

“REMOTE SENSING & GIS STUDIES OF SOLAPUR CITY, M.S., PROVIDING GEOSPATIAL INFORMATION AND SOLUTIONS FOR SUSTAINABLE DEVELOPMENT”

EXECUTIVE SUMMARY



UGC SPONSORED

**MINOR
RESEARCH
PROJECT REPORT**

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➤ Reference; UGC File No; 47-1251/09 (WRO)
Dated; 17-11-2009 ; UGC Western Regional Office,
Ganesh Khind, PUNE.
START DATE; JANUARY 2010-
END DATE - DECEMBER 2012 = 24 MONTHS

EXECUTIVE SUMMARY

- **INTRODUCTION:**

Remote sensing refers to the phenomenon of recording/observing/perceiving objects or events at remote places. In remote sensing, the sensors are not in direct physical contact with the objects or events being observed. The process of acquiring information about earth surface features, from orbiting satellites is known as Satellite remote sensing. Technically, remote sensing usually refers to the technology of acquiring information about the earth surface (land and ocean) and atmosphere using sensors onboard airborne (aircraft, balloons) or spaceborne (satellites, space shuttles) platforms.

- **METHODOLOGY**

1. Acquire satellite data products; a satellite LISS-III imagery from NRSA, Govt. of India, Balanagar, Hyderabad, followed by analysis and interpretation of data, and formulation of solutions, in consultation with NRSA/IIRS Dept. of Space, Govt. Of India, Hyderabad, A.P.

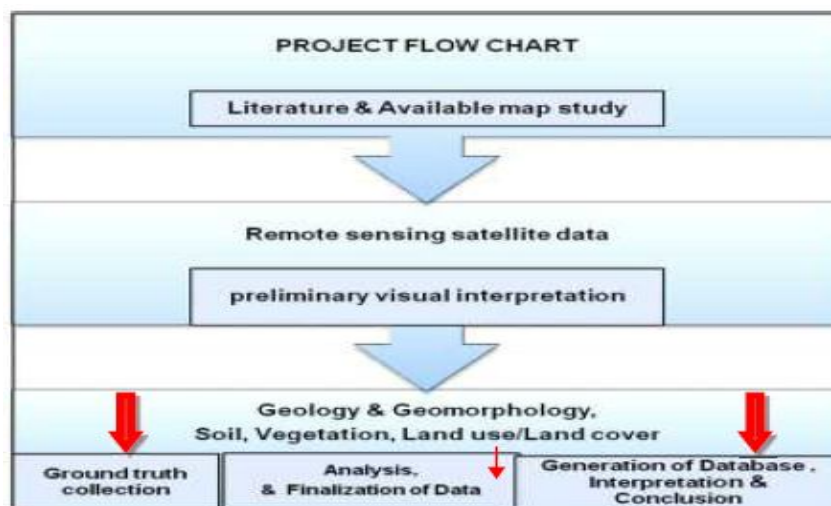
TABLE;1 SATALLITE DATA;

Product type	Scale	Resoultion
LISS- III (24M)* (IRS1C*/1D*/P6) Imagery;- Standard Full Scene ;(141km X 141 km)	250,000 (500 m)	Medium
AWIFS (56M)* (IRS-P6) Imagery ; Standard Full Scene ; (141km X 141 km)	(500m)	Medium

Satellite data	Sensor	Path/row	Shift	Date
LISS III	IRS-P6	97/60	20%	23 rd Oct 2009
IIRS	P6	AWIF 98/55	LISS ROW 059	21 st March 2010
IIRS	P6	AWIF 99/58	LISS ROW 061	2 nd Nov 2009

With the materials and Data: as mentioned above, the input data; i.e. satellite data of the study area are procured from IRS-P6, LISS-III has been used for Geology, Geomorphological, Soil, general study of selected water bodies as; Lake Ekrukh, Lake Siddheshwar. Lake Sambhaji and Lake Hotgi, Agricultural pattern / Vegetation and Land use Land cover studies. Published soil maps, topographic maps, climatic data etc. are also collected and used as collateral data. Data Processing-Satellite data were geo-referenced and suitable Image enhancements are applied to facilitate the delineation and interpretation of different thematic information.

Data Interpretation- Visual and digital interpretation methods were used to prepare pre-field interpreted map. The satellite data is interpreted based on photo elements like tone, texture, size, shape, pattern, aspect, association etc. These pre-field interpreted maps and digitally enhanced satellite data are used on the ground to identify different elements of various themes.



