

Active and Passive Adaptation of Floating Houses (Rumah Lanting) to the Tides of the Melawi River in West Kalimantan, Indonesia

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Abstract

Floating houses or Rumah Lanting are one of the settlement cultures found in most river streams in Kalimantan and are observed to be different from several other houses in the area. They are mitigation-proof houses designed to respond to the risk of disasters usually experienced in the traditional settlements of West Kalimantan. Their structures have the ability to adapt to environmental conditions including natural disasters such as the river tides routinely experienced as a flood during the rainy season and as ebb in the dry season.

This study aimed to identify the human-adaptation process existing in these floating houses through direct observation for two years during the dry and rainy seasons as well as in-depth interviews conducted with occupants of these buildings. The adaptation processes identified include the active and passive adaptation of the dwellers. The active aspect was observed from the behavior of occupants in accommodating the occurrence of disaster in the surrounding environment while the passive was identified as the physical changes implemented in the building to mitigate the disaster. The focus of this research was on some dwellings on the river banks settlement in the Melawi River near Sintang Regency of West Kalimantan Province and a qualitative approach with a case study was implemented. The samples were determined through a non-probability approach in the form of a purposive sampling method based on certain selected criteria which included the previous experience of ebb and flow of river water in the Rumah Lanting.

The results showed the existence of active and passive adaptations for the dwellers of the floating houses in West Kalimantan. The active aspect observed involves the behavior of the occupants in adapting to natural disasters with the focus on the changes in the activity patterns, territory, and privacy. Meanwhile, the passive aspect showed some modifications in the architectural elements of the building such as the position, orientation, access, and function.

Keywords: Floating House; Active Adaptation; Passive Adaptation

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Introduction

Indonesia is a country with cultural diversity spreading throughout the Archipelago as observed with each region having different culture according to its characteristics. One of the manifestations of this is the settlement practice which involves living on the ground and water towards adapting to environmental conditions. This is necessary because nature is always changing and people need to adapt to climate change. Moreover, the settlements in some areas are developed due to the influence of natural reserves, geography, and the supporting capacity of environmental ecology (Clark, 2009). This is associated with the concept of settlement formation which is defined as a process involving ecological elements such as climate, water sources, sunlight, and soil (Marpaung & Senders, 2020). The culture of the locals in a settlement is also usually influenced by the economic, social, and cultural factors of the inhabitants. Furthermore, the spatial characteristics of settlements have been described in a previous study as the relation of the environment with the community's socio-economic conditions (Reinmann et al., 2016).

The settlement culture of Kalimantan is closely related to the natural environment and socio-economic conditions of the local community. The geographical condition with extensive forests and large rivers also influences the settlement cultures of the people with some living in the forest while others chose to live on the large rivers. Historically, the people living on the river are migrants aiming to conduct some economic activities such as trading, storage of goods, etc at the past arrival-time. These riverside settlements are, however, one of the factors initiating regional development in several regions of the city.

The development of these riverbanks as settlements is a consequence of the interaction between migrants and indigenous people as well as the high intensity of their activities. This gradual interaction led to the participation of these migrants in the improvement of the economic conditions of local communities which are geographically located in the interior areas without accessibility and infrastructure. These problems change the orientation of the settlements towards the river (Mentayani, 2016).

A floating house structure is one of the settlement cultures in Kalimantan and it involves the residence of local people by the side of a river. These houses are usually constructed with local materials and are still available in several major rivers in West Kalimantan. They exist as dwellings in the Melawi River which is one of the major rivers in the area. It is important to note that riverside settlement is a culture with a sys-

tem of values, rules, and norms. Moreover, the local wisdom and culture of the people living in the established settlements of a particular area are usually the character of the surviving cultural identity on the riverside (Wicaksono, 2018). Individual efforts to preserve local wisdom also usually affect the sustainability of a community's cultural identity (Pesurnay, 2018).

The scholars in some publications identified the two main reasons people live in a floating house to include history and life necessities. Historically, the floating house is a general dwelling structure for people from outside villages to temporarily stay till the completion of their interaction and economic activities with the indigenous community. In terms of life necessities, the occupants are people without property rights on the mainland that build structures on the river as a place to live (Mustansyir, 2013).

The main problem for the floating house occupants is the limitation of space for activities. This affects their movements and also requires effective utilization of particular existent rooms. The traditional design of the structure also has particular spaces for different activities and the absence of insufficient space to accommodate these activities has the ability to cause conflicts among the dwellers. There is, therefore, the need for adaptations and changes in the living pattern of the house with respect to the environmental conditions. This is important because an efficient arrangement and multi-purpose functionalization of limited space can affect productivity and minimize conflicts (Guo, 2002). This adjustment is usually continuous and has become the habit of the occupants such that they eventually become comfortable while conducting their activities in the building. Moreover, space is continuously provided in line with the daily activities of the owner in order to mitigate the limitations of the floating house (Estaji, 2017).

The process of adaptation by the occupants occurs internally with the focus on the space and activities and externally which involves a creative interaction between the occupants and the environment (Priemus, 1986). The external adaptation process is a measure of the occupants' ability to adapt to the building's conditions and the environment. In several areas of Kalimantan, the floating house is an example of a structure designed to respond to changes in the environmental conditions due to disaster such as a flood during the rainy season and aridity in the dry season. These conditions also occur in the Melawi River with the water level usually rising and reducing significantly due to climate change. The river water level normally rises during the rainy season, thereby, causing the

flood to reach settlements on the land with a height of 1-2 meters while the riverbed is usually visible by leaving 2-5 meters of water surface to river stream width during the dry season. This, therefore, requires some level of adaptation from the occupants of the floating house. This has been the norm for a very long time and has become a habit for the occupants to achieve a comfortable living while performing their daily activities.

This study, therefore, aimed to identify the occupants' adaptation process and activities within a floating house. This involved the observation of the activities of the occupants inside the floating houses during the river's particular disaster in the form of flood and ebb for 2 years using Melawi River in the Sintang Regency of West Kalimantan as the case study.

The purpose of this study was to recognize the adjustment process autonomously implemented by the occupants towards river tides disasters and the physical changes usually made in the floating houses. This is necessary because, according to Riyandari (2018), the direction of the disaster management process in

the riverbank settlements has always been focused on prevention through the involvement of the local governments. It is, therefore, possible for stakeholders to prevent flooding in riverbank settlements by issuing appropriate policies on disaster prevention efforts such as the construction of early warning systems or the development of a natural disaster mitigation layout for dwellings in these settlements.

