Academe *Journal of Education & Psychology* *ISSN: 2249-040X*
Volume-16, Issue-1, Year-2026 (January-June) *Peer Reviewed & Refereed Journal (IF: 6.25)*
PP: 147-156 *Journal Website* www.academejournal.in

SPATIO-TEMPORAL ANALYSIS OF DRY AND IRRIGATED FARMING SYSTEMS IN CHAMARAJANAGAR DISTRICT, KARNATAKA: A GEOGRAPHICAL PERSPECTIVE

Manju S

Research Scholar
Department of Geography, Maharaja's College, Mysuru

Thejomani B.D

Professor
Department of Geography, Maharaja's College, Mysuru

ABSTRACT

The geographical dynamics of agricultural practices in the Chamarajanagar area are examined in this study. Understanding the trends, difficulties, and sustainability of irrigated and dryland agricultural systems under various topographical and agroclimatic situations is the main goal of the research. The study investigates land use trends, irrigation infrastructure, and cropping patterns in the five taluks of Chamarajanagar, Gundlupet, Kollegal, Hanur, and Yelandur using a combination of secondary sources and GIS methodologies. The results show a substantial reliance on groundwater supplies, a decrease in the usage of conventional tank systems, and a growing trend in irrigated zones toward commercial crops. In the meantime, dry farming regions still depend on the monsoon-based production of pulses and millets, a method frequently used by marginal and tribal farmers.

Keywords: Dry land, irrigation farming, cropping pattern, GIS, Chamarajanagar.

INTRODUCTION

Irrigation refers to the process of supplying water to agricultural land through artificial means such as canals, tanks, wells, or borewells. It is primarily used to support crop cultivation in regions where natural rainfall is inadequate or unreliable for sustaining agriculture. (Dubovyk et al., 2013). Agriculture in Chamarajanagar district is primarily dependent on climatic conditions, particularly rainfall, and thus exhibits a diverse range of farming practices, from dry farming to intensive, irrigated agriculture. (Manjunatha, 2015). Dry farming, which relies entirely on the timely arrival of monsoon rains, is practiced predominantly in the semi-arid and drought-prone taluks of the district. In contrast, irrigation farming is confined to areas where water is available through tanks, canals, borewells, and other artificial means. Irrigation in the district plays a crucial role in improving agricultural productivity. It enables the cultivation of water-intensive crops such as sugarcane, paddy, and wheat, which are otherwise not viable under dry conditions. On the other hand, dry farming supports crops such as ragi, jowar, maize, and pulses, which require less water and are well-suited for low-moisture conditions. (Harish M, 2010).

(Badekhan & Nayak, 2023) The geographical analysis reveals that, although irrigation coverage has expanded over the years, it remains limited and unevenly distributed. The southern and western parts of the district, where water bodies and canal networks exist, have better irrigation facilities. In contrast, the northern and interior regions continue to rely on seasonal rainfall, making them vulnerable to droughts and crop failures. Interestingly, the expansion of irrigation has not significantly promoted multiple cropping, as was expected. Instead, farmers often intensify the cultivation of a few high-value, irrigated crops rather than diversifying their operations. This shift has led to the decline of traditional rain-fed crops and raised concerns over groundwater depletion and soil degradation resulting from monocropping. (Mugiyo et al., 2022).

According to the (Dansi et al., 2012),Dry farming, despite its limitations, remains a vital component of the district's agricultural landscape. It sustains livelihoods in water-scarce areas and supports ecological balance through crop rotation and minimal input farming. However, challenges such as erratic rainfall, poor soil fertility, and lack of crop insurance continue to affect its viability. This study emphasizes the importance of integrated planning in Chamarajanagar, with a focus on enhancing irrigation efficiency, promoting drought-resistant crop varieties, and adopting climate-resilient farming practices. A balanced approach that strengthens both dry and irrigated farming will ensure sustainable agricultural development in the district.

