National River Conservation Directorate
Ministry of Jal Shakti,
Department of Water Resources,
River Development & Ganga Rejuvenation
Government of India

Water Bodies Atlas of Krishna River Basin

May 2026

Back of cover page

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National River Conservation Directorate (NRCD)

The National River Conservation Directorate, functioning under the Department of Water Resources, River Development & Ganga Rejuvenation, and Ministry of Jal Shakti providing financial assistance to the State Government for conservation of rivers under the Centrally Sponsored Schemes of 'National River Conservation Plan (NRCP)'. National River Conservation Plan to the State Governments/ local bodies to set up infrastructure for pollution abatement of rivers in identified polluted river stretches based on proposals received from the State Governments/ local bodies.

www.nrcd.nic.in

Centres for Krishna River Basin Management Studies (cKrishna)

The Centres for Krishna River Basin Management Studies (cKrishna) is a Brain Trust dedicated to River Science and River Basin Management. Established in 2024 by NIT Warangal and NIT Surathkal, under the supervision of cGanga at IIT Kanpur, the center serves as a knowledge wing of the National River Conservation Directorate (NRCD). cKrishna is committed to restoring and conserving the Krishna River and its resources through the collation of information and knowledge, research and development, planning, monitoring, education, advocacy, and stakeholder engagement.

www.ckrishna.org

Centre for Ganga River Basin Management and Studies (cGanga)

cGanga is a think tank formed under the aegis of NMCG, and one of its stated objectives is to make India a world leader in river and water science. The Centre is headquartered at IIT Kanpur and has representation from most leading science and technological institutes of the country. cGanga's mandate is to serve as think-tank in implementation and dynamic evolution of Ganga River Basin Management Plan (GRBMP) prepared by the Consortium of 7 IITs. In addition to this, it is also responsible for introducing new technologies, innovations, and solutions into India.

www.cganga.org

Acknowledgment

This report is a comprehensive outcome of the project jointly executed by NIT Warangal (Lead Institute) and NIT Surathkal (Fellow Institute) under the supervision of cGanga at IIT Kanpur. It was submitted to the National River Conservation Directorate (NRCD) in 2024. We gratefully acknowledge the individuals who provided information and photographs for this report.

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Preface

In an era of unprecedented environmental change, understanding our rivers and their ecosystems has never been more critical. This report aims to provide a comprehensive overview of our rivers, highlighting their importance, current health, and the challenges they face. As we explore the various facets of river systems, we aim to equip readers with the knowledge necessary to appreciate and protect these vital waterways.

Throughout the following pages, you will find an in-depth analysis of the principles and practices that support healthy river ecosystems. Our team of experts has meticulously compiled data, case studies, and testimonials to illustrate the significant impact of rivers on both natural environments and human communities. By sharing these insights, we hope to inspire and empower our readers to engage in river conservation efforts.

This report is not merely a collection of statistics and theories; it is a call to action. We urge all stakeholders to recognize the value of our rivers and to take proactive steps to ensure their preservation. Whether you are an environmental professional, a policy maker, or simply someone who cares about our planet, this guide is designed to support you in your efforts to protect our rivers.

We extend our heartfelt gratitude to the numerous contributors who have generously shared their stories and expertise. Their invaluable input has enriched this report, making it a beacon of knowledge and a practical resource for all who read it. It is our hope that this report will serve as a catalyst for positive environmental action, fostering a culture of stewardship that benefits both current and future generations.

As you delve into this overview of our rivers, we invite you to embrace the opportunities and challenges that lie ahead. Together, we can ensure that our rivers continue to thrive and sustain life for generations to come.

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Back of Preface/Blank Page

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Contents

Continuation of Contents/Blank Page

List of Figures

Continuation of Figures/Blank Page

List of Tables

Continuation of Tables/Blank Page

Abbreviations and Acronyms

Abbreviation	Full Form
NWDP	National Water Data Portal
GIS	Geographic Information System
NRCD	National River Conservation Directorate
cKrishna	Centre for Krishna River Basin Management and Studies
cGanga	Centre for Ganga River Basin Management and Studies

1. Introduction

Water bodies constitute one of the most critical natural resources supporting environmental sustainability, agricultural productivity, economic development, and human livelihoods. Rivers, reservoirs, lakes, tanks, wetlands, and ponds play a significant role in maintaining hydrological balance and ensuring water security, particularly in river basins characterized by large spatial and temporal variability in rainfall. In India, river basins form the fundamental hydrological units for water resource planning and management, where the assessment and monitoring of water bodies are essential for sustainable development and climate resilience.

The Krishna River Basin is one of the major river basins of India, extending across the states of Maharashtra, Karnataka, Telangana, and Andhra Pradesh. Originating in the Western Ghats near Mahabaleshwar in Maharashtra, the Krishna River traverses diverse climatic and physiographic regions before draining into the Bay of Bengal. The basin supports a large population dependent on agriculture, irrigation, hydropower generation, domestic water supply, fisheries, and industrial activities. Due to the semi-arid to sub-humid climatic conditions prevailing over large parts of the basin, surface water bodies and reservoirs form the backbone of water resource management (Figure 1.1). It contains a wide range of natural and man-made water bodies including reservoirs, tanks, ponds, lakes, barrages, and irrigation structures. Several major reservoirs such as Tungabhadra, Almatti, Srisailam, Nagarjuna Sagar, and others serve as key infrastructure components for irrigation, hydropower generation, flood control, and drinking water supply. Traditional tank systems distributed across peninsular India, particularly in Telangana, Karnataka, and Andhra Pradesh, also contribute significantly to local water storage and groundwater recharge.

Rapid urbanization, changing land use patterns, increasing water demand, climate variability, sedimentation, and anthropogenic pressures have considerably influenced the spatial and temporal dynamics of water bodies in the basin. Monitoring the distribution, extent, and changes in water bodies is therefore essential for effective basin planning, drought mitigation, ecological conservation, and sustainable water governance. The present study has been prepared to provide a comprehensive spatial and statistical assessment of water bodies within the basin. The atlas integrates district-wise water body statistics, major reservoir information, and temporal water spread area analysis across different sub-basins. The study utilizes geospatial datasets and statistical records to evaluate the spatial distribution and characteristics of water bodies across Andhra Pradesh, Telangana, Karnataka, and Maharashtra.

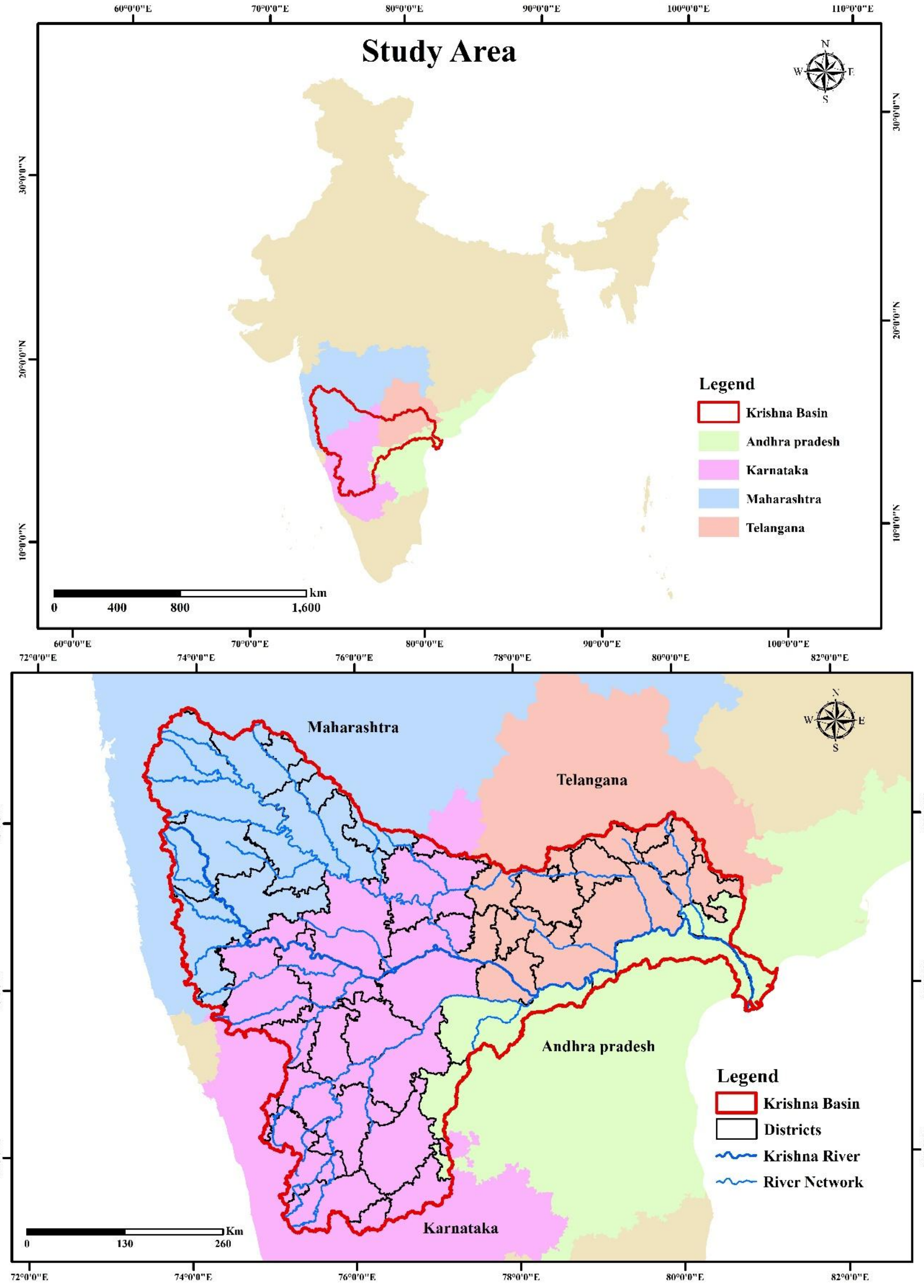

Figure 1. 1 Study Area Map of Krishna River Basin

The atlas includes thematic maps showing the spatial distribution of water bodies in different districts and states, along with detailed information on major reservoirs such as reservoir area, storage capacity, year of construction, river association, and functional purposes. In addition, temporal analysis of sub-basin water spread area from 1985 to 2025 has been incorporated to understand long-term variations and trends in surface water availability. It also includes seasonal variation analysis of water bodies during pre-monsoon and post-monsoon periods using NDWI-based remote sensing techniques. The district-wise statistics indicate substantial spatial variation in both the number and area of water bodies across the basin states. The reservoir inventory further highlights the strategic importance of major water storage structures in supporting irrigation and multi-purpose water management. The temporal analysis of sub-basin water spread area provides valuable insights into hydrological variability and changing water resource conditions within the Krishna Basin.

2. Data and Methodology

The water body atlas was prepared using spatial and statistical datasets obtained from the National Water Data Portal (NWDP) and other supporting geospatial databases related to water bodies and reservoirs distributed across the basin. District-wise water body statistics, major reservoir information, and sub-basin water spread area data were compiled and analysed for the states of Andhra Pradesh, Telangana, Karnataka, and Maharashtra. Spatial datasets were processed in a GIS environment to prepare thematic maps showing the distribution of water bodies and major reservoirs within the basin.

The methodology involved collection and organization of statistical data, preparation of GIS layers, spatial mapping, and comparative analysis of water body distribution across districts and sub-basins. Temporal water spread area data from 1985-2025 were also analysed to understand long-term variations in surface water extent within the Krishna River Basin. The prepared atlas integrates spatial visualization and statistical assessment to support river basin planning, water resource management, and sustainable development initiatives.

3. Water Bodies in Krishna River Basin

The Krishna River Basin contains a large number of reservoirs, tanks, lakes, ponds, and other inland water bodies that support irrigation, domestic water supply, hydropower generation, fisheries, groundwater recharge, and ecological sustainability. The spatial distribution and extent of water bodies vary significantly across the basin states due to variations in rainfall, topography, land use, and irrigation development practices. Based on the datasets obtained from the National Water Data Portal (NWDP), the basin exhibits considerable diversity in both the number and area of water bodies across Andhra Pradesh, Telangana, Karnataka, and Maharashtra as detailed in Table 3.1.

