

## LAB 5- INSTANTANEOUS ORGANIC MATTER BUDGET- PART I: FIELD COLLECTION

6 March 2008

Exercise due: 27 March 2008

The purposes of today's lab are (1) to construct an instantaneous organic matter budget- that is, to conduct a thorough accounting of the pools of organic matter in a stream reach over a very brief period of time, and (2) to have a chance to get out and look around in an actual stream instead of talking about it in the lab. Normally, organic matter budgets emphasize fluxes: the movement of organic matter into and out of the ecosystem. However, this comprehensive approach is not feasible in an afternoon, so we will measure a few fluxes and many pools of organic matter in a reach of Black Earth Creek.

You will be working in 4 groups of 6 to make basic measurements and sample organic matter pools for your "ecosystem," which will be a ~20 m reach of the stream. The very first thing to be done by each group will be to collect water samples so that everyone can get a good, clean sample before everyone gets into the stream and stirs things up.

### A. Water Column Sampling

1. Each group needs to collect 3 1-L water samples from the upstream end of their study reach. To minimize contamination, we will observe the stream ecology tradition of working in a downstream-to-upstream direction. The most downstream group will collect their samples first, followed by the group in the reach immediately upstream.
2. To collect samples: Before filling a bottle, **make sure the bottle is clearly labeled** (date, group ID, site). Fill the bottle ~ ¼ to ½ full, cap, shake and discard to rinse your container. Repeat for a total of 3 rinses per bottle. Collect samples at ¼, ½, and ¾ points across the channel. Fill bottles all the way and make sure the lid is on tight. It's best to screw the lid on while the bottle is submerged to eliminate air bubbles from your sample. Place bottles into a cooler. Water samples will be filtered upon return to the lab and analyzed for particulate and dissolved organic carbon.

### B. Measuring Discharge (Q)

Note: when referring to the left or right bank of a channel, the disciplinary convention is that left and right are based on one's perspective when looking downstream. Calculations are described below for discharge, but we don't expect you to do them in the field. **\*\*Please note\*\*** Current meters are VERY expensive. Handle them with care, and keep the reading end of the unit well secured and dry! Use the straps, even if you think it looks dorky.

1. Establish a transect across the channel, ideally in a location with relatively constant depth (i.e., an even stream bed surface) and away from curves. Stretch a meter tape across the channel so that the person in the channel making depth and velocity measurements can note his/her lateral position.

2. Divide the transect into at least 10 sections or cells of equal width. As a general rule, when measuring discharge, cells should be no wider than 3 m. Record the total channel width and the depth at the center point of each cell. (Hint: add  $\frac{1}{2}$  the cell width for the 1<sup>st</sup> measurement and then add the cell width to each one to get the midpoint of each cell)
3. Measure velocity in the middle of each cell. If depth ( $z$ ) is less than 0.6 m, then measure velocity ( $v$ ) at a height of 40% from the bottom (e.g., if  $z = 0.5$  m, then measure  $v$  at 0.2 m). If  $z$  is greater than 0.6 m, then measure  $z$  at 20% and 80% depths and use the average of these two velocities for your calculations. If there are large obstructions (big rocks, wood, etc.), measure  $v$  at 20, 40, and 80%, and calculate an average velocity ( $v_{avg}$ ) for that cell as:

$$v_{avg} = 0.25(v_{20\%} + v_{80\%} + 2v_{40\%})$$

4. Calculate  $Q$  for each cell  $n$  as:

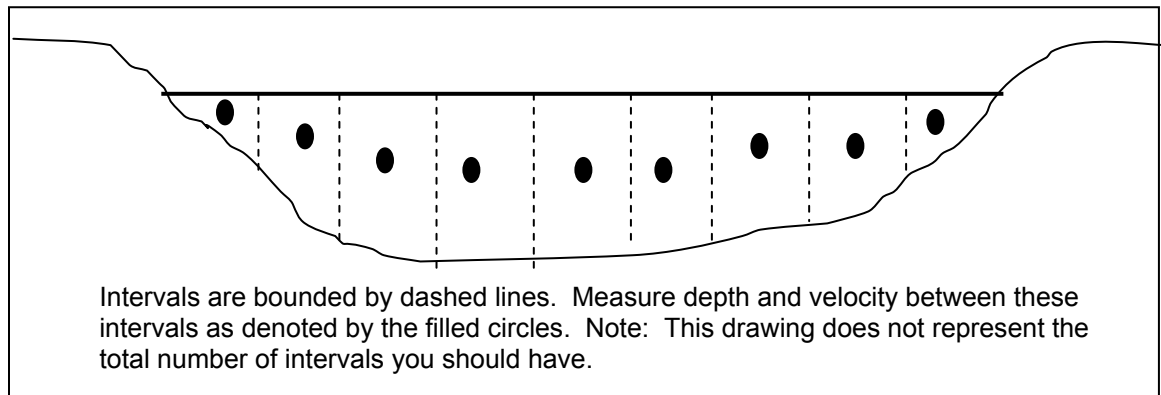
$$Q_{stream} = \sum_1^n w * d_n * v_n$$

Where:

$w$  = width of cells

$d$  = depth of cell  $n$  at the cell's midpoint

$v$  =  $v_{avg}$  for cell  $n$



If time allows,  $Q$  should be measured at both the upstream and downstream end of the reach. Be sure to let someone else measure velocities and depths the second time around.

### C. Reach Surface Area, Volume

In this exercise, each group needs to make the measurements needed to determine how big their reach is and what sort of organic matter pools are present. Data from these measurements will be used to later determine estimates of the amount of organic matter present in the reach.

