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Research Paper

Identification and Mapping of Drinking Water Sources of Mysore Taluk: A Geographical Analysis

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Abstract:
This study examines the spatial distribution of drinking water sources in four Hobli regions of Mysore Taluk, India, contributing to water security discourse. Leveraging primary and secondary data, including population counts and water source inventories, notable disparities emerge. Kasaba, despite having the highest population, exhibits the lowest number of water sources (79), resulting in a significantly high population-to-water-source ratio of 1652.44. Utilizing GIS technology, spatial dynamics and vulnerabilities are analyzed, highlighting areas needing intervention for equitable water access. Statistical analyses like ANOVA reveal significant distribution differences among regions (F = 4.426, p = 0.005). The study aims to inform policymakers, water managers, and communities for informed decision-making, promoting public health while addressing disparities in water resource allocation.
Key Words: *Drinking Water Sources, Spatial Distribution, ANOVA (Analysis of Variance), Geographic Information Systems (GIS), Location Quotient (L.Q)*

I. Introduction:

Access to clean and safe drinking water is universally acknowledged as a fundamental human right vital for sustaining life and promoting public health (United Nations, 2010). The identification and mapping of drinking water sources are pivotal in ensuring the availability and quality of this essential resource (Gleick, 1998). As the global population grows, urbanizes, and faces environmental challenges, understanding the spatial distribution and characteristics of drinking water sources becomes increasingly crucial for effective water resource management (Weng, 2012). This research aims to contribute to the broader discourse on water security by employing a comprehensive approach to identify and map drinking water sources (Gleick, 1998). The significance of accurate mapping lies not only in recognizing the locations of these sources but also in understanding their interconnections, vulnerabilities, and potential threats (WHO, 2022). Leveraging advanced technologies such as geographic information systems (GIS), satellite imagery, and community engagement, this study seeks to provide a nuanced understanding of the spatial dynamics of drinking water sources. Acknowledging the multifaceted nature of the challenge, this research delves into the complexities of water source identification and mapping, considering factors such as climate change, population growth, land use changes, and pollution (Gleick, 1998; UNDP, 2006). Consequently, a robust methodology is essential to capture the dynamic nature of these sources and their susceptibility to external influences (Weng, 2012).

By creating accurate maps and providing valuable insights, this research aims to inform policymakers, water resource managers, and communities about the status and distribution of drinking water sources (Watkins, 2006). Ultimately, the goal is to facilitate informed decision-making, foster sustainable water management practices, and ensure the continued availability of clean and reliable drinking water for present and future generations (United Nations, 2010). Moreover, ensuring a safe water supply and effective management during distribution is crucial for minimizing drinking water contamination and preventing mismanagement of water resources. The provision of a safe, affordable, and easily accessible water supply system is essential for both human health and livelihoods. However, challenges persist, particularly in developing countries, where millions of people encounter difficulties accessing safe water, leading to significant health burdens (Bereskie, 2018; Brenniman, 1999). The unavailability of safe drinking water in many developing countries is a significant concern for communities reliant on public water supply systems (Ashbolt, 2004). Since safe water plays a pivotal role in maintaining human health, the cross-contamination of water sources leads to 80% of diseases in many developing nations (De Jesus et al., 2015). Waterborne diseases pose a substantial threat, with approximately 2.1 billion people worldwide consuming unsafe water, resulting in 2.2 million deaths annually

(WHO, 2017). Sustainable water management and safe water supply systems are crucial for public health and community development. Contaminated drinking water poses increasing health risks due to pathogenic microorganisms, highlighting the severity of waterborne diseases (Omar et al., 2017). The contamination of drinking water with inorganic substances and hazardous microbial loads due to cross-contamination during water supply processes has gained attention due to their potential to cause adverse human toxicity (Umar et al., 2019). To address these challenges, thorough water quality monitoring is essential, involving the analysis of various parameters such as pH, turbidity, and heavy metals (Ghaderpoori et al., 2018). This study focuses on assessing the quality of drinking water in Mysuru, India, considering variations throughout the water supply system, seasons, water supply guidelines, and management practices, with the ultimate goal of optimizing the system for the provision of safe drinking water (Shivaraju, 2012).

