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Floating architecture in the developing world

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Abstract

The worldwide sea level has been rising at a rate of 0.14 inches per year. Increases of this magnitude will have devastating effects in coastal habitats. As the land mass decreases, the already enormous population of the planet will be forced to cohabitate in smaller areas. To deal with these problems, architects and designers need to start understanding the need for typological developments in floating and amphibious architecture.

The precedent for this type of architectural development exists all over the world in water based communities in Peru, Cambodia, Vietnam, Myanmar and many other places, where, existing typologies of architecture have been evolving for centuries to adapt to life over water. It is within these typologies, that we can find solutions that when hybridized with; sustainable materials, smart energy systems and advanced food production techniques will develop a better quality of life for the different communities and their environments. Solving in this way, some of the problems faced by a large population on a planet with a decreasing land mass.

The development of a new water based system of architectural typologies has the potential to help humanity transition and adapt to changes produced by global warming. As the sea level rises and the land mass diminishes, communities will need to develop sustainable ways to produce energy and food, filter water and manage waste. And all these will have to be done in a local and economical way. The developing world will be the most affected by an increase in the water level, but it is also much more adaptive than the first world and change can happen quickly.

Keywords: sustainability, green roofs, floating architecture, self-sufficiency, standard of living, health, containers, hydroponic farming, passive income.

1 Introduction

As the planet starts to tackle the problems created by global warming, we see an increase in ideation methodologies with respect to adaptability of the first world to natural phenomenon. But we are not hearing much about the third world? The developing world will be more affected because of their lack of resources. On the other hand, small financial investments have the potential to go a long way in the developing world, especially when invested in marginal communities. In this paper, I will be presenting the design of a community center in a water based village, produced with local materials and local building techniques to solve some of the immediate problems of the community by generating a central node designed to serve as an educational facility for the development of sustainable systems and methodologies to be implemented in the rest of the community. The proposed building will not only serve the community in terms of its function, but also, it will showcase hi and low tech solutions, with the purpose of helping the users with implementation of these systems to refurbish the existing residences and help the community raise their standard of living.

2 The site

Tonle Sap (Great Lake) lake in Cambodia is the largest fresh water source in South East Asia. It has a population of three million people of which 90% earn a living in jobs related to the lake either through agriculture or fishing. With dimensions changing drastically between the monsoon (May/July to October) and the dry season, the lake fluctuates from 10,000 Km^2 to 3,000 Km^2 (MRCS/WUP-FIN, 2003). This fluctuation allows for the lake to have developed a bio-diverse ecosystem, housing 300 species of fresh water fish, snakes, crocodiles, tortoises, turtles and otters, and about 100 varieties of birds. Making of this area one of the food baskets of Cambodia, with a production of more than half of the fish consumed in the country. “The variation of water volume in the lake is caused by an exceptional hydrological phenomenon determined by the Mekong River. During the southwest monsoon the water level in the Mekong River rises so fast that part of the floodwaters runs to the Tonle Sap River, causing the river to reverse its flow back towards the Tonle Sap Lake that thus loses its only outlet” (Keskinen [1]). Because of the natural richness of the area the population of the area has settled along the edge of the water in stilted houses and floating villages. My research focused on the floating village of Kompong Luong, which has about 115 (floating) households of which the majority make a living out of fishing and some part time agriculture.

3 The problem

Climate change is raising the temperature of the planet’s oceans and atmosphere. This phenomenon increases the volume of precipitation held in clouds, resulting in more frequent, and more severe, flood and storm damage. As the sea level rises the world worries about those cities that historically have grown next to rivers or

oceans. Normally by proposing large-scale solutions looking at places like the Nederland as precedent. This type of approach is expensive and will only be implemented in places that demonstrate benefit in excess of cost. In New Orleans after Katrina it was estimated that "a coastal protection system capable of guarding against a Category Four to Five storm for New Orleans would cost $2.5 billion and require 10 to 20 years of construction" (CRS Report [2]). So it was not implemented because of this, the next time a super storm hits the area we will face the same problems. If this is the case in the first world, what can we expect from the third world? As global warming increases the potential of flooding for communities near water elements will increase, especially in river deltas, lakes shores and ocean areas with low topography.

4 Existing floating architecture in Tonle Sap lake

Floating slums come into existence because no one owns the water. While on land there is a tendency by landowners or governments to dismantle slum communities at will, water gives you the extra freedom of mobility. Communities form but they fluctuate in terms of fishing trends, weather patterns and floods. In this sense, floating villages are more adaptable. In Tongle Sap lake in Cambodia, the community is made of a number of floating villages that interact and mix with villages on stilts depending on the season. The village of Kompong Luong is only composed of floating units and is located in the middle of the lake. In it the existing dwellings are composed of a base made of metal or bamboo framing, holding a number of floatation devices, which normally are recycled metal or plastic barrels. The dwelling is built on top of the unit. All the materials used are lightweight and easy to find within the region. The construction techniques are very craft oriented and simple. In the lifespan of a dwelling unit you can expect multiple elements of the dwelling to be changed or repaired since most of the materials being used don't have longevity. The units will have an enclosed area and a porch. The porch serves as a docking station for boats, and a place where to store equipment, dry fish, fix nets and socialize.

