

## Transpiration characteristics of natural oak (*Quercus mongolica* Fish) forest in the Kawakami Experimental Basin, Univ. Tsukuba

# Shin-ichi Iida[1], So Nakatani[2], Tadashi Tanaka[3]

[1] Doctoral Program in Geoscience, Univ. Tsukuba, [2] College of Natural Sci., First Cluster of Colleges, Univ. Tsukuba, [3] Inst. Geosci., Univ. Tsukuba

The objectives of this study are to quantify transpiration and to investigate seasonal changes of its characteristics in natural oak (*Quercus mongolica* Fish) forest based on long-term and continuous measurements of sap fluxes.

This oak forest is located in the Kawakami Experimental Basin, Univ. Tsukuba. Forest transpiration was estimated for the area, whose radius is 25 m from observation tower of 16 m height. According to Iida and Tanaka (2001), mean diameter at breast height (DBH), stand density, mean tree height and forest age are 19.3 cm, 7.9/100 m<sup>2</sup>, 14.0 m and 65 years, respectively.

Sap fluxes are observed by Granier method (Granier, 1985) at the height of 1 m and 7m to evaluate water uptake by root system and transpiration, respectively. The three test stands for sap flux measurement were selected based on the histogram of DBH. Sap flows were calculated using sapwood area obtained by increment borer and considering the sap flux distribution (Kobayashi and Tanaka, 1996). Downward and upward photosynthesis active radiations (PAR) and net radiation over canopy, downward PAR under canopy, temperature and humidity were observed at the tower. This study analyzed the data observed in 2001.

The phenology of oak was evaluated using the ratio of downward PAR under canopy to that of over canopy. The lower value of this ratio means the larger number of leaves and the denser canopy. This value started to decrease from the early May, and became the constant at the middle of June. At the early October, this value started to increase, and converged the constant value at the end of October as almost similar as that before the early May. Therefore, it is considered that the foliation began from the early May and finished at the middle of June, and the leaf fall began from the early October and finished at the end of October. This phenology almost corresponds with the previous study (Futada et al., 1995). The daily amounts of test stands' transpiration began to increase from the middle of June and to decrease from the early October, and this seasonal trend well corresponded with its phenology. On the other hand, the amounts of smallest test stand's transpiration were smaller than other test stands, as its height was relatively low and the only relatively weak radiation was available.

Considering the number of trees, whose heights were lower than the main canopy, forest transpiration was estimated from transpiration of test stands. Moreover, evaluating forest evapotranspiration by short-time period water-budget method (Suzuki, 1985), forest transpiration and evapotranspiration were compared. As a result, the percentage of transpiration to evapotranspiration was 8.5 to 13.0% when the foliation did not finish, however, this percentage was 83.5% when the foliation finished and this value is similar to the previous study (e.g. Granier et al., 2000).

The relationships between transpiration and water uptake by root system of test stands were changed with procession of season. From the middle to the end of June, that is, the part of rainy season, transpiration became relatively larger. As the foliation almost finished in this period, it is considered that the reason for this phenomenon is the rising of oak activity. On the other hand, at the early July, when few amount of rainfall occurred, transpiration was decreased by the water stress due to the lack of soil water content. Estimation value of relatively extractable water content (REW) was larger than the threshold value reported by the previous studies. Therefore, there are some possibilities that water stress can occur in this forest even if REW is relatively larger than the reported threshold value. Reflecting large amount of rainfall at the early September, transpiration was increased. From these relationships, it is considered that stem water storage was used for transpiration from the time of completing foliation to the summer.