Preservation and Valorisation of cultural and environmental resources and information systems, an investigation into a Web GIS

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ABSTRACT

One of the most important uses of a GIS for the cultural and environmental resources would be in the planning of tourism. Cultural tourism is both a friend and for of historic and natural sites. The money it brings in can be used to support the management of the site and to benefit the surrounding community, which is particularly important in developing countries. The study highlites how the introduction of digital information technologies such as Geographic Information Systems (GIS) and the World Wide Web influences both the preservation and valorisation of cultural heritage and attraction for tourist consumption. Since the social and cultural context of an organization influences the chances of reaching the goals of any new policy or technology, implementation should be seen as a process of social interaction between the technology and its organizational context. Adoption of a Web GIS cannot succeed unless those who use it are convinced of its legitimacy, are well-trained in its use, and have adequate support. The case-study affords easy and rapid collection and dissemination of spatial information in Sicily and would be based on such factors such as cultural and natural resources, biodiversity and the capacity for assimilation of any impacts and residues produced.

1 TECHNOLOGIES FOR THE CULTURAL TOURISM

Heritage tourism, as a part of the broader category of "cultural tourism", is now a major pillar of the nascent tourism strategy of many countries. Cultural heritage tourism strategies in various countries have in common that they are a major growth area, that they can be used to boost local culture, and that they can aid the seasonal and geographic spread of tourism (Richards, 1995).

New Information and Communication Technologies for Cultural heritage is a rapidly growing niche market. This market is fuelled by an increasing number of studies on the field of cultural heritage and by the increasing availability of web communication. Recent studies about cu1tural heritage tourism and new information and communication technologies have focused on identifying the characteristics, development, and management of cultural heritage tourism, as well as on investigating demographic and travel behaviour characteristics of tourists who visit cultural heritage destinations. Micelli and Di Maria (2000) provided a common pattern of cultural heritage towns by analysing the way in which digital technology have significally changes consumer's demand. Musumeci (2000) also analysed how that the exploitation of cultural patrimony produces a positive impact on the economy, particularly in those areas that are better equipped from a cultural and tourist point of view. Formica and Uysal (1998) explored the existing markets of a unique annual event that blends internationally well-known cultural exhibitions with the new information and communication technologies.

ICOMOS analysed how the Preservation planning is perhaps the most effective use of some particular technologies such as geographic information system, since careful planning can prevent some threats to Cultural Heritage sites before they become problems.

ICOMOS and UNESCO are supportive of tourism to Cultural Heritage sites; in fact, the very idea of the World Heritage implies public access to these sites. On the other hand, both organizations are concerned about the destructive effect which tourism can have on a site. According to an article in the *UNESCO Courier* from 1996, UNESCO encourages study and action in four areas:

- defense and promotion of the cultural heritage and cultural identity;
- protection of the natural environment against inroads from tourism;
- encouragement of a form of tourism that respects the social, cultural and natural environment and provides a basis for development;
- extension of cultural tourism activities that generate income and jobs, especially for young people in developing countries. (Bequette, 1996)

UNESCO and ICOMOS are not alone in their concern for sustainable tourism. In 1995, 500 participants in the World Conference on Sustainable Tourism adopted the Charter for Sustainable Tourism. This Charter states, "Tourism should contribute to sustainable development and be integrated with the natural, cultural and human environment; it must respect the fragile balances that characterize many tourist destinations, in particular small islands and environmentally sensitive areas. Tourism should ensure an acceptable evolution as regards its influence on natural resources, biodiversity and the capacity for assimilation of any impacts and residues produced."

States Parties are encouraged to document and protect all culturally and naturally important sites within their borders, not just those which are already listed as World Heritage sites. On such a large scale, tourism planning can play an important role in the protection of sites. For example, some sites are over-visited while others have not yet been discovered by tourists. One way to protect over-visited sites is to divert tourism to other sites. Which sites to develop for tourism should be decided not only on the basis of the sites' cultural or natural interest but also on their ability to support tourism.

For both natural and cultural sites, a tourism carrying capacity can be calculated using a GIS. This analysis would be based on such factors as soil type, biological fragility (some species can tolerate more human interaction than others), topography, and hydrology. Other factors to consider would be the proximity of existing infrastructure such as roads and airports, and the proximity of other sites

of interest. Spatial elements such as these are important to consider not only in the selection of a site to develop, but in the planning of that site. A large natural area may have many possible entry points, but one may wish to encourage entry in a particular location because of its lower fragility and proximity to other sites of interest.

