



SUSTAINABLE WATER RESOURCES MANAGEMENT FOR ENHANCED EQUITABLE ACCESS IN ZULULAND DISTRICT MUNICIPALITY, SOUTH AFRICA

Nomfundo Nomcebo Zulu ¹  and Innocent Simphiwe Nojiyeza ² 

1. Moses Kotane Research Institute. Email: research.assistant01@moseskotane.com

2. Durban University of Technology Business School. Email: InnocentNy@dut.ac.za

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Water is life. However, the difficulties in managing and maintaining water resources create challenges for accessing water in the Zululand District Municipality, leading to problems in most rural communities. Against this backdrop, the article examined the importance of sustainable water resources management in enhancing equitable access to water in the Zululand District Municipality. To guide this analysis, ecological economics was utilised as a suitable theoretical framework that balances the economic system and ecosystems. In terms of methodology, this article employed a quantitative method and applied a post-positivist paradigm to address the complex realities of sustainable water resources management. A stratified random sampling technique was selected to allow for the random selection of households. Subsequently, data were collected using questionnaires and analysed with the Statistical Package for the Social Sciences. The findings revealed that several municipalities in KwaZulu-Natal are facing unsustainable water provision, which harms both households and agricultural activities in these communities. In response, the article recommends that economic policies should promote conservation incentives, the development of new technologies, and equitable water distribution to strike a balance between economic growth and long-term water security.

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1. INTRODUCTION

Sustainable water management requires a fine balance among economic, social, and environmental needs. Water is a vital resource for human survival, economic development, and the stability of the ecosystem; however, it is becoming an increasingly scarce commodity due to the impacts of climate change, population growth, urbanisation, and industrialisation¹. These challenges must be addressed through effective water management strategies that ensure equitable access to clean water, promote efficient water use, and protect aquatic ecosystems.

Water resource management (WRM) ensures food and ecological security by maintaining a stable water supply and providing equitable access. Nonetheless, sustainable management of water resources is a vital component of development that reduces inequality and poverty, and promotes effective access to water (Wong et al., 2020). According to Stratford Global Intelligence, areas under water stress can experience effects that include reduced food and livestock production, population movements, increased living costs, starvation, and other problems, such as limited access to potable water². Thus, the issues of water access and availability worldwide are putting pressure on water resources and access in different countries, and South Africa is no exception.

The Zululand District Municipality (ZDM) faces significant challenges related to water availability, which hinder agricultural activities in the communities. Therefore, by promoting equitable water access, fairly allocating, and distributing water resources among communities, industries, and ecosystems, ZDM will address social and economic disparities and ensure effective water management for all stakeholders. The interconnected relationship between water resources and the environment emphasises the impact of human activities and the need for

¹ Q Guo, 'Strategies for a Resilient, Sustainable and Equitable Mississippi River Basin' (2023) 2(3) *River* 336–349.

² O Lai, *Water Shortages: Causes and Effects* (Earth.Org 2022).

protection for future generations³. Achieving equitable water use and environmental sustainability necessitates integrated approaches, stakeholder involvement in water decision-making, and the implementation of conservation strategies for water resources⁴.

This article is organised into seven sections. The first section provides an introduction to the study and outlines its context and significance. The second section presents the problem statement, highlighting the challenges associated with unsustainable water resource management and the need for sustainable interventions. The third section discusses the theoretical framework and empirical literature, with particular emphasis on sustainable water resource management and the relevance of ecological economics in promoting the sustainable utilisation of water resources. The fourth section outlines the study's contribution to knowledge by identifying the anticipated academic and practical value of the research. The fifth section describes the research methodology, including the tools, techniques, and methods employed to collect and analyse data. The sixth section presents and discusses the findings of the study in relation to the research objectives and existing literature. Finally, the seventh section provides the conclusion and recommendations, summarising the key insights and proposing measures to enhance sustainable water resource management.

2. PROBLEM STATEMENT AND STUDY JUSTIFICATION

Unsustainable management of water resources has led to significant challenges in various countries. Population growth further exacerbates

³ TA Bari, J Rimsha, M Adeel and Y Abdullah, 'Equitable Water Uses and Environmental Sustainability' in *Current Directions in Water Scarcity Research* vol 8 (Elsevier 2024) 135–148.

⁴ S Jahanshahi, R Kerachian and O Emamjomehzadeh, 'A Leader-Follower Framework for Sustainable Water Pricing and Allocation' (2023) 37(3) *Water Resources Management* 1257–1274.

water quality issues in many regions⁵. Additionally, ⁶ reports that millions of individuals worldwide lack reliable access to potable water. Water crises are particularly severe in rural areas, contributing to higher rates of household food insecurity. Furthermore, the Constitution of the Republic of South Africa (1996), Chapter 2, Section 27, affirms the right of every individual to sufficient food and water and mandates government support for those unable to access these necessities⁷.

3. THEORETICAL FRAMING AND EMPIRICAL LITERATURE

3.1 Sustainable Water Resources Management

Water holds great cultural and spiritual importance in society. In most rural areas, rivers and springs are often considered sacred, and some customs dictate how water should be used and respected. This cultural reverence for water can help promote sustainable water-use practices today, as communities may be more inclined to adopt measures that conserve and protect water sources. Although water is abundant, its usage has always been regulated by availability, quantity, and quality⁸.

Rapid global changes have heightened the importance of effective water resources management to address both human and environmental needs⁹. Sustainable water resources management involves planning, developing, and overseeing water resources to maintain both quantity and quality for all uses, ensuring availability for future generations. This approach includes addressing water-related risks such as floods, droughts, and

⁵ Anja du Plessis, 'Persistent Degradation: Global Water Quality Challenges and Required Actions' (2022) 5(2) *One Earth* 129–131.

⁶ S Omer, 'Global Water Crisis: Facts, FAQs, and How to Help' (2025) <https://www.worldvision.org/clean-water-news-stories/global-water-crisis-facts> accessed 5 September 2025.

⁷ Constitution of the Republic of South Africa, 1996, s 27(1)(b).

⁸ T Adam, 'Water Resource Management – Importance, Challenges and Techniques' (2021) <https://globalroadtechnology.com/water-resource-management-importance-challenges-techniques/> accessed 24 July 2025.

⁹ Guo (n 2) 4.

contamination¹⁰.¹¹ identify the promotion of informed decision-making and the implementation of integrated water resources management (IWRM) as key principles for effective water resource management.

