सत्यमेव जयते

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

DEMOGRAPHY OF GODAVARI RIVER BASIN

SEPTEMBER 2024

Centres for Godavari River Basin Management Studies
(cGodavari)

cGanga
Centre for Ganga River Basin Management and Studies
(cGanga)

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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 GODAVARI RIVER BASIN MANAGEMENT STUDIES (cGODAVARI)

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

www.cgodavari.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 a 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 CSIR-NEERI (Lead Institute) and IIT Hyderabad (Fellow Institute) under the supervision of cGanga at IIT Kanpur. It is 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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संदेश

मानव सभ्यता का विकास नदियों के किनारे हुआ है, और इसे सुरक्षित रखने के लिए नदियों का संरक्षण अत्यंत आवश्यक है। भारत की नदियों के स्वास्थ और सुरक्षा के लिए 2019 में संसद के संयुक्त सत्र में राष्ट्रपति ने गंगा नदी के उदाहरण पर अन्य प्रमुख नदियों के बेसिन प्रबंधन की आवश्यकता पर बल दिया था। इस उद्देश्य की पूर्ति हेतु छह प्रमुख नदियों के बेसिन प्रबंधन में सी–गंगा के समग्र समन्वय से 12 प्रतिष्ठित शैक्षणिक संस्थाओं को शामिल करने का निर्णय लिया गया। राष्ट्रीय नदी संरक्षण निदेशालय द्वारा संचालित कंडीशन एसेसमेंट एंड मैनेजमेंट प्लान (कैंप) प्रोजेक्ट नदियों के समग्र बेसिन प्रबंधन को साकार करने का प्रयास है।

नदियों के संरक्षण और उनके प्रबंधन के लिए इस तरह की पहल से न केवल हमारे प्राकृतिक संसाधनों का बचाव होगा, बल्कि स्थानीय समुदायों के जीवन और संस्कृति को भी संरक्षित किया जा सकेगा। यह अत्यंत हर्ष का भविष्य है कि इस प्रोजेक्ट के तहत तैयार की गई ''रिवर एट ए ग्लांस'' रिपोर्ट का लोकार्पण होने जा रहा है। जैसे किसी व्यक्ति के बाह्य स्वरूप से उसकी पुरी पहचान नहीं होती, वैसे ही नदी के व्यवहार और चुनौतियों को सिर्फ मुख्यधारा से नही समझा जा सकता। इसके लिए नदी के इतिहास, उसके किनारे बसे नगरों और गांवों की संस्कृति, सहायक नदियों और उस क्षेत्र के भूगोल को भी समझाना पड़ता है। इसी रिपोर्ट के जरिए नदी की पूरी प्रकृति, उसकी चुनौतियाँ, सहायक नदियां और आसपास के क्षेत्रों की सांस्कृतिक–भौगोलिक स्थिति को समझने के जो कोशिश की गई है, वह बहुत महत्वपूर्ण है।

हमें विश्वास है कि यह रिपोर्ट नदी, जल और पर्यावरण के क्षेत्र में काम करने वाले व्यक्तियों, संस्थाओं और हितकारकों के लिए अत्यधिक उपयोगी साबित होगी। रिपोर्ट के प्रकाशन और लोकार्पण के इस विशेष अवसर पर बधाई।

सीआर पाटील

सत्यमेव जयते

जल शक्ति राज्य मंत्री
भारत सरकार, नई दिल्ली

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संदेश

नदियां हमारे जीवन के लिए अत्यावश्यक संसाधन हैं और उनका पर्यावरणीय, सामाजिक, और आर्थिक महत्व भी बहुत अधिक है। नदियों का संरक्षण भविष्य की पीढ़ियों के लिए जीवन की गुणवत्ता सुनिचित करने की दिशा में एक महत्वपूर्ण कदम है। देश की छह प्रमुख नदियों के बेसिन प्रबंधन के लिए शीर्ष तकनीकी शिक्षण संस्थाओं के सहयोग से राष्ट्रीय नदी संरक्षण निदेशालय का कैंप (कंडीशन एसेसमेंट एंड मैनेजमेंट प्लान) प्रोजेक्ट संरक्षण के लिए वर्तमान सरकार की प्रतिबद्ता दर्शाता है। भारत सरकार के नमामि गंगे मिशन के अंतर्गत किये प्रयासों से आज गंगा नदी के पुनर्जीवन को वैशिक मान्यता मिल चुकी है। उम्मीद है की ऐसी ही सफलता हमें कैंप प्रोजेक्ट में भी मिलेगी।

रिवर बेसिन जनसांखियकी (डेमोग्राफिक) रिपोर्ट को देखकर हार्दिक प्रसन्नता हुई। कम समय में विस्तृत रिपोर्ट तैयार करने के लिए सभी सदस्यों को बधाई। जनसंख्यिकी रिपोर्ट न केवल हमें वर्तमान के बारे में अवगत कराता है, बल्कि इस रिपोर्ट को देखकर भविष्य की चुनौतियों और अपेक्षाओं का भी अनुमान लगाया जा सकता है। यह रिपोर्ट शासन, प्रशासन शिक्षण के लिए एक अहम् दस्तावेज है।

डा. राज भूषण चौधरी

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.

cGodavari and cGanga

CONTENT

1. Basin Overview

The Godavari Basin in India is a diverse region with varying population densities and socio-economic characteristics. The basin is spread over 0.32 million km^2, consisting roughly 72-82 million population as per Census 2011. Major cities like Nashik, Nagpur, and Hyderabad have higher population densities compared to rural areas. The basin is crucial for both the environment and human activities, with urban areas experiencing higher density and urban growth. The Godavari River and its tributaries is life-line to millions of people for food and income. The basin consists of diverse agricultural zones, with fertile alluvial soil supporting various crops. However, challenges such as water distribution, floods and droughts persist. Industrial development, particularly in cities like Hyderabad and Nashik, contributes to regional growth. Economic growth is uneven within the basin, with urban centers experiencing higher rates. Infrastructure development, including transport and irrigation, plays a critical role in economic growth. However, the basin faces challenges related to environmental sustainability, such as water management and pollution. Addressing these disparities and fostering balanced development across the basin is essential for its future growth and sustainability. The present report is to establish the baseline demography of the basin which is essential for understanding the interaction between populations of various categories with the natural resources in the basin.

2. Administrative delineation at various levels in the basin

The basin consists of 7 states and 1 UT. Each state/UT has its own local government and legislature. There are 74 districts covered in the Godavari basin from the states. The districts are further divided into sub-districts/tehsils or talukas, essential for revenue collection and local administration. Villages are the smallest rural administrative units, while urban areas include towns and cities. Local governance in rural areas involves a three-tier system of village panchayat, intermediate panchayat, and district panchayat. Urban areas have municipalities or municipal corporations for local governance. The hierarchy of the administrative structure followed in India is shown in Figure 1.

The basin consists of States viz. Maharashtra, Telangana, Andhra Pradesh, Madya Pradesh, Chattisgarh, Odisha, and Karnataka. The districts and the extent its area covered in the basin is provided in Table 1. Some of the Tehsils in the basin include Nashik, Igatpuri, Satpur, Sinnar, Deola, Betul, Hoshangabad, Dhamtari, Raipur, Abhanpur, Kalahandi, Nabarangpur, Umerkote, Adilabad, Bellampalli, Karimnagar, Karimnagar, and more. Some of the villages in the basin include Shirdi, Igatpuri, Manmad, Chalisgaon, Amla, Ghoradongri, Hoshangabad, Dhamtari, Raipur, Abhanpur, Bhawanipatna, Junagarh, Nabarangpur, Umerkote, Adilabad, Bellampalli, Karimnagar, Karimnagar, and more. The details of the Tehsils and villages are presented in more details in the following sections.

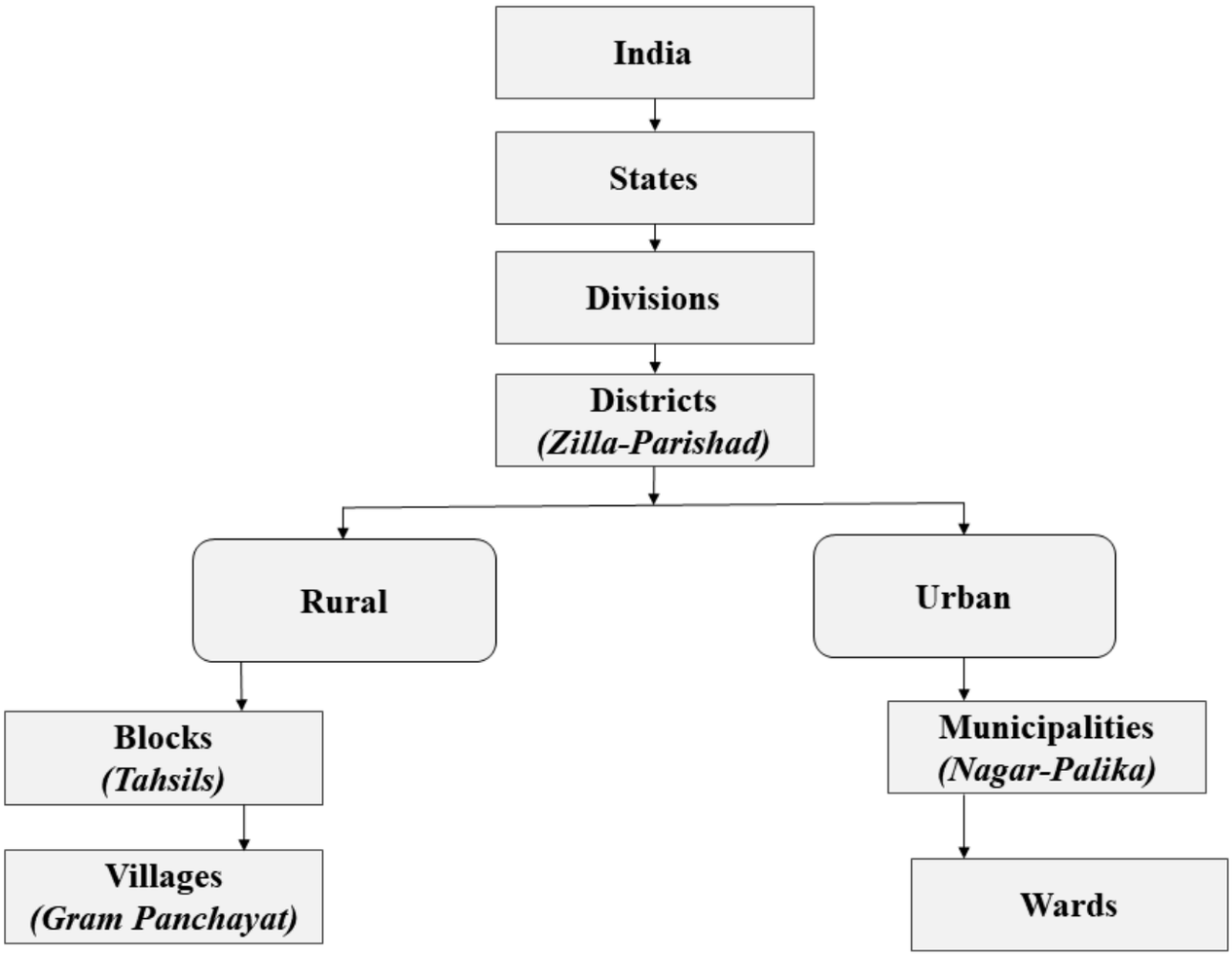

Figure 1. Administrative hierarchy structure in India

2.1 Maps showing States, Districts, Blocks, and Tehsils

There are total 74 districts covered by Godavari basin in various states, in this Maharashtra and Telangana each have 24 districts, Andhra Pradesh has 4 districts, Madhya Pradesh and Odisha have 5 districts each, Chhattisgarh has 10, and Karnataka and Puducherry (UT) has 1 district each (as shown in ***Error! Reference source not found.***). There are 600 tehsils covered in the Godavari basin comprising from the 8 administrative states/UT (as shown in Figure 3). Total gram panchayats covered in the basin are 23677 and the total number of villages covered in the basin are 45119, Maharashtra has more number of the gram panchayats (as shown in ***Error! Reference source not found.***). The state-wise distribution of the districts, sub-districts, gram-panchayats, and villages is presented in Table 1.

Table 1. State-wise distribution of the administrative units

S No.	Name of State	Fully Covered Districts	Partially Covered Districts (% covered in the Godavari Basin)	Sub-districts/ Tehsils	Gram-panchayats	Villages
1	Andhra Pradesh		Vizianagaram (0.01%), Visakhapatnam (32.43%), East Godavari (49.57%), West Godavari (20.61%)	60	833	2681
2	Chhattisgarh	Narayanpur, Dakshin Bastar Dantewada, Bastar, Bijapur, Sukma	Uttar Bastar Kanker (67.29%), Kondagaon (92.77%), Dhamtari (0.29%), Balod (0.34%), Rajnandgaon (28.25%)	37	1922	4072
3	Karnataka		Bidar (84.21%)	5	294	558
4	Madhya Pradesh		Mandla (9.74%), Seoni (74.54%), Chhindwara (69.73%), Balaghat (75.27%), Betul (21.79%)	29	2290	4546
5	Maharashtra	Bhandara, Wardha, Chandrapur, Yavatmal, Hingoli, Nanded, Parbhani, Nagpur	Gondiya (99.48%), Buldana (40.24%), Akola (0.01%), Nashik (46.07%), Gadchiroli (97.85%), Washim (79.04%), Jalna (99.67%), Ahmadnagar (62.79%), Pune (0.48%), Bid (85.90%), Latur (99.94%), Osmanabad (39.58%), Thane, Amravati (34.02%), Aurangabad (88.05%), Jalgaon (0.21%)	203	14249	22900
6	Odisha	Malkangiri	Kalahandi (5.33%), Nabarangapur (68.22%), Rayagada (12.18%), Koraput (82.07%)	14	1069	4206
7	Puducherry		Yanam (25.52%)	1		1
8	Telangana	Adilabad, Jagitial, Kamareddy, Karimnagar, Kumuram Bheem Asifabad, Mancherial, Nirmal, Nizamabad, Peddapalli, Jayashankar Bhupalpally, Rajanna Sircilla	Jangoan (6.03%), Mulugu (99.98%), Khammam (4.6%), Mahabubabad (11.36%), Meda (99.80%), Medchal Malkajgiri (4.45%), Ranga Reddy (1.56%), Sangareddy (95.23%), Siddipet (95.40%), Vikarabad (9.5%), Warangal Rural (32.55%), Warangal Urban (90.85%), Bhadradri Kothagudem (87.64%)	251	3831	6155

Figure 2. Districts in Godavari River basin

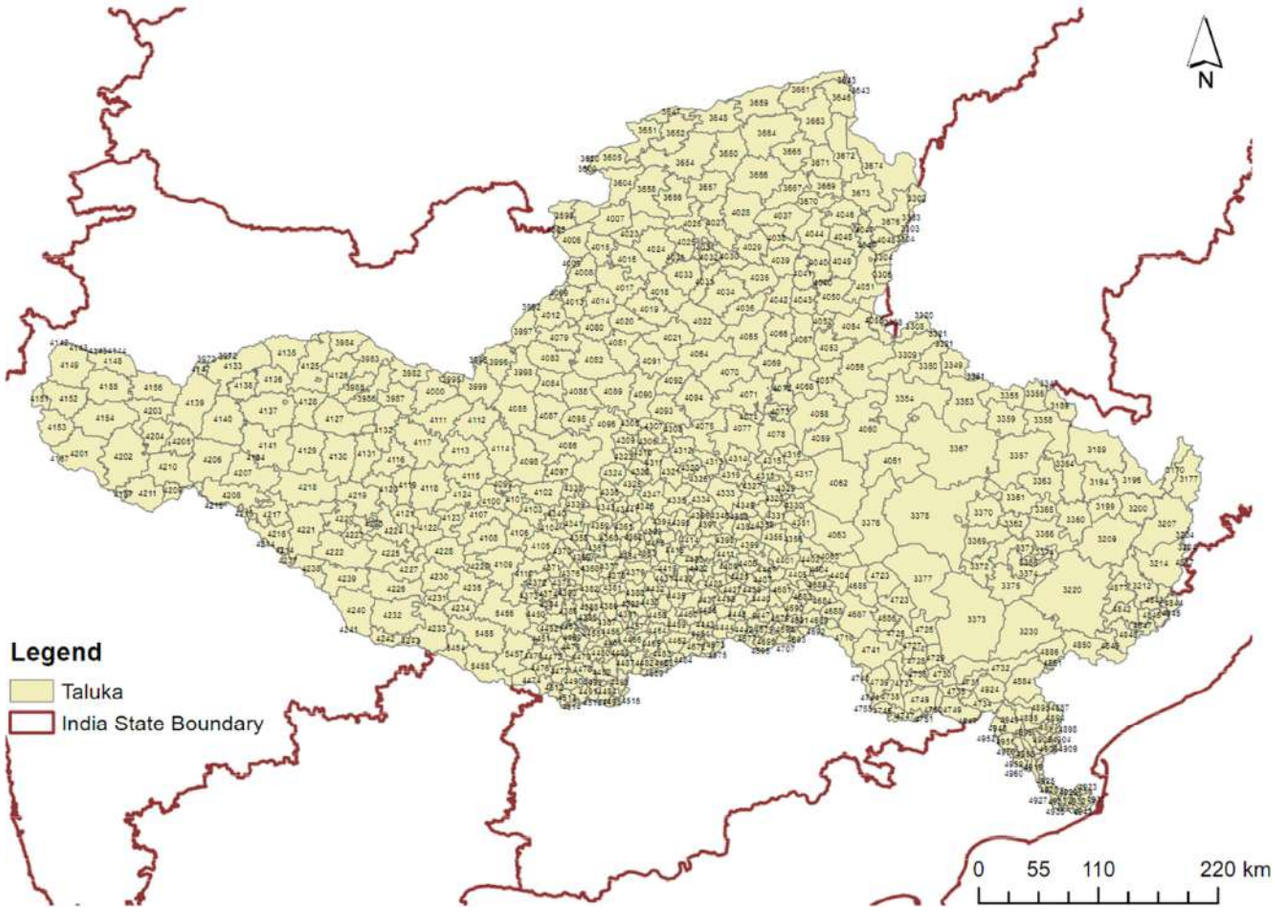

Figure 3. Tehsils/sub-districts in the Godavari River Basin and their census code as per 2011

