# GIS SOLUTION FOR ENVIRONMENTAL MANAGEMENT AND NATURAL RESOURCES DEVELOPMENT

Nitin Sukhadevrao Goje*

Dr. Ujwal A. Lanjewar**

## ABSTRACT

*Environmental management is inherently a spatial endeavor. Its data are particularly complex as they require two descriptors; namely the precise location of what is being described, as well as a clear description of its physical characteristics. For hundreds of years, explorers produced manually drafted maps which served to link the "where is what" descriptors. With an emphasis on accurate location of physical features, early maps helped explorers and navigators chart unexplored territory.*

*The current surge of interest in environmental information springs from the convergence of three profound world-wide trends: environmental awareness, liberation of public affairs, and information technology. Degradation of environmental resources (air, water, soil and biodiversity) has mobilized public opinion. This is because these resources intimately and directly affect the quality of our lives. As a result the public demands to be better informed on the state of the environment. In turn, governments and industries need spatial information in order to manage and utilize the environmental resources in a sustainable manner.*

*The past two decades have witnessed dramatic advances in Information Technology. Spatial data processing has advanced to the point where it matches the applications challenges presented by the natural resource management. In addition, the Internet, Geomatics, and Telecommunications are rapidly changing the way natural resources are being managed and protected. These have provided more accurate and up-to-date information about resources; further the information is readily available to would be users. In this paper we discuss the contribution of Geographic Information System in Natural Resources Development and Environment Management*

***Keywords:*** *GIS, Environmental Management, Natural Resources Development, Data Model.*

*Assistant Professor, ITM Institute of Management & Research, Kamptee, Nagpur.

**Professor, VMV Arts, JMT Commerce and JJP Science College, Nagpur.

## INTRODUCTION

Responsible and successful environmental management is necessary for protecting and restoring the natural environment. The interdependency of the earth's ecosystems and the human impact on the environment present complex challenges to governments and businesses as well as scientists and environmentalists in every discipline.

Geographic information system (GIS) technology is used to support and deliver information to environmental managers and the public. GIS allows the combination and analysis of multiple layers of location-based data including environmental measurements. The environmental application areas of GIS are varied in terms of potential users, environmental spheres, and the specific environmental issue being investigated. [7]

## OBJECTIVE

Objective of the paper is to study the various aspects of environmental management and natural resources development and coming to the conclusion that the solutions provided by the Geographic Information System.

GIS environmental management solutions enable organizations to

- Ensure accurate reporting with improved data collection.
- Improve decision making.
- Increase productivity with streamlined work processes.
- Provide better data analysis and presentation options.
- Model dynamic environmental phenomena.
- Create predictive scenarios for environmental impact studies.
- Automate regulatory compliance processes.
- Disseminate maps and share map data across the Internet.

## LITERATURE SURVEY

### What is GIS?

GIS is a powerful software technology that allows a virtually unlimited amount of information to be linked to a geographic location. Coupled with a digital map, GIS allows a user to see locations, events, features, and environmental changes with unprecedented clarity, showing layer upon layer of information such as environmental trends, soil stability, pesticide use, migration corridors, hazardous waste generators, dust source points, Lake Remediation efforts, and at-risk water wells. Effective environmental practice considers the whole spectrum of the environment. GIS technology offers a wide variety of analytical tools to meet the needs of many people, helping them make better decisions about the environment. [7]

People in the environmental management community use GIS to organize existing information and communicate that information throughout their organizations. GIS can be used as a strategic tool to automate processes, transform environmental management operations by garnering new knowledge, and support decisions that make a profound difference on our environment.

**GIS in Environmental Management and Natural Resources Development**

GIS is a vital tool in natural resources development. The various aspects of resource management it supports include storage and retrieval of data, interpretation and analysis of the resource data, and development of the Resource Management Plans (RMP's). Resource use alternatives are formulated, and the GIS is used to evaluate each in terms of environmental impact, economic implications, acreage, and potential use conflict. One important function of GIS is to assist in recognizing underlying patterns in data. These patterns may be areas of forestland suitable for timber harvest or potential shifts in population distribution. GIS simulations can be used to understand the direct and indirect effects of human activities over long periods of time and over large areas.