STUDY AREA

Geographically, Chamarajanagar district is located on the Deccan plateau near the southernmost point of the state of Karnataka. To the north, it borders Mysuru, Mandya, and Ramanagara. Kerala to the west and Tamil Nadu to the south. Its diverse topography, which includes both the maidan and semi-malnad regions, contributes to the district's diversified agricultural techniques. The district is located between latitudes 11°40'58" and 12°06'32" North and longitudes 76°24'14" and 77°46'55" East. It is 5,101 square kilometers in size. Chamarajanagar, Gundlupet, Yelandur, Kollegal, and Hanur are the five taluks that make up the district. In the research region, Hanur is the largest taluk, and Yelandur is the smallest.

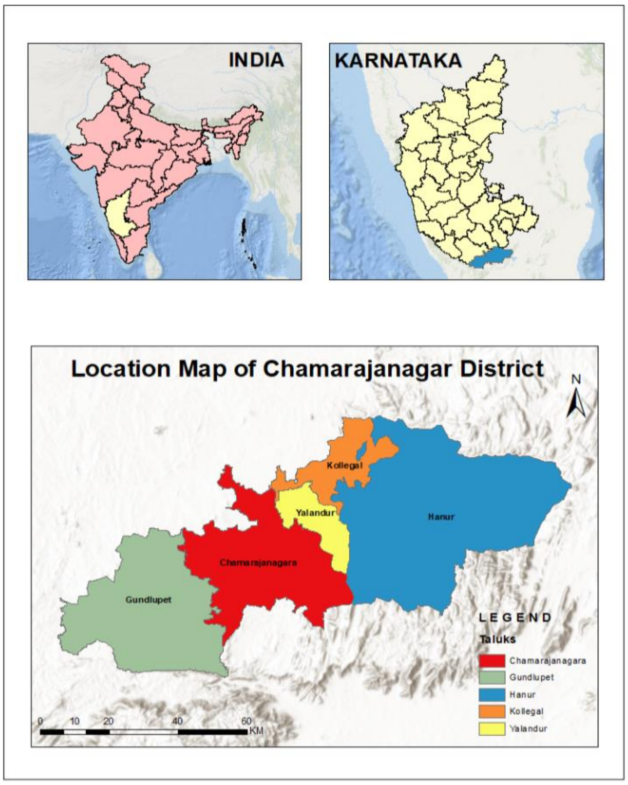

Figure 1: Study area map of Chamarajanagar district

METHODOLOGY

The current study is primarily based on secondary data collected from various authentic sources for the census years 2001, 2011, and 2021. To understand the patterns, distribution, and impact of different farming systems across the district.

RESULTS AND DISCUSSION

An examination of the Chamarajanagar district's irrigation and dry farming practices reveals a complicated interplay between land use, geography, water supply, and agricultural yield. Although Karnataka has made significant strides in developing its irrigation infrastructure, Chamarajanagar's condition is still limited because of topographical, climatic, and administrative issues. A large portion of Chamarajanagar's plains receives little or no rainfall, making it a semi-arid district. But from October to December, areas like Gopalaswamy Betta, where the Eastern and Western Ghats meet, and Biligiri Rangana Betta (BR Hills) receive more rainfall. Similarly, the seasonal monsoon inflow benefits the Male Mahadeshwara Hills. The development of micro-irrigation and macro-level water collection is possible in these high-altitude zones.

In order to assist agriculture in nearby dryland areas, rainwater from these catchments can be stored or redirected to already-existing tanks and canals. The growth of irrigated agriculture in the area has been constrained by the postponed completion of significant irrigation projects and the inadequate upkeep of smaller irrigation infrastructure, such as tanks, lakes, and canals. Farmers' access to water during crucial crop periods has been impacted by inadequate desilting and poor maintenance, which have decreased the water-carrying and storage capacity.

