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Changes in Soil CO₂ Flux from an Urban Environment Due to Anthropogenic Compaction

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Abstract
Compaction or bulk density of soil affects the release of carbon dioxide from soil. This carbon dioxide is produced as a byproduct of below-ground respiration from organisms such as plant roots, fungi, soil animals, bacteria and decomposers. Soil respiration and decomposition account for nearly 29% of all naturally produced atmospheric carbon dioxide. Worldwide this equates to roughly 220 billion tons of carbon emissions. In order to determine the correlation between anthropogenic soil compaction and soil CO₂ flux, measurements were taken on Bowman Field, an area of Clemson University’s campus known to host multiple large-scale social events each year. The soil CO₂ flux dropped significantly after the conclusion of Homecoming 2014 and showed a slow recovery in the following ten weeks. The average soil CO₂ flux from the field before the Homecoming event was 13.89 µM/m²/second. After the event, this average flux dropped to 2.15 µM/m²/second. These results demonstrate a negative relationship between anthropogenic soil compaction and CO₂ flux in which increased activities that cause compaction result in decreased soil CO₂ flux.

Materials and Methods
- Chose 18 plots using GPS and Total Survey Station
- Scheduled data collection before and after Clemson University Homecoming 2014
- Scheduled data collection in January 2015, after allowing recovery period
- Measured soil permeability using infiltrometer
- Measured soil temperature using temperature probe
- Measured soil moisture percentage using soil moisture probe
- Measured fluxes and maximum values using Li-Cor 6200 chamber design system at all 18 plots in August 2014, November 2014 and January 2015
- Used DAS software and excel to analyze data
- Applied corrections to flux values using Ideal Gas Law
- Measured soil moisture percentage using soil moisture probe
- Measured soil temperature using temperature probe
- Measured soil permeability using infiltrometer
- Measured fluxes and maximum values using Li-Cor 6200 chamber design system at all 18 plots in August 2014, November 2014 and January 2015
- Used DAS software and excel to analyze data
- Applied corrections to flux values using Ideal Gas Law

Results

Conclusions
- Average flux dropped from 13.8989 µM/m²/second to 2.15 µM/m²/second between August and November
- Between November and January average flux remained roughly the same
- Findings coincide with lab-based studies
- Data suggests negative relationship between compaction and soil CO₂ flux
- Results are inconclusive because other factors, including season change, soil temperature, permeability, etc., may have caused this change
- No correlation was found between permeability and soil flux or between peak concentration and flux

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References