By using the database integration capabilities of GIS, Planners and Resource Managers gain a better understanding of the complex interrelationship between physical, biological, cultural, economical, and demographic considerations around a specific resource. Access to this information and its understanding makes it essential in making sound resource-use decisions. This ensures balanced management and use of the resources. GIS is increasingly replacing the traditional methods because it is faster, cost efficient and accurate. GIS analyses are hence becoming routine in a significant number of field offices. [6]

**Examples of GIS Application in Natural Resources Development**

GIS applications are diverse and include water quality monitoring, modeling narcotic crop sites, waste site assessment, analyzing effects of carbon dioxide etc. Some analyses relative to forest are overlaying forested areas and logging areas to see what percentage of forest area is in danger of degradation. Adding data on protected areas or biodiversity hot spots allows one to see how these areas fit in the picture. Egregious problems, such as protected areas being included in logging concessions can also be detected.[6]

One notable example is the detection of illegal oil and gas drainage from public lands by wells on private lands. GIS reduces the process of drainage detection from several days done manually to a few hours.

## GIS ENVIRONMENTAL DATA MODEL

Object of data modeling of environment are both its basic components: physical-geographical sphere and social-economical one as well. Process of data modeling of environment can be simply imagined on the basis of Following Fig 1.
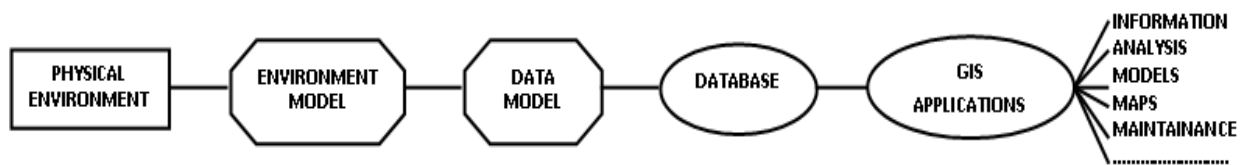


**Fig. 1. GIS Environmental data model [8]**

Model of subjected environment created by geodetic, cartographic and photogrammetric methods should have structure, contents and accuracy enabling to re-create it functional data model. This data model should not only be able to be processed by computer technologies, but also to be simply used for many purposes and users. [8]

## FINDINGS & SUGGESTIONS

Environmental developers and planners work together to bring the environmental management community benefit and value from GIS. The model given in above figure gives various benefits for environmental Management and Natural Resources Development.

Above model adds following benefits

- Database-sharing architecture that supports decision making and daily work tasks
- Interoperable system solutions for integrated workflow and data access
- Internet mapping solutions that support interagency collaboration projects
- Quality control processes that ensure accurate, high-quality data
- Worker-friendly designs that increase agency-wide access and application
- Scalability that supports and adapts to growing and evolving IT demand

We suggest that applying above data model in environmental management and natural resources development can help in accessing accurate data with high speed. It required to integrate above model by using various programming languages, databases and GIS analytical engines.

## CONCLUSION & FUTURE SCOPE

Even though obstacles remain to their full deployment, Geomatics technologies now being developed and demonstrated suggest natural resource applications that were not believed possible using traditional techniques. As we progress towards the long talked about notion of

integrated natural resources development and environmental management, some parallel continuums along which the technology manifests are:

- The technology helps create integrated views of databases that span the levels of map scale, detail and use. This helps in understanding the earth's ecology.

- The technology meets the need for information presentation tools, as the pendulum swings towards community place based management.

- The emergence of shared data infrastructure and accelerated information delivery, e.g. Internet data ordering.

- Significant advances in data acquisition technology.

- Rapid improvement in data storage, retrieval and analysis.

## REFERENCES

1. Fedra, K. (1993) GIS and environmental modelling. In: *Environmental Modelling with GIS* (ed. by M. F. Goodchild, B. O. Parks & L. T. Steyaert), 35-50. Oxford University Press.

2. Goodchild, M. F. (1993) Data models and data quality, problems and prospects. In: *EnvironmentalModelling with GIS* (ed. byM. F. Goodchild, B. 0. Parks &L. T. Steyaert), 94-103. Oxford University Press.

3. Harris, J., Gupta, S., Woodside, G. & Ziemba, N. (1993) Integrated use of a GIS and a three-dimensional, finite-element model: San Gabriel Basin groundwater flow analyses. In: *EnvironmentalModelling with GIS (eu.* by M. F. Goodchild, B. O. Parks & L. T. Steyaert), 168-172. Oxford University Press.

4. Hassan H. M., Hutchinson C., 1992, Natural Resources and Environment Information For Decision Making, The World Bank.

5. Johannsen C.V., Sanders J. L., 1982, Remote Sensing for Resource Management, Soil Conservation Society Of America, Michigan, USA.

6. TS12.2 James Osundwa: The Role of Spatial Information in Natural Resource Management International Conference on Spatial Information for Sustainable Development Nairobi, Kenya 2–5 October 2001.

7. www.esri.com/environment/ GIS solution for Environmental Management.

8. ArtInAppleS, Ltd.: ArtGIS Training Program. ArtInAppleS, Ltd. Bratislava, www.artinapples.sk.