3.2 Integrated Water Resources Management and Enhanced Water Access

Over the past two decades, IWRM has emerged as the dominant paradigm of WRM. It is widely recognised as one of the most influential policy models implemented in river basins worldwide, including in Africa¹². IWRM practices promote the decentralisation of water resource management and have been regarded as a mechanism for reforming the management of both land and water resources¹³. In South Africa, the National Water Policy (1997) and the National Water Act (Act 36 of 1998) were developed through extensive public participation and international expertise. During this period, the foundational philosophy and concepts of IWRM were shaped by key international engagements, declarations, and documents¹⁴.

Furthermore, promoting the participation of community members and relevant stakeholders is essential to achieving sustainable water access. Integrated Water Resources Management seeks to maximize the benefits of water resources by ensuring sufficient supplies for drinking water, sanitation, food production, energy generation, inland water transportation, and water-based recreation. It also aims to preserve

¹⁰ World Bank, *Water Resources Management* (2022). <https://www.worldbank.org/en/topic/waterresourcesmanagement> accessed 22 July 2025.

¹¹ CD Adzobu and BY Ampomah, 'Legislative and Institutional Reforms for Water Resources Management in Ghana' (2013) 30(3) *International Journal of Water Resources Development* 559–571.

¹² L Mehta, S Movik, A Bolding, B Derman and E Manzungu, 'Flows and Practices: The Politics of Integrated Water Resources Management in Southern Africa' (2016) 9(3) *Water Alternatives* 389–411.

¹³ G Meran, M Siehlow and C von Hirschhausen, *The Economics of Water: Rules and Institutions* (Springer 2021).

¹⁴ Department of Water and Sanitation, *National Water Resource Strategy: Water for an Equitable and Sustainable Future* (2nd edn, Republic of South Africa 2013).

healthy water-dependent ecosystems and protect the aesthetic and spiritual values associated with lakes, rivers, and estuaries¹⁵.

3.3 Impact of Climate Change on Water Accessibility and Availability

Climate change represents a significant challenge to water availability and other natural resources. It is a global issue that is difficult to manage due to its unpredictability¹⁶. According to FAO¹⁷, although there are many uncertainties associated with climate change, it generally leads to increased temperatures, greater precipitation intensity, more frequent storms, droughts, and extreme weather events. While changes in average precipitation are less predictable, precipitation patterns are expected to become more erratic, and seasonal shifts are likely.

Southern Africa has been experiencing a series of recurrent droughts over the past few decades (^{18,19}), resulting in many rural communities suffering from the impacts of these droughts. Droughts are costly hazards, with severe negative socio-economic impacts. Drought can be defined as a sustained period of deficit in water availability (such as precipitation, soil moisture, streamflow, groundwater) compared to the norm²⁰. WHO²¹ defines drought as a temporal imbalance of water availability resulting from a persistent lower-than-average precipitation of uncertain frequency, duration, and unpredictable severity. The four common types of droughts are described as (i) meteorological drought (precipitation deficiency), (ii) agricultural drought (soil water deficiency), (iii) hydrological drought

¹⁵ World Bank, *Water Resources Management* (2024) <https://www.worldbank.org/en/topic/waterresourcesmanagement> accessed 2 May 2025.

¹⁶ M Amparo-Salcedo, A Pérez-Gimeno and J Navarro-Pedreño, 'Water Security Under Climate Change: Challenges and Solutions Across 43 Countries' (2025) 17(5) *Water* 633.

¹⁷ Food and Agriculture Organization, *The State of the World's Land and Water Resources for Food and Agriculture: Managing Systems at Risk* (FAO 2018).

¹⁸ Food and Agriculture Organization, *The Future of Food and Agriculture: Trends and Challenges* (FAO 2017) <http://www.fao.org/3/a-i6583e.pdf> accessed 20 August 2025.

¹⁹ I Masih, S Maskey, FEF Mussá and P Trambauer, 'A Review of Droughts on the African Continent: A Geospatial and Long-Term Perspective' (2014) 18 *Hydrology and Earth System Sciences* 3635–3649.

²⁰ World Bank (n 10) 5.

²¹ World Health Organization, *Progress on Sanitation and Drinking Water: 2014 Update* (WHO/UNICEF Joint Monitoring Programme 2014).

(reduced streamflow and inflows from reservoirs), and (iv) socio-economic drought (social, economic, and environmental impacts)²².

Access to potable water is already a serious challenge in developing countries and is expected to become even more problematic as population growth and climate change exacerbate existing inadequate delivery systems and dysfunctional management institutions²³. A report by UN Water²⁴ explores how higher temperatures and more extreme, less predictable weather conditions are projected to affect the availability and distribution of rainfall, snowmelt, river flows, and groundwater, and further deteriorate water quality. Climate change impacts on water resources will have both direct and indirect effects on socio-economic development²⁵.

3.4 Ecological Economics Framing

Ecological economics was initiated during the late 20th century due to a need for environmental protection and economic stability²⁶. It was founded in the 1980s as a modern discipline based on the work of relations between various European and American academics. It was institutionalised with the establishment of the International Society for Ecological Economics in 1988, and, since then, the increasing number of regional societies illustrates the broad interest of researchers in the field of ecological economics²⁷. Ecological economist Malte Faber states that ecological economics is defined by its focus on nature, justice, and time.

²² LM Tallaksen and HAJ van Lanen, *Hydrological Drought: Processes and Estimation Methods for Streamflow and Groundwater* (Elsevier 2023).

²³ G Viljoen, 'The Transformed Property Regime of the National Water Act 36 of 1998' (2019) 52(2) *Law and Politics in Africa, Asia and Latin America* 94–172.

²⁴ UN-Water, *Progress on Integrated Water Resources Management: Global Indicator 6.5.1 Updates and Acceleration Needs* (2021) <https://www.unwater.org> accessed 6 August 2025.

²⁵ S Kusangaya, ML Warburton, EA van Garderen and GPW Jewitt, *Impact of Climate Change on Water Resources in Southern Africa* (Centre for Water Resources Research, University of KwaZulu-Natal 2013).

²⁶ M Ndou and CO Aigbavboa, 'A Theoretical Review of Ecological Economic Thinking amongst Professionals in the Built Environment' (2017) 7 *Procedia Manufacturing* 523–528.

²⁷ R Pagett, *Good Practice for Resilience Planning to Address Water Governance Challenges in Africa* (FIG Publications 2021).

Additionally, issues of intergenerational equity (the idea of fairness or justice between generations, such as using natural resources in a way that prioritises future generations), irreversibility of environmental change (such as species extinction), and uncertainty of long-term outcomes and sustainable development guide ecological economic analysis and valuation²⁸.

