The Role of Geographic Information Systems (GIS) in Environmental Conservation and Sustainable Development: A Geographical Study

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Abstract

This paper attempts to study geographic information system (GIS) for **Environmental Conservation and Sustainable Development**; consists of integrated computer hardware and software that store, manage, analyze, edit, output, and visualize geographic data. Much of this often happens within a spatial database, however, this is not essential to meet the definition of a GIS. The environment is a crucial part of our lives. Our climate is changing, and we are experiencing horrible weather patterns. Crops are dying because we cannot predict the weather. Ice glaciers are melting. The world has worked hard to address these problems, but there is still more to do. We can do more if we use GIS technology. GIS, or Geographic Information System, makes it easy for organizations to create better strategies for preserving the environment. GIS is a powerful tool that helps organizations to collect, analyse and distribute information. As a result, organizations can update their resource management plans and save money. Several research agencies use GIS technology to manage and plan their projects

GIS, together with other tools such as satellite images and documentation, helps organizations to save more trees and control the distribution of forests. For example, GIS makes it easy to observe the distribution of forests using satellite images. Organizations can use this information to allocate funds for tree planting. This helps to sustain the forests. The technology is also used to manage conservation areas in order to help preserve the environment. An organization can use GIS mapping to map forest areas that are near their facilities and their locations along the coastline. This allows them to develop a conservation strategy.

It's also important to note that GIS can be used for gathering data about water resources. Using GIS technology, organizations can observe the level of pollution in water bodies. They can also track the movement of water in order to know where the water is flowing to. They can use this information to solve water issues. Lastly, GIS technology is crucial for creating an inventory of our animals and plants. This will help us to assess the factors that are threatening their population. We can also use GIS technology to track the animals and plants in order to monitor their growth.

Keywords: fragmentation, spatial indicators, GIS, Computer, Maps, Data, Information System, Spatial, Analysis

Introduction

In the process of human evolution the issues confronting today are safe guarding the natural environment and maintaining good quality of life. While taking up developmental activities, the assimilative capacities of the environmental components i.e., air, water and land to various pollution are rarely considered. The developmental activities being haphazard and erratic are leading

to over use, congestion, incompatible landuse and poor living conditions. Hence the problems of environmental pollution are becoming a heated topic of high-risk environment.

GIS can play a vital role for analysis and in formulating the quick mitigation plans for high risk environments. GIS is one of the key tools in the environmental data framework for data validation, digital data transfer standards, data retrieval/dissemination and analysis. It can serve as the ultimate communication of environmental information to the public and policy makers since it is the technical basis for the multimedia approach in environmental decision-making. The evolution of spatial data standards, the Internet, and the next generation of GIS technology allow all types of users to access the environmental information in its proper spatial context. Wildlife, particularly those classified as rare, threatened, or endangered, are increasingly suffering the effects of habitat loss and fragmentation as people continue to modify the environment at a rapid pace. Scientists have agreed that habitat loss has been the primary cause of species extinction worldwide for a long time.

As a result, it is becoming more apparent that our current species conservation methods are insufficient for maintaining biodiversity and naturally functioning ecosystems.

Geographic Information Systems (GIS) are essential instruments in accelerating efforts to preserve species diversity.

1. Using GIS to Predict Wildlife Movement

Wildlife is unconcerned with the limits constructed by humans. When highways are built across the habitats of large, free-ranging animals, such as bears, it frequently results in numerous fatalities.

In this situation, GIS is critical to identifying a workable solution. GIS software has been used to create suitability maps identifying the places animals were most likely to select as crossing points.

Animal movement data may also be used to develop and evaluate models that anticipate the most likely connection sites utilized by bears, lowering construction costs and reducing road-kill.

This sort of study emphasizes the practical use of GIS models over manual and time-consuming data collection methods.

2. Monitoring the Progress/Status of Conservation Efforts

Users may utilize GIS to define conservation targets, create conservation goals for specific places, and track how these actions progress over time.

It is critical to design our towns and maintain natural spaces and protected areas for a healthy environment and sustainable life as our population rises. GIS helps in tracking the current state of an area as well as predicting or planning future requirements.

Consider the following scenario on a smaller scale: you discover an area of your land that appears to be a suitable bird habitat. Using GIS, you can create a map showing birds' most frequented places over several days. Later, you may use this knowledge to place bird feeders in high-traffic locations or areas where you want to see more birds.

3. Mapping Species Populations and Distribution

The distribution of threatened and common animal populations, native plant distribution, and invasive or alien vegetation occurrences are all plotted over time and across regional areas.

Property managers can use GIS to conserve vulnerable environments and populations in the middle of development, such as on recreational grounds (e.g., golf courses).

