

Designing and Development of Environmental Information System using Geomatics: A Case Study from Prakasam District

Dr. P. SriLatha Reddy

Assistant Professor,
Civil Engineering Department,
Malla Reddy Engineering College,
Maisammaguda, Sec-bad-500100

Dr. M. Anji Reddy

Professor of Environmental Science and Technology
Centre for Environment,
Institute of Science and Technology,
Jawaharlal Nehru Technological University,
Hyderabad, Kukatpally, Hyderabad-500085

ABSTRACT: The natural environment plays very important and wellbeing role to our future young generations. Our landscapes, atmosphere, ocean, lakes, and biodiversity plays a vital role for country economy achievement from different industry sectors like cultivation, mining, energy production and tourism are elementary characteristics of our life. To grapple this natural asset responsibly, governments, industry and the community need comprehensive, trusted environmental information periodically. To make elegant decisions, valid information is required for individually and collectively, about the major issues poignant our natural assets.

To furnish to this requirements, research of environmental information for siting of industries, bottleneck of the environmental considerations has been visualized. The environmental information system is one and only remedy for all the issues caused by haphazard industrial siting. The environmental information system found different suitable sites for siting of industries based on environmental consideration. The environmental parameters and conditions are evaluated and quantified and the suitability of sites is determined based on their Physiography, Drainage, Sensitive zones, Air Quality, Risk area map for air polluting activities, Surface water quality, Surface water use, Risk area map for surface water polluting activities and Risk area map for Ground water polluting Activities.

Due to lack of premeditated development and lacking use of appropriate land over exploitation of resources can put the environment to huge risks. By avoiding haphazard siting of industrial sectors can decrease a lot of issues and cost. A significant requirement for judicious siting of industries is to consider the environmental profile of the planed sites.

The research work involves preparation of a number of thematic layers, spatial distribution maps using IRS P6 LISS IV MX 5.8 Meter Resolution satellite data, collateral data and field data and their integration using ARC/GIS software, based on Central Pollution Control Board guidelines for identifying industrial sites. The approach hinges on the idea of scientifically and environmental compatible land use management depending on natural suitability and preservation of environmental fragile and ecological sensitive zones leading to balanced and sustainable development.

It is therefore proposed to develop an Environmental Information System in six Mandals Kanigiri, Hanumanthunipadu, Pamur, Veligadla, Chandrasekharapuram and Pedacheropalli of Kandukur division of Prakasam district in Andhra Pradesh using the techniques of Remote Sensing and Geographical Information System (GIS) and to compile data on a systematic manner and store them for retrieval at a subsequent point of time. Planner's time and price can be reduced in organization of the data in arriving at precise conclusion and decisions.

Key words: Environmental information system, industrial siting.

INTRODUCTION

For sustainable industrial development, the need of the hour is judicious, reasonable and deliberate use of the finite resources of land according to their natural environment properties. To cater this need, the preparation of environmental information for siting of industries, based on environmental considerations has been conceived. The environmental parameters and circumstances are appraised and quantified and the suitability of sites is determined based on their sensitivity to land, water and air pollution. There is a need apart from the avoiding measures, industries/industrial estates should be well sited. Thus, environmental planning is proven to achieve sustainable development. Properly planned new industries / industrial estates are powerful pollution preventive instrument that ensures environmental soundness of the industrial development. Site selection based on environmental criteria with the objective of minimizing adverse environmental impacts is, therefore, a vital prerequisite.

Most of the problems of pollution and costs thereof can be abstained by preventing indiscriminate siting of industrial sectors. A significant pre-requisite for judicious siting of industries is to consider the environmental profiles of the proposed sites. The Central Pollution Control Board (CPCB) has taken a lead in identifying environmentally compatible industrial zones.

