SELF-DEPENDENT HEALTH CARE FOR FLOOD-PRONE GHATAL AREA

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ABSTRACT

Global warming is causing an increase in extreme weather all around the world, extreme weather increases the chance of flooding in coastal and riverine areas in the tropical regions (IPCC, 2014). Especially low-income coastal areas in Southeast Asia are very vulnerable to an increase in floods due to the lack of financial resources to implement structural prevention such as dikes and dams. This research investigates the risks for those areas related to the increase of flood events and looks at the region of Ghatal in West Bengal to find the needs of the inhabitants to become more self reliant in case of flooding. The lack of resilience in low-income coastal areas create health risks for the population. Bad sanitation facilities and water pollution are causes for spreading infectious diseases. In this research the technique of mapping is applied to show the available services and to find the gaps between what the needs are and what is offered.

KEYWORDS: *Global warming, extreme weather, flooding, vulnerability, coastal areas, river floods, low-income, health-care, self-dependent,*

I. INTRODUCTION

It is widely accepted in the academic world that global warming is happening, possible effects are rising sea levels and increasingly frequent extreme weather events. This will pose great problems for humanity, especially the population living in vulnerable coastal and riverine areas.

There are different approaches to deal with the challenges for these communities, structural and non-structural, dependent on the income level of the community there is a distinction in which is feasible to apply. From an architectural perspective the non-structural approach is the most favorable since it is dealing with solutions on community level instead of regional or provincial level. Important to note is that the approach chosen for the outcome of this research is to aim for self-dependence instead of having to rely on temporary relief from outside sources.

What are the main problems the communities in low-income coastal and riverine areas are facing related to flooding? Which elements are of greatest risks? What sustainable strategies can be implemented to create resilience in case of these climatic risks? These questions will be further on in this research related to the example area of Ghatal in West Bengal, India.

The research question guiding the analysis is:

What is needed to become self-dependent for the health care situation of Ghatal block in West Bengal?

The research is structured into multiple chapters. In the first chapter gives an understanding of the relevance of the research namely the environmental challenges posed by global warming on communities. The second chapter will research the impacts on health of floods and which factors play a role. The third chapter describes the coping strategies that inhabitants of low-income flood prone areas have developed and are applying at the moment. The fourth chapter will investigate the health care in rural India and specifically the facilities currently available in the Ghatal block.

II. ENVIRONMENTAL CHALLENGES

2.1 Global warming

According to the IPCC(2014) the effects of global warming are undeniable, the atmosphere and ocean have warmed, the amounts of snow and ice have diminished, and sea level has risen. Glaciers worldwide are shrinking fast and affecting runoff waters downstream. There are various effects all around the globe and the consequences will become increasingly evident over the next years. It is important to recognize the consequences and anticipate on problems this will pose.

2.2 Sea level rise

Since 1900, sea level has risen 20cm already and predictions are that the level will rise another 30cm by 2050 (IPCC, 2014, p16). The rise is mostly due to melting of ice on Greenland and thermal expansion of water by warming up. Even if human increased greenhouse gas emission is stopped soon the effects are still going to have an impact for centuries to come. This makes it a long-term risk for humanity and effects need to be assessed and strategies need to be formed to protect especially low-lying coastal areas from increased coastal floods happening.

2.3 Extreme weather

Due to the increased sea level and the higher temperatures extreme weather is more likely to appear. Storm surges, droughts, increased amounts of precipitation and heat waves are already in present day becoming more extreme. Precipitation is likely to become more intense and frequent in tropical regions as already is being experienced by southwest Asia and West Africa where monsoons are recorded to be heavier and last longer (Garschagen, 2016). The extreme weather is increasing the chance on having natural disasters.

2.4 Natural disasters

Natural disasters are a combination between an extreme or rare natural phenomenon and the interaction with a human resource management system. These natural phenomenons may be geophysical, atmospheric or biological in origin (Chapman, 1994). The natural phenomenon is regarded as a disaster only in relation to the capacity of society to cope with it, only with significant damage to infrastructure and/or loss of life the hazard becomes a disaster. Natural disasters are related to natural phenomena but human interference does have an impact on the severity of the disaster, for example clearing of forest or urbanization will change the way floods are impacting society. A natural disaster is also described by the American Geological Institute as: “A naturally occurring or man-made geologic condition or phenomenon that presents a risk or is a potential danger to life or property” (Alexander, 1993, p7).

