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Field Observations of Soil Piping and associated disasters in the Western Ghats region of Karnataka (Kodagu district)

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The Western Ghats are in the final stage of weathering. Hence, the Laterite, clay, and Saprolite layers can vary to depths greater than 50 meters. Thus, the Western Ghats have unique hillslope hydrology, with more than three-quarters of rainfall entering the subsurface flow, thus developing well-networked sub-surface conduits. These sub-surface conduits help maintain slope stability of the Shayadris' (Western Ghats) laterites, which are usually exposed to high-intensity rainfall for longer durations during the monsoon season. The slope failures and floods in 2018, 2019 and 2020 are due to Catchment Fragmentation leading to a disturbed hydrological cycle in both surface and subsurface levels.

A unique observation showed that most of the landslides (mostly toe failures) were concentrated near the Harangi reservoir and had a valley stream connecting to the reservoir. During field observations in these slope failure sites, soil pipe was observed in the crest of the landslide scarp for most of the accessible locations. The slope failures could be due to backflows in the soil pipes during heavy rainfall and mismanagement of dam gates. Observations from local residents who had witnessed the slope fail gave an idea of backflows in these slopes, which they locally termed as JALASPHOTA – The burst of groundwater up these soil slopes. During field observations post-monsoon, streams were visible at the surface of the scarp through these soil pipes after the landslide.

GSD of Lateritic soils of Kodagu is Clay, sandy clay, sand-silt clay, clayey sand, sand-silt-clay and clayey sand. A slow-moving landslide was observed on the highway connecting to Mangalore, where more clay content was observed.

Juvenile and fully developed soil pipes were observed at the landslide scarp, and slopes with fully mature soil pipes were observed to have more runout distance.

A few case studies of how catchment Fragmentation has disturbed the sub-surface hydrology, leading to slope failure, are discussed in this study.