EGU General Assembly 2020

NH3.4 Landslide hydrology: from hydrology to pore water pressure and slope deformation

Composite Nature of Eco-Hydro-Geological (EHG) Stability of Slopes

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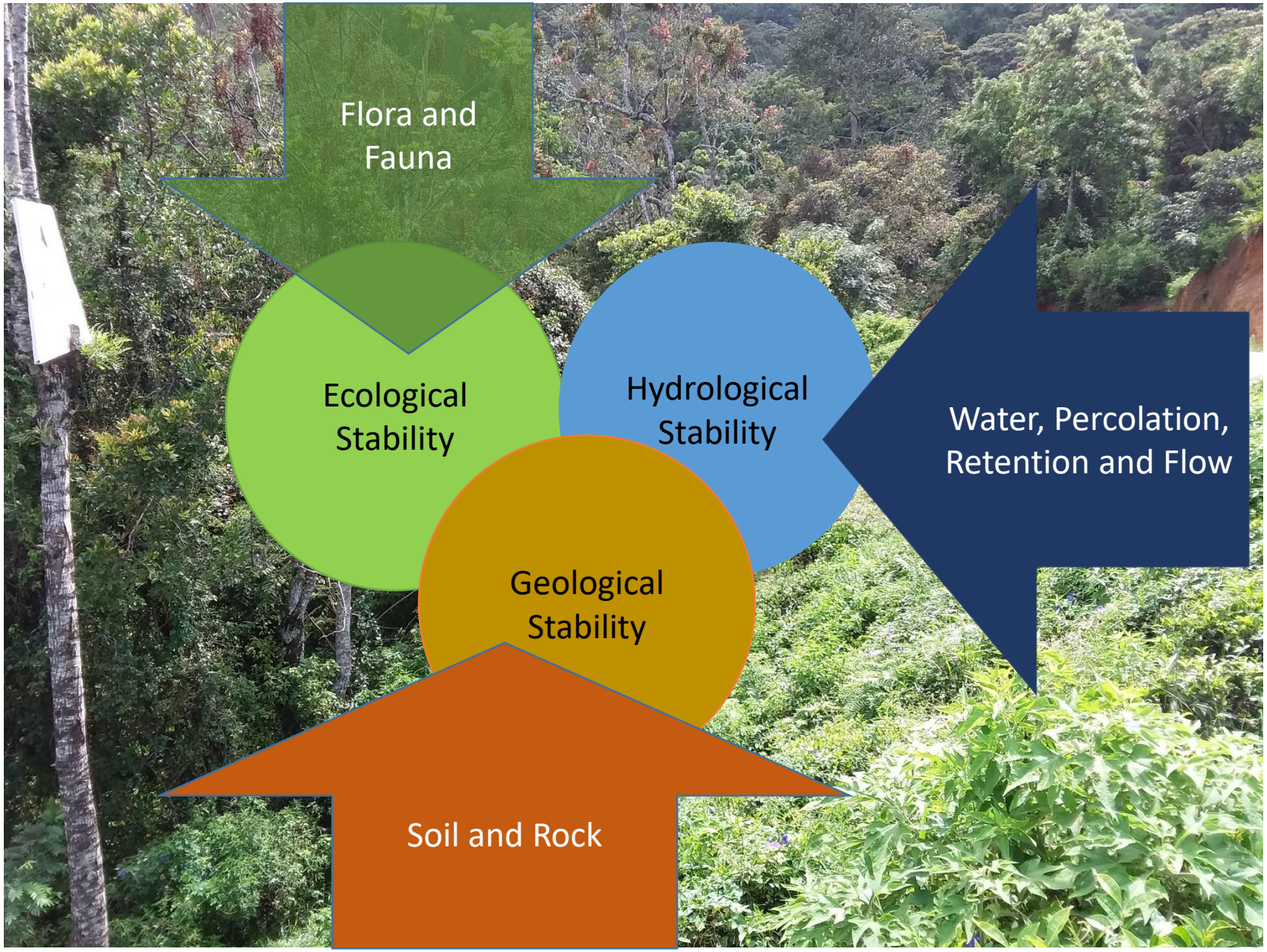
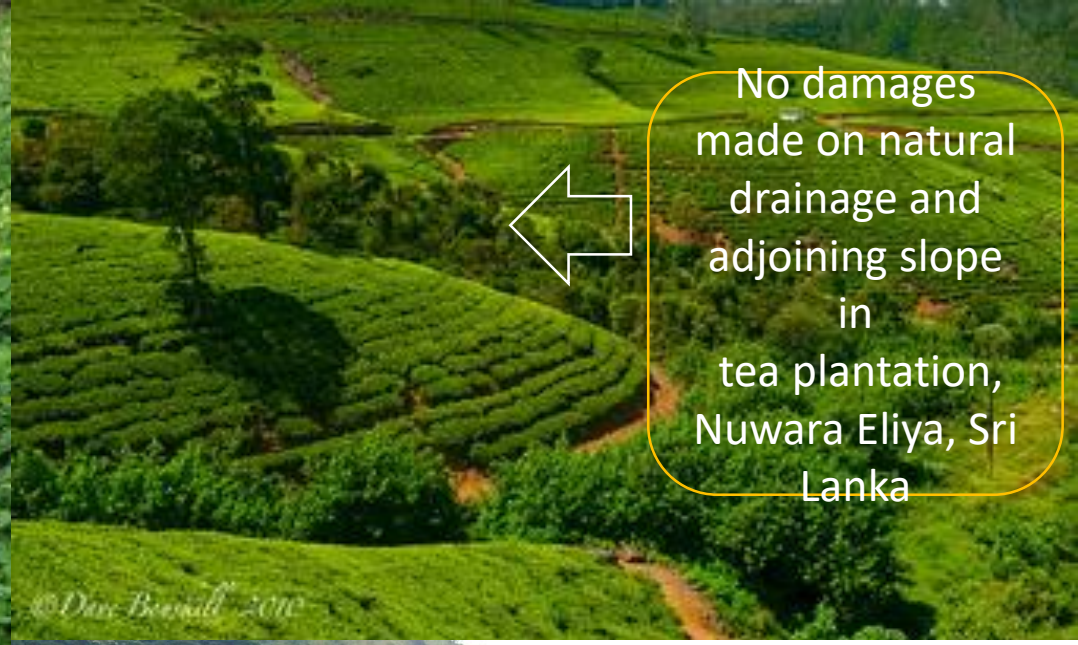
Composite Nature of Eco-Hydro-Geological (EHG) Stability of Slopes

