Effects of Temperature and Vegetative Growth on Respiration from an Alkaline Clay Soil in Central Texas

James McCann

St. Edward's University

Austin, Texas

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What is Soil Respiration?

- Efflux of CO2 from soil

Why is Soil Respiration Significant?

- Soil serves as a huge reserve of accumulated carbon
- Soil releases this carbon to the atmosphere in response to several stimuli
  - Infiltration of precipitation
  - Temperature change
  - Vegetative Occupation

Background

- Rise in concentrations of atmospheric CO2 (Taneva, et al,.2006)
- Soil can hold up to 75% of an ecosystem's CO2(IPCC,2001)
- On average 10% of worlds CO2 is passed through the soil each year (Raich and Tufekcioglu, 2000)

Factors Affecting Soil Respiration

- Many factors affect soil respiration (Kirshbaum, 2000)
- Temperature dominant factor affecting soil respiration
- No unanimous agreement on exact correlation (Katterer et al., 1998)
- As daily minimum temperatures increase (Beier, et al.,2004), soil respiration is likely to increase

Factors (continued)

- Vegetation is also a dominant factor affecting soil respiration (Raich and Tufekcioglu, 2000)
- 3 main fluxes: respiration of roots, of rhizosphere microorganisms, and of root free soil (Kelting et al., 1998)
- Each type depends on a different carbon source

Experimental Design

- Soil
  - Greenvine Clay in Fayette County, Texas
  - Thirty-six to forty-two inches deep, pH= 8.5
  - High shrink-swell capacity
  - Ap, Fine-textured A, AC, C1, C2 horizons
- Samples from Rutersville, Texas
  - Included Ap and A horizons
  - 60 samples in pots with/without vegetation

Experimental Design (continued)

- High temperature regime (30°C) for 30 samples, low temperature (20°C) regime for 30 samples
- 30 Samples were vegetated (15 in each temperature regime) and 30 were not
- Soil respiration measured daily by a soil respirometer on a LiCor 6400

Results

- Respiration was significantly (.01 level) higher in vegetated soils compared to those that were not, with means of 5.11 and 4.01 respectively.
- Respiration was significantly (.01 level) higher in soils exposed to higher temperature regime than those exposed to lower temperatures, with means of 5.96 and 3.93 respectively.

Discussion

- Other factors may be of equal or greater importance in soil respiration IN THIS EXPERIMENTAL DESIGN
  - Soil Aeration produced by cracking
  - Changes in CO2 efflux induced by our artificial “rain”events
    - They were artificially regular
    - Water infiltration and percolation were artificially high
- Observations should be and will be taken over a longer period of time

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