

# Building a GIS database for ecotourism development in Ba Vi District, Ha Tay Province, Vietnam

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**Abstract.** Ecotourism is a concept and a fast growing segment of the tourism industry worldwide. It plays an increasingly important role in the socio-economic development of many districts and provinces in Vietnam. Therefore, it needs to be well planned and managed with the aid of spatial information technologies such as Remote Sensing (RS), Geographic Information System (GIS) and Global Positioning System (GPS). This paper presents the results of building a GIS database for ecotourism development in Ba Vi, a large legendary mountainous district of Ha Tay Province based on field and desk investigations. The created database consists of spatial and attributive data files related to natural and cultural resources in Ba Vi stored in a standard format of ArcView GIS that can and should be effectively retrieved, analyzed and updated to generate useful information in the form of maps, tables and charts to support ecotourism planning and management activities in the district for sustainable development.

*Keywords:* ArcView; GIS; Database; Ecotourism.

## 1. Introduction

In recent years, ecotourism has become a fast growing segment of the world tourism industry. It can be differentiated from traditional tourism in that it not only attempts to minimize the environmental effect of tourism, but also has the goal that local communities and the physical environment will actually benefit from tourism. In its ideal form, ecotourism is a philosophy, an activity, a development policy all at the same time [8]. According to the official definition of the World Conservation Union (IUCN), ecotourism is "environmentally responsible travel and

visitation to relatively undisturbed natural areas, in order to enjoy and appreciate nature (including any accompanying cultural features - both past and present), that promotes conservation, has low visitor impact and provides for beneficially active socio-economic involvement of local populations" [2]. However, for Third World countries, ecotourism, according to Pleumarom [9], can become an ecological and economic trap (bad loan, oversupply,...). That is why it needs to be well planned and managed.

In Vietnam, ecotourism has captured the attention of researchers, investors, and authorities in an effort to boost economic development and environmental protection throughout the country. It is defined as a type

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of tourism based on nature and indigenous culture, which necessarily includes environmental education, and contributes to conservation efforts and sustainable development with the active involvement of the local community [6]. As a tropical, developing country in the Asia Pacific region, and a new member of the World Trade Organization, Vietnam has a great potential for ecotourism development. However, the data and information on ecotourism in Vietnam is still very limited. To fill this gap and help further development of ecotourism in the country, more studies should be carried out and their results should be widely disseminated through different channels. This call for the application of spatial information technologies such as remote sensing, GIS and GPS to develop databases to support ecotourism planning and management at national, provincial and district levels.

This paper describes the research effort to build a GIS database for ecotourism development at the district level with special reference to Ba Vi District, Ha Tay Province in northern Vietnam,

focusing on its local nature and culture. It is believed that the research results will serve as a sound basis for Ba Vi's ecotourism planning and management, and the experience from Ba Vi can be applied to other districts in the country.

## 2. Study area

The study area is the largest and northernmost district of Ha Tay Province. It is located about 60 km west of Hanoi and bordered with provinces of Phu Tho, Vinh Phuc and Hoa Binh (Fig. 1). Ba Vi is a forested district with three mountain peaks: Dinh Vua (1298 m), Tan Vien (1227 m) and Ngoc Hoa (1180 m) surrounded by low undulated hills, and watersheds.

The rock types in Ba Vi include Precambrian, Paleozoic, Mesozoic, and Kainozoic rocks. The soil types comprise red yellow, brown red and yellow feralite soils, red brown basaltic soils, alluvial soils, valley soils, and gley soils.

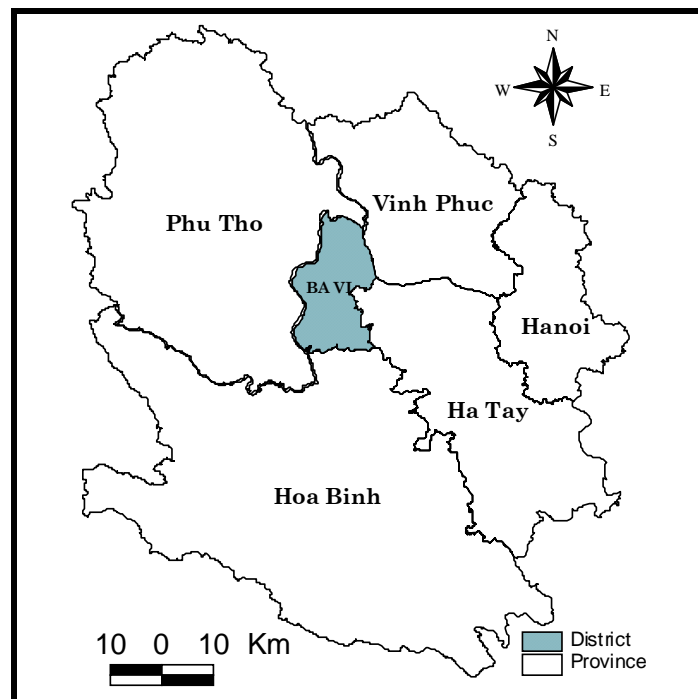


Fig. 1. Location of the study area.