- Stability of mountain slopes is a function of soil, rock, water, flora & fauna
- Ground water recharge, stagnation of water within soil, rock-soil interface saturations, influence of artesian water pressures and subsurface saturation due to geological complexity are common in nature.
- It deals with all natural and man-made stresses from the grass root level until long -term stability of the slope is reached
- Time passes through many adverse scenarios of rainfall events with less disturbances to native hillslopes and significant disturbances to engineered slopes.
- Understanding of composite nature of EHG stability always educate us to improve the stability of slope degraded or manmade slope.



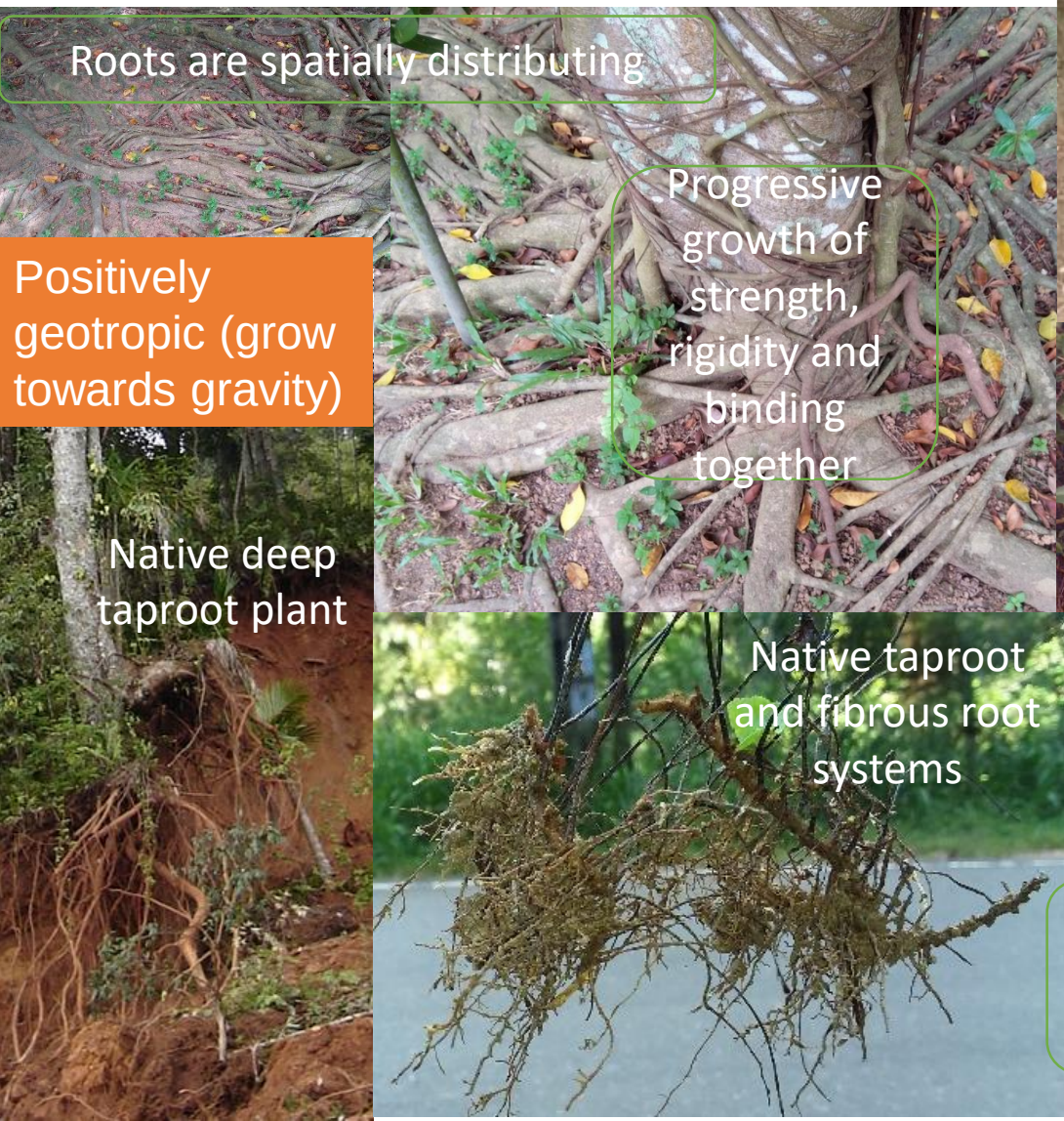

Stability attained in steep rock slopes

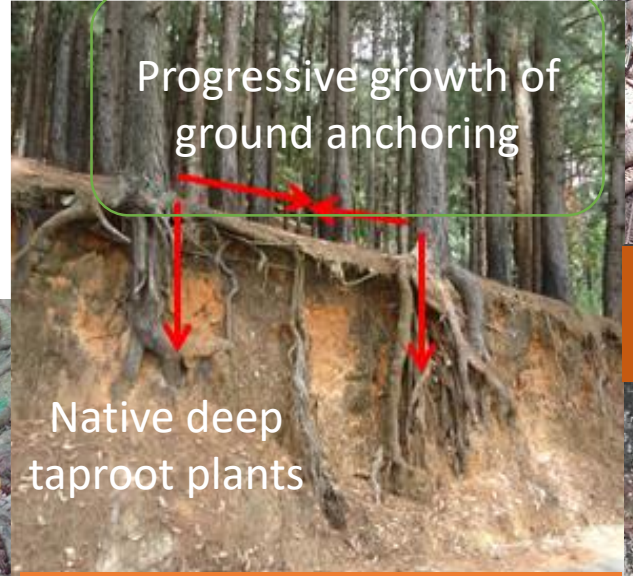

No damages made on natural drainage and adjoining slope in tea plantation, Nuwara Eliya, Sri Lanka

