	Webb Lake,	Burnett	2A/1P	threatened people attacked warden	All 3 shot by DNR warden
May	1997	Danbury,	Burnett	AM	21 calves lost on farm? wolves?	recaptured by owner
Aug	1997	Grantsburg,	Burnett	A?	Stole camper's food and approached people, bold.	live-captured by USDA-WS & NPS, taken to wildlife science center
Feb	1998	Winter,	Sawyer	AF	bred with dog, close approach to people	Shot by DNR biologist.
Apr 20	1998	Monico	Oneida	AM&AF	Attacked German Shepherd in back yard	Captured by owner after USDA-WS investigation
Aug. 13	1998	Tomahawk	Lincoln	3A	Attacked black labrador in back yard	Attempted capture by DNR / USDA-WS, but disappeared
Aug. 26	1998	Monico	Oneida	YF	Roadkill - started DNR investigation	necropsied, carcass to UW-Madison
Sept. 10- Nov. 3	1998	Beaver Dam	Dodge	AF	Roamed farm area after escape	Captured by owner
Oct. 8	1998	Tripoli	Lincoln	AM	Possible hybrid, roadkill, started DNR investigation	necropsied, carcass to UW-Madison investigation ongoing
Oct. 25	1998	Big Falls	Waupaca	2A	Attacked black labrador	DNR/USDA-WS investigated

**APPENDIX H.
Public Attitudes Towards Wolves in Wisconsin**

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The data for this analysis were obtained from the responses of randomly selected respondents drawn from Wisconsin Department of Transportation (DOT) license plate records last updated in January 1997. All responses were entered, coded, and statistically analyzed at the University of Wisconsin-Madison, Department of Rural Sociology using SPSS statistical software.

Sampling

In 1997, I conducted a study of public attitudes towards, knowledge of, and behavioral relations with wolves, rare and endangered wildlife, and natural resources in Wisconsin. A self-administered survey

The survey effort was divided into two separate populations: the first sample was drawn from all registered license plate owners who owned an Endangered Resources license plate (excluding all busi-

Table H 1: Sampling Plan

	Sampling Population Size	Study Sample Size
Endangered Resources Sample	21,075	700
North	843 (4%)	300
South	20,232 (96%)	400
Non-Endangered Resources Sample	5,000,000	700
North	350,000 (7%)	300
South	4,650,000 (93%)	400

questionnaire was mailed to a random sample of all registered license plate owners in Wisconsin, as well as a random sample of all license plate owners who purchased the new Endangered Resources (E-R) license plate provided by the Wisconsin Department of Natural Resources, Bureau of Endangered Resources. The overall response rate to the mail survey was 78.7 percent, with response rates of 87.2 percent for Endangered Species license plate owners, and 69.7 percent for all Wisconsin license plate owners.

Various results are included in this report regarding public support for endangered resources and environmental protection in Wisconsin. Information is reviewed as regards to public knowledge of, and attitudes towards, wolves, rare and endangered species and proposed statewide policies that might affect them. Basic attitudes towards environmental conservation and endangered species protection are also explored among various constituencies and demographic groups in the state.

ness and government vehicles). The second sample was drawn from all other registered license plate owners (excluding ER plate owners, businesses, and government vehicles) in the state of Wisconsin. Approximately 90 percent of Wisconsin residents reside in the southern counties of the state. Therefore it was necessary to oversample residents from northern Wisconsin *within* each sampling population in order to have a sufficient number of cases for analysis by place of residence (See Table H1). Based on this objective, a sample of 300 license plate owners from northern Wisconsin, and 400 license plate owners from southern Wisconsin for each sample population were drawn, resulting in a total of 1400 respondents.

PUBLIC BELIEFS AND ATTITUDES TOWARDS PROTECTING WOLVES, ENDANGERED SPECIES AND NATURAL RESOURCES IN WISCONSIN

Results about public beliefs and attitudes towards wolves, natural resources, the environment, and will-

ingness to support future funding efforts for their protection are examined in this report. This section presents data obtained from responses to a series of questions regarding rare and endangered species and wolves.

A majority of respondents in the survey expressed pro-wildlife and pro-environmental attitudes. What is perhaps most interesting, is the strength and direc-

a long and notoriously negative image in popular folklore. Approximately ninety percent of all ER license plate owners (89.8%) support efforts by the Wisconsin DNR to increase the number of wolves living in the state. An additional nine percent (9.0%) of these respondents are ambivalent about the issue of wolves in Wisconsin, while slightly over one percent (1.2%) are opposed to the idea. For all other Wisconsin license owners, the pattern is more mixed.

Table H2. Do you think that protecting rare plants and animals helps maintain the integrity of the natural environment?

		definitely no	probably no	not sure	probably yes	definitely yes
Plate Type	ENDANGERED	.6%	.3%	.6%	18.8%	79.7%
	ALL WISCONSIN	.8%	5.4%	5.4%	34.6%	53.8%

tion of pro-environmental responses. Table 2 shows, when asked whether they think protecting rare plants and animals helps to maintain the integrity of the environment 98.5 percent of those with ER plates and 88.4 percent of all Wisconsin plateholders sampled indicate a probably or definitely yes.

cent (14.8%) of all license holders actually oppose these efforts. In sum, among the driving population in Wisconsin, there seems to be widespread public support for efforts designed to increase the number of wolves now living in the State of Wisconsin.

Fifty percent of all Wisconsin license plate owners (50.2%) support efforts by the Wisconsin DNR to increase the number of wolves. Approximately fourteen per-

Table H3. For you, how important is the protection of rare predators like the wolf, the barn owl and the lynx in Wisconsin?

		not at all important	somewhat unimportant	mixed	somewhat important	extremely important
Plate Type	ENDANGERED	.0%	.6%	2.1%	18.1%	79.2%
	ALL WISCONSIN	4.6%	4.0%	11.6%	40.4%	39.4%

All respondents were presented with specific questions regarding predators in the state of Wisconsin: including attitudes (1) towards protection of predators in Wisconsin such as Timber Wolf, the Barn Owl and the Lynx and (2) support for Wisconsin DNR efforts to increase the number of wolves.

Over ninety seven percent of the ER group stated that the protection of rare predators was important (97.3%) and more than three-quarters of the group (79.2%) actually stated that it was *extremely* important (Table H3). Most other Wisconsin drivers (79.8%) stated that it was at least somewhat important to protect rare predators in Wisconsin, and less than 9 percent (8.6%) stated that it was unimportant.

Table H4 shows the results when respondents were asked about the wolf in Wisconsin—a predator with

series of questions dealing with past participation in Wildlife related activities. Specifically, respondents were asked if they had hunted, fished, birdwatched or taken a trip away from home primarily to view, photograph or listen to wildlife in the last 12 months.

ER plate holders represent less people that have hunted in the last year than regular Wisconsin license holders (23.7% versus 37.1%). The percentages of people who were anglers was similar between groups. ER plate holders are more likely than the overall group to have participated in birdwatching (79.7%) or taken a trip at least one mile away from their place of residence to view, photograph or listen to wildlife in the previous 12 months (80.7%).

Past Outdoor and Wildlife related Activities

Hunters, anglers, and non-consumptive wildlife users were identified from the survey data according to their responses to a

Table H4. Overall, how much do you support efforts by the Wisconsin Department of Natural Resources (DNR) to increase the number of wolves

		strongly oppose	moderately oppose	neither support nor oppose	moderately support	strongly support
Plate Type	ENDANGERED	.9%	.3%	9.0%	29.0%	60.8%
	ALL WISCONSIN	8.0%	6.8%	35.0%	30.6%	19.6%

respondents who have hunted at least once, seventy eight percent (78.3%) feel that it is either somewhat or extremely important to protect rare predators. For respondents who have never hunted, slightly over eighty percent (80.7%) feel that the protection of rare predators is important.

The trend towards non-consumptive use of wildlife is *not* limited to the ER subgroup. Most Wisconsin license plate holders also participated in birdwatching (72.2%) and nonconsumptive wildlife use (73.2%). In sum, all people who own a licensed vehicle (both ER and all other license plate holders) in Wisconsin are more than twice as likely to have participated in non-consumptive wildlife uses during the last year than they are to have hunted.

tion of rare predators is important. For those respondents who participated in nonconsumptive uses of wildlife over the last year, almost eighty five percent (84.5%) feel that the protection of rare predators is somewhat or extremely important, while less than sixty five percent (64.5%) of respondents who have not done so feel that their protection is important.

I examined attitudes toward predators based on wildlife-related activities (Table H7). There is considerable support for the protection of rare predators among "All Wisconsin" respondents who have hunted and who have participated in nonconsumptive uses of wildlife in the last year. For

Table H5. ER license Plate Holder's participation in Wildlife related activities

	no	yes	don't know
	%	%	%
Hunt last 12 months	76.3%	23.7%	
Hunt Ever	62.9%	37.1%	
Fish Last 12 months	52.3%	47.7%	
Birdwatch	20.3%	79.7%	
Nonconsumptive Wildlife Use	18.7%	80.7%	.6%

Differences between hunters and non-hunters in their attitudes toward increasing wolves was slight (Table H8). For respondents who have hunted at least once, nearly fifty percent (46.7%) stated that they support efforts to increase the number of wolves living in Wisconsin. Only 20% opposed increasing wolf numbers. For non-hunters, fifty four percent (54.2%) of respondents support these efforts. About fifty six percent (56.1%) of all respondents who have participated in the nonconsumptive use of wildlife, support efforts to increase wolf numbers, while only slightly more than thirty percent (33.2%) of respondents who have not participated in nonconsumptive activities support such efforts. There appears to be support by both hunters and nonconsumptive wildlife users for increasing wolf numbers.

Table H6. "All Wisconsin" plate holder's participation in Wildlife related activities.

	no	yes	don't know
	%	%	%
Hunt last 12 months	65.5%	34.5%	
Hunt Ever	50.5%	49.5%	
Fish Last 12 months	48.6%	51.4%	
Birdwatch	27.8%	72.2%	
Nonconsumptive Wildlife Use	24.8%	73.2%	2.0%

These results suggest that fairly strong pro-wildlife and pro-environmental attitudes exist among the Wisconsin population. Moreover, there is a considerable amount of popular support for the protection of

rare and endangered predators in Wisconsin, including the wolf. The data show that there is also widespread popular support for current efforts by the Wisconsin DNR to increase the number of wolves living in Wisconsin. While this is moderated somewhat by the extent to which people have participated in activities such as hunting and nonconsumptive uses of wildlife, a majority of all respondents to the survey expressed support for increasing the number of wolves living in Wisconsin.

Table H7. For you, how important is the protection of rare predators like the wolf, the barn owl and the lynx in Wisconsin?

		Rare Predator Protection				
		not at all important	somewhat unimportant	mixed	somewhat important	extremely important
Hunt Ever	no	4.7%	3.1%	11.5%	36.8%	43.9%
	yes	4.6%	5.0%	12.1%	43.2%	35.1%
Hunt last 12 months	no	3.6%	4.1%	11.9%	38.8%	41.5%
	yes	6.6%	3.9%	11.5%	42.1%	35.9%
Nonconsumptive Wildlife Use	no	7.5%	8.6%	19.4%	35.9%	28.6%
	yes	3.4%	2.8%	9.3%	41.5%	43.0%

Table H8: Overall, how much do you support efforts by the Wisconsin Department of Natural Resources (WDNR) to increase the number of wolves living in Wisconsin?

Support for DNR Increasing Number of Wolves in Wisconsin

		Strongly Oppose	Moderately Oppose	Neither- Support nor Oppose	Moderately Support	Strongly Support
Hunt Ever	no	3.3	6.4	36.1	33.5	20.7
	yes	13	7.5	32.8	28.4	18.3
Hunt Last 12 Mo.	no	5.5	6.9	35.2	33.3	19.1
	yes	13.1	7	33.1	26.5	20.3
Noncon- sumptive Wildlife Use	no	15.9	4.5	46.3	24.3	8.9
	yes	4.9	8.1	30.9	32.9	23.2

Appendix I
Alternative Wolf Management Considered.
by the Wolf Advisory Committee

Wolf management goal alternatives considered: the original draft wolf management plan for Wisconsin called for a long range population level from 300 to 500 wolves. This number was derived after study of the available habitat within the State of Wisconsin.

People comments on Draft 1 of the plan often addressed an upper limit on wolf numbers in Wisconsin. Some said 500 wolves would be too many to be socially acceptable. Others saw no reason for limiting the number of wolves in the state. After examining the public comments and biological data the Wolf Advisory Committee decided, in Draft 2, to recommend delisting wolves as numbers reach 250 and establishing a management goal of 350, the minimum level at which a full range of control activities could occur. After public review of Draft 2 the Wolf Committee agreed that the population threshold of 350 be used as the minimum level for proactive control and possible public harvest.

Discussion of alternatives and impacts of population goals: A population of 350 wolves would impact forest ecosystems in northern and central Wisconsin. Slight declines in deer populations might occur in interiors of wolf territories, but would have only a minor impact on deer harvest. Wolves could also impact populations of beaver, coyotes, and perhaps medium-sized predators such as raccoons and fisher. The higher wolf population would also increase probability of wolf depredation on pets and livestock. Delisting could provide increased flexibility in controlling problem wolves to minimize concerns about depredation. Such increased flexibility in controlling problem wolves when delisted, should help minimize concerns.

Several alternatives were considered for Wisconsin's wolf population goal. A goal of 100 wolves in Wisconsin, similar to federal delisting guidelines, was considered. Although the federal guidelines would provide minimum levels for a viable population if Wisconsin's population of 100 wolves remain connected to other wolf populations (Fritts and Carbyn 1995; U.S. Fish and Wildlife Service 1992); such a population may not be considered viable if it becomes isolated. Also, at a lower population goal, wolves might not be able to fully occupy areas of favorable habitat that exists in Wisconsin (Mladenoff et al. 1995, Mladenoff et al. 1997, Appendix C).

Another alternative considered was to classify wolves in Wisconsin as threatened throughout the next 10 years, and review the population performance after that time to determine criteria for delisting. This alternative was rejected because it may not allow ade-

quate flexibility in controlling problem wolves in the future. Under threatened classification, controls on nuisance wolves would continue to be restricted. Once delisting occurs more flexible control will be used on problem wolves. The WDNR is obligated to remove species from the threatened and endangered list when such a classification is no longer warranted.

Zone management alternatives considered: The wolf management team considered alternatives involving: no zones, two zones, or three zones. The "no zone" alternative was rejected because it provided no special protection to wolves in areas of suitable habitat. All nuisance wolves would need to be controlled on case-by-case basis.

The two zone alternatives did not seem to provide as high levels of wolf protection in areas of suitable habitat, while allowing flexible control in areas of conflict with nuisance wolves. The two zone alternatives did not tie as closely into habitat considerations as would a more complex system.

The wolf management team also considered a three zone concept that incorporated all the land within the Northern Forest Deer Management Units and Central Forest Deer Management units as Zone 1 (Figure I1). This Zone 1 was further divided for management purposes into management on public lands and management on private lands. Zone 1a included public lands and was proposed to be titled Wolf Conservation Area. That area was to have included 7,600 square miles of public and industrial forests in the Northern Forest and Central Forest. Estimates were that the area could support 210-350 wolves. Zone 1b was to include approximately 15,400 square miles of private lands within the Zone 1 area. Wolves in that area were to have been controlled on a case by case basis. Most private lands would not be highly suitable habitat and could support 80-150 wolves. Flexible management was proposed for this (Zone 1b) areas. Habitual depredators on livestock and pets could be euthanized and controlled on private land up to one-half mile from the depredation site. Wolf packs that do not cause depredation were to be protected, and habitat protection done on a case by case basis. Under State delisting, proactive trapping by government agents could be done in areas where chronic wolf problems exist to reduce or eliminate wolves from these areas.