3.5 Understanding Ecological Economics

Ecological economics addresses the relationships between ecosystems and economic systems in the broadest sense and, thus, stresses the importance of these relationships to promote a sustainable economy²⁹. However, these relationships are also the locus of many of the most pressing problems of the present (such as sustainability, acid rain, global warming, species extinction, and wealth distribution). Ecological economics aims to develop a deeper scientific understanding of the complex linkages between human and natural systems, and to use that understanding to develop effective policies that will lead to an ecologically sustainable world, have a fair distribution of resources, and efficiently allocate scarce resources, including natural and social capital³⁰.

In addition, ecological economics plays a major role in stressing that sustainability is a multifaceted factor, focusing on different elements of sustainability, such as economic sustainability (natural resources), ecological sustainability (living and non-living organisms), and social sustainability (human rights). Therefore, the sustainable management of water resources is of critical importance for maintaining safe water and minimising the effects of detrimental behaviour³¹.

²⁸ JC Enders and M Remig, *Theories of Sustainable Development* (Routledge 2015).

²⁹ T Smith, *A Short Introduction to Ecological Economics* (Munich Personal RePEc Archive 2025).

³⁰ E Hay, 'An Ecology of Bad Ideas: Approaching Human Relations with Wider Nature from an Ecological-Complexity Perspective' (2024) 56(2) *African Journal of Ecology*.

³¹ Smith (n 29) 7.

3.6 Sustainability of Water Resources

Economic activities depend upon the availability of water, including its quality. The United Nations Children’s Fund³² argues that scarcity and the misuse of freshwater pose serious and growing threats to sustainable development and protection of the environment, emphasising that human health and welfare, food security, economic development and ecosystems are all at risk, unless water resources are managed more effectively in the future than they have been in the past. A study conducted by Logar³³ observes that even though water shortages are occurring throughout the world, numerous studies document how small communities, industries (i.e., agriculture), developing countries, and industrialised economies are all mismanaging water resources.

As a result of population density, agricultural and industrial use, and water pollution from human activity, the governance of water resources is critical to maintaining safe water. Poor water resources management is due to a lack of coordination among institutions, insufficient funds, and low priority in government policy agendas. Moreover, sustainable water resources management addresses equity and efficiency in resource and service allocation and distribution, water administration, the balancing of use between economic and ecosystem needs, policies, legislation and institutions, as well as the clarification of the roles of government, civil society and the private sector in water management (^{34,35}).

³² UNICEF, ‘Water Scarcity: Addressing the Growing Lack of Available Water to Meet Children’s Needs’ (2020) <https://www.unicef.org/wash/waterscarcity> accessed 18 July 2025.

³³ I Logar, ‘Environmental Economics (EnvEco)’ (2018) <https://www.eawag.ch/en/deparment/es/main-focus/environment-economics-enveco/> accessed 20 August 2025.

³⁴ THF Wong, BC Rogers and RR Brown, ‘Transforming Cities through Water-Sensitive Principles and Practices’ (2020) 3(4) *One Earth* 436–447.

³⁵ Organisation for Economic Co-operation and Development, *OECD Principles on Water Governance* (OECD 2015) <https://www.oecd.org/cfe/regionaldevelopment/OECD-Principles-on-Water-Governance-en.pdf> accessed 11 May 2025.

3.7 Equity in Water

Good water governance and sustainable water resources management are increasingly being recognised as a process that can address critical water challenges such as those of scarcity, risk, service delivery, infrastructure maintenance, ecosystem degradation, deepening citizen participation, and negotiating multiple values associated with water resources and related services^(36,37). Inefficient regulatory enforcement, poor accountability measures, and a near-absence of cooperative governance have manifested as inequitable water allocations among multiple user sectors, particularly between the privileged irrigated agriculture and the less privileged sections of domestic users and emerging farmers³⁸.

Ecological economists argue that the economy must be composed of equity, sustainability, and economic efficiency. Hence, there is growing recognition that equity is important for development. Although issues of equity and inequality had been debated for some time, there is a need for major development that focuses on these issues. In addition, it is indicated that equity is based on the idea of moral equality, the principle that people should be treated as equals regardless of their gender, race, or religion. Thus, despite many differences, all people share a common humanity or human dignity, and, because of this, one must consider how each of them should be treated³⁹.

³⁶ C Pahl-Wostl, 'The Role of Governance Modes and Meta-Governance in the Transformation towards Sustainable Water Governance' (2019) 91 *Environmental Science and Policy* 6–16.

³⁷ SV Berg, 'Seven Elements Affecting Governance and Performance in the Water Sector' (2016) 43 *Utilities Policy* 4–13.

³⁸ ON Odume, 'Searching for Urban Pollution Signatures and Sensitive Macroinvertebrate Traits and Ecological Preferences in a River in the Eastern Cape of South Africa' (2020) 108 *Ecological Indicators* 105759.

³⁹ JP Guyer, *An Introduction to Water Supply Systems Operation and Maintenance* (Continuing Education and Development Inc 2015).

Accordingly, equity in access to and use of water and the distribution of the impacts of water resource development interventions have four elements⁴⁰:

- i. *Social equity*: equity between different groups of people living in the same location (i.e., if nearby towns can have access to water, also rural communities must be able to have access).
- ii. *Spatial equity*: equity between people living in different regions (i.e., rural people must have the same benefits compared to their urban counterparts).
- iii. *Gender equity*: equity between men and women in sharing labour costs, efforts to access and use water and its benefits (i.e., giving women priority because water scarcity poses a major threat to them since they are the ones who fetch water from long distances).
- iv. *Inter-generational equity*: equity in the enjoyment of natural resources, including water, across generations of people (i.e., giving rural communities preference over natural resources found in their areas).

Everyone, without exception, has a right to adequate and clean water that is suitable and physically available⁴¹. However, in most cases, rivers are in rural communities of ZDM, but rural communities suffer more from water scarcity. Hence, rural people must be prioritised and be the first to benefit from local rivers.

4. CONTRIBUTION TO KNOWLEDGE

Although most people have access to piped water, the country struggles with limited water resources. Another concern is the unequal distribution of water supply resources, with some regions having an overabundance of

⁴⁰ SJ Phansalkar, 'Water, Equity and Development' (2007) 3(1) *International Journal of Rural Management* 1–25.

⁴¹ NN Ndimande, 'Equitable Access to Water at Alfred Duma Local Municipality' in IS Nojiyeza, O Mtapuri, P Bazaanah and EE Netshiozwi (eds), *Resource Management and the Struggle for Water Sustainability in Africa* (IGI Global 2021).

water while others face significant scarcity. This has resulted in conflicts over water rights and allocation, particularly between rural and urban communities. Efforts have been made to address these challenges, including infrastructure investments and water conservation campaigns. However, there is still much work to be done to ensure that South Africa's water supply is adequate, equitable, and sustainable for all its citizens⁴². This article focuses on the issue of water resources management at a local level in rural areas, whereas most studies are more concerned with a country as a whole. The aim is to stress the importance of improved sustainable water resources management through policies and principles of ecological economics to balance the economy and the ecosystem.