Water use could be optimized in water-deficient areas by implementing micro-irrigation technology (such as drip and sprinkler systems), especially for horticulture and short-season crops. Additionally, it should be necessary for farms to capture rainwater, particularly in areas that are rainfed and undulating. Using local canal networks to integrate lakes and ponds can assist in controlling water distribution and raising groundwater recharge levels. The availability of rainfall, soil type, temperature, water storage conditions, and market potential must all be taken into consideration while selecting crops. It is crucial to teach farmers how to modify their cropping practices and lessen reliance on crops that require a lot of water.

To lessen the vulnerability of dryland farmers, mixed cropping, crop rotation, and climate-resilient agriculture should be encouraged. Planning for irrigation needs to be devolved to the hobli or Gram Panchayat level. Local governments are in a better position to monitor usage, maintain infrastructure, and evaluate the possibilities for water in the area. In addition to building new projects, government assistance should concentrate on revitalizing old water systems, encouraging sustainable farming methods, and guaranteeing parity between rain-fed and irrigated areas.

NET IRRIGATED AREA BY VARIOUS SOURCES

The amount of land that is irrigated at least once in a given agricultural year is known as the net irrigated area, and it shows how much water is used for crop cultivation. Irrigation is essential to maintaining agricultural output in the semi-arid to sub-humid Chamarajanagar district. In addition to surface water sources like canals and tanks, the district is increasingly dependent on groundwater from open wells and boreholes. The District at a Glance (2001–11) and the District Statistical Report (2020–21) state that terrain, rainfall distribution, and the availability of irrigation infrastructure all have a substantial impact on the net irrigated area, which varies greatly among taluks. understanding of the net irrigated area is essential for understanding the district's agricultural potential, cropping intensity, and regional differences in water access.

Table 1: Distribution of net irrigation area (ha) 2001

Taluks	Canal		Tanks			Wells		
	Gross Irrigated Area	Net Area Irrigated	Nos	Gross Irrigated Area	Net Area Irrigated	Nos	Gross Irrigated Area	Net Area Irrigated
Chamarajnagar	0	3950	0	0	3710	0	0	330
Gundlupete	0	0	0	0	130	0	0	2173
Kollegala	0	6374	0	0	690	0	0	12599
Yalanduru	0	3974	0	0	1274	0	0	2697
Hanur	NA	NA	NA	NA	NA	NA	NA	NA
Total	0	**14298**	**0**	**0**	**5804**	**0**	**0**	**17799**

Taluks	Tube wells			Lift Irrigation			Othere soures		Total	
	Nos	Gross Irrigated Area	Net Area Irrigated	Nos	Gross Irrigated Area	Net Area Irrigated	Gross Irrigated Area	Net Area Irrigated	Gross Irrigated Area	Net Area Irrigated
Chamarajnagar	0	0	10433	0	0	0	0	0	0	18423
Gundlupete	0	0	6356	0	0	0	0	0	0	8659
Kollegala	0	0	974	0	0	800	0	0	0	21437
Yalanduru	0	0	698	0	0	0	0	0	0	8643
Hanur	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Total	0	0	**18461**	0	0	**800**	0	**0**	0	**57162**

Source: District at a glance 2001

Table 1: it evident that groundwater sources, especially wells and tube wells, provided the majority of the irrigation in the Chamarajanagar district, with canals and lift irrigation contributing very little. Due to the lack of significant canal networks during this time, canal irrigation was minimal in all taluks. Particularly in the taluks of Chamarajanagar and Yalandur, tank irrigation contributed a little amount to net irrigated area, suggesting a localized reliance on conventional tank systems. Kollegal, which is mostly supported by wells and tube wells, had the largest net irrigated area among the taluks, indicating extensive groundwater extraction for farming. The taluk of Chamarajanagar also displayed a sizable net irrigated area, which was once more mostly supplied by groundwater. In contrast, Gundlupete and Yalandur exhibited relatively lower net irrigated areas, suggesting greater dependence on rainfed agriculture and limited irrigation infrastructure.

