

## Research Article

# DECENTRALIZATION WITHOUT DELIVERY? URBAN WATER SCARCITY AND RESOURCE INSECURITY IN SECONDARY KENYAN TOWNS, A CASE OF OYUGIS TOWN, HOMA BAY COUNTY, KENYA

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### ABSTRACT

Urban water scarcity in rapidly growing secondary towns presents a critical challenge to sustainable development, particularly within decentralized governance systems where institutional capacity remains uneven. This study examines the dynamics of water scarcity and resource insecurity in Oyugis Town, Homa Bay County, Kenya, interrogating how urbanization, environmental change, and devolved governance interact to shape water access and service delivery outcomes. Anchored in Integrated Water Resources Management (IWRM) and Political Ecology frameworks, the study adopts a convergent mixed-methods design, integrating household survey data ( $n = 384$ ) with key informant interviews, focus group discussions, and spatial analysis. Quantitative data were analyzed using descriptive and inferential statistics, including regression modelling, while qualitative data were examined through thematic analysis. The findings reveal a structurally embedded and multidimensional water crisis characterized by limited access to formal infrastructure, with only 13.5% of households connected to piped water and widespread reliance on informal sources such as boreholes (31.8%) and water vendors (27.1%). Water access is further constrained by high costs, long collection times, and pronounced spatial inequalities. Inferential results demonstrate that urbanization ( $\beta = 0.42$ ), land use change ( $\beta = 0.31$ ), and governance effectiveness ( $\beta = 0.28$ ) significantly influence water scarcity, while climate variability exerts a negative effect on water availability ( $\beta = -0.36$ ), with the model explaining 64% of observed variation ( $R^2 = 0.64$ ). Despite the institutional reforms associated with devolution, the study finds limited improvement in service delivery, with evidence of weak coordination, infrastructural deficits, and growing dependence on informal water markets. The study advances debates on decentralized water governance by demonstrating that devolution, in the absence of adequate technical and financial capacity, may reproduce rather than resolve urban water inequalities in secondary towns. It highlights the need to move beyond institutional restructuring towards integrated, infrastructure-led, and climate-resilient urban water management approaches. These findings provide critical insights for policy and planning in rapidly urbanizing regions of Sub-Saharan Africa, where the “missing middle” of secondary towns remains underserved.

**Keywords:** Urban water scarcity, Decentralized governance, Secondary towns, Water, insecurity, Integrated Water Resources Management (IWRM).

### BACKGROUND TO THE STUDY

Urban water scarcity has increasingly shifted from being understood as a purely biophysical constraint to a complex socio-ecological and governance challenge, particularly in rapidly expanding secondary towns of the Global South. While global estimates indicate that over two billion people live under conditions of water stress (United Nations, 2023), emerging evidence suggests that the geography of water insecurity is being reconfigured, with smaller urban centres becoming critical yet under examined hotspots. Unlike large metropolitan areas that attract sustained infrastructure investment and policy attention, secondary towns often occupy a “missing middle” position: too large for rural service models, yet insufficiently prioritized within national urban development strategies. This structural marginalization raises important questions about how urbanization, environmental change, and governance reforms intersect to shape water access in such contexts.

Across Sub-Saharan Africa, water scarcity is not merely a function of physical availability but is increasingly produced through institutional fragmentation, uneven infrastructure development, and socio-economic inequalities. Despite significant freshwater endowments, over 300 million people in Africa lack access to safe and reliable water services (African Development Bank, 2022).

Rapid urbanization, frequently characterized by unplanned spatial expansion, has intensified pressure on already constrained water systems, particularly in small and intermediate towns where planning capacity and financial resources remain limited. At the same time, climate variability, manifested through prolonged droughts and erratic rainfall patterns, has further destabilized hydrological systems, reducing both surface water availability and groundwater recharge. However, attributing water scarcity solely to climatic factors risks obscuring the central role of governance systems in mediating access, distribution, and control over water resources.

