Geoinformatics For Invoking Transparency And Awareness

Dr. Yashwant B. Katpatal

Professor, Department of Civil Engineering, VNIT Nagpur

Transparency is the basis of good governance and the first step in fighting corruption. It provides a universal rationale for the provision of good records management systems, archive, and financial regulatory and monitoring system. It is directly linked to the practice of socially responsible authorship and journalism, the work of editors, the publishing and the distribution of information through all media.

- Freedom is best served when all citizens have enough knowledge to hold each other reciprocally accountable.
- All of the great enlightenment arenas (markets, science and democracy) flourish in direct proportion to how much their players (consumers, scientists and voters) know, in order to make good decisions.
- To whatever extent these arenas get clogged by secrecy, they fail.

1.0 Concept of Good Governance

Good governance provides a platform that enables the Government to operate efficiently, effectively and transparently and to be accountable to the public. Primary Principles of Good Governance include:

- Public participation in Government.
- Respect for the rule of law
- Freedom of expression and association
- Transparency and accountability
- Legitimacy of Government.

Civil Society's involvement occupies a critical place in the governance process and promotes good governance by facilitating people's collective action for attaining sustainable socio-economic outcomes for the common good of the society.

Civil Society promotes Good governance through:

- **Citizenship Development:** For citizens to be active in public affairs and participate in efforts that promote good governance.
- **Policy Formulation and Advocacy:** Influencing the decisions of legislators, elected representatives and public administrators.
- **Watching role:** Playing a crucial role in evaluating the policies and actions of the Government.

Knowledge Visualization:

Geoinformatics can play a important role in knowledge visualization which in turn can generate awareness amongst masses. This may be done through:

- The use of visual representations to improve the creation and transfer of knowledge between at least two persons.
- All graphic means that can be used to construct and convey complex insights.
- Enables the correct reconstruction, remembrance and appliance of these insights.

Geoinformatics is certainly the best means to bring about this knowledge visualization in the society through.

- Modeling for future
- Better understanding of problems
- Present status of the problems
- Best alternatives through data analysis

When technology moves up, it becomes universal and works for the masses. It becomes available to lower elevations of the society. Probably this must be the vision when Dr. Vikram Sarabhai visualized the Indian space program, a technology which virtually works from top.

Remote Sensing for its repetitive and synoptic coverage and GIS by virtue of its analytical and display capabilities has the capability of invoking transparency in the systems..... **by making the information available to masses.**

Transparency is required by.....

- Policy Makers at the top....
- Executers, Managers, administrators....
- Terminal Service providers....
- Masses....

In several areas our institutions have already achieved milestones....

- ❖ Generation of baseline data
- ❖ Resource evaluation and estimation

But much remains to be done in areas like,

- ❖ Management and administrative reforms
- ❖ Data dissemination and sharing
- ❖ Municipal information system
- ❖ Land information system
- ❖ Performance evaluation
- ❖ Crop acreage and irrigation sector
- ❖ Urban Planning implementation
- ❖ Water resource availability and utilization
- ❖ Spatial Utilization of financial resources
- ❖ Efficiency in Fund utilization
- ❖ Transportation sector
- ❖ Road Management and information systems
- ❖ Sustainability of environment and public participation

Today, this technology is almost ready to give its best to the masses by making the systems transparent by making the information available in spatial format. Temporal information regarding natural resources is must for estimation and evaluation of the resources. Natural resource requires continuous monitoring for its development. Remote sensing and GIS techniques have been very useful in monitoring of resource. Not only the availability aspects can be addressed for better estimation of this resource but also the parameters affecting the quality of resources and the extent of association can also be addressed using geoinformatics involving RS and GIS. In the present paper, few case studies on application of RS and GIS are being discussed. India is endowed with a rich and vast diversity of natural resources. Its development and management plays a vital role in agriculture production. Geospatial tools like Remote Sensing (RS) and Geographical Information System (GIS) must be applied as a monitoring mechanism to update the status of water resources within the watersheds for holistic development of this important resource.

