

(60)

Seasonal Changes of Soil Water Repellency in Pine and *Eucalyptus* Forest Soils in Up Country, Sri Lanka

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Abstract

Soil water repellency is a natural consequence which reduces the rate of wetting and leading water to remain on the soil surfaces for prolonged periods. Water repellency accelerates runoff and soil erosion in natural and agricultural lands by lowering infiltration and thereby increasing surface runoff. It is normally caused by the presence of hydrophobic coatings on mineral surfaces or intermixed hydrophobic organic materials in soils. This hydrophobic organic matter is in general added to the soils from different plant leaves, root exudates, and micro-organisms. Water repellency has been found in soils under wide range of vegetation types around the world, especially in conifer forests including pine and eucalyptus. Pine (*Pinus caribaea*) and eucalypt (*Eucalyptus grandis*) are exotic plant species introduced to Sri Lanka with the aim of preventing the land degradation in hill slopes and to reduce the pressure on natural forests for timber requirements. This study aimed to examine the water repellency, with its possible seasonal changes, in pine (Haputale) and eucalypt (Diyatalawa) forest soils in Up country, Sri Lanka. The vertical distribution of water repellency in the soil profile was studied using bulk soil samples that were collected from 5 soil layers in each site (0-5, 5-10, 10-15, 15-20, 20-25 cm) during both dry and wet seasons November 2016 to July 2018. Following air drying, potential water repellency was examined using water drop penetration time (WDPT) test and modified sessile drop contact angle methods. Actual onsite water repellency was observed using WDPT test. Top soil layer (0-5 cm) of eucalypt site showed extreme water repellent conditions as measured by Log WDPT (>3,600 s) and soil-water contact angle (>85°) in both dry and wet seasons. Pine forest soils showed severely water-repellent conditions in wet season (1000–1100 s) and strongly water repellent conditions (200-300 s) in dry season showing a significant change in water repellency. In both wet and dry seasons, water repellency (log WDPT and soil-water contact angle) showed strong negative exponential relationships with increasing soil depth in both pine and eucalyptus forest soils. Changes in degree and persistency of soil water repellency were observed under natural conditions with seasonal variation in pine and eucalyptus plantations in Up country. In order to determine the actual changes with seasonal variation of soil water repellency, long term seasonal experiments are recommended.

Keywords: Pine, *Eucalyptus*, Soil water repellency, Seasonal changes, Vertical distribution