A model for the selection of a tourist destination could include the following elements:

Cultural Elements	**Natural Elements**
Favorable: Proximity to roads	Soil Type
Type of road (capacity & speed)	Steepness
Proximity to airports	Aspect (e.g. north-facing)
Capacity of port	Biological Fragility
Proximity to border Proximity to population centers Size of population center	Proximity to wild populations (e.g. large mammals or bird colonies
Proximity to cultural monuments	Proximity to special geographic points (e.g. beaches, caves)
Importance of city centres	Importance of geographic points
Unfavorable: Visual access to distracting views	Visual quality (views)

Table 1: Cultural elements for tourist destination

These lists could be expanded upon, but considering only the elements listed above would result in a complex model. To perform all of these analyses with paper maps would be extremely time-consuming. With a GIS, the task of analysis is much simpler. Analysis commonly begins with an operation to remove unsuitable sites from the analysis, those sites which do not meet the boundary conditions. Then the remaining sites are rated in a multi-step process and spatial aspects are weighted according to their importance.

A GIS does more: it allows the user to see spatial relationships such as clusters of sites, patterns of distribution (linear groupings which may suggest a tourist route rather than a single destination), and relationships to other elements which may not have been clear in the initial formulation of the model. Spatial models usually include the option of refining the model at several stages, because the analysis process usually reveals erroneous assumptions. It is the automatic and rapid display of selected spatial data as a map which allows a researcher to explore many alternatives and to perform a complex analysis in a reasonable time period.

The Charter for Sustainable Tourism states, “all those responsible” must take upon themselves a true challenge, that of cultural, technological and professional innovation, and must also undertake a major effort to create and implement integrated planning and management instruments."

2 PROJECT OVERVIEW: THE CASE STUDY

The architecture of the web GIS includes the definition of the information space in terms of identification and representation of its contents, and of the protocols that support the interaction of agents in an information system making use of the space. Web architecture is influenced by social requirements and software engineering principles. These lead to design choices and constraints on the behaviour of systems that use the Web in order to achieve desired properties of the shared information space: efficiency, scalability, and the potential for indefinite growth across cultures and media**.**

The Etna Park of the on-line environmental resources (www.parcoetna.it) represents an important Web source. It is based on an integrated platform which incorporates on-line resources, contacts, information, and administrative programs and services. According to the article in the *UNESCO Courier* from 1996, its principal tasks are:

- the implementation of a web tool for the environmental protection and valorization
- the evolution and the development of the web GIS portal in the future

- the development of Web services and activities
- the extension of cultural tourism activities that respects the social, cultural and natural environment

Based on these considerations the project goal was to develop a single, operational and technical prototype (software and services) which can be set up as a web GIS offering to visit on the internet sources on number of sites (elements of significant architectural, archaeological artistic and historic value, natural areas protected by law such as SIC and ZPS, etc). It works as a joint portal (vertical portal)[36] and GIS.

The geographic access of data through the geographic information technologies stores environmental data on a GIS platform. The system is able to easily produce several services such as real-time thematic maps, more or less complex visualizations, in order to implement tourism on-line services and cultural and environmental promotional tasks.

The GIS on the Web integrates in the same record cultural sites and describes cultural and environmental heritage of the Etna Park and its cultural activities.

The GIS integration with internet has some principal benefits. The position of tourist objects (such as hotels, restaurants, bed and breakfast, sights, event location, etc.) onto map has the objective to integrate tourist information and GIS data. For this reason the location of each tourist object is integrated on to map and identified by geographic coordinate. As user can identify the object location of their objects by selecting the objects position on the map. The geographical coordinates is calculated by the GIS system and is stored in the GIS database. At map creation the object is represented on the map by means of a meaningful object symbol, the object name, the category if the object is an hotel. The object symbols are linked with the homepages to enable further navigation.
The primary sources of information are the cartography of I.G.M.I. (Italian National Geographical Military Institute) and other different cartography (CTR "Carta Tecnica Regionale" sc 1:10.000, parcel orientation maps, development constraints and zoning maps, infrastructure maps, and orthophoto-based site maps, etc.), then projected on the different layers. The GIS is organised according to administrative territory of the Etna Park, within which shapefiles and tables are divided in "base map" layers.

