Vulnerable in Vietnam: Amphibious housing for flood-prone communities in the Mekong Delta

Region	**Asia and the Pacific**
Award Scheme	**Dubai International Award**
Themes	**Climate Change** **Environmental Resilience** **Housing** **Innovation** **Planning & Design** **Resilience & Risk Reduction** **Risk & Resilience**
Start Year	**2017**
Sustainable Development Goals	**Goal 11 - Make cities and human settlements inclusive, safe, resilient and sustainable** **Goal 13 - Take urgent action to combat climate change and its impacts**
New Urban Agenda Commitments	**Environmentally Sustainable and Resilient Urban Development**

Summary

As part of a Canadian-Vietnamese team, and with generous support from the Global Resilience Partnership and Z Zurich Foundation, the Buoyant Foundation Project worked alongside local experts and community members to retrofit four houses in Vietnam's Mekong Delta. Amphibious housing is an innovative flood mitigation strategy that allows homes to rest on the ground in dry conditions, rise with water during a flood, and return to their original positions as the floodwater dissipates.

Background and Objective

Vietnam's Mekong Delta is home to over 21 million people (22% of the national population), most of whom are agricultural and aquacultural farmers. The Delta is comprised largely of wetlands, which contribute 52% of the national rice production and 60% of the national fisheries and aquaculture production. The Mekong Delta is considered the rice bowl of Southeast Asia, making it essential for food supply and the national economy of Vietnam. The flood season occurs annually, typically lasting six months from July to December. With anthropogenic climate change comes increasingly severe flooding. Annual runoff from the upper basin of the Mekong River is projected to increase 21% by 2030, with annual precipitation expected to increase by 200mm a year. More frequent and extreme rainfall periods produce prolonged and more damaging flood events, with the potential for greater disruption to communities in the Mekong Delta. Flooding, however, is a normal seasonal event that is crucial to the ecosystem, as well as to the agricultural and fishing economies of the Delta. Increased precipitation could prove beneficial to the farmland, as flooding brings alluvial soil deposits from the upstream basin to areas downriver. This mineral-rich soil provides spawning grounds for fish, resulting in a well-stocked fishery. It also improves the fertility of the fields, resulting in a high diversity of flora and fauna. Diverting floodwater through typical, infrastructural-scale flood control systems such as dikes or levees prohibits the ecological benefits provided by sediment-bearing seasonal floodwater. In contrast, amphibious retrofit construction works in synchrony with natural flood cycles rather than attempting to control them. The key objective of this project was to implement a flood mitigation strategy that preserves residents' connection to their land and livelihoods, while minimizing the impact to local ecosystems, and ensuring continued ecological benefits from the seasonal flood cycles. Low-cost amphibious retrofits to existing houses in the Mekong Delta provide vulnerable households with a cost-effective alternative to rebuilding on higher stilts. They allow residents to remain on their farmland during flood events with little or no damage to their homes and possessions, while reducing the psychological trauma associated with flood events

Outcomes and Impacts

In 2018, four homes in the Mekong Delta region of Vietnam were retrofitted to become amphibious (two homes in An Giang Province, two homes in Long An Province). Two forms of monitoring were used to evaluate the project: 1) physical monitoring equipment was installed to assess the movement of the house while floating, and 2) interviews were conducted to assess homeowner satisfaction with the home's performance during a flood event, as well

as with the implementation process and living conditions in the house. The monitoring and evaluation of this project revealed wide-spread recognition of the project's success. The four retrofitted homes all floated successfully during the monsoon season, protecting the homes from inundation, and families from expensive or stressful property damages due to flooding. This recognition was shared by all who were involved in the project: homeowners, carpenters, local officials, Vietnamese and Canadian team members, and sponsors. Findings confirm that there is a strong potential to enhance economic resilience and sustainable livelihoods by providing opportunities for entrepreneurship related to amphibious construction. In 2020, an independent evaluation was completed to assess the effectiveness of the project. The successful performance of the retrofitted homes over two flood seasons has had a positive social impact on the community. Aligning with the Vietnamese government's resolution to support sustainable development and climate change adaptation in the Mekong Delta, there is local and government interest to expand the project.

Sustainability and Scalability

The success of this project demonstrates that scaling-up would have significant benefits for many people living in flood-prone communities around the world. The key to successful implementation is to engage in an inclusive and iterative design process that takes into account the social, economic, and environmental conditions. Determining the suitability of the location begins with identifying if the housing typology and flood characteristics are appropriate for amphibious retrofit construction. At the current state of the technology's development, the best-suited contexts for replication are dwellings made of light-weight materials with integrated flooring systems at least slightly elevated above the ground. Dwellings should not be subject to waves or high velocity water. As many households in flood-prone communities in developing countries lack the financial means and knowledge to implement amphibious retrofits, we propose scaling-up involve a training program to teach local tradespeople, entrepreneurs and community groups how to apply amphibious retrofitting techniques. Scaling-up in such a way not only increases community flood resilience but also builds local capacity and enhances local economic development.

Initiative Contribution

• Goal 9 - Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation. • Goal 11 - Make cities and human settlements inclusive, safe, resilient and sustainable. • Goal 13 - Take urgent action to combat climate change and its impacts

Innovative Initiative

Amphibious retrofit construction is an innovative approach to flood risk reduction that works in synchrony with natural flood cycles. This involved inventing a system that supplements the typical static foundation with a buoyant foundation that keeps the house dry by allowing it to float above the water during a flood. Vertical guidance posts allow the house to slide up and down but keep it from floating away. Using a grassroots approach, the community was mobilized and assisted in identifying pilot locations. The iterative design and construction process ensured responsiveness to stakeholders' values and differing circumstances as the basic technology was adapted for each house. The team engaged in a bottom-up approach to technology transfer, collaborating with local tradespeople and community members on how to apply amphibious retrofitting techniques in the Vietnamese context. Local and recycled materials were used for buoyancy elements and guidance posts to help ensure that materials were accessible, culturally appropriate, sustainable and cost-effective.

Conclusion

Through the implementation of this project homeowners and community members realized they no longer need to live in fear of the monsoon floods. This relatively simple technology provides communities in Vietnam's Mekong Delta with increased flood resilience as they face more severe flooding. Providing training opportunities will help to scale this project and will empower communities to implement locally-initiated retrofits.