Table 3. 1 State-wise Water Bodies Statistics in Krishna River Basin

State	No. of Water Bodies	Area (sq.km)
Andhra Pradesh	5,197	346.92
Telangana	19,610	1148.04
Karnataka	22,361	1557.16
Maharashtra	56,581	575.85

3.1 Water Bodies in Andhra Pradesh

The Andhra Pradesh portion of the Krishna River Basin contains approximately 5,197 water bodies with a total water spread area of about 346.92 sq.km. The distribution of water bodies across the basin districts of Andhra Pradesh is presented in Table 3.2, while the spatial distribution is illustrated in Figure 3.1. The districts are primarily characterized by irrigation tanks, ponds, and reservoirs that support agriculture and domestic water requirements.

Among the districts, Krishna district contains the highest number of water bodies with 1,445 water bodies, followed by Kurnool and Anantapur districts. Kurnool district records the highest water spread area of about 106.21 sq.km, whereas Prakasam district contains only a limited number of water bodies within the basin boundary. The presence of irrigation tanks and reservoirs plays a significant role in sustaining agricultural activities and groundwater recharge in the semi-arid regions of Andhra Pradesh.

Table 3. 2 District-wise Water Bodies Statistics in Andhra Pradesh

District	Water Spread Area (sq.km)	No. of Water Bodies
Anantapur	108.18	1320
Guntur	46.96	1101
Krishna	85.20	1445
Kurnool	106.21	1327
Prakasam	0.37	4
Total	**346.92**	**5197**

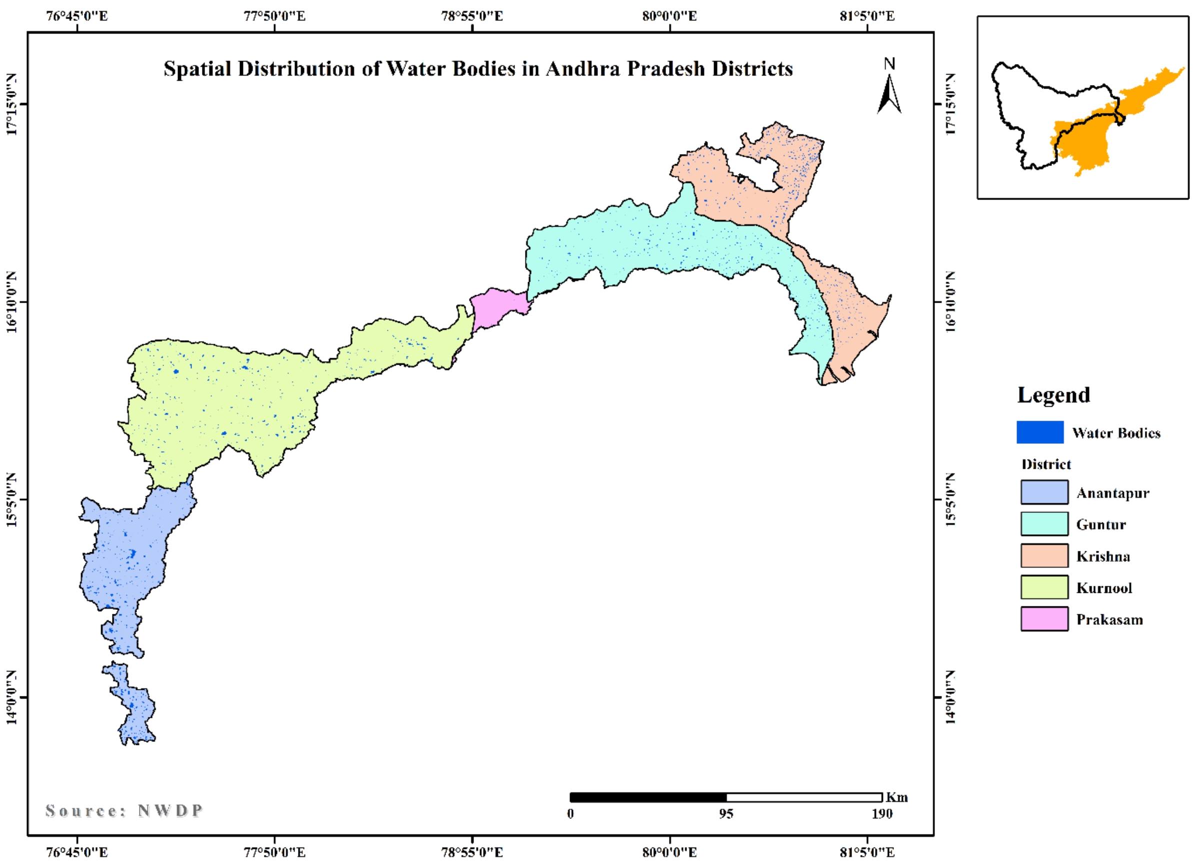

Figure 3. 1 Spatial Distribution of Water Bodies in Andhra Pradesh Districts

3.2 Water Bodies in Telangana

The Telangana region within the Krishna River Basin contains nearly 19,610 water bodies covering a total water spread area of approximately 1,148.04 sq.km. The district-wise statistics are presented in Table 3.3, and the spatial distribution of water bodies is shown in Figure 3.2. Telangana is widely recognized for its extensive traditional tank irrigation systems, which form a major component of the regional hydrology.

Among the districts, Nagarkurnool, Ranga Reddy, Mahabubabad, and Nalgonda districts exhibit a high concentration of water bodies. Nalgonda district records the highest water spread

Table 3. 3 District-wise Water Bodies Statistics in Telangana

District	Water Spread Area (sq.km)	No. of Water Bodies
Bhadradri Kothagudem	9.22	343
Hyderabad	8.91	82
Jangoan	58.72	833
Jogulamba Gadwal	26.19	689
Khammam	103.97	1391
Mahabubabad	100.31	1694
Mahabubnagar	70.40	1305

Medchal Malkajgiri	27.85	710
Nagarkurnool	87.15	1976
Nalgonda	150.57	1693
Narayanpet	67.58	1090
Ranga Reddy	62.03	1711
Sangareddy	3.30	54
Siddipet	2.29	114
Suryapet	106.21	1379
Vikarabad	57.87	1405
Wanaparthy	62.73	1264
Warangal Rural	72.75	764
Warangal Urban	5.90	83
Yadadri Bhuvanagiri	64.08	1030
Total	**1148.04**	**19610**

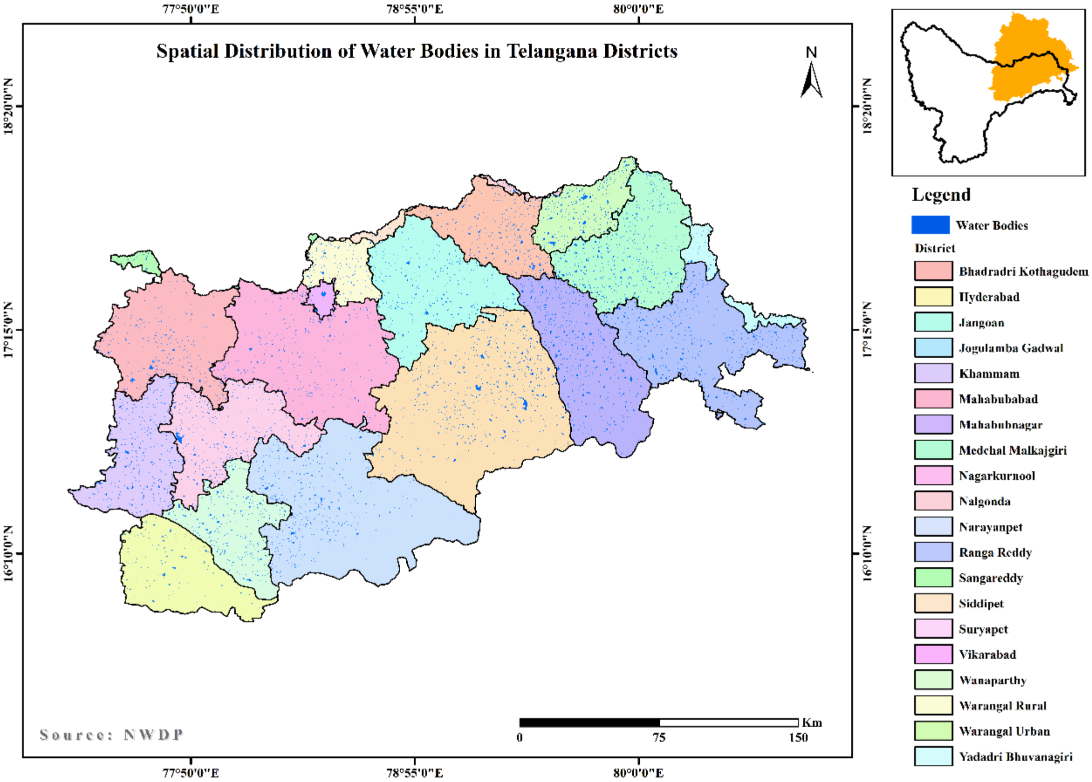

Figure 3. 2 Spatial Distribution of Water Bodies in Telangana Districts

area of around 150.57 sq.km, followed by Suryapet and Khammam districts. The large number of tanks and ponds distributed across Telangana contributes significantly to irrigation development, groundwater recharge, drought mitigation, and local water storage within the basin.

3.3 Water Bodies in Karnataka

The Karnataka portion of the Krishna River Basin contains approximately 22,361 water bodies with a total water spread area of nearly 1,557.16 sq.km. The district-wise distribution of water bodies is presented in Table 3.4, while the spatial distribution is illustrated in Figure 3.3. Karnataka contains several major reservoirs and irrigation systems associated with the Krishna River and its tributaries.

Among the districts, Raichur district contains the highest number of water bodies with about 4,297 water bodies, followed by Shivamogga and Haveri districts. Chitradurga district records the largest water spread area of around 259.60 sq.km, followed by Tumakuru and Davangere districts. The extensive network of reservoirs, tanks, and irrigation structures in Karnataka plays a major role in agricultural production, hydropower generation, and basin-scale water resource management.

Table 3. 4 District-wise Water Bodies Statistics in Karnataka

District	Water Spread Area (sq.km)	No. of Water Bodies
Bagalkote	27.02	556
Ballari	127.86	1201
Belagavi	64.16	1476
Bidar	6.85	31
Chikkamagaluru	77.78	1116
Chitradurga	259.60	1402
Davangere	144.05	1066
Dharwad	9.19	423
Gadag	19.53	665
Hassan	56.19	813
Haveri	110.40	2299
Kalaburagi	72.44	496
Koppal	50.16	794
Raichur	91.90	4297
Shivamogga	114.85	2927
Tumakuru	174.51	1500
Uttara Kannada	10.90	193
Vijayapura	59.89	563
Yadgir	79.87	543
Total	**1557.16**	**22361**