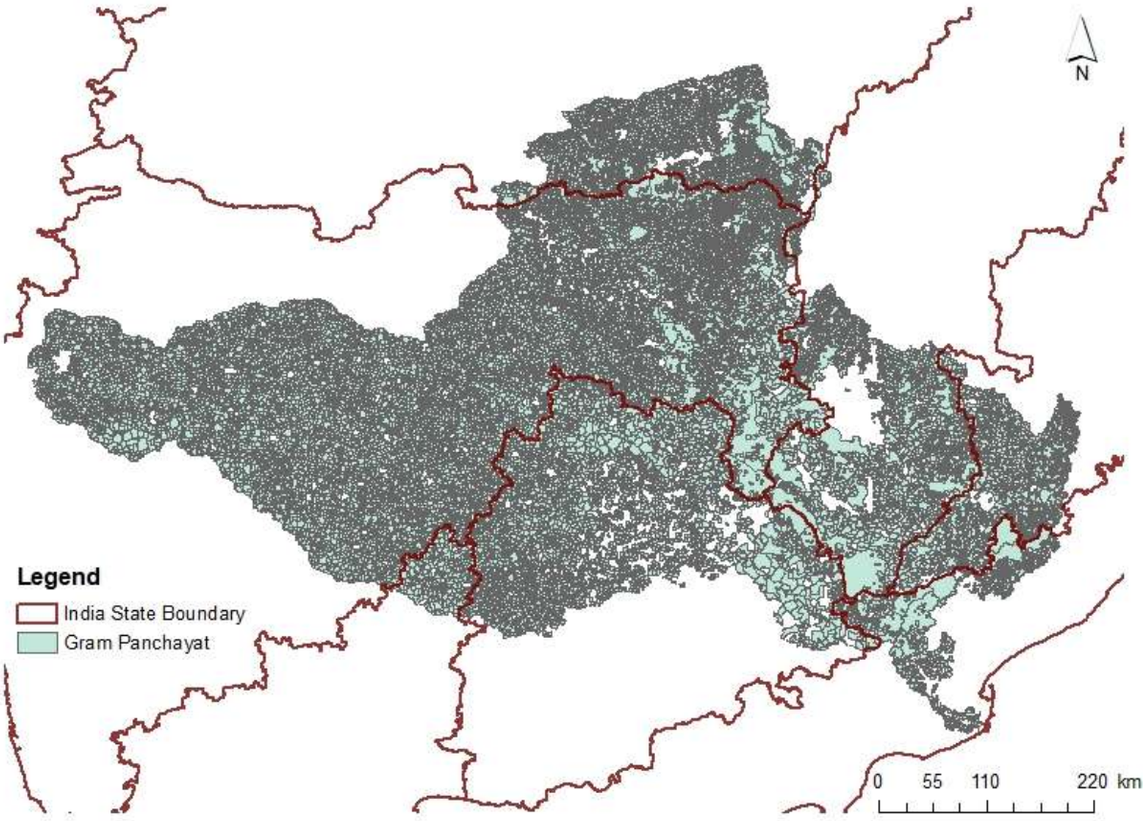

Figure 4. Gram Panchayat map of the Godavari River basin

2.2 Maps showing urban local bodies

Urban Local Bodies (ULBs) in India are municipal institutions responsible for governing and managing urban areas. They play a crucial role in local self-government, addressing urban planning, infrastructure, and public services. The Constitution of India and various laws empower ULBs to administer urban areas effectively. Types of ULBs include Municipal Corporations, Municipal Councils, City Municipal Council, Municipality, Notified Area Council, Town Municipal Council, Town Panchayat, and Cantonment Board. Their functions include infrastructure development, land use regulation, housing planning, public health and safety, revenue collection, financial management, and social services. There are around 267 ULBs in the Godavari basin and their locations are shown in Figure 5. The data is summarized in Table 2.

Table 2. Summary of the ULBs in the Godavari Basin

State/UT	ULBs (count)
Andhra Pradesh	Municipal Corporations (1), Municipality (2), Town Panchayats (1)
Chhattisgarh	Municipal Corporations (1), Municipality (4), Town Panchayats (10)
Karnataka	City Municipal Council (2), Town Municipal Council (1), Town Panchayats (1)
Madhya Pradesh	Municipal Corporations (1), Municipality (11), Town Panchayats (9)
Maharashtra	Cantonment Board (1), Municipal Corporations (8), Municipality (85), Town Municipal Council (1), Town Panchayats (57)
Odisha	Municipality (5), Notified Area Council (2)
Puducherry	Municipality (1)
Telangana	City Municipal Council (1), Municipal Corporations (4), Municipality (54), Town Municipal Councils (1), Town Panchayats (3)

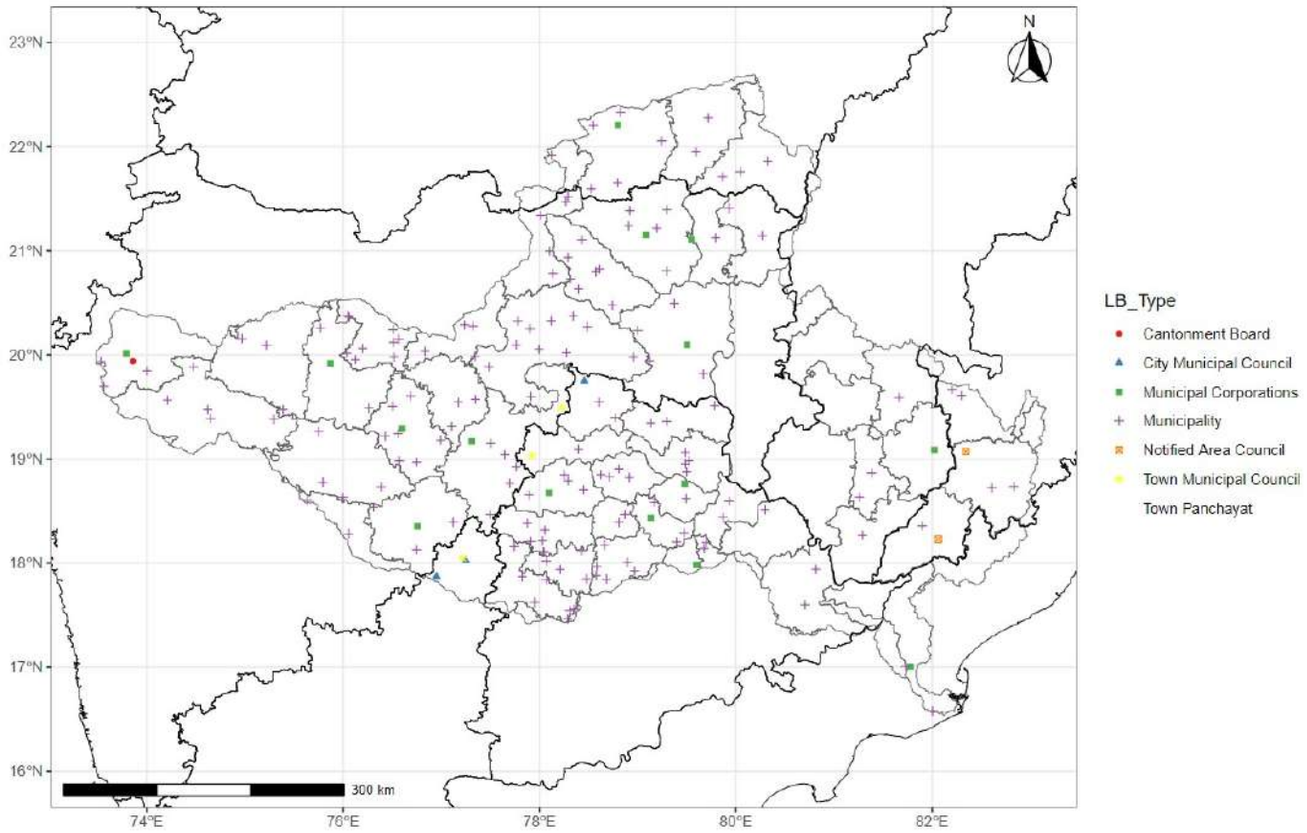

Figure 5. Map showing Urban Local Bodies in Godavari River basin

3. Distribution of Population

3.1 Total Population

Total population includes number of persons from Rural and Urban areas in the administrative areas. The 2011 Census of India provided an approximate population of the Godavari Basin, which includes states such as Maharashtra, Madhya Pradesh, Chhattisgarh, Odisha, Telangana, and Andhra Pradesh is shown in Table 3. The total population in Maharashtra part of the basin was approximately 47.4 million, including the partial counts for Aurangabad, Buldhana, Washim, among others. In population from the Madhya Pradesh part of the basin was around 5.8 million. Chhattisgarh part in the basin had around 4.1 million, with partial counts for Raipur and Bilaspur Districts. Odisha part of the basin had around 1.5 million, and Telangana had around 17.7 million. Andhra Pradesh part of the basin had around 4.2 million. The total population of Godavari basin is around 82.7 million.

3.2 Population Distribution

The tehsil-wise population distribution in the basin is shown in Figure 6. The tehsils with the highest population are Nagpur (urban), Nashik, Aurangabad, Amravati, Nanded, Nagar, Latur, Balanagar, Parbani, Jalna. Nagpur (urban) Tehsil of Nagpur District in Maharashtra State. has the highest population consisting of 2405665 persons. The lowest population of 19507 is

recorded in Maredumilli Tehsil of East Godavari District in Andhra Pradesh. The distribution of the population into rural and urban areas and into males and females is shown in Table 3. The population density is shown in Figure 7. The tehsils with the highest population density are Nagpur (urban, MH) having 11057 persons/km^2, followed by Balanagar (TS) having 7889 persons/km^2, Rajahmundry (urban, AP) having 7682 persons/km^2, etc. The tehsil with the least population density is Maredumilli (AP) with 20 persons/km^2.

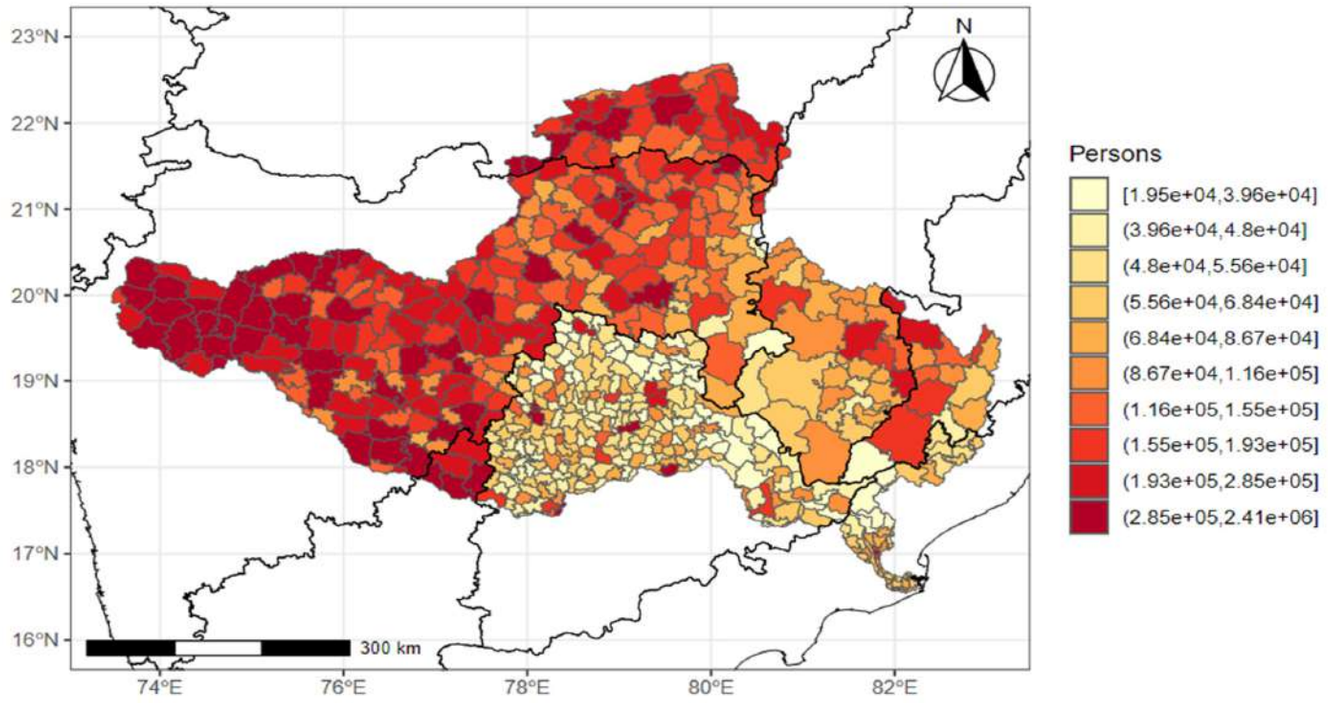

Figure 6. Tehsil-wise Total (urban & rural) population distribution in the Godavari River Basin

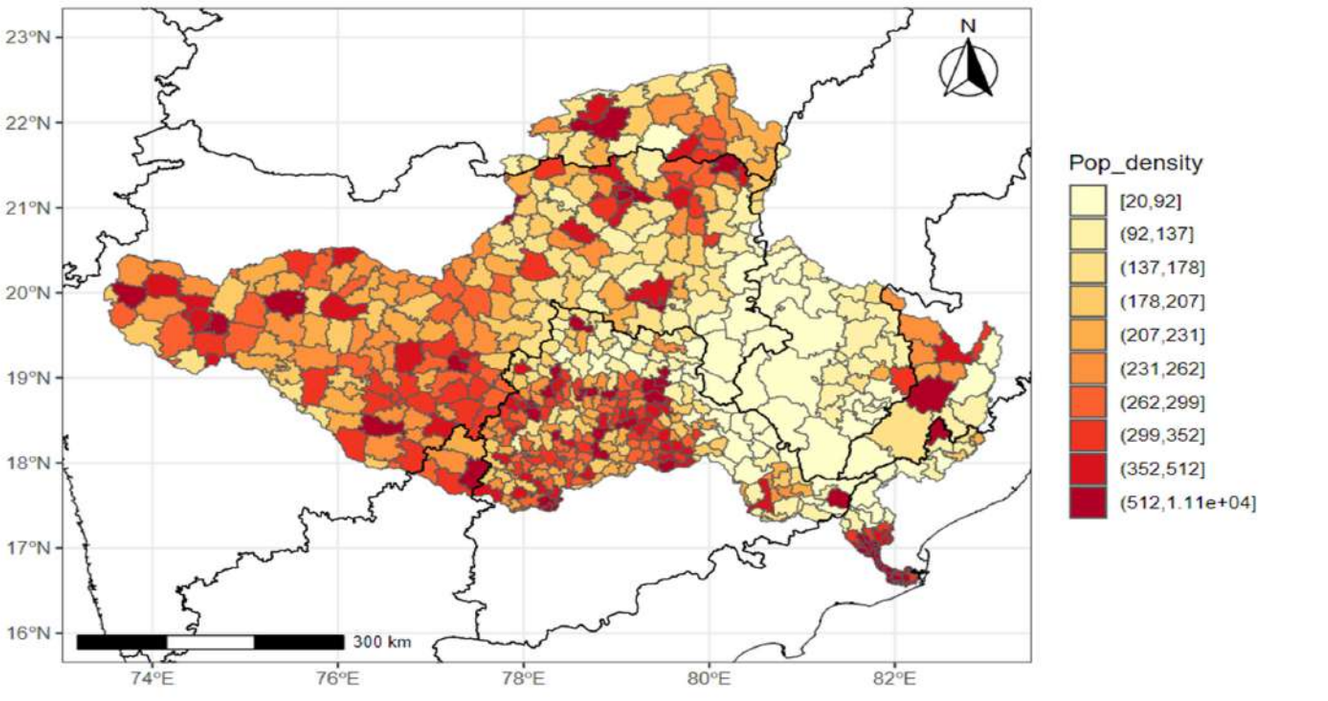

Figure 7. Tehsil-wise population density in the Godavari River basin

Table 3. State wise distribution of total population

State	Type	Persons	Males	Females	Households
Andhra Pradesh	Rural	3414542	1697642	1716900	938496
	Total	4220809	2096560	2124249	1153527
	Urban	806267	398918	407349	215031
Chhatisgarh	Rural	3665520	1812266	1853254	783643
	Total	4188289	2077810	2110479	902119
	Urban	522769	265544	257225	118476
Karnataka	Rural	1277348	651250	626098	239979
	Total	1703300	870665	832635	319937
	Urban	425952	219415	206537	79958
Madhya Pradesh	Rural	4634260	2330097	2304163	1025668
	Total	5804185	2925247	2878938	1282822
	Urban	1169925	595150	574775	257154
Maharashtra	Rural	32500055	16728261	15771794	6957225
	Total	47493417	24451615	23041802	10117757
	Urban	14993362	7723354	7270008	3160532
Odisha	Rural	1317430	648280	669150	310846
	Total	1531471	756461	775010	361121
	Urban	214041	108181	105860	50275
Puducherry	Rural	0	0	0	0
	Total	55626	27301	28325	13812
	Urban	55626	27301	28325	13812
Telangana	Rural	11948494	5937216	6011278	2926026
	Total	17758693	8876637	8882056	4300730
	Urban	5810199	2939421	2870778	1374704

3.3 Population Growth Trend

The growth trends in the population of major districts covered in the Godavari River Basin are plotted in Figure and Figure . The population growth trend in the Godavari Basin is diverse, reflecting varying rates and patterns across different states and districts. Rapid urbanization in some areas contrasts with slower growth in others, influenced by economic development, migration, and infrastructure changes. Effective management of these trends requires addressing both urban and rural needs to ensure balanced and sustainable development across the basin. In Maharashtra, urban growth is driven by economic opportunities and infrastructure development, while rural areas may show slower growth or stable trends. In Madhya Pradesh, growth rates are moderate due to agricultural activities and migration trends. Chhattisgarh's districts are witnessing increasing urbanization, but many rural areas

still experience moderate growth rates. Odisha's growth is influenced by agricultural dependence and lower levels of industrial development. Telangana is experiencing rapid urbanization, particularly in districts like Hyderabad and Karimnagar. Andhra Pradesh's districts show diverse trends, with urban areas showing rapid growth and rural areas showing slower changes. Challenges and implications include infrastructure strain, resource management, and environmental impact, particularly in areas with significant agricultural and natural resources.