Note that the quote above specifically mentions man-made geological condition, where it clearly states the impact of man on creating sometimes hazardous conditions. A differentiation between natural disasters leaves us with the following groups in which we could index the different types of disaster (Chapman, 1994):

- Droughts
- Earthquakes
- Floods
- Storms

As visible in figure 1, flooding is becoming a bigger threat. Rivers, basins and coastal areas are all subject to flooding events at an increasing rate. Over the last years in Southeast Asia many regions suffered from serious floods that lasted for extended periods. These extreme events are happening on a global scale and are increasing in intensity thus, constitutes the most pressing climatic problem to human communities. That is why this paper will focus on flooding.

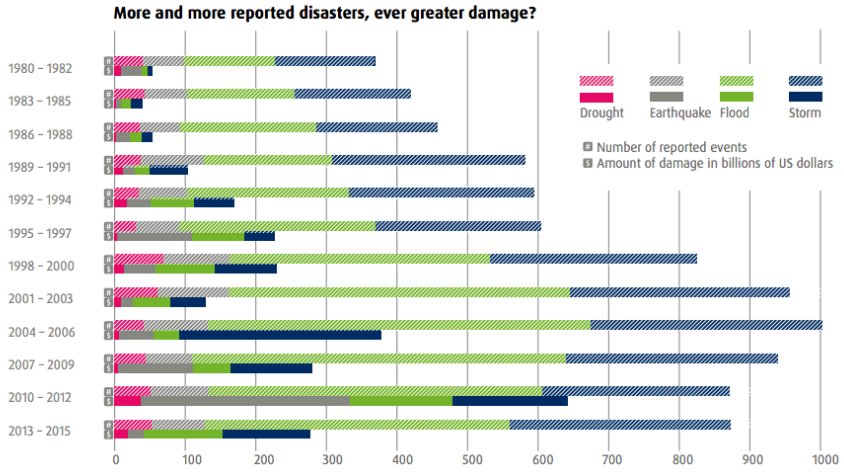

Figure 1: Number of reported disasters and amount of damages

A report from the World Risk Index shows the reported disasters worldwide in each category.

2.5 Study area: Ghatal block, West Bengal

According to the IPCC fifth assessment report there are multiple regions severely affected by the increase of severe weather causing a higher flood frequency. One of the regions mostly in danger is South-East Asia even in case of lower emissions. South East Asia is nowadays already experiencing severe flooding on yearly basis (WRI, 2016). The study area of this research will be around Ghatal, West Bengal India which is a downstream region in the Brahmaputra delta, a coastal area and since it has a history of flooding almost every year.