5. RESEARCH METHODOLOGY

This article employed a descriptive design linked with a quantitative method. Quantitative research method draws conclusions from large numbers of people, uses numerical data from selected subgroups, demonstrates relationships, examines probable cause and effect, controls for bias controlled and establishes efficient data analysis. The questionnaires were utilised in collecting data with questions designed in two languages (English and IsiZulu) as the study area is largely dominated by IsiZulu-speaking households. This article also used a post-positivist paradigm. Using a post-positivist paradigm in studying water resources management values the integration of traditional knowledge and scientific methods, and encourages critical reflection, making it well-suited for addressing the complex realities of sustainable water resources management.

The stratified random sampling technique was selected to allow the selection of households randomly. The households involved three communities from three municipalities: AbaQulusi Local Municipality, Nongoma Local Municipality, and Ulundi Local Municipality (ALM, NLM, and ULM) of Zululand District Municipality. Through Miller and Brewer's formula: $n = N / [1 + N (\alpha)^2]$, the sample size of 373 respondents

⁴² G Seruwagi, *The State of South Africa's Water Supply* (MANZI Publications 2024).

was used for this article, and the Statistical Package for the Social Sciences (SPSS) was used as a tool to present and analyse data.

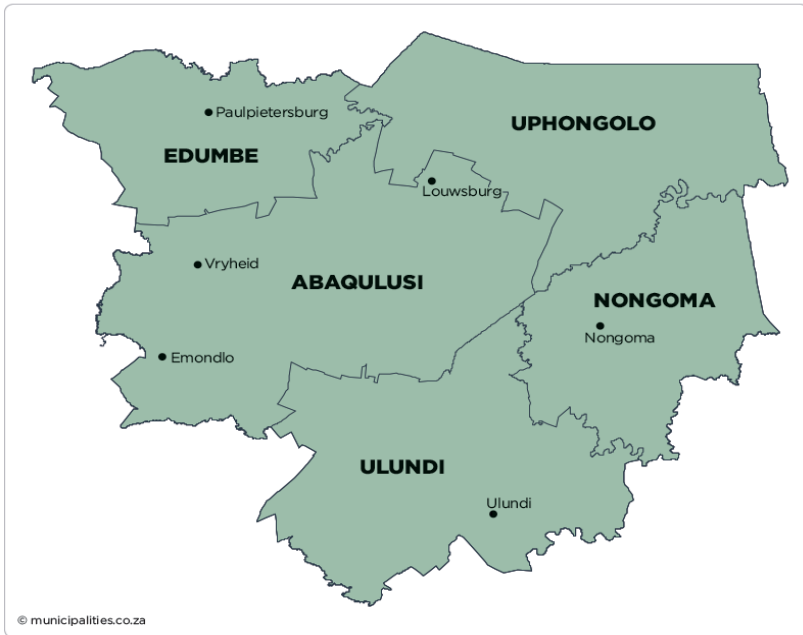


Figure 5.1: Zululand District Municipality map

Source: ⁴³

6. FINDINGS AND DISCUSSION

6.1 Characteristics of Respondents

The following characteristics helped understand how the demographic features of these three municipalities are affected by the prevalence of equitable water access.

⁴³ Zululand District Municipality, 'Municipalities of South Africa' (2026) <https://municipalities.co.za/map/125/zululand-district-municipality> accessed 20 June 2026.

6.1.1 Education Category

The results presented in Table 6.1 reveal that most of the respondents (67.3%) have a secondary educational level, followed by 26% who acquired a tertiary education, about 5.4% of the respondents had a primary education, and, lastly, about 1.3% were illiterate.

Table 6.1: Education status

		Frequency	Percent
Valid	None	5	1.3
	Primary	20	5.4
	Secondary	251	67.3
	Tertiary	97	26.0
	Total	373	100.0

Source: Fieldwork (2023)

Government policies on education place emphasis on the basic education phase as the foundation for lifelong learning but also reiterate the need to expand the duration of education for better outcomes in knowledge and life skills. This is because many areas of social and economic development require skills and understanding only to be developed in higher education. However, one of the biggest impediments to higher educational attainment in South Africa is the low levels of progression of learners within the further education and training phase. This results in a lower percentage of youth achieving a national senior certificate (NSC) pass. In 2017, the progression rates of Grade 10 learners to Grade 11 were 80,8%, whereas only 73,3% of Grade 11 learners progressed to Grade 12. This does not consider the learners who left the school system before reaching those grades.

The breakdown by gender showed lower progression rates for men compared to women. In 2017, 80,8% of enrolled learners wrote the NSC

exams. During the same period, the NSC pass rate among male candidates was 77,2% and 73,4% among women. The percentage of first-time entering students as a ratio of total bachelor and diploma passes declined over the years, with less than half of those who achieved bachelor or diploma passes being enrolled as first-time students in 2016 (46,5%). First-time enrolments at public universities increased by 82,6% from 2000 to 2011 but declined from then onwards. The absolute numbers of continuing students increased by 59,5% between 2000 and 2016⁴⁴.

From an ecological economics perspective, the observed low levels of education within the study area are not only a socio-economic concern but also a critical constraint on sustainable resource management and environmental outcomes. Ecological economics emphasises the interdependence between human systems and natural ecosystems, recognising that human behaviour, knowledge, and institutions significantly shape environmental sustainability. In this regard, limited educational attainment contributes to high unemployment levels (^{45,46,47}), while simultaneously restricting the capacity of communities to adopt environmentally responsible practices, particularly in relation to water conservation and sustainable livelihood strategies.

Furthermore, the results imply that an educated, trained, and well-informed population is relevant for promoting ecologically friendly attitudes and changing attitudes towards water conservation and livelihood activities within the community. Black people also lack access to service delivery, including education and water. An ill-informed and illiterate predominantly black population could invariably affect water quality and quantities required for human consumption and productive activities in the study communities.

⁴⁴ Statistics South Africa, *Education Series Volume V* (2019) <https://www.statssa.gov.za> accessed 16 July 2025.

⁴⁵ Abaqulusi Local Municipality, *Integrated Development Plan 2021/2022* (2022) <https://www.abaqulusi.gov.za/index.php/docs-info/category/6-idp.html> accessed 5 August 2025.

⁴⁶ Nongoma Local Municipality, *Integrated Development Plan 2022/2023* (2023) <https://nongoma.gov.za/download/nongoma-lm-2022-2023-idp/> accessed 5 August 2025.