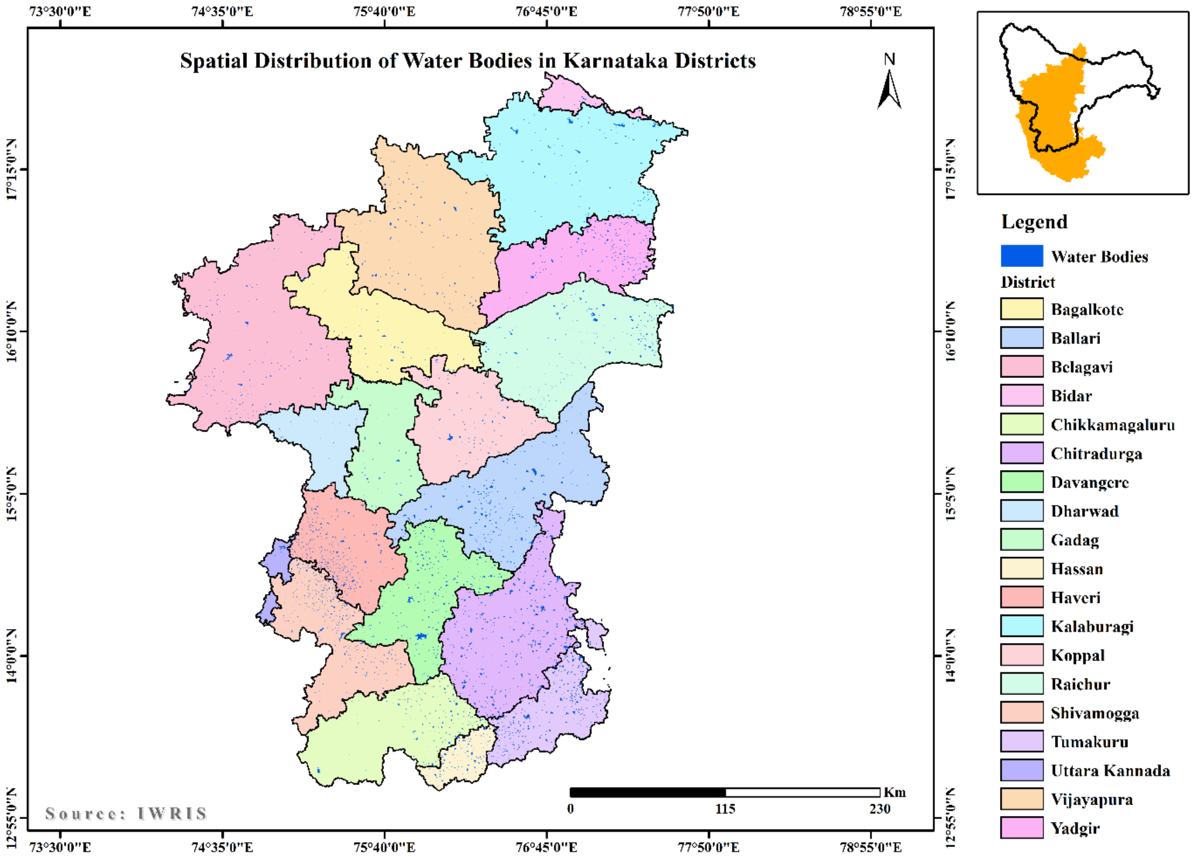

Figure 3. 3 Spatial Distribution of Water Bodies in Karnataka Districts

3.4 Water Bodies in Maharashtra

The Maharashtra portion of the Krishna River Basin contains nearly 56,581 water bodies with a total water spread area of approximately 575.85 sq.km. The district-wise statistics are presented in Table 3.5, and the spatial distribution is shown in Figure 3.4. Maharashtra contains a large number of small ponds, tanks, and storage structures distributed across the upstream regions of the basin.

Among the districts, Solapur district contains the highest number of water bodies with about 12,854 water bodies, followed by Pune and Satara districts. Solapur district also records the highest water spread area of approximately 136.35 sq.km, while Sindhudurg district contains only a few water bodies within the basin boundary. The widespread distribution of small and medium storage structures contributes significantly to watershed management, local irrigation, and rural water supply systems in the upstream basin regions.

Table 3. 5 District-wise Water Bodies Statistics in Maharashtra

District	Water Spread Area (sq.km)	No. of Water Bodies
Ahmednagar	71.82	8574
Beed	24.27	1866
Kolhapur	17.59	1886
Osmanabad	82.11	3200
Pune	91.14	12746
Sangli	68.73	6284
Satara	83.66	9167
Sindhudurg	0.16	4
Solapur	136.35	12854
Total	**575.85**	**56581**

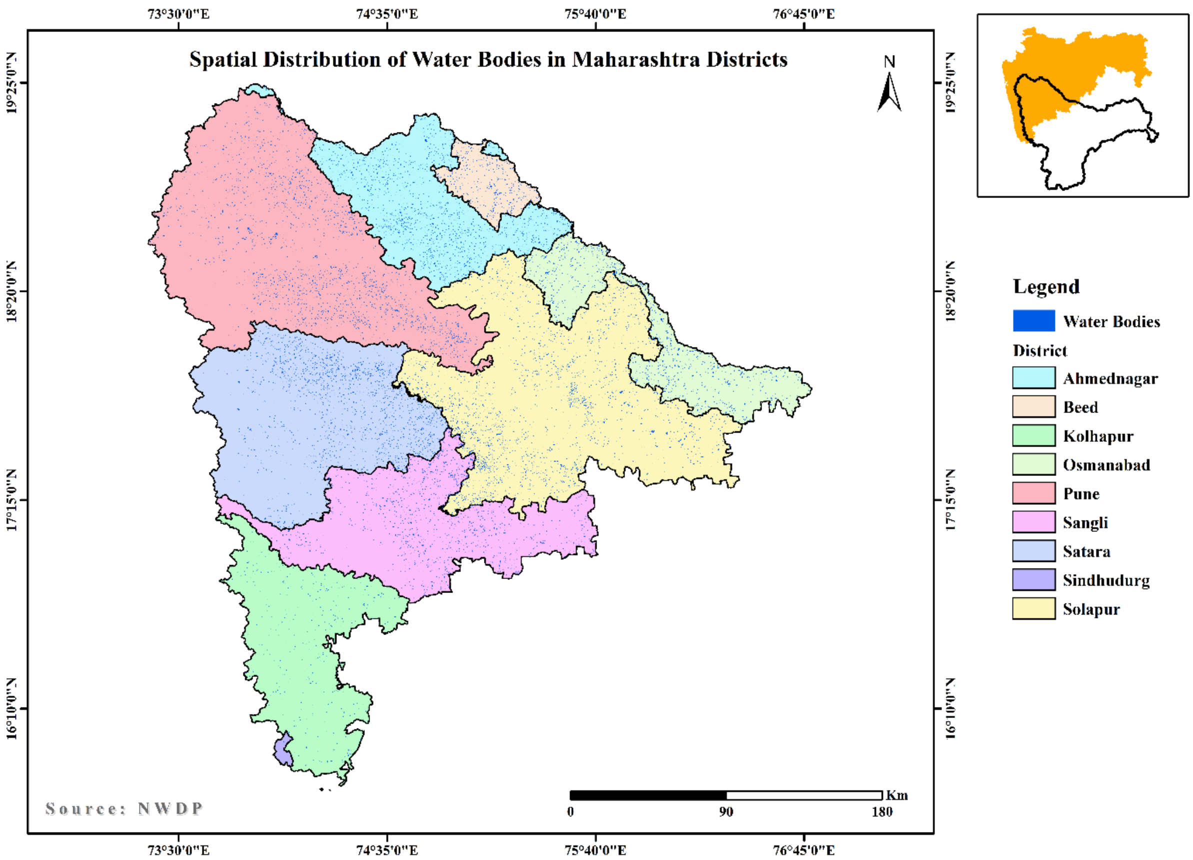

Figure 3. 4 Spatial Distribution of Water Bodies in Maharashtra Districts

4. Temporal Variation in Water Body Area Across Krishna River Basin

The temporal variation in water body area across different sub-basins of the Krishna River Basin was analyzed using the sub-basin-wise water spread area statistics from 1985 to 2025 obtained from the National Water Data Portal (NWDP). The analysis provides important insights into long-term hydrological changes, reservoir development, climatic variability, and changes in surface water availability within the basin.

The comparative statistics of water spread area for different sub-basins are presented in Table 4.1, while the temporal trends are illustrated in Figure 4.1. The graphical representation helps in understanding the increase or decrease in water spread area across different periods.

Table 4. 1 Sub-basin-wise Water Spread Area (sq.km) from 1985–2025

Sub-Basin	1985	1990	1995	2000	2005	2010	2015	2020	2025
Lower Bhima	1980.88	1977.73	2223.04	2199.57	2545.30	2643.43	2633.10	2597.96	2695.76
Lower Krishna	11940.85	11942.69	11160.59	10425.99	9998.67	9661.57	9712.24	10105.59	9995.33
Lower Tungabhadra	2545.50	2547.59	2875.06	3029.79	2737.31	2817.92	2700.63	2616.85	2538.87
Middle Krishna	7438.59	7442.03	7044.52	7177.04	6955.03	6889.06	6950.97	6878.33	5640.26
Upper Bhima	4248.68	4239.19	4058.24	3962.60	4001.44	4066.54	4057.42	4022.06	3966.70
Upper Krishna	4318.13	4322.74	4452.53	4802.19	5277.48	5322.61	5281.15	5297.62	5641.53
Upper Tungabhadra	3299.61	3303.54	3830.47	3743.50	3644.86	3625.45	3781.92	3687.19	3308.15

The temporal analysis indicates considerable variation in water spread area among the different sub-basins of the Krishna River Basin. The Lower Krishna sub-basin consistently records the highest water spread area throughout the study period, although a gradual decline is observed from 1985 to 2025. The water spread area decreased from approximately 11,940.85 sq.km in 1985 to about 9,995.33 sq.km in 2025, indicating changes in hydrological conditions and surface water availability.

The Upper Krishna sub-basin shows a significant increase in water spread area over the study period. The water spread area increased from approximately 4,318.13 sq.km in 1985 to 5,641.53 sq.km in 2025. This increase may be associated with reservoir development, irrigation expansion, and changes in water storage infrastructure within the upstream regions. The Lower

Bhima sub-basin also exhibits a gradual increase in water spread area from about 1,980.88 sq.km in 1985 to 2,695.76 sq.km in 2025. In contrast, the Upper Bhima sub-basin shows relatively stable conditions with only minor fluctuations over the study period. The Middle Krishna sub-basin demonstrates a noticeable reduction in water spread area during recent years, particularly in 2025, where the water spread area reduced to about 5,640.26 sq.km. Similarly, the Lower Tungabhadra and Upper Tungabhadra sub-basins exhibit moderate fluctuations in water spread area across different years.

Overall, the temporal analysis highlights substantial spatial and temporal variability in water spread area across the Krishna River Basin. The observed trends may be influenced by climatic variability, reservoir operation practices, irrigation development, land use changes, and hydrological alterations within the basin.

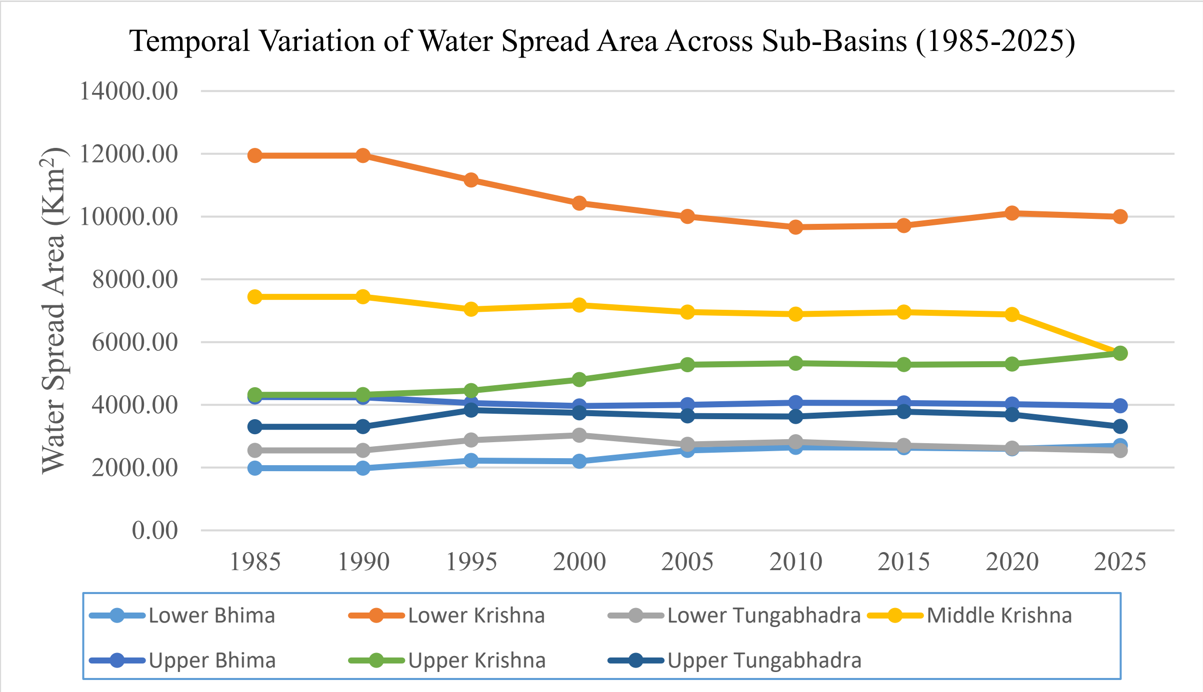

Figure 4. 1 Temporal Variation of Water Spread Area Across Krishna River Basin Sub-basins (1985–2025)

5. Reservoirs in Krishna River Basin

Krishna River Basin contains several major reservoirs constructed across the Krishna River and its tributaries to support irrigation, hydropower generation, flood moderation, drinking water supply, and industrial water requirements. These reservoirs play a crucial role in basin-scale water resource management and significantly influence the hydrology and socio-economic development of the basin states including Maharashtra, Karnataka, Telangana, and Andhra Pradesh. The spatial distribution of major reservoirs in the Krishna River Basin is illustrated in Figure 5.1, while the reservoir characteristics are presented in Table 5.1. The reservoirs are strategically located across different sub-basins to regulate streamflow, store monsoon runoff, and ensure water availability during dry periods.

