

## **CO<sub>2</sub> flux chamber measurement**

### **Measurement principle**

The study plot (a miniature ecosystem) is sealed in an airtight plexiglass chamber. An infrared analyzer, like EGM-4, measures CO<sub>2</sub> concentration in the chamber air continuously for about two minutes. From the CO<sub>2</sub> concentration change, flux per unit time is calculated. Net CO<sub>2</sub> flux is measured in light and in dark. The dark measurement is an estimate of ecosystem respiration (Reco). Gross photosynthesis (PG) is the difference between the light measurement (Net ecosystem exchange NEE) and the dark measurement.

$$NEE = PG + Reco$$

Fluxes into the ecosystem are considered to be positive (PG) and fluxes out of ecosystem negative (Reco).

### **Equipment needed:**

- Chamber with a cooling system
- EGM-4 with PAR sensor
- EGM air inlet tube, tube for connection to chamber
- Large 12 V battery for the cooler (+ a spare battery)
- Spare battery for the EGM
- Soil thermometer
- Stopwatch
- Writing-tablet
- Empty forms: one for each study plot
- Ice and icebox
- Bucket of water for filling the collar grooves
- Measuring rule (metr)
  
- Shades + 4 poles and drawing pins
- Opaque hood for dark measurements

### **Before the measurement:**

- Fill the collar groove with water
- Assemble the chamber measurement system:
  - Connect PAR-sensor wire to EGM
  - Put the inlet tube with filter on the EGM inlet
  - Turn on EGM
  - Put the cooling spiral to the box with ice
  - Connect the long tube to the chamber
  - Turn the cooler on by connecting battery to cooling system

### **Measurement:**

- Write down in the form date, time, study site and study plot
- Put the chamber in the collar groove and make sure that the edge is in the water (=chamber is airtight)
- Sit down on the ice box with the good view to EGM display

- Connect the longer tube from chamber to the EGM inlet tube
- Start the cooling system (if it necessary) by the bottom on the thermostat
- Check the concentration of CO<sub>2</sub>
- First do **light measurements**, start with the natural light level
  - EGM shows CO<sub>2</sub> concentration and PAR value, cooler shows chamber temperature
  - Write down CO<sub>2</sub> concentration, PAR value and chamber temperature every 15 seconds until you have at least 5-8 consecutive values. During the measurement, PAR should not change much. CO<sub>2</sub> concentration should change constantly and regularly.
  - After the measurement, air the chamber by lifting it up from the collar groove. Check that chamber CO<sub>2</sub> concentration returns near the ambient level.
  - Repeat the measurement with up to 3 different PAR levels. Use the shadows.
- Last in the series is the **dark measurement**:
  - Air the chamber after the last light measurement and put it back into the collar groove. Cover the chamber carefully with the opaque hood.
  - Let the plants adapt to the dark until CO<sub>2</sub> concentration starts to rise.
  - Write down CO<sub>2</sub> concentration and chamber temperature every 15 seconds until you have at least 5-8 consecutive values. CO<sub>2</sub> concentration should change constantly and regularly.
- Write down in the form water level and ground temperatures in the study plot. Check that the form is entirely filled out.
- Repeat the whole procedure for every study plot.

**Notice:**

**Never expose EGM to water!** Make sure that EGM air inlet tube doesn't detach itself from the chamber and fall into the water. If you suspect that there might be moisture in the tube, change it.