Kaushik Ravi

Computational Urban Ecologist · Civic Technologist · Researcher

Hosur, India

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Research Interests

I develop and analyze systems at the intersection of urban ecology, computational analysis, and civic technology. My work involves developing scalable, data-driven systems to quantify the socio-ecological value of urban green infrastructure. My specific interests include: citizen-centric climate intelligence, participatory sensing for environmental monitoring, applying machine learning and photogrammetry for urban forestry, and designing sustainable mobility systems that integrate objective environmental metrics.

Education

National Institute of Technology, Tiruchirappalli (NIT Trichy) *Tiruchirappalli, India*

Bachelor of Technology (B.Tech) in Civil Engineering, Minor in Energy & Environmental Engineering *Dec 2021 – May 2025*

- **Cumulative GPA:** 9.5/10.0
- **Relevant Coursework:** Geodesy, Energy and Environmental Engineering, Environmental Management and Impact Assessment, Solid Waste Management Techniques, Conservation Geography, Forests and their Management, Hydrology and Irrigation Engineering, Transportation Planning, Bio-Energy Conversion, Solar Thermal Technology.

Publications / Pre-Prints

Citizen Centered Climate Intelligence: Operationalizing Open Tree Data for Urban Cooling and Eco-Routing in Indian Cities

Ravi, K., & Brück, A. (2025), in HackYourDistrict (Forthcoming Book Chapter, Under Review) (View Preprint)

Urban Tree Density and Its Impact on Temperature and Oxygen Production: A Case Study of Berlin

Ravi, K., & Brück, A. (2024), Technische Universität Berlin. (View Publication)

Work Experience

Inside Out (Independent Research Initiative) *Hosur, India*

Founder & Principal Investigator *Mar. 2025 - Present*

Product 1: Pune Urban Tree Intelligence Dashboard

- Engineered a full-stack urban analytics platform to visualize and analyze a census of 1.79 million trees. The system quantifies city-wide carbon sequestration (288,772 tons) and localized cooling effects.
- Developed a novel ETL pipeline in Python (GeoPandas, Rasterio) to process 390 satellite-derived Land Surface Temperature (LST) images, creating new percentile-based metrics for cooling efficacy that are robust to data outliers.
- Pioneered a data-driven "Tree Archetype" classification system, identifying high-performance growth profiles with up to 13.9°C of cooling potential.
- Designed and implemented a prescriptive "Planting Advisor" in React (TypeScript, Turf.js) that simulates greening interventions, forecasting the thermal impact for a user-defined area.
- Solved a critical performance bottleneck by architecting a Vector Tile (MVT) pipeline, reducing initial map data load from 57MB to kilobytes to enable seamless, city-scale visualization of 1.79 million data points.

Product 2: TreeFolio - AI-Powered Dendrometry Tool

- Developed a full-stack web application (FastAPI, React) that employs Meta's Segment Anything Model (SAM) and photogrammetry to extract dendrometrics from a single smartphone photo.
- Engineered an end-to-end scientific pipeline integrating PlantNet API for species identification.
- Integrated with a Global Wood Density Database to estimate sequestered CO_2 using pantropical allometric equations, calculating 3,210.99 kg of CO_2e for a sample tree.

Product 3: Pune Eco-Path Navigator

- Designed a dual-mode navigation system featuring an eco-friendly driving mode and an AI-powered wellness mode for pedestrians.
- Engineered the driving mode which integrates real-time traffic (TomTom API) with a custom Environmental Quality Score (EQS) to recommend routes that balance travel time, predicted emissions, and exposure to green infrastructure.
- Engineered the wellness mode which generates personalized, guided walking meditations by using Google's Gemini API to create a unique script based on the ecological themes of trees along an intelligently generated path.
- Developed a novel "Serenity Score" for road segments by synthesizing tree data, prioritizing experiential qualities like canopy cover and biodiversity for pedestrians, normalized using robust quantile transformation.