The Census population data from 1911 to 2021 plotted in the figures reveals the steady upward growth with varying incremental changes compared with the previous years. The district population growth during 2001 to 2011 in Maharashtra State varied in the range of 5.18 to 36.1%, with lowest in Wardha District, while the highest in Thane District. The district-wise population growth rates in Telangana State varied in the range of 8.15 to 48.16%, the highest in Ranga Reddy District. In Andhra Pradesh, the growth rate during 2001-2011 varied in the range of 3.51-11.96%, the highest is in Visakhapatnam District. In Odisha State, the growth rate during the same period varied in the range of 11.03 to 21.62%, with the highest rate in Malkangiri District. In Chhattisgarh State, the district-wise population growth rate varied from 8.78 to 19.79%, the lowest in Bijapur, while the highest in Rajnandgaon Districts, respectively. While in Puducherry, Yanam District population has grown by 77.19% from 2001 to 2011, which is the highest in the entire Godavari Basin.

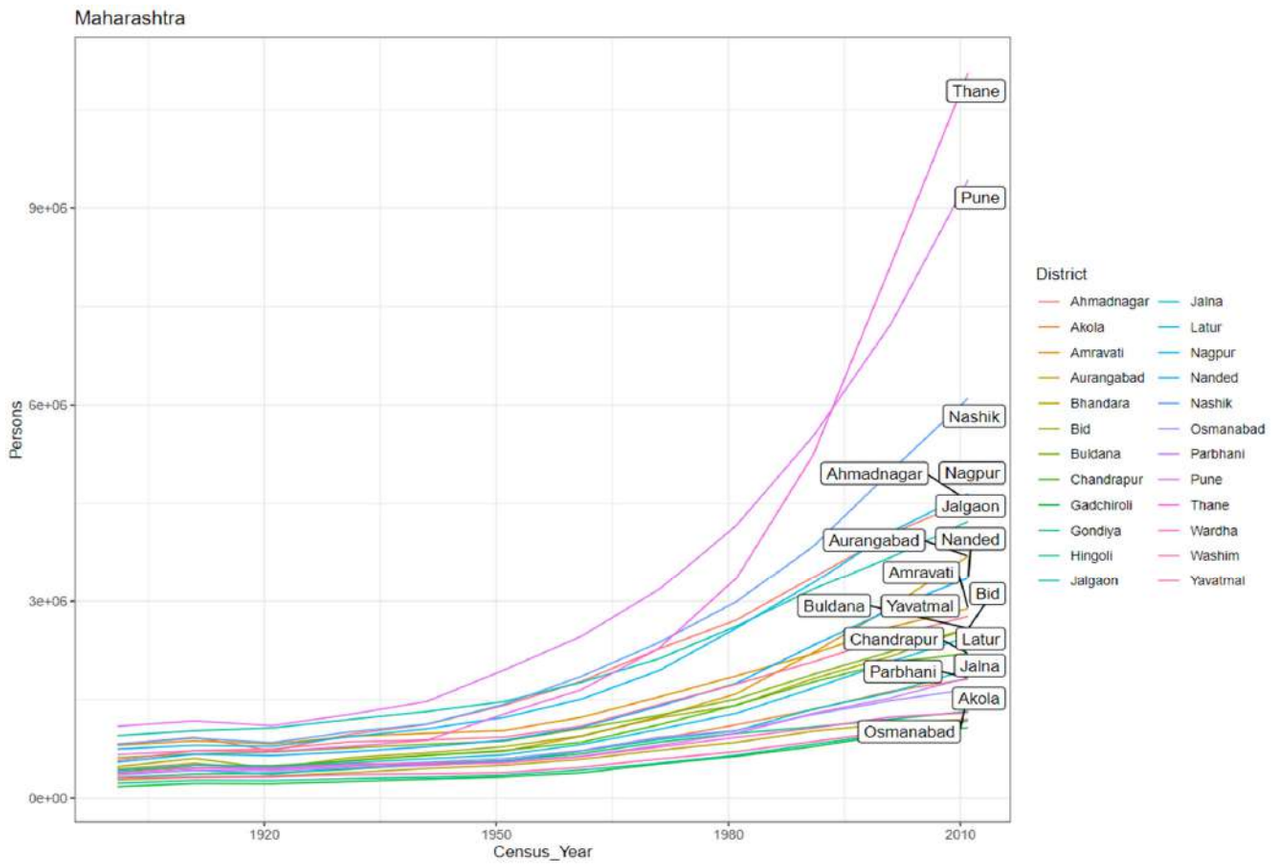

Figure 8. District-wise population growth trends in Maharashtra

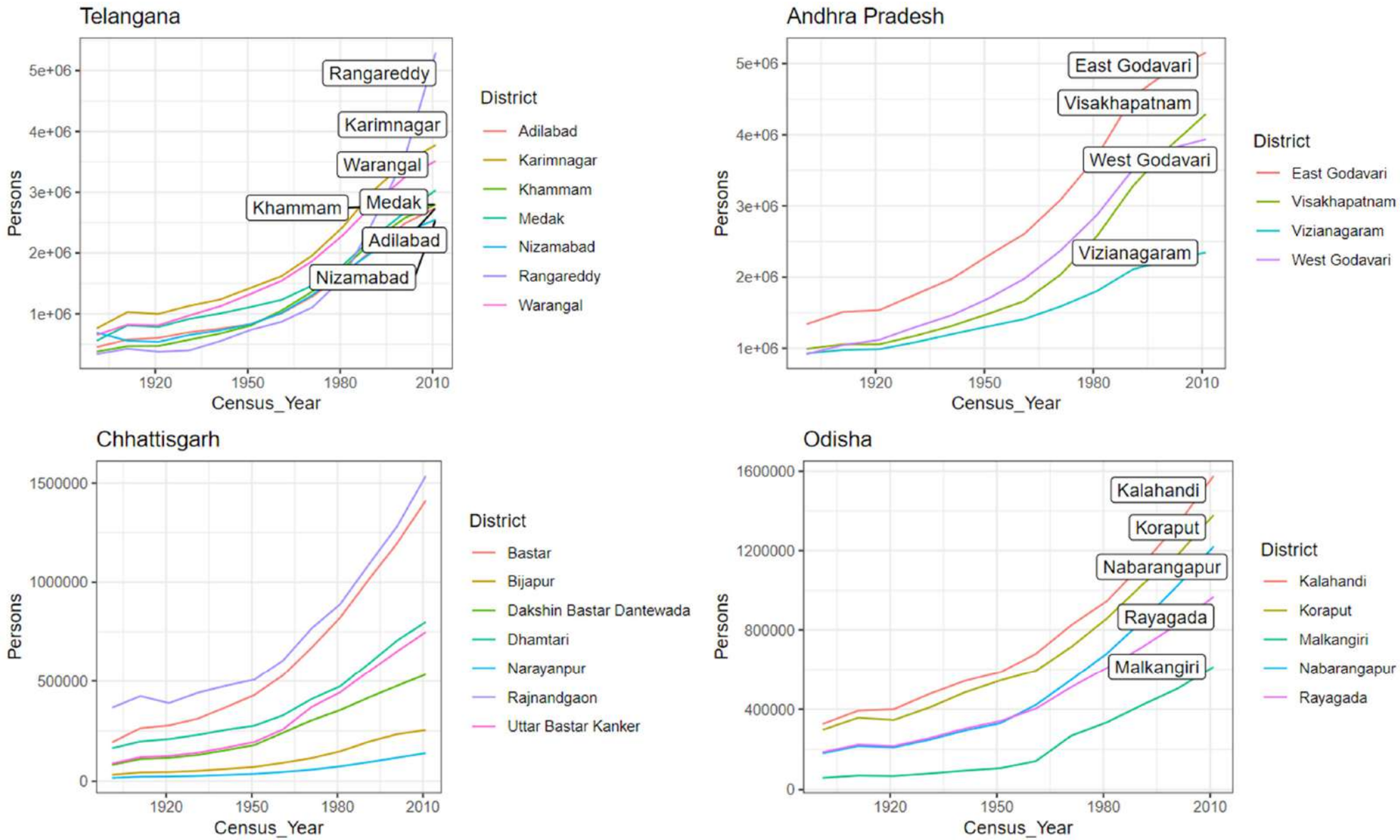

Figure 9. District-wise population growth trends in Telangana, Andhra Pradesh, Chhattisgarh, Odisha

4. Demographic Characteristics

4.1 Age Structure

The age structure of the population in the Godavari Basin can be understood through demographic studies, shown in Figure 10a. Population of age group <20 years constitute around 32-48% of the population in the basin, with higher proportions in regions of Maharashtra (Nanded, Hingoli, and Parbhani Districts), Chhattisgarh (Sukma, Dakshin Bastar, Dantewada, Bastar, Kondagaon, Uttar Bastar Kanker, etc districts), and Odisha (Malkangiri and Koraput Districts). Working-age adults (21-59 years) make up about 46-58%, with urbanized and economically developed districts having a higher proportion due to migration and economic opportunities. The regions with high proportion of the working age consists of Vidarbha districts in Maharashtra (Chandrapur, Wardha, Nagpur, Bhandara, and Gondia Districts), Khammam District in Telangana, and Visakhapatnam, East and West Godavari Districts in Andhra Pradesh. The elderly makes up 3-14%, with areas with better healthcare and living standards having a higher proportion. Districts from the central Maharashtra (Ahmadnagar, Bid, Osmanabad, Latur, Jalna, and Buldana Districts) and central Telangana (Jagital, Sircilla, Peddapalli, Karimnagar, Jayashankar, Mulugu, etc Districts) have the highest elderly population percentage in the basin. Age structure impacts economic productivity, labor force, healthcare, and social services. Urban areas have a balanced age structure due to migration and better healthcare access, while rural areas may have higher proportions of children and elderly. Future trends include an increasing aging population, impacting pension systems and healthcare services, and a need for education and employment opportunities for the younger population. The state-wise distribution of the age-structure in the basin is shown in Figure 10b. The data shows that the composition of the total population is higher for the age group 15-30 years in almost all states in the basin. Similar trends are observed in the age-wise composition of the population data for the entire Godavari basin (shown in Figure 10c).

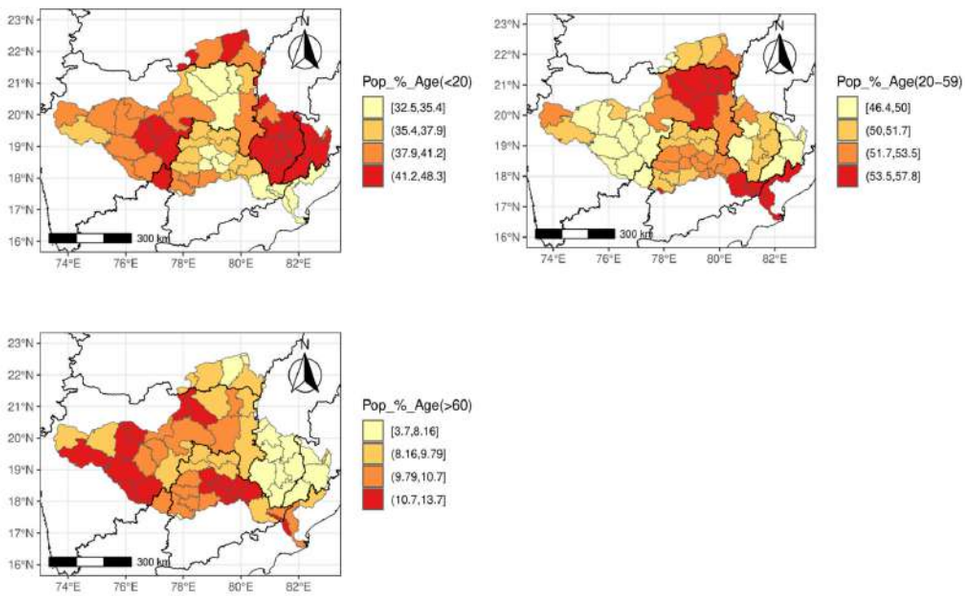

Figure 10a. Distribution of population percentage according to different age groups in the Godavari basin

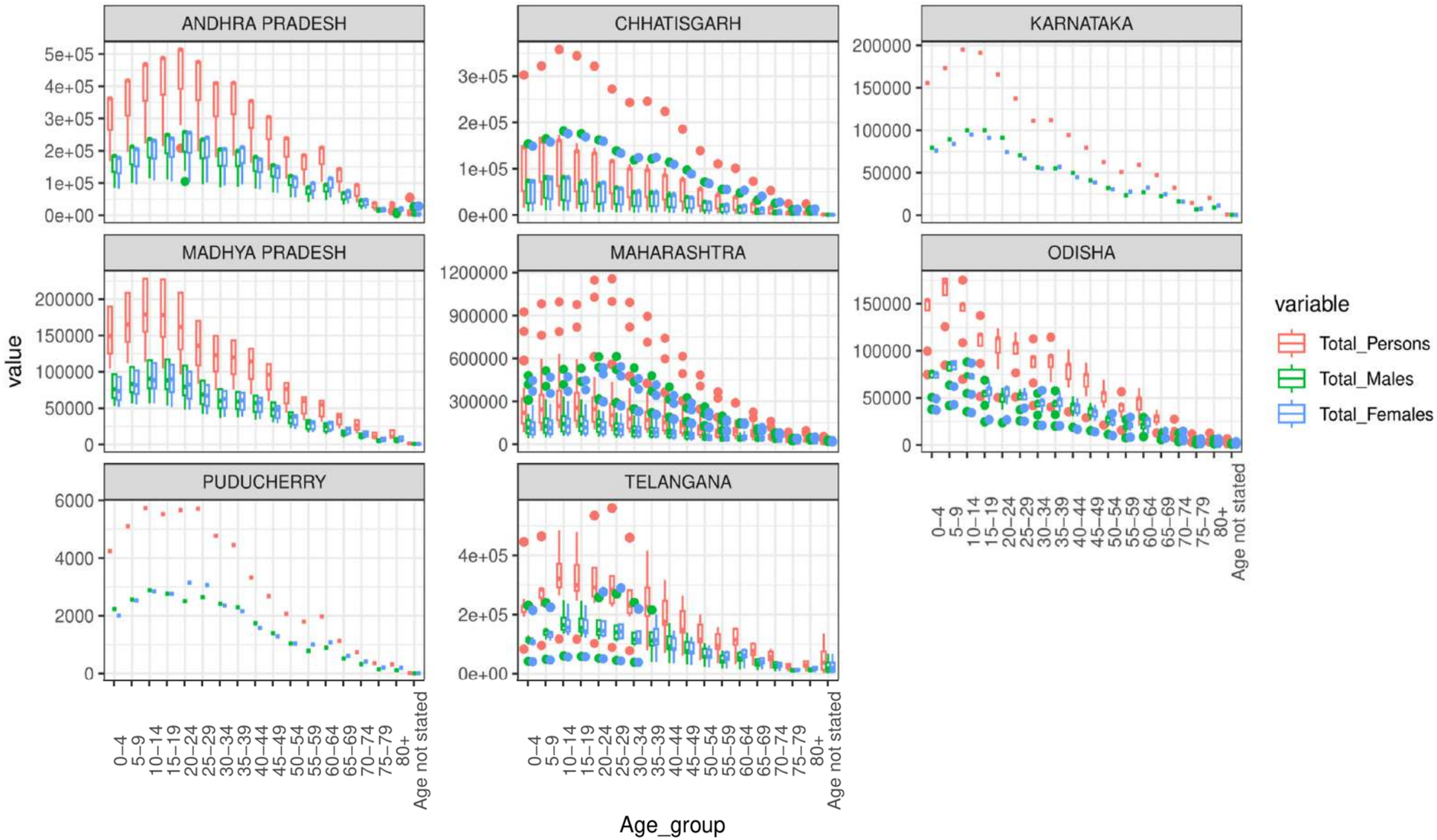

Figure 10b. Tehsil-wise age group distribution of population in various states covered in Godavari River basin

