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## IPL Project Proposal Form 2016

(MAXIMUM: 3 PAGES IN LENGTH)

1. Project Title: Landslides and Related Sediment Disaster Project Covering the Entire South-East Nigeria, West Africa
2. Main Project Fields

Select the suitable topics. If no suitable one, you may add new field.

(1) Technology Development

A. Monitoring and Early Warning, B. Hazard Mapping, Vulnerability and Risk Assessment

(2) Targeted Landslides: Mechanisms and Impacts

A. Catastrophic Landslides, B. Landslides Threatening Heritage Sites

(3) Capacity Building

A. Enhancing Human and Institutional Capacities

B. Collating and Disseminating Information/ Knowledge

(4) Mitigation, Preparedness and Recovery

A. Preparedness, B. Mitigation, C. Recovery

3. Name of Project leader: **IGWE** Ogbonnaya

Affiliation: Department of Geology, University of Nigeria, Nsukka

Contact: ogbonnaya.igwe@unn.edu.ng;igwejames@hotmail.com

Core members of the Project: **Fawu** Wang[1], **Fukuoka** Hiroshi[2], **Nnebedum** Okechukwu[3], **Ikenna** Okonkwo[3], **Oha** Ifeanyi[3], **Onwuka** Solomon[3].

Names/ 1. Shimane University, Japan 2. Niigata University, Japan 3. University of Nigeria, Nsukka

4. Objectives: To understand the distribution, severity and frequency of landslides and related geo-hazards in the whole of South-East Nigeria; and relate these variable parameters to their different mechanisms. Finally, we will produce a susceptibility map as a guide to developmental strategies in the region.
5. Background Justification: The aim of the present study is to understand the distribution, severity, frequency and the different mechanisms of landslides and related geo-hazards in the whole of the south-east Nigeria. Previous studies have focused on only the mechanisms of mass movements in areas with well-known cases of instability, without adequate attention to their distribution, severity and frequency in the entire region underlain by erosion-prone lithologies. This new study have shown that there are other places within the region where similar sediment disaster have destroyed lives, resources and displace thousands, and are about displacing more from their homes. Understanding the different mechanisms controlling the development of huge gullies in the area o interest, and relating them to their distribution, severity and frequency will aid the production of reliable susceptibility maps important in prevention and mitigation strategies.

6. Study Area: South-East Nigeria, West Africa
7. Project Duration: 3 years
8. Resources necessary for the Project and their mobilization

   Personnel, Facilities, and Budgets: A team of local and international experts, field mapping apparatuses, laboratory devices, GPS, GIS networks, USD 40, 000. Some of the funds will come from University Research Grants, contributions from National Governments, and from Private Companies. Collaboration with Shimane and Niigata Universities is very necessary for a successful work.

Project Description: It was found that the occurrence of landslides and related sediment disaster have a close relationship with bedrock geology, slope gradient, vegetation cover and macro and micro landforms. We will attempt to classify the failure modes into complex movements, translational slides and rotational slides, and indicate which are predominant. We will also carry out the analysis of the hydrological response of the regoliths and colluvial slopes during the rainstorm and attempt to relate the failures to the possible development of a perched water table in the thin surface layer of colluvium of sedimentary, igneous or metamorphic origin due to infiltration during the heavy rain. Disturbed and undisturbed samples will be subject to laboratory analysis to isolate their engineering characteristics. An integrated approach incorporating standard penetration test and DEM-based analysis was adopted in the research. Representative samples from different geological units were collected and a total of six SPT boreholes were drilled on the sedimentary basin. Extensive site investigations were conducted including field reconnaissance and detailed mapping, geophysical exploration, and laboratory experiments following ASTM standards. The main target was to evaluate geologic and hydrologic conditions related to the occurrence of different types of landslides. Primary attention was devoted to the study of landslide slopes, water table, thickness of landslide body, slip surfaces and seepage flow which was consistent with (Shoaei and Sidle 2009; Fan and Hsiao 2012). To achieve the aim, available spatial data (geologic, topographic maps and DEM) for the considered areas were assembled. Visual interpretation of stereoscopic aerial photography, field surveys and STRM based on high resolution digital elevation models aided the production of 3D topographic maps. Landslides, geology and hydrogeology in the zones underlain by granite, gneiss, schist and sedimentary rocks were mapped and the potential factors causing their occurrence documented.

9. Work Plan/Expected Results: The methodology employed for this research were carried out systematically in three phases, which includes: (i) Site investigations carried out in the field, (ii) Geotechnical analysis carried out in the laboratory, and (iii) Statistical data gathered from agencies, and also from previous literatures. Also, the results from some geotechnical parameters were applied to a numerical model the Geostudio 2012, to simulate the morphology and mechanism of the landslide on one hand, and to generate a factor of safety value on the other hand, which helped me produce a landslide susceptibility map. The Site investigation involved three stages: the preliminary studies, the reconnaissance and detailed mapping. Pervious works carried out on the area by several authors and researchers on a regional and local scale were consulted with the aim of getting vital information of the study area before going to the field. Topographic, geologic and geographical maps were carefully

studied in order to have a better understanding of the terrain. A base map on a scale of 1: 50,000 was prepared for the field work. Detailed field work will commence in February 2015, which will include the hydrogeology of the area, which included ground water levels, as observed in nearby wells, stream courses, gullies, and the discharge of ground water at the slope; determination of the landslide properties, which included the studies of the slope angles, depth of sliding surface, run-out distance(length of landslide), thickness of the sliding mass, as well as the date the landslide occurred as reported by local residents; the geographical location of all the sampling points was established, using a GPS; geologic descriptions were recorded in geologic field note books, and the descriptions included; the lithologic compositions, the bedding surfaces, faults and joint systems, dip amounts, as well as dip and strike directions with the help of a compass clinometers; disturbed and undisturbed samples of residual soils were collected for further analysis, using a hand auger; the vegetation type was also determined, and it included studies of the tree types, the density of coverage, as well as the cultivation practices; photographs of important geologic and geographical features were taken, as well as photographs of the landslide for reference purposes. To understand the mechanisms controlling the development of translational and rotational slides, and the mobility of the slides it is important to reproduce the pre- and post-failure behavior of the sliding masses. Representative residual soil properties were investigated by subjecting them to several geotechnical analyses including consistency, moisture content, specific gravity, triaxial and ring shear tests. The behaviors of the specimens from different sites were investigated under varying $B_D$ (saturation) levels. Details of sample preparation, consolidation and shearing procedure are in Sassa et al. (2004), Igwe et al. (2013) and Igwe and Fukuoka (2014).

10. Deliverables/Time Frame: This is the first time such project will be carried out in Nigeria. For this reason, we intend to understand the different mechanisms controlling the development of huge gullies in the area of interest, and relate them to their distribution, severity and frequency, which will aid the production of reliable susceptibility maps important in prevention and mitigation strategies.
11. Project Beneficiaries: This work is the first such project in Nigeria, so it will benefit the country and Africa. The universities in the region of study will also benefit as it will increase the capacity of staff and students to deal with landslides and related sediment disaster.