2.0 Water Management

Utilizable water resource is the quantum of withdrawable water from its place of natural occurrence. Within the limitations of physiographic conditions and socio-political environment, legal and constitutional constraints and the technology of development available at present, utilizable quantity of water from the surface flow has been assessed by various authorities differently.

The annual potential natural groundwater recharge from rainfall in India is about 342.43 km^3, which is 8.56% of total annual rainfall of the country. The annual potential groundwater recharge augmentation from canal irrigation system is about 89.46 km^3. Thus, total replenish able groundwater resource of the country is assessed as 431.89%. After allotting 15% of this quantity for drinking, and 6 km^3 for industrial purposes, the remaining can be utilized for irrigation purposes. Thus, the available groundwater resource for irrigation is 361 km^3, of which utilizable quantity (90%) is 325 km^3.

Traditionally, India has been an agriculture-based economy. Hence, development of irrigation to increase agricultural production for making the country self-sustained and for poverty alleviation has been of crucial importance for the planners. Remote sensing and GIS can be successfully utilized in its simplest form for following water resources problems.

- ❖ Flood management
- ❖ Drought management
- ❖ Groundwater management
- ❖ Water conservation
- ❖ Watershed management
- ❖ Rainwater harvesting
- ❖ Water quality conservation and environment restoration

This can be achieved through integrated studies which could be categorized into several domains which could be listed as below.

- ❖ Interbasin water transfer
- ❖ Vulnerability to climate change and adaptation strategies
- ❖ Water demand reduction and management measures
- ❖ Legal restrictions on water use
- ❖ Land use planning and cropping pattern
- ❖ Environmental flow requirement
- ❖ Demand management for urban areas
- ❖ Applications of decision support system in water resources.

Geoinformatics including satellite remote sensing and Geographical information system which provides an input for enhancing our understanding of groundwater resource. Geoinformatics has brought the science and technology into management domain through its application right from characterization, monitoring till the routines governing management of resources in any known area of application. As a whole the technological developments in Geoinformatics has lead to many areas like spatial modeling, geo-visualization, knowledge discovery, data mining, geo-computation, and spatial information management. Large numbers of earth observing satellite are continuously collecting the data on earth features and their pictorial representation provides immensely valuable information.

Systematic approaches involving judicious combination of conventional ground measurements and remote sensing techniques pave way for achieving optimum planning and operational of water resources projects. The synoptic and repetitive coverage provided by the satellites can effectively complement the conventional data to monitor the progress and impact of the above projects. Thus, remote sensing imagery from the polar orbiting satellites is a potential tool for mapping and monitoring of many water resources management projects. Remote sensing in combination with the Global Positioning System (GPS) and Geographical Information System (GIS) produces the terrain maps at his location accuracy and containing detailed information of the variables under study. In India, satellite remote sensing technology is being used effectively in the areas of irrigation performance evaluation, snowmelt-runoff forecasts, reservoir sedimentation, watershed treatment, drought monitoring, flood mapping and management. The steady flow of data from Indian Remote Sensing Satellites – IRS-1A, 1B, P2, 1C, P3, 1D and P4 (Oceansat) have facilitated operationalising many application areas under the aegis of National Natural Resources Management System (NNRMS). Space technology applications capabilities are being further enhanced by the series of new satellites with increasing spatial, spectral and temporal resolution. The more recent IRS satellites – the RESOURCESAT (IRSP6) offers multi spectral data at a resolution of better than 6 metres from LISS-IV and large area coverage with high repetitivity from AWIFS payloads and the CARTOSAT-1 has a PAN camera of 2.5 – metre resolution with stereo view. Thus, the IRS constellation has become one of the most versatile remote sensing satellite series, offering wide range of data and services to meet the variety of applications. Thus multiple satellites concurrently in operation and steer able sensor systems enable dynamic coverage of specific areas. In complement of these developments in the space segment, we are witnessing a dramatic improvement in the ground segment, paying the way for planning, execution and monitoring of water resources projects of different magnitudes.