In Draft 2 of the Management Plan, the original Zone 1 alternative was modified by the Wolf Advisory Committee in lieu of a plan to include six highly protected core areas for wolves in Zone 1 (Figure I2), but which provided more liberal depredation controls outside core areas of that zone. The Draft 2 proposal listed the Central Forest as a unique zone, Zone 2, that provides more flexible control in that

area. In addition, the option continued the coyote hunting closed period during the deer gun season within the Northern Forest management area, but not within the Central Forest.

The six wolf core areas in Draft 2, were designated in Northern Wisconsin to provide additional protection for wolves. (Fig. I2). The intent of these areas was that wolves be completely protected, except under extremely unusual circumstances, such as a wolf with a highly contagious disease such as rabies, a captive-raised wolf that has escaped into the wild, or a wolf that poses a threat to human health or safety.

In draft 1 of the Wolf Management Plan all public lands in northern and central Wisconsin were listed as wolf sanctuaries (7,600 mi²), but the need for such an area was questioned repeatedly at public forums and in individual public comments. The Wolf Advisory Committee believed creation of the Core Areas was a way to provide concentrated protection

on the most appropriate locations, reducing the overall acreage earlier proposed (3,337 mi²) as highly protected.

Protected wolf core areas or sanctuary areas have been recommended for small populations of wolves or wolves near agricultural and developed landscapes (Haight et al. 1998, Mech, 1995). Such protective cores help assure the long term viability of a small population (Haight et al. 1998).

Wolf Core Areas were proposed across northern Wisconsin in areas of favorable wolf habitat (Mladenoff et al. 1995), and large blocks of public land. Areas were selected based on suitability of wolf habitat and the lack of most livestock activity or concentrated human developments. Local wildlife managers were consulted as to reasonable areas and boundaries for Wolf Core Areas.

Although many people accepted the concept of Wolf

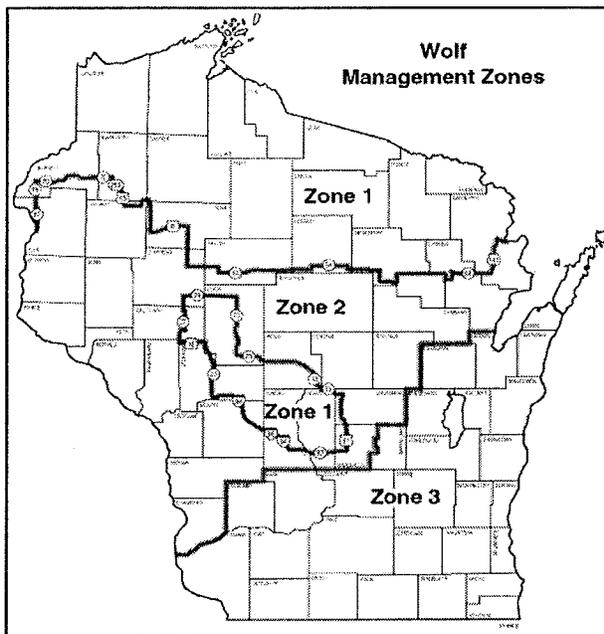


Fig. I1 Original Zone Management Proposal for Draft 1.

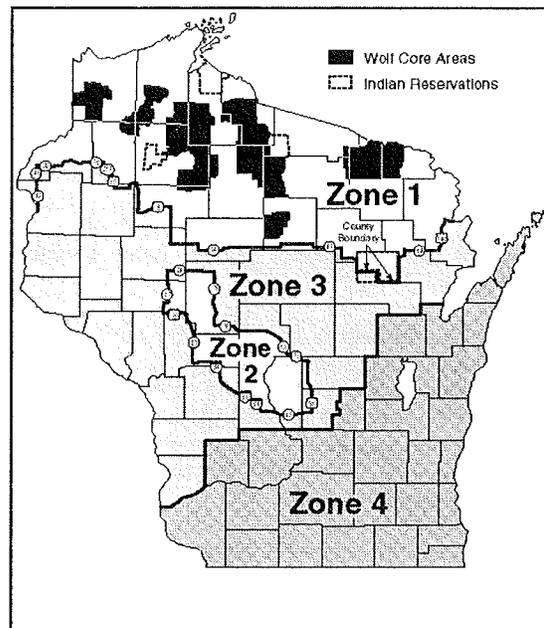


Fig. I2. Zone Map Proposed in Draft 2 (includes Core Areas)

Core Areas, others were very concerned that creation of these distinct zones would mean major restrictions on land use activities within the Cores. It was not the intent of the Wolf Advisory Committee to cause land use restrictions, but only to zone where lethal control on wolves was prohibited. Because the Core Area concept was widely misunderstood, the committee decided that lethal control within prime wolf habitat should be handled on a case-by-case basis. Lethal control would not generally be needed or utilized on or adjacent to large blocks of public land in areas of suitable wolf habitat. The Wolf Core maps created for the Draft 2 Wolf Management Plan could be utilized by WDNR wildlife managers and USDA-WS trappers seeking guidance about lethal control activities on wolves. By carefully considering lethal controls in Zone 1 on a case-by-case basis, a flexible system can exist for controlling wolves in problem areas, while still protecting most wolves in areas of suitable habitat.

Alternate habitat management considered: Other habitat management alternatives were considered by the Wolf Advisory Committee. The committee considered less emphasis on vegetative and access management once wolves are delisted. Because public land agencies manage for a variety of wildlife species, biodiversity protection, and sustainable resource use (forestry, wildlife, fisheries, etc.), it is assumed that such management should also provide habitat for wolves as long as wolves are protected. The committee felt that special considerations for wolves should continue into the future as wildland areas decline. Lack of aggressive access management may expose wolves to higher levels of mortality, and disturbance of den sites may displace wolves to less suitable areas where pups are vulnerable to higher risks of mortality.

We also considered more intense management of habitat for wolves. Such recommendations might include increasing wilderness and other roadless areas to provide additional wolf habitat. But large wilderness and roadless areas without natural disturbance or timber harvest may lack

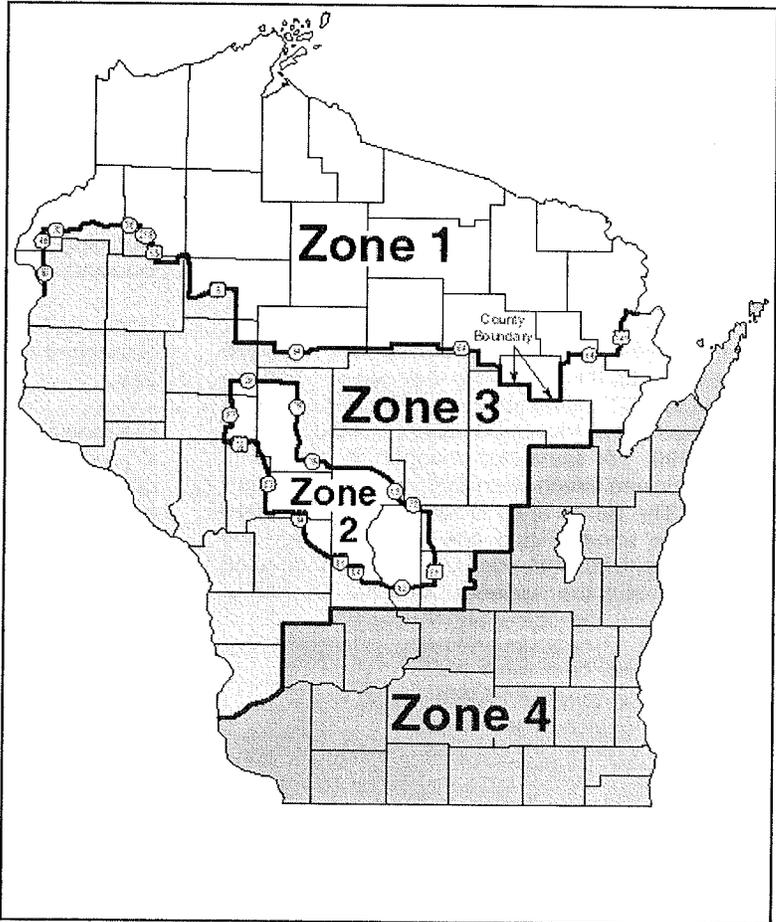


Fig 13. The Four-Zone Wolf Management Zone System for Wisconsin.

deer habitat, and would support only very low wolf densities. Creation of large wilderness areas may cause local economic distress and could create resentment toward wolves. Wolf monitoring in Wisconsin, Michigan and Minnesota have demonstrated that wolves can survive well in more intensely managed forest, and do not need to have large blocks of wilderness set aside for them. Therefore the Wolf Advisory Committee recommended against creation of wilderness areas or extensive road closures on wildlife areas specifically for wolves.

Use of volunteers, alternatives considered: The alternative to using volunteers would be to continue intense involvement by WDNR, and other agencies in all aspects of wolf recovery and conservation. If funding declines as the wolf population increases it will not be possible to maintain existing levels of wolf conservation efforts. Involvement of volunteers will be essential

for the long-term success of wolf conservation in Wisconsin. Also, volunteer programs provide opportunity for public input into determining the wolf population and other wolf conservation activities, in which public support is critical.

Public harvest, alternatives considered: The Natural Resource Board, at its meeting in August, 1999 at Hayward directed staff to determine regulatory language necessary for implementing a hunting season on wolves when the wolf population reaches 350.

The statutory and administrative rule changes necessary for hunting were developed and included in the Wolf Management Plan (Appendix J) submitted to the Natural Resources Board in October, 1999. A significant number of comments were received which were opposed to public harvest. The Board at its October meeting deleted the public harvest language from the plan and then approved the adoption of the plan. It directed staff to retain the appendix material for further study.

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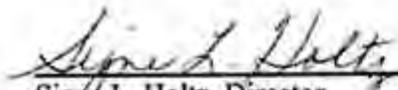
Wisconsin Wolf Management Plan Addendum 2006 and 2007

Compiled by the Wisconsin Wolf Science Advisory Committee in cooperation
with the Wisconsin Wolf Stakeholders Group

For The
Bureau of Endangered Resources, Division of Land for the Wisconsin
Department of Natural Resources

This addendum updates portions of the Wisconsin Wolf Management Plan, approved by the
Natural Resources Board on October, 27, 1999. The addendum to the wolf plan was
presented and approved by the Natural Resources Board at their meeting on June 28, 2006
and updated on August 15, 2007.

Approved:



Sigge L. Holtz, Director
Bureau of Endangered Resources

11/27/06

Date



Laurie J. Osterndorf, Administrator
Division of Land

11/28/06

Date



Scott Hassett, Secretary
Department of Natural Resources

11/28/06

Date



Gerald M. O'Brien, Chair
Natural Resource Board

11/28/06

Date

Wisconsin Department of Natural Resources. 2007. **Wisconsin Wolf Management Plan Addendum 2006 and 2007**. Wisconsin Department of Natural Resources, Madison, Wisconsin 58 pp.

August 15, 2007

Bureau of Endangered Resources

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**Wisconsin Wolf Management Plan,
Addendum 2006 & 2007
Executive Summary
By the Wisconsin Wolf Science Advisory Committee**

In 2004 and 2005, the Wisconsin Wolf Science Advisory Committee conducted a review of the 1999 Wisconsin Wolf Management Plan, in conjunction with the Wisconsin Wolf Stakeholders groups. Both groups advise and report to the Bureau of Endangered Resources on matters of wolf management and conservation in the Wisconsin. This report includes updates and modifications recommended to the 1999 Wisconsin Wolf Management Plan by the Wisconsin Wolf Science Committee.

The review of the wolf plan included several meetings with the Wolf Science Committee in 2004 and 2005, four meetings with the Wisconsin Wolf Stakeholders, and a public review of the 1999 Wolf Plan by interested citizens in between August 13 and September 13, 2004 through email, mail, and contacts at DNR offices (Appendix K). In the following discussion the Wolf Science Advisory Committee will be referred to as “the Committee”.

Wolf population management goals were reviewed and were generally agreed to continue to be reasonable by the Committee. Carrying capacity assessments continued to suggest a potential biological capacity for about 500 wolves. The committee agreed to continue to maintain a state delisting goal of 250 wolves outside of Indian reservations in a late winter count, and a state management goal of 350 wolves outside of Indian reservations in a late winter count. Social surveys indicate that there continues to be strong public support for wolf conservation in the state, although it varies considerably among various groups. In late winter 2007, 540 to 577 wolves were counted statewide, and 528 to 560 were counted outside of Indian reservations. Thus in recent surveys the wolf population seems to be above the state management goal. Federal delisting was completed on March 12, 2007, allowing the state to begin to apply controls on the wolf population.

Concerns and procedure of wolf health monitoring were updated and modified to reflect greater involvement by the Wisconsin DNR in examination and necropsies on dead wolves, which were initially conducted by the National Wildlife Health Center in Madison.

Information on habitat management was updated. New assessments of potential habitat were being conducted, but had not been completed at the time of the review. In general most wolves did continue to occur in heavily forested lands and in areas with low road

densities. The committee in general agreed that access management on public lands and protection of den sites continued to be important conservation practice for wolves. Special protection for wolf rendezvous sites no longer seemed necessary with the higher wolf population and ephemeral nature of these sites. The committee agreed that wilderness areas were not necessary for maintaining healthy wolf populations as long as scientifically sound management and access control were conducted on public and industrial forest lands.

The language for wolf depredation management was updated to include new depredation payments rules adopted in 2005, and clarification of procedures and practices. A solid professional program for providing timely and effective responses to wolf depredations management is outlined. The committee agreed to extend areas of depredation control trapping to 1.0 mile from depredation sites in zones 1 and 2, from 0.5 mile of the 1999 plan, when wolves are delisted or federal regulations allow greater flexibility. Authorizations for control of wolves attacking domestic animals on private land have been updated and will go into effect once federal delisting is completed.

List of potential wolf research projects was updated to reflect expanded knowledge of wolves in the state, new disease concerns such as ehrlichiosis and neosporosis, need for assessing potential changes in human attitudes, and continuing to examine wolf impacts on ecosystems in the state.

Wolf specimen handling information was updated as DNR and USDA-WS have started to handle larger numbers of dead wolves. Modifications are being made with necropsies no longer just conducted by the National Wildlife Health Center in Madison, as had been the case through the early 2000s. Changes in guidelines for wolf specimen handling was also necessary to reflect reorganization changes that have occurred in the WDNR personnel.

Budget information on the wolf plan was updated to reflect annual state wolf management costs of \$250,000 to \$310,000, and annual depredation payment costs of \$60,000 to \$80,000. More secure federal funding has been found to allow USDA-Wildlife Services to be more effective in dealing with wolf depredation management, but additional sources for funding state wolf management and state depredation payments may be needed in the future.

Two appendices to the wolf plan were supplemented and a new appendix was added by the committee. Appendix F on Wolf Health Monitoring and Mortality Factors was supplemented to add additional mortality data through summer 2005. Appendix H on Public Opinions on Wolf Management incorporated new data and surveys conducted between 2001 and 2005. Appendix K was added to include all the results from the DNR questionnaire on wolf management that was conducted in 2004.

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Wisconsin Wolf Science Advisory Committee

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Wisconsin Wolf Management Plan, Addendum 2006 & 2007.

Review of Management Goals

The Wisconsin DNR wolf management plan (1999) contains goals for management and goals for legal status (endangered, threatened, delisted) thereby linking population levels to discrete levels of protective management. In determining various population goals associated with management and legal classification the Wisconsin Wolf Advisory Committee evaluated the following 4 factors.

- The goal needed to meet or exceed federal recovery criteria.
- The goal must represent a population level that can be supported by the available habitat.
- The goal needed to be compatible with existing information on gray wolf population viability analysis.
- The population goal needed to be socially tolerated to avoid development of strong negative attitudes toward wolves.