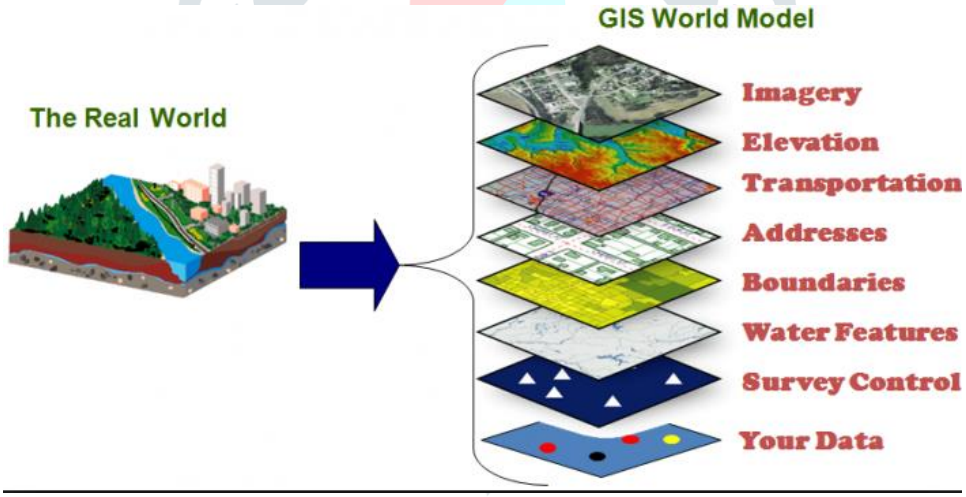
Species invasions can also be studied by simulating the rate of population increase and displaying species distribution data across time.

Objective:

This paper intends to explore and analyze **Geographic Information System (GIS);** a computer system that analyzes and displays geographically referenced information. It uses data that is attached to a unique location.

Geographic Information Science and Technology: Environmental

Geographic Information Science and Technology is all said by its name. It is a technology to capture, Store, process and analyse the spatial topological data. It is one of the fastest growing technologies. Geographic Information Science and Technology is being used by large and small business for a variety of applications. Companies which use Geographic Information Science and Technology today are those industries which are ranging from insurance to urban planning , agricultural health, new line rail construction planning, solar inspection and many more.



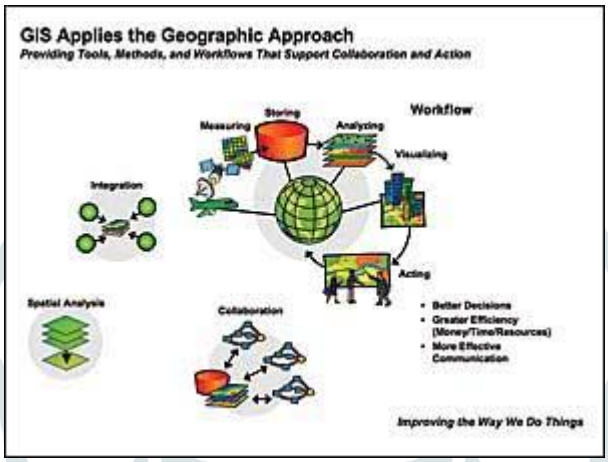
Geographic Information Science and Technology

Future of Geographic Information Science and Technology

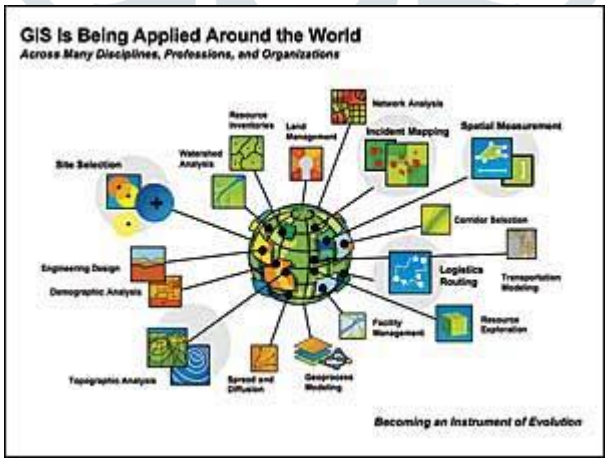
You have heard plenty of trends and development and uses of Geographic Information Science and Technology, but what about where Geographic Information Science and Technology is headed into the future. It can be difficult to foretell the future of a technology but Geographic Information Science and Technology has such a glimpse of technology advantages that it can persuade its future development. The Geographic Information Science and Technology is the technical implementation of GIS (Geographic Information System).

GIS Applies the Geographic Approach for Sustainable Development

GIS is an information system technology with geography at its core foundation. GIS provides technology and methods for data integration, spatial analysis, and collaboration. GIS also provides a science-based framework for organizing workflows that integrate all the factors that need to be considered for decision making. GIS improves the way we do our work by facilitating better decision making; saving money, time, and resources; and allowing us to more effectively communicate through geospatial visualization.



Today GIS is being applied around the world to virtually all the problems that we face. The sheer number of applications suggests it is becoming a major instrument for human understanding of how we increasingly impact and evolve the planet. While some of these systems are focused on automation of technical workflows, such as cartographic production and image analysis, other systems organize society's key information systems, such as cadastral systems, national security, facility management, resource management, and land-use planning. Still others emphasize decision support for site selection, logistics, and natural resource management.