ISSN: 2249-040X
Peer Reviewed & Refereed Journal (IF: 6.25)
Journal Website www.academejournal.in

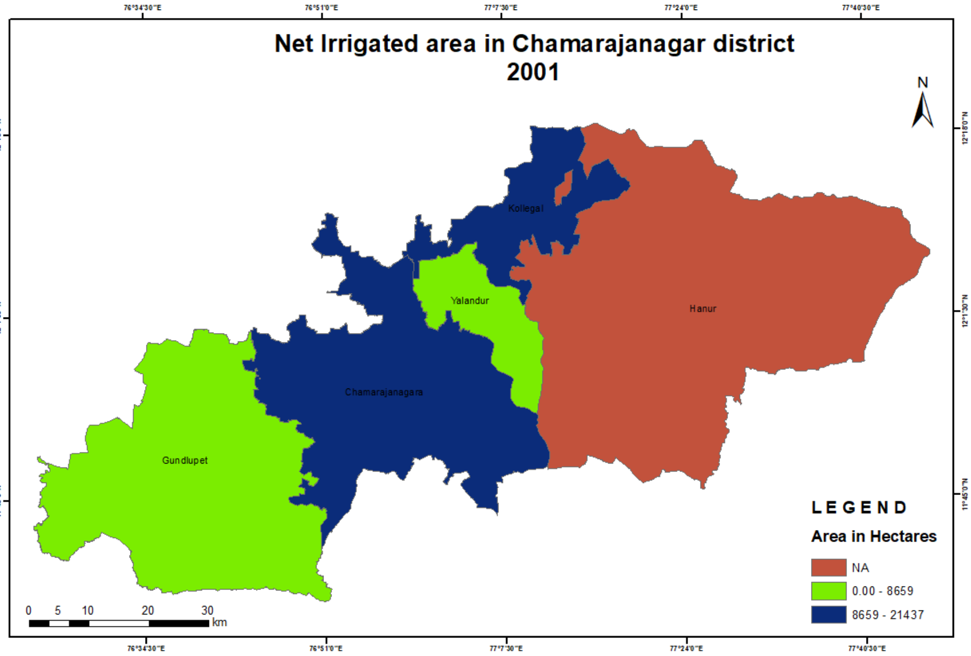

Figure 2: Distribution of net area irrigated in Chamarajanagar district

Table 2: Distribution of net irrigation area (ha) 2011

Name of the Taluks	**Canal**		**Tanks**			**Wells**		
	gross irrigated	net irrigated	no of tanks	gross irrigated area	net irrigated area	no of wells	gross irrigated area	net area irrigated
Chamarajanagar	2892	2460	50	1351	1023	130	1630	1440
Gundlupet	0	0	126	0	0	2501	842	707
Kollegal	6231	5732	16	2591	2012	8326	2016	1735
Hanur	NA	NA	NA	NA	NA	NA	NA	NA
Yelandur	4187	4187	26	2318	2318	1438	658	512
Total	**13310**	**12559**	**218**	**6260**	**5353**	**12395**	**5146**	**4394**

Name of the Taluks	**Tube wells**			**Lift Irrigation**			**Other Sources**		**Total**	
	no of tubewells	Gross area	Net area	no s	Gross area	Net area	Gross area	Net area	Gross area	Net area
Chamarajanagar	14374	18620	16704	0	0	0	0	0	0	24493
Gundlupet	5989	12252	10589	0	0	0	0	0	0	13094
Kollegal	2210	18413	15372	4	427	427	0	0	0	29678
Hanur	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Yelandur	958	1982	1613	0	0	0	0	0	0	9145
Total	**23531**	**51267**	**44278**	**4**	**427**	**427**	**0**	**0**	**0**	**76410**