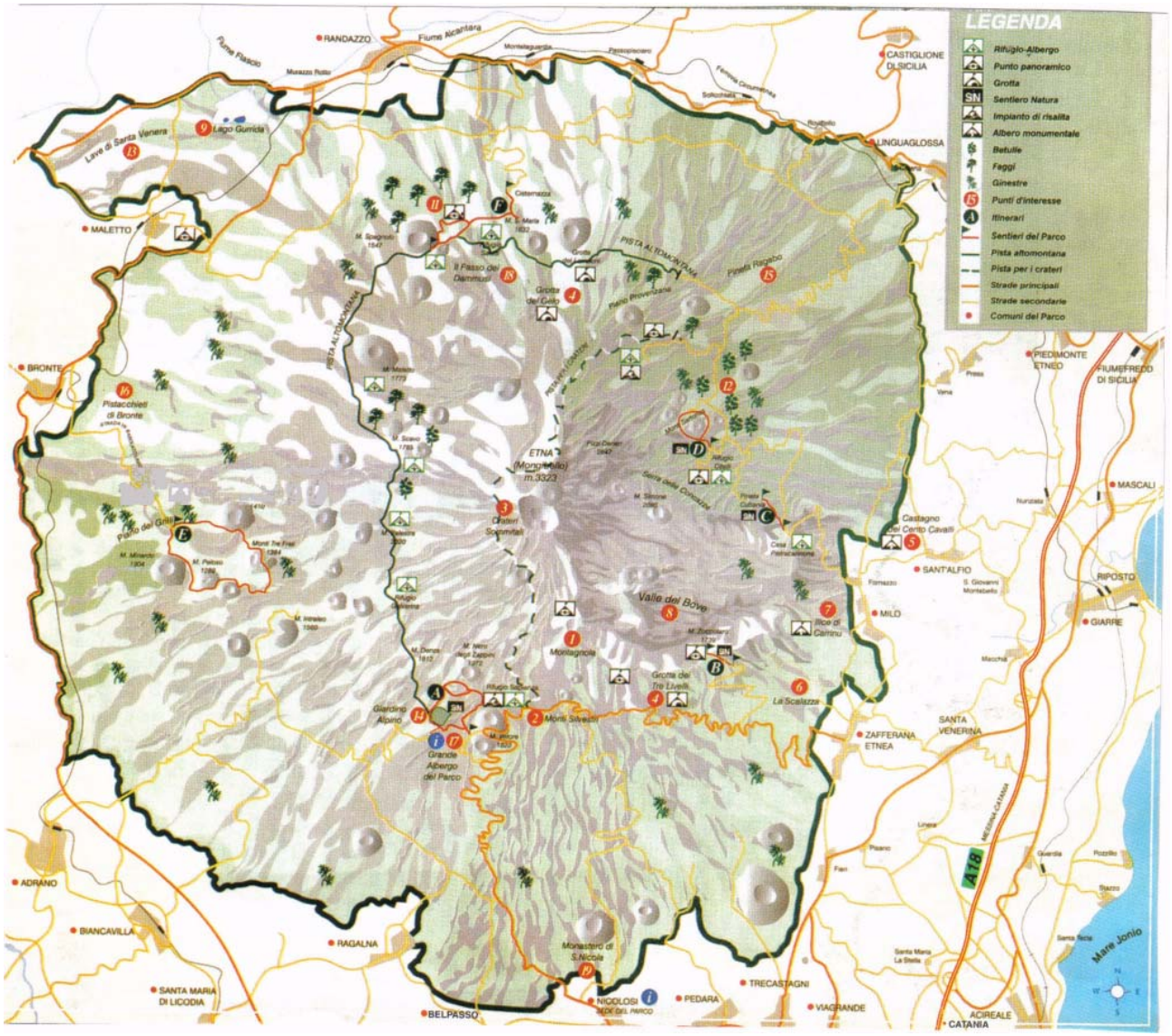
This GIS system involves creating an extensive geographic database that includes many types of *"mappable"* information: roads, zoning, digital orthophotos, utilities, streams, elevation, soil types, parcel boundaries, steep slopes, floodplains, etc. An ArcView GIS system was established (from scratch) to house the geographic database, which was then used to develop high-quality maps and graphics that depict economic development opportunities located throughout Etna Park. The second phase involved designing World Wide Web pages which incorporate the maps and graphics - along with text and photos - into a complete, computer-accessible marketing package.