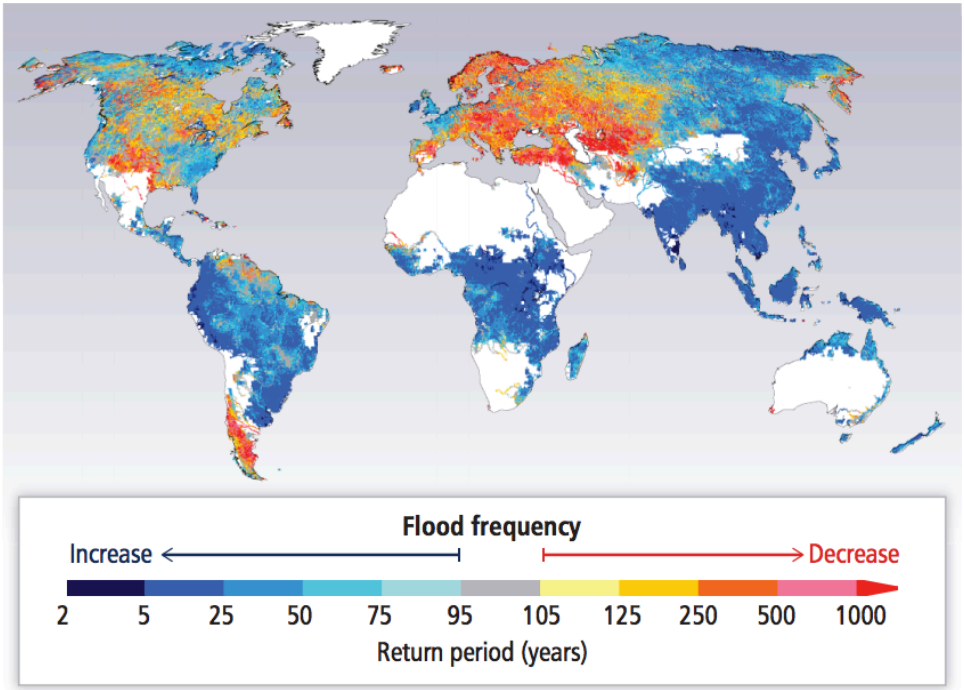

Figure 2: Flood frequency in 2080 in case of continuous high-emissions.

III. FLOODING AND CONSEQUENCES

3.1 Floods

Flooding is a combined name of events of varying magnitude with different causes. Flooding can be caused by extended periods of rainfall causing rivers to overflow, rainstorms, snowmelt, dam breaks, accumulation of water in low-lying areas with high water tables and intrusion of seawater on land during cyclonic/tidal surges. Heavy rainfall is the most common cause of floods but the magnitude, the speed of onset and the duration is influenced by factors as topography, vegetation, river alteration, land use and urbanization(Few, 2003).

The time-span of a flood can be predicted by making a hydrograph curve. A hydrograph curve expresses the actual flood flow of a particular basin or area. It takes in account a variety of factors, the total amount of rain, the reservoir size, time it takes water to come all the way down to the area in question. Although this method is only usable by measuring an isolated storm with uniform rainfall and is still with all the data available just an approximate (Chapman, 1994).

Inundation along floodplains adjacent to major rivers can be both widespread and long in duration, this is very common and apparent in case of the Ganges-Brahmaputra-Megna river system in India and Bangladesh. A very flood-prone river system combined with a highly densified population and relatively low protection against flooding (Smith, 2013). Persistence of flood water means disruptions of services and infrastructure and hazardous situations for weeks and even to months on end. Low-income inhabitants in developing countries do not "have a realistic option of moving elsewhere while waters recede" (Few, 2003, p46).

3.2 Impact of health during floods

3.2.1. Deceases

Impact on health is hard to quantify but is one of the most significant effects of flooding, especially when flooding is for longer periods of time (Kolsky, 1999). The direct physical threat of flooding is minor but flood events can increase risk from waterborne pathogens, insect-borne infections and snakebites. Disease outbreaks are common during long term flooding and can be associated with the floodwater containing waste, disruption of safe water supply and created breeding grounds for mosquitoes by standing water in low-lying areas.

3.2.2 Sanitation

Furthermore disrupted sanitation systems are a great threat to health for when the floodwater contains faeces it can cause respiratory infections, skin allergies and gastrointestinal illnesses (Stephens et al, 1994).

3.2.3 Infrastructure

Next to the floodwaters being a danger for health on itself, major problems are posed for inundated regions due to the disruption of medical facilities and the increased demand on their resources. The lack of good infrastructure in combination with flooding can isolate inhabitants in need of medical assistance from accessible health care (Rashid, 2000)

3.2 Inhabitants in flood-prone areas

As described above floods pose a risk to inhabitants in low-lying water rich regions but why are affected people not moving away from these high risk areas?

The low-lying flood-prone areas are due to the risks of flooding perceived as less desirable areas to live, so people who can afford it try to stay out of the regions affected. This results in a low-income population that actually has to deal with the problems posed by flooding. As Few describes these low-income inhabitants do not have the means to move somewhere else even for a temporary amount of time to wait until the water recedes.

Something overlooked by many is that flooding is not a phenomenon that is only negative. There are positive aspects of flooding such as widespread economic and environmental benefits. Floods can irrigate and fertilize fields, flush out salt and toxins from the soil and recharge reservoirs. These aspects facilitate intense agriculture outside of the rain season so residents can harvest more from their land during the dry season.

