



Root strength of tropical plants - An investigation in the Western Ghats of Kerala, India

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Earlier research on debris flows in the Tikovil River basin of the Western Ghats concluded that root cohesion is significant in maintaining the overall stability of the region. In this paper we present the most recent results (December 2008) of root tensile strength tests conducted on nine species of plants that are commonly found in the region. They are 1) Rubber (*Hevea Brasiliensis*), 2) Coconut Palm (*Cocos nucifera*), 3) Jackfruit trees (*Artocarpus heterophyllus*), 4) Teak (*Tectona grandis*), 5) Mango trees (*Mangifera indica*), 6) Lemon grass (*Cymbopogon citratus*), 7) A variety of Tamarind (*Garcinia gummigutta*), 8) Coffee (*Coffea Arabica*) and Tea (*Camellia sinensis*). About 1500 samples were collected of which only 380 could be tested (in the laboratory) due to breakage of roots during the tests. In the successful tests roots failed in tension. Roots having diameters between 2 mm and 12 mm were tested. Each sample tested has a length of 15 cm.

Results indicate that the roots of Coffee, Tamarind, Lemon grass and Jackfruit are the strongest of the nine plant types tested whereas Tea and Teak plants had the most fragile roots. Coconut roots behaved atypical to the others, as the bark of the roots was crushed and slipped from the clamp when tested whereas its internal fiber was the strongest of all tested. Root tensile strength decreases with increasing diameters, Rubber showing more ductile behaviour than Coffee and Tamarind that behaved more brittle, root tensile strength increasing exponentially for finer roots. Teak and Tea showed almost a constant root tensile strength over the range of diameters tested and little variability.

Jack fruit and mango trees showed the largest variability, which may be explained by the presence of root nodules, preventing the derivation of an unequivocal relationship between root diameters and tensile strength. This results in uncertainty of root strength estimates that are applicable. These results provide important information to quantify the upper limit of the root cohesion at the stand level in combination with land use maps. This is an indispensable component in the evaluation of slope stability in the region.