⁴⁷ Ulundi Local Municipality, *Integrated Development Plan 2023/2024* (2024) https://www.ulundi.gov.za/idp_new accessed 10 July 2025.

6.1.2 Employment Category

As shown in Table 6.2, the study discovered that most of the respondents were unemployed (79.9% and only 20.1% of the respondents were employed. The lower levels of education, as stated in Table 6.5, have a major effect on the employment status.

Table 6.2: Employment status

		Frequency	Percent
Valid	Employed	75	20.1
	Unemployed	298	79.9
	Total	373	100.0

Source: Fieldwork (2023)

Lack of education reduces the chance of employment and the quality of jobs engaged in⁴⁸. South Africa is one of the countries with the highest unemployment rate on the African continent and globally. As of 2021, the unemployment rate stood at almost 34%. The job market had low employment rates, limited youth labour participation, and higher unemployment among youth and women. Furthermore, the labour market took a significant decline due to the coronavirus (COVID-19) pandemic. Between 2021 and 2022, a primary worry among South Africans was unemployment and finding jobs⁴⁹.

Education plays a crucial role in equipping young people with the skills and competencies necessary to succeed in the workforce. However,

⁴⁸ M John and AS Susuman, ‘The Impact of Education and Employment on Economic Competitiveness: A Comparative Analysis of South African Provinces’ (2024) *Journal of Asian and African Studies* 1–19.

⁴⁹ K Shah, ‘Diagnosing South Africa’s High Unemployment and Low Informality’ (CID Research Fellow and Graduate Student Working Paper No 138, Harvard College Growth Lab Publications, 2022).

according to the Quarterly Labour Force Survey for the 1st Quarter of 2024, only 9,8% of the employed youth were graduates. Limited educational attainment, as well as social and economic disadvantages, are the primary factors driving elevated rates of unemployment and the significant proportion of youth not in employment, education, or training in South Africa⁵⁰. According to Statistics South Africa⁵¹, over 30% of youth are unemployed in the Republic of South Africa, which further contributes to financial constraints in the district. Moreover, the study found that most of the respondents with secondary education were unemployed as they lacked appropriate qualifications for seeking decent employment.

Consequently, these dynamics can be perceived as part of a larger disparity among human abilities, economic frameworks, and ecological sustainability. Ecological economics highlights the interconnectedness of social welfare, economic endeavours, and the management of natural resources, positing that sustainable development necessitates investment in human capital in conjunction with the careful utilisation of environmental resources (⁵²; ⁵³). In this context, education serves not only to gain employment but also as an essential element in fostering adaptive capacity and empowering individuals to participate in sustainable livelihood strategies. Therefore, the extent of respondents' tertiary education further influences their capacity to secure stable employment, which is crucial for addressing water access challenges.

6.1.3 Income Category

The results from Table 6.3 showed that the number of respondents with no income is higher (52.3%) than the number of respondents who receive income (35.1%). Moreover, of the respondents who receive income, most

⁵⁰ Statistics South Africa, 'Unemployment in South Africa: A Youth Perspective' (2024) <https://www.statssa.gov.za/?p=17266> accessed 16 July 2025.

⁵¹ Statistics South Africa, 'Statistics South Africa' (2023) <https://www.statssa.gov.za> accessed 18 July 2025.

⁵² Robert Costanza and others, 'Changes in the Global Value of Ecosystem Services' (2014) 26 *Global Environmental Change* 152–158.

⁵³ Herman E Daly, *Beyond Growth: The Economics of Sustainable Development* (Beacon Press 1996).

receive less than R3 500 per month (8.6%), with only 4% of the respondents receiving more than R3 500 per month.

Table 6.3: Income status

		Frequency	Percent
Valid	Receives income	131	35.1
	No income	195	52.3
	Income more than R3 500.00 p/m	15	4.0
	Income less than R3 500.00 p/m	32	8.6
	Total	373	100.0

Source: Fieldwork (2023)

As evident in Table 6.3, some income inequalities exist among the respondents. Income inequality has always been very large and indicative of the enduring hierarchical structure of the global economic system⁵⁴. In addition, high unemployment is a major factor behind inequality levels. South Africa’s unemployment rate is significantly higher than other emerging markets, with youth unemployment being very high. Creating more low-skilled jobs to improve labour force participation, especially in the poorest provinces, will spur inclusion. Employment prospects can be enhanced by improving the quality of education and facilitating affordable transportation to job centres⁵⁵.

Since 2006, there has been a greater dependence on government social grants and less reliance on income from the labour market in the bottom deciles. While labour market income is overwhelmingly the largest

⁵⁴ Lucas Chancel and Thomas Piketty, ‘Global Income Inequality, 1820–2020: The Persistence and Mutation of Extreme Inequality’ (2021) 19(6) *Journal of the European Economic Association* 3025–3062.

⁵⁵ International Monetary Fund, ‘Six Charts Explain South Africa’s Persistent and Multi-Faceted Inequality’ (2020) <https://www.imf.org/en/News/Articles/2020/01/29/na012820-six-charts-on-south-africas-persistent-and-multi-faceted-inequality> accessed 16 July 2025.

contributor to income inequality, when compared to other income sources, social grants and remittances have played a crucial role in reducing the income inequality gap between the bottom and top deciles over the years in South Africa⁵⁶. Nonetheless, income is a major obstacle for many low-income households, particularly in developing countries.

The Gini-Coefficient for the Zululand district is 0.57. This is lower than the national and provincial totals, which are both at 0.63. The average annual income is R15 000, which is about half of the KwaZulu-Natal (KZN) and South Africa averages, with 16% of the households reporting no income and 66% of them reporting that they earn less than R40 000 per annum⁵⁷. Moreover, the upfront costs required for securing water facilities at home are expensive and render many households below the income threshold and with unequal access to water⁵⁸.

6.2 Water Resources Management

Most countries are placing unprecedented pressure on water resources. The global population is growing fast, and estimates show that, with current practices, the world will face a 40% shortfall between forecast demand and the available supply of water by 2030⁵⁹. Thus, as stated earlier, it is important to promote participation of the community and other relevant stakeholders to ensure sustainability in water resources and access. Stakeholder engagement and participation are prerequisites for any innovative sustainable system of water resource management in post-independence South Africa. Additionally, stakeholder engagement is an essential component of reforms and foundational in developing comprehensive pieces of legislation and policies for sustainable water resource management⁶⁰.

⁵⁶ Statistics South Africa (n 50) 16.

⁵⁷ Zululand District Municipality, *Water Services Development Plan 2017–2021* (ZDM 2019).

⁵⁸ J Ikeda and K Liffiton, *Fintech for the Water Sector: Advancing Financial Inclusion for More Equitable Access to Water* (World Bank 2019).