Inappropriate land use practices in the upstream catchment leads to accelerated soil erosion and consequent silting up of reservoirs. Watershed management is thus an integral part of any water resources project. Space bome multispectral data have been used to generate baseline information on various natural resources, namely soils, forest cover, surface water, ground water and land use/land cover and subsequent integration of such information with slope and socioeconomic data in a Geographic Information System (GIS) to generate locale-specific prescription for sustainable development of land and water resources development on a watershed basis.

During past one-and-half decades, it has been demonstrated that satellite imagery are highly useful in mapping and targeting ground water prospective zones. Under National Drinking Water Technology Mission, the Dept. of Space with the active co-operation of various user departments has prepared district-wise hydrogeomorphological maps on 1:250,000 scale covering all 447 districts in the country using satellite imagery with limited field checks and available information. These maps have been found to be very useful in narrowing down the target zones and selection of sites for drilling besides their usefulness in regional / district level planning and identifying alternate sources of drinking water for many problem villages across the country. In order to provide safe drinking water to rural masses, the Dept. of Space has taken up a project titled "Rajiv Gandhi Drinking Water Mission". The project aims at generating groundwater prospects maps at 1:50,000 scale using IRS-1C/1D LISS-III data for entire country. Ten states, namely Rajasthan, Madhya Pradesh, Chhattisgarh, Andhra Pradesh, Karnataka, Jharkhand, Orissa, Gujarat, Himachal Pradesh and Kerala have been covered so far.

Spectrum of applications related to groundwater sustainability using geoinformatics is being attempted by different workers. Useful information is being generated which has enhanced our understanding regarding groundwater development and use. Initially, this technology was applied for regional studies on groundwater development but with advent of high resolution satellite data, sustainability of this resource at micro-level may be addressed.

I. Flood Hazard Zonation: Flood monitoring in specialistic areas like mining areas leading to loss of fertile land life was done in Erai watershed of Chandrapur District.

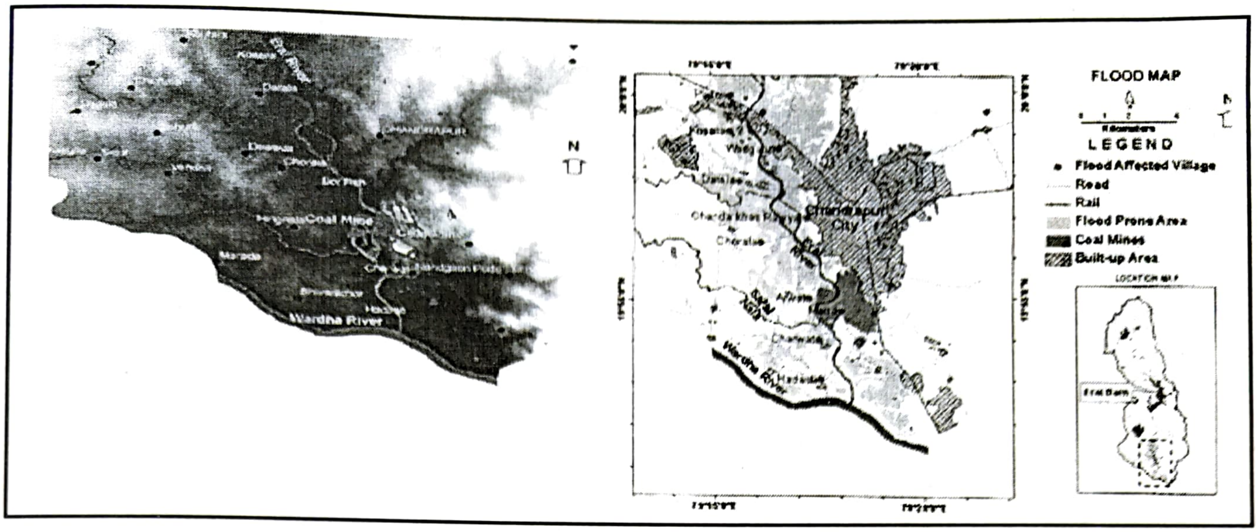

Fig.1. DEM and Flood Map of E..........................