The outcome of this process was a management goal of 350 wolves outside of Native American Reservations. At this level “proactive depredation control can be authorized”. A late winter count of 250 (outside of Native American Reservations) was the threshold for de-listing or removal from state “threatened” status. Eighty individuals was the threshold for classification as a state “endangered” species (Wisconsin DNR 1999, Wolf Management Plan).

Review of population goals will be made in light of the 4 factors considered above.

The goal needed to meet or exceed federal recovery criteria.

The U.S. Fish and Wildlife Service Recovery Plan for Wolves in the Eastern U.S. (1992) recommended maintaining a minimum of 100 wolves in Wisconsin and Michigan. This number apparently depends on an assumption that wolves will continue to emigrate from Minnesota. The assumption of emigration is reasonable given recent long-distance movement of wolves outside on the northern Great Lakes region. Since the federal goals have not changed the Wisconsin goal of 350 continues to exceed the federal goal of 100.

The goal must represent a population level that can be supported by the available habitat.

A detailed assessment of the available habitat and the number of wolves that could be supported by the available habitat was done by Mladenoff et al. (1995, 1997). This effort was based on an logistic regression modeling of the occupancy of a small number of pioneering wolf packs, with covariates reflecting their assumed tolerance for human disturbance and their assumed relationship to deer density. Later colonization and local growth in the wolf population provided additional data and an opportunity for validation of the earlier habitat modeling. This later analysis indicated that the habitat relationships developed by Mladenoff et al. (1995, 1997) were robust, correctly classifying the habitat used by 18 of 23 new wolf packs as favorable (Mladenoff et al. 1999). Mladenoff et al.

predicted that 300 to 500 wolves could occupy the most favorable habitat at saturation. With additional occupancy of marginal or secondary habitat Mladenoff et al (1995, 1997) predicted an equilibrium population size of 500 to 800 wolves. Further analysis suggested that the earlier projections were likely conservative – failing, for example, to identify the currently occupied wolf range of Wisconsin’s central forest region (Mladenoff 1999).

An independent analysis of the growth of Wisconsin’s wolf populations largely corroborated with the equilibrium Mladenoff et al. (1995, 1997, and 1999) predicted based on habitat. Van Deelen (unpublished) fit simple growth models to a XX year time series of wolf population estimates. Models fit were the discrete logistic model (CITATION) and the discrete Ricker model (1975) of the general form $N_{t+1} = f(N_t)$ where N = population size. Model fitting was based on a least squares algorithm and jackknife procedures were used to generate variance estimates because of the inherent temporal autocorrelation (Dennis and Taper 1994). The best fit logistic model estimated an equilibrium (or carrying capacity) of 505 (95% C.I. = 501 - 518, $P < 0.0001$, $R^2 = 0.99$) whereas the best fit Ricker model estimated an equilibrium of 522 (95% C.I. = 295 - 635, $P < 0.0001$, $R^2 = 0.99$). Model selection criteria (Burnham and Anderson 1998) suggested that these 2 models were nearly equivalent given the data. Nonetheless, a Ricker model is probably more useful because of less restrictive assumptions about the shape of the growth curve.

Despite wide use to characterize the growth in a time series of population growth estimates (Lotts et al. 2004) this model fitting approach has recently been criticized in favor of a risk analysis (Population Viability Analysis) that can be generated from the same data (Lotts et al. 2004). Still this exercise demonstrates that the original estimates of 300-800 wolves (depending on the extent to which marginal habitat was used) were reasonable and probably quite accurate.

The goal needs to be compatible with existing information on gray wolf population viability analysis

The wolf advisory committee assessed the viability of the Wisconsin wolf population by reviewing current literature on wolf population viability (Soule 1980, Fritts and Carbyn 1995, Haight et al. 1998) and by conducting an independent analysis tailored to the population biology of Wisconsin wolves (Appendix B, Wisconsin DNR 1999, Wolf Management Plan).

The independent analysis was based on computer simulation of wolf population dynamics using the program VORTEX. VORTEX is a mechanistic individual-based model incorporating stage-specific birth and death rates and stochasticity. Conclusions of this analysis were that a population of 300-500 wolves would have a high probability of persisting for 100 years under most scenarios but that population persistence was susceptible to environmental variation and demographic catastrophes (a severe mange outbreak for example). Simulations for a 300-500 wolf population suggested that under moderate environmental variability and a 5% probability of demographic catastrophe 10-

40% of simulations declined below 80 wolves (threshold for classification as endangered).

The independent analysis in Appendix B is an important and instructive piece of supporting analysis for the wolf management plan. However it was conducted in 1998 when the estimated population size was 178-184 wolves. Additional information on the actual growth of the Wisconsin wolf population (425 in 2005) and the telemetry monitoring since 1998 might be useful for refining or validating the input survival and reproductive parameters used.

That said, highly mechanistic population models like those simulated with the VORTEX suffer from imprecision in their projections and may in fact be biased because of their complexity (Lotts et al. 2004). For instance the description in Appendix M (1999 Wisconsin Wolf Management Plan) suggests that there were at least 14 discrete assumptions made about the values or statistical properties of the input parameters and model structure dictates an additional assumption about how the model inputs relate to one another. Appendix M correctly points out that its population viability analysis should be viewed as a component in an adaptive management process and that correction and updating of predictions should occur as population monitoring provides additional information on the population dynamics of Wisconsin wolves. This point warrants emphasis. Additionally, the lengthening time series of high quality wolf population estimates for Wisconsin will likely support additional modeling approaches (e.g. Lotts et al. 2004) that would serve to validate or identify weaknesses in population viability analysis using a mechanistic approach.

Previous discussion notwithstanding, the population viability analysis done for the Wisconsin Wolf Management Plan (1999) appears to remain valid in the light of the continued growth of the wolf population (see above). And survival analysis of radio collared wolves through 2003 indicated that the input parameters on stage-specific wolf mortality used in Appendix M are reasonable (Van Deelen unpublished).

The population goal needs to be socially tolerated to avoid the development of strong negative attitudes toward wolves.

Determining social carrying capacity is more difficult, because it is hard to put into exact numerical terms. Some recent research and surveys have provided some general suggestions of social carrying capacity or tolerance. In late summer 2004, the Wisconsin DNR, conducted a survey of the state wolf plan to which 1367 people responded (1322 residents of the state, and 45 non-residents). Table 1 lists attitudes toward the state delisting and management goals. Overall, 41 % of the respondents felt the delisting goal was too low, 19% that it was correct, and 40% felt it was too high. Similarly, 39% of respondents felt the management goals was too low, 16% that it was correct, and 45% that it was too high. Among hunters, 57% felt the delisting goals were too high, 64% felt the management goals were too high. On the other hand, among non-hunters, 78% felt the delisting goal was too low, and 74% felt the management goal was too low. When asked about specific numbers for a goal, state residents seemed to prefer 400 or more

wolves, but hunters preferred about 100, and farmers about 150. But among all groups there was a broad range from 0 to 5000 wolves that were considered desirable for the state.

Naughton-Treves et al. (2003) conducted surveys of livestock producers, bear hunters, and northern Wisconsin residents in 2002, when 327 wolves were counted in the state. Bear hunters were the most negative toward wolf numbers in the state and nearly 1/3 felt wolves should be eliminated from the state (Table 2). Livestock producers were more positive, and 55% felt the current population should be maintained or increased. Northern Wisconsin residents who were neither bear hunters nor livestock owners were most positive and 73 % indicated that the current population should be maintained or increased. Most bear hunters wanted the wolf population held to less than 100 wolves, but among farmers, 63% wanted more than 100 wolves. Among the other northern Wisconsin residents, 44% wanted over 250 wolves, and 28 % wanted no cap.

In some more recent research by Naughton-Treves et al. (unpublished report), a survey was done on attitudes of wolves by urban people outside range, rural people outside wolf range, urban people in wolf range, and rural people in wolf range. In general, rural people in wolf range wanted the lowest wolf numbers, while urban people outside wolf range wanted the highest numbers (Table 3). But the average value for rural people in wolf range indicated that most would still accept between 350 and 500 wolves. People outside of wolf range mostly wanted over 500 wolves in the state.

In 2003, Kevin Schanning, Sigurd Olson Environmental Institute of Northland College conducted a study to assess the attitudes, opinions, and concerns of Wisconsin residents regarding the state's wolf population. The study design utilized a random sampling methodology, which included some degree of over-sampling of residents who lived in counties known to be inhabited by wolves. Overall, 647 respondents returned the surveys, yielding a margin of error of plus or minus 4%.

One section of the survey asks respondents about their degree of participation in a wide variety of outdoor activities from berry picking, to ATV riding, to hunting; 16 activities in all. Respondents were asked the degree to which the presence of wolves would affect their participation in such activities. The vast majority of respondents indicated that the presence of wolves would not affect their level of participation in these activities. For example, 88% of the respondents who deer hunted indicated that their level of participation would not change with the presence of wolves. Overall, the percentage of respondents indicating that their activities would not change ranged from a high of 90% for canoeing to a low of 77% for running. Additionally, for each activity listed approximately 3 % of respondents reported that their level of participation in that activity would increase if they knew wolves were present in the area in which they were participating in that activity. These findings suggest that social tolerance of wolves in Wisconsin is high.

Respondents were also asked to respond to the question of whether they thought Wisconsin currently had too few wolves, too many wolves, or the correct amount of

wolves. Findings from this question are: 51% indicated that there are currently the right amount of wolves, 31% indicate that there are not enough wolves, and only 18% stated that there are too many wolves in the state. In 2003 the DNR estimated the wolf population to be between 335-353 animals. Consequently, it would seem that vast majority of respondents felt that the current population of wolves was acceptable.

No attitude surveys on wolves have been conducted with Native Americans in Wisconsin. Future surveys should attempt to determine attitudes toward wolf management by Ojibwa, Menominee, Pottawatomie, Ho-Chunk, Stockbridge, and Oneida people in Wisconsin.

The sampling for these surveys were done somewhat differently. The surveys by Naughton-Treves and Schanning were stratified random samplings, while the DNR survey was available for anyone interested in wolf management in the state. But the 4 surveys do yield some similar results. In general it does appear that goals set in the plan seem to fall about mid-way within the range of population goals expressed by people; although at least one member of the DNR Wolf Science committee felt social surveys did not provide justification to keep the wolf population below the potential biological carrying capacity. Hunters, farmers, and rural landowners in wolf range, were mostly interested in lower wolf numbers. Bear hunters were least tolerant of wolves, and will be a difficult group to satisfy as to wolf population management. For most other groups, the DNR wolf population goals seem fairly reasonable.

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Table 1. Population Goals from Wisconsin Wolf Management Questionnaire

<u>Question/group</u>	<u>Much too low</u>	<u>Somewhat low</u>	<u>About right</u>	<u>Somewhat high</u>	<u>Too high</u>
Delisting at 250					
Hunters	8%	13%	22%	18%	39%
Non-hunters	43%	35%	12%	4%	6%
All	20%	21%	19%	13%	27%
Manage at 350					
Hunters	7%	13%	16%	17%	47%
Non-hunters	39%	35%	16%	3%	7%
All	18%	21%	16%	12%	33%
Recommended Goal	<u>Mean</u>	<u>Median</u>	<u>Range</u>		
State Resident	483 wolves	400 wolves	0 -5000 wolves		
Non Resident	455 wolves	400 wolves	300-1000 wolves		
Hunter (Resident)	185 wolves	100 wolves	0 -3500 wolves		
Farmer (Resident)	252 wolves	150 wolves	0 -3500 wolves		

Table 2 . Wolf Population Goals from Naughton-Treves et al. 2003.

Question	Bear Hunter	Livestock Producer	N. Wis. Gen. Resident	All
Wolf population Should be.....?				
Eliminated	32%	12%	6%	16%
Reduced	48%	31%	20%	32%
Maintained at current level	16%	43%	50%	37%
Increased	4%	14%	23%	14%
Wolf population should be under				
<100	72%	37%	28%	45%
<250	16%	36%	28%	25%
<350	4%	6%	9%	6%
<500	3%	7%	7%	6%
no cap	6%	14%	28%	10%

Table 3. Wolf Population Goals, Naughton-Treves and Treves (unpubl. Data)

Groups\ Wolf Number	1 <250 wolves	2 <350 wolves	3 <500 wolves	4 <1000 wolves	5 No cap
Urban, No Wolf (n=431)			3.47		
Rural, No Wolf (n=216)			3.27		
Urban, Wolf Area (n=206)		2.87			
Rural, Wolf Area (n=493)		2.27			

C. Wolf Health Monitoring

Health monitoring is necessary to assess impact of diseases and parasites on the wolf population. Additionally, comparisons of the health and diseases of culled depredators and investigation of the role of wolves in the ecology of diseases of zoonotic or livestock importance will assist in management of the growing wolf population. Health monitoring includes collection and analysis of biological samples from live-captured wolves, analysis of wolf scats, and necropsies of dead wolves found in the field. While federally listed as endangered/threatened, biological samples of live captured wolves and analysis of scats will be conducted by WDNR, and wolf necropsies will be conducted by the USGS-National Wildlife Health Center and the WDNR. When federal delisting occurs, all health monitoring will be the responsibility of WDNR.

Intensive health monitoring will continue while wolves are listed as a state endangered or threatened species. Live-captured wolves will be tested for diseases, physiological condition and parasites. Ideally about 10% of a population of 100 wolves should be examined, but as the population continues to increase, the percentage of the population live-captured will decline. In recent years 20 to 40 wolves were captured annually. Wolf scats will be collected to monitor for infectious diseases and parasites. Dead wolves will be necropsied to determine cause of death, physical condition and disease status. Additionally, tissues will be archived for future disease and genetic investigations.

Following state delisting, live-trapping will continue, but the percentage of the population captured each year will decline. WDNR will continue to examine dead wolves. Special research studies may occasionally be conducted on wolves and these should include health monitoring. Wolf health monitoring should continue to be part of the capture protocol of studies of wild wolves in Wisconsin, and should be coordinated with WDNR Wildlife Health Team.

D. Habitat Management

1. Potential and Suitable Habitat.

In the 1999 Wisconsin Wolf Plan, it was estimated that about 5812 mi.² of favorable wolf habitat existed in Wisconsin based on research by Mladenoff et al. 1995 and 1997. Favorable habitat was considered areas with road densities of 0.7 mi./ mi.² or less, and also were mostly forest, had low density of humans, lacked urban areas, and included little or no farm land. Areas with road densities of 0.7 -1.0 mi./ mi.² were considered secondary wolf habitat and covered 5015 mi./mi.². Mladenoff et al. (1999), and Wydeven et al. (2001), indicated that road density continued to be a useful indicator of preferred wolf habitat. Mladenoff et al. (2005) examined distribution of Wisconsin wolf packs through 2003, and found that in recent years packs have begun to occupy areas in higher road densities than seemed unsuitable during earlier portions of the colonization.

In 2005, areas occupied by territorial wolves covered 6373 mi.², or about 10% higher than the original predicted favorable habitat. Occupied areas included 5557 mi² in Zone 1, 346 mi² in Zone 2, and 250 mi² in Zone 3. Wolves in northwest and north-central Wisconsin in 2005 appeared to occupy all the areas of primary (favorable) and secondary habitat, and appeared to be spreading into areas previously considered unsuitable habitat. Wolf packs did continue to occur mainly in areas of extensive forest cover or other wildlands (barrens, marsh, bog, forest openings, wild grasslands and brushlands). In northeast Wisconsin wolves had not completely occupied primary and secondary habitat, packs continued to be rather scattered, and only one pack (Dunbar in Marinette and Florence Counties) had any substantial pup survival. Wolf packs in the Central Forest (Zone 2) seemed to occupy all the areas of primary and secondary habitat. A few area of Zone 3 were also occupied by territorial wolves and included Fort McCoy, Burnett/Polk/Barron Counties, south-central Rusk County, Mead Wildlife Area, Dewey Marsh Wildlife Area, west Shawano County, west Oconto County, and southeast Marinette County. Zone 3 contained 6 packs but they consisted only of 2 to 4 wolves. In Zone 3, half the packs were involved in depredation on livestock, compared to <10% annually of packs from the rest of the state (Wydeven et al . 2004). As wolves move into areas considered more marginal habitat, level of depredation on livestock is likely to increase (Treves et al. 2002, Treves et al.2004).

