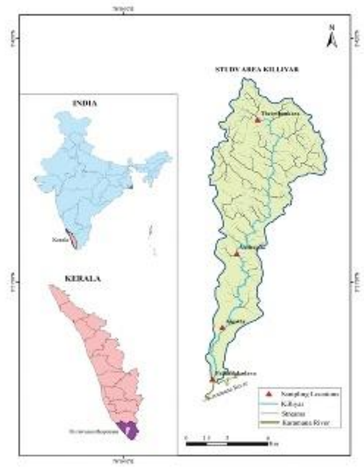
The Impact of Water Pollution in killi river affecting the Thiruvananthapuram Microclimate

Name of Authors - Ar. Akshay SR ,Prof. Habeeba Majeed,Dr. Lea Mathew

Introduction

Urban rivers like Killi River in Thiruvananthapuram act as ecological lifelines, regulating microclimate through evaporative cooling, humidity control, wind channelling, riparian vegetation effects, and surface temperature moderation. These processes counteract urban heat islands by lowering air temperature, enhancing ventilation, and improving thermal comfort.

Pollution from sewage, runoff, and encroachments disrupts these benefits: reduced evaporation, stagnant water, concrete barriers inhibit cooling and airflow, while biochemical reactions release heat and odors, turning rivers into thermal stress sources.



Killi River Case: Originates as freshwater stream supporting agriculture/culture, now degraded through urban zones from headwaters to congested core with sharp water quality decline. Sanitary/ecological impacts studied, but thermal/microclimate effects underexplored.

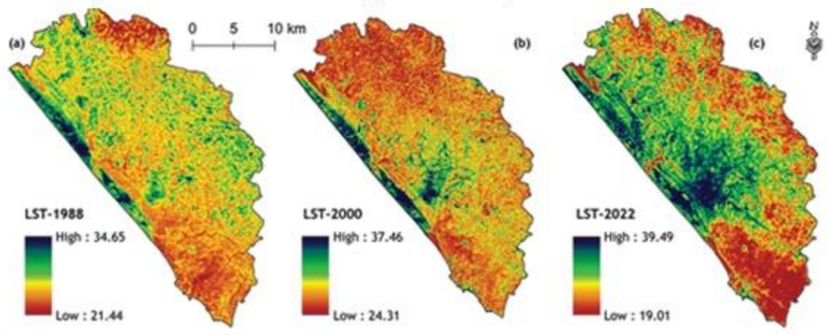
Implications: Calls for design interventions to restore function, enhance liveability, and build resilient cities.

Need for the Study

Urban rivers like Killi (Killiyar), a Karamana tributary in Thiruvananthapuram, serve as socio-ecological corridors shaping hydrology, health, microclimate, and livelihoods.

Key Degradation Factors: Untreated sewage, solid waste, encroachments, industrial effluents.Reduced dissolved oxygen, high BOD, groundwater contamination.

Microclimate Impacts: Diminished evaporative cooling.Increased odor/heat stress, altered humidity/vegetation.Effects: Poorer thermal comfort, reduced outdoor activity, biodiversity loss.



Research Question

How does water pollution in the Killi River influence the microclimate along its flow path, and what environmental design strategies can mitigate these impacts in the urban context of Thiruvananthapuram?

Aim

To examine the impact of Killi River pollution on local microclimate to propose environmental design solutions for sustainable riverfront restoration.

Objective

1. To analyse the water-quality variations of the Killi River across its upstream, midstream, and downstream stretches.
2. To measure and compare microclimatic parameters (air temperature, humidity, surface temperature) along polluted and less-polluted segments of the river.
3. To determine the relationship between river pollution levels and changes in local microclimatic conditions.
4. To propose environmental design strategies that can restore and improve the river's ecological and microclimatic performance

