

GIS Based
Landslide Forecasting Model:
A Case Study in Kaluthara District

By

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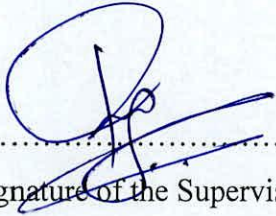
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TABLE OF CONTENTS

	Page
List of Tables.....	iv
List of Figures	v to vi
List of Abbreviations	vii
Acknowledgement.....	viii
Abstract	ix to x
1 INTRODUCTION	1
1.1 General background.....	1
1.1.1 Geology.....	10
1.1.2 Topography	11
1.1.3 Climate	12
1.1.4 Natural disasters and their effect.....	14
1.1.5 Landslide as a natural disaster.....	16
1.1.6 Introduction to GIS	23
1.1.7 GIS in landslide forecasting	24
1.2 Research Problem.....	28
1.3 Research Objectives	29
1.4 Methodology.....	30
1.5 Study area	31
1.6 Data used	32
1.7 Scope	33
1.8 Structure of the research report	34

2	LITERATURE REVIEW	35
2.1	Introduction	35
2.2	Landslide studies in Sri Lanka.....	35
2.3	General background and definition of landslides	39
2.4	Landslide activity	40
2.5	Classification of landslides.....	43
2.6	Landslide forecasting methods.....	44
2.7	Literature review summary	61
3	RESEARCH METHODOLOGY	62
3.1	Introduction	62
3.2	Data Collection Methods and Preparation	62
3.3	GIS features	63
3.3.1	The Geodatabase	63
3.3.2	Feature Data set	64
3.4	Data analysis method	65
3.4.1	Landslide data.....	65
3.4.2	Rainfall data	65
3.5	Forecasting landslide and other mass movements	66
3.5.1	Flow diagram of preparing risk map	66
3.5.2	Flow diagram of landslide forecasting	67
3.5.3	Calculation rainfall threshold	68

3.5.3.1	Antecedent and incident day rainfall combined analysis with date of landslide	68
3.6	Landslide forecasting	69
4	Analysis and Results	70
4.1	Analysis and Results of landslide	70
4.2	Analysis to identify rain gauge stations affect the study area	71
4.3	Analysis to identify landslide locations	80
4.4	Preparing MS Access database and analyse past landslide records	82
4.5	Analysis to identify rainfall factor for slope failure incidents	86
4.5.1	Introduction	86
4.5.2	Antecedent (cumulative) rainfall with landslide incidents	86
4.5.3	Rainfall intensity	88
4.5.4	Antecedent rainfall with incident day rainfall combination	88
5	CONCLUSIONS AND RECOMMENDATION	98
6	REFERENCES	102

LIST OF TABLES

	Page
2.1: Relative weightings for major factors, sub factors and factor classes based on the NBRO model (NBRO user manual, 1995).....	37
2.2: An abbreviated and modified version of the landslide classification scheme developed by Varnes (1978)	43
3.1: Collected Data Layers, Scales, Formats and the Sources.....	63
4.1: shows rain gauge stations details of Kaluthara district.....	71
4.2: shows rain gauge station locations and names of Kaluthara district.....	73

LIST OF FIGURES

	Page
1.1: Schematic indication of hazard, vulnerability, and risk	1
1.2 Landslide disasters in Southern California (A) (Schuster, 1995) and El Salvador (B) (2001).	4
1.3 Landslide mitigation activities in Japan	6
1.4:Map of Sri Lanka showing its location	9
1.5:Maps of Sri Lanka showing major geological divisions (Mathavan,1999) and climatic zones.....	11
1.6:Landslide prone districts of Sri Lanka	16
1.7:Human intervention into vulnerable hill slopes and landslide disaster in Sri Lanka (Landslide inventory-LSSD, NBRO).....	20
1.8:A few recent Sri Lankan landslides showing their damages and vulnerable Communities (Landslide inventory-LSSD, NBRO).....	21
1.9:Distribution of landslides in Sri Lanka showing major events: red dots indicate landslides occurred in May 2003 (Landslide inventory-LRRMD, NBRO).	22
1.10:Study Area Map.....	31
2.1:Block diagram of idealized complex earth slide-earth flow (Varnes,1978).....	39
3.1:Schematic representation of the proposed method of rainfall threshold calculation	68
4.1: The slope failure incidents summary where all slope failure incidence with their locations, incident date, type of failure, DSD, GND, etc.,.....	70
4.2: Rain gauge stations locations map of Kaluthara district	71
4.3: Study area map of Kaluthara district.....	77
4.4:Rain gauge stations locations of study area.....	79

4.5: Landslide locations of study area	81
4.6: Access database of slope failure incidents summary	82
4.7: Study area slope failure data.	83
4.8: Study area slope failure type with date of incident.	84
4.9: Rain fall data of sirikandura estate.....	85
4.10:Scatterplot diagram of 3 day cumulative rainfall vs date of incident.	86
4.11: Scatterplot diagram of 7 day cumulative rainfall vs date of incident	87
4.12: Scatterplot diagram of rainfall intensity vs date of incident.	88
4.13:Scatterplot of Palinda Nuwara , 2010 ,May antecedent rainfall vs Day rainfall with date of failure.....	89
4.14:Scatterplot of Walallawita ,2010 ,May antecedent rainfall vs Day rainfall with date of failure.	90
4.15:Scatterplot of Agalawatta ,2010 ,May antecedent rainfall vs Day rainfall with date of failure.	91
4.16:Scatterplot of Agalawatta antecedent rainfall vs Day rainfall with date of failure.	92
4.17:Rain gauge station covering area	93
4.18: Landslide Hazard Zonation map of usk vally sp area.....	94
4.19: Rrisk map of usk vally sp area	95
4.20: Risk map for a part of study area	96
4.21: Risk map of study area	97