II. Study Area

The Mysore taluk covers a total geographical area of 804 sq.km. Its geographical extents are located between North Latitudes 12° 07’ 01.91” and 12° 27’ 07.39”, and East Longitudes 76° 27’ 16.88” and 76° 50’11.80”. The Mysore Taluk is covered in parts of Survey of India Toposheet Nos. 57 D/7, D/11, D/15, D/8, D/2, and D/16. Mysore taluk is surrounded by Pandavapura and Srirangapatna taluks to the North, T.Narasipura and Chamarajanagara taluks to the East, Nanjangud taluk to the South, and H.D.Kote and Hunsur taluks to the West. The Taluk administration of Mysore is divided into 4 Hoblies and 37 GramaPanchayaths. Mysore town is the taluk headquarters. There are 123 villages present in the taluk. The study region is located in a safe seismic zone and is easily accessible by bus and train routes.

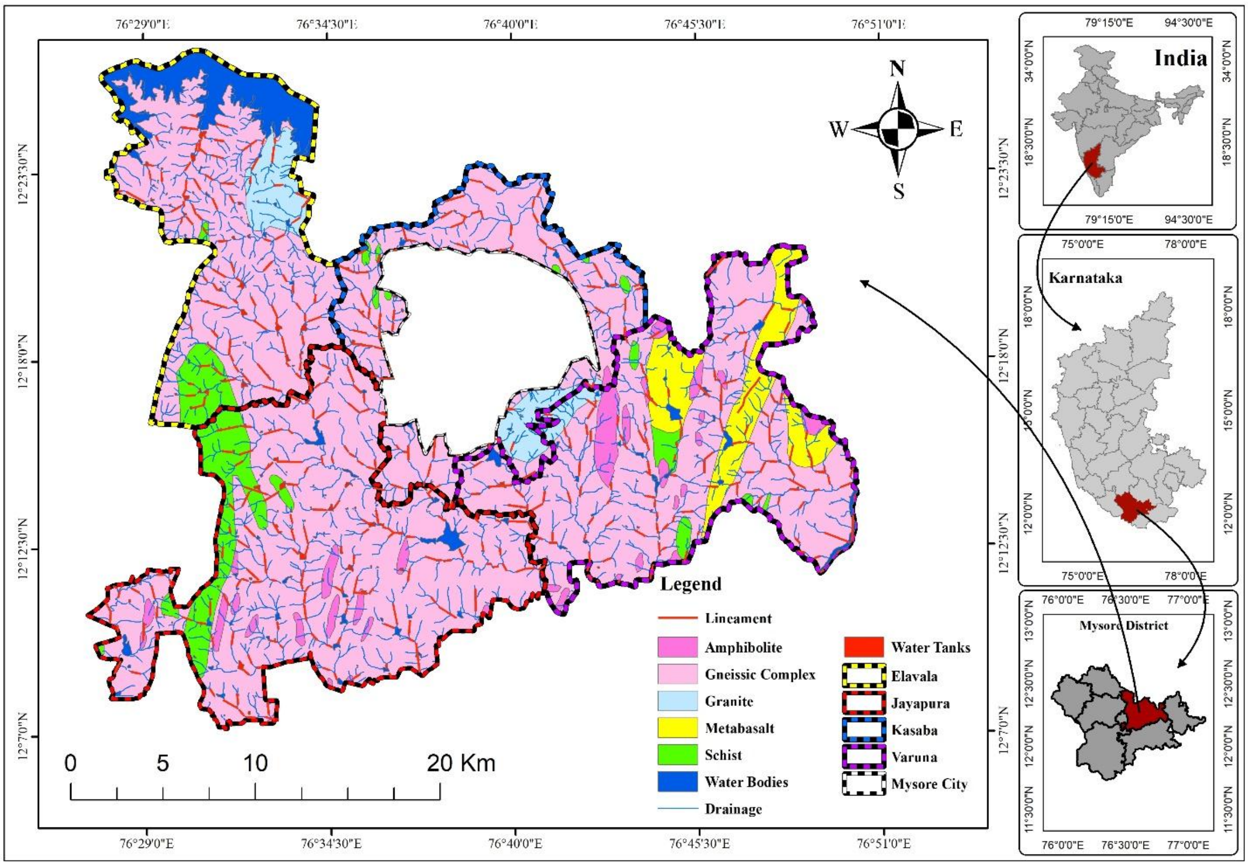

Fig. 1: Study Area

III. Methodology

The data for the analysis have been collected from primary and secondary sources. The secondary data, concerning the number of water sources and population, were gathered from the Department of Census Kasaba. The locations of water sources were determined through a GPS survey using Garmin etrex handheld GPS devices. Furthermore, this collected information was integrated with ArcGIS 10.3, and the spatial data were prepared. Spatial disparities of water sources at the hobli level were measured by applying location quotient and ANOVA. The ratio between population and water sources was calculated to assess the potential stress on water resources at the hobli level.

1. Distribution of Water Sources in Mysore Taluk

The distribution of water sources plays a crucial role in ensuring access to clean drinking water and promoting public health (Resolution, U. N. 2010). Understanding the spatial distribution of various water sources, including treated and untreated tap water, covered and uncovered wells, hand pumps, tube wells/boreholes, springs, rivers/canals, and tanks/ponds/lakes, is essential for effective water resource management (Gleick, 1998; Edition, F. 2011). Analyzing distribution patterns allows policymakers and water resource managers to identify disparities among regions and prioritize interventions to ensure equitable access to clean drinking water (Watkins, 2006). By implementing sustainable water management practices informed by spatial distribution data, communities can mitigate water-related risks and enhance overall water security (Weng, 2012). This underscores the importance of comprehensive mapping and analysis of water sources in promoting public health and sustainable development (Watkins, 2006).

1.1. Treated Tap Water

