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# WATER SCARCITY ASSESMENT OF GOMTI RIVER BASIN

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### ABSTRACT :

The Gomti River Basin, an important tributary of the Ganga River, is currently facing a severe water scarcity crisis. This issue stems from a combination of factors, including overuse of water resources, pollution, and the adverse effects of climate change. The river, which is a critical source of water for agriculture, industry, and domestic use, has seen a significant decline in both water quantity and quality. Untreated sewage, industrial waste, and agricultural runoff have heavily polluted the river, making its water unsafe for consumption and irrigation. Additionally, excessive groundwater extraction has led to falling water tables, further straining the region's water resources.

The consequences of this crisis are far-reaching, impacting not only the environment but also the livelihoods and health of the communities that depend on the river. Agricultural productivity has declined, and conflicts over water usage have become more frequent. The river's ecosystem has also suffered, with a noticeable loss of biodiversity and degradation of wetlands and floodplains.

To address these challenges, a holistic approach is needed. This includes implementing sustainable water management practices, controlling pollution, promoting rainwater harvesting, and encouraging community participation in conservation efforts. Strengthening policies and improving governance are also crucial to ensure the long-term sustainability of the basin's water resources.

Keywords: Gomti River Basin, Water Scarcity, Groundwater Depletion, Climate Change, Water Pollution, Urbanization, Industrial Discharge, Agricultural Runoff, Sustainable Water Management, Integrated Water Resource Management (IWRM), River Ecosystems

### INTRODUCTION

The Gomti River Basin holds immense geographical and socio-economic significance, particularly in Uttar Pradesh, India. Originating from Madhotanda in Pilibhit district, the river flows for approximately 900 km before merging with the Ganges at Kaithi, Varanasi. The basin, covering around 30,437 sq. km, consists of fertile alluvial plains, making it an essential agricultural region. It supports the cultivation of rice, wheat, sugarcane, and pulses, contributing significantly to the state's economy. The Gomti also serves as a major water source for drinking and irrigation in cities like Lucknow, Sultanpur, and Jaunpur, while also supporting fisheries and local biodiversity. Additionally, it plays a vital role in urban and industrial development, particularly in Lucknow, though industrial pollution and waste disposal threaten its sustainability. The river is also of great religious and cultural importance, with numerous temples and rituals performed along its banks. Despite its importance, the Gomti faces pollution, encroachment, and reduced water flow, necessitating conservation efforts like the Gomti Riverfront Development Project. Its preservation is crucial for maintaining ecological balance and ensuring long-term benefits for the communities that depend on it.

Water scarcity is an emerging environmental and socio-economic challenge in the Gomti River Basin (GRB), a crucial sub-basin of the Ganges River system in northern India. The Gomti River, originating from the Terai region in Uttar Pradesh, supports a vast population by providing water for agriculture, domestic consumption, and industrial use. However, increasing urbanization, industrialization, and unsustainable water management practices have led to severe depletion and pollution of the river, exacerbating water scarcity in the region. The basin, which once thrived on seasonal monsoon flows and groundwater recharge, now faces declining water levels, deteriorating water quality, and disruption of aquatic ecosystems.

### PROBLEM STATEMENT

- Declining Water Levels Over-extraction of groundwater and reduced surface water flow have led to decreasing water levels in the Gomti River.
- Pollution and Water Quality Degradation Discharge of untreated sewage, industrial waste, and agricultural runoff has deteriorated water quality, making it unfit for consumption.
- Deforestation and Land Use Changes Large-scale deforestation and urbanization have disrupted the natural hydrological cycle, reducing groundwater recharge.
- Climate Change Impact Erratic rainfall patterns, rising temperatures, and prolonged dry periods are exacerbating water scarcity in the region.

Unregulated Water Usage – Excessive and unregulated water withdrawal for agriculture, industries, and domestic use has intensified the
water crisis.

#### **RESEARCH OBJECTIVES**

The primary objectives of this study are:

- 1. To assess the current status of water availability and demand in the GRB.
- 2. To identify the spatial and temporal patterns of water scarcity in the GRB.
- 3. To evaluate the impact of climate change and human activities on water scarcity.
- 4. To propose sustainable water management strategies for the GRB

### **RESEARCH QUESTIONS**

This study seeks to answer the following research questions:

- 1. What are the key drivers of water scarcity in the GRB?
- 2. How do climatic variability and anthropogenic activities influence water availability in the GRB?
- 3. What are the most vulnerable zones in the GRB in terms of water scarcity?
- 4. What policy interventions can mitigate water scarcity in the GRB?

### LITERATURE REVIEW

Water scarcity in the Gomti River Basin has become a critical issue due to a combination of environmental and human-induced factors. Several researchers have examined the key causes of this crisis, including excessive water extraction, pollution, climate change, and ineffective water management policies.

