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A GIS-based spatial decision support system for tourists of Great Smoky Mountains National Park

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Abstract

Great Smoky Mountains National Park (GSMNP) is filled with an abundance of ecological diversity, historical significance, and recreational opportunities for visitors to explore and experience. The wide range of potential activities available in the park also present a major challenge for park visitors to plan activities that will better meet their preferences and constraints. With the large amounts of spatial and non-spatial data associated with the diverse resources and activities in the park, it is a logical choice to use geographic information systems (GIS) for storing, managing, analyzing, and visualizing the data. Nevertheless, GIS functions alone are insufficient to facilitate activity planning for park visitors. This paper presents a GIS-based spatial decision support system (SDSS) application that integrates GIS functions and SDSS designs with easy-to-use graphic user interfaces to help visitors of GSMNP choose and plan their activities more effectively to match their personal preferences and constraints.

Keywords: Geographic information systems; Spatial decision support system; National park; Tourism

1. Introduction

Great Smoky Mountains National Park (GSMNP) is a national treasure filled with an abundance of ecological diversity, historical significance, and recreational opportunities waiting to be discovered by those who come to explore within its boundaries. GSMNP, which has something for everyone to experience and enjoy in the park, attracts more than twice as many visitors as any other US national park. However, many visitors are new to the park and do not know where to begin exploring the vast number of options they are presented within the GSMNP. Even for visitors who know what they would like to do during their visits, they often do not know where the best places to fulfill their desires are. Repeat visitors to the park may also want to explore new areas of the park that they have not yet encountered, but know little about the park beyond the most popular destinations. Most park visitors stay along the main roads, trails, and popular attractions of the park and do not venture to the equally attractive but lesser known areas. The 308 sq km GSMNP has something to offer everyone who comes to the park and having a memorable trip to the park is a matter of matching the wishes of the visitors to the resources within the park.

The spatial aspect in a problem of this nature lends itself well to applications of geographic information systems (GIS) and spatial decision support systems (SDSS). This paper presents a GIS-based SDSS application that assists the park visitors in discovering various hidden treasures in GSMNP and matches their personal interests to the abundant resources available in the park. Such a GIS-based SDSS will not only offer park visitors with a useful tool to facilitate their activity planning but also increase their satisfaction from the matched personal interests and park resources.

The remaining sections of this paper are organized as follows. Section 2 presents the background information of GSMNP, GIS, and SDSS. Section 3 describes a GIS-based spatial decision system designed to assist the visitors of GSMNP in discovering and planning potential activities in the park. An example is included to illustrate how the

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GIS-based SDSS application can be used to recommend the trails that best match the interests of a park visitor. The paper is concluded with suggestions of future development of the current system and the potential of using GIS and SDSS in other applications related to retailing and consumer services.

2. Background

GSMNP was established in 1934 and is the second largest national park in the eastern United States (Fig. 1). It is known throughout the world for its extraordinary biodiversity with over 100,000 plants and animals estimated to live in the park. Over 70% of the park is forested, providing the largest extent of forested landscape in the eastern USA. Elevation in the park ranges from about 204 m in the park's southwest corner to Clingman's Dome, which at 1830 m is the third highest peak in the eastern United States and the highest point in Tennessee. The peaks, ridgelines, and valleys offer breathtaking vistas around every corner. Geologic formations such as the Anakeesta outcrops of "Charlies Bunion", "The Chimneys", and "Needle's Eye" offer a unique character to the park that leaves a lasting impression on those who visit these sites.

The altitudinal range of GSMNP resembles the latitudinal extent one would experience traveling from Georgia north to Maine. For example, in the lowlands, trees typical of the south, such as sweet gum (*Liquidambar styraciflua*), are in abundance while higher elevations contain species like mountain ash (*Sorbus americana*), which are normally found in northern habitats. Hiking and driving in low elevations is a completely different experience in regard to vegetation, fauna, and climate than exploring the high elevations of GSMNP. Wildflowers cause the mountainside to come alive starting in early spring. Many visitors plan their trips around the colors of the park, whether it is the plentiful colors of the spring and summer wildflowers or the exquisite fall leaves that explode with color in September, October, and November. Waterfalls are another favorite attraction of the park and can be found in most every region and elevation of the park. Abrams Falls and Laurel Falls attract the most attention, as they are the easiest to access, while more dramatic falls such as Spruce Flats Falls and Forney Creek Cascades often go unnoticed by casual visitors.

There are over 528 km of maintained trails and 3300 km of streams and rivers that cover the majority of the park's geographic extent. The fauna of the park ranges from small insects to large mammals such as white tailed deer (*Odocoileus virginianus*), elk (*Cervus elaphus*), and black bear (*Ursus americanus*). The park boasts the most diverse population of salamanders in the entire world with over 30 different species found in the park. With the rich abundance found in GSMNP, encounters with some sort of wildlife are almost guaranteed. Fishing is another major attraction of the park. While brook trout (*Salvelinus fontinalis*) are the only native species to the park, rainbow (*Salmo gairdneri*) and brown (*Salmo trutta*) trout are caught in large numbers in the cold mountain streams.

In addition to the tremendous biodiversity and topographic diversity, the park offers a rich history of early frontier life in Appalachia. Areas such as Cataloochee in the northeast corner of the park and the popular Cades Cove in the southwest offer a unique insight into early life in the park through a number of restored structures such as

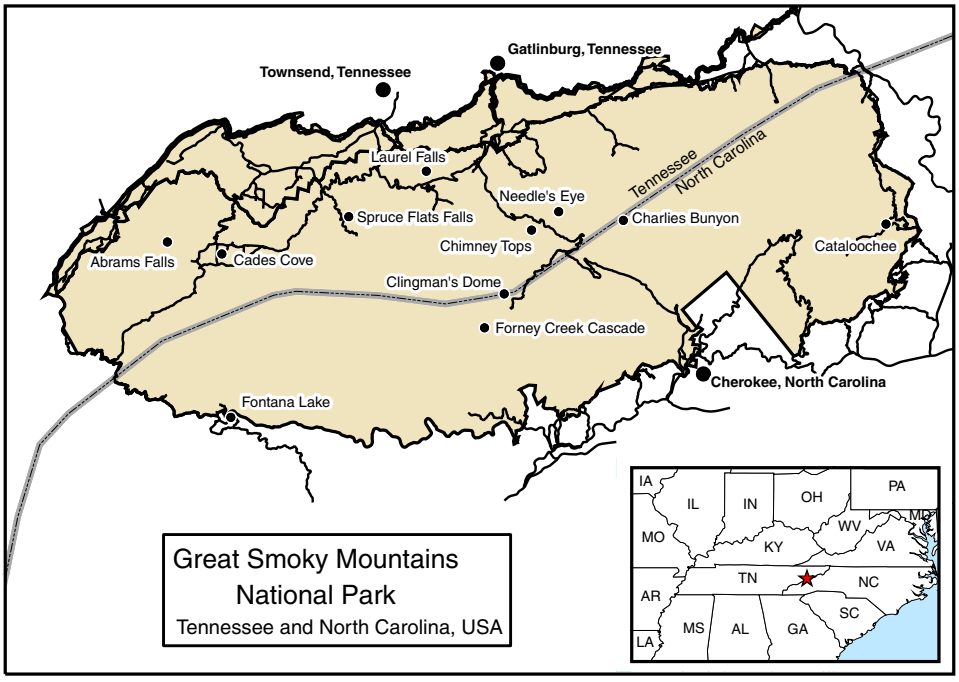

Fig. 1. Map of Great Smoky Mountains National Park.