Treated tap water, essential for public health and economic prosperity, varies significantly across four Hobli regions in Mysore Taluk: Elavala, Jayapura, Kasaba, and Varuna. Elavala and Jayapura exhibit higher treatment rates, with 25% and 33.62% of tap water treated, respectively, while Kasaba and Varuna show lower rates at 12.07% and 29.31%, respectively. This discrepancy influences population-to-treated-tap-water ratios, ranging from 2087.41 in Elavala to 9324.50 in Kasaba. The Location Quotient (L.Q) underscores these differences, with Elavala and Varuna showing L.Qs of 1.51 and 1.42, respectively, indicating a higher concentration of treated tap water sources relative to population. An analysis of variance (ANOVA) reveals significant differences in treated tap water levels between the Hoblis (F-ratio = 10.159, $p < 0.001$), suggesting genuine variations. Multiple comparisons highlight significant mean differences between specific pairs of Hoblis, emphasizing the need for targeted interventions to ensure equitable access to treated tap water and promote public health across Mysore Taluk.

Table 1. Treated Tap water -population ratio and Location Quotient

Hoblis	Treated Tap water		Population	Ratio between population and Treated Tap water	Location Quotient
	Number	Percentage			
Elavala	29	25.00	60535	2087.41	1.51
Jayapura	39	33.62	99353	2547.51	1.24
Kasaba	14	12.07	130543	9324.50	0.34
Varuna	34	29.31	75635	2224.56	1.42
	116	100.00	366066	3155.74	1
F			10.159		
Sig.			.000		

1.2. UNTREATED TAP WATER

Untreated tap water poses health risks due to contaminants and pathogens, underscoring the importance of water treatment facilities in ensuring safe drinking water. Data from four Hobli regions in Mysore Taluk—Elavala, Jayapura, Kasaba, and Varuna—reveals variations in untreated tap water availability. Elavala and Jayapura exhibit higher rates of untreated tap water, with 31.15% and 39.34% remaining untreated, respectively, while Kasaba and Varuna show lower rates at 18.03% and 11.48%. Population-to-untreated-tap-water ratios range from 3186.05 in Elavala to 10805.00 in Varuna, indicating disparities in water quality and potential public health implications. An ANOVA test confirms significant differences between Hoblis (F-statistic = 4.548, $p = 0.005$), with multiple comparison analysis revealing specific variations. While Elavala and Jayapura exhibit similar untreated tap water levels, Varuna consistently shows lower levels compared to other regions. These findings underscore the need for targeted interventions to address disparities in untreated tap water availability and ensure public health across Mysore Taluk.