LABOR K / K LAB, Technische Universität Berlin — *Berlin, Germany*

Summer Research Intern — *Jun. 2024 - Aug. 2024*

- Conducted a quantitative analysis of Berlin's urban forest (885,825 trees), calculating a mean temperature reduction of 1.48°C in high-density areas and estimating total oxygen production using species-specific allometric equations.
- Developed interactive data visualizations to communicate the ecological benefits of urban trees for heat mitigation and air quality improvement.
- Funded by the prestigious DAAD WISE Scholarship.

MIT Senseable City Lab — *Dubai, UAE*

Selected for Exchange Student Position — *Selection for Jan 2025*

- Selected for a competitive research position to work on deploying resilient tree species by integrating urban forestry with smart city solutions.

Research Translation & Civic Impact

Reap Benefit — *Bengaluru, India*

Youth Board Member — *Jan. 2025 – Present*

- Serve as a voting member on the organization's strategic youth board, contributing to long-term planning and governance for a leading national civic-tech NGO.
- Provide a critical youth-centric perspective on organizational strategy, influencing the roadmap for product development, analytics, and fundraising initiatives.
- Collaborate directly with internal teams to ensure strategic goals are translated into actionable, on-the-ground projects for youth changemakers.

The World Bank (Solutions for Youth Employment) — *Remote*

Youth Advisor, Climate Thematic Group — *Nov. 2023 - Present*

- Serve as one of 140 members of the Youth Advisory Group, providing feedback on global climate policies and assessing their stance on sustainability from a youth perspective.
- Collaborate with an international cohort to co-create strategies for impactful, youth-led climate engagement and local solutions to global challenges.

Reap Benefit — *Remote*

Team Leader & Mentor, Urban Data Analysis — *Apr. 2022 - Present*

- In my concurrent operational role, initiated engagement via the selective Solve Ninja Leadership Accelerator, developing a POC that won the national Avery Dennison InvEnt Scholarship.
- Promoted to a leadership position to mentor cohorts of "Solve Ninjas" in applying rigorous, data-driven methods to solve hyperlocal civic and environmental problems.
- Guide student teams through the full project lifecycle, from survey design and spatial analysis to crafting evidence-based narratives for government advocacy.

Technical Skills

Programming Languages	Python, C++, TypeScript, JavaScript (React, Node.js), SQL
Data Science Libraries	NumPy, Pandas, Scikit-learn, Rasterio, Shapely, GeoPandas, Turf.js
Geospatial & Databases	Google Earth Engine (GEE), PostgreSQL / PostGIS, QGIS
AI & Machine Learning	PyTorch, Gemini API, Meta Segment Anything Model, Neural TTS (Piper), Supervised Learning (Regression)
Web Development	React, Vite, MapLibre GL JS, Chart.js, Tailwind CSS, Flask, FastAPI
DevOps & Tools	Docker, Vector Tiles (Tippecanoe), Git
Engineering Software	MATLAB, AutoCAD, SAP2000, ETABS

Honors & Awards

2024	**DAAD WISE (Working Internships in Science and Engineering) Scholarship,** German Academic Exchange Service, One of 150 scholars selected from a national pool of several thousand applicants to fund a research internship in Germany	*Germany*
2025	**Millennium Fellowship & Campus Director,** UN Academic Impact & MCN, Selected as one of 4,000 fellows from a global pool of 52,000+ applicants for a leadership program advancing UN SDGs; appointed to lead the campus cohort	*Global & Trichy, India*
2022	**Avery Dennison InvEnt Scholarship,** Avery Dennison Foundation, National-level award for innovation in combating climate change; one of 10 scholars selected from 500+ applicants across five premier national institutes	*India*
2025	**Ranga Class of 1974 Award,** National Institute of Technology, Tiruchirappalli, Awarded for academic excellence	*Trichy, India*
2023 & 2024	**Seetharaman Narayanan 1984 Trust Scholarship,** National Institute of Technology, Tiruchirappalli, Awarded consecutively for academic excellence	*Trichy, India*