The research work involves preparation of a number of thematic layers, spatial distribution maps and their

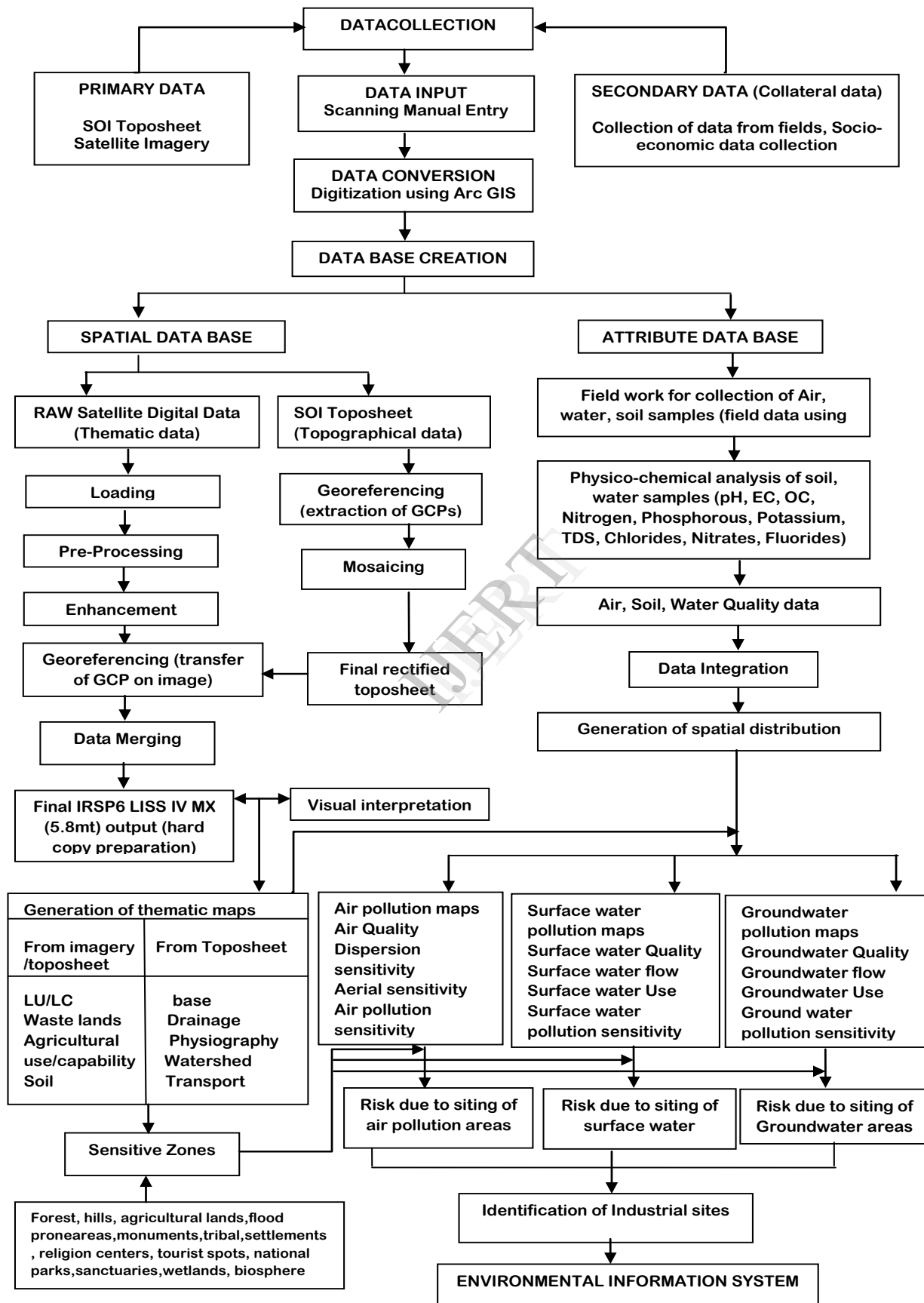
integration using ARC/GIS software, based on CPCB guidelines for identifying industrial sites.

It is therefore proposed to develop an Environmental Information System in six Mandals of Prakasam district in Andhra Pradesh using the techniques of Remote Sensing and Geographical Information System (GIS) and to compile data on a methodical way and store them for retrieval. This information system can support the planners in information retrieval by integrating spatial data and requires sophisticated data management systems to handle voluminous spatially correlated data. The emergence of RS and GIS as a strong tool for spatial analysis and storage has in effect alleviated the problem by computerization of the spatial data. This data can reduce planner's time and cost in organizing data in arriving at precise conclusion and decisions.

OBJECTIVES OF THE STUDY AREA

- Creation of the database for the study area consisting of thematic layers like base, drainage, land use/ land cover, transport, Physiography and soil using SOI toposheet and Satellite data .
- To develop air quality and water quality data generation of spatial distribution of maps for the study area.
- To develop Environmental information by fusion of all the thematic layers, spatial distribution maps generated through ARC GIS software.
- To identify the industrial site and develop environmental information System using geomatics for a part of Prakasam District.

