

Application of GIS Technology in Spatial Planning for Geo-Tourism

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ABSTRACT:Geographic Information Systems are highly valuable in tourism planning. As technology increasingly advances, the use of urban planning tools through GIS applications is very well discussed in this dissertation. Geotourism is emerging sustainable tourism for untapped destinations all around the world. India is still finding geotourism spots and has a large scope for developing geotourism in India. Geotourism spots and potentials are also detailed with locations. The case studies regarding geotourism clouds are also added. Analysing these case studies, it is evident that India has rich topography that can be enhanced by geotourism which can create a new type of tourism.

The various tools in GIS are described, and a matrix of geotourism development is generated with the aim to use GIS as a decision-making tool in tourism planning, impact evaluation, and visitor flow management. By promoting the exploration of historical, natural, and cultural heritage, it indirectly contributes to improving cultural understanding between residents and foreigners. Local attractions are better appreciated and understood through internal tourism as well as improving sustainable tourism. Case studies highlighting India's geotourism clouds are also included. Analysing these case studies, it is evident that geotourism can enhance the economy and create new forms of tourism in India. One of the geotourism hotspots in India (Rajasthan) is chosen as the study area where the application of the tool can be done. A basic level of understanding of the tool is then gained. And deeper studies can be done at the thesis level by applying the matrix arrived at the end of research.

KEY WORDS:Geotourism, GIS,Matrix,Untapped destination.

I. INTRODUCTION

In this paper geotourism is well understood through the definitions and comparison with other

tourisms which is similar to the geotourism. Integrating GIS as well as geotourism is a major potential developer in the future of the tourism sector. The word geotourism was introduced by Dr. Ross Dowling, Geotourism is a new philosophy, "Geotourism(n): Tourism that sustains or enhances the geographical character of place, its environment, culture, aesthetics, heritage and the well-being of its residents."

Geo tourism is a new way of thinking about travel as a positive force in the world we explore and a benefit not just to local economics but to the places themselves to their preservation to cultural, history and to the future of local peoples and environments.

- Geotourism is the future of destination travel.

- A future of destination stewardship.

Today the world's great destinations are under assault as visitor numbers rise exponentially every year. The result is damage to the sites, overcrowding and erosion of the local culture and environment.

What characterizes geotourism?

The term "geotourism" first appeared in National Geographic Society articles only about 20 years ago. It is a form of environmentally friendly tourism, which aims to support and enhance the geographical character of a tourism destination, its biodiversity, culture, heritage and the well-being of its local population.[1]

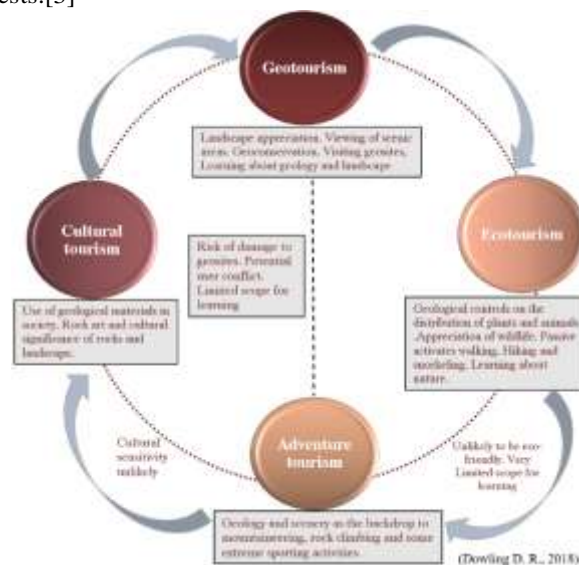
"Geotourism is defined as tourism which focuses on an area's geology and landscape as the basis of fostering sustainable tourism development. It begins with an understanding of the Abiotic (non-living) environment, to build greater awareness of the Biotic (living) environment of plants and animals as well as the Cultural environment of people, past and present. It is argued that geotourism offers a new form of sustainable tourism which is more holistic than previous niche forms of tourism. It promotes tourism to geo-sites and the conservation of geodiversity and an understanding of earth sciences through appreciation and learning.

