











NATIONAL WETLAND ATLAS:

RAJASTHAN

Sponsored by

Ministry of Environment and Forests

Government of India

Space Applications centre
Indian Space Research Organisation
Ahmedabad – 380 015









This publication deals with the updated database and status of wetlands, compiled in Atlas format. Increasing concern about how our wetlands are being influenced has led to formulation of a project entitled “National Wetland Inventory and Assessment (NWIA)” to create an updated database of the wetlands of India. The wetlands are categorised under 19 classes and mapped using satellite remote sensing data from Indian Remote Sensing Satellite: IRS P6- LISS III sensor. The results are organised at 1: 50, 000 scales at district, state and topographic map sheet (Survey of India reference) level using Geographic Information System (GIS). This publication is a part of this national work and deals with the wetland status of a particular State/Union Territory of India, through text, statistical tables, satellite images, maps and ground photographs.

The atlas comprises wetland information arranged into nine sections. How the NWIA project work has been executed highlighted in the first six sections viz: Introduction, NWIA project, Study area, Data used, Methodology, and Accuracy. This is the first time that high resolution digital remote sensing data has been used to map and decipher the status of the wetlands at national scale. The methodology highlights how the four spectral bands of LISS III data (green, red, near infra red and short wave infra red) have been used to derive various indices and decipher information regarding water spread, turbidity and aquatic vegetation. Since, the aim was to generate a GIS compatible database, details of the standards of database are also highlighted in the methodology.

The results and finding are organised in three sections; viz: Maps and Statistics, Major wetland types, and Important Wetlands of the area. The Maps and Statistics are shown for state and district level. It gives details of what type of wetlands exists in the area, how many numbers in each type, their area estimates in hectare. Since, the hydrology of wetlands are influenced by monsoon performance, extent of water spread and their turbidity (qualitative) in wet and dry season (post-monsoon and pre-monsoon period) are also given. Similarly the status of aquatic vegetation (mainly floating and emergent types) in two seasons is also accounted for. Status of small wetlands are also accounted as numbers and depicted in maps as points. Wetland map also show important ancillary information like roads/rail, relevant habitations. False Colour Composite (FCC) of the satellite image used (any one season) is shown along with the derived wetland map to give a feeling of manifestation of wetlands in remote sensing data and synoptic view of the area. The status of some of the important wetlands like Ramsar sites, National Parks are shown with recent field photographs.

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NATIONAL WETLAND ATLAS

RAJASTHAN

Sponsored by
Ministry of Environment and Forests, Government of India

As a part of the project on National Wetland Inventory and Assessment (NWIA)

Space Applications Centre (ISRO), Ahmedabad
and
State Remote Sensing Applications Centre, Jodhpur

August 2010

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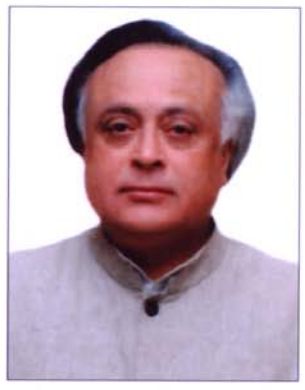
जयराम रमेश
JAIRAM RAMESH



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MESSAGE

It gives me great pleasure to introduce this Atlas, the latest in a series, prepared by Space Applications Centre, Ahmedabad in connection with the National Wetland Inventory and Assessment Project.

This Atlas maps and catalogues information on Wetlands across India using the latest in satellite imaging, one of the first of its kind. Wetlands are areas of land critical ecological significance that support a large variety of plant and animal species adapted to fluctuating water levels. Their identification and protection becomes very important.

Utility-wise, wetlands directly and indirectly support millions of people in providing services such as food, fiber and raw materials. They play important roles in storm and flood control, in supply of clean water, along with other educational and recreational benefits. Despite these benefits, wetlands are the first target of human interference and are among the most threatened of all natural resources. Around 50% of the earth's wetlands are estimated to already have disappeared worldwide over the last hundred years through conversion to industrial, agricultural and residential purposes. Even in current scenario, when the ecosystem services provided by wetlands are better understood - degradation and conversion of wetlands continues.

Aware of their importance, the Government of India has formulated several policies and plans for the conservation and preservation of these crucial ecosystems. Realising the need of an updated geospatial data base of these natural resources as the pre-requisite for management and conservation planning, National Wetland Inventory and Assessment (NWIA) project was formulated as a joint vision of Ministry of Environment & Forestry, Govt. India, and Space Applications Centre (ISRO). I am told that the latest remote sensing data from Indian Remote Sensing satellite (IRS P6) have been used to map the wetlands. The present atlas is part of this project and highlights the results of the study state in terms of statistics of various types of wetlands, extent of water, aquatic vegetation and turbidity in pre and post monsoon period. I also note that special efforts are made to provide detailed information of important wetlands like Ramsar sites, National Parks etc.

I am certain that this Atlas will raise the bar in developing such database and will be of great use for researchers, planners, policy makers, and also members of the general public.

(Jairam Ramesh)

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FOREWORD

Wetlands defined as areas of land that are either temporarily or permanently covered by water exhibit enormous diversity according to their genesis, geographical location, water regime and chemistry. Wetlands are one of the most productive ecosystems and play crucial role in hydrological cycle. Utility wise, wetlands directly and indirectly support millions of people in providing services such as storm and flood control, clean water supply, food, fiber and raw materials, scenic beauty, educational and recreational benefits. The Millennium Ecosystem Assessment estimates conservatively that wetlands cover seven percent of the earth's surface and deliver 45% of the world's natural productivity and ecosystem services. However, the very existence of these unique resources is under threat due to developmental activities, and population pressure. This calls for a long term planning for preservation and conservation of these resources. An updated and accurate database that will support research and decision is the first step towards this. Use of advanced techniques like Satellite remote sensing, Geographic Information System (GIS) is now essential for accurate and timely spatial database of large areas. Space Applications Centre (ISRO) took up this challenging task under the project "NWIA" (National Wetland Inventory and Assessment) sponsored by Ministry of Environment & Forests. To account for numerous small yet important wetlands found in the country, mapping at 1:50,000 scales has been taken up. Two date IRS LISS III data acquired during pre and post monsoon season are used for inventory to account for wet and dry season hydrology of wetlands. The map outputs include the status of water spread, aquatic vegetation and turbidity. Ancillary layers like road/rail, habitations are also created. Very small wetlands below the mappable unit are also identified and shown points. The results are complied as Atlases of wetlands for states/Union Territories of India. This Atlas highlights results for a particular state/UT and hopes to improve our understanding of the dynamics and distribution of wetlands and their status in the area.

I congratulate the team for bringing out this informative atlas and sincerely hope that this will serve as a useful source of information to researchers, planners and general public.

January 25, 2010

(Ranganath R. Navalgund)

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This project has benefited from the wisdom of many people**.** It is a pleasure to acknowledge the contributions made by the wetland experts especially to Prof. C.K. Varshney, Former Dean, School of Environmental Sciences, Jawaharlal Nehru University, New Delhi, Prof. A.R. Yousuf, The University of Kashmir, Srinagar, Prof. Pradeeep Shrivastava, Head, Wetland Research Centre, Barakatullah University, Bhopal, Dr. Prikshit Gautam, Director, WWF-India, Dr. S. Narendra Prasad, Salim Ali Centre for Ornithology and Nature, Coimbtore and Dr. R.K. Suri, Additional Director, Ministry of Environment and Forests, Govt. of India, New Delhi, and the database experts from ISRO who participated in the peer Review meeting to finalise the “Wetland Classification System” followed in this project

We acknowledge the positive role played by 16th SC-B (Standing Committee on Bioresources and Environment) of NNRMS (National Natural Resources Management System) meeting in formulating this project. We are extremely thankful to the members of the“Steering Committee” of the project, under the chairmanship of Dr E J James, Director – Water Institute, Karunya University, for their periodical review, critical comments and appreciation of the efforts by the project team. We are thankful to SC-B under the chairmanship of Secretary, MoEF, for periodic review of the progress of the project and guidance towards timely completion of the work. We acknowledge the valuable contributions made by Dr J K Garg, the then scientist of SAC for his active role in formulation of this project, co-authoring the procedure manual document.

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1.0 INTRODUCTION

It is increasingly realized that the planet earth is facing grave environmental problems with fast depleting natural resources and threatening the very existence of most of the ecosystems. Serious concerns are voiced among scientists, planners, sociologists, politicians, and economists to conserve and preserve the natural resources of the world. One of the constraints most frequently faced for decision making is lack of scientific data of our natural resources. Often the data are sparse or unauthentic, rarely in the form of geospatial database (map), thus open to challenges. Hence, the current emphasis of every country is to have an appropriate geospatial database of natural resources based on unambiguous scientific methods. The wetland atlas of Rajasthan, which is part of the National Wetland Atlas of India, is an attempt in this direction.

1.1 Wetlands

Wetlands are one of the crucial natural resources. Wetlands are areas of land that are either temporarily or permanently covered by water. This means that a wetland is neither truly aquatic nor terrestrial; it is possible that wetlands can be both at the same time depending on seasonal variability. Thus, wetlands exhibit enormous diversity according to their genesis, geographical location, water regime and chemistry, dominant plants and soil or sediment characteristics. Because of their transitional nature, the boundaries of wetlands are often difficult to define. Wetlands do, however, share a few attributes common to all forms. Of these, hydrological structure (the dynamics of water supply, throughput, storage and loss) is most fundamental to the nature of a wetland system. It is the presence of water for a significant period of time which is principally responsible for the development of a wetland. One of the first widely used classifications systems, devised by Cowardin *et al,* 1979, was associated to its hydrological, ecological and geological aspects, such as: marine (coastal wetlands including rock shores and coral reefs, estuarine (including deltas, tidal marshes, and mangrove swamps), lacustarine (lakes), riverine (along rivers and streams), palustarine ('marshy'- marshes, swamps and bogs). Given these characteristics, wetlands support a large variety of plant and animal species adapted to fluctuating water levels, making the wetlands of critical ecological significance. Utility wise, wetlands directly and indirectly support millions of people in providing services such as food, fiber and raw materials, storm and flood control, clean water supply, scenic beauty and educational and recreational benefits. The Millennium Ecosystem Assessment estimates conservatively that wetlands cover seven percent of the earth's surface and deliver 45% of the world's natural productivity and ecosystem services of which the benefits are estimated at $20 trillion a year (Source: www.MAweb.org). The Millennium Assessment (MA) uses the following typology to categorise ecosystem services:

Provisioning services: The resources or products provided by ecosystems, such as food, raw materials (wood), genetic resources, medicinal resources, ornamental resources (skin, shells, flowers).

Regulating services: Ecosystems maintain the essential ecological processes and life support systems, like gas and climate regulation, water supply and regulation, waste treatment, pollination, etc.

Cultural and Amenity services: Ecosystems are a source of inspiration to human culture and education throughout recreation, cultural, artistic, spiritual and historic information, Science and education.

Supporting services: Ecosystems provide habitat for flora and fauna in order to maintain biological and genetic diversity.

Despite these benefits, wetlands are the first target of human interference and are among the most threatened of all natural resources. Around 50% of the earth's wetland area is estimated to already have disappeared over the last hundred years through conversion to industrial, agricultural and residential developments. Even in current scenario, when the ecosystem services provided by wetlands are better understood - degradation and conversion of wetlands continues. This is largely due to the fact that the 'full value' of ecosystem functions is often ignored in policy-making, plans and corporate evaluations of development projects.

1.2 Mapping and Geospatial Technique

To conserve and manage wetland resources, it is important to have inventory of wetlands and their catchments. The ability to store and analyse the data is essential. Digital maps are very powerful tools to achieve this. Maps relate the feature to any given geographical location has a strong visual impact. Maps are thus essential for monitoring and quantifying change over time scale, assist in decision making. The technique used in the preparation of map started with ground survey. The Survey of India (SOI) topographical maps are the earliest true maps of India showing various land use/cover classes including wetlands. Recent years have seen advances in mapping technique to prepare maps with much more information. Of particular importance is the remote sensing and geographic information system (GIS)

technique. Remote sensing is now recognised as an essential tool for viewing, analyzing, characterizing, and making decisions about land, water and atmospheric components.

From a general perspective, remote sensing is the science of acquiring and analyzing information about objects or phenomena from a distance (Jensen, 1986; Lillesand and Keifer, 1987). Today, satellite remote sensing can be defined as the use of satellite borne sensors to observe, measure, and record the electromagnetic radiation (EMR) reflected or emitted by the earth and its environment for subsequent analysis and extraction of information. EMR sensors includes visible light, near-, mid- and far-infrared (thermal), microwave, and long-wave radio energy. The capability of multiple sources of information is unique to remote sensing. Of specific advantage is the spectral, temporal, and spatial resolution. Spectral resolution refers to the width or range of each spectral band being recorded. Since each target affects different wavelengths of incident energy differently, they are absorbed, reflected or transmitted in different proportions. Currently, there are many land resource remote sensing satellites that have sensors operating in the green, red, near infrared and short wave Infra red regions of the electromagnetic spectrum giving a definite spectral signature of various targets due to difference in radiation absorption and reflectance of targets. These sensors are of common use for land cover studies, including wetlands**.** Figure 1 shows typical spectral signature of few targets from green to SWIR region. Converted to image, in a typical false colour composite (FCC) created using NIR, red and green bands assigned as red, green and blue colour, the features become very distinct as shown in Figure 2. In FCC, the vegetation thus appears invariably red (due to high reflection in NIR from green leaves).

Since the early 1960s, several satellites with suitable sensors have been launched into orbit to observe and monitor the earth and its environment. Most early satellite sensors acquired data for meteorological purposes. The advent of earth resources satellite sensors (those with a primary objective of mapping and monitoring land cover) occurred, when the first Landsat satellite was launched in July 1972. Currently, more than a dozen orbiting satellites of various types provide data crucial to improving our knowledge of the earth's atmosphere, oceans, ice and snow, and land. Of particular interest to India is the indigenous series of satellites called Indian Remote Sensing satellites (IRS-Series). Since the launch of the first satellite IRS 1A in 1987, India has now a number of satellites providing data in multi-spectral bands with different spatial resolution. IRS P6/RESOURCESAT 1 is the current generation satellite that provides multi-spectral images in spatial resolution of 5.8 m (LISS IV), 23.5 m (LISS III) and 56m (AWiFS). Over the past few decades, Indian remote sensing data has been successfully used in various fields of natural resources (Navalgund *et al*, 2002).

Development of technologies like Geographic Information System (GIS) has enhanced the use of RS data to obtain accurate geospatial database. GIS specialises in handling related, spatially referenced data, combining mapped information with other data and acts as analytical tool for research and decision making. During the past few decades, technological advances in the field of satellite remote sensing (RS) sensors, computerized mapping techniques, global positioning system (GPS) and geographic information system (GIS) has enhanced the ability to capture more detailed and timely information about the natural resources at various scales catering to local, regional, national and global level study.

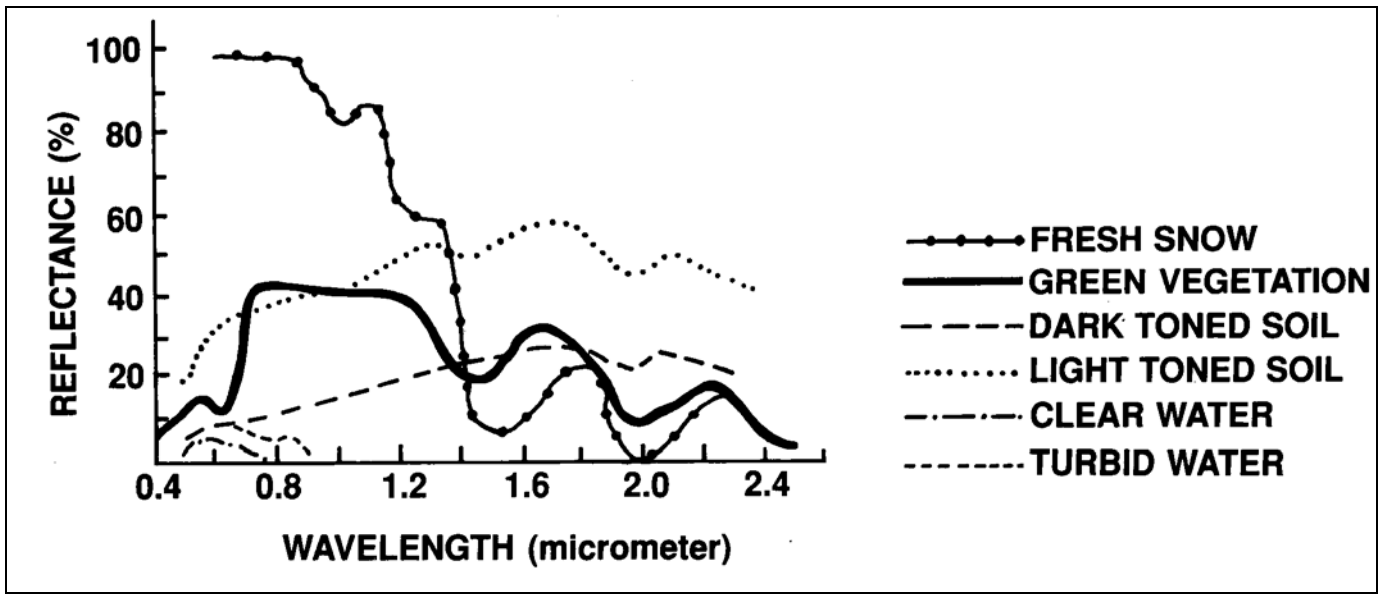
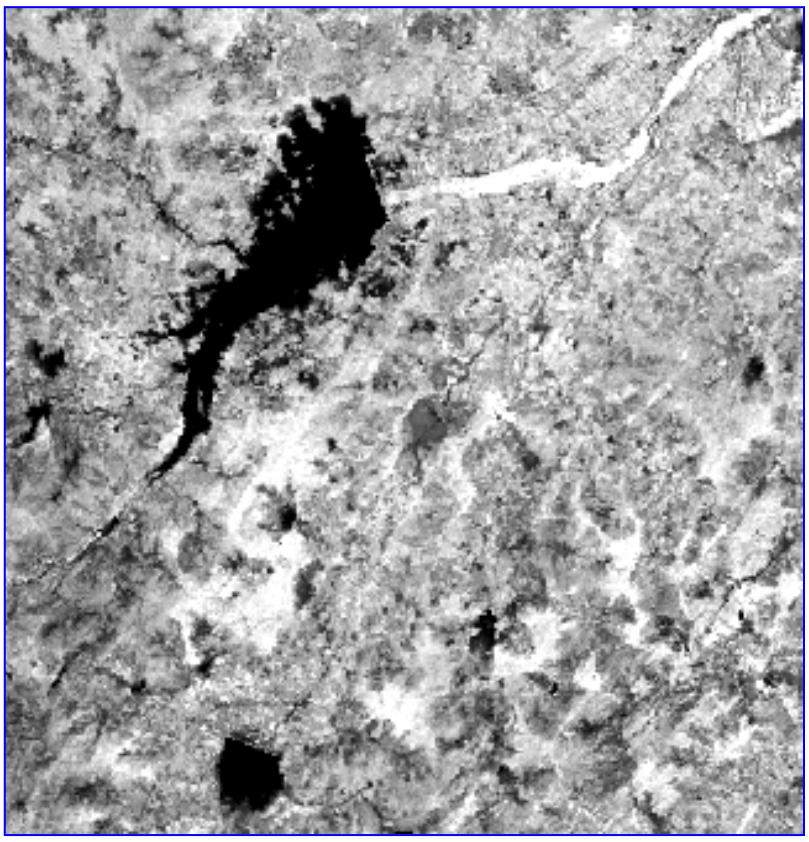


Figure 1: Spectral Signature of various targets



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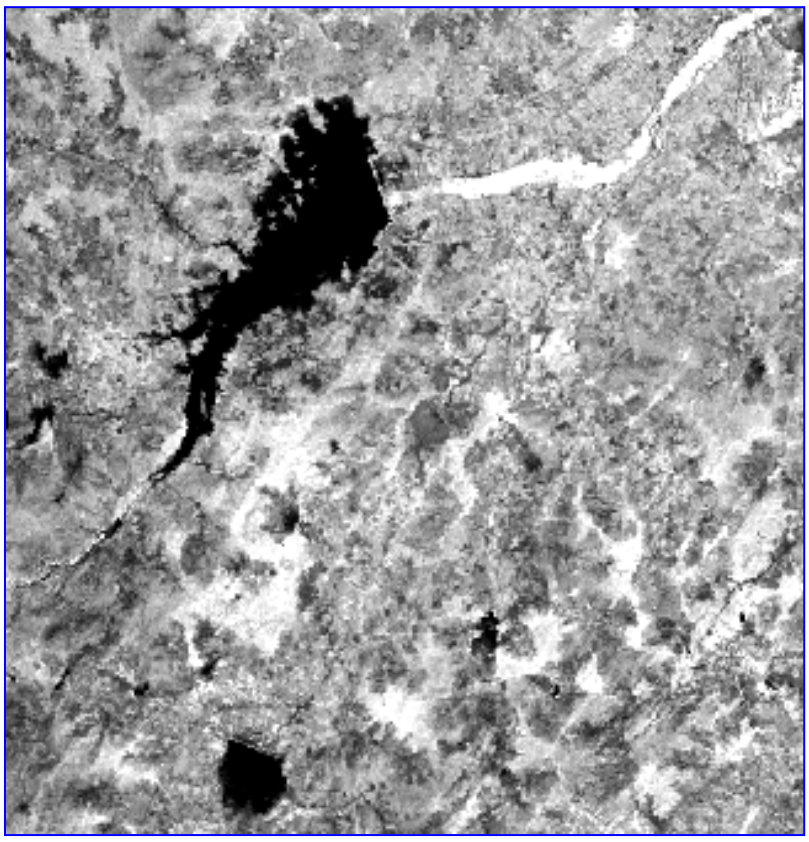

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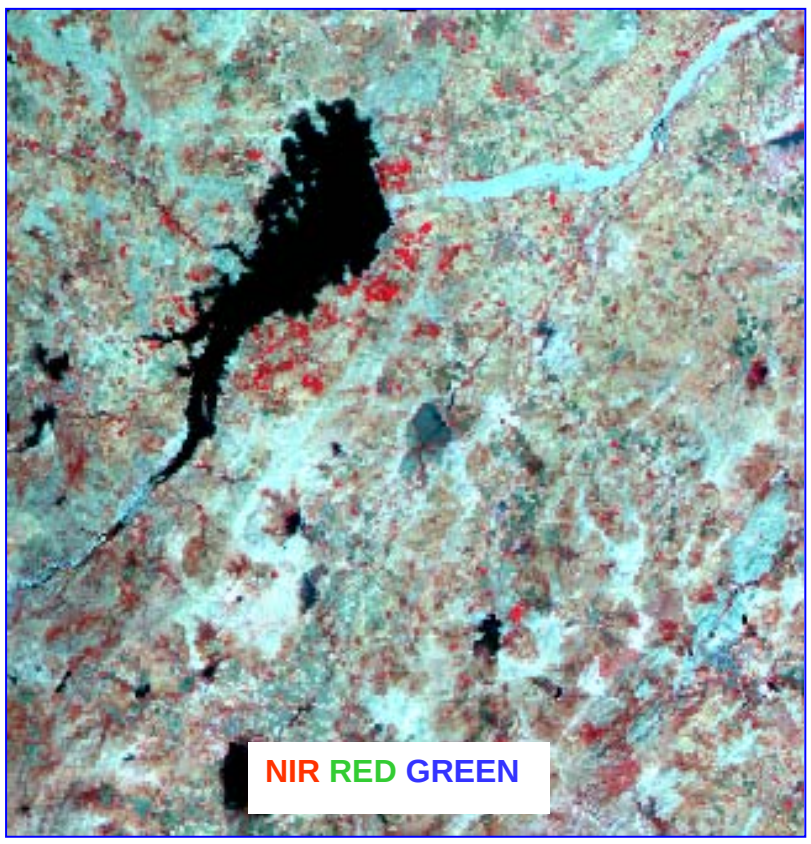
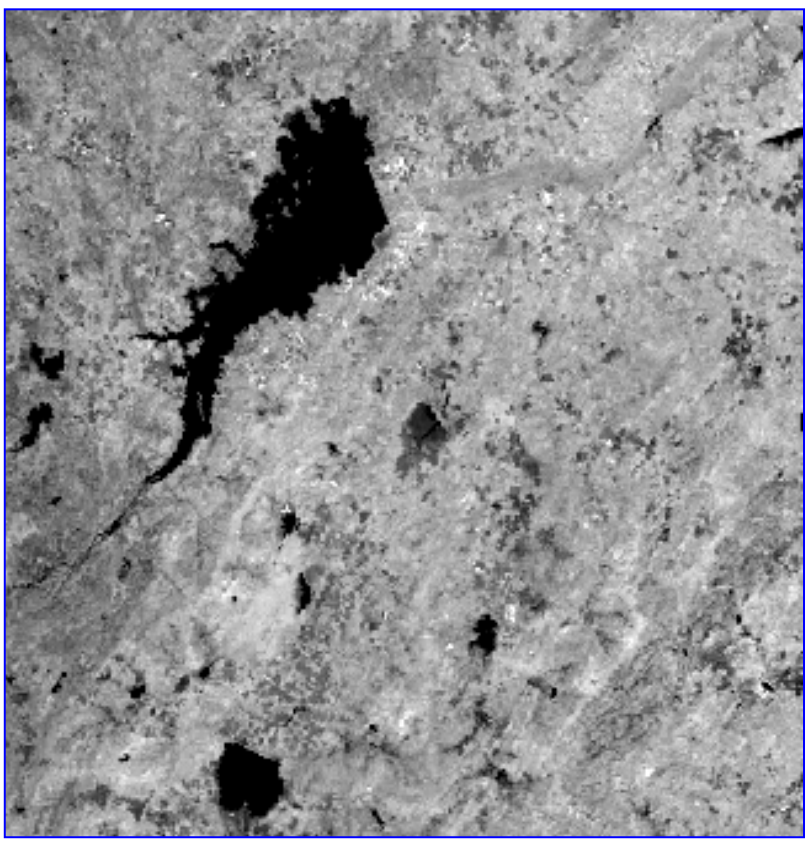


NIR

SWIR



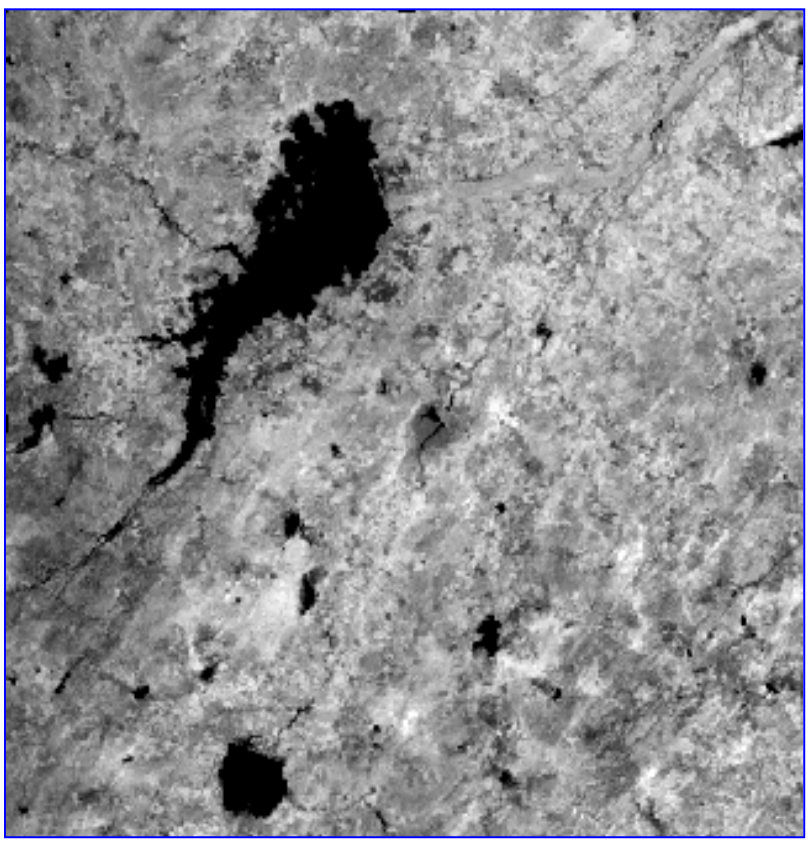


Figure 2: Various land features as they appear in four spectral bands and in a typical three band FCC

1.3 Wetland Inventory of India

India with its large geographical spread supports large and diverse wetland classes, some of which are unique. Wetlands, variously estimated to be occupying 1-5 per cent of geographical area of the country, support about a fifth of the known biodiversity. Like any other place in the world, there is a looming threat to the aquatic biodiversity of the Indian wetlands as they are often under a regime of unsustainable human pressures. Sustainable management of these assets therefore is highly relevant. Realising this, Govt. of India has initiated many appropriate steps in terms of policies, programmes and plans for the preservation and conservation of these ecosystems. India is a signatory to the Ramsar Convention for management of wetland, for conserving their biodiversity and wise use extending its scope to a wide variety of habitats, including rivers and lakes, coastal lagoons, mangroves, peat-lands, coral reefs, and numerous human-made wetland, such as fish and shrimp ponds, farm ponds, irrigated agricultural land, salt pans reservoirs, gravel pits, sewage farms, and canals. The Ministry of Environment and Forests has identified a number of wetlands for conservation and management under the National Wetland Conservation Programme and some financial assistance is being provided to State Governments for various conservation activities through approval of the Management Action Plans. The need to have an updated map database of wetlands that will support such actions has long been realized.

Mapping requires a standard classification system. Though there are many classification systems for wetlands in the world, the Ramsar classification system is the most preferred one. The 1971 Ramsar Convention on Wetlands of International Importance especially as Waterfowl Habitat is the oldest conservation convention. It owes its name to its place of adoption in Iran. It came into being due to serious decline in populations of waterfowl (mainly ducks) and conservation of habitats of migratory waterfowl. Convention provides framework for the conservation and 'wise use' of wetland biomes. Ramsar convention is the first modern global intergovernmental treaty on conservation and wise use of natural resources (www.ramsar.org). Ramsar convention entered into force in 1975. Under the text of the Convention (Article 1.1) wetlands are defined as:

"areas of marsh, fen, peat-land or water, whether natural or artificial, permanent or temporary, with water that is static or flowing, fresh, brackish or salt, including areas of marine water the depth of which at low tide does not exceed six meters".

In addition, the Convention (Article 2.1) provides that wetlands:

"may incorporate riparian and coastal zones adjacent to the wetlands, and islands or bodies of marine water deeper than six meters at low tide lying within the wetlands".

The first scientific mapping of wetlands of India was carried out during1992-93 by Space Applications Centre (ISRO), Ahmedabad, at the behest of the Ministry of Environment and Forests (MoEF), Govt. of India using remote sensing data from Indian Remote Sensing satellites (IRS-Series). The mapping was done at 1:250,000 scale using IRS 1A LISS-I/II data of 1992-93 timeframe under the Nation-wide Wetland Mapping Project. Since, no suitable wetland classification existed for comprehensive inventory of wetlands in the country at that time; the project used a classification system based on Ramsar Convention definition of wetlands. The classification considers all parts of a water mass including its ecotonal area as wetland. In addition, fish and shrimp ponds, saltpans, reservoirs, gravel pits were also included as wetlands. This inventory put the wetland extent (inland as well as coastal) at about 8.26 million ha (Garg *et al*, 1998). These estimates (24 categories) do not include rice/paddy fields, rivers, canals and irrigation channels.

Further updating of wetland maps of India was carried out by SAC using IRS P6/Resourcesat AWiFS data of 2004-05 at 1:250000 scale. In recent years, a conservation atlas has been brought out by Salim Ali Centre for Ornithology and Natural History (SACON, 2004), which provide basic information required by stakeholders in both wetland habitat and species conservation. Space Applications Centre has carried out many pilot projects for development of GIS based wetland information system - West Bengal (Patel *et al*, 2003) and Loktak Lake Information system (Singh *et al*, 2003).

2.0 NATIONAL WETLAND INVENTORY AND ASSESSMENT (NWIA) PROJECT

Realising the importance of many small wetlands that dot the Indian landscape, it has been unanimously felt that inventory of the wetlands at 1:50,000 scale is essential. The task seemed challenging in view of the vast geographic area of our country enriched with diverse wetland classes. Space Applications Centre with its experience in use of RS and GIS in the field of wetland studies, took up this challenging task. This is further strengthened by the fact that guidelines to create geospatial framework, codification scheme, data base structure etc. for natural resources survey has already been well established by the initiative of ISRO under various national level mapping projects. With this strength, the National Wetland Inventory and Assessment (NWIA) project was formulated by SAC, which was approved and funded by MoEF.

The main objectives of the project are:

- To map the wetlands on 1:50000 scale using two date (pre and post monsoon) IRS LISS III digital data following a standard wetland classification system.
- Integration of ancillary theme layers (road, rail, settlements, drainage, administrative boundaries)
- Creation of a seamless database of the states and country in GIS environment.
- Preparation of State-wise wetland atlases.

The project was initiated during 2007. The first task was to have a classification system that can be used by different types of users while amenable to database. An expert/peer group was formed and the peer review was held at SAC on June 2007 where wetland experts and database experts participated and finalized the classification system. It was agreed to follow the classification system that has been used for the earlier project of 1:250,000 scale, with slight modification. Modified National Wetland Classification system for wetland delineation and mapping comprise 19 wetland classes which are organized under a Level III hierarchical system. The definition of each wetland class and its interpretation method was finalized. The technical/procedure manual was prepared as the standard guideline for the project execution across the country (Garg and Patel, 2007). The present atlas is part of the national level data base and deals with the state of Rajasthan.

2.1 Wetland Classification System

In the present project, Modified National Wetland Classification system is used for wetland delineation and mapping comprising 19 wetland classes which are organized under a Level III hierarchical system (Table 1). Level one has two classes: inland and coastal, these are further bifurcated into two categories as: natural and man-made under which the 19 wetland classes are suitably placed. Two-date data pertaining to pre-monsoon and post-monsoon was used to confirm the classes. Wetlands put to agriculture use in any of the two dates are not included as wetland class. Definitions of wetland categories used in the project is given in Annexure-I.

2.2 Spatial Framework and GIS Database

The National Spatial Framework (NSF) has been used as the spatial framework to create the database (Anon. 2005a). The database design and creation standard suggested by NRDB/NNRMS guidelines is followed. Feature codification scheme for every input element has been worked out keeping in view the nationwide administrative as well as natural hierarchy (State-district- within the feature class for each of the theme. All data elements are given a unique name, which are self explanatory with short forms.

Following wetland layers are generated for each inland wetland:

- Wetland extent: As wetlands encompass open water, aquatic vegetation (submerged, floating and emergent), the wetland boundary should ideally include all these. Satellite image gives a clear signature of the wetland extent from the imprint of water spread over the years.

- Water spread: There are two layers representing post-monsoon and pre-monsoon water spread during the year of data acquisition.

- Aquatic vegetation spread: The presence of vegetation in wetlands provides information about its trophic condition. As is known, aquatic vegetation is of four types, viz. benthic, submerged, floating

and emergent. It is possible to delineate last two types of vegetation using optical remote sensing data. A qualitative layer pertaining to presence of vegetation is generated for each season (as manifested on pre-monsoon and post-monsoon imagery).

- Turbidity of open water: A layer pertaining to a qualitative turbidity rating is generated. Three qualitative turbidity ratings (low, medium and high) is followed for pre- and post-monsoon turbidity of lakes, reservoirs, barrages and other large wetlands.

- Small wetlands (smaller than minimum mappable unit: < 2.25 ha) are mapped as point features.

- Base layers like major road network, railway, settlements, and surface drainage are created (either from the current image or taken from other project data base).

Table 1: Wetland Classification System and coding

Wettcode*	Level I	Level II	Level III
1000	Inland Wetlands		
1100		Natural	
1101			Lakes
1102			Ox-Bow Lakes/ Cut-Off Meanders
1103			High altitude Wetlands
1104			Riverine Wetlands
1105			Waterlogged
1106			River/stream
1200		Man-made	
1201			Reservoirs/ Barrages
1202			Tanks/Ponds
1203			Waterlogged
1204			Salt pans
2000	Coastal Wetlands		
2100		Natural	
2101			Lagoons
2102			Creeks
2103			Sand/Beach
2104			Intertidal mud flats
2105			Salt Marsh
2106			Mangroves
2107			Coral Reefs
2200		Man-made	
2201			Salt pans
2202			Aquaculture ponds

* Wetland type code

3.0 STUDY AREA

Rajasthan, the largest state of India (3,42,269 sq. km.) situated in the northwestern part of the India (23° 30' and 30° 11' North latitude and 69° 29' and 78° 17' East longitude) is largely an arid state. It is bounded on the western side by Pakistan, on its north by the states of Haryana and Punjab and Delhi, Uttar Pradesh and Madhya Pradesh on its eastern part while by Gujarat on the south.

The Great Indian Desert the Thar Desert, lies in the western part of the state and gives it its distinguishing character, the state has many hills and rainy areas, forts and palaces, rivers and lakes that attract tourists. The total population of Rajasthan state is 56507188. The most populous districts like Bharatpur, Jaipur, Alwar, Dhaulpur and Kota lie on the eastern fringe of the state, while least populous districts like Jaisalmer, Barmer and Bikaner lie in the west, as compared to total geographical area of the district. Yet its population is only about 5.49 per cent of the total population of the country (Census 2001).

Four major physiographic regions can be identified within the state. These are;

(1) The western desert (Thar),
(2) The Aravalli hill region,
(3) The eastern plains and
(4) The south-eastern plateau region.

The climate of Rajasthan state varies from arid to sub-humid. To the west of the Aravalli range, the climate is characterized by low rainfall with erratic distribution, extremes of diurnal and annual temperatures, low humidity and high wind velocity. The climate is semi-arid to sub-humid in the east of Aravalli range, characterized by more or less the same extremes in temperatures but relatively lower wind velocity and high humidity with better rainfall. The entire state is characterized by hyper-thematic conditions. The desert areas are terribly hot by day but cool down considerably by nightfall. The day temperature ranges from 45^0 to 1^0C during summer and winter respectively. Sometimes the temperature goes up to 52^0 C in remote areas of the Thar desert.

The Rainfall pattern of the state varies significantly and scanty and the ground water tables is deep going down to 60 to 90 meters and in some times to 300 meters. The average precipitation of the state is 530 mm. There is a very rapid and marked decrease in rainfall in western part of the Aravalli range, making western Rajasthan the most arid part. The average annual rainfall in this part ranges from less than 10 cm in north-west part of Jaisalmer (lowest in the state), to 20 to 30 cm in Ganganagar, Bikaner and Barmer regions, 30 to 40 cm in Nagaur, Jodhpur, Churu and Jalor regions and more than 40 cm in Sikar, Jhunjhunun and Pali regions and along the western fringes of Aravalli range.

The river Banas is one of the major rivers of the state and other important rivers of the state are Chambal. Banganga, Gambhiri, Mahi, West Banas, Sabarmati , Sahibi, Kantli. The rivers of Rajasthan, except for the Chambal, are ephemeral and flow only during the rainy season. Luni is the only major stream on the west of the Aravalli ranges, which meets the sea in the Rann of Kutch. The floral wealth of Rajasthan is rich and varied.

There are two National parks and twenty-five wild-life sanctuaries have been established in suitable forest areas. The Keoladeo National Park (KNP) area is partially an artificial lake which gets filled up with water every year during rains and which gets dried up in summer, is a paradise for birds and bird watchers. This is one of the best-known bird sanctuaries in the world. Migratory birds like Demoiselle cranes, pintails, and Coots. Painted storks, pelicans, etc. roots and breed in thousands. Siberian crane, which is a vanishing species, visits the habitat every year during winter season.

Ranthambhor, national park is in the dry deciduous forest in Aravalli hills, provides a suitable and healthy habitat to the great Indian Tiger, which is at apex of the biotope in most of the Indian Jungles. The National park has been included in Project Tiger Scheme in the year 1973 by Government of India. Among other notable fauna the Black buck, Nilgai and chinkara are found in many parts of the state.

Of the lakes, mention must be made of Rajsamund north of Udaipur on the way to Ajmer. The Sambhar Lake is the largest natural salt lake in Rajasthan and covers an area of 230 Sq. km.

Rajasthan is covered by five hundred eighty four (584) 1:50,000 scale SOI topographical maps that form the spatial frame work for mapping (Figure 4). Detail of district -wise information followed in the atlas is given in Annexure-II.

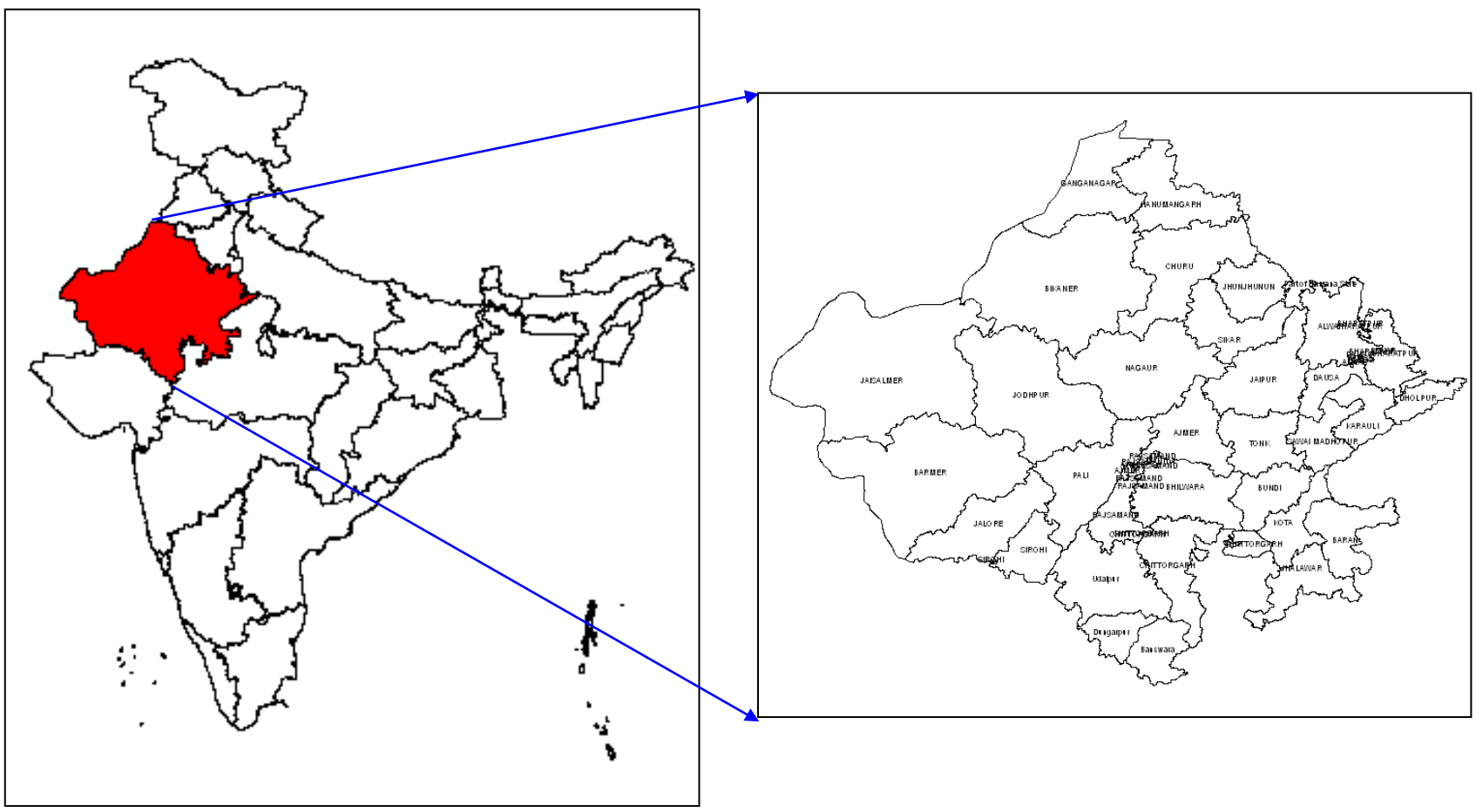


Figure 3: Location map

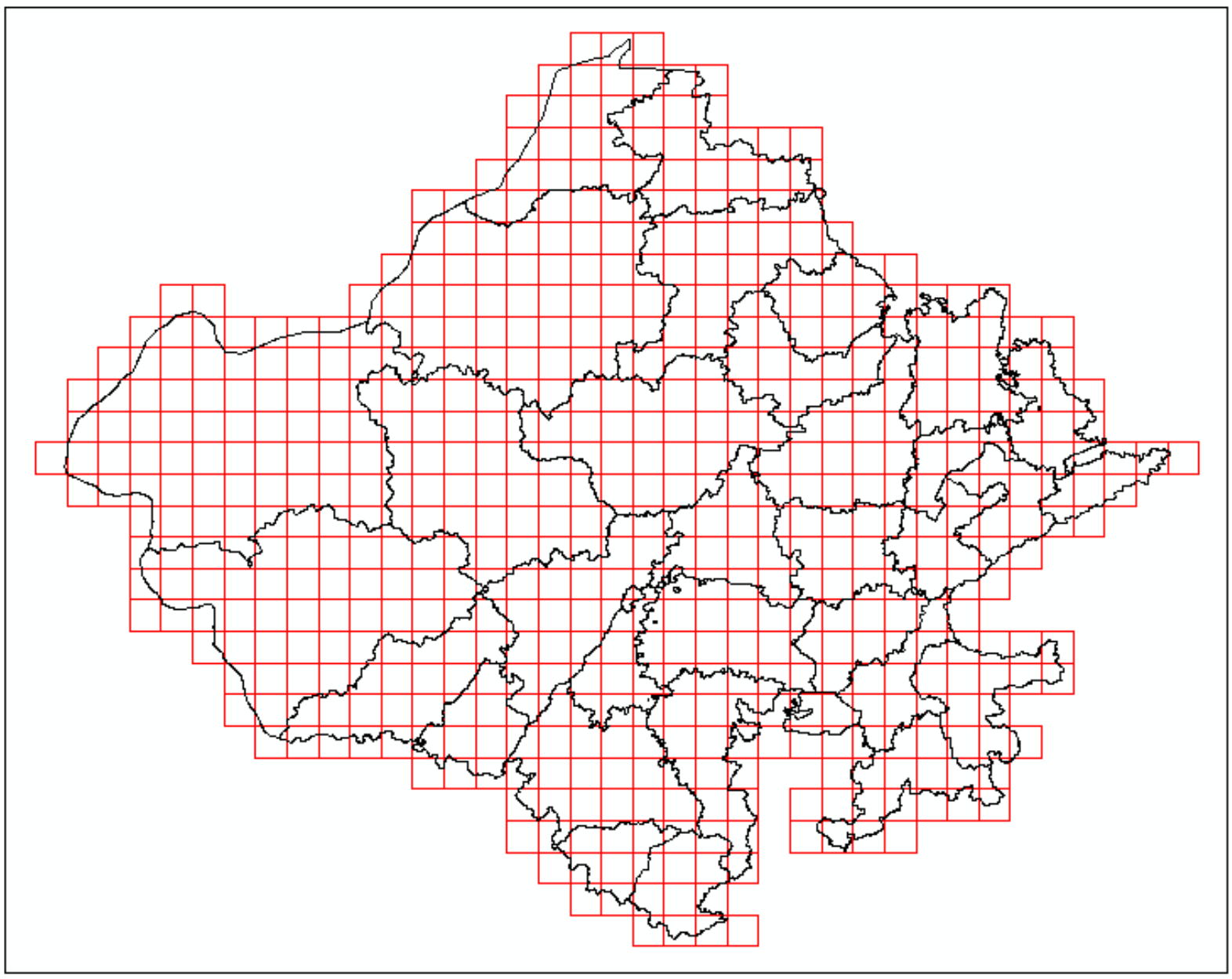


Figure 4: Spatial framework of Rajasthan

4.0 DATA USED

Remote sensing data

IRS P6 LISS III data was used to map the wetlands. IRS P6 LISS III provide data in 4 spectral bands; green, red, Near Infra Red (NIR) and Short wave Infra Red (SWIR), with 23.5 m spatial resolution and 24 day repeat cycle. The spatial resolution is suitable for 1:50,000 scale mapping. The state of Rajasthan is covered in 35 IRS LISS III scene (Figure 5). Two date data (70 scenes), one acquired during March and another during January were used to capture the pre-monsoon and post-monsoon hydrological variability of the wetlands respectively (Table-2). Figure 6 shows the overview of the part of Rajasthan as seen in the LISS III FCC of post-monsoon pre-monsoon data respectively.

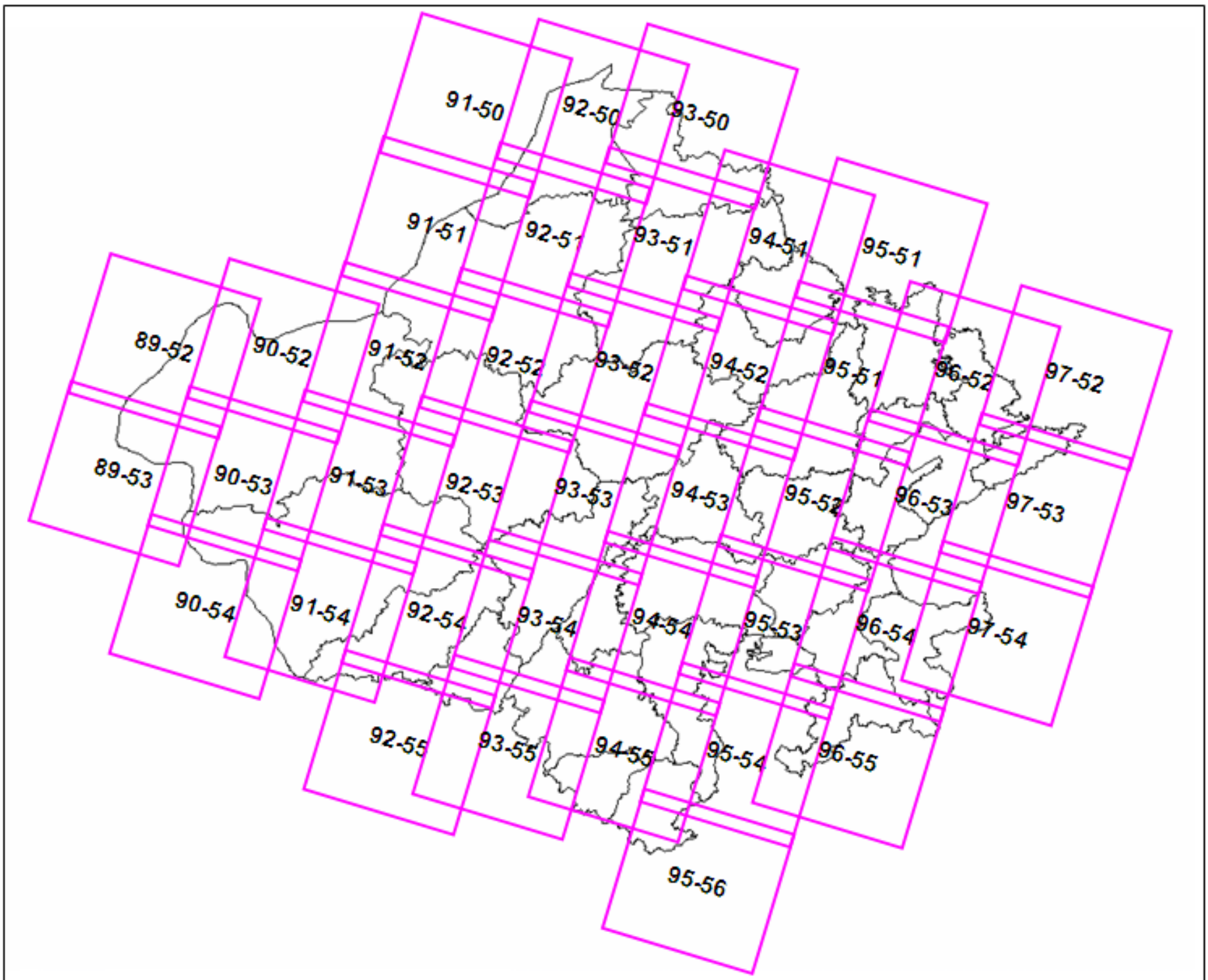


Figure 5: IRS P6 LISS-III coverage of Rajasthan

Ground truth data

Remote sensing techniques require certain amount of field observation called “ground truth” in order to convert into meaningful information. Such work involves visiting a number of test sites, usually taking the satellite images. The location of the features is recorded using the GPS. The standard proforma as per the NWIA manual was used to record the field data. Field photographs are also taken to record the water quality (subjective), status of aquatic vegetation and water spread. All field verification work has been done during October and November 2008.

Other data

Survey of India topographical maps (SOI) were used for reference purpose. Lineage data of National Wetland Maps at 1:250,000 scale was used for reference.

Table-2: Satellite data used

Sr. No	Sensor	Path-Row	Date of acquisition	
			Post-Monsoon (2006)	Pre-Monsoon (2007)
1	LISS-III	90-52	October 28, 2006	May 8, 2007
2	LISS-III	90-53	October 28, 2006	May 8, 2007
3	LISS-III	91-51	October 9, 2006	May 13, 2007
4	LISS-III	91-52	October 9, 2006	May 13, 2007
5	LISS-III	91-53	November 26, 2006	May 13, 2007
6	LISS-III	91-54	November 26, 2006	May 13, 2007
7	LISS-III	92-50	November 7, 2006	May 18, 2007
8	LISS-III	92-51	October 14, 2006	May 18, 2007
9	LISS-III	92-52	October 14, 2006	May 18, 2007
10	LISS-III	92-53	November 7, 2006	May 18, 2007
11	LISS-III	92-54	December 1, 2006	May 18, 2007
12	LISS-III	93-50	October 19, 2006	May 23, 2007
13	LISS-III	93-51	October 19, 2006	May 23, 2007
14	LISS-III	93-52	October 19, 2006	May 23, 2007
15	LISS-III	93-53	October 19, 2006	May 23, 2007
16	LISS-III	93-54	October 19, 2006	May 23, 2007
17	LISS-III	94-51	September 30, 2006	Mar 17, 2006
18	LISS-III	94-52	September 30, 2006	Mar 17, 2006
19	LISS-III	94-53	October 24, 2006	May 4, 2007
20	LISS-III	94-54	October 24, 2006	May 4, 2007
21	LISS-III	94-55	October 24, 2006	May 4, 2007
22	LISS-III	95-52	October 5, 2006	May 9, 2007
23	LISS-III	95-53	October 5, 2006	May 9, 2007
24	LISS-III	95-54	October 5, 2006	May 9, 2007
25	LISS-III	95-55	October 5, 2006	May 9, 2007
26	LISS-III	96-52	October 10, 2006	May 14, 2007
27	LISS-III	96-53	October 10, 2006	May 14, 2007
28	LISS-III	96-54	October 10, 2006	May 14, 2007
29	LISS-III	96-55	November 27, 2006	May 14, 2007
30	LISS-III	97-52	October 15, 2006	April 1, 2007
31	LISS-III	97-54	December 2, 2006	June 12, 2007
32	LISS-III	89-52	October 4, 2005	January 8, 2006
33	LISS-III	93-55	October 19,2006	May 23, 2007
34	LISS-III	95-51	October10, 2005	March 23 2006
35	LISS-III	97-53	October 15, 2006	March 8, 2007

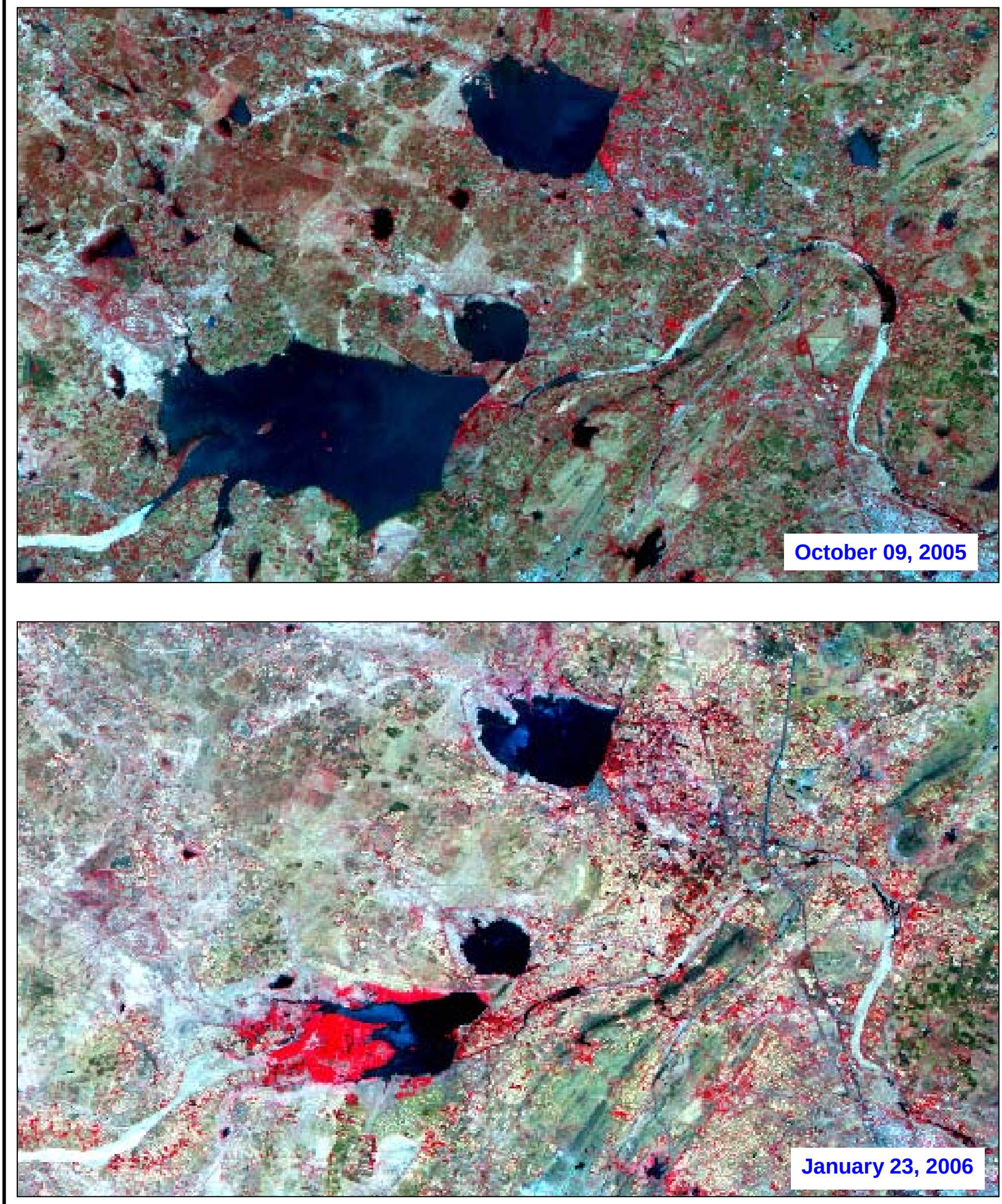


Figure 6: IRS LISS-III FCC (Post-monsoon and Pre-monsoon), Part of Rajasthan state

METHODOLOGY

The methodology to create the state level atlas of wetlands is adhered to NWIA technical guidelines and procedure manual (Garg and Patel, 2007). The overview of the steps used is shown in Figure 7. Salient features of methodology adopted are

- Generation of spatial framework in GIS environment for database creation and organisation.
- Geo-referencing of satellite data
- Identification of wetland classes as per the classification system given in NWIA Manual and mapping of the classes using a knowledge based digital classification and onscreen interpretation
- Generation of base layers (rail, road network, settlements, drainage, administrative boundaries) from satellite image and ancillary data.
- Mosaicing/edge matching to create district and state level database.
- Coding of the wetlands following the standard classification system and codification as per NWIA manual.
- Preparation of map compositions and generation of statistics
- Outputs on A3 size prints and charts for atlas.

Work was carried out using ERDAS Imagine, Arc/Info and Arcgis softwares.

5.1 Creation of Spatial Framework

This is the most important task as the state forms a part of the national frame work and covered in multiple map sheets. To create NWIA database, NNRMS/NRDB standards is followed and four corners of the 1:50,000 (15' x 15') grid is taken as the tics or registration points to create each map taking master grid as the reference. Spatial framework details are given in NWIA manual (Patel and Garg, 2007). The spatial framework for Rajasthan state is shown in Figure 4.

5.2 Geo-referencing of Satellite Data

In this step the raw satellite images were converted to specific map projection using geometric correction. This is done using archive geometrically corrected LISS III data (ISRO-NRC-land use / land cover project). Standard image processing software was used for geo-referencing. First one date data was registered with the archive image. The second date data was then registered with the first date data.

5.3 Mapping of Wetlands

The delineation of wetlands through image analysis forms the foundation for deriving all wetland classes and results. Consequently, a great deal of emphasis has been placed on the quality of the image Interpretation. In the present study, the mapping of wetlands was done following digital classification and onscreen visual interpretation. Wetlands were identified based on vegetation, visible hydrology and geography. There are various methods for extraction of water information from remote sensing imagery, which according to the number of bands used, are generally divided into two categories, i.e. Single-band and multi-band methods. Single-band method usually involves choosing a band from multi-spectral image to distinguish water from land by subjective threshold values. It may lead to over- or under-estimation of open water area. Multi-band method takes advantage of reflective differences of each band.

In this project, five indices known in literature that enhances various wetland characteristics were used (McFeetres, 1986; Xu Hanqiu, 2006; Lacaux *et al*, 2007; Townshend and Justice, 1986; Tucker and Sellers, 1986) as given below:

i) Normalised Difference Water Index (NDWI) = (Green-NIR) / (Green + NIR)

ii) Modified Normalised Difference Water Index (MNDWI) = (Green-MIR) / (Green + MIR)

iii) Normalised Difference Vegetation Index (NDVI) = (NIR - Red) / (NIR + Red)

iv) Normalised Difference Pond Index (NDPI) = (MIR – Green / MIR + Green)

v) Normalised Difference Turbidity Index (NDTI) = (Red – Green) / (Red + Green)

The indices were generated using standard image processing software, stacked as layers (Figure 8). Various combinations of the indices/spectral bands were used to identify the wetland features as shown in Figure 9. The following indices were used for various layer extractions:

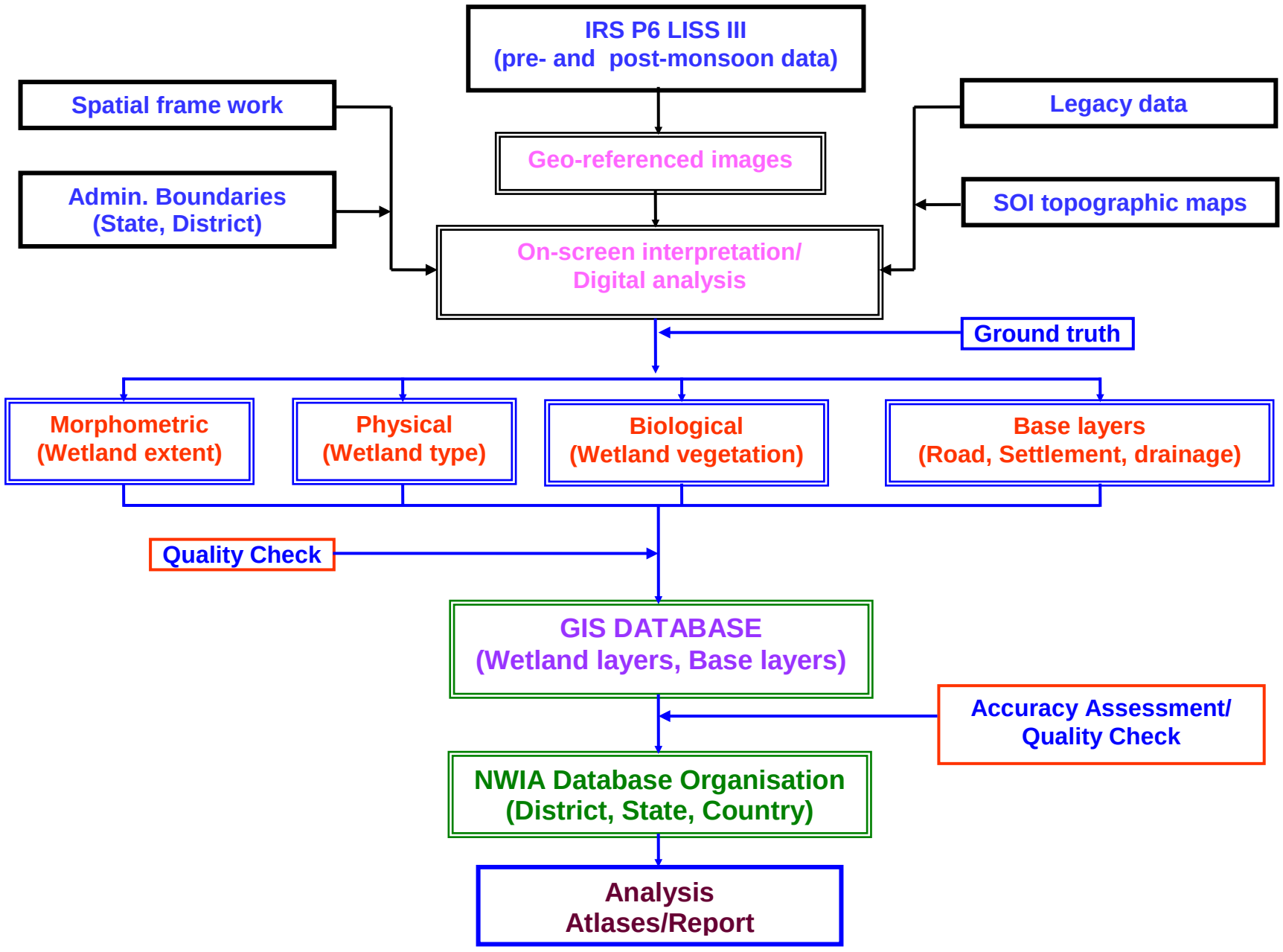


Figure 7: Flow chart of the methodology used

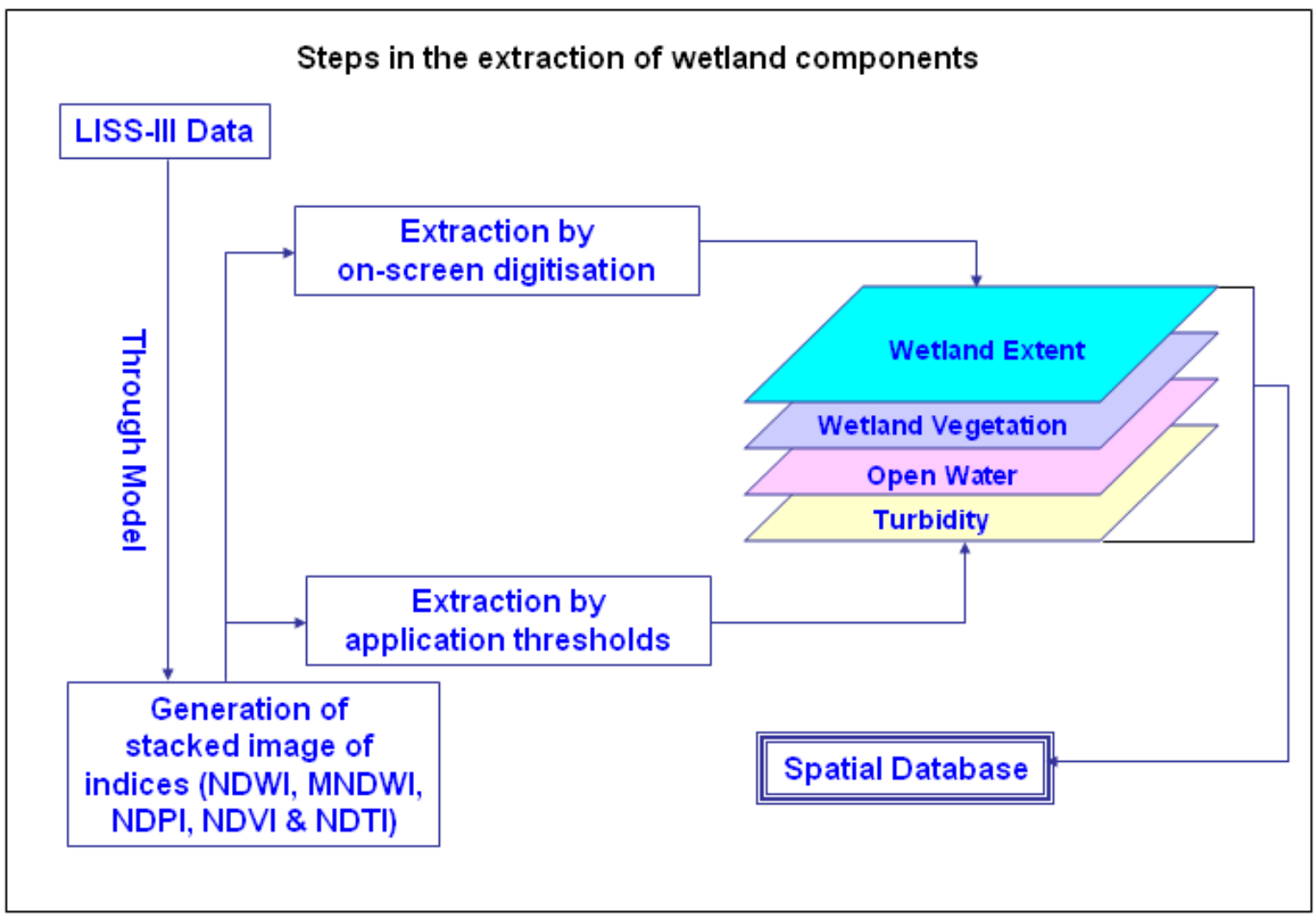


Figure 8: Steps in the extraction of wetland components

- Extraction of wetland extent :
  MNDWI, NDPI and NDVI image was used to extract the wetland boundary through suitable hierarchical thresholds.

- Extraction of open water :
  MNDWI was used with in the wetland mask to delineate the water and no-water areas.

- Extraction of wetland vegetation :
  NDPI and NDVI image was used to generate the vegetation and no-vegetation areas within a wetland using a suitable threshold.

- Turbidity information extraction :
  MNDWI image was used to generate qualitative turbidity level (high, moderate and low) based on following steps:

  a) Conversion of post and pre-monsoon water spread polygons into Area of Interest (AoI).

  b) Grouping of all AoIs excluding all non-wetland areas into a single entity.

  c) Generate a signature statistics like minimum, maximum, mean and standard deviations.

  d) Generate a raster turbidity image through a model for AoI only with *conditional* categorisation.

  e) Convert the raster into vector and update the attributes or edit the water spread layer (copied as turbidity layer) in polygon mode so as to retain all the attributes.

  f) Assign turbidity classes as per the table 3.

Table 3: Qualitative turbidity ratings

Sr. No.	Qualitative Turbidity	Conditional criteria	Hue on False Colour Composite (FCC)
1.	Low	> $+1\sigma$	Dark blue/blackish
2.	Moderate	> -1σ to <= $+1\sigma$	Medium blue
3.	High/Bottom reflectance	<= $\mu - 1\sigma$	Light blue/whitish blue

5.4 Conversion of the Raster (indices) into a Vector Layer

The information on wetland extent, open water extent, vegetation extent and turbidity information was converted into vector layers using regional growing properties or on-screen digitization.

5.5 Generation of Reference Layers

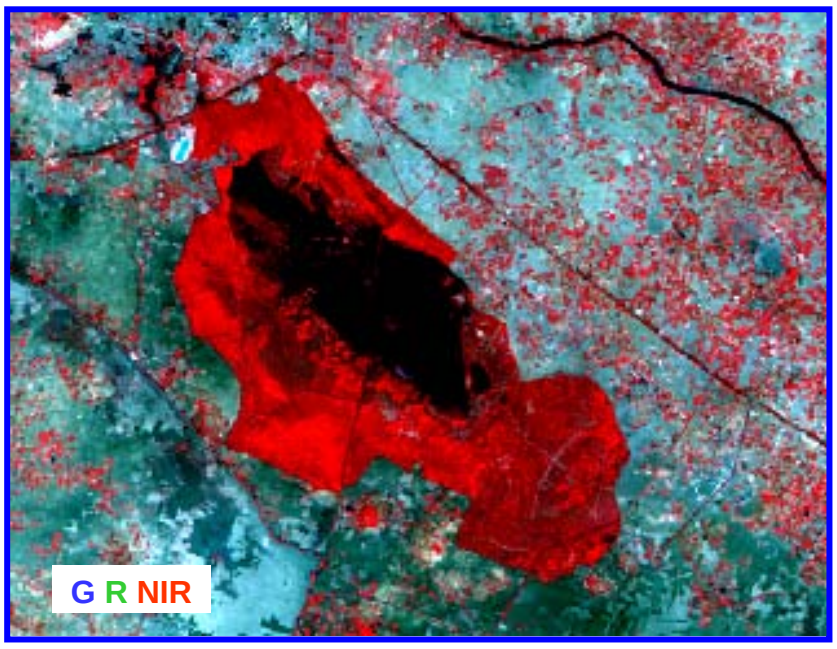
Base layers like major road network, settlements, drainage are interpreted from the current image or taken from other project data base. The administrative boundaries (district, state) are taken from the known reference data.

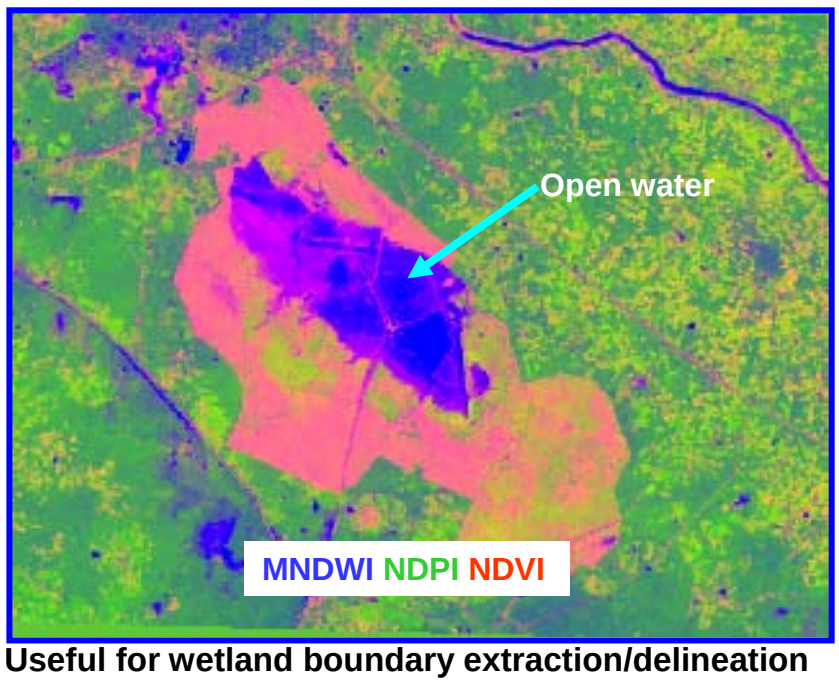
5.6 Coding and Attribute Scheme

Feature codification scheme for every input element has been worked out keeping in view the nationwide administrative as well as natural hierarchy (State-district-taluka) within the feature class for each of the theme. All data elements are given a unique name/code, which are self explanatory with short forms.

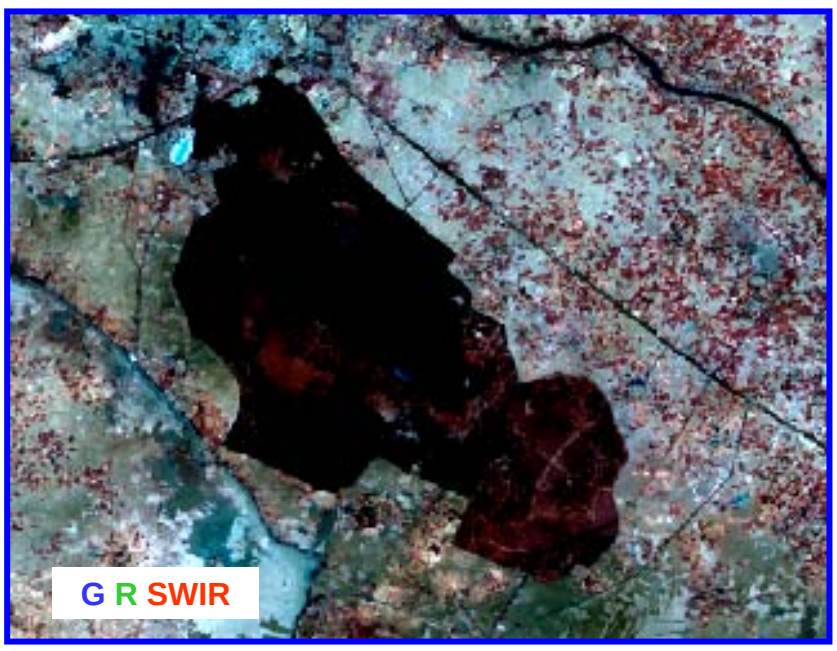
5.7 Map composition and output

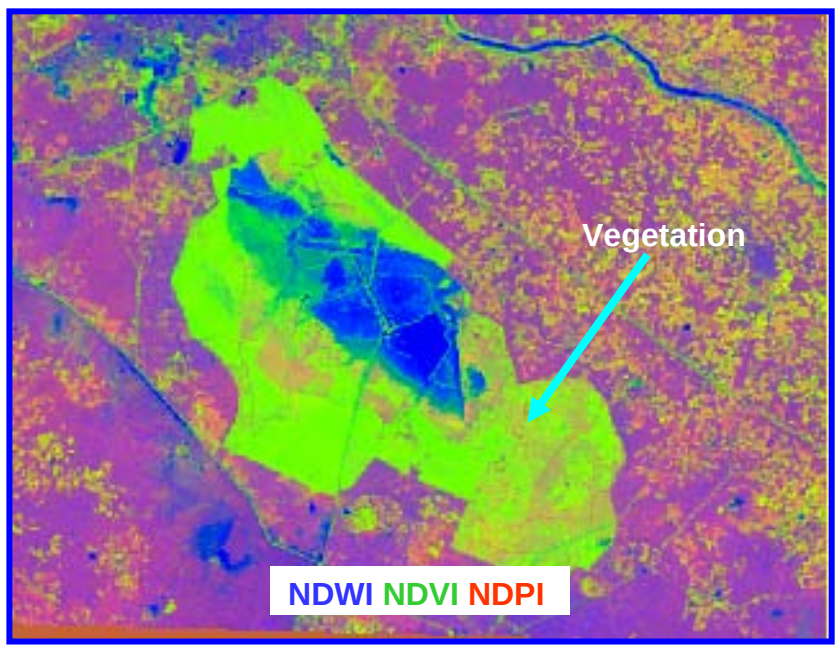
Map composition for atlas has been done at district and state level. A standard color scheme has been used for the wetland classes and other layers. The digital files are made at 1:50,000 scale. The hard copy outputs are taken in A3 size.



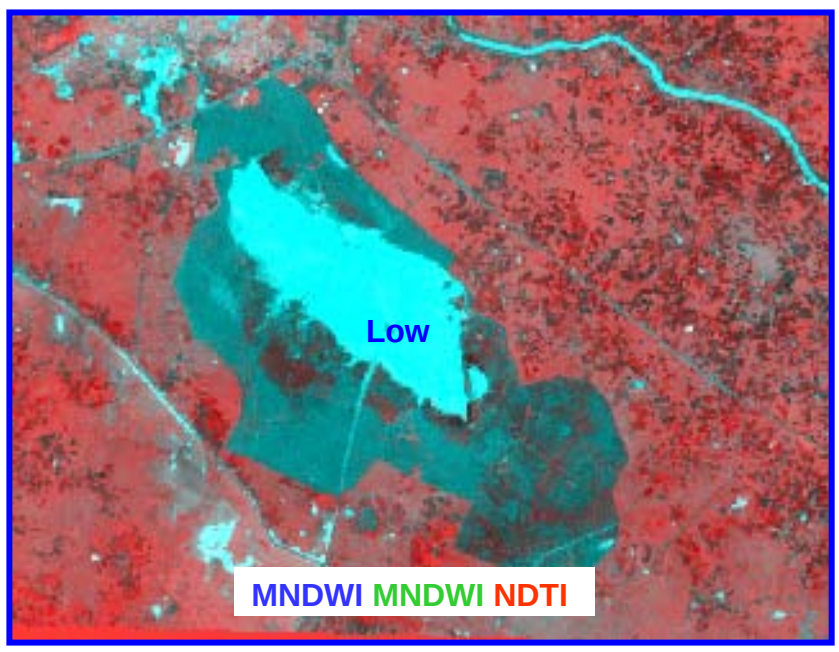


Useful for wetland boundary extraction/delineation





Useful for wetland vegetation & open water features



Useful for qualitative turbidity delineation

Part of Ghana Bird Century,
IRS LISS III data, 23 October, 2006

Figure 9: Various combinations of the indices/spectral bands used to identify wetland components

6.0 ACCURACY ASSESSMENT

A comprehensive accuracy assessment protocol has been followed for determining the quality of information derived from remotely sensed data. Accuracy assessment involves determination of thematic (classification) as well as location accuracy. In addition, GIS database(s) contents have been also evaluated for accuracy. To ensure the reliability of wetland status data, the project adhered to established quality assurance and quality control measures for data collection, analysis, verification and reporting.

This study used well established, time-tested, fully documented data collection conventions. It employed skilled and trained personnel for image interpretation, processing and digital database creation. All interpreted imagery was reviewed by technical expert team for accuracy and code. The reviewing analyst adhered to all standards, quality requirements and technical specifications and reviewed 100 percent of the work. The various stages of quality check include:

1. Image-Image Geo-referencing/Data generation
2. Reference layer preparation using NWIA post monsoon and pre-monsoon LISS-III data.
3. Wetland mapping using visual/digital interpretation techniques.
4. Geo-data base creation and organization
5. Output products.

6.1 Data verification and quality assurance of output digital data files

All digital data files were subjected to rigorous quality control inspections. Digital data verification included quality control checks that addressed the geospatial correctness, digital integrity and some cartographic aspects of the data. Implementation of quality checks ensured that the data conformed to the specified criteria, thus achieving the project objectives. There were tremendous advantages in using newer technologies to store and analyze the geographic data. The geospatial analysis capability built into this study provided a complete digital database to better assist analysis of wetland change information. All digital data files were subjected to rigorous quality control inspections. Automated checking modules incorporated in the geographic information system (Arc/GIS) were used to correct digital artifacts including polygon topology. Additional customized data inspections were made to ensure that the changes indicated at the image interpretation stage were properly executed.

MAPS AND STATISTICS

7.0 WETLANDS OF RAJASTHAN: MAPS AND STATISTICS

Area estimates of various wetland categories for Rajasthan have been carried out using GIS layers of wetland boundary, water-spread, aquatic vegetation and turbidity. Total 12625 wetlands have been mapped at 1:50,000 scale in the state. In addition, 34123 small wetlands (< 2.25 ha) have also been identified. Total wetland area estimated is 782314 ha that is around 2.29 per cent of the geographic area (Table 4). Rivers/ streams contributed 39.95% to the total wetland area. The reservoir/barrages with 190600 ha (24.36% area) is the second major wetland category. Area under Tanks/ponds is 151027 ha (19.31%). Graphical distribution of wetland type is shown in Figure 10.

Open water spread is more during in Post-monsoon (368129 ha) than during Pre-monsoon (158696 ha). Aquatic vegetation is slightly more during Pre-monsoon (5166 ha) than in Post-monsoon (4102 ha). The qualitative turbidity of water is low in both the seasons.