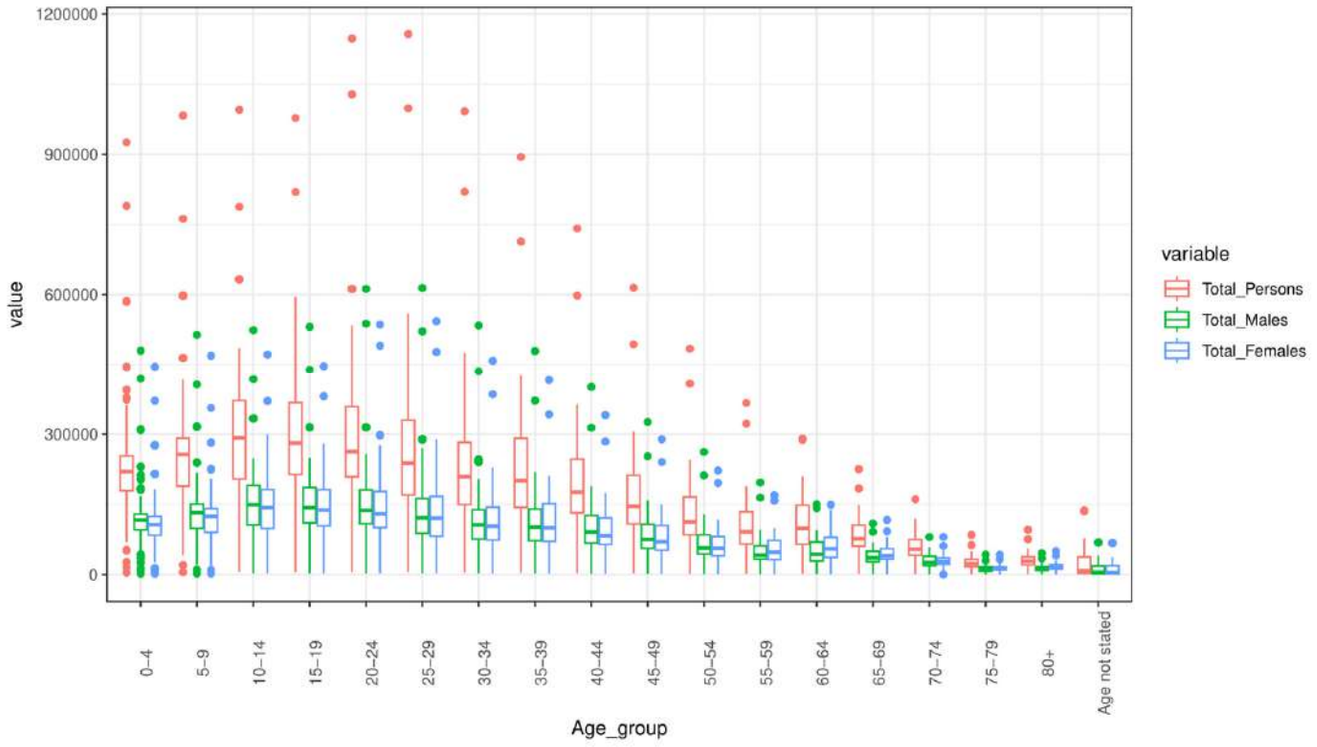

Figure 10c. Tehsil-wise distribution of the population according to various age-groups in the Godavari River basin

4.2 Sex Ratio

The sex ratio is a crucial demographic indicator that indicates the number of females per 1,000 males in a population. In the Godavari Basin, data on the sex ratio is typically aggregated at the district level. The 2011 Census of India provides a breakdown of the sex ratio in the districts within the basin across the states involved. The sex-ratio in the basin is around 977, which is derived by calculating the proportion of the entire female population in the basin to the male population. The age-wise distribution of the sex-ratio, calculated within that particular age-group is shown in Figure 11a. The data shows that the sex-ratio is higher than the basin average for 15-34 age groups in almost all states in the basin, and the sex-ratio is consistently higher in all the states for age group >60 years. It can be inferred from the data that the composition of the elderly female population is relatively higher than that of male population in the basin. Andhra Pradesh, Telangana, Puducherry, Chhattisgarh, Madhya Pradesh, and Odisha states have the all-ages sex-ratio higher than that of basin average. Whereas, Maharashtra and Karnataka States have the all-ages sex-ratio lesser than the basin average. The similar overall trends in the sex-ratio in the basin is shown in Figure 11b.

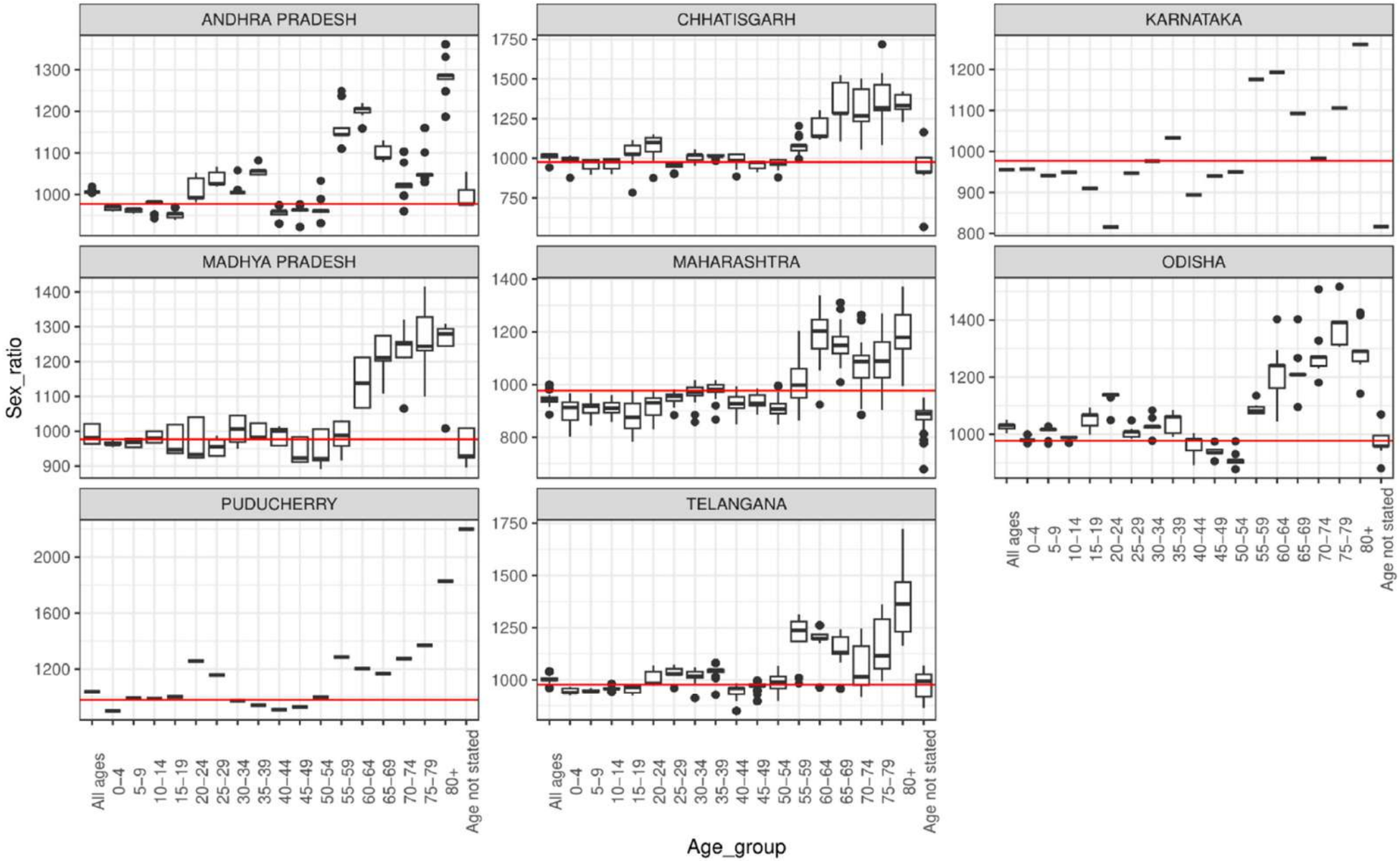

Figure 11a. Age-group-wise sex ratio in Godavari River basin according to the states

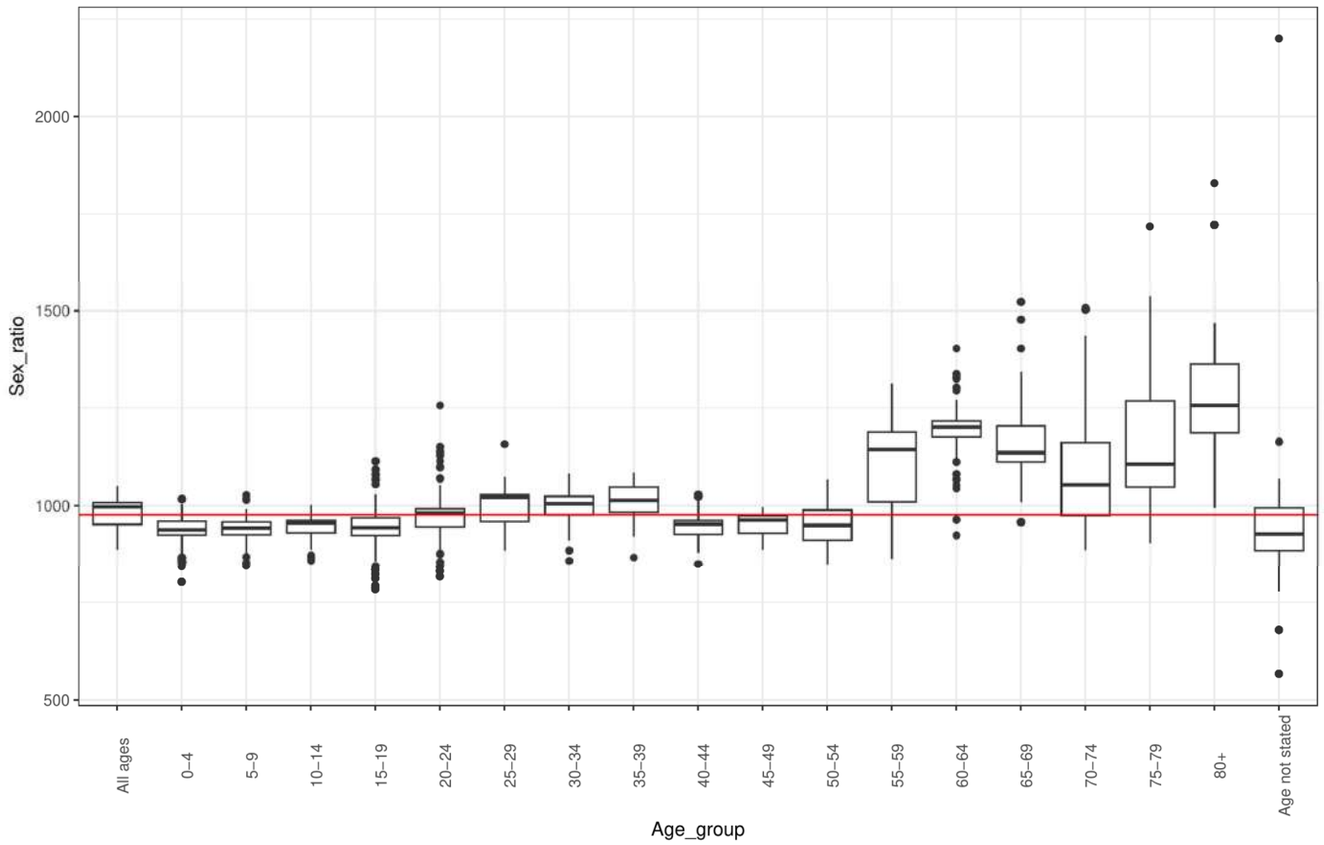

Figure 11b. Age-group-wise sex-ratio distribution in the Godavari River basin

4.3 Household Composition

Household composition data from the 2011 Census of India offers insights into the structure and characteristics of households within a region, particularly in the Godavari Basin. This data is based on the average household size, which is the average number of individuals living in a single household, and the types of households. Key indicators include average household size, which is the average number of persons per household, and the demographic characteristics of the head of the household.

The average household size in the Godavari Basin generally falls between 3.6 to 5.3 individuals per household, slightly comparable to the national average of about 4.8 individuals per household. The summary of household data is presented in Table 4. Household types are nuclear families, more common in urban areas and economically developed districts, and extended families, more prevalent in rural areas. The head of the household is typically an adult, often in the age range of 30-60 years, with male heads being more common. The tehsils with mean household size of 5-6 are spread across the western and central parts of Maharashtra state in the basin. While majority of the tehsils have mean household composition of around 4-5 persons. Telangana and Andhra Pradesh have mean household persons of 3-4 in majority of the area in the basin, shown in Figure 12. The household

distribution in the tehsils categorized according to the states is presented in Figure 13, whereas the household structure in the entire basin is presented in Figure 14. The household cumulative values categorized according to the states in the basin are presented in Table 4.

Socio-economic factors such as urbanization and traditional family practices and agricultural lifestyles also influence household composition. Urbanization increases the prevalence of nuclear families and reduces average household size, while rural areas tend to have larger households and more extended family structures.

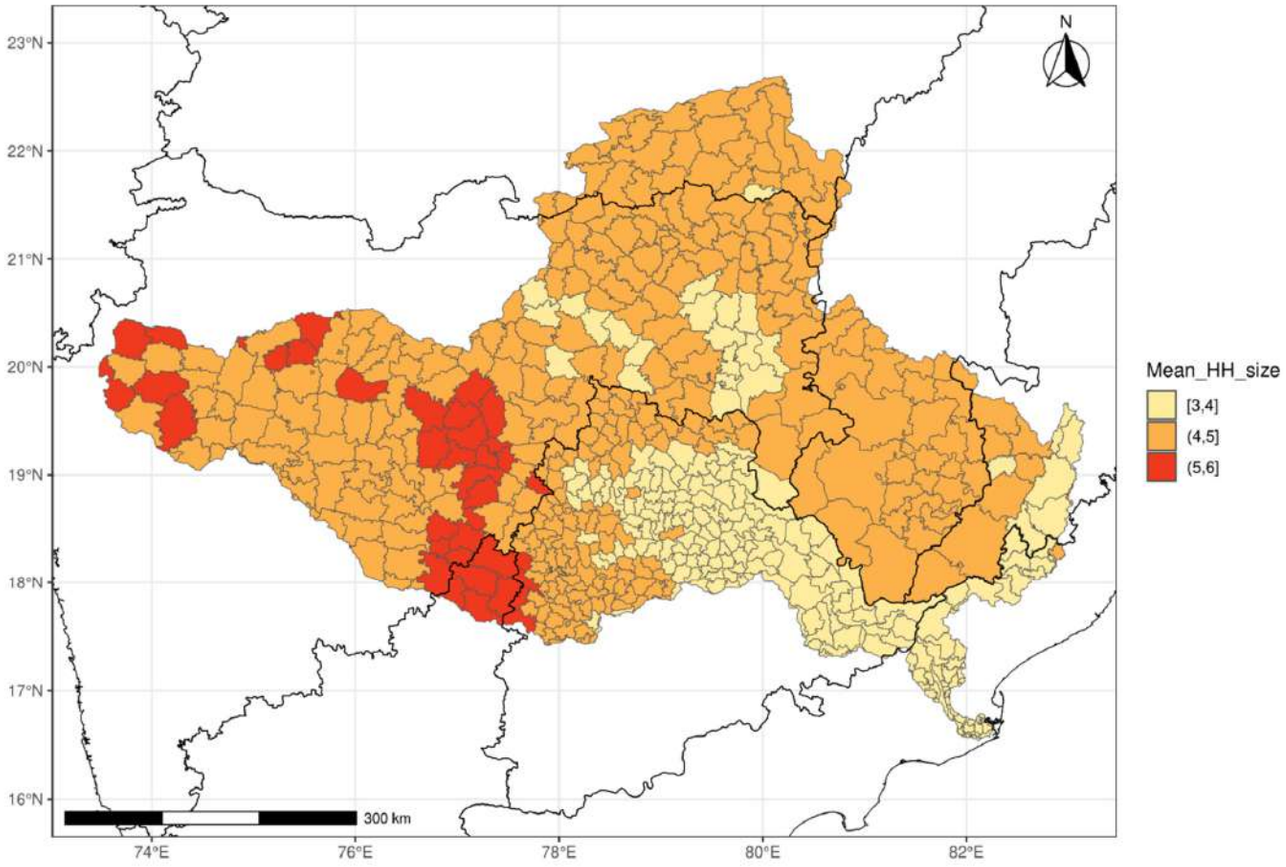

Figure 12. Tehsil-wise distribution of the household size in Godavari River basin