2. Access Management

With recent growth and expansion of the wolf population, access management seems to be less of an issue in wolf management. Although there probably is little justification to reduce road densities on public forest lands for wolves, it would be prudent to maintain areas of low road density for wolves and other wildlife sensitive to human disturbance. These areas of low road density were the first places settled by wolves and probably serve as core habitat for source populations. With future fluctuations in wolf population these core area may be important for maintaining viable populations, and population persistence. Development, especially rural housing continue to increase and expand

across northern Wisconsin, causing further fragmentation and reduction of forest habitat (Radeloff et al. 2005). Also with eventual federal delisting, greater pressure will be placed on wolves in marginal areas, causing these core areas of low road densities to become that much more important in maintaining viable wolf numbers.

In recent years use of All Terrain Vehicles (ATVs) has drastically expanded across much of Wisconsin. This increase has occurred at the same time the wolf population has also expanded, suggesting that current levels of ATV use have had little impact on wolf populations. But changes in attitudes toward wolves, reduction of large blocks of forests, increase human populations and recreational activities, may change these dynamics. Impact of ATV use on forest wildlife, especially low density, sensitive species such as wolves and bobcats, as well as impact on forest ecosystems, should continue to be an important aspect of forest management. Access management and off-road management should occur on all major areas of public forest lands.

3. Vegetation Management

In recent years wolves have had little problem finding adequate prey of deer and beaver across northern and central Wisconsin. It appears that current composition of early succession, mature, and older forest seem to adequately provide prey for wolves. In the future, early succession types such as aspen and jack pine will continue to decline. Although minor declines in these habitats are not likely to greatly affect wolves, major declines would reduce abundance of wolves and may reduce or eliminate some areas as wolf habitat. The new plan for the Chequamegon-Nicolet National Forest (2004) seems to maintain reasonable areas of early succession forest to maintain wolf numbers. The national forest provide some of the best potential for maintaining large blocks of mature forests, and it should serve this role, but adequate areas of young forest also need to be maintained. County Forests are developing 10 - 15 years comprehensive management plans in 2005, and maintaining areas of early succession will be part of most county forest plans. Through state forest master plans it is expected early successional forests will be a continued important component of these properties.

4. Habitat Linkage and Corridors.

It continues to be unclear how wolves disperse across large landscape areas. It is generally assumed wolves use forested parcels, forested riverways, and areas of low road densities, but detailed assessment of habitat used by dispersing wolves have not been made. Research on Highway 53 in northwest Wisconsin did not indicate any major impact of highway development on wolf population expansion or mortality (Kohn et al.2000). Impact of highway development was minimized because highway alignments mostly followed existing roadways, and mitigation measures were used along the highway (Kohn et al.2000). Although some dispersing wolves have done extensive crossings of roads and highways (Merrill and Mech 2000), vehicle collisions continue to be a major mortality factor for wolves in central and southern Wisconsin. Wolves have been killed on many of the major interstate and four-lane highways in the state including I39/U.S. 51, I94, U.S. 53, and State 29.

In Wisconsin wolves have been killed on roadways in Zone 4 counties including Brown, Columbia, Dane, Jefferson, Outagamie, Sauk, and Waukesha Counties. Additionally a yearling male from Jackson County, Wisconsin was found dead in eastern Indiana, 420 miles away, and a 2-year old male from Gogebic County, Michigan/ Iron County, Wisconsin was killed in north-central Missouri about 460 miles away. These extensive movements suggest that some form of dispersal habitat exist along the way. Unfortunately, most were killed by vehicles, suggesting that roadways may still limit movements of dispersers. Several were found near riverways as well, suggesting that these may be important components of dispersal habitat. Maintaining forest cover throughout the state, especially along riverways, seems to still be of value to enable wolves and other long-distant dispersing mammals to travel between habitat patches in Wisconsin and the Midwest.

Kerry Martin with University of Wisconsin- Madison, is researching habitat of dispersing wolves in Wisconsin, and hopefully will be able to give updated guidelines for conservation of wolf corridor or dispersal habitat.

5. Den and Rendezvous Site Management

Within areas of suitable wolf habitat in Zones 1 and 2, protection of den sites continues to be a useful strategy for conserving wolf habitat. Den sites generally occur in the most remote portions of wolf territories (Unger et al. 2005). Although at times wolves can tolerate some disturbance at den sites (Thiel et al 1998), but it may just be in very special circumstances where disturbance will be tolerated at dens. It is not clear as to how such disturbance will affect long term viability of packs. Plus the long-term affects of additional developments in forest areas may reduce potential areas of suitable den site. Therefore protections listed in the 1999 wolf plan should be continued.

It is less clear whether protection of rendezvous sites are still necessary across much of northern Wisconsin. In northwest, north-central, and Central Forest portions of Wisconsin protection of rendezvous sites are probably not necessary. In northeast Wisconsin where few packs are able to successfully raise pups, protection of rendezvous sites may continue to have benefits. Once wolf packs are well established within an area, as long as road densities are maintained at low levels, and sound ecological management is conducted on the forests, rendezvous site protection may not be necessary. In suitable areas where colonization is just beginning or wolf pup survival is extremely poor, protection of rendezvous sites may be appropriate.

6. The Role of Wilderness

As with the 1999 wolf management plan, wilderness areas are not necessary to manage for wolves in Wisconsin. Wilderness area are used by wolves, but as long as sound ecological management is used on forests, wilderness areas are not necessary to maintain a viable population of wolves in the state.

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E. Wolf Depredation Management

{ Details of impact of wolf depredation in Wisconsin are discussed in the “Final Environmental Assessment for management of wolf conflict and depredation of wolves in Wisconsin” (USDA-APHIS 2006). Information on effects of wolves and other predators on farms, beyond verified depredations, are found in the review by Lehmkuhler et al. (2007). }

[\http://www.fws.gov/midwest/wolf/depredation/WiPermitEA.htm\](http://www.fws.gov/midwest/wolf/depredation/WiPermitEA.htm)

Wolf depredation management is one of the most sensitive segments of this Wolf Management Plan. WDNR is charged with protecting and maintaining a viable population of wolves in the state, but also must protect the interests of people who suffer losses due to wolf depredation.

Wolves occasionally kill livestock, poultry, and pets. Although wolf depredation is not anticipated to impact a significant portion of the livestock growers, poultry producers, and pet owners, it can bring hardship to individuals. Minnesota currently has about 3,000 wolves but fewer than 1% of the farms in wolf range experience wolf depredation problems.

WDNR paid \$469,430.88 in wolf damage compensation claims for 270 calves, 13 cows killed and 4 cows injured, 74 sheep, 6 horses, 44 deer (Game Farm), 148 turkeys, 114 chickens and 95 dogs killed and 32 dogs injured between 1985 through 2005. (See [Appendix A1.](#)) Depredation on dogs represented 39 % of reimbursement payments and deer represented 18% of reimbursements provided by WDNR. In the 1990s an average of 2.8 farms suffered wolf depredation annually (range 0 -8), but from 2000 -2005 an average of 14.0 farms annually suffered depredations, and grew to 25 farms with depredations in 2005.

Reclassifying wolves from federally and state endangered to threatened status will provide an option to euthanizing depredating wolves. Under threatened status only government agents would euthanize wolves. Once wolves are delisted, permits may be issued by WDNR to enable private landowners to take depredating wolves. Public comments in autumn 1996 revealed concerns about killing wolves, particularly through public harvests. Other comments strongly supported public harvest. Most who supported euthanizing depredating wolves felt this should only be done by government professionals. Many urged educational programs and preventive efforts by livestock producers to minimize depredation losses. There was strong support for continued damage compensation programs.

1. Depredation Management Plan.

The objectives of the wolf depredation management program are to address wolf depredation problems by investigating reported wolf complaints, accurately verifying wolf depredations, providing damage compensation in accordance with administrative code, and conducting depredation management actions to abate or prevent damage. Depending on circumstances management actions may include providing non-lethal

abatement measures and recommendations, and lethal removal of wolves by WDNR or its agents.

2. Verification Procedures

Verification of reported wolf depredations is a critical step in the process of managing depredation problems. A reported wolf complaint must be verified as a confirmed or a probable wolf depredation before any damage abatement or compensation can be provided. Previous experience has shown that many reported wolf complaints turn out to be non-wolf problems upon investigation. Also, many reported complaints cannot be verified due to lack of evidence. Prompt response by government personnel trained in depredation investigation techniques is important in order to determine the validity of a reported complaint.

Wolf depredation investigations will be conducted by USDA-APHIS-Wildlife Services (WS) personnel under a cooperative agreement between WDNR and WS. Wildlife Services will maintain toll-free telephone lines to facilitate the reporting of wolf complaints. The public will be encouraged to report complaints directly to WS by use of the toll-free line. Upon receipt by WDNR of a reported wolf depredation complaint, WDNR personnel will refer the complainant to WS and provide the appropriate WS toll-free telephone number.

Upon receiving a wolf complaint, WS will contact the complainant by phone within 24 hours. If after a telephone consultation WS determines that a field investigation is warranted, WS will make an onsite inspection within 48 hours of the telephone consultation. An investigation into a reported wolf complaint may include the onsite inspection, as well other components such as interviews with complainant and adjacent landowners, veterinarians, and wolf pack location data.

After the investigation is completed, USDA-WS will classify the complaint under one of the following categories:

2.1. **Confirmed Depredation.** Clear evidence that wolves were responsible for the depredation, which may include, but is not limited to, evidence from a carcass, such as tooth punctures and associated hemorrhaging, broken bones, wolf-like feeding patterns, as well as wolf tracks in the immediate vicinity or other wolf sign.

2.2. **Probable Depredation.** Carcass missing or inconclusive but presence of good evidence which may include, but is not limited to; a characteristic kill site, blood trails, wolf tracks and scat in the immediate vicinity, as well as known presence of wolves, and/or a history of wolf depredations in the area.

2.3. **Confirmed Non-Wolf Depredation.** Clear evidence that the depredation was caused by another species, such as coyotes, black bear, bobcat, domestic dogs or wolf-dog hybrids. Wolf-dog hybrids and wolves that appear to have been raised in captivity will be treated as domestic animals.

2.4. Unconfirmed Loss. Any depredation or livestock loss that does not meet the above criteria.

The first two categories, "Confirmed" and "Probable" are the only ones that will warrant further action under this plan. If a reported complaint is determined by USDA-WS to be "Confirmed Non-Wolf Depredation" or "Unconfirmed Depredation", no further action will be taken except that the incident will be recorded and, if the depredation is determined to be caused by wild animals other than wolves, USDA-WS will provide the appropriate assistance. Appropriate assistance depends on the species involved and may include providing technical or operational assistance, or referral of the complaint to WDNR.

3. Control Response Options

Five control response options are available to resolve confirmed or probable depredations. (Table 3a and 3b) The depredation management program will use a combination of these options in an integrated approach to wolf depredation management as appropriate depending upon the individual situation. These include:

1. Technical assistance to help prevent/minimize problems.
2. Compensation for losses by wolves in accordance with administrative rules.
3. Live-trapping and translocation of wolves causing problems.
4. Trapping and euthanizing, or shooting of problem wolves by government agents.
5. Landowners /occupants will not be allowed to kill depredating wolves in accordance with ESA 4(d) rules while Federally threatened or endangered, but may do so by WDNR permit after Federal delisting has occurred. They would also be allowed to shoot wolves attacking pets or livestock on their land.

Possible Depredation Control Activity	Zone 1	Zone 2	Zone 3	Zone 4
Technical Assistance and Compensation	allowed	allowed	allowed	allowed
Translocation of Wolves	allowed	allowed	allowed	not allowed
Euthanize Wolves (Government Agents Only)	Allowed within 1 mi.			
Private Landowner Control ¹	Not allowed	Not allowed	Not allowed	Not allowed

Possible Depredation Control Activity	Zone 1	Zone 2	Zone 3	Zone 4
Technical Assistance and Compensation	allowed	allowed	allowed	allowed
Translocation of Wolves	allowed	allowed	allowed	not allowed
Euthanize Wolves (Government Agents Only)	Allowed within 1 mi.	Allowed within 1 mi.	Allowed within 5 mi.	Allowed no distance limit
Private Landowner Control	allowed	allowed	allowed	allowed
Intensive Control Management Zones	To be determined	To be determined	To be determined	To be determined
Public Harvest	To be determined	To be determined	To be determined	To be determined

4. Implementation of Options

TECHNICAL ASSISTANCE: Technical assistance will be provided in all Wolf Zones. This may include advice and recommendations on methods or activities that may reduce the likelihood of conflicts with wolves, such as removing carcass dumps. Technical assistance may also include the loaning or sale to a landowner abatement materials such as flashing lights, sirens, temporary fencing, and fladry. These methods are generally short term measures, and their effectiveness varies widely. The use of aversive conditioning or other experimental non-lethal methods will be in accordance with “Guidelines for Conducting Depredation Control” (Appendix L).

COMPENSATION: Compensation will be provided in all Wolf Zones for verified and probable losses of domestic animals to wolves (Wisconsin Administrative Code, subchapter III). Additionally, farmers can be eligible for compensation of missing calves according to the criteria established in NR 12.54, depredation reimbursement procedures (2)(c). The present compensation program is funded through Endangered Resources revenues, and will continue to fund wolf depredations until wolves are designated as game or furbearer species. The WDNR is seeking additional sources for funding the compensation program after delisting. USDA-WS will provide a reimbursement form and instructions to complainants who have suffered a confirmed or probable losses caused by wolves. The Mammalian Ecologist will verify the validity and accuracy of the reimbursement claim based on the USDA-WS investigation, and forward to the Madison Office of the WDNR for approval. The Madison Office will respond to a claimant within

14 days either affirming the claim, and initiating processing or seeking additional justification for the claim. Farmers must follow any technical assistance recommendations to remain eligible for compensation payments.

TRANSLOCATION: Depredating wolves may be translocated from Zones 1, 2 and 3. The trapping and translocation of wolves as a depredation management tool will generally be limited as few suitable release sites exist. Local relocations may be used when wolves are captured next to Indian reservations or large blocks of public forest land, if affective aversions can be used to keep wolves off sites where depredations have occurred. Translocation may be effective in some limited situations, but success will vary depending on the trapping history of a problem wolf, and long-distant translocations would generally not be used if the wolf population is above its goal (> 350 wolves outside of Indian reservations). Translocations will be conducted in accordance with “Guidelines for Conducting Depredation Control”.

LETHAL REMOVAL: When appropriate wolves may be lethally removed in order to manage depredation incidents. Wolves may be trapped by USDA-WS and euthanized, or shot. While wolves are listed as federally endangered or threatened, lethal controls would be restricted to ½ mile or 1 mile from depredation sites, depending on 4d rule designation or authority issued through special permits from the US Fish and Wildlife Service. Once wolves are delisted by the federal government, lethal controls by USDA-WS or DNR will be authorized up to 1 mile from depredation sites in Zones 1 and 2, to 5 miles in Zone 3, and no distance restrictions in Zone 4. Any lethal removal of wolves will be in accordance with the latest version of the “Guidelines for Conducting Depredation Control”.

PRIVATE LANDOWNER CONTROL: Will not be allowed while wolves are federally listed as threatened or endangered. Once wolves are delisted by the federal government, landowners and lessees of land would be allowed to kill a wolf, “in the act of killing, wounding, or biting a domestic animal” with requirements that a conservation warden be contacted within 24 hours (Wisconsin Administrative Rule, NR 10.02 (1) (b)). Landowners/lessees would also be allowed to obtain permits from DNR to control a limited number of wolves during specific time periods on land they owned or leased if they had suffered from wolf depredation.