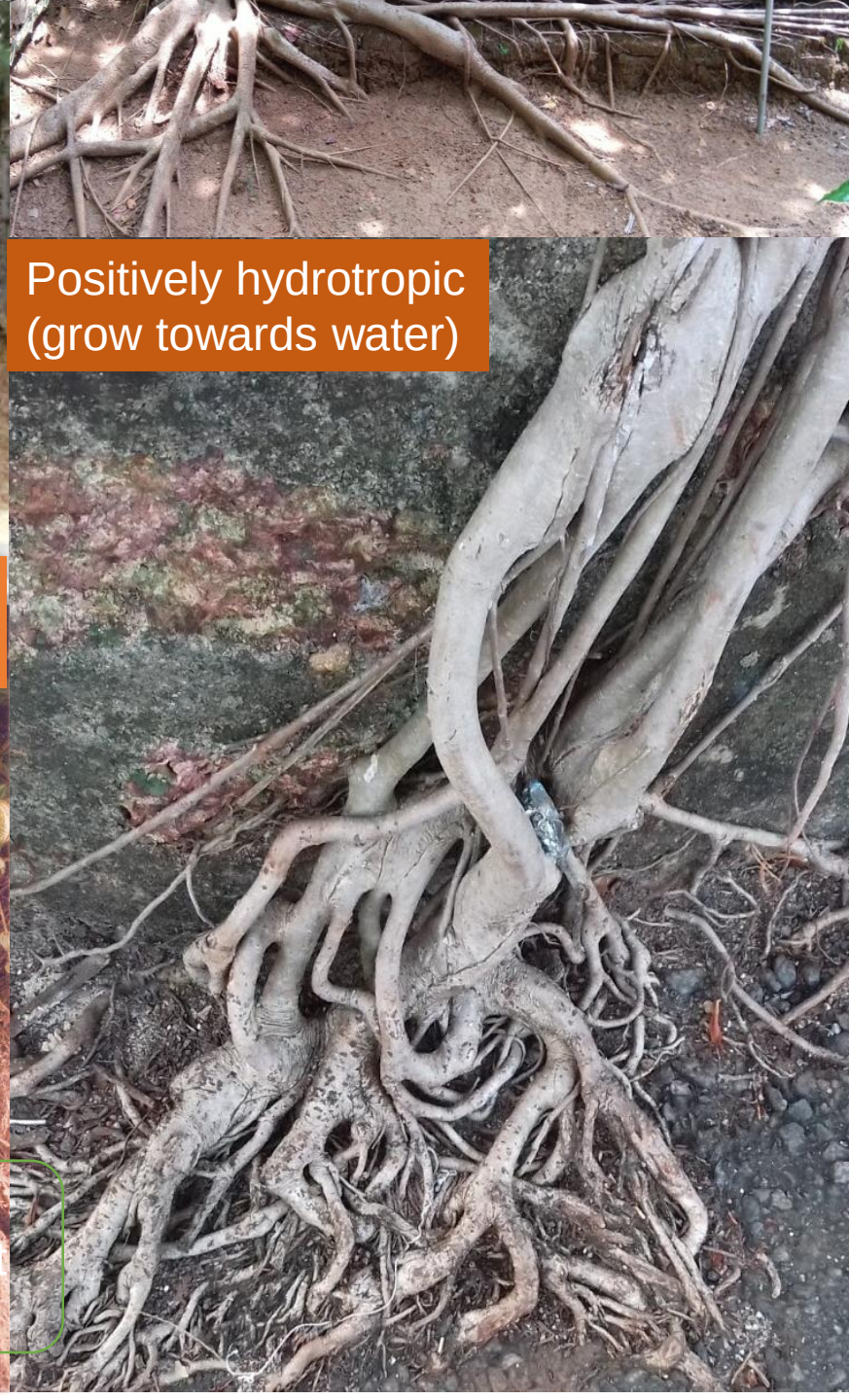

Stability of major stream path in high precipitation zone (more than 6000mm/year)
2013/1/26