The climate is tropical with hot humid summer and cold dry winter. It is altitudinally differentiated into microclimatic zones, particularly favorable for summer tourism. The mean annual temperature is about 23-25°C in the areas below 100 m, 20°C at 500 m, and 18°C at 1000 m elevations. The mean annual rainfall is 2000-2500 mm.

Water resources are represented by Da River, Red River, other small rivers, streams, lakes and reservoirs. Stream density varies from 0,1-1,5 km/km<sup>2</sup>, tending to increase as one goes farther from the Ba Vi peak. Many small streams have been embanked to serve agriculture and tourism.

Vegetation resources comprise natural forest, planted forest, shrub, orchards, rice and grazing fields. There are three types of forest distributed on the Ba Vi Mountain: tropical humid evergreen closed forest, subtropical humid evergreen closed forest, and subtropical mixed broadleaf-needleleaf forest. The Ba Vi National Park (BVNP) was established in 1991 with an area of 7377 ha to conserve biodiversity. The natural forest is mainly distributed at elevations above 600 m. Rare and precious species consist of *Calocedrus marcrolepis* Kurz, *Podocarpus neriifolius*, *Madhuca pasquieri*, *Michelia baviensis*, *Cyathea gygantea*, *Tacca chandrieri*. Endemic species are *Caryodaphnopsis baviensis*, *Litsea baviensis*.

Ba Vi District consists of a township and 31 communes with a total area of about 440.34 km<sup>2</sup>, and a population of about 250,000 people. Kinh, Muong, and Dao are three major ethnic groups living in the area. Their main economic activities are agriculture, forestry and tourism. According to IFPRI (International Food Policy Research Institute) and IDS (Institute for Development Studies) [5], Ba Vi is a poor district with 40-50% of people live below the poverty line. It is believed that ecotourism activity can contribute actively to poverty reduction and sustainable development in Ba Vi District.

According to statistics, the number of tourists coming to Ba Vi has been increasing [1]. However, the number of international tourists is still limited, only about 1%. This may be attributed to unsuitable visit conditions, lack of data, information, and limited advertising. The lack of spatial and non-spatial data necessary for ecotourism planning and management in Ba Vi can be found at both the district departments and the national park management board. This study is an attempt to deal with such a problem by creating a GIS database that allows efficient ecotourism related data input, management, analysis and output.

### 3. Data and methods

#### 3.1. Data

The data used to build the GIS database for ecotourism development in Ba Vi come from different sources including existing maps, atlas [7], research reports, newspapers, magazines, journals, brochures, travel guides, websites and ground survey in the form of text, maps, imagery and pictures. They can be primary or secondary, digital or analogue that depict locations, shape, extent and attributes of natural and cultural resources in the district such as mountains, rivers, springs, falls, lakes, reservoirs, national park, forests, gardens, road network, schools and existing ecotourism sites. They constitute the key themes and attribute tables in the designed ArcView GIS database.

#### 3.2. Methods

The GIS database development required the use of different hardware and software. The hardware used includes PC, laptop computers, scanners, digitizers, printers, GPS receiver and digital camera. The GIS, spreadsheet and database management software packages including MapInfo, ArcView, Idrisi, MS Excel, MS Access were used to create the required themes and

tables in the ArcView GIS environment.

ArcView GIS by the Environmental Systems Research Institute (ESRI) was adopted for this research because of its popularity, ease of installation, ease of use, power, flexibility, intuitivity and extendability. The software is the premier solution for desktop GIS analysis and map presentation. It lets one work with maps, tables, and charts all in a single application [3, 4].

The procedure for developing the GIS ecotourism database for Ba Vi in ArcView includes data collection, data input, data management, data analysis and data output.

The data collection involved surveying and collecting available data and primary data in and outside the district. This work was carried out in the office and in the field. The Internet search engines were employed. During the field investigations, hand held GPS was used to collect spatial data of features of interest and for geo-referencing and updating existing digital maps. Still pictures were taken using digital camera.

During the data input, methods of manual digitizing, scanning, keyboard entry and data conversion were employed. Analogue maps were scanned, digitized using Microstation, MapInfo, and ArcView. GPS data were entered in Excel and imported to create ArcView themes. The data in MapInfo format were converted into ArcView format using Universal Translator.