This is achieved through visits to geological features, use of geo-trails and view-points, guided tours, geo-activities and patronage of geosite visitor centres.” [2]

Geotourism is

Environmentally responsible - committed to conserving resources and maintaining biodiversity
Culturally responsible - committed to respecting local sensibilities and building on local heritage
Synergistic - bringing together all elements of geographical character to create a travel experience that is richer than the sum of its parts and appealing to visitors with diverse interests.[3]

“Geotourism argues that to fully understand and appreciate the environment we must know about the Abiotic (non-living) elements of geology and climate first, as these determine the Biotic (living) elements of animals and plants. By extension, the combination of these components determines the Cultural landscape of how people have lived in the area in the past, as well as how they live there today. These are the key ‘ABC’ elements of geotourism, which is a new holistic approach to interpreting natural areas.”



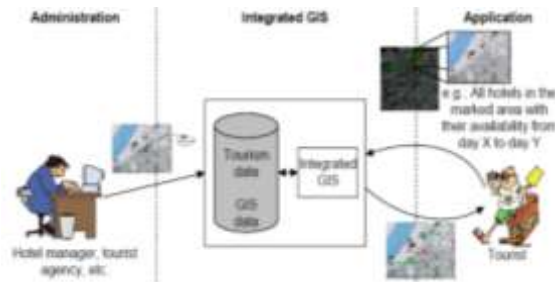
GIS IN GEO TOURISM PLANNING: -

GIS not only provides information on tourist attractions, but it is a database of geographical conditions, transportation, accommodation, ethnic groups of the population and more. GIS produces thematic maps which can help tourists understand their destination in a better and detailed manner. Technological advance, particularly in software and hardware, has resulted in the development of systems which provide a range of searching, querying, presentation and analytical functions in a more user-friendly manner.

5 FACTS ABOUT GEOTOURISM

•It involves the community, local businesses and civic groups join to provide a distinctive, authentic visitor experience.

- Geotourism is all the elements of geographical character work together to create a tourist experience that is richer than the sum of its parts, appealing to visitors with diverse interests.
- Benefits residents economically, travel businesses hire local workers, and use local services, products, and supplies
- Residents discover their own heritage by learning that the things they take for granted may be interesting to outsiders.
- As local people develop pride and skill in showing off their locale, tourists get more out of their visit. The residents who live in a historic area want to show tourist what their homes are like, their cultures, what types of foods they eat and also to show the world what beauty is really like if you really look close enough



NEED TO THE STUDY

Decision-making in tourism development and planning is becoming increasingly complex as organisations and communities have to come to terms with the competing economic, social and environmental demands of sustainable development. Geographical Information Systems (GIS) can be regarded as providing a tool box of techniques and technologies of wide applicability to the achievement of sustainable tourism development.

Spatial (environmental) data can be used to explore conflicts, examine impacts and assist decision-making. Travel businesses do their best to use the local workforce, services, products, and supplies. When the community understands the beneficial role of geotourism, it becomes an incentive for wise destination stewardship. Community interest in developing geo-regions and geotrails as the forerunner to geoparks will foster increased visitation to the regions and as such, will initiate product development, job generation and wealth creation over time.

- Development of framework/Matrix.
- Promote tourism for geosites.
- Asses and predict disaster impacts.
- Creation of cloud infrastructure.
- Destination branding.
- Find untapped travel destinations and pave a source for economy by geotourism promotion.
- Enhance Landscape Appreciations.

The following questions will ground the researchagenda and guide the study:

- 1.How to plan for geo tourism using GIS application?
- 2.What is the relevance of geotourism in spatial planning?

AIM: -

To identify the components of spatial planning for geo tourism using gis application

OBJECTIVES

1. To understand the concept of geotourism in spatial planning.
2. To identify and analyse elements of geotourism for spatial planning.
3. To analyse planning attributes of geotourism planning through best practices.
4. To study and analyse the application of GIS in geotourism planning.
5. To develop a matrix for geotourism planning using GIS.