Recent scholarship has increasingly challenged deterministic narratives of water scarcity by foregrounding the role of institutions and power relations in shaping resource access. Within this perspective, decentralization reforms, widely promoted across Africa as a mechanism for improving service delivery, have generated mixed outcomes. In Kenya, the 2010 Constitution introduced devolution with the expectation that transferring water service responsibilities to county governments would enhance efficiency, accountability, and equity. While some improvements have been reported in major urban centres, growing evidence indicates that these gains have been uneven and spatially differentiated, with secondary towns continuing to experience chronic service deficits (KNBS, 2023; Mwangi & Kariuki, 2022, Kenya). This raises a critical paradox: why does water scarcity persist, and in some cases intensify, despite institutional reforms intended to address precisely these challenges?

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In the Lake Victoria Basin of western Kenya, these dynamics are particularly pronounced. Rapid urban expansion, driven by population growth and economic transformation, has been accompanied by significant land use and land cover changes, including the conversion of vegetated areas into built-up surfaces. Empirical studies in Kisumu and Homa Bay counties demonstrate that such transformations reduce infiltration capacity, increase surface runoff, and disrupt local hydrological cycles (Odhiambo *et al.*, 2022, Kenya). These environmental changes interact with governance constraints, such as overlapping institutional mandates, limited fiscal capacity, and weak coordination mechanisms, to produce highly uneven water access across urban populations. Consequently, water scarcity in this region cannot be adequately explained without considering the interplay between environmental processes and institutional performance.

Oyugis Town exemplifies these intersecting challenges. Over the past decade, the town has experienced rapid demographic and spatial growth linked to rural-to-urban migration and its expanding role as a commercial hub within Homa Bay County. However, this growth has not been matched by proportional investment in water infrastructure, resulting in widespread reliance on informal and often unreliable water sources, including boreholes, shallow wells, and private vendors. These systems, while filling critical service gaps, frequently operate outside formal regulatory frameworks, contributing to price volatility, quality concerns, and deepening socio-economic inequalities. At the same time, ongoing land use changes have reduced groundwater recharge potential, further constraining supply. The persistence of these conditions within a devolved governance framework raises important questions about the effectiveness of decentralization in addressing urban water insecurity in smaller towns.

Theoretically, this study draws on Integrated Water Resources Management (IWRM) and Political Ecology to interrogate these dynamics. IWRM provides a normative framework emphasizing coordinated management of water, land, and related resources across sectors and governance scales to achieve sustainability (Global Water Partnership, 2021). However, its implementation in practice has often been constrained by institutional fragmentation and capacity limitations, particularly in decentralized contexts. Political Ecology, by contrast, offers a critical lens that situates water scarcity within broader socio-political processes, highlighting how power relations, institutional arrangements, and economic structures shape differential access to resources (Robbins, 2020). By combining these perspectives, this study moves beyond technocratic explanations of water scarcity to examine how governance systems and environmental change interact to produce and reproduce water insecurity.

Despite growing interest in urban water governance, existing research remains heavily skewed towards large cities, with limited empirical attention to secondary towns where governance capacity is weaker and service delivery challenges are often more acute. Moreover, few studies explicitly integrate environmental drivers such as land use change and climate variability with institutional analysis to provide a holistic understanding of water scarcity dynamics. This gap is particularly evident in the Kenyan context, where the impacts of devolution on water service delivery in smaller urban centres remain underexplored and contested.

Against this backdrop, this study advances the argument that urban water scarcity in secondary towns is not simply a consequence of rapid urbanization or climatic stress, but is fundamentally shaped by the interaction between environmental change and the limits of decentralized governance. Focusing on Oyugis Town, the study seeks to interrogate how these dynamics converge to produce

persistent water insecurity despite ongoing institutional reforms. Specifically, it aims to: (1) examine the key drivers of urban water scarcity, including urbanization, land use change, and climate variability; (2) evaluate the effectiveness of devolved governance structures in influencing water resource management and service delivery; and (3) assess institutional responses and household coping strategies. In doing so, the study contributes to ongoing debates on decentralization and urban service delivery by providing empirically grounded insights into the challenges facing the “missing middle” of rapidly growing secondary towns in Sub-Saharan Africa.