Melawi River Characteristics

Melawi River is a tributary of the Kapuas River in West Kalimantan. It stretches from Sintang Regency to Ambalau Sub-District which is located at its upstream. The length of this river is approximately 600 km with a depth of approximately 12-16 meters to the riverbed. It currently functions as the economic and transportation lifeblood of the interior communities in West Kalimantan, especially the upstream areas. The Melawi River has experienced regular extreme tides such that it becomes shallow in the dry season, thereby, making it difficult for water transportation routes. Meanwhile, it overflows in the rainy sea-

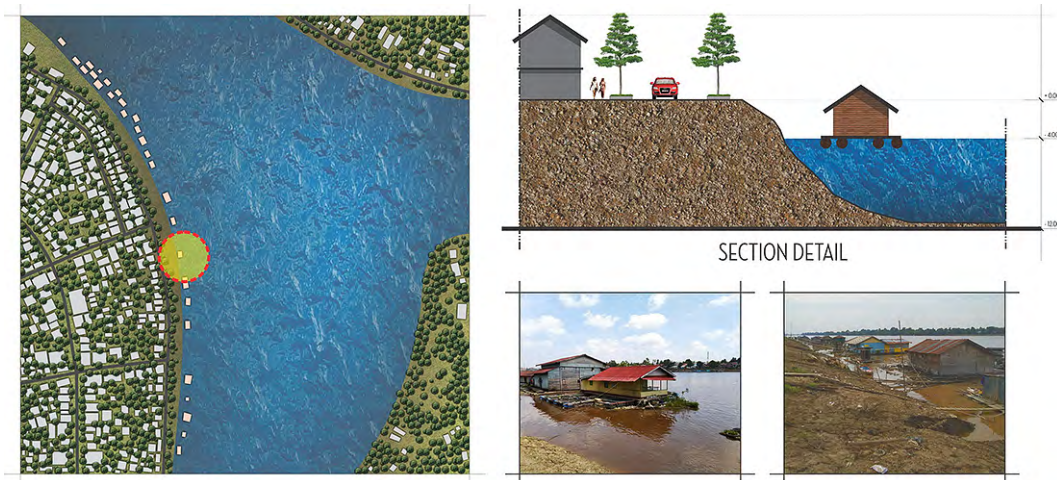


Figure 1. Normal condition of Melawi River

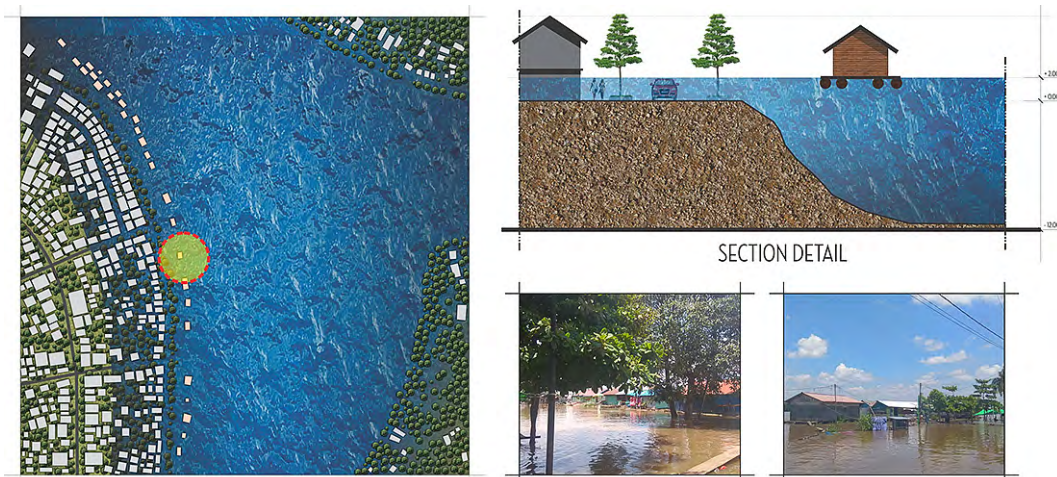


Figure 2. Flood condition of Melawi River

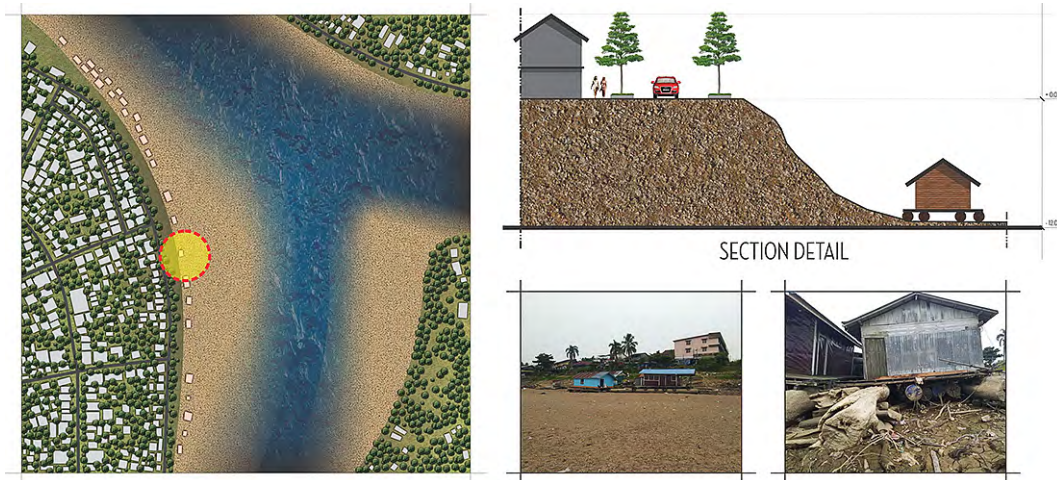


Figure 3. Ebb condition of Melawi River

son and this causes flooding with a height of up to 2 meters in the inland settlement.

Several floating houses on its riverbank are regularly affected by these tides starting from the time the

occupants began the settlement. It has, therefore, become a traditional practice for them to respond to this environmental condition.

Literature Review

Floating House

The floating house is a unique phenomenon usually found in riverside areas. Its uniqueness lies not only in its shape but also in the daily life patterns of the occupants. It is usually made of wood such as Meranti, Bengkirai, or Belian (Mustansyir, 2013) and a built-construction on the water. The design of this house is a flexible structure due to its ability to adjust its level to the changes in the river's tides (Afdholi, 2017). It is considered a cultural asset for the riverside community and has been

reported to be advantageous by being an erosion barrier and river fluctuation controller (Daryanto, 2004).