Table 2: Untreated Tap water -population ratio and Location Quotient

Hoblis	Untreated Tap water		Population	Ratio between population and Untreated Tap water	Location Quotient
	Number	Percentage			
Elavala	19	31.15	60535	3186.05	1.88

Jayapura	24	39.34	99353	4139.71	1.45
Kasaba	11	18.03	130543	11867.55	0.51
Varuna	7	11.48	75635	10805.00	0.56
	61	100.00	366066	6001.08	1.00
F			4.548		
Sig.			.005		

1.3. COVERED WELLS

Covered wells, equipped with protective structures to safeguard water quality, play a vital role in ensuring access to clean and safe drinking water. Data from four Hobli regions—Elavala, Jayapura, Kasaba, and Varuna—reveals disparities in covered well availability. Elavala boasts the highest percentage of covered wells at 44%, followed by Jayapura at 28%, Kasaba at 24%, and Varuna at 4%. Population-to-covered-wells ratios range from 5503.18 in Elavala to 75635.00 in Varuna, indicating varying levels of access to covered wells across regions. An analysis comparing covered wells among Hoblies shows a significant difference (p = 0.010), suggesting variations in covered well distribution. Multiple comparisons reveal significant mean differences between specific pairs of Hoblies, with Jayapura having a higher average number of covered wells compared to Elavala, and Varuna showing both higher and lower averages compared to other regions. These findings underscore the importance of equitable access to covered wells and highlight the need for targeted interventions to ensure water infrastructure development and promote public health across Mysore Taluk.

Table 3: Covered Wells -population ratio and Location Quotient

Hoblis	Covered Wells		Population	Ratio between population and Covered Wells	Location Quotient
	Number	Percentage			
Elavala	11	44	60535	5503.18	2.66
Jayapura	7	28	99353	14193.29	1.03
Kasaba	6	24	130543	21757.17	0.67
Varuna	1	4	75635	75635.00	0.19
	25	100	366066	14642.64	1.00
F			3.927		
Sig.			.010		

1.4. UNCOVERED WELLS

Uncovered wells pose significant risks to water quality and public health due to their susceptibility to contamination from various sources. Data from four Hobli regions—Elavala, Jayapura, Kasaba, and Varuna—reveals differences in uncovered well availability. Elavala has a lower percentage of uncovered wells at 18.64%, with a moderate concentration relative to its population. Jayapura exhibits a higher percentage at 40.68%, indicating a denser distribution of uncovered wells. Kasaba shows a coverage rate of 10.17%, resulting in a notably higher population-to-uncovered-well ratio. Varuna demonstrates a coverage rate of 30.51%, with a relatively high population-to-uncovered-well ratio. Overall, there are variations in uncovered well availability across the regions, reflecting potential disparities in water infrastructure and resource allocation strategies. An analysis comparing uncovered wells among the Hoblies of Mysore Taluk reveals a significant difference (p = 0.023), indicating variations in uncovered well distribution. Multiple comparisons show several significant differences between pairs of Hoblies. Although Jayapura and Varuna exhibit slightly lower average numbers of uncovered wells compared to Elavala, these differences are not statistically significant. However, Kasaba has no significant differences with Elavala or Jayapura, while significant differences are observed between Kasaba and Varuna, as well as between Jayapura and Kasaba. These findings emphasize the importance of equitable access to covered wells and highlight potential differences in water infrastructure and resource allocation strategies across the Hoblies of Mysore Taluk.

Table 4: Uncovered well -population ratio and Location Quotient

Hoblis	Uncovered well		Population	Ratio between population and Uncovered well	Location Quotient
	Number	Percentage			
Elavala	11	18.64	60535	5503.18	1.13
Jayapura	24	40.68	99353	4139.71	1.50
Kasaba	6	10.17	130543	21757.17	0.29
Varuna	18	30.51	75635	4201.94	1.48
	59	100.00	366066	6204.51	1.00
F			3.277		
Sig.			.023		