II. Estimation of Groundwater Potential in Bhandara District using controlling parameters:

Bhandra District of Maharashtra, which is famous for its geological complexities all over India is also, called as "District of Lakes" in Maharashtra State. Bhandara District also receives moderately good rainfall and is assumed to be a good terrain for the paddy cultivation. But a close observation of the agricultural produce suggests that the yields are not commensurate with the rainfall intensities and the terrain capabilities. Also, an analysis of the groundwater potential and availability in different watersheds with Bhandara District suggest that the natural recharge is not commensurate with the precipitation from the rain as well as the storage capabilities of aquifers within the district. This is a contradictory situation. Here, RS and GIS has been employed for estimation of geohydrological parameters for Bhandara District in India on a regional scale and delineation of groundwater potential zones to be utilized for water resources management of Bhandara District. Ranking of the impact parameters within the integrated approach is an important factor, which also decides the accuracy of the results. This ranking can be achieved by several methods and may be based on individual's assumption and experience. The overlay analysis may be performed by directly adopting the qualitative characteristics (2) while quantitative values may be adopted to decide the contribution of the interacting parameters (3). Several other workers have attempted the derivation of the regional parameters using the simple overlay techniques of more than one theme to generate the groundwater potential of different areas (4). Two of several parameters generated are shown here (Fig.1).

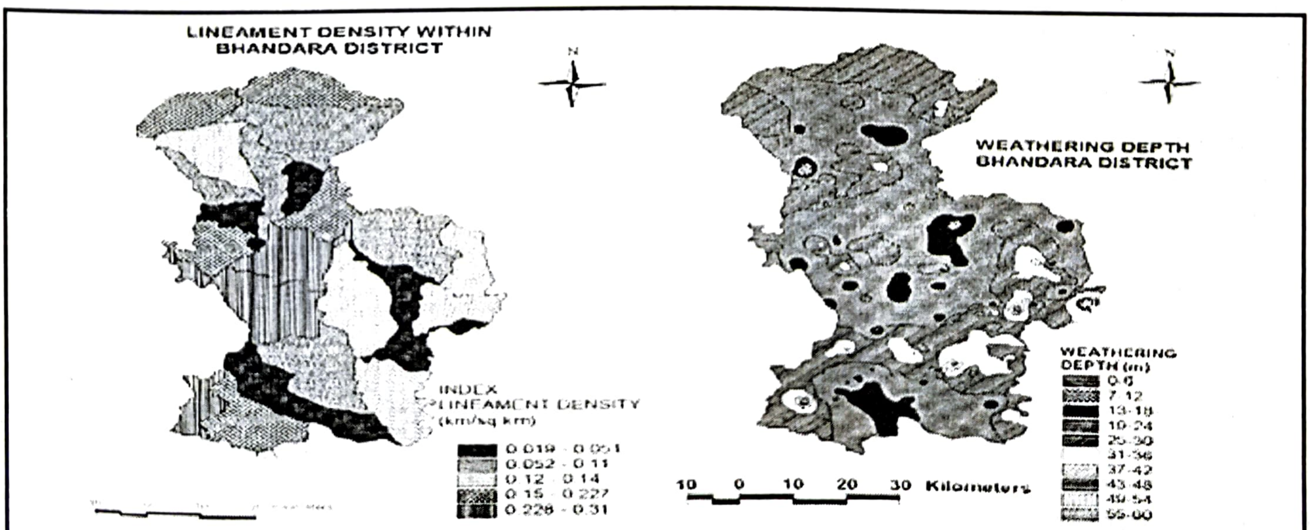

Fig.2. Lineament density map and Weathering depth map of Bhandara District

The results of the two methods have been compared and the estimated results have been validated with the field data and data estimated through traditional methods (5).

