Soil respiration and soil analysis under American sweetgum (*Liquidambar styraciflua*) as affected by pavement type.

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Placing impermeable pavement around existing trees can cause severe declines in tree growth and health because of reduced water infiltration and soil surface gas exchange. In parking lots, pervious concrete, with better water infiltration and gas permeability, could be a good alternative. The purpose of our study was to test soil respiration, root growth and soil extract chemistry in the root zones of American sweetgum (*Liquidambar styraciflua*) as affected by pavement. The experimental setup consisted of twenty-five sweetgum trees, with root zones covered by standard concrete, pervious concrete or left uncovered (control). Each of the plots was outfitted with access points for taking root growth and soil respiration measurements. Data collected from February 2008 to January 2009 indicated that soil respiration increased with seasonal soil temperatures. We observed tremendous variability in the soil CO₂ efflux rates within treatments. In both concrete treatments the rates of CO₂ efflux were extremely high (up to 350 µmol CO₂ m⁻² s⁻¹) as also in the control (45 µmol CO₂ m⁻² s⁻¹). This was likely an experimental artifact as collar depth (15 cm) may have exceeded the capacity of the equipment. However, rates were often higher for standard concrete than pervious and considerably higher for both concrete treatments than the control. It is likely that the pavement causes a buildup of CO₂ in the root zone, resulting in high values. Soil oxygen for control and pervious plots decreased with increasing volumetric water content (VWC). At field capacity (35% VWC), impervious plots had a lower soil oxygen concentration (7% O₂) than pervious plots (15% O₂) and the control (17% O₂).

Dissolved organic carbon (DOC) and nitrogen (DON) in soil extracts were significantly higher under the pervious concrete than the control at 0-10 and 10-20 cm depths. Soil extract chemistry under the impervious concrete was not significantly different from that under the control or pervious concrete. The addition of Ecodirt had a significant effect on DON (p < 0.05), DOC (p < 0.01) at both depths, on total dissolved nitrogen (TDN) at 10-20 cm depth (p < 0.05) and orthophosphate (p<0.05) at 0-10cm depth. Neither treatment nor Ecodirt had an effect on extractable nitrate, ammonium, or pH at either depth.

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