Table 4: Area estimates of wetlands in Rajasthan

Area in ha

Sr. No.	Wettcode	Wetland Category	Number of Wetlands	Total Wetland Area	% of wetland area	Open Water	
						Post-monsoon Area	Pre-monsoon Area
	1100	**Inland Wetlands - Natural**					
1	1101	Lakes/Ponds	65	38269	4.89	28122	21711
2	1105	Waterlogged	61	16856	2.15	12933	5091
3	1106	River/Stream	648	312570	39.95	52080	28021
	1200	**Inland Wetlands -Man-made**					
4	1201	Reservoirs/Barrages	979	190600	24.36	165938	71546
5	1202	Tanks/Ponds	10731	151027	19.31	100594	18659
6	1203	Waterlogged	101	7636	0.98	4423	1284
7	1204	Salt pans	39	12283	1.57	4030	2433
		Total - Inland	**12624**	**729241**	**93.22**	**368120**	**148745**
	2100	**Coastal Wetlands - Natural**					
8	2104	Intertidal mud flats	1	18950	2.42	9	9951
		Total - Coastal	**1**	**18950**	**2.42**	**9**	**9951**
		Sub-Total	**12625**	**748191**	**95.64**	**368129**	**158696**
		Wetlands (<2.25 ha), mainly Tanks	34123	34123	4.36	-	-
		Total	**46748**	**782314**	**100.00**	**368129**	**158696**

Area under Aquatic Vegetation	4102	5166

Area under turbidity levels		
Low	294322	107553
Moderate	40945	7390
High	32862	43753

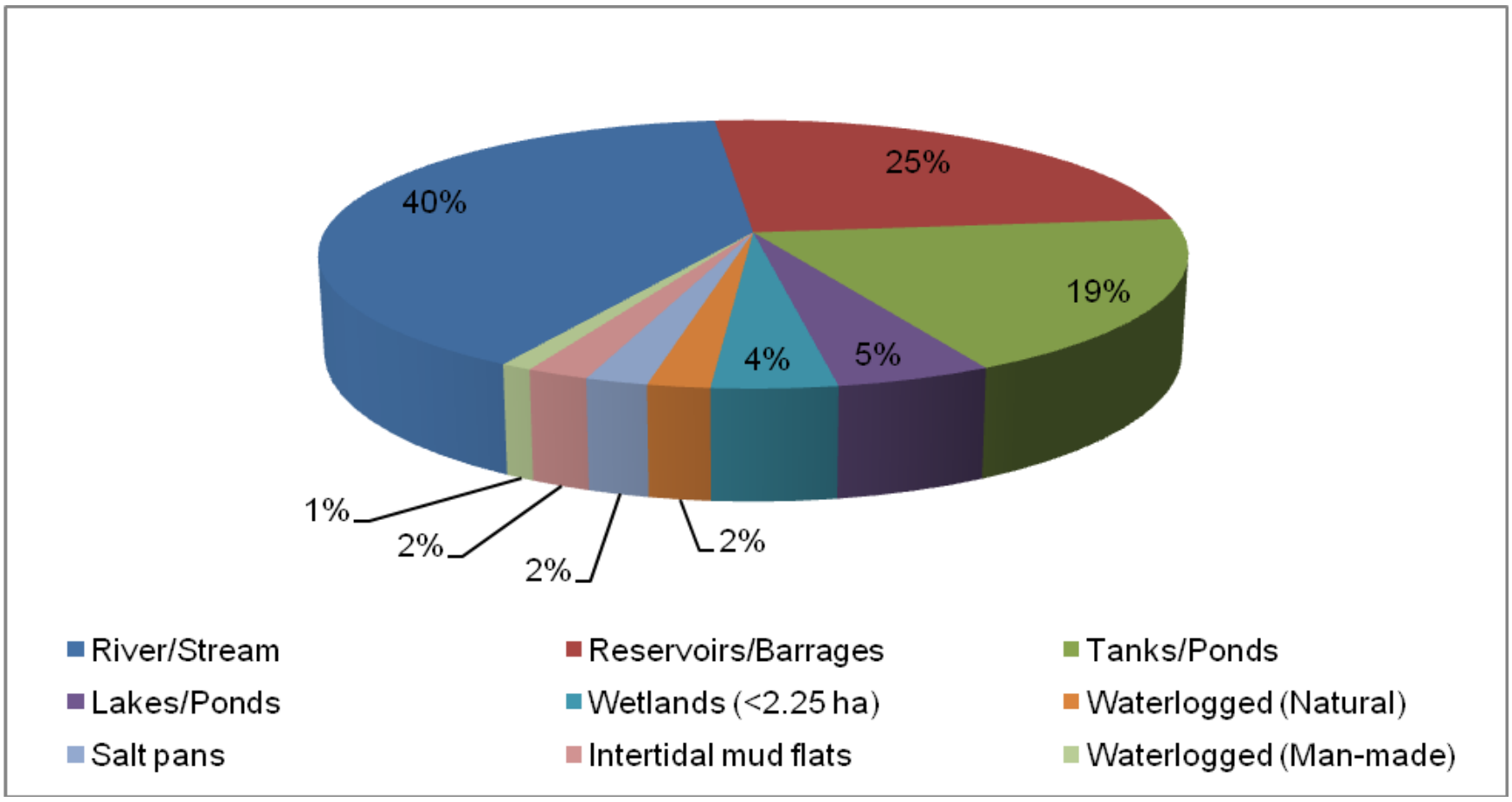


Figure 10: Type-wise wetland distribution in Rajasthan

7.1 DISTRICT-WISE WETLAND MAPS AND STATISTICS

There are 32 districts in the state. The wetlands occupy as high as 6.94% of geographic area (Bhilwara), and as low as 0.08% (Churu). Reservoirs/Barrages and Tanks/Ponds are the dominate wetland types in almost all districts. Jalore and Barmer are the only districts containing coastal wetlands (Inter-tidal mudflats). District-wise wetland area estimates is given in Table-5 and graphical distribution of wetlands is shown in Figure - 11.

The following section gives the details of district wise wetland statistics and maps. The districts are arranged as per census code. Wetland statistics followed by wetland map and corresponding satellite data for each district is given in subsequent pages to visualize the distribution pattern and density of wetlands in the district.

Table-5: District-wise wetland statistics

Sr. No.	District	Geographic Area* (sq. km)	Wetland Area (ha)	% of total Wetland Area	% of district Geographic Area
1	Ganganagar	7984	1708	0.22	0.21
2	Hanumangarh	12645	6549	0.84	0.52
3	Bikaner	27244	2666	0.34	0.10
4	Churu	16830	1368	0.17	0.08
5	Jhunjhunun	5928	5319	0.68	0.90
6	Alwar	8380	12774	1.63	1.52
7	Bharatpur	5066	10415	1.33	2.06
8	Dhaulpur	3084	9370	1.2	3.04
9	Karauli	5530	10042	1.28	1.82
10	Sawai Madhopur	4500	22606	2.89	5.02
11	Dausa	3429	11720	1.5	3.42
12	Jaipur	11152	41352	5.29	3.71
13	Sikar	7732	5388	0.69	0.70
14	Nagaur	17718	30876	3.95	1.74
15	Jodhpur	22850	17032	2.18	0.75
16	Jaisalmer	38401	24876	3.18	0.65
17	Barmer	28387	44638	5.71	1.57
18	Jalore	10640	54440	6.96	5.12
19	Sirohi	5136	19259	2.46	3.75
20	Pali	12387	50304	6.43	4.06
21	Ajmer	8481	32167	4.11	3.79
22	Tonk	7194	46875	5.99	6.52
23	Bundi	5550	21238	2.71	3.83
24	Bhilwara	10455	72563	9.27	6.94
25	Rajsamand	3853	20435	2.61	5.30
26	Udaipur	13430	42292	5.41	3.15
27	Dungarpur	3770	21278	2.72	5.64
28	Banswara	5037	32468	4.15	6.45
29	Chittaurgarh	10856	55537	7.1	5.12
30	Kota	5446	16316	2.09	3.00
31	Baran	6955	22602	2.89	3.25
32	Jhalawar	6219	15911	2.03	2.56
	Total	**342269**	**782384**	**100**	2.29

Data source: http://nic.in

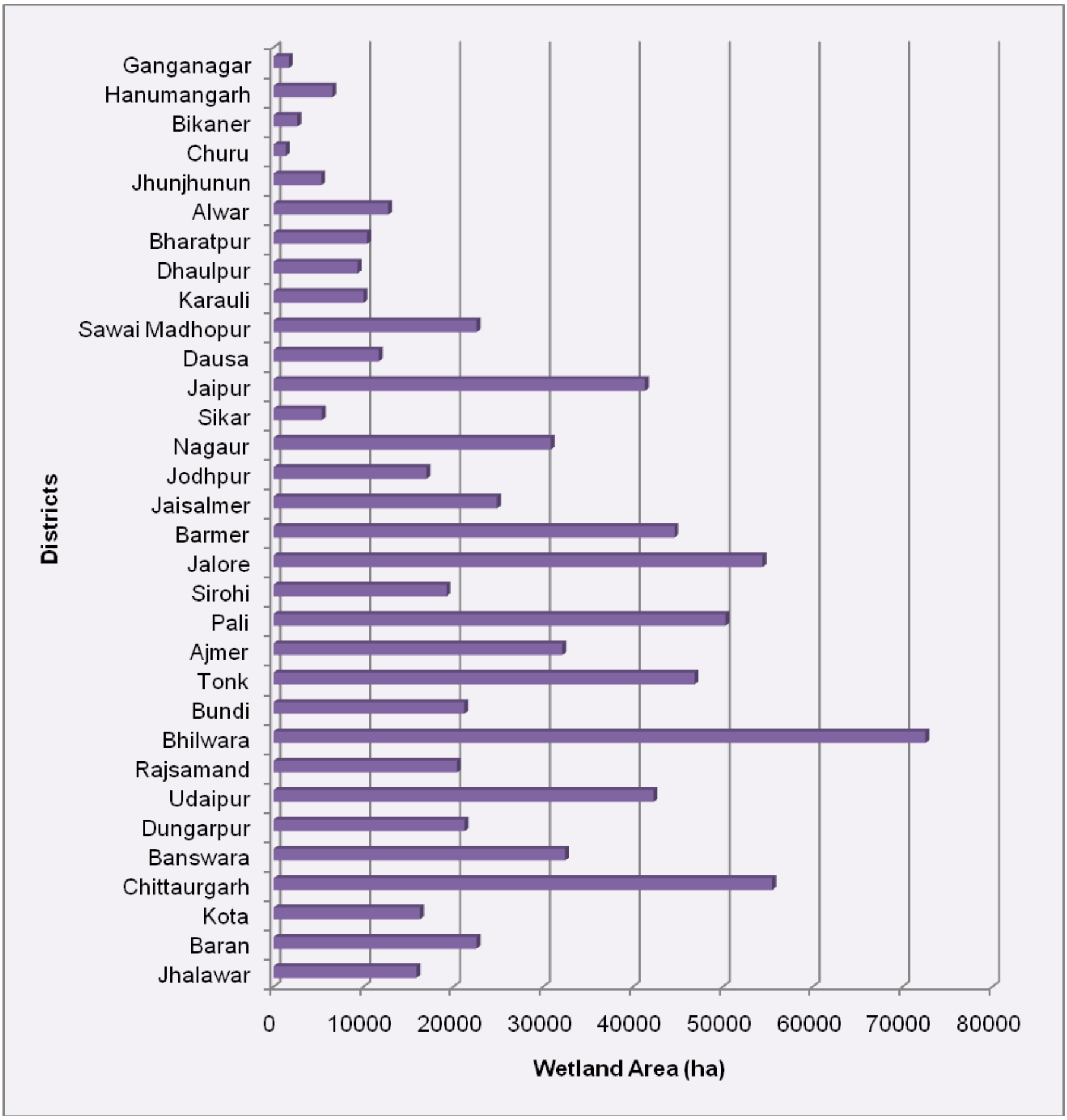


Figure 11: District-wise graphical distribution of wetlands

State : Rajasthan

WETLAND MAP

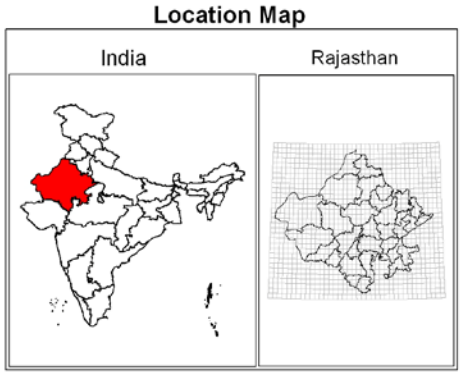


Symbol	Typecode	Level I	Level II	Level III
		Inland Wetlands		
			Natural	
	1101			Lakes/Ponds
	1102			Ox-bow lakes/ Cut-off meanders
	1103			High altitude wetlands
	1104			Reverine wetlands
	1105			Waterlogged
	1106			River/Stream
			Man-made	
	1201			Reservoirs/Barrages
	1202			Tanks/Ponds
	1203			Waterlogged
	1204			Salt pans
		Coastal Wetlands		
			Natural	
	2101			Lagoons
	2102			Creeks
	2103			Sand/Beach
	2104			Intertidal mud flats
	2105			Salt marsh
	2106			Mangroves
	2107			Coral reefs
			Man-made	
	2201			Salt pans
	2202			Aquaculture ponds

Legend

- Wetlands (<2.25ha)
- Drainage (line)
- Major Roads
- Railway
- Settlements
- Town/Settlements
- District Boundary
- State Boundary
- International Boundary

Location Map



Data Source :

IRS P6 LISS III data (Pre-monsoon and Post-monsoon Season 2006-07)

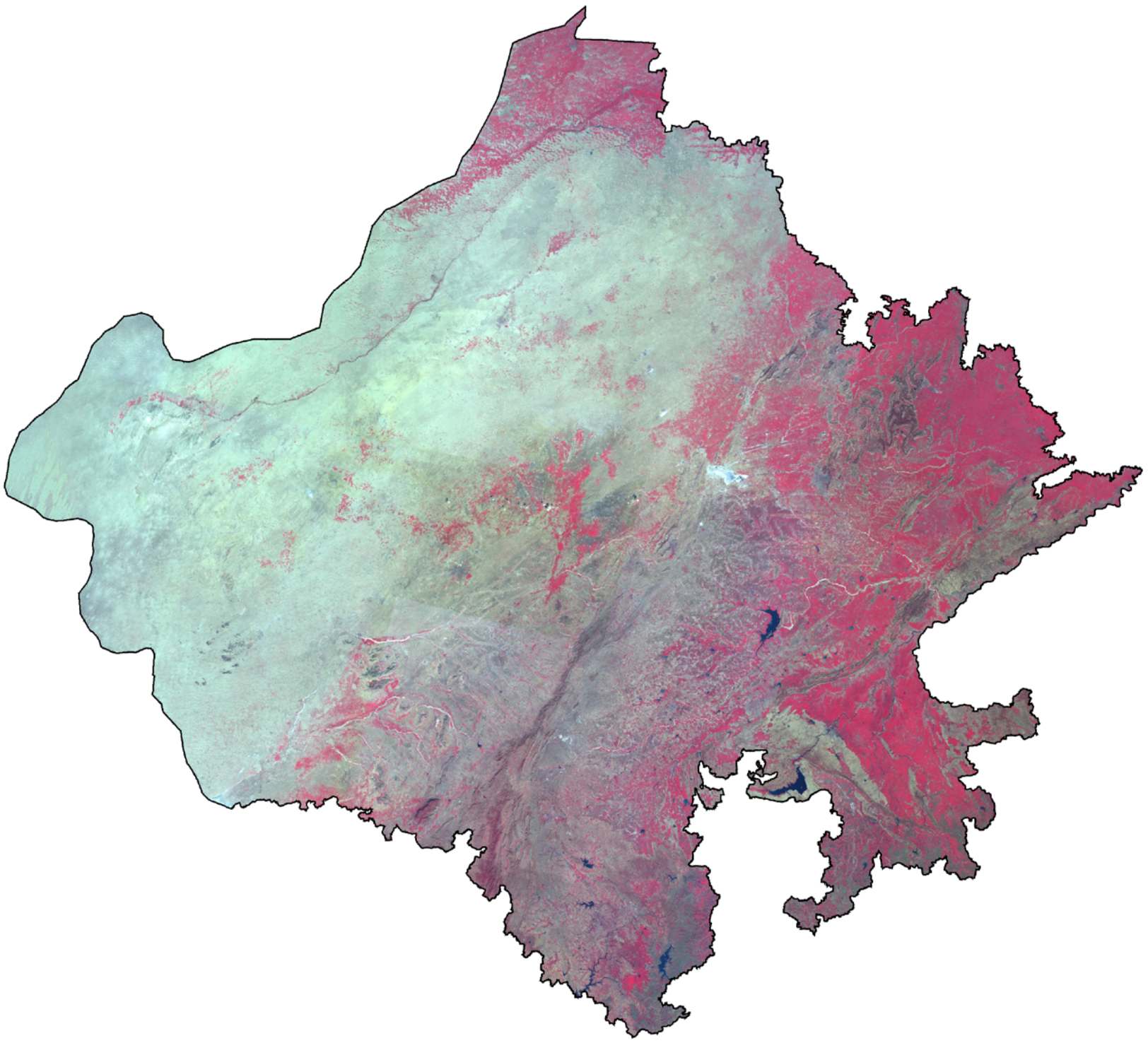
Prepared By :

Space Applications Centre (ISRO), Ahmedabad
and
State Remote Sensing Application Centre, Jodhpur

Sponsored By:

Ministry of Environment and Forests
Government of India

State : Rajasthan



IRS P6 AWiFS Post-monsoon data (2005).

7.1.1 Ganganagar

The district is situated in the northern most region of the state and forms a part of Indo-Gangatic plain. It is located between 28° 42' and 30° 11' North latitudes and between 72° 38' and 74° 17' East longitudes. It has a geographical area of 7984 Sq. km. In the North-east it shares boundary with Hanumangarh and in the South with Bikaner District. On the north by Faridkot & Firozpur districts of Punjab and on west by Bahawalpur district of Pakistan. The climate of the district is marked by the large variation of temperature. November to March is cold season. Minimum and maximum temperature 1°C and 45°C respectively.

Total 1381 wetlands are mapped including 1348 small wetlands (< 2.25 ha) with 1708 ha area. Tanks/Ponds occupies 360 ha. Wetlands are more concentrated in the southern part of the district.

Open water is more during Post-monsoon (175 ha) while in Pre-monsoon (158 ha).The qualitative turbidity of water is low in both the seasons. Details of estimates of wetlands in Ganganagar are given in Table 6.

Table 6: Area estimates of wetlands in Ganganagar

Area in ha

Sr. No.	Wettcode	Wetland Category	Number of Wetlands	Total Wetland Area	% of wetland area	Open Water	
						Post-monsoon Area	Pre-monsoon Area
	1100	**Inland Wetlands - Natural**					
1	1101	Lakes/Ponds	-	-	-	-	-
2	1102	Ox-bow lakes/ Cut-off meanders	-	-	-	-	-
3	1103	High altitude wetlands	-	-	-	-	-
4	1104	Riverine wetlands	-	-	-	-	-
5	1105	Waterlogged	-	-	-	-	-
6	1106	River/Stream	-	-	-	-	-
	1200	**Inland Wetlands -Man-made**					
7	1201	Reservoirs/Barrages	-	-	-	-	-
8	1202	Tanks/Ponds	33	360	21.08	175	158
9	1203	Waterlogged	-	-	-	-	-
10	1204	Salt pans	-	-	-	-	-
		Sub-Total	**33**	**360**	**21.08**	**175**	**158**
		Wetlands (<2.25 ha), mainly Tanks	1348	1348	78.92	-	-
		Total	**1381**	**1708**	**100.00**	**175**	**158**

Area under Aquatic Vegetation	-	-

Area under turbidity levels		
Low	100	158
Moderate	30	-
High	45	-

State : Rajasthan

WETLAND MAP

District : Ganganagar

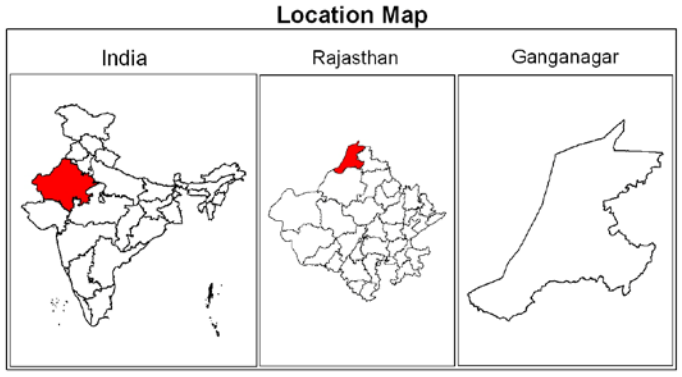


Symbol	Typecode	Level I	Level II	Level III
		Inland Wetlands		
			Natural	
	1101			Lakes/Ponds
	1102			Ox-bow lakes/ Cut-off meanders
	1103			High altitude wetlands
	1104			Reverine wetlands
	1105			Waterlogged
	1106			River/Stream
			Man-made	
	1201			Reservoirs/Barrages
	1202			Tanks/Ponds
	1203			Waterlogged
	1204			Salt pans
		Coastal Wetlands		
			Natural	
	2101			Lagoons
	2102			Creeks
	2103			Sand/Beach
	2104			Intertidal mud flats
	2105			Salt marsh
	2106			Mangroves
	2107			Coral reefs
			Man-made	
	2201			Salt pans
	2202			Aquaculture ponds

Legend

- Wetlands (<2.25ha)
- Drainage (line)
- Major Roads
- Railway
- Settlements
- Town/Settlements
- District Boundary
- State Boundary
- International Boundary

Location Map



6 3 0 6 12 Kilometers

Data Source :

IRS P6 LISS III data (Pre-monsoon and Post-monsoon Season 2006-07)

Prepared By :

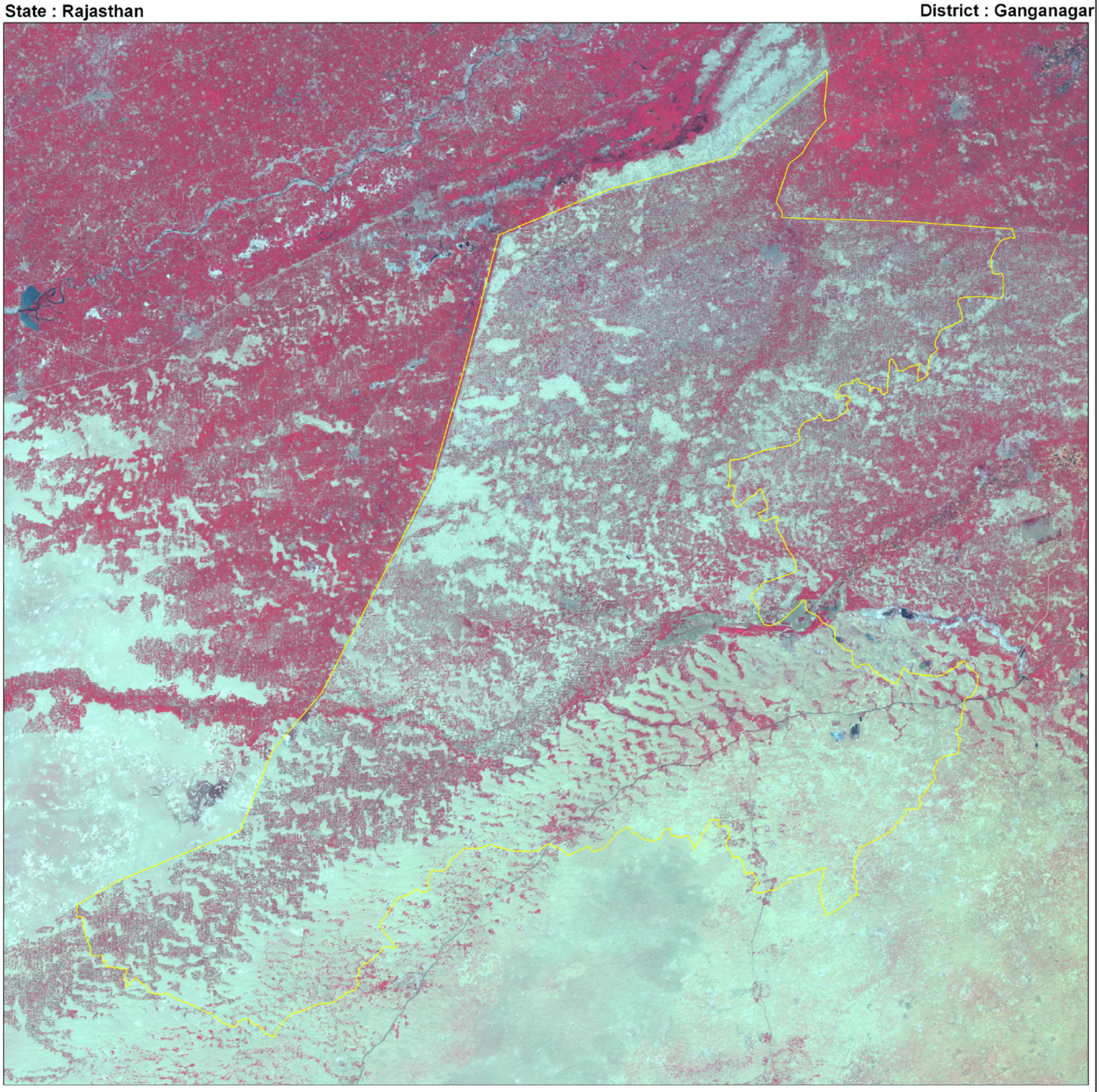
Space Applications Centre (ISRO), Ahmedabad
and
State Remote Sensing Application Centre, Jodhpur

Sponsored By:

Ministry of Environment and Forests
Government of India

State : Rajasthan

District : Ganganagar



IRS P6 AWiFS Post-monsoon data (2007).

7.1.2 Hanumangarh

Hanumangarh lies in between 29° 05' to 30° 06' North latitude and 74° 03’ and 75° 03’ East longitude. The district shares common boundaries with Haryana state in the east, Ganganagar district in the west, Punjab state in the North and Churu district in the South. Hanumangarh, the administrative head quarter of the district is a small town nestling on the banks of the river Ghaggar in northern part of Rajasthan. The geographical area of the district is 12645 sq. km. The average rainfall varies from 225 cms to 300 cms. The maximum temperature fluctuates from 18^0C to 48^0C whereas the minimum temperature goes up to 2^0C.

Total 1263 wetlands are mapped including 1186 small wetlands (< 2.25 ha) with 6549 ha area**. R**ivers/ streams with 3966 ha. contributed 60.56% to the total wetland area. The Tanks/Ponds with 1397 ha (21.33% area) is the second major wetland category.

Open water spread of the wetlands is significantly higher in Pre-monsoon (2197 ha) than during Post-monsoon (513 ha), indicating the rainfall dependence of the wetlands in the state. The qualitative turbidity of water is low in both the seasons. Details of estimates of wetlands in Hanumangarh are given in Table 7.

Table 7: Area estimates of wetlands in Hanumangarh

Area in ha

Sr. No.	Wettcode	Wetland Category	Number of Wetlands	Total Wetland Area	% of wetland area	Open Water	
						Post-monsoon Area	Pre-monsoon Area
	1100	**Inland Wetlands - Natural**					
1	1101	Lakes/Ponds	-	-	-	-	-
2	1102	Ox-bow lakes/ Cut-off meanders	-	-	-	-	-
3	1103	High altitude wetlands	-	-	-	-	-
4	1104	Riverine wetlands	-	-	-	-	-
5	1105	Waterlogged	-	-	-	-	-
6	1106	River/Stream	1	3966	60.56	100	1145
	1200	**Inland Wetlands -Man-made**					
7	1201	Reservoirs/Barrages	-	-	-	-	-
8	1202	Tanks/Ponds	76	1397	21.33	413	1052
9	1203	Waterlogged	-	-	-	-	-
10	1204	Salt pans	-	-	-	-	-
		Sub-Total	**77**	**5363**	**81.89**	**513**	**2197**
		Wetlands (<2.25 ha), mainly Tanks	1186	1186	18.11	-	-
		Total	**1263**	**6549**	**100.00**	**513**	**2197**

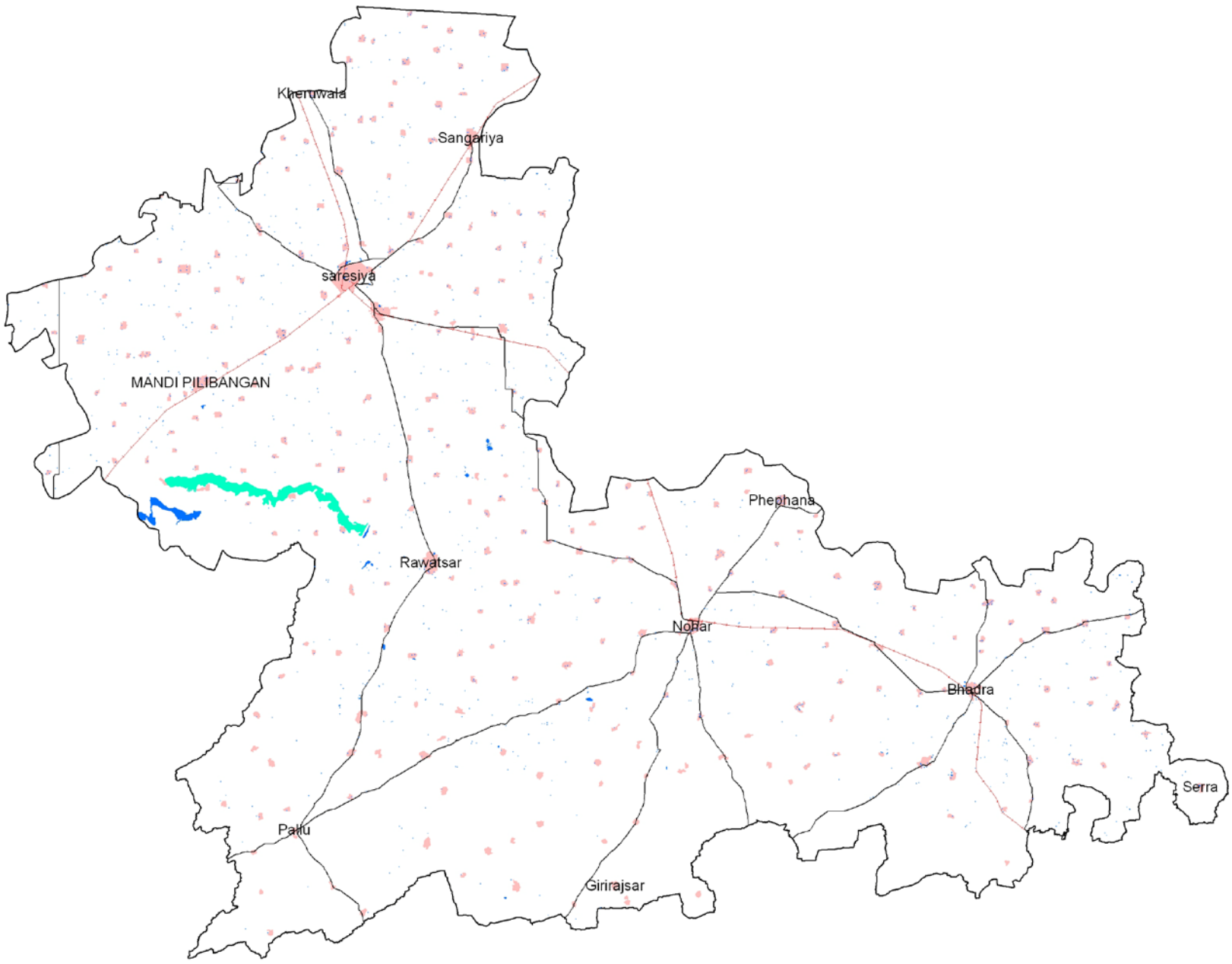
Area under Aquatic Vegetation	-	-

Area under turbidity levels		
Low	435	2171
Moderate	-	-
High	78	26

State : Rajasthan

WETLAND MAP

District : Hanumangarh

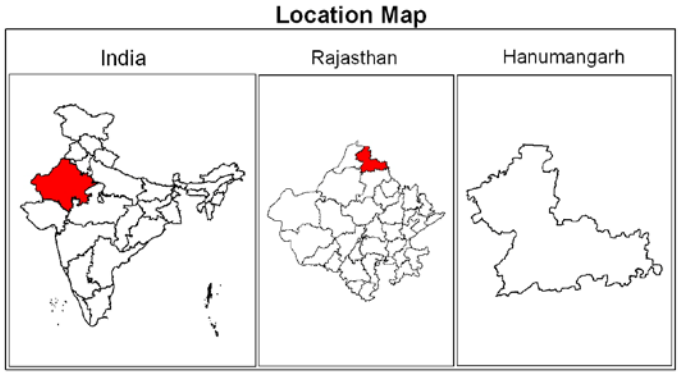


Symbol	Typecode	Level I	Level II	Level III
		Inland Wetlands		
			Natural	
	1101			Lakes/Ponds
	1102			Ox-bow lakes/ Cut-off meanders
	1103			High altitude wetlands
	1104			Reverine wetlands
	1105			Waterlogged
	1106			River/Stream
			Man-made	
	1201			Reservoirs/Barrages
	1202			Tanks/Ponds
	1203			Waterlogged
	1204			Salt pans
		Coastal Wetlands		
			Natural	
	2101			Lagoons
	2102			Creeks
	2103			Sand/Beach
	2104			Intertidal mud flats
	2105			Salt marsh
	2106			Mangroves
	2107			Coral reefs
			Man-made	
	2201			Salt pans
	2202			Aquaculture ponds

Legend

- Wetlands (<2.25ha)
- Drainage (line)
- Major Roads
- Railway
- Settlements
- Town/Settlements
- District Boundary
- State Boundary
- International Boundary

Location Map



6 3 0 6 12 Kilometers

Data Source :

IRS P6 LISS III data (Pre-monsoon and Post-monsoon Season 2006-07)

Prepared By :

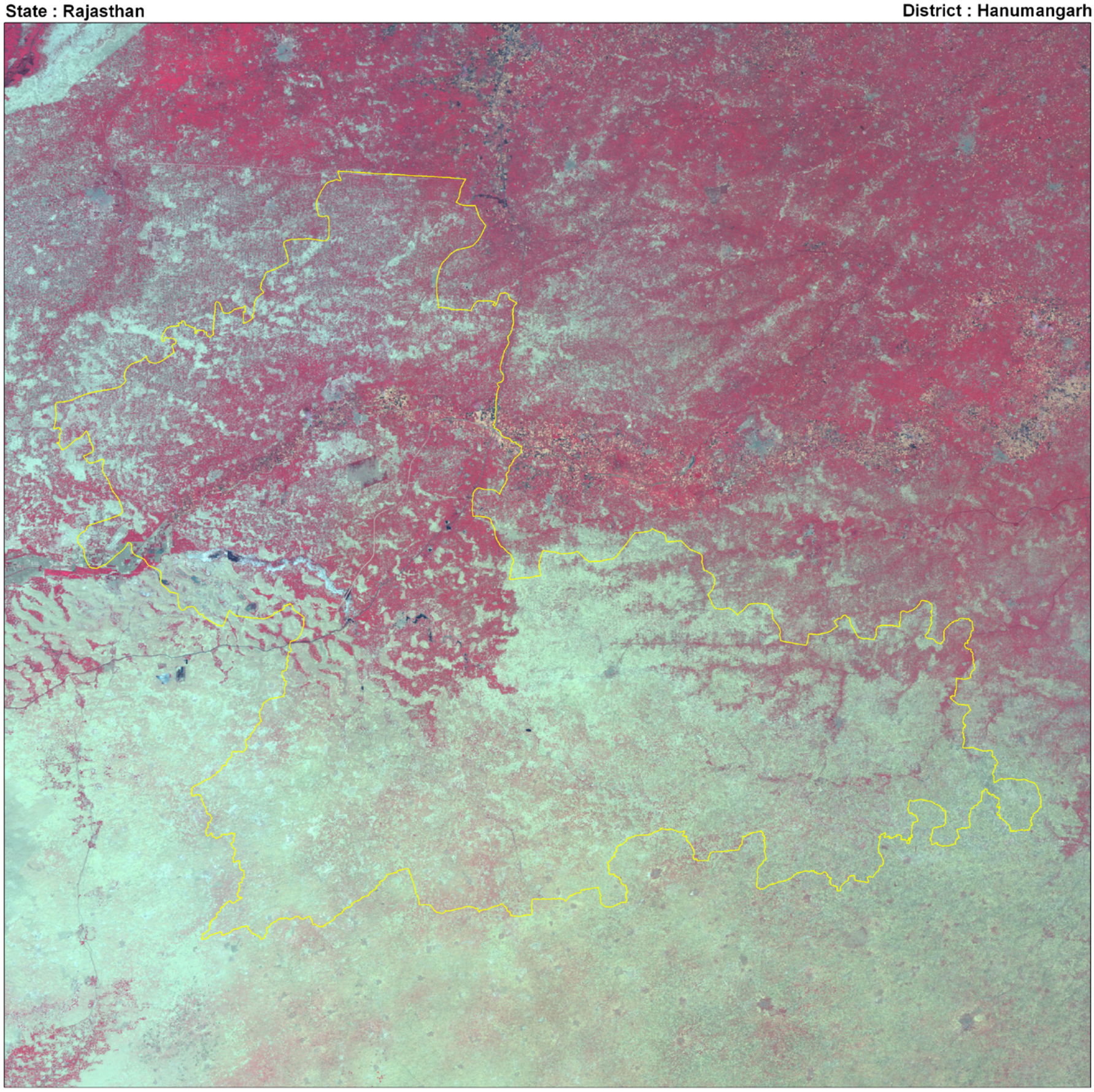
Space Applications Centre (ISRO), Ahmedabad
and
State Remote Sensing Application Centre, Jodhpur

Sponsored By:

Ministry of Environment and Forests
Government of India

State : Rajasthan

District : Hanumangarh



IRS P6 AWiFS Post-monsoon data (2007).

7.1.3 Bikaner

Bikaner is located in the north-western part of the state. It lies in between 27° 11’ and 29° 03’ north latitude and 71° 54’ and 74° 22’ east longitude. The total geographical area of the district is 27244 sq. kms. It is surrounded in the north by districts of Ganganagar, on the west by Jaisalmer and Pakistan, Churu in the east and Nagaur and Jodhpur in the south-east. Bikaner is situated in an arid tract of undulating sand hills where the cultivation of crops is not convenient; hence the breeding of camels, horses, and sheep is the principal occupation of the people. The average rainfall is 21 cms. The maximum temperature reaches 47° while and minimum temperature less than 1°.

Total 1255 wetlands are mapped including 1178 small wetlands (< 2.25 ha) with 2666 ha area**.** Tanks/Ponds with 750 ha. contributed 28.13% to the total wetland area. The waterlogged with 543 ha (20.37% area) is the second major wetland category, followed by reservoir/barrages with 190 ha area i.e. 7.13 %.

Open water spread of the wetlands is significantly higher in Post-monsoon (778 ha). The qualitative turbidity of water is low in both the seasons. Details of wetland statistics of district are given in Table- 8.

Table 8: Area estimates of wetlands in Bikaner

Area in ha

Sr. No.	Wettcode	Wetland Category	Number of Wetlands	Total Wetland Area	% of wetland area	Open Water	
						Post-monsoon Area	Pre-monsoon Area
	1100	**Inland Wetlands - Natural**					
1	1101	Lakes/Ponds	-	-	-	-	-
2	1102	Ox-bow lakes/ Cut-off meanders	-	-	-	-	-
3	1103	High altitude wetlands	-	-	-	-	-
4	1104	Riverine wetlands	-	-	-	-	-
5	1105	Waterlogged	-	-	-	-	-
6	1106	River/Stream	-	-	-	-	-
	1200	**Inland Wetlands -Man-made**					
7	1201	Reservoirs/Barrages	3	190	7.13	135	159
8	1202	Tanks/Ponds	71	750	28.13	294	96
9	1203	Waterlogged	2	543	20.37	349	-
10	1204	Salt pans	1	5	0.19	-	-
		Sub-Total	**77**	**1488**	**55.81**	**778**	**255**
		Wetlands (<2.25 ha), mainly Tanks	1178	1178	44.19	-	-
		Total	**1255**	**2666**	**100.00**	**778**	**255**

Area under Aquatic Vegetation	-	-

Area under turbidity levels		
Low	759	255
Moderate	-	-
High	19	-

State : Rajasthan

WETLAND MAP

District : Bikaner

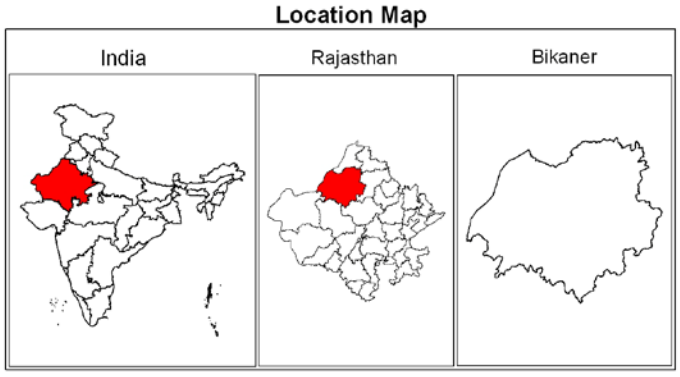


Symbol	Typecode	Level I	Level II	Level III
		Inland Wetlands		
			Natural	
	1101			Lakes/Ponds
	1102			Ox-bow lakes/ Cut-off meanders
	1103			High altitude wetlands
	1104			Reverine wetlands
	1105			Waterlogged
	1106			River/Stream
			Man-made	
	1201			Reservoirs/Barrages
	1202			Tanks/Ponds
	1203			Waterlogged
	1204			Salt pans
		Coastal Wetlands		
			Natural	
	2101			Lagoons
	2102			Creeks
	2103			Sand/Beach
	2104			Intertidal mud flats
	2105			Salt marsh
	2106			Mangroves
	2107			Coral reefs
			Man-made	
	2201			Salt pans
	2202			Aquaculture ponds

Legend

- Wetlands (<2.25ha)
- Drainage (line)
- Major Roads
- Railway
- Settlements
- Town/Settlements
- District Boundary
- State Boundary
- International Boundary

Location Map



10 5 0 10 20 Kilometers

Data Source :

IRS P6 LISS III data (Pre-monsoon and Post-monsoon Season 2006-07)

Prepared By :

Space Applications Centre (ISRO), Ahmedabad
and
State Remote Sensing Application Centre, Jodhpur

Sponsored By:

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State : Rajasthan

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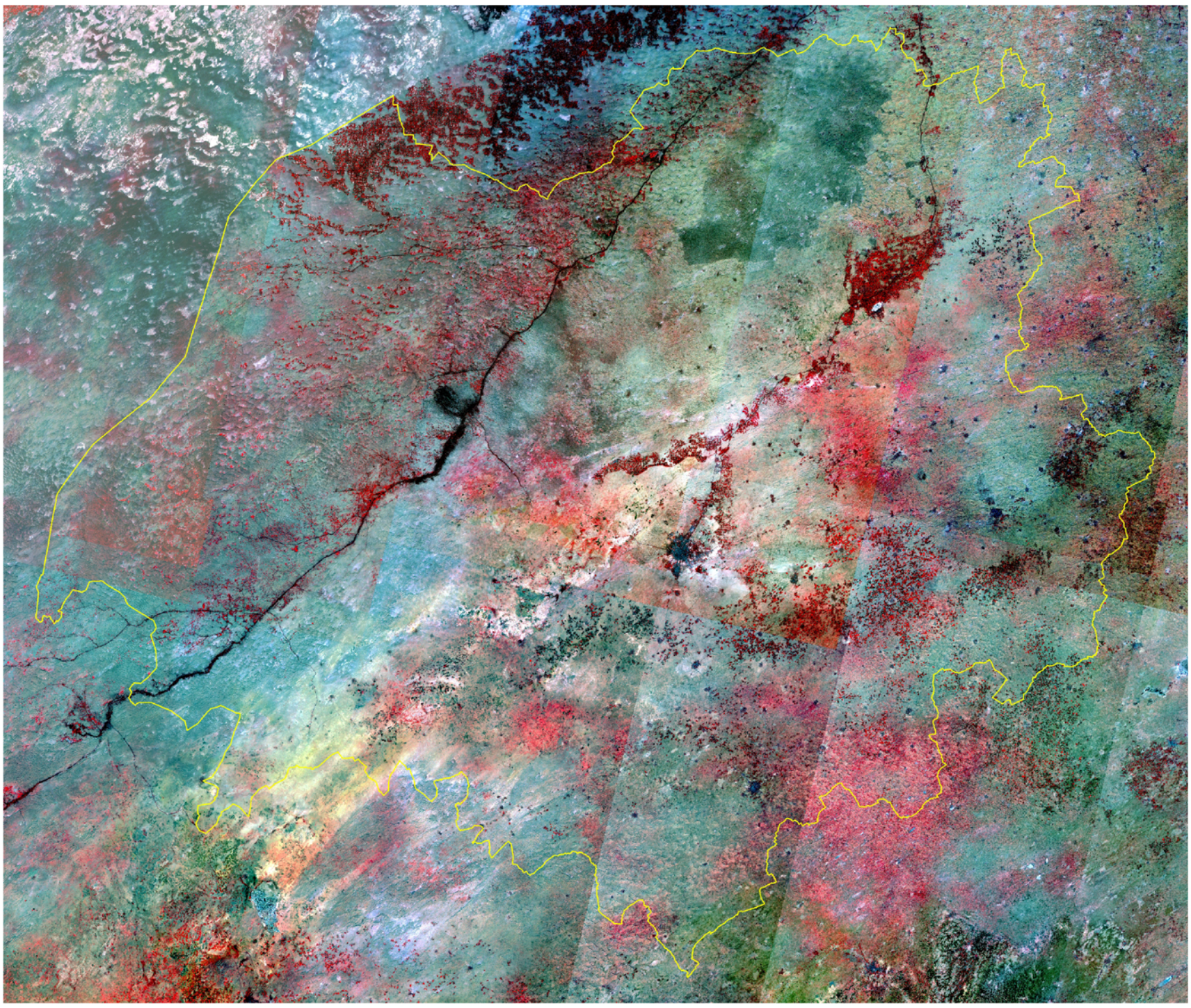


IRS P6 LISS-III Post-monsoon data (2006).

7.1.4 Churu

Churu is located in the north-eastern part of the state. It lies in between 25° 01’ and 25° 58’ north latitude and 74° 01’ and 75° 28’ east longitude. Churu is situated in the middle of the shifting golden sand dunes, opens the gate to the great desert of Thar. The geographical area of the district is 16830 sq. km. It is bounded by Ganganagar district in the North, by Sikar and Jhunjhunun and Hissar district of Haryana in the East, by Nagaur in the South and in the West by Bikaner. The average rainfall is 33 cms. The maximum temperature reaches 48^0 while and minimum temperature touches 0.5^0 C.

Total 426 wetlands are mapped including 391 small wetlands (< 2.25 ha) with 1368 ha area**.** Salt pans with 683 ha. contributed 49.93% to the total wetland area. The reservoir/barrages with 154 ha (11.26% area) is the second major wetland category, followed by tanks/ponds with 117 ha area i.e. 8.55%.

Open water spread of the wetlands is significantly higher in Post-monsoon (108 ha). The qualitative turbidity of water is low in both the seasons.Details of estimates of wetlands in Churu are given in Table 9.

Table 9: Area estimates of wetlands in Churu

Area in ha

Sr. No.	Wettcode	Wetland Category	Number of Wetlands	Total Wetland Area	% of wetland area	Open Water	
						Post-monsoon Area	Pre-monsoon Area
	1100	**Inland Wetlands - Natural**					
1	1101	Lakes/Ponds	-	-	-	-	-
2	1102	Ox-bow lakes/ Cut-off meanders	-	-	-	-	-
3	1103	High altitude wetlands	-	-	-	-	-
4	1104	Riverine wetlands	-	-	-	-	-
5	1105	Waterlogged	-	-	-	-	-
6	1106	River/Stream	3	23	1.68	-	-
	1200	**Inland Wetlands -Man-made**					
7	1201	Reservoirs/Barrages	1	154	11.26	3	0
8	1202	Tanks/Ponds	30	117	8.55	73	22
9	1203	Waterlogged	-	-	-	-	-
10	1204	Salt pans	1	683	49.93	32	44
		Sub-Total	**35**	**977**	**71.42**	**108**	**66**
		Wetlands (<2.25 ha), mainly Tanks	391	391	28.58	-	-
		Total	**426**	**1368**	**100.00**	**108**	**66**

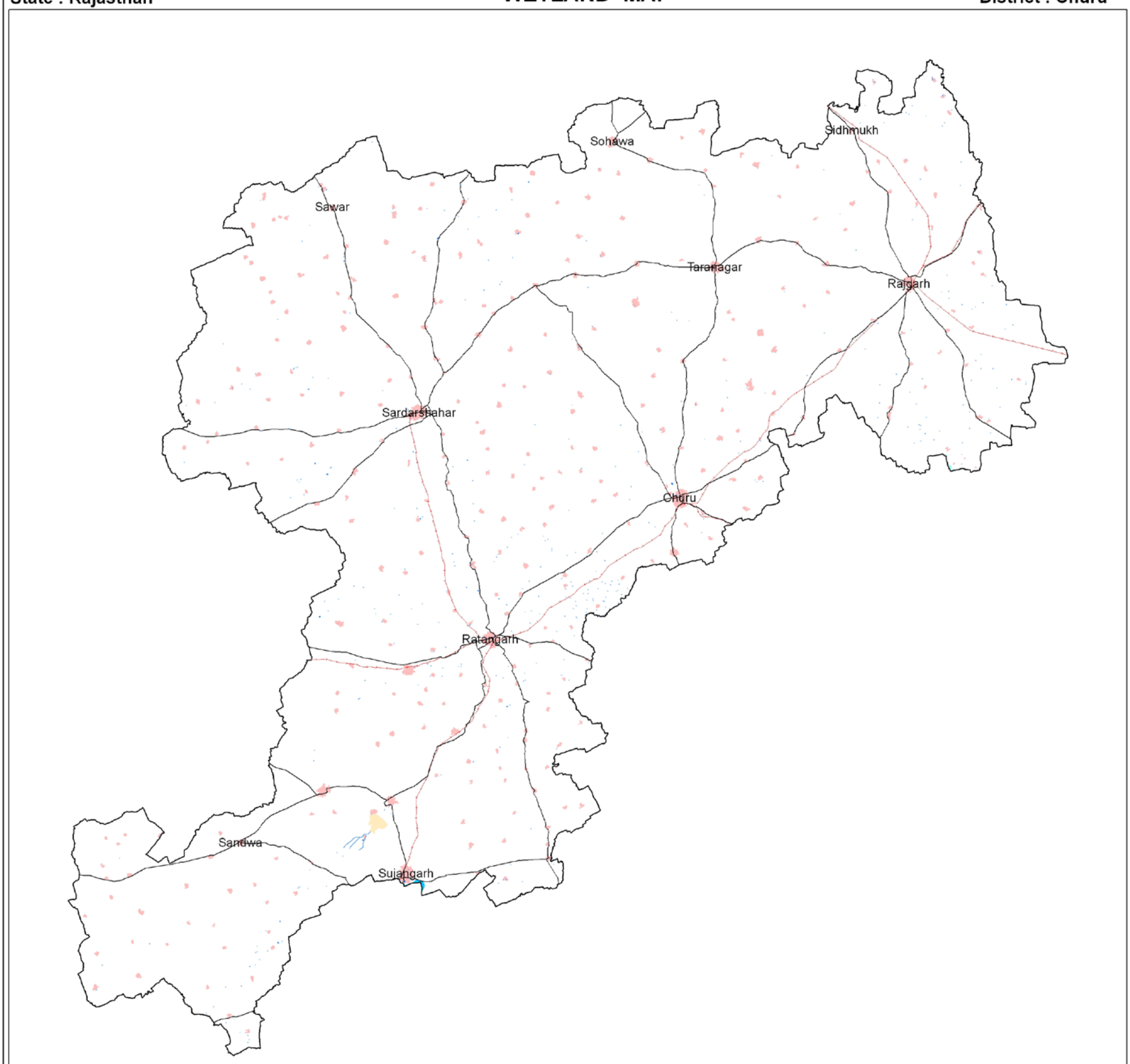
Area under Aquatic Vegetation	-	-

Area under turbidity levels		
Low	98	56
Moderate	5	-
High	5	10

State : Rajasthan

WETLAND MAP

District : Churu

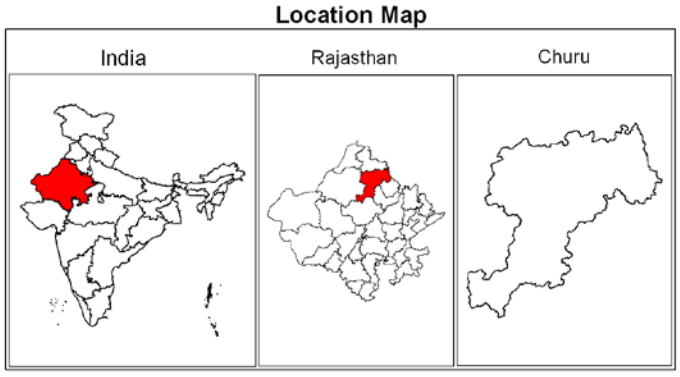


Symbol	Typecode	Level I	Level II	Level III
		Inland Wetlands		
			Natural	
	1101			Lakes/Ponds
	1102			Ox-bow lakes/ Cut-off meanders
	1103			High altitude wetlands
	1104			Reverine wetlands
	1105			Waterlogged
	1106			River/Stream
			Man-made	
	1201			Reservoirs/Barrages
	1202			Tanks/Ponds
	1203			Waterlogged
	1204			Salt pans
		Coastal Wetlands		
			Natural	
	2101			Lagoons
	2102			Creeks
	2103			Sand/Beach
	2104			Intertidal mud flats
	2105			Salt marsh
	2106			Mangroves
	2107			Coral reefs
			Man-made	
	2201			Salt pans
	2202			Aquaculture ponds

Legend

- Wetlands (<2.25ha)
- Drainage (line)
- Major Roads
- Railway
- Settlements
- Town/Settlements
- District Boundary
- State Boundary
- International Boundary

Location Map



10 5 0 10 20 Kilometers

Data Source :

IRS P6 LISS III data (Pre-monsoon and Post-monsoon Season 2006-07)

Prepared By :

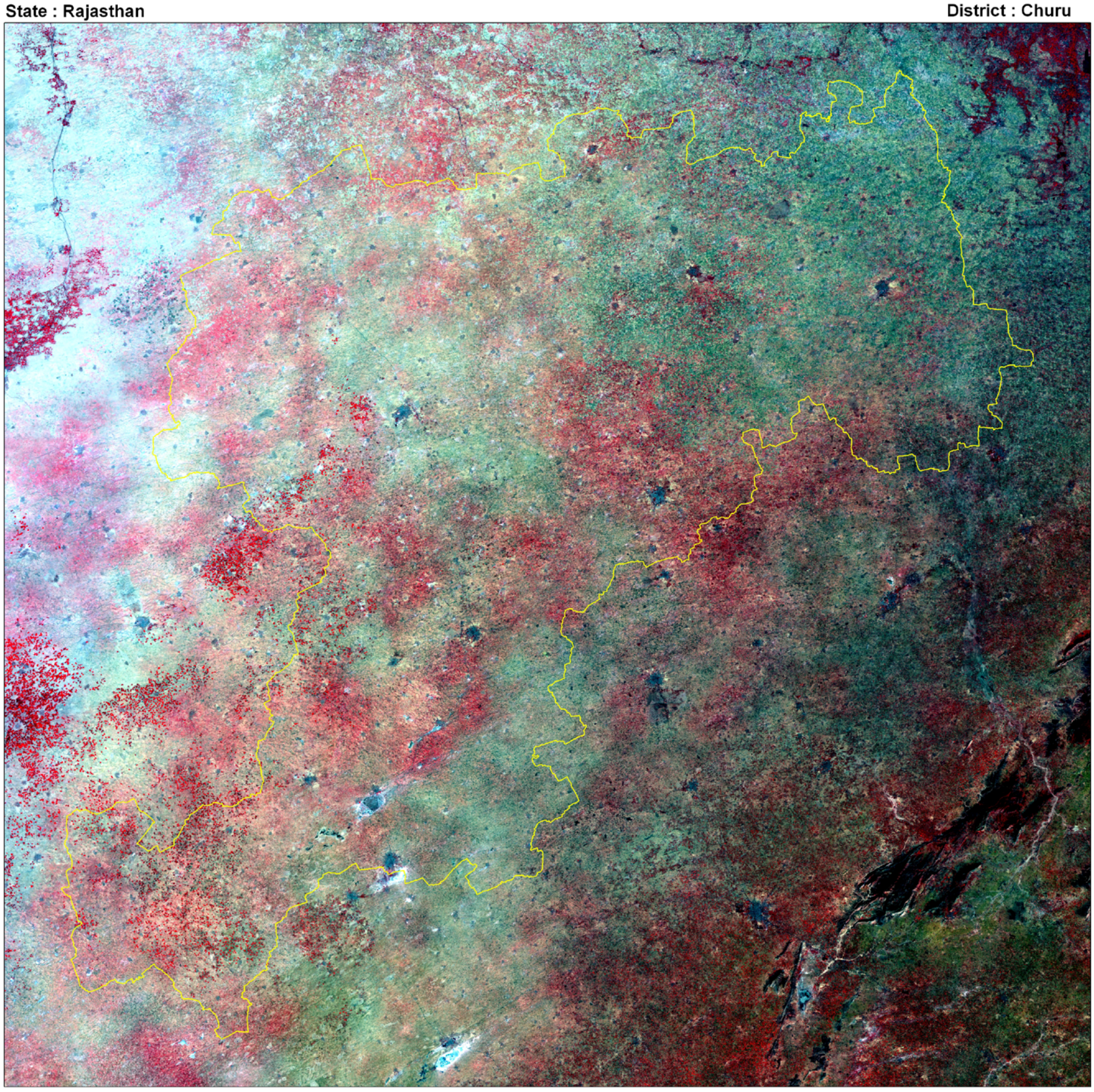
Space Applications Centre (ISRO), Ahmedabad
and
State Remote Sensing Application Centre, Jodhpur

Sponsored By:

Ministry of Environment and Forests
Government of India

State : Rajasthan

District : Churu



IRS P6 AWiFS Post-monsoon data (2007).

7.1.5 Jhunjhunun

Jhunjhunu is one of the administrative districts of Rajasthan located in the north-eastern part of the state. The central co-ordinates of the district are 28^0.13' North latitude and 75^0.4' East longitude. Jhunjhunu district is touches Churu on the North-Western side, Hissar and Mahendragarh of Haryana in North-Eastern part and by Sikar. The geographical area of the district is 5928 sq. Km and. Most of the part of the district is semi-desert. The drainage is inland and is related to the Kantli river system which is a non perennial river, besides this there are four major streams, namely - Dohan, Chandravati, Udaipur, Lohagarh-ki-nadi and Sukh nadi.

Total 330 wetlands are mapped including 310 small wetlands (< 2.25 ha) with 5319 ha area**. R**ivers/ streams with 4929 ha. contributed 92.67% to the total wetland area. The Tanks/Ponds occupies 80 ha.

Open water spread of the wetlands is slightly higher in Pre-monsoon (60 ha) than Post-monsoon (57 ha). The qualitative turbidity of water is high in both the seasons. Wetland statistics are given in Table 10.

Table 10: Area estimates of wetlands in Jhunjhunun

Area in ha

Sr. No.	Wettcode	Wetland Category	Number of Wetlands	Total Wetland Area	% of wetland area	Open Water	
						Post-monsoon Area	Pre-monsoon Area
	1100	**Inland Wetlands - Natural**					
1	1101	Lakes/Ponds	-	-	-	-	-
2	1102	Ox-bow lakes/ Cut-off meanders	-	-	-	-	-
3	1103	High altitude wetlands	-	-	-	-	-
4	1104	Riverine wetlands	-	-	-	-	-
5	1105	Waterlogged	-	-	-	-	-
6	1106	River/Stream	11	4929	92.67	-	-
	1200	**Inland Wetlands -Man-made**					
7	1201	Reservoirs/Barrages	-	-	-	-	-
8	1202	Tanks/Ponds	9	80	1.50	57	60
9	1203	Waterlogged	-	-	-	-	-
10	1204	Salt pans	-	-	-	-	-
		Sub-Total	**20**	**5009**	**94.17**	**57**	**60**
		Wetlands (<2.25 ha), mainly Tanks	310	310	5.83	-	-
		Total	**330**	**5319**	**100.00**	**57**	**60**

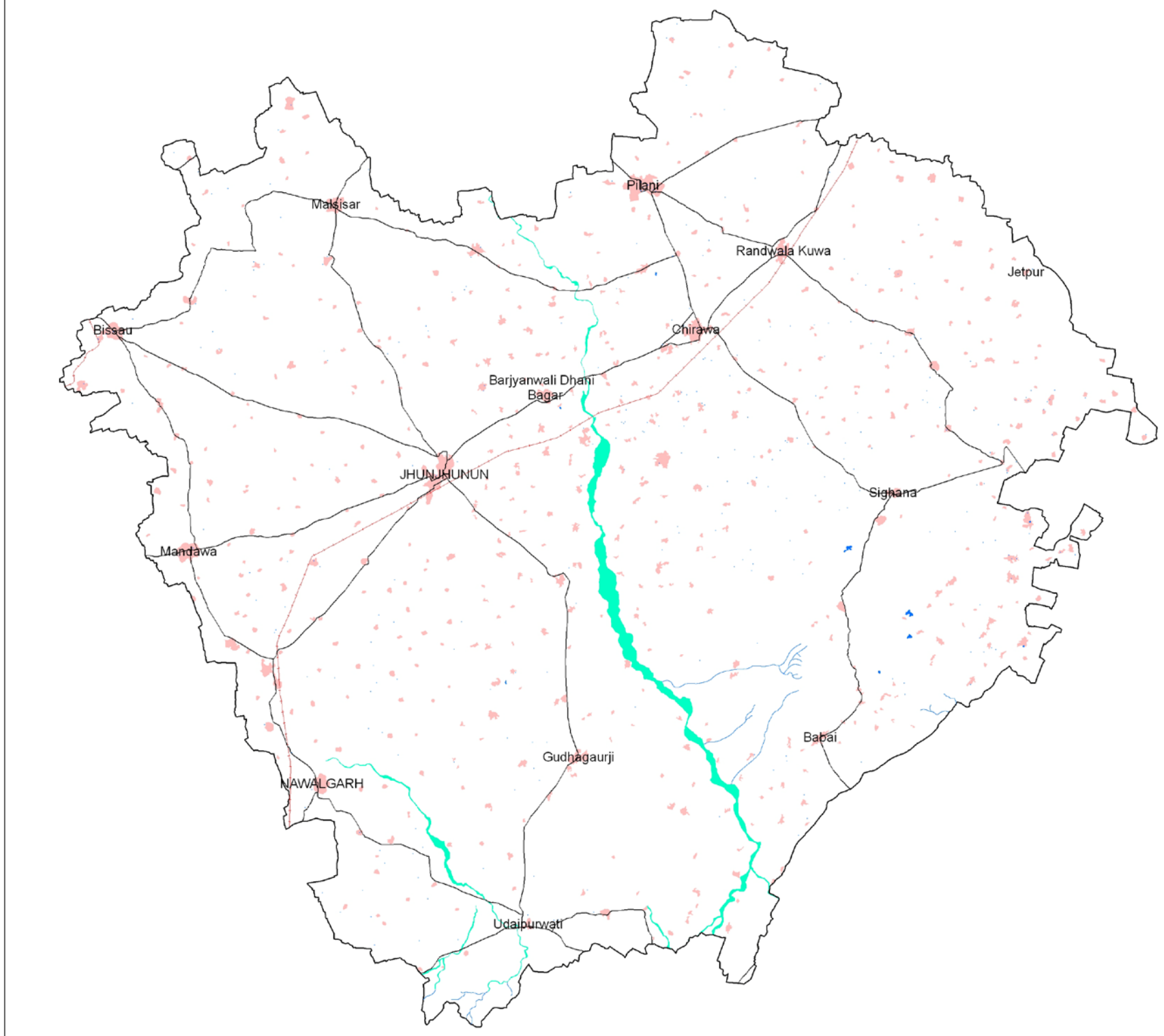
Area under Aquatic Vegetation	-	-

Area under turbidity levels		
Low	16	23
Moderate	-	-
High	41	37

State : Rajasthan

WETLAND MAP

District : Jhunjhunun

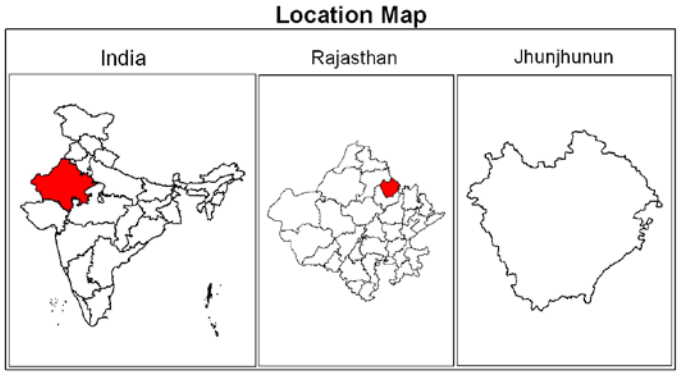


Symbol	Typecode	Level I	Level II	Level III
		Inland Wetlands		
			Natural	
	1101			Lakes/Ponds
	1102			Ox-bow lakes/ Cut-off meanders
	1103			High altitude wetlands
	1104			Reverine wetlands
	1105			Waterlogged
	1106			River/Stream
			Man-made	
	1201			Reservoirs/Barrages
	1202			Tanks/Ponds
	1203			Waterlogged
	1204			Salt pans
		Coastal Wetlands		
			Natural	
	2101			Lagoons
	2102			Creeks
	2103			Sand/Beach
	2104			Intertidal mud flats
	2105			Salt marsh
	2106			Mangroves
	2107			Coral reefs
			Man-made	
	2201			Salt pans
	2202			Aquaculture ponds

Legend

- Wetlands (<2.25ha)
- Drainage (line)
- Major Roads
- Railway
- Settlements
- Town/Settlements
- District Boundary
- State Boundary
- International Boundary

Location Map



4 2 0 4 8 Kilometers

Data Source :

IRS P6 LISS III data (Pre-monsoon and Post-monsoon Season 2006-07)

Prepared By :

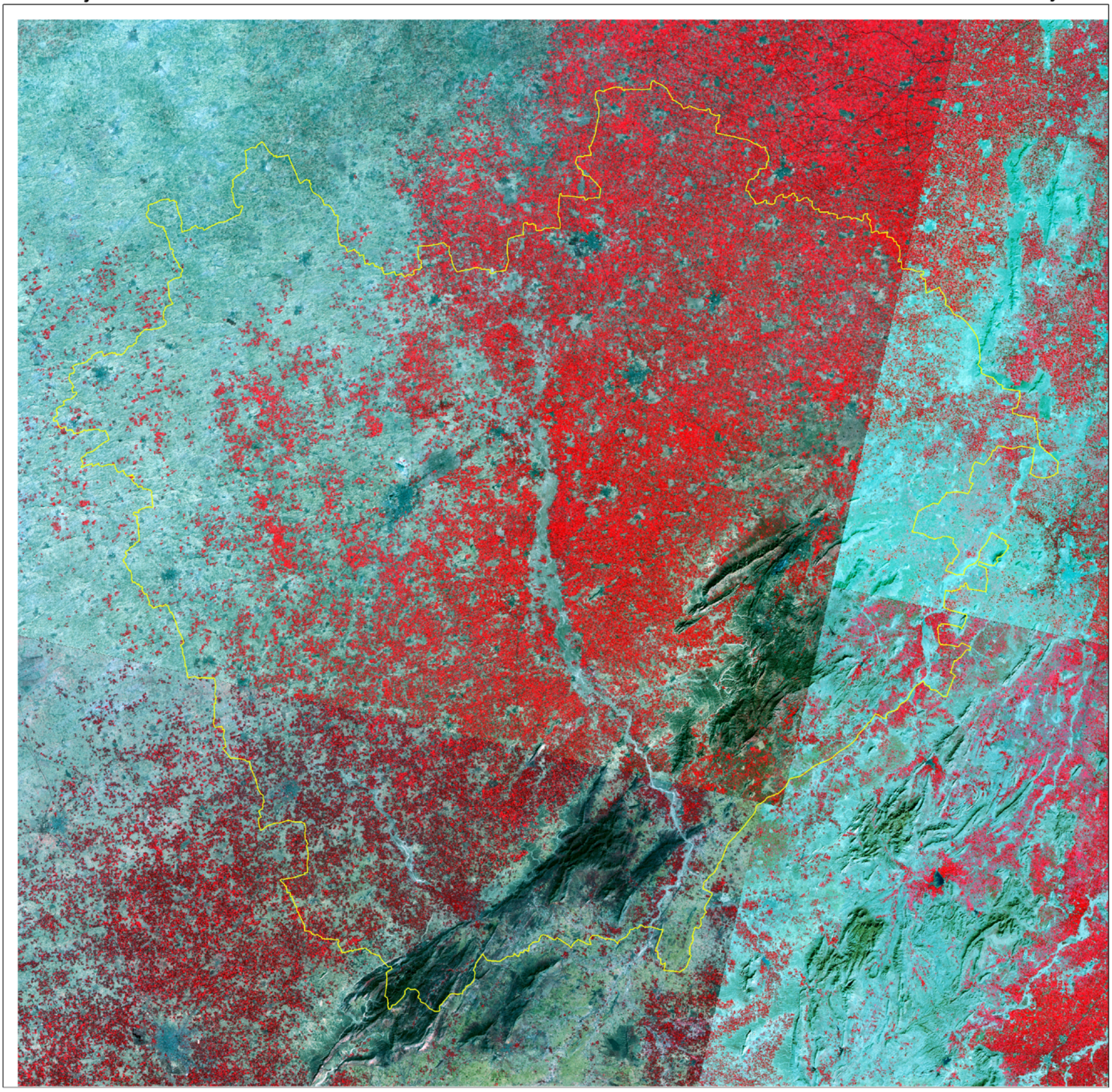
Space Applications Centre (ISRO), Ahmedabad
and
State Remote Sensing Application Centre, Jodhpur

Sponsored By:

Ministry of Environment and Forests
Government of India

State : Rajasthan

District : Jhunjhunun



IRS P6 LISS-III Pre-monsoon data (2007).

7.1.6 Alwar

The district is situated in north east of Rajasthan between 27◦ 04' and 28◦ 04' North latitudes and 76◦ 07’ and 77◦ 13' East longitudes covering a geographical Area is about 8380 sq. km. The climate of the district is very hot in summer and very cold in winter. The maximum temperature of the district has been 47◦C. Two seasonal rivers of the district are Ruparel and the Sabi.

In all 1200 wetlands are mapped including 1070 small wetlands (< 2.25 ha) with 12774 ha area**. R**ivers/ streams with 7066 ha. contributed 55.32% to the total wetland area. The tanks/ponds with 2891 ha (22.63% area) is the second major wetland category, followed by reservoir/barrages with 949 ha area i.e. 7.43 %. Thus, the district is dominated by man-made wetlands mainly comprised of tanks/ponds

Open water spread of the wetlands is significantly higher in Post-monsoon (3192 ha) than Pre-monsoon (747 ha) season. Aquatic vegetation is during Post-monsoon (16 ha) . The qualitative turbidity of water is low in both the seasons. Details of estimates of wetlands in Alwar are given in Table 11.

Table 11: Area estimates of wetlands in Alwar

Area in ha

Sr. No.	Wettcode	Wetland Category	Number of Wetlands	Total Wetland Area	% of wetland area	Open Water	
						Post-monsoon Area	Pre-monsoon Area
	1100	**Inland Wetlands - Natural**					
1	1101	Lakes/Ponds	2	798	6.25	459	279
2	1102	Ox-bow lakes/ Cut-off meanders	-	-	-	-	-
3	1103	High altitude wetlands	-	-	-	-	-
4	1104	Riverine wetlands	-	-	-	-	-
5	1105	Waterlogged	-	-	-	-	-
6	1106	River/Stream	21	7066	55.32	15	-
	1200	**Inland Wetlands -Man-made**					
7	1201	Reservoirs/Barrages	8	949	7.43	676	136
8	1202	Tanks/Ponds	99	2891	22.63	2042	332
9	1203	Waterlogged	-	-	-	-	-
10	1204	Salt pans	-	-	-	-	-
		Sub-Total	**130**	**11704**	**91.62**	**3192**	**747**
		Wetlands (<2.25 ha), mainly Tanks	1070	1070	8.38	-	-
		Total	**1200**	**12774**	**100.00**	**3192**	**747**

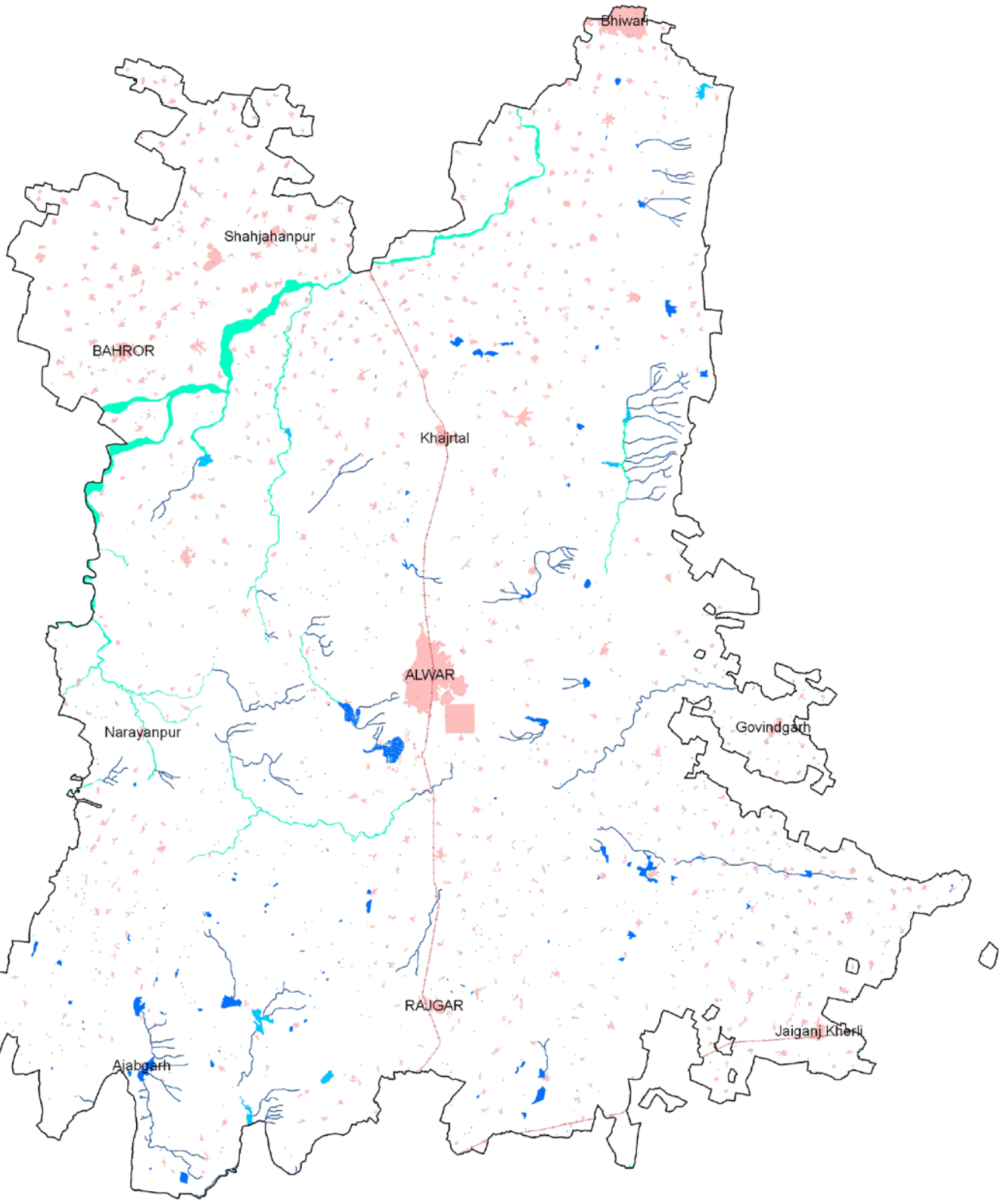
Area under Aquatic Vegetation	16	-

Area under turbidity levels		
Low	2091	615
Moderate	219	-
High	882	132

State : Rajasthan

WETLAND MAP

District : Alwar

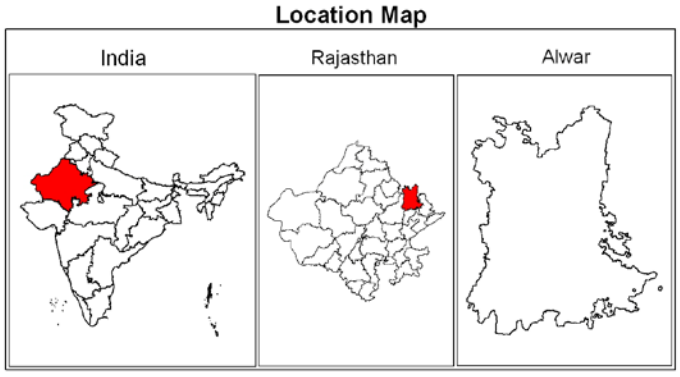


Symbol	Typecode	Level I	Level II	Level III
		Inland Wetlands		
			Natural	
	1101			Lakes/Ponds
	1102			Ox-bow lakes/ Cut-off meanders
	1103			High altitude wetlands
	1104			Reverine wetlands
	1105			Waterlogged
	1106			River/Stream
			Man-made	
	1201			Reservoirs/Barrages
	1202			Tanks/Ponds
	1203			Waterlogged
	1204			Salt pans
		Coastal Wetlands		
			Natural	
	2101			Lagoons
	2102			Creeks
	2103			Sand/Beach
	2104			Intertidal mud flats
	2105			Salt marsh
	2106			Mangroves
	2107			Coral reefs
			Man-made	
	2201			Salt pans
	2202			Aquaculture ponds

Legend

- Wetlands (<2.25ha)
- Drainage (line)
- Major Roads
- Railway
- Settlements
- Town/Settlements
- District Boundary
- State Boundary
- International Boundary

Location Map



8 4 0 8 16 Kilometers

Data Source :

IRS P6 LISS III data (Pre-monsoon and Post-monsoon Season 2006-07)

Prepared By :

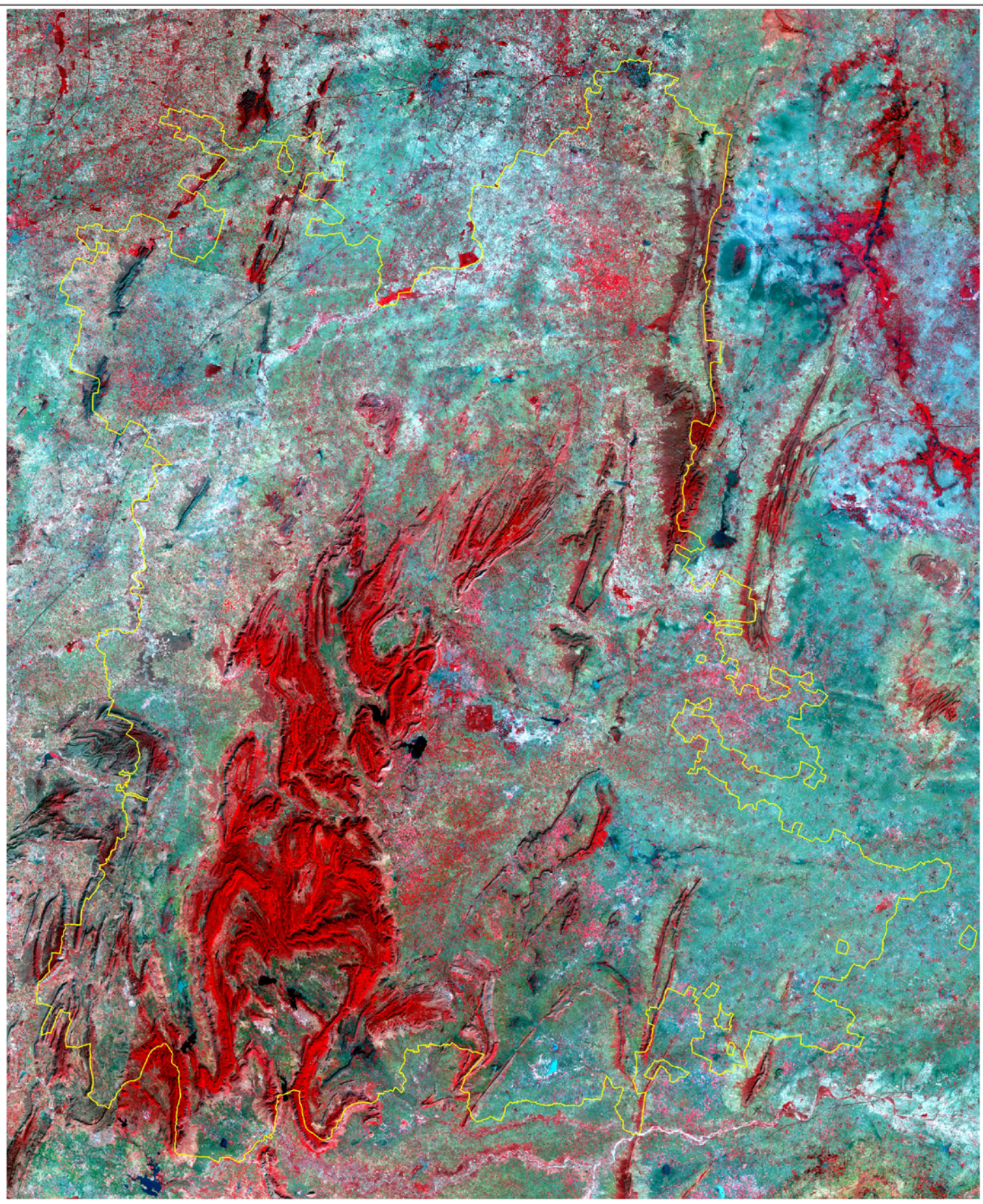
Space Applications Centre (ISRO), Ahmedabad
and
State Remote Sensing Application Centre, Jodhpur

Sponsored By:

Ministry of Environment and Forests
Government of India

State : Rajasthan

District : Alwar



IRS P6 LISS-III Post-monsoon data (2006).

7.1.7 Bharatpur

The district is located in the eastern region of the state lies in between 26° 22' and 27° 50' north latitude and 76° 53' and 78° 17' east longitude. Bharatpur, popularly known as the Eastern Gate of Rajasthan. Northern Border of the district touches district Gurgaon of state Haryana, Eastern Border touches district Mathura, Southern Border touches district Agra of state Uttar Pradesh and district Dholpur of Rajasthan. It shares common boundaries with the district Dausa in south-west and district Alwar in the North-West. The total area of the district is 5066 sq. kms. The most widely visited tourist spots in and around Bharatpur are: Keoladeo National Park (Bird Sanctuary), Lohagarh Fort or The 'Iron Fort. The main rivers are found in the district are Banganga, the Gambhir, the Kakund and Parbati. These rivers flows for only 2 months after the rainy season is over. The average rainfall is 67 cms. The maximum temperature touches 47^0 and the minimum 5^0 C.

Total 1687 wetlands are mapped including 1521 small wetlands (< 2.25 ha) with 10415 ha area**. R**ivers/ streams with 3067 ha. contributed 29.45% to the total wetland area. The waterlogged with 3042 ha (29.21% area) is the second major wetland category, followed by tanks/ponds with 1568 ha area i.e. 15.06 %. Thus, the district is dominated by natural wetlands.

Open water spread of the wetlands is significantly higher in Post-monsoon (2959 ha). Aquatic vegetation during Post-monsoon (2250 ha) is higher than in Pre-monsoon. The qualitative turbidity of water is low in both the seasons. Details of wetland statistics is given in Table- 12.

