**NASA DEVELOP National Program**

****NASA Marshall Space Flight Center

**Summer 2015**

**Short Title: East Africa Disasters**

**Subtitle:** Using NASA Satellite Data to Predict Landslide Hazard in Uganda and Rwanda

**VPS Title:** On a Slippery Slope: Assessing Landslide Hazard in East Africa

**Project Team & Partners**

**Project Team:**

Leigh Sinclair (Project Lead), slb0012@uah.edu

Padraic Conner (Co-Project Lead), padraic.conner@gmail.com

Tyler Finley

Jeanné le Roux

**Advisors & Mentors:**

Dr. Jeffrey Luvall (NASA at National Space Science and Technology Center)

Dr. Robert Griffin (University of Alabama in Huntsville)

**Partner Organizations**

NASA SERVIR Coordination Office at MSFC, Boundary Organization/End-User, POC: Eric Anderson

SERVIR Applied Sciences Team at NASA GSFC, End-User, POC: Dr. Dalia Kirschbaum

Regional Centre for Mapping of Resources for Development (RCMRD), End-User, POC: Denis Macharia

**Project Details**

**Applied Sciences National Applications Addressed:**

Disasters

**Study Area:** Rwanda and Uganda

**Study Period:** Jan 2010 - Present

**Earth Observations & Parameters**

Landsat 8, Operational Land Imager (OLI) - Visible and Near Infrared Reflectance

TRMM, Multi-satellite Precipitation Analysis (TMPA) - Precipitation

GPM, Dual-frequency Precipitation Radar (DPR) - Precipitation

SRTM-V2, C-Band - Digital Elevation Models

Google Earth, various - Visible and Infrared Reflectance

**Ancillary Datasets Utilized**

* NASA/SERVIR Global Landslide Catalog - Dates and locations of landslides
* NASA’s Socioeconomic Data and Applications Center (SEDAC) Population Data - Population density and locations
* USGS Climate Hazards Group InfraRed Precipitation and with Station Data (CHIRPS) - Rainfall measurements

**Software Utilized**

ArcGIS - Raster Processing/Manipulation Vector Data Processing, Map Creation of Landsat 8 OLI, TRMM TMP, GPM DPR, and SRTM-V2

ENVI - Raster Processing/Manipulation of Landsat and Other Imagery

**Project Overview**

**80-100 Word Objectives Overview**

The East African countries of Uganda and Rwanda have a history of landslide disasters due to a combination of intense rainfall events and populations living on or near steep slopes. This project aimed to assess and map landslide-prone regions of Uganda and Rwanda by utilizing a host of geospatial datasets along with historical landslide accounts recorded in the Global Landslide Catalog (GLC). A more refined understanding of regional landslide triggers will aid local mitigation efforts and help educate those living in susceptible areas about signs of imminent landslides.

**Abstract**

The International Emergency Disasters Database indicates that a total of 482 people have been killed and another 27,530 have been affected by landslides in Rwanda and Uganda, although the actual numbers are thought to be much higher. Data for individual countries are poorly tracked, but hotspots for devastating landslides occur throughout Rwanda and Uganda due to the local topography and soil type, intense rainfall events, and deforestation. In spite of this, there has been little research in this region that utilizes satellite imagery to estimate areas susceptible to landslides. This project utilized Landsat 8 Operational Land Imager (OLI) data and Google Earth to identify landslides that occurred within the study area. These landslides were then added to SERVIR’s Global Landslide Catalog (GLC). Next, Landsat 8 OLI, the Tropical Rainfall Measuring Mission (TRMM), the Global Precipitation Measurement (GPM), and Shuttle Radar Topography Mission Version 2 (SRTM V2) data were used to create a Landslide Susceptibility Map. This was combined with population data from the Socioeconomic Data and Applications Center (SEDAC) to create a Landslide Hazard map. A preliminary assessment of the relative performance of GPM and TRMM in identifying landslide conditions was also performed. The additions to the GLC, the Landslide Susceptibility Map, the Landslide Hazard Map, and the preliminary assessment of satellite rainfall performance will be used by SERVIR and the Regional Centre for Mapping of Resources for Development (RCMRD) for disaster risk management, land use planning, and determining landslide conditions and moisture thresholds.

**Community Concerns**

* Landslides threaten life and infrastructure in Uganda and Rwanda due to populations living on or near steep slopes.
* A lack of spatial and temporal information makes landslide risk management difficult for Ugandan and Rwandan officials.
* A means of predicting landslide susceptibility is needed in Uganda and Rwanda since many people living in areas susceptible to landslides are unwilling to relocate for cultural and economic reasons.

**Current Management Practices & Policies**

Currently, both national governments have disaster preparedness policies and programs, but these efforts are limited in scope and are more focused on disaster response than prevention or early warning. These countries lack the spatial and temporal information required to accurately and effectively identify hazardous areas and properly warn at-risk populations. SERVIR’s Global Landslide Catalog (GLC) will aid disaster management teams and foreign governments, such as those of Rwanda and Uganda, in identifying at-risk areas. However, the catalog currently only collects data through online media reports, meaning that it only has information on major landslides affecting large numbers of people. In order to give a more accurate representation of the most at-risk areas, the catalog must incorporate data from other avenues and must be supplemented by additional materials.

**Decision Support Tools & Benefits**

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| **End-Product** | **Earth Observations Used** | **Benefit & Impact** |
| Improvements/Updates to Global Landslide Catalog (GLC) | Landsat 8 OLI  | Additions to the GLC will provide a more comprehensive list of landslide occurrences, enabling SERVIR to more effectively support landslide monitoring efforts  |
| Preliminary Assessment of Satellite Rainfall Performance in Identifying Landslide Conditions  | TRMM TMPA, GPM DPR  | This assessment will highlight how satellite PR products characterize conditions needed for a landslide to occur, including moisture thresholds |
| Landslide Hazard Potential Map | Landsat 8 OLI, TRMM TMPA, GPM DPR, SRTM-V2 C-Band | This map will give government agencies and support groups information on where landslides may strike within the study areas  |

**Project Imagery**



**Caption:** Hazard Potential Map variables. Image Credit: East Africa Disasters Team.

**Image:** 2015Sum\_MSFC\_EastAfricaDisasters\_HighlightImage.jpg