

## Diurnal Changes of Soil Water Content in Surface Soil Layers at a Japanese Red Pine Forest

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### 1. Introduction

Soil water content in surface soil declines during the daytime due to evapotranspiration, but the phenomenon that it rises from midnight to early morning after the daytime decline (diurnal changes) was recorded at a vegetated area (Tanaka et al., 1993). One of the potential mechanisms of the phenomenon is water movement from lower soil layers by upward hydraulic gradients, which are caused by water uptake by plant roots. In addition, hydraulic lift, which deep-rooted plants suck water from lower soil layers and exude the water into upper and drier soil layers, has been observed in recent studies (Caldwell et al., 1998; Horton and Hart, 1998; Ludwig et al., 2004; Sekiya and Yano, 2004). So it is possible that hydraulic lift induces diurnal changes. In this paper, variation of soil water content and oxygen isotope ratio of soil water were measured to clarify the mechanisms which cause diurnal changes.

### 2. Methods

Pressure head, vertical flux, and oxygen isotope ratio of soil water and groundwater were measured in the vicinity of a Japanese red pine (*Pinus densiflora*) and an evergreen oak (*Quercus myrsinaefolia*) in a forest adjacent to the Terrestrial Environment Research Center, University of Tsukuba, Japan.

### 3. Results and Discussion

The amount of soil water variation which was obtained by the water balance method was less than the actual soil water variation (8 to 77%). The changes of the proportion were influenced by difference in unsaturated hydraulic conductivity among the depths and hydraulic gradient. On the other hand, oxygen isotope ratio of soil water changed from 0.1 to 0.6 per mill between day and night in July to September, 2005 at depths of 10-40 cm. Although these changes were small, oxygen isotope ratio of soil water at night tended to show values which close to that of the groundwater. Therefore, the process so called hydraulic lift could be one of the mechanisms that increase soil water content in surface soil layers at night under drier soil conditions.