

# Model of settlements float management based on local wisdom for disaster mitigation in Tempe Lake - Indonesia

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## Abstract

Extreme climatic conditions on water makes float settlements have potential for greater disaster than on land settlements. One way to mitigate disaster of float settlements on Tempe Lake is through a settlement management on water with local wisdom. This research purpose is to develop a model of environmental regulation for float settlement to tackle the disaster effectively to continue the life. Qualitative research methods with Spradley model analysis is used to identify the settlements structure development to maximize the existing model in dealing with disasters. Research results show that the models tend to become clustered management of neighborhoods and spread irregularly based on local wisdom in according with wind direction, float vegetation, sacred area, presence of pole, and trajectory of boat.

**Keywords:** Models, management, float settlement, mitigation

## 1. Introduction

Tempe Lake becomes area to catch fish and alternative place to live at above water. Tidal characteristic at Tempe Lake greatly affect on lake management as a place to life and fishing area (Naing, 2008).

Floats settlements at Tempe Lake have been managed by local wisdom related to natural resource management systems and knowledge based on customary law, in addition to local government regulations. In addition, it also deals with perspective (world view) in form a system faith and interpretation of world environment around them (Naing, 2008).

Floats settlements position creates a pattern based on geographical conditions/rules of nature and some local wisdom legacy for decades. These rules include house placement on vegetation, sacred place and boat track. It is interested to study this environment governance model can mitigate disasters caused by strong winds and waves of water flow.

The specific objective of this study is to assess the neighborhoods pattern at floats settlements to tackle disasters. This study is a continuation of first stage the structural reinforcement study with intention to find a pattern model of environmental governance to mitigate disaster based on local wisdom.

## 2. Research Methodology

This research uses a qualitative method to explore natural object of floats settlement at Tempe Lake, South Sulawesi, Indonesia. Data collection techniques are participant observation, in-depth interviews (depth interview), study the documentation through photographs or recording images through films and also reconstruct the social scale. In addition, data collection also uses techniques triangulation.

This study uses analysis models from Spradley (1980) in Nasution (2002), because the activity in qualitative data analysis is done interactively, from the wide domain then focused on analysis phase from domain analysis, taxonomic, componential and cultural themes. Qualitative research process was started with reliable "key informant" to "open the door" to researchers to enter to research object. The informants consist of residents of float settlements, *panre bola*, or related government. Researchers conducted interviews to informants and record the interviews. After that the researcher's attention was directed to research object and starts to ask descriptive questions, followed by an analysis of interview results.

Based interviews analysis result, researchers conducted a domain analysis. Researchers determine the focus and taxonomy of analysis. Based on taxonomic analysis, researchers ask a contrast question and followed by componential analysis. Componential analysis result becomes basis to found themes of culture. Based on these findings the researchers wrote the ethno-architectural research report.

## 3. Results

### Space utilization at Tempe Lake

Tempe Lake with an area approximately 13,000 ha is a potential aquatic location in South Sulawesi province. It is one largest freshwater that used as a place to live above water with floats settlements system, float vegetation growth as place of many rare bird species and as the second largest tourist destination after Toraja in South Sulawesi.

Several customs rules and addition of government regulations were implemented to prevent any lake misuse that can to destruct some ecosystems in their habitat and to preserve for generations in utilizing the lake. Custom rules concerns with lake utilization as location to catch the fish (*cappeang*, *palawang*, *Bungka and makkaja lalla* '), location rules for living, a ban to catch fish at certain areas and areas to grow float vegetation. Figure 1 shows that *Cappeang* and *Palawang*

is the fish hatcheries location at lake side. This area is controlled by several groups based on auction by government on the approval of indigenous elders for every three years. For fishing communities who do not have enough ability to buy *cappeang* or *palawang*, they can use fishing location outside the area by creating a captive (*Bungka*) at center of Tempe Lake. There is also a special area located in middle of lake called *Reservaat* or *pacobalanda* (pole planted in colonial area by Netherlands). It is a particular place in lake area is forbidden to carry out the installation of fishing gear or fishing activities.

