SPATIAL DISTRIBUTION OF FLOODS IN MATHARA DISTRICT: WITH SPECIAL FOCUS ON 2003 AND 2017 FLOOD EVENTS

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Abstract - Floods are one of the most devastative disasters in the world, and it is most prominent in tropical regions of the world. Sri Lanka being located in between two tropics, witnesses flood every year due to the monsoon, convection rains and sometimes rain due to cyclones. Therefore, this study is mainly focused on Mathara district with the main objective of assessing the impact of floods along with its distribution. Both primary and secondary data were used for the study. Impact data was obtained from the Disaster Management Center and the flood inundation area, and rainfall data was obtained from the Department of Irrigation and Department of Meteorology of Sri Lanka respectively. A questionnaire survey was conducted on selected 100 households from the Peddapitiya Grama Niladhari Division (GND) of Akuressa Divisional Secretariat Division (DSD) which has the highest impact. Spatial analysis techniques were mainly used in this study, specially the weighted overlay method, to identify the affected regions. Statistical analysis methods of descriptive statistics were also used in order to identify the relationship between daily discharge and daily rainfall levels. According to the analysis Kirama ara, Digili oya, Kotapola oya and Urubokka oya tributaries of Nilwala river record the highest impact from floods. It is also clear that April, May and June are the most prominent time period due to the South West Monsoon (SWM) and September, and November due to Second Inter Monsoon (SIM) conventional rains. Comparison between 2003 floods with 2017established that the impact is more devastative in year 2017 flood.

Keywords: Flood, Weighted Overlay, Mathara

I. INTRODUCTION

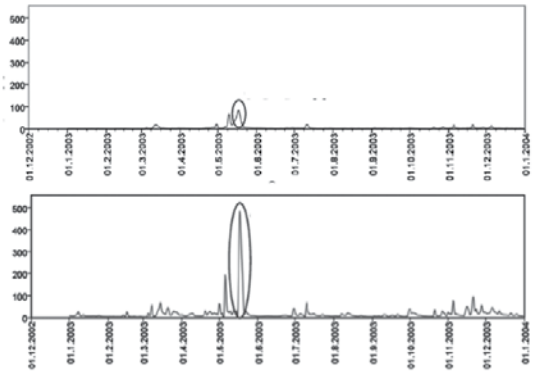
Floods have become most commonly discuss topic under the Disaster Management. There are thousands of strategies all over the world taken to prevent or mitigate flood hazard in the world. Tropical regions are more prone to floods and the coping capacity for the floods and to take proper mitigation methods are considerably low, since most of these countries are still developing nations. But there is international collaboration through various projects to improve flood mitigation and many of these strategies seem to work properly.

Sri Lanka being fed by both SWM and North East Monsoon (NEM) is also highly prone to floods in many parts of the wet zone. Like Kaluthara, Colombo, Rathnapura, Galle Districts, Mathara district has considerable impact on both natural and built environment due to the floods caused by Nilwala River. Nilwala catchment area extends up to 375 square miles with 72 km in length. The area will get 2000 mm – 2500 mm rainfall annually and the lower catchment of the river is highly populated with in many areas. There are previous severe floods recorded in year 1940, 1969, 2003 and the most reason one is in 2017. There were 64 deaths recorded in year 2003 floods with 47637 families being displaced. In 2017 flood also there were 31 deaths recorded and 43382 families were displaced. There were many flood prevention methods being active at the current scenario and flood controlling dam system is one of the main attractions. Due to the dam system small scale floods will not hit severely but with the climate change the intensity of rainfall as well as the floods have become increased. So, if the rainfall exceeds its threshold limits the flooding is unstoppable.

II. METHODOLOGY

Main objective of the study is to assess the impact of the floods in Mathara District and compare the two floods in the year of 2003 and 2017. As the sub objectives, identification of spatial distribution of the floods and its impact along with identify the relationship with river discharge and the rainfall of the area were also considered.

Equal Weights were given to both primary data and the secondary data and a questionnaire survey along with interviews were conducted to obtain the primary information regarding the behaviour and the impact of floods. Among the district the highest impact was recorded in Peddapitiya GN Division which belongs to the Akuressa DS Division and 100 households were selected under the random sampling methods that have been flooded. Interviews were conducted from the key informants of the area like Grama Niladhari, Divisional Secretariat, Police officers and Community leaders of the area. As secondary data flood inundation areas were obtained through the Department of Irrigation, yet they were able to provide only the inundation area of 2017 flood since they have not compiled the 2003 map at the moment. Impact data were obtained from Disaster Management Center and the District Secretariat Office of Mathara District. Data were collected for the GN level under the impact categories of number of deaths, affected families, and numbers of affected people, numbers of houses fully destroyed and numbers of houses partially destroyed. Daily discharge data were obtained from the regional stations and Daily Rainfall data from Department of Meteorology.