Among the major reservoirs, Nagarjuna Sagar, Srisailam, Almatti, Tungabhadra, and Koyna are some of the most significant multi-purpose projects within the basin. These reservoirs support extensive irrigation networks and contribute substantially to agricultural productivity in the semi-arid regions of peninsular India. Several reservoirs are also utilized for hydropower generation and urban water supply. The upstream reservoirs located in Maharashtra and Karnataka mainly contribute to flow regulation and storage, while the downstream reservoirs in Telangana and Andhra Pradesh support large-scale irrigation and drinking water supply systems. The integrated operation of these reservoirs plays a vital role in managing inter-state water sharing and maintaining basin water security. The reservoirs within the basin exhibit considerable variation in storage capacity, reservoir area, and functional objectives depending on their geographic location and hydrological conditions. In addition to major reservoirs, several medium and minor storage structures are distributed throughout the basin, contributing to local irrigation and groundwater recharge.

Table 5. 1 Reservoirs in Krishna River Basin

S.No	Reservoir Name	State	District	Area (sq.km)	River
1	Vani Vilas Sagar Reservoir	Karnataka	Chitradurga	45.99	Vedavati
2	Tungabhadra Reservoir	Karnataka	Ballari (Bellary)	198.77	Tungabhadra
3	Bennethora Reservoir	Karnataka	Kalaburagi (Gulbarga)	21.99	Benithora
4	Hidkal Reservoir	Karnataka	Belagavi (Belgaum)	50.79	Ghatprabha
5	Bhadra Reservoir	Karnataka	Chikkamagaluru	114.79	Bhadra
6	Renuka Sagara	Karnataka	Belagavi	115.37	Malprabha
7	Basava Sagar	Karnataka	Yadgir	101.53	Krishna
8	Gajanur Dam Reservoir	Karnataka	Shivamogga	11.49	Tunga
9	Lal Bahadur Shastri Sagar	Karnataka	Vijayapura (Bijapur)	310.47	Krishna
10	Sanjeevaiah Sagar	Andhra Pradesh	Kurnool	24.49	Hindri
11	Kalrao Sagar Dam	Karnataka	Bagalkot	32.18	Krishna
12	Nira Deoghar	Maharashtra	Pune	14.19	Nira
13	Khadakwasla Dam	Maharashtra	Pune	12.91	Mutha

14	Bhatghar Lake (Lake Whiting)	Maharashtra	Pune	38.29	Kanand
15	Varasgaon Dam	Maharashtra	Pune	21.58	Mutha
16	Tanaji Sagar (Panshet Reservoir)	Maharashtra	Pune	15.64	Mutha
17	Pauna Lake	Maharashtra	Pune	25.38	Pauna
18	Mulshi Lake	Maharashtra	Pune	43.88	Mula
19	Dhom Reservoir	Maharashtra	Satara	24.50	Krishna
20	Vir Reservoir	Maharashtra	Pune	32.91	Nira
21	Sina Kolegaon	Maharashtra	Dharashiv (Osmanabad)	24.50	Bhima
22	Ujjani (Bhigwan) Reservoir	Maharashtra	Solapur	295.81	Bhima
23	Dimbhe Dam	Maharashtra	Pune	19.46	Ghod
24	Manikdoh Dam	Maharashtra	Pune	17.18	Kukdi
25	Andhra Lake (Thokarwadi Dam)	Maharashtra	Pune	29.63	Andra
26	Yedgaon Reservoir	Maharashtra	Pune	13.11	Kukdi
27	Pimpalgaon Joge Dam	Maharashtra	Pune	26.15	Pushpavati
28	Bhama Asakhed	Maharashtra	Pune	17.81	Bhama
29	Kanher Dam	Maharashtra	Satara	19.55	Vena
30	Warna Dam	Maharashtra	Kolhapur / Sangli	31.76	Varna
31	Ghod Reservoir	Maharashtra	Pune	29.71	Ghod
32	Shiravata Sarovar (Bhushi Dam)	Maharashtra	Pune	13.00	Kundali
33	Radhanagari Reservoir	Maharashtra	Kolhapur	17.47	Bhogavati
34	Dudhaganga Reservoir	Maharashtra	Kolhapur	40.36	Dudhganga
35	Urmodi Dam	Maharashtra	Satara	16.21	Urmodi
36	Shiv Sagar (Koyna Reservoir)	Maharashtra	Satara	130.06	Koyna
37	Chaskaman Dam	Maharashtra	Pune	18.85	Bhima
38	Osman Sagar	Telangana	Hyderabad / Rangareddy	16.94	Musi
39	Jurala Reservoir	Telangana	Jogulamba Gadwal	48.46	Krishna
40	Nagarjuna Sagar Dam	Telangana / Andhra Pradesh	Nalgonda (TG) / Palnadu (AP)	259.29	Krishna
41	Srisailam Dam	Telangana / Andhra Pradesh	Nagarkurnool (TG) / Nandyal (AP)	495.09	Krishna
42	Musi Reservoir	Telangana	Nalgonda	22.97	Musi
43	Palleru Reservoir	Telangana	Khammam	14.68	Palleru
44	Wyra Reservoir	Telangana	Khammam	17.66	Wyra

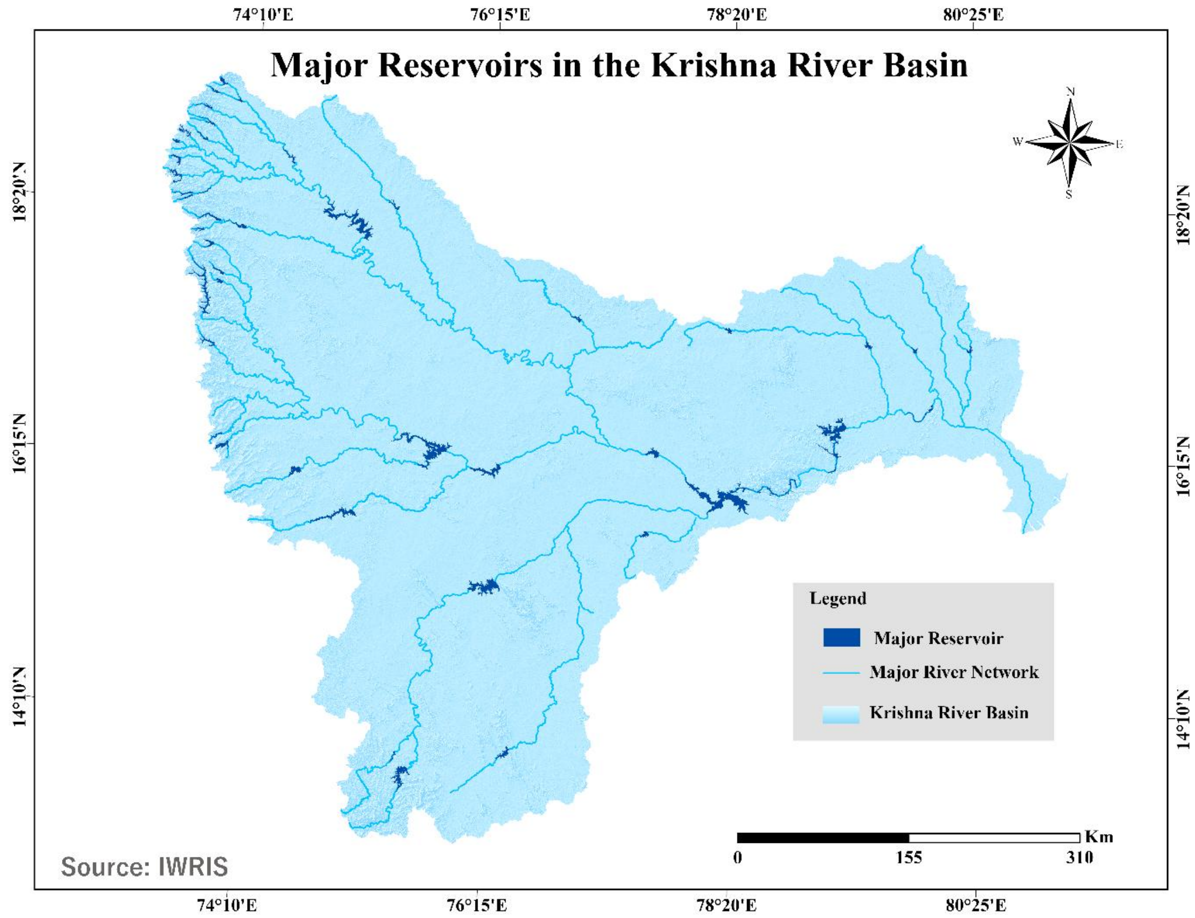

Figure 5. 1 Reservoirs in Krishna River Basin

6. Seasonal Water Body Dynamics Using NDWI-Based Analysis

The seasonal dynamics of water bodies in the Krishna River Basin were analyzed using the Normalized Difference Water Index (NDWI) derived from Sentinel-2 satellite imagery in the Google Earth Engine (GEE) platform. The analysis was carried out to assess the variation in water spread area between pre-monsoon and post-monsoon periods across the major sub-basins of the Krishna River Basin. The study provides valuable insights into seasonal hydrological variability and the influence of monsoon rainfall on surface water availability within the basin.

The spatial distribution of water bodies for pre-monsoon and post-monsoon periods was generated separately for each sub-basin using NDWI-based water extraction techniques. The corresponding maps for individual sub-basins are presented in Figures 6.1 to 6.14, while the comparative statistics of water spread area are summarized in Table 6.1.

6.1 Methodology for NDWI-Based Water Body Analysis

- **Data Collection and Preparation**

The analysis was performed using the Google Earth Engine (GEE) cloud computing platform for efficient processing and analysis of satellite imagery. Sentinel-2 MSI (Multispectral Instrument) imagery with a spatial resolution of 10 m was used for water body extraction and area estimation.

The Region of Interest (ROI) was defined using the Krishna River Basin boundary and corresponding sub-basin boundaries. The satellite images were categorized into pre-monsoon and post-monsoon periods for seasonal comparison.

- **Time Period Selection**
    - Pre-Monsoon Period: March to May 2024
    - Post-Monsoon Period**:** January, February, and October 2024

Cloud masking was applied to remove cloud-contaminated pixels, and only images with less than 20% cloud cover were considered for analysis.

- **Calculation of NDWI**

The Normalized Difference Water Index (NDWI) was computed using Sentinel-2 MSI Bands 3 (Green) and 8 (Near Infrared - NIR) according to the following equation:

$$NDWI = \frac{Green - NIR}{Green + NIR}$$

The NDWI enhances water features while suppressing vegetation and soil reflectance, thereby improving the delineation of water bodies.

- **Image Processing and Water Classification**

Mean NDWI composites were generated separately for the pre-monsoon and post-monsoon periods to obtain representative seasonal water signatures. Water bodies were classified using an NDWI threshold value greater than 0.2.