FLOW CHART SHOWING METHODOLOGY FOR ENVIRONMENTAL INFORMATION DATA



RESULTS & DISCUSSION

The results obtained from the present research entitled "designing and development of environmental information using geomatics : a case study from Prakasam district, Andhra Pradesh" the thematic maps like base, village reference, drainage, transport, Physiography, land use/land cover, watershed, wasteland, and soil maps on 1:50,000 scale are developed. A field survey was conducted during the months of February and March, 2008 in six Mandals Kanigiri, Hanumanthunipadu, Pamur, Veligandla, Chandrasekharapuram, Pedacherloppally of Prakasam district for collection of air, water and soil samples in the study area, 6 air sample locations are taken assuming that air in this area is polluted because of the existence of small scale industries and moderately dense population, 69 surface water samples, 99 ground water samples and 64 soil samples were collected, exclusive Global Positioning System (GPS) survey was done and each GPS point were taken at the sample location. Physico-chemical analysis of the soil and water sample has been done.

The air samples collected from the field work i.e. from study area were found to be high risk or sensitive areas with 12.69% and the remaining area are considered as high with 69.14%, medium with 15.11% and low with 3.05% risk areas for air polluting activities are obtained. In the high risk areas which are very sensitive to air pollution; only very small air polluting activities (A3 categories) may be allowed. The medium risk area may be considered for medium air polluting activities (A2 category) whose impact is not likely to exceed 2Km. The low risk areas may be considered for all types of air polluting activities (A1 category) whose impact is not likely to exceed 5Km. The risk area map for air polluting activities is the super imposition of air quality, aerial sensitivity, dispersion sensitivity, air pollution sensitivity and sensitive zone maps.

The surface water from the study area were found to be Risk areas with 12.69%, High areas with 86.46% and medium areas are with 0.84%. The 'High' risk areas are very sensitive to water pollution and hence no medium or large water polluting activities should be allowed in these areas. Only such activities with very low polluting potential (W3 category) may be considered for sitting in these areas. The 'Medium' risks areas may be considered for sitting medium or low polluting activities (W2/W3 category) whose effluents are easily biodegradable and are non-toxic. The preparation of Risk area map for surface water polluting activities includes super imposition of watershed, surface water use, surface water quality, surface water flow, surface water pollution sensitivity and sensitive zone maps.

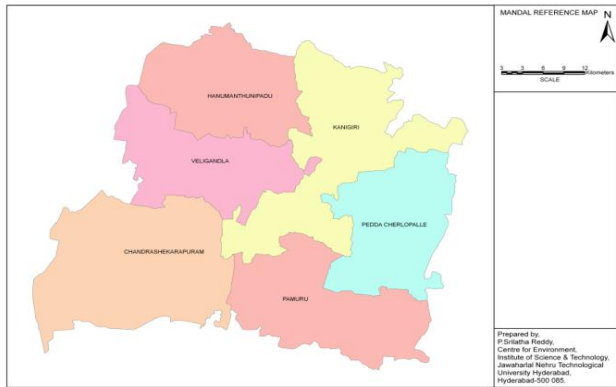
The ground water analysis from the study area was found to be risk areas with 27.88%, high area with 54.33%, medium with 15.85 and low areas with 1.94%. The 'High risk' areas are very sensitive to ground water polluting activities and hence, disposal of effluents or solid/hazardous waste on land should not be allowed. The 'Medium' risk areas may be considered for controlled and limited discharges of only easily biodegradable and non-toxic effluents. The 'Low' risk areas may be considered for discharge of toxic or not easily biodegradable effluents on land and land disposal of hazardous waste following the safety norms. Organic compostable waste may be allowed in 'Medium' risk areas. Inert solid waste may be disposed even in 'High' risk areas. The risk area map for ground water polluting activities is prepared by superimposing of ground water use, ground water quality, ground water potential, ground water table and sensitive zone maps.

The soil quality of the study area ph is ranging from 7.6-8.07, electron conductivity is ranging from the 0.29-0.71, nitrogen is ranging from 57.60-89.04, phosphorous is ranging from 9.45-16.22, and potassium is ranging from 111.58-119.50.