Scope

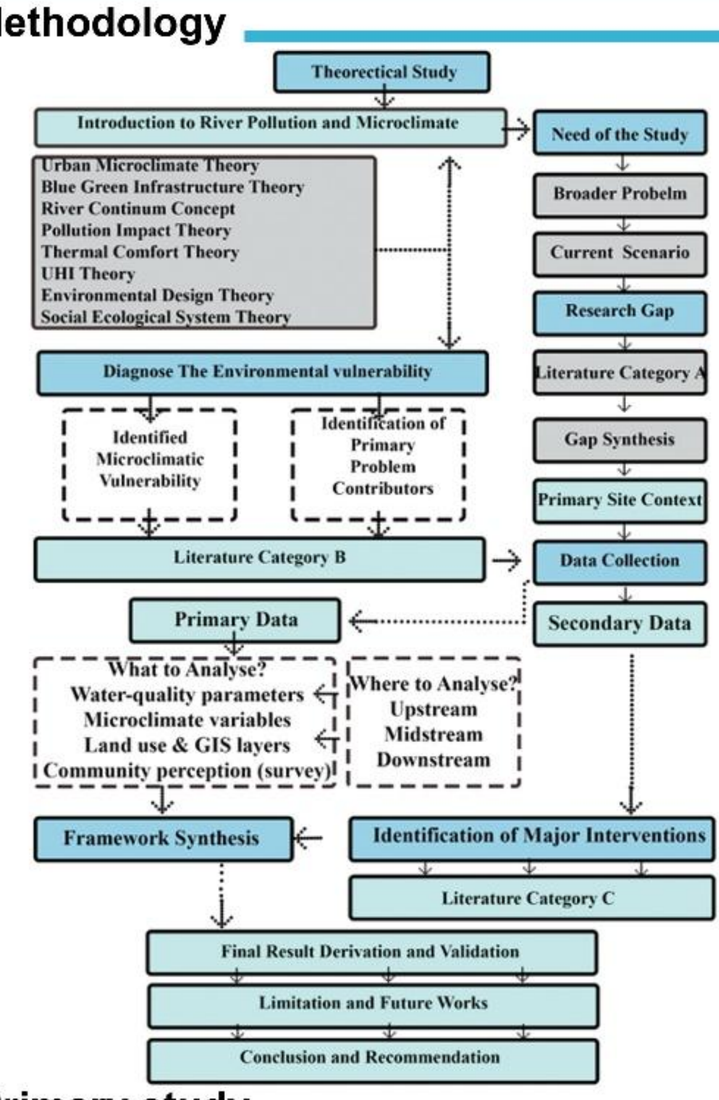
Focuses on water pollution's microclimate impact along urban Killi River in Thiruvananthapuram. Analyzes water quality, temperature, humidity, vegetation via GIS/remote sensing for spatial links. Examines thermal

Limitations

This research covers only the urban Killi River stretch in Thiruvananthapuram, emphasizing water pollution's link to microclimatic changes. It uses short-term field data and secondary sources, missing long-term seasonal trends. Time/resource limits exclude hydrological modeling, air quality, and socio-economic analysis. Design strategies remain conceptual for planning guidance, not full implementation.

Parameter	Description
Sampling Type	Stratified sampling based on river stretch characteristics (upstream, midstream, downstream)
Sample Locations	4 zones along Killi River
Sample Size	4 primary case studies; each with 3 sampling points for water and microclimate measurements
Data Collected	Water quality (pH, DO, BOD, COD, turbidity), air temperature, humidity, surface temperature, vegetation cover
Tools Used	GPS device, thermometer, hygrometer, pH meter, water sampler, camera, Thermal Imager, Kestrel Meter

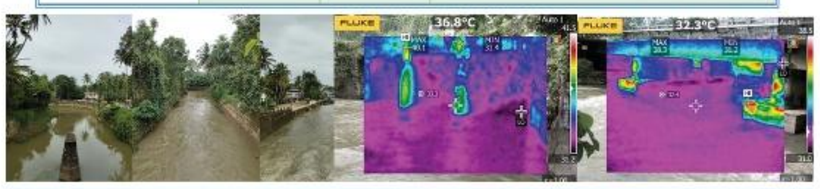
Methodology



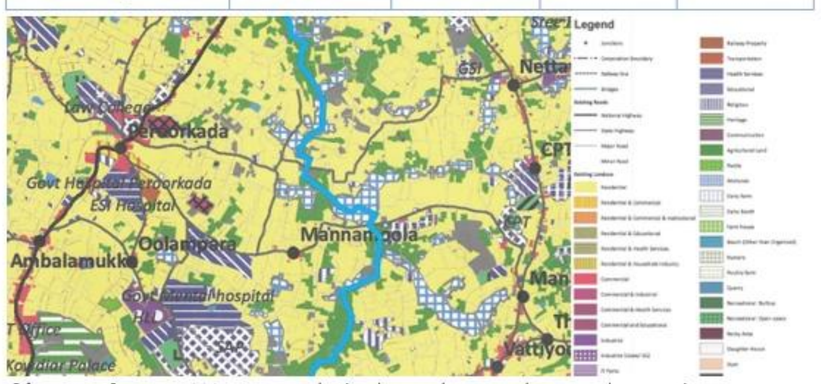
Primary study

Location: Upstream –Thozhuvancode (Near Peroorkada Region)

