Regional Landscape Analysis and Prediction of Favorable Gray Wolf Habitat and Population Recovery in the Northern Great Lakes Region

David J. Mladenoff, University of Wisconsin-Madison
Theodore A. Sickley, University of Wisconsin-Madison
Adrian P. Wydeven, Wisconsin Department of Natural Resources
Robert G. Haight, US Forest Service

INTRODUCTION

BACKGROUND

For 15 years, the endangered eastern timber wolf has been slowly recolonizing northern Wisconsin and, more recently, upper Michigan, largely by dispersing from Minnesota (where it is listed as threatened). We used geographic information systems (GIS) technology, spatial radiocollar data from recolonizing wolves in northern Wisconsin and adjacent Minnesota, and a statistical logistic regression technique to assess the importance of landscape scale factors in defining favorable habitat.

Our goals were to: (1) create a useful model that would allow wildlife biologists and natural resource managers to predict where future wolf recolonization activity might occur in the upper Great Lakes region, and (2) estimate the range of wolf populations that the region might support, based on the availability of favorable habitat and the availability of prey.

Northern Great Lake states (gray) and study area (magenta)

METHODS

(1) Wolf radiocollar locations were digitized from maps provided by the Wisconsin Department of Natural Resources. Locations were grouped by pack, and wolf pack home ranges were generated. For the statistical analysis, an equal number of randomly distributed non-wolf pack areas were created.

(2) Several spatial data bases thought to influence the distribution of wolf packs were assembled in the GIS software program Arc/Info. These data bases include land cover type, land ownership category, road density, human population density, and deer (prey) density.

(3) Pack areas and non-pack areas were intersected with the spatial data bases. A value for each of the data base variables was calculated for each pack and non-pack area.

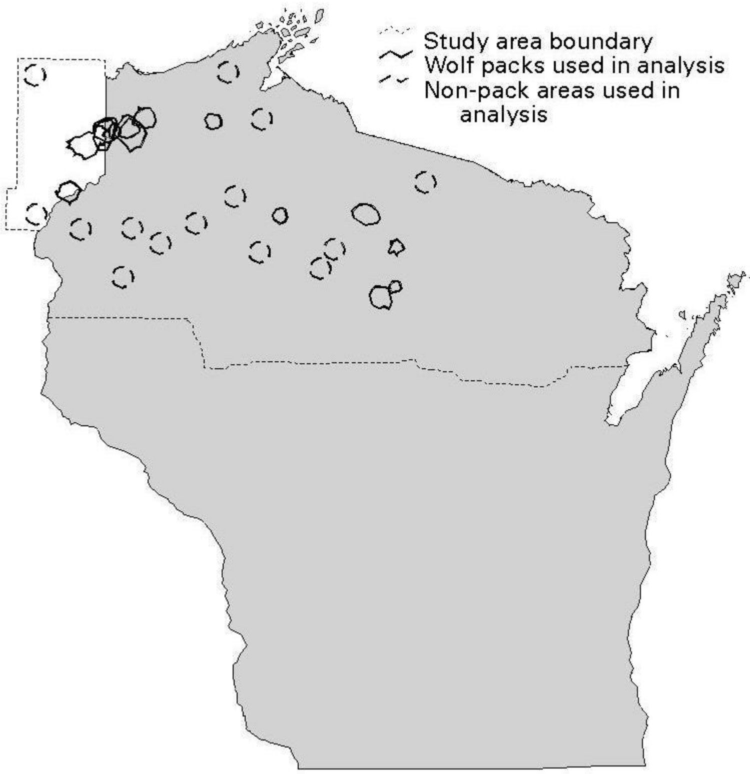
(4) The variables were entered into a logistic regression model to determine which variables were most strongly associated with the presence of wolf packs.

(5) The results of the logistic regression model were applied across the northern Great Lakes region to show the distribution of favorable wolf habitat.

(6) The amount of favorable habitat and the density of prey were used to estimate the potential timber wolf population for the region.