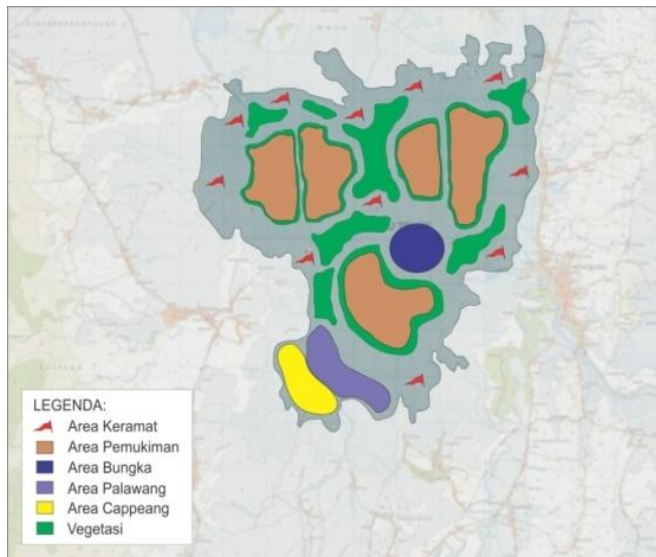


Figure 1. Map the utilization of Tempe Lake space

Community has belief to existence of spirits which inhabit and maintain lake. Community also believes to some sacred place. These areas are marked by some yellow or red flag with high pole. These areas were used by community as a place to perform ceremonies *maccarak tappareng* and to give offerings to lake master.

**Floats settlement patterns at Tempe Lake**

Rapoport (1969) explains three forms of settlement patterns; they are clustered, spread, and elongated pattern. However, settlement pattern at Tempe Lake is different. The pattern is combination spread pattern but tend in group. Community put his house naturally at Tempe lake that so wide. It makes that floats settlements spread irregularly but tend to be clustered by bonding/kinship, as shown in Figure 2. Kinship phenomenon are still attached to community in floats settlements that adjacent to old people's house, near with family house. Group division cannot be measured with naked eye but can be observed physically in social behavior in some activities. House placement is based on social togetherness of social capital group in process to adapt with tidal environment.

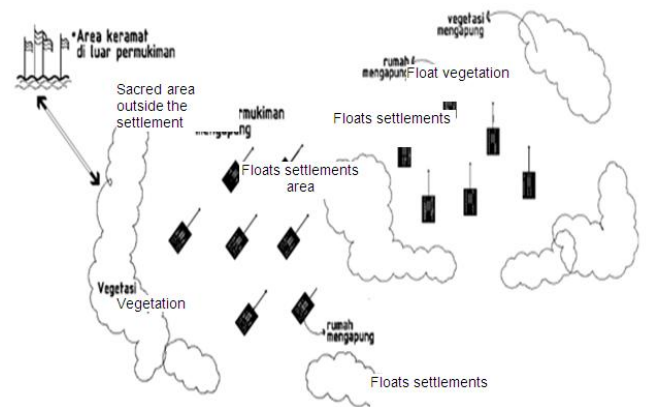


Figure 2. Floats settlements pattern: spread irregularly and clustered

**Settlements floats management to mitigate disaster based on local wisdom**

**a. Orientation of settlements float**

Some orientation theories suggest that each tribe has a different orientation to put their house in a settlement group. It depends on culture development in the community. It associates with floats settlements direction, path and node. These will be discussed below.

**Absolute and contextual directions at float settlements**

Four absolute directions are known by Bugis people at Tempe Lake. They are *manorang* (north), *maniang* (south), *alau* (east) and *orai* (west). These are consistent with four internationally cardinal directions are, as proposed by Norberg-Schulz (1985) and Frake (1995) in Ammarell (2008), as shown in Figure 3. Figure 4 shows four absolute dimensions name of Bugis people in Tempe Lake. The dimension terms can be used to describe the location of a house or an object.

