FLOOD RISK MANAGEMENT ADAPTATION STRATEGIES IN SRI LANKA

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1. INTRODUCTION

Climate change is an irreversible phenomenon that is seen worldwide in various forms such as rising temperatures, hurricanes, rising sea levels, droughts, floods, landslides, and so on (Hussain *et al*., 2020) . Among these various forms, flood is believed to be one of the burden forms of climate change in Sri Lanka. Flood is a natural threat with a variety of direct and indirect topographical, economic, environmental and social implications. It accounts for nearly 34% of all natural disasters that occur worldwide (IFRC, 2019). Floods are occurring due to natural events, such as high intensive precipitation and high tides, where channel blocking or aggravation, incorrect land-use pattern, destruction of vegetation in catchment areas, and some other man made factors contributing to the flood in the country (Teng *et al*., 2006 Extreme flood event can cause losses of property, lives, economy and effect the agricultural sector (Sivakumar, 2015). Furthermore, in Sri Lanka Anuradhapura, Batticaloa, Badulla, Puttalam and Polonnaruwa are highly stricken districts as a result of the extreme flooding that has been occurring since December, 2019. Meanwhile, two people have been reported deceased, 62 houses have been entirely damaged, and 1,463 dwellings have been partially damaged, affecting 64,608 people from 18,840 families. 5,255 families have been relocated to one of the 133 shelters put up to help those who have been displaced (Hussain *et al*., 2020). So, appropriate management measures must be implemented to mitigate the risk level of flood event.

2. METHODS

The official website of the Government of Sri Lanka and the Google Scholar Database have been used to access publications related to flood risk management policies published between 2008 and 2020.

3. RESULTS AND DISCUSSION

Mitigation is described as a sustained activity undertaken to lessen or get rid of long-term risks to persons and properties from natural disasters (FEMA, 2010). It has traditionally been split between structural and nonstructural measures. Structural mitigation strategies including dams and floodwalls modify the characteristics of flood and minimize the chances of flooding in the oncerned a region. Non-structural mitigation strategies could change the results of flooding but have very few to no impact on the features of flood (Tingsanchali, 2011).

Structural measures

Following is a brief list of the most commonly utilized structural flood control measures.

1. **Dam**

Dams are barriers that impound hydrological flows and prevent flood water reaching the vulnerable areas. To create flood control structures and reservoir is one of effective options for reducing flood peak discharge in the basin. The risk of damage to lowland populations during high intensity of rainfall. Constructing water reservoirs and/or other structures is one of the best options to reduce the volume of flood discharge in the lowland buildup areas during high intensity rainfall.

2. **Spillways, channels and floodways**

Spillways, canals and waterways are constructed to transport floodwaters through a settlement or region if the above dead storage to transfer a substantial number of floodwaters beyond a critical site is limited. The channels could be modified in some cases to increase their floodwater transport potential (Department of irrigation, 2021). Alterations in the channels could be resulted in their potential to transport floodwater. How the improvement made in the dams. The number, type and size of the gates must be kept as they currently exist for replacement and renewal (the size of the gate opening is kept as is), although the potential requirement of dam construction had been accepted by the Sri Lankan government (Varshney, 1986).

3. **Improved levee designs**

A levee is a natural reservoir of water that flows along the river, keeping the flood water off the ground behind it until it closes, as the area behind the flood water affects people and property (Department of irrigation, 2021). The risks to people living beyond the shore are determined by the components of the shore, including their strength, height, location, mitigation and transmission measures, and risk mitigation efforts that they or imposed on them. Comprehensive implementation of the Climate Change and Disasters Program (CRIP), launched in 2014 (Department of irrigation, 2021).

4. **Floodwalls, seawalls, and other appurtenant Structures**

Floodwalls, seawalls and other structures are built to halt the flooding and storms from reaching the affected areas. Failure to do so can lead to severe consequences because those behind the building may experience rapid flooding and worse flooding conditions than the slow rise of floodwaters (USACE, 2012).

Nonstructural Mitigation Measures

The cost and effectiveness of non-structured strategies, as well as significant physical and political efforts to implement them vary. The area in which the measures will be applied (geomorphology, expected flood level, etc.), available of funds and approval from the people in surrounding areas are the factors that determine to what extent they should be applied.