Perception of environmental risks can be defined as: "The process whereby individuals and groups judge the degree of danger they face in relation to the benefits they enjoy by staying where they are, and hence searching for and evaluate various means of reducing that danger should they be motivated to do so." (Stephens et al, 1994)

Concluding that the affected population of these areas do not have the means or the intention to move into areas not affected by floods, there is a need to make long lasting sustainable solutions for the current problems imposed on this population.

3.3 Coping strategies

After identifying the problems and eliminating the notion that these people can move away from the flooded areas it is important to identify coping strategies that populations in flood-prone regions already have developed. Why coping and not solving the problems?

3.3.1 Structural and non-structural approaches

For this we need to make a division between structural solutions and non-structural approaches. Structural solutions refers to engineered solutions such as dams, dikes, reservoirs and embankments. Though structural solutions have the preference in western societies and have proved themselves mostly successful, these solutions do not always apply to regions such as the Ganges-Brahmaputra-Megna delta.

These solutions are costly in design, construction and in maintenance, poor maintenance moreover will increase flood hazards as they give the impression of safety but can not be relied on. This makes structural approaches unfeasible for many flood prone developing countries (Parker, 1999). Local inhabitants also perceive man-made interventions, such as attempts to regulate water flow, as more disturbing because these adjustments made familiar hazards into unfamiliar.

Thus, nonstructural approaches have the preference in developing countries. These are not measures to prevent floods but merely to reduce the short- and long-term impacts of them.

3.3.2 Non-structural approaches

Nonstructural approaches both traditional and new on micro scale are involving communities and household level. Since local inhabitants have been dealing with floods for centuries now they developed a variety of coping mechanisms relating to different phases of the flood threat.

"Local-level, indigenous responses include people's own strategies for dealing with flood risks … These responses have been developed by people in many places, often over hundreds of years, especially where people have had to colonize and cultivate new lands in flood plains." (Blaikie et al, 1994, p136)

Nonstructural approaches of impact reduction can be divided in technological and non-technological strategies. Adaptation is the key concept, people will adapt to the problems posed by the flooding in each area.

3.3.3 Household level

Many households prepare for the risk of flooding by raising their plinth level, many do this by using landfill materials on which lay a floor. In such case the house is better prepared against minor floods that do not raise as much.

Another approach by more permanent residents that are wealthy enough to build long term housing is to put the house on piles to allow complete separation from higher flood levels.

Building with water resistant material such as concrete blocks is preferred but also expensive. As Stephens et al have observed in Indore, India, residents preferred wooden construction with mud plaster to mud blocks since these structures appeared to be more damaged as soon as the mud plaster was affected by the flooding. Which in response was more likely to receive money from the government to repair the structures.

For low-income inhabitants of improvised housing roofs are generally made up out of corrugated metal sheeting and is not attached to the house but rather weighed down by heavy objects. In case of danger for the house to be swept away the roof can be detached and taken to a new residence.

Also raising shelving to head height prevents food storage from becoming wet during raising water levels. Extra raised platforms inside the house also facilitated the residents with safe storage for electrical components and other valuables at home. Also putting electrical wiring higher up means it is less threatened by rising water levels (Paul, 2010).

A non-technical strategy is dependency on relief aid. Not simple but quite basic is for example the relief offered by organizations as the Red Cross and Medicin sans Frontieres. This comes in many different shapes, Relief organizations will mostly offer supplies and materials to relief the stress of the initial disaster rather than offering structural help. Governments and local NGO's also offer subsidies, grants and loans, to enable people to build up their destroyed livelihood (Alexander, 1993).

3.4 Relief organizations

Usually relief organizations are on the end of the logistics chain, the main activities are organizing transports due to destroyed infrastructure, ensuring fair distribution of relief items such as water, food and shelter. Although there are some examples of the opposite, the main aim is to supply relief and not long-term solutions to create resilience for inhabitants.

Relief organizations such as Medicin sans Frontieres and Red Cross are familiar with flooded regions and have short term solutions for affected areas. As noted in their reports they mainly provide relief packages consisting of Kitchen sets, tarpaulins, mosquito nets, blankets and bed sheets. As noted this is mainly short-term relief for the disaster struck residents of the area (IFRC, 2017). Another wider spread solution is the installation of temporary toilets to provide an sanitation alternative to defecating in the nature/floodwaters. Temporary sanitation is very useful for preventing pollution of floodwater with water-borne diseases (IFRC, 2017).