Use of Cycad plants for natural slope stability in Mpanga Hydropower Project, Uganda (closer to Queen Elisabeth Park)

Understanding of complexity and advantages of individual plant root systems (Native)

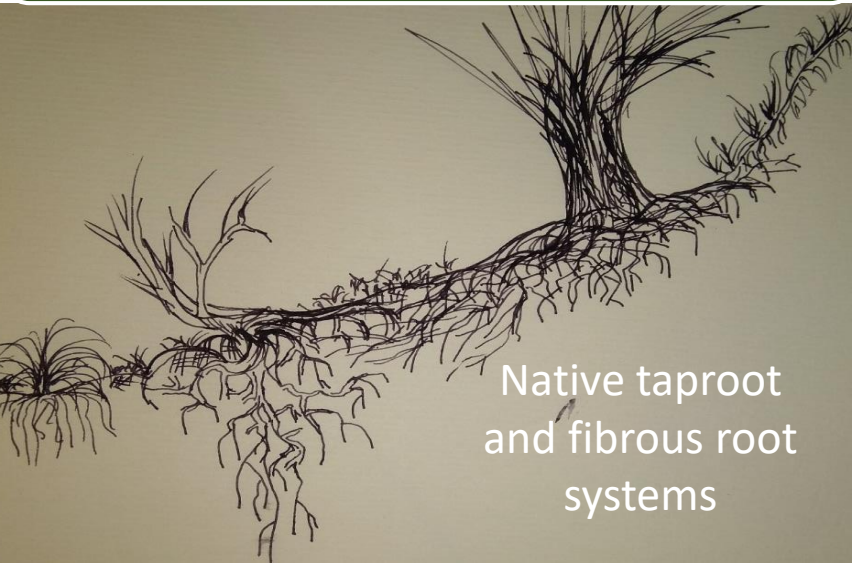




