

The Development-Risk Paradox in Watershed Urbanism: Structural Barriers to Nature-Based Resilience in Rural Taiwan

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Abstract

Climate change is intensifying risks across interconnected ecological and social systems, yet in many Asian watershed towns, urbanization patterns continue to contradict resilience principles. This study examines the "Development-Risk Paradox"—a phenomenon where intensive development coincides with high environmental hazards—using Wufeng District in the Wu River watershed (Central Taiwan) as an empirical case of a stressed Socio-Ecological System (SES). By integrating literature review, field surveys, and ArcGIS-based spatial analysis (overlying IPCC AR6 risk metrics, land use data, and housing prices), we investigated the trade-offs between economic expansion and ecological security.

The results reveal three critical dimensions of vulnerability: (1) Spatial Maladaptation: Densely populated settlements significantly overlap with high-hazard zones (flood, landslide, and fault lines), indicating that urban encroachment is expanding into, rather than retreating from, risk areas. (2) Loss of Nature-Based Buffers: The rapid conversion of agricultural land—which traditionally served as a natural buffer—into impervious residential and industrial surfaces has intensified surface runoff and deteriorated air quality (PM_{2.5}), creating cascading ecosystem disservices. (3) Perverse Economic Incentives: Contrary to risk perception theories, property values in high-risk zones have risen due to industrial-driven speculation. This demonstrates a positive correlation between land use intensity and environmental risk. This study contributes to the session by highlighting a critical governance challenge: the prevailing "growth-first" logic acts as a structural barrier to implementing Nature-based Solutions (NbS). We argue that without addressing these underlying socio-economic drivers and land-market dynamics, community-led adaptation and ecological restoration efforts will remain marginalized in the face of developmental pressure.

Keywords: socio-ecological systems, peri-urbanization, land use change, spatial maladaptation, watershed governance.