

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

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What is Soil Respiration?

- Efflux of CO₂ from soil
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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
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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)
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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
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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
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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
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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
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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.
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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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