SCOPE

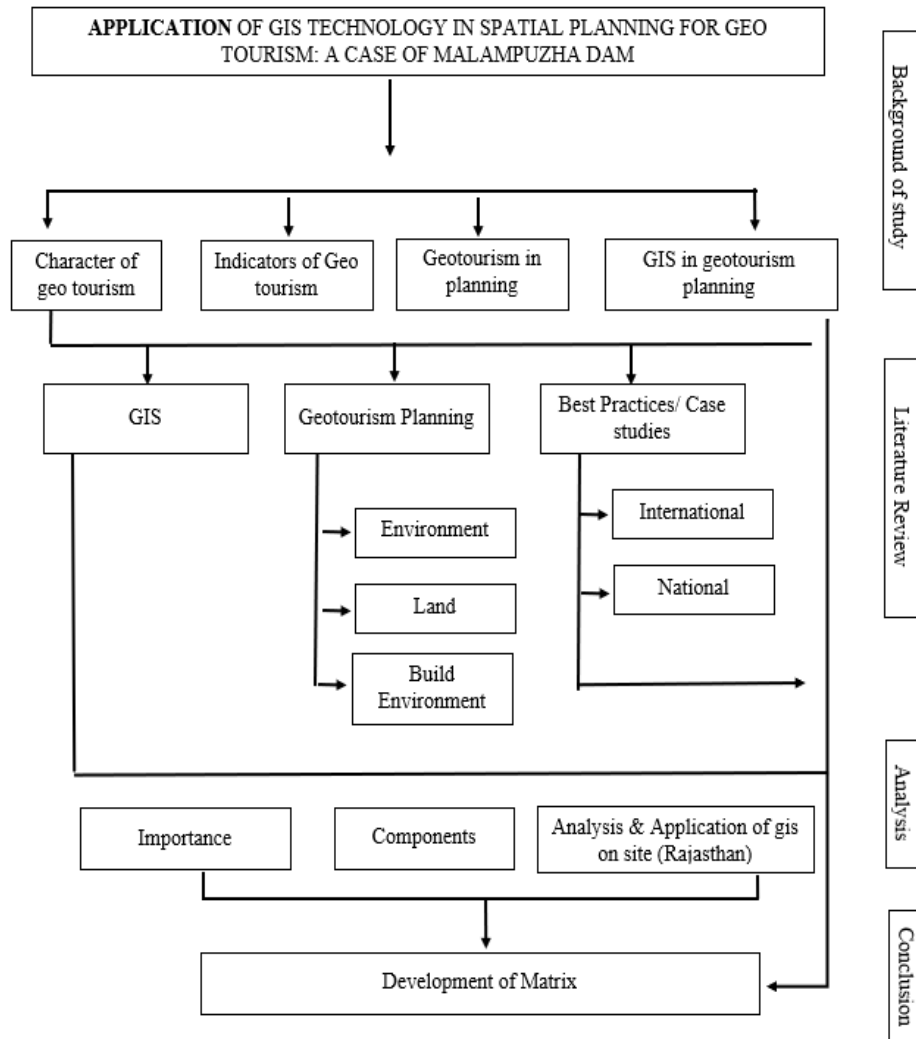
- Optimum planning for sightseeing.
- Query of geographical data.
- Obtaining the visual and detailed information about the geographical data and network analysis applications.
- Identification and promotion of untapped travel destinations.
- Creates increased GDP
- Can be build /modified in existing infrastructure.
- Justifies environmental protection and improvement
- Develop financial planning with stakeholder participation.
- Determination of important and necessary places for tourism. Especially untapped travel destinations. Which creates worldwide image for a destination and promotes global community.
- Determination of historical and tourist places.
- Determination of the best infrastructures and formation of cloud.
- Determination of the shortest distance between the selected places.
- Provide employment opportunity, both skilled and unskilled because it is a labor-intensive industry.

LIMITATIONS !!!

- GIS Software integration with traditional map is difficult.
- Some data analysis is impossible to perform.

- Lack of Registered Geosites and Data. And lack of Planning Research.
- Difficulty in Identification and promotion of untapped travel destinations for Geotourism.

II. METHODOLOGY



III. LITERATURE REVIEW

Literature review was done accordingly.

- Proper selection of Article from Journals and websites.
- Extraction of content from each article and identification of parameters
- Finding planning approaches incorporated if any
- Analyzing and pointing the conclusion of particular literature and finding gaps in it.
- Formulating inference and basic understanding is made for further studies.