Table 12: Area estimates of wetlands in Bharatpur

Area in ha

Sr. No.	Wettcode	Wetland Category	Number of Wetlands	Total Wetland Area	% of wetland area	Open Water	
						Post-monsoon Area	Pre-monsoon Area
	1100	**Inland Wetlands - Natural**					
1	1101	Lakes/Ponds	-	-	-	-	-
2	1102	Ox-bow lakes/ Cut-off meanders	-	-	-	-	-
3	1103	High altitude wetlands	-	-	-	-	-
4	1104	Riverine wetlands	-	-	-	-	-
5	1105	Waterlogged	-	-	-	-	-
6	1106	River/Stream	7	3067	29.45	191	3
	1200	**Inland Wetlands -Man-made**					
7	1201	Reservoirs/Barrages	1	1217	11.69	1084	281
8	1202	Tanks/Ponds	153	1568	15.06	886	78
9	1203	Waterlogged	5	3042	29.21	798	257
10	1204	Salt pans	-	-	-	-	-
		Sub-Total	**166**	**8894**	**85.40**	**2959**	**619**
		Wetlands (<2.25 ha), mainly Tanks	1521	1521	14.60	-	-
		Total	**1687**	**10415**	**100.00**	**2959**	**619**

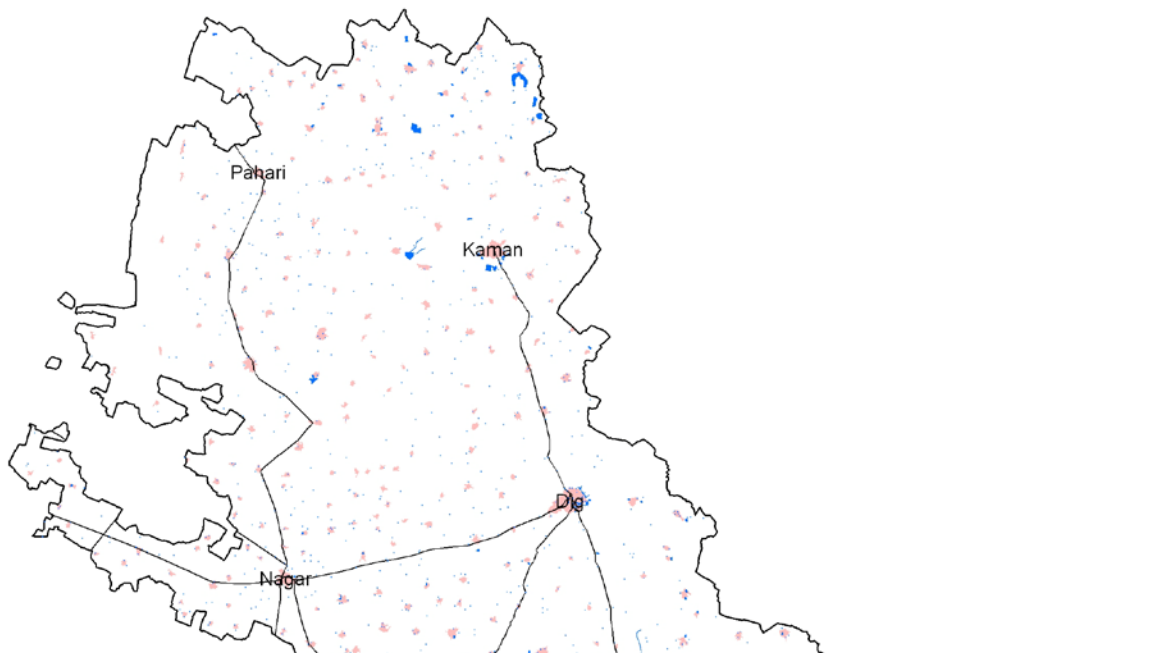
Area under Aquatic Vegetation	2250	4

Area under turbidity levels		
Low	2716	446
Moderate	66	173
High	177	-

State : Rajasthan

WETLAND MAP

District : Bharatpur

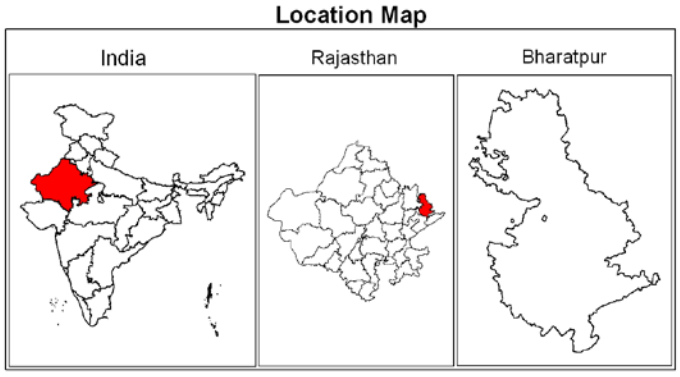


Symbol	Typecode	Level I	Level II	Level III
		Inland Wetlands		
			Natural	
	1101			Lakes/Ponds
	1102			Ox-bow lakes/ Cut-off meanders
	1103			High altitude wetlands
	1104			Reverine wetlands
	1105			Waterlogged
	1106			River/Stream
			Man-made	
	1201			Reservoirs/Barrages
	1202			Tanks/Ponds
	1203			Waterlogged
	1204			Salt pans
		Coastal Wetlands		
			Natural	
	2101			Lagoons
	2102			Creeks
	2103			Sand/Beach
	2104			Intertidal mud flats
	2105			Salt marsh
	2106			Mangroves
	2107			Coral reefs
			Man-made	
	2201			Salt pans
	2202			Aquaculture ponds

Legend

- Wetlands (<2.25ha)
- Drainage (line)
- Major Roads
- Railway
- Settlements
- Town/Settlements
- District Boundary
- State Boundary
- International Boundary

Location Map



10 5 0 10 20 Kilometers

Data Source :

IRS P6 LISS III data (Pre-monsoon and Post-monsoon Season 2006-07)

Prepared By :

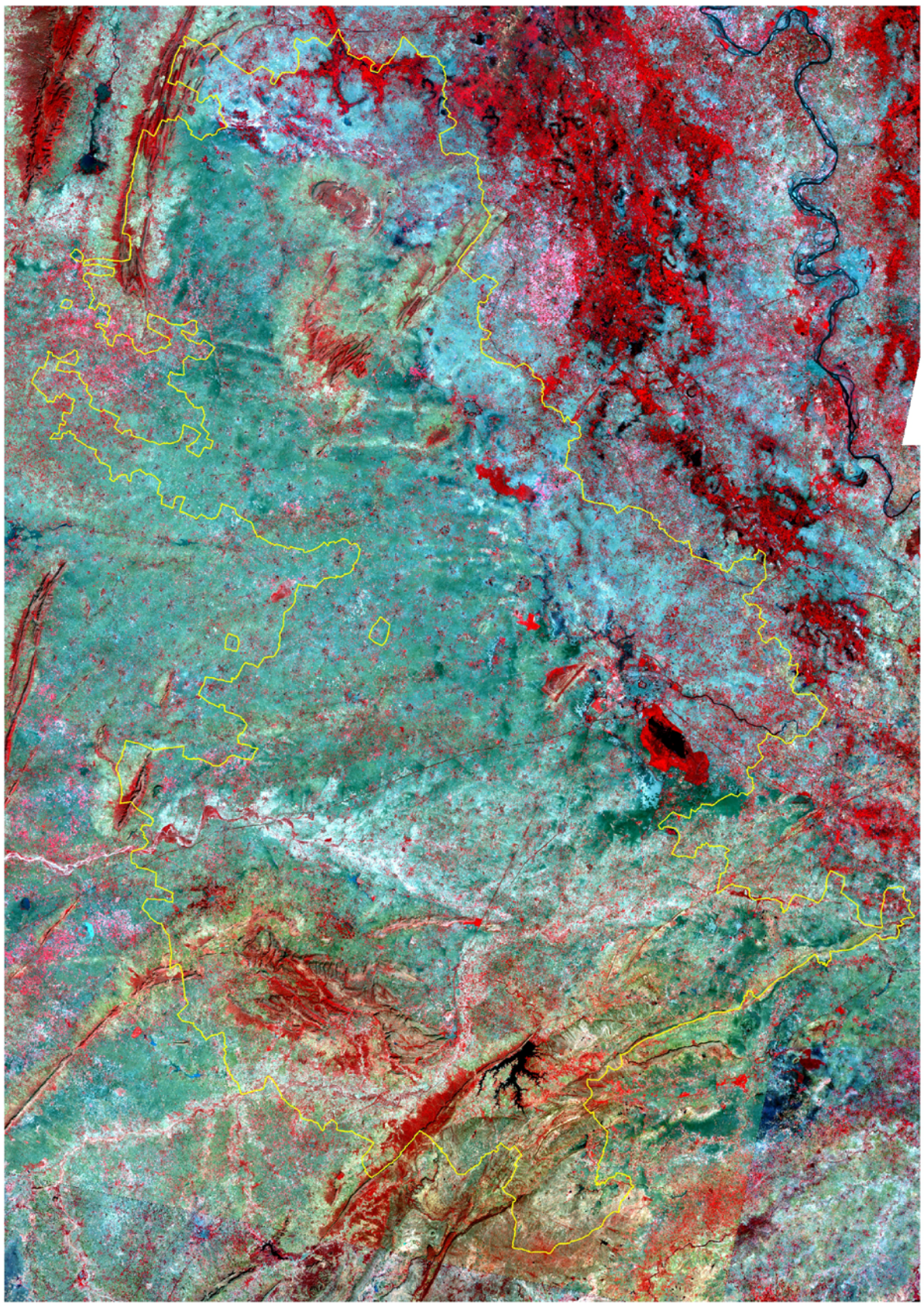
Space Applications Centre (ISRO), Ahmedabad
and
State Remote Sensing Application Centre, Jodhpur

Sponsored By:

Ministry of Environment and Forests
Government of India

State : Rajasthan

District : Bharatpur



IRS P6 LISS-III Post-monsoon data (2006).

7.1.8 Dhaulpur

Dhaulpur lies in between 26° 01' and 26° 57' north latitude and 74° 14' and 78° 16' east longitude. It is surrounded by Agra district in the north-east, Morena district of Madhya Pradesh in the south, Sawai Madhopur district in the west and Bharatpur district of Rajasthan in the north. The geographical area of the district is 3084 sq. kms. Some of the worth visiting places in and around the district are: Ramsagar Sanctuary, Talab-E-Shahi and Van Vihar Wild Life Sanctuary etc. The average rainfall is 67 cms. The maximum temperature reaches 49^0 while and minimum temperature touches 1^0 C.

Total 446 wetlands are mapped including 342 small wetlands (< 2.25 ha) with 9370 ha area**. R**ivers/ streams with 6786 ha. contributed 72.42% to the total wetland area. The Reservoirs/Barrages with 1551 ha (16.55% area) is the second major wetland category, followed by tanks/ponds with 691 ha area i.e. 7.37 %. Thus, the district is dominated by man-made wetlands.

Open water spread of the wetlands is significantly higher in Post-monsoon (4296 ha) than during Pre-monsoon (3108 ha). Aquatic vegetation during Post-monsoon (86 ha) is higher. The qualitative turbidity of water is low in both the seasons.Details of estimates of wetlands in Dhaulpur are given in Table 13.

Table 13: Area estimates of wetlands in Dhaulpur

Area in ha

Sr. No.	Wettcode	Wetland Category	Number of Wetlands	Total Wetland Area	% of wetland area	Open Water	
						Post-monsoon Area	Pre-monsoon Area
	1100	**Inland Wetlands - Natural**					
1	1101	Lakes/Ponds	-	-	-	-	-
2	1102	Ox-bow lakes/ Cut-off meanders	-	-	-	-	-
3	1103	High altitude wetlands	-	-	-	-	-
4	1104	Riverine wetlands	-	-	-	-	-
5	1105	Waterlogged	-	-	-	-	-
6	1106	River/Stream	31	6786	72.42	2998	2274
	1200	**Inland Wetlands -Man-made**					
7	1201	Reservoirs/Barrages	3	1551	16.55	1100	647
8	1202	Tanks/Ponds	70	691	7.37	198	187
9	1203	Waterlogged	-	-	-	-	-
10	1204	Salt pans	-	-	-	-	-
		Sub-Total	**104**	**9028**	**96.35**	**4296**	**3108**
		Wetlands (<2.25 ha), mainly Tanks	342	342	3.65	-	-
		Total	**446**	**9370**	**100.00**	**4296**	**3108**

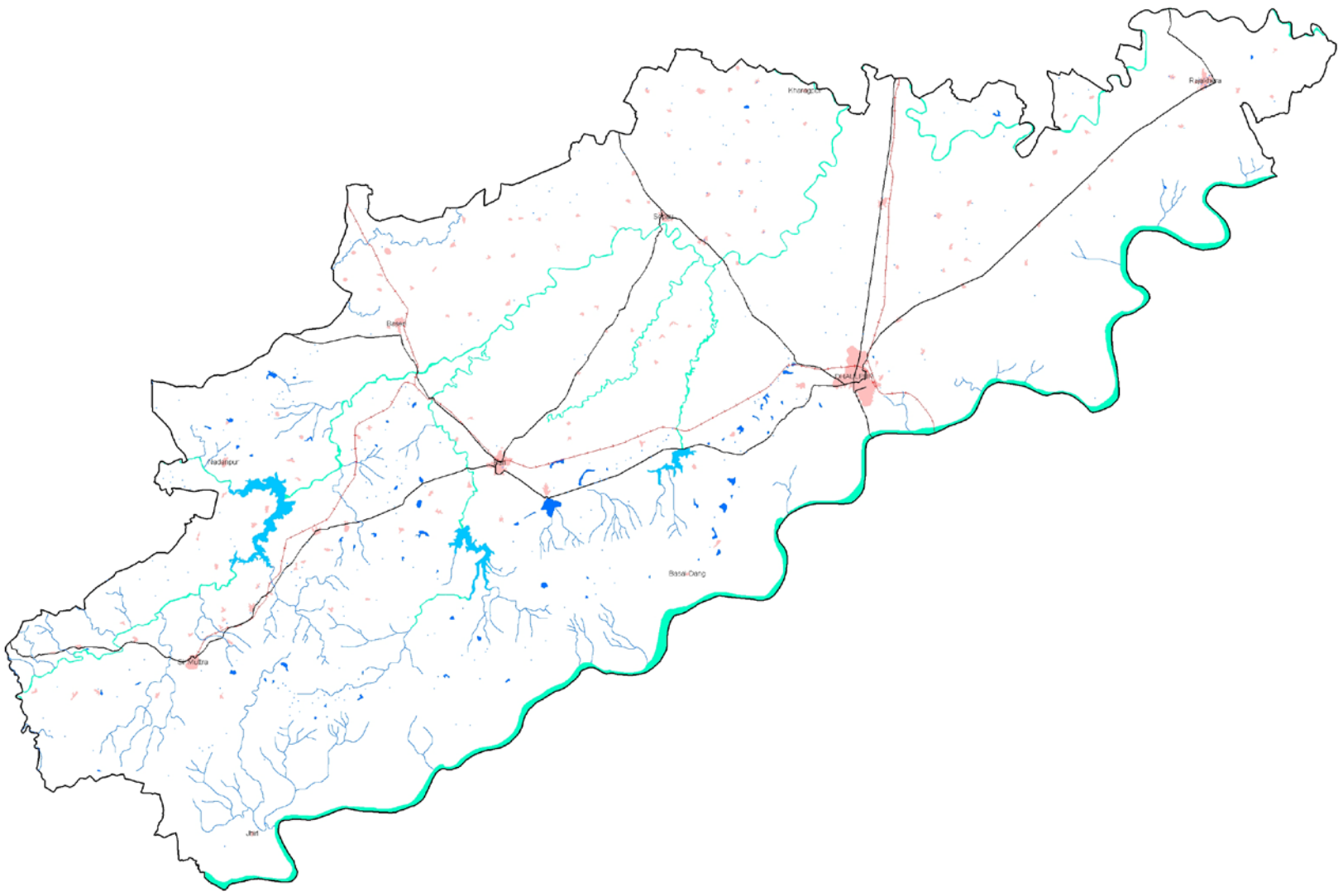
Area under Aquatic Vegetation	86	58

Area under turbidity levels		
Low	4269	2970
Moderate	-	-
High	27	138

State : Rajasthan

WETLAND MAP

District : Dhaulpur

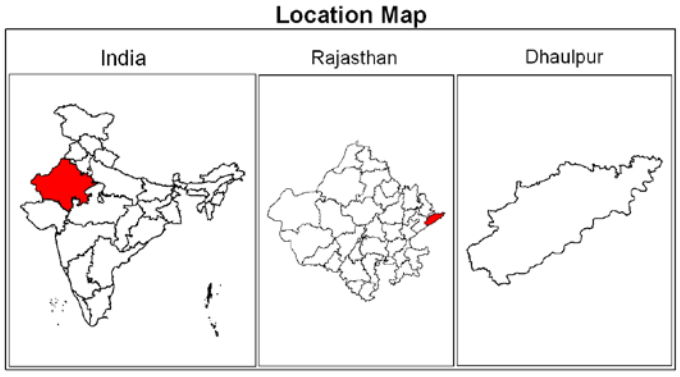


Symbol	Typecode	Level I	Level II	Level III
		Inland Wetlands		
			Natural	
	1101			Lakes/Ponds
	1102			Ox-bow lakes/ Cut-off meanders
	1103			High altitude wetlands
	1104			Reverine wetlands
	1105			Waterlogged
	1106			River/Stream
			Man-made	
	1201			Reservoirs/Barrages
	1202			Tanks/Ponds
	1203			Waterlogged
	1204			Salt pans
		Coastal Wetlands		
			Natural	
	2101			Lagoons
	2102			Creeks
	2103			Sand/Beach
	2104			Intertidal mud flats
	2105			Salt marsh
	2106			Mangroves
	2107			Coral reefs
			Man-made	
	2201			Salt pans
	2202			Aquaculture ponds

Legend

- Wetlands (<2.25ha)
- Drainage (line)
- Major Roads
- Railway
- Settlements
- Town/Settlements
- District Boundary
- State Boundary
- International Boundary

Location Map



6 3 0 6 12 Kilometers

Data Source :

IRS P6 LISS III data (Pre-monsoon and Post-monsoon Season 2006-07)

Prepared By :

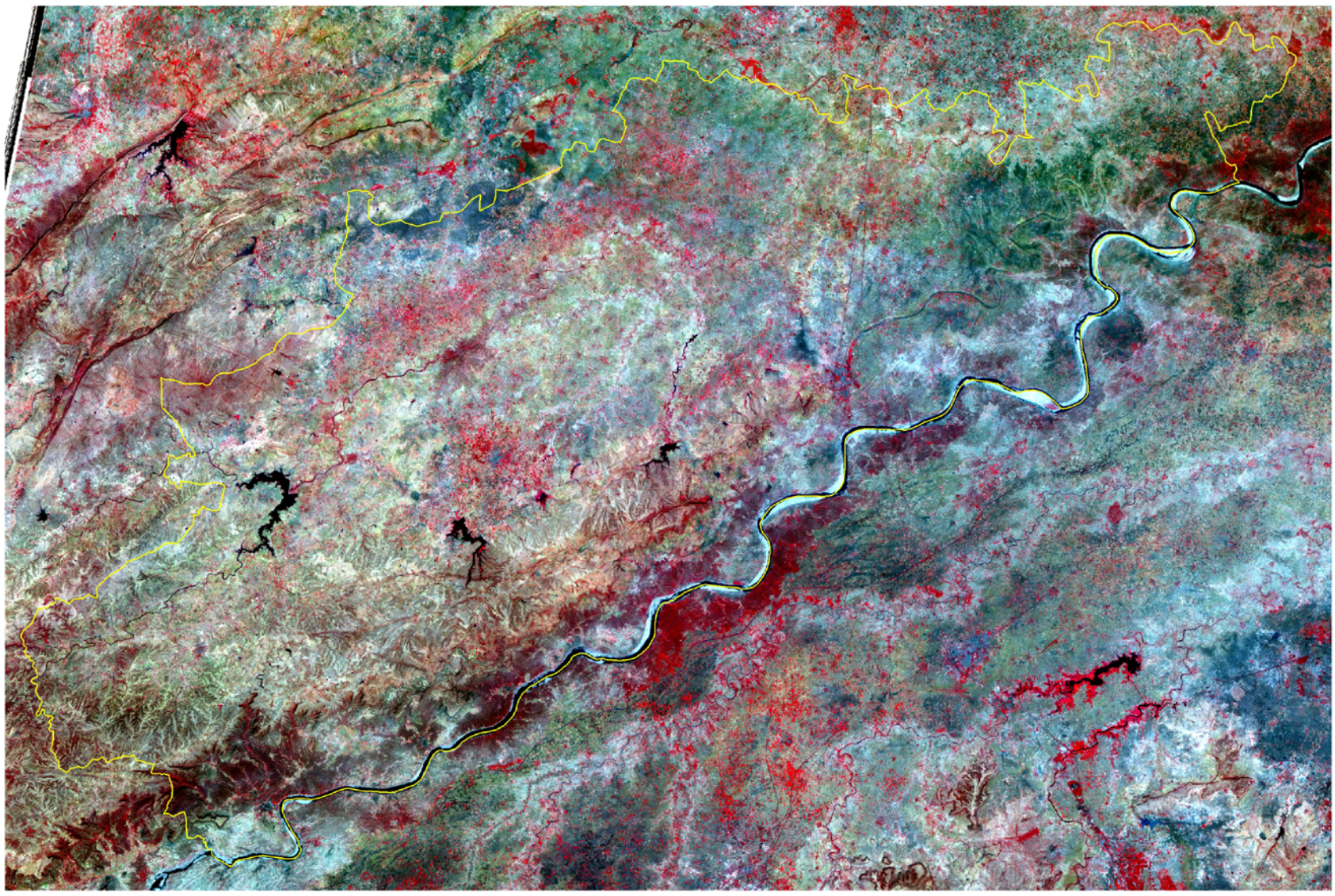
Space Applications Centre (ISRO), Ahmedabad
and
State Remote Sensing Application Centre, Jodhpur

Sponsored By:

Ministry of Environment and Forests
Government of India

State : Rajasthan

District : Dhaulpur



IRS P6 LISS-III Post-monsoon data (2006).

7.1.9 Karauli

Karauli district is bordered by Dholpur District to the east; by Bharatpur District to the north-east; by Dausa District to the north; and by Sawai Madhopur District to the west. The geographical area of the district is 5530 sq. Km. The worth visiting place of the district is Kela Devi Wild Life Sanctuary. The maximum temperature touches 49^0 whereas the minimum temperature 2^0 C.

Total 916 wetlands are mapped including 763 small wetlands (< 2.25 ha) with 10042 ha area**. R**ivers/ streams with 6270 ha. contributed 62.44% to the total wetland area. The Tanks/Ponds with 1679 ha (16.72% area) is the second major wetland category, followed by Reservoirs/Barrages with 1231 ha area i.e. 12.26 %. Thus, the district is dominated by man-made wetlands.

Open water spread of the wetlands is significantly higher in Post-monsoon (4384 ha) than during Pre-monsoon (2457 ha). Aquatic vegetation is higher during pre monsoon (59 ha). The qualitative turbidity of water is low in both the seasons. Details of estimates of wetlands in Karauli are given in Table 14.

Table 14: Area estimates of wetlands in Karauli

Area in ha

Sr. No.	Wettcode	Wetland Category	Number of Wetlands	Total Wetland Area	% of wetland area	Open Water	
						Post-monsoon Area	Pre-monsoon Area
	1100	**Inland Wetlands - Natural**					
1	1101	Lakes/Ponds	2	99	0.99	75	35
2	1102	Ox-bow lakes/ Cut-off meanders	-	-	-	-	-
3	1103	High altitude wetlands	-	-	-	-	-
4	1104	Riverine wetlands	-	-	-	-	-
5	1105	Waterlogged	-	-	-	-	-
6	1106	River/Stream	31	6270	62.44	2303	1707
	1200	**Inland Wetlands -Man-made**					
7	1201	Reservoirs/Barrages	5	1231	12.26	1119	609
8	1202	Tanks/Ponds	115	1679	16.72	887	106
9	1203	Waterlogged	-	-	-	-	-
10	1204	Salt pans	-	-	-	-	-
		Sub-Total	**153**	**9279**	**92.40**	**4384**	**2457**
		Wetlands (<2.25 ha), mainly Tanks	763	763	7.60	-	-
		Total	**916**	**10042**	**100.00**	**4384**	**2457**

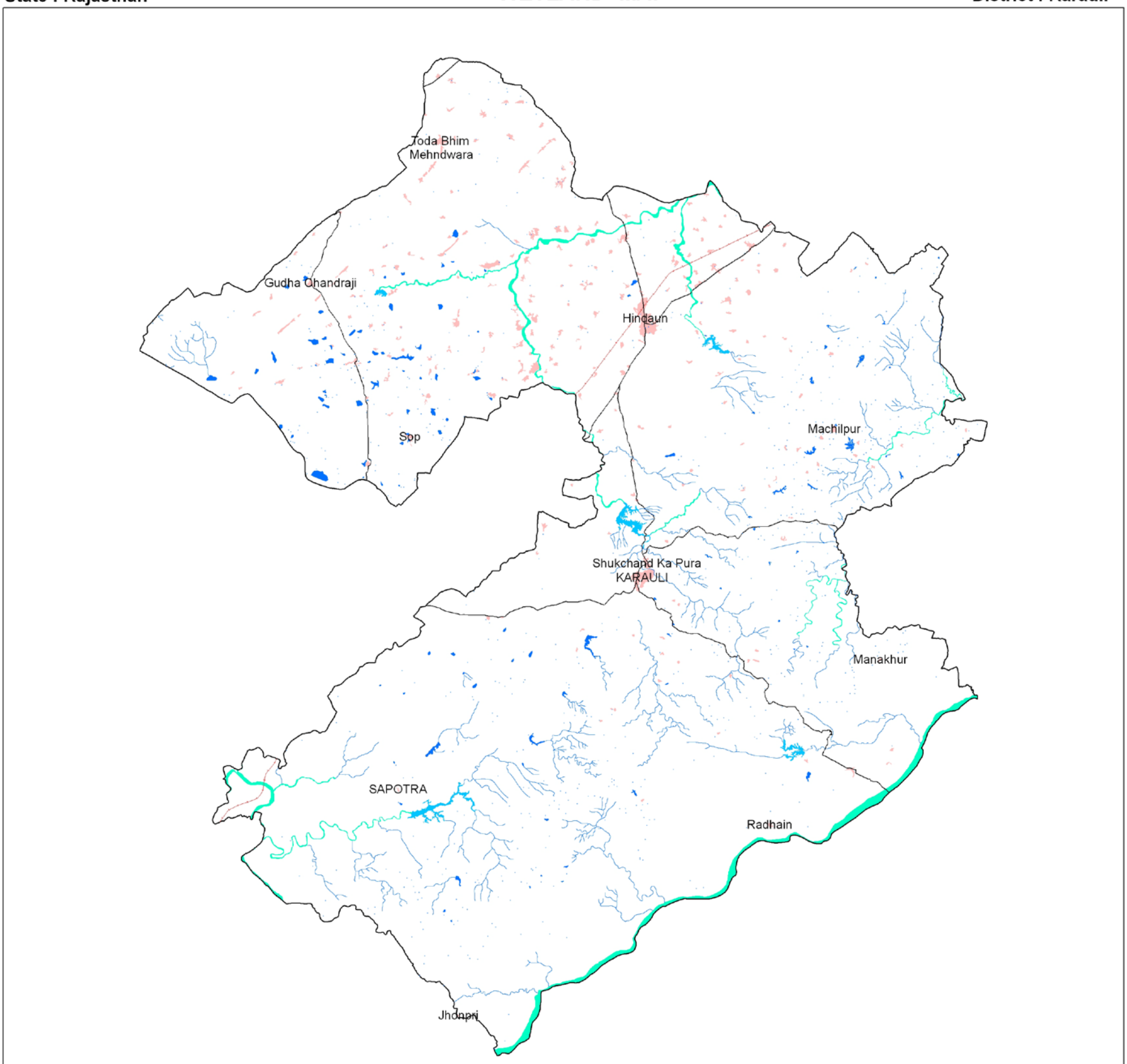
Area under Aquatic Vegetation	29	59

Area under turbidity levels		
Low	4339	2168
Moderate	15	268
High	30	21

State : Rajasthan

WETLAND MAP

District : Karauli

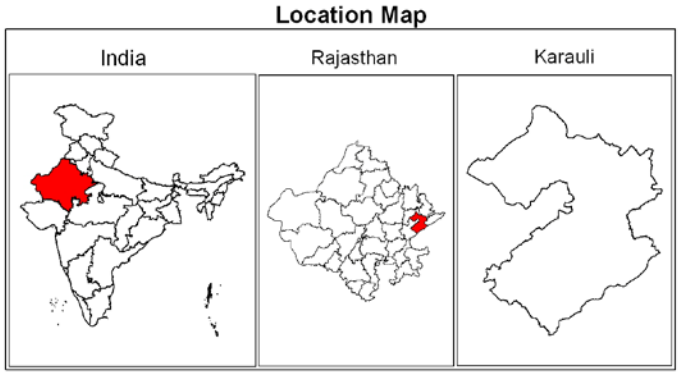


Symbol	Typecode	Level I	Level II	Level III
		Inland Wetlands		
			Natural	
	1101			Lakes/Ponds
	1102			Ox-bow lakes/ Cut-off meanders
	1103			High altitude wetlands
	1104			Reverine wetlands
	1105			Waterlogged
	1106			River/Stream
			Man-made	
	1201			Reservoirs/Barrages
	1202			Tanks/Ponds
	1203			Waterlogged
	1204			Salt pans
		Coastal Wetlands		
			Natural	
	2101			Lagoons
	2102			Creeks
	2103			Sand/Beach
	2104			Intertidal mud flats
	2105			Salt marsh
	2106			Mangroves
	2107			Coral reefs
			Man-made	
	2201			Salt pans
	2202			Aquaculture ponds

Legend

- Wetlands (<2.25ha)
- Drainage (line)
- Major Roads
- Railway
- Settlements
- Town/Settlements
- District Boundary
- State Boundary
- International Boundary

Location Map



4 2 0 4 8 Kilometers

Data Source :

IRS P6 LISS III data (Pre-monsoon and Post-monsoon Season 2006-07)

Prepared By :

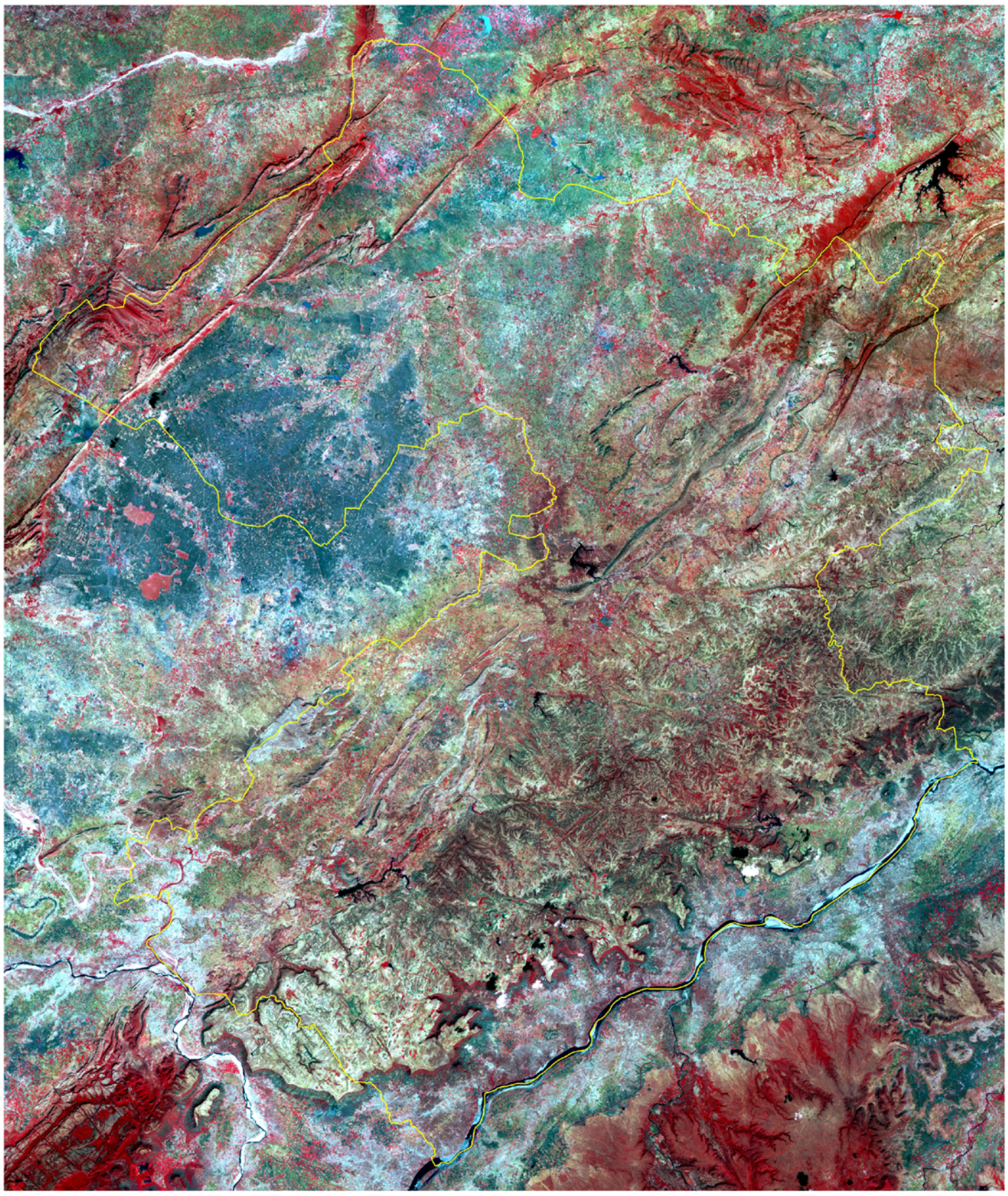
Space Applications Centre (ISRO), Ahmedabad
and
State Remote Sensing Application Centre, Jodhpur

Sponsored By:

Ministry of Environment and Forests
Government of India

State : Rajasthan

District : Karauli



IRS P6 LISS-III Post-monsoon data (2006).

7.1.10 Sawai Madhopur

Sawai Madhopur district is located towards the north-east of Jaipur, along the rolling hills of Vindhyas and Aravali ranges. It lies in between 25^0 45' to 26^0 41' North latitude and 75^0 59' to 77^0 00' East longitude and the geographical area of the district is 4500 sq. Km. The Ranthambor National Park is located in this district. The average rainfall is 873 mm. The maximum temperature touches 45^0 and the minimum temperature 4^0 C.

Total 996 wetlands are mapped including 786 small wetlands (< 2.25 ha) with 22606 ha area**. R**ivers/ streams occupies 15981 ha. contributed 70.69% to the total wetland area. The Reservoirs/Barrages with 3957 ha (17.50 % area) is the second major wetland category, followed by tanks/ponds with 1860 ha area i.e. 8.23 %. Thus, the district is dominated by natural wetlands.

Open water spread of the wetlands is significantly higher in Post-monsoon (7121 ha) than during Pre-monsoon (3395 ha). Aquatic vegetation during Pre-monsoon (10 ha) is higher than in Post-monsoon (7 ha.) . The qualitative turbidity of water is low in both the seasons. Wetland statistics are given in Table 15.

Table 15: Area estimates of wetlands in Sawai Madhopur

Area in ha

Sr. No.	Wettcode	Wetland Category	Number of Wetlands	Total Wetland Area	% of wetland area	Open Water	
						Post-monsoon Area	Pre-monsoon Area
	1100	**Inland Wetlands - Natural**					
1	1101	Lakes/Ponds	1	22	0.10	22	12
2	1102	Ox-bow lakes/ Cut-off meanders	-	-	-	-	-
3	1103	High altitude wetlands	-	-	-	-	-
4	1104	Riverine wetlands	-	-	-	-	-
5	1105	Waterlogged	-	-	-	-	-
6	1106	River/Stream	52	15981	70.69	4041	2330
	1200	**Inland Wetlands -Man-made**					
7	1201	Reservoirs/Barrages	18	3957	17.50	2054	844
8	1202	Tanks/Ponds	139	1860	8.23	1004	209
9	1203	Waterlogged	-	-	-	-	-
10	1204	Salt pans	-	-	-	-	-
		Sub-Total	**210**	**21820**	**96.52**	**7121**	**3395**
		Wetlands (<2.25 ha), mainly Tanks	786	786	3.48	-	-
		Total	**996**	**22606**	**100.00**	**7121**	**3395**

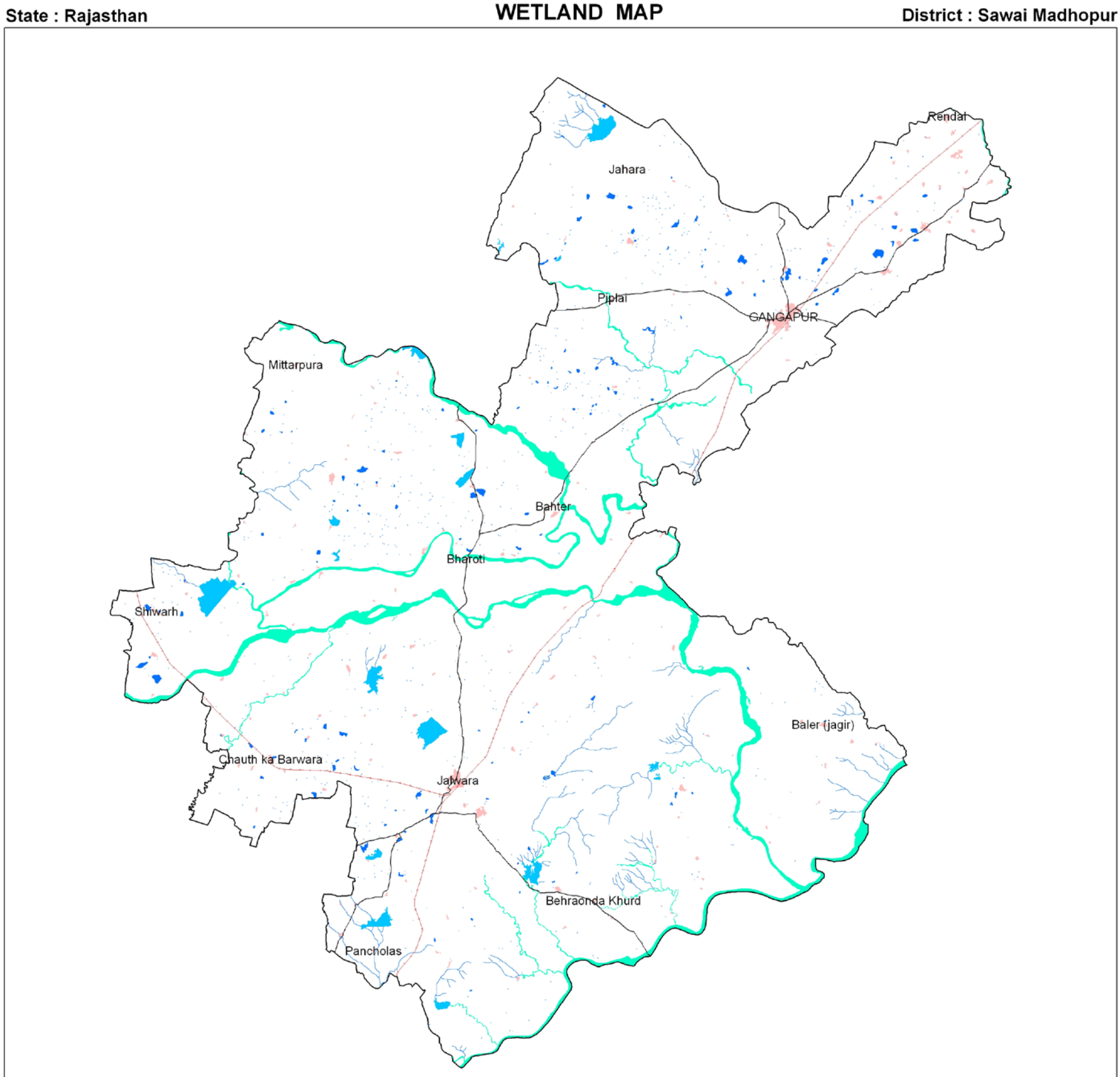
Area under Aquatic Vegetation	7	10

Area under turbidity levels		
Low	6162	3088
Moderate	191	-
High	768	307

State : Rajasthan

WETLAND MAP

District : Sawai Madhopur

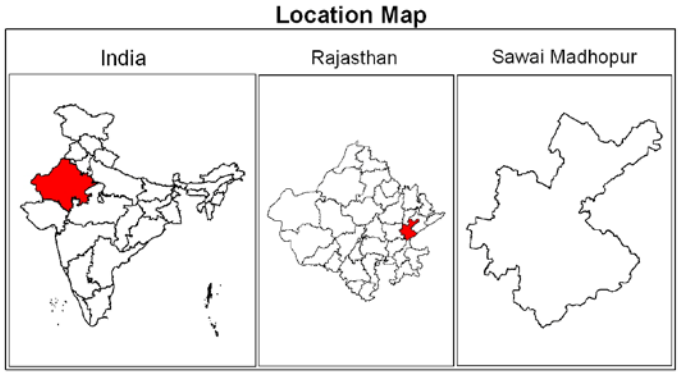


Symbol	Typecode	Level I	Level II	Level III
		Inland Wetlands		
			Natural	
	1101			Lakes/Ponds
	1102			Ox-bow lakes/ Cut-off meanders
	1103			High altitude wetlands
	1104			Reverine wetlands
	1105			Waterlogged
	1106			River/Stream
			Man-made	
	1201			Reservoirs/Barrages
	1202			Tanks/Ponds
	1203			Waterlogged
	1204			Salt pans
		Coastal Wetlands		
			Natural	
	2101			Lagoons
	2102			Creeks
	2103			Sand/Beach
	2104			Intertidal mud flats
	2105			Salt marsh
	2106			Mangroves
	2107			Coral reefs
			Man-made	
	2201			Salt pans
	2202			Aquaculture ponds

Legend

- Wetlands (<2.25ha)
- Drainage (line)
- Major Roads
- Railway
- Settlements
- Town/Settlements
- District Boundary
- State Boundary
- International Boundary

Location Map



4 2 0 4 8 Kilometers

Data Source :

IRS P6 LISS III data (Pre-monsoon and Post-monsoon Season 2006-07)

Prepared By :

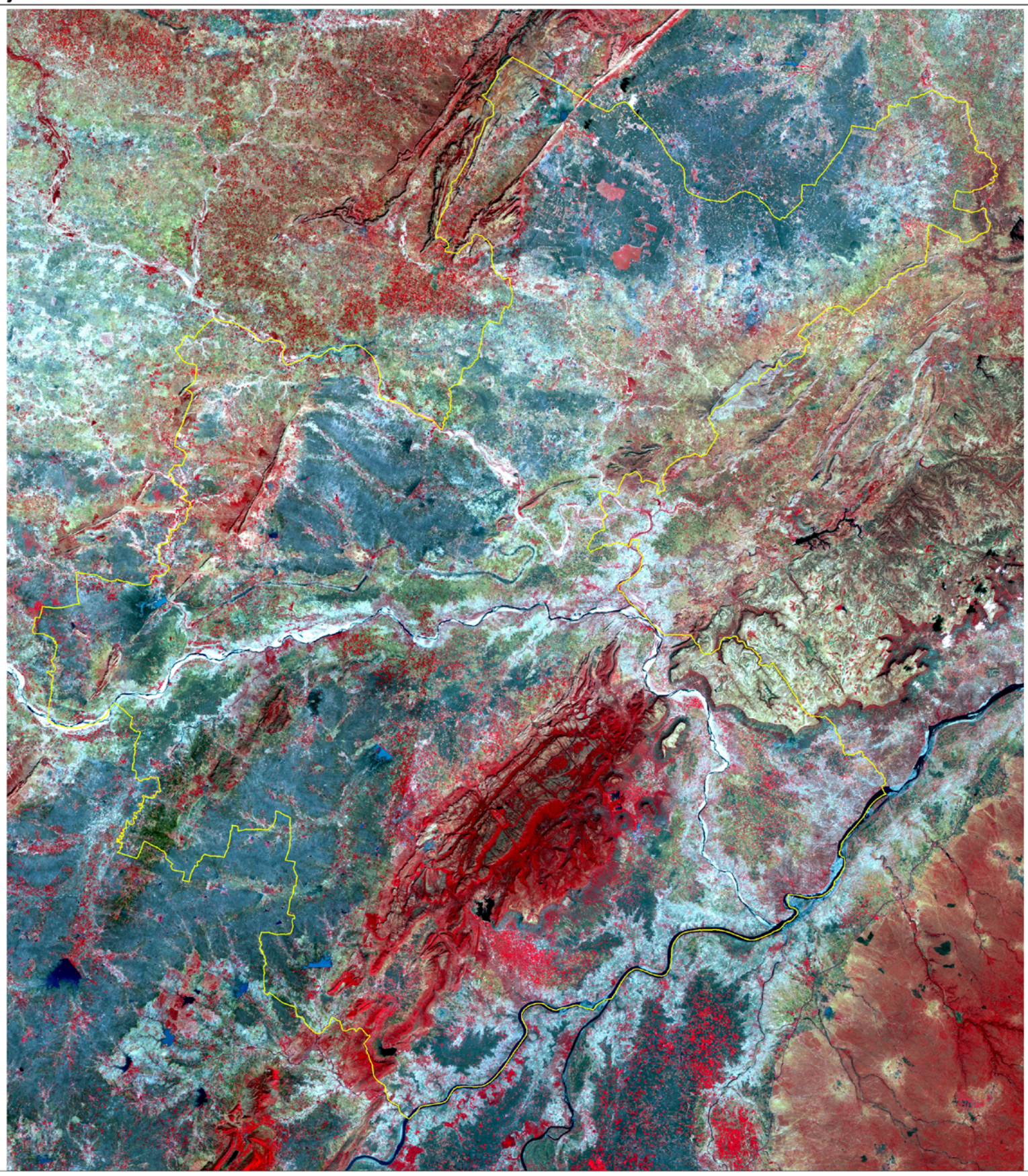
Space Applications Centre (ISRO), Ahmedabad
and
State Remote Sensing Application Centre, Jodhpur

Sponsored By:

Ministry of Environment and Forests
Government of India

State : Rajasthan

District : Sawai Madhopur



IRS P6 LISS-III Post-monsoon data (2006).

7.1.11 Dausa

Dausa is located between 26° 54' to 27° 15' North latitude and 76° 38' to 76° 54' East longitude, covering an area of about 3429 sq.km The minimum and maximum temperature recorded is 3°C and 45°C respectively. The normal annual rainfall is 548.2 mm. Large part of the district is covered by a thick mantle of soil, blown sand and alluvium. The area is occupied by hill ranges and numerous isolated peaks These hills and peaks belong to the Aravalli hill system .

Total 317 wetlands are mapped including 223 small wetlands (< 2.25 ha) with 11720 ha area**. R**ivers/ streams with 8685 ha. contributed 74.10% to the total wetland area. The Tanks/Ponds with 1513 ha (12.91% area) is the second major wetland category, followed by Reservoirs/Barrages with 1299 ha area i.e. 11.08 %. Thus, the district is dominated by man-made wetlands.

Open water spread of the wetlands is significantly higher in Post-monsoon (1281 ha) than during Pre-monsoon (485 ha), indicating the rainfall dependence of the wetlands in the state. Aquatic vegetation is during Pre-monsoon season (22 ha). The qualitative turbidity of water is high in both the seasons.

Details of estimates of wetlands in Dausa are given in Table 16.

Table 16: Area estimates of wetlands in Dausa

Area in ha

Sr. No.	Wettcode	Wetland Category	Number of Wetlands	Total Wetland Area	% of wetland area	Open Water	
						Post-monsoon Area	Pre-monsoon Area
	1100	**Inland Wetlands - Natural**					
1	1101	Lakes/Ponds	-	-	-	-	-
2	1102	Ox-bow lakes/ Cut-off meanders	-	-	-	-	-
3	1103	High altitude wetlands	-	-	-	-	-
4	1104	Riverine wetlands	-	-	-	-	-
5	1105	Waterlogged	-	-	-	-	-
6	1106	River/Stream	25	8685	74.10	13	4
	1200	**Inland Wetlands -Man-made**					
7	1201	Reservoirs/Barrages	12	1299	11.08	492	350
8	1202	Tanks/Ponds	57	1513	12.91	776	131
9	1203	Waterlogged	-	-	-	-	-
10	1204	Salt pans	-	-	-	-	-
		Sub-Total	**94**	**11497**	**98.10**	**1281**	**485**
		Wetlands (<2.25 ha), mainly Tanks	223	223	1.90	-	-
		Total	**317**	**11720**	**100.00**	**1281**	**485**

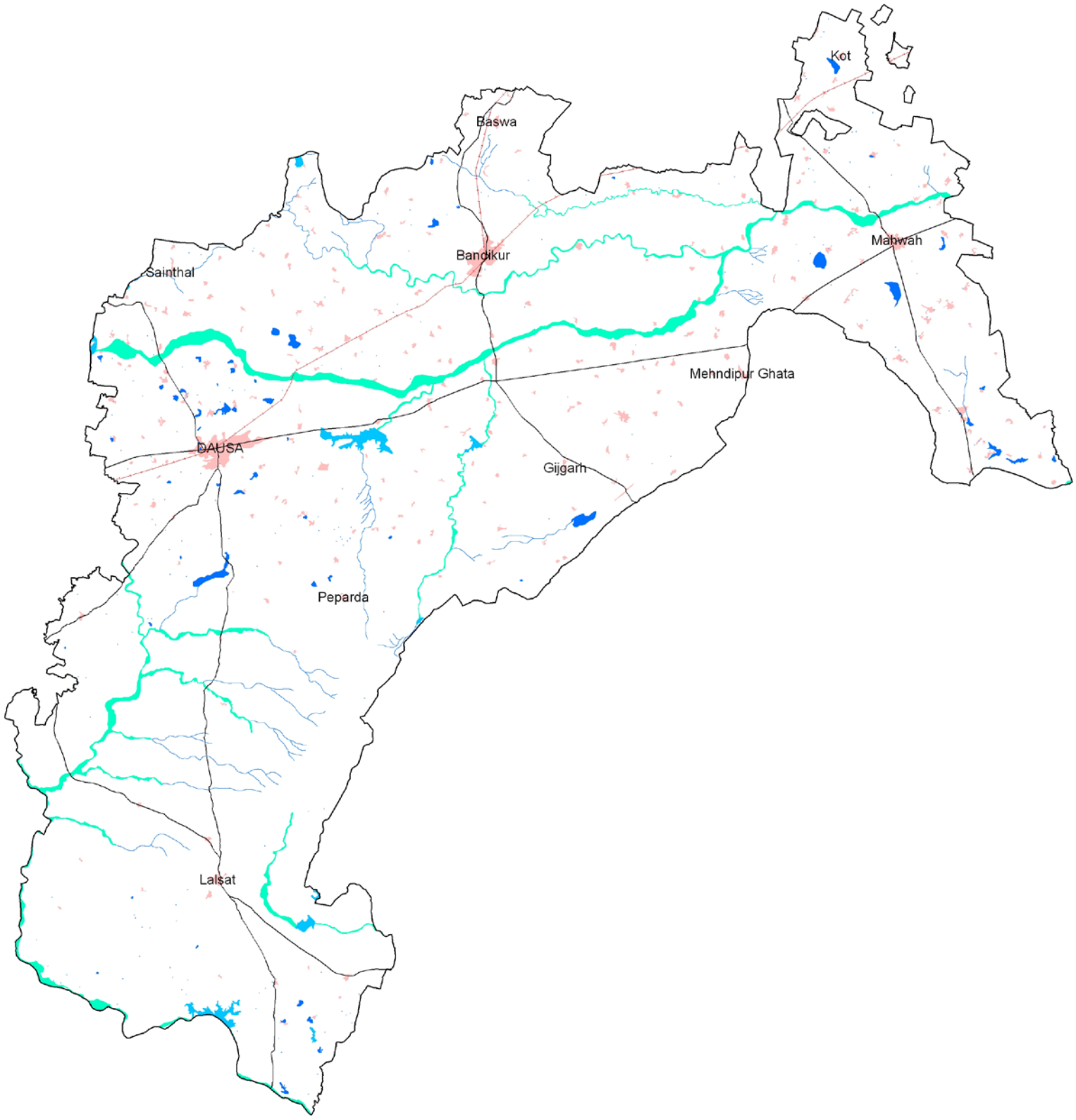
Area under Aquatic Vegetation	-	22

Area under turbidity levels		
Low	512	107
Moderate	254	2
High	515	376

State : Rajasthan

WETLAND MAP

District : Dausa

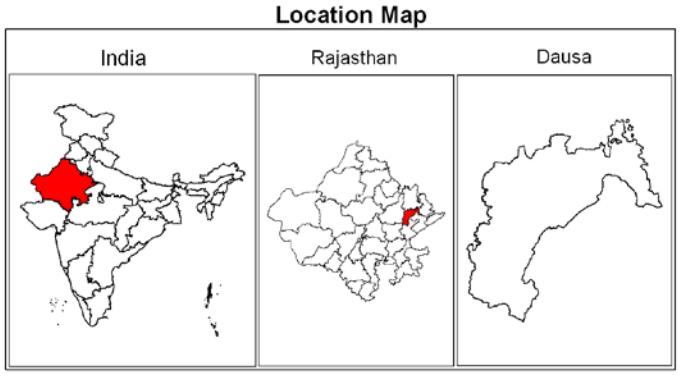


Symbol	Typecode	Level I	Level II	Level III
		Inland Wetlands		
			Natural	
	1101			Lakes/Ponds
	1102			Ox-bow lakes/ Cut-off meanders
	1103			High altitude wetlands
	1104			Reverine wetlands
	1105			Waterlogged
	1106			River/Stream
			Man-made	
	1201			Reservoirs/Barrages
	1202			Tanks/Ponds
	1203			Waterlogged
	1204			Salt pans
		Coastal Wetlands		
			Natural	
	2101			Lagoons
	2102			Creeks
	2103			Sand/Beach
	2104			Intertidal mud flats
	2105			Salt marsh
	2106			Mangroves
	2107			Coral reefs
			Man-made	
	2201			Salt pans
	2202			Aquaculture ponds

Legend

- Wetlands (<2.25ha)
- Drainage (line)
- Major Roads
- Railway
- Settlements
- Town/Settlements
- District Boundary
- State Boundary
- International Boundary

Location Map



4 2 0 4 8 Kilometers

Data Source :

IRS P6 LISS III data (Pre-monsoon and Post-monsoon Season 2006-07)

Prepared By :

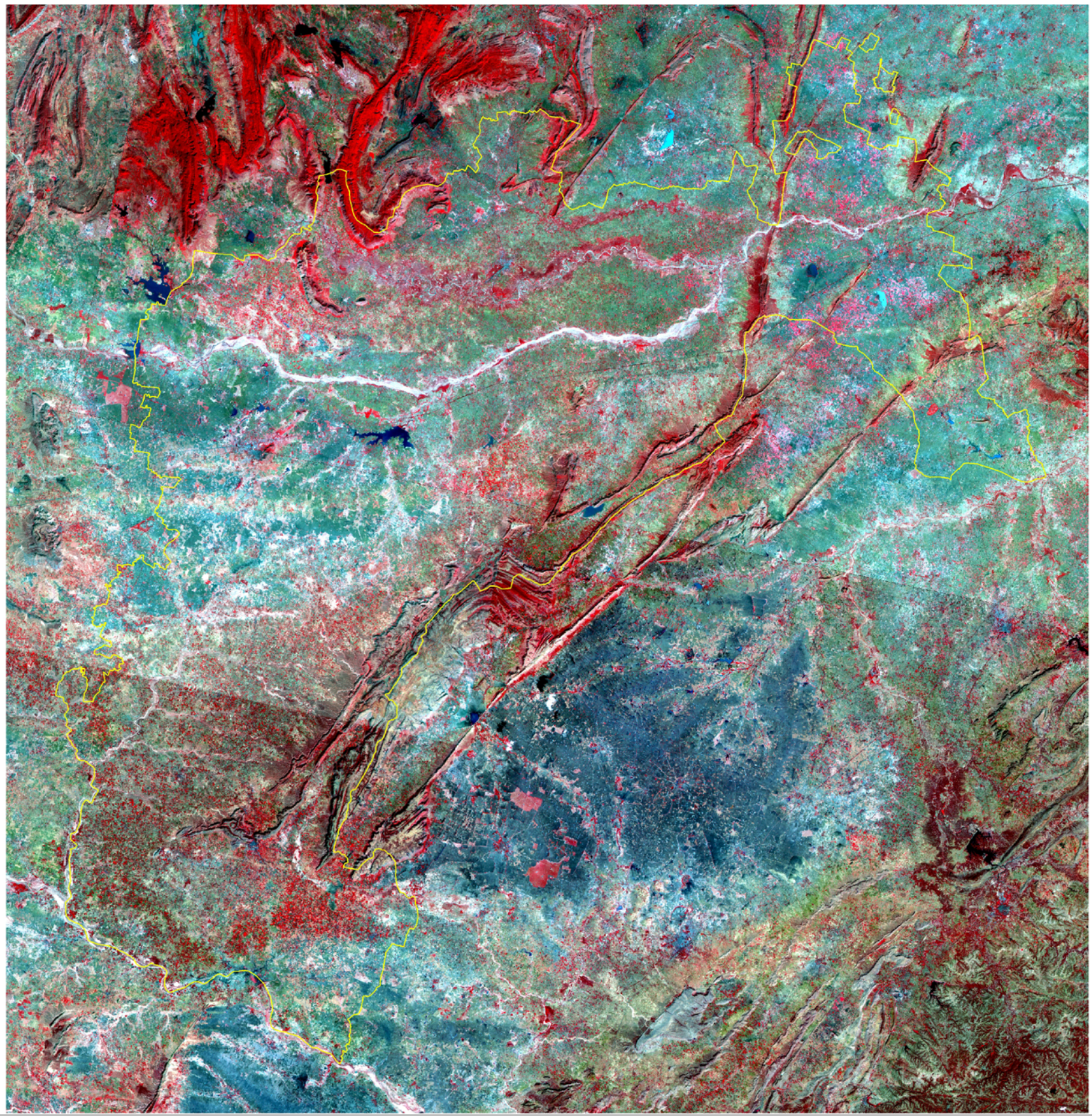
Space Applications Centre (ISRO), Ahmedabad
and
State Remote Sensing Application Centre, Jodhpur

Sponsored By:

Ministry of Environment and Forests
Government of India

State : Rajasthan

District : Dausa



IRS P6 LISS-III Post-monsoon data (2006).

7.1.12 Jaipur

Jaipur is one of the advanced districts of Rajasthan located in the eastern part of the state. It is the capital city of Rajasthan and is also known by the name of “Pink City” owing to its beautifully constructed palaces, havelis and forts. The central co-ordinates of the Jaipur district is 26.55° North latitude and 75.52° East longitude. The city is located at 431 meters altitude from mean sea level. Jaipur district bounded in the North by Sikar. It is touches with Tonk in the South and in the East by Alwar, Dausa, Sawai Madhopur. The district is covered by Nagaur In the West and Ajmer district. The geographical area of the district is 11152 sq. km. The maximum temperature during summer reaches 45^0 whereas the minimum temperature during winter goes down to 5^0 C. Jaipur district is very much important from tourism point of view and is one of the extensively visited places in the country.

Total 1484 wetlands are mapped including 1054 small wetlands (< 2.25 ha) with 41352 ha area**.** The Rivers/ streams with 23598 ha. contributed 57.07% to the total wetland area. The Tanks/Ponds with 3774 ha (9.13% area) is the second major wetland category, followed by Reservoirs/Barrages with 2926 ha area i.e. 7.08 %. Thus, the district is dominated by man-made wetlands.

Open water spread of the wetlands is significantly higher in post monsoon (10854 ha) than during pre monsoon (8673 ha), indicating the rainfall dependence of the wetlands in the state. Aquatic vegetation is higher in post monsoon (82 ha).The qualitative turbidity of water is moderate in post monsoon and high in pre monsoon period .Details of estimates of wetlands in Jaipur are given in Table 17.

Table 17: Area estimates of wetlands in Jaipur

Area in ha

Sr. No.	Wettcode	Wetland Category	Number of Wetlands	Total Wetland Area	% of wetland area	Open Water	
						Post-monsoon Area	Pre-monsoon Area
	1100	**Inland Wetlands - Natural**					
1	1101	Lakes/Ponds	6	8350	20.19	7222	6883
2	1102	Ox-bow lakes/ Cut-off meanders	-	-	-	-	-
3	1103	High altitude wetlands	-	-	-	-	-
4	1104	Riverine wetlands	-	-	-	-	-
5	1105	Waterlogged	-	-	-	-	-
6	1106	River/Stream	58	23598	57.07	197	134
	1200	**Inland Wetlands -Man-made**					
7	1201	Reservoirs/Barrages	23	2926	7.08	1082	880
8	1202	Tanks/Ponds	339	3774	9.13	1913	760
9	1203	Waterlogged	-	-	-	-	-
10	1204	Salt pans	4	1650	3.99	440	16
		Sub-Total	**430**	**40298**	**97.45**	**10854**	**8673**
		Wetlands (<2.25 ha), mainly Tanks	1054	1054	2.55	-	-
		Total	**1484**	**41352**	**100.00**	**10854**	**8673**

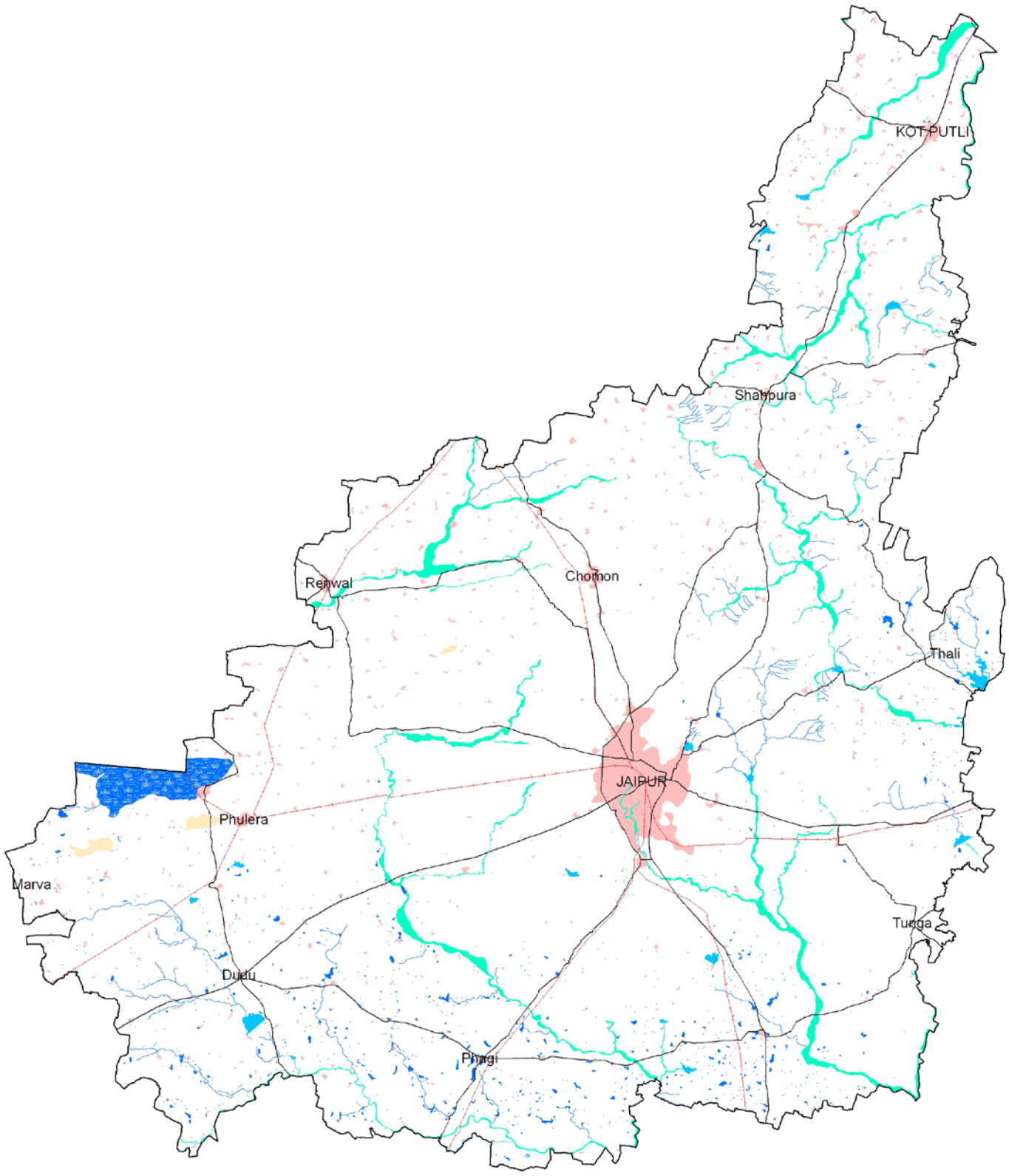
Area under Aquatic Vegetation	82	13

Area under turbidity levels		
Low	2506	772
Moderate	4864	120
High	3484	7781

State : Rajasthan

WETLAND MAP

District : Jaipur

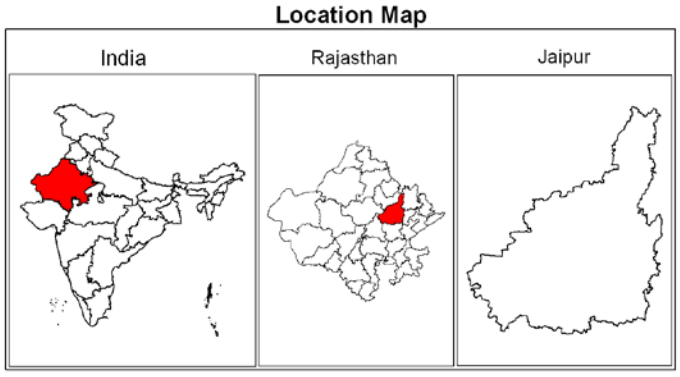


Symbol	Typecode	Level I	Level II	Level III
		Inland Wetlands		
			Natural	
	1101			Lakes/Ponds
	1102			Ox-bow lakes/ Cut-off meanders
	1103			High altitude wetlands
	1104			Reverine wetlands
	1105			Waterlogged
	1106			River/Stream
			Man-made	
	1201			Reservoirs/Barrages
	1202			Tanks/Ponds
	1203			Waterlogged
	1204			Salt pans
		Coastal Wetlands		
			Natural	
	2101			Lagoons
	2102			Creeks
	2103			Sand/Beach
	2104			Intertidal mud flats
	2105			Salt marsh
	2106			Mangroves
	2107			Coral reefs
			Man-made	
	2201			Salt pans
	2202			Aquaculture ponds

Legend

- Wetlands (<2.25ha)
- Drainage (line)
- Major Roads
- Railway
- Settlements
- Town/Settlements
- District Boundary
- State Boundary
- International Boundary

Location Map



6 3 0 6 12 Kilometers

Data Source :

IRS P6 LISS III data (Pre-monsoon and Post-monsoon Season 2006-07)

Prepared By :

Space Applications Centre (ISRO), Ahmedabad
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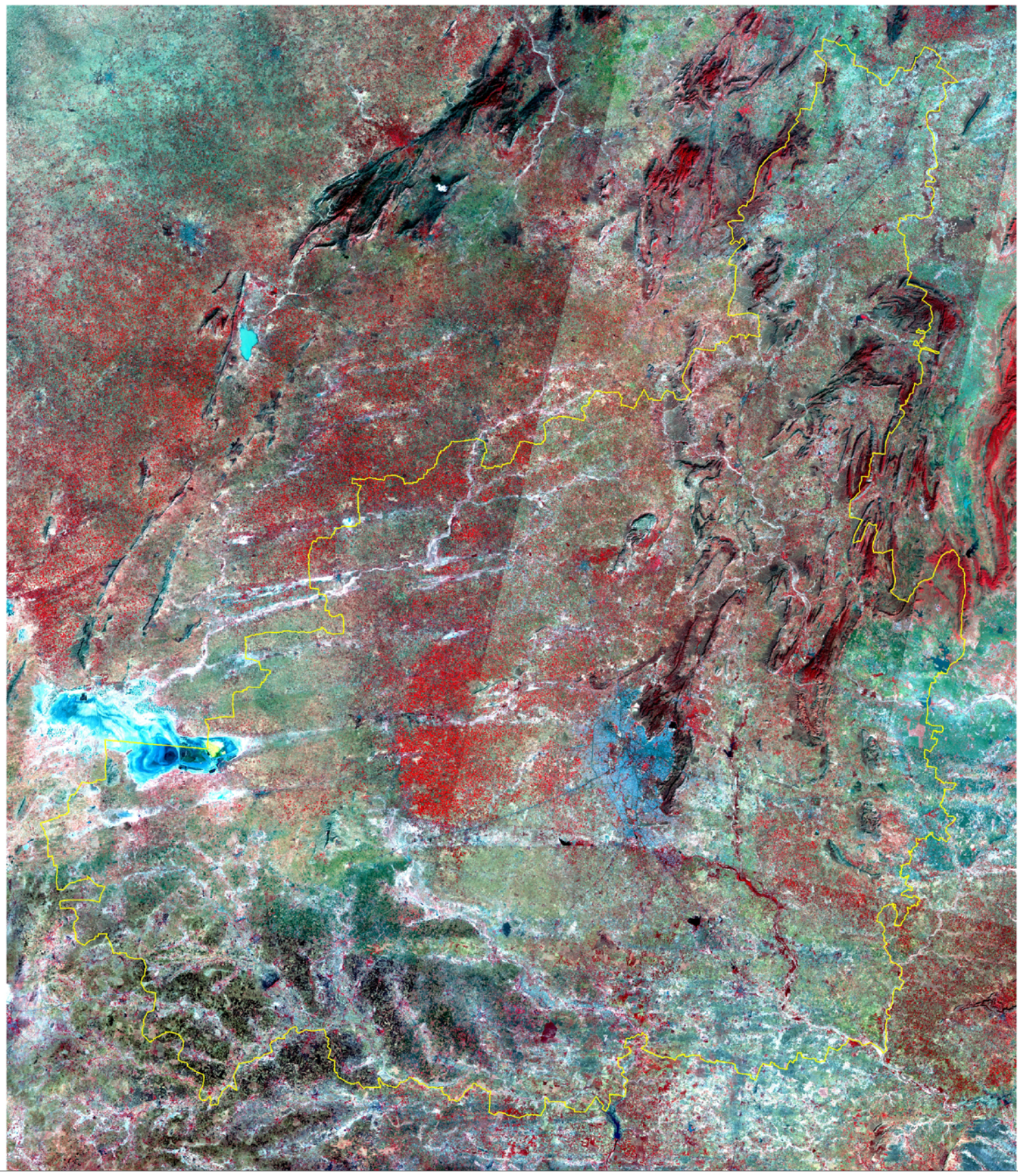
Sponsored By:

Ministry of Environment and Forests
Government of India

State : Rajasthan

District : Jaipur



IRS P6 LISS-III Post-monsoon data (2006).

7.1.13 Sikar

The district head quarters coordinates are 27^0 62' North latitude and 75^0 15' East longitudes. The geographical area of the district is 7732 sq. Km. The average rainfall is 46 cm. The maximum temperature touches 48^0 whereas the minimum temperature 1^0C.

Total 433 wetlands are mapped including 370 small wetlands (< 2.25 ha) with 5388 ha area**.** The Rivers/ streams with 3359 ha. contributed 62.34% to the total wetland area. The Reservoirs/Barrages with 1264ha (23.46% area) is the second major wetland category, followed by Tanks/Ponds with 369 ha area i.e. 6.85 %. Thus, the district is dominated by man-made wetlands.

Open water spread of the wetlands is significantly higher in post monsoon (1192 ha) than during pre monsoon (473 ha), indicating the rainfall dependence of the wetlands in the state. Aquatic vegetation is during pre monsoon (28 ha) . The qualitative turbidity of water is high in both the seasons.Details of estimates of wetlands in Sikar are given in Table 18.

Table 18: Area estimates of wetlands in Sikar

Area in ha

Sr. No.	Wettcode	Wetland Category	Number of Wetlands	Total Wetland Area	% of wetland area	Open Water	
						Post-monsoon Area	Pre-monsoon Area
	1100	**Inland Wetlands - Natural**					
1	1101	Lakes/Ponds	-	-	-	-	-
2	1102	Ox-bow lakes/ Cut-off meanders	-	-	-	-	-
3	1103	High altitude wetlands	-	-	-	-	-
4	1104	Riverine wetlands	-	-	-	-	-
5	1105	Waterlogged	-	-	-	-	-
6	1106	River/Stream	18	3359	62.34	8	-
	1200	**Inland Wetlands -Man-made**					
7	1201	Reservoirs/Barrages	9	1264	23.46	970	311
8	1202	Tanks/Ponds	35	369	6.85	198	143
9	1203	Waterlogged	-	-	-	-	-
10	1204	Salt pans	1	26	0.48	16	19
		Sub-Total	**63**	**5018**	**93.13**	**1192**	**473**
		Wetlands (<2.25 ha), mainly Tanks	370	370	6.87	-	-
		Total	**433**	**5388**	**100.00**	**1192**	**473**

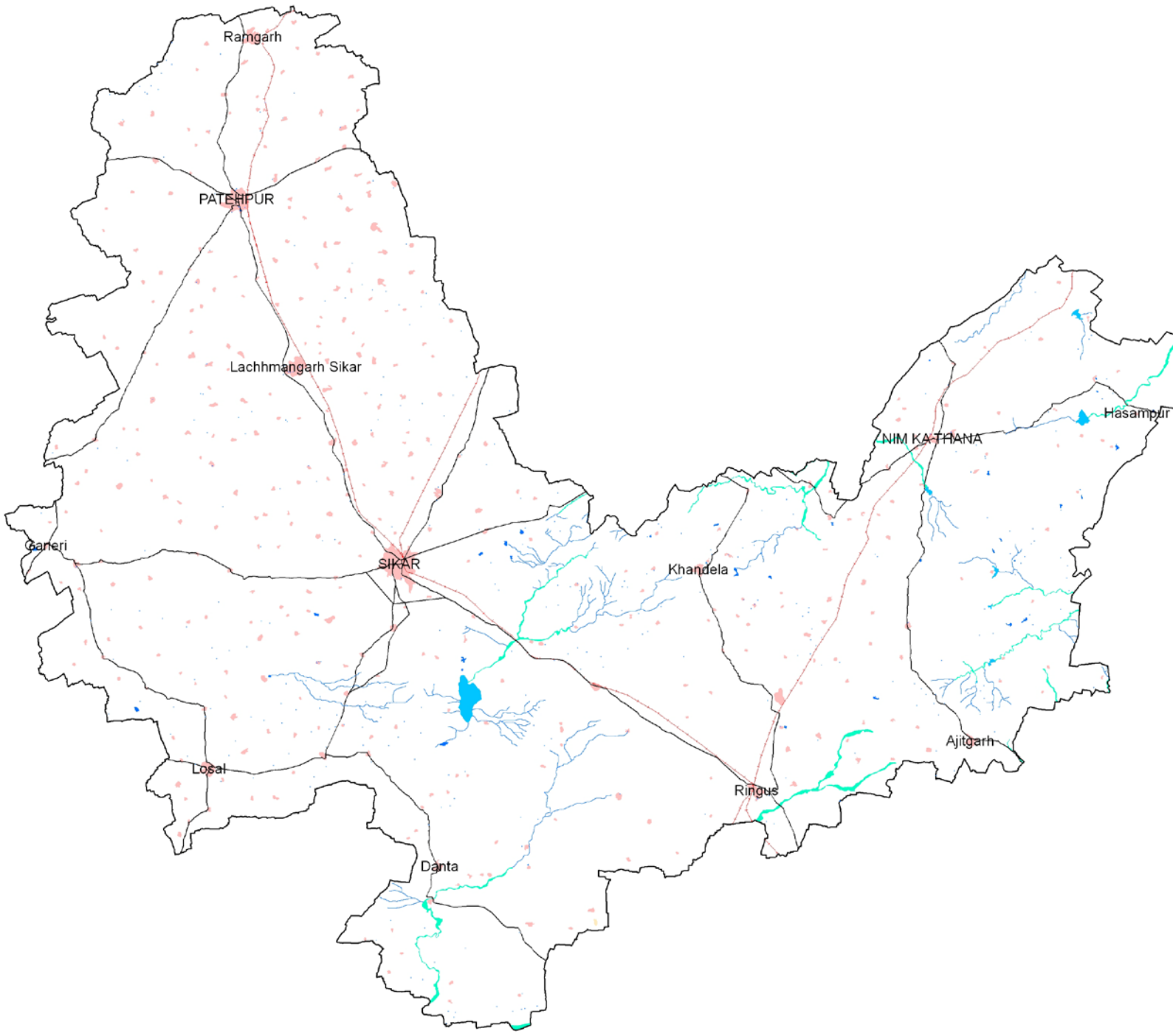
Area under Aquatic Vegetation	-	28

Area under turbidity levels		
Low	337	154
Moderate	-	-
High	855	319

State : Rajasthan

WETLAND MAP

District : Sikar

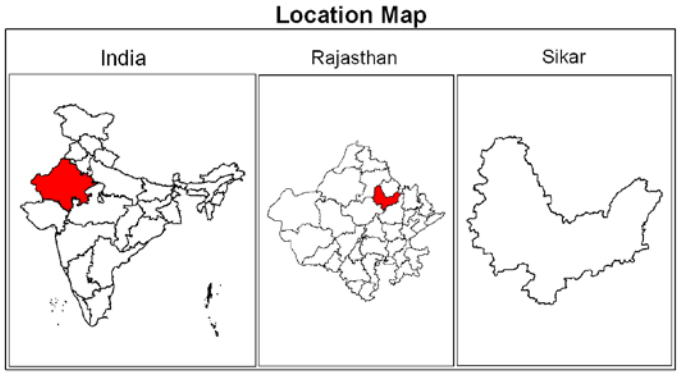


Symbol	Typecode	Level I	Level II	Level III
		Inland Wetlands		
			Natural	
	1101			Lakes/Ponds
	1102			Ox-bow lakes/ Cut-off meanders
	1103			High altitude wetlands
	1104			Reverine wetlands
	1105			Waterlogged
	1106			River/Stream
			Man-made	
	1201			Reservoirs/Barrages
	1202			Tanks/Ponds
	1203			Waterlogged
	1204			Salt pans
		Coastal Wetlands		
			Natural	
	2101			Lagoons
	2102			Creeks
	2103			Sand/Beach
	2104			Intertidal mud flats
	2105			Salt marsh
	2106			Mangroves
	2107			Coral reefs
			Man-made	
	2201			Salt pans
	2202			Aquaculture ponds

Legend

- Wetlands (<2.25ha)
- Drainage (line)
- Major Roads
- Railway
- Settlements
- Town/Settlements
- District Boundary
- State Boundary
- International Boundary

Location Map



6 3 0 6 12 Kilometers

Data Source :

IRS P6 LISS III data (Pre-monsoon and Post-monsoon Season 2006-07)

Prepared By :

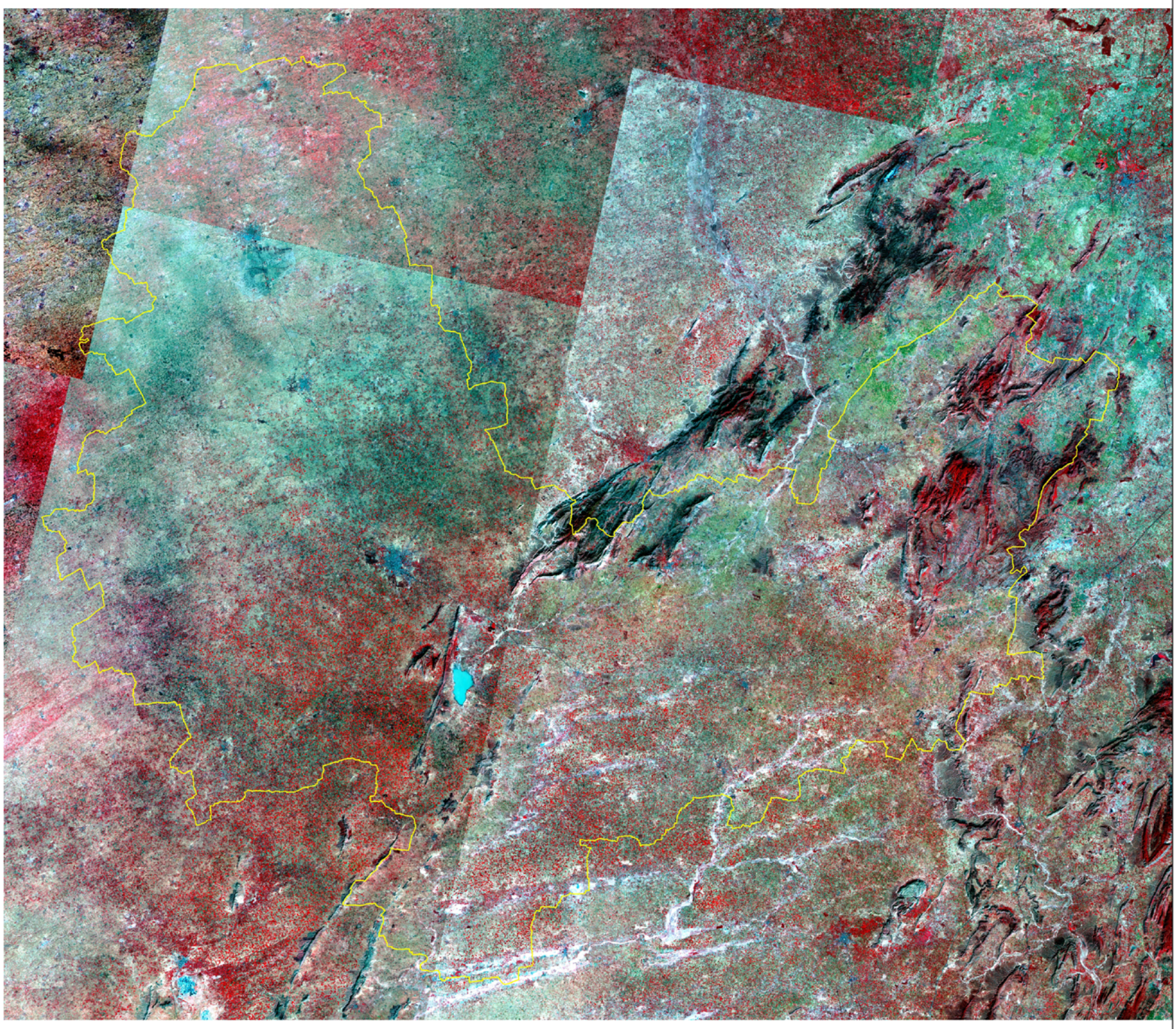
Space Applications Centre (ISRO), Ahmedabad
and
State Remote Sensing Application Centre, Jodhpur

Sponsored By:

Ministry of Environment and Forests
Government of India

State : Rajasthan

District : Sikar



IRS P6 LISS-III Post-monsoon data (2006).

7.1.14 Nagaur

Nagaur is the fifth largest district in Rajasthan with a vast topography spreading over 17,718 sq. kms. It lies in between 26^0 25' to 27 ^{0} 40' degrees North latitude and 73^0 10' to 75^0 15' degrees East longitude. Its landscape is a good combination of plain, hills, sand mounds & it is also a part of the great Indian Thar Desert. The average rainfall is 36 cm. The maximum temperature touches 46^0 whereas the minimum temperature 3^0 C.

Total 2348 wetlands are mapped including 2004 small wetlands (< 2.25 ha) with 30876 ha area. The Lakes/Ponds with 16024 ha contributed 51.90% to the total wetland area. The Rivers/ streams with 7016 ha (22.72 % area) is the second major wetland category, followed by Salt pans with 3030 ha area i.e. 9.81 %. Thus, the district is dominated by man-made wetlands.

Open water spread of the wetlands is significantly higher in post monsoon (12971 ha) than during pre monsoon (10080 ha), indicating the rainfall dependence of the wetlands in the state. The qualitative turbidity of water is high in both the seasons. Details of estimates of wetlands in Nagaur are given in Table 19.

