**PLANT BREATH:**
**Purposefully Looking At Nice Types of Biological Respiration Everywhere Among Terrestrial Hubbub!**

**Background:** Plants allocate resources in systematic ways. This may be influenced by their photosynthetic pathway (C3, C4, and CAM). Plants evolved different photosynthetic pathways to maximize carbon gain and minimize water loss in unique environments. To understand how these pathways impact plant allocation, we compared variation in root and leaf respiration ($\delta^{13}CO_2$ )values to the bulk $\delta^{13}C$ of these tissues.

**Research Questions:** Does $\delta^{13}CO_2$ respiration in leaf vs. root plant tissue differ from bulk $\delta^{13}C$ composition? Do photosynthetic pathways influence this relationship?

**Hypothesis:** Leaf respiration ($CO_2$) will be less enriched in $\delta^{13}C$ than bulk leaf tissue because lighter CO2 will preferentially be incorporated into tissues, leaving heavier CO2 to be respired.

**Methods:**
We bought the following potted plants from Forty Second Street Greenhouse: C3 plant- tomato (*Solanum lycopersicum*), C4 plant- corn (*Zea mays*), and CAM plant- molded wax agave (*Echeveria agavoides*). We sampled roots and leaves from each plant and used a vacuum extraction system (developed by Dave Bowling) and infrared gas analyzer (IRGA) to monitor and collect ambient and respired $CO_2$ from these tissues. We then measured $\delta^{13}C$ and [$CO_2$] (ppm) using a custom valve manifold connected to a continuous flow IRMS.

**Results:**

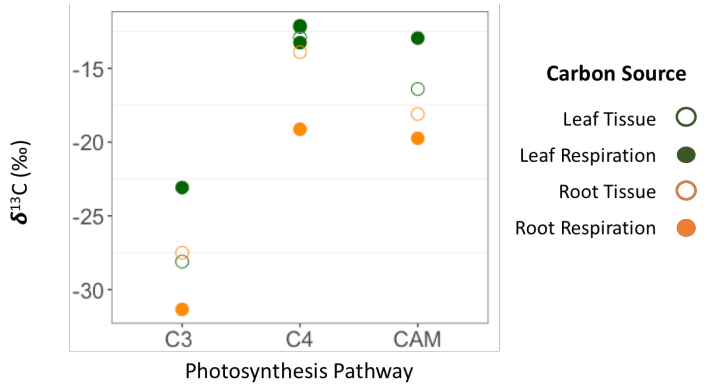



**Figure 1.** Leaf respiration is more enriched in $^{13}C$ than root respiration, as expected. Biomass is more similar amongst leaf and root tissues than respiration is.

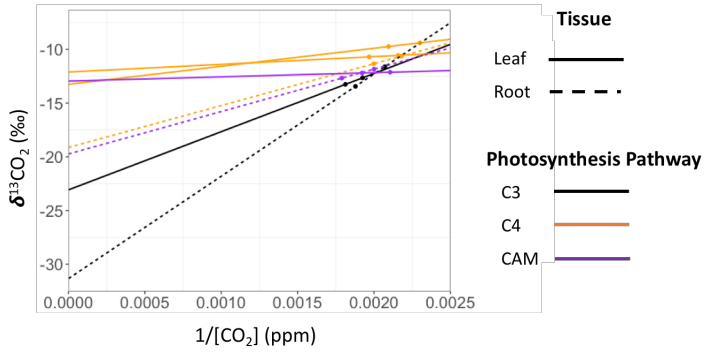



**Figure 2.** Keeling plot for leaf and root respiration modeling respired $\delta^{13}CO_2$ ($C_R$) as a function of background $\delta^{13}CO_2$ ($C_B$) and measured $\delta^{13}CO_2$ ($C_m$) : $\delta_m=(\delta_B C_B-\delta_R C_B)*(1/C_m)+\delta_R$

**ISOPOPE:**
**I**nspired by **S**oil **O**rganisms **P**riming **O**rganic **P**articles **E**xperiment

**Background:** Soil respiration is an important component of the global C cycle. The availability and quality of organic matter in soil regulates C respiration rates mediated by microbes by either increasing or decreasing mineralization rates (Dilly and Zyakun, 2008). This is defined as the *priming effect*. Identifying $\delta^{13}C_{resp}$ helps us understand relative contributions of C via different processes or ecological compartments.

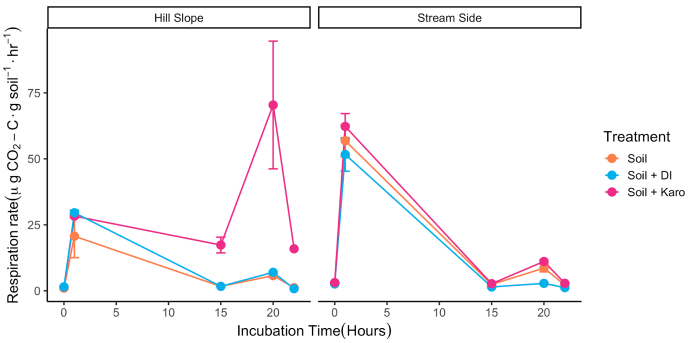
**Research Question:** How do soils with contrasting amounts of organic carbon and water content respond to sugar priming?

**Hypothesis:** Respiration rates and priming effects will differ between our two soil types.

**Methods:**
Surface soils (0-10cm) were collected City Creek Canyon (Salt Lake City, UT) adjacent to City Creek and upslope. Soils were stored in 12 mL vials according to three treatments: control, DI water, DI water + corn syrup. $CO_2$ mol fraction taken across 5 time points was used to calculate respiration rate. Respired gas for $\delta^{13}C$ analysis was also removed from one vial for each treatment at three time points. The fraction and flux of $CO_2$ from sugar and soil substrate in the sugar vials were calculated and compared to the DI treatment to obtain the priming effect.

**Results:**

1) *Respiration rates*: Hill slope soils exhibited higher respiration rates for the sugar primed treatment compared to the non-primed soils. The decrease in hill slope soil respiration for the sugar primed treatment may indicate consumption of C sources. Stream side soils overall decreased respiration rates across all treatment types.




2) *C Fraction*: The fraction of $CO_2$ respired from Karo increased through time for both soil types and was overall higher for streamside soils.

3) *Priming:* There was a higher priming effect in hillslope soils overall. Both streamside and hillslope soils showed maximum priming effect after 20 hours of incubation.