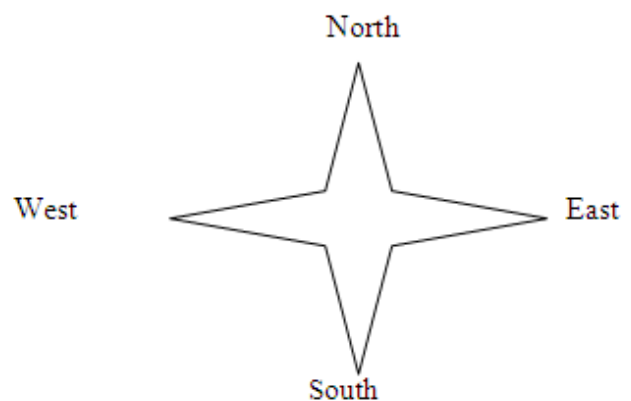
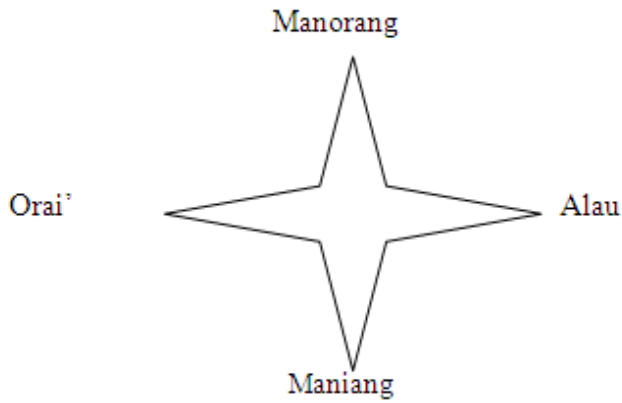


Figure 3. Absolute direction of international community

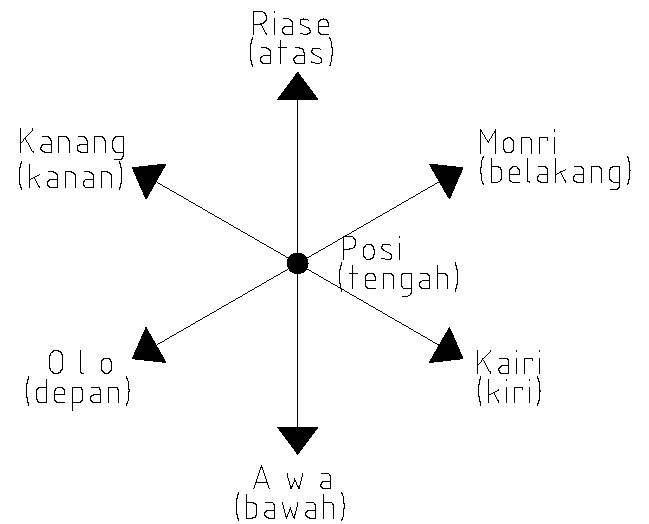


**Figure 4. Absolute direction of Tempe Lake fishermen**

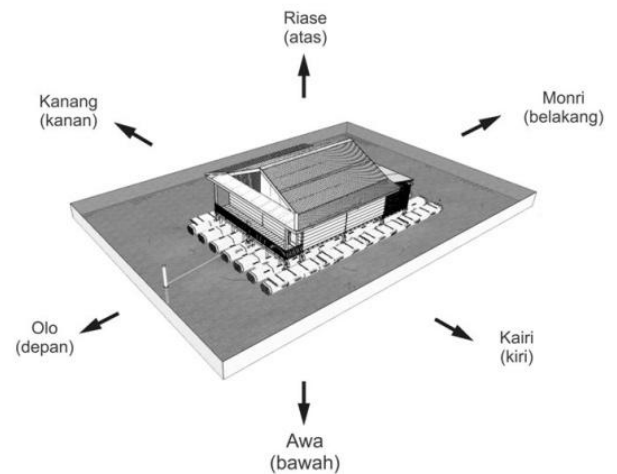
This system is most often used by fishermen community to refer to house position or a boat place. For example, 'house with east direction' (*ball Mangolo Alau*), 'a boat put at west of house' (*lopi Orai ball*), above of floats settlements (*iyase ball*). In addition, signpost is also used to explain absolute longitudinal position of floats settlements on monsoon winds that blow in Southeast Asiato determine house view at that time.