The Web pages are designed to stimulate local job creation by promoting land development, new business investment, and tourism. The Web sites orient users with locator maps, and allow them to access detailed information on the area based on their interests. For example, this system implements spatial relationships and clusters of itineraries such as Burò, Gurrida, Monte Nero-Zappini, Monte Zoccolaro, Pietracannone-Cubania (http://www.parks.it/parco.etna/Eiti.html) of which suggest tourist routes and charming itineraries also for disabled people rather than single destinations (religious buildings, terracings, dry stone walls, the stone "casudde", the folds, etc).

A family planning a vacation to the Etna Park can also point and click their way to information on Etna Park's visitor attractions, lodging, entertainment, historic places, campgrounds, and vast natural amenities. The project Web sites are being linked to other sites on the World Wide Web to increase their usefulness and reach.
Because of this, GIS on the Web covers a wide range of audiences (exsterna; internal) such as tour operators (in particular in the field of cultural tourism), experts in the field of education and training, small and medium-sized enterprises, citizens and in particular the joung generation, techical and administrative staff.

It is useful for administrative management of the Etna Institution (for internal users) and the data necessary for describing the environmental sources (for external or general users). Because of this, different user interface is dedicated to the Administrators or more skilled personnel of the Etna Park Institution, which has the task of implementing databases and web sources. For this reason it contains all functions - tools and buttons – of GIS software (the native ArcGIS) plus tool windows with newly created buttons for the choice of the type of selection for the implementation of the databases and sources.
In other words it is possible to distinguish two search modalities: access for "general users" and access for the members of the staff itself.
This organisation permits to transfer quite easily the entire database under the web GIS structure.

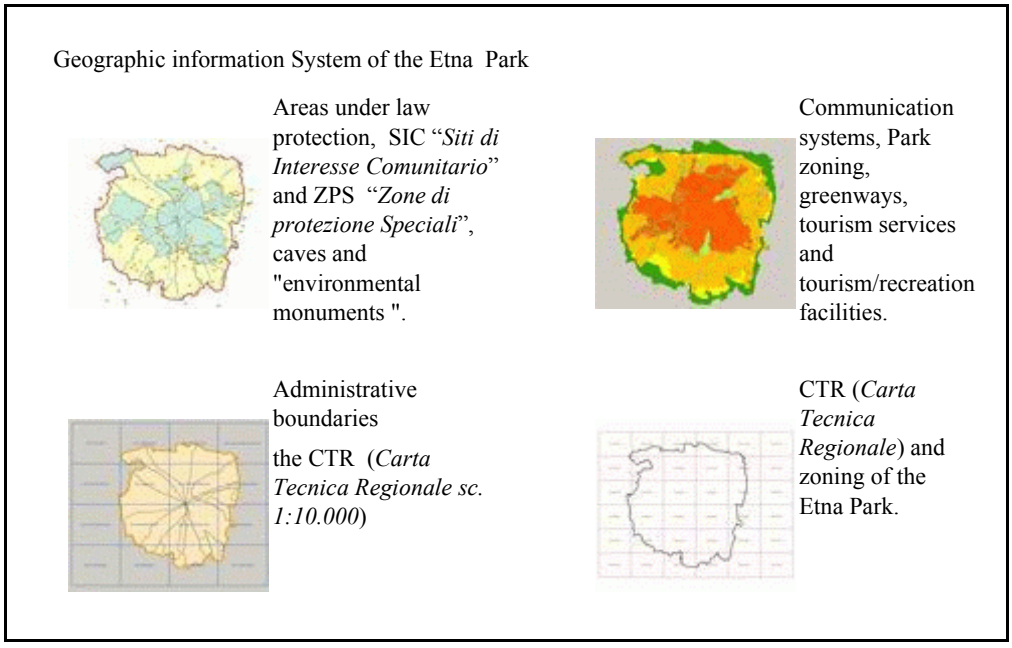
[36] According to Eisler (2000) there are two broad categories of portals -- Horizontal and Vertical. Horizontal portals provide links to a broad spectrum of information across various categories on the same Web page. An example is Yahoo!, where every visitor to the site sees the same display of information categories and these categories range from news to shopping, email, entertainment and so on. They aim to provide all the information a person could be seeking on the Web. Vertical portals (vortals) on the other hand, provide information on a single subject, closely related subjects, or information directed at particular groups of users. Vortals can provide a unique view to a user by recognizing the user class to which they belong, through an authentication process.