INTENSIVE CONTROL MANAGEMENT SUB-ZONES: To be determined.

PUBLIC HARVEST: To be determined.

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K. Wolf Research Needs:

Additional research needs that have been identified since the 1999 plan include the following:

- Continued health monitoring to document significant disease events that may impact the wolf population and to identify new diseases in the population (Modify from, "Continued health monitoring to identify factors causing low pup mortality.....").
- Investigation of the role of sarcoptic mange in wolf population dynamics, including spatial and temporal differences and trends in this disease.
- Comparison of health parameters between wolves involved in livestock depredation and other wolf packs to determine whether disease plays a role in depredation behaviors.
- Investigation of the role wolves play in the ecology of important zoonotic and livestock diseases, such as human ehrlichiosis and bovine neosporosis.
- Conduct social survey of in northeast Wisconsin to determine attitudes and possible factors hindering public acceptance and poor establishment of wolves.
- Conduct a survey similar to Nelson & Franson 1988 on attitudes of landowners and farmers in northern Wisconsin toward wolves.
- Examine impact of ATVs and other recreation activities on wolves.
- Conduct economical analysis of the costs and benefits of a wolf population in northern and central Wisconsin.
- Update habitat analysis of wolf habitat in Wisconsin (Mladenoff et al. 1995, 1997, 1999), and project future declines in wolf habitat due to housing and road development across north and central Wisconsin.
- Examine canid spacing in relationship to depredation management by wolves, bears, coyotes, and domestic dogs.
- Examine the degree and impact of dog gene introgression into the Wisconsin wolf population.
- Continue to examine impact of wolves on elk, and on elk movements and dispersion on the landscape.
- Examine ecosystem impacts of wolves on the landscape by effects on abundance, distribution on habitat use of deer, beaver, and mesocarnivores.
- Update examination of wolf population viability with updated population information.
- Assess changes in mortality and survival of adult wolves with changes in status and application of new control programs.
- Determine productivity, mortality factors, and survival rates of pups, and examine factors that contribute to greater productivity and survival.

- Examine non-predation impacts of wolves and other predators on farms including negative and potential positive impact, economical and social. (Lehmkuhler et al. 2007).

Literature cited:

Lehmkuhler, J., G. Palmquist, D. Ruid, B. Willging, and A. Wydeven. 2007. Effects of wolves and other predators on farms in Wisconsin: beyond verified losses. Wisconsin Wolf Science Committee, Wisconsin Department of Natural Resources, Madison, Wisconsin 15 pp.
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M. Wolf Specimen Management

To date wolf carcasses found in the wild have had necropsy evaluations to determine cause of death and health status. While wolves were listed as endangered, the DNR policy was to have all wolf carcasses studied by the National Wildlife Health Center in Madison, Wisconsin. Eventually they became specimens at research institutions, with most wolf specimens deposited at the University of Wisconsin - Zoology Museum in Madison. With reclassification and eventual delisting, the management of wolf specimens will be modified. The Wisconsin Wolf Advisory Committee developed guidelines for managing wolf specimens under threatened and delisted classification.

1. Wolf Specimen Management – Threatened

With reclassification to threatened, research, population monitoring and health evaluations of dead wolves found in the wild will remain the top priority. Additional wolf carcasses will be made available as euthanasia of depredating wolves become possible, and accidental mortality caused by vehicle collisions increases. Carcasses of collared wolves from the DNR Wolf Monitoring Program will be necropsied by the National Wildlife Health Center, and specimens will be turned over to interested researchers, when there is an identified need for such specimens. If specimens remain available after research needs have been met, the second priority for use of wolf carcasses would be for education purposes and Native American cultural and religious purposes. Such carcasses can be made available to tribal governments, nature centers, state parks, wolf education organizations, WDNR and other agency offices. Carcasses would not be available for private ownership.

Wolves found dead in the field should be collected by wildlife biologists, wildlife technicians or conservation wardens and placed in WDNR freezers until arrangements can be made to ship the carcasses to Madison. Any wolves euthanized by USDA-Wildlife Service will also be turned over to WDNR. All carcasses should be tagged, and labeled with all pertinent information kept with each carcass. The WDNR wolf program manager should be notified of all wolf carcasses found. The wolf program manager will coordinate shipment, necropsies, and eventual designation of specimens. The wolf program manager will keep lists of organizations interested in receiving carcasses, and

will coordinate distribution of carcasses. Any wolf suspected of being killed illegally will be held for conservation wardens until legal investigation and prosecution are completed.

2. Wolf Specimen Management - Delisted

When wolves are no longer listed as threatened or endangered in Wisconsin, management of wolf carcasses can be broadened. Wolf carcasses would be available from depredation control activities, natural mortality, illegal kills, and accidents.

Research will continue to be an important priority, but will require a research proposal identifying needs and anticipated results, and such proposals would need WDNR and/or tribal approval. A portion of carcasses collected each year may be requested by WDNR-Wildlife Health Team to evaluate health status. Following research and health monitoring, wolf education and Native American cultural use would be the next priority for ownership of wolf carcasses. Skins and skulls would be made available for Native American tribal governments, schools, nature centers, state parks, WDNR and other agency offices, tribal centers, and wolf education organizations. Wolf specimens could be turned over to private individuals if specimens are not needed for above purposes. No carcasses should be provided to landowners conducting control on their land, or to persons involved in accidental killing of wolves. Dead canids suspected of being wolf-dog hybrids, but which appear to be mostly wolf, should be treated as wolves for the purpose of wolf specimen management.

Eventually regional wildlife supervisors will coordinate wolf specimen management in each WDNR region. The wildlife supervisors will maintain lists of organizations and individuals interested in receiving specimens, and will determine disposition of carcasses. Annual reports will be submitted to WDNR Endangered Resources or Wildlife Management on carcasses collected and handled in each region, including biological information and final disposition of carcasses. Currently while wolves continue to be listed as federally endangered or threatened, wolf specimen designations will be coordinated through Endangered Resources central office, in Madison.

VI. WOLF MANAGEMENT BUDGET

The budget costs of the wolf program have grown extensively since the start of the recovery/management program in 1979-1980, and grew at higher rates than anticipated in

the 1999 wolf plan (Table 4). In the period 2000-2005, annual costs for wolf management ranged between \$218,000 to \$309,000. The 1999 plan had expected management cost to grow from \$130,000 in FY 99-00 to \$209,000 in FY 04-05. The actual costs were about 50% higher. Some of the cost increase reflect major increase in airplane flights raising costs to fly and locate all collared wolves across the state from about \$300 to about \$1000. Additional costs were also incurred by more DNR personnel spending time on wolf related issues, and the growth and spread of wolf population.

The source of funds for the wolf management program had been from 77% federal funds and 23% state funds in the 1990s, but in recent years the proportions of state funds have increased. Federal funds had included grants from U.S. Endangered Species Act, Pittman-Robertson Wildlife Restoration Act, and U.S Forest Service funds. State funds were mainly from the Endangered Resources Tax Check-Off, and Endangered Resources License Plate. Private funding came from Timber Wolf Alliance, Defenders of Wildlife, National Wildlife Federation, Milwaukee Zoo, Timber Wolf Information Network, and donations from private citizens. U.S. Endangered Species grant money declined in the 2000s. Recently additional Pittman-Robertson funds were found to cover more of wolf management costs. The wolf program was not successful in obtaining any funding through the new State Wildlife Grants program. It is expect that wolf management costs in the near future will continue to be in the range of \$250,000 to \$300,000, and efforts will continue to try to find additional funding for the program and depredation payments.

Cost of depredation reimbursement was higher than anticipated. The 1999 plan had assumed annual depredation reimbursements cost of \$20,000 to \$40,000, but in recent years costs have ranged from \$23,000 to \$77,000. Higher costs have occurred in part due to higher rates of depredation due to lack controls because federal delisting had not occurred as had been expected. Also DNR had started paying for some missing livestock, that were previously not considered for reimbursement payments. Cattle prices also improved in recent years which in turn increased reimbursements provided for wolf losses. Funding for depredation reimbursement when 3 % of Endangered Resources License plates funds were added to the 3 % of Endangered Resources Tax Check-Off, which doubled the wolf/endangered resources depredation payments account to about \$34,000 annually. During years when this amount had been exceeded, other portions of the Endangered Resources funds (Check-Off & License plate) were made available for wolf payments at the cost of other Endangered Resources programs. Donations to these funds have declined in recent years, thus the impact on other Endangered Resources has been magnified. Availability of the new federal State Wildlife Grants program have offset some of these losses to other Endangered Resources. One area where WDNR cost have declined was the funding for USDA-Wildlife Service, which at the time of the plan was funded mainly by WDNR at cost of up to \$30,000 annually. Since the early 2000s, USDA-WS has been able to secure separate federal appropriations from the Department of Agriculture, so that DNR no longer needed to fund out of state money

Table 4. Wisconsin Gray Wolf Program Expenditures by WDNR Fiscal Year (FY)

Year	State or Donated	Federal	Total Management Expenditures	Depredation Payment
1979-80	5,000	15,000	20,000.00	—
1980-81	5,425	16,275	21,700.00	—
1981-82	7,734	35,000	42,734.00	—
1982-83	13,013.44	35,200	48,213.44	—
1983-84	27,905.18	51,440	79,345.18	—
1984-85	11,804.38	28,125	39,929.38	200.00
1985-86	23,625.24	60,600	84,225.24	0.00
1986-87	44,128.80	56,305	100,433.80	2,500.00
1987-88	14,864.00	62,592	77,456.00	0.00
1988-89	23,887.60	18,069	41,956.60	400.00
1989-90	20,410.94	48,319.47	68,730.41	2,500.00
1990-91	15,508.40	95,198.40	110,706.80	187.55
1991-92	25,768.83	67,442.88	93,211.71	1,535.00
1992-93	38,650.75	58,893.00	97,543.75	1,600.00
1993-94	19,005.61	68,893.00	87,898.61	6,125.00
1994-95	19,404.31	91,264.75	110,669.06	1,800.00
1995-96	30,818.99	112,118.50	142,937.49	4,163.12
1996-97	29,908.92	120,450.21	150,359.13	7,465.45
1997-98	31,283.68	98,038.62	129,322.30	16,081.97
1998-99	40,358.72	160,506.58	200,865.30	19,787.19
1999-00	48,423.15	210,251.08	258,674.23	71,450.47
2000-01	43,059.61	209,117.83	252,177.44	22,808.20
2001-02	54,637.44	219,124.67	273,762.11	60,940.20
2002-03	46,888.69	170,997.18	217,885.87	54,585.37
2003-04	172,861.62	136,213.19	309,074.81	67,715.43
2004-05	195,746.86	153,224.97	348,971.83	76,867.32

APPENDIX A-2

Wolf Depredation in Wisconsin through 2005.

By Adrian P. Wydeven, Robert C. Willging, David Ruid and Randle L. Jurewicz

Although wolf depredations on domestic animals were relatively rare events in Wisconsin prior to the mid 1990s, by the late 1990s depredations had become a fairly regular activity (Treves et al. 2002). Rates of depredation on livestock in Wisconsin by the early 2000s were similar to the rates in Minnesota in the early 1980s (Fritts et al. 1992).

Between 1985 and 2005, the Wisconsin DNR paid \$469,430.88 for 270 calves, 13 cows, 74 sheep, 44 deer (deer farm), 6 horses (5 foals), 114 chickens, 148 turkeys, 83 hunting hounds, 12 pet dogs, 4 injured cows and 32 injured dogs. These reimbursements included \$184,226.42 for dogs, \$197,181.56 for livestock, \$82,850.00 for deer, and \$5172.90 for poultry. Most of these payments were for verified depredations (confirmed or probable), but some payments were also made for missing livestock when wolves were believed responsible for some of the losses.

Table A-3 summarizes wolf depredations losses and wolf controls in Wisconsin between 1976 through 2005. Total verified wolf depredations 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. A fairly strong relationship was found between wolf population level and number of cattle killed ($r^2 = 0.66$, $P < 0.01$), dog kills ($r^2 = 59$, $P < 0.01$), and farms with depredation ($r^2 = 0.75$, $P < 0.01$) between 1989 and 2003 (Wydeven et al. 2004a). 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

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 total farms with wolf depredation are relatively low, not all the farms had livestock available, and most farms were outside of wolf range. Thus a small number of farms received most of the wolf depredation losses.

Between 1991 through 2005, 118 wolves were trapped or shot at depredation sites by USDA Wildlife Services or WDNR, and 74 were euthanized. Prior to 2003 only one wolf was euthanized by special permit. From 1991-2002 a total of 32 wolves were translocated long distances (52 to 277 km) away, 3 were released locally (<10 km), 2 died in captivity and 1 was euthanized. Since 2003 federal authority has allowed taking of depredating wolves (threatened status 4d rule in 2003 & 2004, and special permit in 2005), and most captured wolves were euthanized (70 wolves, 90% of captures). Pups

captured prior to August 1 were released near capture sites. At least 3 of the wolves translocated at long distances, depredated on livestock in new locations, and a female wolf that had attacked farm deer, attacked dogs at a new location.

Generally only a few packs were found to depredate on domestic animals. Through 2000, 68% of packs detected in the state caused no depredation to domestic animal (Treves et al. 2002). Between 1995 and 2002, annually 7% of packs depredated on livestock, 10% depredated on dogs, and only about 2 % of packs attacked both dogs and livestock (Wydeven et al.2004). Generally packs attacking livestock occurred near the edge of the northern forest near agricultural land. Packs in the core of wolf range in large blocks of public forest land, rarely were involved in livestock depredation. Thus control actions of trapping and euthanizing depredating wolves is not likely to affect most of the wolf population. If wolves in the future were able to colonize areas outside the large forest blocks in northern and central Wisconsin, wolf depredation levels would likely increase (Treves et al. 2004). Control trapping will need to continue to address depredation problems and reduce colonization of wolves into agricultural areas.

Packs depredating on dogs are more difficult to predict. Dog depredations are generally scattered across wolf range. Generally packs that attack dogs are the larger packs on the landscape, and there apparently is learning involved because 2/3 of packs killing dogs will likely do so again the following year (Wydeven et al. 2004b). Control trapping has not been used on packs killing hunting dogs on public land, and will not likely be used in the future unless such packs also attack livestock on farms or pets near residential areas.

Factors that caused increases in wolf depredation in Minnesota were recently examined (Harper et al. 2005). Major factors included range expansion, colonization of new areas in wolf range, and learning behavior. Range expansion by the Minnesota wolf populations apparently stopped in 1998, and depredation levels have declined since that time (W. J. Paul unpublished reports). Range expansion by Wisconsin wolves, especially recent colonization of more agricultural areas has probably increased numbers of farms with depredation in the state. Future management will need to address stabilization of range expansion to minimize depredations to livestock.

Work has also been done and will continue to explore better methods of nonlethal wolf control in the state. Testing was done with fladry (special flagging material) and movement activated guard devices (use strobe light and loud sounds) to deter predators (Shivik et al. 2003). Both systems have potentials in certain situations to reduce depredation by wolves, but wolves can probably learn to adapt to them, and such systems are generally less successful when actual killing of livestock by wolves has begun. Testing was also conducted on the use of dog shock collars on wolves to deter them from specific areas (Hawley 2005, Schultz et al. 2005). Shock collars may have use in specialized situation where it is desirable to keep wolves in the general area, but keep them off pastures with livestock or other focal points.

Future wolf depredation management is likely to be most successful if an integrated approach is used (USDA-APHIS-Wildlife Services 2006). Such an approach will use a

combination of technical advice, animal husbandry, nonlethal and lethal controls. The approach will also be an adaptive management procedure that builds on new knowledge and adjusts management as new things are learned. Attempts will be made to also document non-predatory effects of wolves to farms (Lehmkuhler et al. 2007). Careful monitoring and research will be an essential part of future depredation management.

