Rhizospheric Respiration Response to Fertilization Proposal

Introduction

In the wake of the industrial revolution humans have become drivers of their environment.  One such component of the environment is the soil and to be even more specific, the rhizosphere.  Humans have enhanced atmospheric nitrogen deposition onto land, released aerosols rich in phosphorus, and acidified the soils via acid rain to the point where calcium leaches away in detrimental quantities (Churkina 2009, Juice 2006, Mahowald 2008).  These trends are also not slowing down or reversing themselves and are expected to become exasperated in the future.  How the change in nutrient flow will affect bulk soil and rhizosphere respiration remains uncertain, as isolation of the rhizosphere is rarely done any respiration experiments.

According to the popular resource model of trees and their associated rhizospheric colonies, a tree is given many inaccessible nutrients by the rhizosphere and exudes labile carbon to support their growth and proliferation.  If the tree were to be supplemented with said nutrients via fertilization, then the tree will seize much of its exudence and reduce rhizosphere activity.  Fertilization experiments using ammonium nitrate and phosphorus, and exclusively ammonium nitrate fertilizer have decreased bulk soil respiration, but there is a lack of rhizosphere separation and analysis to determine where in particular these changes are occurring (Burton 2004).  Thus far, research has been done to determine where the changes are occurring along the vertical dimension but respiration along the lines of the rhizosphere and the rest of the soil was done in 2003 a year after fertilization (Bae 2013, Fahey 2007).  It is believed that one year was not long enough for significant results to be observed.

Question

Are the soil respiration changes associated with different nutrient fluxes in the future going to occur in the rhizosphere or elsewhere in the soil?

Hypothesis

If the soil is fertilized with Nitrogen, Phosphorus, or Calcium, then the rhizosphere will exhibit increased microbial respiration and more activity than the surrounding soil.

Method

Soil samples will be collected from each treatment plot at each stand at Bartlett experimental forest, Hubbard Brook experimental forests, and Jeffers brook.  The samples will have approximately 10g of rhizospheric and non-rhizospheric soil analyzed for carbon content via base-trap titration (Stotzky 1965).  The sample will be incubated and retested multiple times over a twenty-eight day time period.

The results will be further analyzed with an ANOVA test for statistical differences between treatment plots and the controls.

References

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