ARTICLE (Name and Author)	AREA STUDY	PARAMETERS SELECTED	PLANNING APPROACH	CONCLUSION	INFERENCE
Geotourism: definition, characteristics and international perspectives. Ross Dowling and David Newsome	The geotourism spectrum	<ul style="list-style-type: none"> • Tourism • The Environment • Geotourism • The Geotourism Spectrum 	Nil	Understanding of definition and Characteristics of geotourism. And identified the area of applications for geotourism development.	It covers a range of topics, includes numerous examples and case studies, and essentially adds to our knowledge of geotourism that is rapidly growing globally. It describes how there are a range of views about geotourism, explores it in relation to society and sustainability, presents a number of ways it is being used for geoheritage interpretation and education, examines how it is contributing to geoparks, and showcases a number of ways in which it is being used to develop destinations around the world.
Application of gis for tourism Sureshkumar. M	Kanchipuram city is one of the important tourism locations in South India	<ul style="list-style-type: none"> • Tourism • Kanchipuram. • GIS • GPS • Tourism information. 	<ul style="list-style-type: none"> • The application of Geographical Information System (GIS) in tourism 	The created GIS database has supported the tourism activity in Kanchipuram. The database discussed in the report has not only useful for location identification, but also useful for planning and development activity in	GIS technique offers spatial location maps of different tourism spots and other tourism related information. In this study, GIS database was created for the tourism spots in the Kanchipuram city by using spatial and non-spatial data. Global

			<p>m information</p> <ul style="list-style-type: none"> • lanning and development activity in tourism. 	<p>tourism. The prepared digital map can be updatable and editable, so that in future updating of any information is possible. The spatial database can be used for spatial analysis also like proximity study for facility provision.</p>	<p>positioning system (GPS) device was used to locate the tourism and other tourism related spots in the study area. GPS data were incorporated in a GIS platform for creating different thematic maps.</p>
<p>The application of gis and its components in tourism</p> <p>Verkajovanović</p>	<p>Geographic analysis.</p>	<ul style="list-style-type: none"> • Tourism Information technologies. • GIS • Attribute data creation and multimedia development. 	<ul style="list-style-type: none"> • Objective of geographic analysis. • Network analysis 	<p>GIS use has so far provided successful results which promote importance of information over technology.</p>	<p>The reality is that geographic data in actual world come in many different formats. In this paper GIS has been established as a tool for collecting, analysing, modelling and visual presentation of tourist data.</p>
<p>Global Geotourism – An Emerging Form of Sustainable Tourism</p> <p>Ross K. Dowling</p>	<p>conceptualization of the nature and scope of geotourism</p>	<ul style="list-style-type: none"> • Geotourism Characteristics • community enhancing and fosters geoconservation • Geotourists 	<p>Nil</p>	<p>Geotourism has emerged as a credible sustainable tourism industry, which offers new development and employment opportunities for local people. It can generate a range of economic benefits for local communities</p>	<p>Geotourism is defined as tourism which focuses on an area's geology and landscape as the basis of fostering sustainable tourism development. It begins with an understanding of the Abiotic (non-living) environment, to build greater awareness of the Biotic (living) environment of plants and animals</p>

				including revenue creation, job generation, diversification and infrastructure improvement	as well as the Cultural environment of people, past and present. It is argued that geotourism offers a new form of sustainable tourism which is more holistic than previous niche forms of tourism
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INDICATORS AND SUB-INDICATORS

Literature reviews and case studies are used to arrive at indicators and subindicators. These indications and their relevance are flowcharted as well. In the first layer of the indicator chart, the case

studies and their authors are also mentioned. Indicators are developed by analysing these references and are then transformed into a matrix format using GIS tools. In the charts below, tools are discussed along with their intended use.