Rumah Lanting is generally a house made of wood and serves as local wisdom for riverside communities. It is responsive to the environment due to climate change, disasters, and other internal and external factors. The floating houses in West Kalimantan are spread along major rivers such as the Kapuas, Melawi, and other rivers where they experience tides which makes them follow the water level.

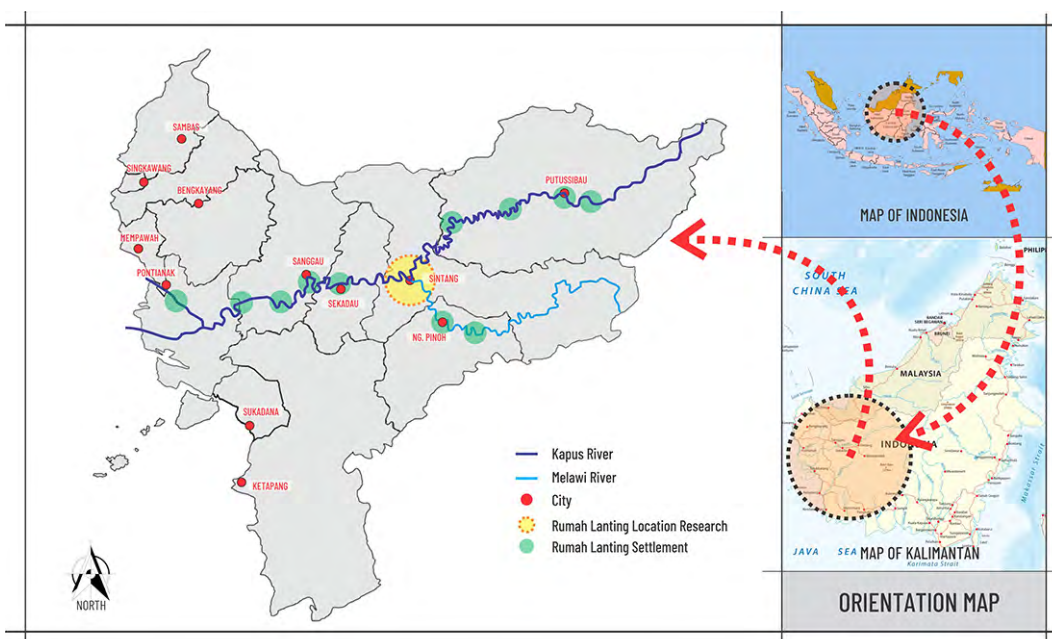


Figure 4. Map of distribution of Rumah Lanting on the Kapuas and Melawi Rivers in West Kalimantan

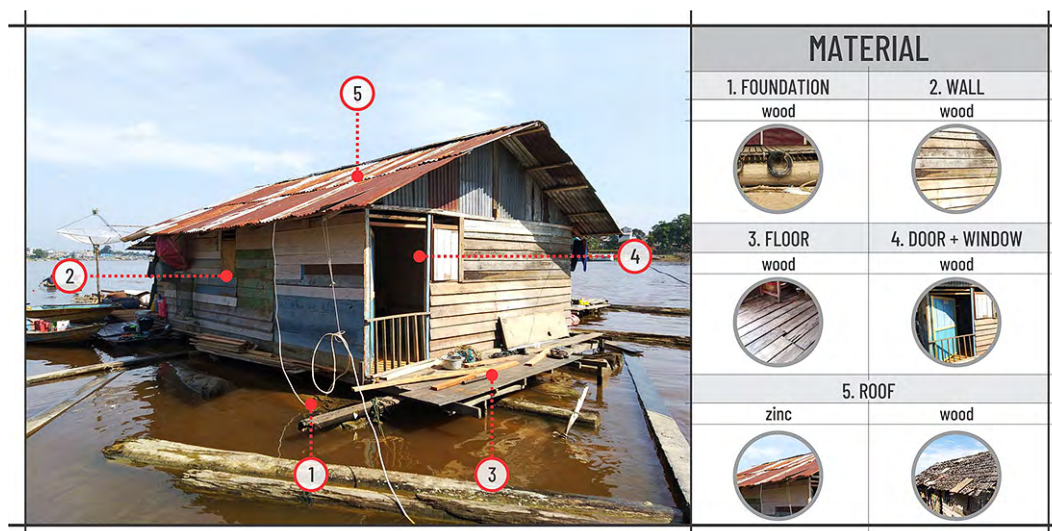


Figure 5. Materials of Rumah Lanting

Adaptation

Adaptation is an individual's ability to adapt to a certain environment through a behavioral process established on psychological factors in anticipation of future issues (Gifford, 2012). It is also defined as people's effort to adapt to the past and unpredictable disasters. The concept is also described as the ability of individuals to adapt to their environment which usually has physiological, morphological, and cultural effects. The process, however, involves the application of technology and social institutions (Soemarwoto, 1991) in adapting to climate change phenomena causing natural disasters in the surrounding environment (Hilmanto, 2010).

Adaptation is an indicator of an individual's capacity and ability to withstand hazards including those caused by changes in natural conditions. Humans

with adequate competence and capability in disaster management survive while those with moderate levels are vulnerable to be victims of disasters. Some of the external factors influencing the individual level of vulnerability to disasters emerge in the form of pressure and shocks from outside while the internal ones involve using resources to cope with disasters (Chambers, 2006). This means individuals adapt to environmental conditions through the employment of all survival aspects in all their activities. There are, however, two types of the adaptation process and they include passive and active processes. The passive process involves changing an individual's particular activities according to environmental conditions while the active aspect means changing the environment's physical elements according to an individual's desires (Gerungan, 1991).

Method

This research was conducted using the qualitative method and this involves understanding certain phenomena in research subjects by considering their behavior, perceptions, motivation, actions, and other activities as an integrated behavior. Moreover, some of the descriptions were made using words or language (Moleong, 2005) and the procedures for the implementation of this method are flexible according to needs and based on field situations and conditions (Danim & Darwis, 2003). A case study approach was employed in this study and this is an in-depth analysis of a system which is the same across different cases. This means all the cases are integrated and interconnected as part of the research process (Merriam & Tisdell, 2016).