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Table A3. Summary of verified wolf depredations on domestic animals in Wisconsin from 1976 -2005, and total number of wolves removed in control actions.

Resources/ years	≤89	'90	'91	'92	'93	'94	'95	'96	'97	'98	'99	'00	'01	'02	'03	'04	'05	Total
Farms Affected	2	0	2	2	3	0	4	1	2	8	6	8	5	10	14	22	25	--
Total Losses*	6	2	116	11	28	2	11	8	16	40	74	19	104	66	55	56	64	678
Horses killed	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	2	5
Horses injured	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
Sheep killed	2	0	1	8	0	0	0	0	0	0	0	0	0	7	24	5	3	50
Sheep injured	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cattle killed	2	0	0	1	0	0	11	1	10	20	7	6	11	37	20	27	31	184
Cattle Injured	0	0	0	0	1	0	0	0	0	0	0	1	1	0	0	0	4	7
Farm Deer	0	0	0	0	0	0	0	0	0	4	19	3	0	5	1	6	0	38
Poultry Losses	0	0	115	0	27	0	0	0	0	0	44	4	74	0	0	0	0	264
Dogs killed	2	0	0	2	0	2	0	5	5	11	2	5	17	10	6	15	17	99
Dogs injured	0	2	0	0	0	0	0	2	1	5	2	0	1	4	4	3	6	30
Wolves captured	0	0	1	0	0	0	0	0	2	4	2	2	8	18	17	27	37	118
Wolves euthanized	0	0	0	0	0	0	0	0	0	0	1	0	0	0	17	24	32	74

* total of animals killed & injured

APPENDIX F2**Wolf Health Monitoring and Mortality Factors****by USGS-National Wildlife Health Center (NWHC) and WDNR-Wildlife Health Team**

The Wisconsin wolf health monitoring program has included necropsy evaluation of all free-ranging wolves found dead or euthanized in Wisconsin, including monitored radio-collared wolves. Table F2 presents a summary of mortality factors identified from necropsies of 269 Wisconsin wolves between 1979-2005. A high percentage of wolf mortality was associated with human causes (70.6%), with vehicle collisions (31.2%) and shooting (18.2%) being particularly important. Since 2003, euthanasia of wolves to control livestock depredation has also added significantly to human-associated wolf mortality (14.9%). Natural mortality factors contribute 23.4% of total mortality, with Sarcoptic mange-related deaths a majority of the 14.5% mortality from disease. Wolves listed in Table F3 included both collared and noncollared wolves, but only those subjected to necropsies by the USGS-National Wildlife Health Center and Wisconsin DNR Wildlife Health Team.

Table F3 lists only radio collared wolves found dead in the field from October 1979 through June 2005, but does include some animals that were not necropsied because carcasses were too decomposed. Human caused mortality accounted for 55% of known mortalities, and 51% of all mortalities. The most important human mortalities were shooting (29%), and vehicle collisions (14% of known mortalities), but unlike total necropsy sample in Table F2, only 1% included wolves euthanized at depredations. Natural mortality included 45% of known mortality and 41% of all mortalities. The most common natural mortalities were disease (27%) and other wolves (13%).

The overall necropsy samples had lower percentages than the collared sample of wolves dying from illegal shooting, other wolves, and disease, in part because these mortalities were rarely detected unless wolves were collared. The overall necropsy sample had higher percentages of wolves killed by vehicle collisions and euthanized depredators, because these represent dead wolves that most likely will be reported to or collected by WDNR without the help of radio telemetry. Although the collared sample probably more closely matches the overall mortality rates within the population, it is important that all forms of wolf mortality are carefully examined. Collared wolves may not be as representative of wolves living in marginal habitat, where it appears that vehicle collisions and depredation controls, may be important limiting factors on the wolf population.

Table F2		
Mortality Summary of wolves from Wisconsin and adjacent areas of Minnesota necropsied Oct. 1979-Sept. 2005 by NWHC and WDNR		
Cause of Death:	Number	Percent Total Mortality
Human Causes:		
Euthanasia/Accident	1	0.4
Euthanasia/Depredation	40	14.9
Capture-Related	9	3.3
Shooting	49	18.2
Accidental Trapping	6	2.2
Vehicle Collision	84	31.2
Poisoning	1	0.4
Unknown Human Cause	0	0
Total Human Caused:	190	70.6
Natural Causes:		
Birth complications	1	0.4
Disease ^a	39	14.5
Killed by Other Wolves	16	5.9
Other Natural Cause ^b	8	3.0
Unknown Natural Cause	0	0
Total Natural Caused:	63	23.4
Unknown Causes^c:	16	5.9
Total Known Mortality:	253	94.1
Total Unknown Mortality:	16	5.9
Total All Mortality:	269	100

^aincludes mange-related deaths

^bincludes blunt trauma of unknown cause (could be prey or vehicle) and debilitated, heavily parasitized animals

^canimals with no lesions and all tests negative, as well as badly decomposed carcasses with no recognizable cause of death

Table F3. *Mortality summary of radio-collared wolves in Wisconsin and adjacent areas of Minnesota from October 1979 – June 2005.*

	Cause of Death	Number	% Known Mortality
Human Causes	Capture Related	6	4%
	Shot Wound*	41	29%
	Trapped	4	3%
	Vehicle Collision	19	14%
	Euthanized (depredation)	2	1%
	<u>Unknown Human Causes</u>	<u>5</u>	<u>4%</u>
	<i>Total Human Causes</i>	<i>77</i>	<i>55%</i>
Natural Causes	Accident	1	1%
	Birthing Complications	1	1%
	Disease	37	27%
	Killed by Other Wolves	18	13%
	Malnutrition/Starvation	2	1%
	<u>Unknown Natural Causes</u>	<u>3</u>	<u>2%</u>
	<i>Total Natural Causes</i>	<i>62</i>	<i>45%</i>
Totals	<i>Known Mortality</i>	<i>139</i>	<i>100%</i>
	<u>Unknown Mortality</u>	<u>13</u>	
	Total Mortality	152	

* 2 wolves were shot by bow and arrow, and 39 by firearms

APPENDIX H2

Public Opinion of Wolf Management in Wisconsin, 2001-2005

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INTRODUCTION

Wolves stir people's emotions and attract public attention far out of proportion to their numbers. Although many U.S. citizens support carnivore conservation and enjoy the environmental, aesthetic, and economic benefits of restoring wolves, the direct costs of conserving these animals fall on a minority of individuals in rural areas who lose livestock or pets to carnivores. Wildlife managers must therefore steward recovering wolf populations in a way acceptable both to the general public and rural communities living with wolves.

In the past, voters and special interest groups have removed authority and flexibility from carnivore managers when unpopular interventions were undertaken or when managers catered to one interest group in particular (Harbo & Dean 1983, Torres et al. 1996). This potential threat to adaptive management suggests a need for rigorous assessment of public opinion about wolf management. Public opinion surveys enable managers to float alternative scenarios for management actions and judge the popularity of options across stakeholder groups. This approach also supports democratic, transparent decision-making about management and policy.

Because management of large carnivores triggers widespread interest in many groups, managers need diverse methods and added resources for sampling the opinions of the varied stakeholders. Partnerships with university and non-profit groups can extend the outreach and sampling effort of state wildlife agencies. The Wisconsin Department of Natural Resources (WDNR) has been proactive and energetic in surveying public opinions and supporting partners' efforts to understand public opinion of wolf management in Wisconsin.

Here we describe the results of three surveys of public opinion regarding wolf control, compensation, harvest and monitoring. We focus on these components of management because they are in use or being considered in Wisconsin. We devote special attention to the opinions of key stakeholder groups, including livestock producers,

hunters and voluntary contributors to the Endangered Resources Fund of the WDNR (ER fund hereafter), which is the major source of revenue for wolf management in the state at present. This appendix updates information from Appendix H, in the 1999 wolf management plan (pp. 66-70), and addresses K2 under research strategies “Re-measurement of public attitudes toward wolves and recovery in the state to define reasonable population goals and acceptable wolf habitat.”

METHODS

In 2001 and again in 2004, L. Naughton, A. Treves and R. Grossberg, conducted surveys of state residents using stratified random sampling. The 2001 survey (Naughton-Treves et al. 2003). was aimed at residents of townships in which verified wolf depredations had occurred. The survey was sent to all people who had complained to the WDNR of wolf depredation on domestic animals and residents of the same townships selected randomly from commercially available lists of taxpayers. Overall, the response rate was 81.6% (n=535 respondents).

The 2004-2005 survey¹ was aimed at residents of six zip codes chosen to span the range of support for wildlife, judged by their relative contributions to the ER fund. Within zip codes, respondents were selected randomly as above. Overall, the response rate was 61.7% (n=1364 respondents), with relatively even response rates across the six zip codes (range 202-272, n=6). A more complete description of findings, sampling bias, and sample population can be found at www.geography.wisc.edu/livingwithwolves/public_reports.htm.

In 2003, K. Schanning randomly selected 5000 Wisconsin residents to mail a questionnaire, using all public telephone listings with name and address as the sampling frame. Of these 5000 surveys, 644 were returned, yielding a response rate of 13%. The length of the survey may help account for this low response rate.

In late summer 2004, the Wisconsin DNR, conducted a survey to which 1367 people responded (1322 residents of the state, and 45 non-residents). Notice of the survey was listed in news papers and other media sources throughout the state. The DNR sent copies of the questionnaire-based survey to all people who requested it, and made the survey available on the web. We believe this approach sampled a group of people very interested in wolves, both from a negative and positive standpoint. The sample was composed of 66% hunters (compared with 57% in the Naughton/Treves 2003-2004 survey), 16% farmers (compared to 34% who had some experience raising livestock or 15% who raised livestock for commercial purposes in the Naughton/Treves survey), and 66% who identified themselves as environmentalists, 83% who identified themselves as conservationists, and 36% who identified themselves as animal preservationists.

¹ for details see www.geography.wisc.edu/livingwithwolves/public_reports.htm

Analyses for all three studies are presented without weighting for under-represented respondents (e.g., women). As a result, the findings should be considered preliminary pending such weighting and peer review of findings. Across the following results and figures and analyses, sample sizes vary as not all respondents answered all of our questions.

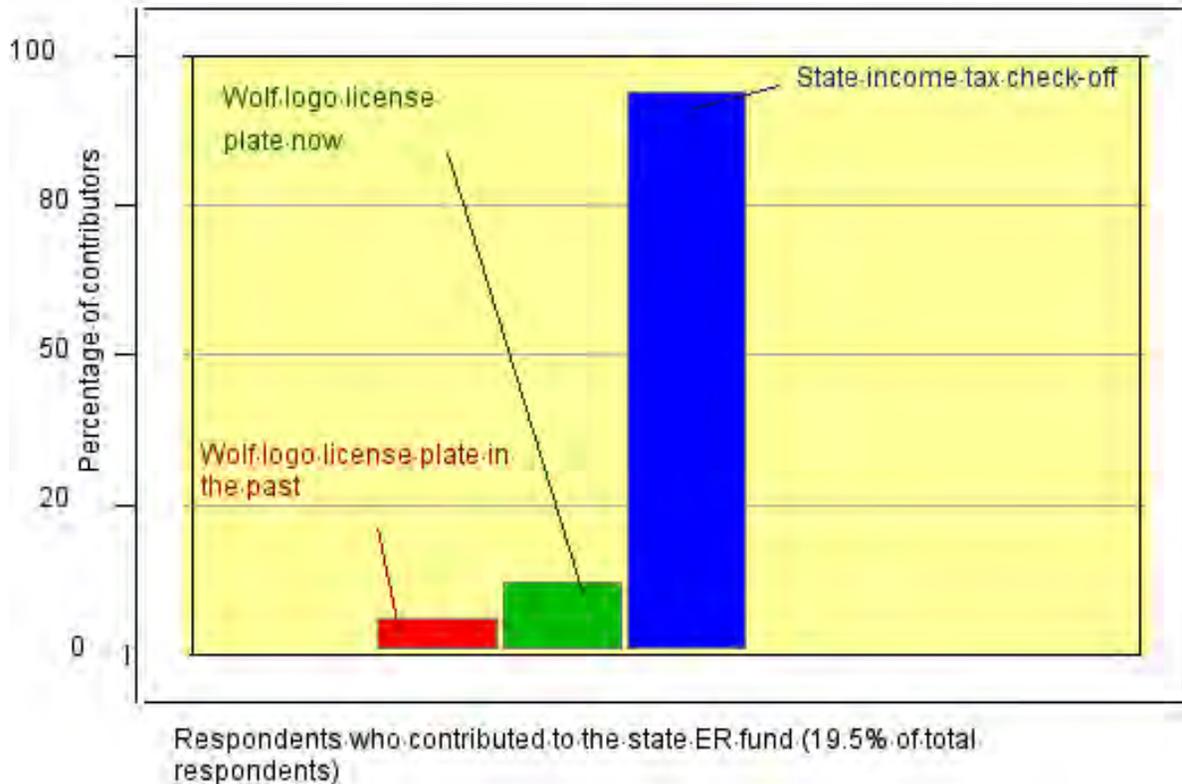
RESULTS

The 2001 survey of wolf county residents by Naughton/Treves offered three conclusions: 1) most respondents favored the presence of wolves in the state provided the population was limited; 2) the existing compensation program for wolf depredations was very popular, but individuals who received compensation payments for reported depredations were no more tolerant of wolves than were individuals claiming losses but who were not paid, and 3) lethal control of wolves was the preferred management response to wolf predation on livestock and pets. The survey also revealed, on average, bear hunters had the most negative attitudes toward wolves and were most critical of current management strategies, while livestock producers were less negative, and other rural residents were the most positive toward wolves and current management practices.

In the second survey (2004/2005), Naughton and Treves found again that the majority of respondents supported wolf recovery in the state, but there were significant differences among citizens regarding preferred management strategies. Here we highlight results for two groups selected randomly from the population: voluntary contributors to the ER fund for wolf management and non-contributors. Such a comparison is significant because the WDNR depends heavily on voluntary contributions for wolf management.

Respondents who had contributed to the ER fund (contributors) represented 19.5% of the sample; most often gave via the state income tax check-off (Figure 1).

Figure 1.
Method of contribution to the ER Fund



To assess individual tolerance for wolves, respondents were asked a series of questions about values and attitudes toward wolves. We present one because all were highly intercorrelated. Respondents were asked if they agreed or disagreed with the following statement: "If I were out hunting and saw a wolf, I might shoot it"; 90% of respondents disagreed strongly or were neutral. In this survey (2004-2005) and the previous one (2001), respondents agreeing or strongly agreeing with this statement were just under 11% of the entire sample.

