FLOOD RISK ASSESSMENT IN KALU RIVER BASIN IN SRI LANKA USING GEOSPATIAL TECHNIQUES AND HYDROLOGICAL MODELLING

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DECLARATION OF THE CANDIDATE AND SUPERVISOR

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ABSTRACT

Flood Risk Assessment in Kalu River Basin in Sri Lanka using Geospatial Techniques and Hydrological Modelling

Kalu Ganga basin is one of the main waterway basins in Sri Lanka which gets exceptionally high rainfalls with higher discharges. This report is about how the different zones, having a higher likelihood of a flood in the Kalu Ganga basin can be identified through remote sensing and geospatial approach. RRI model was additionally used to get the flood extents to verify the flood susceptibility map. Six flood influencing parameters (elevation, slope, land use, flow accumulation, soil, and rainfall) were taken for obtaining a flood susceptibility map with the AHP method in ArcMap. In the RRI model, the built-in data (Flow Direction, Flow Accumulation, DEM, Soil, and Land Cover) with observed rainfall data was used for generating a flood inundation map. The flood susceptibility map has a flood susceptibility area under the Very High category of 267 km² (8.4%) in the Kalu Ganga basin which is the most probable flood occurrence area. The flood inundation maps of May 2003, April 2008, and May 2008 have an area of 217.9 km² (6.3%), 193.6 km² (5.6%), and 108.5 km² (3.1%), respectively with flood depths greater than or equivalent to 1 meter in Kalu Ganga basin where the flood depths greater than or equivalent to 1 meter cover all the flood depths. In the AHP method, the rainfall parameter greatly influenced the flood susceptibility map. The built-in data with *nr* river value and *ns* slope values greatly influence the flood inundation map in the RRI model. The flood susceptibility map from the AHP method in ArcMap has a higher flood potential area than the flood inundation map obtained from the RRI model, and this is because the simulated or observed flood maps are always a subset of the flood susceptibility map. The flood susceptibility map obtained from the AHP method in ArcMap is a flood probability map and the flood inundation map from the RRI model is a simulated flood map. Therefore, they are different. However, the flood inundation area occurs within the flood susceptibility map. The Analytical Hierarchy Process (AHP) method is an alternative quick method of identifying flood potential areas and it can be applied to any other place around the world for the prevention and management of flood hazards.

Keywords: Analytical Hierarchy Process (AHP), Flood Mapping, Flood Risk Analysis, Rainfall-Runoff-Inundation (RRI) Model

DEDICATION

This thesis is dedicated to my father R.B. Gurung and my mother Sumitra Gurung who have been the source of inspiration and gave me moral support to proceed with my higher studies.

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LIST OF ABBREVIATIONS

AHP	Analytical Hierarchy Process
CSV	Comma-Separated Values
DEM	Digital Elevation Model
DMC	Disaster Management Centre
DOI	Department of Irrigation
GIS	Geographic Information System
HDX	Humanitarian Data Exchange
IDW	Inverse Distance Weighting
JICA	Japan International Cooperation Agency
LULC	Land Use Land Cover
MODIS	Moderate Resolution Imaging Spectroradiometer
NBRO	National Building Research Organization
NSC	Nash-Sutcliffe efficiency
OCHA	United Nations Office for the Coordination of Humanitarian Affairs
PDNA	Post Disaster Needs Assessment
R^2	Coefficient of Determination
RF	Rainfall
RRI	Rainfall-Runoff Inundation
SF	Streamflow
SRTM	Shuttle Rader Topographic Mission