ABSTRACT: Research on soil respiration is complicated by the fact that CO2 is an end member which carries very little information about its source (isotopic-only). Therefore, partitioning soil respiration into autotrophic and heterotrophic sources often requires methods that are destructive, invasive, and/or expensive. In this study we have proposed to investigate a new method using the flux of volatile organic compounds (VOCs) from the soil as indicators of CO2 source and below ground processes to non-invasively disentangle this multisource signal.

We hypothesize that the composition and quantity of soil VOCs can be used to separate the respiration associated with roots (autotrophic respiration) and soil organic matter mineralization (heterotrophic respiration). We further contend that the contribution of each autotrophic component, including root respiration, microbial mineralization of root litter, and microbial mineralization of root exudates, can be determined using this approach. We have initiated a greenhouse study of soil respiration and VOC efflux where each respiration component is isolated utilizing pots with and without plants, killed plants, and destructive sampling. The impact of tree species, diurnal cycles, and soil moisture regime will be assessed within the boundaries of this greenhouse study. The objectives of the project are to: 1) Determine the VOCs that uniquely indicate each component of soil respiration; 2) Test the effectiveness of this method over a range of soil moisture conditions; 3) Determine if diurnal cycles affect soil respiration and soil VOC efflux; and 4) Determine if VOCs can uniquely indicate below ground root production of biomass. We will show preliminary relationships of the VOC fingerprint and the experimental manipulations of autotrophic and heterotrophic respiration.