Date of Submission	10 September 2020

IPL Project Proposal Form 2020

(MAXIMUM: 3 PAGES IN LENGTH)

1. Project Title:

   Investigation of Ecohydrological Processes on Soil-root Mechanical Properties and Landslide Susceptibility in the Steep Terrain Regions, Eastern Tibetan Plateau

2. Main Project Fields:

   (1) Technology Development

   B. Hazard Mapping, Vulnerability and Risk Assessment

3. Name of Project leader:

Professor Peng Cui

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Core members of the Project:

Yao Jiang / Qiang Zou / Chonglei Zhang / Yiding Bao, Key Laboratory of Mountain Hazards and Earth Surface Process / Institute of Mountain Hazards and Environment, Chinese Academy of Sciences

4. Objectives:

   The main objectives of this research proposal aim at investigating the mechanical properties of soil-root system, understanding the landslide formation mechanism for vegetated slopes, and finally developing quantitative method for assessing regional landslide susceptibility by comprehensively considering the interactions among ecological, hydrological, and geotechnical processes in the steep terrain regions, Eastern Tibetan Plateau.

5. Background Justification:

   The environmental background with high potential energy and gradient in the steep terrain regions of the eastern Tibetan Plateau can provide favorable occurrence and evolution conditions for mountain hazards, which is also the most hazardous regions in the worldwide. Especially, in recent years, some fata landslide disasters have occurred in this well vegetated area. Although the study of the mechanical properties of soil-root and landslide susceptibility has been receiving increasing attention since last decades, the ability to predict future landslide occurrence for vegetated slopes remains challenging. Therefore, from the perspective of ecology-hydrology-geotechnical coupling effects on vegetated slope stability, it is necessary to carry out interdisciplinary research to further understand the relationships

between the ecohydrological process and evolution mechanism of mountain hazards, which are significant important to enhance our predicting landslide disasters and promoting mitigation abilities.

6. Study Area:

   Several typical basins/catchments in the steep terrain regions of the Eastern Tibetan Plateau will be selected, such as Dadu River Basins, Minjiang River Basin and Jiangjia Gully, etc.

7. Project Duration: Three years (2021.01-2025.12)

8. Resources necessary for the Project and their mobilization:

   More than ten researchers from the Institute of Mountain Hazards and Environment, Chinese Academy of Sciences will join this project. The research infrastructures, field instrumentations and required budget for this project can be fully supported by the Key Laboratory of Mountain Hazards and Earth Surface Process, Chinese Academy of Sciences. A contribution by ICL-IPL project budget might be required for dissemination purposes concerning the project results.

9. Project Description:

   The theory and technical systems of landslide prevention and mitigation will improve the risk prevention level, and serve the safety of the people's livelihood. In this project, by considering the coupling effects of ecology-hydrology processes on the formation mechanism and the spatial occurrence patterns of landslides in the vegetation environment with steep gradients, the present project will select the typical vegetation zones in the watershed regions of eastern Tibet plateau. Through the field surveys and monitoring, in-situ tests, laboratory simulation experiments, theoretical modelling, and numerical analyses, the distributions and development characteristics of landslides in different ecological and hydrological regions will be studied to better understand the spatial occurrence patterns of landslides. By choosing different ecological and hydrological areas, the interaction mechanisms between the soils and roots will be investigated; the physical and mechanical properties of root-soil composites are analyzed. Based on the failure criterion of root-soil composites and the evolution process of landslides in steep gradients, the failure thresholds by considering the coupled ecology-hydrology processes are provided. By improving the methods of mathematical analyses, the properties of root-soil composites and the environmental characteristics, the spatial patterns of landslides will be determined. Finally, a quantitative method for assessing regional landslide susceptibility by rigorously analyzing the interactions among ecological, hydrological, and geotechnical factors based on slope failure and landslide formation mechanisms will be developed. By comparing the actual disaster situations, the proposed method of landslide susceptibility analysis will be verified. The results from the project will be of significance to provide a scientific basis for risk assessment and sustainable development in mountainous areas.

10. Work Plan/Expected Results:

    We plan to carry out this proposed research within three years (i.e., from 2021 to 2023), and the main contents and annual schedules are described as follows.

1st year (2021): Carry out field surveys, sample collection and laboratory tests for soil-root system.

2nd year (2022): Methodology development of landslide susceptibility analysis.

3rd year (2023): Result validation and accuracy assessment

11. Deliverables/Time Frame:

    1st year (2021): Analyze engineering geology background and laboratory test results including the soil-root tension and shear strength; finish the field surveys and laboratory results reports.

    2nd year (2022): Technical report of methodology including the indicators and model for the landslide susceptibility analysis.

    3rd year (2023): Landslide susceptibility map and project report.

12. Project Beneficiaries

    The results of the present study will directly expand our scientific knowledge on the landslide formation mechanism of the vegetated slopes for scientists and engineers. The newly developed method of landslide susceptibility will be used to provide scientific supports for risk assessment, and further guide the establishment of risk mitigation policy by the international and local authorities.

13. References:

    Su Lijun, Sun Changning*, Yu Fangwei and Sarfraz Ali (2018). Seismic stability analysis of slopes with pre-existing slip surfaces. Journal of Mountain Science, 15 (6): 1331-1341

    Su Li-jun, Hu Kai-heng, Zhang Wei-feng, Wang Jiao, Lei Yu, Zhang Chong-lei, Cui Peng*, Pasuto Alessandro and Zheng Quan-hong (2017). Characteristics and triggering mechanism of Xinmo landslide on 24 June 2017 in Sichuan, China. Journal of Mountain Science, 14 (9): 1689-1700.

Note: Please fill and submit this form by 15 September 2020 to ICL Network <icl-network@iclhq.org> and ICL secretariat <secretariat@iclhq.org>