A comparison of hydrological characteristics between a cypress and mixed-broadleaf forest: Implication on water resource and floods

ABSTRACT

Broadleaf or conifer forest? – an ongoing dilemma as regards water resource and flood prevention. Although conifer trees use less water and are hydrophobic, existing studies at the watershed scale have shown varying results due to variability in meteorological conditions and forestry practices. In this study, two adjacent headwater catchments [2.42 ha cypress (CF); 2.08 ha mixed broadleaf (MB)] were gauged. The study area in central Japan has a warm temperate climate with high annual rainfall and typhoons. Daily discharge (n = 1398) and storm event hydrographs (n = 242) were compared between CF and MB and discussed in light of water availability and storm event runoff characteristics. Overall water yield in CF was 6.4% lower than in MB but this was caused by lower streamflow on high discharge periods (30% frequency); thus, may not adversely affect municipal/agricultural water supply. For 70% of the time including during dry periods, water yield was higher in CF. This agrees with the principle that conifers use less water than broadleaf trees – even at the forested catchment scale. Discharge in the CF stream is also less variable than that in the MB stream. During storm events, the CF stream has higher flashiness (shorter response time to rainfall and higher peak discharge) than the MB stream; but in larger storms ($\gtrsim$70 mm), the MB stream may have higher peak discharge. Our data demonstrates that a well-managed plantation forest does not necessarily have inferior hydrological function compared to a natural broadleaf forest, which differs from the stereotype. Frequencies of high and low flows as well as runoff characteristics were also presented in hopes of promoting better forestry decisions when considering water demand and existing stormwater drainage infrastructures.