The floating houses selected as the object of research were those that have experienced ebb and river

water flow. It is important to note that these buildings are designed to withstand disasters (Sihombing, 2019) or respond to natural disasters without changing or adding any physical element to the building. The condition of the floating structures is different from others built on the riverbank which requires adding some properties to bear the occurrence of disasters (Gultom, 2018).

Several floating houses positioned alongside the Melawi River in Sintang Regency of West Kalimantan Province were used in this research with the samples selected using a non-probability approach through purposive sampling based on certain predetermined criteria. This technique was applied due to its ability to determine research samples with specific attention to obtaining more representative data (Sugiyono,

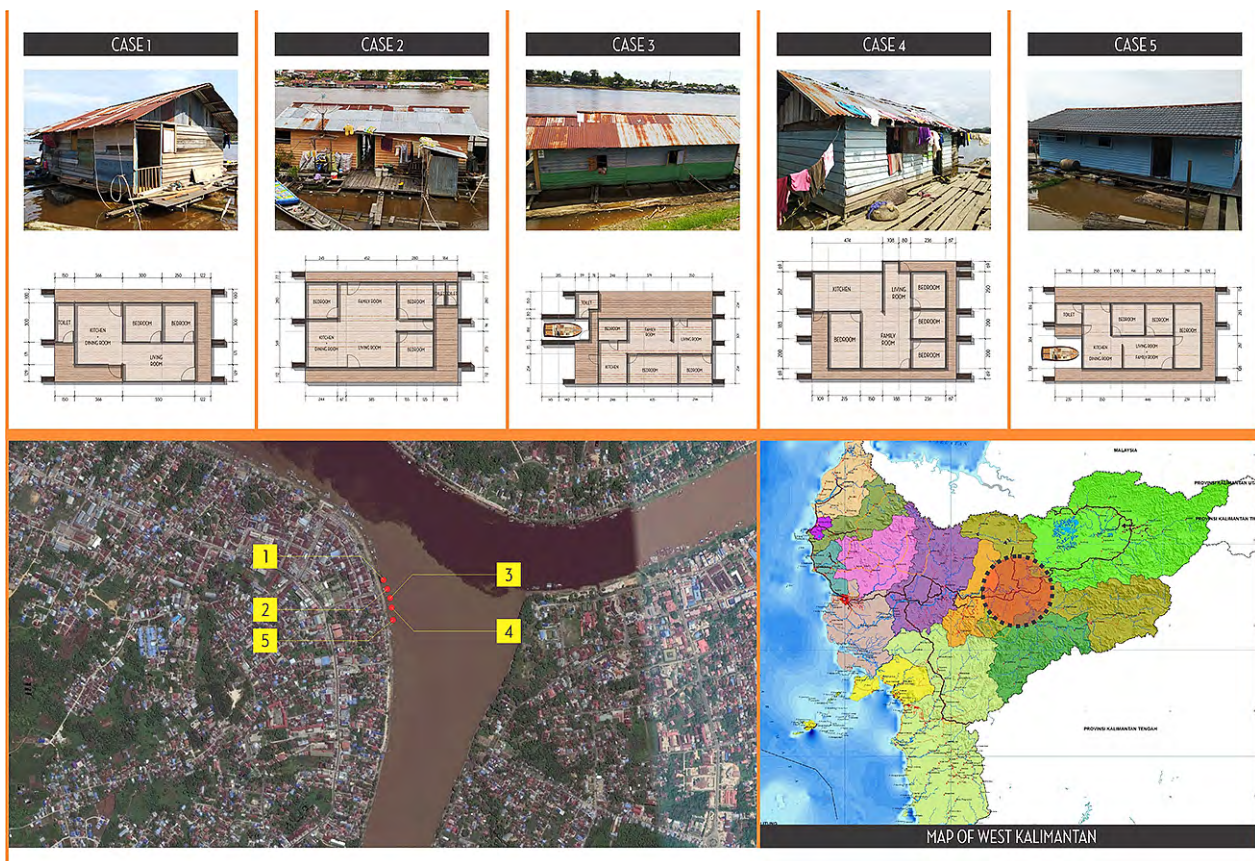


Figure 6. Location and research objects

2012). The selection criteria include the floating houses which is a unit with physical elements adapted to the river's environmental conditions due to climate change and those with certain elements changed as a response towards adapting to environmental conditions such as flood and ebb.

This study aimed to identify the adaptations routinely experienced in the floating houses due to changes in environmental conditions such as a flood

during the rainy season and ebb in the dry season. The variables used were active and passive adaptations with the active aspect analyzed by focusing on the changes in the occupants' behavior in response to the changes in the environmental conditions at the time of disaster while the passive involved determining the changes in the physical aspect of the floating house due to changes in the environmental conditions.

Findings and Discussion

Occupant Characteristics

The occupants were discovered to have lived in a floating house for at least 5 years, 12 years on average, and the longest was 20 years. Most of the occupants are second consecutive generation while the rest are new people that bought the structure from previous owners. Moreover, the physical condition of the floating houses has not changed significantly since they first occupied it with the only modifications focused on repairs due to damaged elements such as roofs, floors, and walls. It was discovered that the length of time they have lived in the structure affects their ability to adapt to the changes in the environmental conditions. The adaptation process currently experienced in the area was reported not to be new but a process of trans-

position and change which occurred through adaptation and deliverance (Hutcheon, 2006).

The analysis of several floating houses in the research location also showed the adaptation process to achieve comfort occurred in the early days of occupying the structure. This was observed from new occupants which were considered to be comfortable with the house in less than a year of residence. This is observed from their ability to adapt to the limited area in the floating house after enjoying wider space in the in-land houses which makes them conduct their activities with ease. It is important to note that the level of comfortability was assessed based on the ease with which the occupants conduct their activities in the floating house area.