- **Area Calculation**

The classified water pixels were multiplied by the corresponding pixel area to estimate the total water spread area. The total water body area for each sub-basin was then calculated separately for pre-monsoon and post-monsoon conditions.

Table 6. 1 Seasonal Variation in Water Spread Area Across Krishna River Basin Sub-basins

Sub-Basin	Pre-Monsoon Area (sq.km)	Post-Monsoon Area (sq.km)	Change in Area (sq.km)
Lower Krishna	709.87	1357.23	647.35
Middle Krishna	430.08	1151.29	721.21
Upper Krishna	820.92	1254.44	433.52
Upper Bhima	646.58	940.94	294.35
Lower Bhima	166.56	260.49	93.93
Upper Tungabhadra	195.88	411.88	216.00
Lower Tungabhadra	285.20	480.21	195.00

6.2 Lower Krishna Sub-basin

The Lower Krishna sub-basin exhibited a substantial increase in water spread area during the post-monsoon period. The water spread area increased from approximately 709.87 sq.km during pre-monsoon conditions to about 1357.23 sq.km during post-monsoon conditions, indicating a net increase of approximately 647.35 sq.km. The spatial distribution of water bodies during pre-monsoon and post-monsoon periods is presented in Figures 6.1 and 6.2 respectively.

6.3 Middle Krishna Sub-basin

The Middle Krishna sub-basin recorded one of the highest seasonal increases in water spread area among all sub-basins. The post-monsoon water spread area increased by approximately 721.21 sq.km compared to pre-monsoon conditions. This increase reflects the strong influence of monsoon rainfall and reservoir inflows within the sub-basin. The seasonal variation in water spread area for the Middle Krishna sub-basin is presented in Figure 6.3 and Figure 6.4.

6.4 Upper Krishna Sub-basin

The Upper Krishna sub-basin exhibited a significant increase in water spread area from 820.92 sq.km during pre-monsoon conditions to approximately 1254.44 sq.km during post-monsoon conditions. The observed increase highlights the seasonal storage dynamics associated with reservoirs and river systems within the upstream basin region. The spatial distribution of water bodies during pre-monsoon and post-monsoon periods is shown in Figure 6.5 and Figure 6.6, respectively.