⁵⁹ World Bank (n 15) 17.

⁶⁰ RK Adom and MD Simatele, 'The Role of Stakeholder Engagement in Sustainable Water Resource Management in South Africa' (2022) 46(5) *Natural Resources Forum* 410–427.

However, despite the guidelines contained in global and national ecological frameworks, which stress broader participation of stakeholders at all levels of water management and governance, many countries across the world barely take public participation into consideration. The interests of women and marginalised groups are often overlooked in the participatory process. Meanwhile, it is widely acknowledged that regulating water use to meet future demands and crafting effective strategies require collective decision-making with all stakeholders on board⁶¹. Therefore, in this section, the study examined respondents' perceptions of the importance of WRM.

6.2.1 Management of Water Resources Towards Meeting Human and Environmental Needs

In the graph of Figure 6.1, the study analysed respondents' perceptions of whether management of water resources is significant towards meeting human and environmental needs.

⁶¹ M Grzybowski and K Glińska-Lewczuk, 'Principal Threats to the Conservation of Freshwater Habitats in the Continental Biogeographical Region' (2019) 28 *Biodiversity and Conservation* 4065–4070.

Management of water resources is significant towards meeting human and environmental needs.

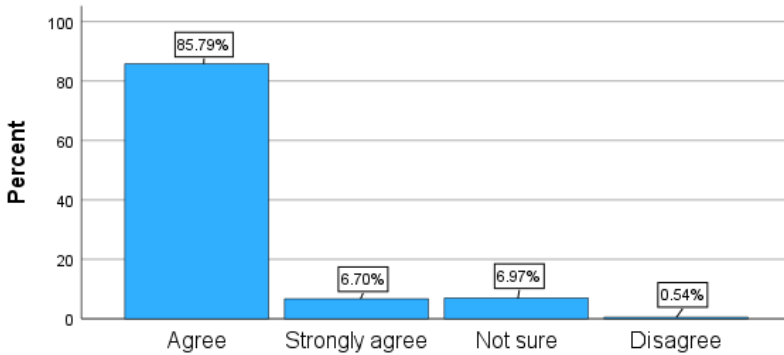


Figure 6.1: Management of water resources is significant towards meeting human and environmental needs

Source: Fieldwork (2023)

The DWS is the custodian of water in South Africa. It is ultimately responsible for ensuring that water as a resource, from rivers, lakes, and dams, is allocated equitably and used beneficially in the public interest, while promoting environmental values⁶². The ZDM is the WSP for the entire district except for the urban areas within the ALM⁶³. The results illustrated in Figure 6.1 show that most of the respondents (85.8%) agreed that management of water resources is significant towards meeting human and environmental needs. Moreover, 6.7% strongly agreed, while 7% were uncertain, and only 0.5% disagreed. The results indicate the important role that stakeholders must play to achieve the sustainable supply of water.

Nonetheless, as stated before, WRM aims to maximise the benefits of water by ensuring adequate water supplies for drinking water and

⁶² Department of Water and Sanitation, *Water is Life, Sanitation is Dignity* (2024) https://www.dws.gov.za/2020Vision/docs/BROCHURE_BLM_.pdf accessed 25 June 2024.

⁶³ Zululand District Municipality (n 43) 19.

sanitation⁶⁴. From an ecological economics standpoint, effective WRM requires integrating considerations of resource scarcity, environmental thresholds, and social equity into planning and decision-making processes. Literature highlights that sustainable water management must align economic utilisation with ecological resilience, particularly in regions experiencing water stress and infrastructural constraints⁶⁵. This is especially relevant in ZDM, where several municipalities face unsustainable water provision, adversely affecting household welfare and agricultural productivity⁶⁶. Hence, to ensure proper management of water resources, there must be a promotion of decision-making and action at the lowest appropriate level⁶⁷.

6.2.2 Water Resources Management for Food and Ecological Security

Figure 6.2 shows the investigated respondents' perceptions of whether WRM is crucial for food and ecological security.

⁶⁴ World Bank, *Water Resources Management* (2017) <https://www.aquatechtrade.com/news/water-treatment/water-resource-management-essential-guide/> accessed 7 October 2025.

⁶⁵ J Olley, M Cvitanovic, T Ginige and L Bunt-MacRury, 'A Systematic Literature Review of Sustainable Water Management in South Africa' (2024) 10(162) *Sustainable Water Resources Management* 2–21.

⁶⁶ Department of Water and Sanitation (n 62) 19.

⁶⁷ RK Adom and MD Simatele (n 11) 19.

Water resource management is crucial for food and ecological security.

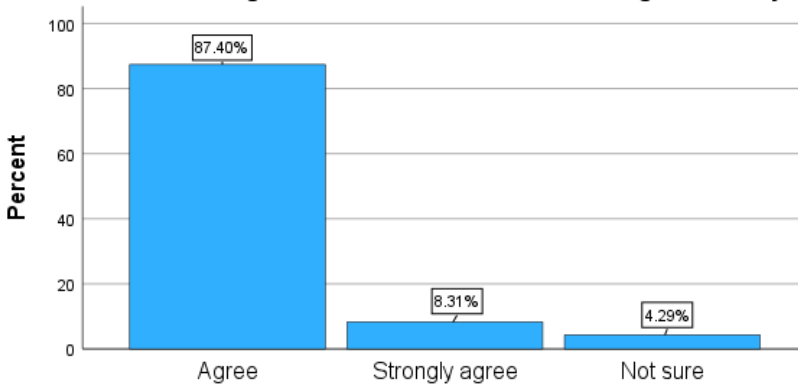


Figure 6.2: Water resources are crucial for food and ecological security.

Source: Fieldwork (2023)

The results show that 87.4% of the respondents agreed that water resource management is crucial for food and ecological security. Moreover, 8.3% of respondents strongly agreed, and 4.3% were unsure. About 40% of all irrigation water is obtained from groundwater. Sustainable use of groundwater requires that pumping does not exceed the aquifer's safe yield⁶⁸. Most rural areas in ZDM practise subsistence farming to attain food. Hence, they need a water supply without jeopardising the environment and their health by using local rivers and dams. A study conducted by McLaughlin and Kinzelbach⁶⁹ asserts that the projected growth in global water and food demand until mid-century will challenge the ability to continue recent increases in crop yield and will have a significant impact on natural resources.

Access to both agricultural land and water resources continue to be disproportionately concentrated along racial lines. In most parts of South Africa, white commercial farmers divert water from the rivers and store it

⁶⁸ FAO (n 17) 20.