Table 19: Area estimates of wetlands in Nagaur

Area in ha

Sr. No.	Wettcode	Wetland Category	Number of Wetlands	Total Wetland Area	% of wetland area	Open Water	
						Post-monsoon Area	Pre-monsoon Area
	1100	**Inland Wetlands - Natural**					
1	1101	Lakes/Ponds	5	16024	51.90	9807	8109
2	1102	Ox-bow lakes/ Cut-off meanders	-	-	-	-	-
3	1103	High altitude wetlands	-	-	-	-	-
4	1104	Riverine wetlands	-	-	-	-	-
5	1105	Waterlogged	-	-	-	-	-
6	1106	River/Stream	7	7016	22.72	11	-
	1200	**Inland Wetlands -Man-made**					
7	1201	Reservoirs/Barrages	33	1352	4.38	223	56
8	1202	Tanks/Ponds	280	1450	4.70	469	92
9	1203	Waterlogged	-	-	-	-	-
10	1204	Salt pans	19	3030	9.81	2461	1823
		Sub-Total	**344**	**28872**	**93.51**	**12971**	**10080**
		Wetlands (<2.25 ha), mainly Tanks	2004	2004	6.49	-	-
		Total	**2348**	**30876**	**100.00**	**12971**	**10080**

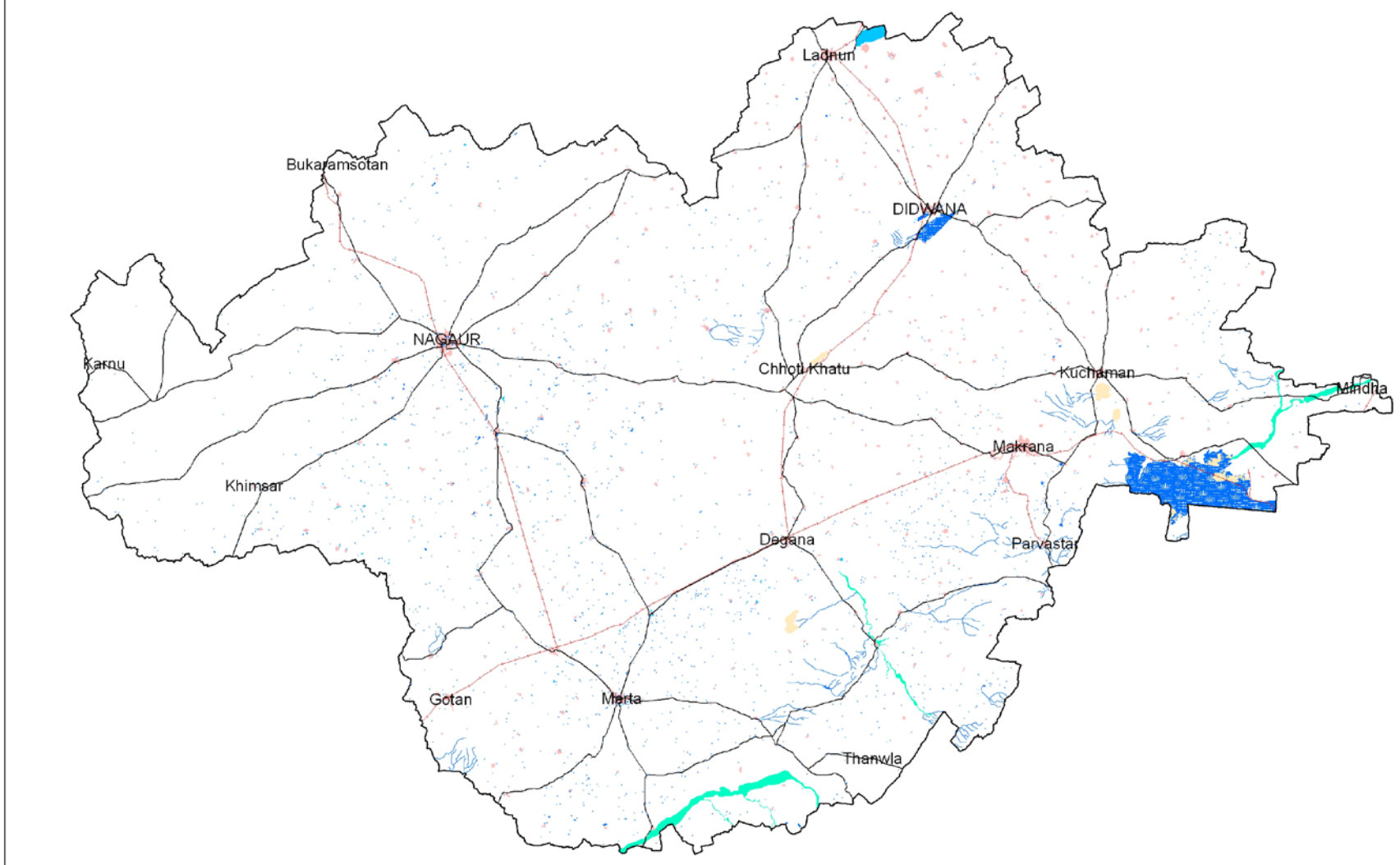
Area under Aquatic Vegetation	-	-

Area under turbidity levels		
Low	894	203
Moderate	4275	91
High	7802	9786

State : Rajasthan

WETLAND MAP

District : Nagaur

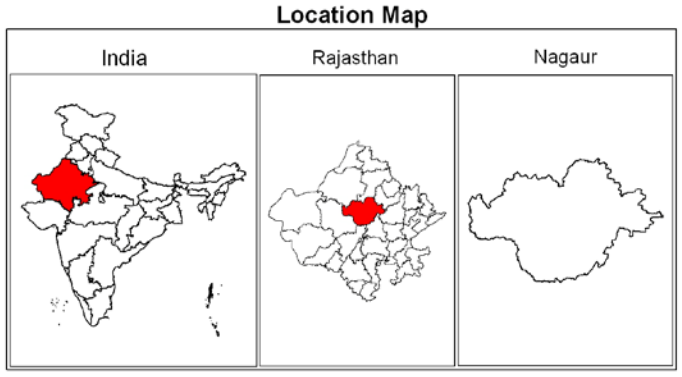


Symbol	Typecode	Level I	Level II	Level III
		Inland Wetlands		
			Natural	
	1101			Lakes/Ponds
	1102			Ox-bow lakes/ Cut-off meanders
	1103			High altitude wetlands
	1104			Reverine wetlands
	1105			Waterlogged
	1106			River/Stream
			Man-made	
	1201			Reservoirs/Barrages
	1202			Tanks/Ponds
	1203			Waterlogged
	1204			Salt pans
		Coastal Wetlands		
			Natural	
	2101			Lagoons
	2102			Creeks
	2103			Sand/Beach
	2104			Intertidal mud flats
	2105			Salt marsh
	2106			Mangroves
	2107			Coral reefs
			Man-made	
	2201			Salt pans
	2202			Aquaculture ponds

Legend

- Wetlands (<2.25ha)
- Drainage (line)
- Major Roads
- Railway
- Settlements
- Town/Settlements
- District Boundary
- State Boundary
- International Boundary

Location Map



10 5 0 10 20 Kilometers

Data Source :

IRS P6 LISS III data (Pre-monsoon and Post-monsoon Season 2006-07)

Prepared By :

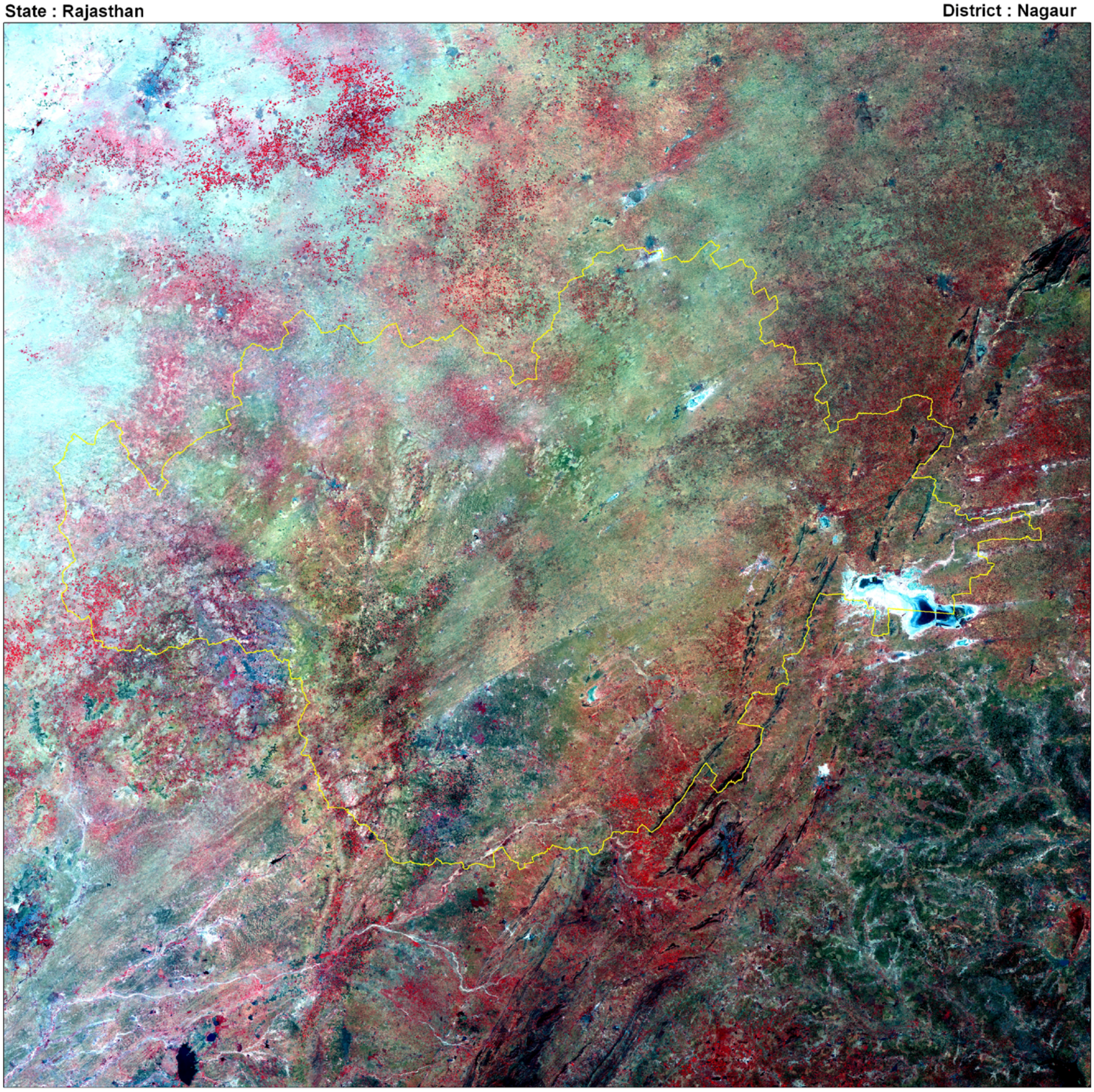
Space Applications Centre (ISRO), Ahmedabad
and
State Remote Sensing Application Centre, Jodhpur

Sponsored By:

Ministry of Environment and Forests
Government of India

State : Rajasthan

District : Nagaur



IRS P6 AWiFS Post-monsoon data (2007).

7.1.15 Jodhpur

Jodhpur is the centrally placed district of Rajasthan surrounded by Nagaur in the East, Jaisalmer in the west, Bikaner in the North and Barmer as well as Pali in the South. The geographical area of the district is 22850 sq. Km. It lies in between 26^0 00' to 27 ^{0} 37' North latitude and 72^0 55' to 73^0 52' East longitude. Some of the area of Great Indian Desert Thar also comes within the district. It is a major tourist's destination and forts, palaces, lakes, gardens and forests are worth seeing. Jodhpur is widely visited by tourists throughout the year. Kaylana Lake and Jaswant Sagar Dam are important water bodies of the district. The average rainfall is 30 cm. The maximum temperature touches 49^0 whereas the minimum temperature 1^0 C.

Total 1934 wetlands are mapped including 1673 small wetlands (< 2.25 ha) with 17032 ha area**.** The River / Streams with 8284 ha. contributed 48.64% to the total wetland area. The Salt pans with 4471 ha (26.25% area) is the second major wetland category, followed by Tanks/Ponds with 1798 ha area i.e. 10.56 %. Thus, the district is dominated by man-made wetlands.

Open water spread of the wetlands is significantly higher in post monsoon (1381 ha) than during pre monsoon (254 ha), indicating the rainfall dependence of the wetlands in the state. The qualitative turbidity of water is low in both the seasons.Details of estimates of wetlands in Jodhpur are given in Table 20.

Table 20: Area estimates of wetlands in Jodhpur

Area in ha

Sr. No.	Wettcode	Wetland Category	Number of Wetlands	Total Wetland Area	% of wetland area	Open Water	
						Post-monsoon Area	Pre-monsoon Area
	1100	**Inland Wetlands - Natural**					
1	1101	Lakes/Ponds	1	81	0.48	81	81
2	1102	Ox-bow lakes/ Cut-off meanders	-	-	-	-	-
3	1103	High altitude wetlands	-	-	-	-	-
4	1104	Riverine wetlands	-	-	-	-	-
5	1105	Waterlogged	-	-	-	-	-
6	1106	River/Stream	15	8284	48.64	110	-
	1200	**Inland Wetlands -Man-made**					
7	1201	Reservoirs/Barrages	15	725	4.26	268	95
8	1202	Tanks/Ponds	229	1798	10.56	700	48
9	1203	Waterlogged	-	-	-	-	-
10	1204	Salt pans	1	4471	26.25	222	30
		Sub-Total	**261**	**15359**	**90.18**	**1381**	**254**
		Wetlands (<2.25 ha), mainly Tanks	1673	1673	9.82	-	-
		Total	**1934**	**17032**	**100.00**	**1381**	**254**

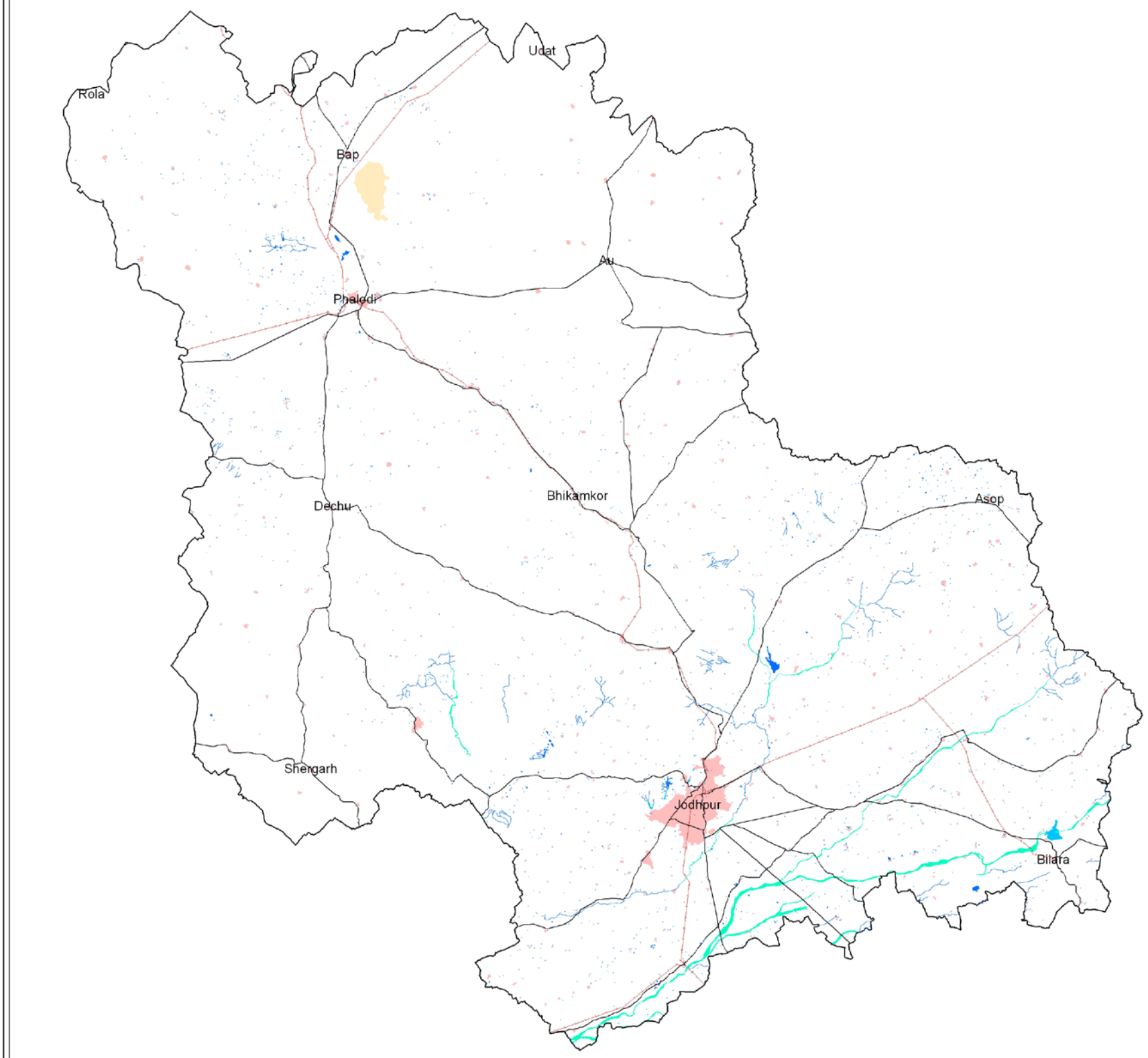
Area under Aquatic Vegetation	-	-

Area under turbidity levels		
Low	1107	254
Moderate	-	-
High	274	-

State : Rajasthan

WETLAND MAP

District : Jodhpur

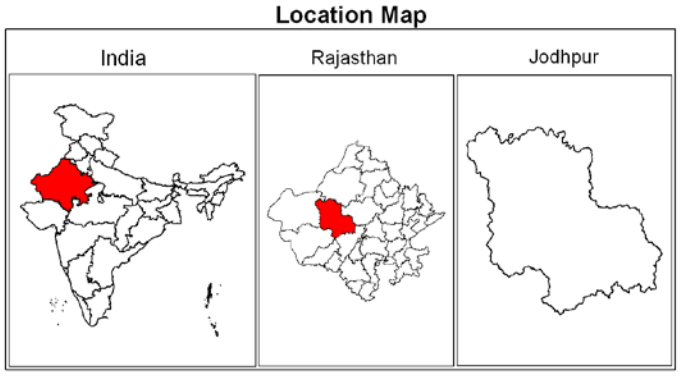


Symbol	Typecode	Level I	Level II	Level III
		Inland Wetlands		
			Natural	
	1101			Lakes/Ponds
	1102			Ox-bow lakes/ Cut-off meanders
	1103			High altitude wetlands
	1104			Reverine wetlands
	1105			Waterlogged
	1106			River/Stream
			Man-made	
	1201			Reservoirs/Barrages
	1202			Tanks/Ponds
	1203			Waterlogged
	1204			Salt pans
		Coastal Wetlands		
			Natural	
	2101			Lagoons
	2102			Creeks
	2103			Sand/Beach
	2104			Intertidal mud flats
	2105			Salt marsh
	2106			Mangroves
	2107			Coral reefs
			Man-made	
	2201			Salt pans
	2202			Aquaculture ponds

Legend

- Wetlands (<2.25ha)
- Drainage (line)
- Major Roads
- Railway
- Settlements
- Town/Settlements
- District Boundary
- State Boundary
- International Boundary

Location Map



8 4 0 8 16 Kilometers

Data Source :

IRS P6 LISS III data (Pre-monsoon and Post-monsoon Season 2006-07)

Prepared By :

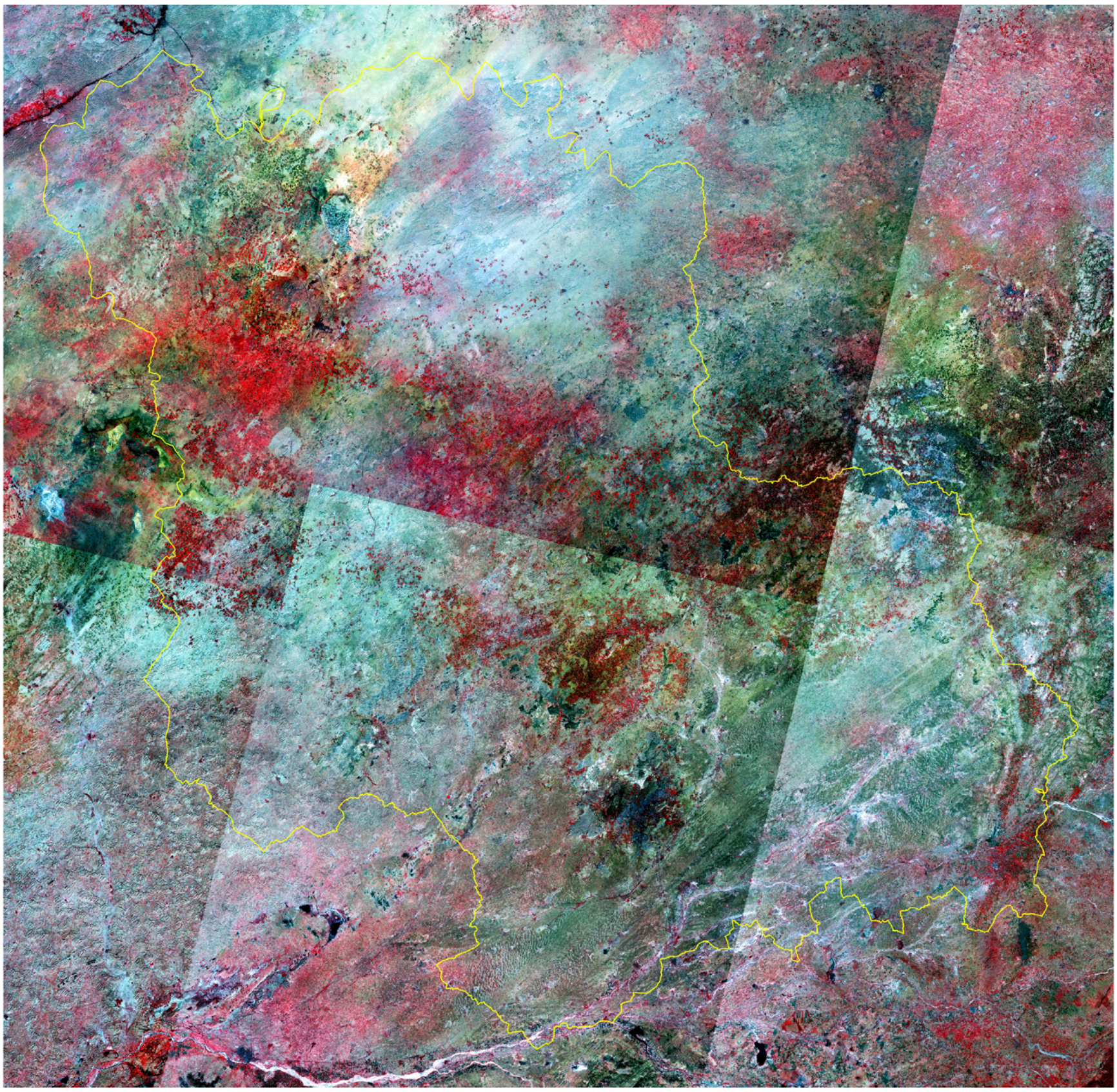
Space Applications Centre (ISRO), Ahmedabad
and
State Remote Sensing Application Centre, Jodhpur

Sponsored By:

Ministry of Environment and Forests
Government of India

State : Rajasthan

District : Jodhpur



IRS P6 LISS-III Post-monsoon data (2006).

7.1.16 Jaisalmer

Jaisalmer is the western-most district of Rajasthan as well as that of India. It lies in between 26^0 01' to 28^0.02' degrees North latitude and $69^0$03' to $72^0$02' degrees East longitude. The central co-ordinates of Jaisalmer are 24^0 06' North latitude and 76^0 15' East longitude. The district is bounded by Pakistan on its North and West, Barmer on South, Jodhpur on East and Bikaner district of Rajasthan on North-East. The geographical area of the district is 38401 sq. Km. The Jaisalmer city is located at 469 meters altitude from mean sea level. The maximum temperature fluctuates from 47^0C to 35^0C where as the minimum temperature from 32^0C to 9^0C.

Total 2648 wetlands are mapped including 2135 small wetlands (< 2.25 ha) with 24876 ha area**.** The Tanks / Ponds with 8976 ha. contributed 36.08% to the total wetland area. The Waterlogged (Natural) with 7826 ha (31.46% area) is the second major wetland category, followed by man-made Waterlogged with 3394 ha area i.e. 13.64%. Thus, the district is dominated by man-made wetlands.

Open water spread of the wetlands is significantly higher in post monsoon (16988 ha) than during pre monsoon (5526 ha), indicating the rainfall dependence of the wetlands in the state. The qualitative turbidity of water is low in both the seasons. Details of estimates of wetlands in Jaisalmer are given in Table 21.

Table 21: Area estimates of wetlands in Jaisalmer

Area in ha

Sr. No.	Wettcode	Wetland Category	Number of Wetlands	Total Wetland Area	% of wetland area	Open Water	
						Post-monsoon Area	Pre-monsoon Area
	1100	**Inland Wetlands - Natural**					
1	1101	Lakes/Ponds	1	81	0.33	81	21
2	1102	Ox-bow lakes/ Cut-off meanders	-	-	-	-	-
3	1103	High altitude wetlands	-	-	-	-	-
4	1104	Riverine wetlands	-	-	-	-	-
5	1105	Waterlogged	17	7826	31.46	7001	3409
6	1106	River/Stream	4	2367	9.52	-	-
	1200	**Inland Wetlands -Man-made**					
7	1201	Reservoirs/Barrages	1	97	0.39	45	-
8	1202	Tanks/Ponds	419	8976	36.08	7219	1069
9	1203	Waterlogged	71	3394	13.64	2642	1027
10	1204	Salt pans	-	-	-	-	-
		Sub-Total	**513**	**22741**	**91.42**	**16988**	**5526**
		Wetlands (<2.25 ha), mainly Tanks	2135	2135	8.58	-	-
		Total	**2648**	**24876**	**100.00**	**16988**	**5526**

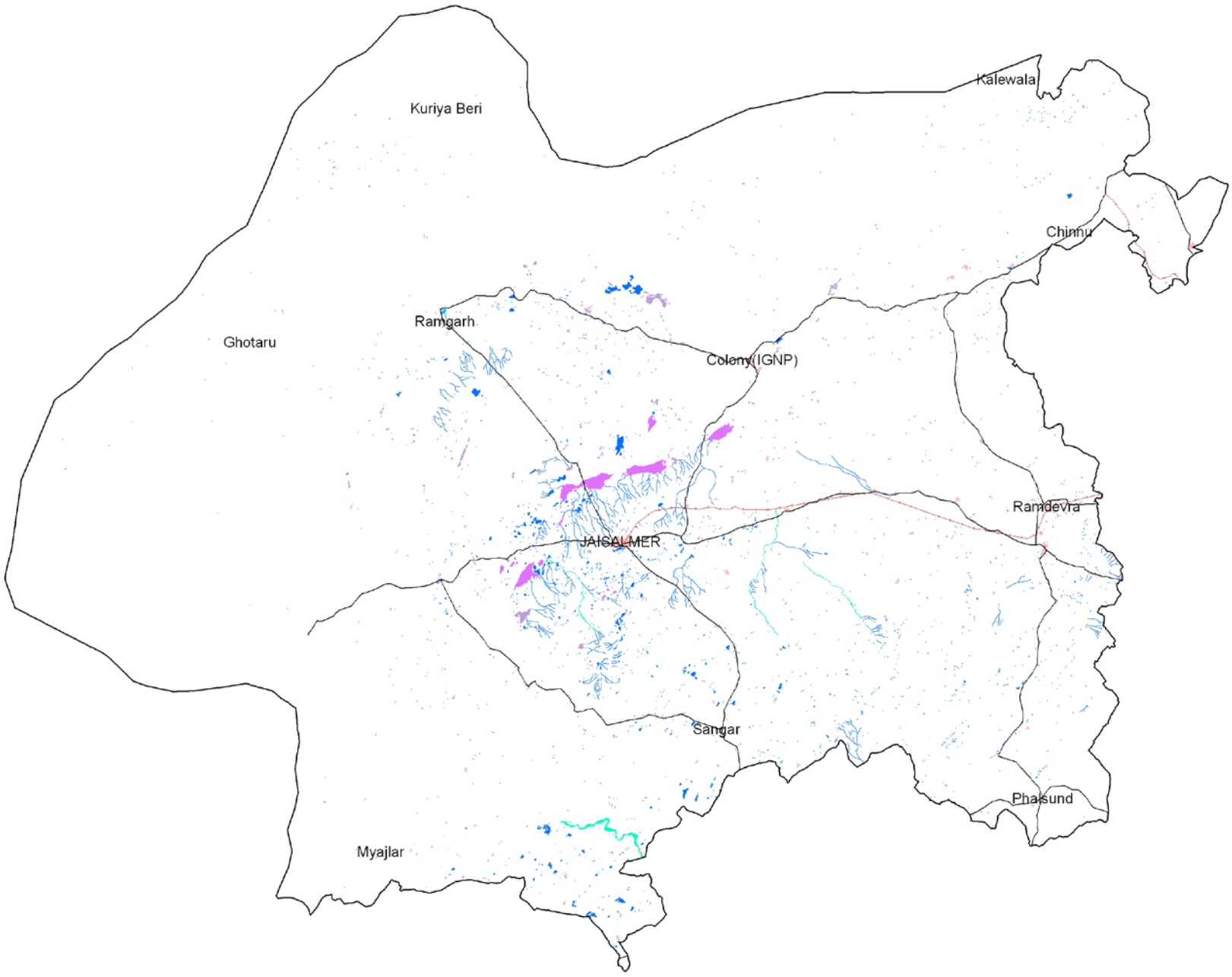
Area under Aquatic Vegetation	-	-

Area under turbidity levels		
Low	14655	5526
Moderate	1711	-
High	622	-

State : Rajasthan

WETLAND MAP

District : Jaisalmer

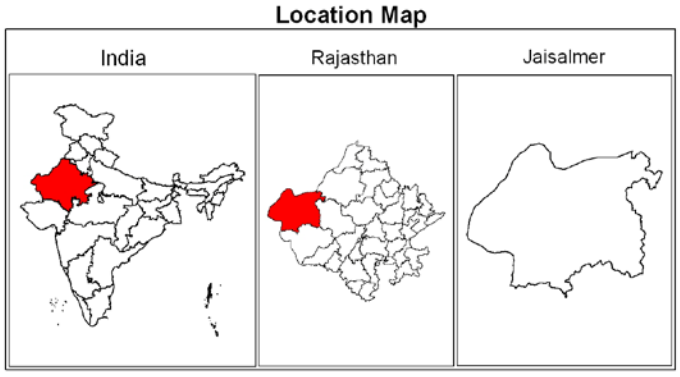


Symbol	Typecode	Level I	Level II	Level III
		Inland Wetlands		
			Natural	
	1101			Lakes/Ponds
	1102			Ox-bow lakes/ Cut-off meanders
	1103			High altitude wetlands
	1104			Reverine wetlands
	1105			Waterlogged
	1106			River/Stream
			Man-made	
	1201			Reservoirs/Barrages
	1202			Tanks/Ponds
	1203			Waterlogged
	1204			Salt pans
		Coastal Wetlands		
			Natural	
	2101			Lagoons
	2102			Creeks
	2103			Sand/Beach
	2104			Intertidal mud flats
	2105			Salt marsh
	2106			Mangroves
	2107			Coral reefs
			Man-made	
	2201			Salt pans
	2202			Aquaculture ponds

Legend

- Wetlands (<2.25ha)
- Drainage (line)
- Major Roads
- Railway
- Settlements
- Town/Settlements
- District Boundary
- State Boundary
- International Boundary

Location Map



10 5 0 10 20 Kilometers

Data Source :

IRS P6 LISS III data (Pre-monsoon and Post-monsoon Season 2006-07)

Prepared By :

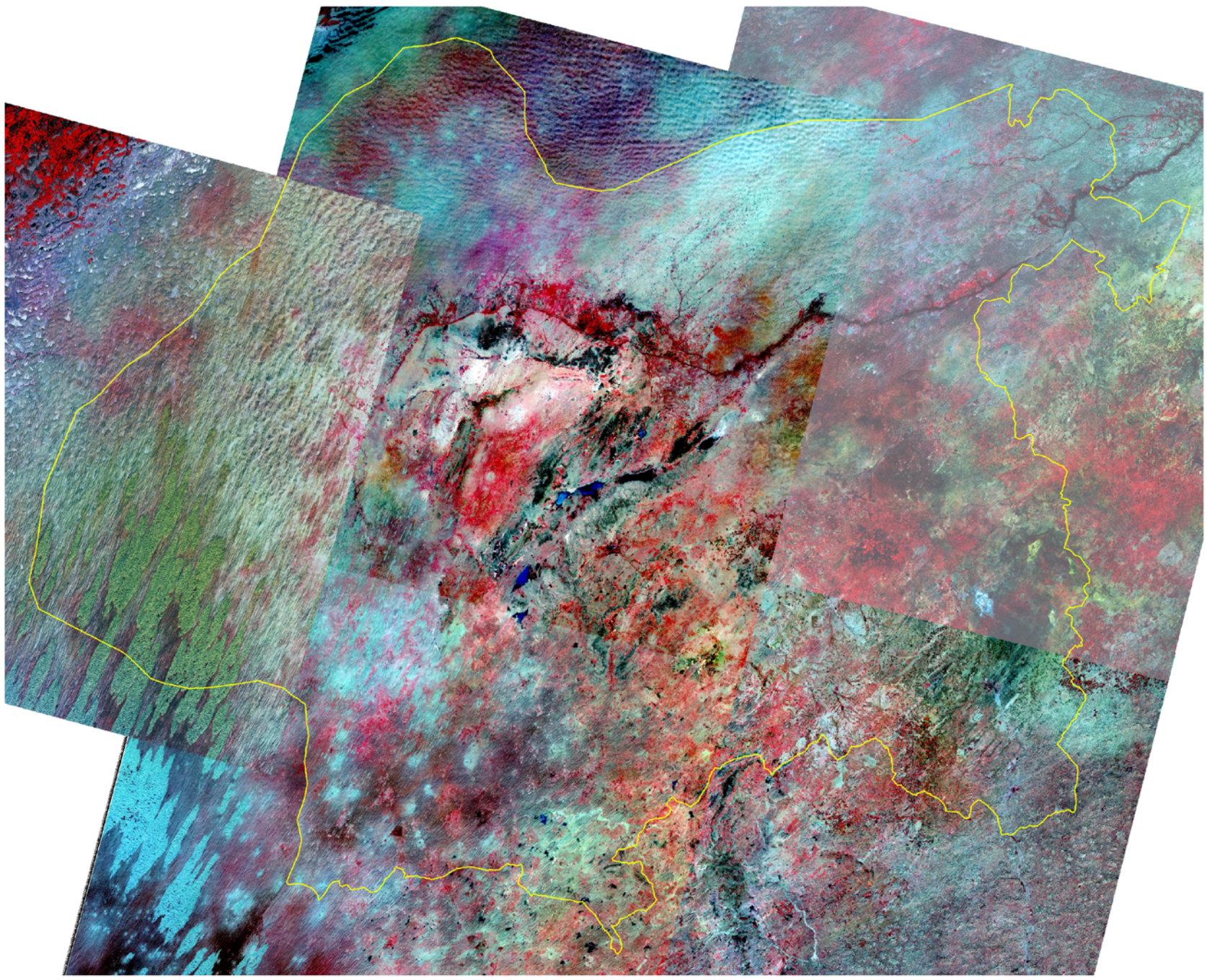
Space Applications Centre (ISRO), Ahmedabad
and
State Remote Sensing Application Centre, Jodhpur

Sponsored By:

Ministry of Environment and Forests
Government of India

State : Rajasthan

District : Jaisalmer



IRS P6 LISS-III Post-monsoon data (2006).

7.1.17 Barmer

Barmer is located in the western part of the state forming a part of the Thar Desert. The district is surrounded by Jaisalmer in the north, Jalore in the south, Pali and Jodhpur in the east and Pakistan in the west. The district is located in the south-west region of the state lies in between 24° 58' and 26° 32' North latitude and 70° 05' and 72° 52' East longitude. The total area of the district is 28387 sq. kms. Barmer is famous for its carved wooden furniture and hand block printing industry. The temperature varies from 45^0 to 9 C^0 and the average rainfall in the region is 28 cms. The Luni river (salt river), which rises in the hills of south-west of Ajmer city. After flowing into Jalore district it finally loses itself in marshy areas of Rann of Kutch.

Total 2124 wetlands are mapped including 1584 small wetlands (< 2.25 ha) with 44638 ha area. The River/Stream with 19700 ha. contributed 44.13% to the total wetland area. The Tanks / Ponds with 11189 ha (25.07% area) is the second major wetland category, followed by Intertidal mud flats with 5294 ha area i.e. 11.86%. Thus, the district is dominated by man-made wetlands.

Open water spread of the wetlands is significantly higher in post monsoon (13769 ha) than during pre monsoon (5925 ha), indicating the rainfall dependence of the wetlands in the state. Aquatic Vegetation in pre monsoon is 150 Ha. The qualitative turbidity of water is low in post monsoon and high in pre monsoon season. Details of estimates of wetlands in Barmer are given in Table 22.

Table 22: Area estimates of wetlands in Barmer

Area in ha

Sr. No.	Wettcode	Wetland Category	Number of Wetlands	Total Wetland Area	% of wetland area	Open Water	
						Post-monsoon Area	Pre-monsoon Area
	1100	**Inland Wetlands - Natural**					
1	1101	Lakes/Ponds	1	155	0.35	5	-
2	1102	Ox-bow lakes/ Cut-off meanders	-	-	-	-	-
3	1103	High altitude wetlands	-	-	-	-	-
4	1104	Riverine wetlands	-	-	-	-	-
5	1105	Waterlogged	32	4283	9.59	2786	360
6	1106	River/Stream	9	19700	44.13	625	25
	1200	**Inland Wetlands -Man-made**					
7	1201	Reservoirs/Barrages	3	187	0.42	177	10
8	1202	Tanks/Ponds	464	11189	25.07	9163	1779
9	1203	Waterlogged	25	657	1.47	634	-
10	1204	Salt pans	5	1589	3.56	370	4
	2100	**Coastal Wetlands - Natural**					
11	2104	Intertidal mud flats	1	5294	11.86	9	3747
		Sub-Total	**540**	**43054**	**96.45**	**13769**	**5925**
		Wetlands (<2.25 ha), mainly Tanks	1584	1584	3.55	-	-
		Total	**2124**	**44638**	**100.00**	**13769**	**5925**

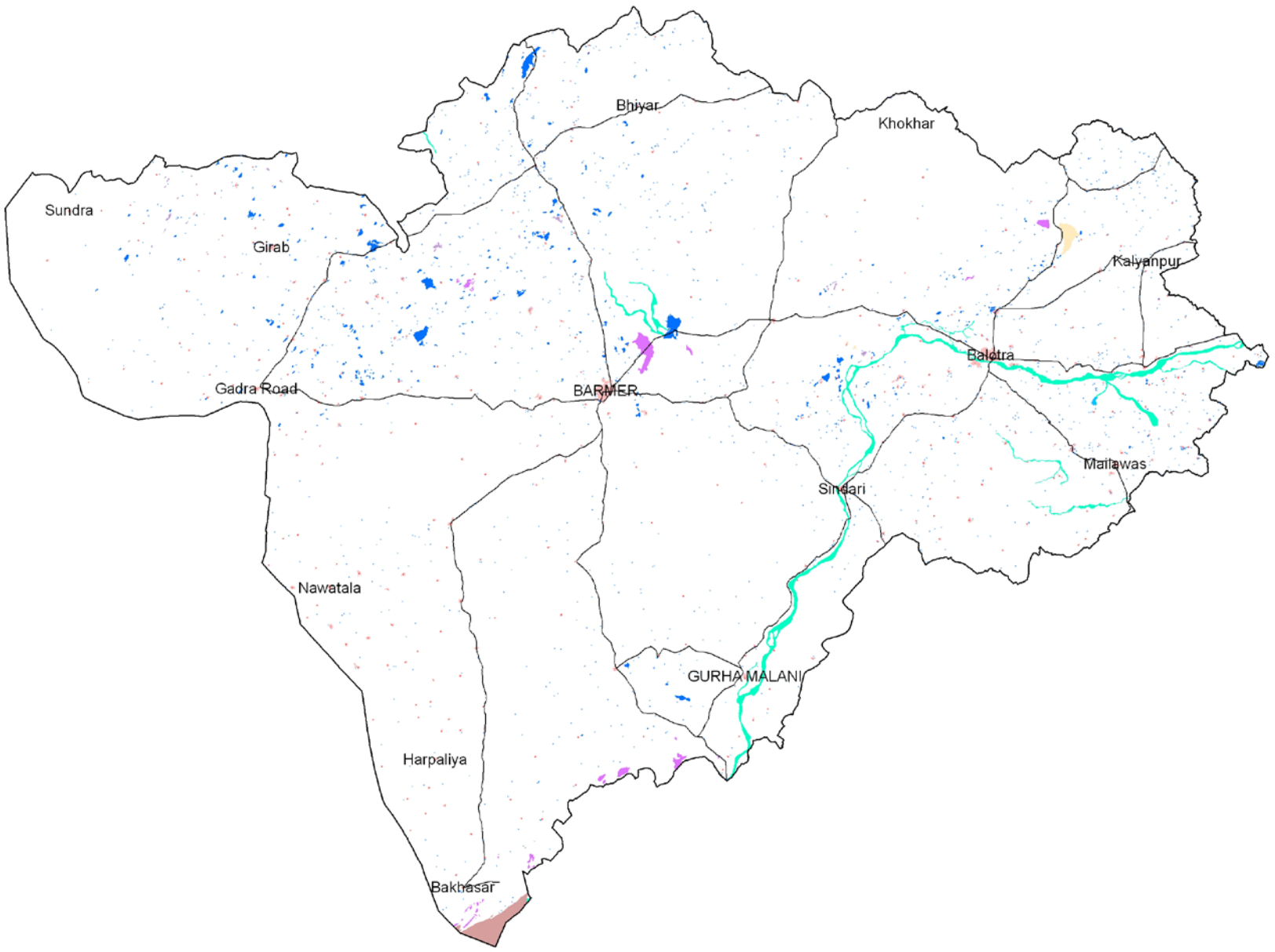
Area under Aquatic Vegetation	-	150

Area under turbidity levels		
Low	13575	1979
Moderate	-	36
High	194	3910

State : Rajasthan

WETLAND MAP

District : Barmer

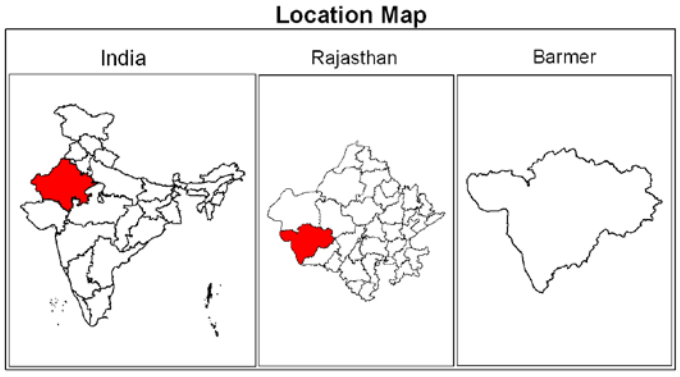


Symbol	Typecode	Level I	Level II	Level III
		Inland Wetlands		
			Natural	
	1101			Lakes/Ponds
	1102			Ox-bow lakes/ Cut-off meanders
	1103			High altitude wetlands
	1104			Reverine wetlands
	1105			Waterlogged
	1106			River/Stream
			Man-made	
	1201			Reservoirs/Barrages
	1202			Tanks/Ponds
	1203			Waterlogged
	1204			Salt pans
		Coastal Wetlands		
			Natural	
	2101			Lagoons
	2102			Creeks
	2103			Sand/Beach
	2104			Intertidal mud flats
	2105			Salt marsh
	2106			Mangroves
	2107			Coral reefs
			Man-made	
	2201			Salt pans
	2202			Aquaculture ponds

Legend

- Wetlands (<2.25ha)
- Drainage (line)
- Major Roads
- Railway
- Settlements
- Town/Settlements
- District Boundary
- State Boundary
- International Boundary

Location Map



20 10 0 20 40 Kilometers

Data Source :

IRS P6 LISS III data (Pre-monsoon and Post-monsoon Season 2006-07)

Prepared By :

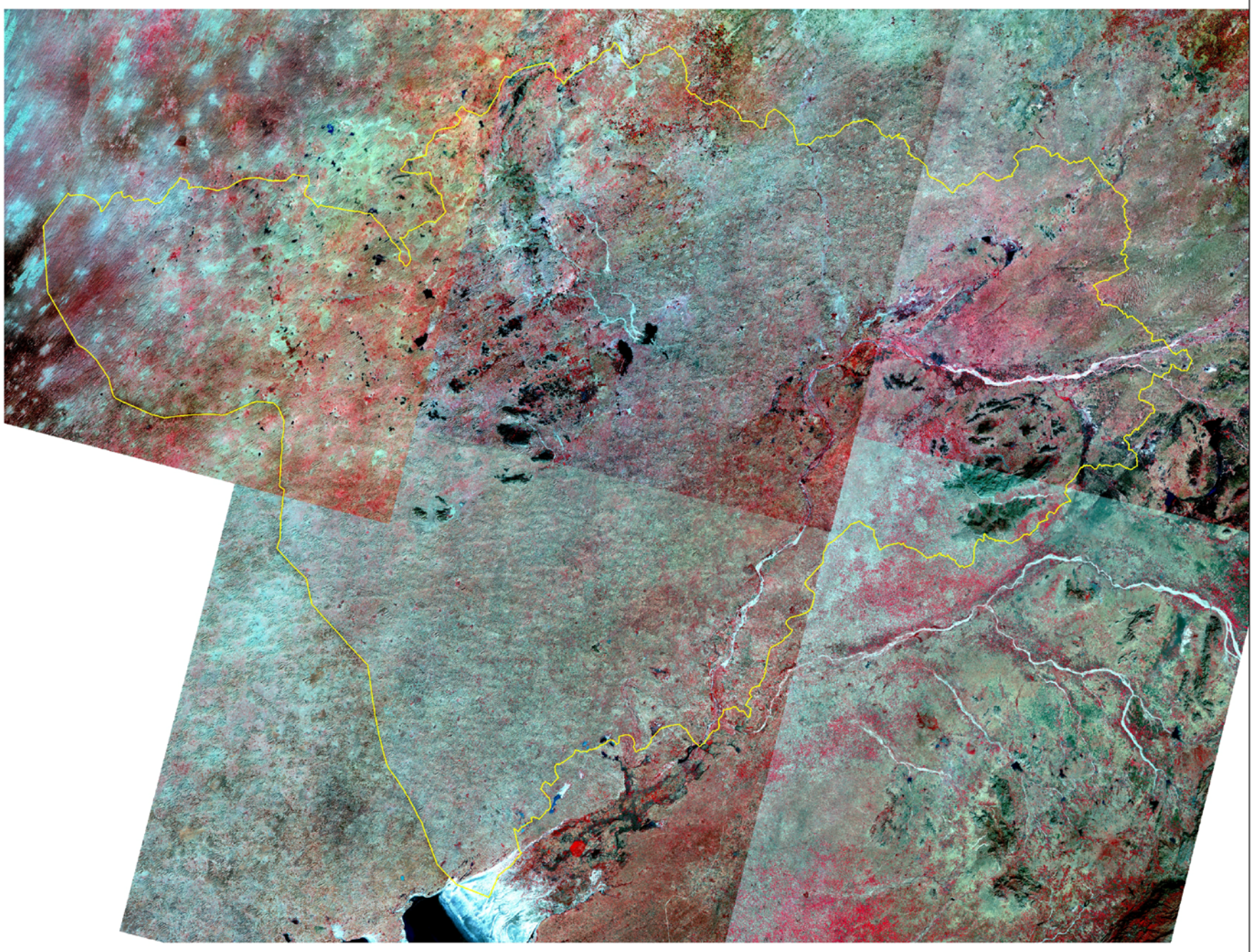
Space Applications Centre (ISRO), Ahmedabad
and
State Remote Sensing Application Centre, Jodhpur

Sponsored By:

Ministry of Environment and Forests
Government of India

State : Rajasthan

District : Barmer



IRS P6 LISS-III Post-monsoon data (2006).

7.1.18 Jalore

Jalore is one of the 32 administrative districts of Rajasthan and its central co-ordinates are 25^0 22' North latitude and 72^0 58' East longitude. This district is surrounded by Barmer on the North-West, Sirohi on the South-East, Pali on the North-East and Banaskantha district of Gujarat on the South-West. Jalore lies south of Sukri River a tributary of Luni River and is about 121 km south of Jodhpur. The geographical area of the district is 10640 sq. Km. The city is located at 268 meters altitude from mean sea level. The average rainfall is 42 cm. The maximum temperature touches 49^0 whereas the minimum temperature 4^0 C.

Total 1642 wetlands are mapped including 1408 small wetlands (< 2.25 ha) with 54440 ha area. River/Stream with 27601 ha. contributed 50.70% to the total wetland area. The Intertidal mudflats with 13656 ha (25.08% area) is the second major wetland category, followed by Waterlogged (Natural) with 4741 ha area i.e. 8.71%. Thus, the district is dominated by man-made wetlands.

Open water spread of the wetlands is significantly higher in post monsoon (9024 ha) than during pre monsoon (8992ha), indicating the rainfall dependence of the wetlands in the state. Aquatic Vegetation in post monsoon is 43 ha while 42 ha. in pre monsoon. The qualitative turbidity of water is low in post and high in pre monsoon season. Details of estimates of wetlands in Jalore are given in Table 23.

Table 23: Area estimates of wetlands in Jalore

Area in ha

Sr. No.	Wettcode	Wetland Category	Number of Wetlands	Total Wetland Area	% of wetland area	Open Water	
						Post-monsoon Area	Pre-monsoon Area
	1100	**Inland Wetlands - Natural**					
1	1101	Lakes/Ponds	-	-	-	-	-
2	1102	Ox-bow lakes/ Cut-off meanders	-	-	-	-	-
3	1103	High altitude wetlands	-	-	-	-	-
4	1104	Riverine wetlands	-	-	-	-	-
5	1105	Waterlogged	15	4741	8.71	3146	1322
6	1106	River/Stream	41	27601	50.70	1504	441
	1200	**Inland Wetlands -Man-made**					
7	1201	Reservoirs/Barrages	18	3813	7.00	2675	776
8	1202	Tanks/Ponds	155	2864	5.26	1583	202
9	1203	Waterlogged	-	-	-	-	-
10	1204	Salt pans	3	357	0.66	116	47
	2100	**Coastal Wetlands - Natural**					
11	2104	Intertidal mud flats	2	13656	25.08	-	6204
		Sub-Total	**234**	**53032**	**97.41**	**9024**	**8992**
		Wetlands (<2.25 ha), mainly Tanks	1408	1408	2.59	-	-
		Total	**1642**	**54440**	**100.00**	**9024**	**8992**

Area under Aquatic Vegetation	43	42

Area under turbidity levels		
Low	7263	634
Moderate	121	140
High	1640	8218

State : Rajasthan

WETLAND MAP

District : Jalore

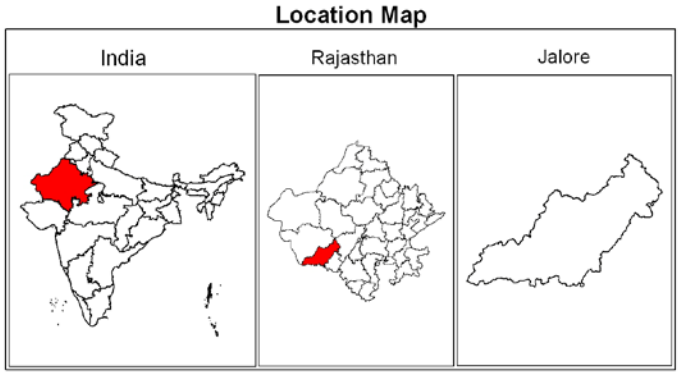


Symbol	Typecode	Level I	Level II	Level III
		Inland Wetlands		
			Natural	
	1101			Lakes/Ponds
	1102			Ox-bow lakes/ Cut-off meanders
	1103			High altitude wetlands
	1104			Reverine wetlands
	1105			Waterlogged
	1106			River/Stream
			Man-made	
	1201			Reservoirs/Barrages
	1202			Tanks/Ponds
	1203			Waterlogged
	1204			Salt pans
		Coastal Wetlands		
			Natural	
	2101			Lagoons
	2102			Creeks
	2103			Sand/Beach
	2104			Intertidal mud flats
	2105			Salt marsh
	2106			Mangroves
	2107			Coral reefs
			Man-made	
	2201			Salt pans
	2202			Aquaculture ponds

Legend

- Wetlands (<2.25ha)
- Drainage (line)
- Major Roads
- Railway
- Settlements
- Town/Settlements
- District Boundary
- State Boundary
- International Boundary

Location Map



10 5 0 10 20 Kilometers

Data Source :

IRS P6 LISS III data (Pre-monsoon and Post-monsoon Season 2006-07)

Prepared By :

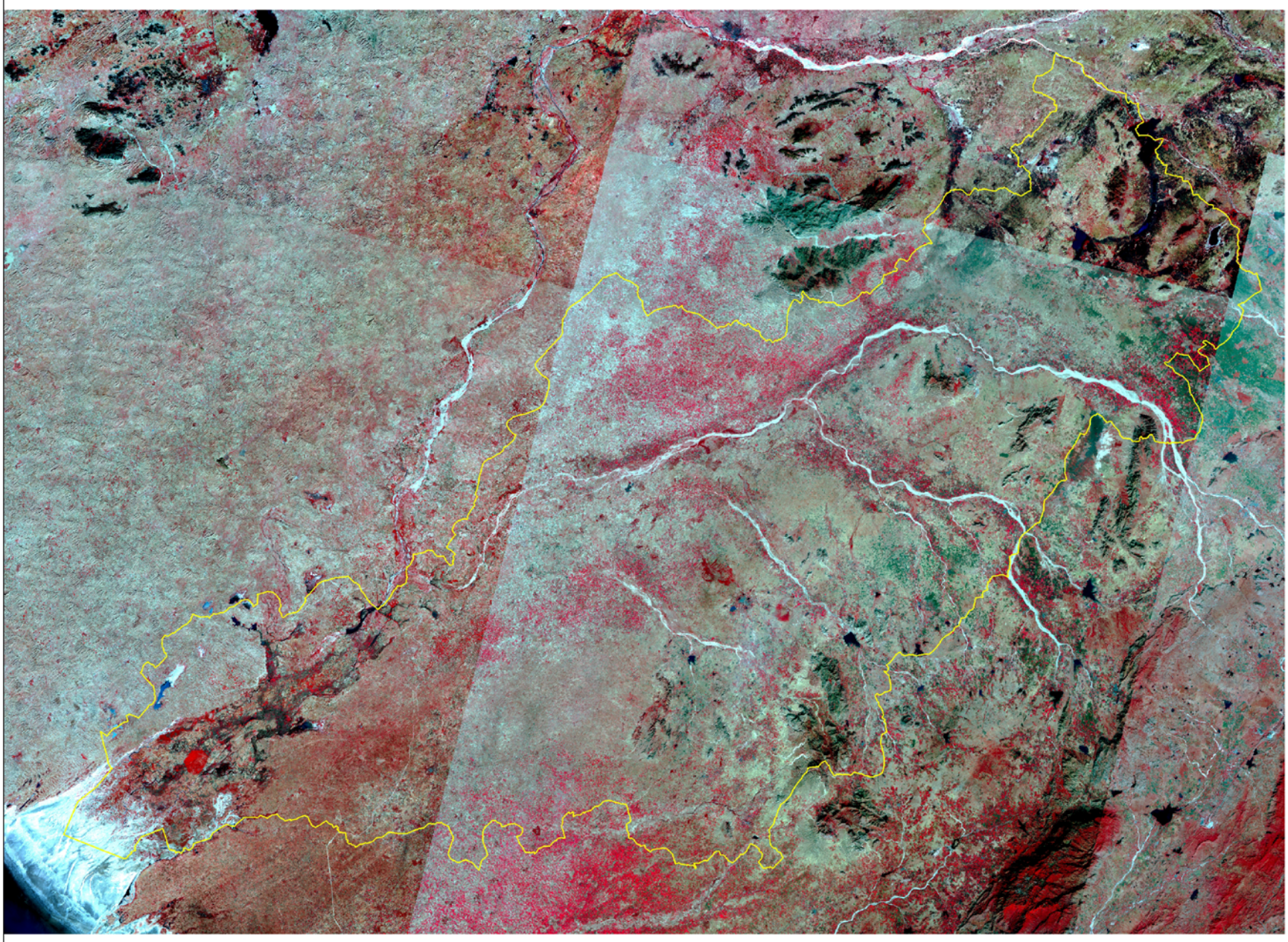
Space Applications Centre (ISRO), Ahmedabad
and
State Remote Sensing Application Centre, Jodhpur

Sponsored By:

Ministry of Environment and Forests
Government of India

State : Rajasthan

District : Jalore



IRS P6 LISS-III Post-monsoon data (2006).

7.1.19 Sirohi

Sirohi is bounded by Pali district in the North-East, by Udaipur district in the East, by Gujarat State and Jalore in the West. It is the third smallest district of Rajasthan. The geographic extension of the district lies in between 24^0 20' to 25 ^{0} 17' North latitude and 72^0 16' to 73^0 10' East longitude and occupies an area of 5136 sq. Km. The annual rainfall is 665 mm. The maximum temperature touches 47^0 whereas the minimum temperature 0^0 C.

In all 1041 wetlands are mapped including 715 small wetlands (< 2.25 ha) with 19259 ha area. The River/Stream with 10887 ha. contributed 56.53% to the total wetland area. The Reservoirs/Barrages with 4565 ha (23.70% area) is the second major wetland category, followed by Tanks/Ponds with 2960 ha area i.e. 15.37%. Thus, the district is dominated by man-made wetlands.

Open water spread of the wetlands is significantly higher in post monsoon (6147 ha) than during pre monsoon (739 ha), indicating the rainfall dependence of the wetlands in the state. Aquatic Vegetation in pre monsoon is 348 ha. The qualitative turbidity of water is low in post and moderate in pre monsoon season.
Details of estimates of wetlands in Sirohi are given in Table 24.

Table 24: Area estimates of wetlands in Sirohi

Area in ha

Sr. No.	Wettcode	Wetland Category	Number of Wetlands	Total Wetland Area	% of wetland area	Open Water	
						Post-monsoon Area	Pre-monsoon Area
	1100	**Inland Wetlands - Natural**					
1	1101	Lakes/Ponds	2	132	-	122	19
2	1102	Ox-bow lakes/ Cut-off meanders	-	-	-	-	-
3	1103	High altitude wetlands	-	-	-	-	-
4	1104	Riverine wetlands	-	-	-	-	-
5	1105	Waterlogged	-	-	-	-	-
6	1106	River/Stream	45	10887	56.53	148	3
	1200	**Inland Wetlands -Man-made**					
7	1201	Reservoirs/Barrages	34	4565	23.70	3713	587
8	1202	Tanks/Ponds	245	2960	15.37	2164	130
9	1203	Waterlogged	-	-	-	-	-
10	1204	Salt pans	-	-	-	-	-
		Sub-Total	**326**	**18544**	**96.29**	**6147**	**739**
		Wetlands (<2.25 ha), mainly Tanks	715	715	3.71	-	-
		Total	**1041**	**19259**	**100.00**	**6147**	**739**

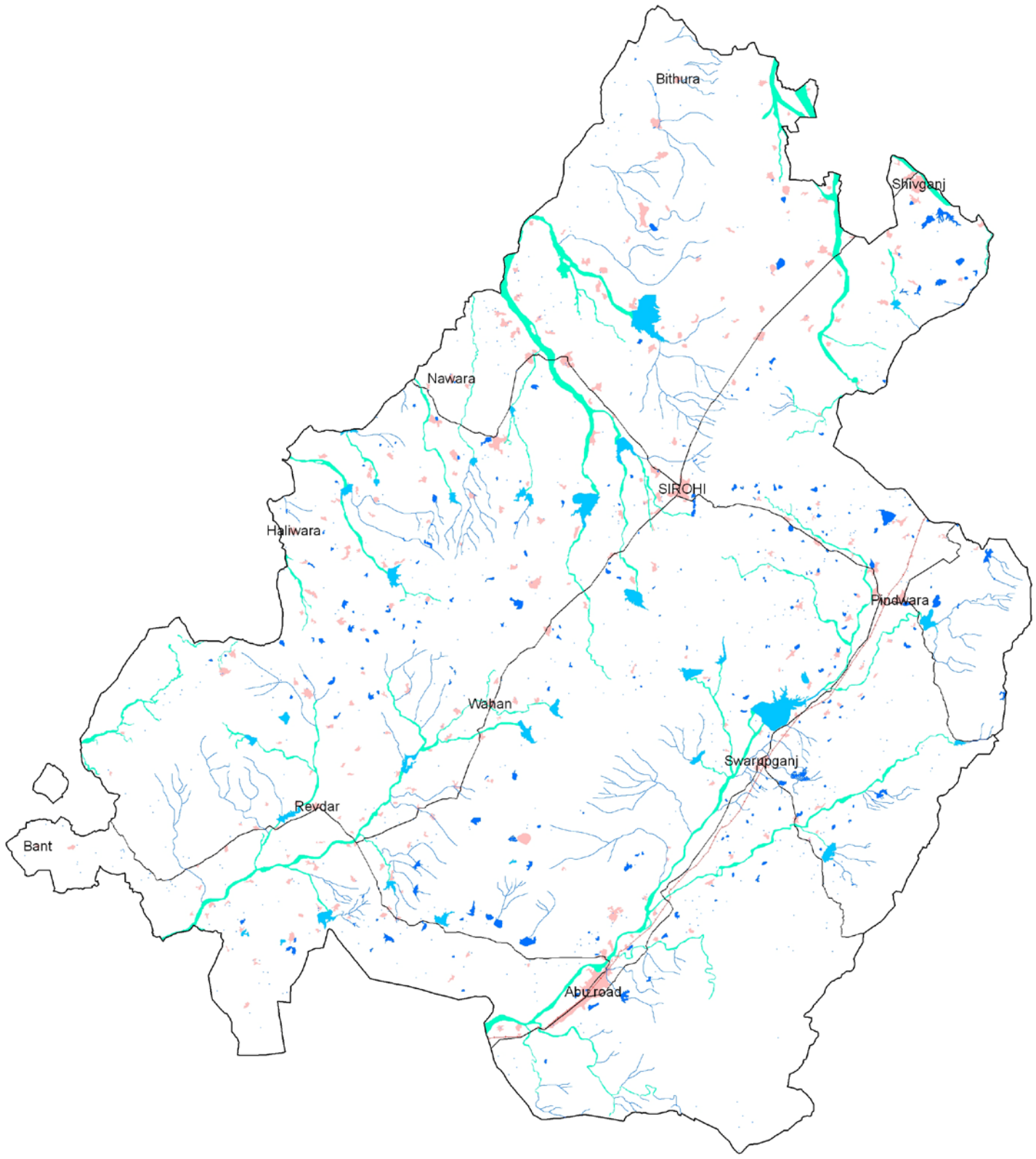
Area under Aquatic Vegetation	-	348

Area under turbidity levels		
Low	5535	234
Moderate	272	505
High	340	-

State : Rajasthan

WETLAND MAP

District : Sirohi

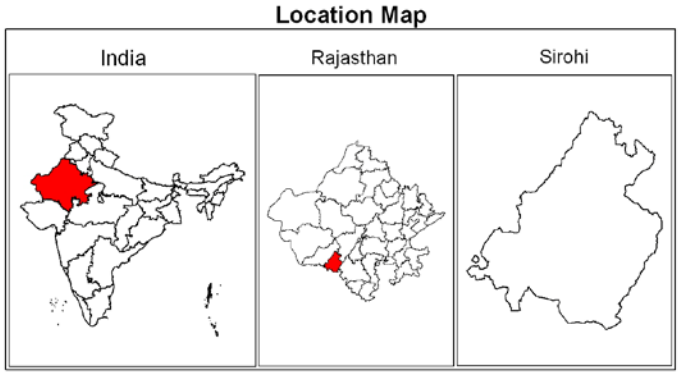


Symbol	Typecode	Level I	Level II	Level III
		Inland Wetlands		
			Natural	
	1101			Lakes/Ponds
	1102			Ox-bow lakes/ Cut-off meanders
	1103			High altitude wetlands
	1104			Reverine wetlands
	1105			Waterlogged
	1106			River/Stream
			Man-made	
	1201			Reservoirs/Barrages
	1202			Tanks/Ponds
	1203			Waterlogged
	1204			Salt pans
		Coastal Wetlands		
			Natural	
	2101			Lagoons
	2102			Creeks
	2103			Sand/Beach
	2104			Intertidal mud flats
	2105			Salt marsh
	2106			Mangroves
	2107			Coral reefs
			Man-made	
	2201			Salt pans
	2202			Aquaculture ponds

Legend

- Wetlands (<2.25ha)
- Drainage (line)
- Major Roads
- Railway
- Settlements
- Town/Settlements
- District Boundary
- State Boundary
- International Boundary

Location Map



6 3 0 6 12 Kilometers

Data Source :

IRS P6 LISS III data (Pre-monsoon and Post-monsoon Season 2006-07)

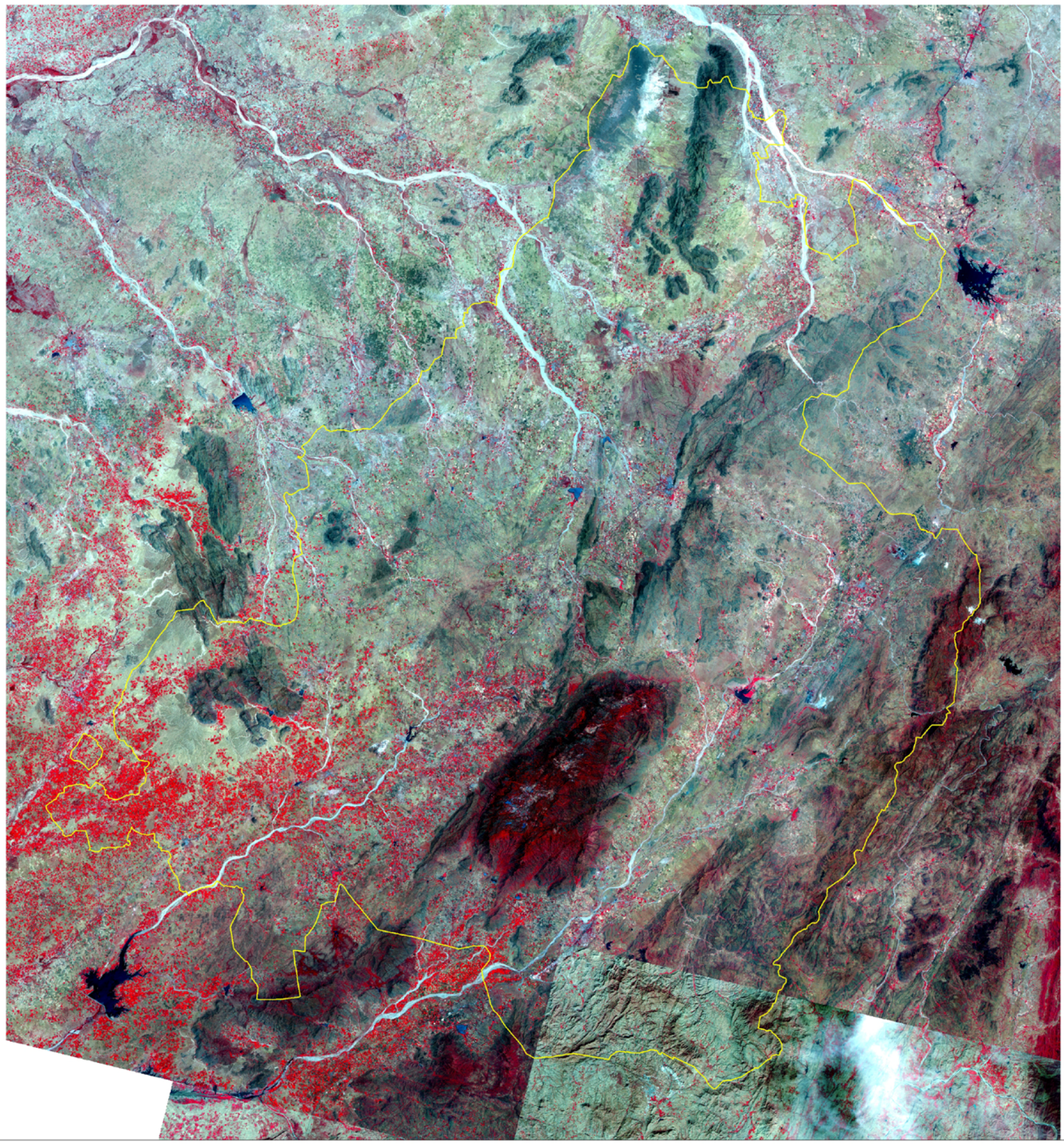
Prepared By :

Space Applications Centre (ISRO), Ahmedabad
and
State Remote Sensing Application Centre, Jodhpur

Sponsored By:

Ministry of Environment and Forests
Government of India

State : Rajasthan **District : Sirohi**



IRS P6 LISS-III Pre-monsoon data (2006).

7.1.20 Pali

Pali lies in between 24^0 45' to 26 ^{0} 55' degrees North latitude and 72^0 48' to 74^0 20' degrees East longitude. Pali district is covered by Jodhpur, Jalore, Sirohi, Udaipur, Rajasamand, Ajmer and Nagour districts. The geographical area of the district is 12387 sq. Km. The district receives annual rainfall of 300 mm. The maximum temperature touches 47^0 during summer whereas the minimum temperature 5^0 C in winters.

In all 2170 wetlands are mapped including 1437 small wetlands (< 2.25 ha) with 50304 ha area. The River/Stream with 27216 ha. contributed 54.10 % to the total wetland area. The Reservoirs/Barrages with 13178 ha (26.20% area) is the second major wetland category, followed by Tanks/Ponds with 8144 ha area i.e. 16.19%. Thus, the district is dominated by man-made wetlands.

Open water spread of the wetlands is significantly higher in post monsoon (16823 ha) than during pre monsoon (2173 ha), indicating the rainfall dependence of the wetlands in the state. Aquatic Vegetation in pre monsoon is 463 ha which is higher than post monsoon Aquatic Vegetation i.e. 141 ha. The qualitative turbidity of water is low in both the seasons. Details of estimates of wetlands in Pali are given in Table 25.

Table 25: Area estimates of wetlands in Pali

Area in ha

Sr. No.	Wettcode	Wetland Category	Number of Wetlands	Total Wetland Area	% of wetland area	Open Water	
						Post-monsoon Area	Pre-monsoon Area
	1100	**Inland Wetlands - Natural**					
1	1101	Lakes/Ponds	1	323	0.64	43	-
2	1102	Ox-bow lakes/ Cut-off meanders	-	-	-	-	-
3	1103	High altitude wetlands	-	-	-	-	-
4	1104	Riverine wetlands	-	-	-	-	-
5	1105	Waterlogged	1	6	0.01	-	-
6	1106	River/Stream	72	27216	54.10	523	98
	1200	**Inland Wetlands -Man-made**					
7	1201	Reservoirs/Barrages	57	13178	26.20	11115	1797
8	1202	Tanks/Ponds	602	8144	16.19	5142	278
9	1203	Waterlogged	-	-	-	-	-
10	1204	Salt pans	-	-	-	-	-
		Sub-Total	**733**	**48867**	**97.14**	**16823**	**2173**
		Wetlands (<2.25 ha), mainly Tanks	1437	1437	2.86	-	-
		Total	**2170**	**50304**	**100.00**	**16823**	**2173**

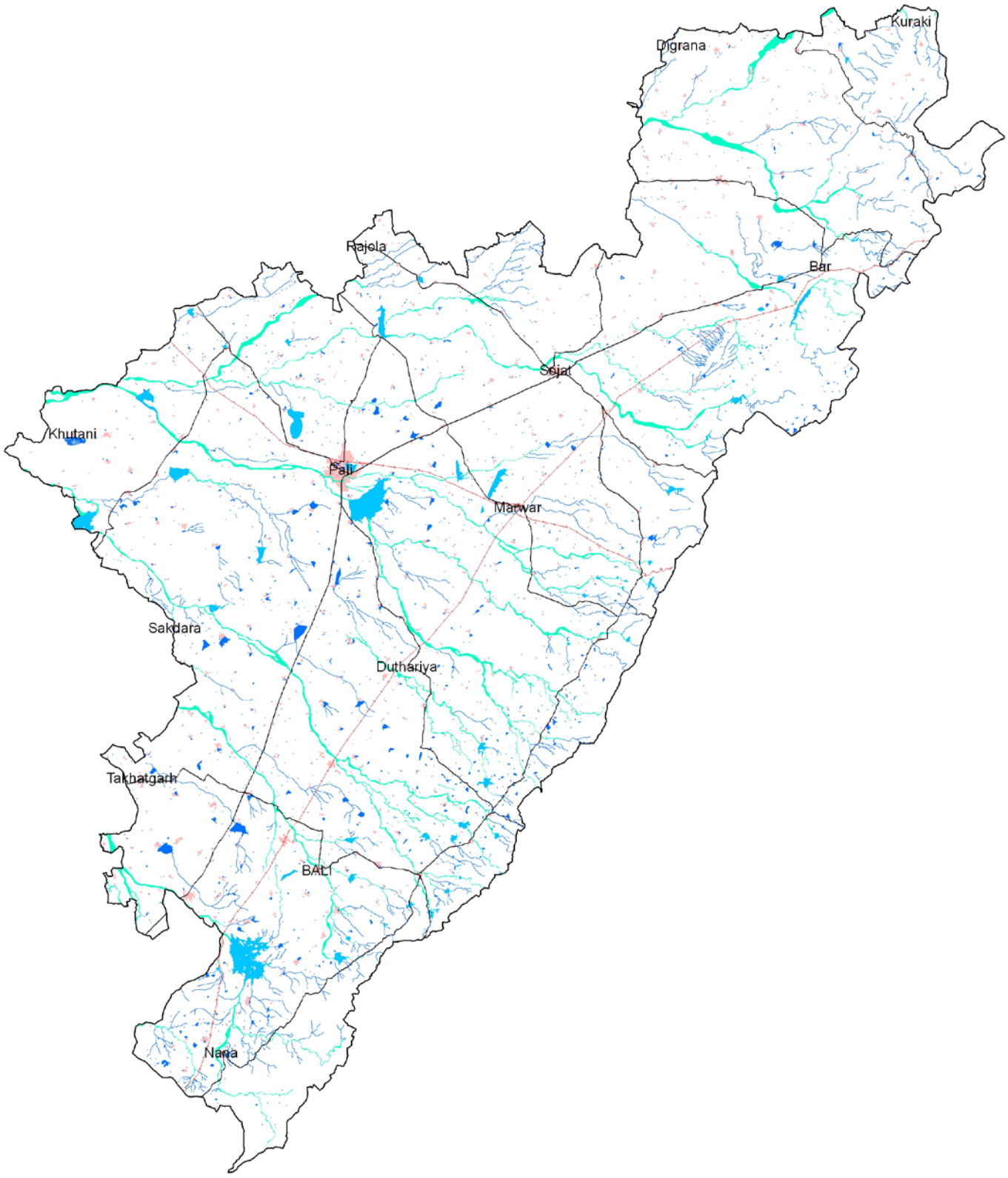
Area under Aquatic Vegetation	141	463

Area under turbidity levels		
Low	10867	1883
Moderate	2907	84
High	3049	206

State : Rajasthan

WETLAND MAP

District : Pali

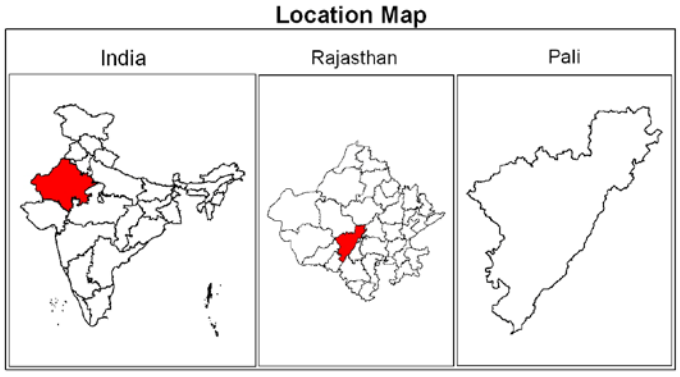


Symbol	Typecode	Level I	Level II	Level III
		Inland Wetlands		
			Natural	
	1101			Lakes/Ponds
	1102			Ox-bow lakes/ Cut-off meanders
	1103			High altitude wetlands
	1104			Reverine wetlands
	1105			Waterlogged
	1106			River/Stream
			Man-made	
	1201			Reservoirs/Barrages
	1202			Tanks/Ponds
	1203			Waterlogged
	1204			Salt pans
		Coastal Wetlands		
			Natural	
	2101			Lagoons
	2102			Creeks
	2103			Sand/Beach
	2104			Intertidal mud flats
	2105			Salt marsh
	2106			Mangroves
	2107			Coral reefs
			Man-made	
	2201			Salt pans
	2202			Aquaculture ponds

Legend

- Wetlands (<2.25ha)
- Drainage (line)
- Major Roads
- Railway
- Settlements
- Town/Settlements
- District Boundary
- State Boundary
- International Boundary

Location Map



8 4 0 8 16 Kilometers

Data Source :

IRS P6 LISS III data (Pre-monsoon and Post-monsoon Season 2006-07)

Prepared By :

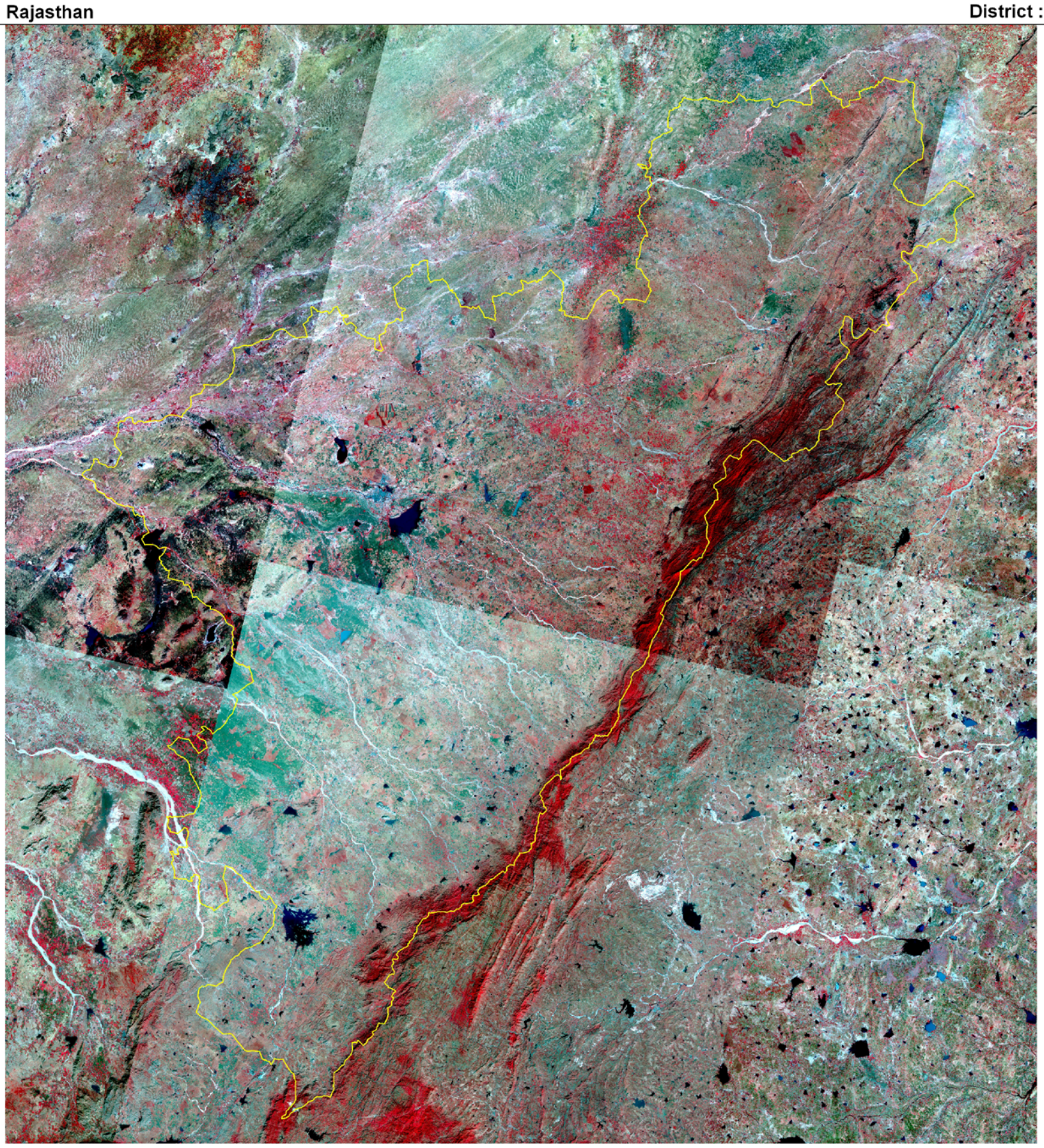
Space Applications Centre (ISRO), Ahmedabad
and
State Remote Sensing Application Centre, Jodhpur

Sponsored By:

Ministry of Environment and Forests
Government of India

State : Rajasthan

District : Pali



IRS P6 LISS-III Post-monsoon data (2006).

7.1.21 Ajmer

The district is located in the centre of Rajasthan state and lies in between 25° 38’ and 26° 58’ North latitude and 73° 54’ and 75° 22’ East longitude. Ajmer is the third largest city of Rajasthan and located at the altitude of 486meters above sea level. It is bounded on the north by Nagaur district, on the south by Bhilwara district, on the east by Jaipur and Tonk districts and on the west by Pali district. The total area of the district is 8481 sq. Km.

There are five rivers which flow thorough the district viz. Banas, Khari, Sagarmati, Saraswati and Rupnagar. Among the important tanks/lakes in the district are Anna sagar, Foy sagar, Phool sagar, Bisala, Ramsar, Pushkar, Budha Pushkar etc. Temperature ranges from 2° C during winter season and 45° C during summer season. The normal annual rainfall is around 527 mm.

Total 3093 wetlands are mapped including 2022 small wetlands (< 2.25 ha) with 32167 ha area**.** The Tanks/Ponds with 14682 ha contributed 45.64% of the total wetland area. Rivers/Stream is the second major wetland category with 6928 ha contributed 21.54%, followed by Reservoirs/Barrages with 6599 ha area i.e. 20.51 %. Thus, the district is dominated by man-made wetlands.

Open water spread of the wetlands is significantly higher in post monsoon (14663 ha) than during pre monsoon (2928 ha), indicating the rainfall dependence of the wetlands in the state. Aquatic vegetation during post-monsoon and pre -monsoon are 153 ha and 98 ha respectively. The qualitative turbidity of water is low in post and high in pre monsoon season. Details of estimates of wetlands in Ajmer are given in Table 26.

Table 26: Area estimates of wetlands in Ajmer

Area in ha

Sr. No.	Wettcode	Wetland Category	Number of Wetlands	Total Wetland Area	% of wetland area	Open Water	
						Post-monsoon Area	Pre-monsoon Area
	1100	**Inland Wetlands - Natural**					
1	1101	Lakes/Ponds	6	1464	4.55	34	14
2	1102	Ox-bow lakes/ Cut-off meanders	-	-	-	-	-
3	1103	High altitude wetlands	-	-	-	-	-
4	1104	Riverine wetlands	-	-	-	-	-
5	1105	Waterlogged	-	-	-	-	-
6	1106	River/Stream	27	6928	21.54	618	67
	1200	**Inland Wetlands -Man-made**					
7	1201	Reservoirs/Barrages	54	6599	20.51	5227	1166
8	1202	Tanks/Ponds	973	14682	45.64	8411	1232
9	1203	Waterlogged	-	-	-	-	-
10	1204	Salt pans	11	472	1.47	373	449
		Sub-Total	**1071**	**30145**	**93.71**	**14663**	**2928**
		Wetlands (<2.25 ha), mainly Tanks	2022	2022	6.29	-	-
		Total	**3093**	**32167**	**100.00**	**14663**	**2928**

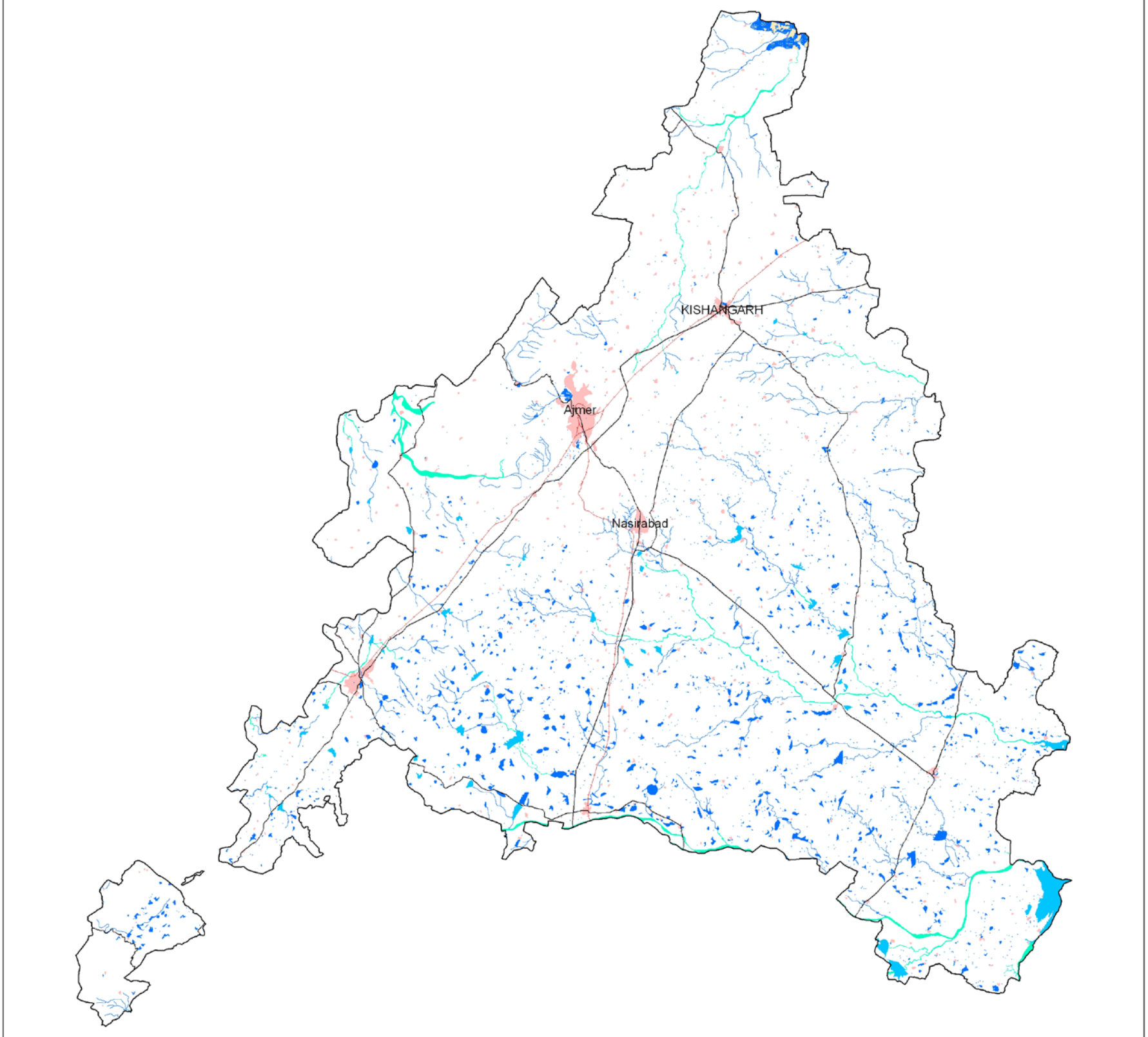
Area under Aquatic Vegetation	153	98

Area under turbidity levels		
Low	12562	1360
Moderate	1010	32
High	1091	1536

State : Rajasthan

WETLAND MAP

District : Ajmer

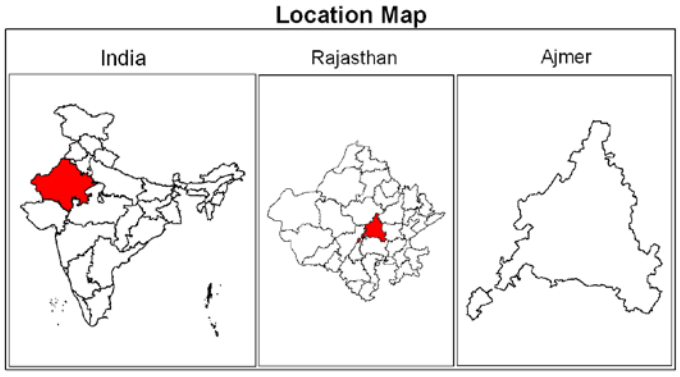


Symbol	Typecode	Level I	Level II	Level III
		Inland Wetlands		
			Natural	
	1101			Lakes/Ponds
	1102			Ox-bow lakes/ Cut-off meanders
	1103			High altitude wetlands
	1104			Reverine wetlands
	1105			Waterlogged
	1106			River/Stream
			Man-made	
	1201			Reservoirs/Barrages
	1202			Tanks/Ponds
	1203			Waterlogged
	1204			Salt pans
		Coastal Wetlands		
			Natural	
	2101			Lagoons
	2102			Creeks
	2103			Sand/Beach
	2104			Intertidal mud flats
	2105			Salt marsh
	2106			Mangroves
	2107			Coral reefs
			Man-made	
	2201			Salt pans
	2202			Aquaculture ponds

Legend

- Wetlands (<2.25ha)
- Drainage (line)
- Major Roads
- Railway
- Settlements
- Town/Settlements
- District Boundary
- State Boundary
- International Boundary

Location Map



10 5 0 10 20 Kilometers

Data Source :

IRS P6 LISS III data (Pre-monsoon and Post-monsoon Season 2006-07)

Prepared By :

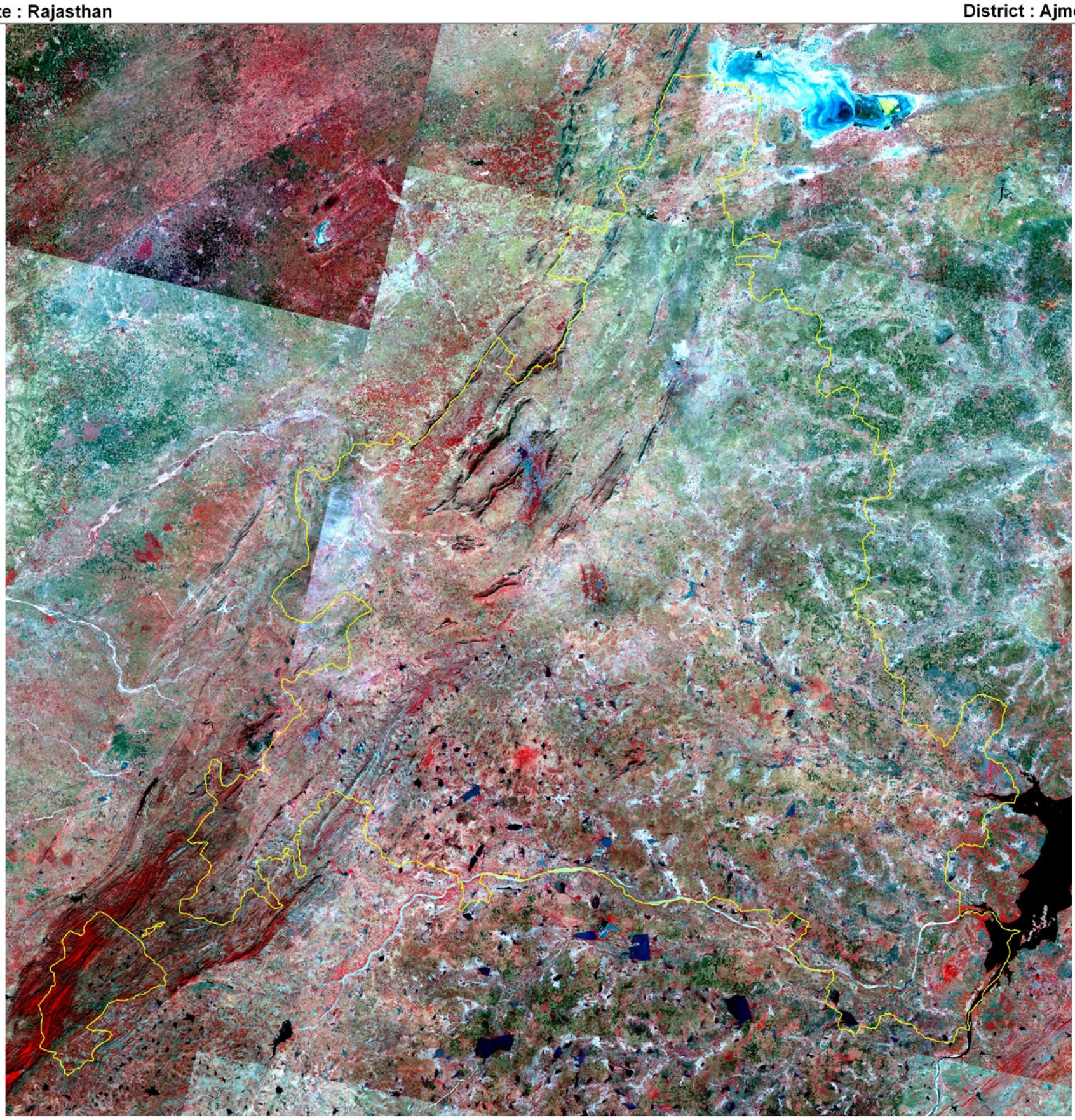
Space Applications Centre (ISRO), Ahmedabad
and
State Remote Sensing Application Centre, Jodhpur

Sponsored By:

Ministry of Environment and Forests
Government of India

State : Rajasthan

District : Ajmer



IRS P6 LISS-III Post-monsoon data (2006).