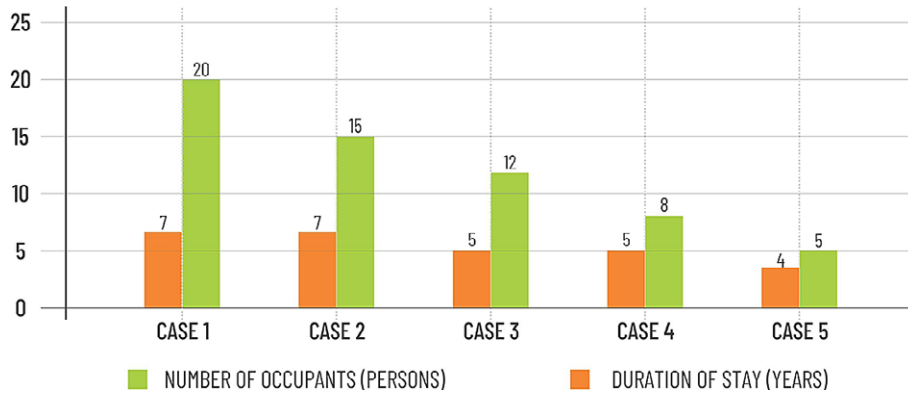


Figure 7. Number of occupants and duration of stay in Rumah Lanting

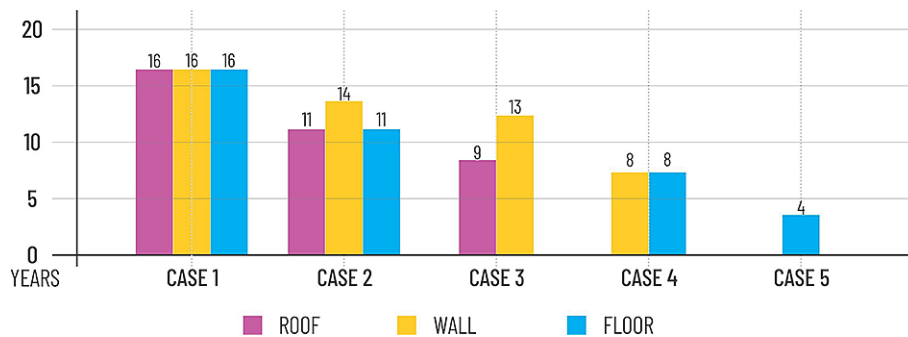


Figure 8. Part of Rumah Lanting renovation time

Floating House Characteristics

The characteristics of the floating houses were determined by analyzing the inner and outer spatial layout patterns. These patterns were created based on the behavior of occupants in arranging the spaces in line with their activities and intimate relationships as well as in relation to the physical environment. This is in line with the description of behavior patterns as a unit of the relationship between behavior and the environment (Laurens, 2004). Moreover, the occupants' experience and habits also influence the arrangement of spaces towards achieving comfort. It is also important to note that the ability of an individual to adapt to the environment differs according to their response (Rapoport, 1998).

The spatial layout in the floating house is arranged using a centralized approach and this pattern does not usually change due to the difficulties associated with maximizing the limited area. The living room is usu-

ally the center area for most activities due to its status as the only public area. It is used as a multifunctional space due to the need to perform several activities in the limited space. It is, however, important to note that the same activities conducted in normal houses on the mainland are also in the floating houses such as bathing, eating, sleeping, working, playing, and several others.

The outdoor layout is also closely related to the inner space and the surrounding environment. Behavioral settings are interactions between an activity and a specific place which occur consistently according to time and situation (Haryadi & Setiawan, 2010). Most of the floating houses are oriented towards both the land and the river and they also have a circulation route for entrance in both directions. There is also a terrace which serves as an intermediate area between the outer and inner spaces and surrounds the building to serve as an open space for the occupants.

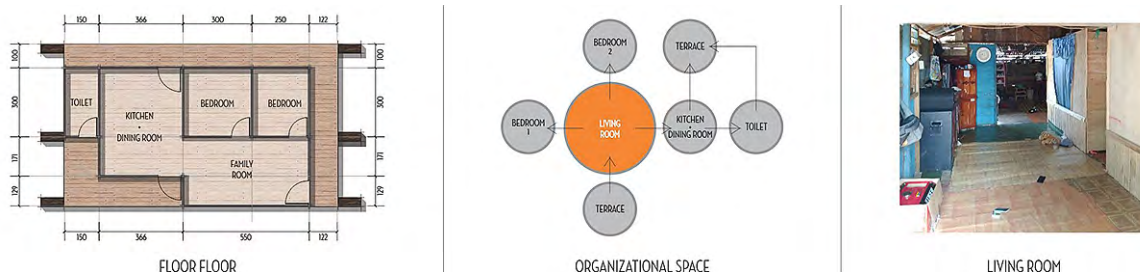


Figure 9. (a) Floor plan case 1; (b) Organizational space case 1; (c) Living room case 1

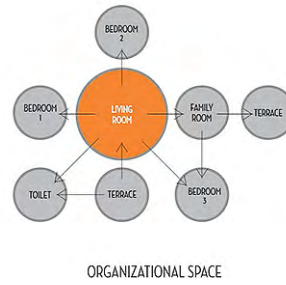


Figure 10. (a) Floor plan case 2; (b) Organizational space case 2; (c) Living room case 2

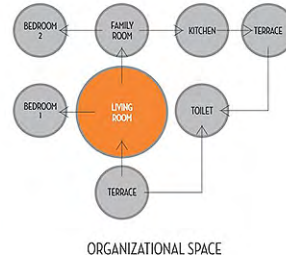
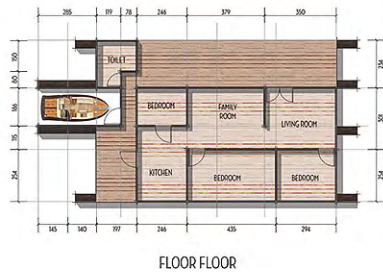


Figure 11. (a) Floor plan case 3; (b) Organizational space case 3; (c) Living room case 3

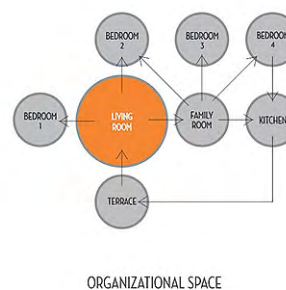
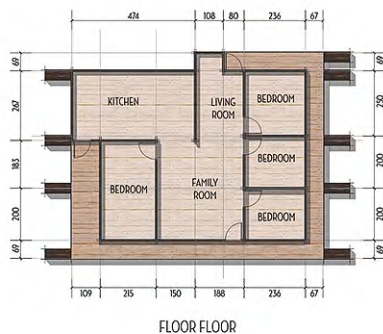


Figure 12. (a) Floor plan case 4; (b) Organizational space case 4; (c) Living room case 4

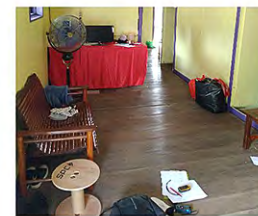
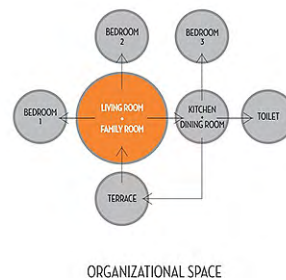


Figure 13. (a) Floor plan case 5; (b) Organizational space case 5; (c) Living room case 5

Adaptation Process

The occupants of the floating house usually experience a drastic change in environmental conditions when the water level rises or drops and this indirectly forces the people to adapt. This means each of them can modify the building according to the climatic conditions in order to achieve comfort and safety (Roaf et al., 2009). This involves understanding the

nature of the natural phenomena usually experienced (Lang, 1987) in order to individually adapt to deal with the environmental pressures. The adaptation is required to survive and ensure comfortability and it is mostly achieved through several engineering actions, improvements, or changes in different aspects of life. This process, however, occurred both actively and passively.

