BUDDHIST SITES IN ANDHRA PRADESH- A GIS PERSPECTIVE

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I am going to present before you a brief report on the mapping of the Buddhist sites of Andhra Pradesh, India, with the aid of GIS (Geographic Information System) technology. This presentation comprises of two parts -

- How to apply GIS in Archaeology
- Buddhist sites in Andhra Pradesh – A GIS Perspective.

Here I would like to state that in this Project the mapping of Buddhist sites in Andhra Pradesh has been done and attachment of attribute data and other related information is in progress. Site-specific, local level and regional level GIS will be developed during this Project. After this first phase is over, factors affecting the spread of Buddhism shall be analysed in the GIS framework using the tools available.

What is GIS ?

GIS or Geographic Information System is the combination of computer-assisted cartography and data analysis. With the help of GIS it is possible to devise dynamic views of past experience in the form of animated series of map images that can be started and stopped as "time" progresses to show conditions at any given moment. GIS technology also enables us to put multiple maps in a single image and to represent and analyse information as multiple layers in a single map document. Thus with the help of GIS, we can not only study maps, depicting geographical features, but also analyse the historical, cultural attributes with just a click of the mouse.

How to apply GIS IN ARCHAEOLOGY

Archaeologists study human societies and their evolution over 'Time' and 'Space'.

Time

Archaeologists regulate the time dimension using extensive excavation techniques and specialized relative and absolute dating techniques, eg. Seriation, artefact typologies, stratigraphic relationships and a variety of physical dating techniques (C-14, K-Ar, Thermoluminescence).

Space

Archaeologists regulate the spatial dimensions using extensive excavation and survey methods, maps, profile drawings, photographs and through remote sensing (aerial photography, ground penetration, radar and magnetometry).

Utility of GIS

Historical GIS provides the tools to combine the study of spatial differentiation provided by Geography, with temporal differentiation made by history, and study patterns of change over space and time. With the aid of GIS we can integrate 'vector' data (point plotted artefacts, features, excavation units, sites) with 'rastar' data (feature and level photographs, geophysical data, remote-sensing images, interpolated artefact density surfaces). It also enables relating tabular data to vector data. GIS facilitates easy storage, retrieval and portability of data, especially when the data is in traditional formats like *Tamrapatras*[1], seals, inscriptions etc. GIS data is scaleable-it works at site level, local level, regional level and global level. GIS is specially useful for its mapping capabilities and for visualization of 3D relationships and time series. Archaeologists utilize GIS for its analytical capabilities - like proximity analysis, viewshed analysis and predictive modelling.

[1] Writings on palm leaves.

Buddhist sites in Andhra Pradesh – a GIS perspective

Introduction

Buddhism is one of the greatest of the world religions and owes its origin to India. It was founded by Gautama Buddha or Siddartha, who was born in Lumbini near Kapilvastu in 567 B. C. His first sermon was at Sarnath (modern Varanasi), known as *Dharma Chakra Pravartana* or turning the wheel of law. Buddhism gradually spread to all corners of the country. The main tenets of Buddhism, '*ahimsa*' (non-violence), '*karma*' (doing one's duty) and the observance of the '*ashtanga marg*' or the noble eight fold path, which leads to '*nirvana*' (salvation), still have great relevance. Buddha also propounded the principle of egalitarianism.

Though initially started in Magadha, Buddhism gradually spread all over India, and then to other parts of the world. Buddha established a monastic order or '*sangha*', which consisted of '*bhikshus*' (monks) and '*bhikshunis*' (nuns), who spread his teachings far and wide. It gradually spread to all corners of the country. Emperor Ashoka was the greatest propagator of Buddhism and under his patronage Buddhism spread outside India also.

Andhra Pradesh, which is the fifth largest state in India, is spread over 276,754 sq. km. It has 140 listed Buddhist sites, which provide a rich history of Buddhism from the third century BC to the fourteenth century A. D. Buddhist sites in Andhra Pradesh are located in general, in close proximity to rivers and sources of drinking water, or along trade routes stretching to various parts of the country. The eastern coast was used for maritime trade and it was through sea routes that Buddhism spread to other parts of the world. The eastern coast is thus dotted with numerous Buddhist sites. The Andhra coastline became the hub of trade with the Romans. Buddhist establishments came up with the support of local chieftains along the trade routes in the hinterland.