Source: District at a glance 2011

Table 2: With 6,231 hectares under canal irrigation and 8,326 wells spanning 2,016 hectares, Kollegal is the most irrigated taluk, making great use of all three sources, especially canals and wells. With equal gross and net acreage under canal and tank irrigation (4,187 ha and 2,318 ha, respectively), Yelandur demonstrates balanced irrigation and consistent water

availability. Canals and wells, which irrigate 2,892 and 1,630 hectares, respectively, are the main sources of irrigation in Chamarajanagar taluk. It's 50 tanks, however, irrigate a comparatively lesser area, indicating underutilization. Gundlupet, on the other hand, relies only on 2,501 wells to irrigate 842 hectares, indicating surface water scarcity or poor management, despite having the most tanks (126) and no land irrigated by them or canals. With 5,989 and 958 wells, respectively, Gundlupet and Yelandur also depend on tube wells, albeit to a lesser degree. The dataset only includes tube wells and lift irrigation as irrigation sources; Hanur's data is unavailable.

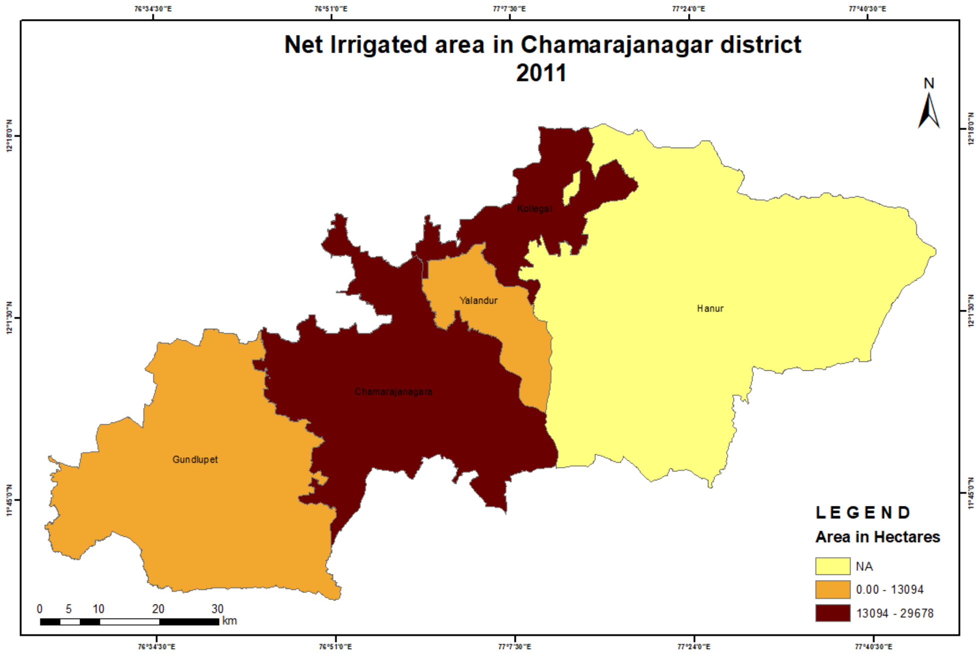

Figure.3: distribution of net area irrigated in Chamarajanagar district

Table 3: Distribution of net irrigation area (ha) 2021

Name of the Taluks	**Canal**		**Tanks**			**Wells**		
	gross irrigated	net irrigated	no of tanks	gross irrigated area	net irrigated area	no of wells	gross irrigated area	net area irrigated
Chamarajanagar	75	75	53	25	25	175	1720	1410
Gundlupet	0	0	75	0	0	75	1305	825
Kollegal	5850	5850	16	360	360	1150	785	400
Hanur	2150	2150		200	200	1420	325	250
Yelandur	2860	2860	11	75	75	338	90	25
Total	**10935**	**10935**	**155**	**660**	**660**	**3158**	**4225**	**2910**

