Doctoral abstract

Thesis title: Rebuild, retreat or resilience: can Taipei plan for resilience?
Candidate name: Dr Yu-Shou Su
National Development Council of Taiwan, Taipei, Taiwan and Penn Institute for Urban Research, University of Pennsylvania, Philadelphia, USA
Department: Graduate Group in City and Regional Planning, School of Design
College/university: University of Pennsylvania
Country: USA
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Thesis supervisor(s): Professor Eugénie L. Birch
Graduate Group in City and Regional Planning, University of Pennsylvania, Philadelphia, Pennsylvania, USA and Penn Institute for Urban Research, University of Pennsylvania, Philadelphia, Pennsylvania, USA
Postal address: No. 3, Baoqing Rd., Taipei 10020, Taiwan
Contact email: yushou.su@gmail.com; yusu@design.upenn.edu; yssu@ndc.gov.tw

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Taiwan is ranked as the country most exposed to multiple hazards (The World Bank 2005). Taipei City is the capital city as well as the economic and political center of Taiwan. The United Nations report *World Urbanization Prospects: The 2011 Revision* places Taipei City third on the list of the world's top ten urban areas exposed to three or more natural hazards, with the highest risk of cyclones, floods and landslides. To gauge the vulnerabilities and damages of Taiwan and Taipei City, this research creates a natural disaster density indicator (NDDI) to conduct a comparative study of Taiwan, Japan, China, USA, UK, France and The Netherlands over the past three decades. The results indicate that Taiwan has both – the highest disaster occurrence and highest death toll among these seven countries. The Taipei case study, a chronology of policies implemented to prevent flooding, explains that costly engineering structure rebuilding and fortification against floods eventually created a false sense of security, which has encouraged more intensive residential and commercial developments in flood-prone areas and led to a higher level of vulnerability.

This research further simulates and evaluates the vulnerabilities of population, land value, properties, gross domestic product (GDP) and critical facilities in three scenarios: heavy rainfall, typhoon conditions and extreme weather rainfall, through the technology of geographic information system (GIS) by using ArcMap 10.2.2 software. The results indicate 40 per cent of Taipei City is located in flood-risk areas in an extreme weather scenario. This percentage is higher than that of other global cities such as London's 15 per cent, Tokyo's 10 per cent and New York City's 25 per cent. Based on the 10 per cent of total flooding areas above 0.5 m the vulnerable population is estimated at 200,000 people or 7 per cent of the total population. The GDP impact will be more than $28 billion. More than $67 billion of land value is vulnerable. At least one million subway passengers will be impacted each day. There is little evidence that the urban poor are particularly vulnerable to floods. On the contrary, some neighborhoods with high-income households face a higher risk of floods. Very few medical centers, oil and

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gas stations and electrical power substations are located in flood-prone areas, but a large number of public schools, administrative buildings and major subway stations are susceptible. Additionally, the likelihood analysis of flooding in an extreme weather rainfall scenario concludes that the possibility will be five times that of the existing assumption, with a flood in every 200 years. Thus, Taipei City's infrequent once-in-two-century floods are likely to occur more frequently. Further, the 1 per cent of Taipei metropolitan region flooding above 1 m, will possibly cost up to $ 1.5 billion in damages. Therefore, in the future, rather than strengthening and rebuilding costly structures, Taipei should focus on land-use and environmental planning for resilience. Urban policies should include environmentally responsible development in the face of continued population and economic growth and being resilient regarding natural disasters. Most important is the need of a strong political commitment and leadership to initiate and implement urban policies toward resilience. In doing so, resilience can be achieved in Taipei.