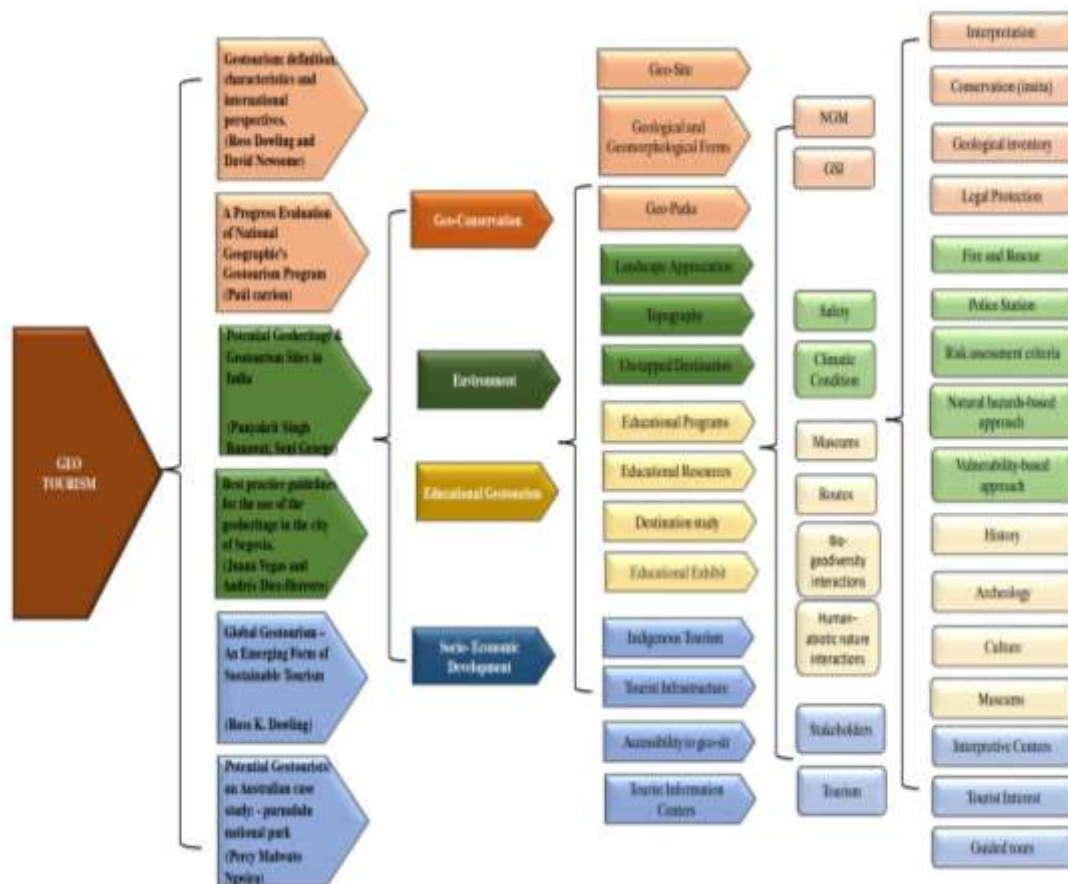







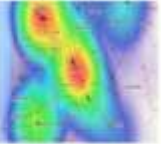












Figure 1 Indicators and Sub indicators

GIS TOOLS

Territory Building Tools  Distinct Territories can be created using map-based filters or via tabular groupings.	Buffers  Circular buffers (used for analyzing proximity)	Shortest Path  The shortest path calculation allows for determining the cost of the path in an ordered/unordered route with options to produce directions and to return to the origin.	Drive-time Bands  Drive time/territory bands allow you to visualize the extent to which locations can be accessed within a certain drive-time or distance.	Drive-time Territories  Drive-time partitions allow regions across a line layer to be defined based on network cost.	Facility Location  A facility location tool identifies the best location for one or more facilities from a set of candidate sites.
Geographic Overlay  Geographic overlay (aggregation) is supported and allows attribute assignment between layers based on percentage overlap for estimating demographics of territories, buffers, areas of influence, and more.	Hot Spots  Kernel-based density grids can be created using the quartic, triangular, gaussian, or cross methods, and allow 'hot spot' mapping.	Clustering  A clustering tool groups points or areas into compact clusters, while placing optional constraints on the clusters such as maximum size or a balanced total field, such as Sales or Population.	Balancing  A balancing tool automatically creates territories that are balanced by a specific demographic.	Routing Deliveries & Pickups  Routing tools optimize routes for several vehicles needing to reach many destinations for deliveries and pickups in fixed time windows.	Weighted Center  Weighted center calculations allow the identification of centers of 'gravity' among points.
Measuring Tools  Length-area measurement tools allow map-based calculations.	Desire Lines  Desire lines (also known as spider diagrams) allow the visualization of flows.	Surface Analysis  Surface analysis tools include spot heights data queries, surface profiling, viewsheds, contour, 3D terrain visualization, DEM/DSM creation, and the calculation of vector distance grids.	Data Classification  Data classification methods include quartiles, equal weight, equal interval, standard deviation, natural breaks, arithmetic or geometric progression.	Areas of Influence  Areas-of-Influence (also known as Thiessen Polygons or Voronoi Diagrams) are a powerful GIS tool that divide the study area using a triangulated irregular network (TIN).	GPS Support  GPS support includes the ability to read/write/import GPS data, overlay tracks with aerial photos and topographic or vector maps, track real-time GPS locations, create vector map/point layers from GPS pick-up/drop files, and import/export tracks such as GPS for GPS Exchange Format.