## RESEARCH METHODOLOGY

The study adopted a convergent mixed-methods design to examine the multidimensional nature of urban water scarcity in Oyugis Town within a devolved governance context. This approach was informed by the recognition that water insecurity is not only a measurable service delivery outcome but also a socially constructed phenomenon shaped by institutional arrangements, environmental change, and household-level coping strategies. The integration of quantitative and qualitative data enabled a more comprehensive analysis of these interacting dynamics, consistent with recent applications in urban water governance research in Sub-Saharan Africa (Creswell & Plano Clark, 2021; UN-Habitat, 2022). Furthermore, the analytical approach was guided by a combined Integrated Water Resources Management (IWRM) and Political Ecology framework, which facilitated both systems-level assessment and critical interrogation of power relations influencing water access.

The study was conducted in Oyugis Town, located in Homa Bay County within the Lake Victoria Basin of western Kenya, an area characterized by rapid population growth and spatial expansion. The town's emergence as a commercial hub has intensified demand for water resources without corresponding infrastructural development, making it a suitable case for examining the limits of decentralised service delivery. The target population comprised households, institutional actors, and community stakeholders, reflecting the multi-scalar nature of water governance. Household-level data captured patterns of access, affordability, and coping strategies, while institutional actors provided insights into governance performance and service delivery constraints under devolution.

A sample size of 384 households was determined using Cochran's formula to ensure statistical representativeness at a 95% confidence level and a 5% margin of error. To account for spatial and socio-economic heterogeneity, a stratified random sampling technique was employed, with residential zones serving as strata to capture variations between formal and informal settlements. This approach is widely recommended in urban service delivery studies where access to infrastructure is unevenly distributed (World Bank, 2021). Within each stratum, households were selected through systematic random sampling. In addition, purposive sampling was used to identify key informants, including county water officials, utility managers, and local administrators, while focus group discussion participants were selected to reflect diversity in gender, age, and livelihood characteristics.

Data collection involved a combination of household surveys, key informant interviews, focus group discussions, field observations, and secondary data sources, enabling robust triangulation. The household questionnaire generated quantitative data on water sources, accessibility, reliability, affordability, and consumption patterns, and included Likert-scale items to assess perceptions of governance effectiveness under devolution. Surveys were administered through face-to-face interviews to enhance response accuracy and minimize

non-response bias, particularly in areas with varying literacy levels (KNBS, 2023). Key informant interviews provided detailed insights into institutional arrangements, policy implementation challenges, and financing constraints, while focus group discussions captured shared experiences and social dimensions of water insecurity, including gendered burdens of water collection (UNICEF, 2022).

Secondary data were utilized to contextualize and validate primary findings, including county policy documents, water utility reports, and climate data on rainfall variability. In addition, satellite imagery and land use datasets were analyzed to assess spatial changes influencing water availability, particularly the expansion of built-up areas and the reduction of groundwater recharge zones. The integration of spatial data strengthened the analysis by linking environmental transformations to observed patterns of water scarcity, an approach increasingly adopted in environmental planning research (FAO, 2021). This multi-source data strategy enhanced the robustness of the study and enabled cross-validation of findings.

Quantitative data were coded and analyzed using the Statistical Package for the Social Sciences (SPSS), generating descriptive statistics such as frequencies, percentages, and cross-tabulations to examine patterns of water access across socio-economic groups. Inferential analysis included chi-square tests to assess relationships between variables such as settlement type and water accessibility. Multiple linear regression analysis was conducted to identify key determinants of water scarcity, with predictors including urbanization, land use change, governance effectiveness, and climate variability. Diagnostic tests for multicollinearity, normality, and homoscedasticity were performed to ensure model robustness, strengthening the validity of the statistical results (Field, 2020).

Qualitative data from key informant interviews and focus group discussions were transcribed and analyzed thematically using NVivo software, following the framework outlined by Braun and Clarke (2021). Coding was conducted both deductively, based on predefined themes such as governance and infrastructure, and inductively to capture emergent patterns and contradictions. This approach facilitated deeper interpretation of institutional dynamics and community experiences, complementing the quantitative findings. Integration of qualitative and quantitative results was undertaken at the interpretation stage, enabling triangulation and providing a more nuanced understanding of how governance and environmental factors interact to shape water insecurity.