The data management was performed to ensure efficient storage of data files on different media such as hard disk, CD, DVD and USB and in the right map projection. This involved renaming, copying, deleting and saving data files. The data files were analyzed by location or attribute to create Ba Vi specific themes and tables. Finally, the output from the database was made in the form of hard copies, electronic copies using the above mentioned hardware and software tools.

#### 4. Results and discussion

As a main result, an ArcView GIS database was developed which contains spatial and attribute data files of natural and cultural resources in Ba Vi. The spatial data include feature themes (e.g., points, lines, polygons) and image themes (e.g., satellite images, and ground photos) (Fig. 2, 3, 4, and 5).

The themes and associated tables in the database allow one to view, query, and analyze ecotourism in Ba Vi. For example, different ArcView GIS project files can be created containing one or more views with multiple themes that can be displayed, queried, and edited to allow for various spatial interpretations of the Ba Vi ecotourism opportunities.

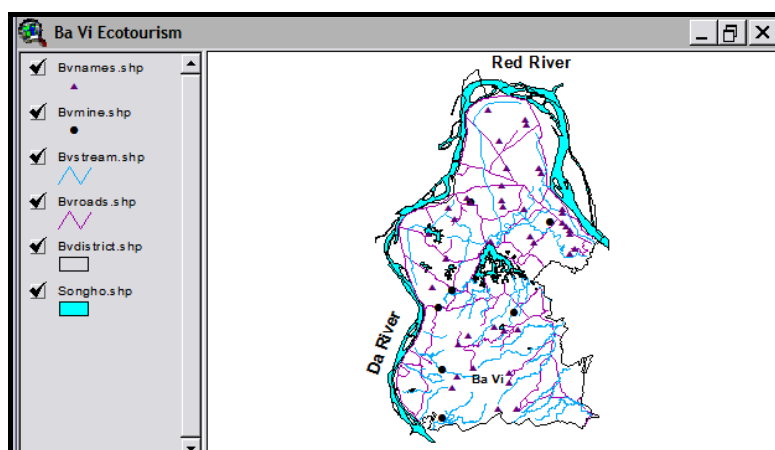
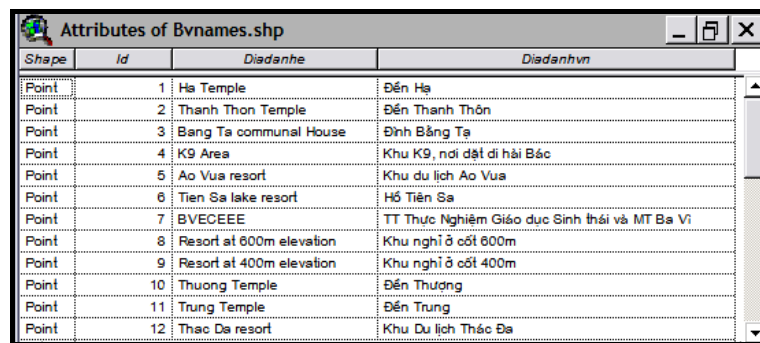


Fig. 2. Example of feature themes in the database.



| Shape | Id | Diadanhe                 | Diadanhnv                                     |
|-------|----|--------------------------|---|
| Point | 1  | Ha Temple                | Đền Hạ  |
| Point | 2  | Thanh Thon Temple        | Đền Thanh Thôn                                |
| Point | 3  | Bang Ta communal House   | Đình Bằng Tạ                                  |
| Point | 4  | K9 Area                  | Khu K9, nơi đặt di hài Bác                    |
| Point | 5  | Ao Vua resort            | Khu du lịch Ao Vua                            |
| Point | 6  | Tien Sa lake resort      | Hồ Tiên Sa                                    |
| Point | 7  | BVECEEE                  | TT Thực Nghiệm Giáo dục Sinh thái và MT Ba Vi |
| Point | 8  | Resort at 600m elevation | Khu nghỉ ở cốt 600m                           |
| Point | 9  | Resort at 400m elevation | Khu nghỉ ở cốt 400m                           |
| Point | 10 | Thuong Temple            | Đền Thượng                                    |
| Point | 11 | Trung Temple             | Đền Trung                                     |
| Point | 12 | Thac Da resort           | Khu Du lịch Thác Bà                           |

Fig. 3. An attribute table in the database.