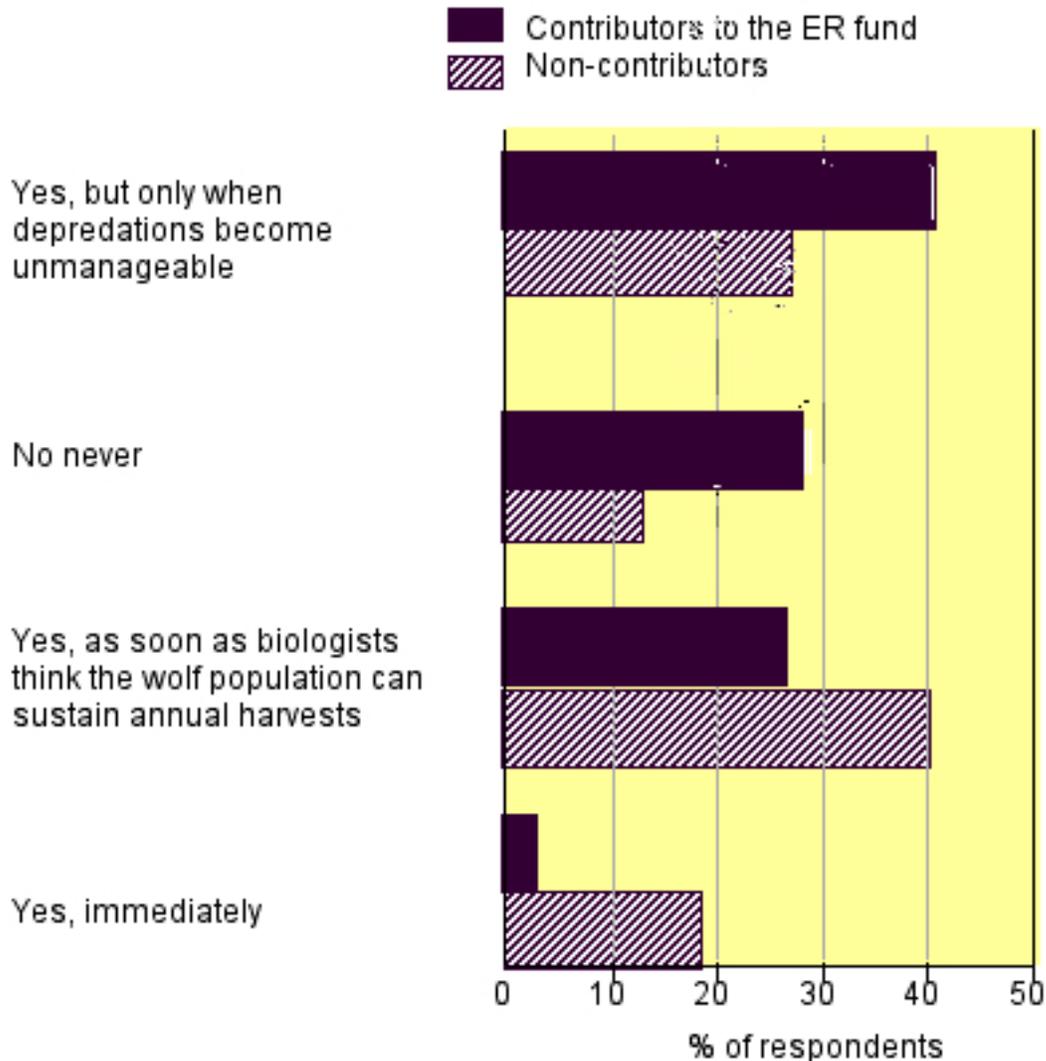
When asked "If a wolf kills livestock..." or "If a wolf kills a family pet...", a majority of respondents preferred "capture and relocate the wolf to a wilderness area" (43-57% of all respondents) followed by "kill the wolf" (35-39% of non-contributors) or "take no immediate action toward the wolf but monitor the situation" (21-23% of contributors). By contrast, when asked "if a wolf kills a hunting dog on public land...", the most popular response was "take no immediate action toward the wolf but monitor the situation" (35% and 64% among non-contributors and contributors respectively) followed by "capture and relocate the wolf to a wilderness area" (31% for either group). Note that wilderness areas in Wisconsin are too small to support whole wolf packs and most were already occupied by wolves, thus the term was subject to respondents' interpretations. The action "Try to frighten away the wolf or deter it from approaching..."

was least popular in all situations. Hence the general population of Wisconsin is less likely to favor lethal control than Northwoods residents (Naughton et al. 2003).

When asked, “If there must be lethal control of wolves, who should be allowed to kill wolves?”, most respondents (76% of contributors and 55% of non-contributors) approved of “government agents”. Non-contributors also approved of “private landowners who provide evidence of wolf predation on livestock” (56%); this choice received support from almost half the contributors (48%). No other personnel achieved >49% approval for conducting wolf control.

Wolf harvest (not initiated in Wisconsin at the time of writing) received more positive than negative responses among both contributors and non-contributors (Figure 2). However among those respondents approving of a wolf harvest (68% of our sample), few wanted the immediate initiation of a wolf season (2% of contributors and 18% of non-contributors). The preferred timing was “only when depredations become unmanageable” (41% of contributors) or “as soon as biologists think the wolf population can sustain annual harvests” (41% of non-contributors).

Figure 2.
Do you believe there should be a public hunting/trapping season on wolves?



Contributors vs. Non-contributors, Pearson $\chi^2=71.1$, $df=3$, $n=1131$, $p<0.0001$

To assess if support for lethal control depended on the accuracy of removing the individual wolves implicated in depredations, we asked if errors in lethal control affected approval. Seventy-seven percent of contributors and 54% of non-contributors wanted either “no lethal control” or error rates $<10\%$. By contrast 23% of contributors and 48% of non-contributors accepted error rates $\geq 10\%$. There are currently no data on Wisconsin wolf removal accuracy nor effective techniques for assessing past or future likelihood of causing depredations.

Far and away, the most popular source of funding for compensation was the existing state ER fund (70% and 78% approval among non-contributors and contributors respectively) although “hunting fees” also appealed to a majority of contributors.

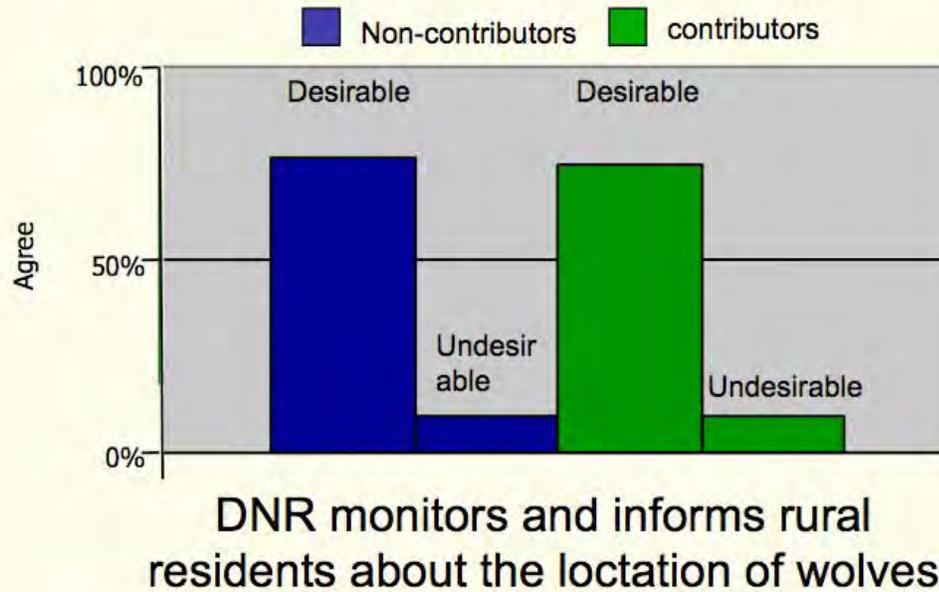
There was overwhelming approval among both contributors (80%) and non-contributors (69%) for farmer compensation contingent upon “best livestock management practices”. Similar majorities favored compensation “only if government agents find evidence of wolf involvement” (88% and 79% respectively). Compensation for hunters who lose a hunting dog on public land was far less popular, with 51% of contributors favoring no compensation and 52% of non-contributors favoring the following recipe: “He/she should be compensated for loss only if government agents find evidence of a wolf”.

We described an incentive scheme as follows: “Some managers propose that landowners living near wolf packs be given a monetary incentive to protect the wolves. The incentive would help offset the risks they face, and compensate for any domestic animal losses. This incentive might also prevent people from illegally killing wolves.” and asked “Assuming you live on or near land suitable for wolves, would you consider participating in such an incentive program?”. This was far more popular among contributors (81% would participate) than among non-contributors (34% would participate).

Monitoring and informing rural residents about the locations of wolves was highly popular among both contributors and non-contributors (Figure 3).

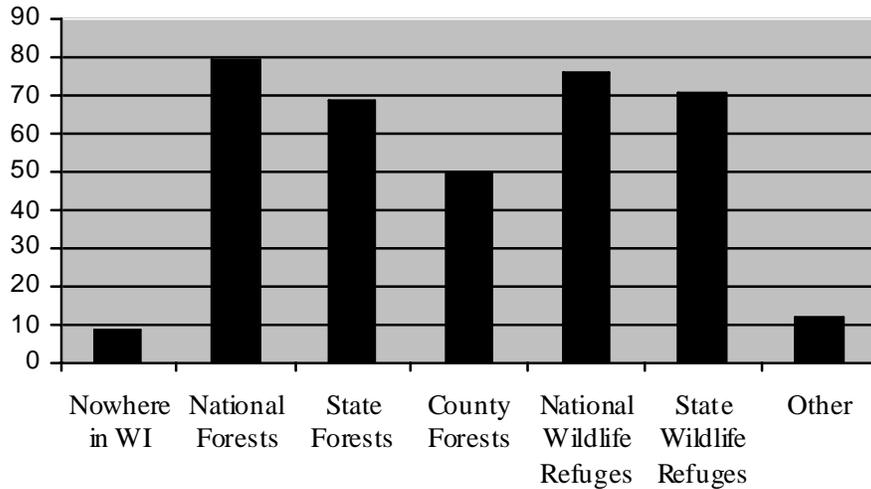
Figure 3.

How should the DNR manage problem wolves?



Results from the Northland College Survey

Respondents showed an acceptance of wolves on the landscape, and favored wolves living in National Forests and Wildlife Refuges, while also showing strong support for wolves inhabiting State Forests (Figure 4).

Figure 4. Public wolf acceptance on various landscapes in Wisconsin.

When asked if a public harvest should be used to manage the wolf population, respondents were split about hunting, but, opposed to a public trapping season. However, no other methods of management were found to be more popular than a public harvest. Having the DNR trap wolves was the next most preferred technique, even though only 33% of all respondents supported this method.

Relating to methods of managing problem wolves that have caused damage, support was shown for the relocation of problem wolves. Respondents were equally supportive of allowing both the landowner and the DNR to shoot a wolf that had caused harm. However, much more support was shown for allowing farmers to shoot problem wolves in general. Respondents overwhelmingly opposed the hypothetical poisoning of problem wolves by farmers or the DNR.

Respondents showed more support for the compensation of livestock loss to wolves than for losses of farmed deer or bear dogs. When given the dollar figure of how much was paid out in compensation to livestock farmers in one fiscal year, 81% of respondents wanted to continue compensation for livestock, while 10% wanted it reduced. Asked the same question about deer farmers, 42% of respondents wanted to continue compensation for deer at current levels, and 25% wanted it reduced. Even less support was shown for the compensation of bear dogs killed by wolves, with 52% of respondents indicating compensation for bear dogs should stop, and 25% wanting it reduced. Most respondents wanted to compensate livestock owners only if they had taken some protective measures against wolves or were using Best Management Practices. However, 40% wanted to continue compensating all livestock owners for depredations, and only 5% wanted to stop compensation altogether.

Results from the Wisconsin DNR survey

After being told “Currently an intense system of population monitoring is being used including radio tracking, winter track surveys by DNR and volunteers, summer howl surveys, and collection of reports of public observations of wolves.”, respondents were asked “What is your impression of the current level of wolf monitoring?” 43% thought it was about right, 28% thought it was too intense, and 29% thought it was not adequate. Of the wolf population survey methods listed below, respondents were asked whether efforts should increase, decrease or remain about the same:

- Live-trapping and radio-tracking: increase 32%, remain the same 38%, decrease 31%
- Snow track surveys by DNR: increase 35%, remain the same 46%, decrease 19%
- Snow track surveys by volunteers: increase 47%, remain the same 40%, decrease 13%
- Computer models estimations: increase 20%, remain the same 49%, decrease 31%
- Collect reports from the public: increase 52%, remain the same 37%, decrease 11%

The results again supported the conclusion that current monitoring should remain the same, except for the participation of volunteers, which most respondents wanted to increase. Overall, increases in effort outnumbered decreases in effort:

The DNR asked about the wolf management zones and provided a map of these zones with definitions of appropriate management in each. When respondents were asked “Do you support the concept of zone management for wolves?”, 33% opposed it, 51% supported it, and the remainder were neutral. When asked “Do you feel the current zone system provides appropriate protection for wolves?”, 44% thought it was too protective, while 29% thought it not protective enough, with many (27%) neutral on the subject.

The DNR asked how desirable the following control action would be: “Public harvest if the population goal for the state is exceeded”. 55.5% found it desirable, while 38% found it undesirable. This result is higher than that found by Naughton/Treves (above) who found fewer respondents (40% for contributors, 26% for non-contributors) wanted a wolf harvest “as soon as biologists think the wolf population can sustain annual harvests”. The difference may reflect that Naughton/Treves offered an alternative “only when depredations become unmanageable” that was attractive to many respondents (see above).

- The DNR asked respondents how desirable the following control activities were:
- “USDA-Wildlife Services should continue to provide technical assistance including non-lethal methods to persons who have problems with wolf depredations” 66% desirable, 25% undesirable.
 - “USDA-Wildlife Services should trap and euthanize wolves that cause depredation on domestic animals on private land.” 60% desirable, 30% undesirable.
 - “Control trapping should be avoided on public lands (currently trapping is only allowed on private land or public lands immediately adjacent to private lands where depredations have occurred).” 45% desirable, 43% undesirable.

These findings match the Naughton/Treves results but there is higher support for lethal control, perhaps because translocation was not offered as an alternative control strategy or because the DNR sampled more hunters and more people with an interest in wolves (see methods).

When respondents were asked whether the state should allow trapping of wolves up to 1.0 mile from depredation sites in Zones 1 and 2 to be consistent with 2003 federal regulations, a majority of respondents agreed (58%) with only 27% disagreeing.

“Once delisted by both the state and federal government, permits can be issued to landowners or occupants to control a limited number of wolves on land they own or lease, if they have had recent wolf depredations.” Respondents agreed with this procedure in 60% of cases and disagreed in 36% of cases.

CONCLUSIONS

Examining public opinion broadly, one finds three surveys with similar general findings, namely that a majority of the public approves of current wolf management strategies and policies as implemented by the Wisconsin DNR. This conclusion is robust judging from the very different sampling approaches used by the three surveys that yielded this same general conclusion. However, the details of our results suggest some changes may be needed.

A majority of the public approves of changes to the ongoing policies of compensation and control, and wishes to guide any potential future harvest in various ways. Briefly, the compensation program in place with requirements of evidence before compensation is popular, but recently enacted programs to pay for missing livestock with less evidence do not seem to be strongly supported. Although livestock specialists disagree on best management practices for reducing depredations in all situations, if reasonable practices can be found, most of the public seems to support requiring implementation of such practices as part of determining payments. Payments for hunting dogs killed on public land received limited support and many want to see such payments eliminated. The current practice of lethal control of depredating wolves is popular but approval will decline if lethal control is implemented on public lands, or if other than government agents conduct controls. Non-lethal control remains popular and can in some scenarios exceed the popularity of lethal control, but the public is often unaware of limitations of non-lethal methods. Finally, pertaining to a potential, future wolf harvest, there is support among a majority of state residents, contingent upon either biologists' assessments of the sustainability of a hunt or contingent upon excessive depredations by wolves. It appears that broad acceptance of a public harvest would not likely occur unless such harvest is strongly tied to reduction or elimination of wolf depredation on livestock and pets.

A somewhat surprising result, was that almost 11% of hunters would consider shooting wolves while hunting for deer (results from two surveys of different populations). With over 650,000 deer hunters in the state, 72,000 might consider shooting a wolf, although

other research in the Great Lakes generally shows support for wolf conservation among about 70% of hunters. Thus, there remains a sizeable subset of hunters that could severely negatively impact the wolf population. Illegal killing of wolves may be one of the factors that will restrict wolves from colonizing open, developed landscapes. Habitat management will need to continue to provide adequate refuge habitat by maintaining forested areas of low road density. While legal restrictions will provide some protection for wolves, we also see the need for additional policies and management supported by a vast majority of the public, including those who might consider killing wolves.

