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Resource Effective Mapping Through Integrated RS-GIS Approach

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ABSTRACT

Mapping is the basic requirement for any survey, whether mineral exploration, hydrogeological, engineering geological or change detection studies are concerned. An integrated approach through Remote Sensing (RS) and Geographical Information System (GIS) offers one of the best solutions. Various types of mapping can be done by visually interpretation or through Digital Image Processing (DIP) of the satellite images. Now days, these techniques is playing major role in the field of Mineral & Groundwater Exploration, Natural Resource Management, land use pattern analysis, etc.

The collection of data about the spatial distribution and its interpretation in the earth has long been an important part of the activities of mineral and groundwater exploration. From the earliest civilizations to modern times, spatial data have been collected by the geographers and surveyors and is obvious that it consumes lot of time, money and effort. In the last two decades innovative technologies have been greatly applied to experimental and operational activities. These technologies have their antecedents. For instance, Remote Sensing and GIS have been developed from earlier technologies such as surveying, photogrammetry, cartography, mathematics and statistics.

In the present study IRS LISS-IV ResourceSat Digital Image (64G/14-NE) of Raipur District, Chhattisgarh has been used for resource effective mapping and it is compared with the Survey of India Toposheet of the same area for effective change detection over a period of time.

Keywords: Remote Sensing, GIS, IRS, Resourcesat

1.0 INTRODUCTION

It is well known fact that regional geological and geomorphological mapping is a prerequisite for all exploration programmes. The aerial, as well as satellite based remote sensing has contributed significantly to advancement of geoscientific mapping in the well known as well as in the remote regions of the world. Such maps have been of great uses in exploration of mineral, groundwater, oil, engineering geological investigations and for geoenvironmental studies (Agarwal *et al*, 2000).

Large scale use of computers, together with modern communication facilities has not only changing the whole spectrum of approach but has made the economic progress a global issue.

2.0 METHODOLOGY

IRS LISS-IV RESOURCESAT image (Feb, 2005), covering the area falling under frame no. 64G/14-NE has been used for resource effective mapping purpose (Fig. 1.0) and compared the features from the digitized, Survey of India topographical sheet no. 64G/14-NE of 1971 (Fig. 2.0).

The sequence of activities carried out for GIS mapping are as follows:

2.1 Registration of Survey of India (SOI) topographical sheets of 64G/14-NE (1: 50,000 scale) into geographic latitude – longitude projection system using the Everest 1969 spheroid and Everest 1969 datum with the help of ERDAS IMAGINE (v.8.6) image processing software.

2.2 Registration of RESOURCESAT image (Feb, 2005), of 64G/14-NE with the help of earlier registered SOI sheet 64 G/14-NE into same projection system.

2.3 Re-registration of the SOI sheets for joining them, through edge-matching process in same projection system and then with the help of these registered SOI sheets, re- registering the images.

2.4 Digital Image Processing techniques (Drury, 1987 and Gupta, 2002). i.e. Radiometric correction, Noise Reduction, Haze Reduction, and Contrast Adjustments as applied over the image for better visibility of the area.

2.5 Digitization has been carried out from the registered SOI toposheet and digitally processed image using the ArcView GIS software.

2.6 Change detections have been compared.

3.0 RESULTS AND DISCUSSION

Remote sensing data are almost invariably used as basic data in geo-investigations and serves a very important input data source to GIS. Such an integration technique developed around multiple-image processing and data handling are immediately applicable to assembling and working multidata sets. If a GIS methodology is not used, then integrating such vast data sets would involve elaborate manual exercises in order to extract relevant information.

Gathering geological data and disseminating the data by traditional methods is a slow and expensive process. In order to re-address the deficiency of geological information worldwide within a reasonable time frame and cost, a more rapid approach is required (Smith *et al.*). Geological Survey of India is increasingly searching for resource effective and rapid techniques to increase the efficiency of their geological data gathering.

Multispectral nature of the remote sensing image provides appropriate information base of various natural resources. Its repetitive coverage is an added advantage which provides information on the changes that are taking place over the interaction of environment and natural resources. Its interaction with Geographic Information System (GIS), Global Positioning System (GPS) and laser-range finders can significantly contribute to improve the efficiency of all those concerned.

Advances in the RS technology have a direct impact on GIS, as it is the primary source for spatial data. India has indigenously built IRS-1C/1D satellite systems providing multispectral data with 23.5 m resolution in and RESOURCESAT with multispectral data having 5.8 m resolution. These data provides a capability to map thematic natural resources on 1:12,500 scale. Use of high resolution satellite images along with GPS, has enabled to generate detailed cartographic database. Therefore, it provides an accurate and reliable back-drop for mineral resource management applications.