Absolute directions are contrast with contextual direction, as 'left: right, front winds: down winds, mainland direction: the sea and upstream: estuary'. Examples of absolute wind directions are construed as something outside the body or boat toward or free from its geographical position. Fishing communities at Tempe Lake apply 'left-right' (*kairi: Kanang*) along with 'front-back' (*olo: monri*) to decide house direction at the front. Left-right has permanent meaning for house or boat. The idea of center or middle (*posi*) as driveways or attachment point of 'cosmic life force' or 'life' is also widened from the human to the house.

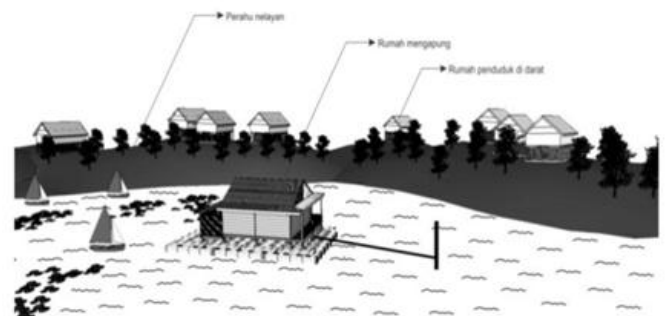
When building a house, ritual attention is focused on physical center where the prayers and offerings submitted to 'life', as illustrated in Figure 5. Opposition of 'inside and outside' (*laleng: risaliweng*) is used to describe the location of a person or object or space in floats settlements. 'Above and below' (*riase: awa*) is more commonly used to determine fishing community places in house. 'Above the house/in float settlements' (*riase bola*), 'the bottom floor of float settlements' (*awa bola*) is the distance between the floor (*salima*) and raft (*rai* '). Figure 6 shows the contextual opposition direction commonly used for houses position toward object/other house and men in a house. Other than horizontal position, also there is other contextual opposition to describe the vertical movement of water. Direction determination is based on house position to lake water or land position to lake. Figure 7 is an illustration 'go down to look for fish in lake' (*no'i makkaja ko tapparengne*).



**Figure 5. Contextual direction of fisherman community**



**Figure 6. Opposition of contextual direction at floats settlements**



**Figure 7. Vertical move of water and house, and boat**

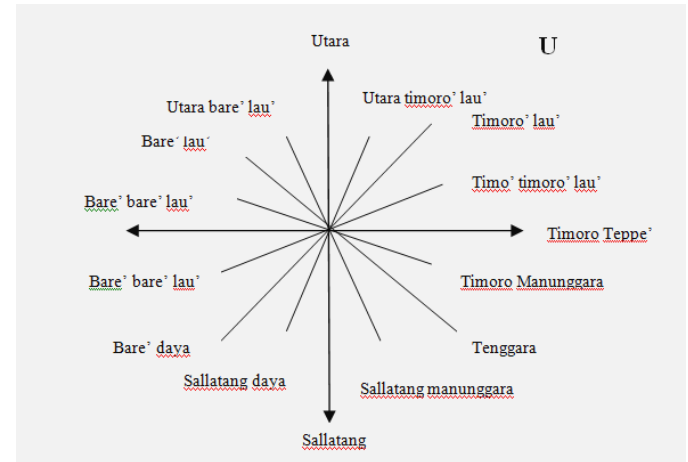
In this dimension, someone says 'down' (*no'i*) from house to boat and from boat to lake. Adversely, from lake 'go up'

(*menre*) to house. If the fishermen were on land, then 'go down to lake' (*no'i ko tapparengnge*) indicate the position of ground down to water. Up down direction is also used to indicate the condition of rise and fall of lake water. 'Water is rising' (*menre'si waiyye*) and 'water is coming down' (*no'si waiye*). This condition can be seen at figure 8 and 9.

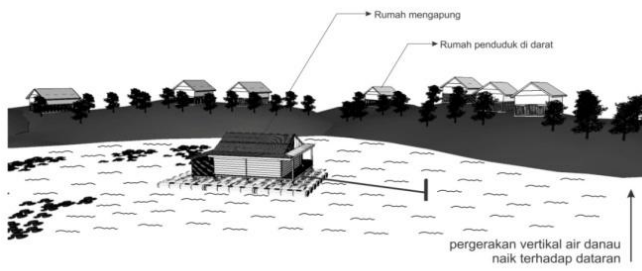
**Wind direction and floats settlements position**

Among Bugis society, winds have a very specific function, namely to identify and explaining the wind and boat direction. Wajo Bugis people live at move settlements in Tempe Lake with four cardinal wind directions. Northern direction is called *manorang*, southward is called *maniang*, eastward is called *alau* and westward is called *orai*. Change of wind direction at any time affects on orientation of floats settlements. mostly Bugis community in Indonesia has known signpost system with 16 nodes in according with sixteen points on international naming. Ammarell (2008) illustrates about the wind direction for Bugis society who live Balobaloang islands.