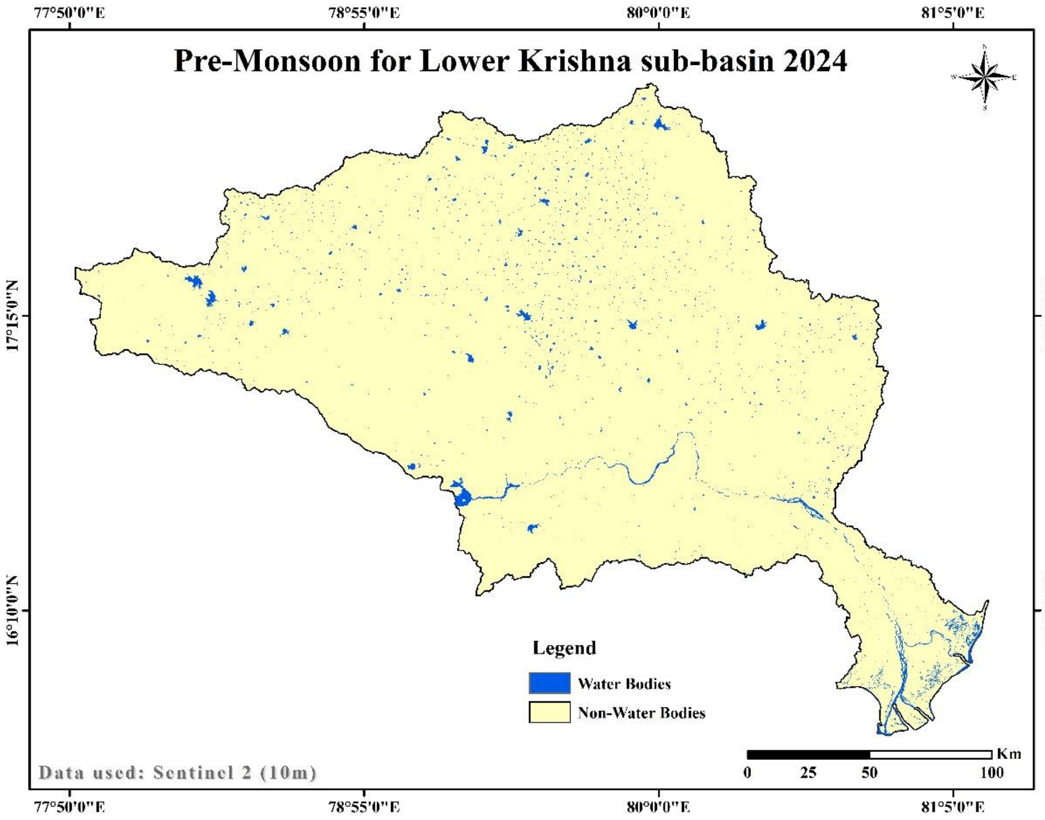

Figure 6. 1 Pre-Monsoon Water Bodies in Lower Krishna Sub-basin

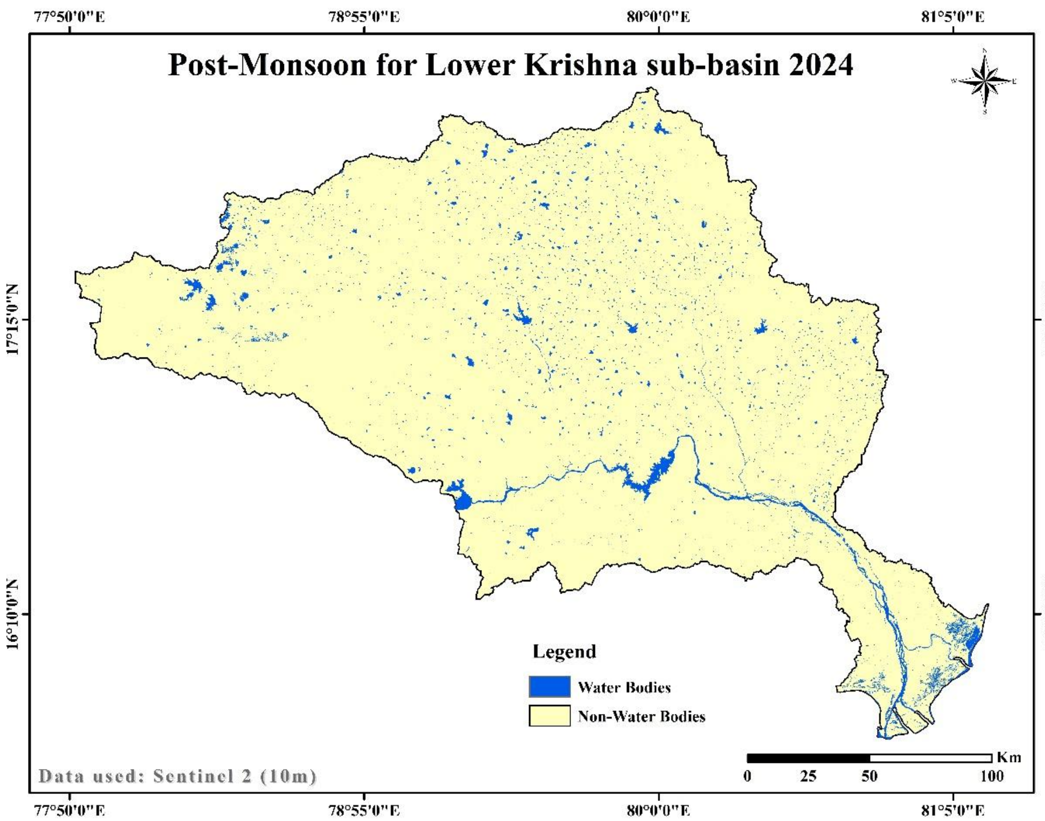

Figure 6. 2 Post-Monsoon Water Bodies in Lower Krishna Sub-basin

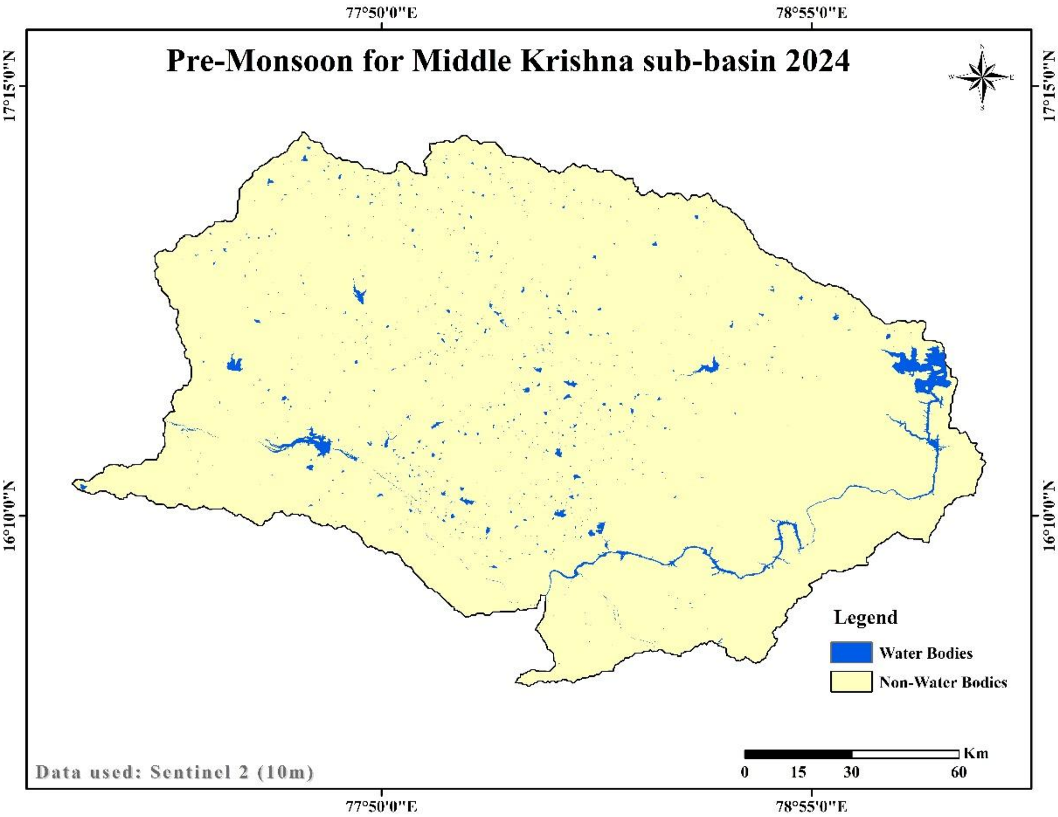

Figure 6. 3 Pre-Monsoon Water Bodies in Middle Krishna Sub-basin

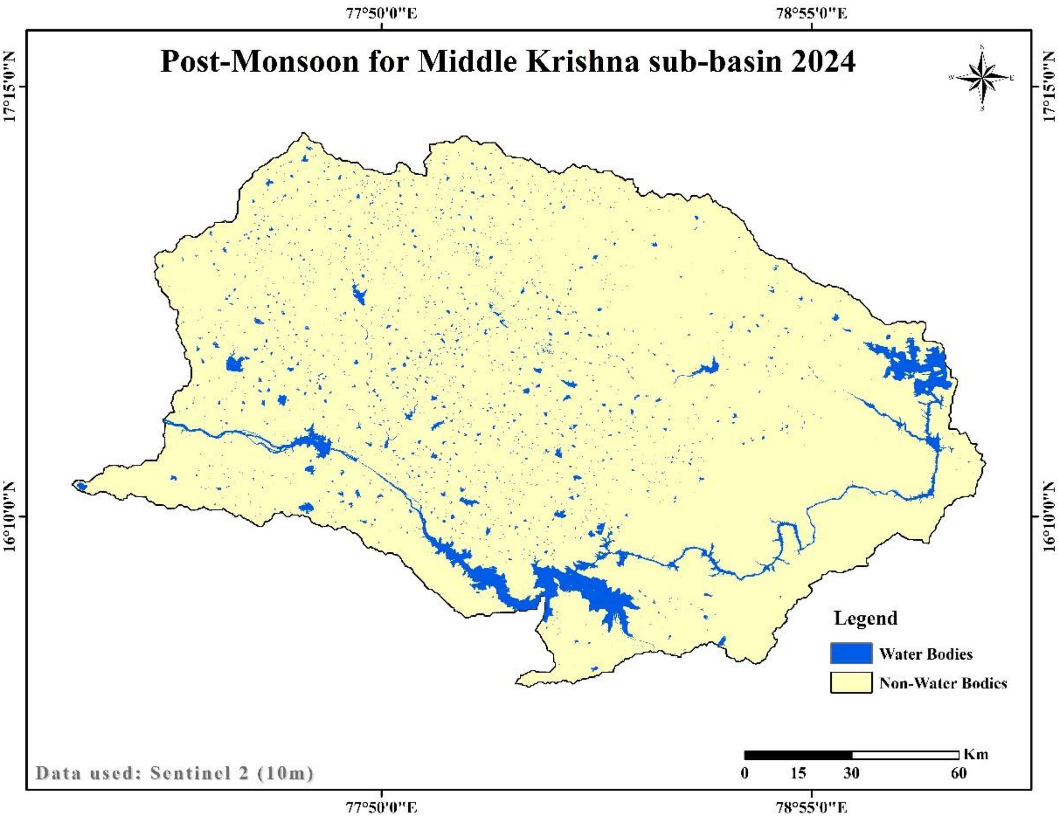

Figure 6. 4 Post-Monsoon Water Bodies in Middle Krishna Sub-basin

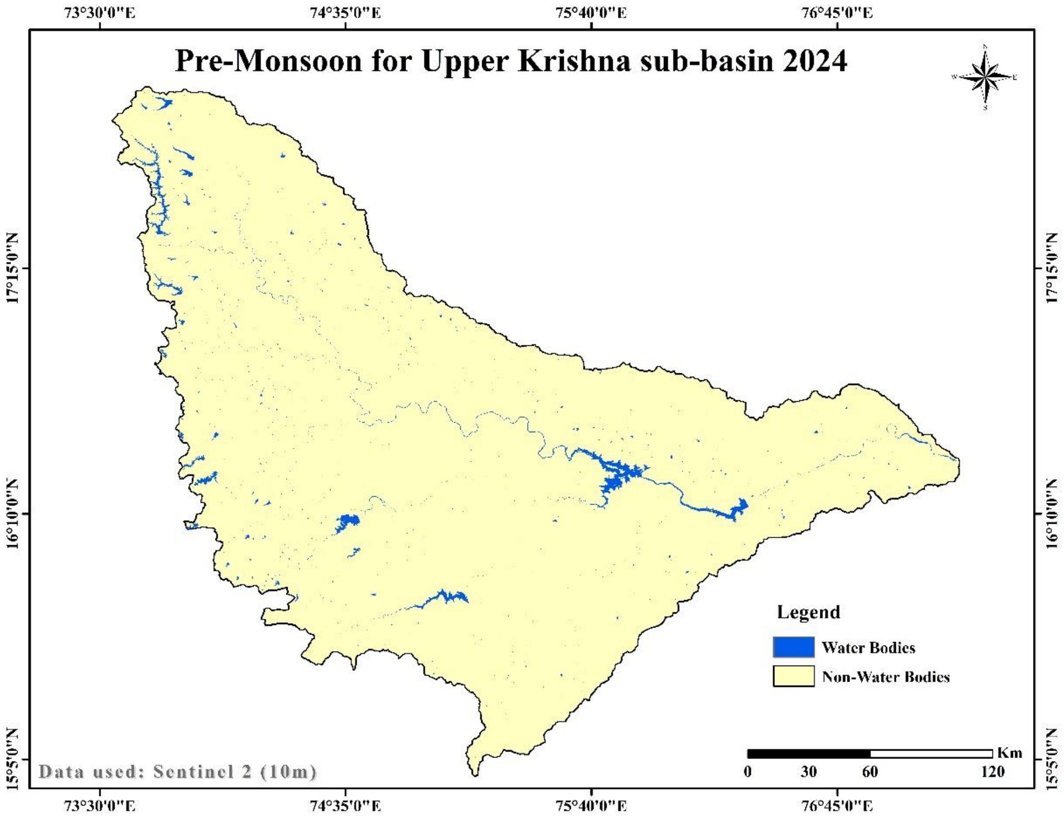

Figure 6. 5 Pre-Monsoon Water Bodies in Upper Krishna Sub-basin

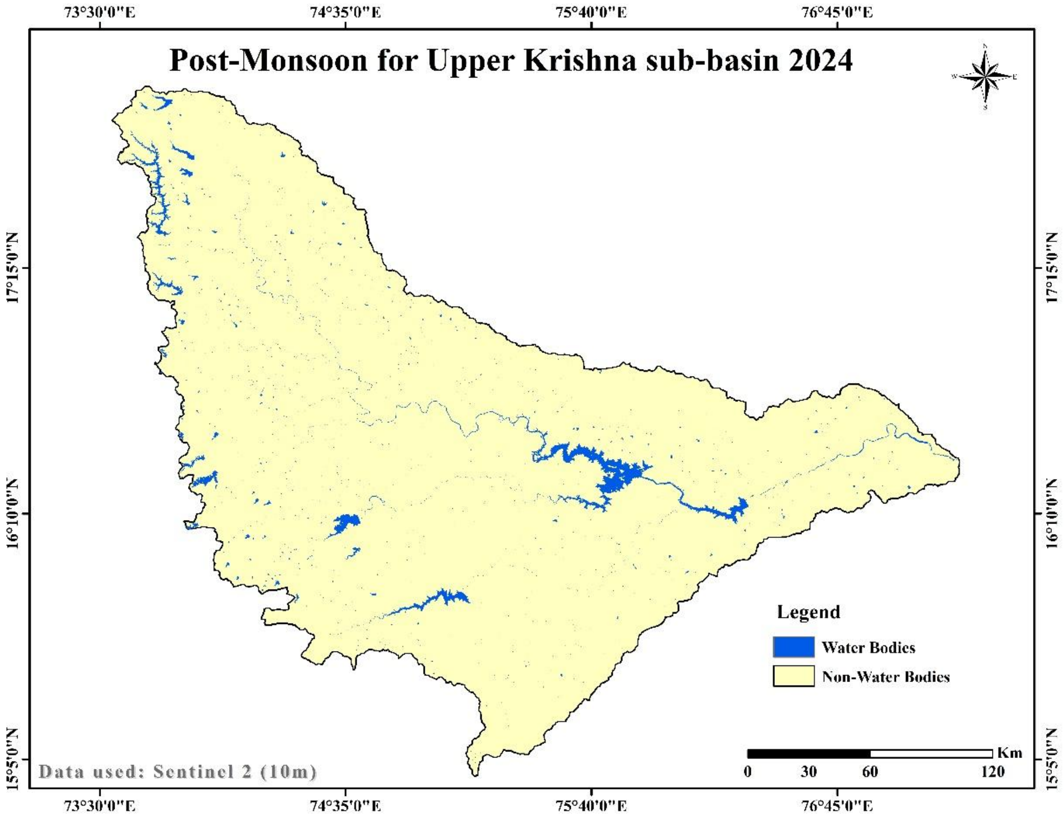

Figure 6. 6 Post-Monsoon Water Bodies in Upper Krishna Sub-basin

6.5 Upper Bhima Sub-basin

The Upper Bhima sub-basin showed a noticeable seasonal increase in water spread area during the post-monsoon period. The total water spread area increased by approximately 294.35 sq.km, indicating enhanced surface water availability following the monsoon season. The corresponding pre-monsoon and post-monsoon water body maps are presented in Figure 6.7 and Figure 6.8, respectively.

6.6 Lower Bhima Sub-basin

The Lower Bhima sub-basin recorded a moderate increase in water spread area during post-monsoon conditions. The increase of approximately 93.93 sq.km reflects seasonal recharge and improved surface water storage following rainfall events. The seasonal spatial distribution of water bodies in the Lower Bhima sub-basin is illustrated in Figure 6.9 and Figure 6.10.

6.7 Upper Tungabhadra Sub-basin

The Upper Tungabhadra sub-basin experienced a significant increase in post-monsoon water spread area from approximately 195.88 sq.km to 411.88 sq.km. The observed increase highlights the influence of monsoon runoff and reservoir storage within the sub-basin. The pre-monsoon and post-monsoon water body distributions are presented in Figure 6.11 and Figure 6.12, respectively.

6.8 Lower Tungabhadra Sub-basin

The Lower Tungabhadra sub-basin exhibited a considerable seasonal increase in water spread area during the post-monsoon period. The water spread area increased from approximately 285.20 sq.km during pre-monsoon conditions to about 480.21 sq.km during post-monsoon conditions. The seasonal variation in water bodies for the Lower Tungabhadra sub-basin is illustrated in Figure 6.13 and Figure 6.14, respectively.

