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 CO_2 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 CO_2 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 m^2 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 Wong[1]. 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.

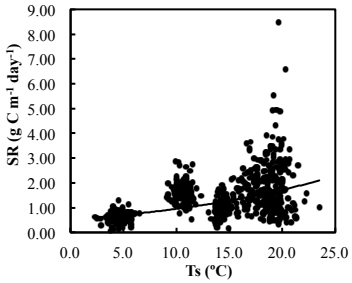

Fig. 1 Positive correlation between SR and T_s.

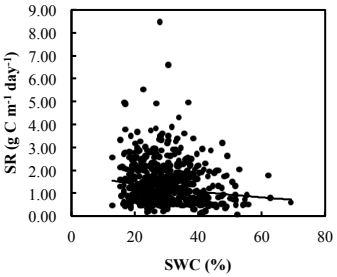

Fig. 2 Negative correlation between SR and SWC.

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).

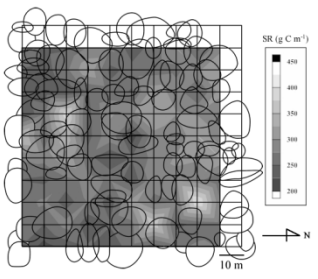

Fig. 3 Variation of total SR during growing season.

Reference

[1]Keith H and Wong SC. 2006. Measurement of soil CO_2 efflux using soda lime absorption: both quantitative and reliable. Soil Biology & Biochemistry 38: 1121-1131.