Several measures were implemented to ensure validity and reliability throughout the study. The questionnaire was pre-tested in a neighbouring town with similar socio-economic characteristics to refine its structure and clarity. Triangulation across multiple data sources enhanced credibility by cross-verifying findings, while member checking during interviews and discussions ensured that interpretations accurately reflected participants' perspectives (Creswell & Plano Clark, 2021). Quantitative reliability was further assessed using internal consistency measures for Likert-scale items, while regression diagnostics ensured robustness of inferential analysis.

Ethical considerations were strictly adhered to, with approval obtained from relevant institutional review bodies and local authorities. Informed consent was secured from all participants, who were assured of confidentiality, anonymity, and voluntary participation. Cultural sensitivity was maintained throughout the data collection process, and all data were handled in accordance with established ethical standards for social science research (UNICEF, 2022). These procedures ensured the integrity of the research process and the protection of participants.

Despite its strengths, the study has several limitations that should be acknowledged. The reliance on self-reported household data may introduce recall bias, particularly in estimating water consumption and expenditure. Additionally, while stratified sampling enhanced representativeness, highly mobile populations in informal settlements may be underrepresented. The cross-sectional nature of the study also limits the ability to capture seasonal variations in water availability, particularly during extreme climatic events. Furthermore, while regression analysis identifies significant associations, it does not establish causality, and findings should therefore be interpreted within this constraint.

Overall, the methodological approach adopted in this study provides a robust and integrative framework for analyzing urban water scarcity in secondary towns. By combining quantitative measurement, qualitative insights, and spatial analysis within a theoretically informed structure, the study captures both the material and institutional dimensions of water insecurity. This approach contributes to a more comprehensive understanding of how decentralized governance systems interact with environmental and socio-economic processes to shape water access, thereby offering valuable insights for policy and planning in rapidly urbanizing regions of Sub-Saharan Africa.

## RESULTS AND DISCUSSION

### Social-Demographic Characteristics of Respondents

The sample comprised 384 households representing a diverse cross-section of Oyugis Town's urban population. The gender distribution indicated that 56% of household heads were female and 44% were male, reflecting the significant role of women in household water management (see Table 1: Social-Demographic Characteristics). The majority of respondents (62%) were aged between 31 and 50 years, with 23% aged above 50 and 15% below 30, indicating a predominantly adult population. In terms of educational attainment, 68% had completed primary or secondary education, 21% possessed tertiary qualifications, and 11% had no formal education.

**Table 1: Social-Demographic Characteristics of Respondents**

Variable	Category	Frequency (n)	Percentage (%)
Gender	Male	178	46.4
	Female	206	53.6
Age	18–25	62	16.1
	26–35	104	27.1
	36–45	96	25.0
	46–55	70	18.2
	56+	52	13.5
	Education Level	No formal	48
Primary		126	32.8
Secondary		142	37.0
Tertiary		68	17.7
Occupation	Informal	168	43.8
	Self-employed	102	26.6
	Formal	58	15.1
	Unemployed	56	14.6

Source: Field Data, 2026

The average household size was 5.1 persons, with 47% of households classified as low-income, 39% as middle-income, and 14% as high-income based on self-reported monthly earnings. Most respondents (66%) were engaged in informal employment or small-scale trading, while the remainder worked in formal sectors or were unemployed. These socio-demographic patterns are consistent with recent studies in secondary towns in Kenya and Sub-Saharan Africa, where urbanization is accompanied by a youthful, economically diverse, and increasingly female-headed household structure (KNBS, 2023; Banda *et al.*, 2023).

### Urban Water Supply Patterns

The study reveals a highly fragmented urban water supply system, characterized by limited formal infrastructure and widespread reliance on informal sources. Only 13.5% of households reported access to piped water, while the majority depended on boreholes (31.8%), water vendors (27.1%), and shallow wells (22.4%). A small proportion (5.2%) relied on surface water sources such as rivers and streams (see Table 2: Household Water Sources). This dominance of informal provision underscores the consistent failure of formal infrastructure expansion to keep pace with rapid urbanization and spatial growth.