1.5. HAND PUMPS

The comparison of hand pump distribution among the four Hobli regions in Mysore Taluk reveals notable disparities in availability and coverage. Elavala exhibits a moderate percentage of hand pumps at 24.79%, serving a population of 60,535 with 29 hand pumps, resulting in a population-to-hand-pump ratio of 2087.41 and an L.Q of 1.50. Jayapura shows a higher percentage of hand pumps at 34.19%, but with a slightly lower population-to-hand-pump ratio of 2483.83 and a lower L.Q of 1.26. Kasaba presents a lower coverage rate at 11.97%, with a substantially higher population-to-hand-pump ratio of 9324.50 and a lower L.Q of 0.34, while Varuna demonstrates a coverage rate of 29.06%, resulting in a population-to-hand-pump ratio of 2224.56 and an L.Q of 1.41. Cumulatively, across all regions, the data reflects a population of 366,066 with 117 hand pumps, yielding an overall population-to-hand-pump ratio of 3128.77 and an L.Q of 1. The ANOVA test, with a substantial F-statistic of 11.063 ($p = 0.000$), suggests significant differences in hand pump distribution among the hoblies. Multiple comparison analyses further highlight variations between pairs of regions. Specifically, Elavala and Jayapura show no significant difference in hand pump numbers, while significant differences are observed when comparing either of these regions with Kasaba or Varuna. These findings underscore the diverse availability of hand pumps among the Hoblies of Mysore Taluk, suggesting potential disparities in water infrastructure and resource allocation strategies.

Table 5: Hand pumps -population ratio and Location Quotient

Hoblis	Hand pumps		Population	Ratio between population and Hand pumps	Location Quotient
	Number	Percentage			
Elavala	29	24.79	60535	2087.41	1.50
Jayapura	40	34.19	99353	2483.83	1.26
Kasaba	14	11.97	130543	9324.50	0.34
Varuna	34	29.06	75635	2224.56	1.41
	117	100.00	366066	3128.77	1.00
F			11.063		
Sig.			.000		

1.6. TUBE WELLS/BOREHOLES

The comparison of tube wells and boreholes among the four Hobli regions in Mysore Taluk highlights significant variations in availability and coverage. Elavala and Jayapura both demonstrate moderate to high percentages of tube wells/boreholes, with Elavala at 24.35% and Jayapura at 35.65%. However, despite Jayapura's higher coverage percentage, Elavala exhibits a slightly lower population-to-tube well/borehole ratio of 2161.96 compared to Jayapura's 2423.24, indicating a concentration of tube wells/boreholes relative to the broader region. In contrast, Kasaba presents a lower coverage rate of 10.43% and a substantially higher population-to-tube well/borehole ratio of 10878.58, suggesting limited access to these water extraction structures. Varuna falls in between, with a coverage rate of 29.57% and a population-to-tube well/borehole ratio of 2224.56. Overall, the data reflects significant differences in tube well and borehole availability among the Hobli regions, as indicated by the ANOVA test results showing a substantial F-statistic of 15.884 ($p = .000$).

Multiple comparison analyses further highlight variations between pairs of regions, emphasizing differences in accessibility and resource allocation strategies.

Table 6: Tube wells/bore holes-population ratio and Location Quotient

Hoblis	Tube wells/bore holes		Population	Ratio between population and Tube wells and boreholes	Location Quotient
	Number	Percentage			
Elavala	28	24.35	60535	2161.96	1.47
Jayapura	41	35.65	99353	2423.24	1.31
Kasaba	12	10.43	130543	10878.58	0.29
Varuna	34	29.57	75635	2224.56	1.43
	115	100.00	366066	3183.18	1.00
F			15.884		
Sig.			.000		

1.7. SPRINGS

The data highlights variations in spring availability among four Hobli regions: Elavala, Jayapura, Kasaba, and Varuna. Elavala and Varuna exhibit significant concentrations of springs, with percentages of 25% and 50% respectively, resulting in population-to-springs ratios of 30,267.50 and 18,908.75, and L.Q values of 1.51 and 2.42. Jayapura lacks any springs, resulting in a population-to-springs ratio and L.Q of 0.00, while Kasaba reports a moderate presence with 2 springs, serving a larger population, yielding a ratio of 65,271.50 and an L.Q of 0.70. The ANOVA analysis suggests no significant difference in spring numbers among the Hoblies, with a calculated F-statistic of 1.646 and a significance level (p-value) of 0.182. Multiple comparisons reveal varying mean differences between pairs of Hoblies, with only the comparison between Jayapura and Varuna showing a significant mean difference, indicating fewer springs in Varuna compared to Jayapura. Overall, while some variations exist, many differences are not statistically significant, implying potential differences in water sources and geographical characteristics among regions.