Also distributing water disinfectants such as chlorine tablets or bleaching powder is effective in providing drinking water on small scale so water borne infections are not ingested. Though during heavy floods the supply does not meet the immediate needs of many.

3.5 Summary

To summarize the previous chapter flooding poses hazardous situations for weeks and even to months on end. Low-income inhabitants that suffer during these periods of time do not have realistic options of moving somewhere else to avoid the hazards. Although floods also create fertile soil and have positive effects for agriculture in the area so there is not always an incentive for inhabitants to move. During flooding there is an increased risk on disease outbreaks due polluted water and bad sanitation. The floods disrupt the infrastructure in the region, which isolated inhabitants from healthcare facilities. People do have developed coping strategies on house level to minimize the impact of the floods but rely on relief organizations to provide necessary supplies.

IV. HEALTH CARE IN GHATAL BLOCK

4.1 Ghatal block

Ghatal block is a rural area, west of Kolkata with 219.555 inhabitants (2011). As a rural area statistically it has a lack of healthcare facilities. According to a study conducted by Jhunjhunwala 66% of inhabitants of rural India does not have access to the necessary healthcare and 31% of the

population needs to travel more than 30 kms to seek any kind assistance (Jhunjhunwala, Prashant, Sawaker, 2017).

The directorate of census operations makes a division in certain health care facilities available in West-Bengal. There is a clear distinction between the guidelines that are set for the types of healthcare that have to be offered according to this document and the ones that are actually in the area available.

Table 1: Overview healthcare facilities and characteristics

	Community Health centre (CHC)	**Primary Health centre (PHC)**	**Primary Health sub-centre (PHS)**	**Health centre (HC)**
Population to serve	80.000	20.000	3000	>1500
Beds	30	4-6	-	-
Staff	Specialists Medical officers Support staff	Medical officer Para-medical staff	1 male staff 1 female staff	1 staff

The regarded facilities are selected on offering allopathy, medical assistance by offering drugs against symptoms. Health care is quite a broad term to use so it's important to narrow it down to what facilities are actually offered in the area.(Achin, Mukherjee, 2003)

4.2 Available services

According to the directorate there are 36 medic related posts in the area. These include also dispensaries, local "medics", alternative healthcare, maternity posts, veterinary posts and nursing homes. Closer analysis shows that in the area are only 2 General Practitioners and 1 sub division hospital (CHC).

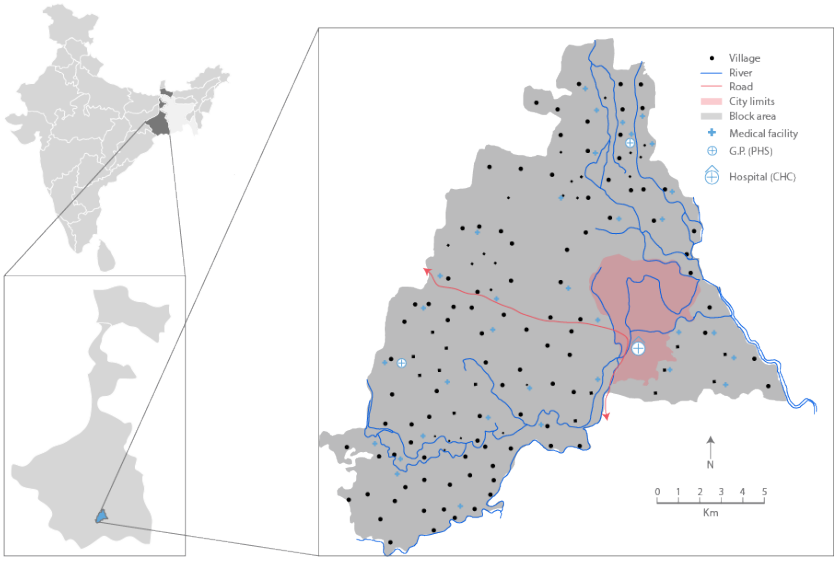

Figure 3: Ghatal block and healthcare facilities.