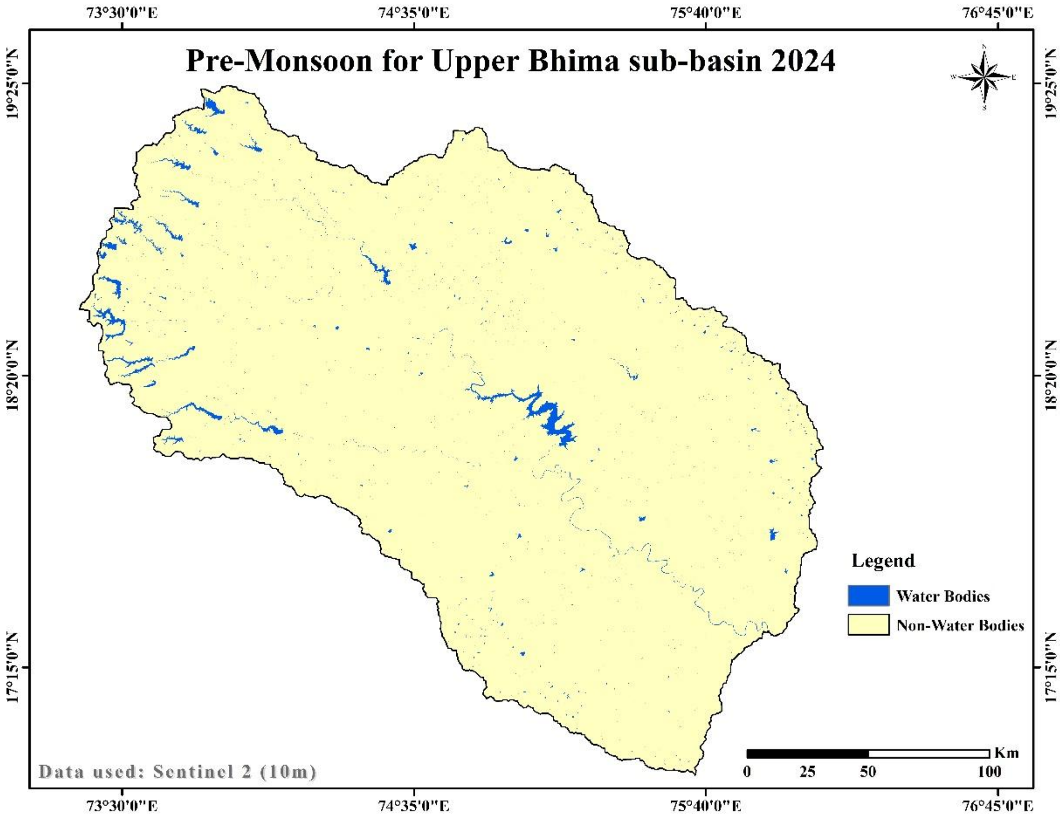

Figure 6. 7 Pre-Monsoon Water Bodies in Upper Bhima Sub-basin

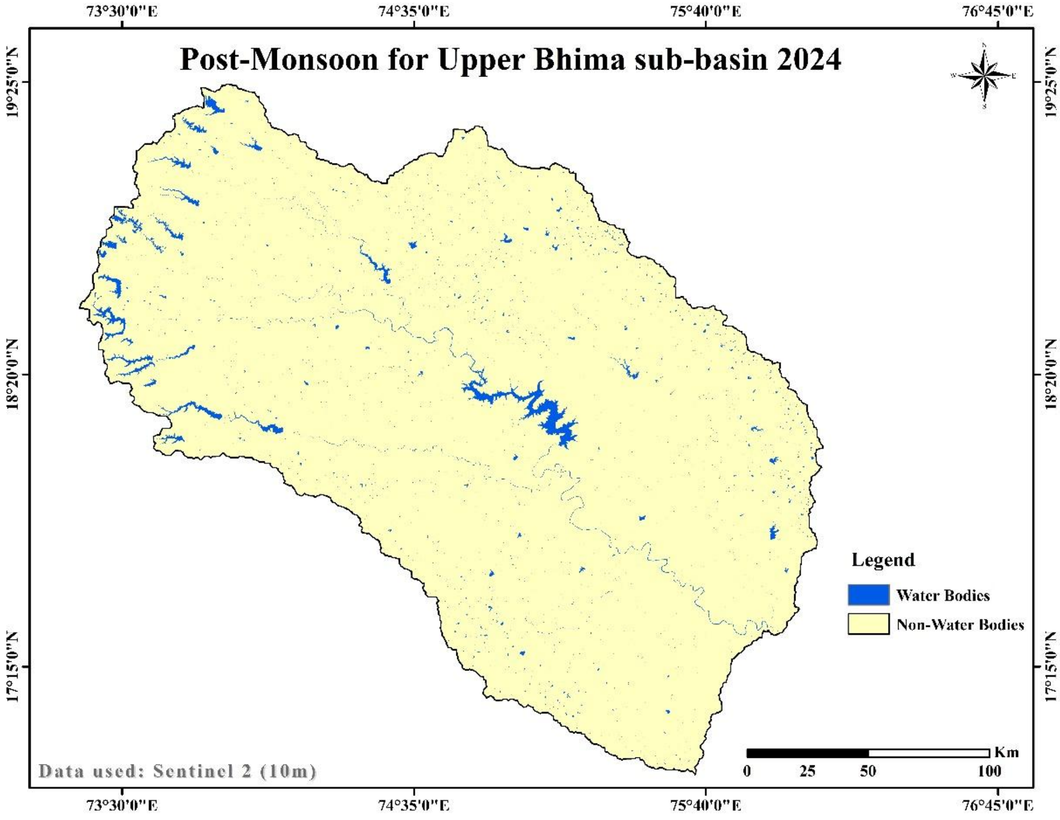

Figure 6. 8 Post-Monsoon Water Bodies in Upper Bhima Sub-basin

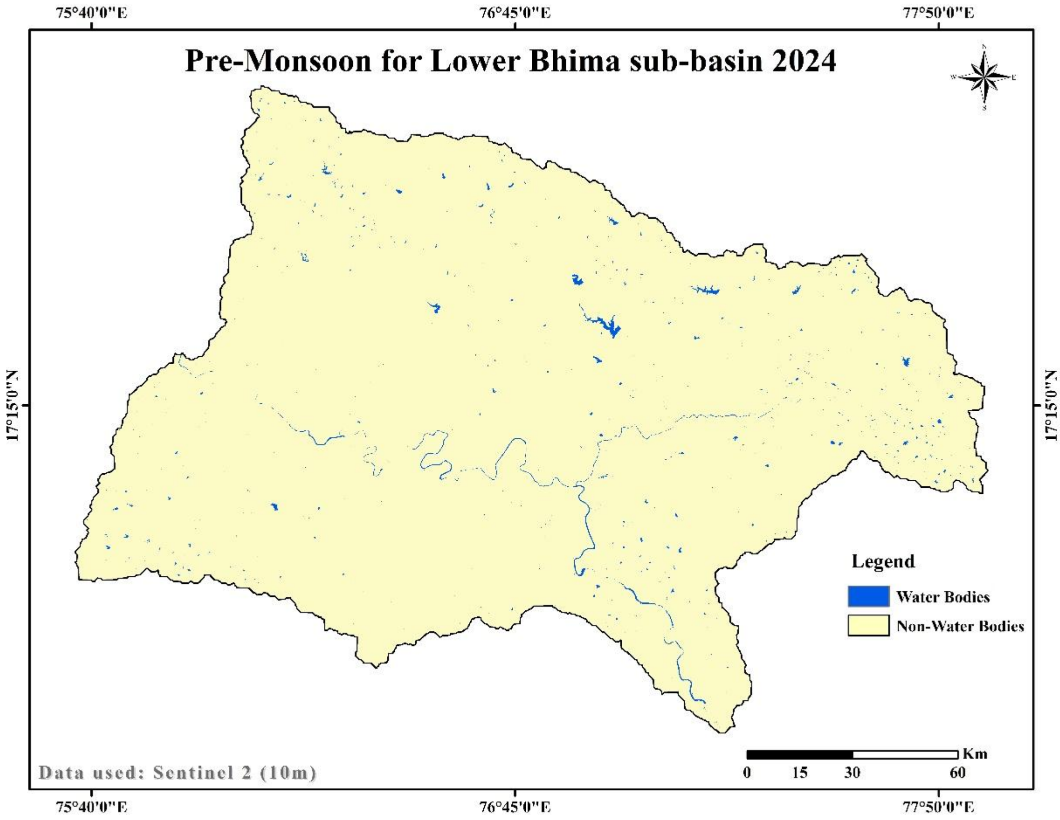

Figure 6. 9 Pre-Monsoon Water Bodies in Lower Bhima Sub-basin

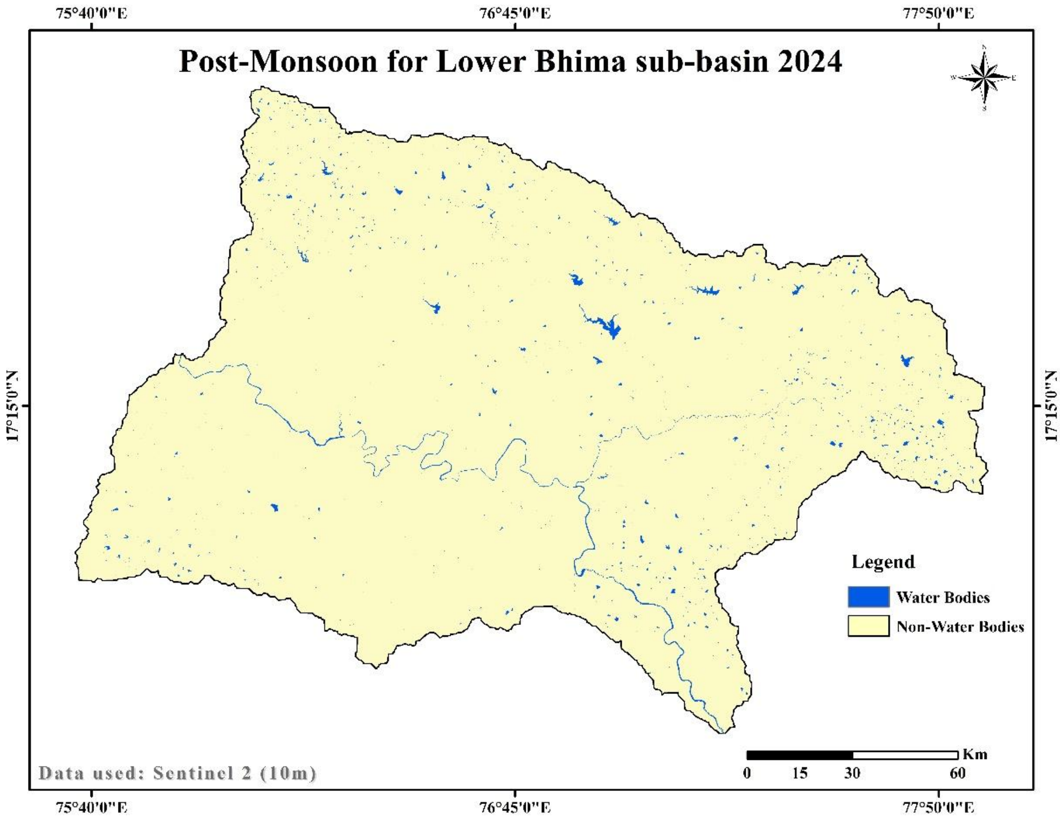

Figure 6. 10 Post-Monsoon Water Bodies in Lower Bhima Sub-basin

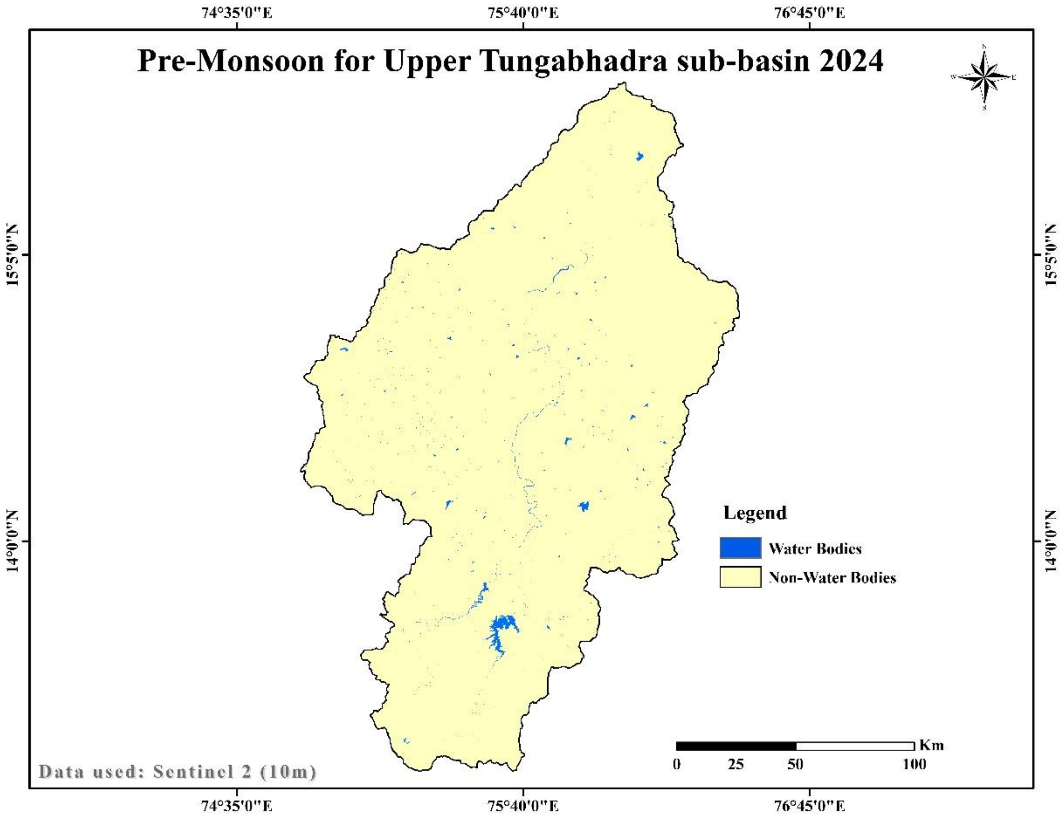

Figure 6. 11 Pre-Monsoon Water Bodies in Upper Tungabhadra Sub-basin

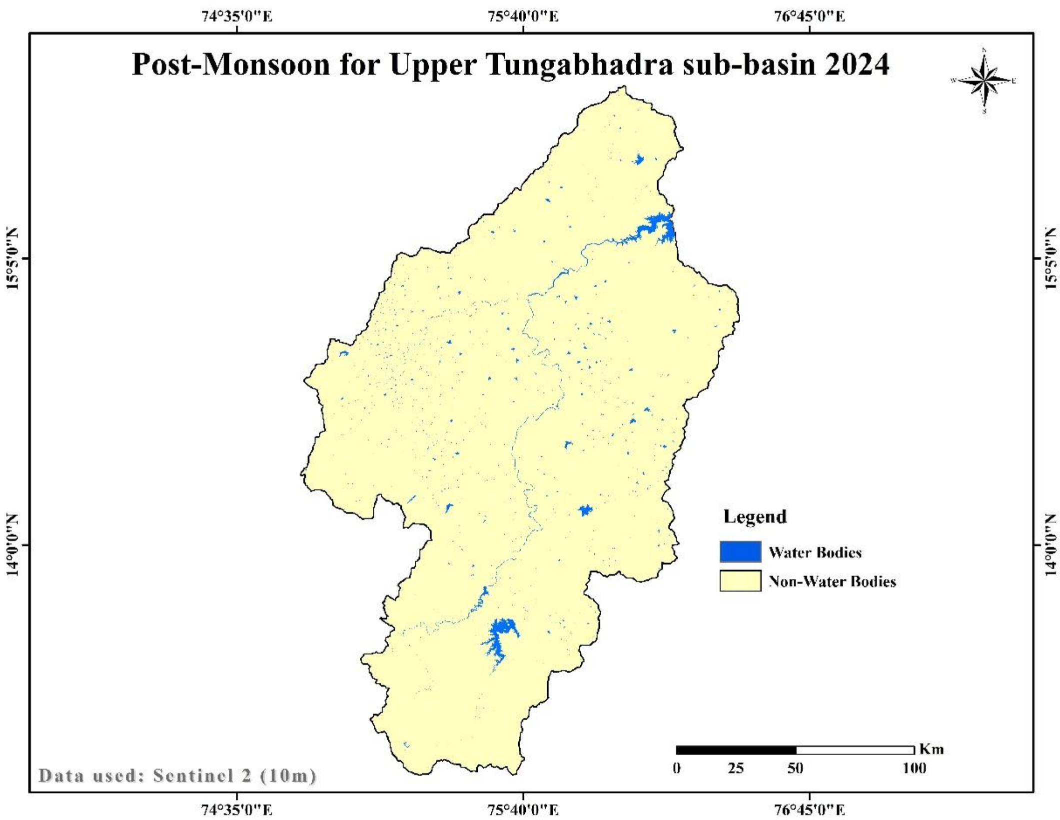

Figure 6. 12 Post-Monsoon Water Bodies in Upper Tungabhadra Sub-basin

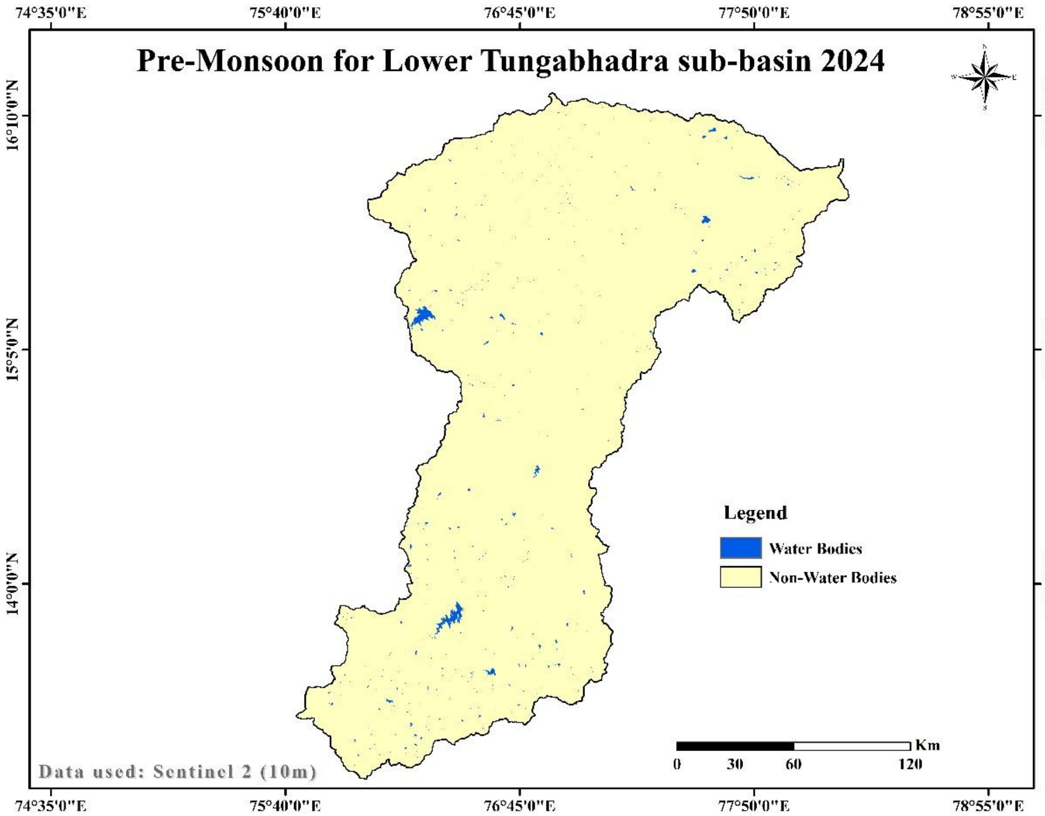

Figure 6. 13 Pre-Monsoon Water Bodies in Lower Tungabhadra Sub-basin

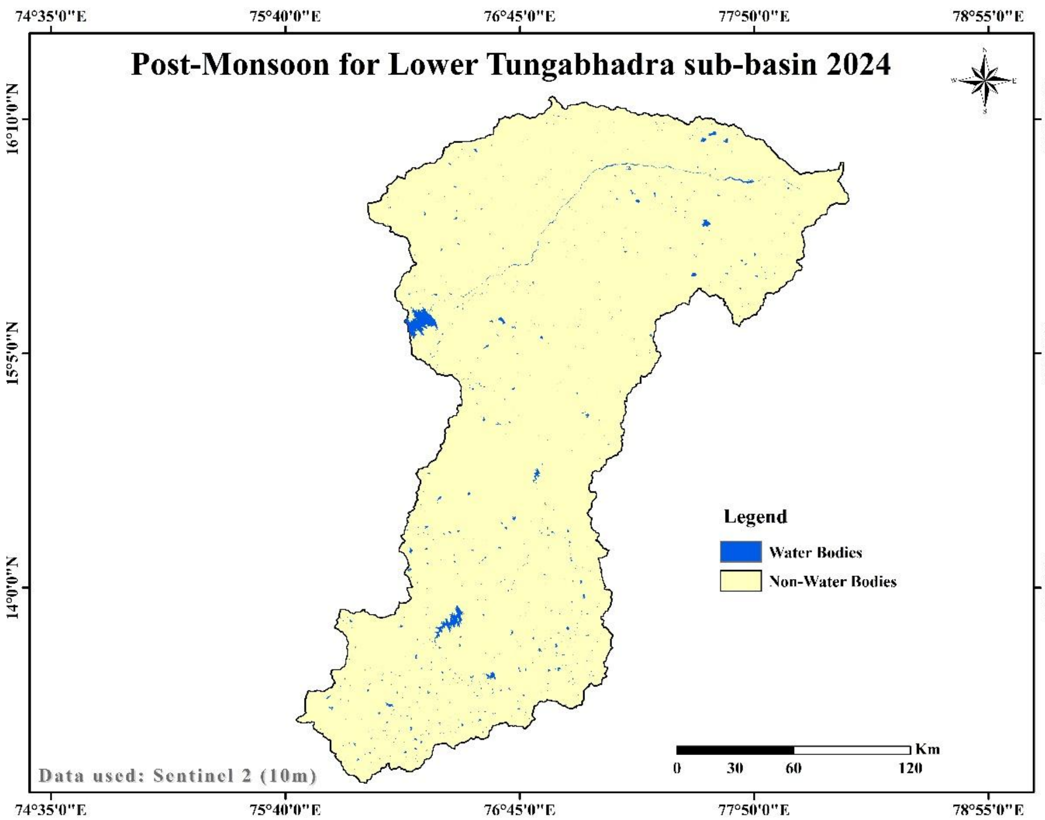

Figure 6. 14 Post-Monsoon Water Bodies in Lower Tungabhadra Sub-basin

7. Summary

The present study presents a comprehensive spatial and statistical assessment of water bodies and reservoirs distributed across the Krishna River Basin. The study integrates district-wise water body statistics, reservoir inventory data, and temporal water spread area analysis using datasets obtained from the National Water Data Portal (NWDP) and supporting geospatial databases. The atlas provides thematic maps, statistical tables, graphical analysis, and basin-scale interpretations to support sustainable river basin management and water resource planning.

The Krishna River Basin contains a diverse network of reservoirs, tanks, ponds, lakes, and wetlands distributed across the states of Andhra Pradesh, Telangana, Karnataka, and Maharashtra. The analysis indicates significant spatial variation in both the number and extent of water bodies across the basin states. Maharashtra contains the highest number of water bodies, while Karnataka records the highest total water spread area among the basin states. The district-wise assessment highlights the uneven spatial distribution of water bodies within the basin. Several districts such as Solapur, Pune, Raichur, Nalgonda, Kurnool, and Chitradurga exhibit significant concentrations of water bodies and reservoirs, reflecting the importance of irrigation and water storage infrastructure in semi-arid regions of the basin.

Temporal analysis of sub-basin water spread area from 1985 to 2025 reveals substantial hydrological variability across the Krishna River Basin. The Lower Krishna sub-basin consistently records the highest water spread area, although a gradual decline is observed during recent decades. In contrast, the Upper Krishna and Lower Bhima sub-basins show increasing trends in water spread area, likely associated with reservoir development and irrigation expansion. Moderate fluctuations are observed in the Tungabhadra and Bhima sub-basins, indicating changing hydrological conditions and climatic influences.