Parameter	Standard Data	Sample values	Notes
pH	6.5 – 8.5	7.0	Natural upstream rivers usually near-neutral
Dissolved Oxygen (DO)	≥ 5 mg/L	6.0 mg/L	Higher DO due to cleaner water, more flow
BOD	≤ 3 mg/L	2 mg/L	Low BOD because upstream has limited sewage intrusion
COD	≤ 10–25 mg/L	12 mg/L	Indicates moderately clean upstream conditions
Nitrate (NO_3^-)	≤ 10 mg/L	0.5 mg/L	Agricultural runoff minimal near origin
Phosphate (PO_4^{3-})	≤ 0.1 mg/L	0.05 mg/L	Very low as detergents/urban sewage is not present upstream
Turbidity	≤ 5 NTU	2 NTU	Slight sediment presence but still clear water



Parameters	Standards	Zone 01	Zone 02	Zone 03
Air Temperature	26°C – 32°C	**31°C**	**29°C**	**32°C**
Surface Temperature	28°C – 35°C	**36°C**	**33°C**	**37°C**
Humidity	60% – 80%	**68%**	**75%**	**65%**
Radiant Temperature	30 °C – 40 °C	**39°C**	**35°C**	**41°C**



Observations Water relatively clear; less domestic sewage inflow.Temperature slightly moderated by tree cover and open land.
Humidity levels stable riverbank vegetation supports evapotranspiration.

Findings The upstream zone maintains a balanced microclimate, with noticeable cooling effects due to vegetation and flowing water.Minimal pollution impact and stable water parameters

Location: Upstream –Maruthankuzhi (Near Sasthamangalam Region)

Parameter	Standard Data	Sample values	Notes (Why It Changes Here)
pH	6.5 – 8.5	7.3	Slight increase due to detergents & early domestic discharge
Dissolved Oxygen (DO)	≥ 5 mg/L	4.7 mg/L	Beginning depletion from organic load & reduced flow
BOD	≤ 3 mg/L	3.5 mg/L	Early sewage inflow increases organic decomposition
COD	≤ 10–25 mg/L	24 mg/L	Indicates moderate pollution, chemicals + organic matter
Nitrate (NO_3^-)	≤ 10 mg/L	1.6mg/L	Slight rise from greywater, fertilizers, runoff
Phosphate (PO_4^{3-})	≤ 0.1 mg/L	0.6 mg/L	Detergents & domestic wastewater begin influencing levels
Turbidity	≤ 5 NTU	6 NTU	Soil erosion, waste dumping, and channel disturbance raise turbidity

Parameters	Standards	Zone 01	Zone 02	Zone 03
Air Temperature	26°C – 32°C	**32°C**	30°C	**33°C**
Surface Temperature	28°C – 35°C	**37°C**	**34°C**	**38°C**
Humidity	60% – 80%	**66%**	**72%**	**63%**
Radiant Temperature	30 °C – 40 °C	40°C	**36°C**	**42°C**

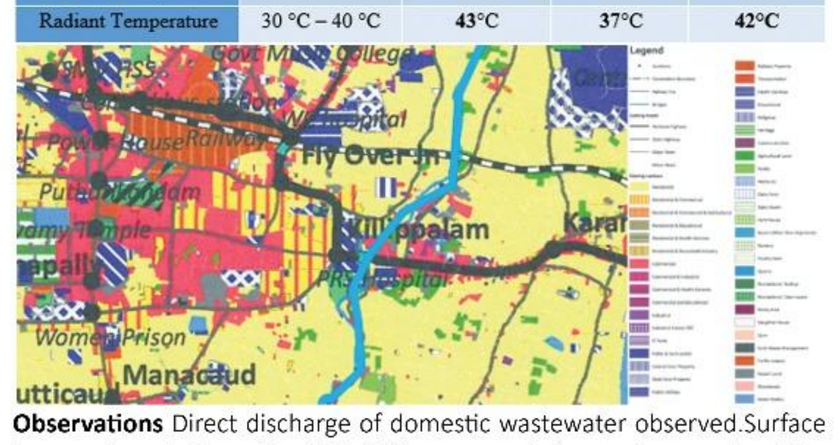
Observations Water relatively clear; less domestic sewage inflow.Temperature slightly moderated by tree cover and open land.Humidity levels stable; riverbank vegetation supports evapotranspiration.