Table 7: Springs-population ratio and Location Quotient

Hoblis	Springs		Population	Ratio between population and Springs	Location Quotient
	Number	Percentage			
Elavala	2	25	60535	30267.50	1.51
Jayapura	0	0	99353	0.00	0.00
Kasaba	2	25	130543	65271.50	0.70
Varuna	4	50	75635	18908.75	2.42
	8	100	366066	45758.25	1.00
F			1.646		
Sig.			.182		

1.8. RIVER/CANAL

The data reveals variations in the availability of rivers and canals across four Hobli regions: Elavala, Jayapura, Kasaba, and Varuna. While Varuna and Jayapura exhibit notable concentrations of rivers/canals, Elavala and Kasaba display comparatively lower concentrations. ANOVA analysis suggests no significant difference in river/canal numbers among the Hoblies, with a calculated F-statistic of 1.896 and a significance level (p-value) of 0.133. Multiple comparisons reveal differences in mean values between pairs of Hoblies, with significant mean differences noted between Elavala and Varuna, indicating that Varuna has more rivers/canals on average compared to Elavala. However, many differences observed are not statistically significant, suggesting that while variations exist, they are not significant across the Hobli regions.

Table 8: River/canal-population ratio and Location Quotient

Hoblis	River /canal		Population	Ratio between population and Rivers and canals	Location Quotient
	Number	Percentage			
Elavala	4	11.43	60535	15133.75	0.69
Jayapura	10	28.57	99353	9935.30	1.05
Kasaba	9	25.71	130543	14504.78	0.72
Varuna	12	34.29	75635	6302.92	1.66
	35	100.00	366066	10459.03	1.00
F			1.896		
Sig.			.133		

1.9. TANK/POND/LAKE

The data highlights the distribution of tanks, ponds, and lakes across four Hobli regions: Elavala, Jayapura, Kasaba, and Varuna. While Elavala and Jayapura exhibit relatively high concentrations of these water bodies, Kasaba displays a notably lower presence, and Varuna falls in between. ANOVA analysis suggests that although there may be some differences in the number of tanks, ponds, and lakes among the Hoblies, the results are not statistically significant at the conventional significance level of 0.05. Multiple comparison analysis reveals significant mean differences between pairs of Hoblies, particularly between Elavala and Kasaba and between Jayapura and Kasaba, indicating that Kasaba tends to have a higher average number of water bodies compared to Elavala and Jayapura. However, no significant differences are found between other pairs of Hoblies. These findings underscore variations in the presence of tanks, ponds, and lakes among the Hobli regions, with Kasaba consistently exhibiting a higher average compared to Elavala and Jayapura.

Table 9: Tank/Pond/ Lake-population ratio and Location Quotient

Hoblis	Tank/Pond/ Lake		Population	Ratio	Location Quotient
	Number	Percentage			
Elavala	14	29.79	60535	4323.93	1.80
Jayapur a	18	38.30	99353	5519.61	1.41
Kasaba	4	8.51	130543	32635.75	0.24
Varuna	11	23.40	75635	6875.91	1.13
	47	100.00	366066	7788.64	1.00
F			2.217		
Sig.			.089		

1.10. OTHER WATER SOURCES

The data highlights the distribution of other water sources across four Hobli regions: Elavala, Jayapura, Kasaba, and Varuna. Elavala and Jayapura exhibit a significant percentage of these sources at 40%, with respective population-to-source ratios of 30,267.50 and 49,676.50 people per source, and high Location Quotients (L.Qs) of 2.42 and 1.47. In contrast, Kasaba displays a lower percentage of 20%, resulting in a notably higher ratio of 130,543.00 people per source and a lower L.Q of 0.56. Varuna has no recorded other water sources. Despite these disparities, the ANOVA analysis and multiple comparison tests indicate no statistically significant differences in the mean number of these sources among the regions. The calculated F-ratio of 0.656 with a corresponding p-value of 0.580 suggests no significant variation between groups, and the multiple comparison results confirm that no meaningful disparities exist between any pair of regions. Further investigation or a larger sample size may be required to ascertain any significant differences comprehensively.

