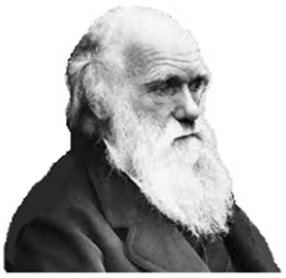
Available online at www.worldnewsnaturalsciences.com



World News of Natural Sciences

An International Scientific Journal

WNOFNS 18(2) (2018) 114-123 EISSN 2543-5426

GIS Based Flooding Analysis Kaluwanchikudy DS Division, Sri Lanka

S. Mathanraj[1,*] and **M. I. M. Kaleel**[2]

[1]Department of Geography, Eastern University of Sri Lanka, Vantharumoolai, Sri Lanka

[2]Department of Geography, South Eastern University of Sri Lanka, Oluvil, Sri Lanka

*E-mail address: kaleelmim@yahoo.com

ABSTRACT

The major objective of this study is to identify the flood severity level of the study area using GIS applications. By employing this map, safer habitation zones were established. Direct personal observation and face-to-face interview was done to gather the primary data and Disaster Management center reports, Census reports of Sri Lanka; images and published research reports were used as secondary data. The severity level of flooding in this area was analyzed using SRTM imagery in ArcGIS and overlaid on a Google Earth pro map. The findings of the study established that the highly affected area consisted of around 8,953.003 sq·km, the moderately affected area was around 9,190.781 sq·km, and the lowly affected area was approximately 9,310.39 sq·km within the study area. The major causes for flood disaster in this area are the lack of drainage systems in some potential flood regions, the low landscape, poorly maintained drainage systems and the geographical arrangement of the road network. By creating this map, the inhabitants will be aware of danger areas and can relocate accordingly [3, 5-9].

***Keywords*:** Disaster Management, SRTM, Severity level, flooding, drainage system, Kaluwanchikudy

1. INTRODUCTION

Water is the most precious resource to human life. Sometimes, this valuable resource change it form as flooding disaster. Flooding is one of the most dangerous natural hazards which causes economic losses and death globally [4]. Flooding is severe water flow towards the low land which is forming by continuous rainfall.

(Received 15.March 2018; Accepted 29 March 2018; Date of Publication 30 March 2018)

It is one of the most common natural disaster in the study area. Flood is the most regularly occurring in this area due to the diminishing of wetland as well [1, 2].

Floods often cause damage to homes and businesses if they are in the natural flood plains of rivers. Some floods develop slowly while others, such as flash floods, can develop in just a few minutes and without visible signs of rain. Additionally, floods can be local, impacting a neighborhood or community, or very large, affecting entire river basins.

Planners identify and analyze options for reducing potential flood losses and protecting natural values. By this, they identify the instructions that can affect the degree of hazard, the event of development at risk and the potential components of the hazard mitigation programme.

1. 1. Types of Flood in Study Area

There are several types of flooding, categorized below.

1. 1. 1. Areal (rainfall-related)

Floods can happen on flat or low-lying areas when the ground is saturated and water either cannot run off or cannot run off quickly enough to stop accumulating. This may be followed by a river flood as water moves away from the flood plain into local rivers and streams.

1. 1. 2. Riverine

River flows may rise to the flood levels at different rates, from a few minutes to several weeks, depending on the type of river and the source of the increased flow.

1. 1. 3. Slow-rising floods

Most commonly occur in large rivers with large catchment areas. The increase in flow may be the result of a sustained rainfall, monsoons, or tropical cyclones. Localized flooding may be caused or exacerbated by drainage obstructions, such as landslides.

2. STUDY AREA

The District of Batticaloa itself consists of several administrative divisions, of these Kaluwanchikudy Divisional Secretariat Division has been located in Southeast part of the district (**Figure 1**). It has an extent of 52 sq·km. It consists of 45 Grama Niladhari Divisions and 136 villages.

Its population is 63,108 and consists of 17,784 families, and they have found their main occupations as farming and fishing to win their daily life. The proceeds of the people residing in 30 Grama Niladhari Divisions badly affected due to the Tsunami Tidal waves held in 2004 (Divisional Secretariat Porativupattu, 2017).

