

Assessing Flood Risk Through Urban Drivers: Insights for Urban Resilience From Yozgat, Türkiye

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ABSTRACT

This study assesses flood risk in Yozgat District, Yozgat Province, Türkiye, by linking urban drivers to planning responses. Its mixed-methods design integrates hydrometeorological series, historical event records, national hazard/risk layers, terrain diagnostics, and a cross-scale review of the planning hierarchy. Its results show how risk concentrates along culverted or hard-lined reaches in Büyükbaltaözü, Şehiriçi, and Taşlıburun, where impervious cover is high and stormwater wastewater interactions persist. An action matrix for priority belts is distilled from its findings, comprising selective daylighting and renaturalization, protection of overland flow routes, micro-retention/detention in public space, riparian setbacks, and targeted gray upgrades with routine maintenance. Benchmarking the transferability of Copenhagen’s pluvial toolkit, this research emphasizes the suitability of surface-based blue-green measures to inland valley cities. The major contribution of this study is the operational link it makes between risk evidence and implementable planning instruments.

KEYWORDS

Climate Change, Urban Adaptation, Risk Reduction, Urban Planning, Pluvial Flooding, Blue-Green Measures, Cloudburst Streets, Hazard Mapping, Türkiye

INTRODUCTION

The interaction between urbanization and climate change has two paradoxical dimensions. Cities are the central location for human efforts to adapt to the effects of the climate crisis and the reduction of greenhouse gases; at the same time, they are the focal points of risks resulting from climate change. Among the most important indicators of climate change are doubtlessly overflows and floods. With the increase in extreme rainfall, flood risks are realized more frequently and more intensely on a daily basis. Precipitation regime changes and unplanned urbanization have led to an increase in the types, strength, frequency, and area of impact of flooding. Floods are now one of the most common natural risks that affect people. At present, 19% of the world’s population (1.47 billion people) is exposed to serious flood risk once every 100 years (Rentschler & Salhab, 2020). In addition, of the natural disasters that occurred across the world between 2000 and 2019, 44% (3,254 cases) were

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flood disasters (Centre for Research on the Epidemiology of Disasters & United Nations Office for Disaster Risk Reduction, 2020).

Two-thirds of the major cities of the world are located on the coast, which makes them vulnerable to flood risks. At the same time, the intensification of urban land take and the modification of natural drainage systems amplify surface runoff and peak flows in inland catchments, such that even cities far from coasts have increased flood-risk exposure. With projections that 75% of the world's population will be living in cities—including coastal cities sensitive to flood risk—in the future (United Nations Department of Economic and Social Affairs, [UNDESA], 2019), flood-risk exposure areas will almost certainly continue to increase. Understanding the drivers behind flood risks is critical to reducing their devastating impact on society (Zhou et al., 2019).

In this context of elevated risk, country-specific risk profiles matter as much as global trends. Türkiye frequently experiences severe hydrometeorological events; floods rank among the top disaster types after earthquakes (Disaster and Emergency Management Authority [Afet ve Acil Durum Yönetimi Başkanlığı; AFAD], 2022; AFAD, 2023). At the provincial scale, Yozgat recorded 177 flood events between 1950 and 2019, placing it 10th nationwide (AFAD, 2020) and floods/flash floods were the most common events during 2010–2020 (Yozgat AFAD, 2022). Three streams traversing the urban core—Büyükbaltaözü, Şehiriçi, Taşlıburun—create recurrent flood pathways in densely built areas (Kızılırmak Basin Flood Management Plan, 2019). These conditions motivate a city-scale assessment that links physical drivers to planning responses. It is thus urgent that cities having historically struggled with flood risks be examined and that innovative strategies of adapting to possible flood risks in the future are devised. Yet, even as the literature on flood risks all over the world grows, a local knowledge gap for Yozgat persists; to our knowledge, no integrated flood-risk study combining multilayer hazard/risk analysis with plan-hierarchy assessment has been published for the city to date.

Accordingly, this study aimed (a) to identify the flood risk factors in Yozgat District and (b) specify risk-reduction policies tailored to the local context as a core component of urban resilience. In formulating these policies, we selectively drew on the experience of cities that have pioneered design-led approaches to pluvial flooding (e.g., Copenhagen) to derive locally adaptable solutions. Guided by this goal, the study addressed three research questions (RQ):

- RQ1. How do climate-related rainfall extremes and local urban drivers jointly shape pluvial flood pathways and impacts in Yozgat District¹?
- RQ2. Which factors generate flood risk in Yozgat District?
- RQ3. Which risk-reduction and adaptation policies should be advanced to reduce flood risk in Yozgat District?

To address these questions, we conducted an empirical case study of Yozgat District that integrated a cross-scale assessment of the planning hierarchy² with hydrometeorological datasets, historical event records, and flood hazard/risk layers, which we adapted into three scenarios from the national hazard layers produced by the Turkish General Directorate of Water Management (Su Yönetimi Genel Müdürlüğü [SYGM]): Q50 (high-probability/frequent), Q100 (medium-probability reference), and Q500 (low-probability/extreme). The analysis linked physical drivers to exposure in priority subareas and then translated the evidence into measures implementable within local planning instruments. We briefly reference international practice in the discussion section to contextualize policy transfer to pluvial/urban-drainage settings. The core of the paper remains the field-based evidence from Yozgat District.

Methodologically, the paper first outlines a concise framework for resilience (concept, resilient city approach, and key indicators) to organize risk drivers and responses. We then present our methodology and data from the Yozgat analysis, comprising multisource hydrometeorological and spatial datasets, hazard–risk mapping, and plan-hierarchy compliance review. The subsequent section

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