The reservoir inventory prepared as part of the study documents 44 reservoirs and dam structures distributed across the basin. Major reservoirs such as Srisailam Dam, Nagarjuna Sagar Dam, Tungabhadra Reservoir, Koyna Reservoir, and Ujjani Reservoir play a crucial role in irrigation development, hydropower generation, flood control, industrial water supply, and basin-scale water management. The integrated reservoir system of the Krishna Basin forms the backbone of regional water security and agricultural productivity.

The atlas highlights the importance of continuous monitoring and scientific assessment of water bodies for effective basin management. The integration of geospatial mapping, statistical analysis, and temporal evaluation provides valuable insights into changing water resource conditions within the Krishna River Basin.

8. Conclusions

The Krishna River Basin represents one of the most significant river systems in peninsular India, supporting extensive agricultural, industrial, ecological, and socio-economic activities. Water bodies and reservoirs within the basin play a vital role in sustaining irrigation, hydropower generation, drinking water supply, groundwater recharge, fisheries, and environmental balance across the basin states.

The present atlas successfully documents the spatial distribution, statistical characteristics, and temporal variability of water bodies within the Krishna River Basin using geospatial and statistical datasets. The study reveals considerable variation in the distribution and extent of water bodies across Andhra Pradesh, Telangana, Karnataka, and Maharashtra, reflecting differences in climatic conditions, topography, irrigation development, and water management practices. The temporal assessment of water spread area demonstrates that several sub-basins are experiencing noticeable changes in surface water availability over time. Declining trends in some sub-basins and increasing trends in others indicate the influence of reservoir development, land use changes, climatic variability, and hydrological alterations within the basin. These observations highlight the importance of integrated basin-scale monitoring and adaptive water resource management strategies.

The reservoir inventory further emphasizes the strategic importance of reservoir systems in regulating river flows and ensuring regional water security. Large multipurpose reservoirs such as Srisailam, Nagarjuna Sagar, Almatti, Tungabhadra, and Koyna continue to play a dominant role in supporting irrigation networks and water supply systems across the basin. The findings of this atlas provide a valuable scientific database for planners, policymakers, researchers, engineers, and water resource managers involved in river basin management and sustainable development initiatives. The atlas can support informed decision-making related to reservoir operation, drought preparedness, watershed management, ecological conservation, and climate resilience planning.

Overall, the study serves as an important reference document for understanding the spatial and temporal dynamics of water resources within the basin and contributes towards the broader goal of sustainable and integrated river basin management.