



Seoul National University

Connecting long term species changes and their water competitions in temperate forest Mt. Baegun, Rep. of Korea using hydrogen and oxygen stable isotope analysis

Jihyeon Jeon^{1*}, HoonTaek Lee¹, MinSu Lee¹, Wookyung Song¹, SiYeon Byeon¹, Boknam Lee², Sungsik Cho³, Juhan Park⁴, Hyun Seok Kim^{1,2,3,4}

¹Department of Forest Sciences, Seoul National University, ²Research Institute of Agriculture and Life Sciences, Seoul National University,

³Interdisciplinary Program in Agricultural and Forest Meteorology, Seoul National University, ⁴National Center for Agro Meteorology, Seoul National University

w920827@gmail.com



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Background

- More than 15-years-long 880 permanent plots tree survey data in Mt. Baegun, Rep. of Korea, showed substantial decrease of conifer species and their productivities and increase of broadleaved species (Figure 1).

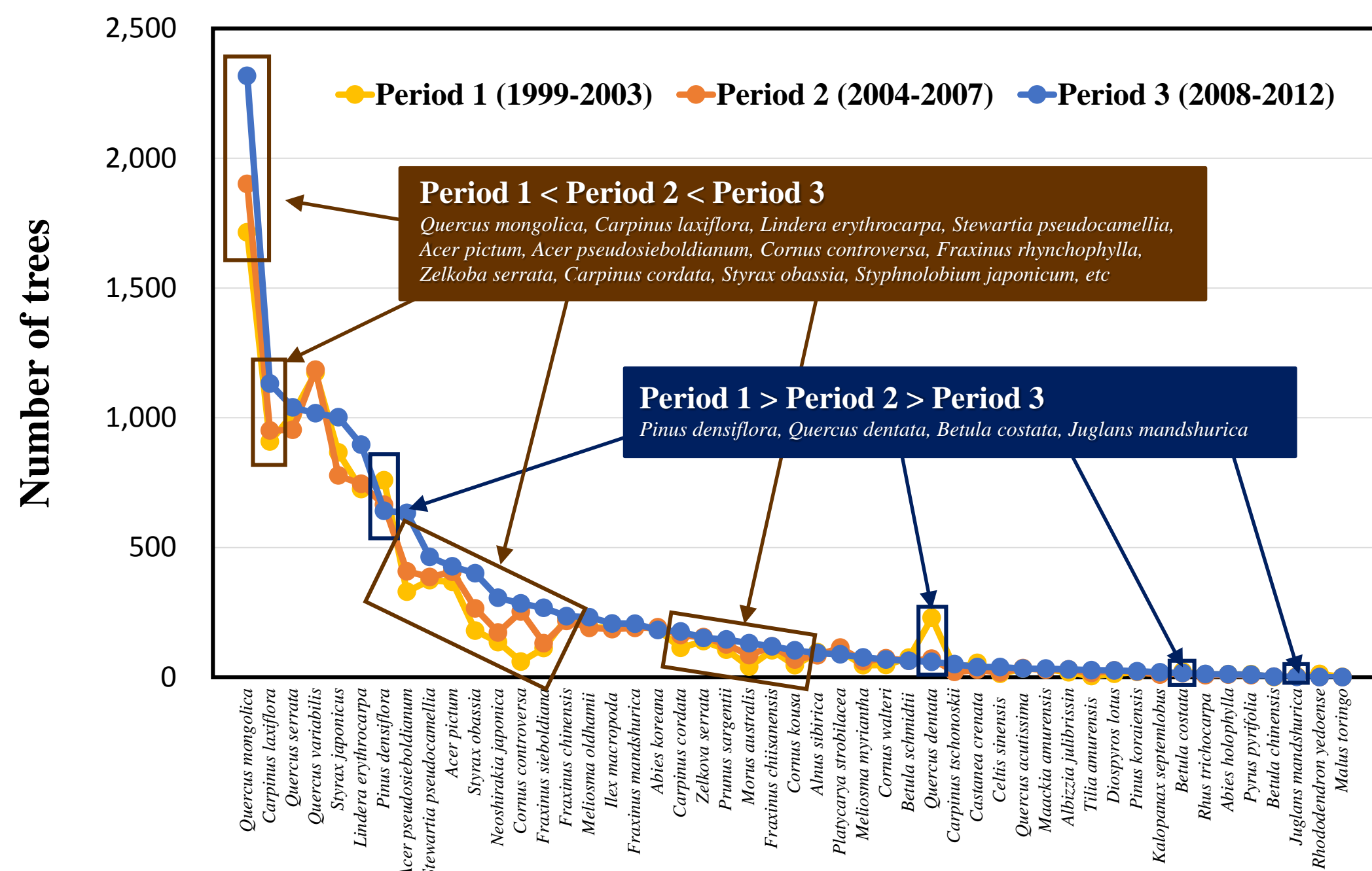


Figure 1. Long term survey of vegetation change in Mt. Baegun

- One of main reasons for these changes in species could be attributed to the water competition among tree species in the same stand.
- Therefore, we investigated the differences in water uptake scheme between conifer and broadleaf species from the temperate forests of Korea using stable isotopes.
- Stable isotope analysis ($\delta^2\text{H}$ and $\delta^{18}\text{O}$) is a credible method to investigate the plant water use scheme (X. Leng et al. 2013, B. Yang et al. 2015).