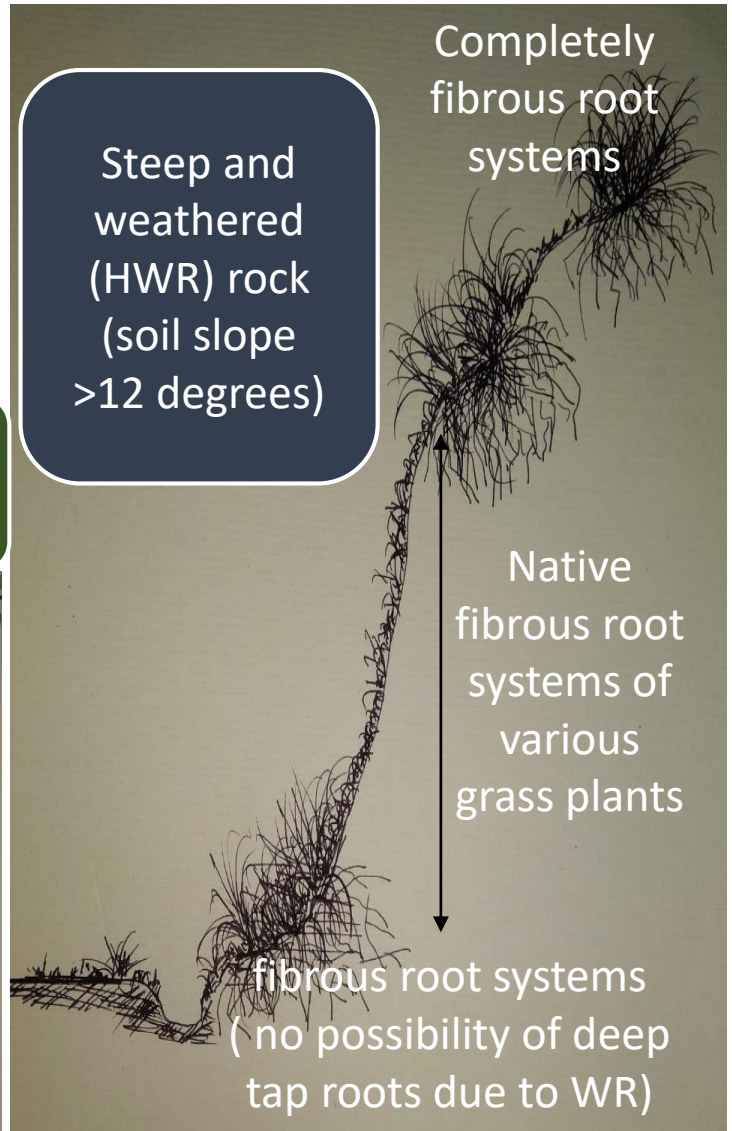


Selection of plant roots systems for soil slopes/earth-cutting stabilization

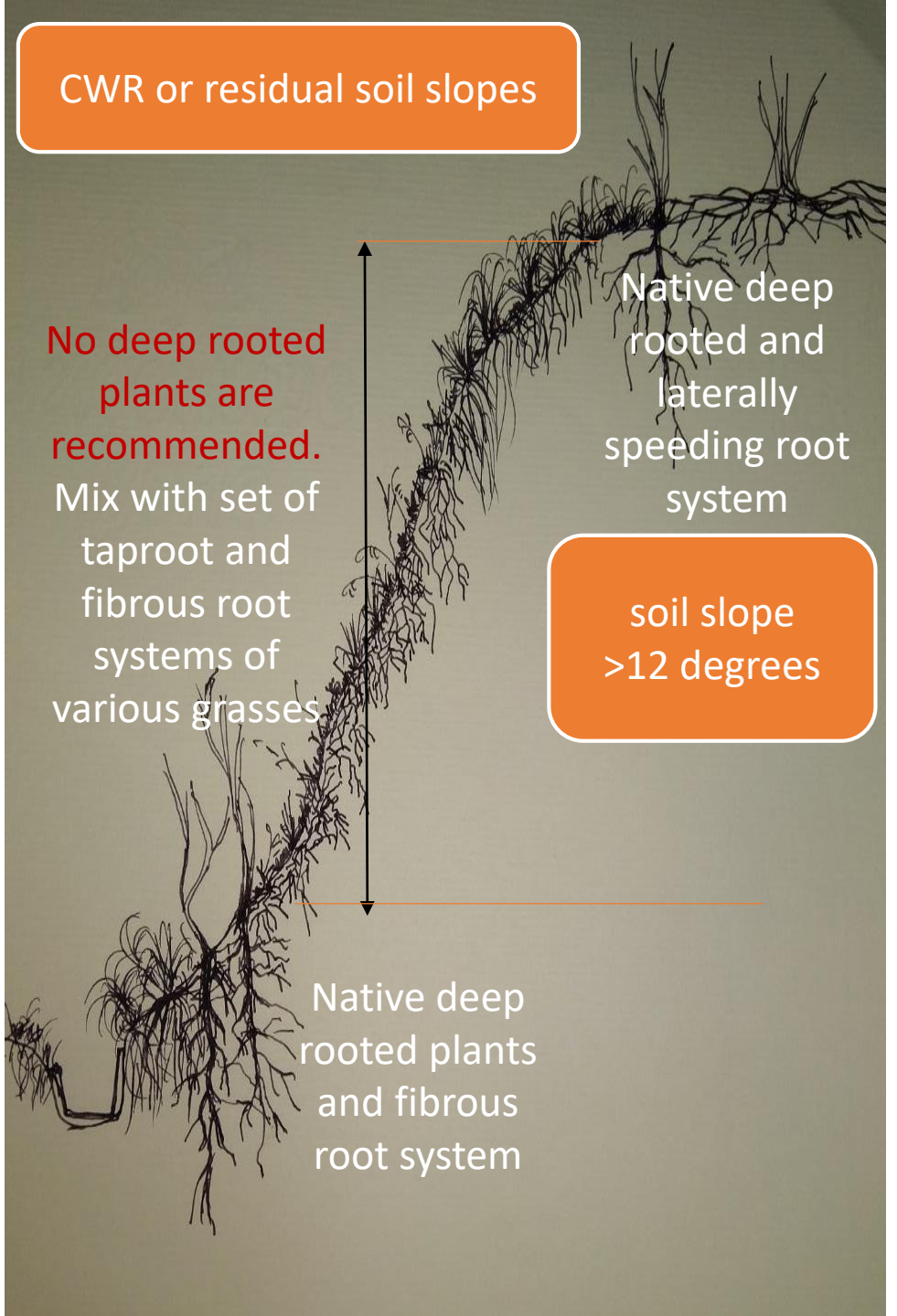
Gentle soil slopes (less than 12 degrees)