Objective

The objective of this research is to collect all Buddhism related data in Andhra Pradesh (A. P.) from different sources and store it in GIS framework. I

propose to map Buddhist sites in A.P. using GIS - Geographic Information System technology. There is an intimate relationship between geography of an area, its settlements, trade routes and religious sites. In order to have a holistic picture before us, we need to map all the existing sites along with their attributes and study it in an analytical framework. As the ancient culture mostly developed in the plains, locating of archaeological sites with proper scientific reasoning becomes plausible after paleo-environmental and landform analysis aided through remote sensing data.

Remote sensing data can be very useful for providing auxiliary information. Paleochannels are proven to have archaeological relevance. Paleochannels and ancient beach ridges can be identified on satellite images by virtue of their typical formation and high reflectance. Using information of existing sites, quaternary pedogenetic plain over weathered pediment also gives clues for archaeological findings.

The data thus collected will be analysed with the aid of GIS – Geographic Information System tools. GIS is the combination of computer-assisted cartography and data analysis. GIS technology also enables us to put multiple maps in a single image and to represent and analyse information as multiple layers in a single map document. Thus with the help of GIS, we can not only study maps, depicting geographical features, but also analyse the historical, cultural attributes with just a click of the mouse.

In this study it is proposed to use the existing data from sites already discovered in combination with other historical data and remote sensing data, and analyse it in a Geographical Information System to study relationships, regions of influence, paleochannels and attempt predictive modelling for probable sites. It entails the study of already existing literary, epigraphical and archaeological data, reviewing accounts of foreign travellers and study the historical geography of the Buddhist sites in coastal Andhra. Historical GIS provides the tools to combine the study of spatial differentiation provided by Geography, with temporal differentiation made by history, and study patterns of

change over space and time. Thus historical GIS is an important research method, which provides a framework for digital archives and a means of bringing a geographical sensibility to our view of history.

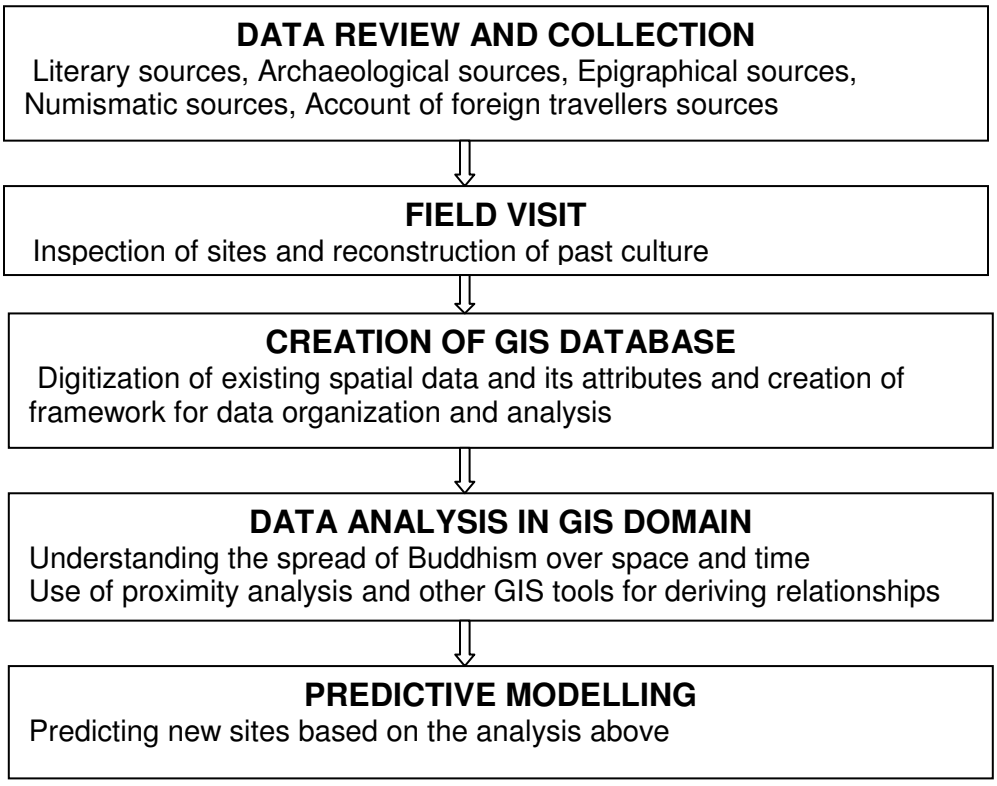
Hypothesis

Our study involves the spread of Buddhism in modern Andhra Pradesh, especially the Buddhist sites in coastal Andhra. The following are the hypotheses of the proposed study

- Historical data analysed in GIS framework will provide new methods for analysing the spread of Buddhism.
- Geographical, topographical and historical factors can be analysed together to give a holistic view of spread of Buddhism.

