

# Decreasing effectiveness of protected areas due to increasing development in the surroundings of U.S. National Park Service holdings after park establishment

Urs Gimmi<sup>1,2</sup>, Ulf Gafvert<sup>3</sup>, Volker C. Radeloff<sup>1</sup>

<sup>1</sup> Department of Forest and Wildlife Ecology, University of Wisconsin, Madison, WI, USA

<sup>2</sup> Swiss Federal Institute for Forest, Snow and Landscape Research, Birmensdorf, Switzerland

<sup>3</sup> Great Lakes Inventory and Monitoring Program, U.S. National Park Service, Ashland, WI, USA

## Keywords

protected areas; park effectiveness; road development; housing growth; landscape fragmentation; U.S. Great Lakes

Table 1: Percentage of area disturbed by roads and buildings and size of the largest contiguous undisturbed area for Indiana Dunes and Pictured Rocks National Lakeshores inside the park area, the 3.2km zone around the parks, and the total area between 1938 and 2005.

		Indiana Dunes		Pictured Rocks	
		Disturbed area (% of total area)	Largest undist. area (km <sup>2</sup> )	Disturbed area (% of total area)	Largest undist. area (km <sup>2</sup> )
park area	1938	14.7	3.38	1.7	176.61
	1966	16.2	3.24	3.6	83.08
	2005	17.5	2.86	3.2	143.69
3.2 km zone	1938	23.8	10.30	4.3	26.36
	1966	38.2	6.89	4.8	25.97
	2005	52.4	6.42	5.8	30.25
total area	1938	22.8	13.98	2.9	242.28
	1966	35.7	6.74	4.2	94.43
	2005	48.6	7.26	4.5	186.82

## Summary

Protected areas are cornerstones of biodiversity conservation, but protected areas are in danger of becoming islands in a sea of human dominated landscapes. It has been hypothesized that protected areas may foster development in their surrounding area by providing specific amenities, thus partially causing the isolation that limits their functioning. In our study we assessed road development and building growth within and around Indiana Dunes and Pictured Rocks National Lakeshores in the U.S. Great Lakes region before and since the establishment of these two parks in 1966 and estimate the effects of park creation on changes in landscape patterns. Roads and buildings were mapped for 1938, 1966 and 2005 from aerial photographs and topographical maps for both the park area and a 3.2 km zone around each park. U.S. census housing density data from 1940 to 2000 were used as a baseline to compare observed changes with those in the broader landscape. Additionally, we quantified the effects of building growth and road development on landscape fragmentation. Our results show that park establishment was effective in reducing and stopping the fragmenting impact of development within park boundaries. However, increased

amenity levels led to enhanced development in the 3.2 km zone around both parks following park establishment with rates of change much higher than in the broader landscape. The potential amenity effect was up to 14,900 new buildings in the 3.2 km zone around Indiana Dunes between 1966 and 2005. For Pictured Rocks the absolute effect was smaller but still 20% of the observed building growth was potentially due to amenity effects. Our findings highlight the need for conservation planning at broader scales, incorporating areas beyond the boundaries of protected areas.

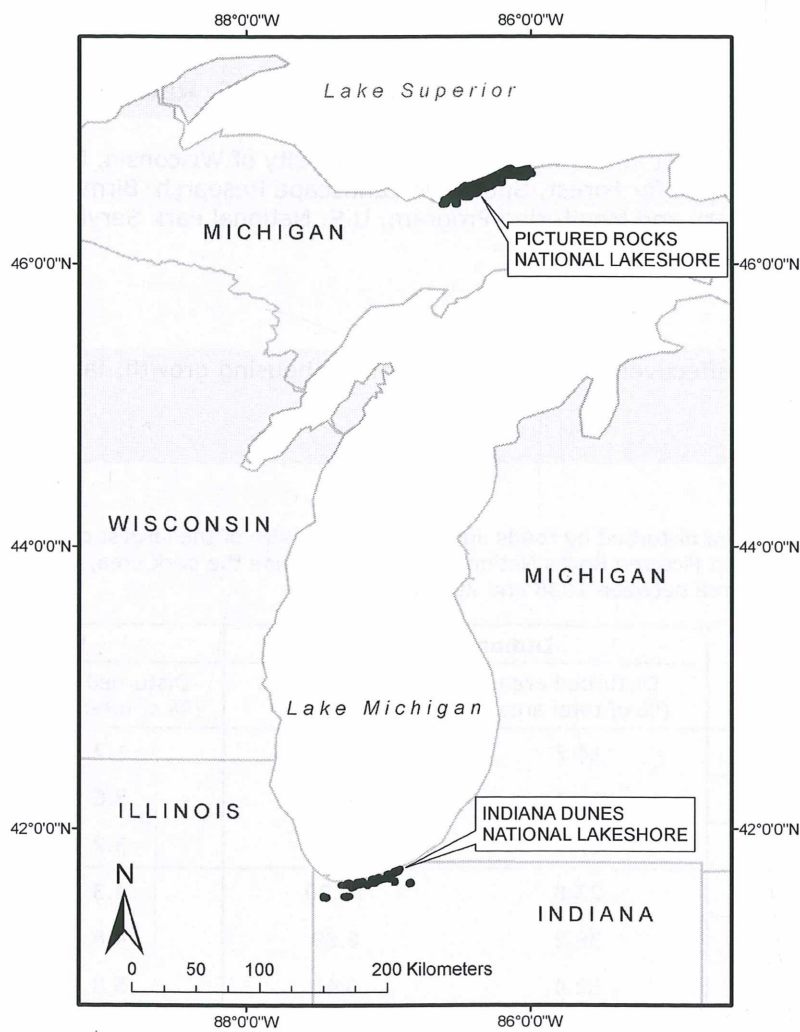


Figure 1: Location of Indiana Dunes and Pictured Rocks National Lakeshores in the U.S. Great Lakes region

Contact

Urs Gimmi  
[urs.gimmi@wsl.ch](mailto:urs.gimmi@wsl.ch)

Swiss Federal Research Institute WSL  
Land Use Dynamics  
Zürcherstrasse 111  
CH-8903 Birmensdorf  
Switzerland