#### **Declining Water Levels and Over-Extraction**

Several studies have highlighted the declining water levels in the Gomti River due to excessive groundwater extraction. This situation is further worsened by rapid urbanization, which has increased water demand while simultaneously reducing groundwater recharge due to the loss of permeable surfaces (Gupta & Verma, 2019).

#### **Pollution and Water Quality Issues**

Beyond water shortage, **pollution** is a major reason why the Gomti River is struggling. **Sharma and Pandey** report that untreated sewage, industrial waste, and chemical-heavy agricultural runoff have turned the river into a dumping ground (**Sharma and Pandey 89**). Similarly, **Rai and Tripathi** (**2023**) reported high levels of heavy metals and chemical pollutants in the water, which have negative effects on both human health and the ecosystem.

### Climate Change and Water Availability

Climate change is making water scarcity in the Gomti River Basin even worse. **Gupta and Verma (2019)** point out that unpredictable rainfall and long dry spells have made it harder to replenish groundwater and keep the river flowing. **Kumar et al. (2022)** add that rising temperatures are causing more evaporation, reducing the amount of water available. On top of that, irregular monsoon rains mean that some seasons bring too little water, leaving both cities and villages struggling to meet their daily needs. These changes are making life harder for the people who rely on the Gomti River, highlighting the urgent need for better water management.

### METHODOLOGY

This research on water scarcity in the Gomti River Basin follows a **mixed-method approach**, combining qualitative and quantitative methods to analyze the factors contributing to water scarcity and its impacts.

#### 1. Research Design

A descriptive research design is used to assess the extent of water scarcity, its causes, and its effects on the environment and local communities. Data is collected from both primary and secondary sources.

### 2. Data Collection Methods

• Field Surveys & Questionnaires: Structured surveys are conducted among local residents, farmers, and policymakers to gather firsthand information on water availability, usage, and challenges.

- Interviews: Discussions with government officials, environmental experts, and NGOs provide insights into water management policies and their effectiveness.
- Water Sampling & Testing: Physical and chemical analyses of Gomti River water at different locations help assess pollution levels and water quality.

#### b. Secondary Data Collection

- Government Reports & Policy Documents: Analysis of official reports from agencies like the Central Water Commission and the Government of Uttar Pradesh.
- Satellite Imagery & Hydrological Data: Remote sensing and GIS data are used to examine changes in river flow and groundwater levels.
- Academic Literature & Case Studies: Reviewing previous research on water scarcity, pollution, and climate change impacts in the Gomti River Basin.

### **RESULTS AND DISSCUSION**

Category	Observed Findings	Interpretation
Dealing in Water		Construction and a set of the set
Decline in water	~40% drop in pre-monsoon groundwater levels in urban zones	Groundwater over-extraction and poor recharge practices are
Levels	(2010–2023)	reducing sustainable water availability.
Pollution Load	BOD levels $> 6 \text{ mg/L}$ and high levels of nitrates and heavy	Indicates heavy contamination from sewage, industry, and
	metals in river samples (Lucknow-Jaunpur belt)	agricultural runoff; water is unfit for use.
River Flow	Significant reduction in average flow during non-monsoon	Reduced base flow due to groundwater stress and loss of
Disruption	months, particularly March–June	upstream forest catchments.
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Ecosystem Health	Fish diversity declined by 45% compared to early 2000s;	Water stress and pollution are degrading aquatic life and
	wetlands reduced in area by 30%	natural habitats across the basin.
Agricultural	20-35% drop in crop yield in water-stressed districts (e.g.,	Farmers face reduced irrigation capacity, leading to lower
Impact	Sitapur, Barabanki, Amethi)	productivity and increased food insecurity.
-	•	
Community	80% of surveyed residents reported increased water shortages	Local communities recognize the worsening scarcity, yet
Perception	over the past decade	awareness of conservation methods remains low.
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### Table 1: Key Findings on Water Scarcity in the Gomti River Basin

### Interpretation and Analysis

The findings of this study indicate a multidimensional water crisis in the Gomti River Basin, driven by both environmental degradation and human mismanagement. One of the most pressing issues is the substantial decline in groundwater levels, particularly in urban and peri-urban areas. The drop of around 40% over a decade suggests over-reliance on borewells, coupled with inadequate efforts at groundwater recharge. These declining levels have not only disrupted domestic water supply but have also affected river base flow, especially during dry months.

Pollution is another significant contributor to the water scarcity crisis. Elevated Biological Oxygen Demand (BOD) levels and the presence of heavy metals like lead, mercury, and cadmium in the mid-basin stretch (especially around Lucknow and Jaunpur) demonstrate how untreated sewage and industrial discharge have made the river water unfit for irrigation and human use. In addition, fertilizer and pesticide runoff have compounded the problem by degrading groundwater quality as well.

