

GIS Used to Develop Fire Management Strategies

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Researchers and resource management personnel at Indiana Dunes National Lakeshore (NL) are using the lakeshore's geographical information system (GIS) to determine wildfire frequency in given areas within the lakeshore. The information from the analyses will be used by lakeshore staff to refine the Fire Management Plan, currently being revised, and to better manage lakeshore resources through the proper application of prescribed fire.

A linear park located on the southernmost shore of Lake Michigan in urban Northwest Indiana, the lakeshore is the meeting place of the western prairie, northern boreal forest, and southeastern hardwoods and is noted for its biodiversity. The area has been heavily impacted by modern human activities. Transportation and utility corridors, drainage ditches, industry, and communities divide the lakeshore into isolated segments. Mining of sand, logging of timber, draining of wetlands, and suppression of wildfires have vastly altered the plant composition of the area.

Despite these impacts, Indiana Dunes has an unusually high plant diversity, currently third highest of any area in the National Park System, with 1,445 species of vascular plants (Pavlovic and Cole, In Press). It also possesses 29 percent of the state's threatened and endangered plant species (Bowles et al 1986).

The lakeshore experiences an average of 29 wildfires annually, all human caused, with the majority occurring in its western portion. Based on information from past fire reports, the fires were divided into spring and fall burns, and the perimeters of all fires for which accurate maps existed were digitized into the GIS data base. The staff was able to digitize approximately 90 percent of the reported wildfires that occurred between 1982 and 1989, and 100 percent of the wildfires occurring after 1989. However, wildfires as large as 100 acres that occurred prior to 1989 were not entered into the data base because their mapping format could not be digitized. Although attempts were made to reconstruct the fire maps, in some cases too much time had elapsed for accurate reestablishment of the fire perimeters on appropriate maps.

The work has resulted in a reasonably complete digitized record of the wildfires in the lakeshore since 1982 and the data base will provide researchers and members of the Resource Management Branch with a highly credible statistical sample.

The data can be used in a variety of ways. For example, the annual occurrence and location of each reported wildfire, when combined with similar fire maps from other years, provides investigators with a much clearer picture of fire frequency for different park units. Over a period of time, these overlays can be used with a high degree of confidence to test statistical hypotheses. For instance, the staff has found that some areas of the lakeshore have burned at least six times between 1982 and 1990. This combined wildfire data was overlaid with a digital map of the fire-dependent vegetation types. When the two were compared, the lakeshore areas that experienced the highest frequency of burns closely matched the distribution of fire dependent plant species and community types.

The lakeshore is in the process of developing a new fire management plan and will use the various outputs derived from the GIS data base to recommend courses of action to management and to identify trends. These outputs, in a variety of combinations, will be used to



High flames penetrate into a thicket of aspen sprouts in the wet prairie.



Igniters work around the perimeter of prescribed burn area using drip torches.

determine the size and location of burn units, complete a fire prevention and risk analysis, identify and rank values at risk, verify fuel models, and recommend optimum burn frequencies for the different plant communities in the lakeshore.

The lakeshore's Research Division has been conducting studies for the past eight years to determine historic fire frequencies and to develop an understanding of the effects of fire and other natural phenomenon on existing plant and animal communities. Based on these studies, the following premises have been developed concerning the effectiveness of fire as a management tool at the lakeshore:

- Oak savanna and prairie communities will best be maintained by a fire interval of from two to eight years, depending on the unit history, specific goals, and year-

to-year climatic variations (Cole et al, 1990; Taylor, 1990; Henderson and Long, 1984).

- Annual fires are not recommended for either restoration or maintenance of oak savanna as these burns often have little fuel and may damage sensitive herbaceous species.

- Remnants of the oak savanna/prairie community must be burned at least every 15 years or they may be lost because of the increasing diameter of saplings (Cole and Klick, 1990) and the increase in canopy cover.

- Spring burns seem to be the most cost effective because the appropriate climate windows occur more predictably during this season.

- The fire dynamics of marshes and wet prairies are

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complicated by additional factors such as water table fluctuations and herbivores and are in need of further study.

The results of this research have formed the basis for future fire management activities at the lakeshore. Beginning in 1991, members of the resource management staff are using the data displayed on the combined burn frequency overlays to locate monitoring plots designed to document the effects of fire frequency on species composition and fuel loading, especially for fuel size distribution. Attempts also will be made to compare areas experiencing spring and fall burns.

Results of these studies will be used to validate the results of the research conducted thus far, including effects of fire on threatened and endangered plant species.

To date no attempt has been made to integrate burning conditions of past fires. However, starting in 1991, observed weather conditions at wildfires over five acres in size are being recorded. The observed conditions are being entered into BEHAVE, a fire effect program. The results will be used to categorize the severity of the burn to verify past output values from BEHAVE. A limited amount of pertinent information concerning each fire will be entered into a dBase file, which may be utilized by GIS.

Summary

The proper utilization of the GIS, when combined with research and monitoring activities, will greatly enhance the understanding of the effects of fire on plant and animal communities and provide researchers and managers with creditable data to make management decisions that will stand up to public scrutiny and peer review.

Douhan and Knutson, at the time of writing, were resource management specialists at Indiana Dunes NL. Knutson is still there in that capacity, while Douhan moved in May 1991 to the NPS National Capital Region as a fire management specialist. Cole is a research ecologist with the Indiana Dunes Research Division.

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