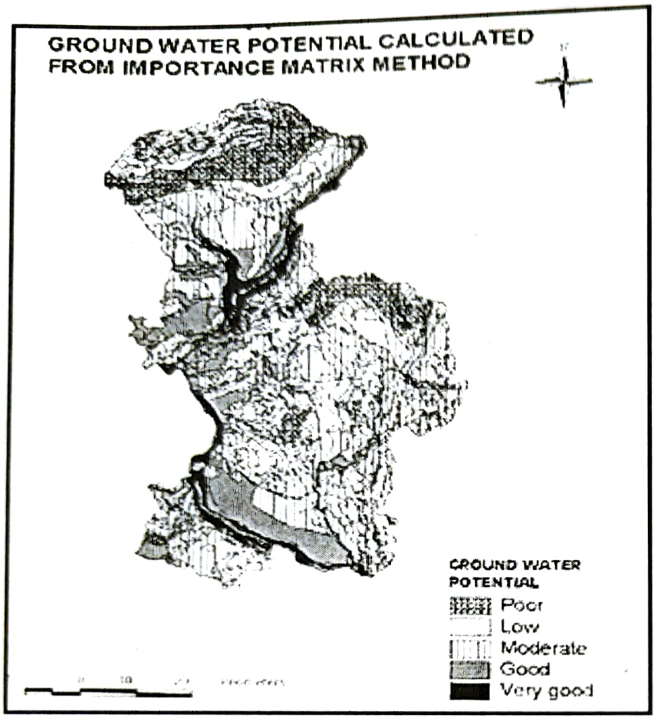

Fig.3. Groundwater Potential using ranking of parameters

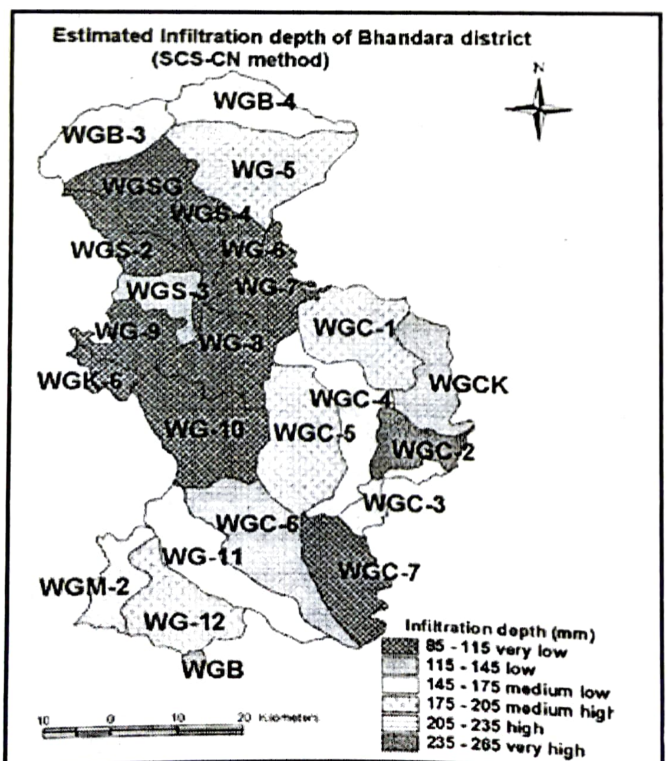

Fig.4. Estimated Infiltration depth of Bhandara District (SCS-CN Method)

III. Delineation of Infiltration Zones:

The objective of this study (6) was to identify infiltration potential area in different litho logical classes. Analytical Hierarchy Process (AHP) has been used to delineate the infiltration zones in basaltic as well as alluvial watersheds (5).