RESOURCESAT image (Feb, 2005), covering the area falling under frame no. 64G/14-NE has been used for resource effective mapping purpose (Fig. 1.0) and compared the features from the digitized, Survey of India topographical sheet no. 64G/14-NE of 1971 (Fig. 2.0). In this study comparison has been carried out in term of the changes occurred in development of infrastructural facilities in the area, urban areas development, development of mining sectors in areas and industrial setup. Comparison between digitized map of RESOURCESAT and digitized topographical sheet have been carried out to evaluate the changes causes by development of industries, infrastructural facilities, mining and urban areas (Fig. 1.0 and 2.0) in mapped area and results have been summarized as follows:

I. Approximately 21km long railway line has developed in the mapped area.

II. Approximately in 2 sq km areas, mining activities are being carrying out by M/s Century Cement and M/s Grasim Cement around Hirmi and Rawan areas, Raipur District, Chhattisgarh.

III. A major cement plant has been setup by M/s Century Cemant in Hirmi area.

IV. Roads facilities have been also developed in the mapped areas by development of new roads as well as up-gradation of motarable roads to WBM and Tar roads.

V. Urban areas have also been developed by setting up of two cement industries in the mapped area and the road connectivity between the villages.

VI. Drainage densities have been reduced due to development of agriculture land on the drainage and conversion of drainage to ponds and reservoirs.

4.0 CONCLUSION

Remote sensing techniques are now increasingly being used for temporal monitoring, conservation and proper management of mineral resources in the cost effective manner. Satellite remote sensing provides a synoptic view of a large area and has the capabilities of spectral discrimination of landuse, infrastructural development, hydrological conditions which is must for setup a development new mineral sectors.

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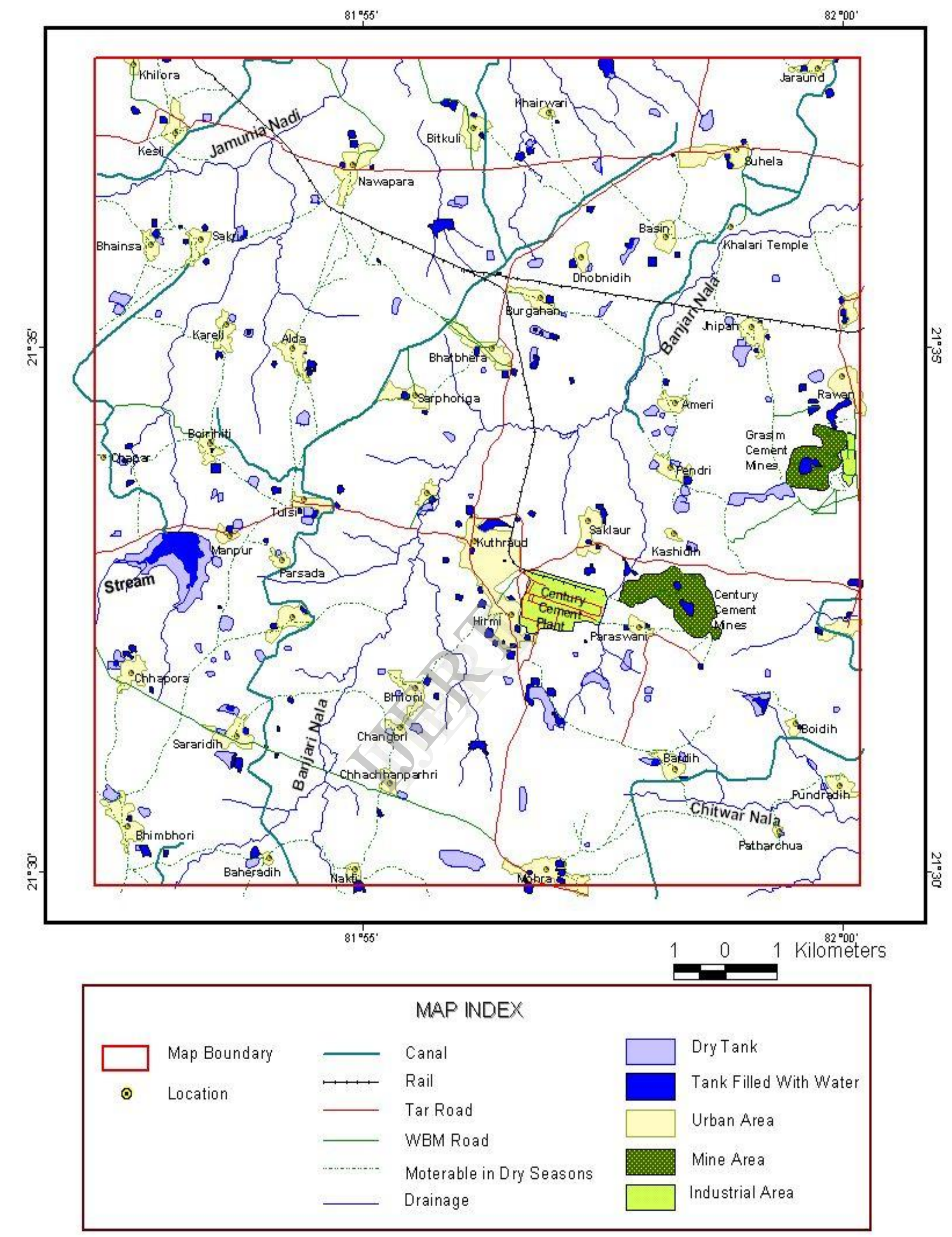