MODEL BUILDING

WISCONSIN WOLF PACKS



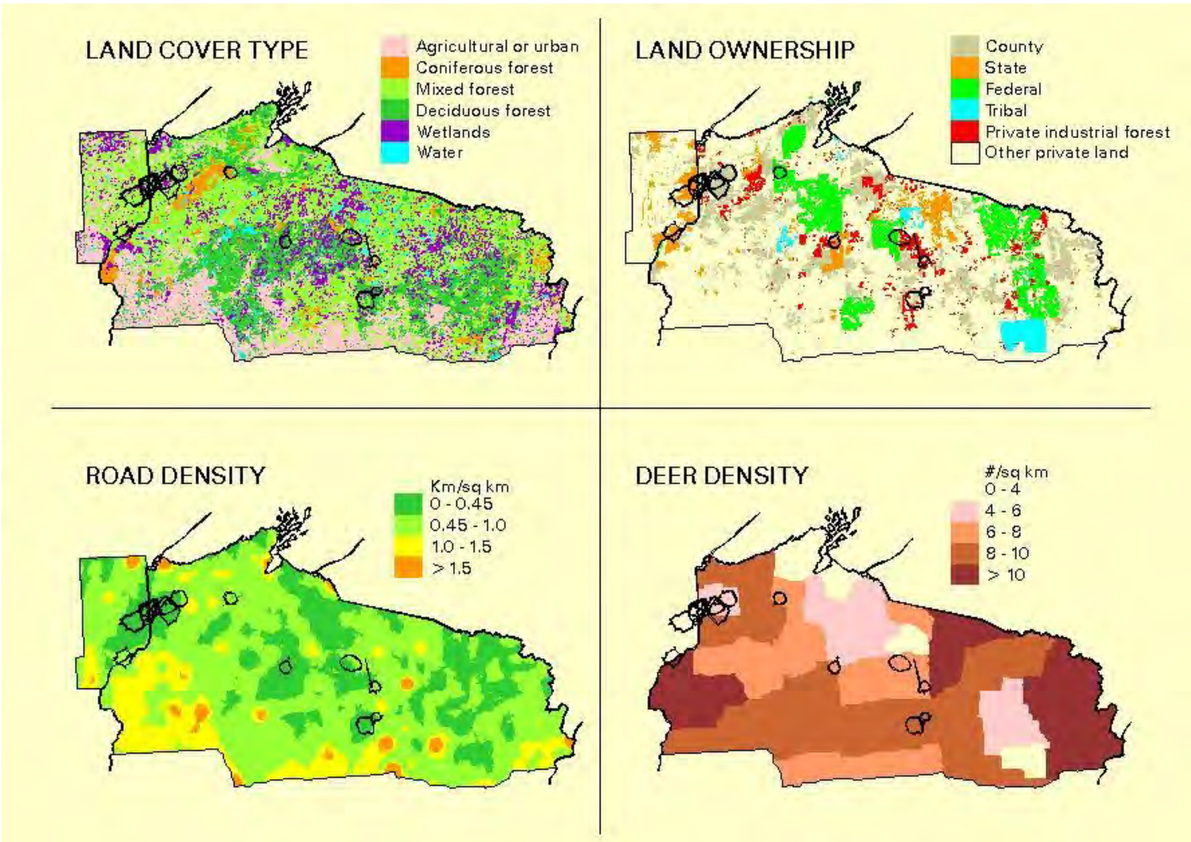
In 1974 the eastern timber wolf was given protection under Federal Endangered Species Act of 1973. At that time, Minnesota had the only breeding population of timber wolves in the lower 48 states. Since then, the wolf population of Minnesota has grown from roughly 500 to nearly 2000 animals. This growing population in Minnesota is thought to be the source of timber wolves sited in neighboring Wisconsin in the late 1970s. Wisconsin currently supports approximately 100 wolves. Upper Michigan has a population of approximately 115 wolves. Wisconsin wolves have been captured, radiocollared, and tracked by the Department of Natural Resources since 1979. We used the radiocollar points and a harmonic mean method to determine the home range of each wolf pack. Several wolf packs in Wisconsin contain no collared wolves, or contain wolves that were collared for a very short time. These packs were not used in the statistical analysis, but were used to assess the results of the model.

HABITAT VARIABLES

- ***Land cover*** data were taken from the US Geological Survey 1:250,000 Land Use/Land Cover data base.
- ***Major land ownership*** data were digitized from 1:500,000 Land Resources Analysis Program maps created in 1974 by the Wisconsin Planning Agency.
- ***Road density*** data were created from a roads coverage extracted from the US Census Bureau TIGER/line files. These roads include highways, other paved roads, and

improved unsurfaced roads passable by auto, but exclude unimproved forest roads and trails.

