GEO-INFORMATICS FOR SUSTAINABILITY AND QUALITY OF LIFE - SPECIAL FOCUS ON THE STUDIES DONE BY SRI LANKAN SCHOLARS

INTRODUCTION

Primitive man ate wild fruits and berries by hunting and fishing; he relied heavily on nature for his very existence. Even these basic activities had a demand on nature to some extent. At that time man did not concern himself with conservation methods, however nature was able to cope with whatever damage was inflicted quickly restoring its resources. As society developed man's impact on nature grew in scope and strength. Until very recently we adhered to the following dictum" we can not expect favors from nature; we must take them". More often than not no thought was given to the possible consequences of such " taking" from nature. But the consequences were significant and pervasive. Mankind has long trusted in natures' potential and restorative power though there is no research to believe that these powers were inexhaustible. Only recently has man come to realize the necessity for conservation. Undoubtedly this is a result of the revolution in science and technology which has dramatically increased man's ability to use natural resources. Nature has been increasingly damaged and restoration capabilities have progressively weekend and human environment have deteriorated to the point affecting the quality of life. But today the technology which gives the man a chance to exploit nature has further developed to overcome all the adverse effects pertaining to use of resources on this five billion years old planet which survived in twelve billion year old universe.

Technology on the other hand supported mankind to manage the use of resources rationally in order to sustain the planet for another billion of years. Utilizing the rational spatial analysis tools for best use of resources for the betterment of mankind based on information available in the space; the geo-informatics (Remote sensing, Global Positioning System, Geographic Information Systems).

At the very outset of this discussion let us see geospatial technology and remote sensing : how they connect people and conservation.

REMOTE SENSING

Like many developing fields, remote sensing has been defined in numerous ways. Definitions are ranged from very "technical" to very "honest". Broadly speaking, remote sensing simply involves the collection of information about distant objects. However in the context of geographical study, remote sensing refers specifically to collection of images of parts of the earth surface using the specialized instruments, mainly aerial cameras and satellite sensors. The implications of remote sensing for basic topographic mapping are obvious. It is considerably cheaper and quicker to generate topographic maps from remotely sensed images than from conventional field survey data. Traditionally topographic mapping has been performed using aerial photographs since high level spatial detail is required. Recently, however, fine spatial-resolution satellite sensor images have been adopted for this purpose, following the launch of IKONOS in 1999. Similarly many urban remote sensing

studies, which also require fine spatial resolution data, are now feasible with satellite sensor images. Other forms of mapping are being revolutionized by new remote sensing developments such as "interferometric" radar analysis and availability of Lidar data. (Methods in Geography –Clifford and Valentine-2004)

Further, the use of remote sensing includes environmental applications such as monitoring water resources and measuring atmospheric pollution. Remote sensing also holds much practical value for mineral exploration, forestry, and agriculture. Traditional military and meteorological remote-sensing applications remain common. However, I would like to focus my attention to few studies done very recently using sophisticated remote sensing applications in Sri Lanka.

A) ***"Applications of Geo-informatics to develop noise zoning maps for Dehiwala-Mount Lavinia municipal area using ambient and back round noise data"*** (A Gunawardana, S. Wejesekera, S. Hapuarachchi- 2006) The primary data used in this study was IKONOS image acquired in 2002. GPS was used to demarcate sampling locations and geo rectifications of satellite images. Real time and base station data were also used for deferential connection of GPS coordinates to achieve high accuracy of locations. The modeling has been done using spatial and three dimensional analysis (3D and spatial analysis of ArcGIS).

B) ***"Development of simple spatial methodology to access the human exposure to aerosols in urban areas"*** (SR Wadduwage-2006). Spot multi-spectral satellite images were used to extract the vegetation cover and water bodies for the study.

C) ***" Developing and testing a spatially distributed hydrological model for a meso- scale watershed- a case study from Hulanda oya catchment SR Lanka"*** (L Muttuwatte, P Jayakody-2006). During the basic data preparation of the study, the land use map and the digital elevation model of the study area were derived with the help of GIS and remotely sensed topographical information using Shuttle Radar Topography Mission(SRTM).

Taking all these above mentioned studies in to account, it is obvious that Remote sensing method facilitates to identify the required locations, first the noise generating locations, their relationship with land use and subsequently to map the noise distribution over an area. The result of the analysis shows that high noise is generated during day, evening and night from the commercial locations. Further, it was found that the noise generation is associated with the socio-economic condition of the residential areas where low noise is generated by the prime residential areas compared to congested residential areas. Reference to the study B , the satellite images helped the researcher to extract features; the vegetation cover and water bodies which absorb NOx and deposit particulate. Finally mapping of air pollutant concentration on health was done, Thereby the researcher identified the health risk zones and vulnerable population in the city of Colombo. Thirdly, the researcher stated that the study was complimented by using DEM based on remotely sensed data. But the DEM based on the contour information was complicated and suffered the problem of not including a sufficient number of proper elevation values.