1. Natural Systems

Natural or restored wetlands and regularly cultivated lands can help to reduce the lowland downstream damages by store the excess water from river floods. Wetlands also serve as a natural buffer against storm surges (FEMA, 2010). Coastal sand dunes help the protective structure built behind them by slow down the process of coastal soil erosion and reducing the rapid effects of storm surges. Floods designed to relieve flood stress can also help ecosystems. This natural system has the potential to reduce flooding behind dams that have internal drainage problems (Magdelaine, 2010)

2. Risk Mapping

Accurate risk mapping provides information to those working or living in flood-affected areas before and after dams that they need to design their own reasonable flood risk management strategies (USACE, 12)

3. Hazard Forecasting, Early Warning Systems, and Emergency Plans

Government officials and the public may decide to move or relocate valuable property from high-risk areas based on detailed weather forecasts, accurate estimates of river levels (altitudes) (Magdelaine,2010), roads, and the intensity of tropical storms. Establishing an automated water level and precipitation measurement with community disaster management components in this study will help provide emergency measures and evacuation plans to eliminate accidents and property damage (Varshney, 1986).

4. Dry and Wet Flood proofing

Dry and wet flood insulation can prevent structural damage in dams. Wet flood insulation creates an uninhabited part of the flood-resistant structure by letting water enter the structure during flood conditions and allowing it to flow (Hussain *et al*., 2020). Dry flood insulation clogs the structure to prevent floodwater from entering; Wet flood resistance makes uninhabited parts of the structure flood resistant by allowing water to enter the structure and flow through during flooding (USACE, 2012).

5. Land-Use Planning and Zoning

Appropriate use of land is a powerful tool to reduce risks of flooding. Land use planning establishes public policy by determining how the land should be used in a specific area (Magdelaine, 2010). It is carried out by zonal rules and takes place at various levels of government, from global to municipal policy, where a lot can be appointed for a specific purpose. When needed, prudent land use indicates a lack of investment in a particular area (Department of irrigation, 2021)

6. Construction Standards and Building Codes

Construction standards and construction regulations only apply domestically but can be developed at any level of government. While the code ensures public safety, it requires procedures and actions that directly address the root cause of the disaster. New construction

standards and construction regulations will significantly reduce damage (Opperman *et al*., 2009).

4. CONCLUSION

The purpose of flood management is to reduce the impact on people living in flood-prone areas. Action must be taken to prevent flooding. These functions can be divided into two types: structural and non-structural. Engineers and locals prefer structural measures because they protect confidential areas to some degree. Social and conservation scientists focus on reducing losses in non-structural activities. Every disaster mitigation and mitigation strategy reduce the overall risk to some extent, but the risk cannot be completely eliminated.

REFERENCES

FEMA. (2010). Mitigation Planning Fact Sheet on Risk MAP. Available online at http://www.fema.gov/library/viewRecord.do?id=2066. Accessed November 14, 2012

Gunaratne,G.L.,Priyadarshana,T.,Manatunge,J.,Tanaka,N.and Yasuda,S., 2010. Water balance and renewal time of Rekawa lagoon,Sri Lanka;A restorative approach. Moratuwa: international Conference on Sustainable Built Environment

Hussain, S., Huang, J., Huang, J., Ahmad, S., Nanda, S., Anwar, S., and Zhang, J. (2020). Rice production under climate change: Adaptations and mitigating strategies. In *Environment, Climate, Plant and Vegetation Growth* (pp. 659-686). Springer, Cham.

Implementing Flood Risk Management Strategies." National Research Council, (2013). *Levees and the National Flood Insurance Program: Improving Policies and Practices*. Washington, DC: The National Academies Press. doi: 10.17226/18309.

International Federation of Red Cross And Red Crescent Societies (IFRC), (2019). Sri Lanka: Floods and landslides - Information bulletin. Retrieved from: https://reliefweb.int/report/sri-lanka/sri-lanka-floods-and-landslides-information-bulletin-mdrlk010.

Magdelaine, C. (2010). Bilan des catastrophes naturels dans le monde, http://www.notre planete.info/geographie/risques_naturels/catastrophes_naturelles.php, accessed October 31st 2010.

Opperman, J. J., G. E. Galloway, J. Fargione, J. F. Mount, B. D. Richter, and S. Secchi. (2009). Sustainable Floodplains Through Large-Scale Reconnection to Rivers. Science 326: 1487-1488.

Sivakumar, S. S. (2015). Irrigation Scheme Development and Management Strategy for Conflict Affected Northern and Eastern Province of Sri Lanka. *International Journal of Scientific and Engineering Research*, *8*, 6.

Teng, W.H., Hsu, M.H., Wu, C.H. and Chen, A.S., (2006). Impact of flood disasters on Taiwan in the last quarter century. *Natural Hazards*, *37*(1), pp.191-207.

Tingsanchali, T. (2011). Urban flood disaster management. Procedia Engineering 32 (2012) 25 – 37. Available online at www.sciencedirect.com

USACE. (n.d.a). National Nonstructural Flood Proofing Committee. Available online at http://www.usace.army.mil/Missions/CivilWorks/ProjectPlanning/nfpc.aspx. Accessed November 15, 2012.

Varshney, R.S. (1986). Engineering Hydrology. NEM Chand and Bros, Roorkee (U.P), India.