Seasonal and Spatial Variation of Soil Respiration in a Pacific Northwest Second-Growth Forest
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Introduction

- Forests of the Pacific Northwest store and cycle more biomass carbon per unit area than most other ecosystems. Forests in this region have the capacity to store and cycle more biomass carbon per unit area than most ecosystems. Soil respiration is a large component of ecosystem respiration that largely determines whether or not a given ecosystem acts as a carbon sink or source. More than half of ecosystem respiration comes from soil CO2 efflux, which includes both root respiration and soil microbial respiration.

- Here, we present preliminary analyses of seasonal and spatial trends in soil CO2 efflux in a seven-year data set in the Evergreen State College forest reserve experimental plot network (ECON).

- We address seasonal patterns and potential abiotic (soil temperature and moisture) controls on CO2 efflux.

Methods

- This study was conducted in the Evergreen Ecological Observation Network (ECON; Figure 1), 44 permanent ecological monitoring plots located within the 380 ha Evergreen State College forest reserve in Olympia, Washington.

- Of the 44 plots, 10 have been monitored intensively since 2008, with a new set of 10 intensively monitored plots established in August of 2014.

- Each intensive plot contains four permanent subplots oriented in the cardinal directions, where long-term net soil carbon efflux rates (NCER) were measured.

- Measurements were made during a 7-year period (2008-2014). NCER was measured using an LC Pro+ Infrared Gas Analyzer (ADC BioScientific Ltd., Hoddesdon, UK) every month.

- These data were compiled and analyzed for temporal and spatial trends in soil CO2 efflux in a seven-year data set, and for measurements taken in summer of 2014. All data analyses were conducted using JMP Pro 10 software (SAS Institute 2014).

Results

- Seasonal trends in soil respiration exist in our system, with peaks occurring in summer and continuing through early fall.

- There is variation in average soil respiration between plots where certain plots (e.g., A7, C5) have NCER that is 2-3 higher, potentially due to plant community differences.

- Soil respiration is generally higher at higher soil and air temperatures.

- There was no clear significant relationship between soil CO2 efflux and soil moisture, and soil CO2 efflux was negatively related to monthly average precipitation.

Major Findings

- Researchers at The Evergreen State College continue to collect monthly NCER readings throughout 2014-2015.

- Differences in soil net CO2 efflux rates will be evaluated to determine differences are related to patterns in vegetation diversity.

- Previous work (Kirsch et al. 2012) demonstrated that higher soil CO2 efflux was common when tree diversity was high in the ECON. New plots will be evaluated to see if patterns of diversity predicting NCER continue.

Future Work

- Researchers at The Evergreen State College continue to collect monthly NCER readings throughout 2014-2015.

- Differences in soil net CO2 efflux rates will be evaluated to determine differences are related to patterns in vegetation diversity.

- Previous work (Kirsch et al. 2012) demonstrated that higher soil CO2 efflux was common when tree diversity was high in the ECON. New plots will be evaluated to see if patterns of diversity predicting NCER continue.

References


