

## Indeterminacy: An Urban Design Tool to Measure Resilience to Climate Change, a Caribbean Case Study

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**Abstract :** How well are our city forms designed to adapt to climate change and its resulting uncertainty? What urban design tools can be used to measure and improve resilience to climate change, and how would they do so? In addressing these questions, this paper considers indeterminacy, a concept originated in the resilience literature, to measure the resilience of built environments. In the realm of urban design, 'indeterminacy' can be referred to as built-in design capabilities of an urban system to serve different purposes which are not necessarily predetermined. An urban system, particularly that with a higher degree of indeterminacy, can enable the system to be reorganized and changed to accommodate new or unknown functions while coping with uncertainty over time. Underlying principles of this concept have long been discussed in the urban design and planning literature, including open architecture, landscape urbanism, and flexible housing. This paper argues that the concept indeterminacy holds the potential to reduce the impacts of climate change incrementally and proactively. With regard to sustainable development, both planning and climate change literature highly recommend proactive adaptation as it involves less cost, efforts, and energy than last-minute emergency or reactive actions. Nevertheless, the concept still remains isolated from resilience and climate change adaptation discourses even though the discourses advocate the incremental transformation of a system to cope with climatic uncertainty. This paper considers indeterminacy, as an urban design tool, to measure and increase resilience (and adaptive capacity) of Long Bay's coastal settlements in Negril, Jamaica. Negril is one of the popular tourism destinations in the Caribbean highly vulnerable to sea-level rise and its associated impacts. This paper employs empirical information obtained from direct observation and informal interviews with local people. While testing the tool, this paper deploys an urban morphology study, which includes land use patterns and the physical characteristics of urban form, including street networks, block patterns, and building footprints. The results reveal that most resorts in Long Bay are designed for pre-determined purposes and offer a little potential to use differently if needed. Additionally, Negril's street networks are found to be rigid and have limited accessibility to different points of interest. This rigidity can expose the entire infrastructure further to extreme climatic events and also impedes recovery actions after a disaster. However, Long Bay still has room for future resilient developments in other relatively less vulnerable areas. In adapting to climate change, indeterminacy can be reached through design that achieves a balance between the degree of vulnerability and the degree of indeterminacy: the more vulnerable a place is, the more indeterminacy is useful. This paper concludes with a set of urban design typologies to increase the resilience of coastal settlements.

**Keywords :** climate change adaptation, resilience, sea-level rise, urban form

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