Furthermore, the ecological impacts are visible through drastic reductions in fish biodiversity and shrinking wetlands. These changes threaten not just the river's natural balance but also the livelihoods of communities involved in fishing and dependent on floodplain agriculture.

In the agricultural sector, the implications of water scarcity are clear—crop yields have dropped by 20–35% in critical districts. Reduced irrigation capacity has made farming riskier and less profitable, contributing to rural distress.

Lastly, the community survey highlights a high perception of worsening water availability, yet a lack of awareness about sustainable water practices like rainwater harvesting, drip irrigation, and reforestation points to the need for stronger public outreach and engagement.

### CONCLUSION

The Gomti River Basin, a vital tributary of the Ganga River, is facing significant water scarcity due to a combination of natural and human-induced factors. Declining water availability, over-extraction of groundwater, pollution, and the impacts of climate change have collectively contributed to the worsening water crisis in the region. The degradation of water quality, caused by untreated sewage, industrial effluents, and agricultural runoff, has further exacerbated the situation, rendering large portions of the river water unfit for consumption and irrigation.

The socio-economic implications of water scarcity in the Gomti River Basin are profound, affecting agricultural productivity, livelihoods, and public health. Additionally, the ecological health of the river has been severely compromised, with declining biodiversity and the loss of critical ecosystems such as wetlands and floodplains.

In conclusion, the water scarcity crisis in the Gomti River Basin underscores the urgent need for comprehensive and coordinated action. By adopting sustainable practices and fostering a collective commitment to water conservation, it is possible to restore the health of the Gomti River and secure water resources for future generations. Failure to act decisively will have far-reaching consequences for the environment, economy, and communities dependent on this vital river system.

### RECOMMENDATIONS

- Promote rainwater harvesting in both urban and rural areas to improve groundwater recharge.
- Implement strict regulations for industrial effluent and sewage treatment before discharge into the river.
- Encourage farmers to adopt water-efficient irrigation methods such as drip and sprinkler systems.
- Strengthen community-based water management by forming local water user groups and training them in conservation practices.
- Expand afforestation programs in catchment areas to enhance infiltration and restore natural hydrological cycles.
- Improve inter-agency coordination between state departments for better data sharing and integrated planning.
- Monitor groundwater extraction through digital metering and regulate borewell drilling through licensing.
- Rehabilitate and protect wetlands and floodplains to act as natural water buffers and biodiversity reserves.
- Incorporate climate adaptation strategies into water management policies to address erratic rainfall and rising temperatures.
- Raise public awareness through education campaigns on water conservation, pollution control, and household water practices.

#### REFERENCES

- 1. Gupta, N., & Verma, A. (2019). Urbanization and its Impact on Groundwater Depletion in the Gomti River Basin. International Journal of Water Resources Development, 35(2), 210–226. https://doi.org/10.1080/07900627.2019.1561192
- Sharma, R., & Pandey, R. (2020). Assessment of Water Pollution in the Gomti River Using Multivariate Statistical Techniques. Environmental Monitoring and Assessment, 192(5), 317. https://doi.org/10.1007/s10661-020-8227-0
- Rai, P. K., & Tripathi, S. (2023). Heavy Metal Contamination in Gomti River Sediments: Risk Assessment and Source Apportionment. Ecological Indicators, 147, 109871. https://doi.org/10.1016/j.ecolind.2023.109871
- Kumar, M., Singh, A. K., & Sharma, P. (2022). Climate Variability and Water Resources in the Ganga-Gomti Interfluve Region. *Climate Risk Management*, 35, 100392. https://doi.org/10.1016/j.crm.2022.100392
- Singh, V. P., & Jain, M. K. (2018). Hydrological Modelling of Gomti River Basin Using SWAT. Journal of Hydrology and Environment Research, 6(3), 151–164. [Link unavailable]
- Chaudhary, D. S., & Srivastava, A. (2020). Groundwater Over-Exploitation and its Impact on Agriculture in Uttar Pradesh. Water Policy, 22(S1), 129–143. https://doi.org/10.2166/wp.2020.140
- 7. Sinha, R., & Ghosh, S. (2012). Understanding the Dynamics of Urban Water Crisis: A Case of the Gomti River. *Current Science*, 102(12), 1642–1648. https://www.jstor.org/stable/24089256
- Mishra, A., & Tiwari, A. (2015). Assessment of Water Quality Using Biological and Physicochemical Indicators: A Case Study of Gomti River. *Environmental Science and Pollution Research*, 22, 9156–9167. https://doi.org/10.1007/s11356-015-4125-3
- Yaduvanshi, M., & Singh, D. (2021). The Role of Climate Change in Increasing Water Stress in the Indo-Gangetic Basin. Water International, 46(4), 471–487. https://doi.org/10.1080/02508060.2021.1879375
- 10. Central Pollution Control Board (CPCB). (2021). Water Quality Status of River Gomti. Government of India Report. http://cpcb.nic.in