Heterogeneity of Soil Respiration in an Old-Growth Beech-Oak Forest, Central Japan.
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Introduction

Soil respiration (SR) in a forest ecosystem is a large carbon source releasing CO₂ back to atmosphere which depend on environmental factors: soil temperature ($T_s$), soil water content (SWC), etc. Old-growth forest is considered as a climax stage of forest succession. Its unique characteristics are the forest structure explained using an inverse-J shape age and size pattern, and a large gap that may lead to vary microenvironment on the forest floor resulting on varies CO₂ efflux from SR. Therefore, this work aims to study heterogeneity in SR using soda-lime method in 1-ha old-growth beech-oak forest at Ohshirakawa. Many environmental factors relating to SR were also studied.

Study site and Methodology

The study plot was located in more than 350-year-old beech-oak forest at Ohshirakawa, Gifu. A plot of sized 100x100 m² was dominated by Fagus crenata and Quercus mongolica var. crispula. The understory was crowned by dwarf bamboo (Sasa kurilensis).

SR was measured in total 100 chambers using soda lime technique every month during the growing season (June 2012 to November 2012). The algorithm and calculation was assimilated to Keith and Wong¹. Environmental factors including $T_s$, SWC, litter weight, soil compaction (SC), Sasa density and basal area were also observed. Daily $T_s$ and SWC in each chamber during growing season were estimated from data at experiment days and the continuous $T_s$ monitoring in forest.

The relationship between SR rate and environmental factors was tested using Pearman Correlation and Multiple Regression Analysis.

Result and Discussion

SR was positively correlated with $T_s$ (Fig. 1) but negatively related to SWC (Fig. 2) and SC. Multiple regression analysis using stepwise method clarified the relationship as following equations: $SR=0.106T_s+0.026SWC−0.025SC−0.51$ ($R^2=0.232$, N=482). We used this equation to estimate daily SR during growing season (184 days). Total SR ranged from 209.5 to 402.9 g C m⁻² which clearly varied in 1-ha study site (Fig. 3).

Reference