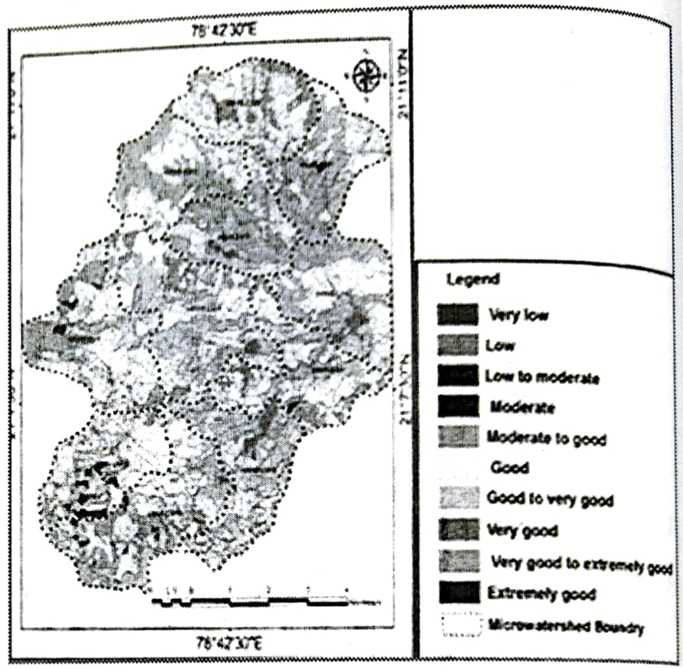

Fig.5. Infiltration Zones derived through overlay analysis

IV. Groundwater Quality Studies in Nagpur Urban Area:

Groundwater samples 74 locations were obtained and the quality parameters have been spatially represented along with the groundwater trends in Nagpur urban areas (7). The results are shown in Fig. 6,7,8.

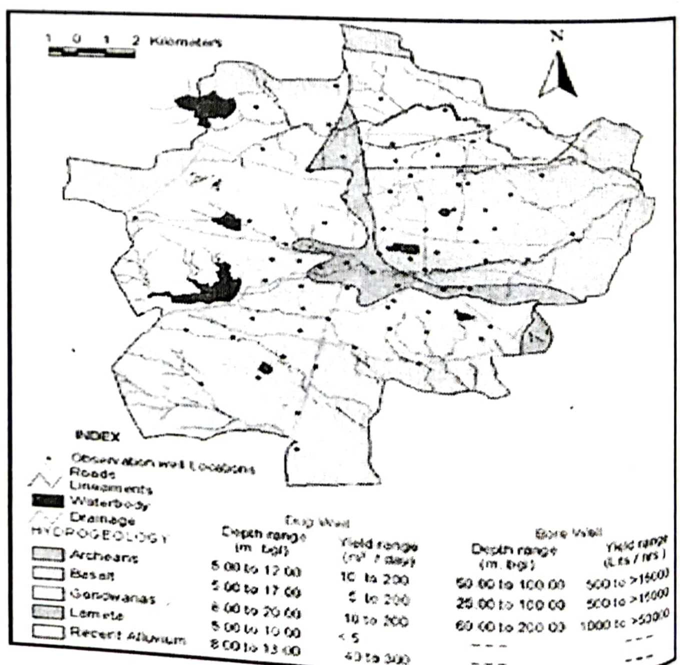

Fig.6. Groundwater availability status in Nagpur Urban Area.

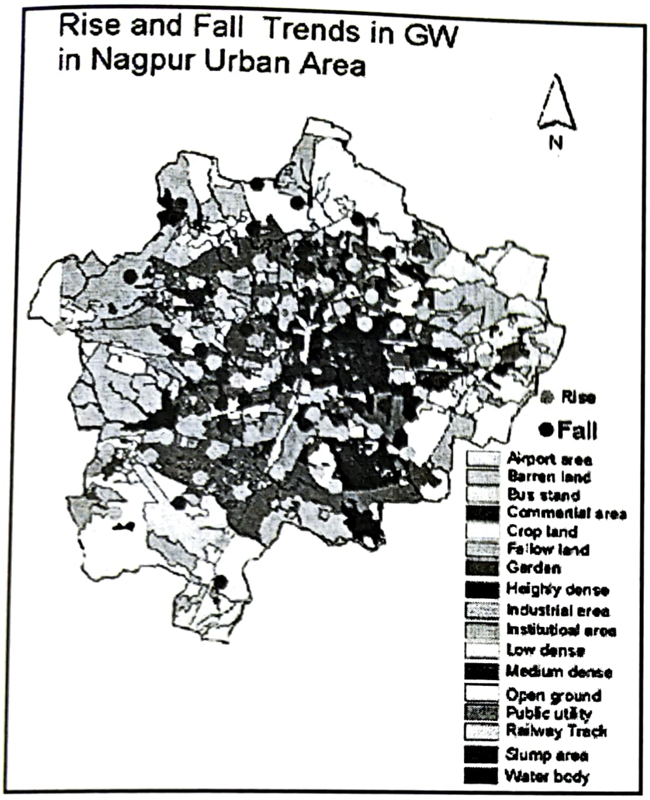

Fig.7. Litho logical Units with groundwater depths, yield and trends in Nagpur Urban Area.