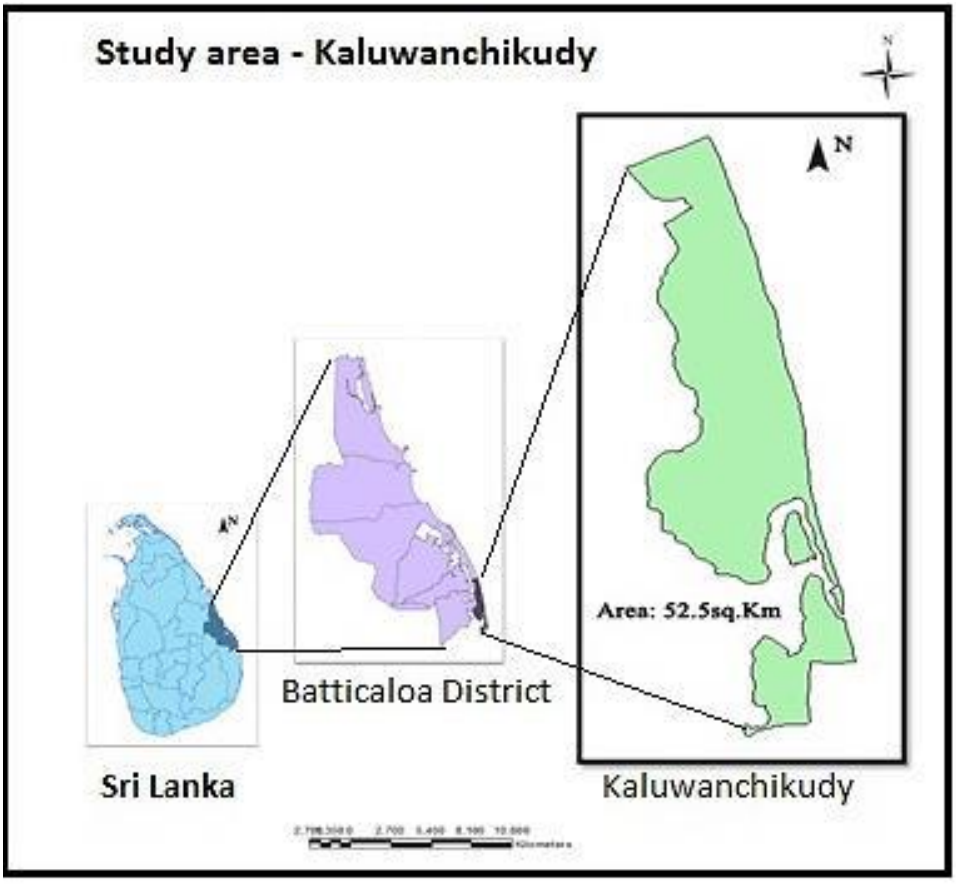


Figure 1. Study area

3. OBJECTIVES

- To identify the flood severity zone in the study area
- To create flooding map to the study area
- To find the flooding effects of this area.

4. METHODOLOGY

4. 1. Primary Data

Direct personal observation in the flooded zone and face-to-face interview had been done with Disaster Management officials 02, Grama Niladhari 08, People 30.

4. 2. Secondary Data

The secondary data have been collected from Disaster Management center reports, Census reports of Sri Lanka, Rainfall, and temperature data from Meteorological Department, images, and published research reports, SRTM image from Earth explorer.

4. 3. Data Analysis

To examine the severity level of flooding in this area had been analyzed using SRTM image. Through this, severity zones were created to get the result. ArcGIS 10.4.1 software were utilized for preparing map.

5. RESULTS

One of the most severe disaster is flooding creating lots of effect to the physical environment and human beings. The study area, which occasionally involved to this disaster, those people whose lives are suffering economically every year. The below **Figure 2** shows the severity level of the study area.