Name of the Taluks	**Tube wells**			**Lift Irrigation**			**Other Sources**		**Total**	
	no of tubewells	Gross area	Net area	nos	Gross area	Net area	Gross area	Net area	Gross area	Net area
Chamarajanagar	9720	29782	21025	0	0	0	0	0	31602	22535
Gundlupet	7276	16205	11985	1	0	0	0	0	17510	12810
Kollegal	4632	12636	4840	4	0	0	0	0	1963	11450

									1	
Hanur	0	15199	14410	0	0	0	0	0	1787 4	17010
Yelandur	1221	8190	5040	0	0	0	0	0	1121 5	8000
Total	**22849**	**82012**	**57300**	**5**	**0**	**0**	**0**	**0**	**9783 2**	**71805**

Source: District Statistical Report 2020-21

Table 3 shows significant regional differences in the usage of wells, tanks, and canals as irrigation sources. With 5,850 hectares of gross and net irrigated area, Kollegal Taluk leads the field in canal irrigation. Hanur (2,150 ha) and Yelandur (2,860 ha) follow, suggesting a moderate reliance on canal-fed systems in several taluks. Despite having a shorter canal, Chamarajanagar Taluk maintains equal gross and net irrigation (75 ha), greatly enhanced by well irrigation (1,720 ha gross and 1,410 ha net irrigated with 175 wells). Gundlupet is notable for its complete reliance on wells (1,305 ha gross and 825 ha net) and lack of canal or tank-based irrigation, indicating a strong reliance on groundwater.

With a total of 660 hectares irrigated and 155 active tanks, tank irrigation is restricted throughout all taluks, suggesting a decline or underuse of conventional water harvesting techniques. The overall coverage of well-based irrigation (4,225 ha gross and 2,910 ha net) exceeds that of surface water irrigation, underscoring the growing reliance on groundwater resources, particularly in regions with inadequate or nonexistent canal and tank infrastructure.

Taluk-wise Spatial Distribution of Irrigation Sources

Gundlupet Taluk

Gundlupet Taluk exhibits a distinct irrigation pattern, characterized by a firm reliance on groundwater sources, particularly borewells and tube wells, due to its semi-arid climate and limited surface water availability. While traditional tanks 75 in operation continue to provide supplemental irrigation for 113 hectares, canal irrigation remains negligible, with only 25.2 km of canal length. The taluk’s agricultural landscape is primarily sustained by 7226 tube wells, which irrigate over 12,000 hectares, reflecting a clear shift towards intensive groundwater usage. This reliance has intensified due to moderately deep aquifers and the increasing cultivation of water-intensive commercial crops, such as cotton, maize, and turmeric. However, unregulated extraction and erratic rainfall patterns have led to alarming groundwater depletion, raising serious environmental and sustainability concerns for the future of agriculture in the region.

Chamarajanagar Taluk

Chamarajanagar Taluk presents a well-balanced and diversified irrigation system supported by both traditional and modern sources. Dominated by surface water through canals and tanks, the taluk benefits from a 59 km canal network, which irrigates approximately 1,405 hectares, and 75 operational tanks, contributing to a total of 113 hectares of irrigated area. This firm's reliance on surface water is further strengthened by its proximity to major reservoirs, such as Suvarnavathi and Chikkahole, which feed into the taluk’s canal system, ensuring dependable irrigation during the monsoon and post-monsoon seasons. Complementing surface sources, groundwater irrigation is also steadily rising, with 820 hectares gross and 654 hectares net irrigated through open wells, and a significant 15,748 hectares gross and 10,840 hectares net supported by tube wells. Although groundwater usage is increasing, it remains secondary to surface irrigation, unlike in more groundwater-stressed taluks. This comprehensive irrigation framework supports a variety of crops, including drought-resilient ragi and water-intensive crops like sugarcane and paddy, reflecting both agro-climatic adaptability and relative agricultural stability within the taluk.