Table 4. Household (HH) distribution in the basin across various states

State	Type	Num_HH	Population	HH_1	HH_2	HH_3	HH_4	HH_5	HH_6	HH_7-10	HH_11-14	HH_>15	Mean_HH
Andhra Pradesh	Rural	935639	3340784	72884	168831	188658	291692	132684	50836	29275	672	107	3.6
	Total	1149640	4129755	84908	202161	232224	367677	163552	62309	35765	897	147	3.6
	Urban	214001	788971	12024	33330	43566	75985	30868	11473	6490	225	40	3.7
Chhatisgarh	Rural	780817	3590721	43215	91990	108937	148815	151882	107112	119000	8149	1717	4.6
	Total	898437	4089228	52106	106462	128091	176846	173653	119235	130784	9237	2023	4.6
	Urban	117620	498507	8891	14472	19154	28031	21771	12123	11784	1088	306	4.2
Karnataka	Rural	239192	1270573	8755	17919	21659	39748	52060	40277	50705	6143	1926	5.3
	Total	318570	1688467	10335	23127	30324	56201	69449	52733	65710	7987	2704	5.3
	Urban	79378	417894	1580	5208	8665	16453	17389	12456	15005	1844	778	5.3
Madhya Pradesh	Rural	1023340	4614475	53829	110998	128899	228878	221871	141168	130594	6197	906	4.5
	Total	1279355	5772773	66354	135036	164780	295283	276298	171415	159511	9064	1614	4.5
	Urban	256015	1158298	12525	24038	35881	66405	54427	30247	28917	2867	708	4.5
Maharashtra	Rural	6931098	32154178	292067	722132	839125	1695086	1476112	914068	879800	90152	22556	4.6
	Total	10073364	46967397	386651	976827	1299943	2578661	2113305	1272555	1261263	143690	40469	4.7
	Urban	3142266	14813219	94584	254695	460818	883575	637193	358487	381463	53538	17913	4.7
Odisha	Rural	309746	1284799	19412	50297	52427	60929	55076	36933	33645	896	131	4.1
	Total	359740	1494709	22578	56329	61319	73887	63830	41882	38443	1265	207	4.2
	Urban	49994	209910	3166	6032	8892	12958	8754	4949	4798	369	76	4.2
Puducherry	Rural												
	Total	13790	55520	326	1554	2526	5047	2667	1054	599	16	1	4
	Urban	13790	55520	326	1554	2526	5047	2667	1054	599	16	1	4
Telangana	Rural	2914187	11793158	158881	404664	480506	851646	543665	263886	197096	11328	2515	4
	Total	4278280	17520413	197054	556575	721570	1306610	798651	381930	292257	19093	4540	4.1
	Urban	1364093	5727255	38173	151911	241064	454964	254986	118044	95161	7765	2025	4.2

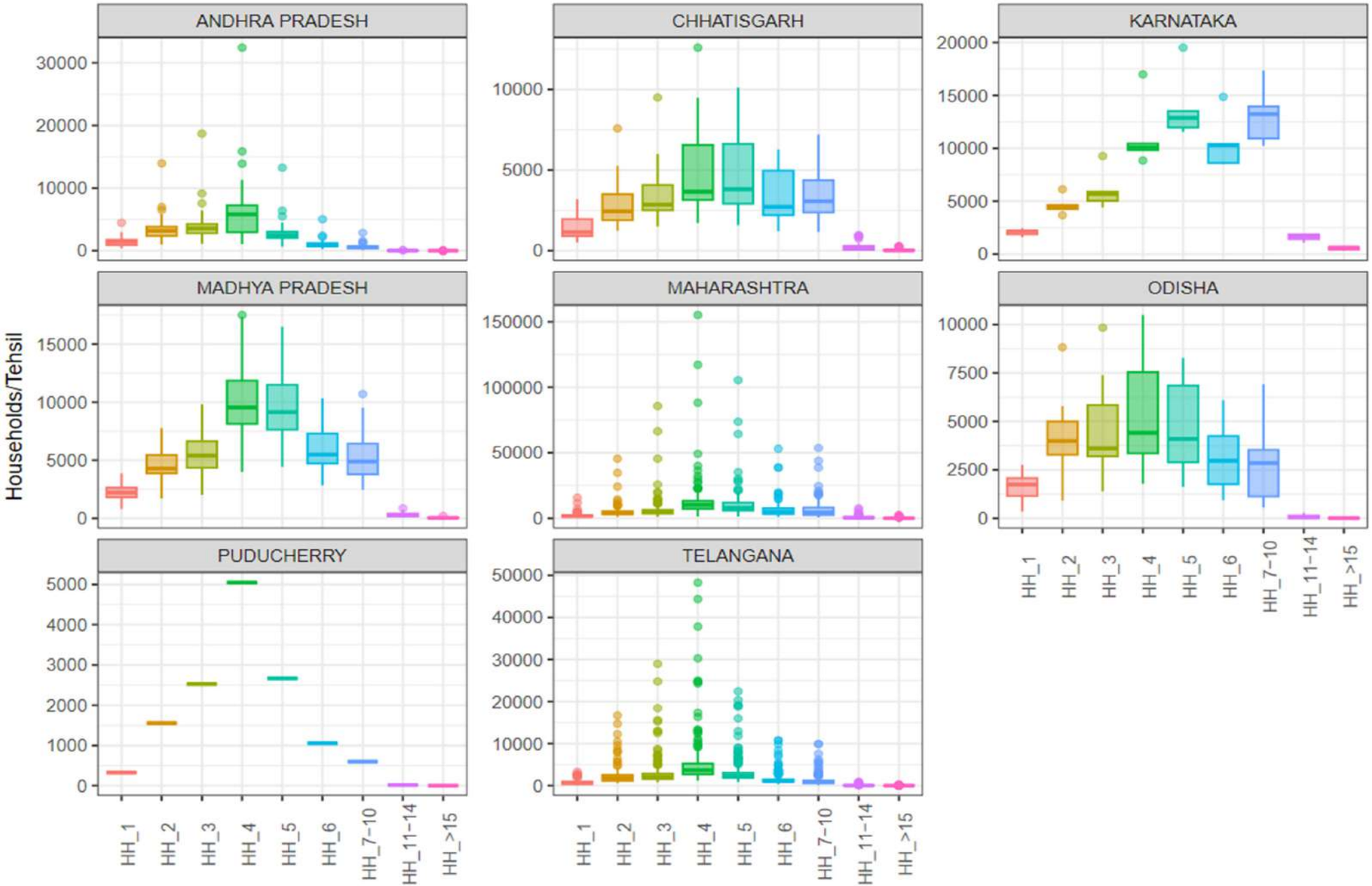

Figure 13. Tehsil-wise household size distribution of various states in Godavari River basin

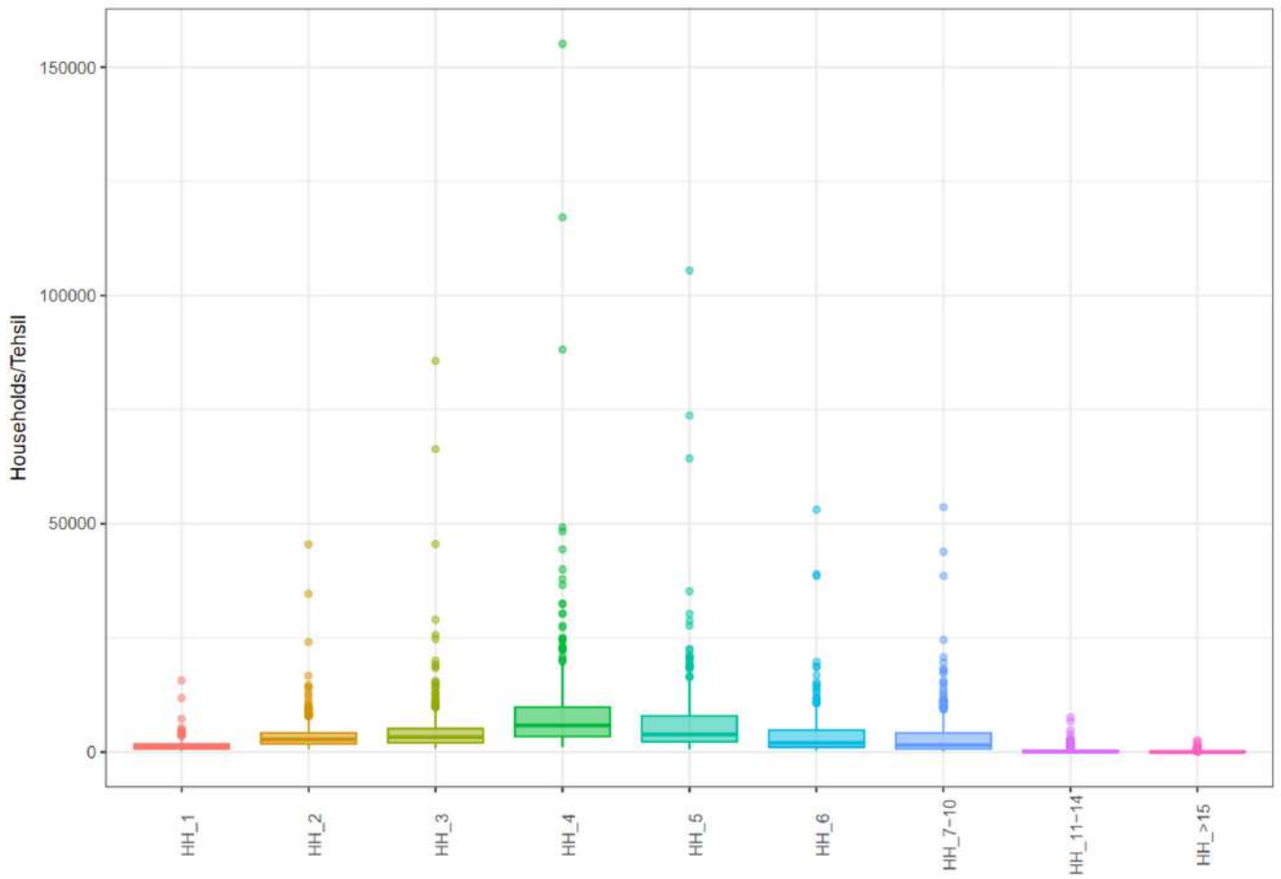

Figure 14. Tehsil-wise household size distribution in entire Godavari River basin

5. Socio-Economical Characteristics

5.1 Population Health

The region includes both urban and rural areas, with a substantial rural population engaged in agriculture. Rural areas face health challenges, including access to healthcare and sanitation. Health infrastructure varies across the basin, with urban areas generally having better access to services. Rural areas may face issues with fewer medical facilities and health professionals. The quality of water and sanitation facilities also impacts health outcomes. Various states in India are working on improving water quality and sanitation, but challenges persist, especially in rural areas. Nutritional status and disease prevalence also vary, with malnutrition affecting different parts of the basin differently. Waterborne diseases can be a concern in areas with poor sanitation.

Access to healthcare services varied, with urban areas generally having better facilities compared to rural areas. Infant mortality rates varied by state, with some states like Andhra Pradesh and Maharashtra having lower rates compared to less developed healthcare infrastructure. Access to clean drinking water and sanitation facilities was a concern in many rural areas, leading to health issues like waterborne diseases. Efforts to improve sanitation through government programs persisted, but challenges persisted. Nutritional deficiencies and malnutrition were reported in certain areas, particularly among vulnerable groups like children and women.

The health data on Anemia (representative of malnutrition), hypertension and diabetes (representative of lifestyle-diseases) are compiled from the National Family Health Survey-5 (2019-2021) sample data from each district. The percentage of the respondents within the sample are plotted in the choropleths shown in **Error! Reference source not found.**, **Error! Reference source not found.**, and Figure 17. The data shows that severe anemia in children (<5 years) is relatively higher in some districts of Maharashtra and Chhattisgarh in the Godavari Basin. Moderate anemia is relatively higher in parts of Chhattisgarh, Maharashtra, and Odisha. Women surveyed in parts of Telangana and Chhattisgarh have relatively higher severe and moderate anemia, compared with other parts of the basin. Lifestyle diseases are relatively higher in Telangana and Andhra Pradesh States compared with other parts in the basin.

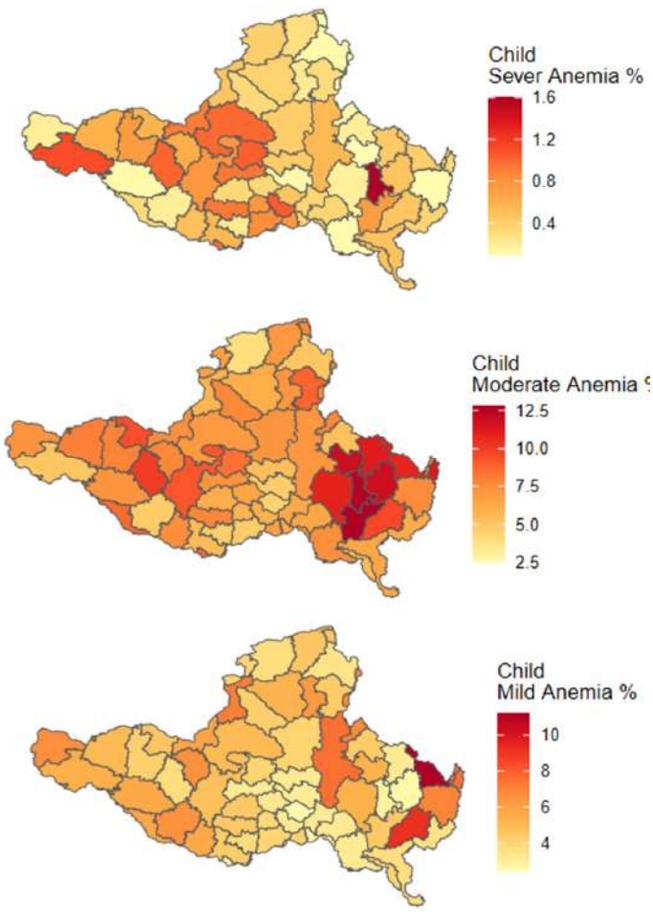

Figure 15. Choropleths of the percentage of Anemia severity in Children < 5 years based on the National Family Health Survey-5 (2019-2021)

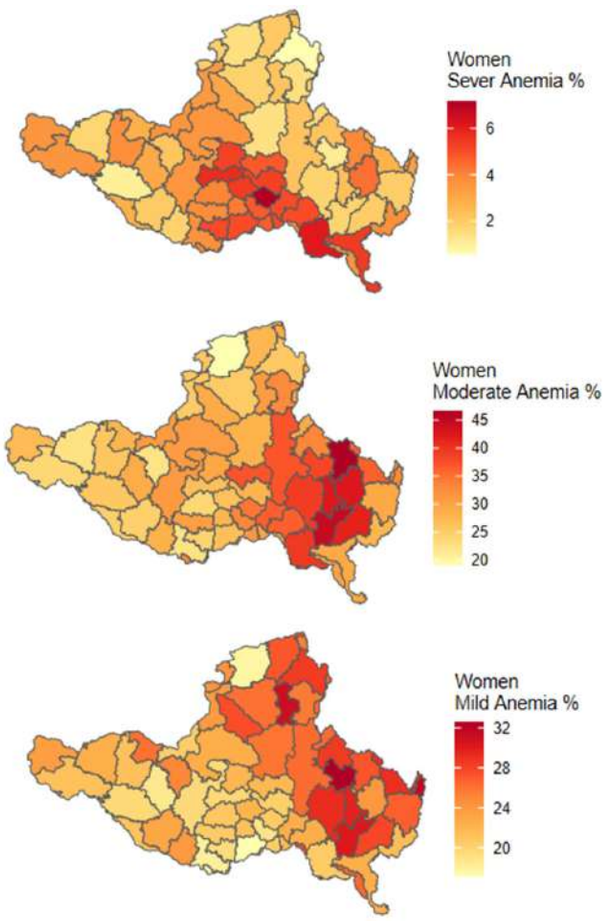

Figure 16. Choropleth representing the percentage of Anemia in Women aged <49 years according to NFHS-5 (2019-2021)

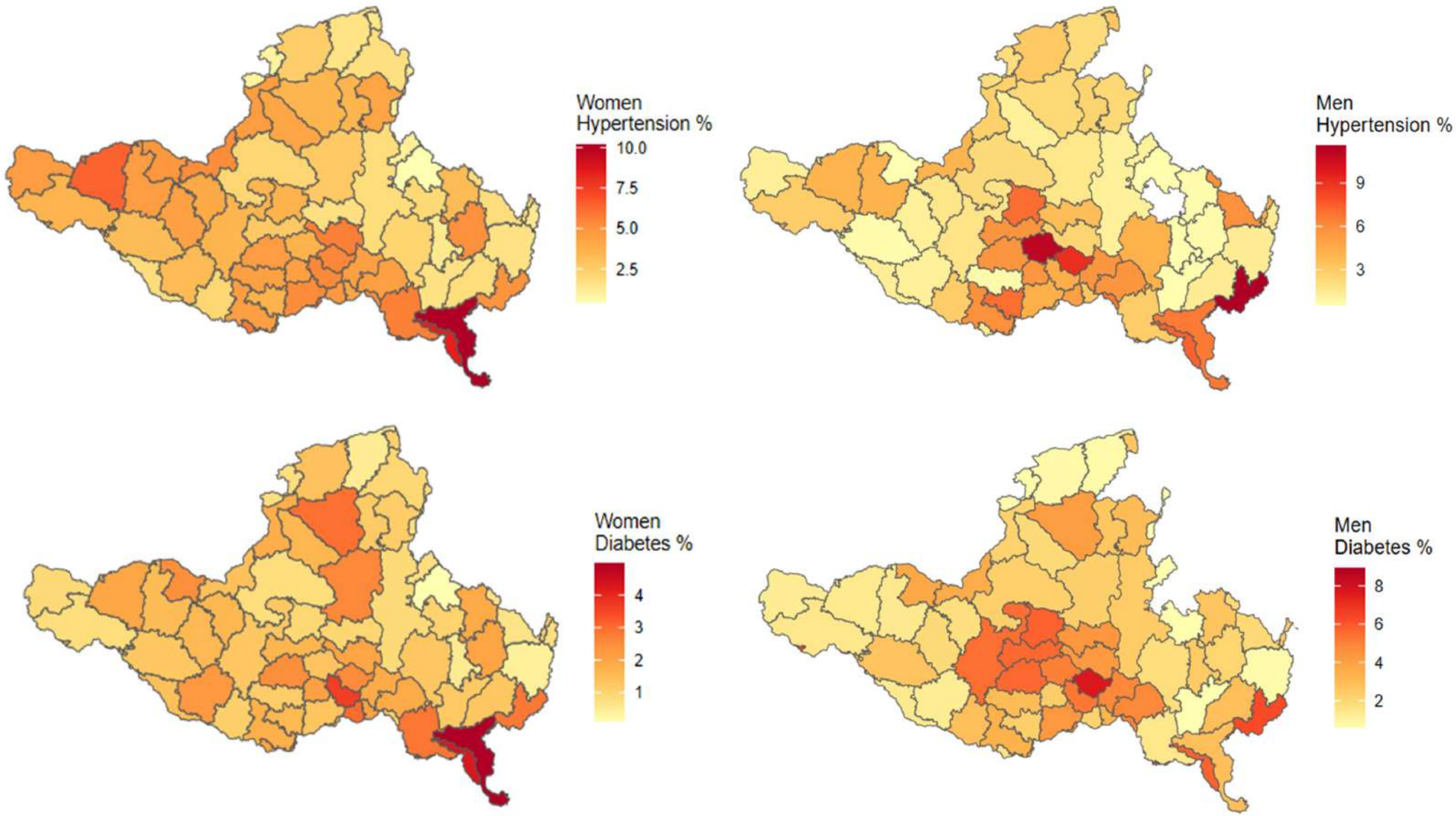

Figure 17. Choropleths showing the percentage of Lifestyle diseases among women (<49 years) and men (<54 years) according to the NFHS-5 (2019-2021)

