'APPLICATION OF REMOTE SENSING AND GIS FOR THE STUDY OF ENVIRONMENTAL POLLUTION AND MONITORING: A THEORETICAL APPROACH'

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ABSTRACT

Over the period, level of pollution in air, water, and soil has crossed the limit considerably because of poor environmental management. An integrated geo-spatial technology i.e. Remote Sensing (RS), Geographic Information System (GIS), and Global Positioning System (GPS) can also help in assessing, understandings, utility mapping, and service facility. The main objective of the present research paper is to enlighten advanced technology viz. Remote Sensing, GIS and GPS in determining the degree of environmental pollution and remedial measures thereof. The remotely sensed data could be analyzed with the help of GIS and may be verified partially with GPS. Today various softwares, like, ARC-GIS, ERDAS imagine, GRAM ++, are being used. In addition, softwares like, BASINS 4.0, GEOMATICA, GRASS and like that many others are available at free of cost. Geographic Information System software's satellite data is available at free of cost from Global Land Cover Facility (G. L. C.F.).

Key Words: *Remote Sensing, GIS, GPS, D-GPS, GEOMATICA, GRAM ++, ERDAS IMAGINE, ARC-GIS, GRASS, Environmental Pollution.*

1.0 INTRODUCTION:

Over the period, level of pollution in air, water, and soil has crossed the limit considerably because of poor environmental management. An alteration against the laws of nature changes the energy pattern, radiation level, chemical or physical constitution or the abundance of organism defined as environmental pollution *(Khopkar, S. M., 2004, p. 7).* Increasing population and urbanization leads to increase in environmental pollution rate *(Bhatt, Bindu, Gupta, Amit Kumar and Gogoi Gunin, 2003).* An integrated geo-spatial technology i.e. remote sensing (RS), geographic information system (GIS) and global positioning system (GPS) can contribute substantially in a more supplementary fashion to some of the interactive operations that should become an asset for assessing, understandings, utility mapping and service facility to solve complex urban environmental issues *(Idowu Innocent Abbas and J.A. Ukoje, 2009).*

Recent advances in atmospheric remote sensing offer a unique opportunity to compute indirect estimates of air quality, particularly for developing countries that lack adequate spatial –temporal coverage of air pollution monitoring *(Ludovic BASLY and Lucien WALD).* Remote Sensing technique is used to measure and monitor the real extent of the environmental degradation, especially environmental pollution.

To state the present status of the environment and to provide quantifiable estimates of the amount of environmental degradation the field of Geoinformatics is must essential *(Bhatt, Bindu, Gupta, Amit Kumar and Gogoi Gunin, 2003).* Over the last two decades, satellite data of the cloud free environment with high resolutions is available at various scales. Earth observation by satellites gives new solutions in gathering spatial environmental information on cities as

well as biodiversity rich regions. A review of current studies on use of satellite data for air pollution monitoring clearly indicates that the instrumentation on the satellites can provide us with valuable information about the constituents of atmospheric pollution, but rather limited as far as the study of surface concentrations is concerned.

2.0 OBJECTIVES:

The main objective of the present research paper is to enlighten advanced technology viz. Remote Sensing, GIS and GPS in determining the degree of environmental pollution and remedial measures thereof. However, the specific objectives are as under

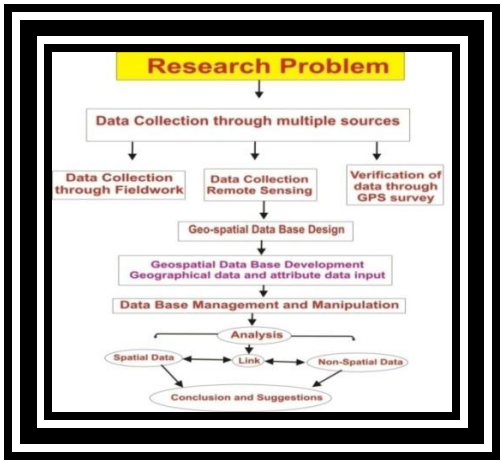
1. To comment on the role of Remote Sensing, Geographical Information System (GIS), and Global Positioning System (GPS) in the study of environmental pollution and monitoring.
2. To explain the sources of satellite data and GIS softwares.