Kollegal Taluk

Kollegal Taluk, located in the eastern part of Chamarajanagar district, features a diverse irrigation system that effectively combines traditional and modern water sources to sustain agriculture in semi-arid conditions. The taluk primarily depends on tank irrigation, with 16 tanks irrigating approximately 1,509 hectares, reflecting a long-standing reliance on surface water. Open wells, numbering 2,570, further support about 416 hectares of gross and 346 hectares of net irrigated area, providing essential backup where tanks fall short. Additionally, lift irrigation schemes and a widespread network of 4,632 tube wells collectively irrigate over 10,936 hectares (gross), indicating a growing shift toward groundwater use. However, Kollegal's mixed terrain, characterized by rocky patches and undulating landscapes, limits groundwater recharge and makes tube well sustainability variable across the region. As a result, irrigation reliability remains uneven, which in turn influences crop choices. The taluk primarily supports drought-tolerant crops, such as millets and pulses, which are well-suited to its agro-climatic conditions. Though sugarcane is cultivated in select areas, its expansion is constrained by high water requirements and inconsistent irrigation support, underscoring the need for balanced water resource management.

Hanur Taluk

Hanur Taluk, situated in the northeastern part of Chamarajanagar district, presents a challenging agro-ecological setting, where irrigation is primarily dependent on seasonal streams and traditional rainwater harvesting tanks. These sources, although crucial during the monsoon, often dry up in the summer, resulting in inconsistent and limited water availability. As a result, agricultural activity is confined mainly to low-input, drought-resistant cropping systems. The taluk's hilly and forested terrain restricts the construction of large-scale irrigation infrastructure such as canals or reservoirs, further limiting irrigation coverage. This topographical constraint, combined with erratic rainfall, significantly influences land use and crop selection. Additionally, a large portion of Hanur is home to tribal communities who practice traditional rain-fed farming and, in some areas, shifting cultivation near forest fringes. These methods reflect a strong cultural bond with the land, but also highlight the vulnerability of these communities due to their dependence on monsoonal variability and limited access to modern irrigation facilities.

Yelandur Taluk

Yelandur Taluk, situated in the southeastern part of Chamarajanagar district, features a traditional yet adaptable irrigation framework, primarily relying on tanks and borewells to meet its agricultural water needs. The taluk is notable for its use of cascaded tank systems interconnected with rain-fed tanks that effectively capture and store monsoon runoff, thereby sustaining soil moisture and supporting irrigation across cropping seasons. These tanks form the backbone of surface water irrigation in the region. In parallel, borewells provide a crucial supplementary source, especially during dry spells or in years with erratic rainfall, helping to stabilize crop production. Certain low-lying areas in the taluk also benefit from canal-fed irrigation, further enhancing seasonal water availability. This blend of surface and groundwater sources strengthens Yelandur’s resilience to drought and climatic variability. As a result, farmers can cultivate key crops such as ragi and paddy, both of which are well-suited to the region’s agro-climatic conditions. Moreover, the irrigation mix supports the production of vegetables, contributing to both household food security and income diversification for small and marginal farming households.

