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Landslide Monitoring and Mapping in Rwanda and Uganda

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The Expanding Horizons through Research Program,
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Project Title: Landslide monitoring and mapping in Rwanda and Uganda

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Project Summary: In the United States alone, landslides cause more than $1 billion in damages and upwards of 50 deaths per year[1]. Globally, figures are much more grave, yet monitoring, mapping, and forecasting, of these hazards are less than adequate.

Landslides, and more broadly disasters, are a priority application area for SERVIR—the Regional Visualization and Monitoring System—an initiative led by NASA and the US Agency for International Development (USAID). SERVIR seeks to use Earth observations to improve decision making in environmental and disaster management in developing regions around the world[2]. The Regional Centre for Mapping of Resources for Development (RCMRD) leads SERVIR activities in the Eastern & Southern Africa region. In this role, RCMRD has conducted user needs assessments with the Ministry of Disaster Management and Refugee Affairs (MIDIMAR) of Rwanda, which identified as major challenges 1) access to geospatial information on recent and historic hazards, and 2) coordinated data sharing among agencies within the National Platform for Disaster Risk Reduction (NPDRR)[3].

The project at hand is intended to contribute directly to these challenges by compiling landslide hazard data for the region. Using NASA and other satellite assets, the student will build on and improve initial landslide inventories begun for Rwanda and Uganda. At the end of the project, the student will have contributed to a more robust depiction of landslide hazards in the countries and a preliminary predictive susceptibility model that may serve to mitigate future impacts of landslides.

The International Space Station - SERVIR Environmental Research and Visualization System (ISERV), is a camera-telescope system onboard the ISS with pointing and tasking capabilities. Since February 2013, tens of thousands of images have been acquired, and many are focused on known landslide-prone areas. This opportunity offers the student the chance to explore such images as well as data from other NASA assets such as Landsat, ASTER, and EO-1, and high resolution commercial imagery. Moreover, the newly released SRTM-2 digital elevation model for the African continent should offer new analysis opportunities[4].

It is hoped that the final products be incorporated into NASA's global landslide inventory[5] as well as national and regional disaster catalogues such as the NPDRR in Rwanda. SERVIR's success to date has

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[1] USGS, 2014. "Landslides 101." http://landslides.usgs.gov/learn/ls101.php

[2] SERVIR, 2014. "About SERVIR." https://www.servirglobal.net/Global/About.aspx

[3] SERVIR, 2014. "Rwanda National Disaster Early Warning Information Systems." http://servircatalogue.net/Product?product_id=70

[4] NASA Jet Propulsion Laboratory, 2014. "Shuttle Radar Topography Mission." http://www2.jpl.nasa.gov/srtm/

[5] Kirschbaum, D., et al., 2009. "A global landslide catalog for hazard applications: methods, results, and limitations." *Natural Hazards*. http://trmm.gsfc.nasa.gov/publications_dir/Kirschbaum_et_al._2009_Global_landslide_catalog_for_hazard_applications.pdf

relied heavily on a diverse network of partners and team members who bring creative solutions to large environmental challenges. Women and minority students are strongly encouraged to apply.

Student Duties: The student will have a unique opportunity to directly contribute to SERVIR activities related to disaster management in Rwanda. Specifically, he/she will focus on three activities:

1. Building on an existing landslide inventory for Rwanda and Uganda by searching media reports and performing heads up digitization of satellite images (weeks 1-3)
2. Preparing geospatial datasets of potential explanatory variables such as elevation, slope, geology, land cover, roads, hydrologic indices, and rainfall (weeks 4-6);
3. Logistic regression analysis to determine the explanatory variables needed to best map landslide hazards (weeks 7-11).

The first will involve verifying possible landslides identified in previous work and attempting to assign more specific dates to such landslides. The second will require intermediate to advanced GIS data analysis capabilities, some skills of which are expected to be acquired during the summer research experience. The third activity will require an understanding of spatial statistics likely to be novel to the student, but he/she will receive close mentoring on the subject and computational tools required. The student will maintain a 32-40 hour work week for the 12 week summer term. The final week will be reserved for completing the final report and presentation.

Benefits to the student include working on a NASA Applied Science- and USAID Bureau for Economic Growth, Education and Environment-funded activity, addressing real life environmental challenges using new geospatial datasets, and gaining new analytical skills that should be applicable to future research or professional scenarios. Progress and results will be delivered in the form of a mid-term progress report and informal presentation to the immediate research team, followed by a formal final report and presentation to the SERVIR Coordination Office at NASA Marshall Space Flight Center / UAH Earth System Science Center.

Mentor Supervision and Interaction: The student will meet regularly to report on progress and discuss any obstacles on a weekly basis with Mr. Anderson. He/she will be part of a SERVIR research team composed of SERVIR scientists, graduate research assistants and other NASA summer interns. As such, he/she will also participate in weekly to bi-weekly meetings with other SERVIR researchers at the Coordination Office in Huntsville. The student will be able to take advantage of Mr. Anderson's open door policy to address any issues or concerns and can also benefit from the experience of SERVIR graduate research assistants. Although the broad research question and general methods will be posed by Mr. Anderson at the beginning of the summer, the student will be expected to conduct creative work to address the challenge, starting by researching background literature, developing his/her own methods and creating a project timeline. These will be presented in a mid-term progress report and informal presentation to peers and the mentor for constructive feedback. At the end of the program, the student will deliver a formal report and presentation of findings and recommendations for future analysis and research. Further, Mr. Anderson will expect the student to submit his/her work in one or more public event such as GeoHuntsville, the Von Braun Memorial Symposium Student Poster Competition, etc. Should the student express sufficient interest and availability beyond the summer research experience, we expect him or her to contribute to a peer-reviewed publication or conference proceeding.