5.2 Education-Level and Health

The Census of India 2011 provides detailed demographic data for the population living in the Godavari River Basin, revealing literacy rates in various states and districts. Maharashtra has a literacy rate in the range of 60-80% (district-wise), followed by Telangana at 40-60%, Andhra Pradesh at 60-65%, Madhya Pradesh at 60-65%, and Chhattisgarh at 30-50% (shown in

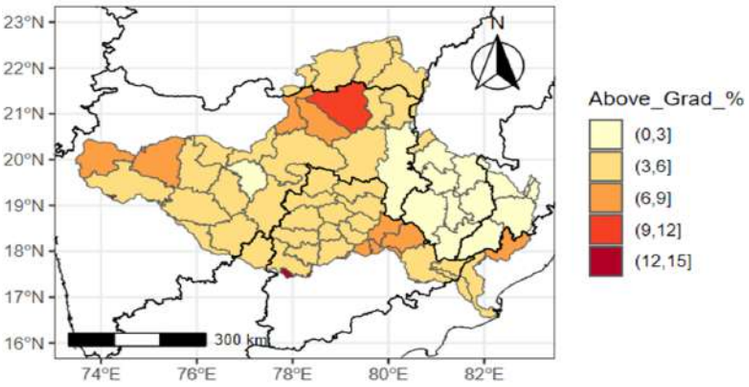

Figure **18**). Overall, the district-wise literacy percentage in the basin varied from 30 to 80%. Gender disparity was evident, with male literacy generally higher than female literacy. Educational attainment improved over time, but challenges remained, particularly in rural areas where access to quality education was less compared to urban areas. The percentage of people with higher education degrees was lower compared to those with primary or secondary education. The above-graduation percentage in the basin varied from 0 to 15%. Nagpur District has the highest above-graduation percentage of people with 9-12% share, followed by Wardha, Amaravati, Nashik, and Aurangabad Districts having 6-9 % share. In Telangana State, the share of above-graduation percentage is higher in Warangal Urban, Warangal Rural, Jayashanakar Bhupalpalli, and Mulugu Districts (6-9 %), shown in

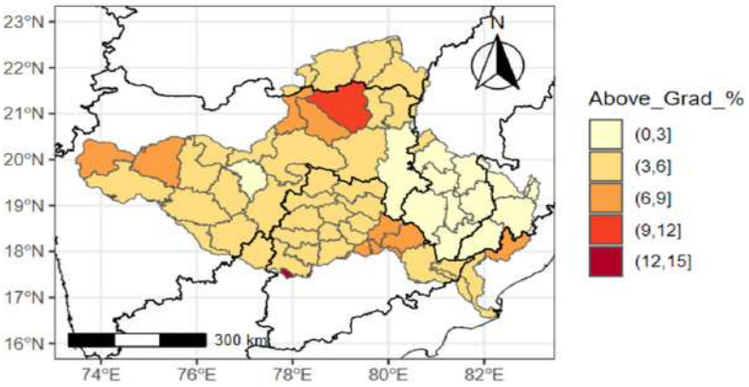

Figure **18**.

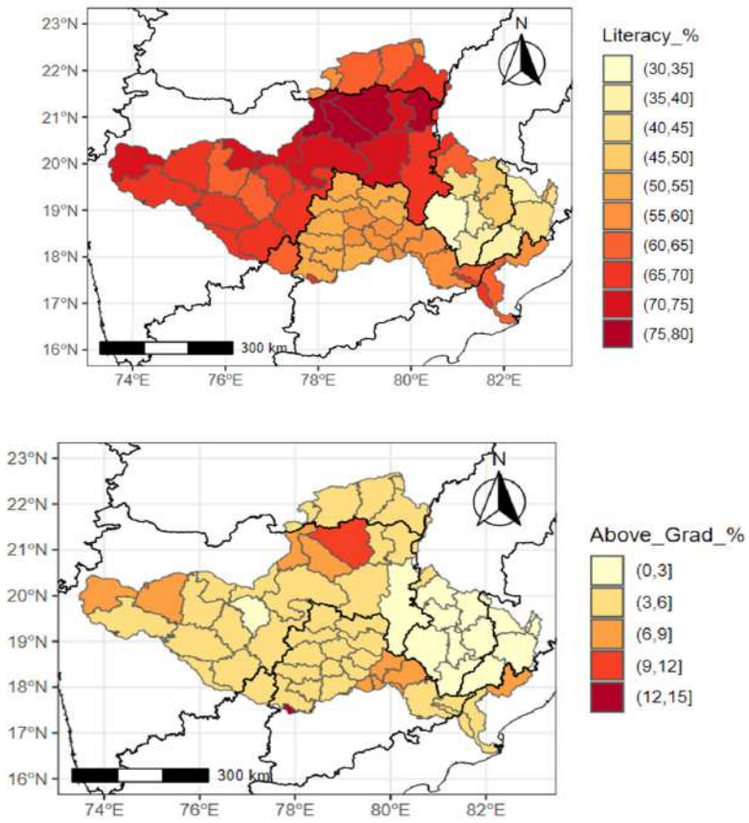

Figure 18. District-wise literacy percentage (left) and Above Graduation percentage (right) in Godavari River basin

Age-group-wise education-levels in the basin is shown in Figure 19. The boxplots in the figure represent the percentage of people in age-group who have attained a particular education level. The basin average education category and percentage of total population is shown in Figure 20. The illiteracy varied from 20-65 % in the basin, with an average of 40 %. Around 10-15 % are below primary, ~15 % are primary-level, ~5 % are above-graduation level in the basin.

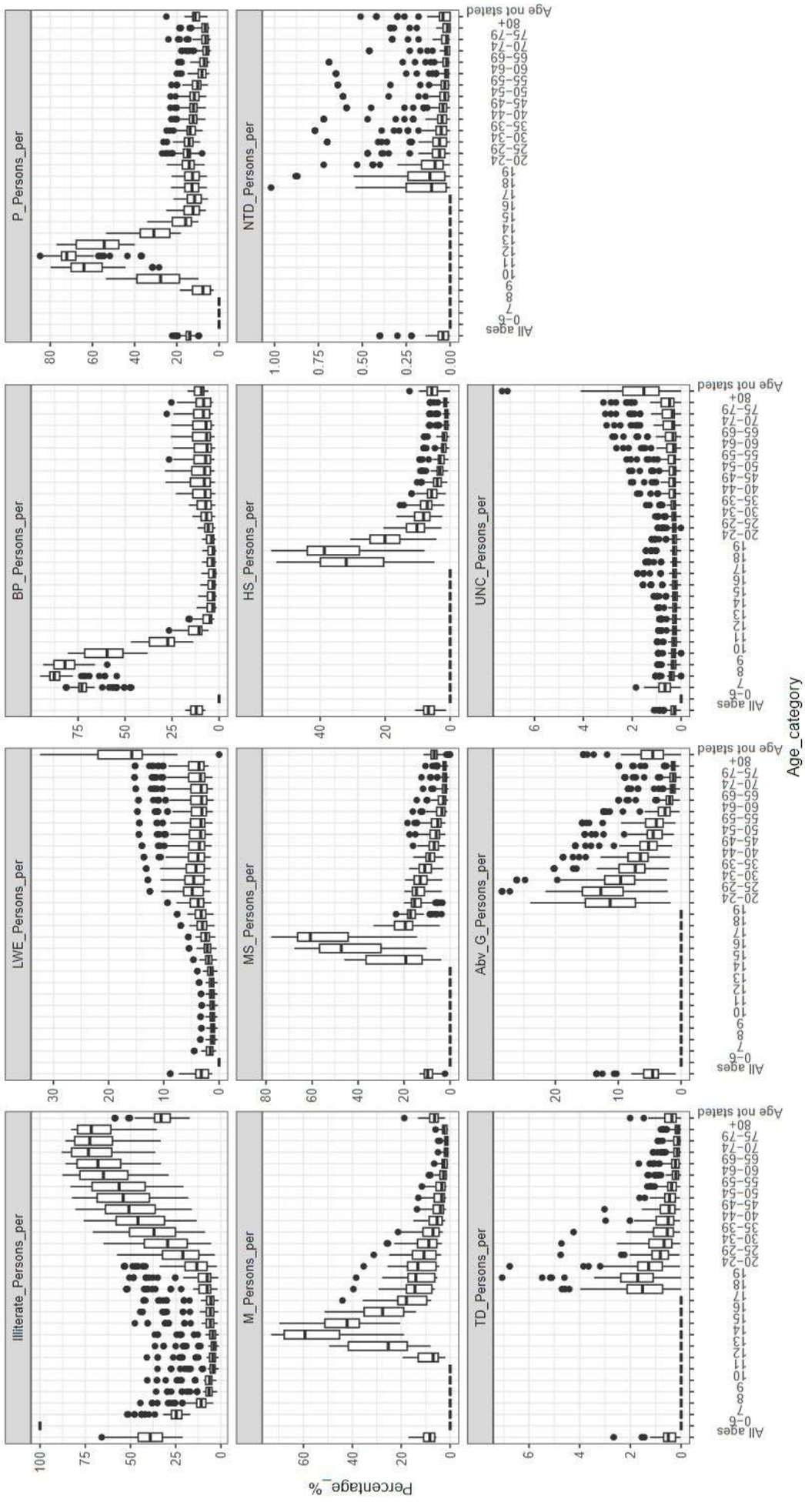

Figure 19. Age-wise education category in Godavari River basin*

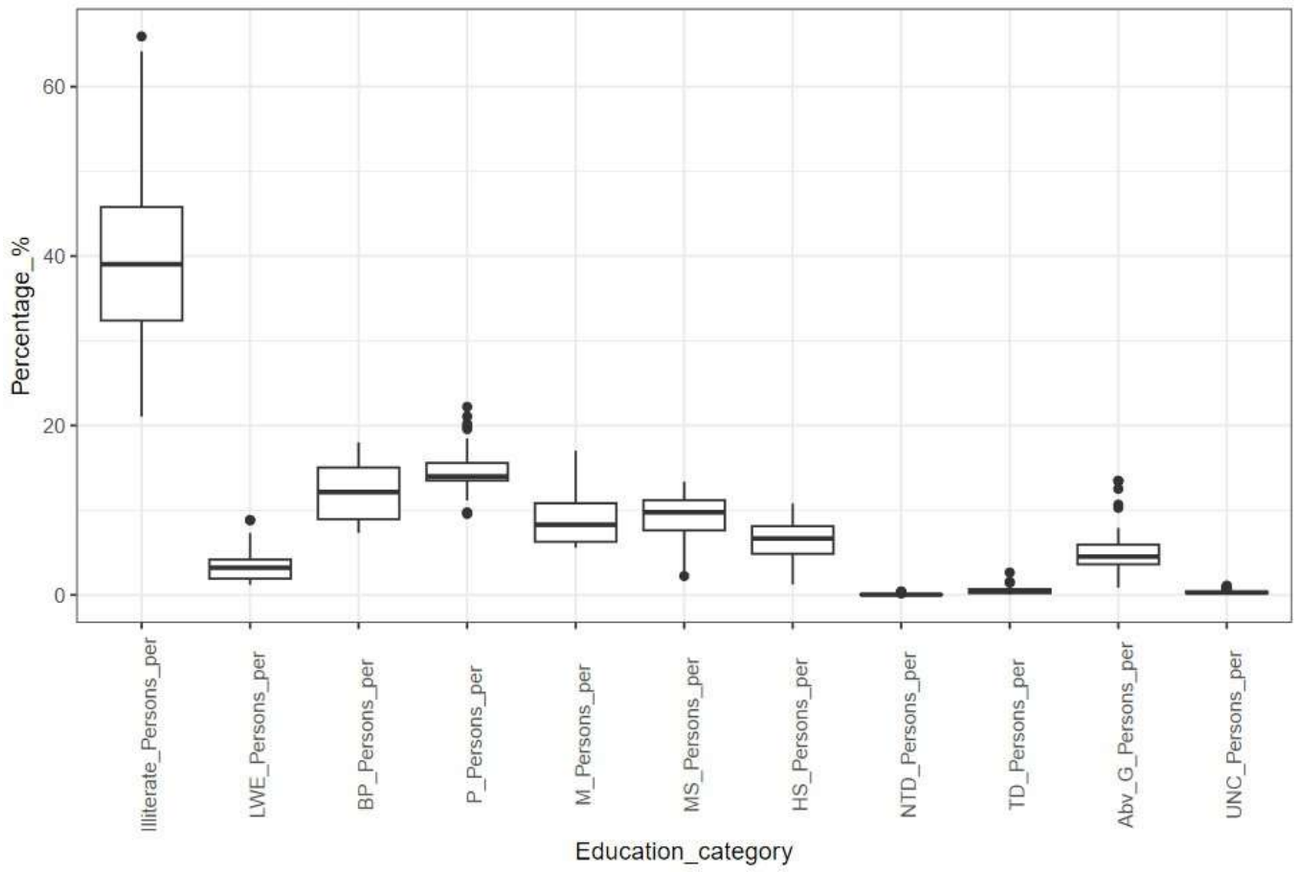

Figure 20. Percentage of education category in entire Godavari River basin*

**** the codes of education-level is expanded as below, according to the Census 2011***

LWE	Literate without Education level
BP	Below Primary
P	Primary
M	Middle
MS	Matric/Secondary
HS	Higher Secondary/Intermediate, Pre-University/Senior Secondary
NTD	Non-technical diploma or certificate not equal to degree
TD	Technical diploma or certificate not equal to degree
Abv_G	Graduation and above
UNC	Unclassified

5.3 Employment and occupation

The employment and occupational patterns in the Godavari River Basin are influenced by the region's geography, resources, and economic development. The basin spans several Indian states, each with its own economic and occupational profile. Agriculture is the primary occupation, with activities like farming, livestock rearing, and fishing being prevalent in rural areas. The basin supports the cultivation of various crops, such as rice, cotton, sugarcane, and pulses, with water availability from the Godavari River playing a crucial role in irrigation. Industry varies by state, with Maharashtra and Andhra Pradesh having more developed industrial sectors, while urban areas like Hyderabad and Nashik have more diverse industrial bases and provide employment in sectors like information technology, pharmaceuticals, and manufacturing. The service sector is growing, especially in urban areas, including education, healthcare, retail, and hospitality services.

Employment distribution varies between rural and urban areas, with higher participation rates in urban areas due to more diverse job opportunities. Occupations include farmers and agricultural laborers, manual labor, small businesses and traders, government employees, and education and healthcare services. Challenges and opportunities include skill development and vocational training to enhance employment opportunities, economic diversification efforts to create more varied job opportunities, and regional disparities in economic and employment opportunities.

The occupation data from the Census 2011 shows that the majority of the total main-workers (60-80%) in the basin are dependent on agriculture and allied sectors (Forestry and fishing), shown in Figure 21 and Figure 22. The next major occupation is the manufacturing sector consisting of 5-10% of total main workers, followed by workers involved in construction, wholesale and retail trade, and transportation and storage trade. The total workers include workers from both urban and rural areas. The state-wise distribution of main workers into various industry categories almost follows a similar trend.