FIG; 1 The project flow chart

• CONCLUSIONS

Interpretations of the lake studies;-

- 1. THE EKRUH LAKE** is located at north Solapur of Maharashtra State. The geographical Coordinates are / (Altitude) :- Latitude: N 17° 44' 38.51, Longitude E; 75° 55' 0.79, Altitude 506.15 m above MSL. The lake type is Natural Lake + Man-made reservoir. It occupies an area of 8.1187 SQ.KM, {8118700 SQ MTR}, with an extensive perimeter of 15300 meters. Regarding hydrology the source of water inflow is through Rainfall / Drain. The lake dries occasionally in the event facing scarce rains. The catchment Watershed area extends to 8.1187 SQ.KM. The nature of the lake is plain. The lake water is used for local water supply and agriculture as well. Sewerage hasn't been provided nor the sewage treatment. The lake faces solid waste disposal through religious offerings/idol immersion and paraphernalia etc. however the water is potable. About the water quality the odour is fishy and the colour is observed blue. The source of water inflow rainfall, runoff & drain. The lake can be categorized as a mesotrophic lake. Aquatic Plants recorded are ; Submerged, emergent, free floating algae. Aquatic Animals recorded are; Zooplankton, Benthic Invertebrates, Molluscs, Fishes, Amphibia, Reptiles, Birds, and Mammals.
- 2. THE LAKE SIDDHESHWAR** is located approx. 6 kms the city Solapur of Maharashtra state. It is a man-made lake 138500 SQ MTR water spread area. The reservoir is located approximately geographically, it lies between Latitude: N 17° 40' 30 & Longitude: E 75° 54' 28.05, an altitude of 514.50 m msl. The water from the reservoir is used for Religious, Recreation, Fish culture, idol immersion in seclusion in addition to fisheries use. The Survey of India topographical sheets (1:50,000 scale) were used to prepare the locality map of the reservoir along with satellite imageries. The Lake Type is Natural Lake + Man-made (Reservoir) It occupies 0.1385 SQ KM Area, {138500 SQ MTR}. The Perimeter is about 1434.42 METERS. Regarding Hydrology the Source of water (inflow) is Rainfall & Drain. It dries out occasionally .The Catchment or Watershed Area in sq.km; is about 8.1187 SQ.KM. However the Nature of the lake is plain. The lake is used for Religious, Recreation, Fish culture, idol immersion in seclusion (practiced nowadays). The sewerage is not provided. Solid waste disposal in lake occurs due to religious offerings/idol immersion & paraphernalia. The Water Quality & Pollution Status of the lake indicates presumably potable water with fishy odour and Blue-Green colour. Siddheshwar lake as of now is however a mesotrophic lake as regards it's pollution status. The aquatic Plants are found to be Submerged, Emergent, & Free floating Algae. The aquatic animals recorded are Zooplankton, Benthic Invertebrates, Molluscs, Fish, Amphibia, Reptiles, Birds & Mammals. Functions and Values of the lake can be titled as usage for Religious, Recreation, Fish culture, idol immersion in seclusion (practiced nowadays). Regarding the use of Biological Resources it is observed that the reeds & grasses are used for thatch or fodder, fishing through tendering system. Functions of the Lake are groundwater recharge & supports biodiversity & socio-cultural Aesthetic Major Problems are reduction in area (shrinkage) & Algal blooms, Organic Pollution, Reduction in depth due to siltation, aquatic weeds, organic pollution, decline or loss of fisheries & eutrophication, where the trust authorities with public initiatives do curb the problem occasionally. There is an immediate need to monitor the lake for its water quality, Algal bloom, & Fish culture. The lake has been monitored only once in several years.
- 3. Lake SAMBHAJI** is located on the Solapur- Bijapur highway at Solapur city. The lake type is Natural Lake+ Man-made (Reservoir) as such a seminatural lake. It occupies an area of about 0.2177 SQ KM, {217700 SQ MTR} water spread area. The geographical Coordinates in terms of Latitude/Longitude/Altitude are ; Latitude N 17° 38' 55.61 and Longitude E 75° 54' 13.9, with an altitude of 491.94 m above MSL. The lake records a perimeter of about 2936.58 Meters.Regarding hydrology the source of water inflow is rainfall / Drain, and most of the part dries off occasionally in case extreme summers and scarce rainfall. The catchment Watershed area is 0.2177 SQ KM. The nature of the lake is however plain. The lake is used for recreation, washing/Laundry, solid waste, idol immersion in seclusion (followed nowadays), sewerage has not been provided yet and there is no sewage treatment followed. Solid waste disposal in lake occurs because of religious offerings/idol immersion , addition or deposition or paraphernalia, washing/Laundry.

