

Integrating Migration, Vulnerability and Coping Capacity into Multi-Dimensional Flood Risk Assessment: Empirical Evidence from Flood Prone Peri-Urban Phnom Penh

M. Nong*

Department of Civil and Environmental Engineering, Graduate School of Urban Environmental Sciences,
Tokyo Metropolitan University, Hachioji City, Japan

Centre for Natural Resources and Environment, Cambodia Development Resource Institute, Tuol Kork,
Phnom Penh, Cambodia

T. Konishi

Department of Civil and Environmental Engineering, Graduate School of Urban Environmental Sciences,
Tokyo Metropolitan University, Hachioji City, Japan

T. Kumagae

Department of Civil and Environmental Engineering, Graduate School of Urban Environmental Sciences,
Tokyo Metropolitan University, Hachioji City, Japan

H. Amaguchi

Department of Civil and Environmental Engineering, Graduate School of Urban Environmental Sciences,
Tokyo Metropolitan University, Hachioji City, Japan

Y. Imamura

Department of Civil and Environmental Engineering, Graduate School of Urban Environmental Sciences,
Tokyo Metropolitan University, Hachioji City, Japan

Abstract:

Peri-urban migration in Phnom Penh concentrates new settlements in flood-prone zones, increasing population exposure. This study applies a flood risk assessment framework integrating exposure, vulnerability, and coping capacity at both community and household levels. The study employs Ordinary Least Squares regression with robust standard errors to estimate the effects of flood exposure, household demographics, socioeconomic status, housing characteristics, prior flood experience, and community-level flood risk interventions on household flood vulnerability. Analysis is based on 454 surveyed households. The results confirm that population growth through migration increases exposure, as new migrants disproportionately settle in high-risk areas. Flood exposure is the strongest predictor of vulnerability ($\beta = 0.244$, $p < 0.001$). Vulnerability is higher among recent migrants, larger households, those with more dependents, poor households, and renters. Higher income and high school education slightly reduce vulnerability. Households with weak or absent flood risk reduction support ($\beta = -1.274$, $p < 0.001$) and limited flood response planning ($\beta = -2.322$, $p < 0.001$) at the community level experience higher vulnerability. Household-level preparedness measures show the least effect. These results provide empirical evidence that multiple factors influence vulnerability toward high flood risk. Household vulnerability and migration status further elevate risk for resource-

limited households. Weak community coping capacity amplifies vulnerability, particularly for new migrants and low-income groups. The proposed framework, integrating multi-factor hazard assessment with household and community coping capacity indicators, can be applied to other rapidly urbanizing cities to guide targeted interventions in high-risk areas.

Keywords:

Urban flooding, peri-urban migration, vulnerability and coping capacity, adaptive capacity, capital city Cambodia.