Water infiltration and uptake around a Japanese cypress growing on a flat upland

*Masahiro Kobayashi[1], Shin-ichi Onodera[2], Yuko Itoh[1], Tadashi Sakata[1]

1. Forestry and Forest Products Research Institute, 2. Graduate School of Integrated and Arts Sciences, Hiroshima University

In forest ecosystems, trees strongly influence the water movement above and below the ground. During rainfall events, some rainwater flows as stemflow, which provides concentrated water input into soil. The redistribution of soil water during periods without rainfall is affected by water uptake by roots. To clarify the effects of trees on soil water dynamics during and after rainfall events, we monitored the distribution and temporal dynamics of the soil water potential around the stem of a Japanese cypress (*Chamaecyparis obtusa*) using a two-dimensional array of tensiometers installed at multiple soil depths and distances from the tree. During rainfall events with wet antecedent moisture conditions, stemflow infiltrated into the soil and recharged the shallow groundwater near the stem. The matric potential often increased at lower positions before upper positions, indicating bypass flow through macropores. After large rainfall events, once the matric potential distribution became uniform horizontally, gravity-driven drainage proceeded. During the drying process, the matric potential decreased markedly proximal to the stem compared to distally. A horizontal gradient in the matric potential was observed in both the shallow and deeper soil layers. This indicates an intense sink caused by water uptake by roots from the deeper soil layer. Upon excavating the roots after monitoring the matric potential, dense fine roots were observed in the deeper soil layer. The tree studied may feed the deeper soil around its root zone with rainwater as stemflow and use the water advantageously following the drying process.

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