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学 位 論 文 要 旨
Dissertation Abstract

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学位論文題目：
Title of Dissertation

Throughfall and stemflow by rainfall and fog under different tree characters in a montane forest of Popa Mountain Park, Central Myanmar
(中部ミャンマー・ポッパ山林における異なる樹種を対象とした降雨と霧による林冠通過雨水量と樹幹流に関する研究)

学位論文要旨：

Rainfall partitioning is a crucial and fundamental research subject to assess the net water input of a forest, which redistribute the rainfall into three components; (i) throughfall (TF): rainwater that reaches the ground by passing through the small gaps within the canopies or intercepted rainwater dripping via the foliage, (ii) stemflow (SF): rainwater that reaches the ground by flowing down along the branches and stems, and (iii) interceptive loss (IL): rainwater that is intercepted by the canopies and does not reach the ground due to the evaporation loss from the canopy.

Popa Mountain Park (PMP) is enclosed in central Myanmar, an arid region with limited rainfall and limited water resources. In PMP, government focus on conservation of natural montane forest to sustain the water sources. However, forest area decreases due to land-use changes. Hence, afforestation and reforestation programs are widely implementing in degraded forest area. However, there have been no scientific studies related to rainfall partitioning research in this region. This study aims to: (1) examine the partitioning amount of TF, SF, and IL, (2) investigate the influences of tree characters on TF and SF, (3) investigate the importance of trees for soil water replenishment, and (4) monitor the impacts of land-use changes on conservation of montane forest. Gross rainfall (Pg), TF under different canopies, SF at different tree types, and soil water at different places were measured in PMP for 125 days (from 30th Jun to 2nd Nov, 2019). Reference points for accuracy assessment of land-use land cover changes were collected during Feb and Mar in 2019.

Mean TF, SF and IL rates were 58.7% (442.3 mm), 18.9% (142.4 mm) and 22.4% (168.8 mm) of total Pg, respectively. By comparing IL under three different Pg classes (Pg>10.0 mm, 10.0 mm ≥ Pg ≤ 50.0 mm, and Pg >50.0 mm), this study found that IL did not have significant correlation with any Pg classes ($p > 0.05$). This study successfully could partition total TF and total SF into TF and SF caused by Pg and fog. By comparing TF and SF in four different vegetation types (two for TF and two for SF), this study found that a sparser canopy produced larger TF by Pg than a denser canopy ($p > 0.05$). However, a denser canopy produced larger TF by fog ($p < 0.05$). TF rates from Pg in the sparser and denser canopies were 54.5% and 51.5% of total Pg, respectively, while those from fog were 15.2% and 27.2% of total TF, respectively. As

a result, total TF rate in the denser canopy (70.7% of total rainfall) was significantly higher than that of the sparser canopy (64.3%). Shorter trees with small crown projection area and smoother bark (Type I) could produce larger SF from Pg than taller trees with large crown projection area and rougher bark (Type II) ($p < 0.05$). However, Type II trees could produce larger SF from fog ($p < 0.05$). SF rates from Pg at Type I and II trees were 17.5% and 12.2% of total Pg, respectively, while those from fog were 22.2% and 39.5% of total SF, respectively. As a result, no significant total SF rates were found at Type I and II trees (22.5% and 20.1% of total rainfall).

By comparing soil moisture near tree stem and outside the canopy area at two soil depths (5 cm and 15 cm), this study found that near tree stem could replenish more soil water to deeper soil depths than outside the canopy area ($p < 0.05$). Land-use land cover assessment showed that the total forest area decreased with increasing non-forest areas due to agricultural expansion and fuelwood extraction. between 1989 and 2019

This study suggested that forest conservation should be prioritized, but with participatory of all stakeholders. Afforestation and reforestation could implement as an environmental restoration approach. This study recommended the denser canopy and shorter trees with smaller crown projection area and smoother bark for afforestation and reforestation projects to gain more TF and SF. In an area where a foggy condition occurs frequently and continues for a long time, however, taller trees with large CPA and rougher bark could be recommended to gain more SF.