However it is clear from the above examples that the use of remote sensing technique is more useful for accurate mapping in order to solved some problems that could be obtained from field reconnaissance and hence enhance the simulation results.

GEOGRAPHIC INFORMATION SYSTEM(GIS)

A GIS is a computer based system capable of capturing, storing, analyzing and displaying geographically referenced information, that is data identified according to location. Practitioners also define a GIS as including the procedures, operating personnel, and spatial data that go into the system.

HOW DOES GIS WORK?

Relating information from deferent sources is the basic. The power of GIS comes from the ability to relate different information in spatial context and to reach a conclusion about this relationship. Most of the information we have about our world contains a location reference, placing that information at some point on the globe. e.g. when the rain fall information is collected, it is important to know where the rainfall is located. This is done by using a location reference system, such as longitude and latitude, and perhaps elevation. Comparing the rainfall information with other information, such as location of marshes across the landscape may show that certain marshes receive little rain fall. This fact may indicate that these marshes are likely to dry up and their influence can help us make the most appropriate decision about how humans should interact with the marsh. A GIS therefore can reveal important new information that leads to better decision making for sustainable development.

GIS links location to information (such as people to address, buildings to parcels, or street with a network) and layers that information to give you a better understanding of how it all interrelates. You choose what layer to combine based on your purpose. There are three views of a GIS:

The data base view - a GIS is a unique kind of data base of the world- a geographic data base. It is an "information system for geography". Fundamentally, a GIS is based on a structured data base that describes the world in geographic terms.

The map view- a GIS is set of intelligent maps and other views that show feature and feature relationship on the earth surface. Maps of the underlying geographic information can be constructed and used as" windows in to the data base" to support quarries, analysis, and editing of the information. This is called geo-visualization.

The model view- a GIS is a set of information transformation tools that derive new geographic data sets from existing data sets. These geo-processing functions take information from existing data base, apply analytic functions, and write results into new derived data sets.

However, currently GIS technology has advanced to the stage where the focus is no longer a graphical representation per se but an integrating visualization with method so that both quantitative and qualitative analysis might be enriched.

Let us set back and illustrate how it is used to visualize and analyze spatial data in different studies; soil , hydrology, urban studies, habitat studies.

A) ***" Development of soil data base for Sri Lanka and its applications for environmental concerns"*** (RB Mapa, AR Dassanayaka , KMA Kendaragama, H Kadupitiya-2006). In this study the digital data base was computed using ArcView , version 3.2.and the researches were able to find that the data base's capacity to make quarries in relation to agricultural applications and to be combined with other available data for best results. However, any resource planner can formulate a query based on his requirements and the data base is capable of displaying benchmarks, soil mapping units which fulfill his criteria. The data base also could be used for determining the sensitive areas for soil erosion to demarcate the regions, where the lands should be reforested for conservation measures for sustainable development.

B) ***"Ground water distribution and quality characteristics in the right bank of Nilwala Ganga"*** (Badulu Oya and Kirama Oya basins)Sri Lanka- RUK Piyadasa, KDN Weerasinghe, PW Harsh Kumara-2006). In order to achieve the objective of the above study 60 open shallow dug wells were selected from the right bank of the Nilwala Ganga and Badullu oya basins. The hydro geological features of the study area were identified by measuring and monitoring the water levels of dug wells in the sandy/ sandstone aquifer areas. Accordingly, hydrological and hydro-geo-chemical maps were prepared with the help of GIS. The hydro isographs maps of the right bank of the Nilwala river basin are demonstrated to be a reliable tool to identify recharge and discharge areas.

C) ***"Flood inundation mapping in Ratnapura town using Geographical Information Systems"*** (P Liyanaarachchi, CP Gunasena-2006). The research dealt with the problem of floods in the Ratnapura Municipal council area. Ratnapura town is subjected to floods when river levels rise up to 18m msl. Geographic Information Systems provides a broad range of tools for determining area affected by floods and forecasting areas that are likely to be flooded due to high water levels in the river. Spatial data stored in the digital data base of GIS, such as DEM has been used to predict the future flood events. These produced maps could provide valuable information in planning of new development projects and incorporate flood hazard reduction technique into development.