V. Monitoring encroachment in cities in Nagpur Urban Area: The built ups several times encroach the road right of way. Simple study through satellite data can provide insight into the status of encroachment as shown in Fig.9.

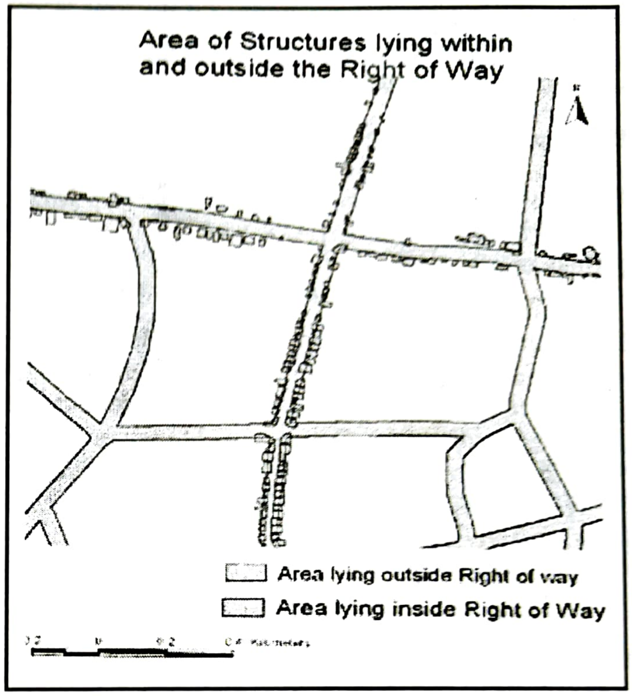

Fig.9. Encroachment along the roads in Nagpur Urban Area.

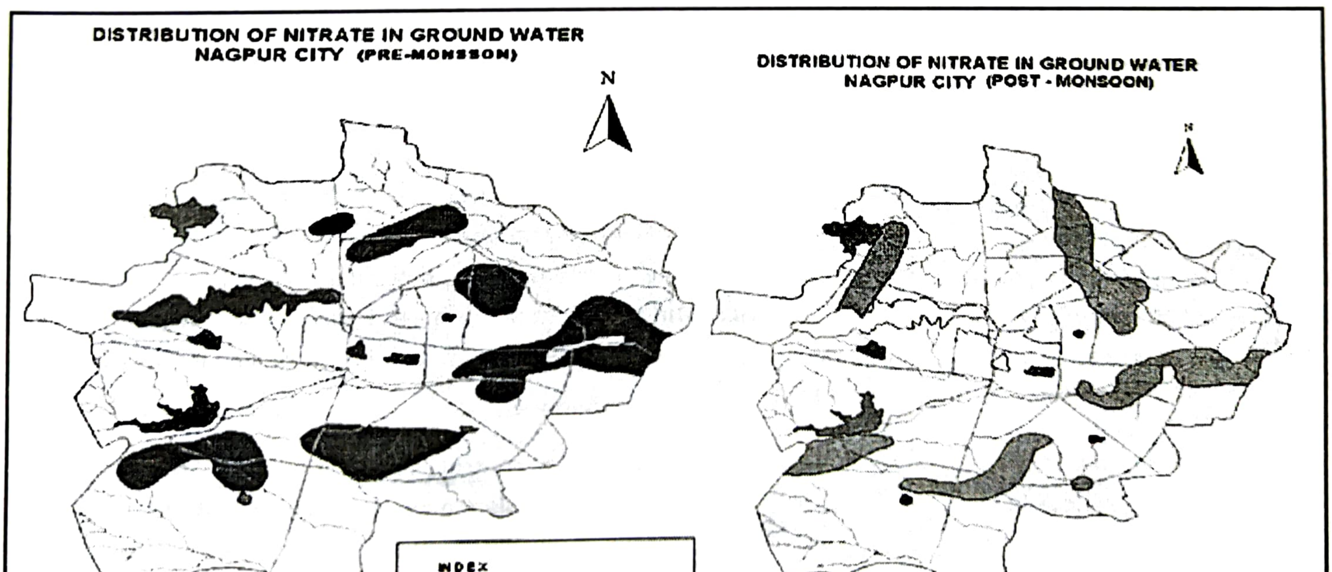

Fig.8. Spatial occurrence of Nitrate (Pre and Post Monsoon) in Nagpur Urban Area.