Research Approach

For this we will first collect data on Buddhism using historical sources, then using GIS technology we will classify it and analyse it. GIS will help us in integrating vector data (point plotted artifacts, features, excavation units, sites) with raster data (feature and level photographs, geo-physical data, remote sensing images, and interpolated artefact density surfaces). GIS will also help in relating tabular data with vector data.



Buddhist sites in Andhra Pradesh

. The eastern coast is thus dotted with numerous Buddhist sites. According to Dr. B. Subrahmanyam,[2] Buddhism spread in Andhra from Neelavathi in the north to Nandalur in the south-west, Ghantasala Kanuparthy on the east to Kotalingala and Kondapur in the northwest, whereas Hinayana Buddhism (Theravada) was prevalent more in north-coastal Andhra, Mahayanism was predominant in mid-coastal Andhra, especially the fertile tracts between the rivers Godavari and Krishna. The notable sites in coastal Andhra are Saripally, Kalingapatnam, Salihundam, Ramatirtham, Mangamaripeta, Buvikonda, Sankaram, Kottur, Lingarajupalem, Pithapuram, Kodavali, Adurru, Gudivada, Ghantasala, Bhattiprolu, Chinnaganjam, Peddaganjam, Nandalur, and Buddam.

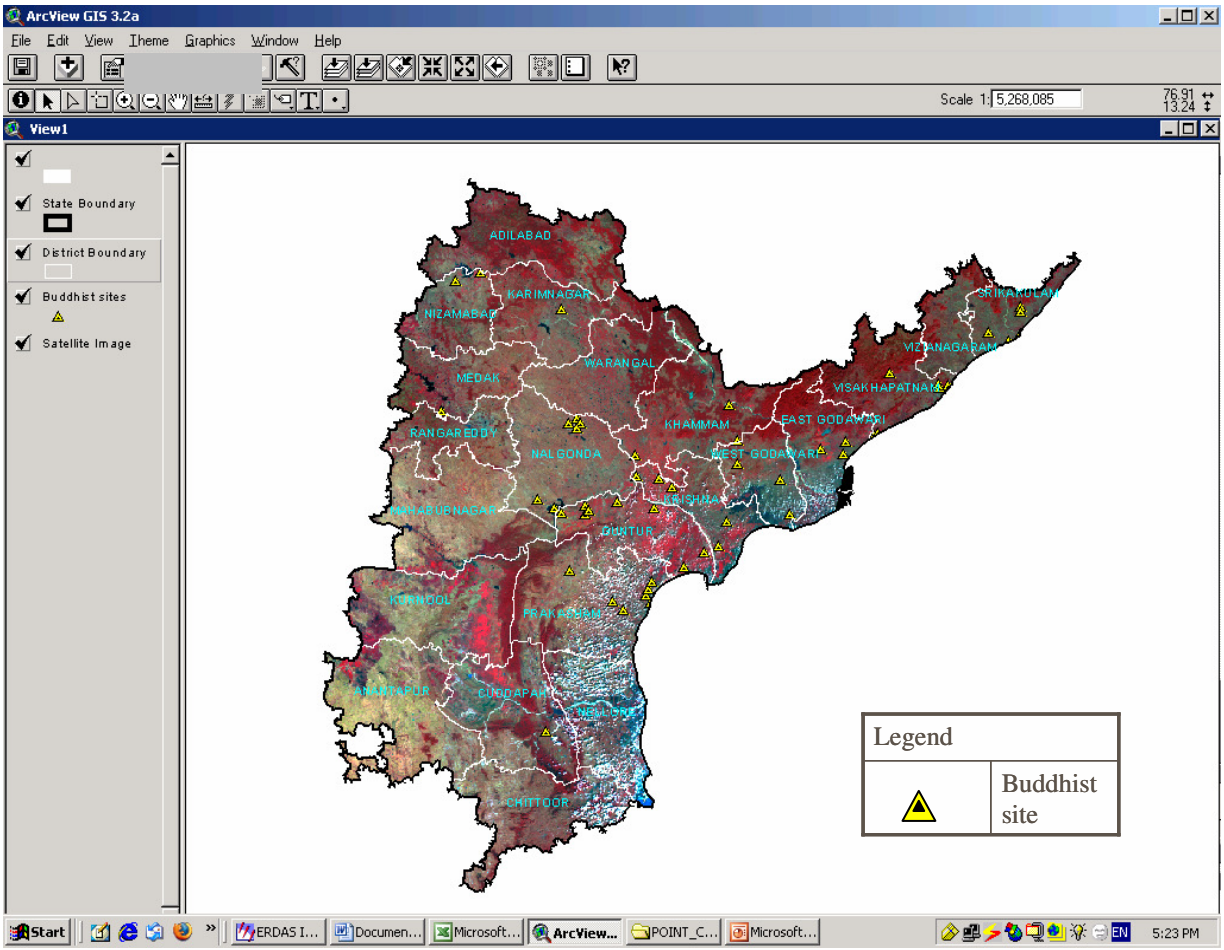
Dhanyakataka, an urban center with access to the Bay of Bengal coast, grew as the focal point of Buddhism in Andhradesa. Its importance grew further when it became the capital of the Satvahanas. The Andhra coastline became the hub of trade with the Romans. Buddhist establishments came up with the support of local chieftains along the trade routes in the hinterland. A list of Buddhist sites is given below.