**Table 2: Water Sources**

Variable	Category	Frequency (n)	Percentage (%)
Water Source	Borehole	122	31.8
	Water vendors	104	27.1
	Shallow wells	86	22.4
	Piped water	52	13.5
	River/stream	20	5.2

Source: Field Data, 2026

Similar patterns have been documented in recent comparative studies of secondary towns in Sub-Saharan Africa, such as in Dodoma, Tanzania, and Kumasi, Ghana, where infrastructural deficits have fueled the commodification of water through informal markets (African Development Bank, 2022; Abubakar *et al.*, 2021; Kaseje *et al.*, 2022).

### Reliability of Water Supply

The reliability of water supply remains critically low, with 43.8% of households reporting unreliable access and 32.8% indicating very unreliable access (see Table 3: Reliability of Water Access). This means that over three-quarters of households face frequent supply interruptions. Only 4.7% reported very reliable access. Qualitative evidence attributes these disruptions to ageing infrastructure, inadequate pumping capacity, and weak operational coordination.

**Table 3: Reliability of Water Access**

Variable	Category	Frequency (n)	Percentage (%)
Reliability	Very reliable	18	4.7
	Reliable	72	18.8
	Unreliable	168	43.8
	Very unreliable	126	32.8

Source: Field Data, 2026

These findings indicate that water insecurity in Oyugis is not episodic but structurally embedded within institutional and infrastructural constraints. These patterns are mirrored in recent studies from secondary towns in Nigeria and Uganda, which similarly report

chronic reliability challenges rooted in systemic governance issues (UNEP, 2023; Olanrewaju *et al.*, 2022; Kazibweet *et al.*, 2021).

### Socio-Economic Implications of Water Scarcity

Time burdens associated with water collection have significant socio-economic consequences, including diminished labour productivity, lower school attendance, and restricted household welfare (see Table 4: Average Time Spent Collecting Water). Recent comparative research in Nairobi's informal settlements and in secondary towns in Ethiopia demonstrates that extended water collection times severely limit income-generating opportunities among low-income households (Mutisya *et al.*, 2022, Kenya; Gebremedhin *et al.*, 2021, Ethiopia). Consequently, water scarcity in Oyugis is not solely an infrastructural concern but constitutes a principal driver of urban socio-economic marginalization.

**Table 4: Water Accessibility and Time Burden**

Variable	Category	Frequency (n)	Percentage (%)
Distance to Source	<100m	74	19.3
	100 – 500m	102	26.6
	500 – 1km	126	32.8
	> 1km	82	21.4
Time Spent Fetching	<30 mins	68	17.7
	30 – 60 mins	104	27.1
	1 – 2 hours	138	35.9
	>2 hours	74	19.2

Source: Field Data, 2026

### Water Affordability and Market Dynamics

Water affordability is a critical dimension of urban inequality. Although 37.0% of households spend between KES 1,000 and 2,000 per month on water and 25.5% spend above KES 2,000, a substantial 73.4% still perceive water as unaffordable (see Table 5: Household Water Expenditure). This paradox underscores the inefficiencies and price distortions inherent in informal water markets, where scarcity enables unchecked price escalation. Comparable findings have emerged from recent studies in Dar es Salaam and Lusaka, revealing that informal vendors often charge significantly higher prices than formal utilities due to persistent supply constraints (Nganyanyuka *et al.*, 2021, Tanzania; Chitonge & Moya, 2022, Zambia).

**Table 5: Household Water Expenditure**

Variable	Category	Frequency (n)	Percentage (%)
Monthly Cost	<500	48	12.5
	500–1000	96	25.0
	1000–2000	142	37.0
	>2000	98	25.5
Affordability	Affordable	102	26.6
	Not affordable	282	73.4
Daily Consumption (Litres)	<50	126	32.8
	50–100	168	43.8
	100–200	70	18.2
	>200	20	5.2

Source: Field Data, 2026

### Patterns of Water Consumption

Water consumption patterns further underscore the severity of deprivation. A majority (32.8%) consume less than 50 liters per day,

while 43.8% consume between 50 and 100 liters, resulting in 76.6% of households falling below basic water consumption thresholds (see Table 6: Daily Household Water Consumption). This widespread rationing compels households to prioritize essential uses like drinking and cooking, often sacrificing hygiene and sanitation. Recent research in secondary towns across Ghana and Malawi corroborates that such constrained consumption patterns signal structural deprivation rooted in weak public provision, rather than individual behavioral choices (Kaseje *et al.*, 2022; Banda *et al.*, 2023).