Graph 2: GIS on the internet - Cultural elements for tourist destination

The GIS of the Etna Park provides the integrate access to the following layers and maps:

- Administrative boundaries
- Zoning (A, Ha 19.200 – B, Ha 25.350 - C Ha 4.100 and D Ha 10.250);
- Woodlands, forest areas and vegetation;
- Protected areas (SIC and ZPS);
- Species (wild populations e.g. bird colonies - migratory birds, like ducks and grey herons) and their habitat
- Land use;
- Communication systems (Type of roads, railway "Circumetnea, greenways, etc.)
- Cultural heritage (religious monuments, rural industrial sites and buildings, etc.)
- Special geographic points (e.g. beaches, caves)
- Geomorphology and idrology
- Tourism services and tourism/recreation facilities
- Layer of the habitat boundaries



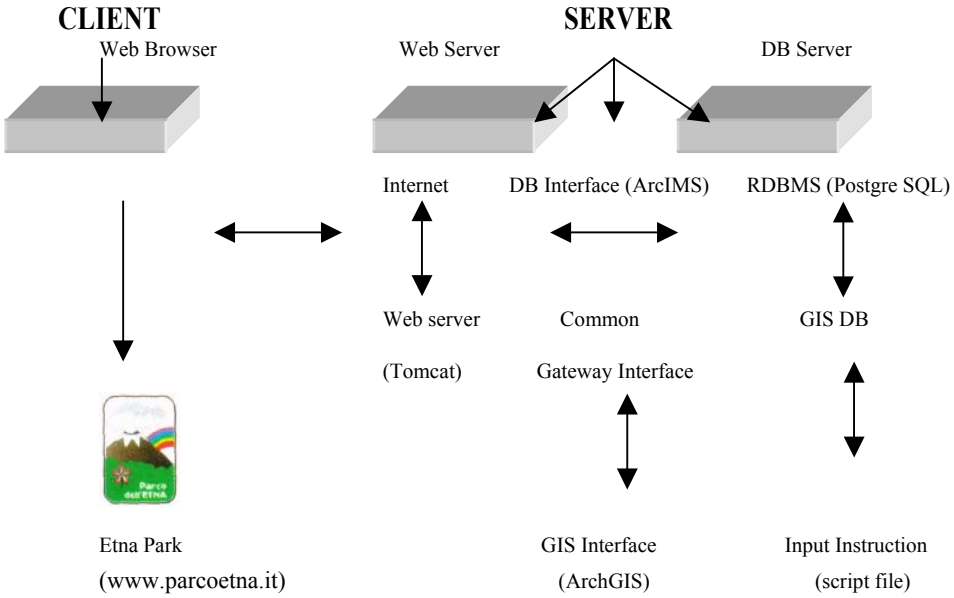
Graph 3: The interactive layers and maps of the GIS (produced by the GISAT www.gisat.it and financed by P.O.R. 2000-2006 - 1.11 "Integrated Information Systems" www.parcoetna.ct.it/sitgis.htm)

Dynamically generated, interactive layers and maps offer a variety of trend-selling functionalities like integration of vector shapes, images and performance panning inside of graphics without reloading data, in combination with the possibility of all related technologies. In particular, tourist maps in information system offer a powerful, clear and user-friendly access to tourism data with great benefits for substantial advantages for tourism information systems because maps change from static raster graphics to interactive graphical.

3 PROJECT OUTCOMES

Internet based geographical data services in the field of cultural and environmental heritage involve management spatial and non-spatial (attribute) data. As we have seen, Geographic Information System (GIS) has come to be an indispensable tool for analysing and managing spatial data. Data pertaining to spatial attributes were efficiently managed using Database Management System (DBMS Microsoft Access). The development of the Etna Park Web-based system by integrating GIS and RDBMS serves two crucial purposes. Firstly it allows the user to operate the system without having to grapple with the underlying intricacies of GIS and RDBMS technology. Secondly, it allows sharing of information and technical expertise among a wide range of users. The system described aims at providing a web-based platform for collaboration and data sharing between specialists, planning agencies, citizens, and private entities. In order to access the spatial database, the user need only have a Web browser and access to the Internet.