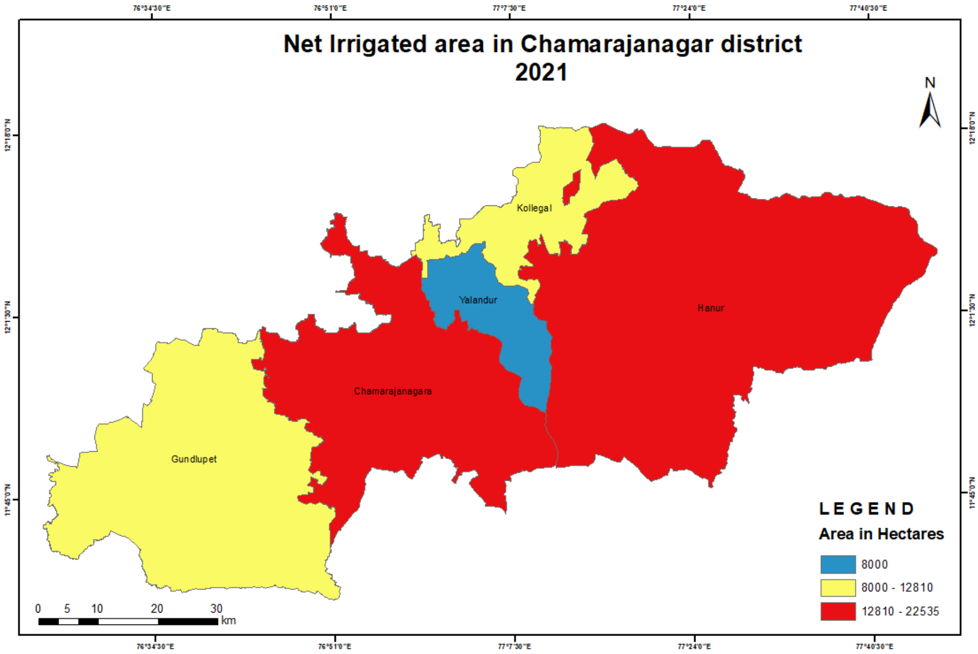

Figure 4: Distribution of net area sown in Chamarajanagar district

CONCLUSION

The study concludes that sustainable agriculture in Chamarajanagar district is heavily dependent on effective water resource management, particularly given the rain-fed nature of a significant portion of the district. While irrigation has the potential to improve productivity and rural livelihoods, its success depends on the integration of natural resources, technology, and local governance. Adequate irrigation relies not just on physical infrastructure but also on the coordination between water management authorities and farmers. Conflicts between irrigated and non-irrigated farmers should be mediated at the local level to promote fair access to resources. With proper planning and community-based water governance, Chamarajanagar can strike a balance between dryland resilience and irrigation efficiency, thereby ensuring stable agricultural growth in the district.

REFERENCES

1. Badekhan, A., & Nayak, M. R. (2023). *Spatio-temporal variation of climatic parameters across the Northern dry zone of Karnataka*. *12*(6), 4610–4615. https://www.researchgate.net/publication/371958151
2. Dansi, A., Vodouhè, R., Azokpota, P., Yedomonhan, H., Assogba, P., Adjatin, A., Loko, Y. L., Dossou-Aminon, I., & Akpagana, K. (2012). Diversity of the neglected and underutilized crop species of importance in Benin. In *The Scientific World Journal* (Vol. 2012). https://doi.org/10.1100/2012/932947
3. Dubovyk, O., Menz, G., Conrad, C., Kan, E., Machwitz, M., & Khamzina, A. (2013). Spatio-temporal analyses of cropland degradation in the irrigated lowlands of Uzbekistan using remote-sensing and logistic regression modeling. *Environmental Monitoring and Assessment*, *185*(6), 4775–4790. https://doi.org/10.1007/s10661-012-2904-6
4. Harish M. (2010). *STUDY ON IRRIGATION PROJECTS IN CHAMARAJANAGAR DISTRICT: A REPORT*. *3*(4), 705–709. http://www.rasayanjournal.com

5. Manjunatha, M. (2015). *land use / land cover classification analysis and soil conservation in precambrian terrain of chamarajanagars district, karnataka, india using geomatics application land use/land classification analysis and soil conservation in precambrian terrain of chamarajanagara district, karnataka, india using geomatics application*. https://doi.org/10.2348/ijset06150739
6. Mugiyo, H., Chimonyo, V. G. P., Kunz, R., Sibanda, M., Nhamo, L., Ramakgahlele Masemola, C., Modi, A. T., & Mabhaudhi, T. (2022). Mapping the spatial distribution of underutilised crop species under climate change using the MaxEnt model: A case of KwaZulu-Natal, South Africa. *Climate Services*, *28*. https://doi.org/10.1016/j.cliser.2022.100330