⁶⁹ D McLaughlin and W Kinzelbach, 'Food Security and Sustainable Resource Management' (2015) 51(7) *Water Resources Research* 4966–4985.

in dams that they own. The unequal distribution of agricultural land and water resources in South Africa reflects deeply embedded historical and institutional inequalities that continue to shape access to natural capital. Ecological economics argues that inequitable access to environmental assets such as water and land undermines both social justice and sustainability⁷⁰. In South Africa, access to water remains disproportionately concentrated along racial and economic lines, a legacy of colonial and apartheid systems that privileged white commercial farmers, who continue to control significant water resources through private abstraction and storage infrastructure such as dams.

Furthermore, ecological economics advocates for participatory and decentralised governance systems as mechanisms to promote equitable resource distribution and sustainable management. Decentralised water resource management can facilitate the inclusion of historically disadvantaged individuals in decision-making processes, thereby enhancing local agency and enabling communities to reshape their socio-economic conditions. This aligns with broader ecological economics principles that emphasise democratic participation, local knowledge, and collective stewardship of natural resources as pathways to sustainability⁷¹. Therefore, the Zulu Kingdom can play a significant role in assisting historically disadvantaged individuals to practise commercial farming and have access to water.

6.2.3 Climate Change and Its Effect on Water Resources and Availability

In Figure 6.3, the graph shows the respondents' views on whether climate change is a major problem affecting water availability.

⁷⁰ Lucas Chancel, *Unsustainable Inequalities: Social Justice and the Environment* (Harvard University Press 2020).

⁷¹ L Mendez-Barrientos, JS Kemerink, P Wester and F Molle, 'Commercial Farmers' Strategies to Control Water Resources in South Africa: An Empirical View of Reform' (2016) *International Journal of Water Resources Development*.

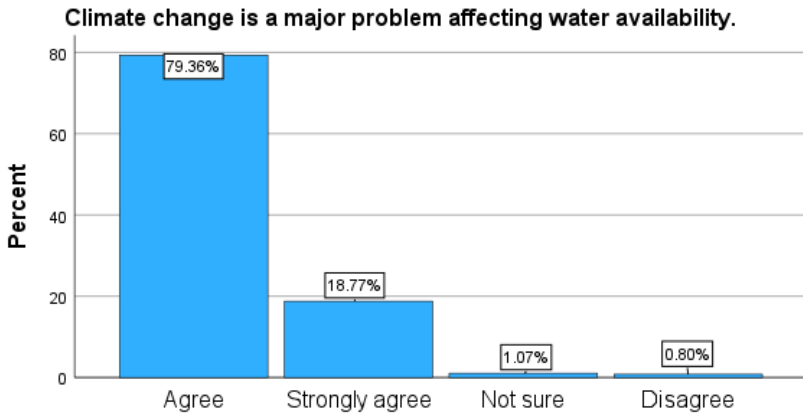


Figure 6.3: Climate change is a major problem affecting water resources and availability

Source: Fieldwork (2023)

As evident in Figure 6.3, the outcomes display that most of the respondents (79.4%) agreed that climate change is a major problem affecting water resources and availability. About 18.77% of the respondents strongly agreed, while 1.1% were uncertain, and 0.8% disagreed. The African continent has been identified as particularly vulnerable to the changing climate due to its low adaptive capacity and vulnerability. The Southern African region is regarded as one of the most vulnerable regions in Africa. Within the climate change matrix, water resources are at the epicentre of projected climate change impacts. If the observed changes in climate in the last century persist into the future, the potential impacts on water resources are likely to increase in magnitude, diversity, and severity. Hence, climate change impacts on water resources will have both direct and indirect effects on the socio-economic and biophysical environments⁷².

Additionally, the relationship between climate change, water resources, and economic performance can be understood as an interaction between

⁷² S Kusangaya, ML Warburton, EA van Garderen and GPW Jewitt (n 25) 22.

ecological systems and economic systems, where environmental constraints directly shape economic outcomes. Ecological economics emphasises that the economy is embedded within, and dependent on, natural systems such as the hydrological cycle, making water availability a critical form of natural capital. Climate change has increasingly disrupted this natural capital base, particularly through altered rainfall patterns, increased evaporation, and more frequent droughts. These changes have placed significant pressure on water systems, threatening both household water access and agricultural productivity. As noted by the OECD⁷³, climate change is intensifying water scarcity through changes in runoff, soil moisture, and evaporation, thereby constraining economic growth and reducing living standards.

The water cycle is part of our everyday lives, but climate change may have dire consequences for everyday water access⁷⁴. South Africa has a long history of recurrent droughts that have adversely affected its economic performance. The 2015 drought was declared the most serious in 26 years and impaired key agricultural sectors, including the forestry sector⁷⁵. Nonetheless, KZN and other provinces are experiencing climate change challenges that result in adverse effects, such as extreme weather conditions, heat waves, drought, and floods⁷⁶. The findings further imply that an effective relationship between ecosystems and economic systems (ecological economics) can play a significant role in addressing issues caused by climate change⁷⁷.

⁷³ OECD, *Economic Surveys: South Africa* (OECD 2025).

⁷⁴ National Geographic Society, 'How Climate Change Impacts Water Access' (2024) <https://education.nationalgeographic.org/resource/how-climate-change-impacts-water-access/> accessed 2 August 2025.

⁷⁵ S Xulu, K Peerbhay, M Gebreslasie and R Ismail, 'Drought Influence on Forest Plantations in Zululand, South Africa, Using MODIS Time Series and Climate Data' (2018) 9(9) *Forests* 528.

⁷⁶ IMS Anekwe, H Zhou, MM Mkhize and SO Akpasi, 'Addressing Climate Change Challenges in South Africa: A Study in KwaZulu-Natal Province' in *Sustainable Development Goals Series* (Springer 2024) 475–496.

⁷⁷ T Distefano and S Kelly, 'Are We in Deep Water? Water Scarcity and Its Limits to Economic Growth' (2017) 142 *Ecological Economics* 130–147.

6.3 Integrated Water Resources Management and Water Access

According to Dirwai et al.⁷⁸, IWRM is a concept that is meant to foster effective water resource management. IWRM is an approach that helps to balance competing water demands and access from across society and the economy, without compromising the sustainability of vital ecosystems. This is achieved through coordinated policy and regulatory frameworks, management arrangements, and financing⁷⁹. Additionally, the IWRM strategy approach and implementation are ideally linked to an individual country's developmental policies. Southern Africa (Zimbabwe and South Africa) is the biggest adopter of the IWRM and produces different uptake patterns.

6.3.1 Maintenance of Water Pipes and Water Engines: Addressing Issues of Water Accessibility

The study examined whether maintenance of water pipes and water engines may address the issues of water accessibility.