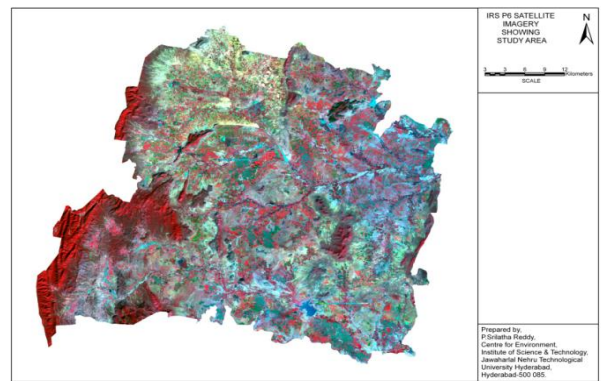
Environmental information system is used for proposing industrial site selection based on CPCB guidelines. For selecting final search areas of industrial sites parameters includes physiography, drainage, sensitive zone, risk area map for air polluting activities, risk area map for surface water polluting activities, risk area map for ground water polluting activities and soil maps. The ratings have been given for the industrial site selection depending on the distance the rating is divided into very high (<1km), high (1-5km), medium (5-10km), low (10-15km), very low (>15km) and also weightage is given according to the distance and rating 5,4,3,2, and i.e., 1 for the >15km with very low rating, same the way ratings and weightage is given to all the parameters like major settlements, water availability, industrial estates, sensitive areas, land availability, drainage, electricity, distance from the nearest habitation from source of air pollution and environmental issues (distance from nearest IDA, IE or village).

This research work identifies suitable sites for siting industries based on environmental considerations. The environmental parameters and conditions are evaluated and quantified and the suitability of sites is determined based on their sensitivity to air, water and land pollution. Thus, environmental planning is a proven tool for achieving sustainable development. Proper siting of newly planned industries is a strong pollution preventive instrument that ensures environmental soundness of the industrial development. Site selection based on environmental criteria with the objective of minimizing adverse environmental impacts is, therefore, a vital prerequisite.