The system is a hybrid vector-raster GIS designed to provide digitising, image processing, map production, and GIS system capabilities to its user. The web GIS contains several routines for importing spatial data of a wide variety of commonly used formats. The spatial data included in prototype system consists of raster, vector and site data layers that provide the geographical reference. The RDBMS enables the fast storage and retrieval of large amounts of information. The interface that is used to insert, manipulate, and extract data is called the Structured Query Language (SQL). In case of the prototype system, the SQL database server has been used to manage the attribute data and multi-media content. The SQL works as an RDBMS, supporting almost all SQL constructs, including sub-selects, transactions, and user-defined types and functions. The database consists of tables that hold all the available attribute data. The attribute table includes fields that can be used to store binary data (images, multi-media contents etc.). Remote update of the database by permitted users is also made possible. An authentication mechanism to check which users can be allowed to enter new data or update the existing attribute data in the database is also provided.



Graph 3: Components and Information Flow within the GIS on the Web

Since a majority of commands can be executed in the command mode, it is quite easy to enhance the Links interface to provide added functionality to the system. Several additional features could be incorporated into the GIS web-interface to tailor the system for its present requirements.

The user could be able to select the data layers from an interactive menu based on which the raster layer is displayed on the web-browser. The user can also select vector maps and site data as overlays for raster map layer. Interactive zoom/pan capability will allow the user to view the displayed maps in greater details or to choose different areas for display. Once the desired area is displayed on the web-browser, the user is allowed to view the attribute table by "clicking" on respective site. The relation database is queried based on the geographical location of the "clicked" site. Attribute data is displayed in two stages. Firstly, a brief summary of the attribute information will be presented. The summary table also includes a hypertext link, which can be followed to view more detailed information including figures and field photographs will be also provided.

The application "search for tourist objects" will implement a geographic search to perform complex geographic queries to search for tourist objects like hotels, restaurants, event location, etc. A hotel search can be a time-based search and extends the map with availability information of rooms. To guarantee a sensible use, the user will have the possibility to zoom in or out to change the scale of the map, to scroll in the map and to print as well. In order to ease the administrative overload in maintaining the database, other options such as edit and delete and update functions will also be added in the final version of the system. Options for using thematic coloring, vector/site data overlay and rendering of animation sequences could also be supported. Apparently, one of the main limitations of the present system is the interoperability and non-compliance with widely accepted Web mapping standards. In using the system described above, access to spatial data requires the information to be stored in the GIS format and the GIS needs to be installed on the server in order to get the system running. The advantage in having a full fledged backend GIS running on the server would be the ability to implement online systems with spatial analytical capabilities rather than providing visualization or portrayal capabilities alone as are commonly available in other web GIS applications.

4 CONCLUSIONS

The explosion of new applications of information system shows that web GIS can be a powerful tool for heritage conservation and valorisation. As the vision of heritage preservation is evolving to consider sites and their context holistically, preservation will inevitably involve a greater use of electronic tools such as GIS. Adoption of this tool among researchers and conservationists will increase in the coming years, particularly for the documentation of larger sites and data. Apparently, one of the main limitations of the present system is the interoperability and non-compliance with widely accepted Web mapping standards. In using the system described above, access to spatial data requires the information to be stored in the GIS format and the GIS needs to be installed on the server in order to get the system running. The advantage in having a full fledged backend GIS running on the server would be the ability to implement online systems with spatial analytical capabilities rather than providing visualization or portrayal capabilities alone as are commonly available in other Web GIS applications.

The purpose of the project was to demonstrate the use of Geographic Information Systems and the Internet to market communities to relocating or expanding tourists nationwide. In the process, the project helped to build local information systems capacity; educate community leaders about cutting-edge information technologies; and boost local economic development strategies with a new tool: the web GIS. The web GIS of the Etna Park can be considered a work-in-progress: the contents of the database could be able to be implemented on line in real time from everywhere by the allowed users as the GIS has been designed to be dynamic and interactive.

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