The water of lake Sambhaji is used for the irrigation of the social forestry plants at Smruti udyan located just besides the lake Sambhaji. SMRUTI VAN is located near Lake Sambhaji at Solapur district and is spread in about 20.24 hectares. It was established as a community social forestry pilot project by the keen intervention of the district collectorate Hon. Jain and signaling by the state tourism minister Hon. Jaganathrao Patil, on the 3rd January 1996. Later on Hon. Pradipsinha Pardeshi who took over as the Dist. Collectorate showed keen interests in further development of the said project and further by community participation Smruti Van/Udyan flourished marking an excellent example of social forestry across the state of Maharashtra. The Smruti Van 24 sectors developing thousands of plant species and harbouring innumerable animal species. It is excellent site of preservation of biodiversity.

The present investigations of the lake water revealed that the water is most polluted due to high alkalinity, free carbon dioxide, hardness, pH and low dissolved oxygen. Thus it is quite clear that the lake may soon stop supporting the organisms concerned. This has given a red alarm for immediate action and need to stop all such and allied activities, for if the present human activities continue to any extent further, the lake may become a permanently ecologically inactive Lake. The addition of pollutants due to the uncontrolled human activities surprisingly even though in the declared bird sanctuary area, is a tragic testimony to the deterioration of this ecologically natural healthy lake. Eichornea and Typha species have spread over a large area from the main entrance to the core area of the lake, and have started offering obstacles in the mobility and viability of the variety of water birds.

4. The lake Hotgi is located near Solapur city. It is a natural & Man-made reservoir as well. The geographical coordinates in terms of Latitude/Longitude/Altitude being Latitude; N 17° 36' 37.54, Longitude ; E 75° 58' 0.29 with an altitude of 499.08 m above MSL. The Perimeter being 5873.11 Meters and it occupies an area of 1.3049 SQ KM, {1304900 SQ MTR}.

Regarding hydrology the source of water inflow is Rainfall / Drain. No records of drying yet observed. Catchment Watershed area is recorded area is 8.1187 SQ.KM, and the nature of the lake is plain. The water of the lake is potable and is used for local supply and for irrigation as well. Sewerage hasn't been provided yet and no sewage treatment is practiced. Solid waste disposal in lake include religious offerings/idol immersion and paraphernalia etc. The water is Potable water lake is used for water supply. The odour is fishy and the colour is observed Blue. The source of water inflow is rainfall, runoff, and drain. The lake however is mesotrophic. The aquatic Plants recorded are; submerged, emergent, free floating algae, where the aquatic Animals recorded are phytoplankton, zooplankton, benthic invertebrates, mollusks, fishes, amphibian, reptiles, birds and mammals. The lake in major functions for drinking water supply and irrigation as well along with the resources as reeds & grasses used for thatch or fodder, fish. The lake has groundwater recharge and supports rich biodiversity & socio-cultural aesthetic values. The major problems observed are reduction in area shrinkage, algal blooms, organic pollution and Reduction in depth due to siltation, aquatic weeds, organic pollution. Further a decline or loss of fisheries and eutrophication also cannot be ruled off.

➤ **LIMITATIONS:**

- Being the first attempt it was quite hard enough to study independently due to lack of training and availability of facilities. This imposed dependency on experts and agencies which led to additional time consumption.
- A greater depth of knowledge in terms of RS & GIS analytical techniques is necessary to progress independently for the future studies.
- The number of ground control points was inadequate to cover such a large extent of the area.
- The results presented here are specific to the moderate resolution imagery and may or may not be applicable to other resolution data.
- The results are also area specific and may or may not be applicable to other areas with same resolution image data.

The objective of the project was to analyze the extent and status of natural water bodies, mapping the existing green cover in the city area, and reasoning for its corroboration with the city planning law and environmentally delineated obligation. However analysis was possible to the extent of :- agriculture, water bodies limited to three major lakes of Solapur city as Lake Ekrukh, Lake Siddheshwar, Lake Sambhaji, Lake Hotgi was possible in terms of geographical locations, extent of water spread area. The studies, due to time constraints, were limited to the detailed studies of Lake Ekrukh and Lake Sambhaji. Agricultural analysis was limited to cropping pattern, soil analysis. More extended work could have been possible, as mentioned in following future work discussions.