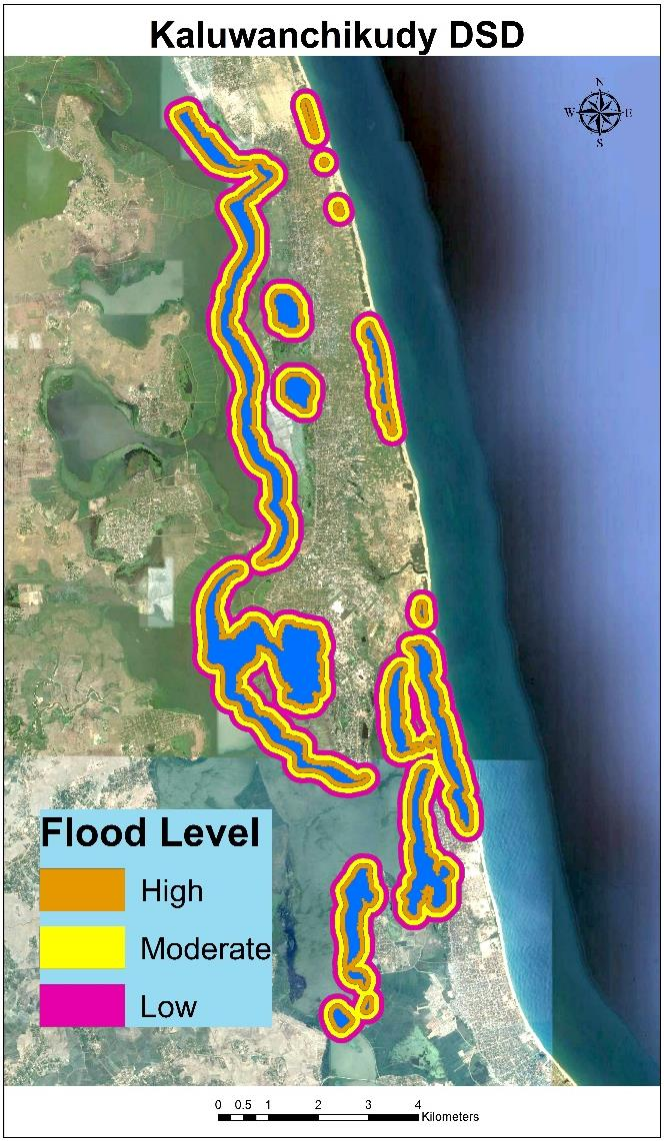


Figure 2. Flood affected zone

5. 1. Causes of Flood

Ironically, flood has now become a severe disaster in the study area. Some factors are given below (**Figure 3**), divided into two categories.

5. 1. 1. Natural factors

- Heavy rain fall
- Topography
- Sudden rainfall
- Monsoons
- Drainage facilities
- Low land
- A lack of vegetation or woodland
- Little to slow the floodwater down.

5. 1. 2. Manmade factors

- Block of drainage with wastage
- Improper drainage facilities
- Lack of drainage facilities
- Reduces of wet lands
- Damage of drainage
- Improper infrastructure
- Lack of wet lands by buildings
- Improper disposal of solid
- Wastes.

