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FINDINGS

Appropriate management of disaster risk in a dynamic urban context requires performance criteria to be explicit in considering both direct and indirect impacts generated by the interdependent elements of urban system to which these criteria apply.

Urban Form and Disaster Risk Reduction:

Developing Performance Criteria for Urban Areas Exposed to Flooding

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Australia's national policies have advocated a flexible performance-based approach to planning for disaster resilience. The Victoria Planning Provisions warrant performance-based planning mainly by Overlay controls. In an existing urbanized area, Flood Overlays come as a development-control measure, but they have no or limited implication on land use, land subdivision, dwelling density, distribution of open space etc. which have significant connection with risk avoidance and recovery process. In addition, Overlays are ineffective in reducing indirect impact of flooding. It also lacks performance criteria to assess urban form's capacity to mitigate the flood risk.

Introduction

Although existing spatial and urban resilience approaches have dealt with urban form indirectly, and, conversely, some studies in urban morphology have tried to grasp the complexity of urban-natural environments, an explicit morphological perspective on disaster risk reduction (DRR) is still lacking in academic research[1]. This study seeks to address this gap by identifying performance criteria at the morphological scale based on the substantive evidence of associations between urban form variables (Density, Street, Land use, Plot, Building, Open space) and DRR (response, recovery and mitigation). It is argued here that, an urban morphological approach provides an appropriate framework for examining urban form's performance in disaster risk reduction.

Methods

This study has been undertaken as a systematic literature review. The research question addressed by this study is: What particular role can urban form play in disaster risk reduction? Thompson Reuters Web of Science and Google Scholar bibliographic databases were used to identify the literature on urban form and environmental performance; urban form and disaster risk recovery, response and mitigation. When combined, the dataset included publications (articles, book chapters, conference proceedings, reports) from a variety of disciplines (Engineering, Urban Planning, Environmental Study, Geoscience Study, Disaster Science, etc.). The studies were then reviewed to determine if they actually covered the intended search. They were excluded if the studies (a) failed to address the research question and (b) were not based on empirical data.

Results

There are substantial indications that urban form has bearing on disaster risk reduction. Fig1 (i)-(v), show the implication of various urban form variables on flood risk assessment. However, in several cases evidence on the relationship between urban form elements is contentious, ambiguous and even contradictory. This contradiction seems to lay on contextual variations, and the selection of control variables during analysis. Inconsistency is also observed in consideration of multi-scalar implications of urban form on disaster risk reduction.

Discussion

The alliance between urban morphological elements and disaster risk reduction are discussed below:

- The association between density and DRR is controversial. High-density development within a pre-existing vulnerable location may expose more people and property to flood hazards, increasing disaster risk. Conversely, when coupled with land use diversity, high net density offers more room for avoidance of sensitive areas and can influence attributes such as social capital and place attachment which facilitates recovery.
- Street patterns, permeability and drainage feature were identified as associated with disaster response and recovery both at the macro and micro scales. At the macro scale, gridded networks, with small blocks, are found more desirable for improving emergency service accessibility and for facilitating rapid evacuation, while at the micro scale, the incorporation of various street design features such as vegetated swales, wayfinding systems, and a network of small and medium assembly areas may enhance the ability of rapid recovery.
- Open spaces have the potential to act as an agent of recovery, to provide essential life support, as a primary place for rescue and shelters; and a mode for mitigation.
- Various aspects of plot(subdivision, impervious coverage) and building (form, footprint, setback, roof type, material and technology) have bearing on disaster risk reduction. Studies also showed that urban wide transformations in this micro scale aspects can have positive effects on the macro scale.

In reducing disaster risks, various urban form measures may reinforce or conflict with one another. Different trade-offs may occur due to conflicts in purposes and priorities, and varying requirements depending on the type of disaster and the stage of risk management. Trade-offs may also occur within spatial scales. Any intervention in urban form should be pursued in an integrated manner in order to maximize synergies and minimize trade-offs between potentially competing strategies for risk reduction and urban development.

1. Forgaci, C. and Van Timmeren, A., 2014. Urban form and fitness: Towards a space-morphological approach to general urban resilience. In ISDRC 2014: 20th Annual International Sustainable Development Research Conference" Resilience–The New Research Frontier", Trondheim, Norway, 18-20 June.

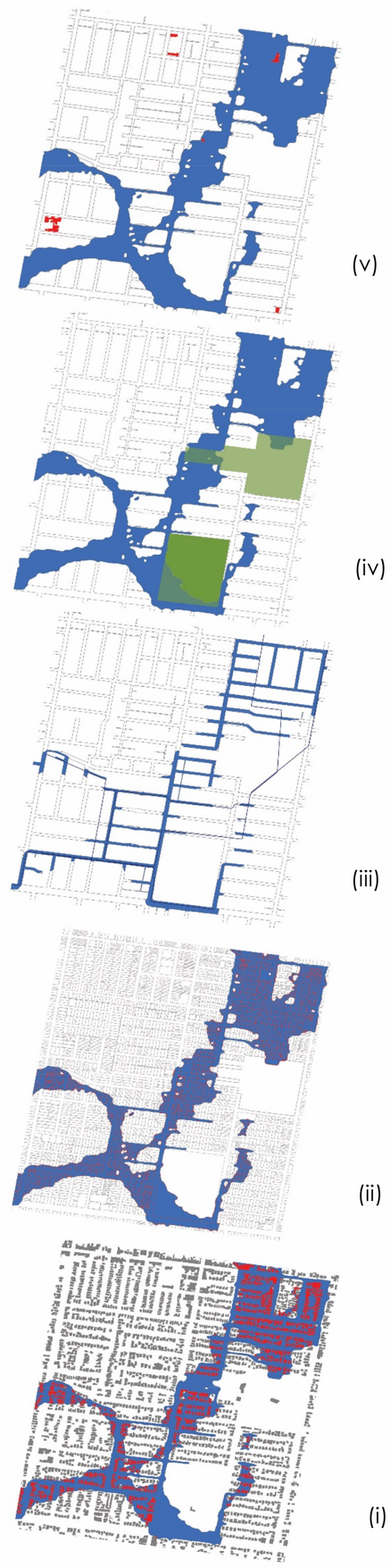

Figure1: Implication of Urban form on flood risk assessment

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