Spatial Analytical techniques were used in order to identify the spatial patterns of each parameter of the impact categories. At the end overlay method was applied to identify the agglomerated impact of the study area. Arc GIS 10.1 was used as the tool of analysis and maps as the main visualization techniques. Graphical representation of the rainfall and water discharge was also done along with. Descriptive illustrations were also applied in this study to investigate the matters in deeper context.

III. RESULTS AND DISCUSSIONS

This section is divided in to two groups as in first part is to discuss the relationship with rain fall and flood levels in Nilwala River Bain and second half is to discuss the impact and its relationship with terrain characteristics.

Rainfall in Nilawala river basin comes to its maximum during the South West Monsoon period. During the monsoon the river carries all the water accumulates in basin area and discharge from the estuary located at Matara town. Elevation of the river up to 40 km in to the land area is less than 50 meters but after that it has an accelerated gradient up to 600 meters.

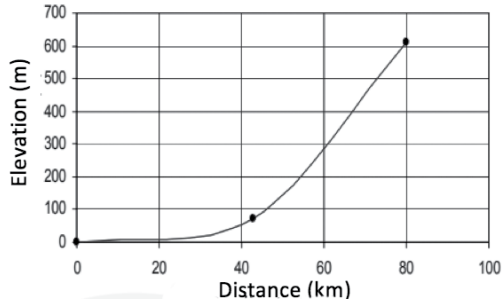


Figure 2. Cognitive map of research findings

According to the gradient it is also clear that the water from upper catchment area where above 40 km from the sea comes with high velocity and suddenly release in to the lower basin where the flooding started.

Not only the main river but also the tributaries of Nilwala River indicate flooding. Department of Irrigation has identified three stages of flooding which they named as High, Moderate and Low. If the water level is less than eight feet it is considered as a low flooding stage and the areas of Matara, Nadugala, Bandaththara and Kadduwa areas are most likely to be flooded. If the water level is less than 13.5 feet, it is considered as a moderate flood where

Mavarala, Mulatiyana and Akuressa areas will be flooded apart from the areas of low level flooding. If the water le vel exceeds 18.5 feet it is considered as high level flooding where flood will extend up to Bopadoda, Pitabeddara, Malimboda and Pasgoda areas.

There were two main flood occurrences which considered being high or severe, which was occurred in 2003 and 2017. There were annual floods but these two events are being considered as the severe. Based on the flood inundation area map of the Matara district the most flooded DS division in 2017 flood was Thihagoda.

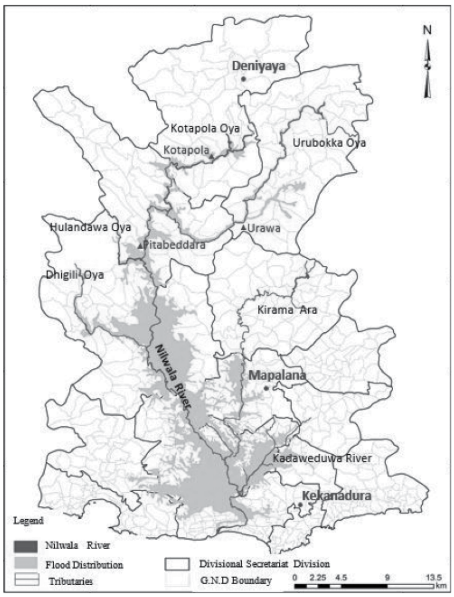


Figure 2. Flood inundation area with rain gauge and water gauge station in Matara District

The map indicates that the highest numbers of deaths were recorded in Morawaka GN division and the main reason for that is the overflow of Urubokka oya, which is a main tributary of the Nilwala River. Second highest is recorded in Makandura west and Batuwita GN divisions. Kirama area is the major reason for the flooding of Makandura and Batuwita is directly located adjacent to the Nilwala river. The deaths in the upper catchment are mainly due to the over flow of tributaries and some of the cases are happened due to the landslides related to floods.

When considering the number of displaces people it is very clear that the large numbers of them are agglomerated on the flood plains of the river basin. Highest number of displaced amount is recorded in Weragampitiya GN division which is located in Matara DSD and it is 4064 to be exact. Also highest displacement is recorded in Matara and Akuressa DSDs and it is 30 and 26 precent respectively. More than half of the displaced population lives in this two DSDs. There are 38127 people have lost their places to live. Considering the fully damaged houses indicates a different pattern where the large number of housed are damaged in upper catchment area.

Figure 7. Number of displaced people in Mathara district due to 2017 flood

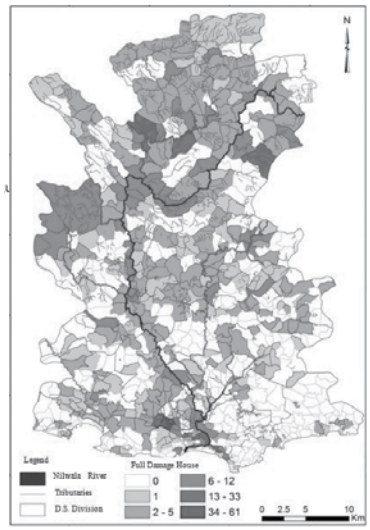


Figure 8. Fully damage in Mathara district in 2017 flood

One reason for the pattern indicated in figure 8 is, when collecting data by the Disaster Management Centre they collect both Floods and landslides together. Therefore the exact picture of the flood impact is not clearly depicted. The authorities have not collected data separately for the flood victims and landslide victims.