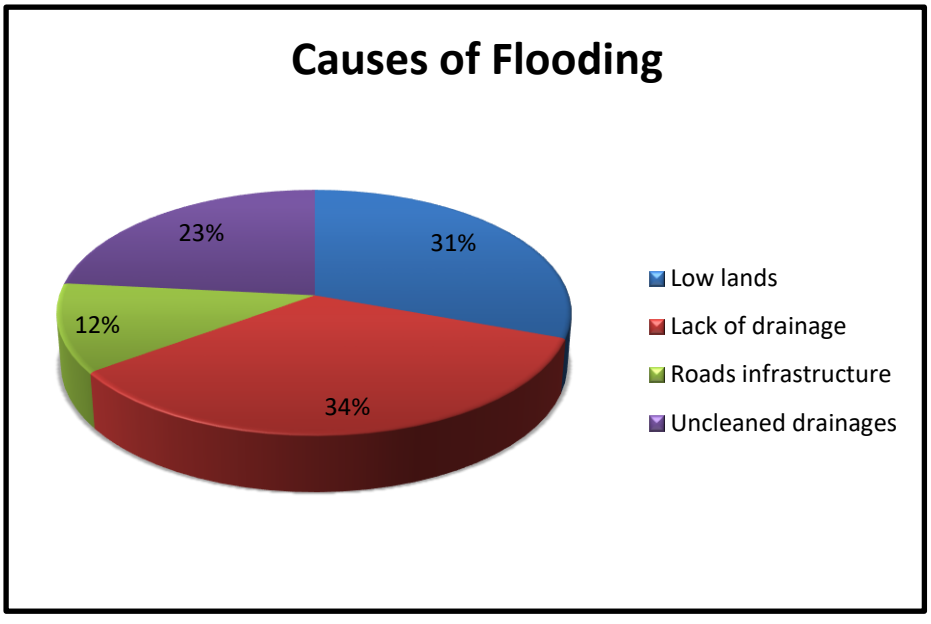


Figure 3. Causes of Flooding

5. 2. Effects of Flood in Study Area

5. 2. 1 Primary effects

- Damage the buildings and other structures including roadways and drainage.
- Loss of drinking water treatment which may result in loss of drinking water or severe water contamination.
- Damage of houses, property and important possessions, such as furniture, other electrical appliances.
- Flood waters typically inundate farm land, making the land unworkable and preventing cropsfrom being planted or harvested and affect the livestock which can lead to shortage of food both for humans and farm animals.
- Increasing the people to move from their house to temporary area as a refuge.
- Lack of hygienic foods.

5. 2. 2. Secondary and long-term effects

- Psychological damage to those affected, in particular where serious injuries and loss of property occur.
- Small businesses never re-open their doors following a flooding disaster.

6. DISCUSSIONS

According to the Figure 2, the severity zone was prepared into three categories as follow: highly affected area, moderately affected area, and lowly affected area. Each area has the distance, respectively 100 m, 200 m, and 300 m. 100 m from the water bodies there are highly risk zones, 200 m from the water bodies are moderately risk zones, and 300 m from the water bodies are lowly risk zones.

Around 8,953.003 sq.km area below 100 m locations was affected during the flood season, 9,190.781 sq·km area between 100 m to 200 m, and approximately 9,310,39 sq·km area was affected between 200 m to 300 m in the study area (Source: Calculated by GIS 10.4.1, 2017).

According to Figure 3, the major causes for facing the flood disaster in this area is lack of drainage system 34% in some flooded area, low land 31%, and unclean drainages 23%, and ups and downs roads 12% (Field data, 2017).

The study area has been located in the monsoonal climatic zone usually gets the rainfall by Northeast monsoon period. The annual rainfall varies from 864 mm to 3081 mm with the evidence of past years in this area. This severe rainfall directly caused the flood. This is a low land, often got the sudden water flow, caused the flooding and also this area has very little drainage facilities.

Further, this area does not contain the proper drainage facilities, with very rare maintenance of drainage because of developing region, so it is mostly the reason for flooding. In addition, wet lands area nowadays changing, as settlement land (**Figure 4**). Lots of mangrove plants were destroyed by the flood events in the past years.