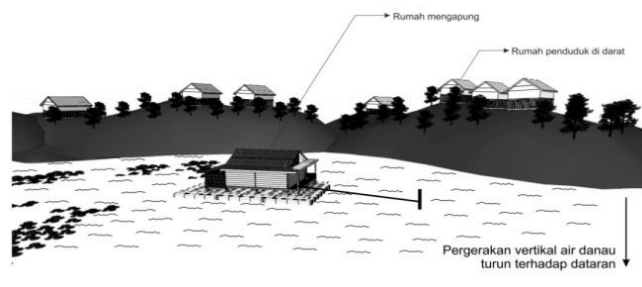
Malay-Polynesian maritime community. They often decides wind direction based on two monsoons (Blust, 1997) in Ammarell (2008).



**Figure 10. Wind direction in Bugis community**



**Figure 8. Vertical movement of lake water down to base**



**Figure 9. Vertical movement of lake water up to land**

Description of Ammarell (2008) is clearly shows that sixteen-point system is understood as the horizon circle to include eight pairs of opposite direction with same broad part (Figure 10). According to season, wind direction change is occurred every six months. East monsoon (*wettu bare'*) usually comes in April, bringing strong winds and more constant. East season (*wettu timo'*) finish at October and wind slow down, usually a month later the wind came from the west direction. Floats settlements position in lake does not makes a specific pattern based on specific house orientation. It just opposite to wind direction. If the wind comes from the east, house direction is west. This is consistent with wind direction of

Local geographic dent can change the wind direction. Bugis language still mentions this monsoon and direction in associated with term from the Proto-Malay-Polynesian *tumuR* and *habaRat*. First point refer to local shape of southeast monsoon and the second refer to northwest monsoon (Blust, 1997 in Ammarell, 2008). Some Bugis dialects follow this pattern by linking *timo':bare'* with international usage of *east:west*. *Timo'* 'east. And *bare'* 'west' locally synonymous with two directions of wind monsoons. Fishermen emphasize the importance of this case to know the signs of nature by adjusting the time to catch fish and preparation to anticipate the house from wind blow.

Floats settlements is only bind to pole attached to bottom lake. It allows the floats settlements to rotate to follow the wind direction. The changes are happened every time based on other factors such as the wind deflection (change in wind direction), whirlwind and effect of wave and waves. This illustration can be seen in Figure 11 and Figure 12. Daily orientation is affected by waves and wind deflection. Orientation changes irregularly toward the house direction in according to time. Daily observations show that in morning at 08.00 pm wind moves from north to south, house will be oriented to north. Sun began to rise at 10:00 pm, and when the wind moves 90 degrees from the north to south, then house orientation will lead to southwest. While in afternoon when the sun go to overhead, when the wind moves from the west, the whole float settlements will orient to westward. At late afternoon wind will continue to move from the west to south to meet the morning dawn and sunrise in morning. The house orientation based on direction wind is going to continue to change for 24 hours and will return to its original position on next morning. This illustration can be seen in Figure 13. Floats settlements rotate continuously on its axis to follow the wind direction to make the house safe from the wind. When the mobile houses move at a certain position dynamically, the house can break wind with drain/reflect wind through the other floats settlements. In addition, wall structure of floats



settlements can also stream the wind to avoid crashing against strong winds. It differs with fix house. Tight wind can become a problem if not anticipated early.