7.1.22 Tonk

Tonk district is located in north- eastern part of the state bordering Jaipur in the north, Sawai Madhopur in the east, Bundi and Bhilwara districts in the south and Ajmer district in the west. It lies in between 25^0 41' to 26^0 24' North latitude and 75^0 19' to 76^0 16' East longitude. The geographical area of the district is 7194 sq. Km. The climate of the district is dry and healthy. The average minimum temperature of the district varies between 15°C to 17S°C, while the maximum fluctuates between 27.5°C to 44°C. Average rainfall of the district is about 613.6 mm. The only important river of district is Banas, which divides it into two halves.

Total 2722 wetlands are mapped including 1849 small wetlands (< 2.25 ha) with 46875 ha area**.** Reservoirs/Barrages with 22692 ha contributed 48.41% to the total wetland area. The River/Stream with 12126 ha (25.87% area) is the second major wetland category, followed by Tanks/Ponds with 10169 ha area i.e. 21.69 %. Thus, the district is dominated by man-made wetlands.

Open water spread of the wetlands is significantly higher in post-monsoon (26016 ha) than during pre monsoon (15337 ha), indicating the rainfall dependence of the wetlands in the state. Aquatic vegetation during post-monsoon is 6 ha. The qualitative turbidity of water is low in both the seasons. Details of estimates of wetlands in Tonk are given in Table 27.

Table 27: Area estimates of wetlands in Tonk

Area in ha

Sr. No.	Wettcode	Wetland Category	Number of Wetlands	Total Wetland Area	% of wetland area	Open Water	
						Post-monsoon Area	Pre-monsoon Area
	1100	**Inland Wetlands - Natural**					
1	1101	Lakes/Ponds	2	39	0.08	8	28
2	1102	Ox-bow lakes/ Cut-off meanders	-	-	-	-	-
3	1103	High altitude wetlands	-	-	-	-	-
4	1104	Riverine wetlands	-	-	-	-	-
5	1105	Waterlogged	-	-	-	-	-
6	1106	River/Stream	55	12126	25.87	1596	146
	1200	**Inland Wetlands -Man-made**					
7	1201	Reservoirs/Barrages	39	22692	48.41	19941	12700
8	1202	Tanks/Ponds	777	10169	21.69	4471	2463
9	1203	Waterlogged	-	-	-	-	-
10	1204	Salt pans	-	-	-	-	-
		Sub-Total	**873**	**45026**	**96.06**	**26016**	**15337**
		Wetlands (<2.25 ha), mainly Tanks	1849	1849	3.94	-	-
		Total	**2722**	**46875**	**100.00**	**26016**	**15337**

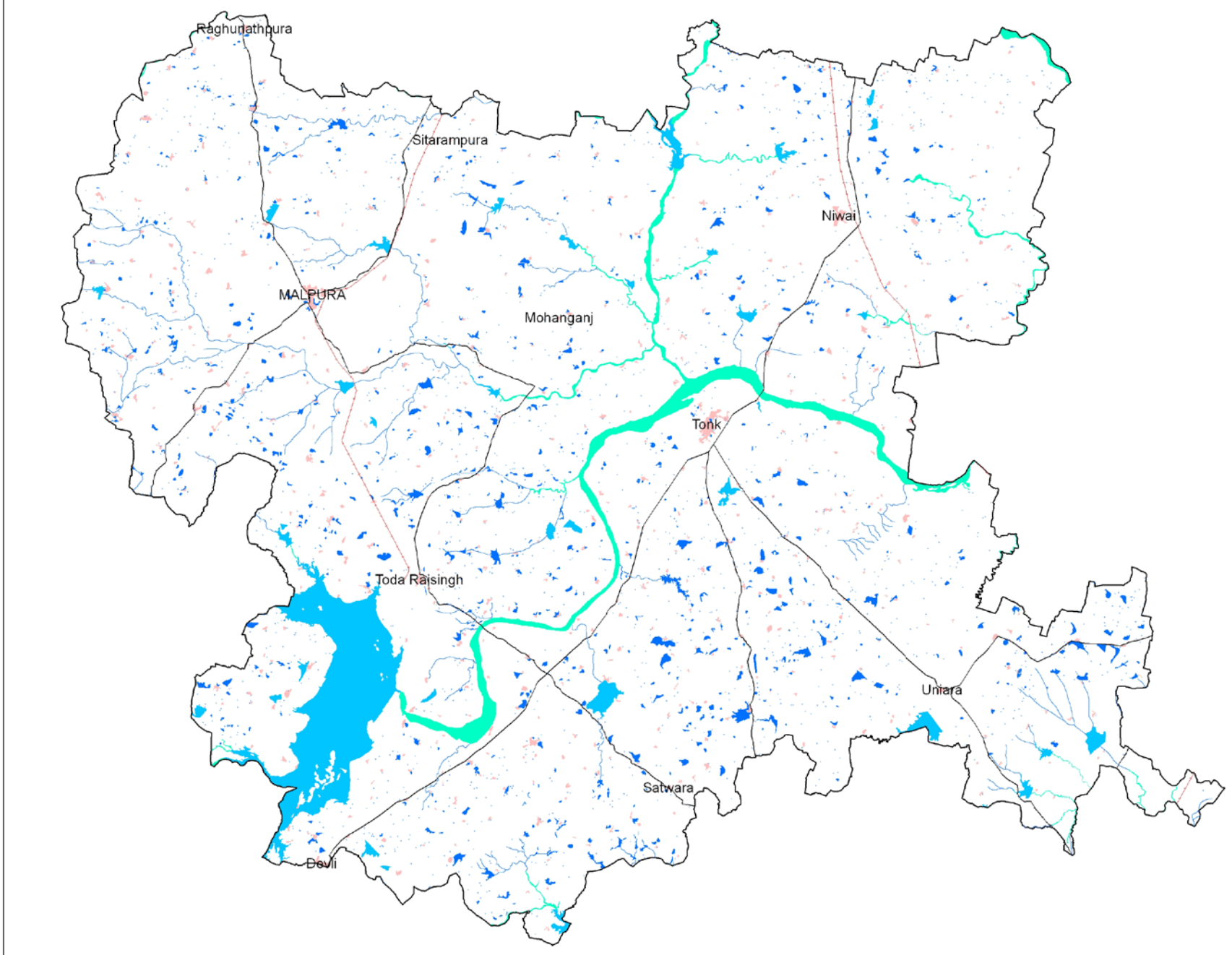
Area under Aquatic Vegetation	6	-

Area under turbidity levels		
Low	23594	12882
Moderate	576	370
High	1846	2085

State : Rajasthan

WETLAND MAP

District : Tonk

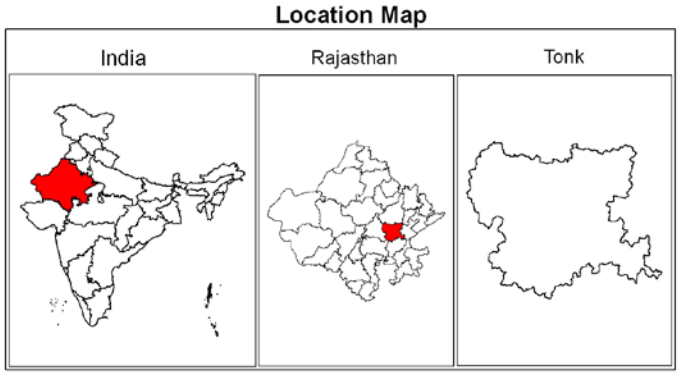


Symbol	Typecode	Level I	Level II	Level III
		Inland Wetlands		
			Natural	
	1101			Lakes/Ponds
	1102			Ox-bow lakes/ Cut-off meanders
	1103			High altitude wetlands
	1104			Reverine wetlands
	1105			Waterlogged
	1106			River/Stream
			Man-made	
	1201			Reservoirs/Barrages
	1202			Tanks/Ponds
	1203			Waterlogged
	1204			Salt pans
		Coastal Wetlands		
			Natural	
	2101			Lagoons
	2102			Creeks
	2103			Sand/Beach
	2104			Intertidal mud flats
	2105			Salt marsh
	2106			Mangroves
	2107			Coral reefs
			Man-made	
	2201			Salt pans
	2202			Aquaculture ponds

Legend

- Wetlands (<2.25ha)
- Drainage (line)
- Major Roads
- Railway
- Settlements
- Town/Settlements
- District Boundary
- State Boundary
- International Boundary

Location Map



6 3 0 6 12 Kilometers

Data Source :

IRS P6 LISS III data (Pre-monsoon and Post-monsoon Season 2006-07)

Prepared By :

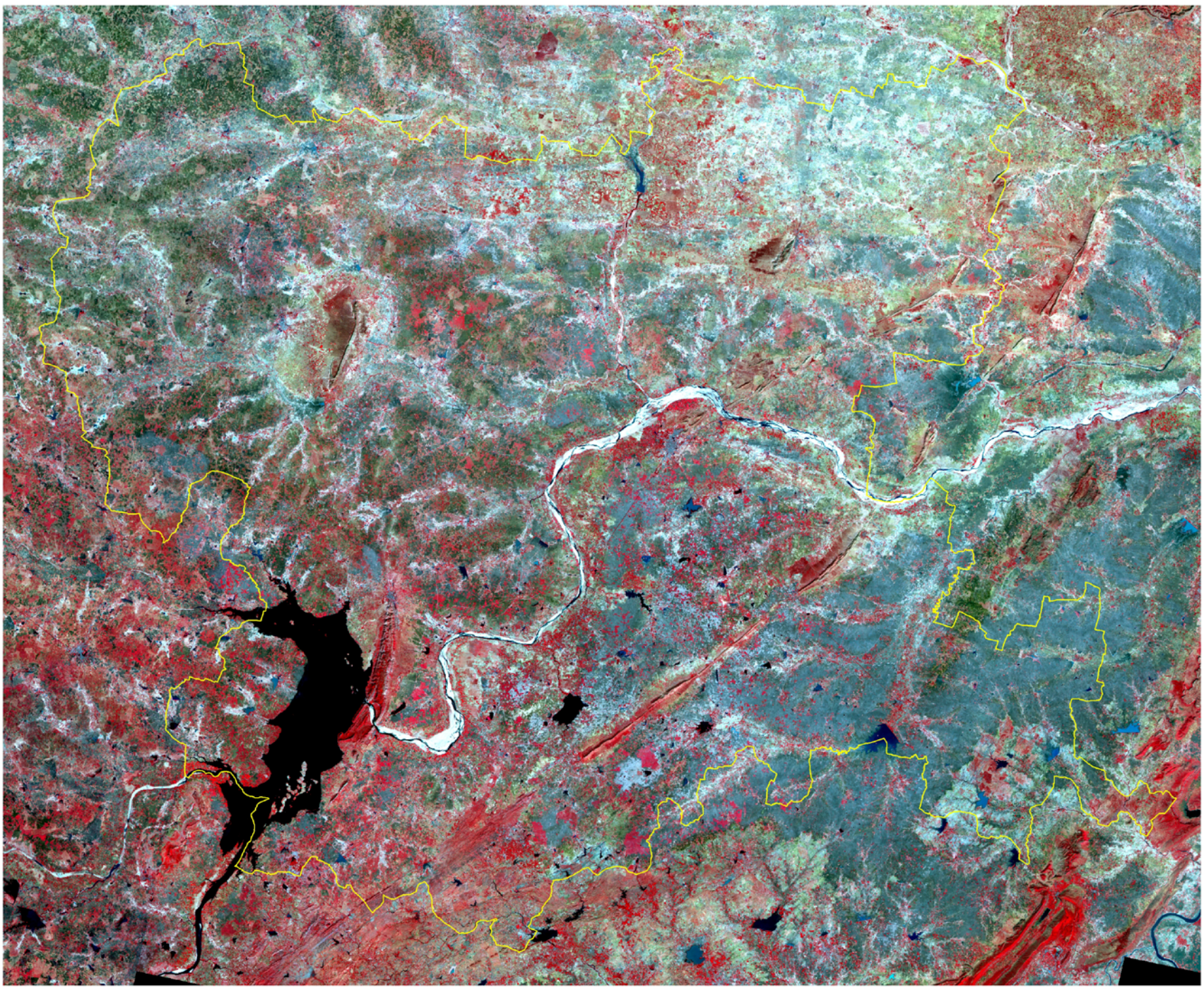
Space Applications Centre (ISRO), Ahmedabad
and
State Remote Sensing Application Centre, Jodhpur

Sponsored By:

Ministry of Environment and Forests
Government of India

State : Rajasthan

District : Tonk



IRS P6 LISS-III Post-monsoon data (2006).

7.1.23 Bundi

Bundi is located in south-eastern part of Rajasthan and has an area of 5,550 sq. kms**.** It lies in between 24° 59' and 25° 53' North latitude and 75° 01' and 76° 19' East longitude. The district is s bounded by Tonk in the east, in the west by Bhilwara and on the south-west by Chittorgarh districts. The river Chambal forms the southern and eastern boundaries separating the Bundi and Kota districts. Bundi is fascinating for the fact that it has historical monuments, natural beauty, scenic dams & ponds, wild forests, fairs and festivity and many more to explore. The maximum temperature reaches 43^0 while and minimum temperature touches 30^0 C. The annual rainfall is 76 cms.

Total 913 wetlands are mapped including 599 small wetlands (< 2.25 ha) with 21238 ha area**. R**ivers/ streams with 10205 ha. contributed 48.05% to the total wetland area. The Reservoirs/Barrages with 6905 ha (32.51% area) is the second major wetland category, followed by Tanks/Ponds with 3529 ha area i.e. 16.62 %. Thus, there is almost equal distribution of natural as well as man-made wetlands.

Open water spread of the wetlands is significantly higher in post monsoon (12701 ha) than during pre monsoon (4104 ha), indicating the rainfall dependence of the wetlands in the state. Aquatic vegetation during post-monsoon and Pre-monsoon are 108 ha and 36 ha. The qualitative turbidity of water is low in both the seasons. Details of estimates of wetlands in Bundi are given in Table 28.

Table 28: Area estimates of wetlands in Bundi

Area in ha

Sr. No.	Wettcode	Wetland Category	Number of Wetlands	Total Wetland Area	% of wetland area	Open Water	
						Post-monsoon Area	Pre-monsoon Area
	1100	**Inland Wetlands - Natural**					
1	1101	Lakes/Ponds	-	-	-	-	-
2	1102	Ox-bow lakes/ Cut-off meanders	-	-	-	-	-
3	1103	High altitude wetlands	-	-	-	-	-
4	1104	Riverine wetlands	-	-	-	-	-
5	1105	Waterlogged	-	-	-	-	-
6	1106	River/Stream	50	10205	48.05	4693	2774
	1200	**Inland Wetlands -Man-made**					
7	1201	Reservoirs/Barrages	21	6905	32.51	5669	911
8	1202	Tanks/Ponds	243	3529	16.62	2339	419
9	1203	Waterlogged	-	-	-	-	-
10	1204	Salt pans	-	-	-	-	-
		Sub-Total	**314**	**20639**	**97.18**	**12701**	**4104**
		Wetlands (<2.25 ha), mainly Tanks	599	599	2.82	-	-
		Total	**913**	**21238**	**100.00**	**12701**	**4104**

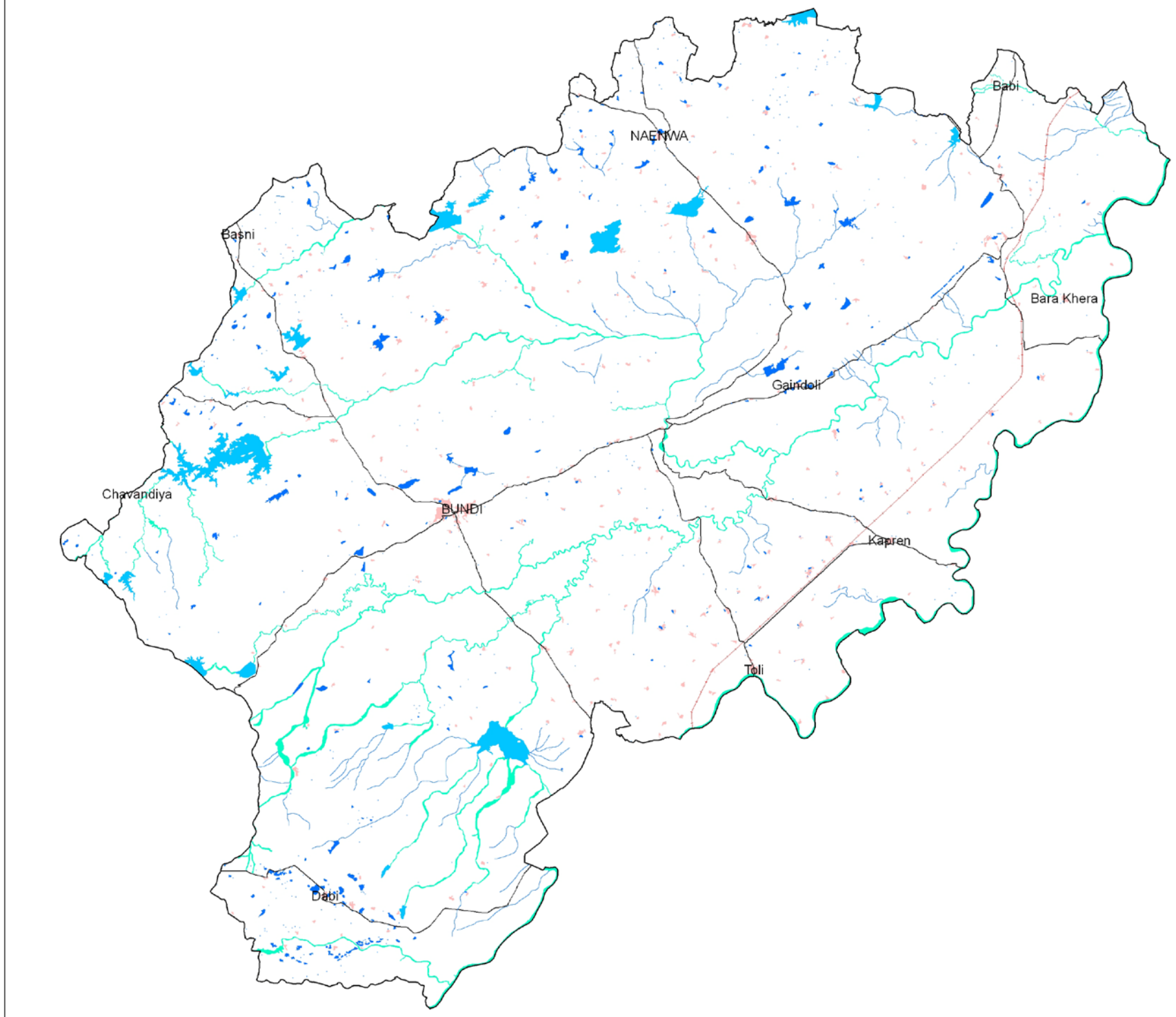
Area under Aquatic Vegetation	108	36

Area under turbidity levels		
Low	9583	3498
Moderate	1013	127
High	2105	479

State : Rajasthan

WETLAND MAP

District : Bundi

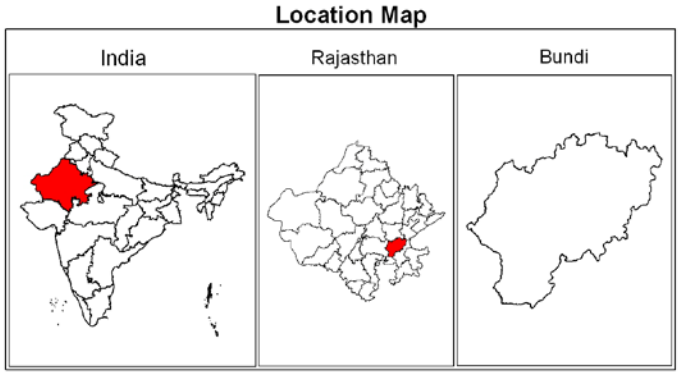


Symbol	Typecode	Level I	Level II	Level III
		Inland Wetlands		
			Natural	
	1101			Lakes/Ponds
	1102			Ox-bow lakes/ Cut-off meanders
	1103			High altitude wetlands
	1104			Reverine wetlands
	1105			Waterlogged
	1106			River/Stream
			Man-made	
	1201			Reservoirs/Barrages
	1202			Tanks/Ponds
	1203			Waterlogged
	1204			Salt pans
		Coastal Wetlands		
			Natural	
	2101			Lagoons
	2102			Creeks
	2103			Sand/Beach
	2104			Intertidal mud flats
	2105			Salt marsh
	2106			Mangroves
	2107			Coral reefs
			Man-made	
	2201			Salt pans
	2202			Aquaculture ponds

Legend

- Wetlands (<2.25ha)
- Drainage (line)
- Major Roads
- Railway
- Settlements
- Town/Settlements
- District Boundary
- State Boundary
- International Boundary

Location Map



6 3 0 6 12 Kilometers

Data Source :

IRS P6 LISS III data (Pre-monsoon and Post-monsoon Season 2006-07)

Prepared By :

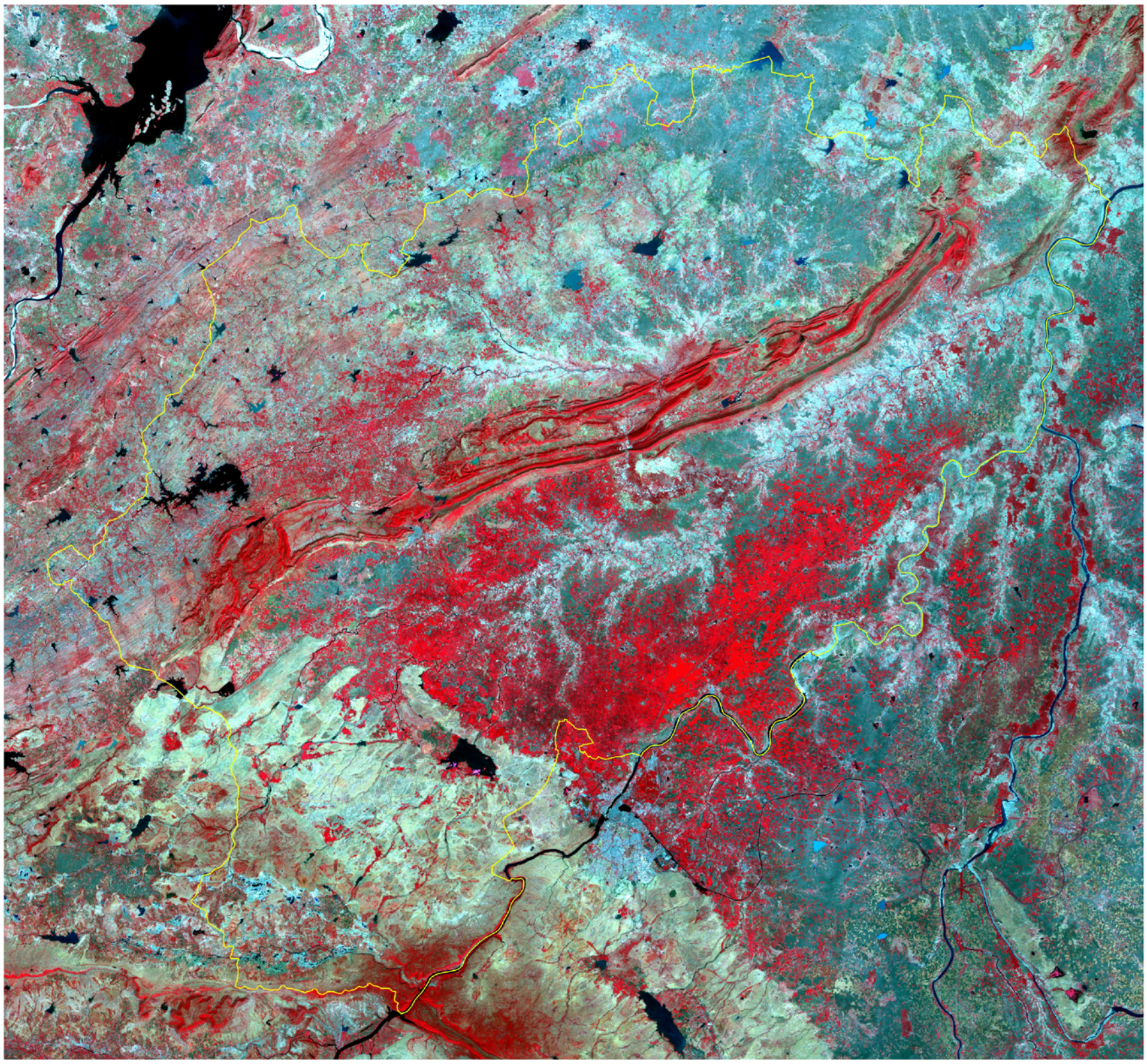
Space Applications Centre (ISRO), Ahmedabad
and
State Remote Sensing Application Centre, Jodhpur

Sponsored By:

Ministry of Environment and Forests
Government of India

State : Rajasthan

District : Bundi



IRS P6 LISS-III Post-monsoon data (2006).

7.1.24 Bhilwara

Bhilwara is located in the south-eastern region of the state and lies in between 25° 00' and 27° 50' North latitude and 74° 03' and 75° 25' East longitude. The total geographical area of the district is 10455 sq. kms. Bhilwara is an industrial town. It is famous country wide for the textiles industry and hence known as "Textile City of Rajasthan". The administrative head quarter is located at Bhilwara town. The northern border of the district touches district Ajmer, north-west border touches district Rajsamand, south & south-east border touches district Chittor and east & east-north border touches district Bundi & Tonk.

The important rivers, which flow in the district, are the Banas and it's tributaries. The river Banas rises in the Aravali hills in the north of Udaipur district. The average rainfall is 70.40 cms. The maximum temperature reaches 45^0 while and minimum temperature touches 7^0 C.

Total 4261 wetlands are mapped including 2213 small wetlands (< 2.25 ha) with 72500 ha area. Tanks/Ponds with 31970 ha contributed 44.10% to the total wetland area. The Reservoirs/Barrages with 19020 ha (26.23% area) is the second major wetland category, followed by River/Stream with 18004 ha area i.e. 24.83 %. Thus, the district is dominated by man-made wetlands.

Open water spread of the wetlands is extensively higher in post monsoon (46994 ha) than during pre monsoon (4377 ha), indicating the rainfall dependence of the wetlands in the state. Aquatic vegetation in Pre-monsoon season is much more higher (1125 ha) than in post-monsoon (37 ha) season. The qualitative turbidity of water is low in both the seasons. Details of estimates of wetlands in Bhilwara are given in Table 29.

Table 29: Area estimates of wetlands in Bhilwara

Area in ha

Sr. No.	Wettcode	Wetlamd Category	Number of Wetlands	Total Wetland Area	% of wetland area	Open Water	
						Post-monsoon Area	Pre-monsoon Area
	1100	**Inland Wetlands - Natural**					
1	1101	Lakes/Ponds	22	1293	1.78	1102	7
2	1102	Ox-bow lakes/ Cut-off meanders	-	-	-	-	-
3	1103	High altitude wetlands	-	-	-	-	-
4	1104	Riverine wetlands	-	-	-	-	-
5	1105	Waterlogged	-	-	-	-	-
6	1106	River/Stream	112	18004	24.83	4872	881
	1200	**Inland Wetlands -Man-made**					
7	1201	Reservoirs/Barrages	144	19020	26.23	17671	2436
8	1202	Tanks/Ponds	1770	31970	44.10	23349	1053
9	1203	Waterlogged	-	-	-	-	-
10	1204	Salt pans	-	-	-	-	-
		Sub-Total	**2048**	**70287**	**96.95**	**46994**	**4377**
		Wetlands (<2.25 ha), mainly Tanks	2213	2213	3.05	-	-
		Total	**4261**	**72500**	**100.00**	**46994**	**4377**

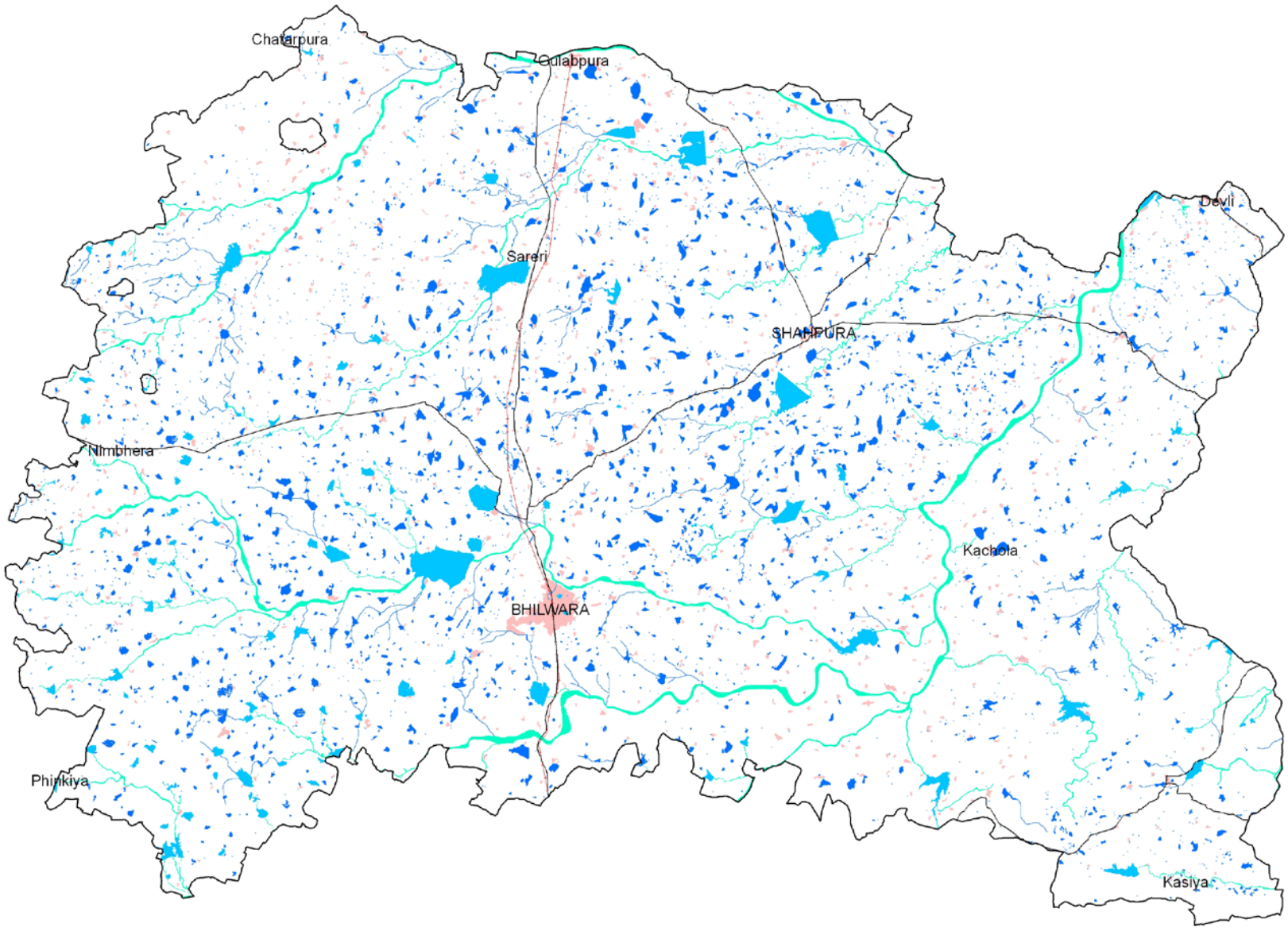
Area under Aquatic Vegetation	37	1125

Area under turbidity levels		
Low	35667	4130
Moderate	8888	148
High	2439	99

State : Rajasthan

WETLAND MAP

District : Bhilwara

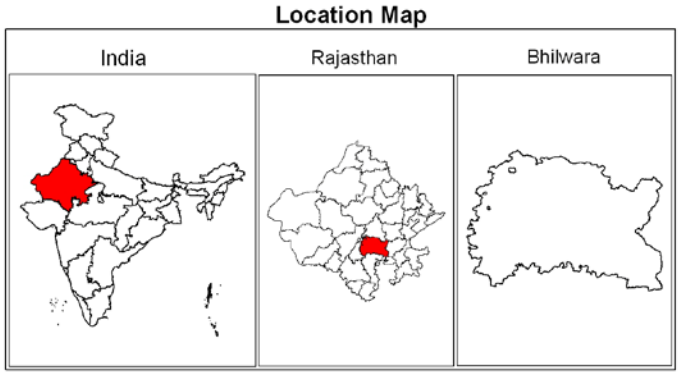


Symbol	Typecode	Level I	Level II	Level III
		Inland Wetlands		
			Natural	
	1101			Lakes/Ponds
	1102			Ox-bow lakes/ Cut-off meanders
	1103			High altitude wetlands
	1104			Reverine wetlands
	1105			Waterlogged
	1106			River/Stream
			Man-made	
	1201			Reservoirs/Barrages
	1202			Tanks/Ponds
	1203			Waterlogged
	1204			Salt pans
		Coastal Wetlands		
			Natural	
	2101			Lagoons
	2102			Creeks
	2103			Sand/Beach
	2104			Intertidal mud flats
	2105			Salt marsh
	2106			Mangroves
	2107			Coral reefs
			Man-made	
	2201			Salt pans
	2202			Aquaculture ponds

Legend

- Wetlands (<2.25ha)
- Drainage (line)
- Major Roads
- Railway
- Settlements
- Town/Settlements
- District Boundary
- State Boundary
- International Boundary

Location Map



10 5 0 10 20 Kilometers

Data Source :

IRS P6 LISS III data (Pre-monsoon and Post-monsoon Season 2006-07)

Prepared By :

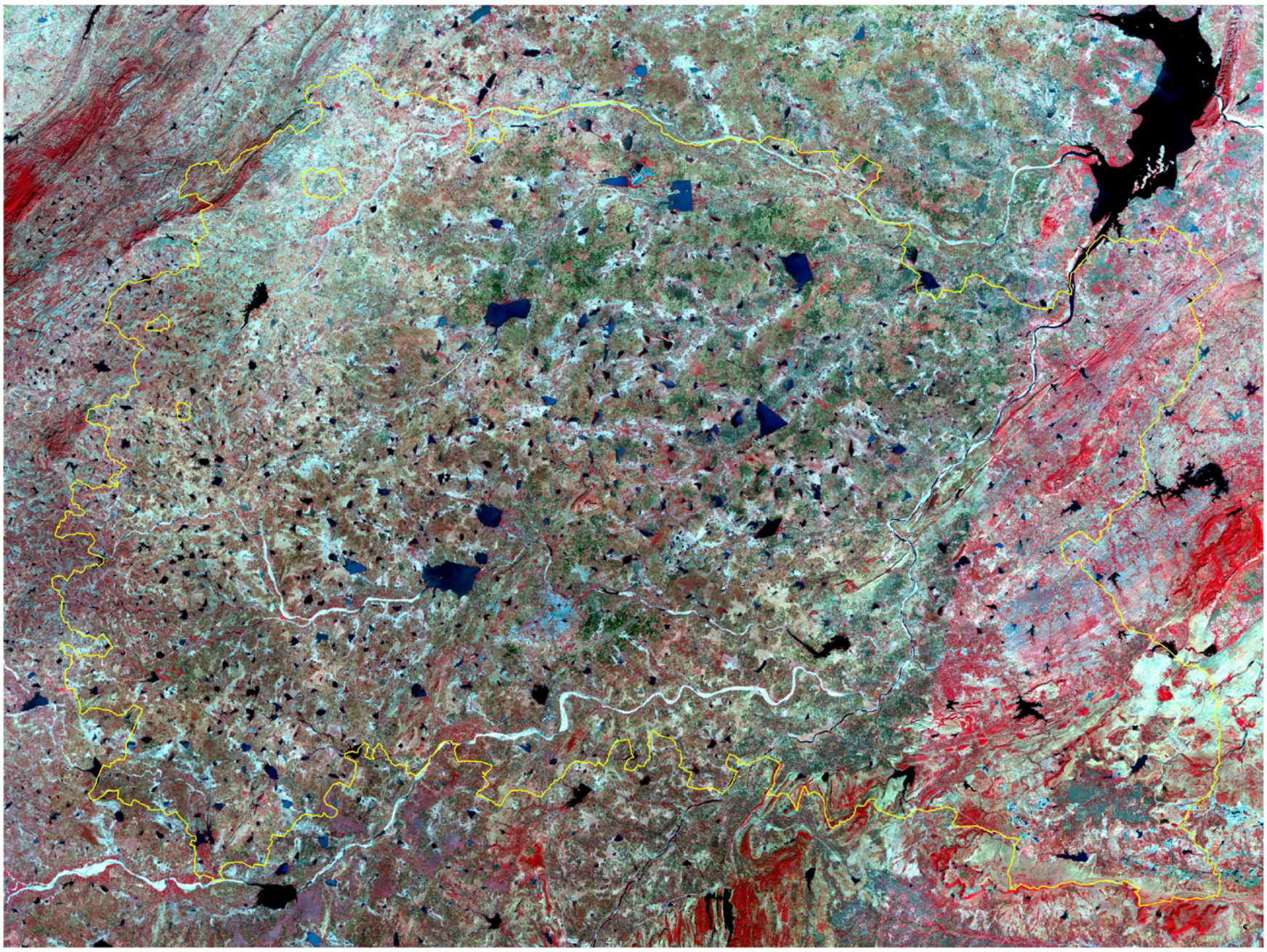
Space Applications Centre (ISRO), Ahmedabad
and
State Remote Sensing Application Centre, Jodhpur

Sponsored By:

Ministry of Environment and Forests
Government of India

State : Rajasthan

District : Bhilwara



IRS P6 LISS-III Post-monsoon data (2006).

7.1.25 Rajsamand

Rajsamand lies in between 24^0 46' to 26 ^{0} 01' North latitude and 73^0 28' to 74^0 18' East longitude. The geographical area of the district is 3853 sq. Km. Rajsamand district is considered to be the major producer of Marble in the state and also single major producer in the country. The city is located at 532 meters altitude from mean sea level. The average rainfall is 50 cm. The maximum temperature touches 49^0 whereas the minimum temperature 1^0 C.

Total 1408 wetlands are mapped including 732 small wetlands (< 2.25 ha) with 20430 ha area. Rivers/ streams with 6805 ha. contributed 33.31% to the total wetland area. The Reservoirs/Barrages with 6518 ha (31.90% area) is the second major wetland category, followed by Tanks/Ponds with 5008 ha area contributing 24.51 % of the total wetland area. Thus, the district is dominated by man-made wetlands.

Open water spread of the wetlands is significantly higher in post monsoon (11445 ha) than during pre monsoon (2355 ha), indicating the rainfall dependence of the wetlands in the state. Aquatic vegetation in Pre-monsoon season is 146 ha and 19 ha in post-monsoon. The qualitative turbidity of water is low in both the seasons. Details of estimates of wetlands in Rajsamand are given in Table 30.

Table 30: Area estimates of wetlands in Rajsamand

Area in ha

Sr. No.	Wettcode	Wetland Category	Number of Wetlands	Total Wetland Area	% of wetland area	Open Water	
						Post-monsoon Area	Pre-monsoon Area
	1100	**Inland Wetlands - Natural**					
1	1101	Lakes/Ponds	4	1367	6.69	1326	672
2	1102	Ox-bow lakes/ Cut-off meanders	-	-	-	-	-
3	1103	High altitude wetlands	-	-	-	-	-
4	1104	Riverine wetlands	-	-	-	-	-
5	1105	Waterlogged	-	-	-	-	-
6	1106	River/Stream	47	6805	33.31	979	190
	1200	**Inland Wetlands -Man-made**					
7	1201	Reservoirs/Barrages	100	6518	31.90	5482	1191
8	1202	Tanks/Ponds	525	5008	24.51	3658	302
9	1203	Waterlogged	-	-	-	-	-
10	1204	Salt pans	-	-	-	-	-
		Sub-Total	**676**	**19698**	**96.42**	**11445**	**2355**
		Wetlands (<2.25 ha), mainly Tanks	732	732	3.58	-	-
		Total	**1408**	**20430**	**100.00**	**11445**	**2355**

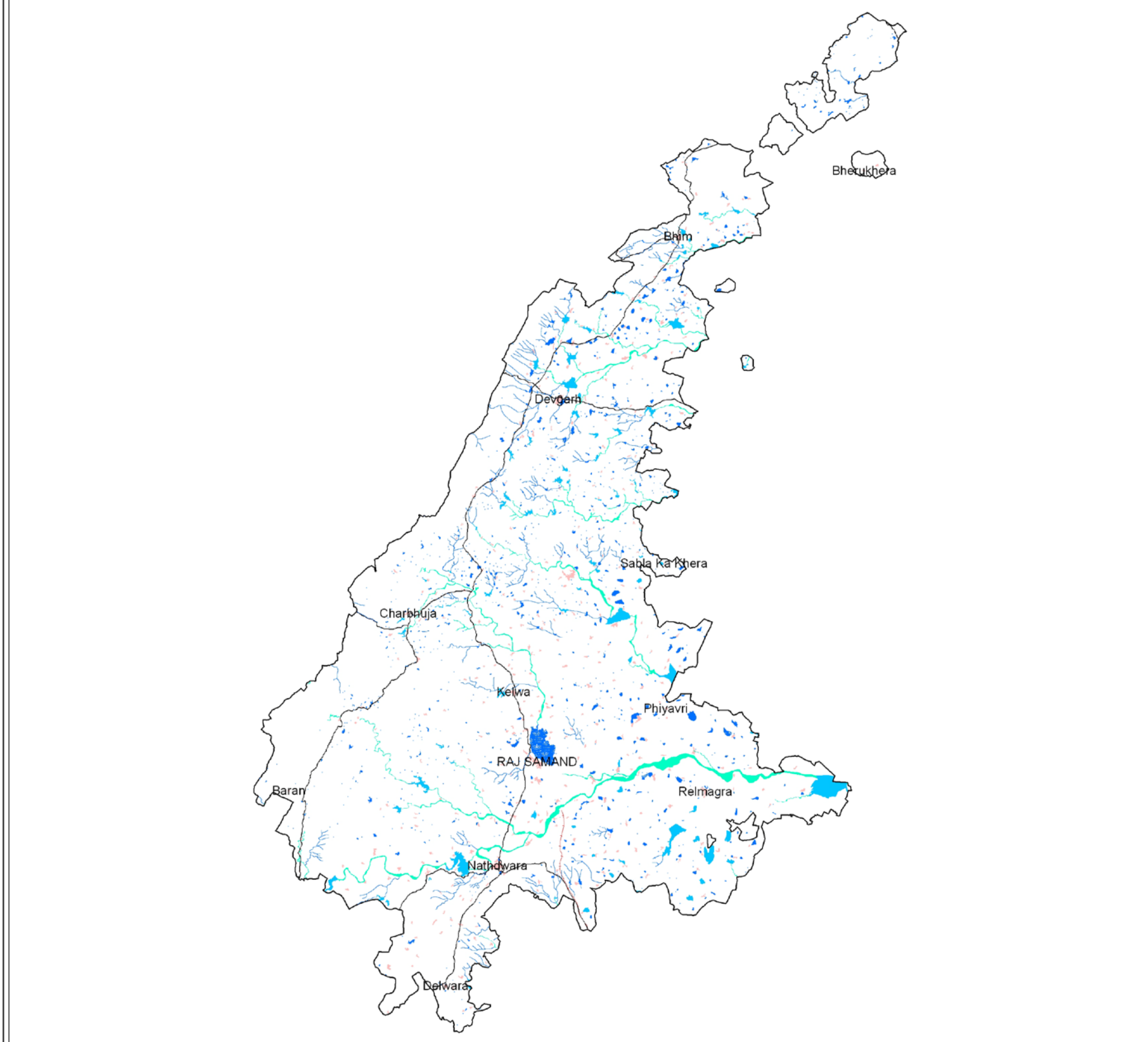
Area under Aquatic Vegetation	19	146

Area under turbidity levels		
Low	10504	1062
Moderate	690	736
High	251	557

State : Rajasthan

WETLAND MAP

District : Rajsamand

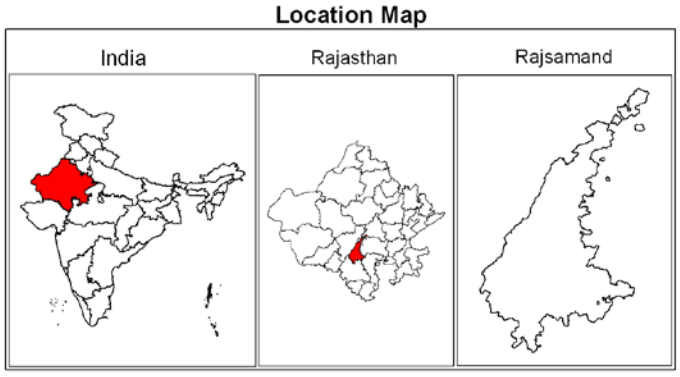


Symbol	Typecode	Level I	Level II	Level III
		Inland Wetlands		
			Natural	
	1101			Lakes/Ponds
	1102			Ox-bow lakes/ Cut-off meanders
	1103			High altitude wetlands
	1104			Reverine wetlands
	1105			Waterlogged
	1106			River/Stream
			Man-made	
	1201			Reservoirs/Barrages
	1202			Tanks/Ponds
	1203			Waterlogged
	1204			Salt pans
		Coastal Wetlands		
			Natural	
	2101			Lagoons
	2102			Creeks
	2103			Sand/Beach
	2104			Intertidal mud flats
	2105			Salt marsh
	2106			Mangroves
	2107			Coral reefs
			Man-made	
	2201			Salt pans
	2202			Aquaculture ponds

Legend

- Wetlands (<2.25ha)
- Drainage (line)
- Major Roads
- Railway
- Settlements
- Town/Settlements
- District Boundary
- State Boundary
- International Boundary

Location Map



8 4 0 8 16 Kilometers

Data Source :

IRS P6 LISS III data (Pre-monsoon and Post-monsoon Season 2006-07)

Prepared By :

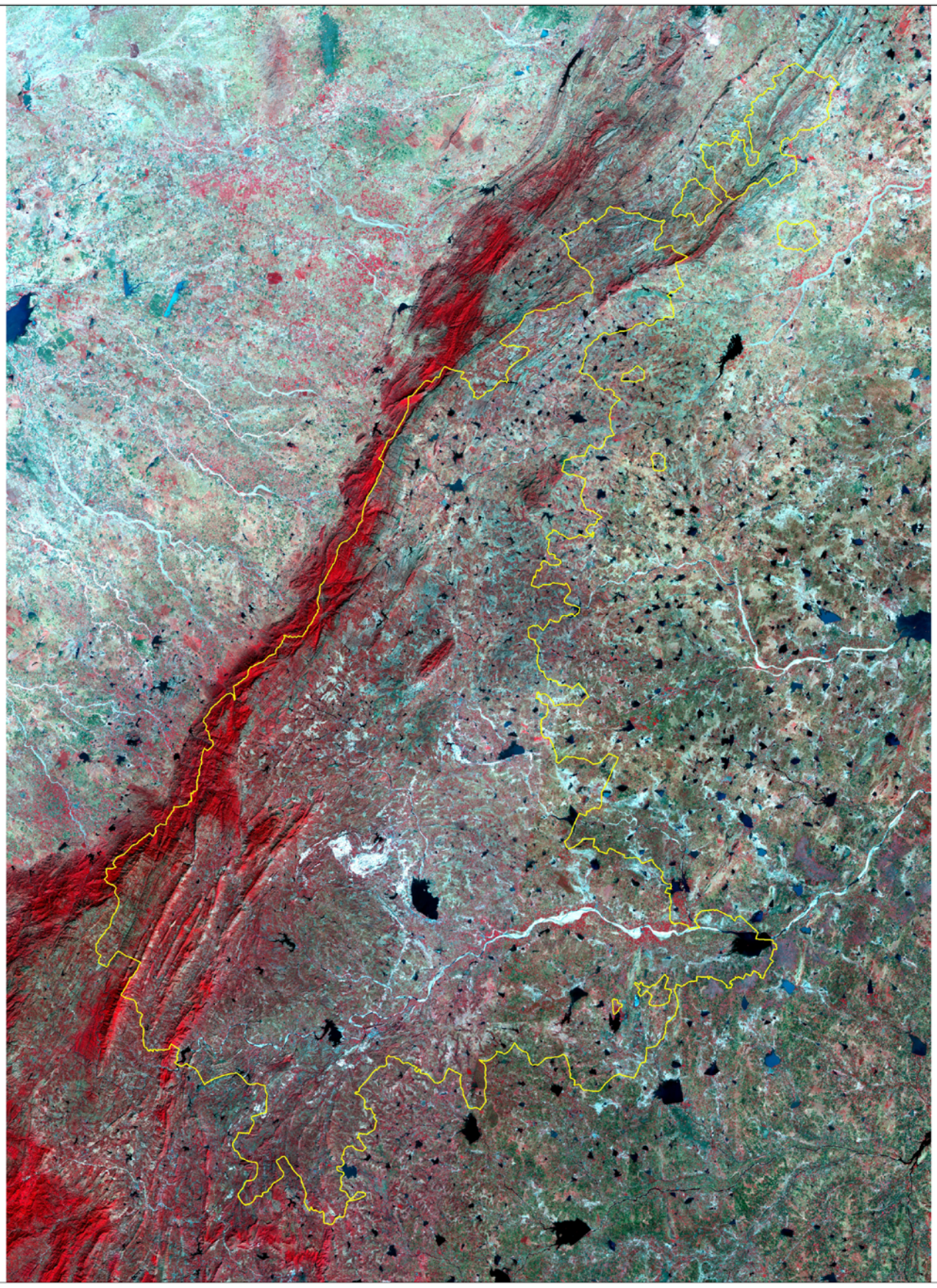
Space Applications Centre (ISRO), Ahmedabad
and
State Remote Sensing Application Centre, Jodhpur

Sponsored By:

Ministry of Environment and Forests
Government of India

State : Rajasthan

District : Rajsamand



IRS P6 LISS-III Post-monsoon data (2006).

7.1.26 Udaipur

Udaipur lies in between 23^0 45' to 25 ^{0} 10' degrees North latitude and 73^0 0' to 74^0 35' degrees East longitude. The geographical area of the district is 13430 sq. Km.. The district is bounded by Rajsamand and Pali districts in the north while, in the south by Dungarpur and Banswara. Eastern side is touches by Bhilwara and Chiittorgarh and on the west by Pali and Sirohi districts and Sabarkantha district of Gujarat. Udaipur city is located at 577 meters altitude from mean sea level. The annual rainfall is 624 mm, which is a good amount to store rainwater in major reservoirs of the district during monsoon season. The maximum temperature touches 46^0 whereas the minimum temperature is around 3^0 C.

Udaipur is also known as the city of lakes. The marble palaces, beautifully laid out gardens and the lakes make Udaipur seem almost like a mirage. The important lakes of the district area Fateh Sagar and Pichhola Lake.

Total 1661 wetlands are mapped including 772 small wetlands (< 2.25 ha) with 42292 ha area. Rivers/ streams with 14373 ha. contributed 33.99% to the total wetland area. The Reservoirs/Barrages with 13944 ha (32.97% area) is the second major wetland category, followed by Lakes/Ponds with 6908 ha area i.e. 16.33%. Thus, the district is dominated by man-made wetlands.

Open water spread of the wetlands is significantly higher in post monsoon (26524 ha) than during pre monsoon (13066 ha), indicating the rainfall dependence of the wetlands in the state. Aquatic vegetation in Pre-monsoon season is 190 ha and 75 ha in post-monsoon. The qualitative turbidity of water is low in both the seasons. Details of estimates of wetlands in Udaipur are given in Table 31.

Table 31: Area estimates of wetlands in Udaipur

Area in ha

Sr. No.	Wettcode	Wetland Category	Number of Wetlands	Total Wetland Area	% of wetland area	Open Water	
						Post-monsoon Area	Pre-monsoon Area
	1100	**Inland Wetlands - Natural**					
1	1101	Lakes/Ponds	4	6908	16.33	6747	5209
2	1102	Ox-bow lakes/ Cut-off meanders	-	-	-	-	-
3	1103	High altitude wetlands	-	-	-	-	-
4	1104	Riverine wetlands	-	-	-	-	-
5	1105	Waterlogged	-	-	-	-	-
6	1106	River/Stream	75	14373	33.99	2010	1043
	1200	**Inland Wetlands -Man-made**					
7	1201	Reservoirs/Barrages	143	13944	32.97	12813	5247
8	1202	Tanks/Ponds	667	6295	14.88	4954	1567
9	1203	Waterlogged	-	-	-	-	-
10	1204	Salt pans	-	-	-	-	-
		Sub-Total	**889**	**41520**	**98.17**	**26524**	**13066**
		Wetlands (<2.25 ha), mainly Tanks	772	772	1.83	-	-
		Total	**1661**	**42292**	**100.00**	**26524**	**13066**

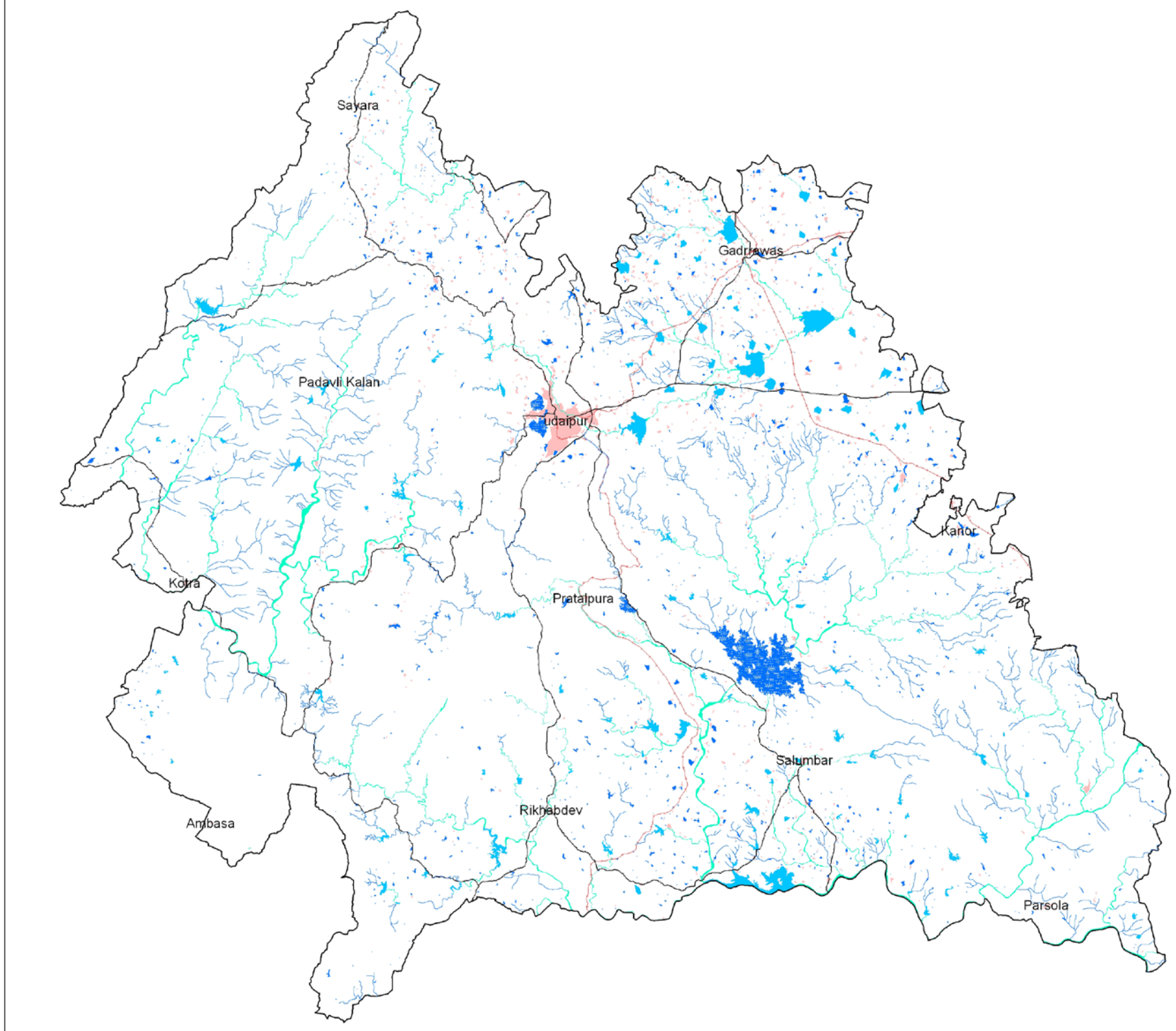
Area under Aquatic Vegetation	75	190

Area under turbidity levels		
Low	25514	11848
Moderate	869	754
High	141	464

State : Rajasthan

WETLAND MAP

District : Udaipur

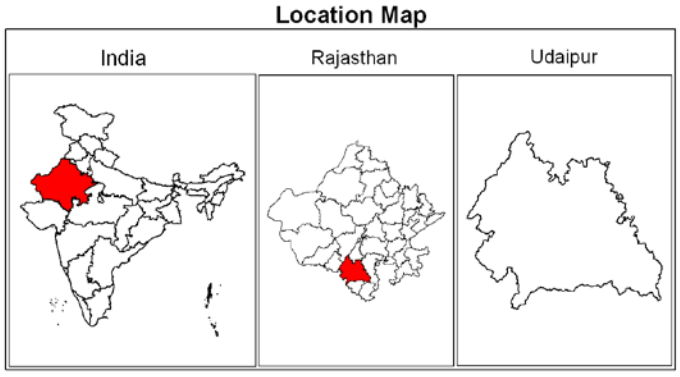


Symbol	Typecode	Level I	Level II	Level III
		Inland Wetlands		
			Natural	
	1101			Lakes/Ponds
	1102			Ox-bow lakes/ Cut-off meanders
	1103			High altitude wetlands
	1104			Reverine wetlands
	1105			Waterlogged
	1106			River/Stream
			Man-made	
	1201			Reservoirs/Barrages
	1202			Tanks/Ponds
	1203			Waterlogged
	1204			Salt pans
		Coastal Wetlands		
			Natural	
	2101			Lagoons
	2102			Creeks
	2103			Sand/Beach
	2104			Intertidal mud flats
	2105			Salt marsh
	2106			Mangroves
	2107			Coral reefs
			Man-made	
	2201			Salt pans
	2202			Aquaculture ponds

Legend

- Wetlands (<2.25ha)
- Drainage (line)
- Major Roads
- Railway
- Settlements
- Town/Settlements
- District Boundary
- State Boundary
- International Boundary

Location Map



8 4 0 8 16 Kilometers

Data Source :

IRS P6 LISS III data (Pre-monsoon and Post-monsoon Season 2006-07)

Prepared By :

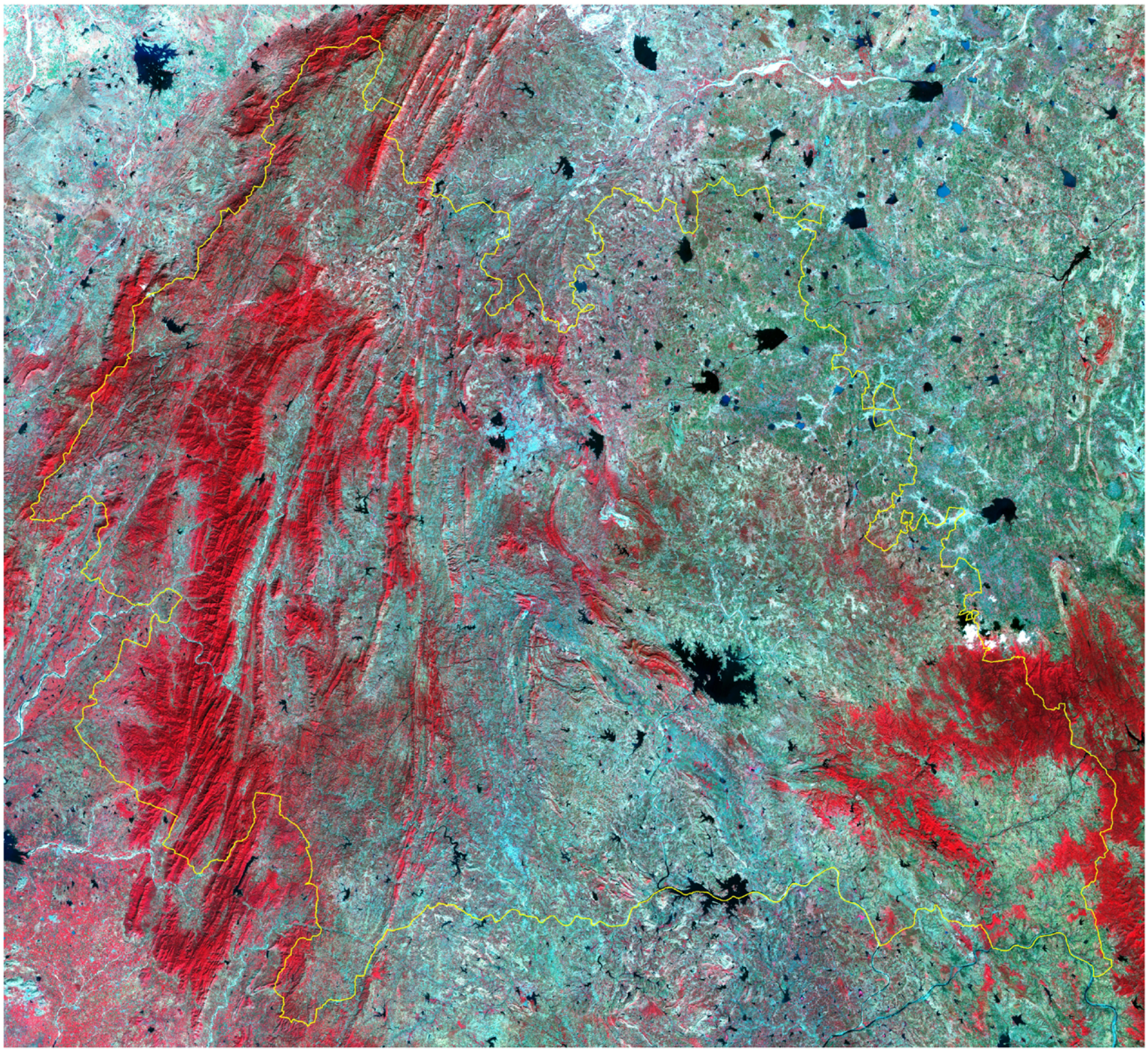
Space Applications Centre (ISRO), Ahmedabad
and
State Remote Sensing Application Centre, Jodhpur

Sponsored By:

Ministry of Environment and Forests
Government of India

State : Rajasthan

District : Udaipur



IRS P6 LISS-III Post-monsoon data (2006).

7.1.27 Dungarpur

The district Dungarpur is lies in between 23° 20’ and 24° 01’ North latitude and 73° 21’ and 74° 01’ East longitude. The geographical area of the district is 3770 sq. kms. The annual rainfall varies from 820 cms to 477cms. The maximum temperature fluctuates from 40 t0 45^0 whereas the minimum temperature touches 9^0 C. The district is located in the southern part of Rajasthan and is the smallest in terms of area. Dungarpur is surrounded by Udaipur in the north and Banswara in east respectively; on south and west, it is surrounded by the borders of the neighboring state of Gujarat.

Total 1528 wetlands are mapped including 818 small wetlands (< 2.25 ha) with 21278 ha area. Reservoirs/Barrages with 10829 ha contributed 50.89% to the total wetland area. The River/Stream with 4865 ha (22.86% area) is the second major wetland category, followed by Tanks/Ponds with 4403 ha area i.e. 20.69 %. Thus, the district is dominated by man-made wetlands.

Open water spread of the wetlands is significantly higher in post monsoon (15625 ha) than during pre monsoon (8537 ha), indicating the rainfall dependence of the wetlands in the state. Aquatic vegetation in post-monsoon is 120 ha and in Pre-monsoon, it is 367 ha. The qualitative turbidity of water is low in both the seasons. Details of estimates of wetlands in Dungarpur are given in Table 32.

Table 32: Area estimates of wetlands in Dungarpur

Area in ha

Sr. No.	Wettcode	Wetland Category	Number of Wetlands	Total Wetland Area	% of wetland area	Open Water	
						Post-monsoon Area	Pre-monsoon Area
	1100	**Inland Wetlands - Natural**					
1	1101	Lakes/Ponds	5	363	1.71	299	95
2	1102	Ox-bow lakes/ Cut-off meanders	-	-	-	-	-
3	1103	High altitude wetlands	-	-	-	-	-
4	1104	Riverine wetlands	-	-	-	-	-
5	1105	Waterlogged	-	-	-	-	-
6	1106	River/Stream	29	4865	22.86	1631	1382
	1200	**Inland Wetlands -Man-made**					
7	1201	Reservoirs/Barrages	101	10829	50.89	10179	6317
8	1202	Tanks/Ponds	575	4403	20.69	3516	743
9	1203	Waterlogged	-	-	-	-	-
10	1204	Salt pans	-	-	-	-	-
		Sub-Total	**710**	**20460**	**96.16**	**15625**	**8537**
		Wetlands (<2.25 ha), mainly Tanks	818	818	3.84	-	-
		Total	**1528**	**21278**	**100.00**	**15625**	**8537**

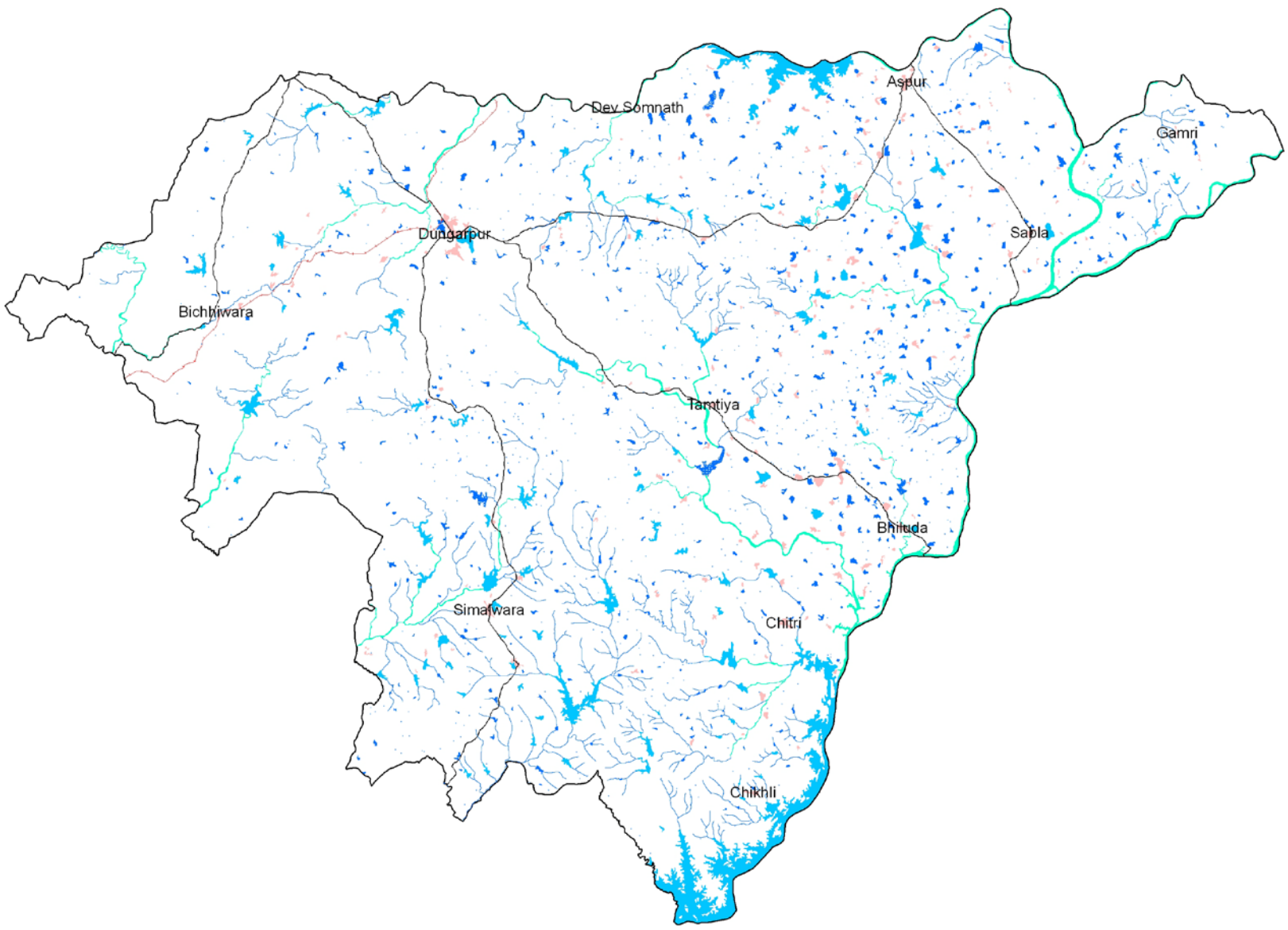
Area under Aquatic Vegetation	120	367

Area under turbidity levels		
Low	15153	8526
Moderate	452	-
High	20	11

State : Rajasthan

WETLAND MAP

District : Dungarpur

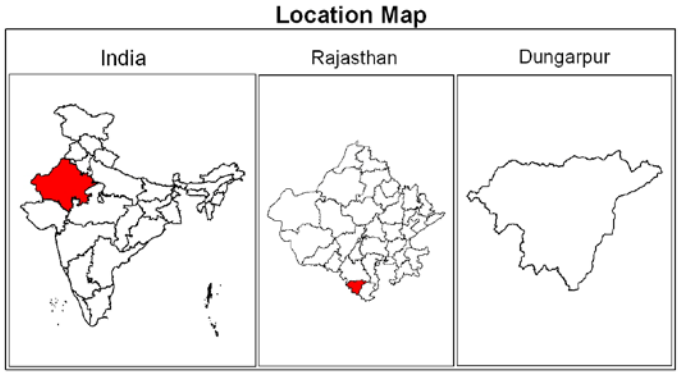


Symbol	Typecode	Level I	Level II	Level III
		Inland Wetlands		
			Natural	
	1101			Lakes/Ponds
	1102			Ox-bow lakes/ Cut-off meanders
	1103			High altitude wetlands
	1104			Reverine wetlands
	1105			Waterlogged
	1106			River/Stream
			Man-made	
	1201			Reservoirs/Barrages
	1202			Tanks/Ponds
	1203			Waterlogged
	1204			Salt pans
		Coastal Wetlands		
			Natural	
	2101			Lagoons
	2102			Creeks
	2103			Sand/Beach
	2104			Intertidal mud flats
	2105			Salt marsh
	2106			Mangroves
	2107			Coral reefs
			Man-made	
	2201			Salt pans
	2202			Aquaculture ponds

Legend

- Wetlands (<2.25ha)
- Drainage (line)
- Major Roads
- Railway
- Settlements
- Town/Settlements
- District Boundary
- State Boundary
- International Boundary

Location Map



6 3 0 6 12 Kilometers

Data Source :

IRS P6 LISS III data (Pre-monsoon and Post-monsoon Season 2006-07)

Prepared By :

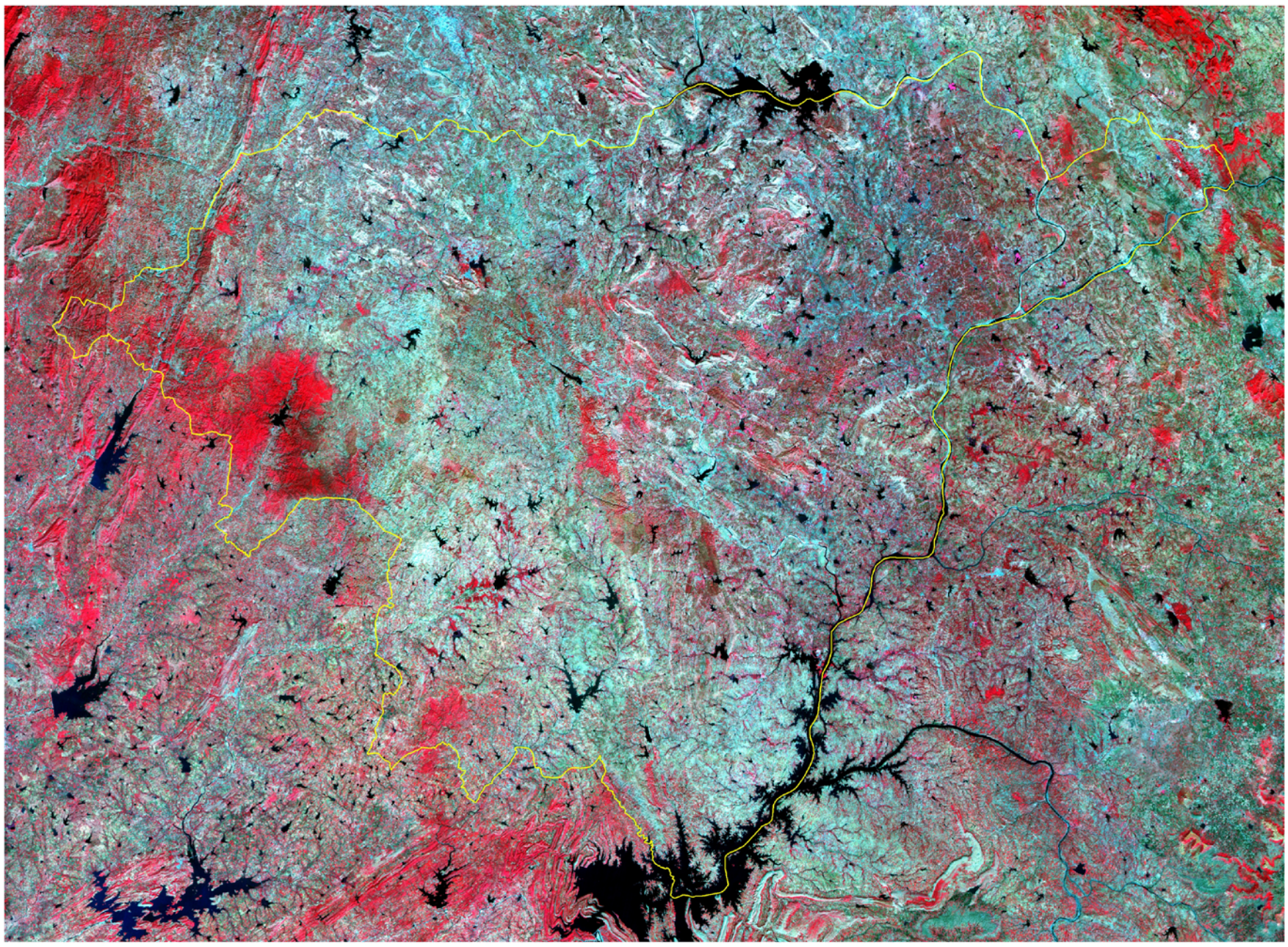
Space Applications Centre (ISRO), Ahmedabad
and
State Remote Sensing Application Centre, Jodhpur

Sponsored By:

Ministry of Environment and Forests
Government of India

State : Rajasthan

District : Dungarpur



IRS P6 LISS-III Post-monsoon data (2006).

7.1.28 Banswara

The district is located in the southern region of the state and lies in between 23° 11' and 23° 55' North latitude and 74° 00' and 74° 47' East longitude. It is bounded on the north by Dhariawad tehsil of Udaipur district and Chittourgarh district. On the south by Bhilwara district, on the east by Jaipur and Tonk districts and on the west by Pali district. It also touches the boundary of Panchmahal district of Gujarat on the south-west. The total area of the district is 5037 sq. kms. The maximum temperature of 46^0 C reaches during summer months while the minimum 8^0 C during winter season. The average rainfall is around 92 cms.

The region represents a rugged terrain punctuated by short ridges west of Banaswar. The eastern part of the district is occupied by flat-topped hills of the Deccan trap. The forest in the district constituting mainly teak, are situated on the slopes of the Aravali hills and undulating terrain. The area is drained by drainage system of Mahi River, which originates near Dhar district of Madhya Pradesh.

Total 913 wetlands are mapped including 443 small wetlands (< 2.25 ha) with 32468 ha area. Reservoirs/Barrages with 18858 ha. contributed 58.08% to the total wetland area. The River/Stream with 9956 ha (30.66% area) is the second major wetland category, followed by Tanks/Ponds with 3211 ha area i.e. 9.89 %. Thus, the district is dominated by man-made wetlands.

Open water spread of the wetlands is significantly higher in post monsoon (24334 ha) than during pre monsoon (11620 ha), indicating the rainfall dependence of the wetlands in the state. Aquatic vegetation in post-monsoon is 137 ha and in Pre-monsoon, it is 624 ha. The qualitative turbidity of water is low in both the seasons. Details of estimates of wetlands in Banswara are given in Table 33.