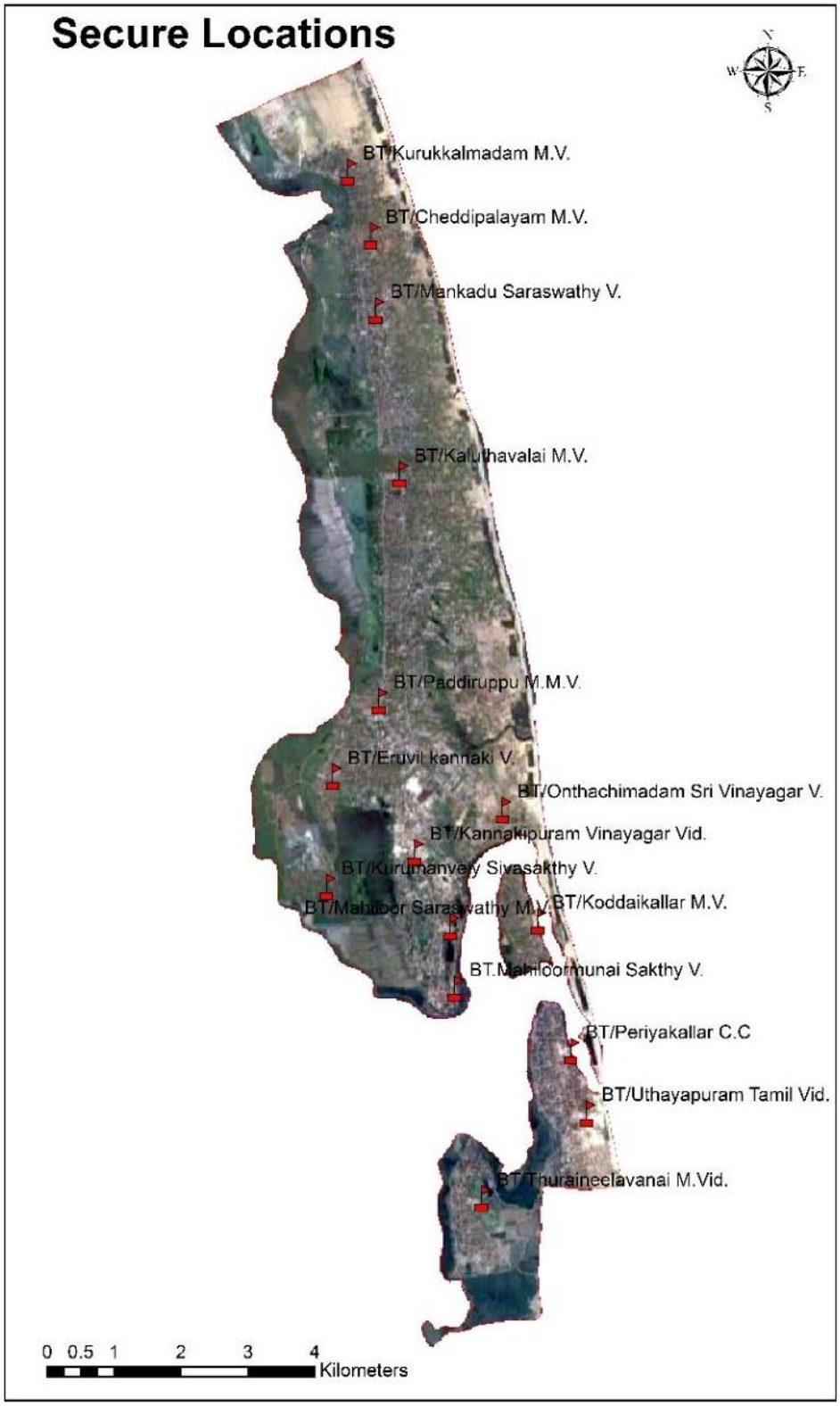


Figure 4. Safe zones

7. CONCLUSION

The study area is often affected by the flood disaster. According to the interview, every year those people are facing the flood event in the study. By concentrating this things, the flood severity zone and safe zone were prepared to keep the people from the effects (Figure 4). According to the GIS analysis, highly affected area is around 8,953.003 sq·km, moderately affected area is around 9,190.781 sq·km and lowly affected area is approximately 9,310.39 sq·km in the study area. Using this prepared map, the people can be kept from this severity zone during the flood season or can be aided to settle them to the highland area. In addition, the disaster management center of this area has to take a necessary action to mitigate the flood effects and the prepared map is given them to identify the event zone of this area.

8. RECOMMENDATIONS

8. 1. Controlling Methods

8. 1. 1. Diversion canals

Floods can be controlled by redirecting excess water to purpose-built canals or floodways, which in turn divert the water to temporary holding ponds or other bodies of water where there is a lower risk or impact to flooding.

8. 1. 2. Self-closing flood barrier

The self-closing flood barrier (SCFB) is a flood defense system designed to protect people and their property from inland waterway floods caused by heavy rainfall. The SCFB can be built to protect residential properties and the whole communities, as well as industrial or other strategic areas. The barrier system is constantly ready to deploy in a flood situation, it can be installed in any length to use the rising flood water to deploy.