Fig. 1.0: Resource-effective mapping from RESOURCESAT satellite data of 64G/14 - SE (Feb., 2005)

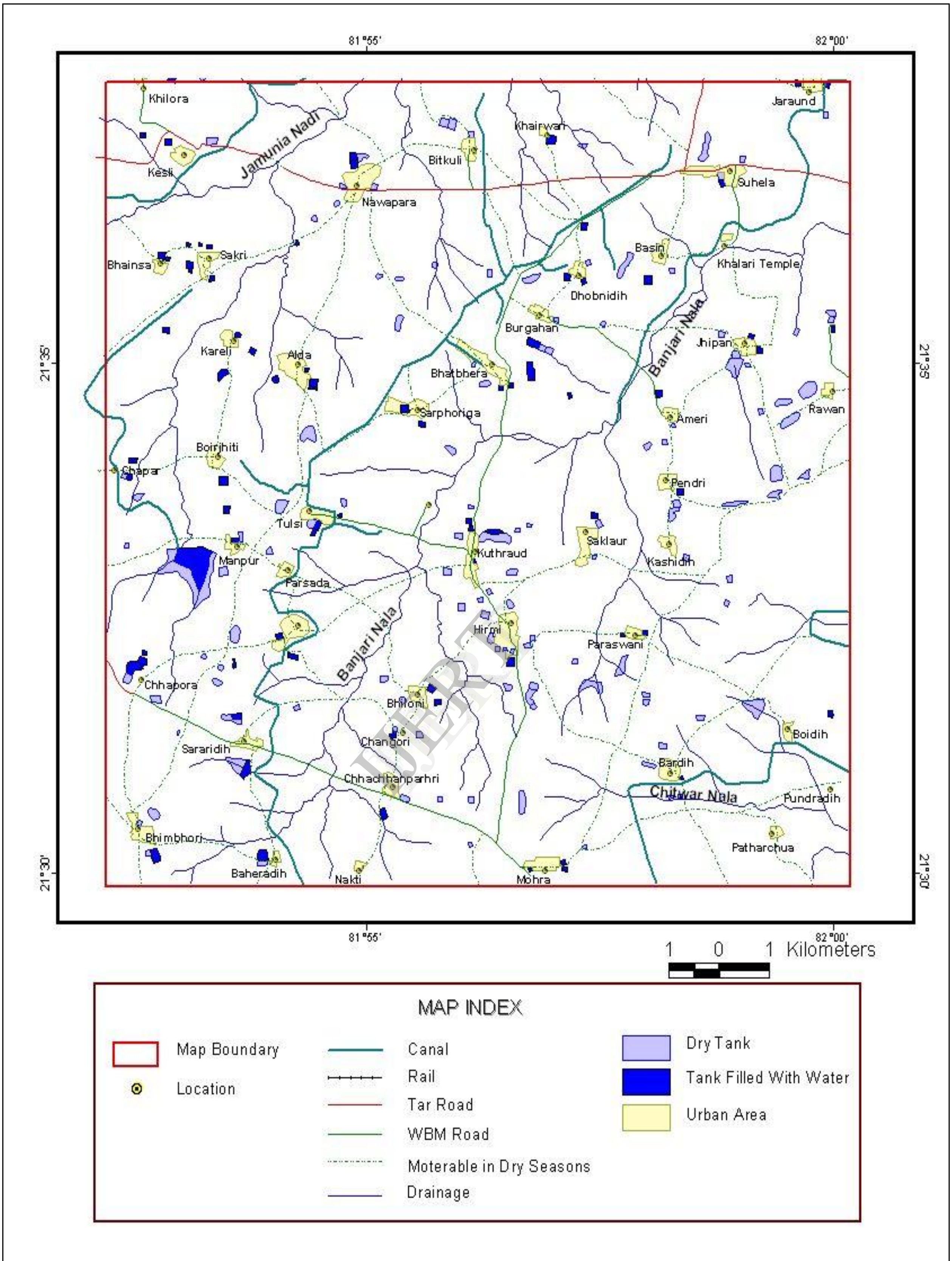

Fig. 2.0: Comparison of mapped area from old toposheet data of 64 G/14 –SE (SOI, 1971)