3.0 METHODOLOGY:

There is an excessive awareness in the society for environmental pollution. However, the degree accuracy in the determination is poor due to the lack of knowledge in monitoring methodology. Recently Geoinformatics, which includes Remote Sensing, Geographical Information System (GIS), and Global Positioning System (GPS), is becoming emerging techniques in interdisciplinary of research.

The present research paper focused on the theoretical aspect only. Hence, the related data is collected through the various books, journals, and websites explained in the references.

The following flow chart tries to explain about research methodology researcher can opt for to analyze data related to environment.



Source: *Compiled by the Researcher*

4.0 REMOTE SENSING – DATA COLLECTION TECHNIQUE:

The environmental pollution and its monitoring is the matter of concern for sustainable development. Conventionally environmental pollution and planning is generally being carried out in four phases, viz. monitoring, modeling, development of decisions by planner and finally by execution *(Singh, Savindra, 2003, p. 393)*. Previous studies demonstrate that the conventional approaches to assess the pollution level are not efficient towards contact measurement, integrated path measurement, simultaneous analysis, and flux measurement. These techniques are inadequate at global level. Since, data collection plays the major role in environmental quality, precision in status planning, accuracy and speed is on the priority. It has been found that remote sensing environmental pollution monitoring equipments have the capability to assess the pollution status in the desired area that may be more beneficial for environmental pollution management.

Today there are number of satellites mapping the earth constantly. In India, the National Remote Sensing Centre (NRSC) is the focal point for distribution of remote sensing satellite data products in India and its neighboring countries. NRSC has an earth station at Balanagar, about 55Km from Hyderabad, to receive data from almost all contemporary remote sensing satellites such as IRS-P5, IRS-P6, IRS-P4, IRS-1D, IRS-1C, IRS-P3, ERS-1/2, NOAA series, AQUA and TERRA satellites.

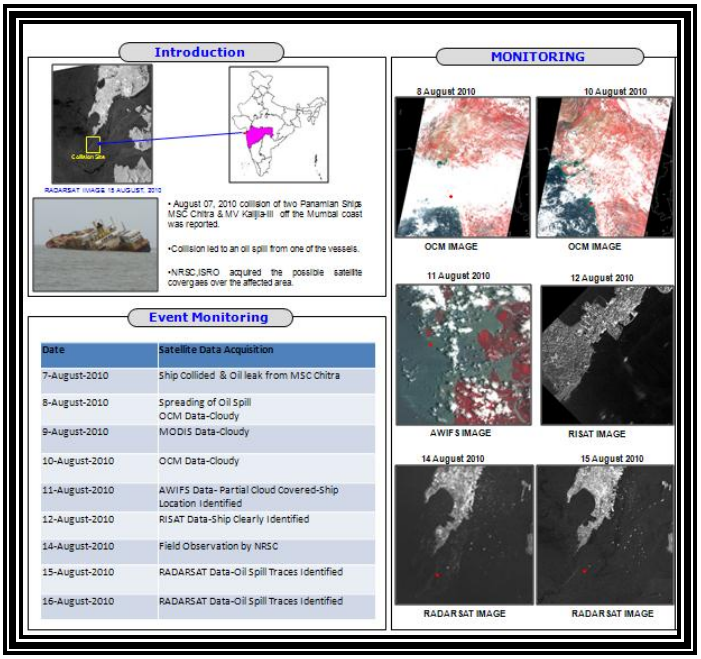
In addition to the above-mentioned satellites, ENVISAT, OCEAN SAT, CARTOSAT, WiFS, LISS series, RADAR SAT etc. are some more important satellites whose data is used for the detection of environmental pollution. Following pictures depicts recent tragic accident of the "Mumbai oil spilt" in the Arabian Sea.

Remote sensing data may be used for the study of water quality, air quality, land use and land degradation, forest cover change, fire detection etc. The remote sensing data is available from NRSC at concessional rate as well as on Internet (Download from Global Land Cover Facility (GLCF)).