Materials and Method

1. Study area

- This study was conducted in six study plots based on previous survey data in Mt. Baegun in 2016 (only 2 plots in this poster).
- The annual average precipitation and air temperature from 2011 to 2015 were 1670mm and 13.9°C, respectively. However, the monthly precipitation in summer was decreased in 2016 (Figure 2).

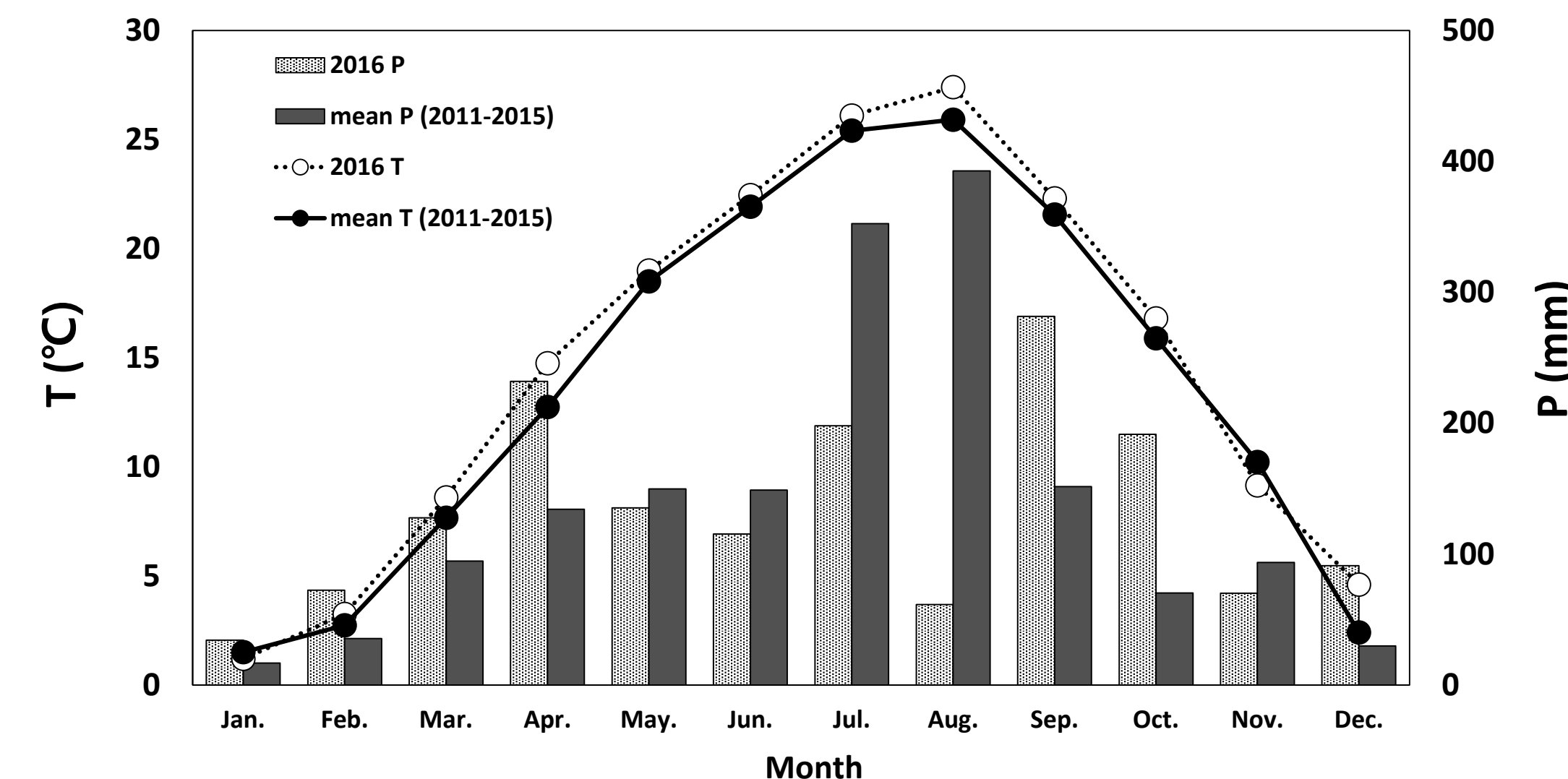


Figure 2. The monthly variation of precipitation and temperature

2. Experimental design and sample collection

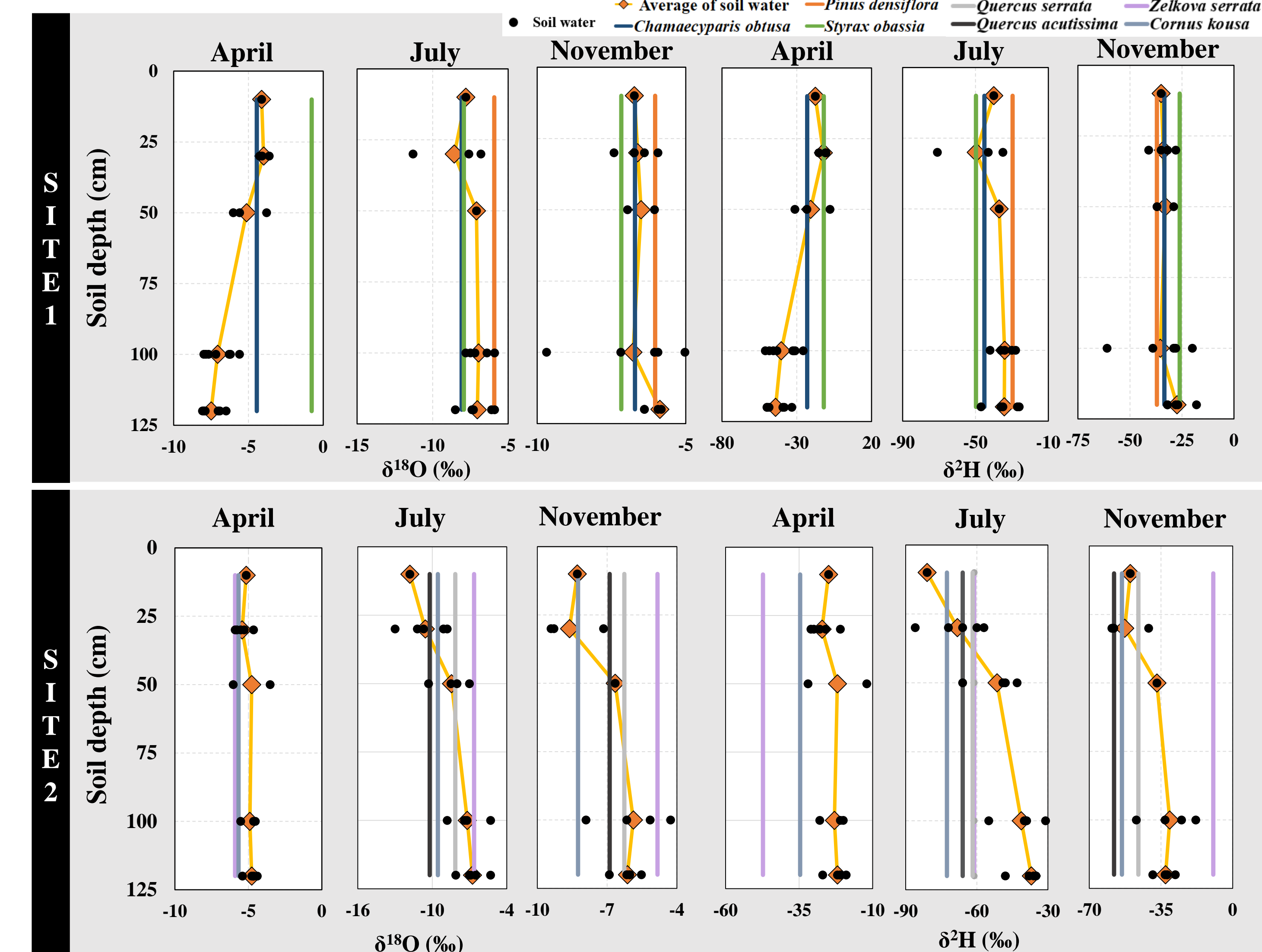
- In each study plots, we established 5 subplots and installed tension lysimeters at 5 soil depths (10, 30, 50, 100 and 120 cm). We sampled soil water and branches to measure isotope signatures from Apr. 2016 to Nov. 2016 with about 2-month interval.

3. Isotope analyses

- Isotopic measurements of ^{18}O and ^2H from soil water and branch were conducted using Induction module cavity ring-down spectroscopy (IM-CRDS, Picarro, USA)
- A Bayesian-mixing model (MixSIAR 3.1) was used to determine the partitioning of water from each soil depth to xylem water.

Results

1. Seasonal variation in isotopic composition



- In general, the discrimination of ^2H and ^{18}O in soil water decreased as soil depth, except for April in site 1.
- At site 1, trees used more than 50% of transpiration water from less than 30cm depth in April and November, however, trees increased absorption of water from deeper soil (more than 50cm in depth) in July making more evenly distribution of water absorption.
- However, trees at site 2 had different water absorption patterns, using water from shallow soil in July and November, but using water from deeper soil in July.
- We need further investigation to clarify the species and site specific features.

2. Seasonal variation in proportion of water uptake