5 The project

The advantage that developing communities have is that the financial cost of moving a disenfranchised community is not high. So when we start looking at the developing world, we find that we can improve the standard of living in large communities through education and small investments. A slum dwelling on stilts can be turned into a floating dwelling at very low cost, but as that happens, we have the opportunity to add to this transformed unit, a series of elements that can increase the quality of life of the user. After spending one month studying existing traditional dwelling structures with the purpose of developing an anthropological understanding of life on the lake, it became evident that the best option was to design a public building. This structure was intended to provide the community with an adaptive space that could serve multiple socio-educational needs and at the same time work as a place to showcase different ideas, designed to tackle

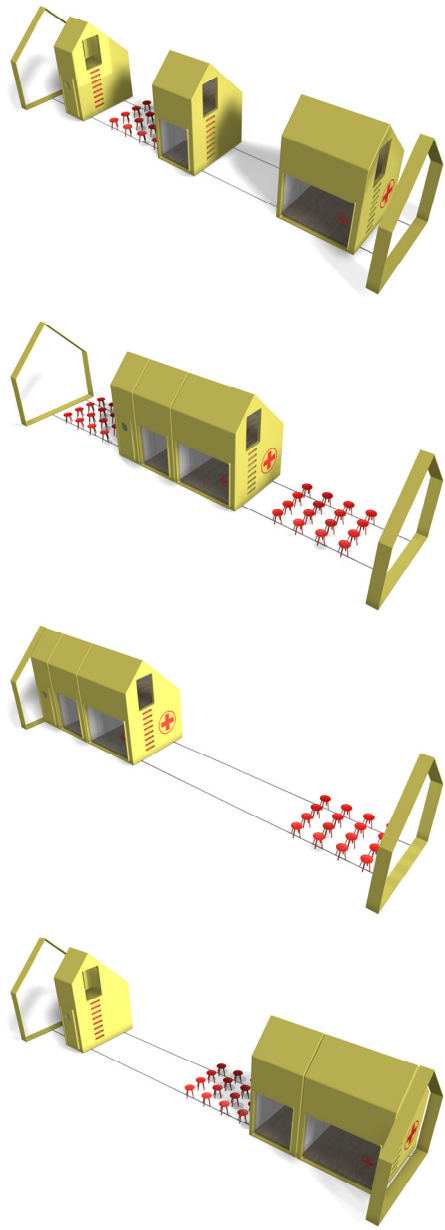

Figure 1: The inner volumes slide on tracks to create multiple spaces.

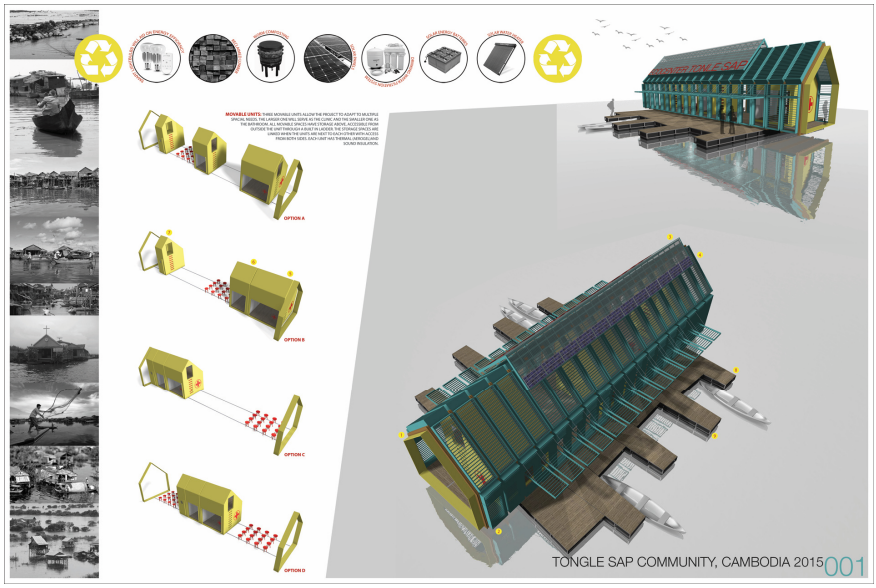

Figure 2: Board one.