Active Adaptation Process

One of the adaptation processes in the floating house is active adaptation. This involves the participation of the occupants in making adaptive actions and also emphasizes the important role of individuals in influencing the environment (Kartasapoetra, 1987). This adaptation can be allopathic and regarded as an individual active strategy in dealing with environmental changes (Gerungan, 1991). It is important to note that the environmental conditions in the study area change due to the rise and fall of water level in the Melawi river and the occupants are required to respond through a behavior

that there is enough space to conduct activities both within and around the house.

The privacy of the floating house is also adjusted in the time of disaster such that the access to the buildings is controlled by occupants in normal conditions but this is limited due to the environmental conditions during floods. Meanwhile, the access can be easily visible to guests during periods of low tides, and this is known as the open limitation access type of privacy.

The activity patterns of the occupants in the Rumah Lanting also change during the period of natural disasters. These activities are standard during normal conditions but the movement in space becomes more

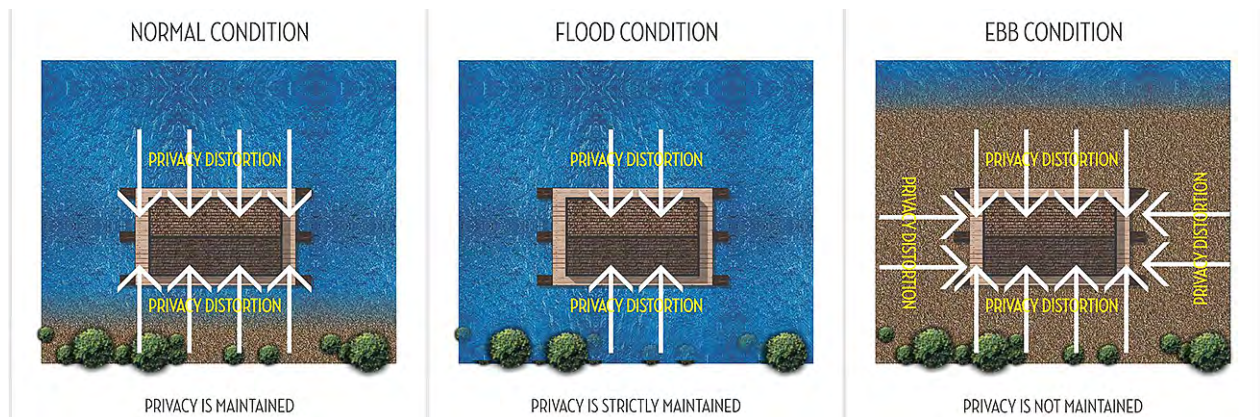


Figure 14. Territory modification in floating house

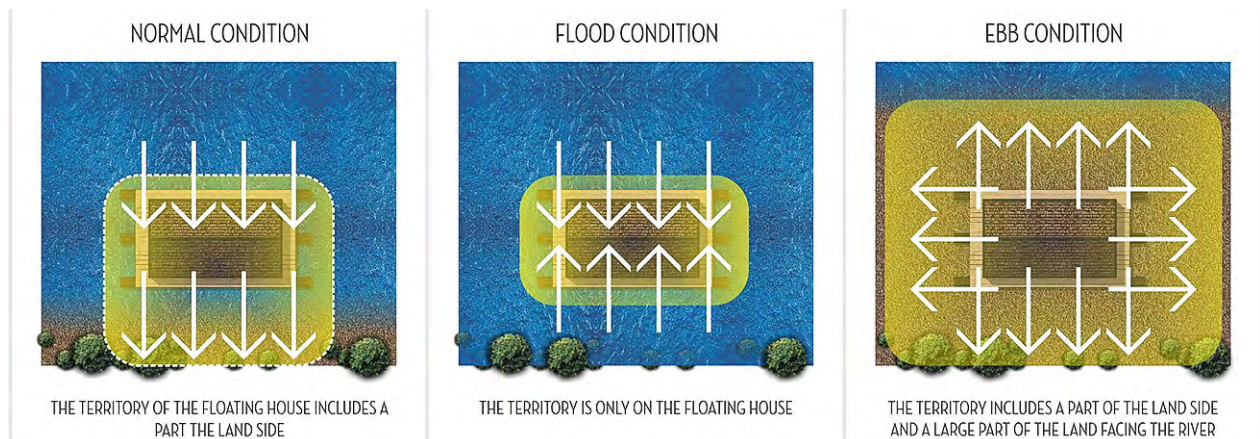


Figure 15. Privacy modification in floating house

change. Some of the activities inside the house such as bathing, playing, and interacting with neighbors are moved outside in order to adapt to the environment and this further affects territory, privacy, and activity restrictions.

The territory of the floating house is usually changed during a disaster. It is land-oriented in normal conditions but the activities towards the land are reduced during flooding and this makes the territory narrower, thereby, leading into the building. During low tide, the territory becomes wider due to the fact

conservative and tends to be focused more on the inside during floods while the activity space is more expansive with the use of outdoor space during the time of low tides. These activities are similar to those usually conducted by residents living in mainland houses. Meanwhile, Rumah Lanting is a house which can be adjusted based on the activity patterns and the wishes of the occupants as well as the changes caused by natural disasters. This is observed from its elevation which is always designed to be above the surface of water and land.