Steep and weathered (HWR) rock (soil slope >12 degrees)



CWR or residual soil slopes



Incorporation of principal mechanism of eco-hydro-geological(EHG) techniques for slope protection

Observations

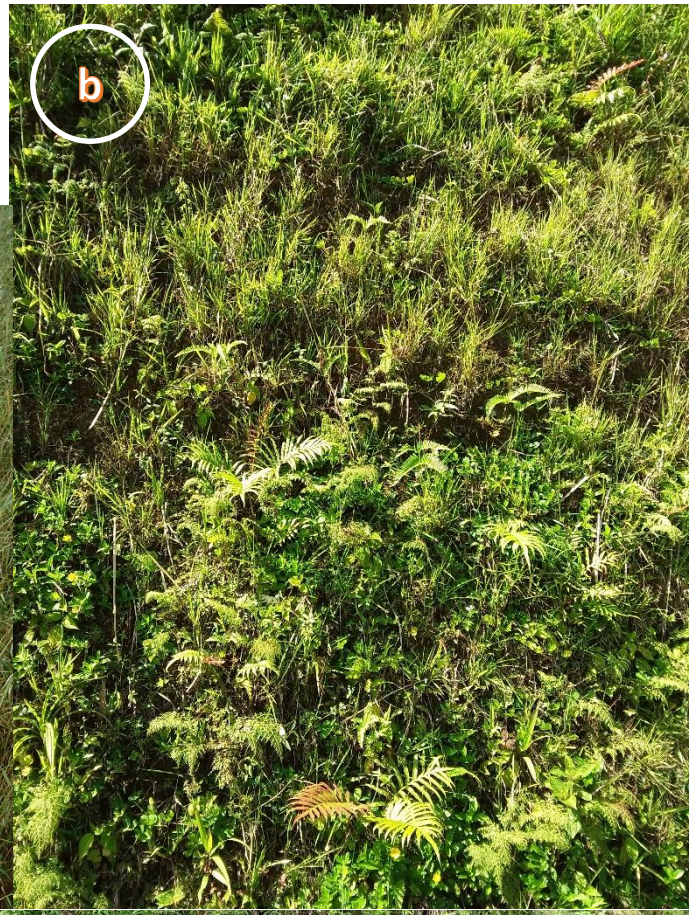
a. No mono-culture plant species to be selected for slope conservation measures.

b. Multi-nature root architecture will immensely improve the reinforcing capacity and hydro-geological stability in many directions in slopes.