D) ***"Habitat mapping at Horton Plains using IRS satellite data"*** (KDBL Jayarathna, RP de Silva, NDK Dayawansa-1990-2004). The main objective of the researches were to have comprehensive management system for the sustainability of its landscape and the biodiversity. Mapping of plant and animal habitat makes the above function easy and more effective. The plant and animal habitat maps were prepared with the help of satellite remote sensing and GIS. The researches sated that the remote sensing together with GIS proved to be very effective in habitat mapping in Horton Plains national park. As a result it was possible for the researches to in corporate important spatial information together to identify the plant and animal habitats in the area of its sustainability.

GLOBAL POSITIONING SYSTEM(GPS)

Historically, positioning has played a vital role in the field of navigation and mapping. Positioning can be simply explained as any methodology providing answers to the question of " where you are?". However the Global Poisoning System(herein after referred to as GPS) was designed as a military tool by the US Department of Defence to provide instantaneous accurate positioning. As it was designed as a military tool, various security measures were introduced to the system so that the system can be degraded at any time. The system has three segments; space segment, control segment, user segment.

The space segment consists of six orbital plans. The original plan was to keep four satellites on each orbit totaling twenty-four satellites. The system can support up to thirty-two satellites. At present twenty-eight satellites are in orbit. The NAVESTAR GPS; Navigation System with Time and Range System is a satellite based radio navigation systems providing precise three dimensional positions, direction, speed and time information sustainable equipped user. NVASTAR GPS consists of 21 satellites. The altitude of the satellite is about 20200km above the earth surface(De Silva RP 2004).

Since the GPS can be used as a positioning tool, it could collect the data for Geographic Information Systems. The GPS also can be used to control traffic in congested airways and water ways. Vehicle fleet management is also possible with GPS. If each vehicle of the fleet is equipped with a GPS receiver and a radio transmitter the position of the vehicle can be displayed at the central room. This ensure a better control over fleet. Besides, there are many applications of GPS; Agriculture, Archeology, Asset management, conservation, environment, forestry, factory automation, mapping and GIS, marine and oceanography, mobile resource management, telecommunication etc. As I noted in the previous paragraph, although both NAVESTAR and GLONASS GPS systems were originally conceived as military systems, GPS applications are found in the civilian domain. It has massive civilian benefit. Let us see how GPS technology help the researchers in Sri Lanka for their research studies:

a) "An application of Global Positioning Systems in traffic flow studies"(Gamunu S Gunasinghe – 2004). The researcher used real time kinemetric GPS (RTKGPS) method for acquisition of car following data. The main objective of the study was to explain the three parameters ; positioning, speed, and acceleration of moving vehicles. However a comparison of GPS data and conventionally acquired data is also given. The data acquired using GPS proved to be superior to the data acquired using conventional method. The researcher finally concluded that speed measured by RTKGPS is more accurate, GPS has no synchronization problems since there is only one data source, GPS gives reliable data for car following experiments.

b) "Geographic Information System (GIS) based risk mapping and warning system for monitoring of transmission of Dengue in Kurunagala district" (MD Hapugoda, NR de Silva, W Abeyawickrama, H Senarathna, UA Chandrasena, P Rajamanthri- Sri Lanka journal of Geo-Informatics –volume 01-2004). The objective of the study was to map

a Dengue risk area in the Kurunagala district and study the transmission of Dengue virus in relation to entomological, epedomological and meteorological parameters using spatial analysis tools available in GIS. In the case of collection of information, the position: exact position (latitude and longitude) of each selected premises was obtained according to the international coordinate system using a hand-held GPS receiver. GPS information of the selected areas was converted to a local coordinate system and then the points were overlaid on digital land use maps using GIS.

Detail review of the above studies ensure that the advent of GPS has enhanced greatly the positioning of vehicles in traffic engineering and how the GPS can be used effectively to collect data for GIS.

CONCLUSION

This paper has attempted to expose the true character of Geo-Informatics and the use of Geo-Informatics for sustainability and quality of life. Sustainable development and quality of life can be successfully achieved only when the relevant information for decision making is identified, valid and available on a continuous basis. The remote sensing method is providing resourceful information for decision making in any area of concern i.e. population, land use, movements, weather changes etc. Remote sensing and GPS navigation function to enhance , create, and analyze data that can be utilized in multi-faceted arenas. Remote sensing and GIS data create a single forum for both sustainable developers and sustainable conservations and cooperatively plan and manage for the environment and people.

In this paper I have attempted to explain how organized is the Geo-Informatics for general use of the people and to focus on the studies done by Sri Lankan scholars using this sophisticated technology today. It is virtually observed that no geographical study without tough upon the GIS, GPS and RS due to its strong link and smart character in gathering information, analysis, and interpretation with high accuracy of respective locations. However I believe that the use of geo-informatics would go beyond its limitations to support other areas of specialization in the next few decades or future.

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