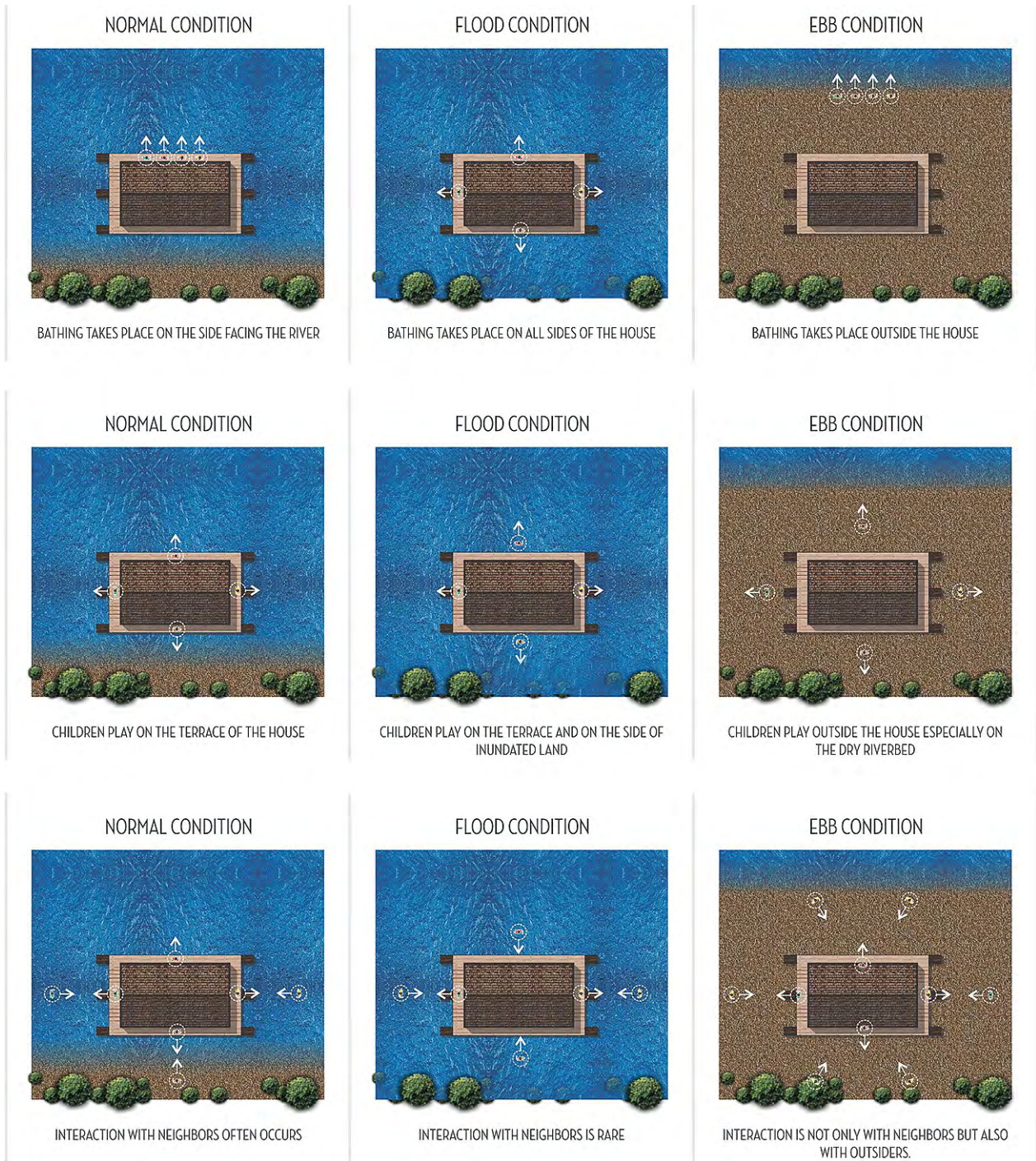


Figure 16. Activity pattern modification in floating house

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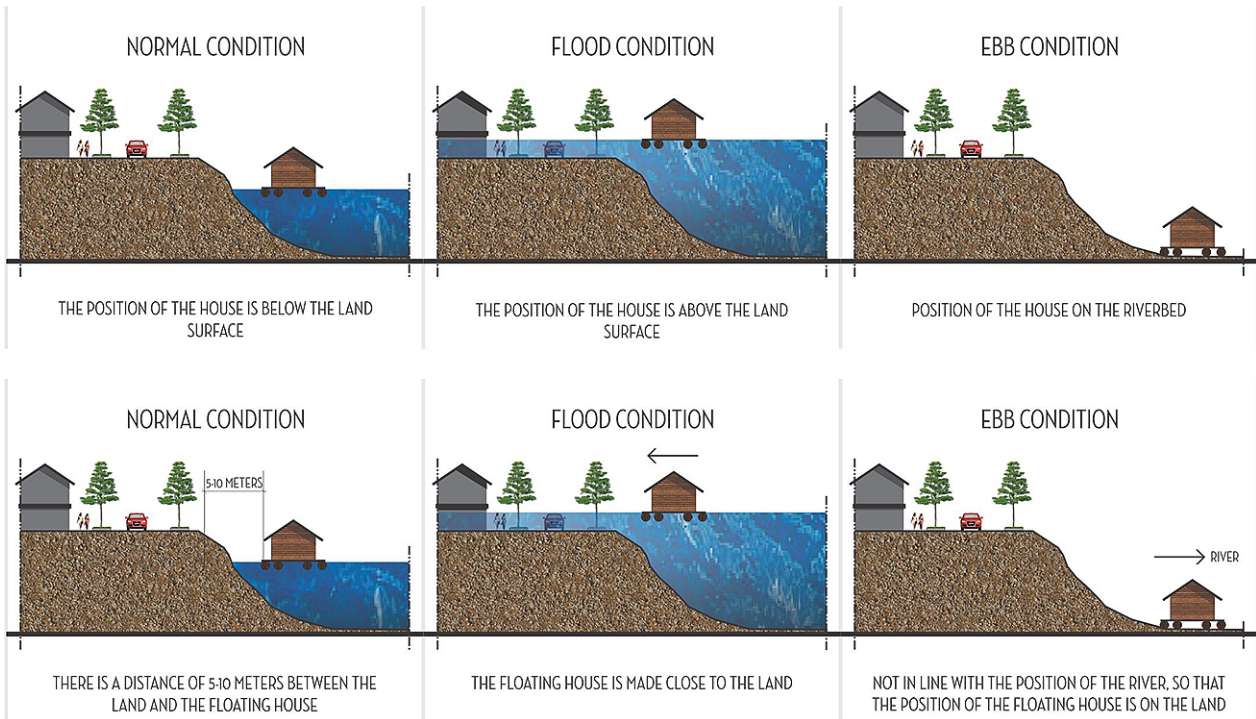