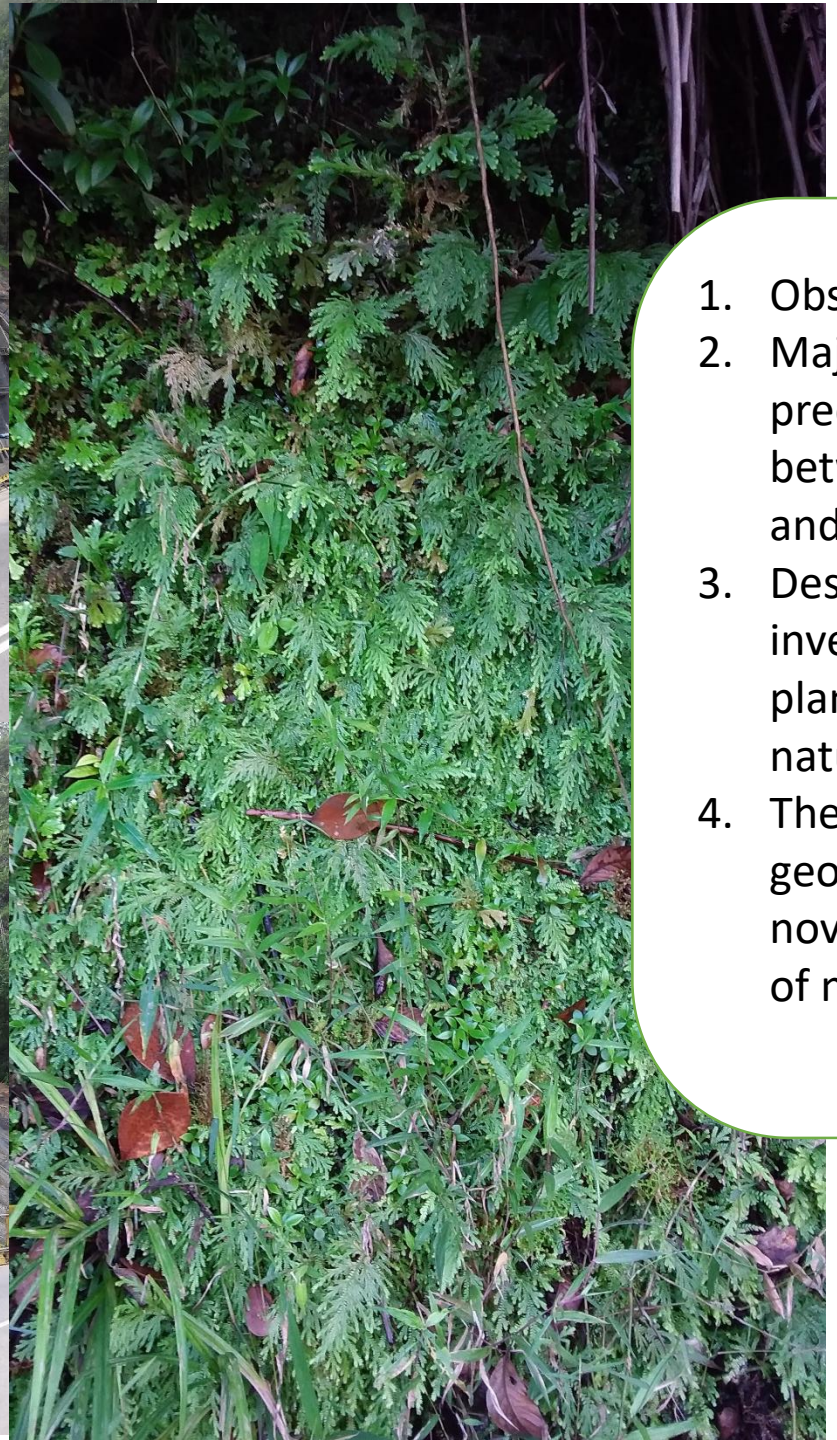
c. Understanding the water pathways within heterogeneous regolith soils under vegetation will improve new design concepts.

d. Hydrological exchange between potentially unstable slopes will accelerate plant roots growth in different directions and strengthen the stability of its surrounding.

Native species are rich with microbes which contribute for long term sustainability of plant growth and improve the stability of slopes.



Reduce use of the structural mitigation measures for natural slope stability and adding EHG approach by recreating the stability of natural slopes



Conclusions,

1. Observations are naturally site specific
2. Major challenges still remain on predicting the hydrological exchange between a potentially unstable slopes and existing natural slopes.
3. Designs must be based on site specific investigations, multi-culture of native plant species and satisfactory to soil/rock nature of geological conditions.
4. The principals of eco-hydro-geological(EHG) approach is not a novelty. It's about recreating the stability of natural slopes.

Thank you.