If regarded the whole area of the Ghatal block the number of inhabitants is 219.555 of which all are considered as rural population. In that case according to the distribution of health-care facilities the

amount of CHC's in the area should be 2,75 so 3 however there is only one, situated in the city of Ghatal.

Next to the the CHC that exists in the area there are 2 General practitioners, this concludes on (219.555 - 80.000) / 2 = 69.777 inhabitants per G.P. which is an impossible amount for one G.P. to handle. If we would compare that to a developed country as the Netherlands which has about 2.168 inhabitants per G.P (NZa, 2016) Even for a rural area in a developing country there is a lack of medical facilities available.

We do need to take in account that a significant number of people visit alternative healthcare in rural India. In rural West Bengal 11.7% of the questioned population trusted on Homeopathy (Rudra et al, 2017). Homeopathy however does not offer a scientifically based protection against infections, it does however work as a placebo which can have positive effects anyway (Dossett, 2008).

4.3 In case of flooding

Ghatal block is a relatively flat area with a combination of rivers running through. The enormous expansion of these rivers during the wet season creates a situation where water relatively often overflows the boundaries of the river and flows into the area adjacent to the rivers. Due to the lack of structural flood protection for this area, this happens every wet season at least once (NOAA, 2012).

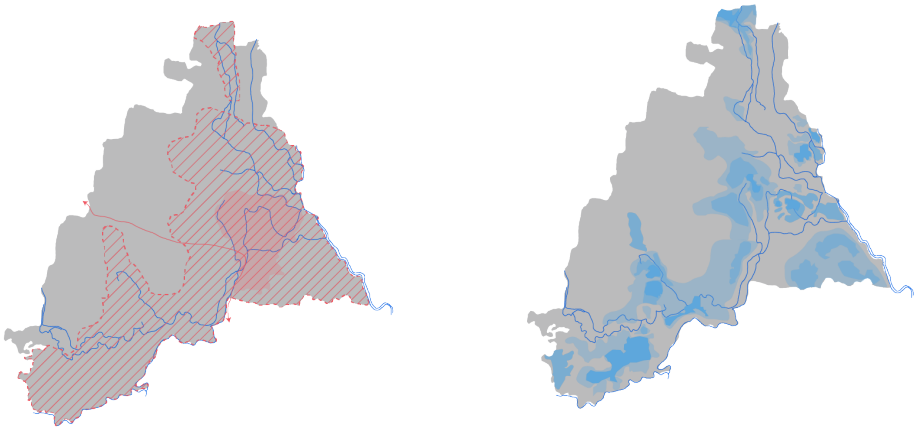

Figure 4: Ghatal block flood risk zone (left) & Ghatal block regularly flooded area(right)

About 85 of the 142 villages in this region are inside the risk zone and do encounter problems with flooding. A large number of these villages are either under or surrounded by water repeatedly every year. During severe flooding the water can enter even the higher parts of the city and invade the area around the hospital that is build on higher ground. Figure 5 shows the hospital in dry situation and wet situation.

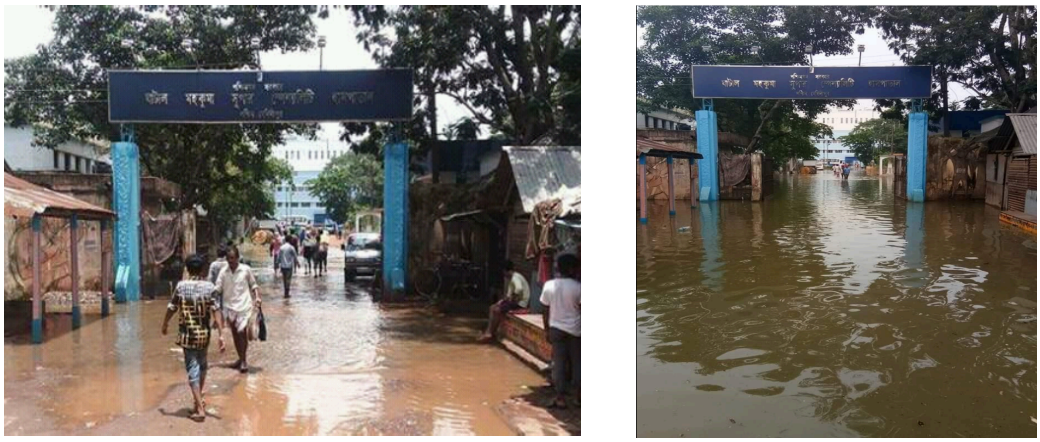

Figure 5: Entrance to hospital in dry and flooded situation.