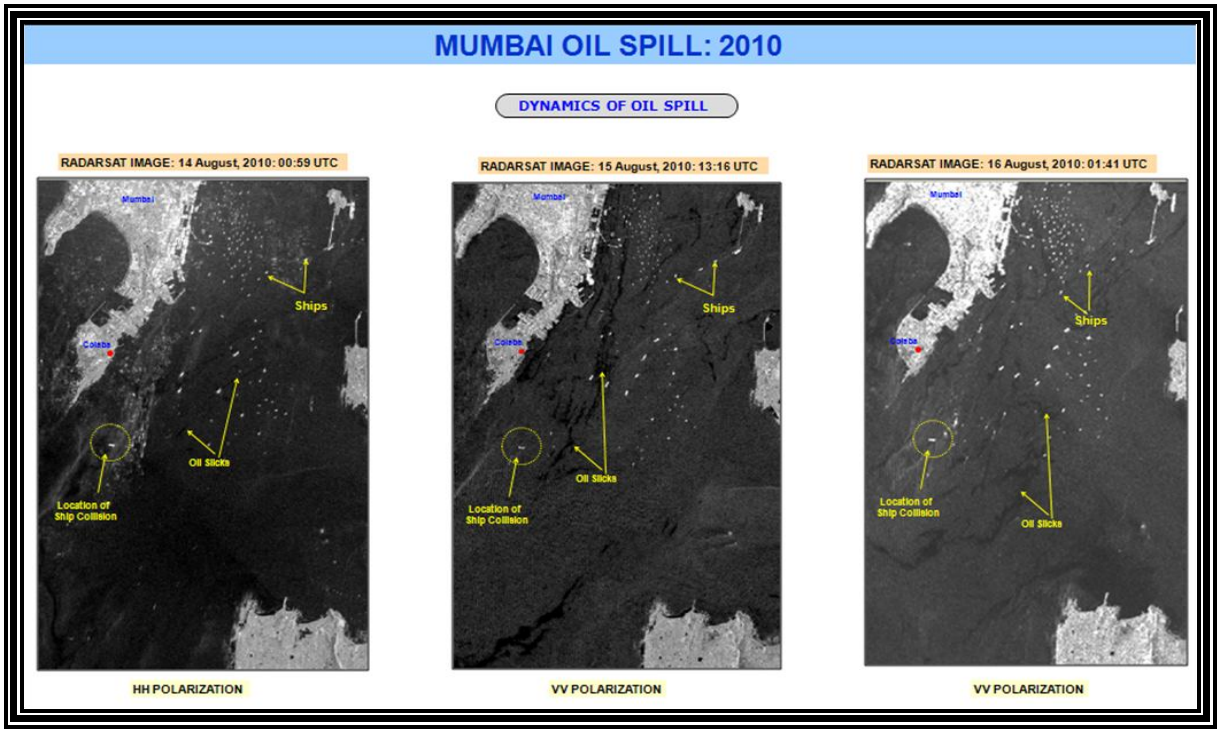
5.0 GPS AND GIS TECHNIQUES:

GPS is the most advanced system used for the verification of data collected through satellite. There are two types of GPS - Hand GPS and D GPS- used for the verification of data. Geographic Information System (GIS) is used by the environmentalists, planners and scientists for the better, efficient, and cost effective approach towards environmental planning using spatial records. GIS is the technique used for the analysis of data i.e. spatial as well as non-spatial data. Satellite imagery may be analyzed by the two ways- manual analysis and automated analysis.

The ERDAS Imagine is the basic software used for the image analysis. Along with ERDAS Imagine Arc-GIS software is used for the analysis of spatial as well as non-spatial data. In addition to these two softwares there are so many softwares available either at low cost or free of cost from the internet. These includes GRAM ++, ILWIS, GEOMATICA , GRASS, BASINS 4.0 and so many.



Source: http://www.nrsc.gov.in/tmp-images/cartosat-2B.html



Source: http://www.nrsc.gov.in/tmp-images/cartosat-2B.html

6.0 CONCLUSION:

Space technology is one of the best-suited means for the assessment of damage brought about by environmental pollution as well as detection of environmental pollution. Remote sensing satellites provide synoptic view, repetitive coverage, and high-resolution images. This advanced high-resolution sensor technology has provided immense scope to the mapping and monitoring of environmental pollution by using Remote Sensing, GIS, and GPS techniques. The development in the remote sensing and GIS provide the base for the environmental pollution monitoring, that includes water quality, air quality, forest fire detection, soil pollution and erosion, etc. This has proved by the example of Mumbai oil spilt. GPS used for the verification of data. In short, Remote Sensing technique is used for the environmental pollution monitoring is more beneficial than the conventional methods. GPS used for verification of data and GIS used for the analysis of data.

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