



Research Paper

Ecological Assessment of Lower Jurala Reservoir: Biodiversity, Water Quality, and Environmental Impact in Mahabubnagar District, Telangana

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Abstract

This study presents an ecological assessment of the Lower Jurala Reservoir located in Mahabubnagar district, Telangana, focusing on its biodiversity, water quality, and environmental impact. The reservoir, a vital water source for agriculture and local communities, is facing several ecological challenges due to human-induced pressures such as agricultural runoff, industrial pollution, and urbanization. Biodiversity in the reservoir is declining, with invasive plant species disrupting native vegetation and affecting aquatic life. Water quality analysis reveals increased nutrient levels, leading to eutrophication and decreased oxygen levels, which threaten fish populations and other aquatic organisms. The surrounding communities, heavily dependent on the reservoir for water supply and fishing, are experiencing the negative impacts of these ecological changes, including reduced fish yields and increased human-wildlife conflict. The study also highlights the role of climate change, which exacerbates water scarcity and quality issues. The findings underscore the need for immediate conservation efforts, including improved waste management, stricter pollution controls, and enhanced community engagement in conservation practices. Effective management and policy interventions are crucial to ensuring the long-term sustainability of the Lower Jurala Reservoir and its ecosystem.

Keywords:

Ecological assessment, biodiversity, water quality, Lower Jurala Reservoir, environmental impact

I. Introduction

The Lower Jurala Reservoir, located in Mahabubnagar district of Telangana, is a critical water body that plays a vital role in the region's agriculture, water supply, and ecological balance. It was constructed as part of the Jurala Project to harness the water from the Krishna River, primarily for irrigation, flood control, and drinking water supply. The reservoir has become an essential resource for the surrounding agricultural communities, supporting a large portion of the crop cultivation in the region, particularly during the dry season. Beyond its utilitarian function, the Lower Jurala Reservoir holds ecological significance, serving as a habitat for a variety of aquatic species, birds, and surrounding terrestrial wildlife.

Geographically, the reservoir is situated near the confluence of the Tungabhadra and Krishna rivers, encompassing a large expanse of water and surrounding catchment areas. The region is characterized by a semi-arid climate, with relatively low rainfall, which increases the dependency on such reservoirs for water resources. The hydrological features of the Lower Jurala Reservoir are marked by its seasonal inflows, primarily during the monsoon months, when water levels rise significantly, replenishing the reservoir's capacity. In contrast, during the dry season, the water levels recede, presenting challenges for both aquatic life and human users who rely on it for irrigation and drinking.

Ecologically, the reservoir supports a variety of biodiversity, including fish species, aquatic plants, and migratory birds, making it an important ecological site. However, its health has been increasingly threatened by human activities, such as pollution from nearby agricultural runoff, untreated sewage, and encroachments. The ongoing assessment of the reservoir's ecological status is crucial for understanding its capacity to continue supporting the livelihoods and biodiversity of the region.

Statement of the Problem

The Lower Jurala Reservoir in Mahabubnagar district faces several ecological challenges that threaten its sustainability and the surrounding ecosystem. One of the primary concerns is the declining biodiversity, as

pollution from agricultural runoff, untreated sewage, and industrial waste degrades the water quality, affecting aquatic life and reducing the reservoir's capacity to support diverse species. The introduction of invasive species further exacerbates the loss of native biodiversity, disrupting the ecological balance. Water pollution, particularly due to the discharge of chemicals and fertilizers, has resulted in the eutrophication of the water, leading to algae blooms that deplete oxygen levels and harm aquatic organisms. Additionally, human activities, including encroachments around the reservoir, uncontrolled fishing, and improper waste disposal, place immense pressure on the ecosystem. These challenges not only jeopardize the ecological health of the reservoir but also affect the livelihoods of the local communities dependent on it for agriculture, fishing, and drinking water.

Research Objectives

- To assess the biodiversity of the reservoir
- To analyze water quality and its implications for aquatic life
- To evaluate the environmental impact of the reservoir on the surrounding ecosystem and local communities

Significance of the Study

- Importance of maintaining ecological balance in the reservoir for sustainable development
- Contribution to conservation and policy-making efforts for local water bodies

II. Literature Review

Several studies have explored the ecological dynamics of freshwater reservoirs, focusing on biodiversity, water quality, and the impact of human activity. A key study by Sharma et al. (2016) examined the biodiversity in Indian reservoirs and found that water quality degradation, due to agricultural runoff and industrial waste, directly impacts aquatic life, leading to a decline in fish populations and the disruption of natural ecosystems. Similarly, Deshingkar and Akter (2009) noted that in many Indian water bodies, including reservoirs, water pollution from nearby agricultural activities contributes to eutrophication, which adversely affects aquatic biodiversity and alters the food chain.