**Table 6: Daily Household Water Consumption**

Variable	Category	Frequency (n)	Percentage (%)
Daily Consumption (Litres)	<50	126	32.8
	50–100	168	43.8
	100–200	70	18.2
	>200	20	5.2

Source: Field Data, 2026

### Drivers of Urban Water Scarcity

The results demonstrate that urban water scarcity in Oyugis Town is driven by multiple, interacting factors. Poor infrastructure was identified by 83.9% of respondents as the most significant driver, followed by population growth (77.6%), governance challenges (74.5%), climate variability (71.9%), and land use change (64.6%) (see Table 7: Perceived Drivers of Water Scarcity). The prominence of infrastructure deficits underscores a systemic failure to expand supply networks in line with urban growth. Recent comparative studies in Maputo (Mozambique), Kumasi (Ghana), and Arusha (Tanzania) reveal that secondary African towns face similar structural challenges, with infrastructure development persistently lagging behind demographic expansion (World Bank, 2023; Abubakar *et al.*, 2021; Banda *et al.*, 2023).

**Table 7: Perceived Drivers of Water Scarcity**

Driver	Frequency (n)	Percentage (%)
Population growth	298	77.6
Climate variability	276	71.9
Poor infrastructure	322	83.9
Land use change	248	64.6
Poor governance	286	74.5

Source: Field Data, 2026

### Environmental and Land Use Change

Land use change exerts a significant environmental influence, as qualitative data indicate that the conversion of vegetated areas to built-up surfaces reduces groundwater recharge and increases surface runoff. These findings align with recent studies from the Lake Victoria Basin and comparable urban contexts in Uganda, where urban expansion has disrupted local hydrological systems (Odhiambo *et al.*, 2022, Kenya; Kazibwe *et al.*, 2021, Uganda). Notably, governance challenges were ranked above climate variability, suggesting that institutional inefficiencies are perceived as more immediate constraints than environmental change. This reinforces Political Ecology perspectives that scarcity is primarily socially and institutionally mediated, rather than a purely natural phenomenon.

### Governance and Decentralization

Perceptions of governance under devolution reveal widespread dissatisfaction with water service delivery. All governance indicators

recorded low mean scores: perceived improvement under devolution scored 2.1, transparency 2.0, responsiveness 2.3, and infrastructure improvement 2.2 (see Table 8: Governance Perceptions under Devolution). These findings indicate that, although devolution has enhanced local participation, it has not translated into meaningful improvements in water service provision or addressed enduring structural constraints such as fiscal limitations and technical capacity deficits.

**Table 8: Governance Perceptions under Devolution (Likert Scale Mean Scores)**

Statement	Mean	Std. Dev
Devolution improved water services	2.1	0.9
County responsiveness	2.3	1.0
Transparency in governance	2.0	0.8
Infrastructure improvement	2.2	0.9

Source: Field Data, 2026

However, qualitative insights reveal a partial contradiction: some respondents acknowledged enhanced engagement in local decision-making processes. This suggests that while devolution has improved procedural governance, it has not delivered substantive service outcomes. Parallel findings in other Kenyan and Ugandan counties report that decentralization improved institutional proximity but failed to address persistent infrastructure and financing gaps (Wekesa & Onyango, 2023, Kenya; Kazibwe *et al.*, 2021, Uganda). This highlights a critical governance paradox, where decentralization, absent capacity reinforcement, may perpetuate rather than resolve service inequalities.