Table 10: Other Water Sources-population ratio and Location Quotient

Hoblis	Other Water Sources		Population	Ratio between population and Other water sources	Location Quotient
	Number	Percentage			
Elavala	2	40	60535	30267.50	2.42
Jayapura	2	40	99353	49676.50	1.47
Kasaba	1	20	130543	130543.00	0.56
Varuna	0	0	75635	0.00	0.00
	5	100	366066	73213.20	1.00
F			.656		
Sig.			.580		

1.11. Total Water Sources

The dataset provides insights into total water sources across four hoblis: Elavala, Jayapura, Kasaba, and Varuna. Notably, Kasaba stands out with the lowest number of water sources (79) despite having the highest population (130,543), resulting in a significantly high population-to-water-source ratio of 1652.44. Conversely, Elavala, Jayapura, and Varuna show more balanced ratios, suggesting better management of water resources relative to their populations. All hoblis exhibit location quotients above average, indicating a higher concentration of water sources compared to the broader region. However, the imbalance in Kasaba highlights the need for targeted interventions in water resource management. The ANOVA test reveals significant differences in total water sources among the hoblis ($F = 4.426$, $p = 0.005$), with further multiple comparison analysis indicating specific pairs with significant mean differences, emphasizing areas where water availability significantly varies.

Table 11: Total Water Sources-population ratio and Location Quotient

Hoblis	Total water sources		Population	Ratio between population and Total water sources	Location Quotient
	Number	Percentage			
Elavala	149	25.34	60535	406.28	1.53
Jayapura	205	34.86	99353	484.65	1.28
Kasaba	79	13.44	130543	1652.44	0.38
Varuna	155	26.36	75635	487.97	1.28
	588	100.00	366066	622.56	1.00
F			4.426		
Sig.			.005		

