

# Utilization of GIS on Visitor Use Management in National Parks

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## ABSTRACT

Damage on the natural environment of National Parks due to excessive visitors' activities has become a growing concern in Japan. Geographic data such as ArcGIS can be utilized in supporting visitor use management by monitoring times and areas of congestion, which can be potentially detrimental to the natural environment. In this study, Mt. Shibusu in Nikko National Park, i.e. one of the most popular national park with daily visitors of up to 1,800 (during peak seasons) is therefore particularly vulnerable to serious ecological destruction, has been selected as our case study. It is believed that the development of such a database system is advantageous and its wider application in the national parks management.

## 1. INTRODUCTION

Control and regulation on visitor use of National Parks has gained increased recognition in Japan following the growing global concerns on nature conservation. Geographical Information System (GIS) has emerged as a useful tool in storing and processing crucial information that are beneficial in National Parks management.

### **BACKGROUND: Japan's National Parks System-*Chiiki-sei***

Japan's National Parks System started in 1931 with 12 designated parks. These parks are managed by a unique system unlike with those in the North America. Instead of establishing parks in state-owned or public land, these are special designated park as when the need to preserve a certain landscape and the natural resources arisen.

At national level, these national parks are managed by the Ministry of Environment (MoE). Of these, only 0.2 percent is owned by the MoE. In addition to that, 24.8 percent of the national park areas are privately owned, meanwhile the remaining 75.2 percent are either classified as National Forest (61.2 percent) under the jurisdiction of the Forestry Agency or publicly owned by the local governments (13.5 percent). In many cases, various activities such as agricultural, forestry and tourism are taking place within the parks. Due to the level of complexity in the management of

such “multiple-use” areas, integration of various law and regulations in its management system is therefore essential.

## **2. OBJECTIVES**

This study aims to demonstrate the importance of GIS as a valuable tool in meeting that need. ArcGIS Tracking Analyst was used in visualizing the actual visitor use on the study area and in identifying specific time and area of congestion, which is believed to be the main factors of soil erosion as a result of excessive hiking activities.

### **2.1 STUDY AREA: Mt.Sibutsu in Nikko National Park**

One of the most advanced nature conservation measures have been adopted in the management of Mt.Sibutsu in Nikko National Park participated by local environmental NGOs, local governments and private enterprises.

With its renowned scenic beauty, Mt. Shibutsu (2,228m in height), located in Gunma prefecture, is one of the most popular national parks in Japan, with daily visitor records of 1,800 during peak seasons. It offers a huge variety of alpine flora particularly between the months of July to October. Most of the land is owned by Tokyo Electric Power Company (TEPCO).

Despite the extensive conservation measures taken by the various environmental NGOs and local governments, this national park is facing serious land erosion problems. With its only hiking trail route being between the gate Hatomachi- touge and the gate Yamanohana, Mt. Sibutsu is experiencing serious land erosion problems caused by too many hikers in areas beside the trail between the top of the mountain and the gate Yamanohana.

### **2.2 Mt.Sibutu Management System (SMS)**

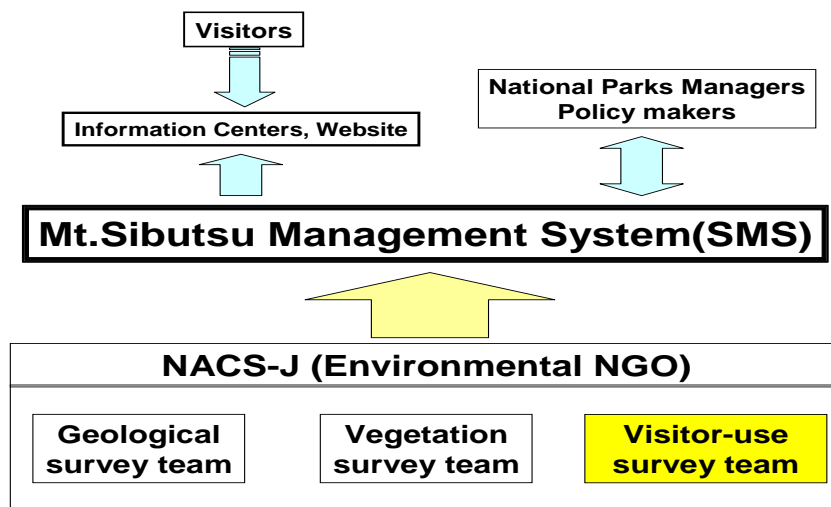
In 2002, Mt.Sibutsu Conservation Project was launched by the Nature Conservation Society of Japan (NACS-J), i.e. the pioneer environmental NGO in Japan. This project was initiated by the Gunma prefectural government in their attempts to understand the mechanism of environmental destruction which will then serves as a foundation for an effective conservation policy making.

The project members comprise of expertise from various universities and, research institutes as well as private consultants. As illustrated in Figure 2, Mt. Sibutsu Management System (SMS) composed of three survey teams, namely the geological, vegetation and visitor use survey team, led by NACS-J. The main objectives of SMS include the examination of various environmental impacts as a consequent of the

existing vegetation patterns, geological and visitor-use and to establish the correlation between these factors. It is also of interest to identify areas susceptible to future land development. Such information is crucial in formulating effective land protection strategies.