Conclusion

Remote Sensing (RS) and Geographical Information System (GIS) play a very important role in monitoring mechanism to update the status of resources scenario within the watersheds. These technologies can fill the gaps in the data non availability and help in visualizing the status of water resources parameters.

References:

1. National Water Policy, Ministry of Water Resources, New Delhi, 2002.
2. Lal, M. Climate Change – Implications for India's Water Resources, J.India Water Res. Soc., 2001, 21, 101-119.
3. Seth, S.M. Integrated Water Resources Management – role of research and development in hydrology. Proceedings of the International Conference on Integrated Water Resources Management of Sustainable Development, New Delhi, Organized by National Institute.
4. Padma, T.V., India unveils new monsoon forecast model, Source: Sci, Dev. Net, http://www.clivar.org/recent/monsoon_forec2.htm, 2004.
5. Bose, D. and Saxena, N. Monsoon, Employment News, 2001, XXVI, No.8.
6. Rakesh Kumar, Singh R.D and Sharma K.D. (2005), Water resources of India, Current Science, Vol.89, No.5, 10 September, 2005.
7. Roy P.S. and Rao V.V., Indo-Remote Sensing and GIS-Water Management US Workshop on Innovative E-technologies for Distance Education and Extention/Outreach for Efficient Water Management, March, 5-9, 2007, ICRISAT, Hyderabad, Andhra Pradesh, India.
8. Katpatal Yashwant B., Dube Y.A. (2010), Comparative Overlay Analysis through Analytical Hierarchical Process to delineate Groundwater Potential Zones using Satellite Data, Int. Jour. Earth SC. & Engg. (Oct. 2010).
9. Mane V.P., Kalpatal Y.B., (2010), Study of Lithological control over infiltration thro;ugh water level fluctuation and F-index in micro-watersheds proceedings of ninth international conference on Hydro-Science and Engineering (ICHE 2010), IIT Madras, Chennai, India. 2-5, Aug. 2010.
10. Katpatal, Y.B., Dube, Y.A. (2010), "Pioli watershed health assessment through Remote Sensing and GIS", Published by Jain Brothers (New Delhi), Edited by K.S. Raju, A.K. Saraf, M.L. Dash, ISBN: 81:86321-98-5, P.153-159.
11. Satapathy, D.R, Salve Pradeep, Katpatai Y B (2009), Spatial distribution of metals in ground/surface waters in the Chandrapur district (Central India) and their plausible sources, int. Jour. Environmental Geology (Feb.2009), Vol.56, No.7, 1323-1352.

Tipu stood against British Imperialism

The stories about the anti-Hindu policy of Tipu are imperialist fabrications. He was one of the staunchest anti-imperialists among the Indian feudal rulers, and, throughout his life, fought against British imperialism. Far from persecuting the Hindus. Tipu actually promoted 'Hindu' feudal to high positions. Purnayya, a 'Hindu', was his Prime Minister, Krishna Rao his treasurer, Shama Iyengar, the minister of post and police, and a host of other 'Hindus' were his chief confidents, military generals, and members of his diplomatic missions.

The Mysore archaeological report brines to light a number of presents and contributions given by Tipu to various temples. A document, preserved in the Ernakulam Archieves (No VII, Ist series, (pp.481-83), states that the head priest of Sringeri Math, during the fourth Mysore war, wrote a letter to the Maratha chief, urging him to terminate his alliance with the British and to help Tipu, instead.

—The Indian Society, R.P.Saraf, Published by M.Yosuf, Progressive Studies, Kashmir, April 1974, P.394.