LIST OF ABBREVIATIONS

NBRO	- National Building Research Organization
DSD	- Divisional Secretariat Division
GND	- Grama Niladari Division
GIS	- Geographic Information System
LRRMD	- Landslide Research & Risk Management Division
SQL	- Structured Query Language

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GIS Based Landslide Forecasting Model:

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ABSTRACT

Among the natural hazards, landslides draw and more attention due to its increasing impact on economic and human losses. Hazard zonation mapping plays a vital role in identifying the vulnerable zones for future land-use planning activities, designing of early warning systems and applying adequate mitigation measures in landslide-prone areas, very often lack of real time early warnings significantly increases the damages Worldwide.

Landslides associated with intense rain during monsoon and inter-monsoon seasons are the most pressing natural disaster in the Central Highland of Sri Lanka. About 20% area of the country within ten administrative districts are considered to be prone to landslides and almost 42% of the total population of the country is living in these districts. According to the available records, major landslides occurred during past three decades have caused a loss of more than 775 human lives making over 90,000 people homeless. Most significantly, Galle, Matara, Hambantota and, Kaluthara districts. The catastrophic event occurred on 17th May 2003 killing more than 150 people in a single day. 855 houses were completely destroyed and another 2858 were damaged rendering almost 20,000 people homeless. Every year huge economic and human losses are recorded and damages causes throughout the island. This is because people live everywhere at their own risk and use even the marginal lands for housing, farming, infrastructure and development activities without an adequate attention to the problem as a result of higher demand of lands with rising population. Thus, as a measure to save lives and property it is incumbent upon to develop real time prediction models for such regions to manage future events successfully. Under the present study, a contribution is made to evaluate the capabilities of available static and dynamic modelling approaches to cope with the real time forecasting of rain induced landslides within Kaluthara district of Sri Lanka.

Theoretically, slope instability hazard zonation is defined as the mapping of areas with an equal probability of occurrence of landslides in a given area within a specific period of time. However, calculation of landslide probability is extremely difficult, since there is no simple relationship between magnitudes of landslide events, return periods and as well as due to lack of reliable historical records of landslide dates and triggering events. Thus, susceptibility assessment to identify the critical locations and establishment of triggering thresholds to predict the timing of the events can be considered as a realistic approach in landslide hazard zonation.

The research presents uses three district secretariat divisions of Kaluthara district to identify the rainfall threshold value for trigger landslides. Rainfall is commonly known as one of the principal landslide triggers. Thus the concept of hydrological triggering thresholds can be utilized for the prediction of timing of rain induced landslides. Hydrological triggering thresholds can be established in a statistical or in a deterministic way. In present study obtained a rainfall thresholds value and also prepare a risk map according to past landslide records and GND population.

This research developed model can be use for the purpose of performance and accuracy improvements of landslide forecasting.

CHAPTER 1

1 Introduction

1.1 General background

World's natural hazards are many folds such as earthquakes, volcanic eruptions, tsunamis, hurricanes or tropical cyclones, droughts, hot and cold weathers, lightening and thundering, wildfires, floods, and landslides. They can be considered as a sort of consequences of exogenic and endogenic processes of the earth and extra-terrestrial processes of the solar system. These events are in fact natural agents that maintain the stability of the dynamic Earth and transform vulnerable human conditions into disasters. In very general term, disasters can be expressed as,

$$\text{Disaster} = \text{Hazard} * \text{Vulnerability}$$

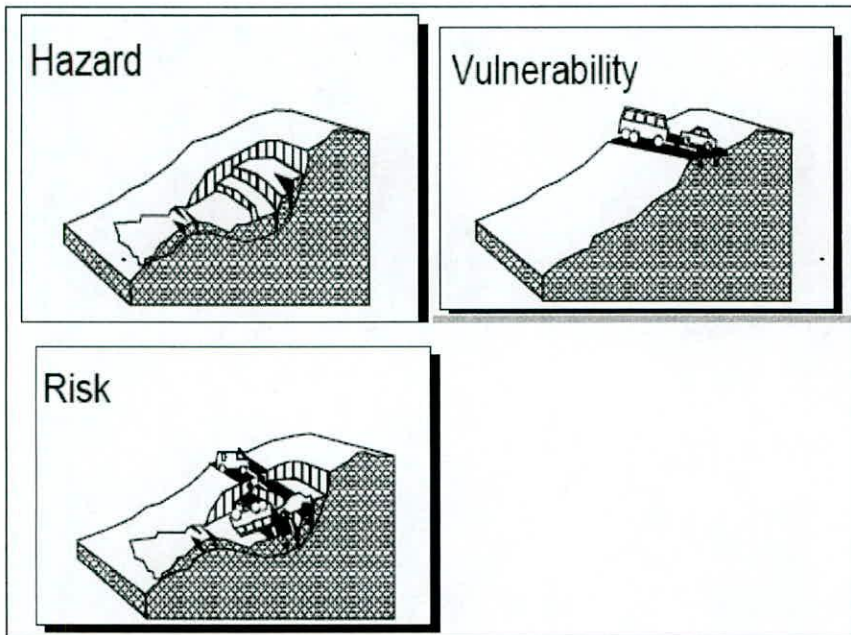


Figure 1.1: Schematic indication of hazard, vulnerability, and risk

The natural hazard means the probability of occurrence within a specified period of time and within a given area of a potentially damaging phenomenon. Vulnerability means the degree of loss to a given element or set of elements at risk, resulting from the