GIS in Environmental Studies

GIS is a powerful tool for environmental data analysis and planning. GIS stores spatial information (data) in a digital mapping environment. A digital basemap can be overlaid with data or other layers of information onto a map in order to view spatial information and relationships. GIS allows better viewing and understanding physical features and the relationships that influence in a given critical environmental condition. Factors, such as steepness of slopes, aspects, and vegetation, can be viewed and overlaid to determine various environmental parameters and impact analysis.

GIS can also display and analyze aerial photos. Digital information can be overlaid on photographs to provide environmental data analysts with more familiar views of landscapes and associated data. GIS can provide a quick, comparative view of hazards (highly prone areas) and risks (areas of high risk which may occur) and areas to be safeguarded.

On completion of Data analysis GIS helps in Planning and Managing the environmental hazards and risks. In order to plan and monitor the environmental problems, the assessment of hazards and risks becomes the foundation for planning decisions and for mitigation activities. GIS supports activities in environmental assessment, monitoring, and mitigation and can also be used for generating Environmental models. Below are some of the applicable areas where GIS can be implemented for effective planning and management (See also Figure 1)

GIS applicable Areas :

- Wild Land Analysis
- Emergency Services like Fire Prevention
- Hazard Mitigation and Future planning
- Air pollution & control
- Disaster Management
- Forest Fires Management
- Managing Natural Resources
- Waste Water Management
- Oil Spills and its remedial actions
- Sea Water – Fresh water interface Studies
- Coal Mine Fires

GIS in Field

Apart from data analysis in laboratories GIS can also help the environmental data analysts in the field, the GIS tool is flexible enough to work in the field to give the exact location of devastation and amount of devastation. Some of the examples in field where GIS is applicable are

- Using GIS in the field, an environmental inspector can rapidly map waste storage sites; describe the volume, content, and state of waste containers.
- Retrieve previous inspection records to compare with the existing environmental conditions.
- View environmental data in relation to adjacent geographic features such as waterways, neighborhoods, or other sensitive areas such as high-risk zones for landslides, water pollution etc.
- Integrated with a global positioning receiver, a field crew can use GIS to accurately ground truth satellite imagery in oil spill mapping and its affects on surrounding ecosystem.

Constraints using GIS

There are some intricate problems in implementation of GIS in Environmental studies in India. The problems posed with our Indian scenario are 1) Non availability of properly spatial data 2) Lack of proper infrastructure with the Government bodies 3) Meager skilled Manpower in the government planning and development departments 4) GIS softwares being more costly.

Some of the probable solutions are 1) Availability of map data in a centralised facility 2) Awareness and increasing the skills proficiency in GIS in government and private sector. 3) Increasing the infrastructure facilities to cope up with the latest technologies and 4) Supplementing the Environmental planning division with adequate funds

The Importance of GIS in Environment Preservation

Lack of technology is a major reason why many organizations fail their projects. They fail because they cannot collect accurate data. They cannot distribute information to all concerned parties. They cannot achieve their objectives because they were not well planned. GIS makes it easier for organizations to plan and manage projects concerning the environment.

In this case, GIS technology helped gather the data needed to make these decisions. They used the available map data to collect information about the available resources. They used the data to decide where to plant trees. They then used the data to plant trees in the most strategic locations.

GIS makes it easy to monitor the environment using satellite images. Satellite images help monitor the natural resources, soil, and habitat of different species. With the help of GIS, an organization can observe the distribution of different species and use this information to allocate funds for the species. This helps conservationists search for endangered species and do something to help preserve them.

Utilize the Effectiveness of GIS for Environment Preservation

The environment needs our protection. We need to do something to make sure that the world is habitable for future generations. GIS technology is a critical part of conservation efforts and will become quite useful in mapping out our forests and observing the distribution of the resources. In the long run, this very tool can lead us to the conservation of our environment.

Conclusion

A geographic information system (GIS) is a system designed to capture, store, manipulate, analyze, manage, and present all types of geographical data. The key word to this technology is **Geography** – this means that some portion of the data is spatial. In other words, data that is in some way referenced to locations on the earth.

Coupled with this data is usually tabular data known as attribute data. Attribute data can be generally defined as additional information about each of the spatial features. An example of this would be schools. The actual location of the schools is the spatial data. Additional data such as the school name, level of education taught, student capacity would make up the attribute data. It is the partnership of these two data types that enables GIS to be such an effective problem solving tool through spatial analysis. GIS is more than just software. People and methods are combined with geospatial software and tools, to enable spatial analysis, manage large datasets, and display information in a map/graphical form.

GIS technology will continue to play a vital role in environmental system management. GIS becomes the primary repository of information that can be quickly accessed and viewed when required. GIS is becoming more suitable for emergency operations and is integrating tools that allow real-time display of information. Rapid access to information, safety, efficiency, and better resource management decisions can be made with the use of GIS. GIS technology can provide critical information at the need of the hour to take the remedial measures in no time as effective as possible.

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