



# Forest Transpiration as a Key Water Balance Component: Comparing Deciduous, Mixed, and Coniferous Forests in Soyang Watershed

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## Motivation:

Forests play a critical role in the hydrological cycle making the study of water use by trees and forest stands important in the global change context. Intra- and inter-specific differences in both physiology and morphology exert an influence on the water balance of forest ecosystems. In Korea, coniferous forests, mostly planted during 1970s, cover larger area than natural deciduous forests. However, the area of the coniferous forests is gradually decreasing, while that of deciduous is increasing.

Different stand structures and species compositions can cause different patterns of rainfall interception, runoff and water fluxes of the whole ecosystem. This study will investigate the role of species composition, tree canopy status and species specific sensitivity to key environmental drivers in water use by Korean forests. The experiments will address both natural forests and forest plantations. Main mechanisms that influence water use by forest tree species, relevance of tree size and age, along with forest stand characteristics, in conditioning water use and the impact of different silvicultural practices and forest management on the water resource will be investigated.

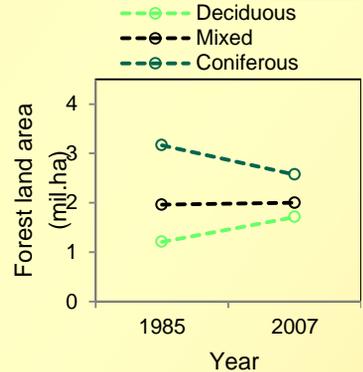


Fig.1. Change in forest area in South Korea

## General Objectives:

- Quantify and compare seasonal patterns of water use by deciduous, mixed, and coniferous forest trees in Soyang Watershed
- Examine relationships between forest structure and water use
- Estimate total transpirational water use in Soyang Watershed using landscape models and based on plot-level measured data

## Specific Objectives:

- Compare sap flux density and tree water use between deciduous and evergreen species or between ring and diffuse porous species growing in Soyang Watershed
- Characterize forest structures of natural deciduous and mixed and planted coniferous forests
- Identify the key environmental parameters that influence forest structure and tree transpiration
- Up-scale tree transpiration to forest stand transpiration based on identified relationships with forest structure and environmental factors

## Materials and Methods:

- Environmental data: Vapor pressure deficit, radiation, soil water content
- Sap flow method: Tree water use
- Forest inventory: Tree species, stem diameter, tree height, canopy area, stem density
- Dendrometer: Tree growth
- Porometry: Leaf level stomatal conductance, transpiration rate

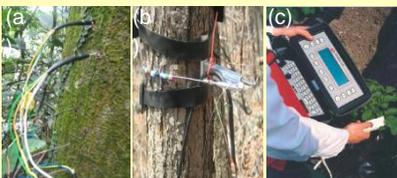


Fig. 2. (a) sap flow method, (b) dendrometer, (c) porometry, AP4.

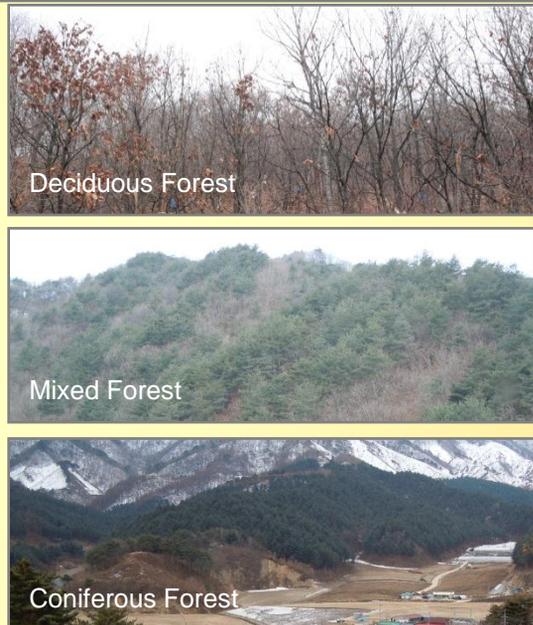
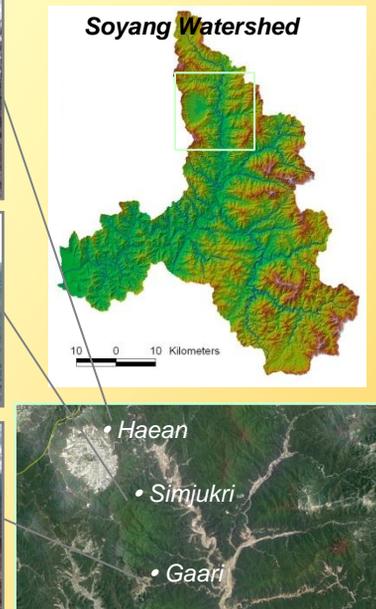


Fig. 3. Study sites. Deciduous, mixed, and coniferous forests are located in Haeon, Simjukri, and Gaari, respectively.



## Expected Outputs:

- Gain knowledge on tree transpiration of the dominant tree species
- Identify key drivers of forest water use
- Gain knowledge on forest water use among forest types in South Korea
- Perform Landscape-level estimates of water use by forests

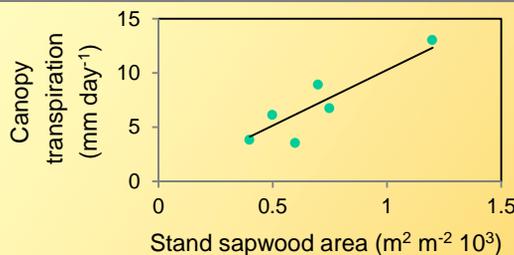


Fig. 4. Relationship between canopy transpiration of the stand and sapwood area of the stand (after Zimmermann et al. 2000).