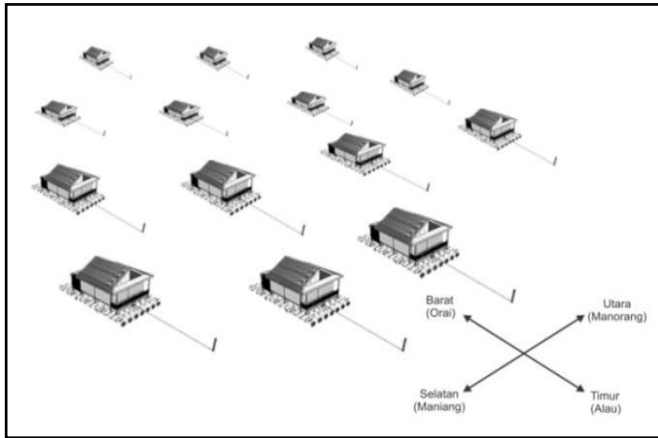


Figure 11. Wind orientation based on west (*bare'*) season

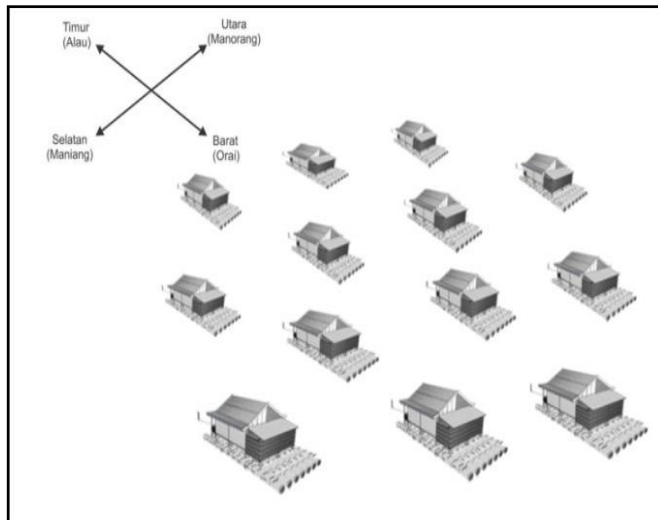


Figure 12. Wind orientation based on east (*timo'*) season

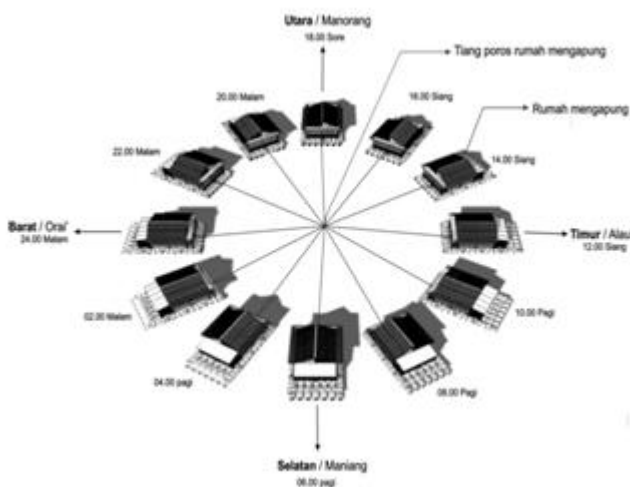


Figure 13. Daily orientation of floats settlements

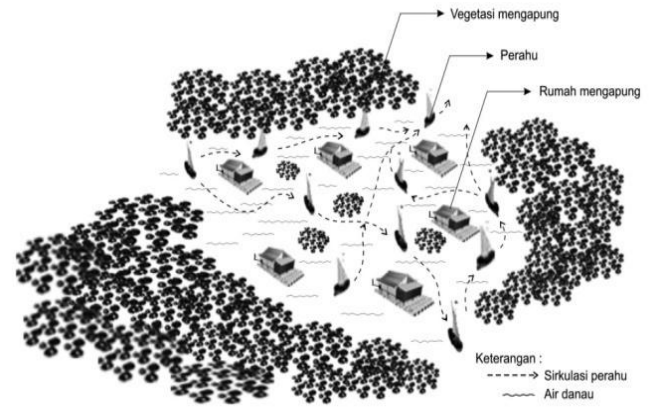


Figure 14. Floats settlements at boat track

**b. Tracks (Path)**

Floats settlements on Tempe Lake has a layout pattern based on track entry and exit of boats. Boat track around the floats settlements are located at front, left, right and rear. Every house is a single house with certain distance to other houses. Floats settlements layout are not governed by concepts of universe as proposed Indorf (2002), which applies to several traditional settlement land in Indonesia, but it is based on accessibility easiness. Boat track is used as the guidelines to manage floats settlements group on Tempe Lake. Illustration of boat track in floats settlements can be seen in Figure 14. Boat track management is also associated with disaster mitigation. Certain distance between house and boat track means that wave generated by engine vibration does not make the floats settlements moves or shifts away from its place.