Sl. No.	Buddhist Site	District
1.	Saripally	Srikakulam
2.	Kalinga Patnam	
3.	Salihundam	
4.	Rama Tirtham	
5.	Mangamaripeta	Visakhapatnam
6.	Duviinunda	
7.	Sankaram	
8.	Kottur	
9.	Lingarajupalem	East Godavari
10.	Pithapuram	
11.	Kodavali	
12.	Kapavaram	Khammam
13.	Adurru	West Godavari
14.	Arugolenu	
15.	Guntupally	
16.	Aswaraopet	Khammam

[2] B. Subrahmanyam, Buddhist Relic Caskets in Andhradesa, Secunderabad ,1999, p.1.

Sl. No.	Buddhist Site	District
17.	Alluru	Krishna
18.	Gummadidurru	Nalgonda
19.	Gudivada	Krishna
20.	Ghantasala	
21.	Jaggaiahpeta	
22.	Nelakondapally	Khammam
23.	Tirumalagiri	Nalgonda
24.	Dhulikatta	Karimnagar
25.	Pashigam	Nizamabad
26.	Kondapur	Medak
27.	Gajulabanda	Ranga Reddy
28.	Panigiri	Nalgonda
29.	Yeleswaram	
30.	Nagarjunakonda	Guntur
31.	Manchikallu	
32.	Goli	
33.	Grandisiri	
34.	Amaravati	
35.	Rentala	
36.	Bhattiprolu	
37.	Chandavaram	Prakasham
38.	Dupadu	
39.	Chinnaganjam	
40.	Peddaganjam	
41.	Kanuparti	
42.	Uppugundur	
43.	Ramatirtham	
44.	Nandalur	Kadapa
45.	Buddam	Guntur
46.	Wadhamankota	Nalgonda
47.	Waddamani	
48.	Kotilingala	Nizamabad
49.	Gopalapatnam	East Godavari
50.	Pavurallakonda	Visakhapatnam
51.	Dharapalem	
52.	Dantapuiram	Vizianagaram

The following map depicts Buddhist sites in A.P., generated with the aid of GIS software.



With the aid of GIS software we can create active links to the sites marked on the map, giving attribute information. The information can range from historical info, to data based on uniform parameters such as elevation, distance from river, road and village. The map may illustrate the position at a certain period of time, or an animated series of maps can be generated, which can be started and stopped as 'time' progresses, to show conditions at any given moment. Such time-series maps will be specially useful to study and analyse the spread of Buddhism from its inception to the present day.

Thus the spread of Buddhism can be analysed over time and space i.e. from its inception to present day; and from India to other parts of the world.

The GIS data is scaleable from the site level - ranging from microscopic information, to the global level - presenting a holistic view.

CONCLUSION

Historical data analysed in GIS framework provides new methodologies for mapping Buddhist sites and analysing the spread of Buddhism. Thus, maps of the Buddhist sites of Andhra Pradesh, in combination with other historical data and remote sensing data, aid in analysing in a Geographical Information System, relationships, regions of influence, and attempt predictive modelling for new sites. Thus historical GIS is an important research method, which provides a framework for digital archives and a means of bringing a geographical sensibility to our view of history.