Research Presentations & Publications :-

1) National Conference on Earth Sciences in India: Challenges and Emerging Trends (ESICET-2013) 7-9 November 2013

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Remote Sensing studies of some wetlands of Solapur city, Maharashtra, providing geospatial solutions for sustainable development

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There is an inherent linkage between development and management of ground water resources. For an effective supply side management, it is essential to have full knowledge of hydro-geological controls which govern the yields and behavior of ground water levels under abstraction stress. Wetlands are considered the most biologically diverse of all ecosystems, a repository of various species of flora and fauna available in the area. RS and GIS offers a cost

effective means of identifying and monitoring wetlands over large areas on a temporal scale. A study was taken up with an intention that the dataset be used to provide geospatial solutions towards framing immediate priorities of conservation and sustainable activities in the region. Both Survey of India toposheets of on 1:50,000 scale as well as LISS- III (24m) (IRS1C/1D/P6) Imagery;- Standard Full Scene ;(141km X 141 km), scale 250,000 (500 m), Satellite data IRS-P6, path/row- 97/60, with shift 20%, provided by NRSC, Hyderabad was used. Solapur district is geographically located - 17.10 to 18.32 degrees North Latitude and 74.42 to 76.15 degrees East Longitude. The total geographical area is 14844.6 Sq.Kms. Four lakes falling within the city limits were mapped. The lake Ekrukha is a semi-natural lake 8.11 km² water spread area, lies between Latitude:N 17° 44' 38.51 and Longitude:E 75° 55' 0.79, an altitude of 506.15 m msl. Lake Siddheshwar is a semi-natural lake 138500 m² water spread area, lies between Latitude: N 17° 40' 30 and Longitude: E 75° 54' 28.05, an altitude of 514.50 m msl. Lake Sambhaji is a natural lake with 0.2177 km² {217700 m²} water spread area, lies between Latitude: N 17° 38' 55.61 and Longitude: E 75° 54' 13.9, an altitude of 491.94 m msl. The Lake Hotgi is located approx. 4.367 83 km = 4367.83 m near the city Solapur of Maharashtra state. It is a natural lake 1.3049 km² {1304900 km²} water spread area, lies between Latitude: 17° 36' 37.54 and Longitude: E 75° 58' 0.29, an altitude of 499.08 m msl. The water from is being supplied to the suburbs of the lake in addition to irrigation and fisheries use. Major Problems faced by the lake is reduction in area shrinkage, algal blooms, organic pollution, and reduction in depth due to siltation, aquatic weeds, organic pollution, encroachments and illegal water uplift for irrigation. Decline or loss of fisheries is also on records. The lake hasn't been monitored for several years. The Lake studies show that the lake Ekrukha occupies the highest and extensive area of 8118700 sq. mtrs. Followed by the lake Hotgi occupying an area of 1304900 sq. mtrs. as compared to the other lakes. There is a greater scope for the monitoring of these lakes in terms of hydrology and hydrobiology. These two lakes since they have a greater water spread area are taken up on top priority for monitoring and maintaining ecological health for sustainable development for detailed inventories in the proposed next phase.

II) *Environment Observer*.

I.C.E.C.A.N.T. 28th & 29th Jan 2014

Assessment of geo-referenced land use land cover status providing geospatial solutions of Sholapur District M.S.

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Abstract:

One of the prime prerequisites for better use of land is information on existing land use patterns and changes in land use through time. Knowledge of the present land pattern distribution of an area and the changing proportions is needed by planners, to determine better land use policy to identify future development pressure points to implement effective plans for regional development. This can be judiciously administered through remote sensing (RS) and GIS studies where RS & GIS offers a cost effective means of identifying and monitoring land use land cover over a temporal scale.

In view of the same a study was undertaken through a UGC sponsored MRP (with an intention that the dataset be used to provide geospatial solutions towards framing immediate priorities of conservation and sustainable activities in the study region. Both LISS- III (24M)* (IRS1C*/1D*/P6) Imagery;- Standard Full Scene :(141km X 141 km), scale 250,000 (500 m), Satellite data IRS-P6, path/row- 97/60, with shift 20%, provided by NRSC, Hyderabad as well as Survey of India topo-sheets on 1:50,000 scale was used.

Geo-referenced studies indicate availability of water resource being extremely poor as compared to the agricultural area. Of the total geographical area the agricultural usage is about 45%. However agriculture of this area has limited irrigation facilities, and because of erratic rainfall it has given a way to a verity of crop patterns to adjust with prevailing best possible alternative cropping system. The region has full scope for the percolation tank, checks dams, farm ponds, dug well, bore well and dug cum bore well. This study directs need of proper management in accordance to rainfall providing a base for understanding the complex structure of agriculture landscape of the study region helping better planning.