**c. Pole, center (pole)**

Wind direction assessment indicate that floats settlements does not have fix orientation on four winds to 16 primary or cardinal points. But wind direction can influence the direction of this floats settlements. It is affected by presence of pole as single-point in floats settlements management as the horizontal center of house. Tight pole can be interpreted as a 'hub' to turn floats settlements on water.

Single pole as axis of house can change the orientation of house at any time, depending on wind conditions. Pole at floats settlements only serves to make the house more flexible to wind movement. It will have an impact on durability of structure and material of house. House movement will always follow the rhythm of wind and against the wind (Figure 15). Single pole as center (axis) to turn floats settlements affect on layout management between houses in safe settlement. Minimal space is two times length of floats settlements to makes float settlements never intersect even in windy conditions.

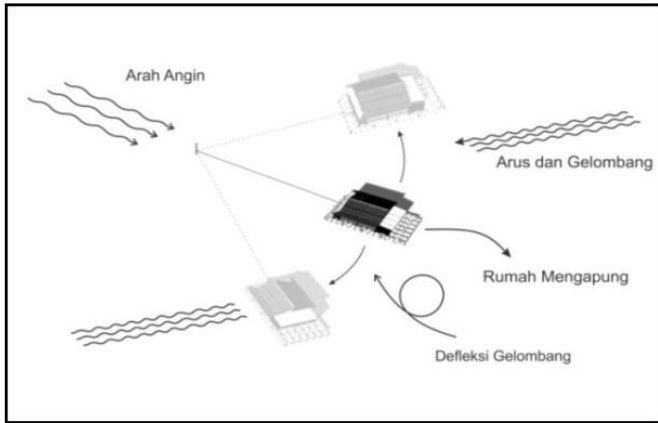


Figure 15. Floats settlements rotation at single pole binding

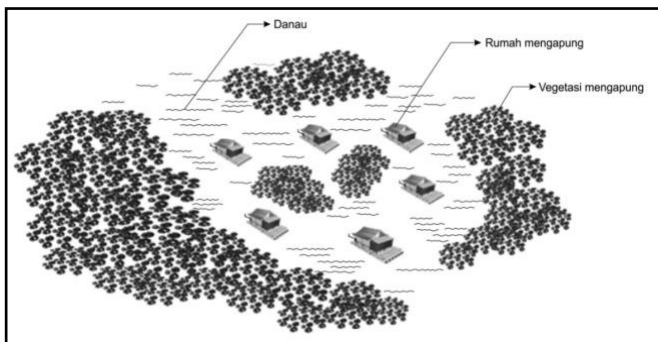


Figure 16. Floats settlements position near the float vegetation

**d. Floats settlements position on vegetation**

There are float vegetations around the floats settlements on Tempe Lake, as water hyacinth and spinach to protect floats settlements wind and hard wave. Amid a cluster of vegetation is planted bamboo to bottom of lake to withstand this vegetation from hard wave. Strong winds or storms can cause wave in lake, wind direction will be deflected and held by vegetation, so that houses and neighborhoods can be shielded from the wave drag. This can be seen in figure 16. In addition as a haven for floats settlements, float vegetation can also become a threat. If the number is increasing, will gradually move closer to floats settlements. Fast wind blows makes the float vegetation is easily push the house from the binding pole. Fishermen will work together in mutual cooperation to clear this vegetation by encouraging and flowing into rivers nearby.