8. 2. Flood Management Process

8. 2. 1. Before the Floods

- To know about your local relief centers and evacuation routes.
- To keep emergency numbers and important information handy as well as emergency supplies, kits, first aid items. These may include water, canned food, can opener, battery-operated radio, flashlight and protective clothing.
- To fold and roll up anything onto higher ground (or upper floors of your home) including chemicals and medicines.
- To make sure everything that is of importance to be secured (jewelry, documents, pets and other valuables).
- Plant trees and shrubs and keep a lot of vegetation in your compound if you are in a low-lying area as that can control erosion and help soften the speed of the flowing water.

8. 2. 2. During Flood

- Listen to a battery-operated radio for the latest information.

- Turn off all utilities at the main power switch and close the main gas valve if advised to do so.
- If you have come in contact with floodwaters, wash your hands with soap and disinfected water.
- If flooding occurs, go to a higher ground and avoid areas subject to flooding.
- Do not attempt to walk across flowing streams or drive through flooded roadways.
- If water rises in your home before you evacuate, go to the top floor or roof.
- Move valuables, important papers, and clothing to upper floors.
- If you have only one floor, put items on shelves, tables or countertops.
- Sanitize your bathtub and sinks and fill them with fresh, clean water in case the water supply becomes contaminated.
- If you feel threatened by rising water, leave your home or move to upper floors.
- Stay away from the downed power lines.

8. 2. 3. After Flood

- If it's dark, use a flashlight – not matches, a candle, or a lighter.
- Listen for reports to see when drinking water is safe again.
- Begin the initial cleanup as soon as waters recede. Separate damaged from undamaged items and clean and disinfect everything that got wet.
- Check for structural damage before re-entering your home to avoid being trapped in a building collapse.
- Take photos of any floodwater in your home and save any damaged personal property.
- Keep power off until an electrician has inspected your system for safety.
- Boil water for drinking and food preparation until authorities tell you that your water supply is safe.
- When cleaning, wear a mask, gloves and coveralls to minimize exposure to possible hazardous materials.
- Wet items should be cleaned with a pine-oil cleanser and bleach, completely dried, and monitored for several days for any fungal growth and odors.

References

[1] M.I.M. Kaleel, The Impact on Wetlands: A Study Based on Selected Areas in Ampara District of Sri Lanka, *World News of Natural Sciences* 7 (2017) 16-25

[2] K. Nijamir, Socio-economic impact of wetlands: a study based on Navithanveli DS Division, *World News of Natural Sciences* 14 (2017) 116-123

[3] Erich J. Plate, Flood risk and flood management, *Journal of Hydrology* 267 (2002) (1-2): 2-1

[4] Abdelhafid El Alaoui EL Fels, A. Bachnou, Noureddine Alaa, and Said Rachidi, Flood frequency analysis and generation of flood hazard indicator maps in a semi-arid environment, case of Ourika watershed (western High Atlas, Morocco), *Journal of African Earth Sciences,* 141 (2018) 94-106

[5] S. Mathanraj and M.I.M. Kaleel. The Influence of Rainfall Variability on Paddy Production: A Case Study in Batticalloa District. *World Scientific News* 52 (2016) 265-275

[6] M.B. Muneera and M.I.M. Kaleel, Emerging challenges of urbanization: a case study of Kalmunai municipal area in Ampara district. *World Scientific News* 59 (2016) 35-51

[7] M.I.M. Kaleel, Pipe-borne water consumption and its wastage: A study based on Panandura Urban Area in Sri Lanka. *World Scientific News* 66 (2017) 250-262

[8] M.I.M. Kaleel and M.J. Rizwin Reeza, The Impact of Landslide on Environment and Socio-Economy: GIS Based Study on Badulla District in Sri Lanka. *World Scientific News* 88(2) (2017) 69-84

[9] J.J. Wijetunge, Field Measurements and Numerical Simulations of the 2004 Tsunami Impact on the East Coast of Sri Lanka. *Pure and Applied Geophysics* April 2009, Volume 166, Issue 4, pp 593–622