The preliminary study of sap flux based stand transpiration estimates in a natural broadleaved forest in Fukuoka

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1. Introduction

The amount of water used by trees has been widely researched for more than 100 years and several studies have mentioned that forest types can affect the hydrological cycle of watersheds when precipitation is higher than evapotranspiration (Calder 1999; Zhang *et al*. 2001). More than 45 % of the forest area is covered by natural broadleaved forests in Japan and most of them consist of mixed forests (Japanese Forestry Agency 2010). Although considerable researchers have examined stand transpiration in conifer forests in Japan, only a few studies have conducted sap flux measurement in natural broadleaved forest to estimate stand transpiration.

Estimating stand transpiration of mono-specific forest can be straightforward because of accurate determination of sapwood area-DBH relationships and representative measurements of sap flux in relation to DBH and sapwood depth (Čermák *et al*. 1995). In a natural broadleaved forest, on the other hand, estimating stand transpiration could be difficult due to species-specific water use variations. To establish the method to estimate stand transpiration accurately based on sap flux measurement, we evaluate stand transpiration of a temperate mixed broadleaved forest in Kasuya Research Forest in Fukuoka, western Japan. We also compared the stand transpiration with the one measured in a conifer forest (Komatsu *et al*. 2013) next to our study site to examine if the forest type lead differences in stand transpiration.

2. Methods

This study site was made in the Yamanokami Site in Kasuya Research Forest of the Kyushu University (33°38'N, 130°31'E, 50 m a.s.l.). We conducted the sap flux measurement in a 20 m x 15 m plot located on the north-face slope of a small hill in a natural broadleaved forest. Granier-type heat dissipation sensors were installed on 49 stems of total 12 species including three ring-porous species and nine diffuse-porous species in the plot. To avoid azimuthal variations caused by steep slope, we measured sap flux at two aspects, north and south. The mean DBH was 15.2 cm (range: 5-

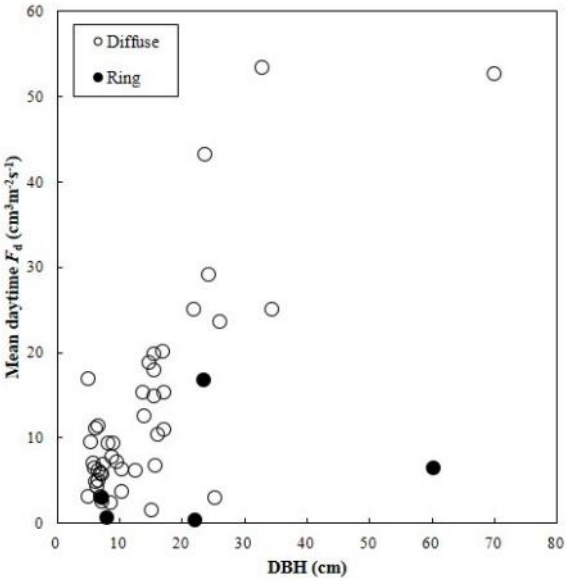

Figure 1 The relation between mean daytime F_d and DBH among ring- and diffuse-porous species.

70 cm) and mean tree height was 10.2 m (range: 2.5-22.4 m). The measured period was between June and August, 2013.

3. Results and discussion

The results showed that the sap flux density (F_d) of diffuse-porous species had positive relation with DBH while F_d of ring-porous species did not depend on DBH (Figure 1). This implies that, in diffuse-porous species, the species-specific variation was not the major factor in stand transpiration estimates.

The stand transpiration in the broadleaved forest was significantly larger than the one in the nearby conifer forest even before the thinning (Figure 2). This was possibly because the F_d of the broadleaved species was larger than the one of the conifer species. Note that, this study did not consider the radial variations of sap flux inside the stem. The difference of estimated stand transpiration between the broadleaved forest and conifer forest might be larger if including radial variations in the estimation.

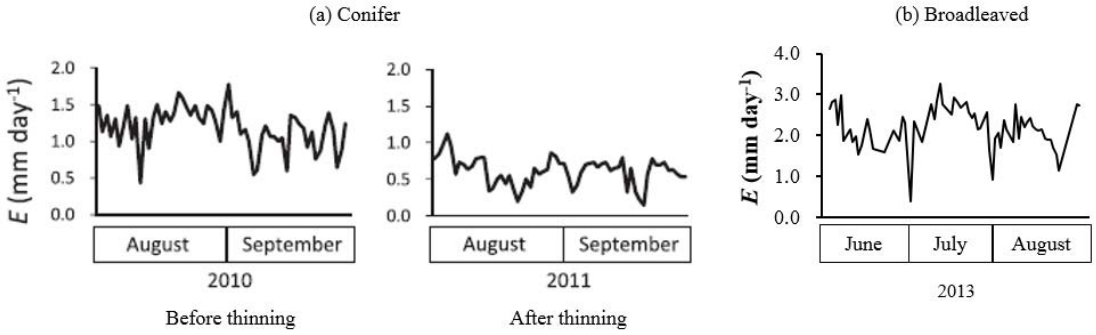

Figure 2 The comparison of stand transpiration (E) in the conifer and broadleaved forest. (a) and (b) represented the data from Komatsu et al. (2013) and this study, respectively

4. Reference

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