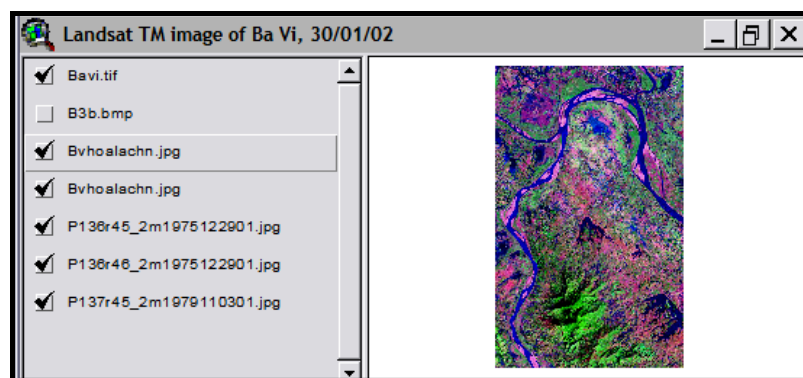


Fig. 4. A satellite image theme in the database.

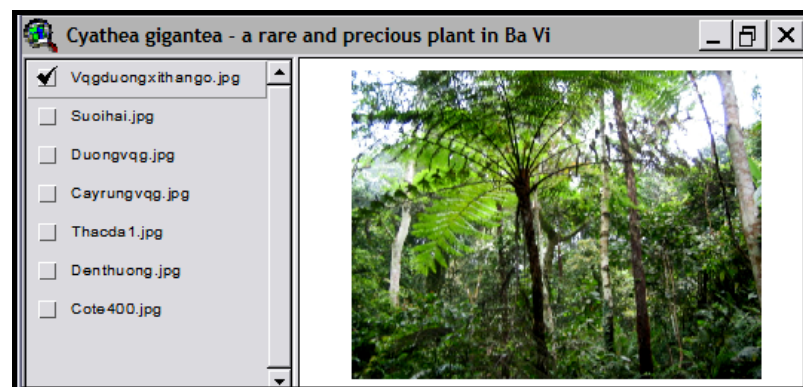


Fig. 5. A ground photo of tree ferns in Ba Vi National Park.

The database meets the needs of spatial and attribute analysis to derive useful qualitative and quantitative information about locations of ecotourism sites, best or nearest lodges, optimum plan for sight seeing and shortest route in getting to ecotourism destinations. The database and its products can be used for

efficient marketing of ecotourism activities and destinations in the district.

In other words, from the GIS database, various outputs including maps, graphics, pictures are generated to support education, planning, management and promotion of ecotourism in Ba Vi. The ArcView maps

generated from the GIS database can show the extent of Ba Vi District, as well as hydrology, roads and major ecotourism sites in and around BVNP, including Khoang Xanh, Ao Vua, Thac Da, Bang Ta - Dam Long, Ngoc Nhi stork garden, Suoi Hai reservoir. Ecotourism routes can be developed to connect BVNP, Suoi Hai reservoir, Ao Vua, Khoang Xanh, Dam Long or can start from VNU's Ba Vi Experimental Center for Ecological and Environmental Education (BVECEEE) to Ba Vi peaks; to Da Chong, Minh Quang; and Xom Quyt amian extraction site.

Specific activities or products that can be developed in Ba Vi include destination lodge (ecolodges or resorts), freshwater fishing, forest walk, mountain biking, hiking, nature observation, bird watching and wildlife viewing, attending a festival, a cultural event, visiting an ethnic minority village, a historic site.

The created database is a powerful tool to explore local ecological factors, admire, and enjoy the natural beauty, biodiversity as well as cultural values of the Kinh, Muong and Dao people living in the area. This digital source of data and information is essential to understanding and conserving the unique character of Ba Vi District. It is a well structured database, which can be easily updated, and expanded to meet the future needs of ecotourism development in Ba Vi.

## 5. Conclusions and recommendations

Ba Vi District, Ha Tay Province in northern Vietnam is a forested area with great ecotourism potential. An ArcView GIS database has been developed for ecotourism development in the district using different data sources, popular GIS and other software packages. It consists of spatial and attributive data files of local natural and cultural resources.

The created GIS database is useful in thematic mapping, tabulating and charting to support education, planning, management and promotion of ecotourism in Ba Vi. It is a tool to

raise awareness and advertise Ba Vi ecotourism products more, faster and better.

The database can and should be used for further studies in Ba Vi ecotourism using remote sensing, GIS and GPS. It can be easily and quickly updated and expanded as new data become available. It is also desirable to upgrade with sound data to form a multimedia GIS ecotourism database.

Finally, the experience of GIS database development for Ba Vi District can and should be applied to other districts in the country to better capture, store, manage, analyze and display data for sustainable ecotourism development.

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