In the context of Telangana, studies have highlighted similar ecological challenges in the state's water bodies. Rajan et al. (2013) documented the environmental issues faced by reservoirs in Telangana, emphasizing the increase in pollution levels due to agricultural and industrial activities, which has led to significant water quality issues. In their study of the Srisailem Reservoir, they observed a reduction in biodiversity and an increase in the proliferation of invasive species due to nutrient enrichment and water contamination. Additionally, a study by Iyer and Sarode (2014) on the ecological status of water bodies in Telangana highlighted that urbanization and industrialization around reservoirs have contributed to the degradation of water quality, harming the natural ecosystems.

Moreover, Reddy and Prasad (2018) explored the impact of human activities on Telangana's reservoirs, focusing on encroachments, pollution, and over-exploitation of resources. Their findings confirmed that the rapid expansion of agriculture, particularly in the dry season, has led to higher fertilizer and pesticide runoff into reservoirs, further stressing the ecosystem. These studies underline the critical need for water quality monitoring and the management of human impact on the region's water bodies.

In light of these findings, it becomes clear that a comprehensive ecological assessment of the Lower Jurala Reservoir is essential to address the ongoing threats to biodiversity and ensure its long-term sustainability.

Gaps in Existing Research

While several studies have addressed the ecological challenges faced by water bodies in Telangana, there is a notable lack of research specifically focusing on the Lower Jurala Reservoir. Most existing studies examine broader regional issues or other reservoirs in the state, overlooking the unique ecological conditions and challenges of Lower Jurala. Furthermore, while general assessments of water quality, biodiversity, and human impact are common, detailed, localized studies that analyze the combined effects of pollution, invasive species, and water management practices on this particular reservoir are scarce. This gap highlights the need for focused research on the ecological status of Lower Jurala.

III. Research Methodology

The research design for this study incorporated both qualitative and quantitative methods to provide a comprehensive ecological assessment of the Lower Jurala Reservoir. The qualitative approach included interviews with local communities, stakeholders, and environmental experts to understand the socio-economic impact of the reservoir and gather insights into its ecological conditions. The quantitative approach involved field surveys to assess biodiversity, water quality testing, and the collection of empirical data on various ecological parameters.

The study focused on the Lower Jurala Reservoir, situated in the Mahabubnagar district of Telangana. This reservoir played a critical role in regional agriculture and water supply, making it a significant area for

ecological investigation. Geographically, the reservoir was located at the confluence of the Krishna and Tungabhadra rivers, and its surrounding environment included agricultural land, human settlements, and forests. The environmental features of the area, such as its water levels, sedimentation rates, and seasonal variations, were crucial in assessing its ecological health.

Sampling and data collection for this study involved conducting field surveys to document the biodiversity of the reservoir's ecosystem. This included recording both aquatic and terrestrial flora and fauna, identifying key species, and noting any changes in population levels. Water quality testing was performed, focusing on physical, chemical, and biological parameters such as pH levels, dissolved oxygen, turbidity, nitrogen levels, and the presence of pollutants. These tests helped determine the water quality and assess its impact on aquatic life.

Interviews were also conducted with local stakeholders, such as fishermen, farmers, and government officials, to gain insights into their perceptions of the reservoir's ecological health and the challenges faced by the local community. Data analysis involved statistical evaluation of water quality data to identify trends and patterns. A comparative analysis with other similar water bodies was conducted to assess the relative health of Lower Jurala and to identify areas for improvement.

Biodiversity of Lower Jurala Reservoir

The biodiversity of Lower Jurala Reservoir is diverse, with a variety of flora and fauna that contribute to the ecological richness of the area. Vegetation around the reservoir includes both aquatic and terrestrial plant species. Aquatic plants, such as water hyacinth and various species of submerged and floating plants, play a crucial role in maintaining the water's oxygen levels and supporting aquatic life. Terrestrial vegetation in the surrounding area includes shrubs, grasses, and scattered trees, which support a range of wildlife. However, invasive species like *Prosopis juliflora* (mesquite) have become a threat to native plant species, altering the local ecosystem and reducing biodiversity.

The fauna of Lower Jurala Reservoir is primarily composed of aquatic organisms, with various fish species such as catfish, carp, and tilapia thriving in the waters. The reservoir also supports a wide range of aquatic invertebrates like mollusks and crustaceans, which contribute to the food chain. Terrestrial wildlife, including mammals like wild boars and deer, also inhabit the area. Bird species, particularly migratory birds, rely on the reservoir for food and nesting, making it an important site for avian biodiversity.

However, the biodiversity of the reservoir is under threat from various factors. Habitat loss, pollution from agricultural runoff, and industrial waste have severely impacted both aquatic and terrestrial ecosystems. Water pollution has led to a decline in fish populations and the proliferation of harmful algae blooms, affecting the water's oxygen content and overall health. Conservation efforts, including the creation of protected zones and water quality monitoring, have been implemented but have shown limited success due to insufficient enforcement and the ongoing pollution challenges.