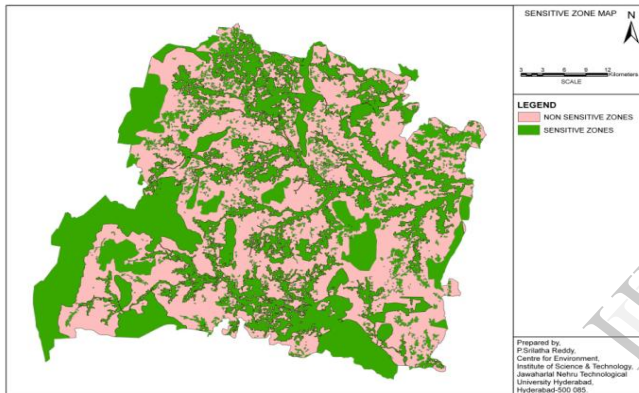
Base Map



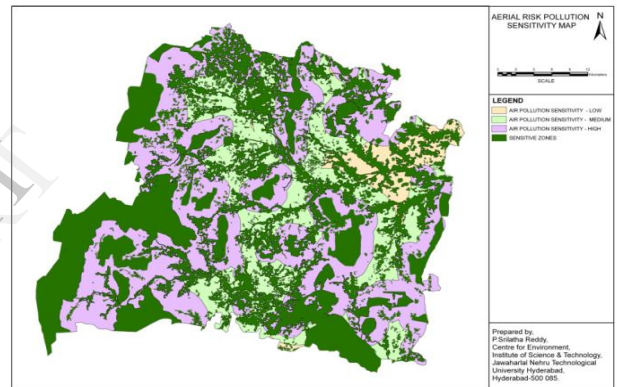
IRS P6 Satellite Imagery



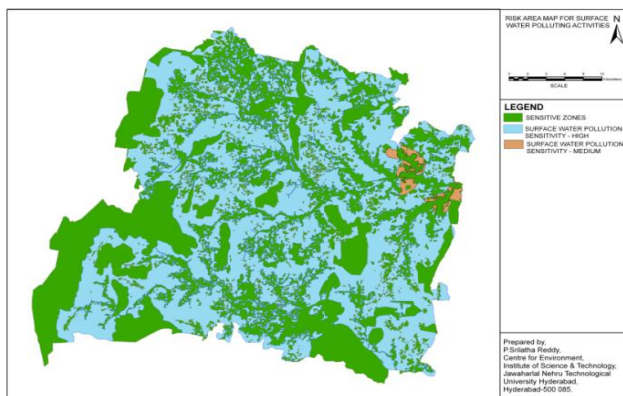
Sensitive Zone Map



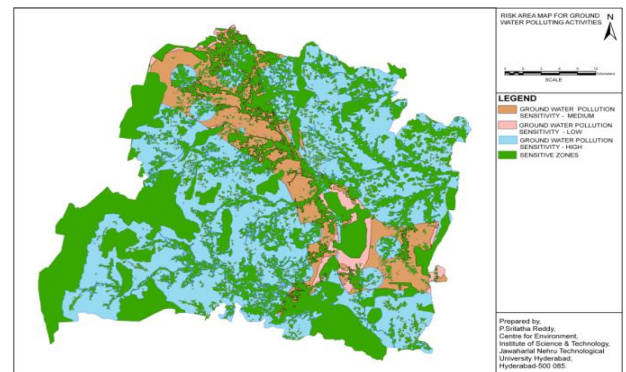
Aerial Risk Pollution Sensitive Map



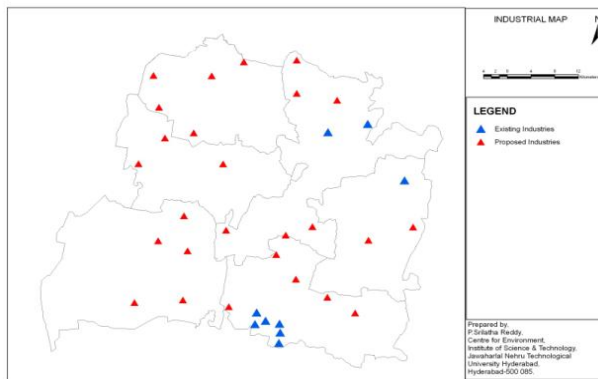
Risk Area Map for S. Water Polluting Activities



Risk Area Map for G.W. Polluting Activities



INDUSTRIAL SITE SELECTION MAP



CONCLUSIONS

This research work identifies suitable sites for siting industries based on environmental considerations. The environmental parameters and conditions are evaluated and quantified and the suitability of sites is determined based on their sensitivity to air, water and land pollution. Thus, environmental planning is a proven tool for achieving sustainable development. Proper siting of newly planned industries is a strong pollution preventive instrument that ensures environmental soundness of the industrial development. Site selection based on environmental criteria with the objective of minimizing adverse environmental impacts is, therefore, a vital prerequisite.

REFERENCES

- All India Soil and Land Use Survey (AISLUS) (1989). Soil Survey Manual. Department of Agriculture and Co-operation. IARI Campus, New Delhi.
- Anji Reddy, M., Text Book Of Remote Sensing and Geographical Information Systems, 2nd edition, 2001, B.S Publications, Hyderabad.
- Anjaneyulu Y, "Environmental Impact Assessment", B.S. Publications, 2002.
- Ambient Air quality Standards (National). Environmental information system CPCB, Ministry of environment and forests govt. of India.
- Ayers, R.S. and D.W. Westcot, 1985. Water Quality for Agriculture. FAO Irrigation and Drainage Paper, 29 Rev., 1-144
- A BI, 1976, IS: 10500 – 1991, Indian Standard, Drinking water Specification, pp 1 – 4.
- A BI, 2004, IS: 15442 – 2004, Indian Standard, Parameters for Environmental Impact Assessment of Water Resources Projects.
- Bihar state pollution control board. <http://bspcb.bih.nic.in/ZoningAtlas.htm>
- Census of India 2001. Prakasam district; Directorate of Census Operations, Andhra Pradesh.
- CPCB, June, 1996, EMAPS/1/1996-97, Zoning Atlas for Siting of Industries (based on environmental considerations), the conceptual Frame work, pp: 1 – 64.
- Environmental Awareness in Tamil Nadu: www.environment.tn.nic.in/ngc/site/index.htm
- Hand book of statistics 2008 -Prakasam District Compiled and Published by: Chief Planning Officer Prakasam District Ongole.
- Industrial profile Prakasam district <http://industriesportal.apcgg.gov.in/Documents/prakasam.pdf>