1. Establish transect markers every 1m along the length of your channel and label your flag with the meter distance (e.g., 15 m). Using the field random number generator without replacement (numbers picked from a bag), select 5 random transects to measure channel cross-sectional area.
2. For each transect, record channel width and measure water depth at 5 or more evenly spaced intervals (every 1-2 m).

*\*\*Note: every person in the group should run at least one transect- either for discharge or cross-sectional area.*

3. Using graph paper, transect measurements of width, and any additional measurements that might be needed, draw a planform map of your study reach. Try to be as accurate and neat as possible.
4. Note/sketch locations of major structures (logs, point bars, etc.) and channel features (e.g., if there are extensive macrophyte beds). Look around and make some notes about your reach, the stream, the riparian environment, and the study area surrounding the stream. This information will likely be useful next week when writing up the report.

#### **D. Benthic Organic Matter Sampling**

In this exercise, each group will make measurements of the different organic matter pools present in their study (i.e., CPOM and FBOM). Noah will demonstrate the basic technique for this exercise.

1. Select 5 random  $x$  and  $y$  coordinates (with replacement) using the field random number generator (e.g., 11 m, 2/5 channel width). Record your sample locations and label at least 1 bag and bottle with location and group information. You may need to label more bags but that can be done while collecting samples.
2. Go to your 1<sup>st</sup> sample location and insert the OM sampling bucket into the sediment 5-10 cm. Measure and record the water depth in the bucket at 5 locations within the bucket to account for un-evenness in the benthic surface (3 across and 1 at the top and bottom; pattern should form + sign). Next, collect all CPOM on the benthic surface inside the bucket by grabbing at the big chunks with your hand and place in clearly labeled bags. After all the CPOM has been collected, stir the sediment to a depth of approximately 5cm and, while continually stirring the water, (in order to keep the sediment suspended) fill a FBOM sample container (250-mL bottle) through a 1 mm mesh screen (we will address how to analyze this at a later).
3. Repeat for each sample location and put all of your replicates into a larger bag to keep them all together. These samples will be frozen for processing next week.

## E. Upon Return to the Lab

When we get back to the lab, a few things must be done before the lab is complete.

1. First and most importantly, we need to unload the gear (note that some items are to remain in the truck- one of the current meters, some of the boots).
2. Sample processing: Double check to be sure that all of your baggies and bottles are clearly labeled and completely closed. Put these benthic organic matter samples into the freezer for later processing.
3. Water samples: All three samples need to be filtered, and both the filter and some of the filtrate (the water) need to be kept.

### 1 L water bottles

- a) Label the bottom of 3 aluminum pans with the date, group name, sample ID. Use a ballpoint pen to write the labels. Collect 3 clean DOC vials with your group ID on the label.
- b) Invert your bottle several times, then remove 40 mL with a syringe (or measure out this volume using a graduated cylinder) and filter the sample into a glass tube for your DOC sample using a GF/F filter. Transfer filtrate into your pre-labeled DOC vial and put the 3 samples on the front lab bench for analysis when you're done. (Note- 1 filter and 1 tube can be used for all 3 samples.)
- c) Remove the GF/F filter. Noah will give each group 3 pre-weighed filters in aluminum pans (do not use these pans). Record the weight of each filter *and* write the filter weight on the bottom of the small aluminum pan you labeled in step (a).
- d) Determine the volume of water remaining in your 1-L bottle with a graduated cylinder and record the volume. Then filter water through the pre-weighed filter- 1 filter per sample. When you're done, make sure there are no particles left behind. Use a squirt bottle filled with deionized water to rinse the inner surfaces of the 1-L bottle and the graduated cylinder and filter this rinse water.
- e) When the entire sample has been filtered, dismantle the filtration apparatus and transfer the filter into your labeled pan. Be sure to keep the side with the particulate OM up! Determine
- f) The filtered water gets discarded. Repeat this procedure for the two other replicate water samples.

### FBOM Bottles

- g) Next you will need to filter your FBOM samples onto pre-weighed filters as above. You will use a separate filter for each sample. Aggressively shake your sample and immediately dump a small amount of the slurry onto the filter (you have to be careful not to dump too much or you will clog the filter) and repeat until the filter is clogged. Remove the filter and place into a labeled aluminum

- pan. Determine the volume of water filtered using a graduated cylinder and record both the sample volume and the filter weight.
- h) After determining the volume of water you filtered, the sample can be discarded. Repeat this procedure for the four other replicate water samples.
  - i) Loosely cover all pans from both sets of water samples with aluminum foil and place in the drying oven.
4. Data sheets: before you leave, make sure that your data sheets are complete and make sense. Have each group member look over the data to make sure it is understandable to everyone. Keep in mind that what seems obvious today may make no sense in a week's time, so be as clear as possible. You will be responsible for your data sheets and data until next week. Consider making a copy as a back up to be held by a couple of different people in the group.
  5. For next week- Some follow-up processing will be need to be completed in the hour after the test. Bring your data sheets!

## **F. Lab Report**

Lab reports are to be done as a group report and should contain the following information:

1. Very brief statement of the overall purpose/accomplishment of the exercise
2. Methods section. Be sure to provide clear descriptions of any modifications your group made.
3. Results:
  - Site characteristics: Length, average width, surface area, volume, discharge
  - Organic matter pools: what pools were present, percent cover of benthic pools
  - Organic matter content of each pool
  - Budget: calculate the total organic matter content of each pool for your reach and for your entire reach
4. Additional questions
  - What is the biggest organic matter pool in your reach?
  - For the water column, how much dissolved and particulate matter are moving into or out of your reach per unit time? (what is the OM flux?)
  - What estimate of the OM budget do you think is most unreliable and why?