Indicators	Sub-Indicators	GIS Layers	Resource Data
Geo-Conservation	Geo-Site	Land Use Analysis	Land Use /Land cover Map
		Geographic Overlay	Areas of statistics
		Measuring Tools	Geospatial database
		Desire Lines	Waste Land Map
Environment	Geological and Geomorphological	Statistical Analysis	Coastal zone Management map
	Geo-Parks	Land Use Analysis	Environment Impact assessment map
	Landscape Appreciation	Areas of Influence	Contour Mapping
		Surface Analysis	Forest cover Map
Topography	Land Use Analysis	Flood zone Map	
	GPS Support	Hydro-morphological Map	
	Buffers	Zonal Regulations	
Un-tapped Destination	Spatial Queries	Route alignment and spatial communication map	
	Spatial Queries	Spatial analysis Mapping	
Socio-Economic Development	Indigenous Tourism	Data Classification	Road Safety Surveys
		Areas of Influence	Surveys
	Tourist Infrastructure	Hot Spots	Watershed Land Map
		Market Share (Huff Model)	Wetland Map
	Accessibility to geo-sit	Shortest Path	Road/Rail, Regional connectivity
		Drive-time Bands	OD Survey
	Tourist Information Centers	Routing Deliveries & Pickups	Transport Planning Surveys
		Internet Mapping	Satellite based development community Network
		GPS support	



Source - <https://pining.com/64c/f66d/1a/f66d1a0973114954e07812e22e73e088/>

GEO TOURISM IN INDIA

Due to its diverse geography, India offers a lot of potential for geotourism both domestically and internationally. The nation has recently made significant attempts to promote its rural, even most remote hinterland. Some of India's areas have seen long-term topographical and climatic changes. There are many intriguing geographic characteristics in these places. These locations draw both regular tourists and geo-enthusiasts due to their distinctive aesthetic traits.

26 of these geotourism destinations have already been recognised as National Geological Monuments by the Geographical Survey (GSI) of the Department. It is GSI's responsibility to safeguard and publicise those areas. India's most

popular geotourism destinations are in Rajasthan. Geotourism in Rajasthan: More to discover. According to the Geological Survey of India GSI, Rajasthan is home to the most geotourism destinations on the list with ten. The state's geo sites include fossil preserves, rock monuments, stratigraphic sites, economic geological sites, and a site with a rare granite rock formation.

SITES OF GEO-HERITAGE IN RAJASTHAN

Rajasthan, like every other state in India, has a variety of distinctive geological and geomorphologic elements that make up its geoheritage. In the State of Rajasthan, GSI designated 10 Geo-heritage Sites in 2001.



1. Nepheline Syenite, Kishangarh, Ajmer District
2. Sandra Granite Pali District
3. Bar Conglomerate, Pali District
4. Jodhpur Group - Malani Igneous Suite Contact, Jodhpur District
5. Welded Tuff, Jodhpur District
6. Akal Fossil Wood Park, Jaisalmer District
7. Great Boundary Fault at Satur, Bundi District
8. Stromatolite Park, Bhojunda, Chittaurgarh District
9. Gossan, Rajpura-Dariba, Rajsamand District
10. Stromatolite Park, Jhamarkotra, Udaipur District

IV. CONCLUSION

Geotourism offers a **new form of sustainable tourism** which is more holistic than previous niche forms of tourism. It **promotes tourism to geo-sites** and the **conservation of geodiversity** and an **understanding of earth sciences** through **appreciation and learning**. Integrating and promoting new form of tourism and

incorporating a tool GIS to this was the main idea behind the study. By analyzing different case studies and inferring different literature reviews how effectively it can be executed is well understood. A **matrix** is derived from the indicators arrived and from Gis layers. A broader understanding of GIS layers, as well as geotourism indicators, are made in order to apply in any Geosites to promote geotourism. And how effectively it can be measured is checked by analyzing with geosites.

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