Findings The upstream zone maintains a balanced microclimate, with noticeable cooling effects due to vegetation and flowing water.
Minimal pollution impact and stable water parameters.

Location: Midstream - (Killipalam-Chalai) Region

Parameter	*Standard Data*	*Sample values*	*Notes (Environmental Interpretation)*
pH	**6.5 – 8.5**	**7.6**	**Slight shift due to detergents + chemical runoff**
Dissolved Oxygen (DO)	**≥ 5 mg/L**	**2.7 mg/L**	**Severe depletion; organic load still high even after mixing**
BOD	**≤ 3 mg/L**	**12 mg/L**	**Accumulated sewage + organic waste from urban core**
COD	**≤ 10–25 mg/L**	**70 mg/L**	**Persistent chemical pollutants + greywater discharge**
Nitrate (NO_3^-)	**≤ 10 mg/L**	**5 mg/L**	**Nutrient accumulation from detergents/fertilizers**
Phosphate (PO_4^{3-})	**≤ 0.1 mg/L**	**0.7 mg/L**	**High due to detergent-rich wastewater**
Turbidity	**≤ 5 NTU**	**25 NTU**	**Heavy particulate matter, silt, and floating debris**

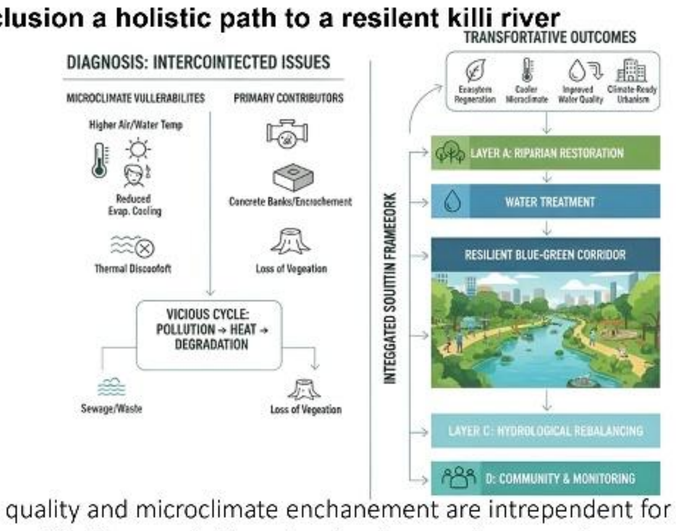
Parameters	Standards	Zone 01	Zone 02	Zone 03
Air Temperature	26°C – 32°C	**35°C**	**31°C**	**34°C**
Surface Temperature	28°C – 35°C	**40°C**	**35°C**	**39°C**
Humidity	60% – 80%	**60%**	**70%**	**62%**
Radiant Temperature	30 °C – 40 °C	**43°C**	**37°C**	**42°C**



Observations Direct discharge of domestic wastewater observed.Surface temperature higher (by 1.5–2°C) compared to upstream; humidity reduced.Reduced vegetation; built-up density high.

Findings Water pollution and concretization contribute to localized heating and reduced humidity. Strong correlation between poor water quality and microclimatic imbalance.

Conclusion a holistic path to a resilent killi river



Water quality and microclimate enchanement are intrependent for urban resilence.Killi River pollution elevates temperatures, cuts evaporative cooling, and worsens urban heat, especially in midstream urban stretches. GIS shows vegetation loss amplifies heat islands. Study urges integrated restoration—riparian rehab, wetlands, soft edges—for water quality, ecology, and microclimate gains, treating the river as a vital urban ecosystem.

CWAS CRDF CEPT UNIVERSITY
CEPT UNIVERSITY FACULTY OF PLANNING
Gates Foundation
viega foundation