Poster #1-5

How Topography and its Effects on Fine Root Production Impact Soil Respiration in the Susquehanna-Shale Hills Critical Zone Observatory

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A crucial component of modeling global carbon is an accurate estimation of carbon flux out of forests systems. Soil respiration, which is primarily comprised of heterotrophic and autotrophic respiration, accounts for a large percentage of carbon flux out of a forest system. Of the known components, plant fine roots are considered a main contributor of soil respiration. Furthermore, soil temperature and soil water content are known to impact fine root metabolic rates as well as soil respiration rates. Previous investigations of soil respiration have not taken into account variations of fine root production across topographic gradients within a landscape. We hypothesized that 1) topography across a catchment would shape soil water conditions influencing fine root production and 2) topographic differences would result in differences in soil respiration rate. To test these hypotheses, we collected and analyzed biweekly minirhizotron images and weekly soil respiration data across four topographic regions in the NSF-funded Susquehanna-Shale Hills Critical Zone Observatory (CZO) in central Pennsylvania. Over part of the 2016 growing season, specifically 5/6/16 to 9/30/16, observations were taken from 50 macroplot sites (10 m diameter) with three soil respiration collars and three minirhizotron tubes nested within each macroplot. Macroplot sites were divided into four topographies, specifically ridge top, mid slope planar, swale, and valley floor. Swales refer to concave as opposed to planar midslope locations. Minirhizotron images were collected with a Bartz minirhizotron camera system (Bartz Technology Corp., Carpinteria, CA, USA) in 1 cm increments to a maximum depth of 113 cm in the soil profile. Root production (number of roots/month) was measured on captured images by tracing root growth in Rootfly v2.0.2 (Wells and Birchfield, Clemson University, SC, USA). Soil respiration ($\mu mol/m^2/s$), volumetric water content (cm^3cm^{-3}) and soil temperature (°C) measurements were taken at each soil collar with a LiCOR 8100 Soil Gas flux system, (LI-COR Biosciences, Lincoln, NE, USA), a Theta Probe model ML2x (Delta-T Devices, Cambridge, UK), and a Taylor 9842 thermometer© respectively. Soil respiration at each topographic location showed a bimodal peak during the growing season. Preliminary analyses suggest that the June peak in respiration was likely caused by fine root production, while the August peak was likely due to soil water and soil temperature. Volumetric water content and soil temperature were not substantially different among topographic locations. Results from this and future analyses will address our hypotheses and improve models of carbon flow through ecosystems at multiple scales.