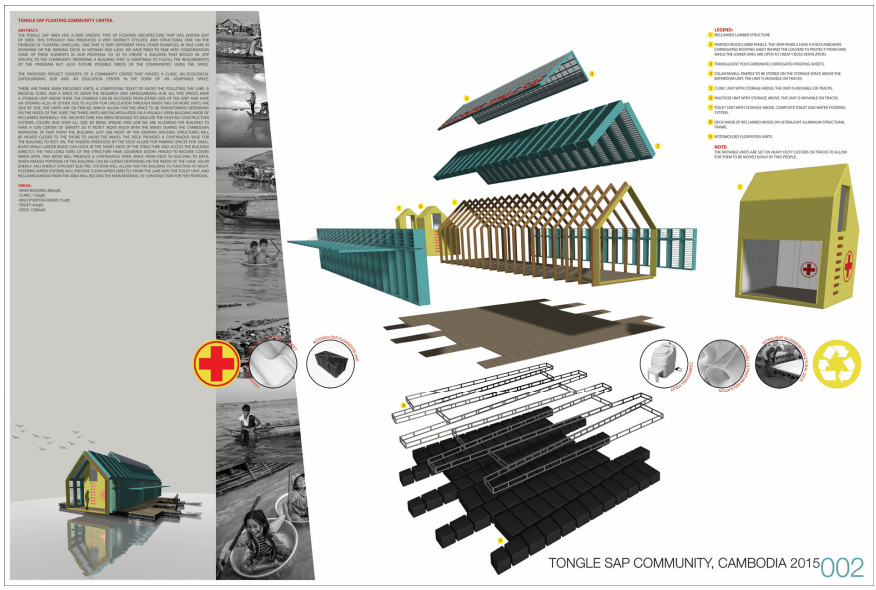

Figure 3: Board two.

health, energy, sanitation and social issues. The idea is that the village dwellers would use the space by participating in the use of its program and from that interaction get acquainted with the different workings of the different technologies.

In the interior the center has three volumes that move on tracks to reconfigure the space as needed (figure 1). One of the volumes is a composting toilet. The next one is an office for the study of the lakes ecology and the last a clinic. Presently there are no medical facilities in the village. The different configurations give the space a versatility that can allow for large, small or multiple groups to meet simultaneously. All the materials and technologies presented in this project exist in the immediate area surrounding the lake. The building is designed to be an eco-facility for the study and preservation of the lake with the added function of providing the community with a space where to have social and educational activities. The idea is that the center will serve as an example of how to add s series of technologies to the existing dwellings that can help increase the quality of life, health and economy of the village, and at the same time help preserve the ecology of the lake.

The building is set on a base made of metal tubes welded together that serves to hold a wooden deck and to lock in place refurbished plastic barrels that form the floatation system. The deck has been designed to split loads to balance the weight of the structure centrally. This is very important because in a lake this size, waves can become an issue. Panels on the deck can be removed to access aquaponic bays. Once the base is finished, it will serve as the platform from which all the other elements get built on. The building is made out of modular components that repeat to produce the main volume. Instead of walls the building has operable elements that serve both as dividers or covers depending on the position they are used as. This allows for flexibility when defining the use of the different activities taking place in the space. The roof of the building is angled to shed rainwater. Between the modular frames, boxes are used to stabilize the structure. These elements also serve to give the building thermal protection from the sun and work as beds for gardening. This roof garden serves as a learning tool to teach the community how to grow food in their floating dwellings. The roof also has solar panels to generate energy for the centers illumination and other electrical needs (figures 2 and 3).

6 Developing economic growth

The center has the potential to serve as a vocational school to develop an ecological and sustainable awareness in the community. This can be done by teaching; hydroponic farming, aquaponics, solar panel installation, composting, and a series of skills in construction that can help the community evolve. All of these through a building designed to address existing problems of; health, nutrition, and energy, all of which are direct obstacles linked to increasing quality of life. Hydroponic farming will give the families extra nutrients and save them money by growing a percentage of their own food. Any excess in production can be sold adding passive income to the finances of the dwelling. The solar panels

will provide extra hours of light, which will help the family to have more illuminated time for work or play. These families lack refrigeration, and the aquaponics systems will allow them to preserve caught fish alive until needed. The composting will produce passive income and maintain the lake clean of sewage and trash. The community center is not only a sustainable building but it can help turn the whole village into a sustainable community and by doing this bettering their quality of life.

7 Conclusion

Change in a community has to come from within, it can't be imposed, I believe that education, and the appropriate educational environment have the potential to allow communities to better their quality of life while respecting the cultural values of those who inhabit them. By creating a building that serves as a node for social and educational interaction we guaranty flow of public through the facility allowing for change to happen by example. The proposed building will not only serve the community in terms of its function, but also, it will showcase hi and low tech solutions, with the purpose of helping the users with implementation of these systems to refurbish the existing residences and help the community raise their standard of living. And by doing so helping improve the economic, education and health of a community as a whole.

References

[1] Keskinen, M. (2006:466) "The lake with floating villages: Socio-economic analysis of Tongle Sap lake", 22(3), pp. 463–480.

[2] CRS Report, New Orleans Levees and Floodwalls: Hurricane Damage Protection, Sept. 6, 2005. These estimates are likely to be vastly optimistic. See Peter Whoriskey & Spencer S. Shu, Levee Repair Costs Triple, Washington Post, March 31, 2006, at A01, available at http://www.washingtonpost.com/wp-dyn/content/article/2006/03/30/AR2006033001912.html?nav=rss_email/components (noting that the Bush Administration had raised cost estimates for rebuilding the New Orleans levee system to "federal standards" to $10 billion in light of better understanding of wetlands loss, subsidence, and hurricane frequency and intensity).