Table 33: Area estimates of wetlands in Banswara

Area in ha

Sr. No.	Wettcode	Wetland Category	Number of Wetlands	Total Wetland Area	% of wetland area	Open Water	
						Post-monsoon Area	Pre-monsoon Area
	1100	**Inland Wetlands - Natural**					
1	1101	Lakes/Ponds	-	-	-	-	-
2	1102	Ox-bow lakes/ Cut-off meanders	-	-	-	-	-
3	1103	High altitude wetlands	-	-	-	-	-
4	1104	Riverine wetlands	-	-	-	-	-
5	1105	Waterlogged	-	-	-	-	-
6	1106	River/Stream	38	9956	30.66	4018	2500
	1200	**Inland Wetlands -Man-made**					
7	1201	Reservoirs/Barrages	95	18858	58.08	17787	8279
8	1202	Tanks/Ponds	337	3211	9.89	2529	841
9	1203	Waterlogged	-	-	-	-	-
10	1204	Salt pans	-	-	-	-	-
		Sub-Total	**470**	**32025**	**98.64**	**24334**	**11620**
		Wetlands (<2.25 ha), mainly Tanks	443	443	1.36	-	-
		Total	**913**	**32468**	**100.00**	**24334**	**11620**

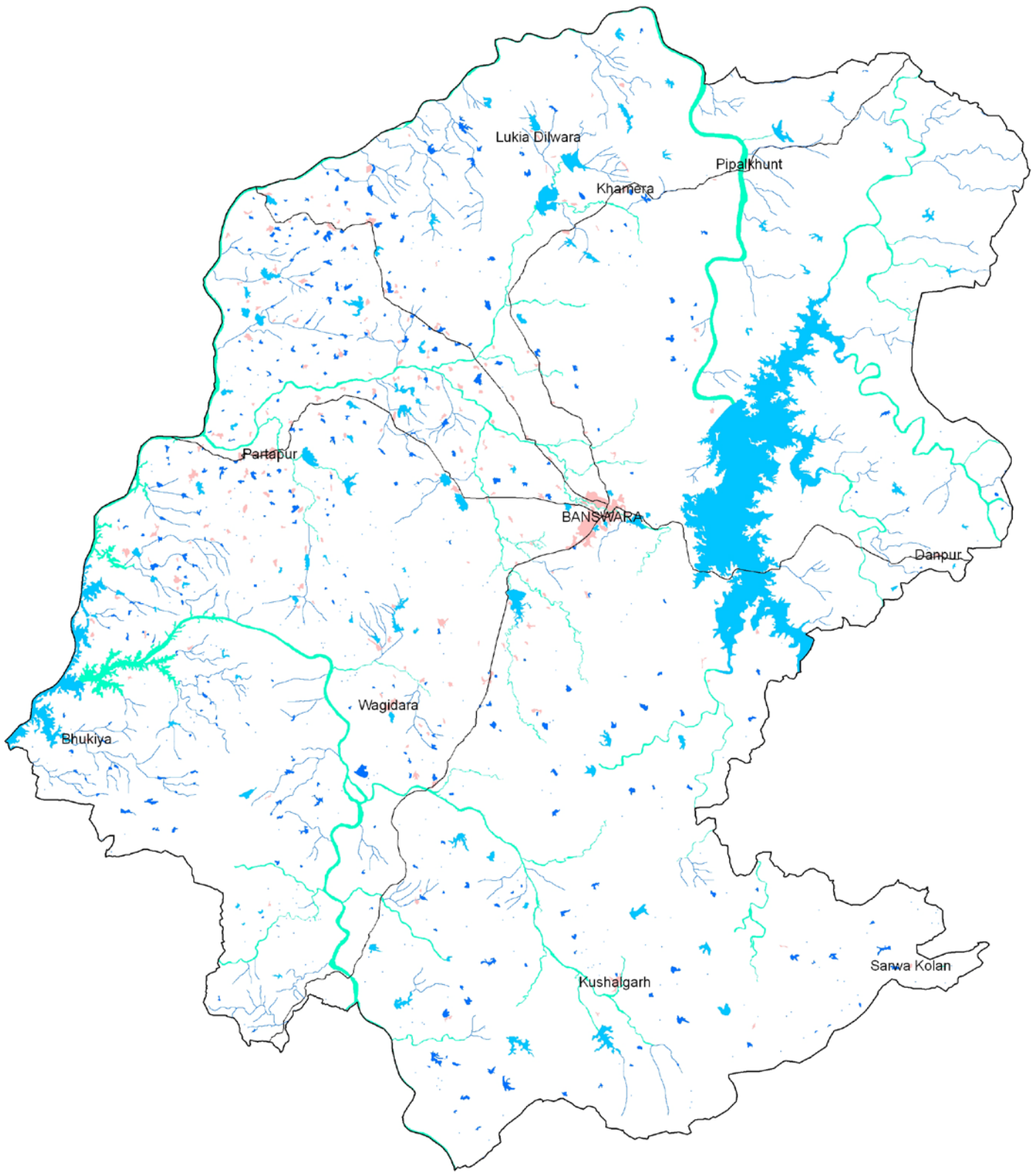
Area under Aquatic Vegetation	137	624

Area under turbidity levels		
Low	19572	5768
Moderate	4676	167
High	86	5685

State : Rajasthan

WETLAND MAP

District : Banswara

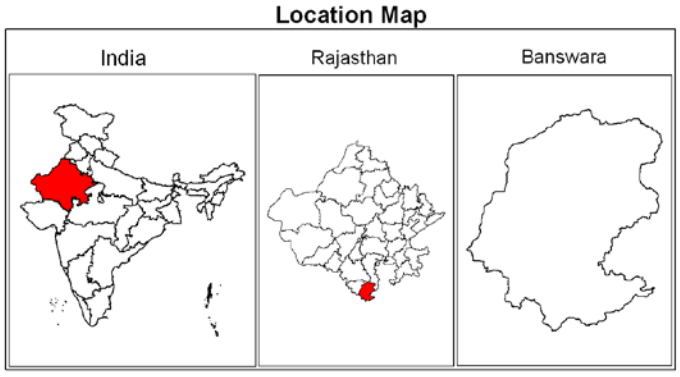


Symbol	Typecode	Level I	Level II	Level III
		Inland Wetlands		
			Natural	
	1101			Lakes/Ponds
	1102			Ox-bow lakes/ Cut-off meanders
	1103			High altitude wetlands
	1104			Reverine wetlands
	1105			Waterlogged
	1106			River/Stream
			Man-made	
	1201			Reservoirs/Barrages
	1202			Tanks/Ponds
	1203			Waterlogged
	1204			Salt pans
		Coastal Wetlands		
			Natural	
	2101			Lagoons
	2102			Creeks
	2103			Sand/Beach
	2104			Intertidal mud flats
	2105			Salt marsh
	2106			Mangroves
	2107			Coral reefs
			Man-made	
	2201			Salt pans
	2202			Aquaculture ponds

Legend

- Wetlands (<2.25ha)
- Drainage (line)
- Major Roads
- Railway
- Settlements
- Town/Settlements
- District Boundary
- State Boundary
- International Boundary

Location Map



8 4 0 8 16 Kilometers

Data Source :

IRS P6 LISS III data (Pre-monsoon and Post-monsoon Season 2006-07)

Prepared By :

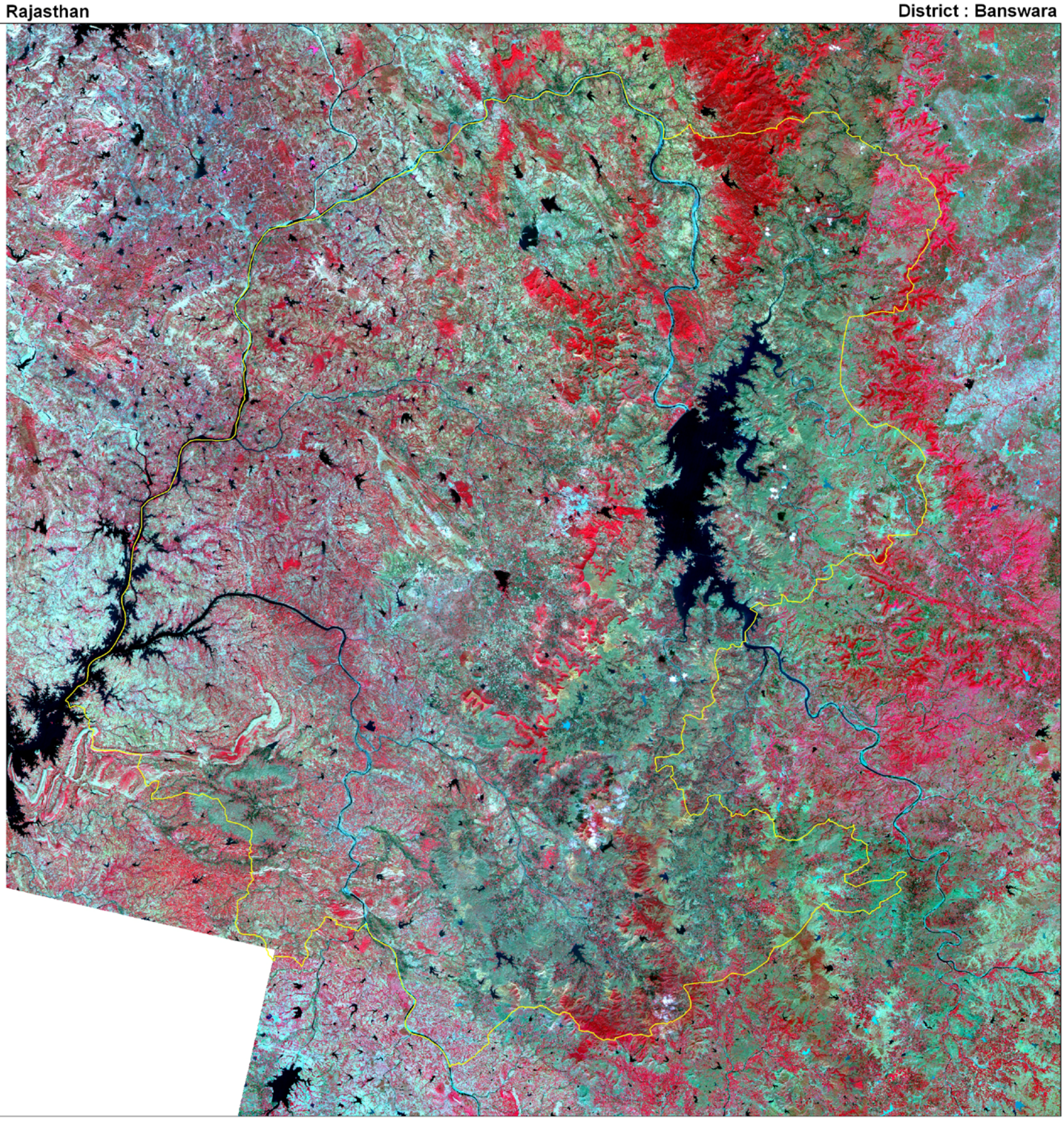
Space Applications Centre (ISRO), Ahmedabad
and
State Remote Sensing Application Centre, Jodhpur

Sponsored By:

Ministry of Environment and Forests
Government of India

State : Rajasthan

District : Banswara



IRS P6 LISS-III Post-monsoon data (2006).

7.1.29 Chittaurgarh

Chittaugarh district is situated in the south-eastern part of the state of Rajasthan. It lies in between 25° 01' and 25° 58' north latitude and 74° 01' and 75° 28' east longitude. The total geographical area of the district is 10856 sq. kms. It is surrounded by Kota in the east and Mandsaur district of Madhya Pradesh and Banswara in the south-west, Udaipur and Rajsamand in the west and Bhilwara and Bundi in the north. Chittaugarh is a bustling industrial town in Rajasthan known for its Marble Industry, Cement Plants, Zinc Smelter and Industrial Materials. The average rainfall is 85 cms. The maximum temperature reaches 45^0 while and minimum temperature touches 7^0 C.

Major tourist attractions in the district are Bassi Wildlife Sanctuary, Bhainsorgarh Wildlife Sanctuary, and Sitamata Sanctuary.

Total 1815 wetlands are mapped including 1020 small wetlands (< 2.25 ha) with 55537 ha area. Reservoirs/Barrages with 35786 ha. contributed 64.44% to the total wetland area. The River/Stream with 9360 ha (16.85% area) is the second major wetland category, followed by Tanks/Ponds with 9145 ha area i.e. 16.47 %. Thus, the district is dominated by man-made wetlands.

Open water spread of the wetlands is significantly higher in post monsoon (45192 ha) than during pre monsoon (27867 ha), indicating the rainfall dependence of the wetlands in the state. Aquatic vegetation in post-monsoon season is 126 ha and in Pre-monsoon, it is 1128 ha which is much more higher. The qualitative turbidity of water is low in both the seasons. Details of estimates of wetlands in Chittaurgarh are given in Table 34.

Table 34: Area estimates of wetlands in Chittaurgarh

Area in ha

Sr. No.	Wettcode	Wetland Category	Number of Wetlands	Total Wetland Area	% of wetland area	Open Water	
						Post-monsoon Area	Pre-monsoon Area
	1100	**Inland Wetlands - Natural**					
1	1101	Lakes/Ponds	3	226	0.41	205	70
2	1102	Ox-bow lakes/ Cut-off meanders	-	-	-	-	-
3	1103	High altitude wetlands	-	-	-	-	-
4	1104	Riverine wetlands	-	-	-	-	-
5	1105	Waterlogged	-	-	-	-	-
6	1106	River/Stream	86	9360	16.85	4494	2091
	1200	**Inland Wetlands -Man-made**					
7	1201	Reservoirs/Barrages	65	35786	64.44	34333	23518
8	1202	Tanks/Ponds	641	9145	16.47	6160	2188
9	1203	Waterlogged	-	-	-	-	-
10	1204	Salt pans	-	-	-	-	-
		Sub-Total	**795**	**54517**	**98.16**	**45192**	**27867**
		Wetlands (<2.25 ha), mainly Tanks	1020	1020	1.84	-	-
		Total	**1815**	**55537**	**100.00**	**45192**	**27867**

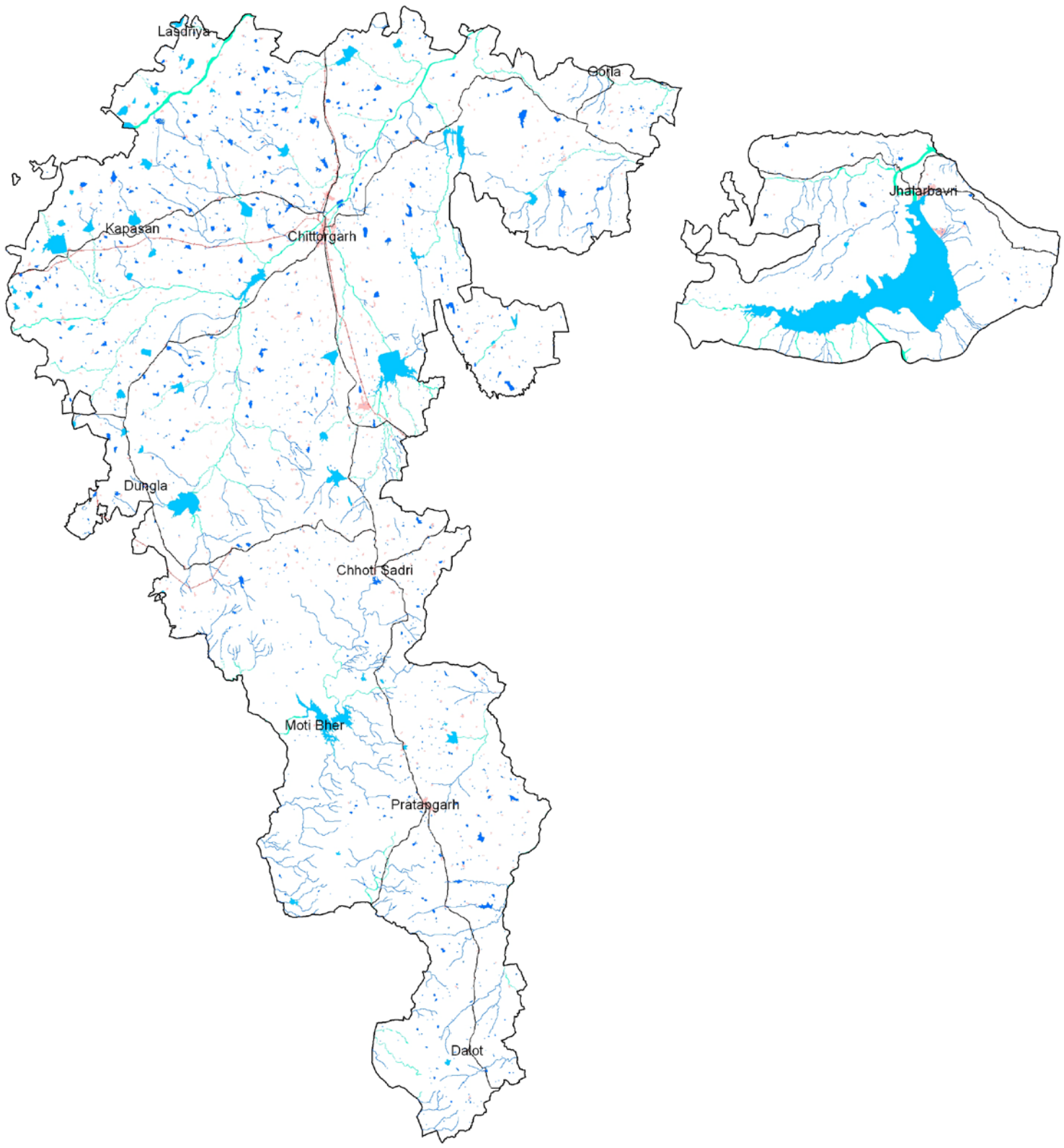
Area under Aquatic Vegetation	126	1128

Area under turbidity levels		
Low	41020	26410
Moderate	3340	114
High	821	1343

State : Rajasthan

WETLAND MAP

District : Chittaurgarh

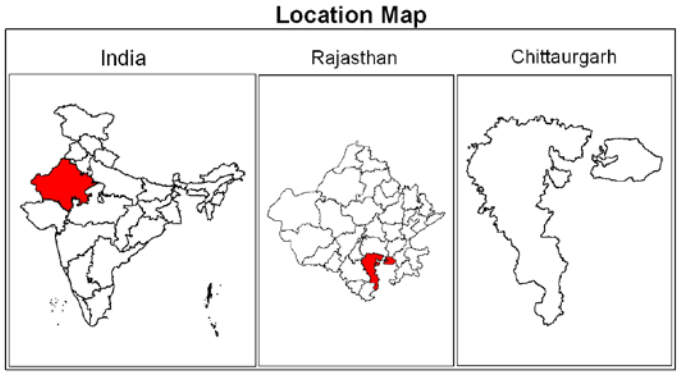


Symbol	Typecode	Level I	Level II	Level III
		Inland Wetlands		
			Natural	
	1101			Lakes/Ponds
	1102			Ox-bow lakes/ Cut-off meanders
	1103			High altitude wetlands
	1104			Reverine wetlands
	1105			Waterlogged
	1106			River/Stream
			Man-made	
	1201			Reservoirs/Barrages
	1202			Tanks/Ponds
	1203			Waterlogged
	1204			Salt pans
		Coastal Wetlands		
			Natural	
	2101			Lagoons
	2102			Creeks
	2103			Sand/Beach
	2104			Intertidal mud flats
	2105			Salt marsh
	2106			Mangroves
	2107			Coral reefs
			Man-made	
	2201			Salt pans
	2202			Aquaculture ponds

Legend

- Wetlands (<2.25ha)
- Drainage (line)
- Major Roads
- Railway
- Settlements
- Town/Settlements
- District Boundary
- State Boundary
- International Boundary

Location Map



10 5 0 10 20 Kilometers

Data Source :

IRS P6 LISS III data (Pre-monsoon and Post-monsoon Season 2006-07)

Prepared By :

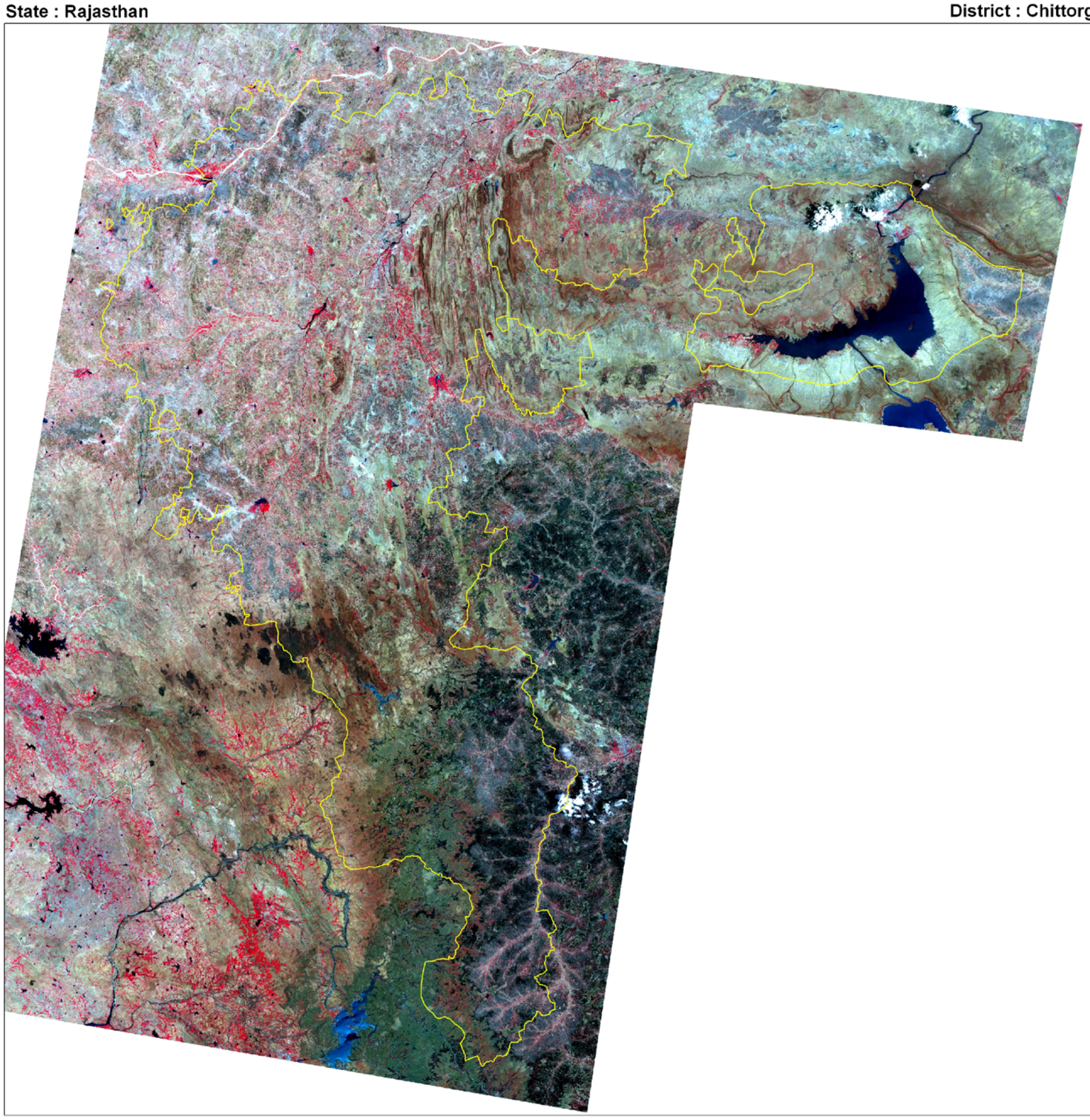
Space Applications Centre (ISRO), Ahmedabad
and
State Remote Sensing Application Centre, Jodhpur

Sponsored By:

Ministry of Environment and Forests
Government of India

State : Rajasthan

District : Chittorgarh



IRS P6 LISS-III Pre-monsoon data (2006).

7.1.30 Kota

Kota is situated on the banks of the river Chambal. The administrative head quarter of the district is located at Kota and it the fifth largest city of Rajastthan. The central co-ordinates of the district head quarters are 25^0 18' North latitude and 76^0 23' East longitude. The district is bounded on the north and north-west by Sawai Madhopur, Tonk and Bundi districts. The Chambal River separates these districts from Kota district. The geographical area of the district is 5446 sq. Km. The average rainfall is 89 cm. The maximum temperature touches 45^0 whereas the minimum temperature 9^0 C.

Total 919 wetlands are mapped including 680 small wetlands (< 2.25 ha) with 16316 ha area. River/Stream with 10780 ha. contributed 66.07% to the total wetland area. The Tanks/Ponds with 3171 ha (19.43% area) is the second major wetland category, followed by Reservoirs/Barrages with 1238 ha area i.e. 7.59 %. Thus, the district is dominated by natural wetlands.

Open water spread of the wetlands is significantly higher in post monsoon (10055 ha) than during pre monsoon (5709 ha), indicating the rainfall dependence of the wetlands in the state. Aquatic vegetation in post-monsoon season is 140 ha and in Pre-monsoon, it is 177 ha. The qualitative turbidity of water is low in both the seasons. Details of estimates of wetlands in Kota are given in Table 35.

Table 35: Area estimates of wetlands in Kota

Area in ha

Sr. No.	Wettcode	Wetland Category	Number of Wetlands	Total Wetland Area	% of wetland area	Open Water	
						Post-monsoon Area	Pre-monsoon Area
	1100	**Inland Wetlands - Natural**					
1	1101	Lakes/Ponds	1	447	2.74	412	163
2	1102	Ox-bow lakes/ Cut-off meanders	-	-	-	-	-
3	1103	High altitude wetlands	-	-	-	-	-
4	1104	Riverine wetlands	-	-	-	-	-
5	1105	Waterlogged	-	-	-	-	-
6	1106	River/Stream	20	10780	66.07	6305	5057
	1200	**Inland Wetlands -Man-made**					
7	1201	Reservoirs/Barrages	3	1238	7.59	1215	106
8	1202	Tanks/Ponds	215	3171	19.43	2123	383
9	1203	Waterlogged	-	-	-	-	-
10	1204	Salt pans	-	-	-	-	-
		Sub-Total	**239**	**15636**	**95.83**	**10055**	**5709**
		Wetlands (<2.25 ha), mainly Tanks	680	680	4.17	-	-
		Total	**919**	**16316**	**100.00**	**10055**	**5709**

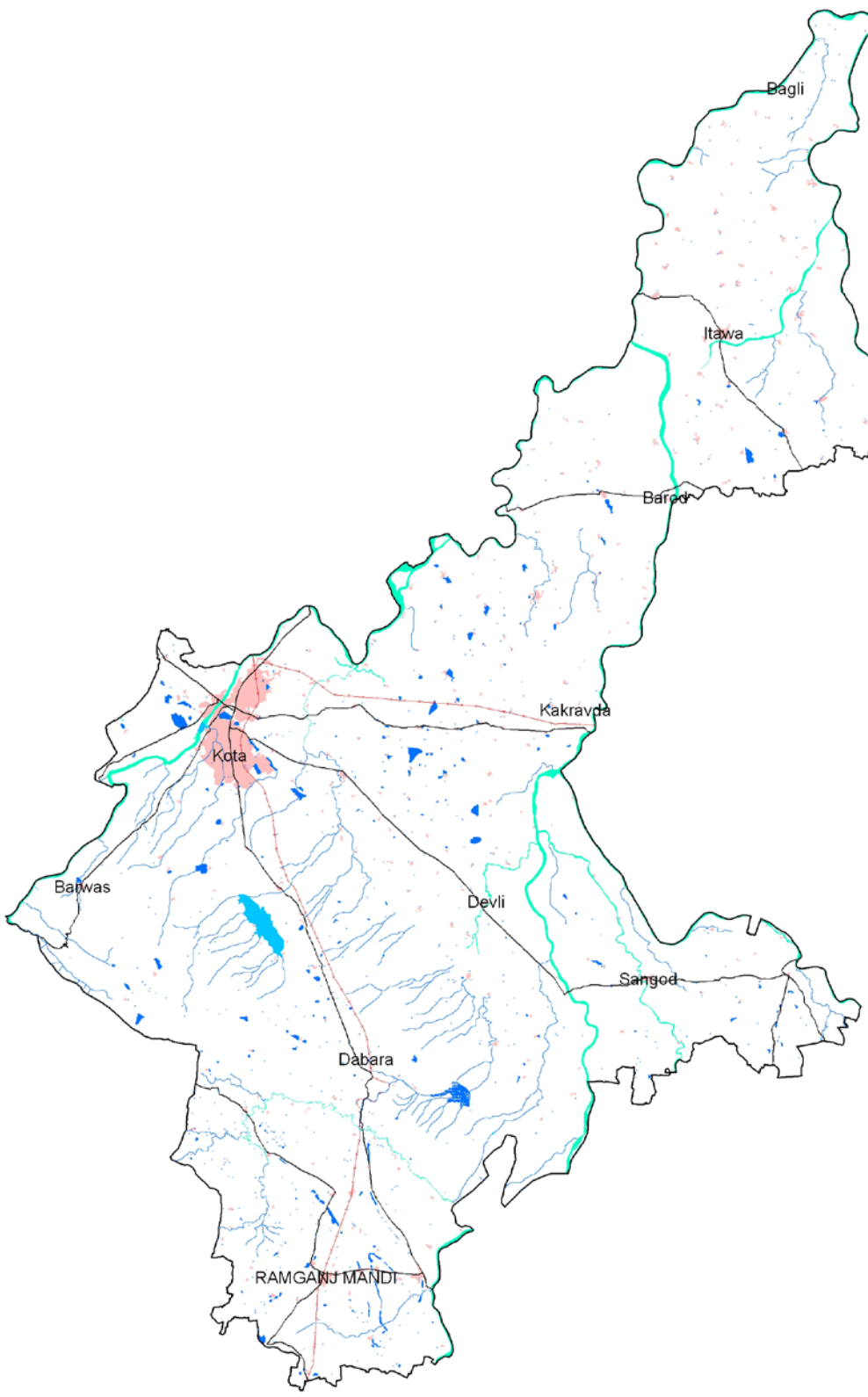
Area under Aquatic Vegetation	140	177

Area under turbidity levels		
Low	7634	5408
Moderate	1735	219
High	686	82

State : Rajasthan

WETLAND MAP

District : Kota

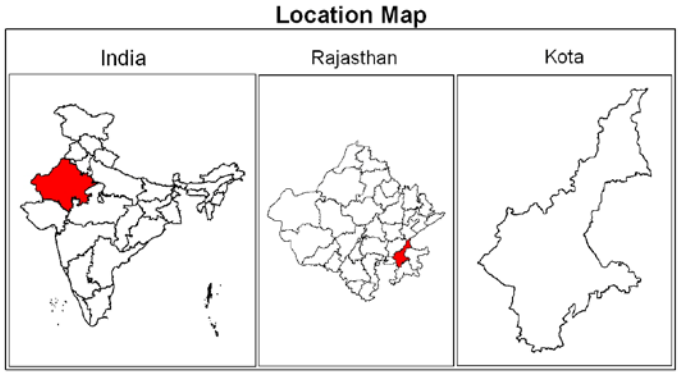


Symbol	Typecode	Level I	Level II	Level III
		Inland Wetlands		
			Natural	
	1101			Lakes/Ponds
	1102			Ox-bow lakes/ Cut-off meanders
	1103			High altitude wetlands
	1104			Reverine wetlands
	1105			Waterlogged
	1106			River/Stream
			Man-made	
	1201			Reservoirs/Barrages
	1202			Tanks/Ponds
	1203			Waterlogged
	1204			Salt pans
		Coastal Wetlands		
			Natural	
	2101			Lagoons
	2102			Creeks
	2103			Sand/Beach
	2104			Intertidal mud flats
	2105			Salt marsh
	2106			Mangroves
	2107			Coral reefs
			Man-made	
	2201			Salt pans
	2202			Aquaculture ponds

Legend

- Wetlands (<2.25ha)
- Drainage (line)
- Major Roads
- Railway
- Settlements
- Town/Settlements
- District Boundary
- State Boundary
- International Boundary

Location Map



6 3 0 6 12 Kilometers

Data Source :

IRS P6 LISS III data (Pre-monsoon and Post-monsoon Season 2006-07)

Prepared By :

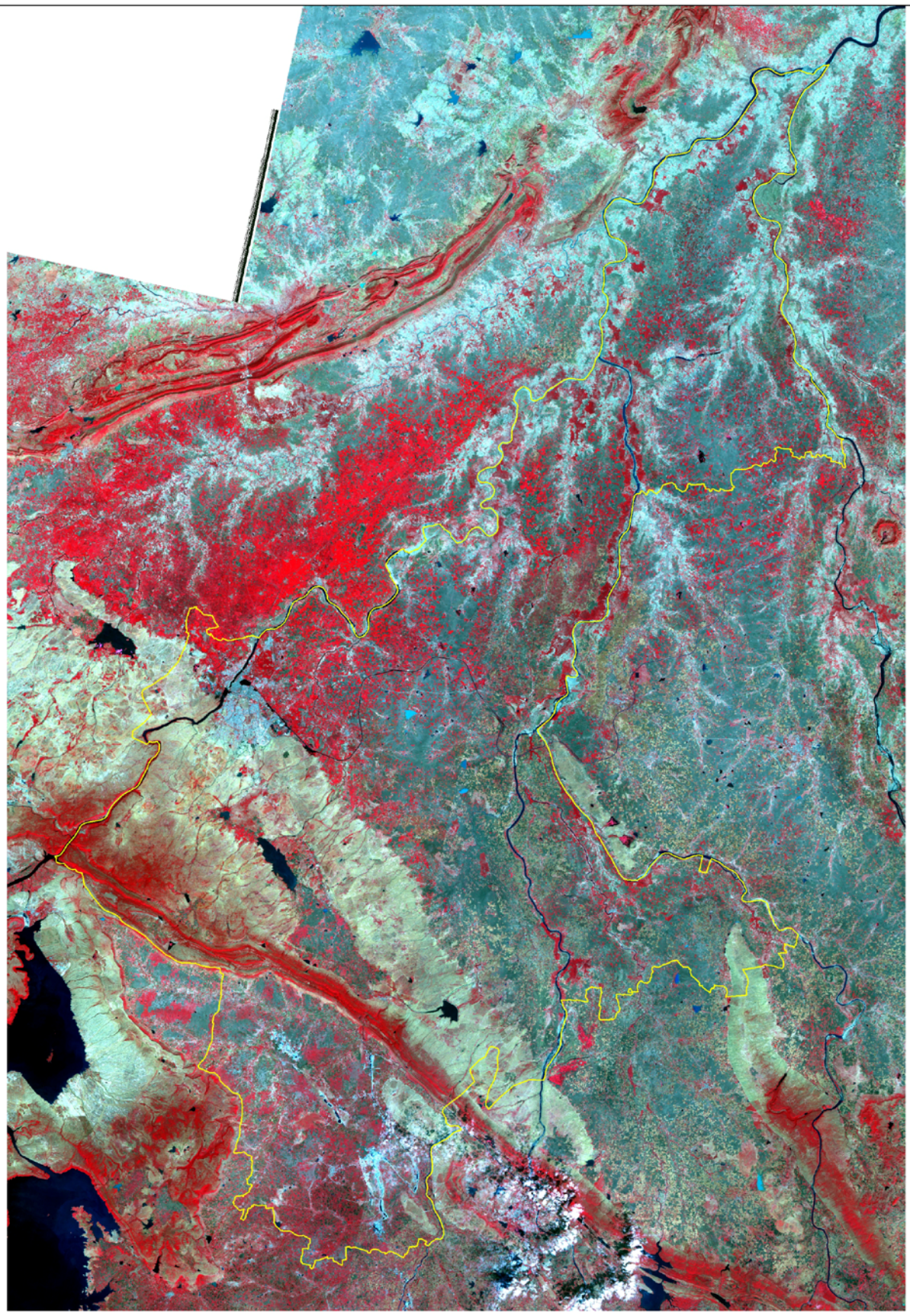
Space Applications Centre (ISRO), Ahmedabad
and
State Remote Sensing Application Centre, Jodhpur

Sponsored By:

Ministry of Environment and Forests
Government of India

State : Rajasthan

District : Kota



IRS P6 LISS-III Post-monsoon data (2006).

7.1.31 Baran

Baran district is lies in between 24° 25’ and 25° 25’ North latitude and 76° 12’ and 77° 26’ East longitude. The area is 6955 sq. km. The district is bounded by Piplda of Kota district on the northern side and on the east by Madhya Pradesh. The maximum length of the district from North to South is 103 km and maximum width from west to east is 104kms. The land slopes gently northward. It is well watered, drained by rivers Chambal and its tributaries flowing in north and north-eastern direction. The highest point is Mamooni (546 meters) located at Shahabad Tehsil. Temperature touches 46^0 C during summer and the minimum 3^0 C during winter season. The annual rainfall is around 854 mm.

Total 1229 wetlands are mapped including 867 small wetlands (< 2.25 ha) with 22602 ha area. River/Stream with 14570 ha. contributed 64.46% to the total wetland area. The Reservoirs/Barrages with 4479 ha (19.82% area) is the second major wetland category, followed by Tanks/Ponds with 2635 ha area i.e. 11.66 %. Thus, the district is dominated by natural wetlands.

Open water spread of the wetlands is significantly higher in post monsoon (10553 ha) than during pre monsoon (3114 ha), indicating the rainfall dependence of the wetlands in the state. Aquatic vegetation in post-monsoon season is 365 ha and it is negligible in Pre-monsoon season which is 8 ha. The qualitative turbidity of water is low in both the seasons. Details of estimates of wetlands in Baran are given in Table 36.

Table 36: Area estimates of wetlands in Baran

Area in ha

Sr. No.	Wettcode	Wetland Category	Number of Wetlands	Total Wetland Area	% of wetland area	Open Water	
						Post-monsoon Area	Pre-monsoon Area
	1100	**Inland Wetlands - Natural**					
1	1101	Lakes/Ponds	1	51	0.23	28	13
2	1102	Ox-bow lakes/ Cut-off meanders	-	-	-	-	-
3	1103	High altitude wetlands	-	-	-	-	-
4	1104	Riverine wetlands	-	-	-	-	-
5	1105	Waterlogged	-	-	-	-	-
6	1106	River/Stream	79	14570	64.46	4669	2192
	1200	**Inland Wetlands -Man-made**					
7	1201	Reservoirs/Barrages	23	4479	19.82	4015	652
8	1202	Tanks/Ponds	259	2635	11.66	1841	257
9	1203	Waterlogged	-	-	-	-	-
10	1204	Salt pans	-	-	-	-	-
		Sub-Total	**362**	**21735**	**96.16**	**10553**	**3114**
		Wetlands (<2.25 ha), mainly Tanks	867	867	3.84	-	-
		Total	**1229**	**22602**	**100.00**	**10553**	**3114**

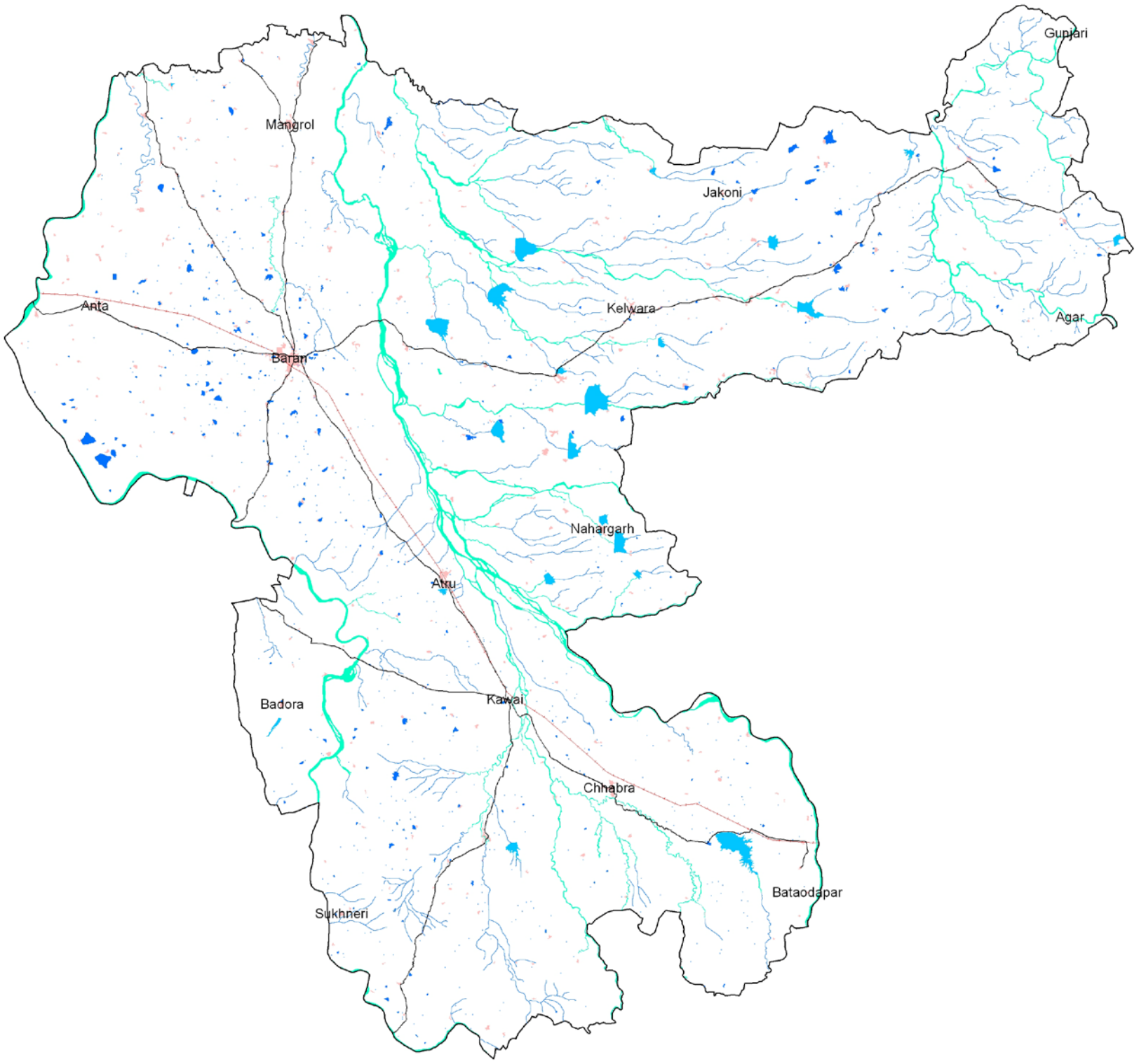
Area under Aquatic Vegetation	365	8

Area under turbidity levels		
Low	7479	2281
Moderate	937	741
High	2148	92

State : Rajasthan

WETLAND MAP

District : Baran

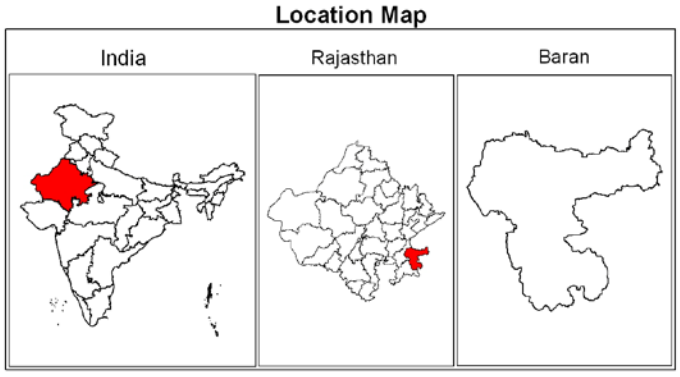


Symbol	Typecode	Level I	Level II	Level III
		Inland Wetlands		
			Natural	
	1101			Lakes/Ponds
	1102			Ox-bow lakes/ Cut-off meanders
	1103			High altitude wetlands
	1104			Reverine wetlands
	1105			Waterlogged
	1106			River/Stream
			Man-made	
	1201			Reservoirs/Barrages
	1202			Tanks/Ponds
	1203			Waterlogged
	1204			Salt pans
		Coastal Wetlands		
			Natural	
	2101			Lagoons
	2102			Creeks
	2103			Sand/Beach
	2104			Intertidal mud flats
	2105			Salt marsh
	2106			Mangroves
	2107			Coral reefs
			Man-made	
	2201			Salt pans
	2202			Aquaculture ponds

Legend

- Wetlands (<2.25ha)
- Drainage (line)
- Major Roads
- Railway
- Settlements
- Town/Settlements
- District Boundary
- State Boundary
- International Boundary

Location Map



10 5 0 10 20 Kilometers

Data Source :

IRS P6 LISS III data (Pre-monsoon and Post-monsoon Season 2006-07)

Prepared By :

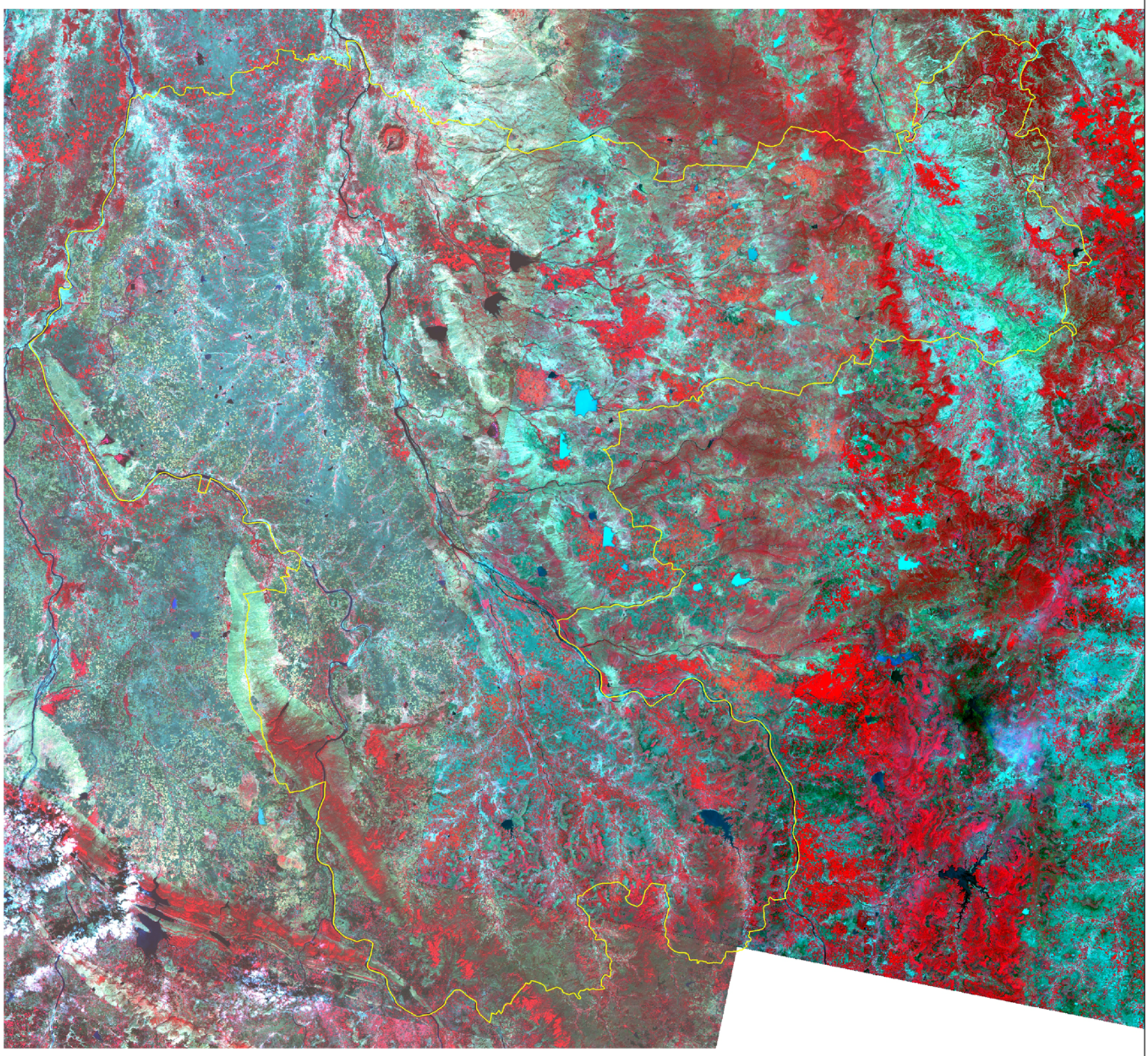
Space Applications Centre (ISRO), Ahmedabad
and
State Remote Sensing Application Centre, Jodhpur

Sponsored By:

Ministry of Environment and Forests
Government of India

State : Rajasthan

District : Baran



IRS P6 LISS-III Post-monsoon data (2006).

7.1.32 Jhalawar

Jhalawar district is located in the south-eastern region of Rajasthan, at the edge of Malwa Plateau. The central co-ordinates of the district are 24^0 06' North latitude and 76^0 05' East longitude. It shares common boundaries with the state of Madhya Pradesh on the South-West and East; in the North it touches the Mukandra range, running from North- West to East forms a rough boundary between the two district viz. Jhalawar and Kota. The geographical area of the district is 6219 sq. Km. The city is located at 469 meters altitude from mean sea level. The average rainfall is 42 cm. The maximum temperature touches 47^0 whereas the minimum temperature 10^0 C.

The region is famous for its forests having exotic flora and fauna and a heaven for numerous species of birds, which can be spotted on the roads as one drives along the lush-green fields.

Total 896 wetlands are mapped including 612 small wetlands (< 2.25 ha) with 15911 ha area. River/Stream with 7797 ha. contributed 49% to the total wetland area. The Reservoirs/Barrages with 5077 ha (31.91% area) is the second major wetland category, followed by Tanks/Ponds with 2379 ha area i.e. 14.95 %. Thus, the district is dominated by natural wetlands.

Open water spread of the wetlands is significantly higher in post monsoon (10014 ha) than during pre monsoon (3300 ha), indicating the rainfall dependence of the wetlands in the state. Aquatic vegetation in post-monsoon season is 162 ha and in Pre-monsoon season it is 70 ha. The qualitative turbidity of water is low in post monsoon and moderate in pre monsoon season. Details of estimates of wetlands in Jhalawar are given in Table 37.

Table 37: Area estimates of wetlands in Jhalawar

Area in ha

Sr. No.	Wettcode	Wetland Category	Number of Wetlands	Total Wetland Area	% of wetland area	Open Water	
						Post-monsoon Area	Pre-monsoon Area
	1100	**Inland Wetlands - Natural**					
1	1101	Lakes/Ponds	1	46	0.29	44	-
2	1102	Ox-bow lakes/ Cut-off meanders	-	-	-	-	-
3	1103	High altitude wetlands	-	-	-	-	-
4	1104	Riverine wetlands	-	-	-	-	-
5	1105	Waterlogged	-	-	-	-	-
6	1106	River/Stream	65	7797	49.00	3408	1534
	1200	**Inland Wetlands -Man-made**					
7	1201	Reservoirs/Barrages	21	5077	31.91	4675	1487
8	1202	Tanks/Ponds	197	2379	14.95	1887	279
9	1203	Waterlogged	-	-	-	-	-
10	1204	Salt pans	-	-	-	-	-
		Sub-Total	**284**	**15299**	**96.15**	**10014**	**3300**
		Wetlands (<2.25 ha), mainly Tanks	612	612	3.85	-	-
		Total	**896**	**15911**	**100.00**	**10014**	**3300**

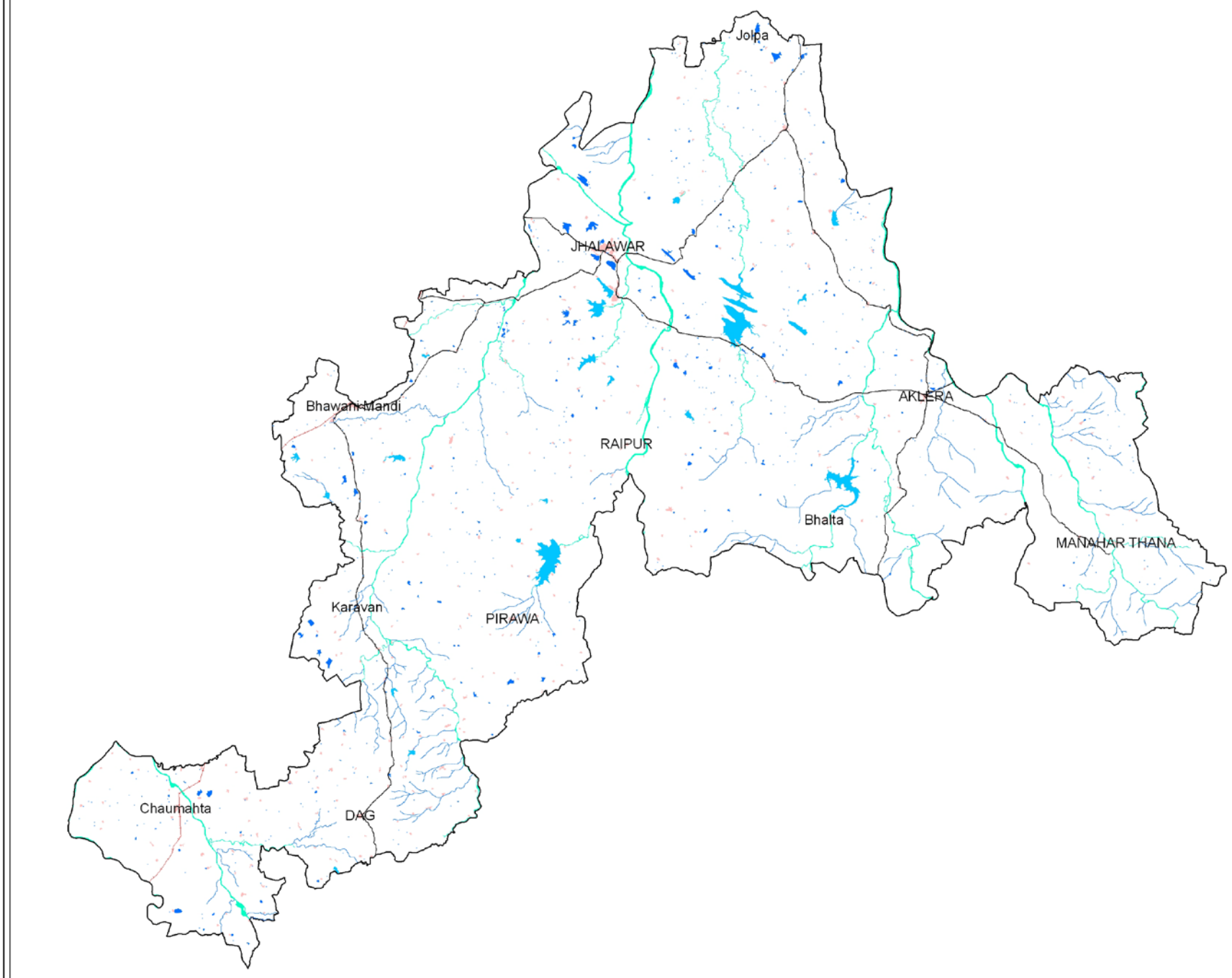
Area under Aquatic Vegetation	162	70

Area under turbidity levels		
Low	7804	684
Moderate	1829	2563
High	381	53

State : Rajasthan

WETLAND MAP

District : Jhalawar

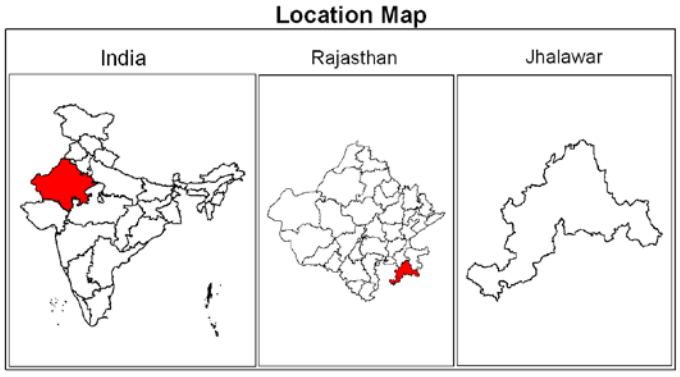


Symbol	Typecode	Level I	Level II	Level III
		Inland Wetlands		
			Natural	
	1101			Lakes/Ponds
	1102			Ox-bow lakes/ Cut-off meanders
	1103			High altitude wetlands
	1104			Reverine wetlands
	1105			Waterlogged
	1106			River/Stream
			Man-made	
	1201			Reservoirs/Barrages
	1202			Tanks/Ponds
	1203			Waterlogged
	1204			Salt pans
		Coastal Wetlands		
			Natural	
	2101			Lagoons
	2102			Creeks
	2103			Sand/Beach
	2104			Intertidal mud flats
	2105			Salt marsh
	2106			Mangroves
	2107			Coral reefs
			Man-made	
	2201			Salt pans
	2202			Aquaculture ponds

Legend

- Wetlands (<2.25ha)
- Drainage (line)
- Major Roads
- Railway
- Settlements
- Town/Settlements
- District Boundary
- State Boundary
- International Boundary

Location Map



8 4 0 8 16 Kilometers

Data Source :

IRS P6 LISS III data (Pre-monsoon and Post-monsoon Season 2006-07)

Prepared By :

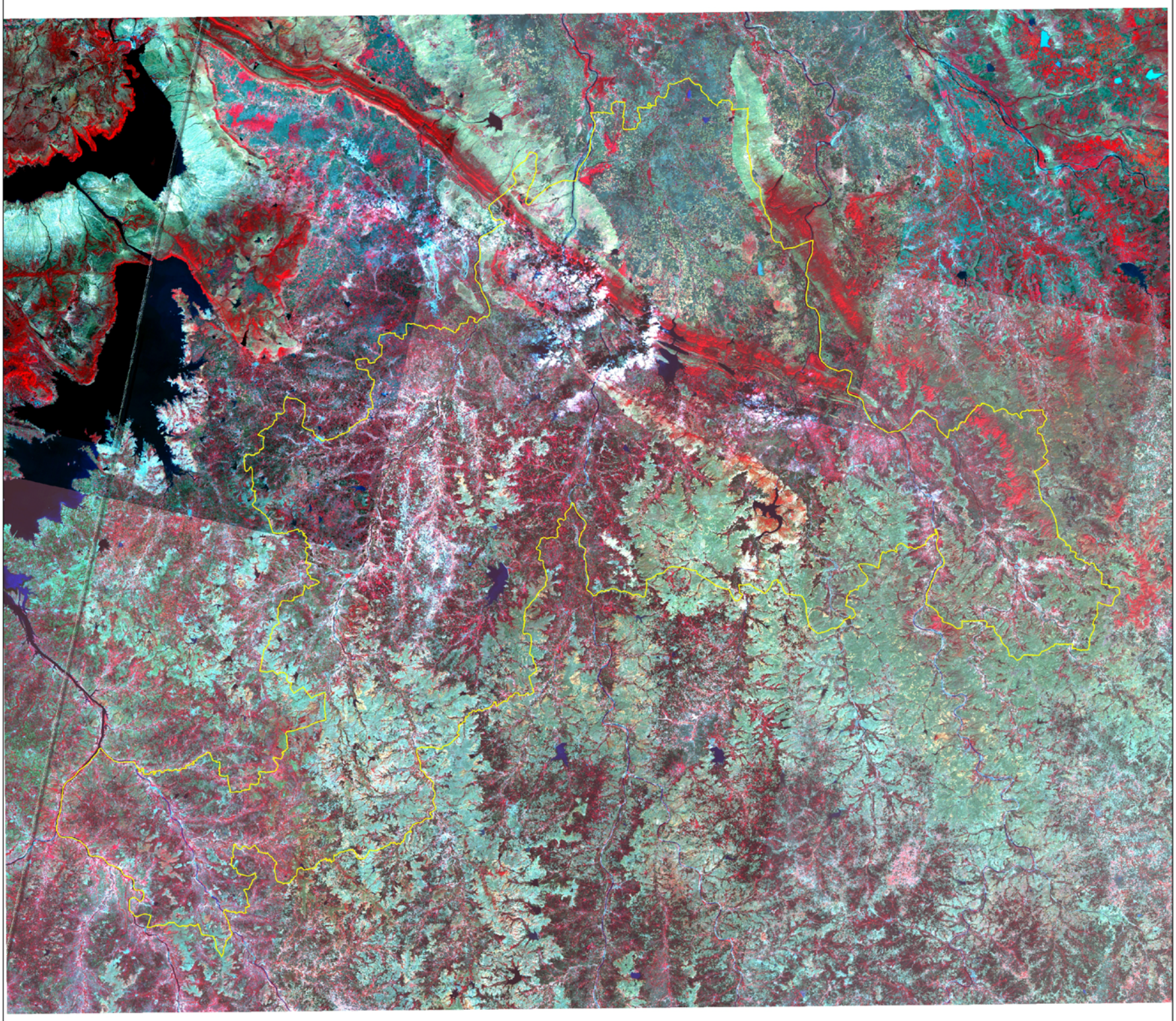
Space Applications Centre (ISRO), Ahmedabad
and
State Remote Sensing Application Centre, Jodhpur

Sponsored By:

Ministry of Environment and Forests
Government of India

State : Rajasthan

District : Jhalawar

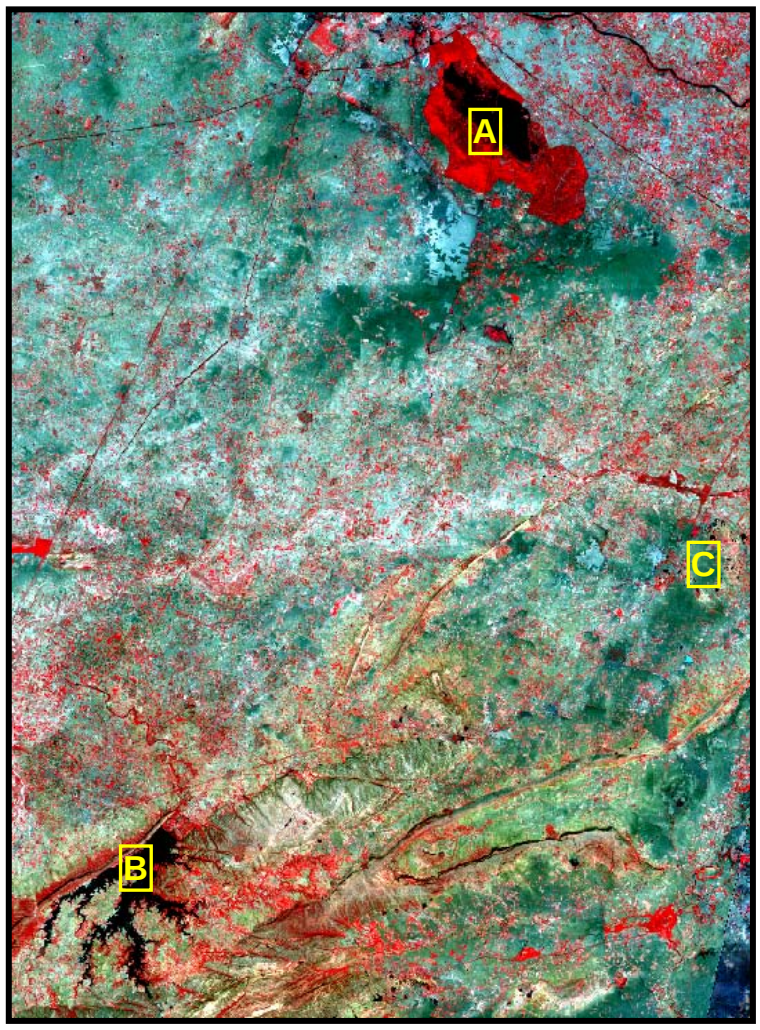


IRS P6 LISS-III Post-monsoon data (2006).

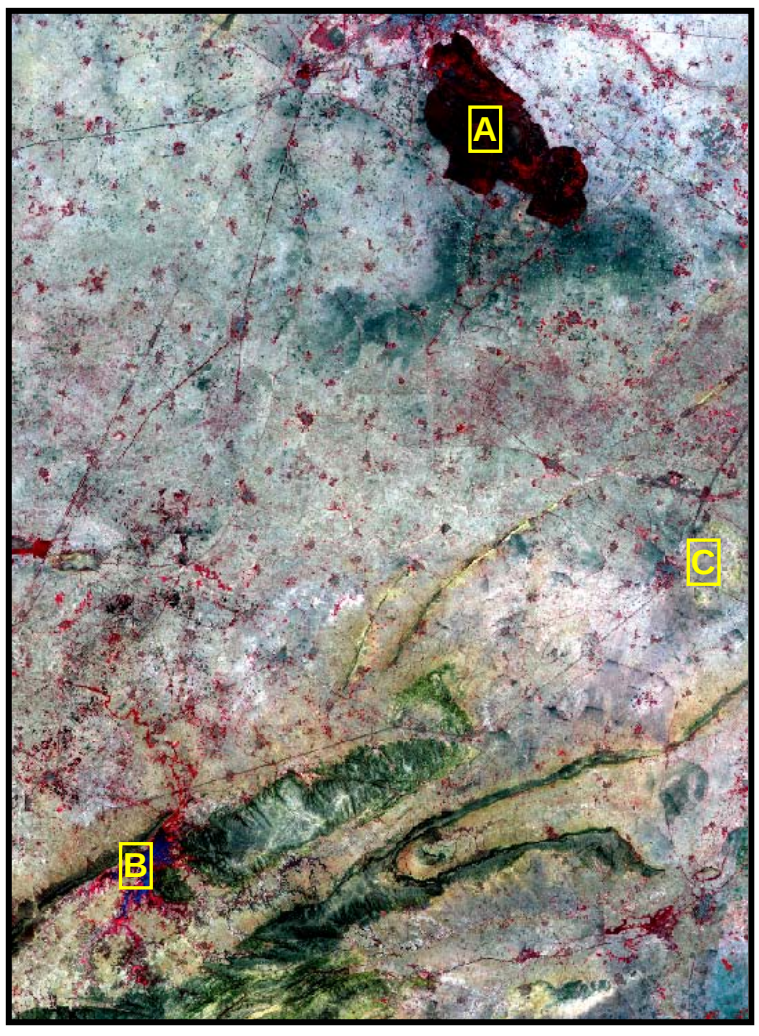
MAJOR WETLAND TYPES

8.0 MAJOR WETLAND TYPES OF RAJASTHAN

Major wetland types observed in the state are Reservoirs/Barrages, Tanks/Ponds, River/Stream, Lakes/Ponds, Man-made Waterlogged area and Salt pans. Details are given in Plates1a and 1b. Ground truth data was collected for selected wetland sites. The standard proforma was used to record the field observations. Field photographs are also taken to record the water quality (subjective), status of aquatic vegetation and water spread. The location of the features was recorded using GPS. Field photographs of different wetland types are shown in Plates 2a, 2b and 2c.



Part of Bharatpur District
(IRS-P6 LISS-III FCC, 2006)



Part of Bharatpur District
(IRS-P6 LISS-III FCC, 2007)

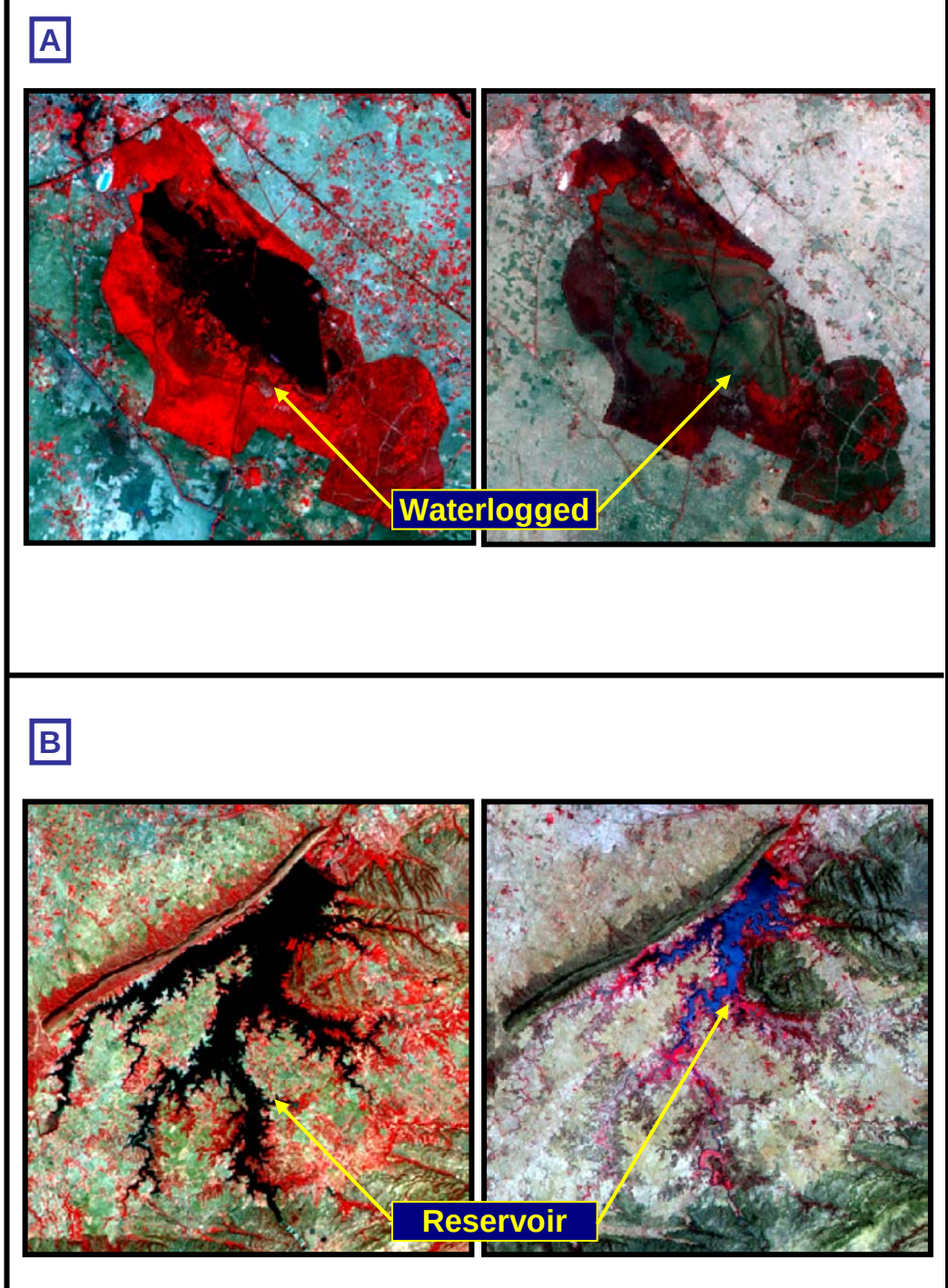
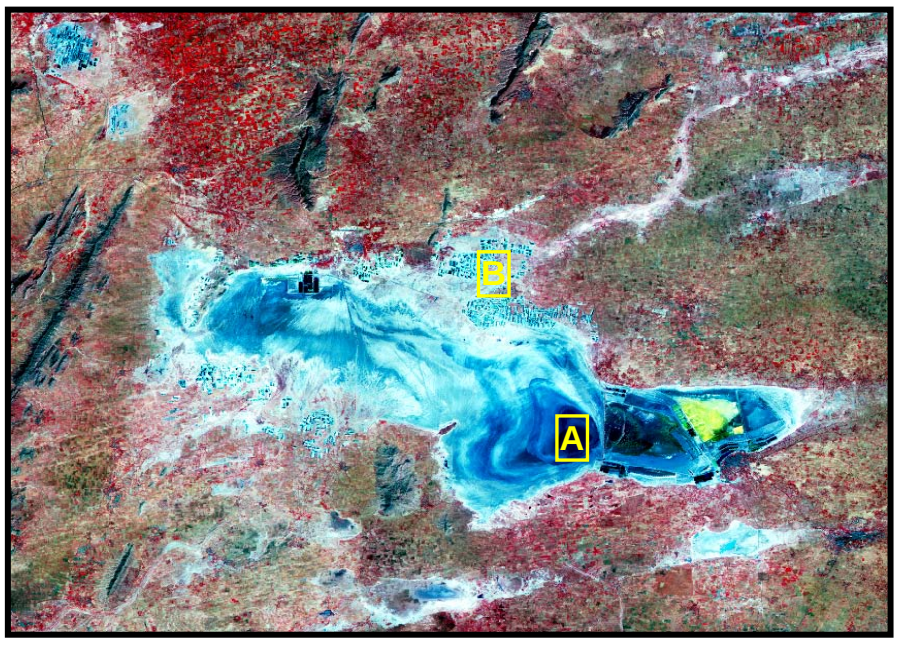
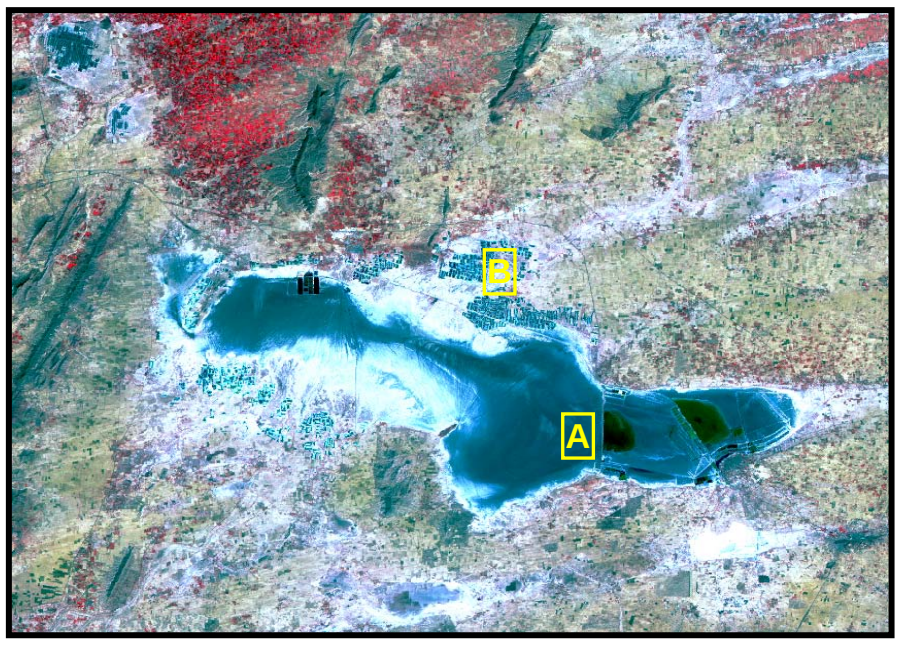


Plate – 1a: Major wetland types of Rajasthan



Sambhar Lake and surrounding area
(IRS-P6 LISS-III FCC, 2006)



Sambhar Lake and surrounding area
(IRS-P6 LISS-III FCC, 2007)

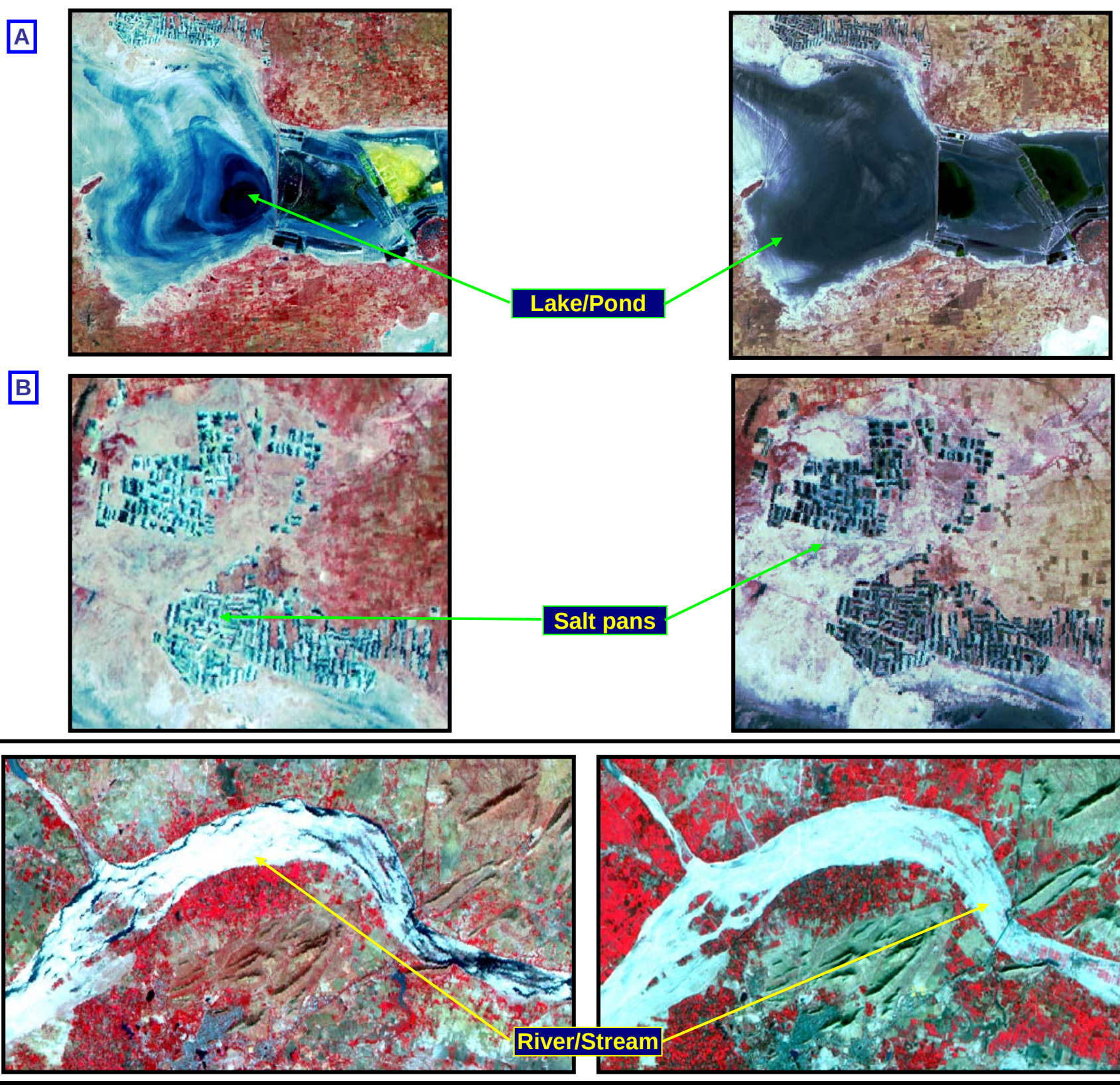


Plate – 1b: Major wetland types of Rajasthan

Sr. No	Description	Field Photograph
1	**Wetland Type**: Lakes/Ponds (Pichola Lake) **Location**: Latitude : 24º 34' 17" N Longitude : 73º 40' 31" E **Aquatic vegetation**: Present (Emergent and submerged) **Turbidity**: Low	
2	**Wetland Type**: Tanks/Ponds **Location**: Latitude : 24º 18' 52" N Longitude : 74º 53' 58" E **Aquatic vegetation**: Present (Emergent and submerged) **Turbidity**: Moderate	
3	**Wetland Type**: Reservoir/Barrages (Mansarover Reservoir) **Location**: Latitude : 25º 55' 46" N Longitude : 76º 26' 23" E **Aquatic vegetation**: Not Present **Turbidity**: Low	
4	**Wetland Type**: Waterlogged Man-made (Ghana Bird Sanctuary) **Location**: Latitude : 27º 31' 45" N Longitude : 76º 31' 45" E **Aquatic vegetation**: Present **Turbidity**: Low	

Plate 2a: Field photographs and ground truth data of different wetland types in Rajasthan

Sr. No	Description	Field Photograph
5	**Wetland Type**: Salt pans **Location**: Latitude : 26º 57' 04" N Longitude : 74º 57' 43" E **Aquatic vegetation**: NA **Turbidity**: Low to Moderate	
6	**Wetland Type**: River/Stream (Mahi River) **Location**: Latitude : 23º 38' 59" N Longitude : 74º 07' 50" E **Aquatic vegetation**: Present **Turbidity**: Low to Moderate	
7	**Wetland Type**: Tank/Pond **Location**: Latitude : 25º 10' 19" N Longitude : 76º 06' 44" E **Aquatic vegetation**: Present **Turbidity**: Low	
8	**Wetland Type**: Reservoir/Barrage (Bajaj Sagar) **Location**: Latitude : 23º 37' 30" N Longitude : 74º 32' 13" E **Aquatic vegetation**: Absent **Turbidity**: Low	

Plate 2b: Field photographs and ground truth data of different wetland types in Rajasthan

Sr. No	Description	Field Photograph
9	**Wetland Type**: Lake/Pond (Rajsamand Lake) **Location**: Latitude : 25º 03' 39" N Longitude : 73º 54' 06" E **Aquatic vegetation**: Present **Turbidity**: Low	
10	**Wetland Type**: River/Stream (Banas River) **Location**: Latitude : 25º 58' 47" N Longitude : 75º 32' 58" E **Aquatic vegetation**: Present **Turbidity**: Low to Moderate	
11	**Wetland Type**: Tank/Pond **Location**: Latitude : 25º 13' 12" N Longitude : 76º 04' 51" E **Aquatic vegetation**: Present (Floating) **Turbidity**: Low	
12	**Wetland Type**: Reservoir/Barrage (Bilaspur Reservoir) **Location**: Latitude : 25º 55' 17" N Longitude : 75º 27' 30" E **Aquatic vegetation**: Absent **Turbidity**: Low	

Plate 2c: Field photographs and ground truth data of different wetland types in Rajasthan

IMPORTANT WETLANDS OF RAJASTHAN

9.0 IMPORTANT WETLANDS OF RAJASTHAN

Major part of Rajasthan is arid but western and southern portion of the state have diversified habitats ideal for aquatic and terrestrial flora and fauna. There are various types of sanctuaries and National parks were notified in Rajasthan state. There are two National parks and twenty-five wild-life sanctuaries established in suitable habitats of forest areas.

Some of the most important wetlands of state are Sambhar Lake, Keoladeo Ghana National Park, Jaisamund Lake, Dhebar Lake, Jawai Reservoir, Annasagar Lake, Udaisagar Reservoir and Rajsamund. These wetlands are unique in terms of trophic state-flora and fauna and plays very important role in the economy of the state. Salient features of each wetlands along with present status in term so spatial extent using satellite data is given in this chapter however, brief discussion of them is worth mentioning before we proceed further:

The Keoladeo National Park (KNP) is a paradise for birds and bird watchers. This is one of the best-known bird sanctuaries in the world. KNP is a man-made wetland. Thousands of migratory birds like Demoiselle cranes, pintails, Coots, Painted storks, pelicans, etc. roots and breeds every year. Siberian crane, which is a vanishing species, visits the habitat every year during winter season. The health of the wetland depends of availability of water resources in the wetland.

The Sambhar Lake, is the largest natural saline lake of Rajasthan and covers an area of 230 Sq. km. It is used for salt mining and also tourist place for watching flamingoes during winter season. The catchment of sambhar lake is covered with sand dunes and there are no settlements mainly in the western part of the lake. Transportation of salt is being done mainly by train. Sambhar lake is a Ramsar site.

The jaisamund lake is constructed to meet the drinking water requirement of Udaipur city and also supply hydro power to the city. It is a recreational site and habitat verity of avifauna and fishes .

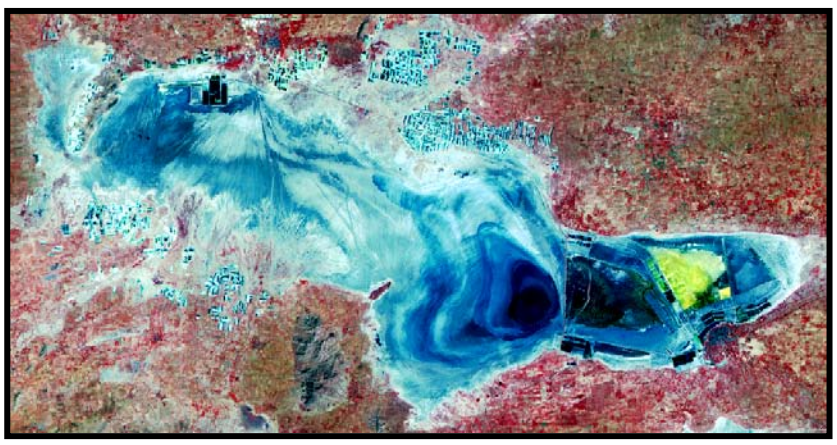
Anna sagar situated in the heart of Ajmer city. it is a man made wetland and highly eutrophic in nature. In spite of Its status it considered to be an important recreational place of the Ajmer city.

Udaisagar Reservoir is centrally located in Udaipur city. It is an impoundment across the river Bedach a tributary of river Banas. It is tourist place and known for recreational activities. Most of the tourists visit this place during evenings.

Extensive field work was carried out for these wetland areas. Wetland maps have been prepared for 5km buffer area of each wetland sites. Details of the wetlands and wetland maps of 5 km buffer area are shown in plates 3 to 23.