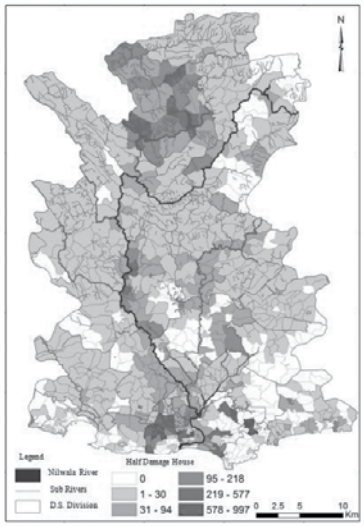


Figure 9. Partially damage in Mathara district in 2017 flood

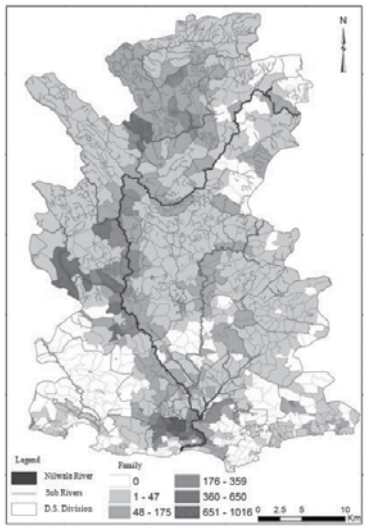


Figure 10. Impact households in Mathara during 2017 flood

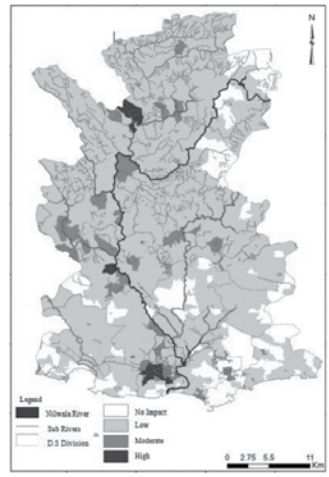


Figure 10. Cumulative impactof Mathara during 2017 flood

There is a scattered distribution of the moderately impacted households in many parts of the district. It is mainly because of the tributaries of the area. Apart from very few GNDs almost all the district was under flood and had some sort of an impact at least based on one parameter.

For the uneven distribution of the impacted GNDs the terrain characteristics were another major influenced factor. Upper catchment of the Nilwala basin consists with high terrain features but the morphology has allowed some areas to have floods during the rainy season. Following diagram indicates three cross sections of the Nilwala basin which belongs to the Matara district.

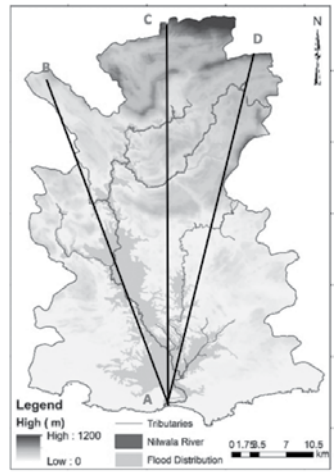


Figure 11. Lines of the cross sections of the district

The cross sections are clearly indicates the terrain variation and it is clear that there are basin areas in the high elevation which can retain floods in some parts. They will act as flood pockets by creating flood hazards in some high elevation sections of the Matara District. The terrain dynamics will always have a huge impact on the floods and considering the Nilwala river basin there are floods which can be identified in the upper part of the basin. Many anthropogenic activities have intensified the flood risk of many areas and the impact even with non-severe flooding has become higher than the previous situation. There is a complex network of tributaries which will act together with relief to intensify the floods.

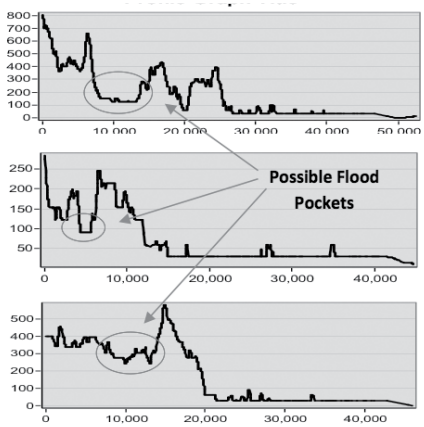


Figure 12. Cross sections of the district profile

III. CONCLUSION

In conclusion it is clear that there are floods which normally annually accruing in the Nilwala river basin and in many occurrences both human and natural environments were severely disturbed. It is our duty to prevent floods or may be to take necessary actions to mitigate and reduce the impact of flooding. But to do that, proper studies of floods has to be conducted to identify the flood characteristics of the given area. This will enables the decision makers to plan for the future floods in mitigating or may be preventing them being occur.

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