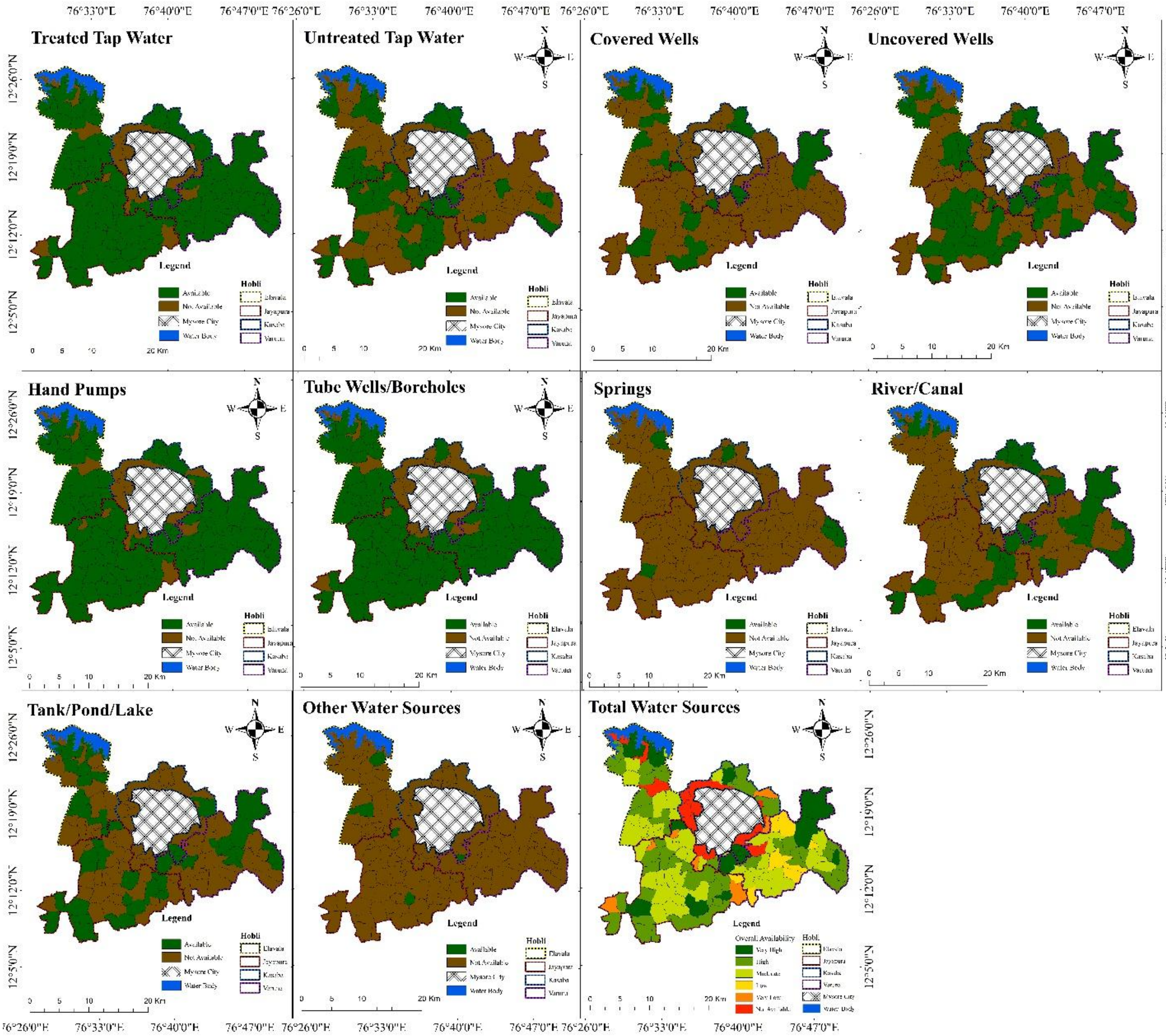

Fig. 2: Mapping of Water Sources of Study Area

IV. Discussion

The study conducted in four Hobli regions of Mysore Taluk, India, sheds light on significant variations in the availability and distribution of drinking water sources, revealing disparities that have implications for water security and public health. Notably, Kasaba stands out with the lowest number of water sources (79) despite having the highest population (130,543), resulting in a strikingly high population-to-water-source ratio of 1652.44. This imbalance underscores potential challenges in water resource management and highlights the need for targeted interventions to ensure equitable access to clean drinking water. In contrast, other regions such as Elavala, Jayapura, and Varuna demonstrate more balanced ratios, suggesting relatively better management of water resources relative to their populations.

Utilizing advanced technologies like Geographic Information Systems (GIS), the study provides a nuanced understanding of the spatial dynamics and vulnerabilities of drinking water sources. GIS technology enables the identification of areas where interventions are needed to address disparities in water source distribution. Statistical analyses, including ANOVA, reveal significant differences in water source distribution among the regions, emphasizing the importance of tailored approaches to water resource management. For instance, the ANOVA test reveals significant differences in total water sources among the Hobli regions ($F = 4.426$, $p = 0.005$), indicating areas where water availability significantly varies and requiring targeted interventions.

The findings have crucial implications for policymakers, water resource managers, and communities, as they provide evidence-based insights to guide decision-making processes and interventions aimed at improving access to clean drinking water. By informing policies and interventions, the study contributes to the promotion of public health and the reduction of disparities in water resource allocation. Moreover, the study underscores the importance of sustainable water management practices to ensure the availability of clean and reliable drinking water for present and future generations. Overall, the research contributes to the broader discourse on water security and resource management, providing a foundation for future research and action in this critical area.

V. Conclusion

In conclusion, the research conducted on the identification and mapping of drinking water sources in four Hobli regions of Mysore Taluk, India, highlights significant disparities in water availability and distribution, with implications for water security and public health. Kasaba, despite having the highest population, exhibits the lowest number of water sources, resulting in a notably high population-to-water-source ratio. Conversely, other regions like Elavala, Jayapura, and Varuna demonstrate more balanced ratios, suggesting relatively better management of water resources. Leveraging advanced technologies like GIS and statistical analyses such as ANOVA, the study provides valuable insights into the spatial dynamics of drinking water sources, emphasizing the need for tailored interventions to address disparities. These findings underscore the importance of informed decision-making and targeted interventions by policymakers, water resource managers, and communities to ensure equitable access to clean drinking water and promote public health. Ultimately, the research contributes to the broader discourse on water security and resource management, advocating for sustainable practices to ensure the availability of clean and reliable drinking water for present and future generations.

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