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GIS in EIA for Environment Management

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Abstract

The capabilities of GIS in EIA are extremely important in many project formulation and environment management. It is possible to store large amounts of different kinds of data. The access to these rich databases allows the performance of dynamic queries based on real world representations. Concerning the analytical capabilities, some potential functionality can be added such as the use of interactive video and digital sound associated with zoning maps, to help planners and decision-makers to visualize and better evaluate the impact of a new infrastructure. Other capabilities are related to the integration of spatial simulations associated with real images and to stereoscopic aerial photographs in order to get an improved visualization of the phenomena and their evaluation in real time. The results of EIA correspond to compressed information to synthesize in a small number of descriptors the complex and diversified universe that has been analysed. In a GIS, the improvements in the communicability of the results are associated with the use of images, which represent information in a compact way, of easier comprehension.

Keywords: GIS; EIA; environment; management.

1. Introduction

The Environmental Pollution Control GIS platform currently focuses on integrating all kinds of pollution modeling analyses such as marine and air pollutions which enable decision-makers to combine the data with existing pollution layer for further application use. The Pollution Control GIS successfully integrates the simulating results of marine and air pollution, offering up-to-date pollution data and feasible

spatial statistical analyses to decision-makers for further application use [1-6]. GIS is a versatile support platform of integrating any development devices for offering the efficient data collection service, the enhanced system environment, and the smoother investigations and operations [7-11]. Preliminary exploration (geology, geochemistry, and geophysical exploration) during geothermal projects does not affect atmospheric air. During drilling, air pollution can result from non-condensable gas emissions, exhaust smoke from generators, compressors and vehicles. Combustion of diesel fuel in the drilling rig produces NOx, CO, SO2 and hydrocarbons, but the amount of these gases is not significant and does not have an important effect on the atmosphere. During well testing, steam and spray can have an adverse effect on the local vegetation, scalding trees and grass. Fugitive dust is generated by several activities scheduled during construction, operation and decommissioning. The principal source is dust generated by travel on unpaved roads, dust generated by earthmoving activities during construction and reclamation on the power plant site and well pads, and dust carried by wind blowing across exposed surfaces [12-14].

2. Geographical Information System

Geographical information system (GIS) is a set of computerized tools (including both hardware and software) for collecting, storing, retrieving, transforming, and displaying spatial data. GIS is essentially a marriage between computerized mapping and data base management systems. Anything that can appear on a map can be encoded into a computer and then compared to anything on any other map, using longitude-latitude coordinates. GIS is a computer system capable of assembling, storing, manipulating, and displaying geographically referenced information to their locations. GIS technology can be used for scientific investigations, resource management, and community education. Maps have been used for thousands of years, but it is only within the last few decades that the technology has existed to combine maps with computer graphics and databases to create GIS. In other words, GIS can be regarded as the high-tech equivalent of a map. An individual map contains a lot of information, which is used in different ways by different individuals and organizations. It represents a means of locating ourselves in relation to the world around us. When a database is updated, the associated map can be updated as well. GIS databases include a wide variety of information including geographic, social, political, environmental, and demographic. GIS technology has tremendous scope due to spatial data generation, management, modeling, analysis and application, satellite image georeferencing, enhancement and filtering capabilities, transformations, classification and accuracy assessment and applications, for total environment management. In Database Management, the system adopts Microsoft SQL 2008 as the database management software to manage spatial data and optimize query efficiency. For data integration, the data source contains the information about cadastre, images, pollution surveys, water and other basic maps. Most importantly, the system allows each unit to collect and analyze the data from other units to display the analyze results on the system. The platform includes public query system, intranet system, and back-end data

management system. The public query system allows the public to query the pollution data and with basic map navigation tools, such as spatial positioning, map measuring. The intranet system offers comprehensive map information and related simulation tools. The back-end data management system allows adding new layers, updating data, and managing authorization.

3. Purpose of EIA

Environmental assessment enables us to carry out an environmental cost-benefit analysis of projects at an initial stage. It is a precursor to detailed analysis of environmental impacts, which are taken up only if a need for the same is established. It gives a view of the actors involved in the development environment linkages. This is required in view of the fact that the community at large is always at a loss in terms of deterioration of living environment that accompanies industrial development. Based on Environmental Impact Assessment, regulatory measures can be identified and the roles of agencies concerned defined for achieving more efficient environmental management. EIA is a process with several important purposes. Its general purposes are to ensure that environmental considerations are explicitly addressed and incorporated into the development decision-making process; to anticipate and avoid, minimize or offset adverse significant biophysical, social and other relevant effects of developmental proposals; to protect the productivity and capacity of natural systems and the ecological processes which maintain their functions; and to promote development that is sustainable and optimizes resource use and management opportunities.

4. Application of GIS in EIA

Geographical information systems can be applied at all EIA stages. EIA is a decision process, which aims to both identify and anticipate impacts on the natural environment. The interface between these two components produces several effects, which will generate specific impacts. GIS can also be explored within the EIA process to improve different features, mainly related to data storage and access, to the analytical capabilities and to the communicability of the results. The development of such a system will allow a more realistic approach to the environmental descriptors and a better understanding of their interrelationships. GIS will bring to the EIA process a new way of analyzing and manipulating spatial objects and an improved way of communicating the results of the analysis, which can be of great importance to the public participation process. The use of GIS in the EIA process, where public participation is of great importance, requires the development of applications allowing a better understanding of spatial phenomena. During the EIA process many different variables and phenomena presenting complex interrelationships, which vary in space and time are considered. These procedures involve technical analysis that includes changing assumptions and priorities and descriptions of significant visual and audible impacts.

5. Analysis in GIS Integration with EIA

The overall functionality of Environmental Pollution Control GIS includes positioning, layer management, marine and air pollution modeling, and data management. The positioning function contains coordinate positioning, road positioning, address positioning, landmark positioning, layer positioning, and cadastral positioning. Users can use the layer positioning tool to zoom to the location they would like to query. Users can choose the layers to display and mark the event location on the map. Users can click the icon on the map to know more about the point, like viewing photos, location, related documents, attributes, experiment data, and business information through attribute query. Results have greatly assisted decision-makers in understanding the possible extent, area, and disaster-effected population of hazards and establish possible prevention programs in advance. The system is designed to satisfy users' requirements of data search and export functions such as rectangle selection, polygon selection, circular selection and multiple selection to obtain information that they are interested in, also ensuring that the data can be reused efficiently. The data management platform of the system provides users with the flexibility to manage data and add new layers and fields based on the different requirements. In addition, the layer management tool allows users to easily configure the settings for adjusting the classifications and extents of layers to display.

6. Conclusion

The development of GIS for EIA requires the analysis of this process in order to identify the tasks that will be beneficial. To better understand the study area it may be necessary to view it from several different perspectives: aerial views, static and dynamic ground views. The aerial view corresponds to a combined flight through aerial photographs or satellite digital photographs, giving a perspective of the study area. This representation can be associated with the corresponding route of the flight over a map, allowing the interrelationship between the two spatial representations to be established.

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