### Statistical Analysis and Modelling

Inferential analysis substantiates the multidimensional nature of water scarcity in Oyugis. A statistically significant relationship between settlement type and water access ( $\chi^2 = 18.72$ ,  $p < 0.05$ ) highlights persistent spatial inequality. Correlation analysis reveals a strong positive relationship between urbanization and water scarcity ( $r = 0.68$ ,  $p < 0.001$ ), and a negative relationship between climate variability and water availability ( $r = -0.61$ ,  $p < 0.001$ ) (Table 9). Governance effectiveness is positively associated with water access ( $r = 0.55$ ,  $p = 0.001$ ), confirming its critical mediating role. These quantitative findings are consistent with recent comparative studies in Addis Ababa and Accra, which demonstrate similar patterns of multidimensional scarcity and institutional mediation (Gebremedhin *et al.*, 2021, Ethiopia; Banda *et al.*, 2023, Ghana).

**Table 9: Correlation Analysis**

Variables	Correlation (r)	p-value
Urbanization vs Water Scarcity	0.68	0.000
Climate variability vs Water Availability	-0.61	0.000
Governance effectiveness vs Wateraccess	0.55	0.001

Source: Field Data, 2026

Regression analysis identifies urbanization ( $\beta = 0.42$ ), land use change ( $\beta = 0.31$ ), and governance ( $\beta = 0.28$ ) (Table 10) as significant predictors of water scarcity, while climate variability exerts a negative effect ( $\beta = -0.36$ ). The model explains 64% of variance ( $R^2 = 0.64$ ), demonstrating robust explanatory power (see Table 9: Regression Results). These results align with recent studies in Addis Ababa and Blantyre, where urban expansion and governance inefficiencies jointly determine water insecurity (Gebremedhin *et al.*,

2021, Ethiopia; Banda *et al.*, 2023, Malawi). Thus, water scarcity in Oyugis is best understood as a structurally produced outcome of intersecting environmental and governance systems, rather than as a singularly environmental constraint

**Table 10: Regression Analysis**

Variable	Beta ( $\beta$ )	Std. Error	p-value
Urbanization	0.42	0.05	0.000
Climate variability	-0.36	0.04	0.000
Governance	0.28	0.06	0.002
Land use change	0.31	0.05	0.001

**Model Summary:**  $R^2 = 0.64$ ,  $F = 48.2$  ( $p < 0.001$ )

**Source:** Field Data, 2026

## CONCLUSION

This study demonstrates that urban water scarcity in Oyugis Town is a complex, multidimensional challenge rooted in rapid urbanization, land use changes, climate variability, and persistent governance inefficiencies under devolution. The problem disproportionately affects low-income households, women, and informal workers, with only 13.5% of households accessing piped water and over three-quarters experiencing unreliable supply. Despite reforms aimed at decentralization, the anticipated improvements in water service delivery remain limited. The findings highlight infrastructure deficits and governance weaknesses as the principal drivers of water scarcity, outweighing the impact of climate variability alone. While devolution has fostered greater community participation, it has not translated into substantive functional outcomes, reflecting a gap between policy intent and practical delivery. Overall, water scarcity in Oyugis is best understood as the result of interconnected institutional, infrastructural, and environmental factors. Addressing these challenges requires integrated, infrastructure-led, and governance-responsive approaches, tailored to the unique needs of rapidly growing secondary towns in Sub-Saharan Africa.

## RECOMMENDATIONS

To address urban water scarcity in Oyugis and similar secondary towns, the study recommends prioritizing integrated, infrastructure-led, and governance-responsive strategies. First, substantial investment in water infrastructure is essential to expand piped water coverage and reduce reliance on informal, costly markets. Infrastructure planning should align with projected urban growth to avert future deficits. Second, county governments need to strengthen institutional capacity by enhancing technical skills, financial management, and inter-agency coordination to ensure efficient and equitable service delivery. Third, urban planning should integrate water-sensitive land use to protect groundwater recharge areas and manage the conversion of vegetated land into built-up zones. Fourth, promoting climate adaptation measures such as rainwater harvesting, decentralized storage, and diversified water sources will build resilience against variability. Finally, regulating and gradually integrating informal water markets into the formal system will help ensure affordability, quality, and fairness. These actions, tailored to local contexts, are vital for sustainable urban water security.

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