9.1 Sambhar Lake (Ramsar Site)

Name	**Sambhar Lake**
Location	26°52'31" to 27°01'57" N Latitude and 74°53'47" to 75°13'41" E Longitude
Area	24294 ha (Wetland Area)
Wetland Type	Lake/Pond
Climate	Average annual rainfall : 500 mm Average annual temperature range from a maximum of 36.7^{o} C and a minimum of 11.7^{o} C.
Description	Sambhar lake is a Ramsar site and it is a typical shallow saline wetland of Rajasthan located near Sambhar village. The average depth is 3 meters in the monsoon while in pre-monsoon it becomes very shallow (< 100 cm). During monsoon season it receives rain water from its catchments. The flora and fauna mainly represent of fresh water during monsoon season while season proceeds the water becomes saline. Fresh water flora of monsoon season will be replaced by fresh water flora and fauna mainly plankton population. A large part of the lake dry up during summer to accelerate mining activity of ground water for manufacturing of salt . There are thousands of salt plan constructed at the periphery of the Sambar Lake.
Vegetation	The vegetation present in the catchment area in mostly *xerophytic* type. Shoreline vegetation includes the halophytes *Suaeda fruticosa, Solsola baryosma* and *Cressa cretica*. The most dominant algae in Sambhar lake and the salt pans are *Dunaliella salina* (dominant saline algae of the lake), *Chlmydomonas sp., Anabaena sp*., and *Aphanothece halophytica.*
Fauna	Zooplankton studies are limited. In depth studies were made to record avifauna of the lake. Every year thousands of migratory birds visit the lake and feed on plankton and fish fry. Some of the common birds recorded are: lesser flamingo, greater flamingo, tufted duck, pochard, white pelican, brown-headed gull, black-headed gull, herring gull, redshank, greenshank, common sandpiper, blackwinged stilt, pintail, shoveler, dabchick, purple moorhen, demoiselle crane, large Indian pratincole, and avocet.
Turbidity	Low - High



Post monsoon data (2006)



Pre monsoon data (2007)



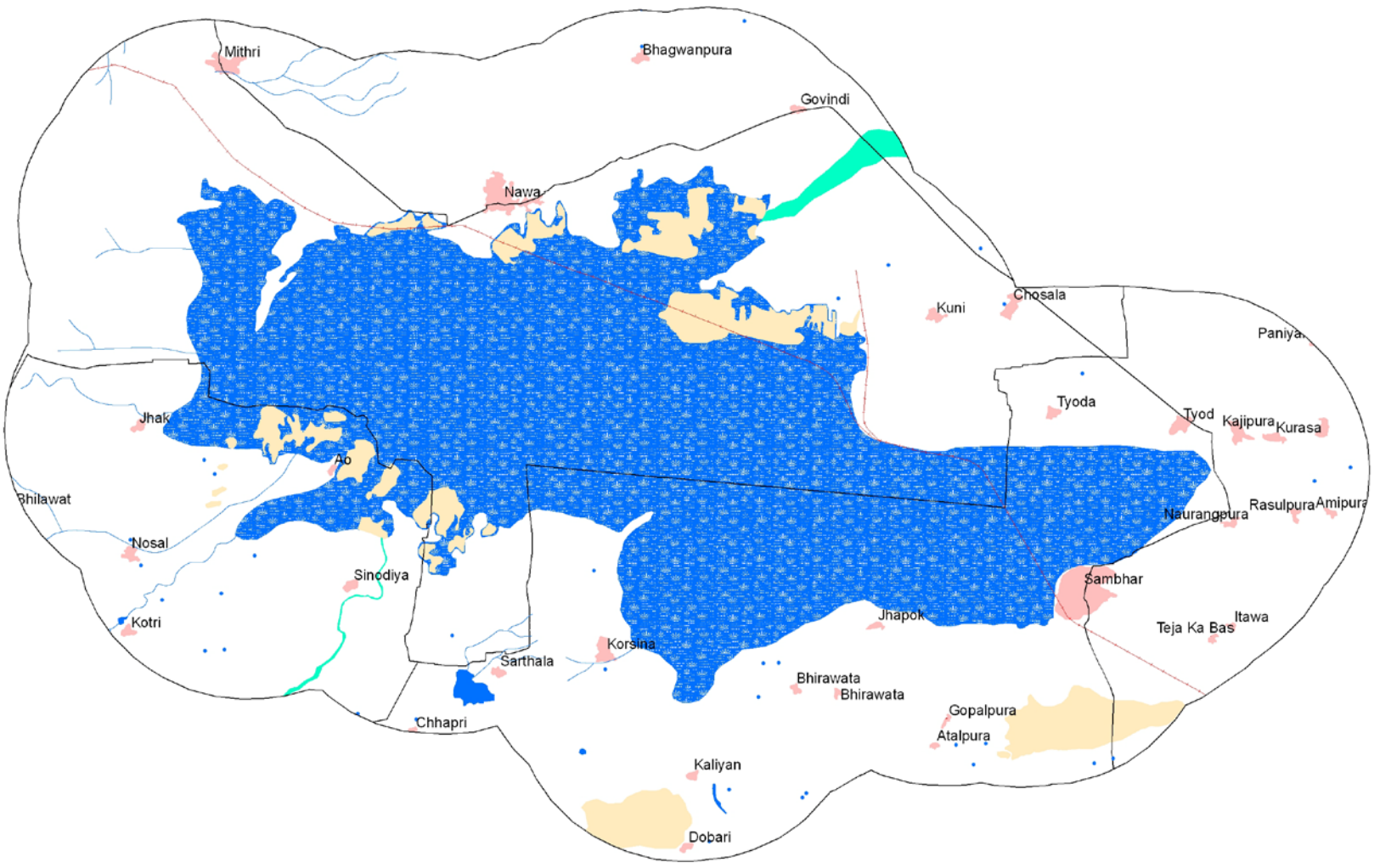


Plate 3: Sambhar Lake

State : Rajasthan

WETLAND MAP

Sambhar Lake

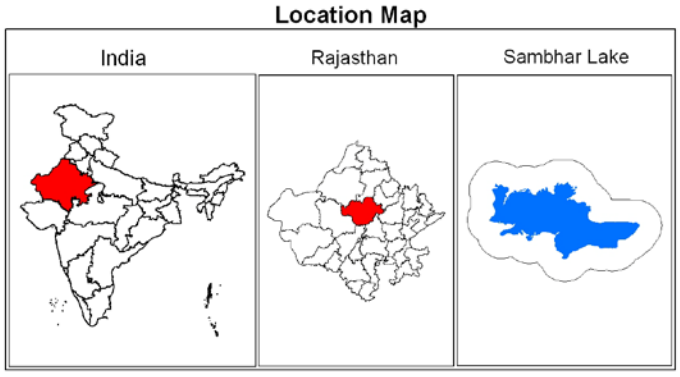


Symbol	Typecode	Level I	Level II	Level III
		Inland Wetlands		
			Natural	
	1101			Lakes/Ponds
	1102			Ox-bow lakes/ Cut-off meanders
	1103			High altitude wetlands
	1104			Reverine wetlands
	1105			Waterlogged
	1106			River/Stream
			Man-made	
	1201			Reservoirs/Barrages
	1202			Tanks/Ponds
	1203			Waterlogged
	1204			Salt pans
		Coastal Wetlands		
			Natural	
	2101			Lagoons
	2102			Creeks
	2103			Sand/Beach
	2104			Intertidal mud flats
	2105			Salt marsh
	2106			Mangroves
	2107			Coral reefs
			Man-made	
	2201			Salt pans
	2202			Aquaculture ponds

Legend

- Wetlands (<2.25ha)
- Drainage (line)
- Major Roads
- Railway
- Settlements
- Town/Settlements
- District Boundary
- State Boundary
- International Boundary

Location Map



4 2 0 4 8 Kilometers

Data Source :

IRS P6 LISS III data (Pre-monsoon and Post-monsoon Season 2006-07)

Prepared By :

Space Applications Centre (ISRO), Ahmedabad
and
State Remote Sensing Application Centre, Jodhpur

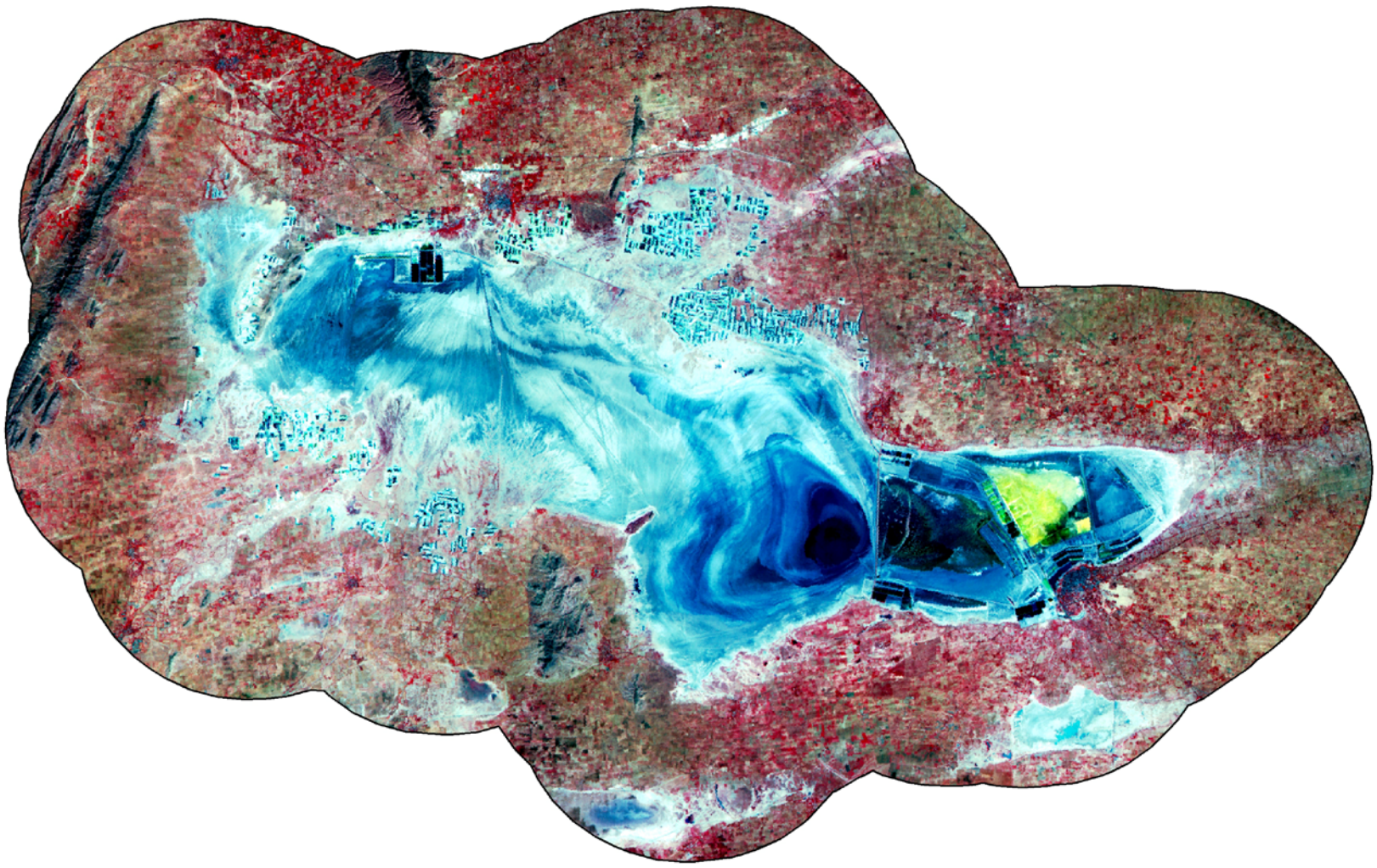
Sponsored By:

Ministry of Environment and Forests
Government of India

Plate 4: Wetland map - 5 km buffer area of Sambhar Lake

State : Rajasthan

Sambhar Lake

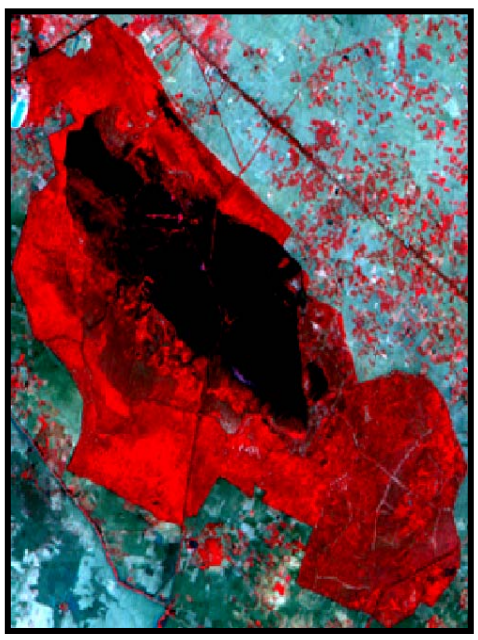


IRS P6 LISS-III Post-monsoon data (2006).

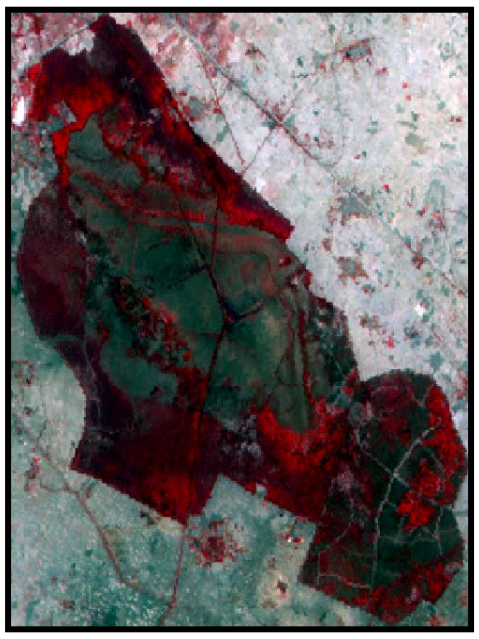
Plate 5: IRS LISS III FCC - 5 km buffer area of Sambhar Lake

9.2 Keoladeo Ghana National Park (Ramsar Site)

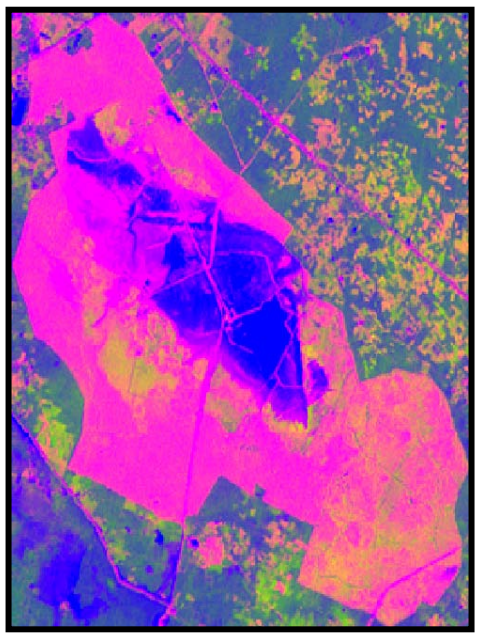
Name	**Keoladeo Ghana National Park**
Location	27°07'34" to 27°12'16" N Latitude and 77°29'28" to 77°33'40" E Longitude
Area	2912 ha
Wetland Type	Inland Wetlands : Man-made Waterlogged
Climate	Average annual temperature range from a maximum of 32.6^{o} C and a minimum of 15.6^{o} C.
Description	Keoladeo National Park comprises a freshwater swamp which is part of the Indo-gangetic Great Plains. Keoladeo Ghana is often known, is the most famous wetland in India. It was designated as a Wetland of International Importance under the Ramsar Convention in October 1981. It is situated in a shallow, natural depression at the western edge of the Gangetic plain. The environment is partly man-made with earthen dykes (bunds) dividing the area in 10 to 15 units, each with a system of sluice gates to control water level. It support large number of avifauna but due to non-availability of water from Ajan Dam the number is diminishing every year.
Vegetation	The surround area of bunds is predominated by angiosperms- terrestrial vegetation. There is egress of *prosopis sp. Salvadora oleoides, and Capparis aphylla* and it is a major nuisance causing change in biodiversity of terrestrial vegetation.
Fauna	In all 332 species of birds have recorded in the park. Keoladeo is particularly famous for its wintering flock of Siberian white cranes (*Grusleucogeramus*). Some of the important avifauna includes Sarus cranes (*Grus antigone*), *Pelecanus philippensis*, *P. crispus*, *Amaurornis phoenicurus*, *Anhinga melanogaster, E. garzetta, Charadrius alexandrinus, Limosa limosa, Tringa stagnatilis, T. glareola, Anas acuta, A. crrcca, A. strepera Fulica atra, G. grus,* etc.
Turbidity	Low-moderate



Post monsoon data (2006)



Pre monsoon data (2007)



Indices image
Post monsoon data (2006)







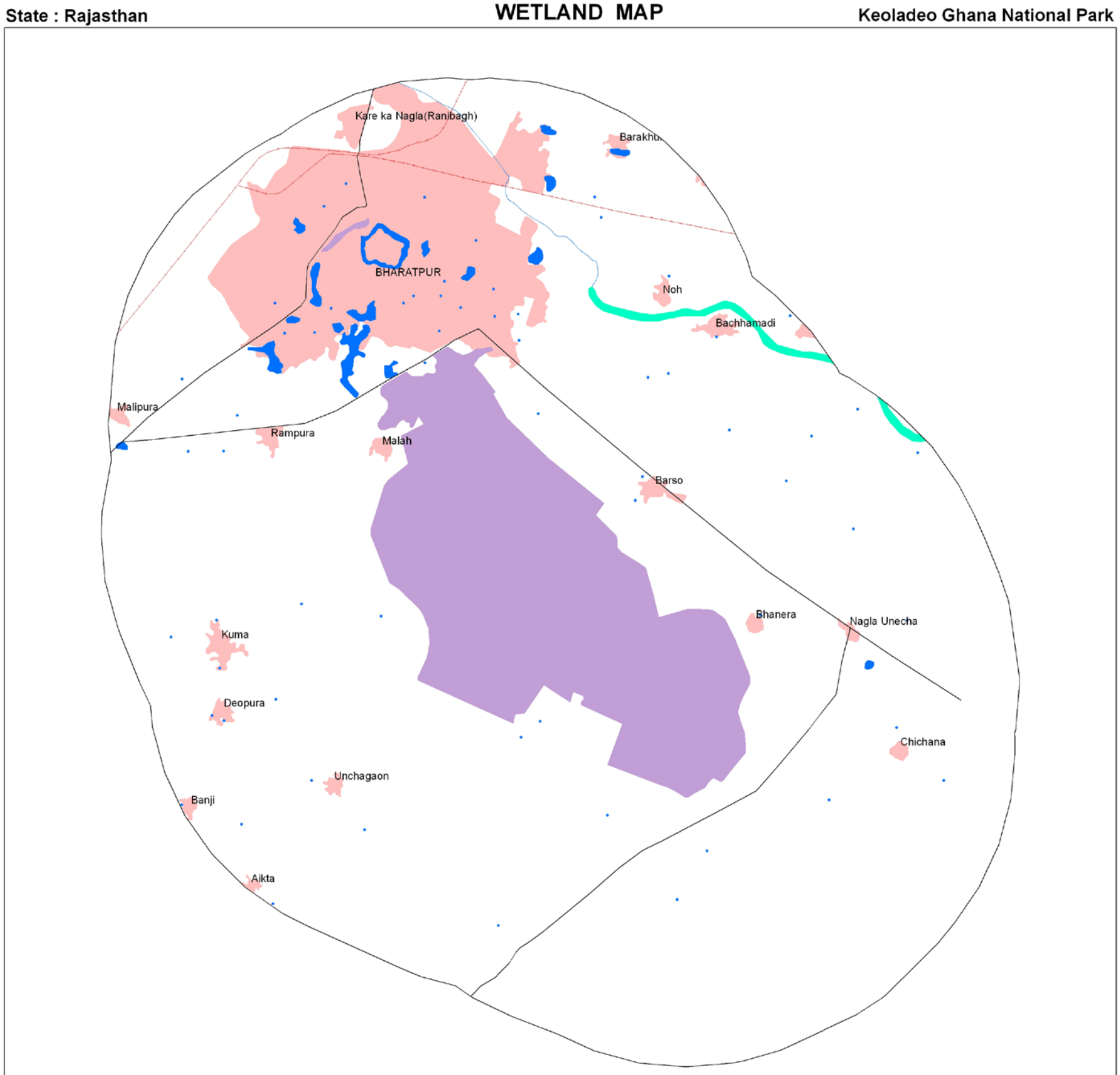


Plate 6: Keoladeo Ghana National Park

State : Rajasthan

WETLAND MAP

Keoladeo Ghana National Park



Symbol	Typecode	Level I	Level II	Level III
		Inland Wetlands		
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			Man-made	
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	1203			Waterlogged
	1204			Salt pans
		Coastal Wetlands		
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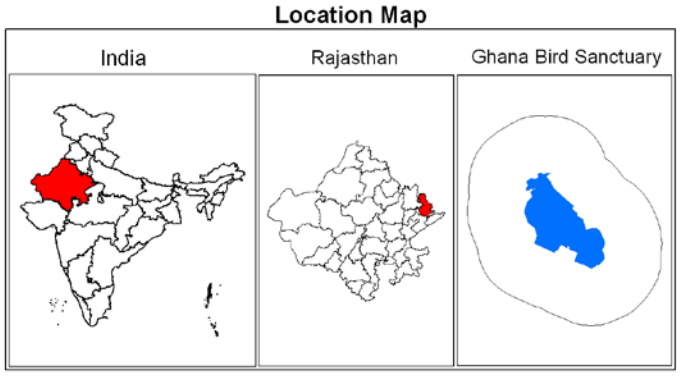
	2105			Salt marsh
	2106			Mangroves
	2107			Coral reefs
			Man-made	
	2201			Salt pans
	2202			Aquaculture ponds

Legend

- Wetlands (<2.25ha)
- Drainage (line)
- Major Roads
- Railway
- Settlements
- Town/Settlements
- District Boundary
- State Boundary
- International Boundary

Location Map



2 1 0 2 4 Kilometers

Data Source :

IRS P6 LISS III data (Pre-monsoon and Post-monsoon Season 2006-07)

Prepared By :

Space Applications Centre (ISRO), Ahmedabad
and
State Remote Sensing Application Centre, Jodhpur

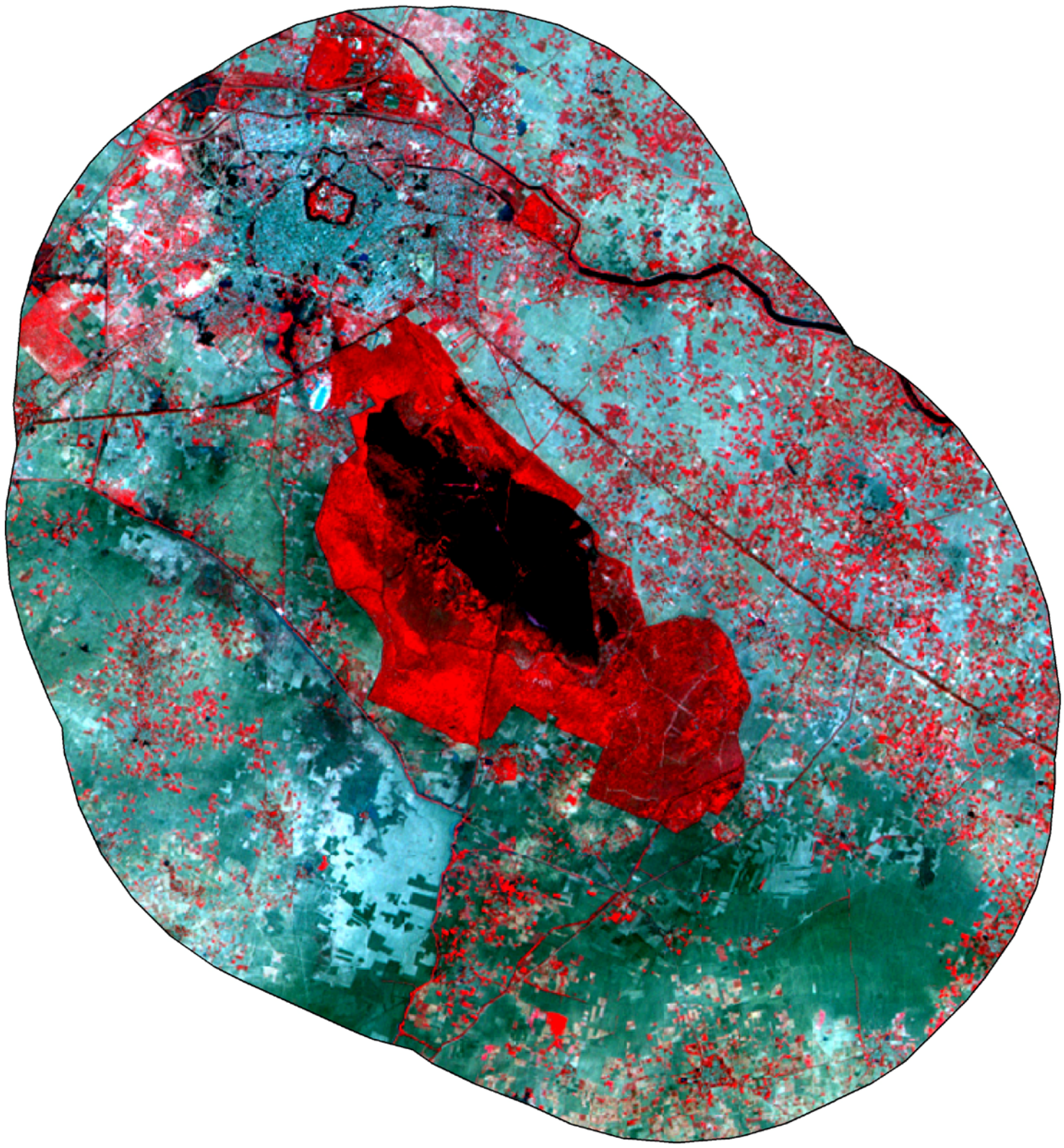
Sponsored By:

Ministry of Environment and Forests
Government of India

Plate 7: Wetland map - 5 km buffer area of Keoladeo Ghana National Park

State : Rajasthan

Keoladeo Ghana National Park

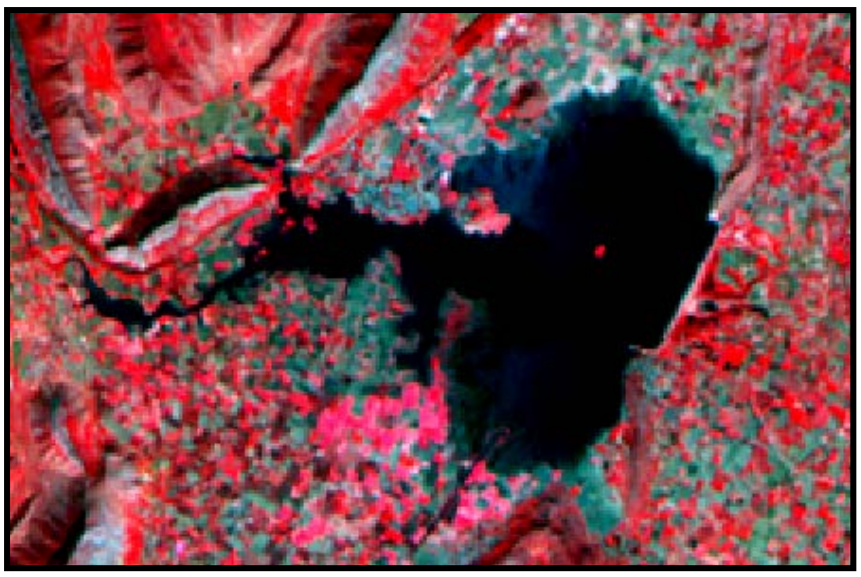


IRS P6 LISS-III Post-monsoon data (2006).

Plate 8: IRS LISS III FCC - 5 km buffer area of Keoladeo Ghana National Park

9.3 Jaisamund Lake

Name	Jaisamund Lake
Location	27°28'45" to 27°30'24" N Latitude and 76°32'36" to 76°35'19" E Longitude
Area	512 ha.
Wetland Type	Lake/Pond
Climate	Average annual rainfall of about 62.67cm. Summer season is very hot and winter is very cold. There is drastic reduction in water storage capacity of lake during summer as it is the source of irrigation .
Description	The catchment area is about 1127 sq.km, almost all of which extends towards northwest and northeast. Its source of water is from five rivers, the principal being river Gomti and others are small and seasonal. The maximum length and breadth of the are 13.68 and 8.05 km respectively.
Fauna	A total of 22 species included *Catla catla*, *Channa maruliis*, *C. punctatus*, C. striatus, *Cirrhina mrigala*, *C. reba, Heteropneustes fossilis, L. qonius*, L. rohita, *Labeo bata*, *L. boqut L*, *calbasu*, *L. fimbriatus*, *mastacembelus armatus*, *Mystus aor*, *M. cavasius*, *M. seenghala*, *Notopterus*, *Ompok pabda*, *Puntius sarana*, *Tor tor*, *Wallago attu*. The lake is possibly of considerable importance for migratory waterfowl and the greater flamingo (*Phoenicopterus ruber*) is known to occur. Gole recorded small numbers of herons, ducks,gulls and terns.
Turbidity	Low



Post monsoon data (2006)



Pre monsoon data (2007)







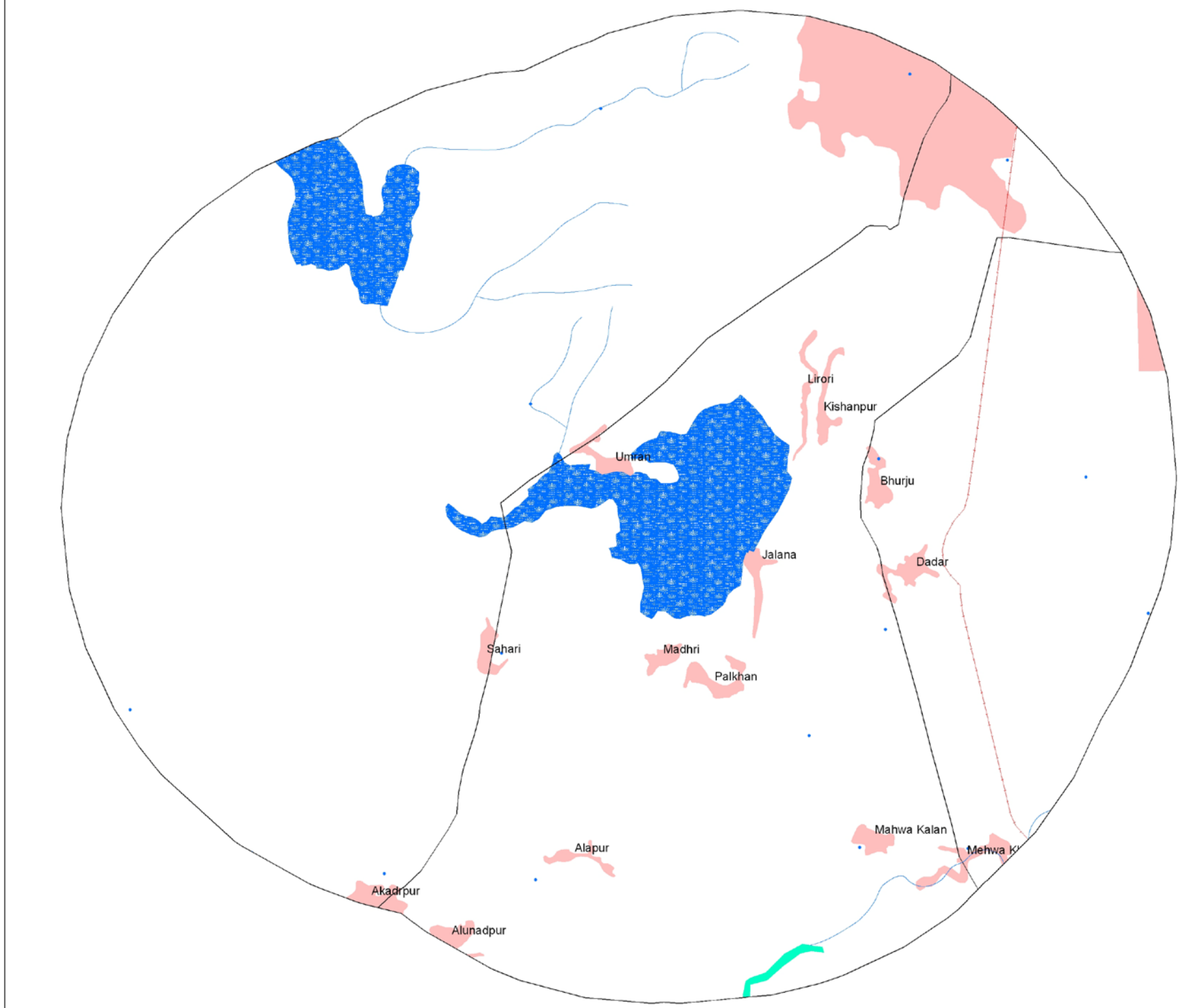


Plate 9: Jaisamund Lake

State : Rajasthan

WETLAND MAP

Jaisamund Lake

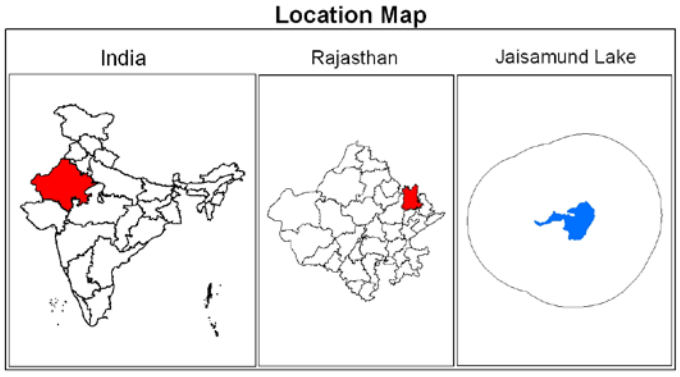


Symbol	Typecode	Level I	Level II	Level III
		Inland Wetlands		
			Natural	
	1101			Lakes/Ponds
	1102			Ox-bow lakes/ Cut-off meanders
	1103			High altitude wetlands
	1104			Reverine wetlands
	1105			Waterlogged
	1106			River/Stream
			Man-made	
	1201			Reservoirs/Barrages
	1202			Tanks/Ponds
	1203			Waterlogged
	1204			Salt pans
		Coastal Wetlands		
			Natural	
	2101			Lagoons
	2102			Creeks
	2103			Sand/Beach
	2104			Intertidal mud flats
	2105			Salt marsh
	2106			Mangroves
	2107			Coral reefs
			Man-made	
	2201			Salt pans
	2202			Aquaculture ponds

Legend

- Wetlands (<2.25ha)
- Drainage (line)
- Major Roads
- Railway
- Settlements
- Town/Settlements
- District Boundary
- State Boundary
- International Boundary

Location Map



1 0.5 0 1 2 Kilometers

Data Source :
IRS P6 LISS III data (Pre-monsoon and Post-monsoon Season 2006-07)

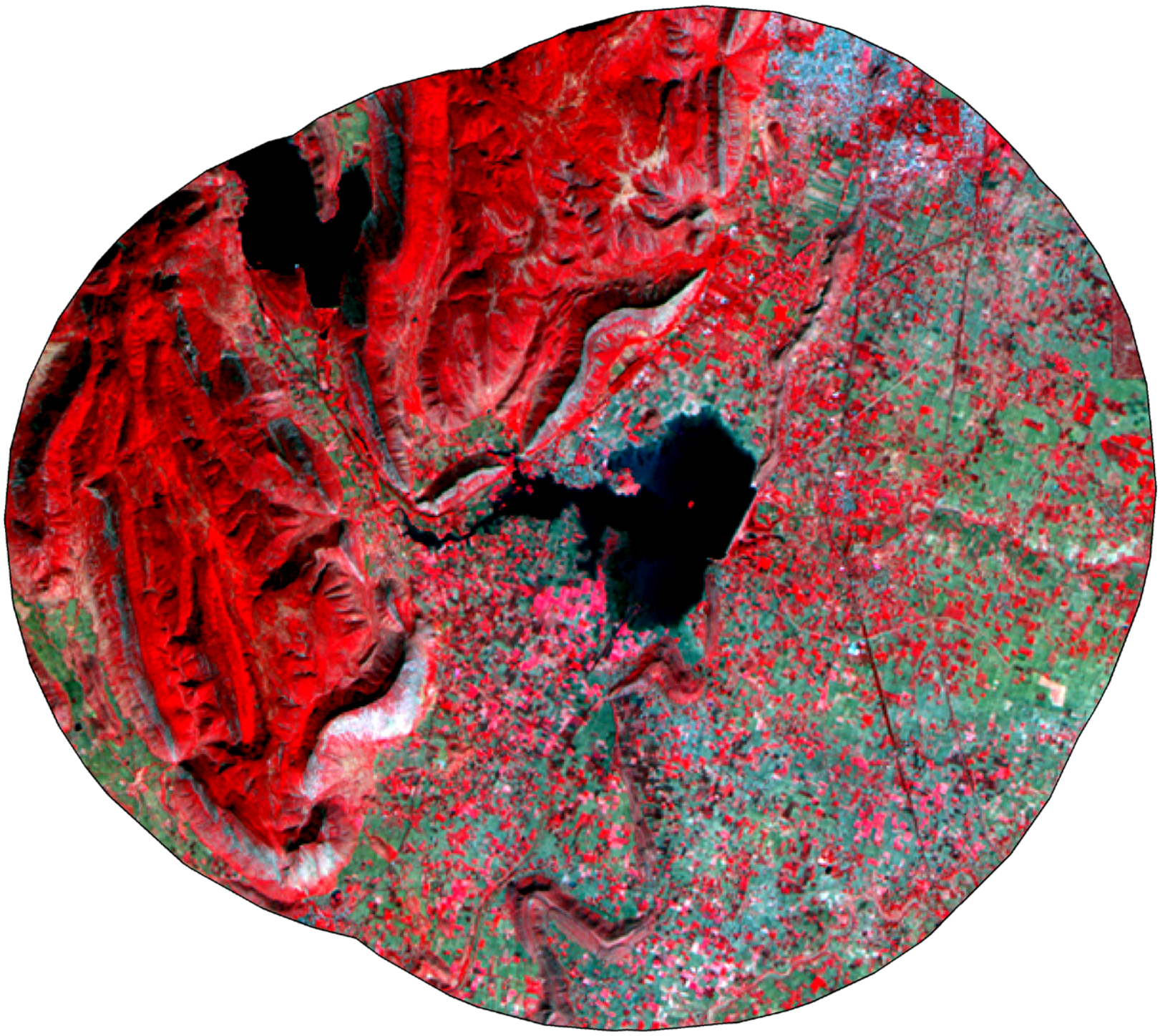
Prepared By :
Space Applications Centre (ISRO), Ahmedabad
and
State Remote Sensing Application Centre, Jodhpur

Sponsored By:
Ministry of Environment and Forests
Government of India

Plate 10: Wetland map - 5 km buffer area of Jaisamund Lake

State : Rajasthan

Jaisamund Lake

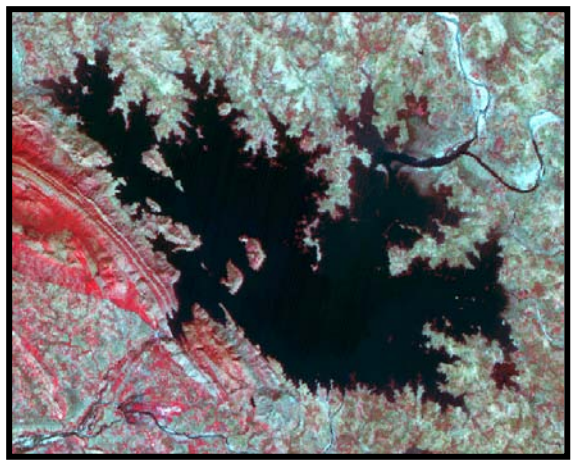


IRS P6 LISS-III Post-monsoon data (2006).

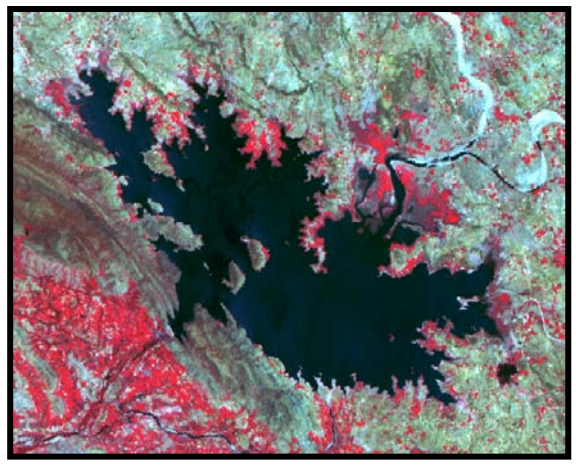
Plate 11: IRS LISS III FCC - 5 km buffer area of Jaisamund Lake

9.4 Dhebar Lake

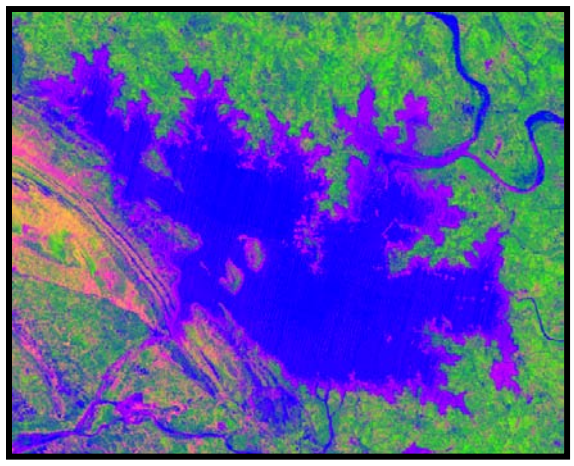
Name	Dhebar Lake
Location	24°13'08" to 24°18'52" N Latitude and 73°54'57" to 74°2'53" E Longitude
Area	5985 ha
Wetland Type	Lake/Pond
Description	It is located south of Udaipur city Dhebar Lake an impoundment at the confluence of two rivers viz. Gomati river and Hukh river. The total water spread is 26542 ha. The depth is 5-6 m which indicate that it a shallow lake. It is a recreational place and an ideal wetland for fisheries point of view. It is a main source of water for irrigation for downstream villagers.
vegetation	Vegetation includes macrophytes and phytoplankton .Macrophytes includes Potamegeton, Hydrilla, Elodea, and Vallisneria. These sp. are considered as weed are found mainly during summer season . Through they are considered as weed they are an ideal habitat for breeding of fisheries and act as an ideal habitat for fish fry. Phytoplankton consist of Melosira sp., Chlarococcum sp., Fragiliaria sp., Frustulia sp., Microcystis sp., Naviculi sp., Oedogonium sp., Oscilatoria sp., Scenedesmus sp., etc.
Fauna	Zooplankton sp. are Keratella. Filinia,Asplancha, Moina, Brachionus, Diaptamus. Mesocyclop, and Daphnia, and Chironomids constitute 83.8 per cent of the population of macrobenthos.
Turbidity	Low



Post monsoon data (2006)



Pre monsoon data (2007)



Indices image
Post monsoon data (2006)





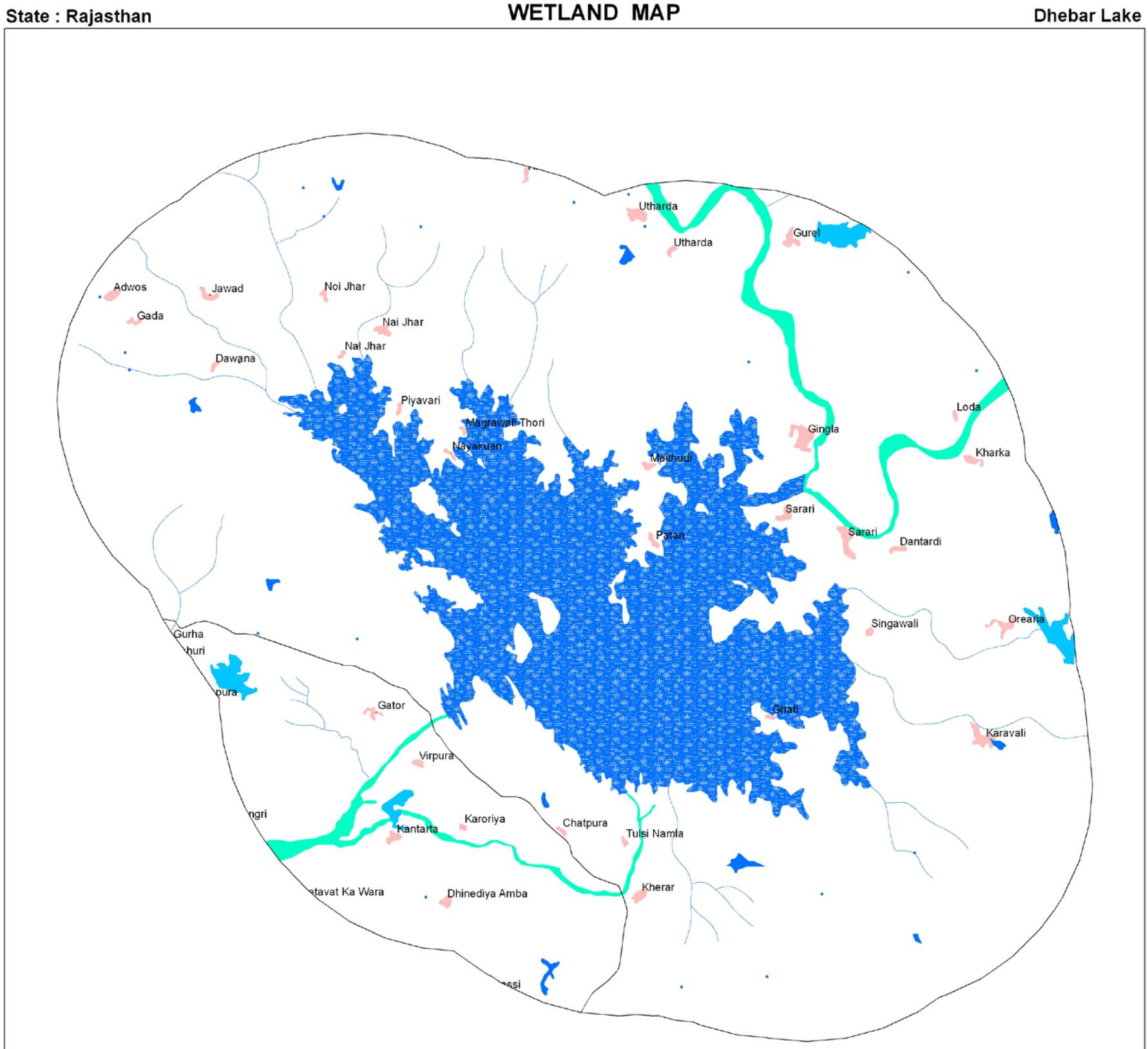


Plate 12: Dhebar Lake

State : Rajasthan

WETLAND MAP

Dhebar Lake

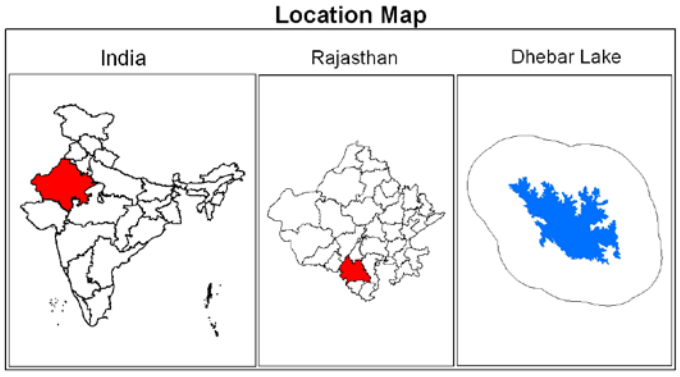


Symbol	Typecode	Level I	Level II	Level III
		Inland Wetlands		
			Natural	
	1101			Lakes/Ponds
	1102			Ox-bow lakes/ Cut-off meanders
	1103			High altitude wetlands
	1104			Reverine wetlands
	1105			Waterlogged
	1106			River/Stream
			Man-made	
	1201			Reservoirs/Barrages
	1202			Tanks/Ponds
	1203			Waterlogged
	1204			Salt pans
		Coastal Wetlands		
			Natural	
	2101			Lagoons
	2102			Creeks
	2103			Sand/Beach
	2104			Intertidal mud flats
	2105			Salt marsh
	2106			Mangroves
	2107			Coral reefs
			Man-made	
	2201			Salt pans
	2202			Aquaculture ponds

Legend

- Wetlands (<2.25ha)
- Drainage (line)
- Major Roads
- Railway
- Settlements
- Town/Settlements
- District Boundary
- State Boundary
- International Boundary

Location Map



2 1 0 2 4 Kilometers

Data Source :

IRS P6 LISS III data (Pre-monsoon and Post-monsoon Season 2006-07)

Prepared By :

Space Applications Centre (ISRO), Ahmedabad
and
State Remote Sensing Application Centre, Jodhpur

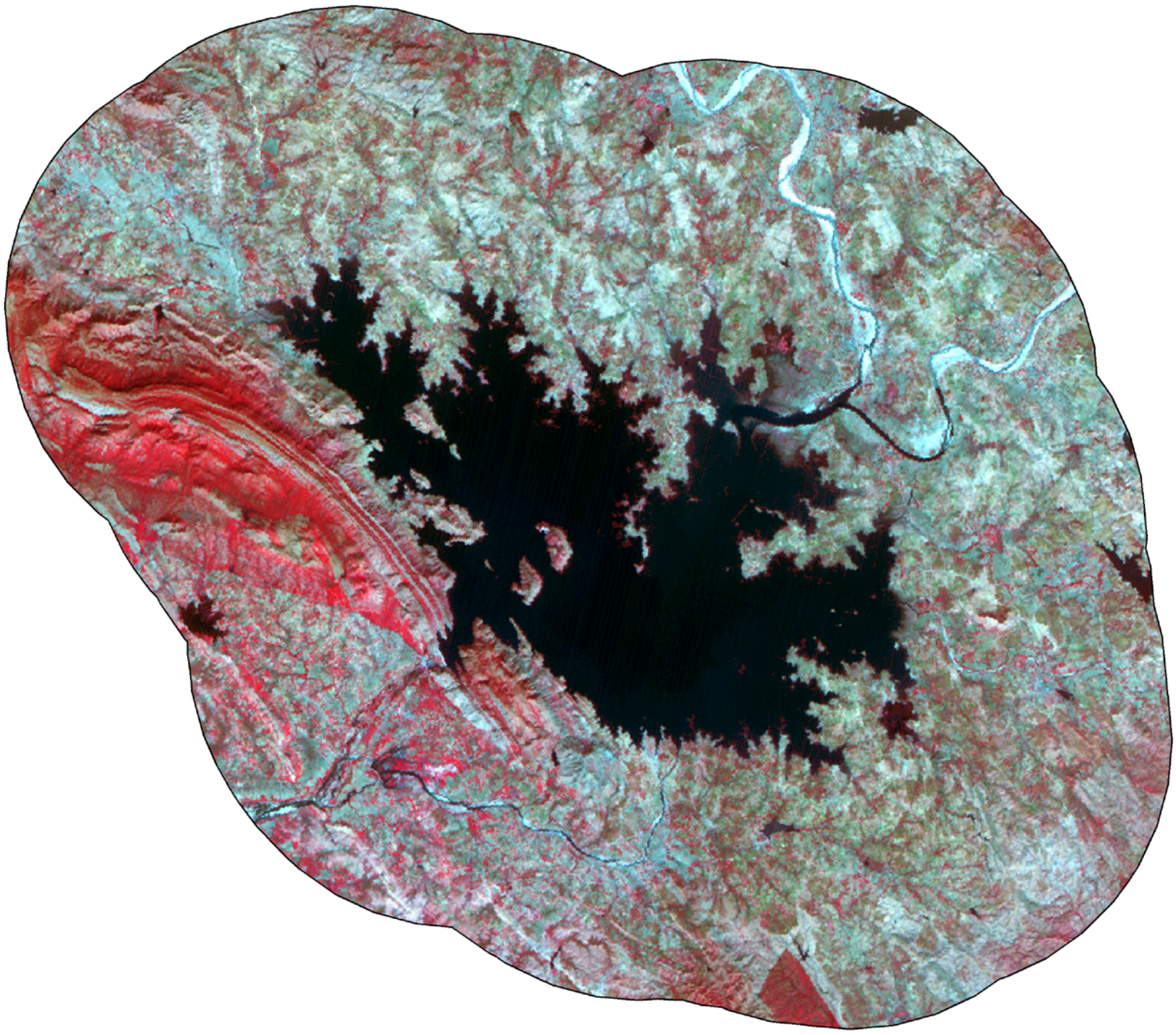
Sponsored By:

Ministry of Environment and Forests
Government of India

Plate 13: Wetland map - 5 km buffer area of Dhebar Lake

State : Rajasthan

Dhebar Lake

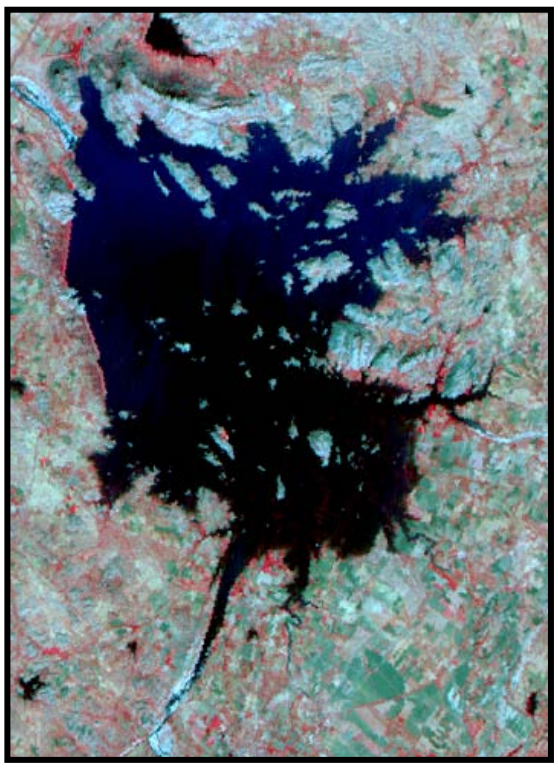


IRS P6 LISS-III Post-monsoon data (2006).

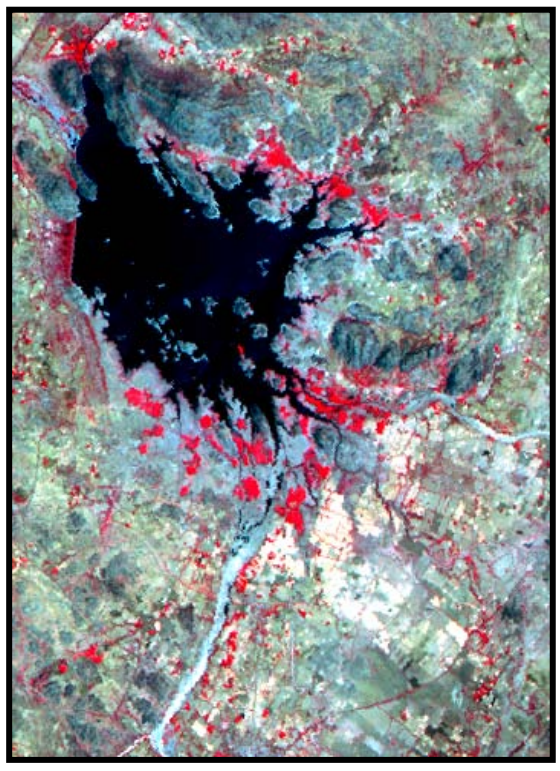
Plate 14: IRS LISS III FCC - 5 km buffer area of Dhebar Lake

9.5 Jawai Reservoir

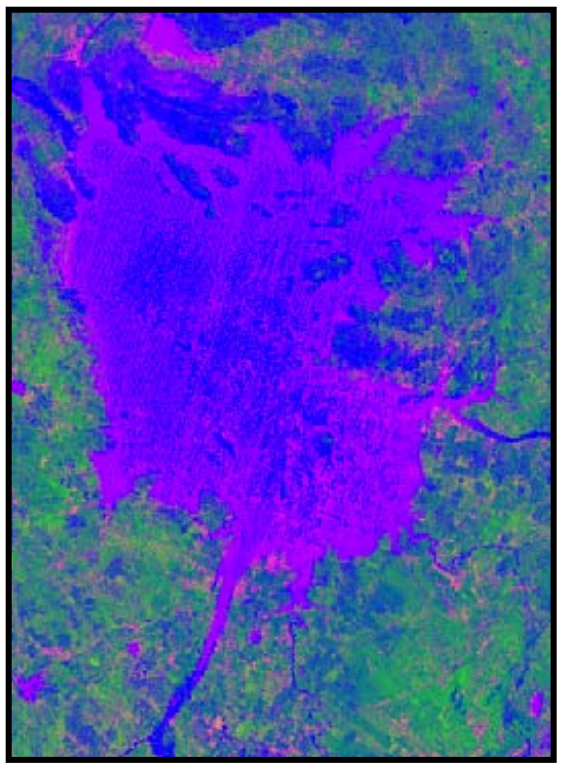
Name	Jawai Reservoir
Location	25°00'48" to 25°05'57" N Latitude and 73°08'47" to 73°12'59" E Longitude
Area	3027 ha
Wetland Type	Reservoir/Barrage
Climate	The mean maximum temperature is 26.5^{o} C, and the minimum of 22° C.
Description	The impoundment is located across the river Jawai which originates from the eastern slope of Aravali ranges. It has catchment area of 787 sq.km. It is an oligotrophic in nature receives very little amount of sediments from the catchment. The mean depth of the reservior is 7.7m and water spread area is about 2590sq.km.
Vegetation	Aquatic vegetation is mainly comprised of phytoplankton and *Periphyton*. Which includes *Anabaena sp*., *Characiopsis sp*., *Characium sp*., *Microcysits sp*., *Navicula sp*., *Oscillatoia sp*., *Peridinium sp*., *Rhizoclonium sp*., *Scenedesmus sp*., *Synedra sp*., *Tabellaria sp*., *Zygnema sp*., etc.
Fauna	Aquatic fauna includes zooplankton and fishes. Zooplankton sp. are Keratella. Brachionus, Diaptamus. Mesocyclop, Monosyla, and Daphnia, and fishes includs Catla catla
Turbidity	Low



Post monsoon data (2006)



Pre monsoon data (2007)



Indices image
Post monsoon data (2006)

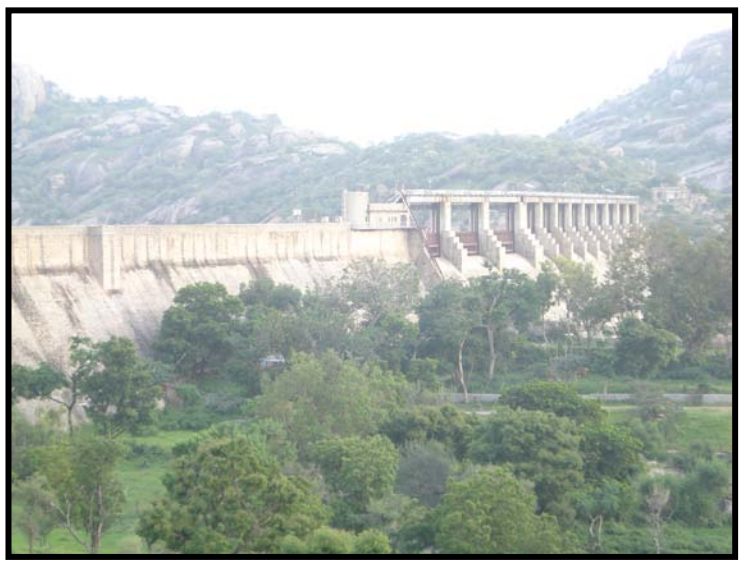


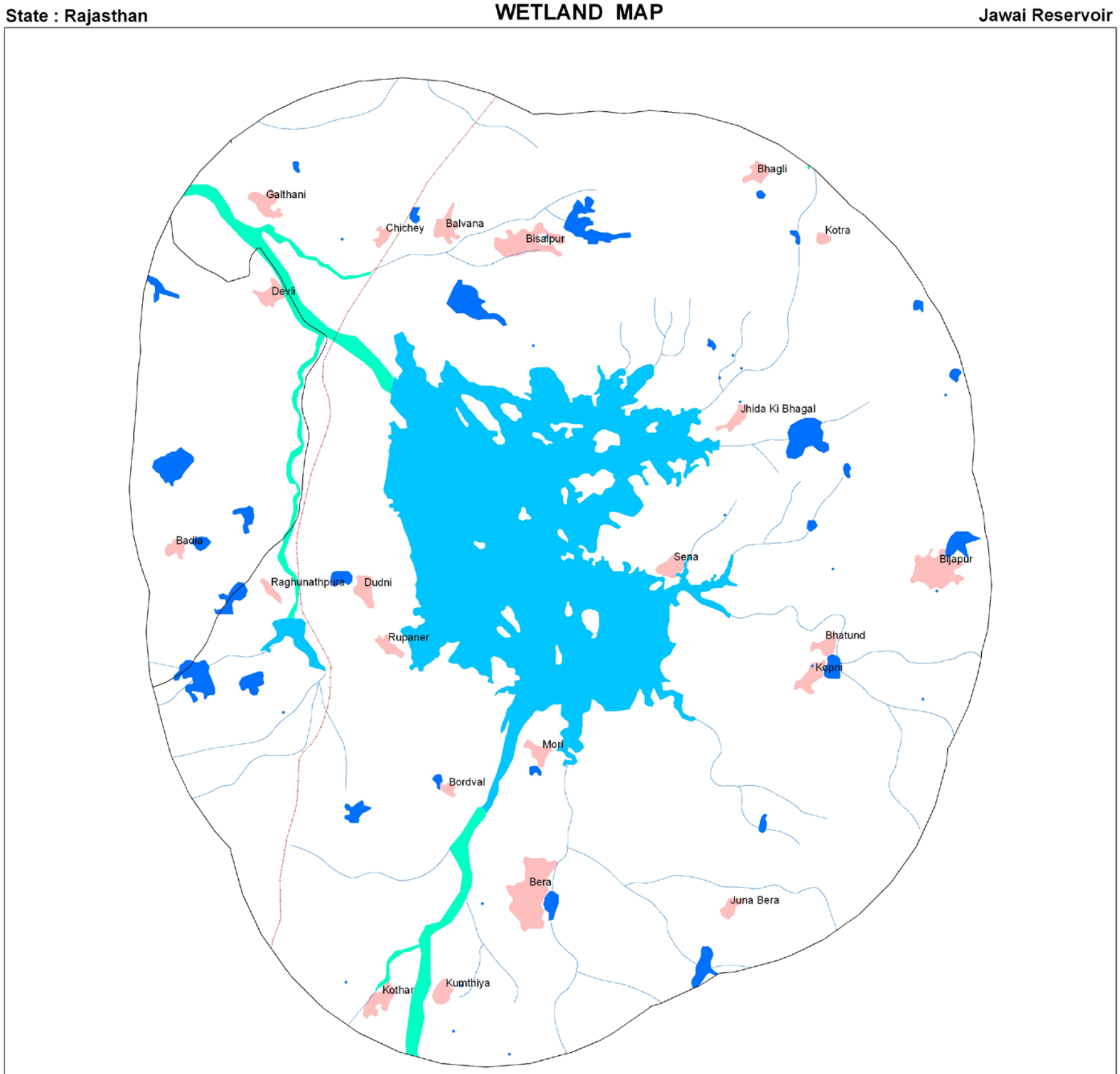


Plate 15: Jawai Reservoir

State : Rajasthan

WETLAND MAP

Jawai Reservoir

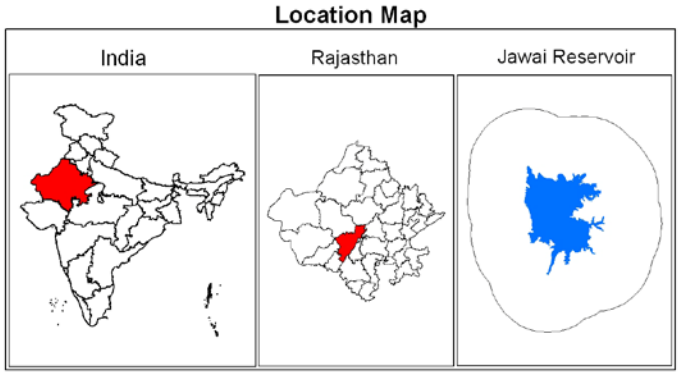


Symbol	Typecode	Level I	Level II	Level III
		Inland Wetlands		
			Natural	
	1101			Lakes/Ponds
	1102			Ox-bow lakes/ Cut-off meanders
	1103			High altitude wetlands
	1104			Reverine wetlands
	1105			Waterlogged
	1106			River/Stream
			Man-made	
	1201			Reservoirs/Barrages
	1202			Tanks/Ponds
	1203			Waterlogged
	1204			Salt pans
		Coastal Wetlands		
			Natural	
	2101			Lagoons
	2102			Creeks
	2103			Sand/Beach
	2104			Intertidal mud flats
	2105			Salt marsh
	2106			Mangroves
	2107			Coral reefs
			Man-made	
	2201			Salt pans
	2202			Aquaculture ponds

Legend

- Wetlands (<2.25ha)
- Drainage (line)
- Major Roads
- Railway
- Settlements
- Town/Settlements
- District Boundary
- State Boundary
- International Boundary

Location Map



2 1 0 2 4 Kilometers

Data Source :
IRS P6 LISS III data (Pre-monsoon and Post-monsoon Season 2006-07)

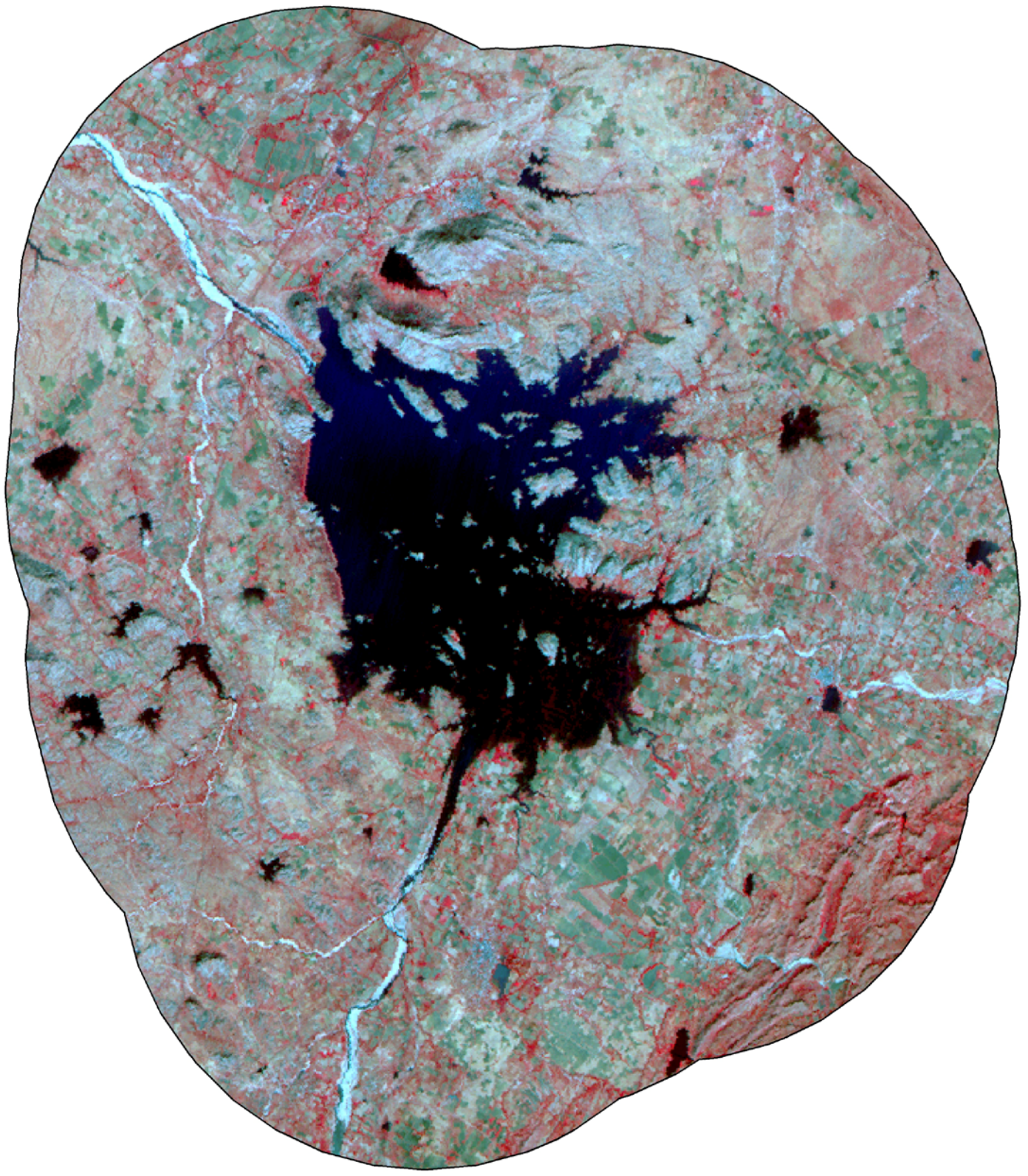
Prepared By :
Space Applications Centre (ISRO), Ahmedabad
and
State Remote Sensing Application Centre, Jodhpur

Sponsored By:
Ministry of Environment and Forests
Government of India

Plate 16: Wetland map - 5 km buffer area of Jawai Reservoir

State : Rajasthan

Jawai Reservoir

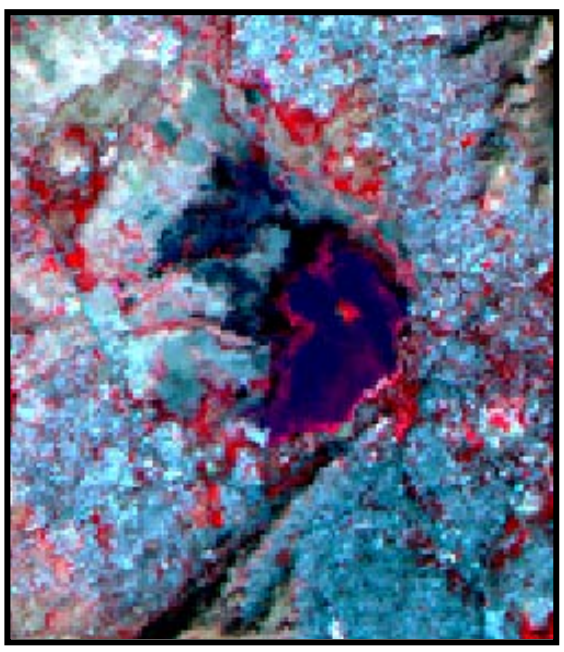


IRS P6 LISS-III Post-monsoon data (2006).

Plate 17: IRS LISS III FCC - 5 km buffer area of Jawai Reservoir

9.6 Annasagar Lake

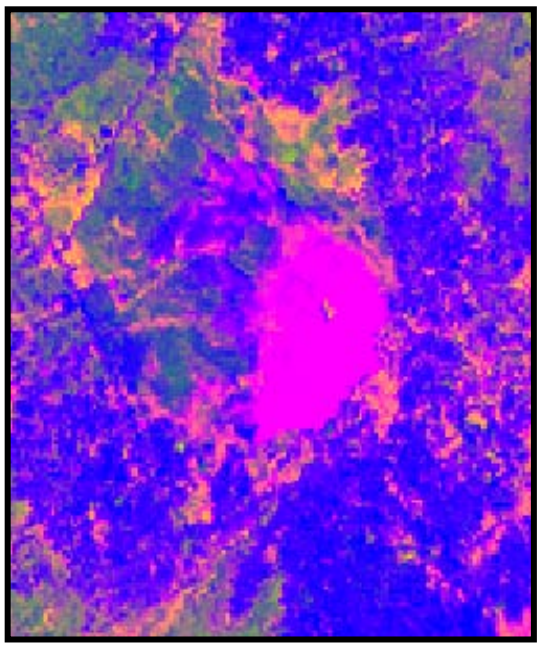
Name	Annasagar Lake
Location	26°28'00" to 26°29'01" N Latitude and 74°36'59" to 74°37'58" E Longitude
Area	155 ha
Wetland Type	Lake/Pond
Climate	The study area is exposed to sub-tropical monsoon climate, which may be described as transitional between semi-arid and sub-humid zones. Temperature ranges from 5 C° during winter season and 38 C° during summer season
Description	Annasagar located at an elevation of 487.28 m MSL, is a perennial fresh water body situated in the heart of Ajmer city covering a large surface area. It is an artificial lake formed by constructing an embankment in between of two hills named Bajrang Garh and Khobra Bherun. The water spread is 124 ha. It clearly reflects reduction in the water holding capacity and fragmentation of lake bed. There is a large amount of encroachment in the lake bed making the lake almost half. It receives untreated sewage from surrounding settlements. As on today one can say it is one of the highly eutrophic lake of Rajasthan state. It is also one of the recreational place of the Ajmer city.
Vegetation	The sub-tropical climate of semi-arid nature is reflected in dry deciduous type vegetation in the area. The floristic composition of the area generally can be classified as of "Mixed deciduous species". Aquatic vegetation is consist of *Typha sp.,* water hyacinth, *Azolla sp.* and *Ipoma sp.*, and *microcystis aerinosa* is proliferates during winter season.
Fauna	Aquatic fauna includes zooplankton, fishes and avifauna. Zooplankton sp. are Keratella. Brachionus, Diaptamus. cyclop, Monosyla, and Daphnia, and fishes includs mainly *Catla catla.* Avifauna includes lesser flamingo,, tufted duck, white pelican, , pintail, shoveler, purple moorhen, demoiselle crane, brahminy ducks, cormorant, Weaver bird, sea gulls, Field king fisher etc. .
Turbidity	Low



Post monsoon data (2006)



Pre monsoon data (2007)



Indices image
Post monsoon data (2006)



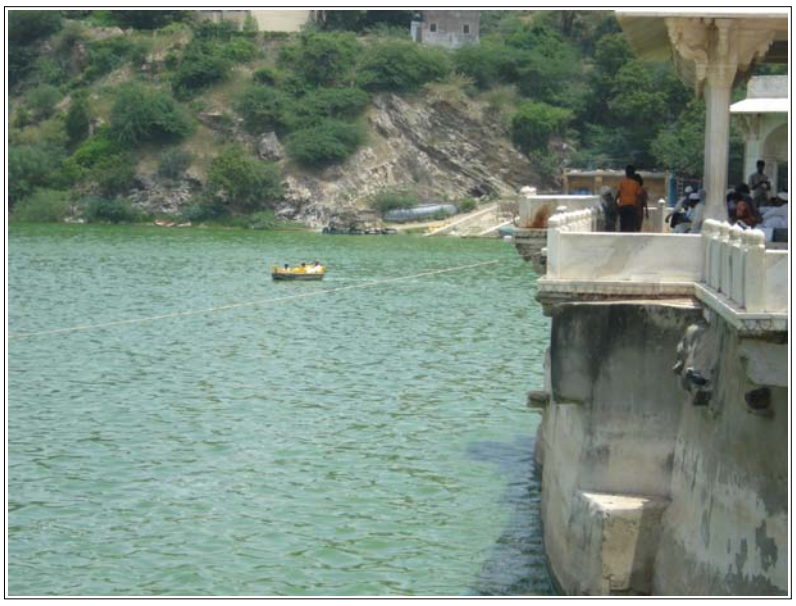
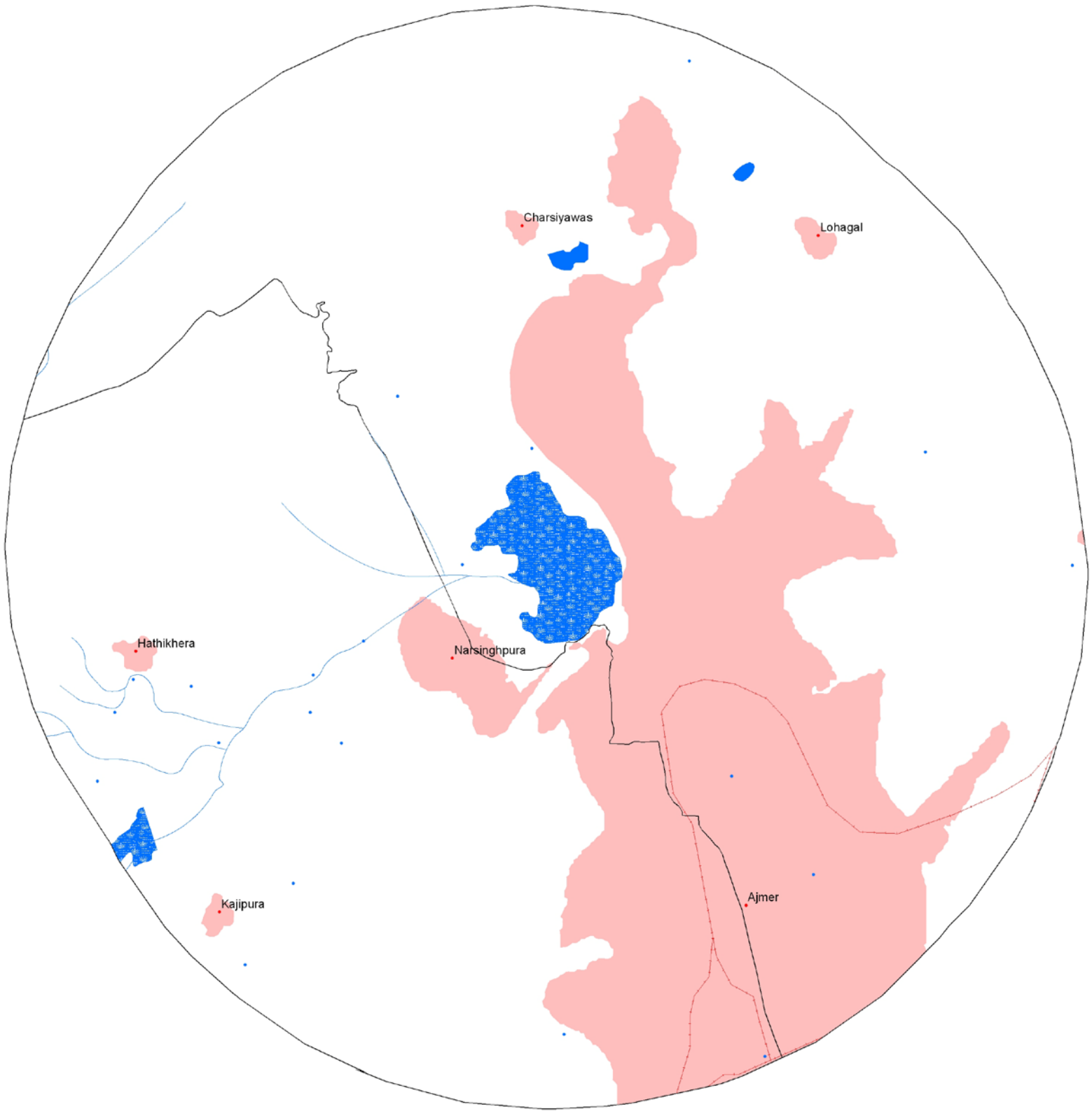


Plate 18: Annasagar Lake

State : Rajasthan

WETLAND MAP

Annasagar Lake

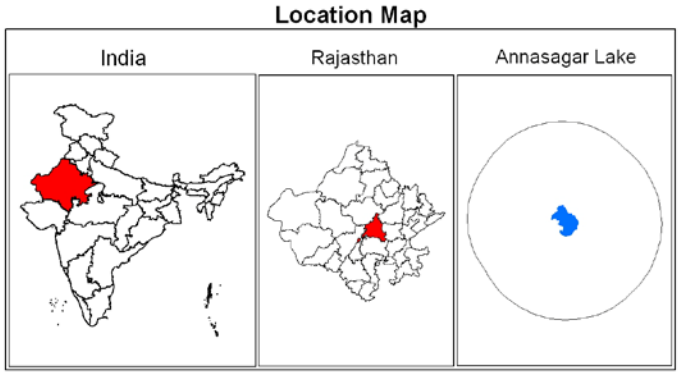


Symbol	Typecode	Level I	Level II	Level III
		Inland Wetlands		
			Natural	
	1101			Lakes/Ponds
	1102			Ox-bow lakes/ Cut-off meanders
	1103			High altitude wetlands
	1104			Reverine wetlands
	1105			Waterlogged
	1106			River/Stream
			Man-made	
	1201			Reservoirs/Barrages
	1202			Tanks/Ponds
	1203			Waterlogged
	1204			Salt pans
		Coastal Wetlands		
			Natural	
	2101			Lagoons
	2102			Creeks
	2103			Sand/Beach
	2104			Intertidal mud flats
	2105			Salt marsh
	2106			Mangroves
	2107			Coral reefs
			Man-made	
	2201			Salt pans
	2202			Aquaculture ponds

Legend

- Wetlands (<2.25ha)
- Drainage (line)
- Major Roads
- Railway
- Settlements
- Town/Settlements
- District Boundary
- State Boundary
- International Boundary

Location Map



1 0.5 0 1 2 Kilometers

Data Source :

IRS P6 LISS III data (Pre-monsoon and Post-monsoon Season 2006-07)

Prepared By :

Space Applications Centre (ISRO), Ahmedabad
and
State Remote Sensing Application Centre, Jodhpur

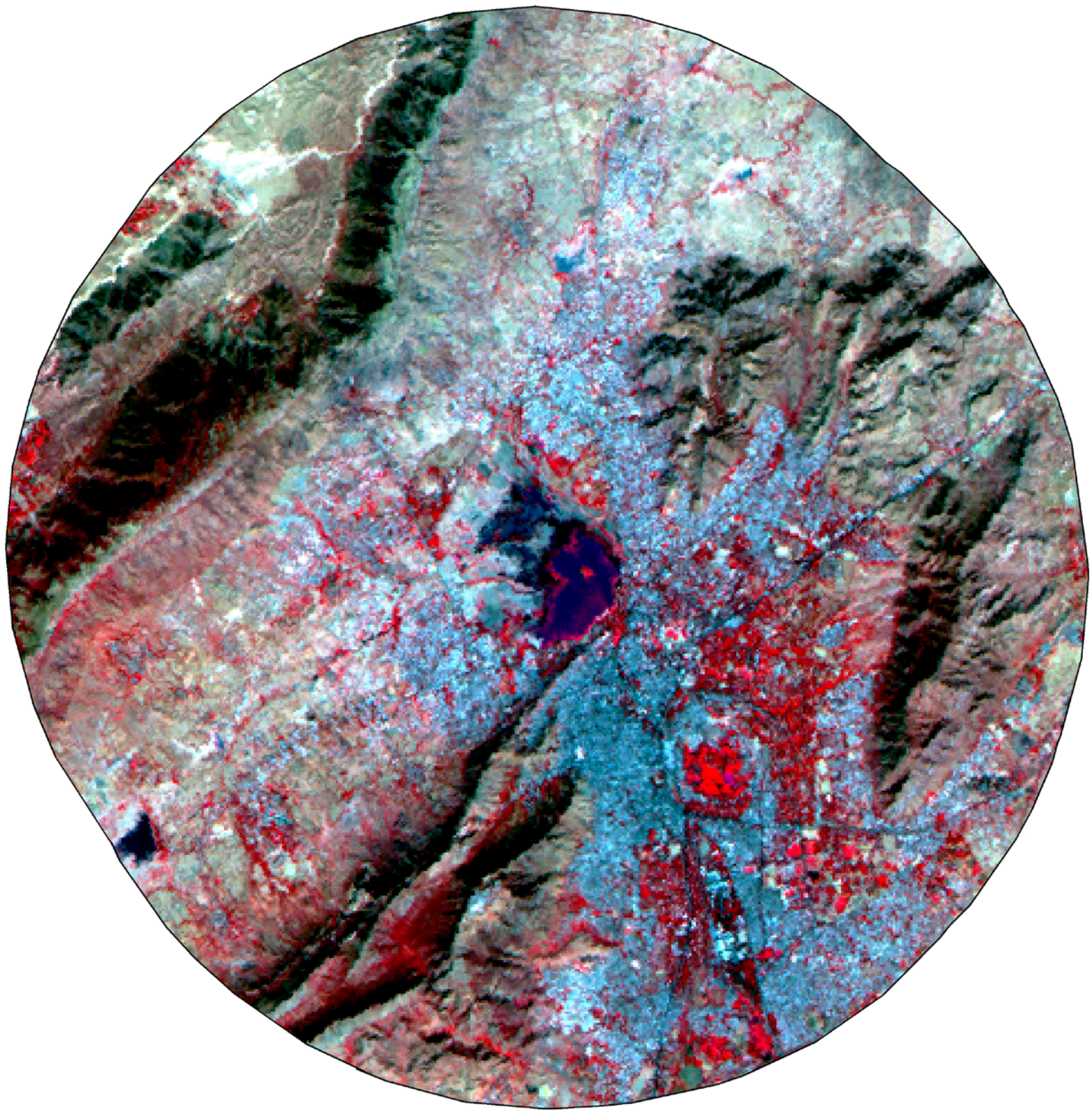
Sponsored By:

Ministry of Environment and Forests
Government of India

Plate 19: Wetland map - 5 km buffer area of Annasagar Lake

State : Rajasthan

Annasagar Lake

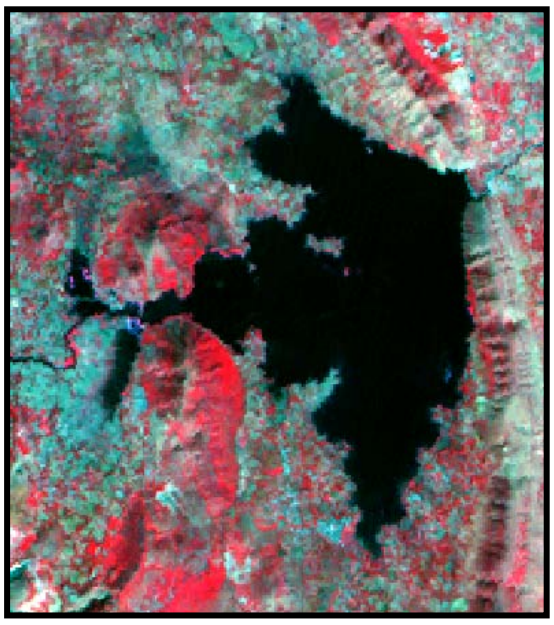


IRS P6 LISS-III Post-monsoon data (2006).

