

SOIL CO₂ FLUX SAMPLING INSTRUCTIONS

Field Guide

OVERVIEW

- In the exercise, students will use the Soda Lime Method to measure soil respiration (CO₂ flux). This method is a common and simple way of measuring soil respiration because soda lime absorbs carbon dioxide from the air.
- Soda lime is made from sodium hydroxide (NaOH) and calcium hydroxide (Ca(OH)₂). When soda lime absorbs CO₂, two chemical reactions take place, both of which absorb water:
$$2\text{NaOH (s)} + \text{CO}_2 \text{ (g)} \leftrightarrow \text{Na}_2\text{CO}_3 \text{ (s)} + \text{H}_2\text{O (ads)} [1]$$
$$\text{Ca(OH)}_2 \text{ (s)} + \text{CO}_2 \text{ (g)} \leftrightarrow \text{CaCO}_3 \text{ (s)} + \text{H}_2\text{O (ads)} [2]$$
- In the Soda Lime Method, a mini-atmosphere is created by placing a bucket facedown over a pre-weighed jar containing soda lime (Figure 1). As roots and microorganisms in the soil respire, CO₂ is released into this mini-atmosphere, or chamber, and CO₂ is then absorbed by the soda lime.
- Over the sampling period, the amount of CO₂ released from soils can be measured by comparing the initial starting weight of the soda lime to the final weight. The soda lime gains weight as it absorbs CO₂.
- There are four “base traps” of soda lime placed at the sampling site. Three of the traps are left open to absorb CO₂ over the sampling period. A fourth “blank” base trap stays closed and acts as a control to account for any CO₂ absorbed during sample preparation and transportation.

PURPOSE

- Soil respiration, or soil CO₂ flux, represents the activities of roots and soil organisms. Like other biological processes, soil respiration tends to be faster at higher temperatures and when more liquid water is available. Soil respiration can also differ between land uses like forests and fields given differences in nutrients and leaf litter.

MATERIALS

- Soda lime (~ 400 grams per jar)
- Half gallon mason jars plus lids (four total)
- Labeling tape and permanent marker
- Five-gallon buckets (four total)
- Risers for keeping jars off of the soil surface
- Soil hand tools (trowel, serrated knife for installing buckets)
- Scale
- Drying oven
- Deionized water (~600 ml)
- Graduated cylinder
- Calculator
- Pen/pencil
- Notebook



Figure 1: Shows the bucket being placed over the jar to create a mini atmosphere.

* Drying and weighing of the soda lime can occur offsite if the proper lab facilities are not in place*