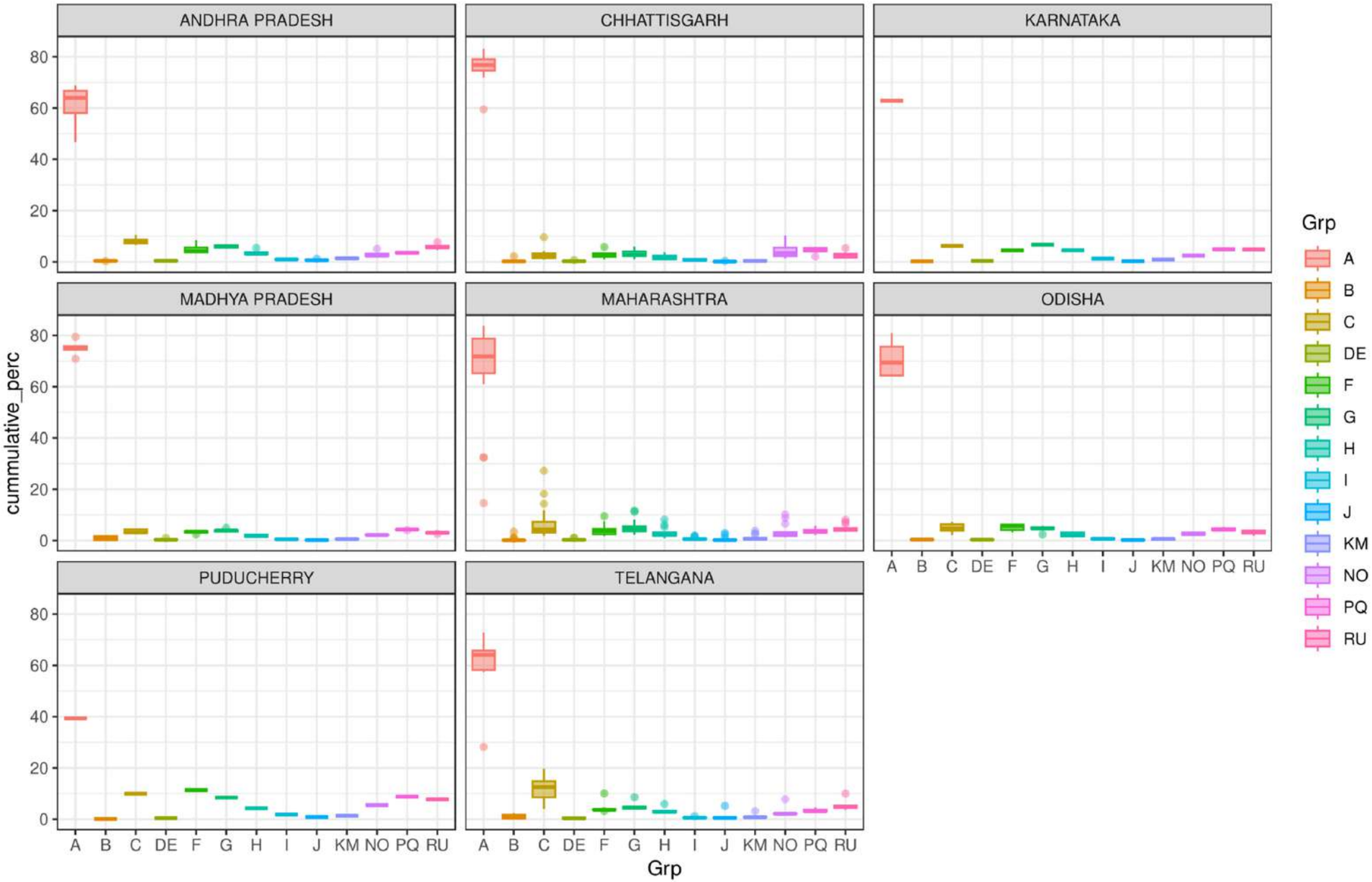

Figure 21. Percentage of different occupations in various states covered in the Godavari River basin*

* the codes of occupation categories in various industries is expanded as below, according to the Census 2011

Industrial Categories.

A- Agriculture, Forestry and Fishing
B - Mining and Quarrying
C- Manufacturing
D - Electricity, Gas, steam and Air conditioning Supply
E - Water Supply; (Sewerage, Waste Management and remediation activities)
F- Construction;
G- Wholesale and Retail Trade (Repair of motor vehicles and motorcycles)
H- Transportation and Storage
I- Accomodation and food service activities
J- Information and Communication
K - Financial and Insurance activities
L- Real Estate activities
M- Professional, Scientific and Technical activities
N- Administrative and support service activities
O- Public Administration and Defence, Compulsory Social Security
P- Education
Q- Human Health and Social Work activities
R- Arts, Entertainment and recreation
S- Other Service Activities
T- Activities of Households as Employers. Undifferentiated Goods and Services
U - Activities of Extra-Territorial Organisations and Bodies

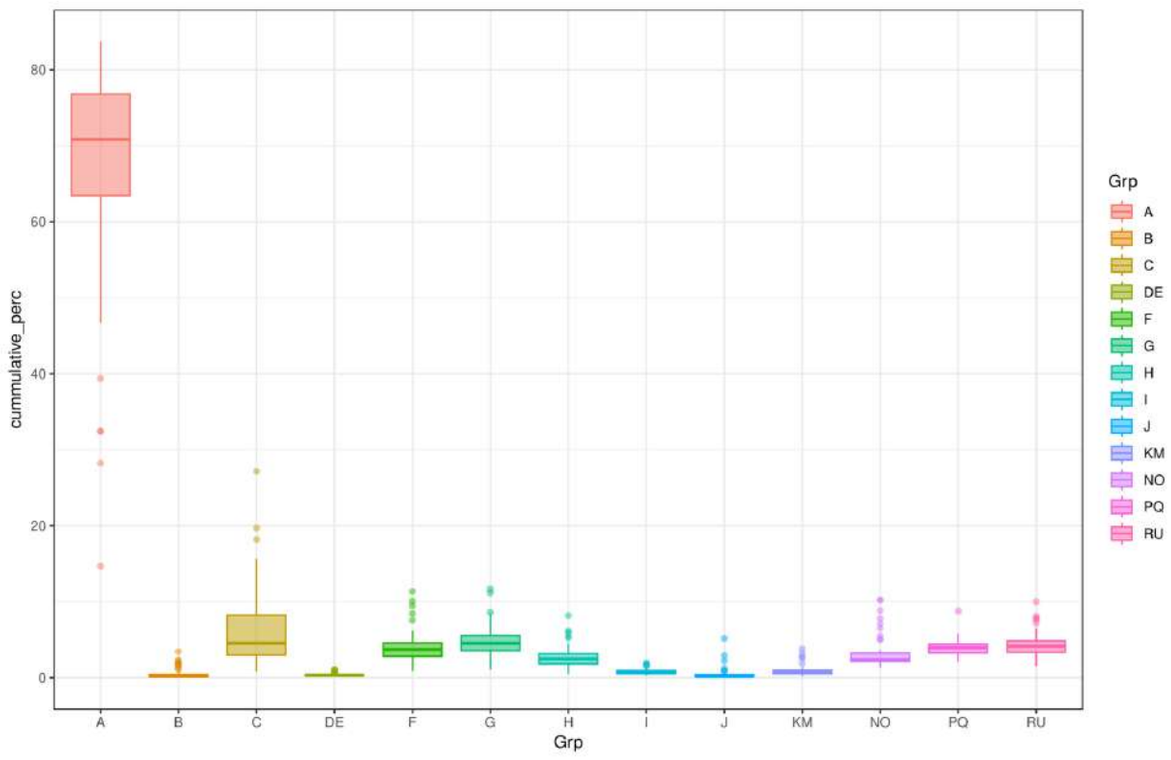

Figure 22. Percentage of different occupations in entire Godavari River basin*

5.4 Total working population

The distribution of the main-workers, non-workers, and marginal-workers in the basin shown in Figure 23. main workers are full-time workers, whereas marginal workers work for a part of a year. Marginal workers are further categorized into two groups viz. (a) work for less than 3 months a year and (b) works around 3-6 months a year. The district-wise data from Census 2011 shows that, the share of main-workers in the total population (combined rural and urban) is around 40-45% in parts of Maharashtra and Telangana States, which is relatively higher than the rest of the basin. The composition of marginal workers (<3 months) is relatively higher (3-4 %) in parts of Chhattisgarh, Odisha and Madhya Pradesh, compared with Maharashtra or Telangana. The second category of marginal workers (3-6 months) also follows a similar spatial pattern with relatively higher share of around 10-20 % from parts of Chhattisgarh, Odisha, and Madhya Pradesh. Whereas, the percentage of non-workers is relatively higher in parts of Maharashtra and Telangana in the basin, around 50-60 %. The overall basin data shows that nearly 40 % are the working population, 50% are non-working, and the remaining are marginal workers (Figure 24). Nearly 50-80 % of the working population consists of 25–70-year age group population. An inverse trend is followed by the non-worker population versus age-distribution.

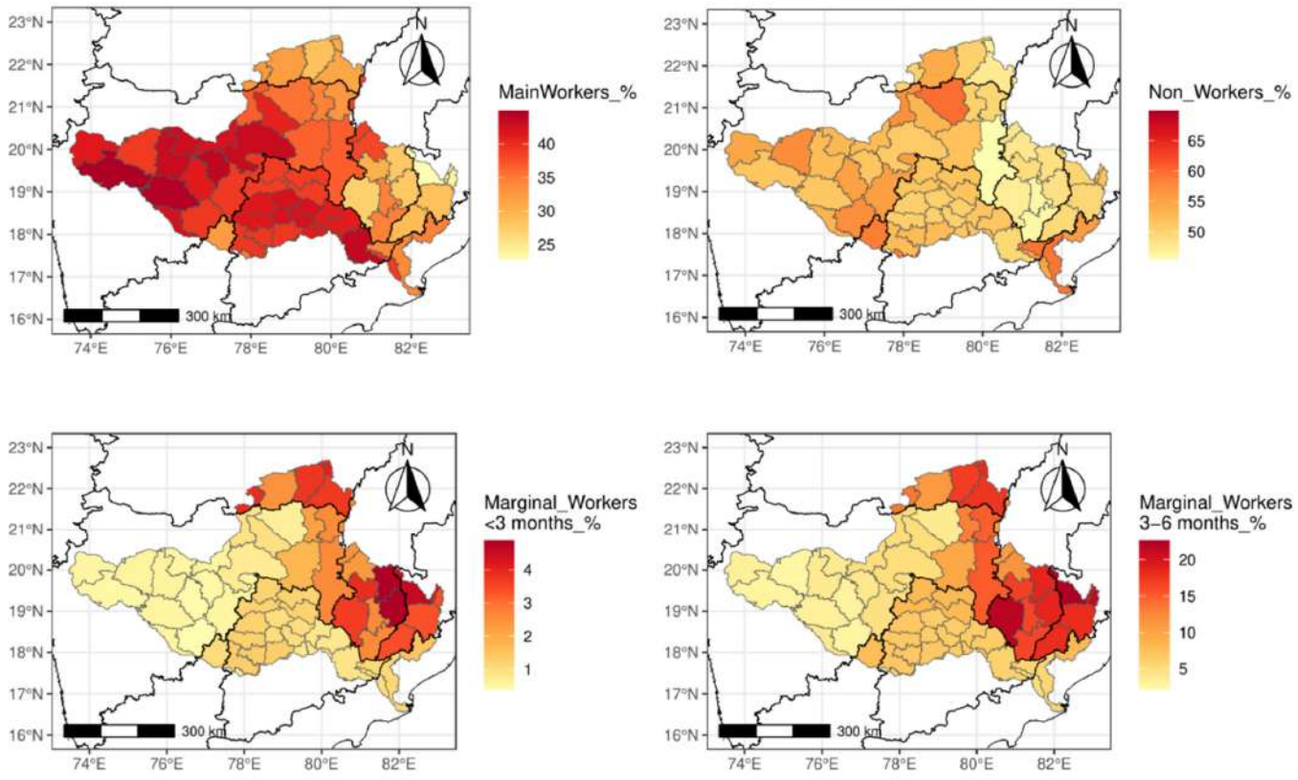

Figure 23. District-wise percentage of main workers (above left), non-workers (above right) and marginal workers(below)

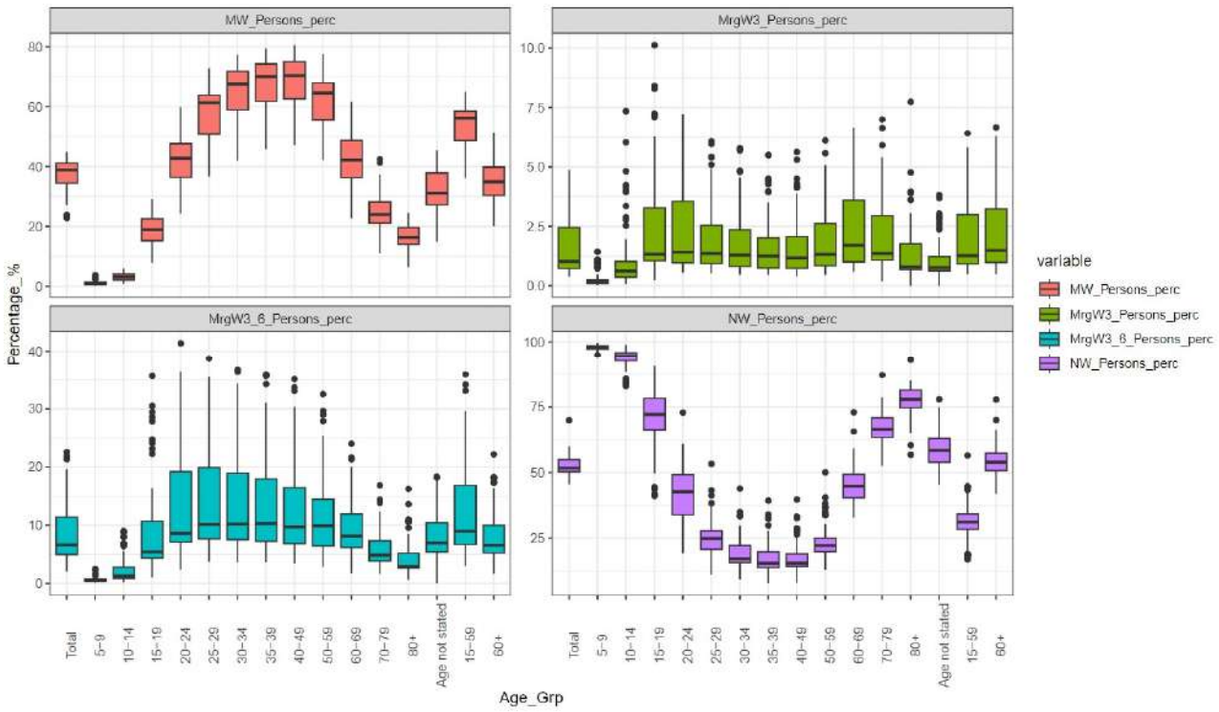

Figure 24. Age group wise percentage of workers in Godavari River basin

5.5 Working force population ratio

The summary of the main-workers, marginal-workers, and non-workers in the basin population is depicted in Figure 25. The main work force ratio in the entire population with all year around work ranges from 0.23 to 0.45 in the basin. The marginal work force (<3 months) ratio in the basin ranges from 0.004 to 0.048. The marginal work force ratio (3-6 months) in the basin ranges from 0.0211 to 0.23. Whereas the non-working population ratio in the basin ranges from 0.45 to 0.69, which is more than the working force.

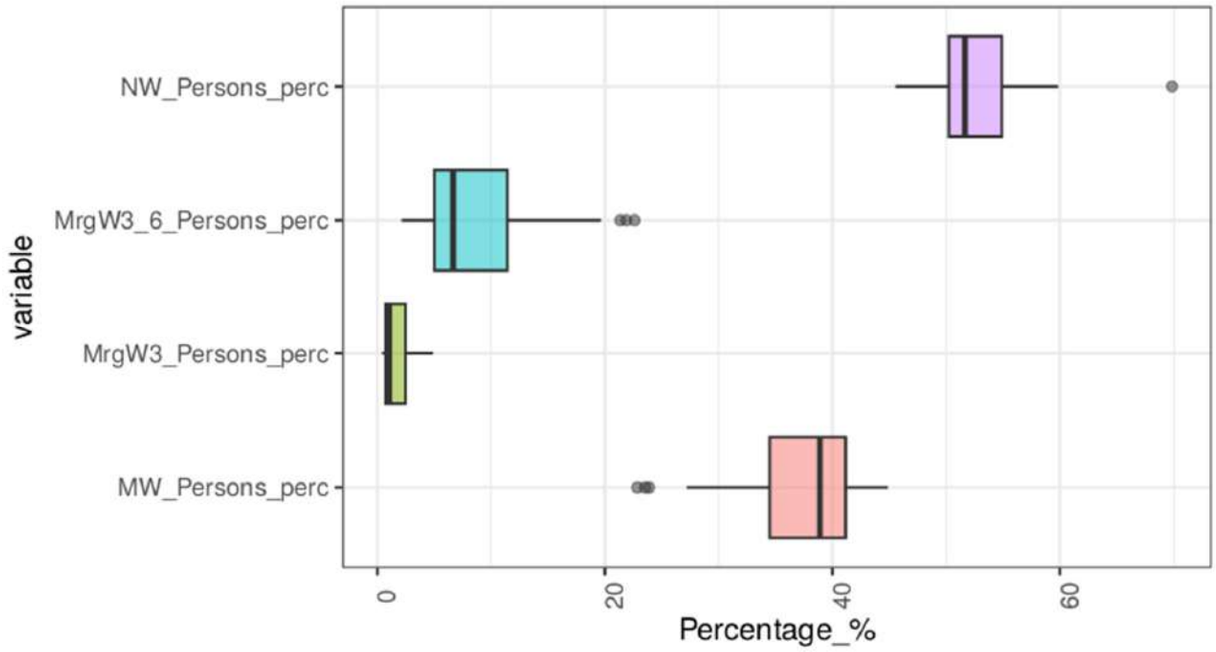

Figure 25. Total percentage of workers in Godavari River basin

5.6 Income level

The per capita income of the Godavari River basin can vary significantly depending on the specific states and regions it encompasses. The basin blessed with major cities like Nagpur, Aurangabad and Nashik are contributing more to the national economy. According to the data shown in Figure 26 the per-capita income is relatively higher (varying in the range of 2.76 to 6.23 lakhs/year) in Nagpur, Nashik, Chandrapur, Wardha, Ahmadnagar, and Aurangabad Districts of Maharashtra State. Major portions of Telangana State and a few of Maharashtra State have per-capita income varying in the range of 1.40-2.76 lakhs/year. While the portions of Odisha, Chhattisgarh, and Madhya Pradesh in the basin have relatively lower per-capita income varying in the range of 0.55 to 1.40 lakhs/year.

