LANDSLIDE AND FLOOD HAZARDS AND VULNERABILITY IN NORT-WESTERN RWANDA: TOWARDS APPLICABLE LAND MANAGEMENT AND DISASTER RISK REDUCTION

(LAFHAZV PROJECT)

Follow-up Committee 2

Questions and Answers part

Hydrogeomorphological approaches to understanding flood hazards and flood-risks management in NW Rwanda

1. Question: During your presentation you said that you are going to use HEC-HMS and HEC-RAS, as Rwanda Water Resources Board (RWB) has now some consultancy services in which it is expected to use the same models, it will be better to work with us as far as we can have the new data.

Answer: Yes, even in the past I was working with RWB, as I was involved in the supervision of flood management in the volcanoes area. The Director General of RWB knows that I was involved in the supervision of drainage systems and construction of the retention ponds in the volcanoes area as hydrologist before going to PhD studies. So we will work together as far as we have the memorandum of understanding with you.

2. Question: There are some updated LULC maps (from Rwanda Space Agency) we have so that we can share with you, as now we are planning to make the flood risk zoning in Sebeya catchment.

Answer: Yes we will consult you in the coming days. In addition, my supervisors asked me to delineate the recent flooded areas so that they can be used during the validation process.

3. Question: During your presentation you showed us the sub-catchments chosen as the monitoring site, we didn't see some sub-catchments without the outlets, there is a consultancy project under its implementation by SHER-Consults Sal. It will be better to add at least another sub-catchment without outlet.

Answer: We know that there are some sub-catchments without outlet such as Mutobo and Kinoni, even SHER-Consults Sal invited me to work with them but I refused I cannot mix the consultancy service with the PhD studies. But you have to know that the PhD studies have the live span, it is in this regard that we cannot choose additional sub-catchments as far as we cannot have enough time to collect data for validation of the proposed sub-catchments, knowing that we are in the step of data processing (year four).

4. Question: I want to know if you have integrated the component of climate change in your analysis.

Answer: There are a lot of studies in the literature that tried to integrate a lot of parameters such as integrating and changing parameters with time by adopting the parameters using the step forwards and backward but they failed. The only way is to choose one parameter and see how it has changed with the time. For our study we have chosen the rainfall parameter where we are going to use a multi-stage Intensity-Duration-Frequency (IDF) curves development in order to see how the precipitation pattern has changed with the time (refer to the methodology of our presentation).

5. Question: While modeling flood hazards, you said that you used stochastic models, why you didn't use deterministic models.

Answer: Even though the deterministic models and stochastic models produce the same exact results for a particular set of inputs, stochastic models are the best one as they present data and predict outcomes that account for certain level of unpredictability or randomness. Stochastics models are all about calculating and predicting outcomes while deterministic models are based only to the calculations but not to predict the outcomes.

6. Question: what criteria did you base on in choosing the sub-catchments set as the monitoring site?

Answer: There are a lot of criteria we based on during choosing the sub-catchments set as the monitoring site. These are among others: sub-catchment subjected to flooding during the past, accessibility of the outlet, sub-catchment having cross-section which does not change a lot so that flow measurement is easy to be done and establishment of rating curve can be easily done. An example is the situation we faced on Bihongora sub-catchment where we found that the radar for water level measurement was installed at the cross-section which is difficult to measure the flow velocity.

Landslides distribution in the changing landscapes of NW Rwanda

1. The government of Rwanda has invested a lot in the implementation of agricultural terraces, which are known to have good results. So, what to do?

Answer: "The agricultural terraces have been implemented worldwide, including in Rwanda, as soil and water conservation measures." However, our study (an analysis of three landslide events that occurred in the NW provinces of Rwanda) shows that terraces increase the frequency of smaller landslides whose total impact in terms of cumulative areas is larger than the landslides in non-terraces. Nonetheless, at this stage, we cannot simply abandon them without investigating the mechanism that leads the terraces to increase the landslide frequency. In addition, some local people informed us that the terraces contribute to landslide occurrences. Hence, we continue to investigate more in this area.

Moreover, the way the terraces are constructed (flattening the slope) favor the infiltration rate that increase the positive pore water pressure predisposing the slope to failure. This has been documented.

2. But the studies (in Rwanda) show that terraces are good for soil stabilization!

Answer: So far, the existing literature investigating the potential effect of terraces on landslide occurrence has focused on Europe (Italy and Spain) and China, while in tropical environments, especially in Africa, there is no literature about that. The existing literature (in Rwanda) in relation to terraces is about runoff reduction and productivity.

Assessing the Vulnerability of the Population to Flood and Landslide Hazards in North-Western Rwanda

- Comment from Ephrem from MINEMA:

In the preliminary result talking about the quality of housing, it should be better to consider the building codes in the area and how they are respected. Because this is a big issue when it comes to settle in the high-risk zones.

- Questions from Aldo from National Land Authority:

Talking about the low education as the one of the indicators of vulnerability, are you talking in general or just it's linked with the landslides and flood hazards?

What do you mean by saying you shall present spatial distribution of the social vulnerability Index?

- *Answers*:

Low education was asked in general, however regarding landslide and flood hazards, it is interpreted as an indicator of vulnerability as it influences people's perception regarding implementing prevention, response and recovery measures, as well as the fact of settling in high-risk zones.
Spatial distribution of the social vulnerability Index means presentation of the social vulnerability Index on a map, to display the variability of the vulnerability within the study area. The social vulnerability Index serves as a tool to quantify the social vulnerability of the area and it indicates the place where the vulnerability is high, medium and low in order to inform police-makers the area to be prioritize when they are implementing interventions regarding vulnerability reduction.

Using mobile communication microwave links to detect rainfall

Feedback from Hussein Bizimana (RWB) that they are very keen to collaborate on this topic, since they are about start the new Volcanoes Community Resilience project to develop early warning systems for hazards in the Volcanoes region. Kwinten Van Weverberg will have a follow-up meeting with RWB online to see how he can tailor his project as much as possible to bring it in line with the needs of the Rwanda Water Resources Board and the Volcanoes Community Resilience project.

Question from Judith Uwihirwe about whether they plan application to landslide early warning systems within the proposed project. K. Van Weverberg explained that his primary focus will be on creating high-resolution rainfall maps over Rwanda and applications for early warning systems. These could include flash floods and landslides, and they are still open to input to make these questions more concrete. Judith and Kwinten exchanged contacts and will be in touch later.