- ***Deer density*** data were calculated from Wisconsin Department of Natural Resources deer management unit maps and annual deer population estimates.
- ***Human population density*** (not shown below) was calculated from US Census Bureau data.



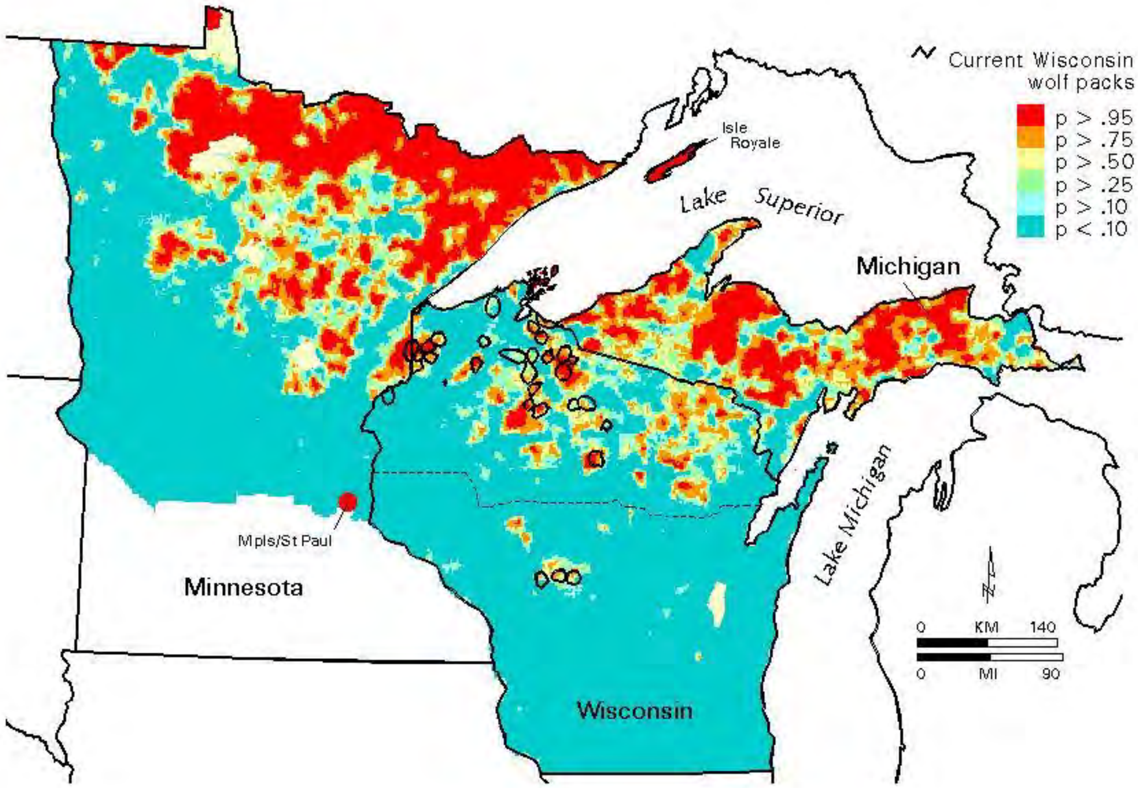
MODEL RESULTS

After habitat values were calculated for each pack and non-pack area, variables correlated with other variables were dropped. For example, human population density and percent of private land are correlated to road density and were therefore dropped from the analysis.

Road density proved to be the strongest predictor of wolf pack presence. Our logistic regression analysis predicts a greater than 50% chance of a wolf pack occurring where road densities are less than 0.45 km/sq km.