Table 6.4: Maintenance of water pipes

		Frequency	Percent
Valid	Agree	339	90.9
	Strongly agree	26	7.0
	Not sure	8	2.1
	Total	373	100.0

Source: Fieldwork (2023)

The results from Table 6.4 indicate that the greatest number of respondents (90.9%) agreed that maintenance of water pipes and water engines may

⁷⁸ TL Dirwai, EK Kanda, A Senzanje and TI Busari, 'Water Resource Management: IWRM Strategies for Improved Water Management: A Systematic Review of Case Studies of East, West and Southern Africa' (2024) 19(5) *PLOS ONE* e0301187.

⁷⁹ UN-Water (n 24) 24.

address the issues of water accessibility. Only 7% of the respondents strongly agreed, while 2.1% were uncertain.

The Department for Environment, Food and Rural Affairs promotes effective water supply by making sure the broken pipes are mended (as water loss from broken pipes can be as much as 30%)⁸⁰. Moreover, regular inspection of water equipment is part of an operator's routine duties to ensure proper functioning of the system⁸¹. It is also crucial that water is not wasted through leaking pipes or faulty water engines. This will assist in effective water supply to communities.

Small repair issues can quickly escalate into major problems if not addressed. Regular inspections can identify minor leaks or clogs before they become severe. Therefore, preventative maintenance is far more cost-effective than emergency repairs. By committing to regular pipe and engine maintenance, the high costs associated with pipe replacements and extensive damage repairs can be avoided. Additionally, clean and well-maintained pipes allow for efficient water flow and drainage, reducing the risk of backups and slow drains⁸². Thus, water supply systems must be managed within the limits of natural ecosystems, recognising that economic activities are embedded within, and dependent on, finite ecological systems.

Accordingly, water supply infrastructure should be maintained in optimal condition, supported by efficient preventive maintenance strategies and continuous performance monitoring of maintenance teams⁸³. Such technical efficiency, however, must be complemented by ecological governance approaches that prioritise sustainability, resource conservation, and intergenerational equity. Therefore, the effective

⁸⁰ CJ Seago, *A Comparison of the South African Approach to Water Resources Management and Planning with Four International Countries* (Water Research Commission 2016).

⁸¹ JP Guyer (n 39) 25.

⁸² S Firdaus, 'Procedures & Best Practices for Proper Pipeline Maintenance' (2023) <https://www.petrosync.com/blog/pipeline-maintenance/> accessed 18 July 2025.

⁸³ AH Safaraz, AK Yadzi, T Hanne and PF Wanke, 'Assessing Repair and Maintenance Efficiency for Water Suppliers: A Novel Hybrid USBM-FIS Framework' (2023) 16 *Operations Management Research* 1321–1342.

maintenance of water infrastructure, coupled with ecologically informed governance, is essential for achieving a sustainable water supply that supports both human development and ecosystem preservation.

6.2.3.3 Water Access to Rural Households Compared to Urban or White Minorities

The study analysed whether water access to rural households seems to be a rising issue compared to urban or white minorities, as shown in Table 6.5.

Table 6.5: Water access: rural compared to urban

		Frequency	Percent
Valid	Agree	317	85.0
	Strongly agree	53	14.2
	Not sure	3	.8
	Total	373	100.0

Source: Fieldwork (2023)

The findings, as presented in Table 6.5, indicate that a substantial majority of respondents (85%) agreed that access to water in rural households is an increasingly critical issue when compared to urban areas or historically advantaged groups. A further 14.2% strongly agreed, while only 0.8% expressed uncertainty. These perceptions reflect the lived realities of many rural communities, where access to adequate, safe, and reliable water remains constrained. Households in such areas often depend on compromised water sources, exposing them to health risks and limiting their capacity to sustain livelihoods. These challenges are further exacerbated by rising water costs, deteriorating infrastructure, declining water availability, climate variability, and governance inefficiencies⁸⁴.

⁸⁴ R Rose, ‘Addressing Water Access Challenges through USDA Rural Development’s Commitment to Rural Communities’ (2024) <https://www.rd.usda.gov/newsroom/success->

These findings highlight the unequal distribution and management of natural resources, particularly water, which is regarded as a critical form of natural capital. Ecological economics emphasises that economic systems are embedded within ecological limits, and that sustainable development requires equitable access to essential resources such as water⁸⁵. The observed disparities between rural and urban areas illustrate a misalignment between resource allocation and social equity, reinforcing structural inequalities in access to ecosystem services.

Furthermore, ecological economics stresses the importance of integrating environmental sustainability with social justice, particularly in the allocation of scarce resources. The unequal access to water in rural areas reflects not only environmental constraints but also institutional and policy failures that hinder effective resource governance⁸⁶. In this regard, water scarcity is not solely a biophysical issue but also a socio-economic and political challenge that requires inclusive and context-specific interventions.

The findings therefore support the argument that rural communities should be prioritised in water resource allocation and infrastructure development. Ensuring equitable access to water aligns with the principles of ecological economics, which advocate for the fair distribution of natural resources and the maintenance of ecological integrity. Addressing these inequalities will require integrated policy approaches that balance environmental sustainability with the socio-economic needs of vulnerable populations, thereby promoting both human well-being and long-term resource resilience.

7. CONCLUSIONS AND RECOMMENDATIONS

Water is a driver of socio-economic development and environmental stability. It supports biodiversity, plays a role in regulating climate by maintaining wetland ecosystems, and the water cycle. In terms of

[stories/addressing-water-access-challenges-through-usda-rural-developments-commitment-rural-communities](#) accessed 11 August 2025.

⁸⁵ R Costanza and others (n 52) 26.

⁸⁶ HE Daly (n 53) 27.

agriculture, food is produced, and in the industries, it provides the means of manufacturing and energy generation. Water is additionally significant for cleanliness, wellbeing, and general health as it assumes an important part in preventing health issues and general wellbeing.

The findings revealed that climate change is one of the challenges when it comes to enhanced water access, hindering the achievement of food security in most rural communities. The increase in global population and urbanisation has already added extra pressure on global water resources, the result of which is associated with scarcities and conflicts for access. Therefore, there must be a long-term, sustainable, and encouraging environment for community-driven water resource management, in which different support organisations work together both horizontally and vertically, both within and between communities, to deliver integrated services in accordance with people's integrated needs.

Equitable water distribution, efficient resource utilisation, and protection of the ecosystem depend on a balance among economic, social, and environmental aspects. Beyond its economic importance, water is a basic natural resource essential to economic activities, such as industry, agriculture, and urban development. Economic policies should also advocate for conservation incentives, development of new technologies, and fair water distribution to strike a balance between economic growth and long-term water security. Integrating water management into economic planning constitutes a pathway to sustainable development while minimising the financial costs of water crises for countries.