Keywords: Remote sensing, Land use land cover mapping, geospatial solutions.

“National Conference on “Plant Biotechnology for Agricultural Development and Human Welfare”

**PROVIDING INSIGHT TOWARDS DEVELOPING WETLAND MANAGEMENT PLANS TO RESTORE
AND PROTECT WETLANDS OF SOLAPUR CITY, M.S.**

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Abstract:

Wetlands are an important part of our biosphere heritage. Our economic well-being and quality of life largely depend on our biospheres wealth of natural resources, and wetlands are the vital link between our land and water resources. The current status of the ecological health of the major lakes at Solapur city empirically indicate deterioration and calls immediate attention towards defining wetland management plan to address existing or future water quality problems at the lakes under study. The present primary wetland pragmatic assessment outcome of Solapur city designate an impaired and threatened surveillance that call immediate attention towards defining restoration strategies before it is too late. The investigation should provide an insight providing an analytic framework to restore water quality developing a scientifically defensible plan leading to measurable results and an overall improvement in the water quality of the wetlands under investigation.

IV) Excerpt of UGC MRP 47-1251/09 (WRO) dated 17 Nov. 2009

**Remote Sensing Studies for Crop Inventory and Spatial Distribution of Irrigation of
Solapur, M.S. India**

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Abstract:

Through remote sensing acquisition of images of earth from space and computer based Geographic Information System (GIS) has opened new frontiers in mapping providing definitions of vegetation patches occurring in unique environmental setup. It provides information for defining the habitats and improving vegetation type descriptions in space and time. Applications of RS & GIS prove crucial to determine of soils, potential for improved multiple crop discrimination, crop: monitoring, condition, assessment, canopy, water stress, yield estimates, crop management, precision farming, damage assessment, pest and disease surveillance, spatial irrigation etc.

Present investigation during the conduct of a UGC sponsored MRP on remote sensing studies basic tools as satellite data products; both Survey of India topo-sheets of on 1:50,000 scale as well as LISS- III (24M)* (IRS1C*/1D*/P6) Imagery;- Standard Full Scene:(141km X 141 km), scale 250,000 (500 m), Satellite data IRS-P6, path/row- 97/60, with shift 20%, provided by NRSC were used. Elaborate studies of Land use / Land Cover Classification, Hydro-geo-morphology & ground water studies, soil studies, agricultural activities, cropping pattern, crop concentration index, spatial distribution of irrigation, crop productivity, water bodies, were primarily considered. With reference to the agriculture studies indicate Sugarcane as the dominant irrigated crop (Table-2). In Solapur district, Malshiras and Pandharpur have very high sugarcane concentration where Barshi taluka shows a very low concentration index value being comparatively at higher altitude. Mohol, Sangola, Mangalwedha, Solapur North and Solapur South tehsils show moderate concentration index value for sugarcane. Agro-climatically entire district comes under rain shadow area. Rainfall is uncertain and scanty, due to which water scarcity conditions prevail in the district adversely affecting the socio-economic condition of people.

Of the total geographical area 15017 sq. km the agricultural usage is about 45%, where the cultivated area is about 518641.4 hectares. Drought prone area of Solapur is basically agricultural and rural. However agriculture of this area has limited irrigation facilities, coarse, shallow and poor quality soil. Unpredictable rainfall has given way to the crop patterns to adjust with prevailing best possible alternative cropping system. Hence, water resources by all means, seem to be important for the irrigation purpose. Studies indicate an immediate need to monitor the natural water bodies and implement irrigation projects to elevate agricultural production. The spatial distribution of irrigation at Solapur district is uneven. The study further indicates a contrast ratio of the irrigated land to the un-irrigated land (Table-3). Irrigated land area is too less to develop the agriculture. For improving irrigated area and agriculture production, it is very essential to educate farmers regarding the Govt. subsidized facilities, providing information about water table and the sites for the wells. To avoid water losses through evaporation, seepage, the crop should be irrigated by drip and sprinkler method. It urges for a need to incorporate remote sensing studies for the magnification of agricultural production in the interests of our nation.

AWARENESS WORKSHOP ON RS AND GIS APPLICATIONS

DATE; 15-10-2010

A part of the programme scheduled as per the UGC Research Project;-

“REMOTE SENSING & GIS STUDIES OF SOLAPUR CITY, M.S., PROVIDING GEOSPATIAL INFORMATION AND SOLUTIONS FOR SUSTAINABLE DEVELOPMENT”

Reference; UGC File No; 47-1251/09 (WRO) dated; 17-11-2009 ;

UGC Western Regional Office, PUNE.