These results and others pertaining to public opinion may help the Wisconsin DNR to refine its policies and fine-tune its management actions on the ground. Such alterations of current practices should not be done in pursuit of popularity as an end in itself, but rather because sound management designed with public opinion in mind can help to avoid illicit actions, grassroots political resistance, and high-level political interference in science-based management.

Surveys of public opinion should be conducted every few years to gauge continued acceptance of management programs, or determine shifts in public attitudes toward wolves. Additional surveys should also be conducted if there are plans for major changes in wolf management, such as public harvests or changes in population goals.

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APPENDIX K.**Wisconsin Wolf Management Questionnaire 2004**

By Wisconsin Wolf Science Committee.

The questionnaire was available by mail, email or at DNR offices from August 13 through September 13, 2004. A Wisconsin DNR news release went out to media sources throughout the state to let people know about the questionnaire. A total of 1367 completed questionnaires were received, with over 90% being from state residents. The questionnaire and total responses to each question are listed below.

The Wisconsin DNR would like your opinion on the 1999 Wisconsin Wolf Management Plan. We wish to assess how well the plan is working and to determine if portions of the plan need to be modified or new items need to be included. Along with asking questions on specific portions of the plan, there will be opportunity at the end of this questionnaire, to include additional items you feel are needed in the plan.

Detailed information on each question are found in the 1999 Wolf Management Plan (<http://www.dnr.state.wi.us/org/land/er/publications/wolfplan/toc.htm>)

We value you input, and to assure that all are legitimate citizen comments, we will only consider comments when you include your name and address at the end of the questionnaire.

A. Population Goals.

1. Delisting / Re-listing Goal. The state delisting goal (the level at which wolves could be removed from the state endangered and threatened species list) was a population of 250 wolves outside of Indian reservations for one year. . The goal was achieved in 2002 and state delisting was completed in 2004. Wolves would be state re-listed as threatened if the population dropped below 250 for 3 years, and re-listed as endangered if it dropped below 80 for one year.

In your opinion, the delisting/re-listing goal of 250 wolves is:

- Much too low **273**
- Somewhat low **284**
- About right **256**
- Somewhat high **177**
- Much too high **361**

Recommended alternate goal? (**Avg. = 160, stdev =331**).

2. Management Goal. The state management goal is to maintain a population of 350 wolves outside of Indian reservations. If the wolf population exceeds this level, proactive control by government trappers or public harvest may be used to reduce the population back to this level.

In your opinion, the management goal of 350 wolves is:

- Much too low **240**
- Somewhat low **283**
- About right **219**
- Somewhat high **167**
- Much too high **440**

B. Wolf Management Zones.

The state wolf management plan identified four wolf management zones to provide different levels of wolf protection and management.

Zone 1 (northern Wisconsin) and Zone 2 (central Wisconsin forest):

Zones where wolf presence is most acceptable and given the highest level of protection. Habitat management for wolves would focus mainly on these zones. Control efforts would be allowed on private land to reduce wolf depredation on domestic animals. In 2003-2004, there was a minimum of 306 wolves that occurred in at least 88 packs in Zone 1, and 49 wolves in at least 15 packs in Zone 2.

Zone 3 (central and southwest Wisconsin):

A buffer area and important dispersing habitat for wolves between Zones 1 and 2, but contains only limited habitat for wolf packs and has high potential conflict with agriculture. Habitat management would focus mainly on maintaining dispersal habitat and corridors. Agriculture is fairly extensive and control on depredating wolves would be fairly aggressive. In 2003-2004, at least 17 wolves occurred within this zone.

Zone 4 (eastern and southern Wisconsin):

Zone of intense agriculture and large urban areas that is considered unsuitable as wolf habitat. Control on problem wolves would be aggressive. A small number of dispersing loners probably exist in the zone. Three wolves were killed in the zone in winter 2003-2004 from vehicle collisions (2) and illegal kill (1).

Do you support the concept of zone management for wolves?

- Very Opposed **252**
- Moderately Opposed **193**
- Neutral **212**
- Moderately Supportive **354**
- Very Supportive **334**

Do you feel the current zone system provides appropriate protection for wolves.

- It is far too protective **421**
- It is moderately too protective **166**
- Protection is about right **364**
- It is not protective enough **289**
- It is not nearly protective enough **104**

C. Population Monitoring and Management.

1. The level of monitoring necessary to assess the wolf population varies with population status and intensity of management. At low population levels, monitoring needs to be intense to prevent disappearance of wolves from the state. At higher population levels monitoring can be less intense. Currently an intense system of population monitoring is being used including radio tracking, winter track surveys by DNR and volunteers, summer howl surveys, and collection of reports of public observations of wolves. Intense monitoring will also need to continue for 5 years after federal delisting (which could occur in 2005). Intense monitoring will also be necessary if regular harvests are begun, to make sure that over-harvest does not occur.

a. What is your impression of the current level of wolf monitoring?

- Far too intense **217**
- Somewhat too intense **162**
- About right **573**
- Somewhat inadequate **250**
- Very inadequate **138**

b. Of the survey methods listed below, please indicate whether you feel the efforts should increase, decrease or remain about the same.

	Increase	Remain the same	Decrease
Livetrapping and radio-tracking	420	500	410
Snow track surveys by DNR	460	615	250
Snow track surveys by volunteers	618	534	178
Computer models estimations	259	640	410
Collect reports from the public	694	496	144

2. The Wisconsin Wolf Management Plan recommends different control measures based on wolf population status. When wolves were listed as a State Threatened Species (80 to 250 wolves outside Indian reservations), lethal controls were restricted to government trappers on verified depredators, or government agents on wolves that posed threats to human safety. As a delisted, state protected wild animal, below the population goal (250 –350 wolves outside Indian reservations), landowners would have authority to kill wolves attacking domestic animals on private land, and could also be issued permits to kill problem wolves (as long as federal de-listing had also occurred). Above the population goal (> 350 wolves outside of Indian reservations), proactive control by government trappers could be used to reduce the population by

eliminating wolves from unsuitable area. Public harvest could also be considered (as long as federal de-listing had occurred).

Please circle the response that best describes how you feel about the desirability of each of the following wolf management strategies:

	Highly Desirable	Desirable	Neutral	Undesirable	Highly Undesirable
Control by government trappers on wolves verified as predators on domestic animals	480	332	191	154	185
Control by government agents on wolves that pose threats on human safety	551	347	188	117	135
Landowner authority to kill wolves in the act of attacking domestic animals on private land	669	183	120	170	210
Landowner permits to kill a limited number of wolves during specific time period on private land with history of wolf depredation	562	142	93	177	375
Proactive control by government trappers on wolves in areas considered unsuitable because of high risk of human conflict if the state population goal is exceeded	424	326	205	189	199
Public harvest if the population goal for the state is exceeded	635	114	90	89	421

D. Habitat Management.

The Wolf Management Plan recognized about 5812 square miles of favorable wolf habitat. By 2003 most areas of favorable wolf habitat in northwest, north central, and central forest were occupied by wolf packs. In portions of northwest and central Wisconsin, wolves have started to occupy less suitable habitat, but in northeast Wisconsin areas of favorable habitat are still not fully occupied. The Wolf Management Plan recommends various levels of habitat management that would be emphasized in Zones 1 and 2. The Wisconsin DNR is interested in your thoughts on these various management tools.

What is your opinion on the following aspects of the Wolf Management Plan?

Please circle the response that best describes your level of agreement with each of the following statements.

	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
The plan encourages maintaining low road densities in Zones 1 and 2 on public lands where wolves occurred, and encourages keeping road densities at or below current levels.	520	229	201	106	268
The plan encourages managing public forest land in Zones 1 and 2 in diverse forest cover including some areas of early successional forest that maintain reasonable levels of prey populations.	483	333	246	88	171

E. Wolf Depredation Management.

The Wolf Management Plan discusses five control responses to reduce the impact of wolf depredation on domestic animals. These include: 1. technical assistance including non-lethal methods, 2. compensation for losses, 3. livetrapping and translocating wolves by government trappers, 4. trapping and euthanizing wolves by government trappers, and 5. landowner controls on problem wolves. Wildlife specialists from Wisconsin DNR and USDA-Wildlife Service conduct investigations of possible wolf depredations. These specialists also provide technical assistance, help producers apply nonlethal controls, and if necessary attempt to trap problem wolves. Reimbursements for losses due to wolves come from the state Endangered Resources Fund (from individual voluntary contributions on tax returns) and the sale of special wolf license plates.

Please indicate the extent to which you agree with each of the following policies related to wolf depredation management.

	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
USDA-Wildlife Services should continue to provide technical assistance including non-lethal methods to persons who have problems with wolf depredations.	625	266	110	125	216
USDA-Wildlife Services should trap and euthanize wolves that cause depredation on domestic animals on private land.	543	263	133	186	218
Control trapping should be avoided on public lands (currently trapping is only allowed on private land or public lands immediately adjacent to private lands where depredations have occurred).	383	220	156	184	399

1. In your opinion, should the Wisconsin DNR continue to reimburse owners for depredation on the following groups of animals if killed or injured by wolves?

Please indicate the extent to which you agree with each of the following policies related to wolf depredation management.

	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
livestock and poultry on private land	780	398	73	44	58
pets on private land	686	347	132	85	101
pets on public land	510	164	148	222	304
pets on industrial forest	493	146	155	233	318
Hunting dogs legally used on public or industrial forest land	539	163	102	183	364

2. The 1999 Wolf Management Plan allows control trapping to occur up to 0.5 miles from depredation sites in Zones 1 and 2, up to 5 miles away in Zone 3, and any distance from depredation sites in Zone 4. Do you agree with these restrictions?

- strongly agree **178**
- somewhat agree **383**
- no opinion **253**
- somewhat disagree **273**
- strongly disagree **258**

The 2003 federal reclassification of wolves includes regulations that allow the state of Wisconsin to trap problem wolves up to 1 mile from depredation sites while listed as federal threatened. Should the plan allow trapping up to 1.0 mile from depredation sites in Zones 1 and 2 to be consistent with federal regulations?

- strongly agree **378**
- somewhat agree **394**
- no opinion **207**
- somewhat disagree **175**
- strongly disagree **187**

3. Wolves have been delisted by the State of Wisconsin, and may be removed from the federal threatened species list in 2005. Once the federal action is completed, the Wisconsin plan may allow private landowners to shoot wolves in some situations.

- a. Private landowners or occupants on private land would be able to shoot wolves in the act of attacking pets or livestock on private land. The owner or occupant would be required to contact a conservation warden within 48 hours. Do you agree with this procedure?

- strongly agree **634**
- somewhat agree **274**
- no opinion **33**
- somewhat disagree **184**
- strongly disagree **226**

b. On public land, owners of domestic animals being attacked by wolves would be allowed to harass and scare wolves, but would not be allowed to use lethal force. Do you agree?

- strongly agree **365**
- somewhat agree **245**
- no opinion **32**
- somewhat disagree **142**
- strongly disagree **561**

c. Once delisted by both the state and federal government, permits can be issued to landowners or occupants to control a limited number of wolves on land they own or lease, if they have had recent wolf depredations. Do you agree with this procedure?

- strongly agree **547**
- somewhat agree **263**
- no opinion **51**
- somewhat disagree **193**
- strongly disagree **287**

F. Wolf Education Programs.

Wolf Education Programs continue to be an important part of wolf management in Wisconsin. These include annual wolf awareness week, a pamphlet on wolves in farm country, updated wolf information on the DNR web site, a pamphlet on wolves and dogs, periodic news releases, working with wolf education organizations, and providing wolf talks.

1. In your opinion, the amount of effort DNR spends to educate the public about wolves is:

- Far too much effort **240**
- Somewhat too much effort **111**
- About right **387**
- Somewhat too little effort **368**
- Much too little effort **236**

G. Interagency Cooperation.

Interagency cooperation has been critical to successful wolf management in Wisconsin, especially with federal agencies, tribes, and state DNRs in Michigan and Minnesota. When wolves are delisted by the federal government, the role of federal agencies will decline. However, some level of involvement will continue by the U.S. Fish and Wildlife Service for 5 years after delisting, and Forest Service involvement in wolf conservation will continue indefinitely on National Forest lands containing wolves.

1. Do the efforts of interagency management of wolves in Wisconsin seem adequate?

<input type="radio"/> strongly agree	144
<input type="radio"/> somewhat agree	412
<input type="radio"/> no opinion	454
<input type="radio"/> somewhat disagree	192
<input type="radio"/> strongly disagree	141

H. Volunteer Efforts.

The DNR makes extensive use of volunteers in education and survey work on wolves. Each year about 100 people are trained to assist in track surveys. Volunteers from Timber Wolf Alliance, Timber Wolf Information Network, and other organizations provide talks and training to thousands of people each year on wolves.

1. Should DNR continue to support these volunteer efforts in wolf management in Wisconsin?

<input type="radio"/> strongly agree	726
<input type="radio"/> somewhat agree	236
<input type="radio"/> no opinion	134
<input type="radio"/> somewhat disagree	80
<input type="radio"/> strongly disagree	170

Of the following wolf management issues, please indicate three that are most important to you (rank 1=most important, 2=2nd most important, 3=3rd most important).

	1	2	3
___ Population monitoring	152	147	123
___ Population management and control.....	287	196	164
___ Education.....	143	164	153
___ Habitat protection and management.....	338	156	111
___ Controlling depredation on domestic animals.....	195	181	169
___ Depredation compensation.....	85	171	156
___ Training of volunteers.....	27	38	62
___ Wolf research.....	56	105	115
___ Public Involvement and agency cooperation.....	46	53	126
___ Law enforcement and legal protection.....	70	97	114
___ Diseases Monitoring and Management.....	32	48	62
___ Public Harvest.....	233	96	189

Thank you for your comments, The Wisconsin Wolf Science Committee. Please fill out the following:

Name:

Address:

Phone:

Email Address if available

Additional Background Information (Optional):

Have you read the 1999 Wisconsin Wolf Management Plan? Yes (**673**) No (**298**).

Are you a male (**915**) or female (**72**)?

Do you hunt? Yes (**848**) No (**444**)

If yes, which animals do you hunt?

<input type="checkbox"/> Deer (798)	<input type="checkbox"/> Upland Game Birds (662)
<input type="checkbox"/> Bear (375)	<input type="checkbox"/> Rabbits & Squirrels (492)
<input type="checkbox"/> Waterfowl (375)	<input type="checkbox"/> Predators & Furbearers (326)

Do you trap furbearers? Yes (**165**) No (**1094**).

Do you hunt with dogs? Yes (**516**) No (**737**).

If yes, which kind of dogs and hunting?

<input type="checkbox"/> Hounds for bears and other predators.	224
<input type="checkbox"/> Beagles & other dogs for small game.	177
<input type="checkbox"/> Dogs for upland gamebirds.	367
<input type="checkbox"/> Dogs for waterfowl	230

Do you farm? Yes (**205**) No (**1069**).

If yes, what kind of farming?

<input type="checkbox"/> Row crop	75
<input type="checkbox"/> Orchard or Fruit	26
<input type="checkbox"/> Vegetable	45
<input type="checkbox"/> Beef Cattle	62
<input type="checkbox"/> Dairy Cattle	23
<input type="checkbox"/> Sheep	13
<input type="checkbox"/> Hogs	19
<input type="checkbox"/> Poultry	38
<input type="checkbox"/> Deer or Elk	5
<input type="checkbox"/> Other	67

Do you consider yourself an environmentalist? Yes (**855**) No (**389**).

List any environmental organizations to which you belong.

Do you consider yourself a conservationist? Yes (**1066**) No (**172**).

List any conservation organizations to which you belong.

Do you consider yourself an animal protectionist ? Yes (**471**) No (**745**).

List any animal protection or animal welfare organizations to which you belong.