**e. Settlements position to sacred area**

In conjunction with settlements position, some places are considered sacred by local community and kept away from settlements. It is associated with belief and local culture. Fishermen community believe that sacred areas are inhabited by creature that should be respected and safeguarded by not contaminating the surrounding environment. Sacred areas in Tempe Lake are regarded as a 'hub' to connect the upper world (the macrocosm) and lower world

(microcosm). However 'center' is understood as 'abstract belief' that are not associated with settlement management physically but as a ritual part floats settlements development. Environment image relates with customs and beliefs, namely respecting sacred that cannot be used for settlement. These can be seen in Figure 17 and Figure 18.

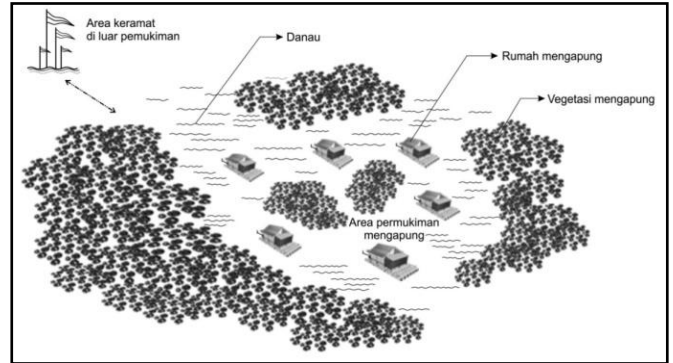


Figure 17. Floats settlements far from Sacred area



Figure 18. Sacred area for *maccerak tappareng* at Tempe Lake

The center is generally understood as the axis *mundi*, vertical union between earth and sky. This is a point where all the horizontal movement go towards the end point. It can be shown that center becomes a sacred dimension. Axis *mundi* is defined more than just the center of earth, and also a link of earth and cosmic to serves as a meeting between one condition with other conditions (Norberg, 1985).

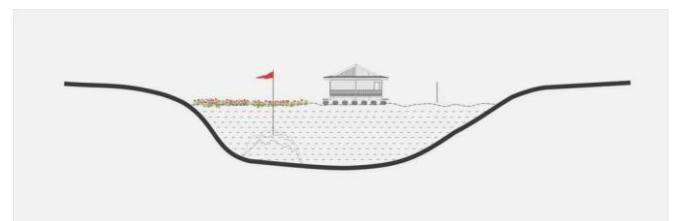
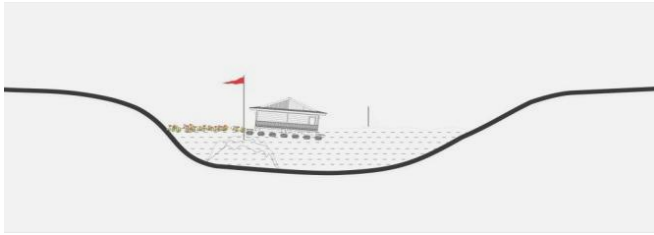


Figure 19. Floats settlements near the sacred place at high tide



**Figure 20. Floats settlements near place at low tide**

According to local wisdom, float settlements should be kept away from sacred places because if too close house will be reversed (Figure 19 and 20). However this can be explained scientifically. There is a mound of dirt on surface of lake bottom is contoured at every point of sacred place. Floats settlements that move at sacred spot will be reversed due to hit the mound in shrine. It is reason to avoid disaster that caused by contour of bottom Tempe Lake.

#### **4. Conclusions**

Float settlement pattern is a combination of irregular and clustered patterns based on bonds/kinship. To anticipate a disaster, model of floats settlements management is affected by:

- (1) Wind direction, which consists of absolute and contextual direction to follow the wind direction and water movement;
- (2) Boat path near floats settlements;
- (3) Column, Center (pole), serves to make the house more flexible to movement of wind, so it will have an impact on durability of structure and material house;
- (4) Floats settlements location on vegetation, serves as a protective settlements from wind and strong wave;
- (5) floats settlements position from holy places (sacred area), according to public belief in Tempe lake some places that are considered holy or sacred should be kept away from settlements.

#### **5. Suggestions**

Floats settlements management need to be preserved as a local wisdom. System structure of floats settlements with pole fastening has been shown can to mitigate the disaster for decades on water, so that life on water can continue.

Although general floats settlements layout has been able to cope with disasters, but there are still some weaknesses that need to be refined as set several houses in group. In addition, it required the addition of bamboo at around the floats settlements group to break the wind blow.

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