MODEL APPLICATIONS

FAVORABLE HABITAT PREDICTION



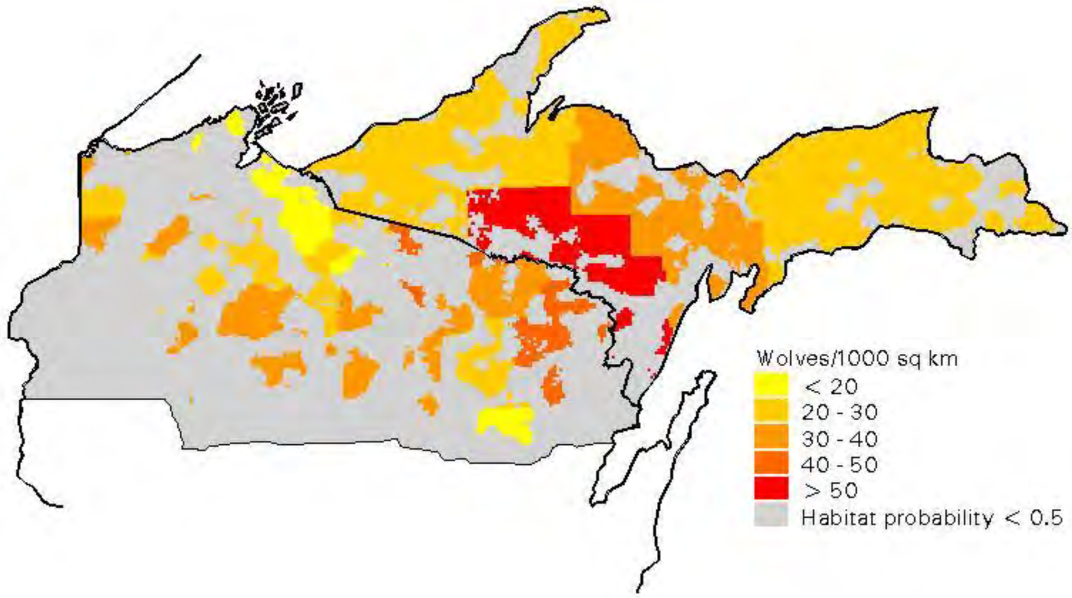
The above map shows the results of the logistic regression model applied to the northern Great Lakes region. Blue shading represents those areas where wolf packs are least likely to occur. Red shading represents those areas where wolf pack are most likely to occur. Note that Minnesota contains the largest amount of favorable habitat (50,200 sq km). Michigan contains 29,400 sq km of favorable habitat, while Wisconsin contains 15,400 sq km of favorable habitat.

WOLF POPULATION ESTIMATES

Two methods of predicting future wolf populations in the region were used: (1) estimates based on the amount of favorable habitat, and (2) estimates based on the availability of deer.

Favorable habitat is defined here as those areas with a greater than 50% chance of supporting a wolf pack (yellow, orange, and red on the map above). Based on the predicted amount of favorable habitat that occurs in Wisconsin and Michigan, the following wolf population estimates were calculated:

- Wisconsin 357 wolves (90% CI 276-413)
- Michigan 705 wolves (90% CI 545-815)



The second set of wolf population estimates were based on the relationship between wolf density and prey density, in this case deer. The above map shows wolf densities as calculated from deer densities, for those areas with a greater than 50% chance of supporting wolf packs.

The following wolf population estimates were determined by multiplying the wolf densities by the areas they represent:

- Wisconsin 462 wolves (90% CI 262-662)
- Michigan 969 wolves (90% CI 829-2019)

CONCLUSIONS

- Wisconsin and Michigan are experiencing a strong recovery in their wolf populations, which had been extirpated by 1960.
- Recolonization has occurred by virtue of a large and stable population in adjacent northeastern Minnesota.
- Results from the logistic regression model show that potential wolf habitat in northern Wisconsin is highly fragmented, broken up by devolopment corridors. This may contribute to the low level of recolonization activity in northeastern Wisconsin.
- Potential wolf habitat in upper Michigan occurs in larger, more contiguous blocks than in Wisconsin. This area could maintain a significant wolf population that would be capable of serving as a source for Wisconsin, should increased development and fragmentation make wolf movement across northern Wisconsin more difficult.
- Wisconsin appears capable of supporting approximately 350-450 wolves. Michigan appears capable of supporting approximately 700-950 wolves.

- In general, public attitudes toward wolves has grown significantly more tolerant in the last two decades. As wolf numbers increase, however, there is likely to be a corresponding increase in conflict between wolves and humans and between wolf abundance and other biodiversity values.

BIBLIOGRAPHY

For further information and a complete explanation of the information displayed on this web page, please see:

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or contact:

Dr. David J. Mladenoff
Department of Forestry
120 Russell Laboratories
1630 Linden Dr.
Madison, WI 53706
djmladen@facstaff.wisc.edu