Figure 17. Position modification in floating house

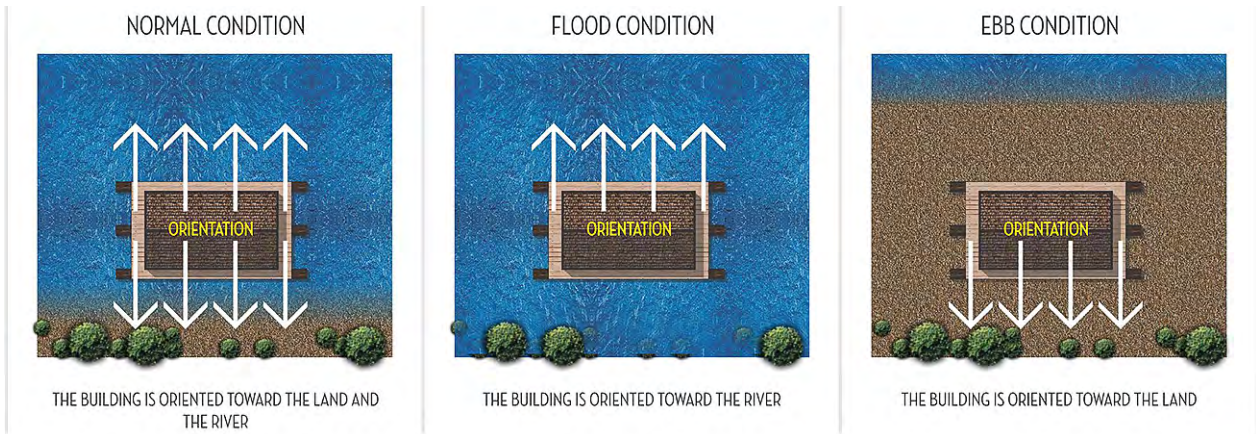


Figure 18. Orientation modification in floating house

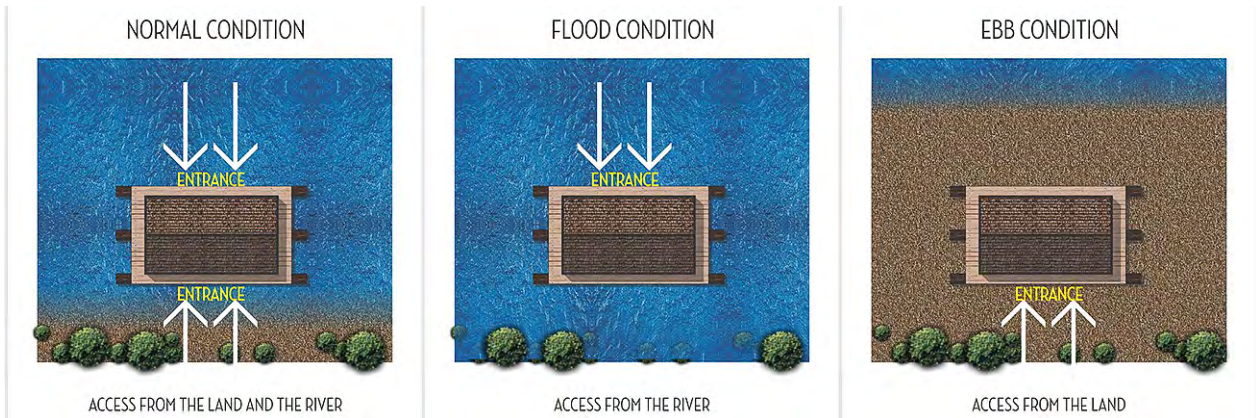


Figure 19. Access modification in floating house

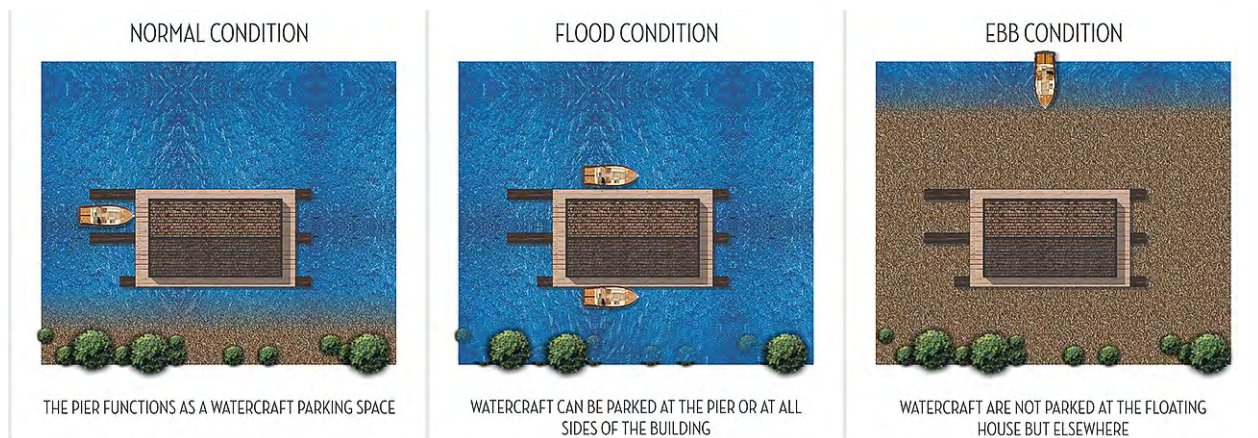


Figure 20. Function modification in floating house

Conclusions

The data and analysis obtained were used to draw the following conclusions:

1. The adaptation of the occupants was observed to be related to their period of stay in the floating house. Their focus is usually to ensure comfortability inside the house despite the changes in environmental conditions.
2. The floating house has a multi-functional space which accommodates different activities. The adjustments made to these activities do not prevent the adaptation process and the changes implemented inside the house do not significantly affect the building's physical appearance.
3. There are two main actors in the adaptations of a floating house and these include the occupants and the house. The occupants are significant to the active adaptation process while the house is the main object of the passive adaptation process.
4. Active adaptations involve the responses of the occupants towards adapting to the changes in environmental conditions with the focus on activity patterns, territory, and privacy.
5. Passive Adaptations are made by making adjustments and changes to the floating house with the focus on the position, orientation, access, and function in order to achieve comfortability.

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