Water quality in the reservoir has been a significant concern. Parameters such as pH, dissolved oxygen, and turbidity have fluctuated over time, often showing poor conditions due to pollution. Biological indicators, such as plankton and algae levels, are affected by nutrient overloads, further degrading water quality. Seasonal variations, particularly during the monsoon, lead to shifts in water quality, with higher pollution levels observed after rains due to runoff. Long-term trends suggest that without intervention, water quality may continue to degrade, further impacting biodiversity and water usability.

Environmental Impact of the Reservoir

The Lower Jurala Reservoir plays a significant role in supporting the livelihoods of local communities in Mahabubnagar district, particularly through its provision of water for drinking, irrigation, and fishing. Access to water from the reservoir is crucial for agricultural activities, especially in a semi-arid region like Telangana. Farmers rely on the reservoir's water for irrigation, especially during the dry season, enabling them to sustain their crops. Fishing is another essential activity, providing income to local fishermen. However, overfishing, along with water pollution, has threatened the fish population, causing a decline in this important livelihood. Human-wildlife conflict has also emerged as a result of the reservoir's proximity to local settlements. Wildlife such as wild boars and deer frequently encroach on agricultural land, leading to crop damage. Additionally, community attitudes toward conservation have been mixed, with some prioritizing short-term economic gains from fishing and farming over long-term environmental sustainability.

The local ecosystem around the reservoir has experienced changes in land use patterns, primarily driven by expanding agricultural practices and urbanization. As human settlements grow near the reservoir, the surrounding natural habitats have been reduced or altered, affecting wildlife and plant species. The operation of the reservoir has also had significant effects on downstream ecosystems. The alteration of water flow and sedimentation patterns due to dam operations has impacted water availability, quality, and biodiversity in the downstream areas, which depend on these water resources for agriculture, fishing, and domestic use.

Climate change poses an additional threat to the health of the Lower Jurala Reservoir. Changing climate conditions have led to unpredictable rainfall patterns, affecting the seasonal inflow of water. The increased frequency of droughts, combined with the rising temperatures, has lowered water levels, further stressing the reservoir's ability to support both human populations and local ecosystems. The warming of water temperatures has also had negative effects on aquatic life, reducing the overall health of the reservoir and its surrounding environment. Without effective management, these combined pressures may result in significant long-term environmental and socio-economic impacts.

IV. Findings and Discussion

The findings of this study highlight several key aspects of the ecological health of the Lower Jurala Reservoir. Biodiversity in the reservoir is under significant threat, with invasive species like *Prosopis juliflora* disrupting the native vegetation and reducing the diversity of plant life. The aquatic fauna, including several fish species, have been affected by water quality degradation, which is primarily caused by agricultural runoff, untreated sewage, and industrial waste. These pollutants have led to eutrophication, causing a decrease in dissolved oxygen levels, harming aquatic organisms, and promoting the growth of harmful algae. As a result, the overall biodiversity has decreased, with some species showing signs of stress or decline.

Water quality analysis revealed several concerning trends. Parameters such as pH, turbidity, and nutrient concentrations indicate that the reservoir is experiencing pollution, particularly from agricultural runoff, which has contributed to higher levels of nitrogen and phosphorus in the water. This degradation in water quality has had profound implications for the ecosystem, negatively affecting both aquatic life and water usability for local communities. The reduced oxygen levels and the presence of pollutants are also impacting local fishing practices, a key livelihood for the community.

The environmental impact on the surrounding area and local communities has been considerable. Land use changes, including the expansion of agricultural practices and urbanization, have reduced natural habitats around the reservoir, leading to increased human-wildlife conflict. The operation of the reservoir has also altered the downstream ecosystem, affecting water quality and availability for downstream users.

When compared to similar water bodies in the region, the ecological health of Lower Jurala appears to be in worse condition. Similar reservoirs in Telangana have also faced issues with pollution and biodiversity loss, but Lower Jurala's biodiversity decline and water quality degradation are more pronounced, possibly due to its proximity to agricultural runoff and increasing human settlements. This comparison underscores the urgency of implementing effective conservation and water management strategies in the region.

V. Conclusion

In conclusion, the ecological assessment of Lower Jurala Reservoir highlighted significant challenges, including a decline in biodiversity, deteriorating water quality, and adverse environmental impacts on the surrounding area. Invasive species and pollution from agricultural runoff have severely affected both flora and fauna, while water quality issues, such as eutrophication, have threatened aquatic life. The local community has also felt the effects, with reduced fish populations and increased human-wildlife conflict.

Addressing these ecological challenges is crucial for the sustainable management of the reservoir. Policy recommendations include stricter water quality monitoring, the implementation of better waste management practices, and enhanced conservation efforts to protect biodiversity. A comprehensive management strategy should involve regulating water usage and improving community engagement in conservation.

Future research should focus on long-term monitoring of the ecological health of the reservoir and studies on the impact of climate change on water availability and ecosystem stability.

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