In addition to the lack of facilities the risk of flooded services and infrastructure as is visible in figure 5 leaves people without help and dependent on external relief care to make sure that during this period the well being of inhabitants is secured. In case of heavy flooding, relief care is too much relied on and does not have the means to make sure everyone is looked after.

4.4 Duration of floods

The duration of the floods is variable in the area: elevation, flow path and soil composition are all effecting the duration of floods and thus the impact on the lives of inhabitants of this region. Longer flooding means increased hazards for health by mosquitos and water-borne infections. Furthermore the infrastructure blocked by the rising water is longer blocked and access to higher healthcare is blocked for a longer period of time. In figure 6 the duration of floods in different areas of the Ghatal region is illustrated.

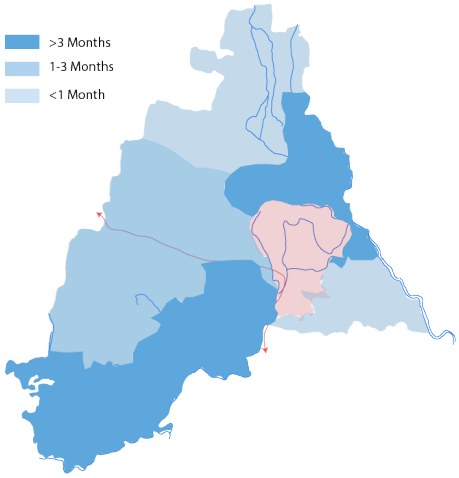

Figure 6: Duration of floods in Ghatal block

V. CONCLUSIONS

Due to climate change it is expected that sea levels will rise and weather patterns will become more extreme. Increase in intensity and duration of precipitation are causing higher risks of flooding and especially coastal delta areas are in danger. To prevent these natural hazards becoming natural disasters for low-income areas where there is no financial capacity to deal with these threats on structural level, there is a need for non-structural solutions.

Flooding offers challenges for the health of affected population since it is proven that the mixture of floodwater with sewage and animal faeces creates a dangerous mixture of polluted water. The current situation in most low-income flood-prone coastal areas is not self-dependence during these severe floods and inhabitants rely heavily on relief organizations.

For the case in Ghatal block to become self-dependent during flooding events it needs a solution to provide health care during the wet season for it's inhabitants. The current lack of health care facilities available shows that there is room and a need for extra facilities especially small-scale G.P. facilities and one or two facilities that can deal with infectious deceases. Extra medicine dispensaries could assist in prevention.

Important is that the new solution would be accessible during the floods and does not rely on existing infrastructure for people to access it. The sheer size of the area that is repeatedly inaccessible during the wet season is too great in size to rely on the traditional infrastructure.

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Figure 2: (IPCC, "Summary for Policymakers," in Climate Change 2014: Impacts, Adaptation, and Vulnerability. Part A: Global and Sectoral Aspects. Contribution of Working Group Ii to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change, ed. C. B. Field, et al. (Cambridge, United Kingdom, and New York, NY, USA: Cambridge University Press, 2014), 66.)

Figure 3: By author

Figure 4: By author

Figure 5: Maji, P.,Dutta O.N., retrieved from https://www.google.nl/maps/place/Ghatal+Sub+Divisional+Hospital/@22.6570574,87.7376614,3a,75y,90t/data!3m8!1e2!3m6!1sAF1QipOmp_IV7y91yH4yfIbZ1um1AjTEucRsSCHQpzw!2e10!3e12!6shttps:%2F%2Flh5.googleusercontent.com%2Fp%2FAF1QipOmp_IV7y91yH4yfIbZ1um1AjTEucRsSCHQpz-w%3Dw203-h270-k-o!7i720!8i960!4m8!1m2!2m1!1ghatal+sub+division+hospital!3m4!1s0x39f80901f0f570b9:0x872e7598b2058c84!8m2!3d22.6570552!4d87.7377301

Figure 6: By author