Here, we report on the survey conducted by the visitor use survey team, mainly focuses on the adverse environmental impact due to external facilities (e.g., trails and benches) and visitors-use (e.g., hikers' step)

**Figure 2. Mt. Sibutsu Management System**



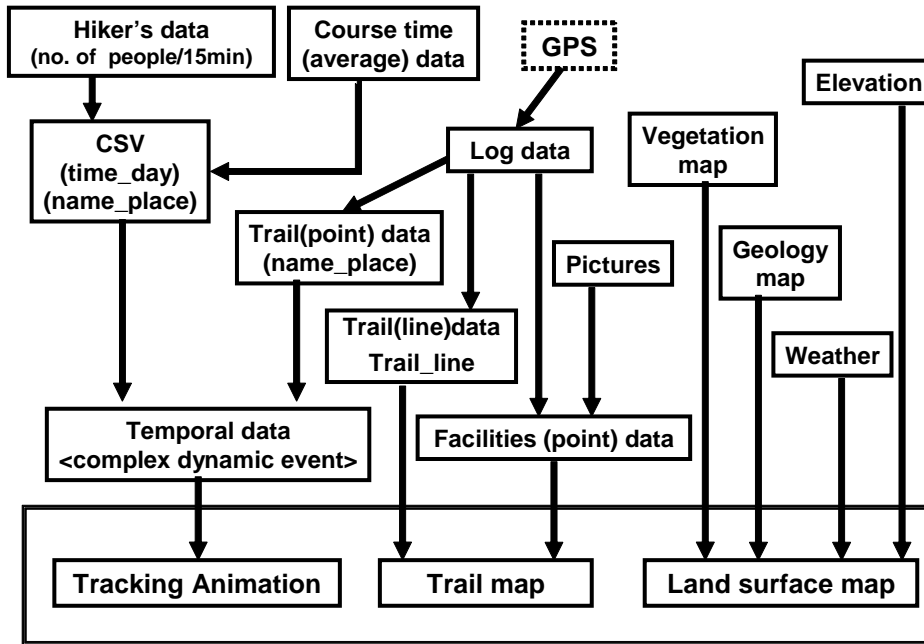
Apart from being a useful research tool, SMS could be utilized by park management staff in obtaining essential trail maintenance information. Moreover, this information can be made available for public use either via the website or PC at the on-site information center, allowing the visitors to research for specific information concerning the trail prior to their visit.

### **3. METHODOLOGY & FINDINGS: Visitor use survey by Tracking Analyst**

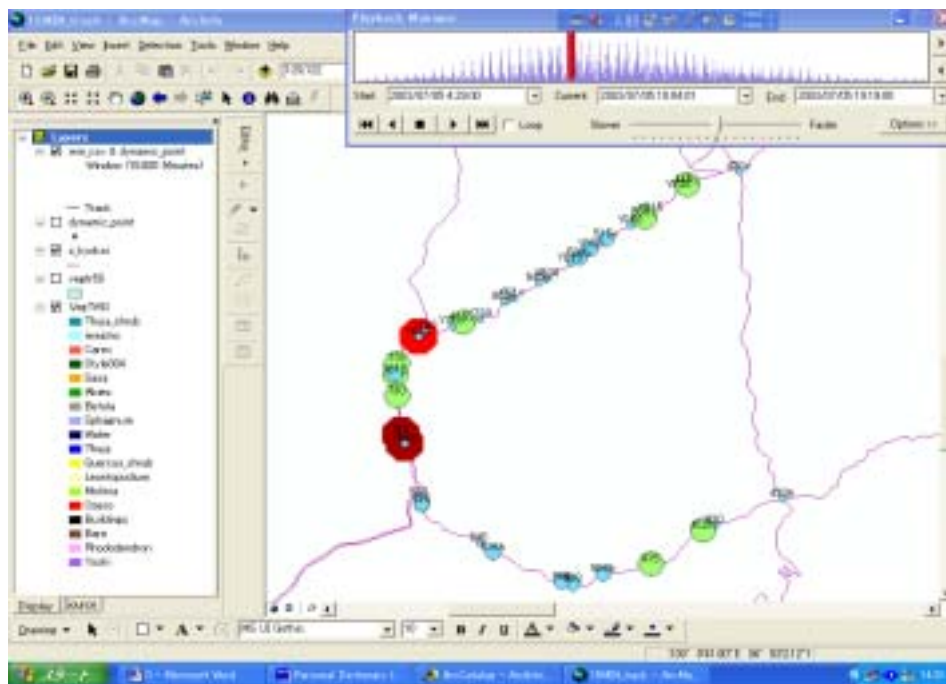
ArcGIS's extension Tracking Analyst was used in identifying specific time and area of congestions. Trail data and the positional information of trail were compiled using the Global Positioning System (GPS). Numbers of visitors were counted at the two gates mentioned (the gate Hatomachi-touge and the gate Yamanohana) at a 15 min interval between 4 a.m. to 4 p.m. on a Saturday (July 4th 2003), i.e. one of the busiest days during the peak season. Implementation of SMS in ArcGIS Tracking Analyst is simplified using a flow diagram as illustrated in Figure 3.

Based on the data collected, areas and times of trail congestion could be visualized using ArcGIS Tracking Analyst, as shown in Figure 4.

**Figure 3. Flow chart of SMS in Arc GIS Tracking Analyst**



**Figure4 Visitor use visualization by ArcGIS Tracking Analyst**



#### **4. CONCLUSION**

ArcGIS and its extension Tracking Analyst were successfully used in identifying areas that are especially susceptible to environmental damages due to the aforementioned factors. This information can be utilized in the formulation of an effective land protection strategy for the highlighted areas; hence results in a sustainable Mt.Sibutsu trail resources and providing an ever-lasting hiking opportunity.

In addition, ArcGIS Tracking Analyst can be used to simulate variation in visitors' movement due to zones closure and conservation activities. Hence, allowing the management team to acquire a more objective ground in their actual measure takings.

#### **Acknowledgement**

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