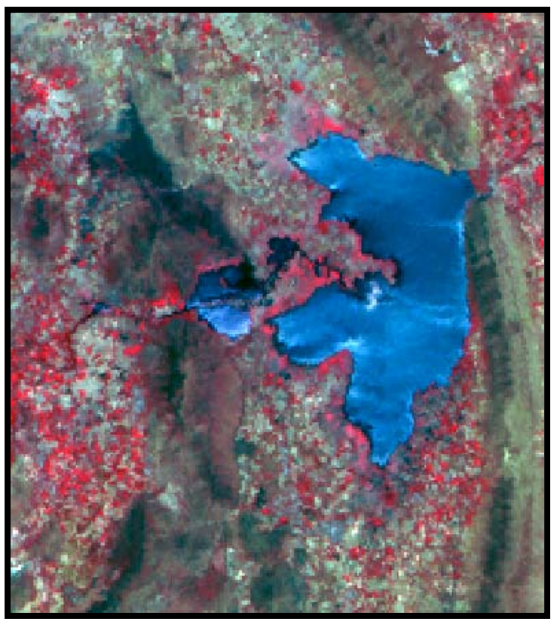
Plate 20: IRS LISS III FCC - 5 km buffer area of Annasagar Lake

9.7 Udaisagar Reservoir

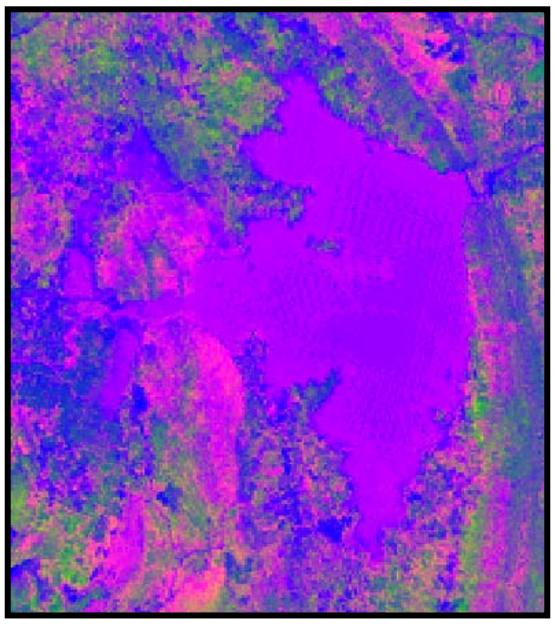
Name	Udaisagar Reservoir
Location	24°32'45" to 24°35'19" N Latitude and 73°47'09" to 73°49'33" E Longitude
Area	719 ha
Wetland Type	Reservoir/Barrage
Climate	Tropical monsoon climate with mean maximum temperature is 25.5^{o} c, and the minimum 16° c.
Description	It is located within the township of Udaipur city. Udaisagar Reservoir an impoundment across the river Bedach a tributary of river Banas. The catchment of the reservoir is surrounded by Aravali rages. It has a catchment of 31.1 sq.km. and the total water spread is 440 ha. The depth is 7m which indicate that it a shallow lake. It is tourist place and known for recreational activities.
vegetation	Vegetation includes macrophytes and phytoplankton population. Macrophytes includes Potamegeton, Hydrilla, Elodea, water hyacinth and Vallisneria. These sp. are considered as weed are found mainly during summer season. Phytoplankton consist of Achnanthes sp., Amphora sp., Melosira sp., Chlarococcum sp., Fragiliaria sp., Frustulia sp., Microcystis sp., Naviculi sp., Oedogonium sp., Oscilatoria sp., Scenedesmus sp., etc.
Fauna	Zooplankton sp. are Keratella, Filinia,Asplancha, Moina, Brachionus, Diaptamus. Mesocyclop, Daphnia. Chironomids constitute 83.8 per cent of the population of macrobenthos.
Turbidity	Low



Post monsoon data (2006)



Pre monsoon data (2007)



Indices image
Post monsoon data (2006)







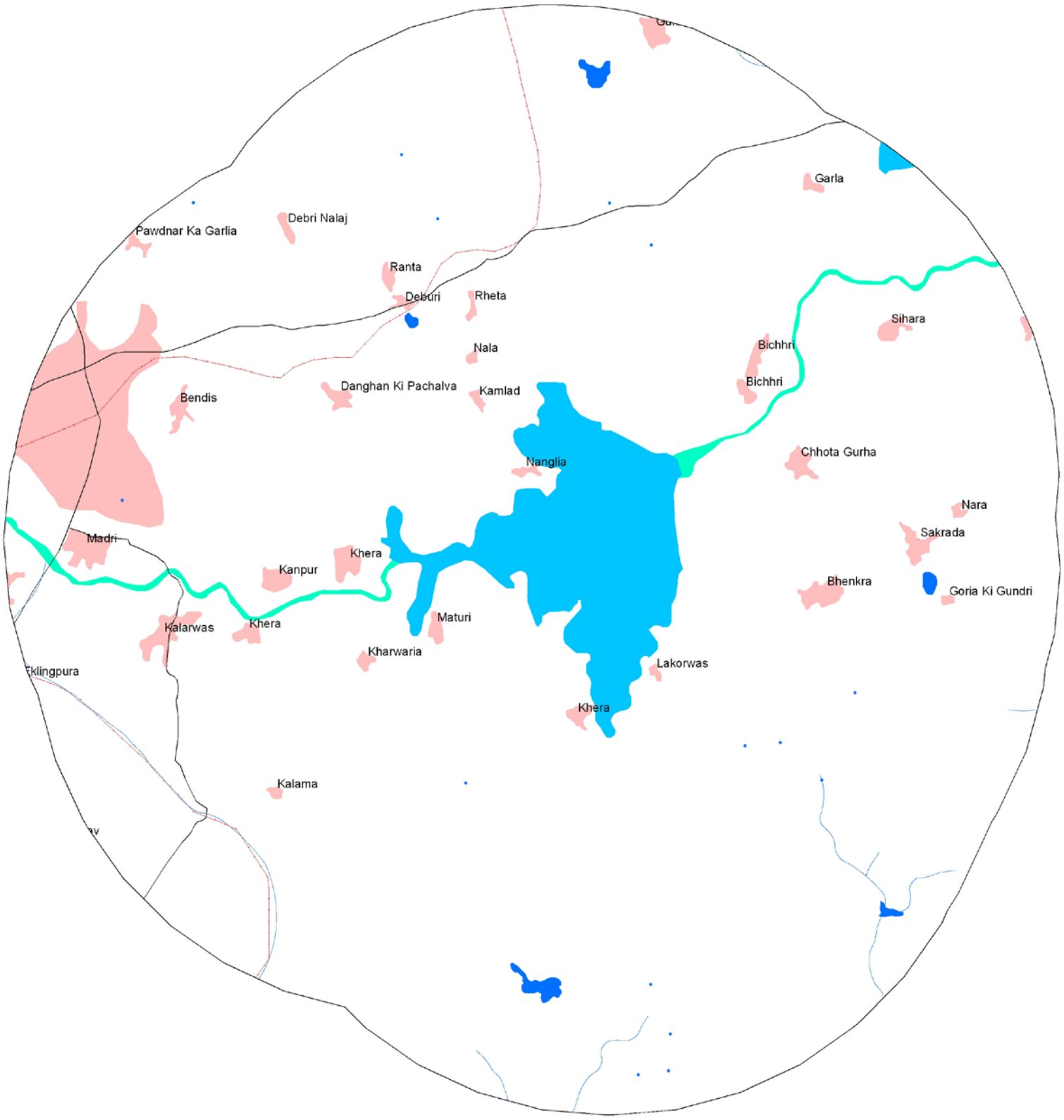


Plate 21: Udaisagar Reservoir

State : Rajasthan

WETLAND MAP

Udaisagar Reservoir

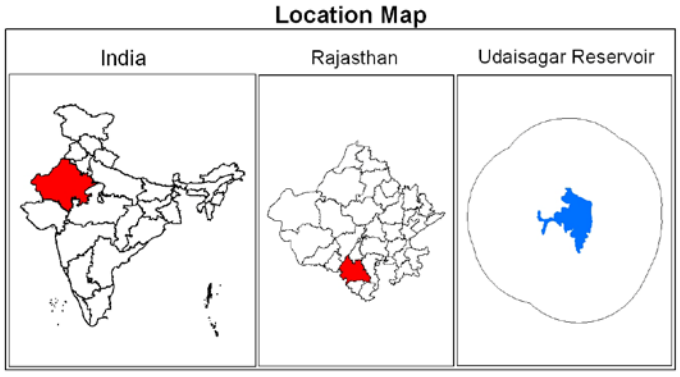


Symbol	Typecode	Level I	Level II	Level III
		Inland Wetlands		
			Natural	
	1101			Lakes/Ponds
	1102			Ox-bow lakes/ Cut-off meanders
	1103			High altitude wetlands
	1104			Reverine wetlands
	1105			Waterlogged
	1106			River/Stream
			Man-made	
	1201			Reservoirs/Barrages
	1202			Tanks/Ponds
	1203			Waterlogged
	1204			Salt pans
		Coastal Wetlands		
			Natural	
	2101			Lagoons
	2102			Creeks
	2103			Sand/Beach
	2104			Intertidal mud flats
	2105			Salt marsh
	2106			Mangroves
	2107			Coral reefs
			Man-made	
	2201			Salt pans
	2202			Aquaculture ponds

Legend

- Wetlands (<2.25ha)
- Drainage (line)
- Major Roads
- Railway
- Settlements
- Town/Settlements
- District Boundary
- State Boundary
- International Boundary

Location Map



1 0.5 0 1 2 Kilometers

Data Source :

IRS P6 LISS III data (Pre-monsoon and Post-monsoon Season 2006-07)

Prepared By :

Space Applications Centre (ISRO), Ahmedabad
and
State Remote Sensing Application Centre, Jodhpur

Sponsored By:

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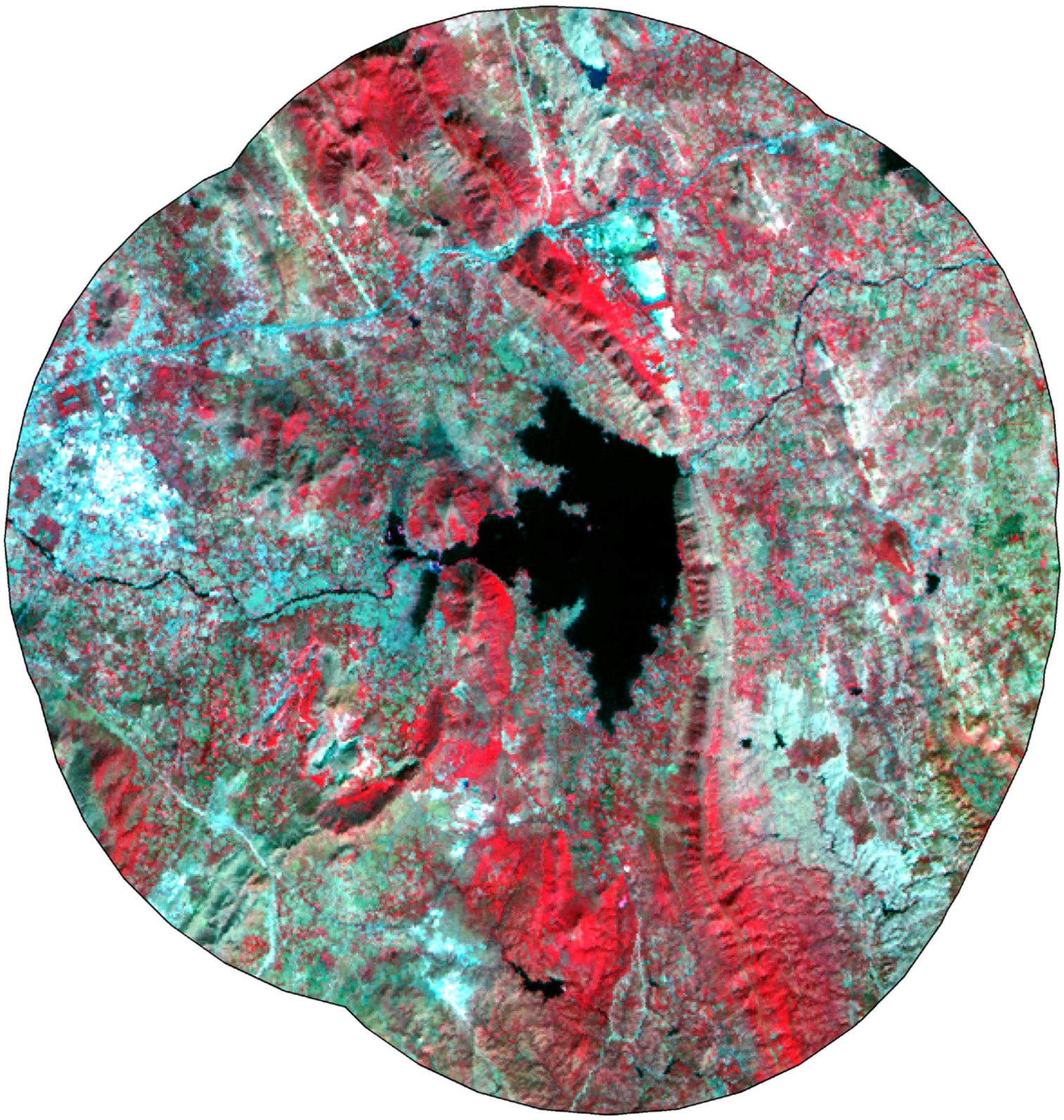
Government of India

Plate 22: Wetland map - 5 km buffer area of Udaisagar Reservoir

State : Rajasthan

Udaisagar Reservoir



IRS P6 LISS-III Post-monsoon data (2006).

Plate 23: IRS LISS III FCC - 5 km buffer area of Udaisagar Reservoir

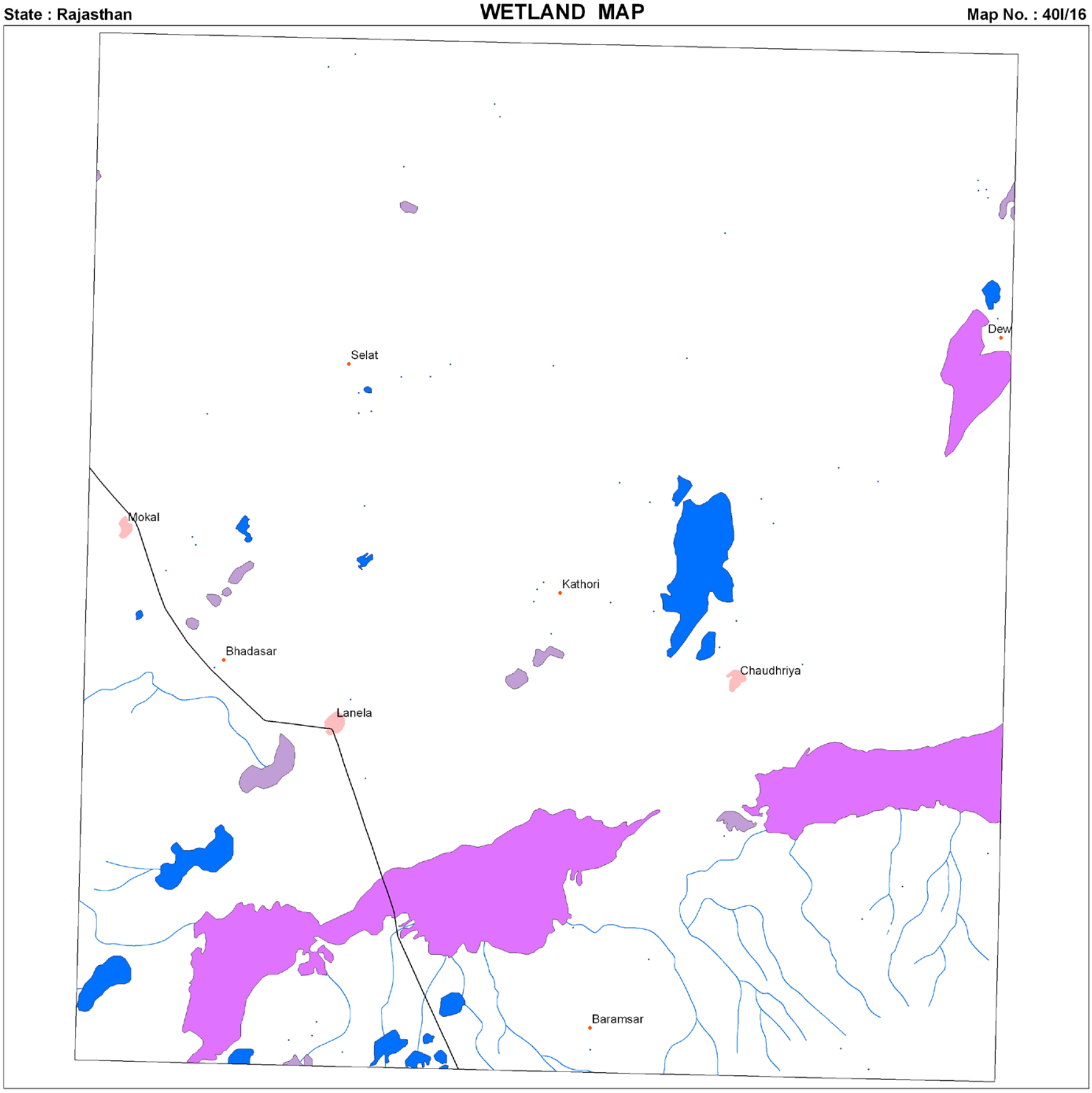
SOI MAP-SHEET-WISE WETLAND MAPS

(Selected)

State : Rajasthan

WETLAND MAP

Map No. : 40I/16

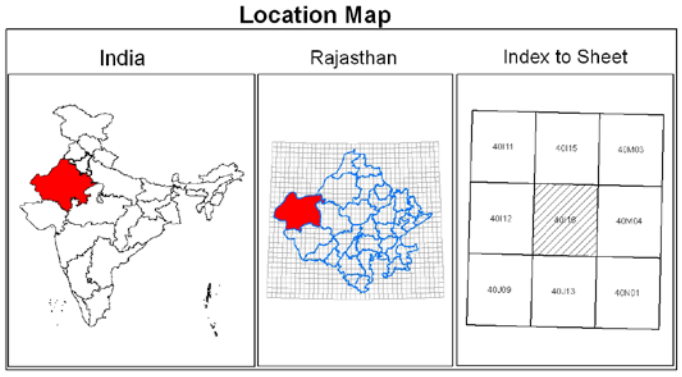


Symbol	Typecode	Level I	Level II	Level III
		Inland Wetlands		
			Natural	
	1101			Lakes/Ponds
	1102			Ox-bow lakes/ Cut-off meanders
	1103			High altitude wetlands
	1104			Riverine wetlands
	1105			Waterlogged
	1106			River/Stream
			Man-made	
	1201			Reservoirs/Barrages
	1202			Tanks/Ponds
	1203			Waterlogged
	1204			Salt pans
		Coastal Wetlands		
			Natural	
	2101			Lagoons
	2102			Creeks
	2103			Sand/Beach
	2104			Intertidal mud flats
	2105			Salt marsh
	2106			Mangroves
	2107			Coral reefs
			Man-made	
	2201			Salt pans
	2202			Aquaculture ponds

Legend

- Wetlands (<2.25 ha)
- Settlements
- Drainage (line)
- Canal
- Roads
- Railways
- Town/Settlements
- District Boundary
- State Boundary
- International Boundary

Location Map



Data Source :

IRS P6 LISS III data (Pre-monsoon and Post-monsoon Season 2006-07)

Prepared By :

Space Applications Centre (ISRO), Ahmedabad
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State Remote Sensing Application Centre, Jodhpur

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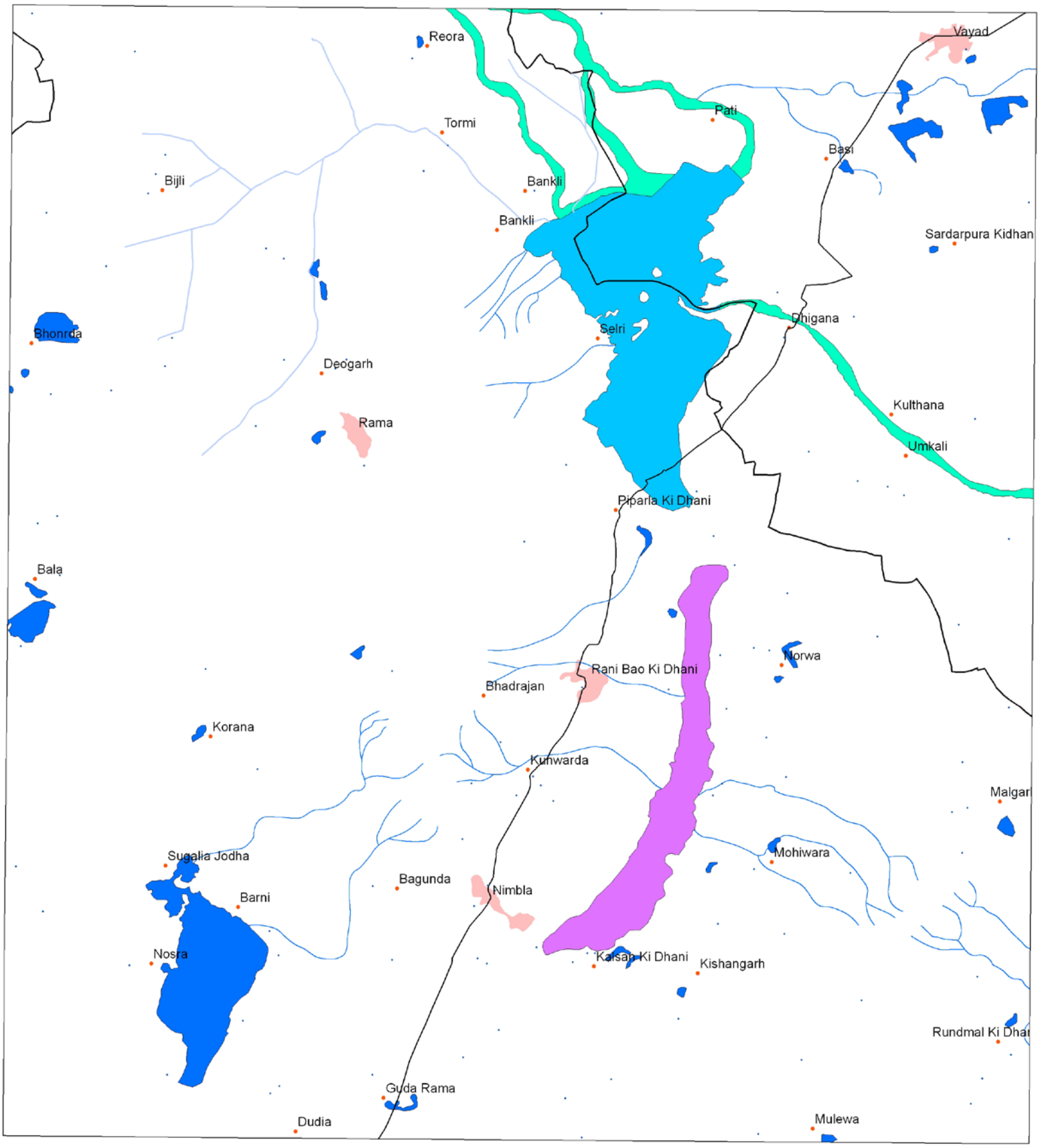
State : Rajasthan

WETLAND MAP

Map No. : 45C/14

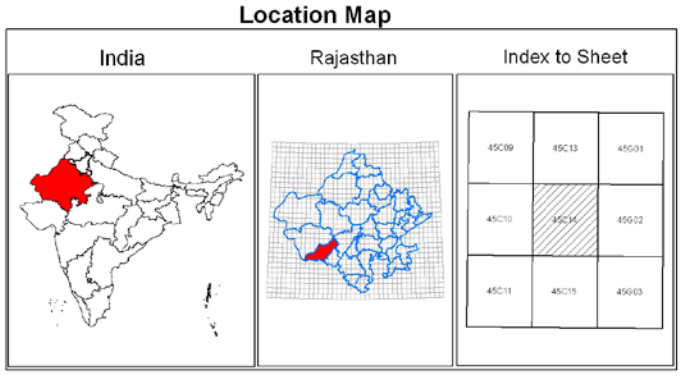


Symbol	Typecode	Level I	Level II	Level III
		Inland Wetlands		
			Natural	
	1101			Lakes/Ponds
	1102			Ox-bow lakes/ Cut-off meanders
	1103			High altitude wetlands
	1104			Riverine wetlands
	1105			Waterlogged
	1106			River/Stream
			Man-made	
	1201			Reservoirs/Barrages
	1202			Tanks/Ponds
	1203			Waterlogged
	1204			Salt pans
		Coastal Wetlands		
			Natural	
	2101			Lagoons
	2102			Creeks
	2103			Sand/Beach
	2104			Intertidal mud flats
	2105			Salt marsh
	2106			Mangroves
	2107			Coral reefs
			Man-made	
	2201			Salt pans
	2202			Aquaculture ponds

Legend

- Wetlands (<2.25 ha)
- Settlements
- Drainage (line)
- Canal
- Roads
- Railways
- Town/Settlements
- District Boundary
- State Boundary
- International Boundary

Location Map



Data Source :

IRS P6 LISS III data (Pre-monsoon and Post-monsoon Season 2006-07)

Prepared By :

Space Applications Centre (ISRO), Ahmedabad
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State Remote Sensing Application Centre, Jodhpur

Sponsored By:

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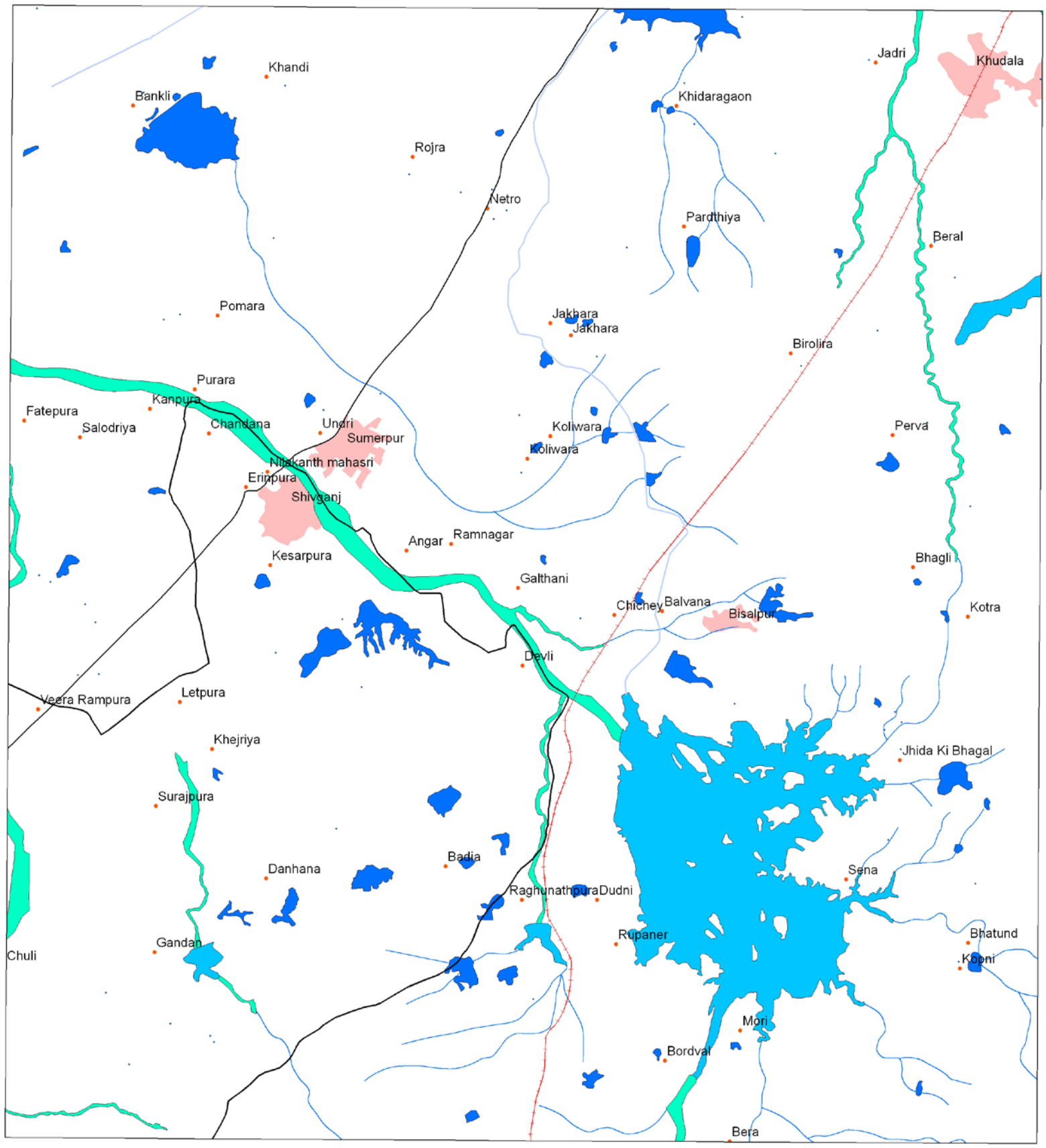
Government of India

State : Rajasthan

WETLAND MAP

Map No. : 45G/04

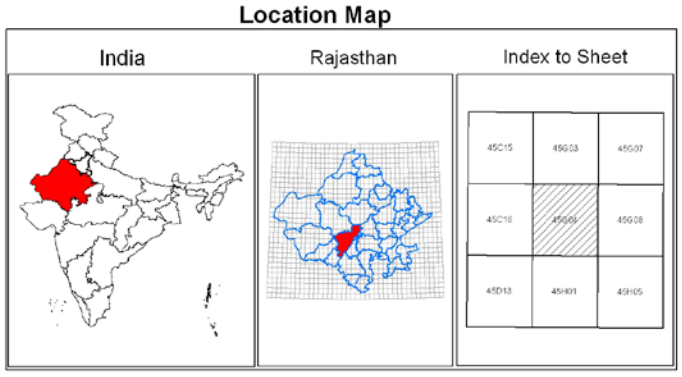


Symbol	Typecode	Level I	Level II	Level III
		Inland Wetlands		
			Natural	
	1101			Lakes/Ponds
	1102			Ox-bow lakes/ Cut-off meanders
	1103			High altitude wetlands
	1104			Riverine wetlands
	1105			Waterlogged
	1106			River/Stream
			Man-made	
	1201			Reservoirs/Barrages
	1202			Tanks/Ponds
	1203			Waterlogged
	1204			Salt pans
		Coastal Wetlands		
			Natural	
	2101			Lagoons
	2102			Creeks
	2103			Sand/Beach
	2104			Intertidal mud flats
	2105			Salt marsh
	2106			Mangroves
	2107			Coral reefs
			Man-made	
	2201			Salt pans
	2202			Aquaculture ponds

Legend

- Wetlands (<2.25 ha)
- Settlements
- Drainage (line)
- Canal
- Roads
- Railways
- Town/Settlements
- District Boundary
- State Boundary
- International Boundary

Location Map



0 1 2 4 6 Kilometers

Data Source :

IRS P6 LISS III data (Pre-monsoon and Post-monsoon Season 2006-07)

Prepared By :

Space Applications Centre (ISRO), Ahmedabad
and
State Remote Sensing Application Centre, Jodhpur

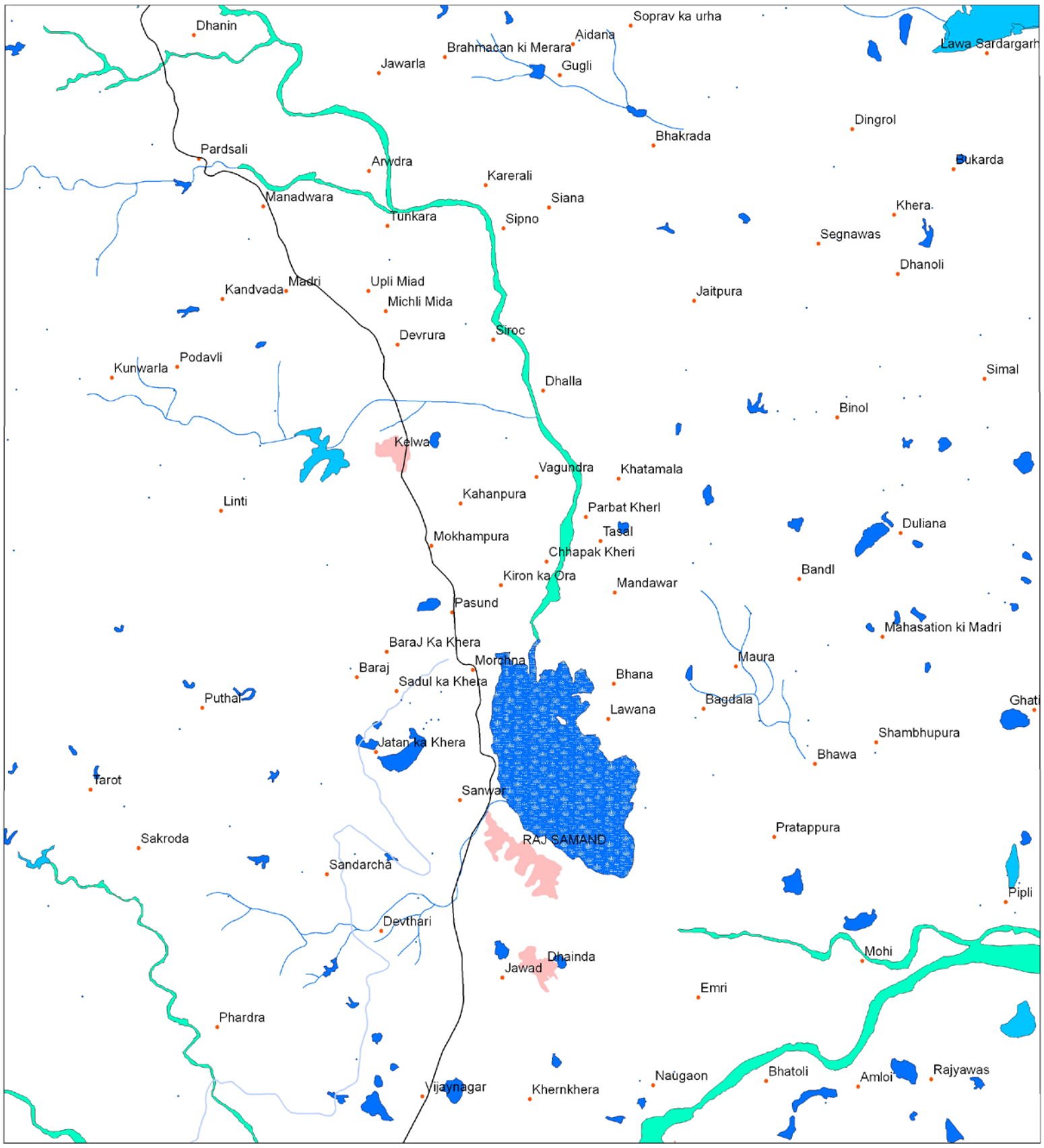
Sponsored By:

Ministry of Environment and Forests
Government of India

State : Rajasthan

WETLAND MAP

Map No. : 45G/16



Symbol	Typecode	Level I	Level II	Level III
		Inland Wetlands		
			Natural	
	1101			Lakes/Ponds
	1102			Ox-bow lakes/ Cut-off meanders
	1103			High altitude wetlands
	1104			Riverine wetlands
	1105			Waterlogged
	1106			River/Stream
			Man-made	
	1201			Reservoirs/Barrages
	1202			Tanks/Ponds
	1203			Waterlogged
	1204			Salt pans
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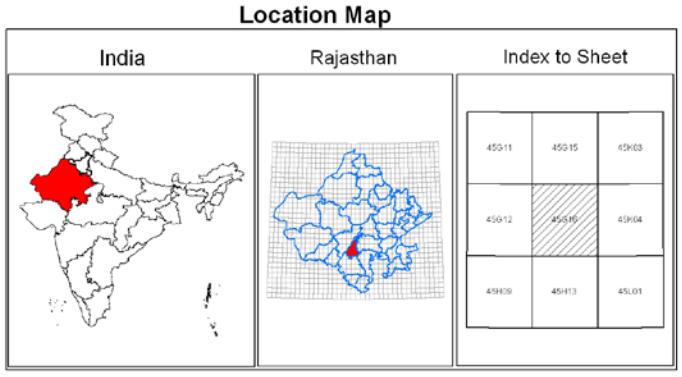
			Natural	
	2101			Lagoons
	2102			Creeks
	2103			Sand/Beach
	2104			Intertidal mud flats
	2105			Salt marsh
	2106			Mangroves
	2107			Coral reefs
			Man-made	
	2201			Salt pans
	2202			Aquaculture ponds

Legend

- Wetlands (<2.25 ha)
- Settlements
- Drainage (line)
- Canal
- Roads
- Railways
- Town/Settlements
- District Boundary
- State Boundary
- International Boundary

Location Map



Data Source :

IRS P6 LISS III data (Pre-monsoon and Post-monsoon Season 2006-07)

Prepared By :

Space Applications Centre (ISRO), Ahmedabad
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State Remote Sensing Application Centre, Jodhpur

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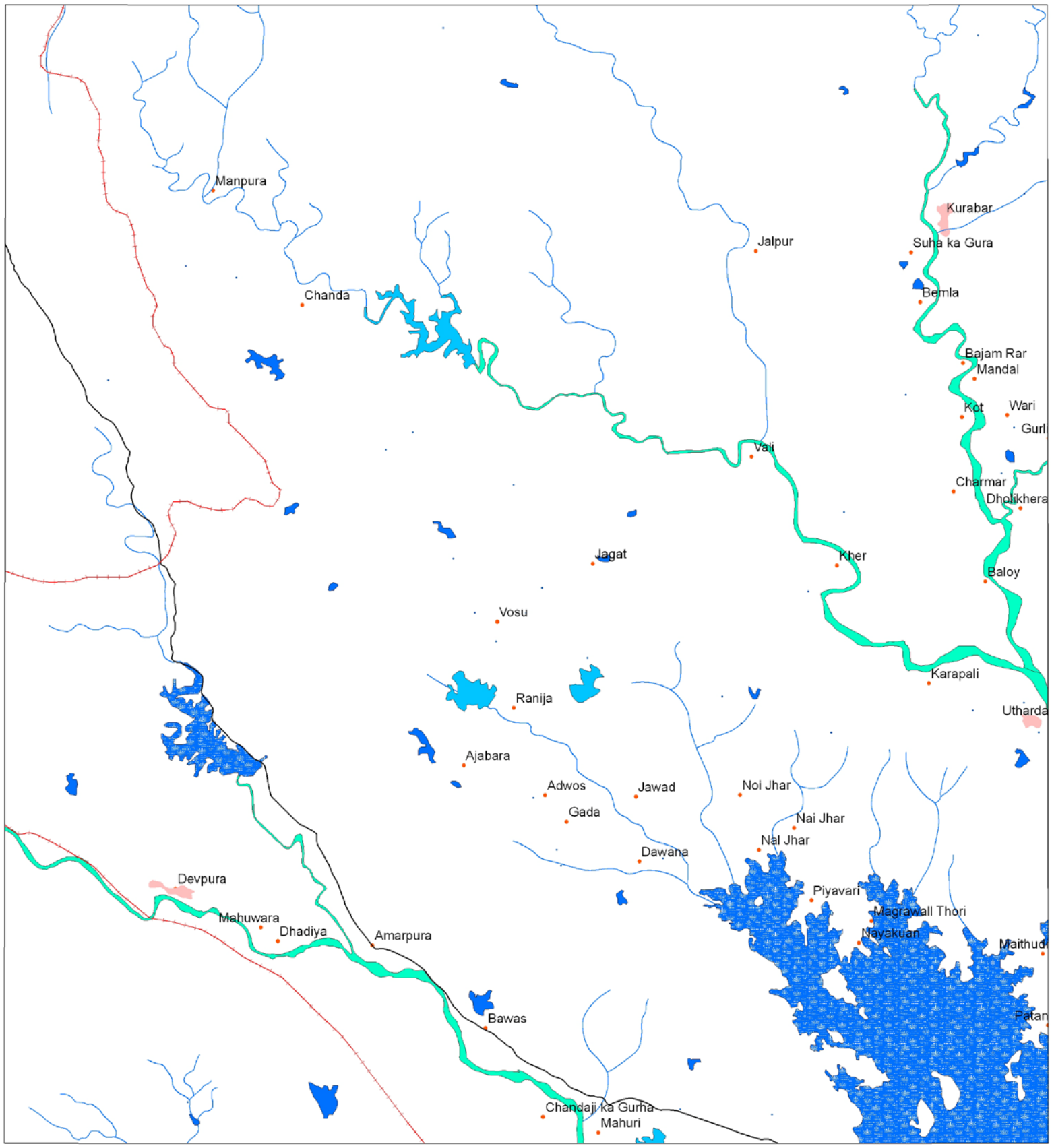
Ministry of Environment and Forests
Government of India

State : Rajasthan

WETLAND MAP

Map No. : 45H/15



Symbol	Typecode	Level I	Level II	Level III
		Inland Wetlands		
			Natural	
	1101			Lakes/Ponds
	1102			Ox-bow lakes/ Cut-off meanders
	1103			High altitude wetlands
	1104			Riverine wetlands
	1105			Waterlogged
	1106			River/Stream
			Man-made	
	1201			Reservoirs/Barrages
	1202			Tanks/Ponds
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	1204			Salt pans
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	2101			Lagoons
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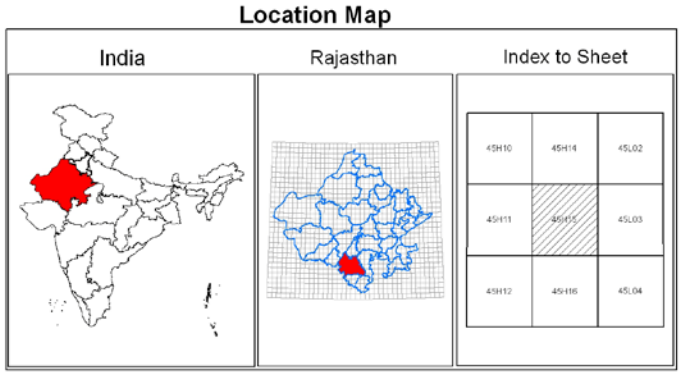
	2105			Salt marsh
	2106			Mangroves
	2107			Coral reefs
			Man-made	
	2201			Salt pans
	2202			Aquaculture ponds

Legend

- Wetlands (<2.25 ha)
- Settlements
- Drainage (line)
- Canal
- Roads
- Railways
- Town/Settlements
- District Boundary
- State Boundary
- International Boundary

Location Map



Data Source :

IRS P6 LISS III data (Pre-monsoon and Post-monsoon Season 2006-07)

Prepared By :

Space Applications Centre (ISRO), Ahmedabad
and
State Remote Sensing Application Centre, Jodhpur

Sponsored By:

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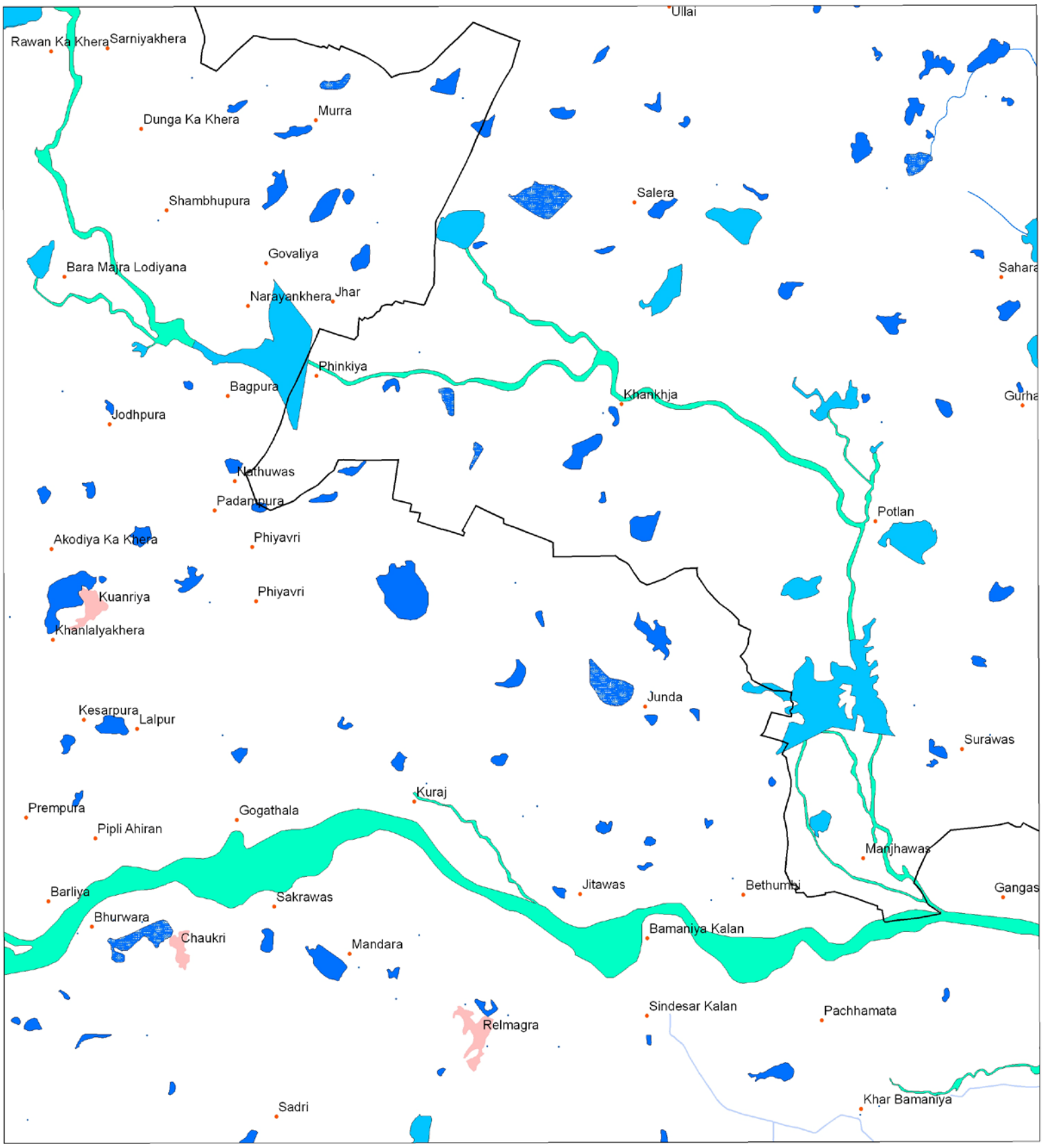
Government of India

State : Rajasthan

WETLAND MAP

Map No. : 45K/04



Symbol	Typecode	Level I	Level II	Level III
		Inland Wetlands		
			Natural	
	1101			Lakes/Ponds
	1102			Ox-bow lakes/ Cut-off meanders
	1103			High altitude wetlands
	1104			Riverine wetlands
	1105			Waterlogged
	1106			River/Stream
			Man-made	
	1201			Reservoirs/Barrages
	1202			Tanks/Ponds
	1203			Waterlogged
	1204			Salt pans
		Coastal Wetlands		
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	2101			Lagoons
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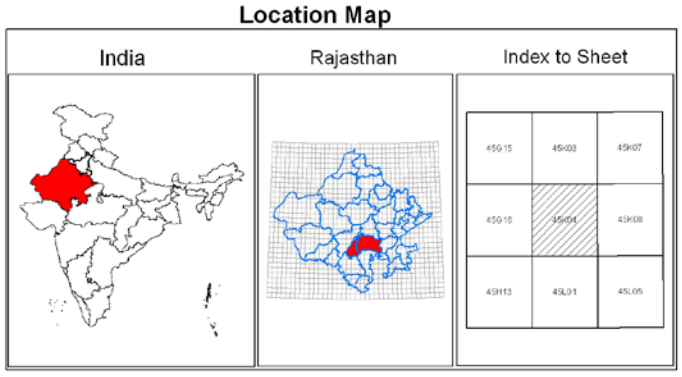
	2105			Salt marsh
	2106			Mangroves
	2107			Coral reefs
			Man-made	
	2201			Salt pans
	2202			Aquaculture ponds

Legend

- Wetlands (<2.25 ha)
- Settlements
- Drainage (line)
- Canal
- Roads
- Railways
- Town/Settlements
- District Boundary
- State Boundary
- International Boundary

Location Map



Data Source :

IRS P6 LISS III data (Pre-monsoon and Post-monsoon Season 2006-07)

Prepared By :

Space Applications Centre (ISRO), Ahmedabad
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State Remote Sensing Application Centre, Jodhpur

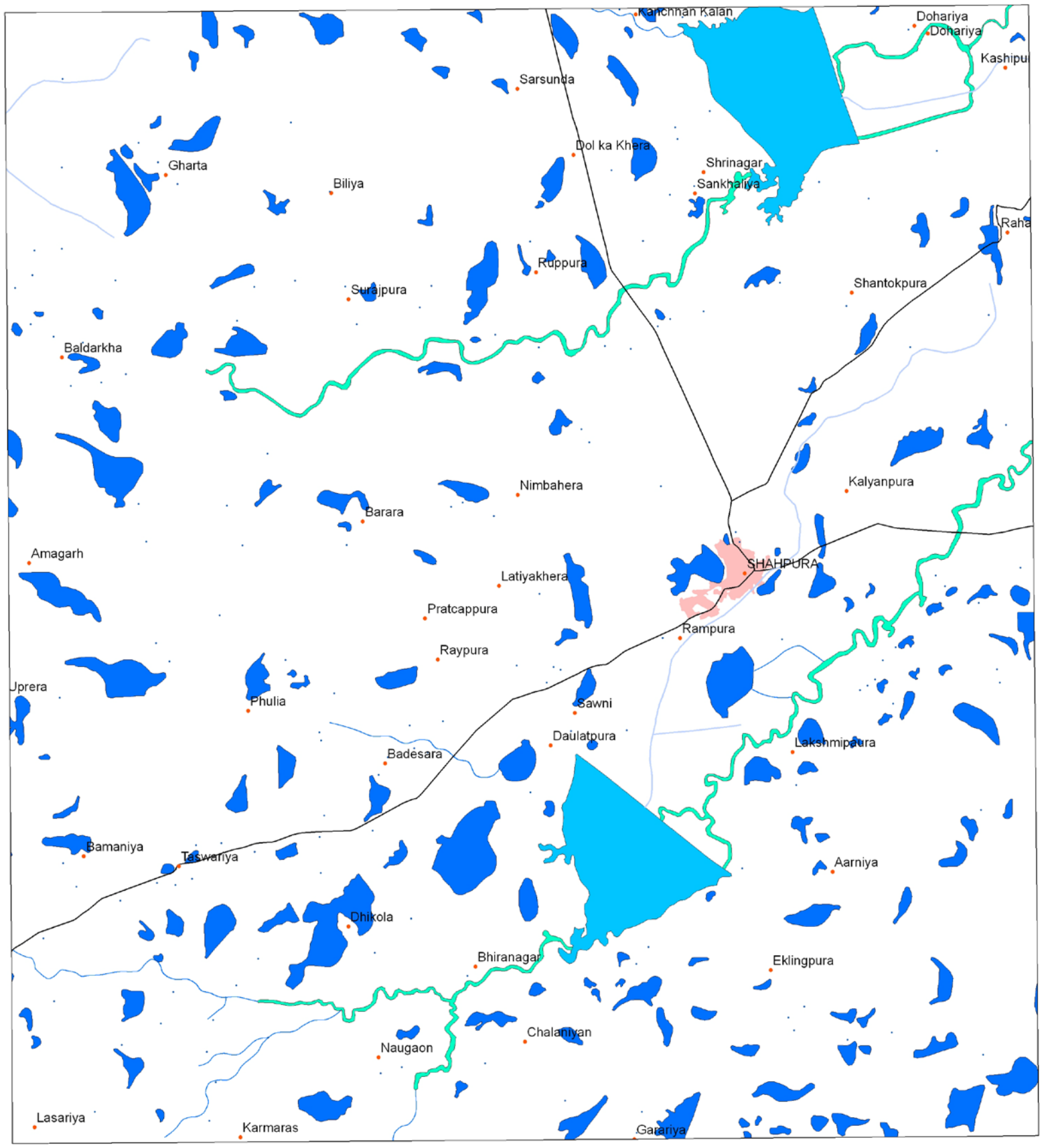
Sponsored By:

Ministry of Environment and Forests
Government of India

State : Rajasthan

WETLAND MAP

Map No. : 45K/14

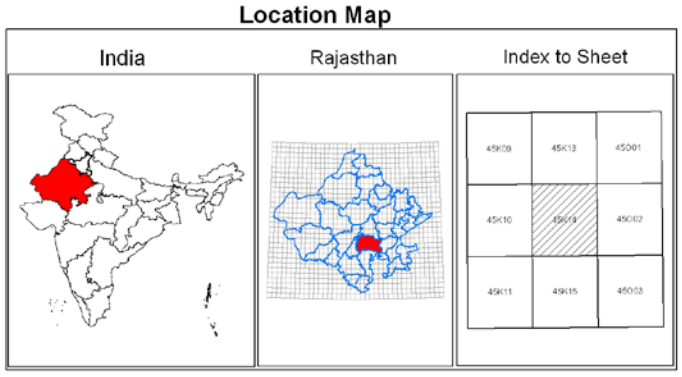


Symbol	Typecode	Level I	Level II	Level III
		Inland Wetlands		
			Natural	
	1101			Lakes/Ponds
	1102			Ox-bow lakes/ Cut-off meanders
	1103			High altitude wetlands
	1104			Riverine wetlands
	1105			Waterlogged
	1106			River/Stream
			Man-made	
	1201			Reservoirs/Barrages
	1202			Tanks/Ponds
	1203			Waterlogged
	1204			Salt pans
		Coastal Wetlands		
			Natural	
	2101			Lagoons
	2102			Creeks
	2103			Sand/Beach
	2104			Intertidal mud flats
	2105			Salt marsh
	2106			Mangroves
	2107			Coral reefs
			Man-made	
	2201			Salt pans
	2202			Aquaculture ponds

Legend

- Wetlands (<2.25 ha)
- Settlements
- Drainage (line)
- Canal
- Roads
- Railways
- Town/Settlements
- District Boundary
- State Boundary
- International Boundary

Location Map



Data Source :

IRS P6 LISS III data (Pre-monsoon and Post-monsoon Season 2006-07)

Prepared By :

Space Applications Centre (ISRO), Ahmedabad
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State Remote Sensing Application Centre, Jodhpur

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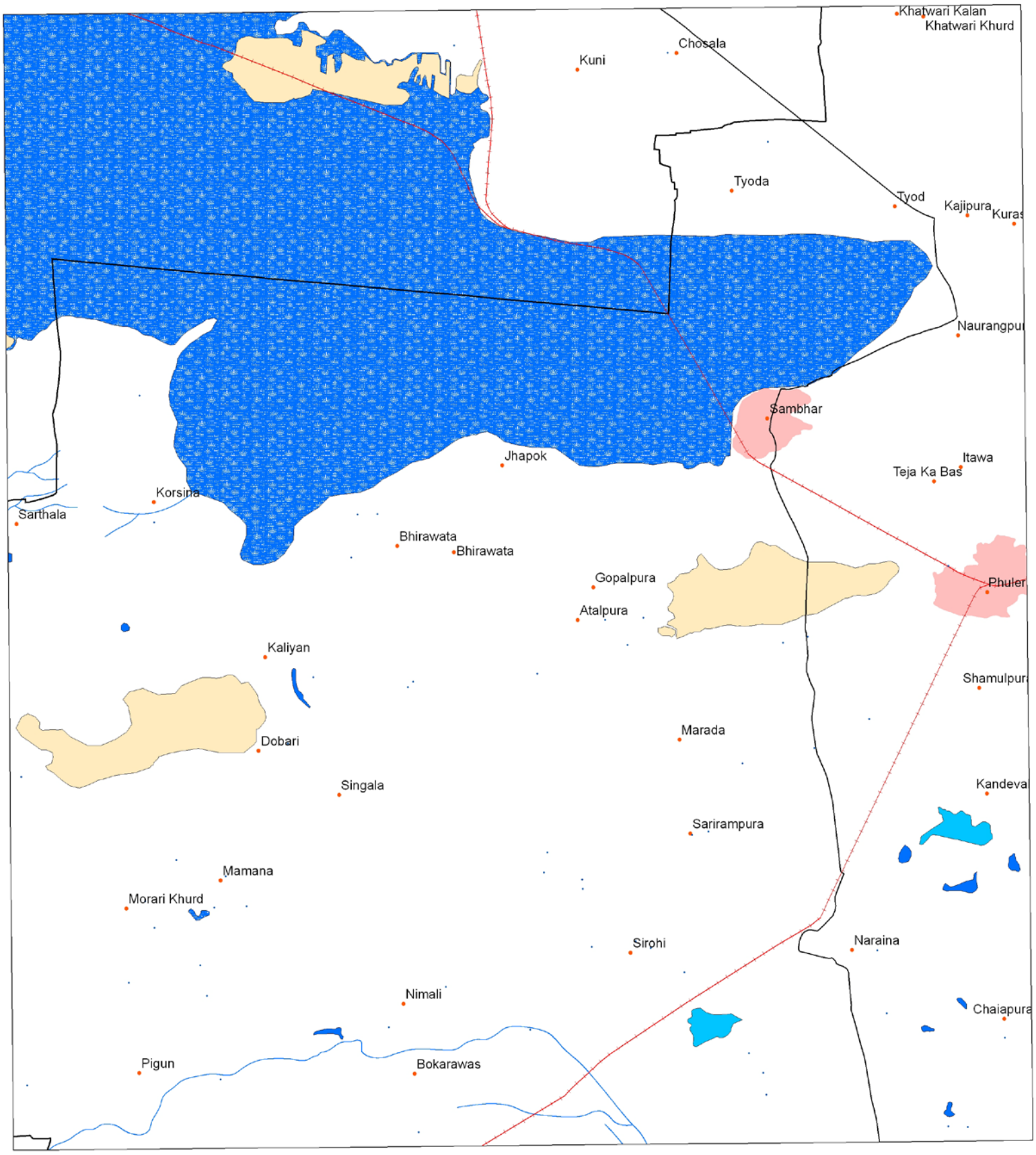
Government of India

State : Rajasthan

WETLAND MAP

Map No. : 45N/01



Symbol	Typecode	Level I	Level II	Level III
		Inland Wetlands		
			Natural	
	1101			Lakes/Ponds
	1102			Ox-bow lakes/ Cut-off meanders
	1103			High altitude wetlands
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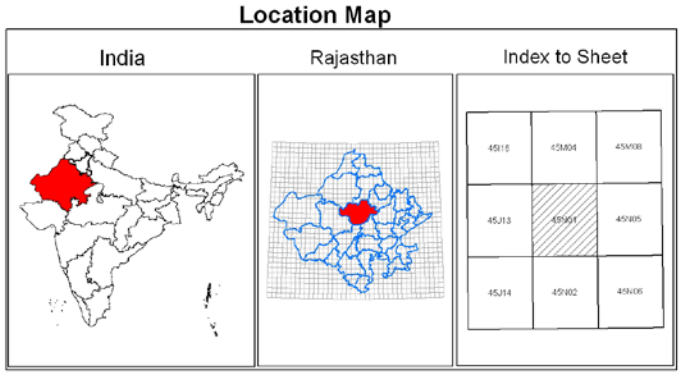
	2106			Mangroves
	2107			Coral reefs
			Man-made	
	2201			Salt pans
	2202			Aquaculture ponds

Legend

- Wetlands (<2.25 ha)
- Settlements
- Drainage (line)
- Canal
- Roads
- Railways
- Town/Settlements
- District Boundary
- State Boundary
- International Boundary

Location Map



Data Source :

IRS P6 LISS III data (Pre-monsoon and Post-monsoon Season 2006-07)

Prepared By :

Space Applications Centre (ISRO), Ahmedabad
and
State Remote Sensing Application Centre, Jodhpur

Sponsored By:

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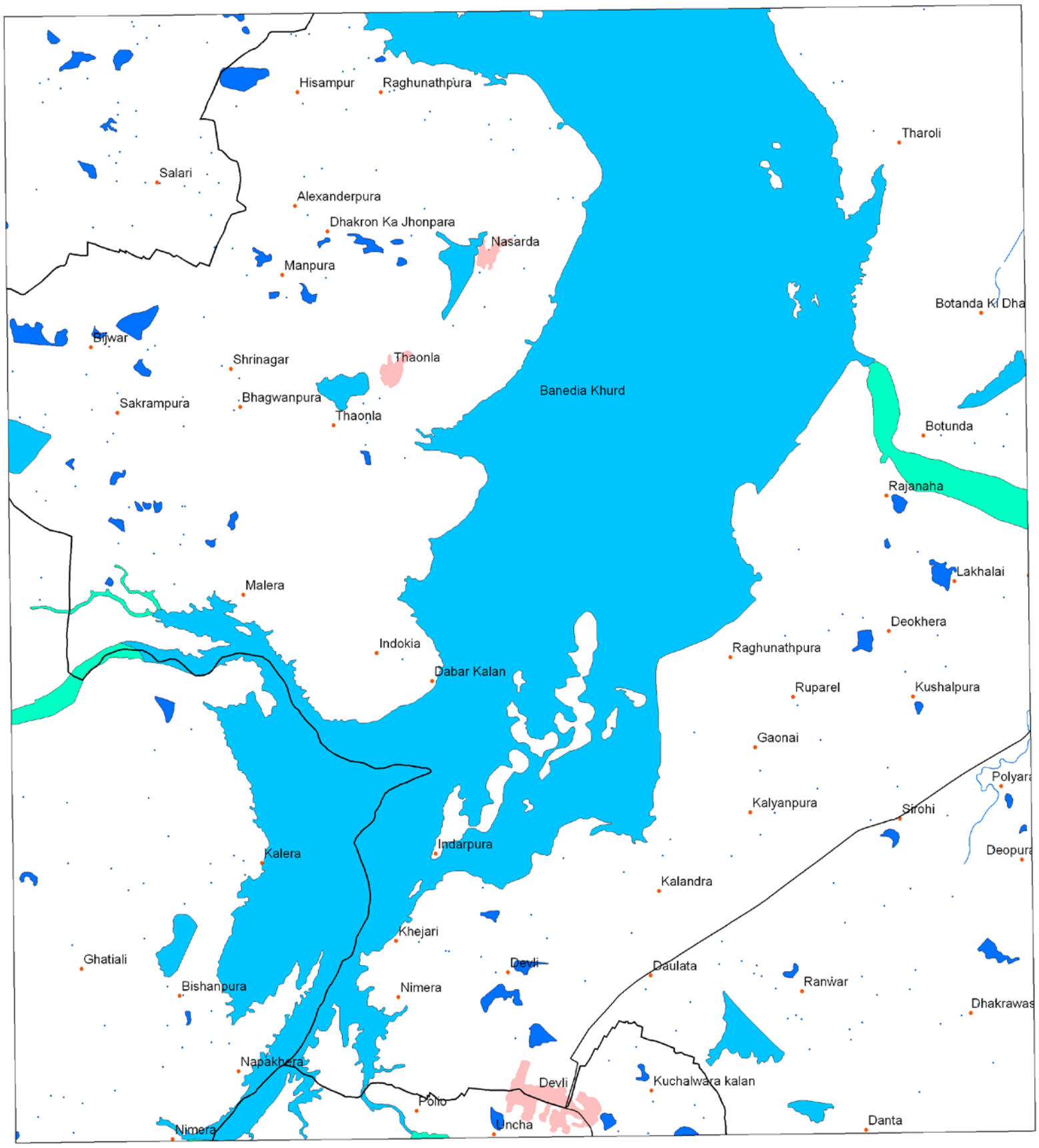
Government of India

State : Rajasthan

WETLAND MAP

Map No. : 45O/05



Symbol	Typecode	Level I	Level II	Level III
		Inland Wetlands		
			Natural	
	1101			Lakes/Ponds
	1102			Ox-bow lakes/ Cut-off meanders
	1103			High altitude wetlands
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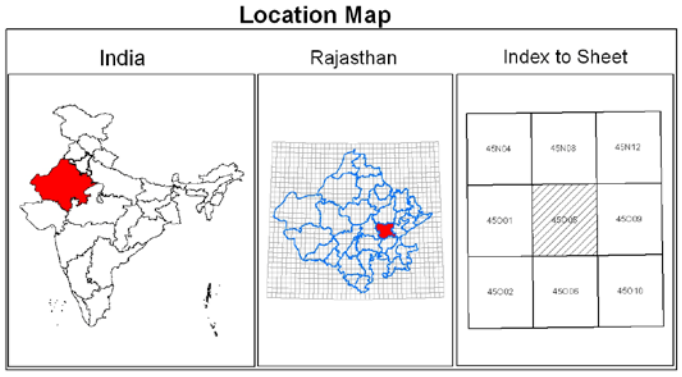
	1105			Waterlogged
	1106			River/Stream
			Man-made	
	1201			Reservoirs/Barrages
	1202			Tanks/Ponds
	1203			Waterlogged
	1204			Salt pans
		Coastal Wetlands		
			Natural	
	2101			Lagoons
	2102			Creeks
	2103			Sand/Beach
	2104			Intertidal mud flats
	2105			Salt marsh
	2106			Mangroves
	2107			Coral reefs
			Man-made	
	2201			Salt pans
	2202			Aquaculture ponds

Legend

- Wetlands (<2.25 ha)
- Settlements
- Drainage (line)
- Canal
- Roads
- Railways
- Town/Settlements
- District Boundary
- State Boundary
- International Boundary

Location Map



Data Source :

IRS P6 LISS III data (Pre-monsoon and Post-monsoon Season 2006-07)

Prepared By :

Space Applications Centre (ISRO), Ahmedabad
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State Remote Sensing Application Centre, Jodhpur

Sponsored By:

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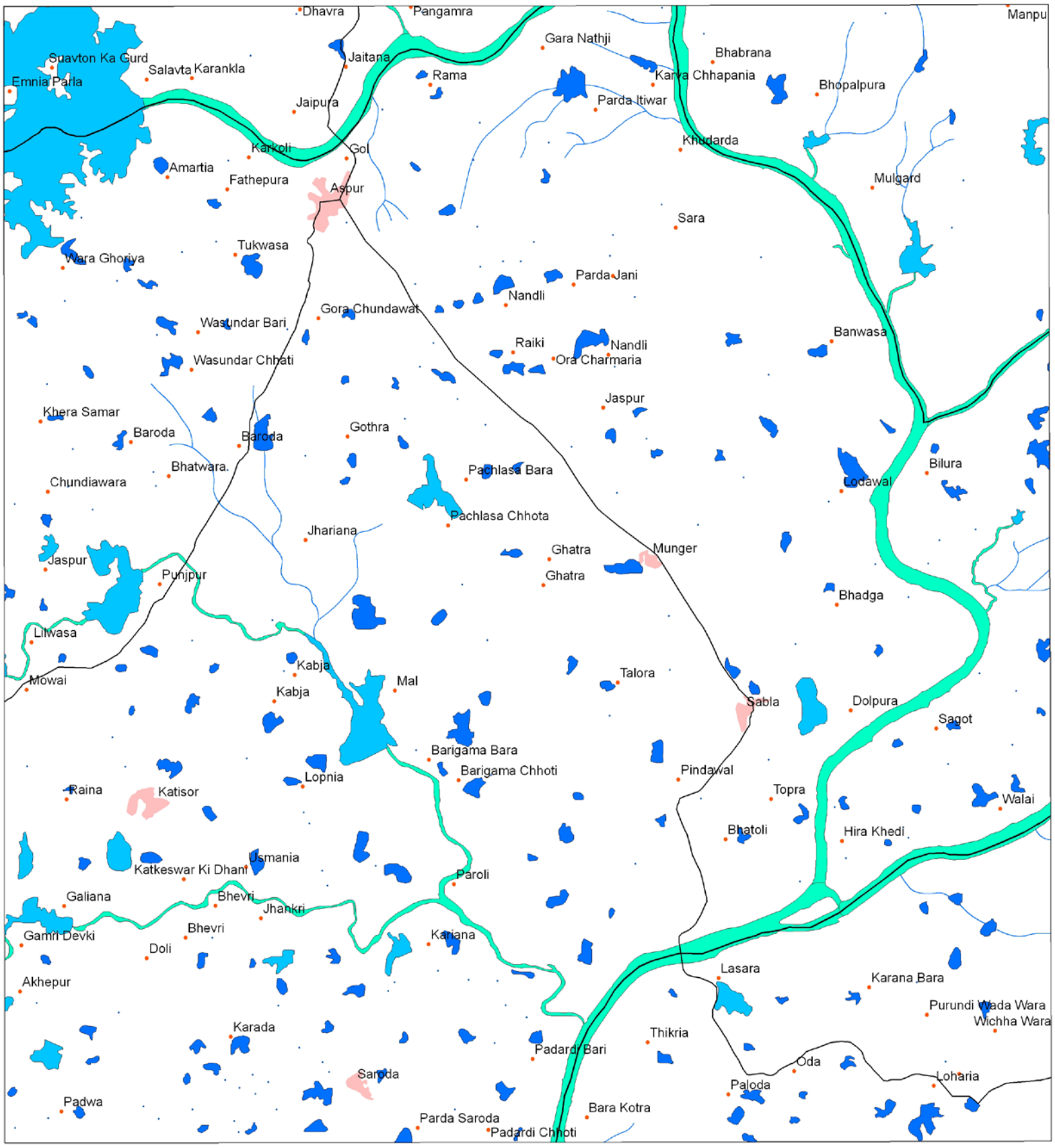
Government of India

State : Rajasthan

WETLAND MAP

Map No. : 46I/01



Symbol	Typecode	Level I	Level II	Level III
		Inland Wetlands		
			Natural	
	1101			Lakes/Ponds
	1102			Ox-bow lakes/ Cut-off meanders
	1103			High altitude wetlands
	1104			Riverine wetlands
	1105			Waterlogged
	1106			River/Stream
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	2101			Lagoons
	2102			Creeks
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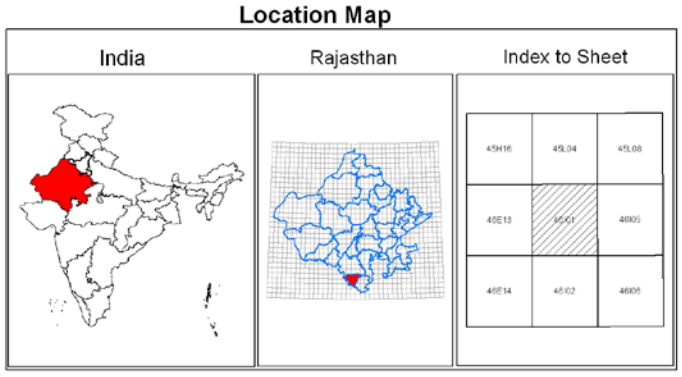
	2104			Intertidal mud flats
	2105			Salt marsh
	2106			Mangroves
	2107			Coral reefs
			Man-made	
	2201			Salt pans
	2202			Aquaculture ponds

Legend

- Wetlands (<2.25 ha)
- Settlements
- Drainage (line)
- Canal
- Roads
- Railways
- Town/Settlements
- District Boundary
- State Boundary
- International Boundary

Location Map



Data Source :

IRS P6 LISS III data (Pre-monsoon and Post-monsoon Season 2006-07)

Prepared By :

Space Applications Centre (ISRO), Ahmedabad
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State Remote Sensing Application Centre, Jodhpur

Sponsored By:

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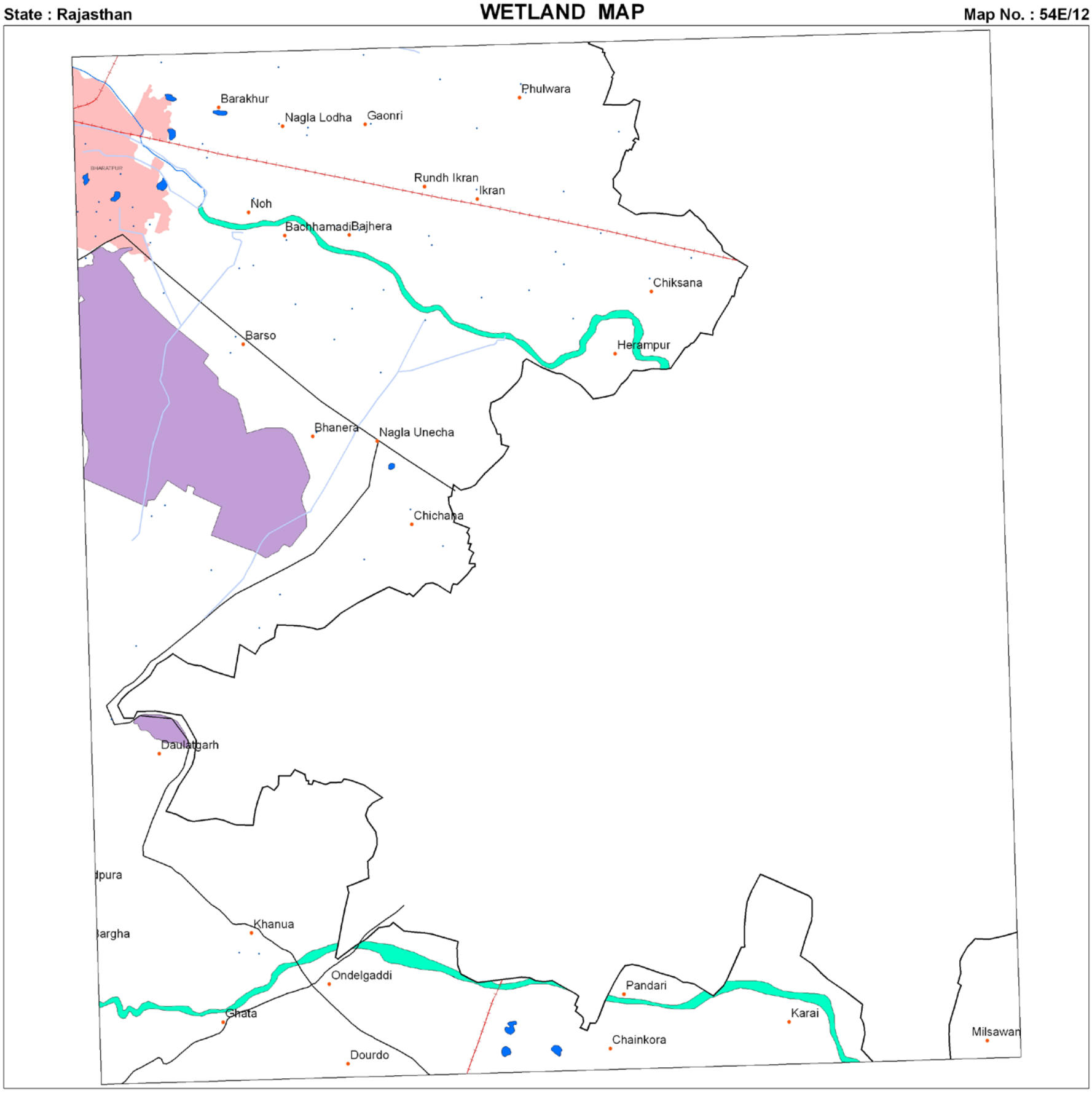
Government of India

State : Rajasthan

WETLAND MAP

Map No. : 54E/12

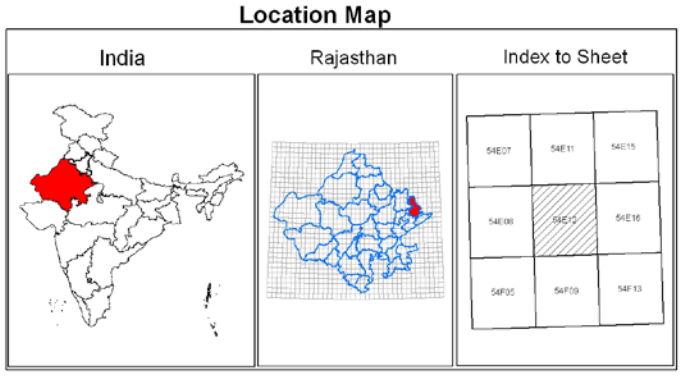


Symbol	Typecode	Level I	Level II	Level III
		Inland Wetlands		
			Natural	
	1101			Lakes/Ponds
	1102			Ox-bow lakes/ Cut-off meanders
	1103			High altitude wetlands
	1104			Riverine wetlands
	1105			Waterlogged
	1106			River/Stream
			Man-made	
	1201			Reservoirs/Barrages
	1202			Tanks/Ponds
	1203			Waterlogged
	1204			Salt pans
		Coastal Wetlands		
			Natural	
	2101			Lagoons
	2102			Creeks
	2103			Sand/Beach
	2104			Intertidal mud flats
	2105			Salt marsh
	2106			Mangroves
	2107			Coral reefs
			Man-made	
	2201			Salt pans
	2202			Aquaculture ponds

Legend

- Wetlands (<2.25 ha)
- Settlements
- Drainage (line)
- Canal
- Roads
- Railways
- Town/Settlements
- District Boundary
- State Boundary
- International Boundary

Location Map



0 1 2 4 6 Kilometers

Data Source :

IRS P6 LISS III data (Pre-monsoon and Post-monsoon Season 2006-07)

Prepared By :

Space Applications Centre (ISRO), Ahmedabad
and
State Remote Sensing Application Centre, Jodhpur

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Annexure I
Definitions of wetland categories used in the project

For ease of understanding, definitions of wetland categories and their typical appearance on satellite imagery is given below:

Wetland type code	Definition and description
1000	**Inland Wetlands**
1100	**Natural**
1101	**Lakes**: Larger bodies of standing water occupying distinct basins (Reid *et al*, 1976). These wetlands occur in natural depressions and normally fed by streams/rivers. On satellite images lakes appear in different hues of blue interspersed with pink (aquatic vegetation), islands (white if unvegetated, red in case of terrestrial vegetation). Vegetation if scattered make texture rough.
1102	**Ox-bow lakes/ Cut off meanders**: A meandering stream may erode the outside shores of its broad bends, and in time the loops may become cut-off, leaving basins. The resulting shallow crescent-shaped lakes are called oxbow lakes (Reid *et al*, 1976). On the satellite image Ox-bow lakes occur near the rivers in plain areas. Some part of the lake normally has aquatic vegetation (red/pink in colour) during pre-monsoon season.
1103	**High Altitude lakes:** These lakes occur in the Himalayan region. Landscapes around high lakes are characterized by hilly topography. Otherwise they resemble lakes in the plain areas. For keeping uniformity in the delineation of these lakes contour line of 3000 m above msl will be taken as reference and all lakes above this contour line will be classified as high altitude lakes.
1104	**Riverine Wetlands**: Along the major rivers, especially in plains water accumulates leading to formation of marshes and swamp. **Swamps** are 'Wetland dominated by trees or shrubs' (U.S. Definition). In Europe, a forested fen (a peat accumulating wetland that has no significant inflows or outflows and supports acidophilic mosses, particularly *Sphagnum*) could be called a swamp. In some areas reed grass - dominated wetlands are also called swamps). (Mitsch and Gosselink, 1986). **Marsh**: A frequently or continually inundated wetland characterised by emergent herbaceous vegetation adapted to saturated soil conditions. In European terminology a marsh has a mineral soil substrate and does not accumulate peat (Mitsch and Gosselink, 1986). Tone is grey blue and texture is smooth. **Comment**: Using satellite data it is difficult to differentiate between swamp and marsh. Hence, both have been clubbed together.
1105	**Waterlogged:** Said of an area in which water stands near, at, or above the land surface, so that the roots of all plants except hydrophytes are drowned and the plants die (Margarate *et al*, 1974). Floods or unlined canal seepage and other irrigation network may cause waterlogging. Spectrally, during the period when surface water exists, waterlogged areas appear more or less similar to lakes/ponds. However, during dry season large or all parts of such areas dry up and give the appearance of mud/salt flats (grey bluish).
1106	**River/stream:** Rivers are linear water features of the landscape. Rivers that are wider than the mapping unit will be mapped as polygons. Its importance arises from the fact that many stretches of the rivers in Indo-Gangetic Plains and peninsular India are declared important national and international wetlands (Ex. The river Ganga between Brajghat and Garh Mukteshwar, is a Ramsar site, Ranganthattu on the Cavery river is a bird sanctuary etc.). Wherever, rivers are wide and features like sand bars etc. are visible, they will be mapped.
1200	**Man-made**
1201	***Reservoir****: A pond or lake built for the storage of water, usually by the construction of a dam across a river (Margarate et al, 1974). On RS images, reservoirs have irregular boundary behind a prominent dyke. Wetland boundary in case of reservoir incorporates water, aquatic vegetation and footprint of water as well. In the accompanying images aquatic vegetation in the reservoir is seen in bright pink tone. Tone is dark blue in deep reservoirs while it is ink blue in case of shallow reservoirs or reservoirs with high silt load. These will be annotated as Reservoirs/Dam.* **Barrage:** Dykes are constructed in the plain areas over rivers for creating Irrigation/water facilities. Such water storage areas develop into wetlands (Harike Barrage on Satluj – a Ramsar site, Okhla barrage on the Yamuna etc. – a bird sanctuary). Water appears in dark blue tone with a smooth texture. Aquatic vegetation appears in pink colour, which is scattered, or contiguous depending on the density. Reservoirs formed by barrages will be annotated as reservoir/barrage.

1202	**Tanks/Ponds:** A term used in Ceylon and the drier parts of Peninsular India for an artificial pond, pool or lake formed by building a mud wall across the valley of a small stream to retain the monsoon (Margarate *et al*, 1974). **Ponds** Generally, suggest a small, quiet body of standing water, usually shallow enough to permit the growth of rooted plants from one shore to another (Reid *et al*, 1976). Tanks appear in light blue colour showing bottom reflectance. In this category **Industrial ponds/mining pools mainly comprising Abandoned Quarries are also included (**Quarry is defined as "An open or surface working or excavation for the extraction of stone, ore, coal, gravel or minerals." In such pits water accumulate (McGraw Hill Encyclopaedia of Environmental Sciences, 1974), **Ash pond/Cooling pond** (The water body created for discharging effluents in industry, especially in thermal power plants (Encyclopaedic Directory of Environment, 1988) and **Cooling pond**: An artificial lake used for the natural cooling of condenser-cooling water serving a conventional power station (Encyclopaedic Directory of Environment, 1988). These ponds can be of any shape and size. Texture is rough and tonal appearance light (quarry) to blue shade (cooling pond).
1203	**Waterlogged :** Man-made activities like canals cause waterlogging in adjacent areas due to seepage especially when canals are unlined. Such areas can be identified on the images along canal network. Tonal appearance is in various hues of blue. Sometimes, such waterlogged areas dry up and leave white scars on the land. Texture is smooth.
1204	**Salt pans:** Inland salt pans in India occur in Rajasthan (Sambhar lake). These are shallow rectangular man-made depressions in which saline water is accumulated for drying in the sun for making salt.
2000	**Coastal Wetlands**
2100	**Natural**
2101	**Lagoons/Backwaters:** Such coastal bodies of water, partly separated from the sea by barrier beaches or bass of marine origin, are more properly termed lagoons. As a rule, lagoons are elongate and lie parallel to the shoreline. They are usually characteristic of, but not restricted to, shores of emergence. Lagoons are generally shallower and more saline than typical estuaries (Reid *et al*, 1976). **Backwater**: A creek, arm of the sea or series of connected lagoons, usually parallel to the coast, separated from the sea by a narrow strip of land but communicating with it through barred outlets (Margarate *et al*, 1974).
2102	**Creek:** A notable physiographic feature of salt marshes, especially low marshes. These creeks develop as do rivers "with minor irregularities sooner or later causing the water to be deflected into definite channels" (Mitsch and Gosselink, 1986). Creeks will be delineated, however, their area will not be estimated.
2103	**Sand/Beach:** Beach is an unvegetated part of the shoreline formed of loose material, usually sand that extends from the upper berm (a ridge or ridges on the backshore of the beach, formed by the deposit of material by wave action, that marks the upper limit of ordinary high tides and wave wash to low water mark(Clark,1977).Beach comprising rocky material is called rocky beach.
2104	**Intertidal mudflats**: Most unvegetated areas that are alternately exposed and inundated by the falling and rising of the tide. They may be mudflats or sand flats depending on the coarseness of the material of which they are made (Clark, 1977).
2105	**Salt Marsh**: Natural or semi-natural halophytic grassland and dwarf brushwood on the alluvial sediments bordering saline water bodies whose water level fluctuates either tidally or non- tidally (Mitsch and Gosselink, 1986). Salt marshes look in grey blue shade when wet.
2106	**Mangroves**: The mangrove swamp is an association of halophytic trees, shrubs, and other plants growing in brackish to saline tidal waters of tropical and sub-tropical coastlines (Mitsch and Gosselink, 1986). On the satellite images mangroves occur in red colour if in contiguous patch. When mangrove associations are scattered or are degraded then instead of red colour, brick red colour may be seen.
2107	**Coral reefs:** Consolidated living colonies of microscopic organisms found in warm tropical waters. The term coral reef, or organic reef is applied to the rock- like reefs built-up of living things, principally corals. They consist of accumulations of calcareous deposits of corals and corraline algae with the intervening space connected with sand, which consists largely of shells of foraminefera. Present reefs are living associations growing on this accumulation of past (Clark, 1977). Reefs appear in light blue shade.
2200	**Man-made**
2201	**Salt pans**: An undrained usually small and shallow rectangular, man-made depression or hollow in which saline water accumulates and evaporates leaving a salt deposit (Margarate *et al*, 1974). Salt pans are square or rectangular in shape. When water is there appearance is blue while salt is formed tone is white.
2202	**Aquaculture ponds**: Aquaculture is defined as "The breeding and rearing of fresh-water or marine fish in captivity. Fish farming or ranching". The water bodies used for the above are called aquaculture ponds (Encyclopaedic Directory of Environment, 1988). Aquaculture ponds are geometrical in shape usually square or rectangular. Tone is blue.

Annexure – II
Details of District information followed in the atlas

State : Rajasthan

District Boundary Map



List of Districts

District Code	District Name
01	Ganganagar
02	Hanumangarh
03	Bikaner
04	Churu
05	Jhunjhunun
06	Alwar
07	Bharatpur
08	Dhaulpur
09	Karauli
10	Sawai Madhopur
11	Dausa

District Code	District Name
12	Jaipur
13	Sikar
14	Nagaur
15	Jodhpur
16	Jaisalmer
17	Barmer
18	Jalor
19	Sirohi
20	Pali
21	Ajmer
22	Tonk

District Code	District Name
23	Bundi
24	Bhilwara
25	Rajsamand
26	Udaipur
27	Dungarpur
28	Banswara
29	Chittaurgarh
30	Kota
31	Baran
32	Jhalawar

Legend

State Boundary

District Boundary

Source: Survey of India (Surveyed in 2004 and published in 2005)

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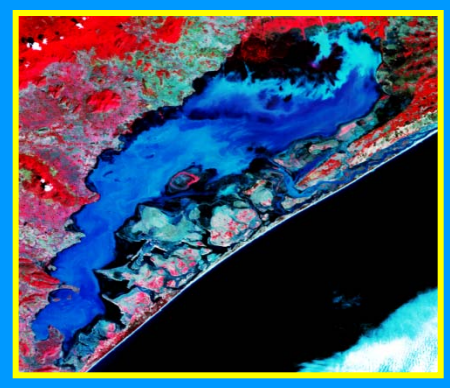

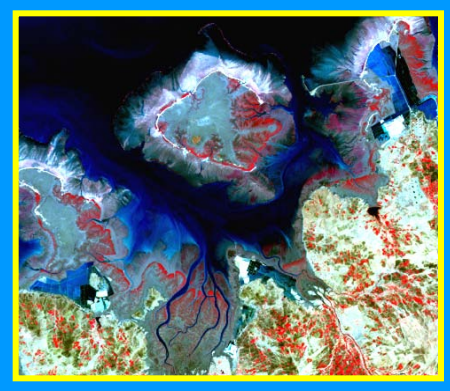



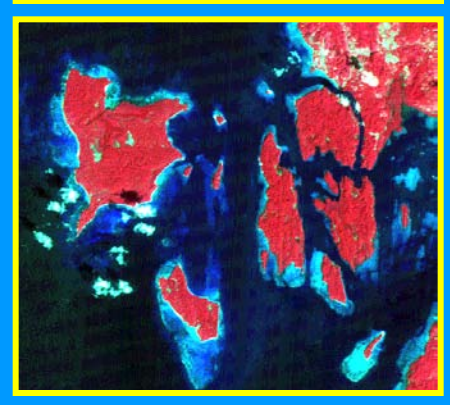



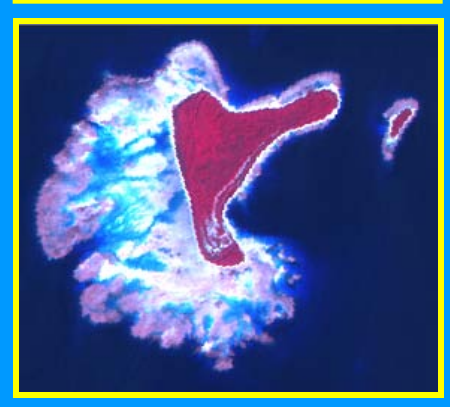

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