Chapter 13

Integrating Geoinformatics and Remote Sensing Data to Assess Impacts of Flooding on Land Productivity in the Zambezi River Floodplains, Namibia

Kelebogile B. Mfundisi
University of Botswana, Botswana

Alex M. Mudabeti
Namibia Statistics Agency, Namibia

Anastacia Makati
University of Botswana, Botswana

ABSTRACT

Exposure to flood waters poses a risk to land productivity and livelihoods of communities in the Zambezi River Basin who are engaged in arable agricultural activities along its floodplains. This is exacerbated by occurrence of frequent flooding events in the area since 2008 due to climate variability. The objective of this research is to assess the extent of exposure to flooding on floodplain land used for maize production along the Zambezi River in Namibia. Existing survey information on geospatial locations of farms is used as baseline data. Field survey maps are then overlaid into flood maps developed using 2013 Landsat satellite data taken during peak flood event, and DEM. Weighted sum overlay results show that 14.5% of croplands were inundated with floods by March 2013. Integration of inundation results into a DEM show areas at low, medium and high risk to flooding. This provides useful geospatial information for flood mitigation.

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INTRODUCTION

Exposure to flood waters poses a risk to land productivity and livelihoods of communities in the Zambezi River Basin who are engaged in arable agricultural activities along its floodplains. This is exacerbated by occurrence of frequent flooding events in the area since 2008 due to climate variability, which is receiving attention from geospatial scientists and policy makers alike in Namibia. It is in accordance with Turner (2010) who asserts that the global environmental and landuse and landcover patterns are changing at an unprecedented rate. Moreover, land is now utilized more intensively than in the past (Scharlemann et al. 2014). And there is increased pressure on the ecosystems capability to provide essential services to human beings such as food, energy, water, biodiversity and climate regulation (Mooney et al. 2009). Furthermore, the intertwined catastrophes on food security, land degradation, and changes in environmental flows hinder sustainable development and poverty reduction. Increased climate variabilities aggravate the situation (Duda 2003) due to increase in atmospheric and sea surface temperatures (Musa et al. 2014) with the years 1990, 1995, 1997 and1998 as the warmest since 1400 (Jones et al. 1999). As a result, weather- and climate-related disasters (IPCC 2012) are increasingly causing damages (Howe & White 2004, Huggel et al. 2015). For example, dramatic river flooding has affected various regions all over the world (van der Sande et al. 2003). Mitigating the impacts of such intricate and unpredicted flooding events requires improving the relationship between environmental planning and flood risk management (Howe & White 2004; Prenger-Berninghoff et al. 2014).

Flooding as a physical process affects the floodplains dwellers, their infrastructure and environs, the Government and non-governmental organizations in an area exposed to flooding and its effects (Hall et al. 2003). There is a global shift towards integrated flood risk management concept as opposed to the use of engineering structures for flood control (Büchele et al. 2006). The interconnection between the costs, efficacy, and analysis of the risk management procedures within changing socioeconomic and environmental settings is fully recognized by integrated flood risk management (Hall et al. 2003). It considers the interplay of human, environmental and climatic factors that can lead to flooding impacts and disasters (IPCC 2012). The quickest way to evaluate the impacts of flooding subsequent to an unforeseen extreme flood event is to be able to assess the flood extent, landcover types and landuse covered by floodwaters (Wang et al. 2002). The end results can be shown as flood hazard and risk maps (de Moel et al. 2009), visualizing valuable flooding information that can be used for science, insurances, planning, emergency management and public awareness for improved disaster risk management (Köhler et al 2006). However, the geographical context of the flooded area and availability of accurate geospatial data determine the outcomes of flood risk assessment (Apel et al. 2009; de Moel et al 2009). For instance, very detailed geospatial data on the flooded area is necessary for cost-benefit analysis of flooding impacts and preparation of mitigation strategies (Apel et al. 2009). And estimations of business interruptions, fatalities, financial/economic losses incurred from the floodwater are addressed through flood vulnerability investigations, which are normally limited to valuation of damages (Apel et al. 2008, Apel et al. 2009).

Namibia is in the process of developing flood maps and models to be used for integrated flood risk management of the Cuvelai, Kavango and Zambezi River Basins. Our study forms part of this broad initiative with the goal to develop flood maps and assess the effects of flooding on land productivity in the Zambezi River floodplains. Our objective is to assess the extent of exposure and risk to flooding on floodplain land used for maize production along the Zambezi River in Namibia.

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