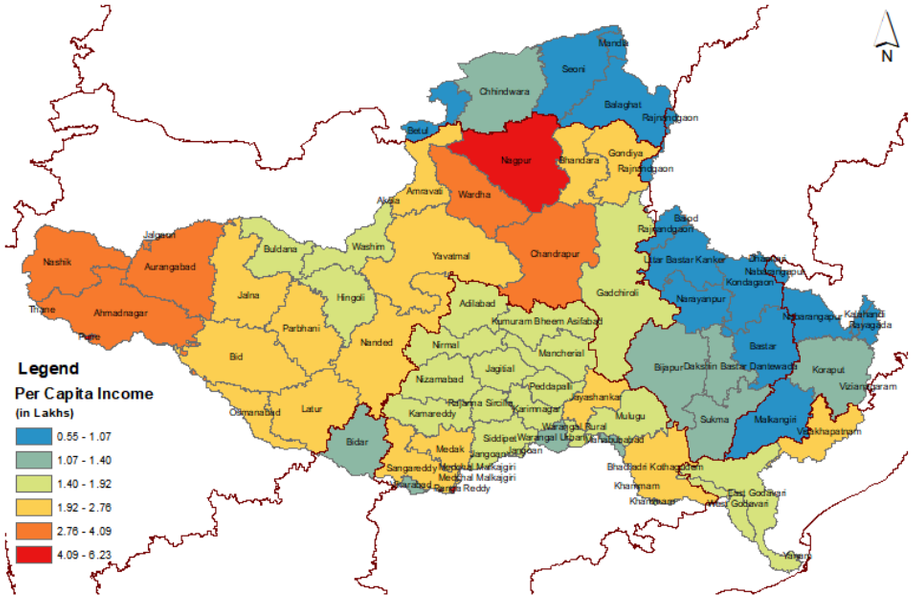

Figure 26. Per-capita income of Districts in the Godavari Basin

5.7 Map showing boundaries of notified and un-notified slums

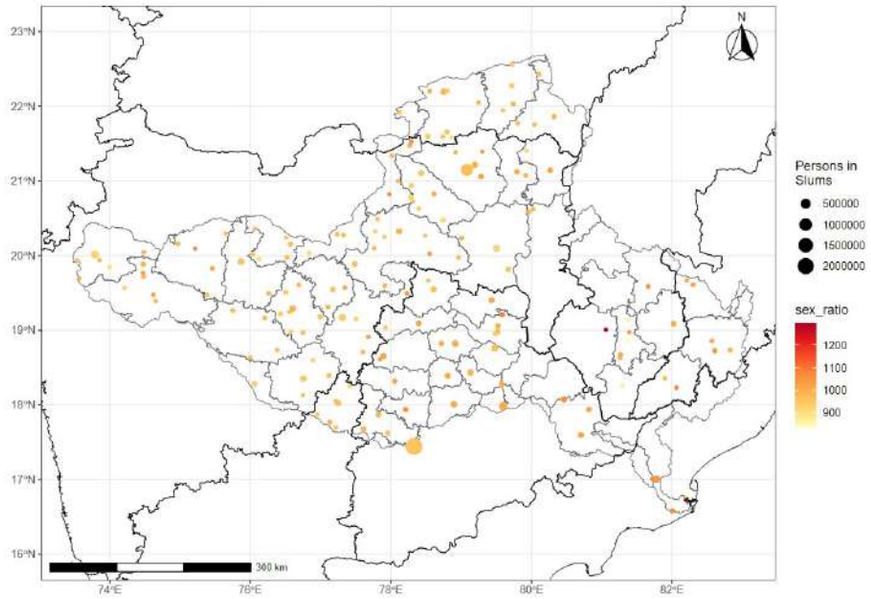

Figure 27. Locations of the slum areas and its sex ratio spread in the Godavari River Basin

The locations of the notified and un-notified slums in the urban areas of the basin are marked in Figure 27. The data in Table 5 shows that there are around 3.6 million people in the slums in parts of Telangana State in the basin, and around 2.4 million people in slums in parts of Maharashtra State in the basin.

Table 5. Distribution of urban slums in the basin

State Name	Persons	Male	Female
Andhra Pradesh	185768	90625	95143
Chhattisgarh	81373	40786	40587
Karnataka	107117	54636	52481
Madhya Pradesh	212574	108324	104250
Maharashtra	2427364	1234894	1192470
Odisha	63100	31392	31708
Puducherry	31250	15348	15902
Telangana	3670071	1860337	1809734

6. Future Projection and Scenario

The future population in the basin has been projected according to CCM (cohort-component) method, which includes the birth rate, death rate and fertility of the population. This method of population projection is more robust compared to conventional methods of exponential or incremental increase methods. The results show that the total population (after adjusting with the ratio of district area covered in the basin) in the basin is around 72 million in 2011, consisting of around 35.25 million females and around 36.34 million males. The total population is projected to increase by 8.38% by 2021 to 77.59 million. Further the values are projected to increase by 4.75% from 2021 to 2031, with a projected population of 81.28 million in the basin. The female population is projected to increase at a rate of 7.38 % and 4.77 % from 2011-2021 and 2021-2031, respectively. Whereas the male population is projected to increase at a rate of 9.35 % and 4.72 % from 2011-2021 and 2021-2031, respectively. The state-wise projections in the basin is shown in Figure 28, and the entire basin area projections is shown in Figure 29. The spatial distribution of the present and future projected district-wise population is shown in Figure 30.

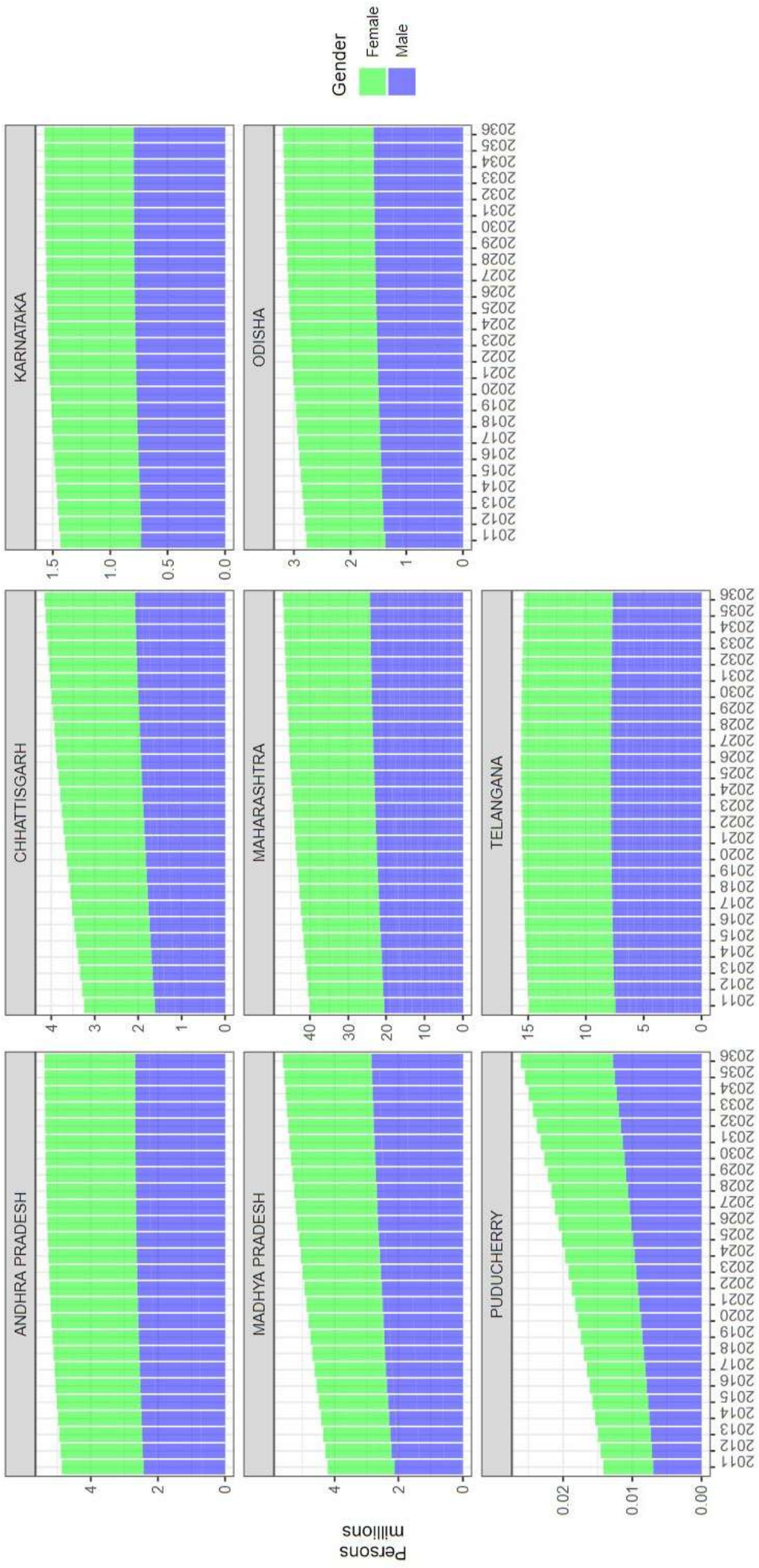

Figure 28. State-wise future population projection in Godavari River basin

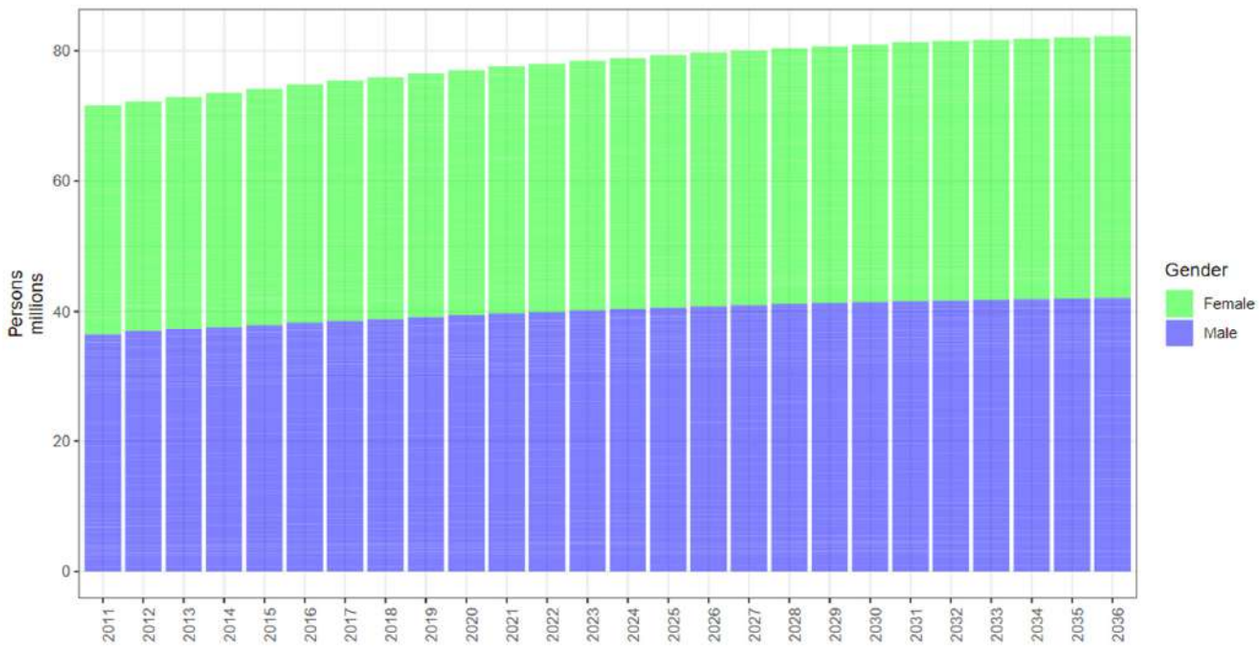

Figure 29. Future population projection in entire Godavari River basin

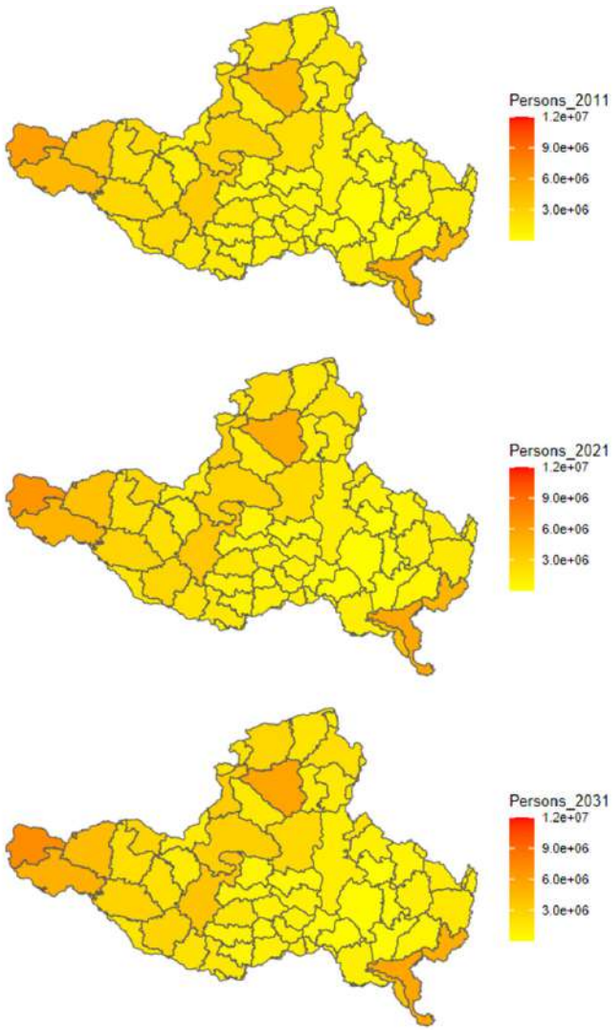

Figure 30. District-wise distribution of the population in the Godavari Basin

7. Findings and Summary

- The basin is spread over 0.32 million km^2, consisting roughly 82.7million population as per Census 2011
- The basin consists of 7 states and 1 UT
- There are 74 districts covered both partially and completely in the basin, having 600 tehsils, 23677 gram panchayats, and 45119 villages.
- There are around 267 ULBs in the Godavari basin.
- The tehsils with the highest population density are Nagpur (urban, MH) having 11057 persons/km^2, followed by Balanagar (TG) having 7889 persons/km^2, Rajahmundry (urban, AP) having 7682 persons/km^2, etc. The tehsil with the least population density is Maredumilli (AP) with 20 persons/km^2.
- The district-wise population growth rate in the basin from 2001 to 2011 varied in the range of 5.18 to 77.19%, the lowest in Wardha District (MH), while the highest in Yanam District (Puducherry UT)
- Population of age group <20 years constitute around 32-48% of the population in the basin, with higher proportions in regions of Maharashtra, followed by Chhattisgarh, and Odisha. Working-age adults (21-59 years) make up about 46-58%, the highest in Vidarbha districts in MH. The elderly (>60 years) population is highest in central Maharashtra and Telangana States.
- The data shows that the composition of the total population is higher for the age group 15-30 years in almost all states in the basin.
- The sex-ratio in the basin is around 977.
- The data shows that the sex-ratio is higher than the basin average for 15-34 age groups in almost all states in the basin, and the sex-ratio is consistently higher in all the states for age group >60 years. It can be inferred from the data that the composition of the elderly female population is relatively higher than that of male population in the basin.
- The average household size in the basin generally falls between 3.6 to 5.3 individuals per household, which is comparable to the national average of about 4.8 individuals per household.
- The tehsils with mean household size of 5-6 are spread across the western and central parts of Maharashtra state in the basin.
- The data shows that severe anemia in children (<5 years) is relatively higher in some districts of Maharashtra and Chhattisgarh in the basin. Moderate anemia is relatively higher in parts of Chhattisgarh, Maharashtra, and Odisha States. Women surveyed in parts of Telangana and Chhattisgarh have relatively higher severe and moderate anemia, compared with other parts of the basin. Lifestyle diseases (hypertension and

diabetes) are relatively higher in Telangana and Andhra Pradesh States compared with other parts in the basin.

- Maharashtra has district-wise literacy rate in the range of 60-80%, followed by Telangana at 40-60%, Andhra Pradesh at 60-65%, Madhya Pradesh at 60-65%, and Chhattisgarh at 30-50%. Overall, the district-wise literacy percentage in the basin varied from 30 to 80%.
- The occupation data from the Census 2011 shows that the majority of the total main workers (60-80%) in the basin are dependent on agriculture and allied sectors (Forestry and fishing), followed by manufacturing sector consisting of around 5-10% of the total main workers.
- The district-wise data from Census 2011 shows that, the share of main-workers in the total population (combined rural and urban) is around 40-45% in parts of Maharashtra and Telangana States, which is relatively higher than the rest of the basin.
- The overall basin data shows that nearly 40% are working population, 50% are non-working, and the remaining are marginal workers.
- The main work force ratio in the entire population with all year around work ranges from 0.23 to 0.45 in the basin. The marginal work force (<3 months) ratio in the basin ranges from 0.004 to 0.048. The marginal work force ratio (3-6 months) in the basin ranges from 0.0211 to 0.23. Whereas the non-working population ratio in the basin ranges from 0.45 to 0.69, which is higher than the working force.
- The per-capita income is relatively higher (varying in the range of 2.76 to 6.23 lakhs/year) in Nagpur, Nashik, Chandrapur, Wardha, Ahmadnagar, and Aurangabad Districts of Maharashtra State. Major portions of Telangana State and a few of Maharashtra State have per-capita income varying in the range of 1.40-2.76 lakhs/year. While the portions of Odisha, Chhattisgarh, and Madhya Pradesh in the basin have relatively lower per-capita income varying in the range of 0.55 to 1.40 lakhs/year.

The demographic information provided in this report serves as the basis to understand the vulnerable hotspots to changing hydrology, climate variability, and extreme events. The information of underlying socio-cultural aspects, education level, employment opportunities, health, income level of the people in the basin could be helpful in informed-policy planning, eventually leading to the efficient resource management in the basin.

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