LTER Streams Methods
Bryophyte Point Transect Sampling
Breck Bowden, University of Vermont
Modified from Bowden et al. (2006) Macrophytes and Bryophytes. In: Hauer and Lambertti (eds). Methods in Stream Ecology, 2nd Edition. Academic Press.

Introduction

Cover or *abundance* is one way to address how commonly macrophytes and bryophytes (or individual species of either group) occur in streams. Most of the wide variety of techniques commonly used for this purpose in terrestrial vegetation analyses can be used in streams with only minor modifications (e.g., Kent and Coker 1995). Approaches that rely on visual cover estimation (e.g., plot assessments) or quantitative cover measurement (e.g., point transects) are useful, quick, and inexpensive.

Visual cover estimations derive from an approach developed by the phytosociologist Josias Braun-Blanquet (1932). The core of this approach is a classification system based on the estimated (visual) abundance of a species in a defined area (Fig. 18.2 and Table 18.2). Other classifications with other intervals have been proposed, but the approach is similar. Due to the subjective nature of this approach it is best that one person does all of the visual plot assessments. An alternative is to have two or more observers simultaneously estimate the visual cover of a species and then 'negotiate' an agreed value to record. When multiple people are involved in the study, but do their assessments separately, it is essential to inter-calibrate the individual assessments for some (5-10%) of the observed plots.

An alternative approach is to estimate cover and abundance from 'point transects', which is a modification of the point frame method used in terrestrial vegetation analysis. In this method, the type of cover observed beneath specific points spaced at regular intervals is recorded (Fig. 18.2). The spacing of the intervals depends on the size of the stream, but intervals of 5 to 50 cm are appropriate for streams from a few meters to 20 m wide (or streams too deep to wade). The number of times that a particular cover type (e.g., a macrophyte or bryophyte species) is 'hit' is used as an estimate of cover, as described in the detailed methods below. The point transect method can be modified easily to accommodate as many characteristics as you wish. Thus, the same approach can be used simultaneously to estimate cover by species, percentage of flowering versus non-flowering individuals, substrate quality, or any other characteristic that can be identified at a short distance. By simply changing the orientation and sampling interval, this approach can be used for intensive, site-specific characterizations or for extensive, longitudinal characterizations of streams.

A plot-based approach increases the chance that you will include rare species in the assessment, as a larger area is surveyed and large areas have more species than small areas. On the other hand, making plot observations takes more time and so normally, fewer plot observations can be made compared to point measurements.

Field Equipment – General Comments

The equipment required to make the field measurements described here is relatively simple (see below). One or two items will be particularly useful and can be constructed from materials that can be obtained easily from local suppliers. For both the visual estimation and quantitative point transect approaches to define cover or abundance, a *view scope* will be a useful aid to clearly see the bottom through the surface of the stream. A view scope is simply an opaque box or tube, open on the top and with a clear bottom. A view scope can be purchased from recreational fishing supply stores or can be constructed from a short (25 cm long) section of wide (25 cm diameter) PVC pipe that has a piece of Plexiglas sealed on the bottom. Never use glass or other easily breakable materials. Some sort of handle fixed to the

PVC tube will make it easier to hold the view scope steady in the stream. If the point transect method will be used, it is helpful to affix a small dot to the center of the view scope bottom to act as sighting target.

Field gear

- 50-m field tape
- view scope
- tennis shoes for wading (felt bottom boots are better)
- waders (if the water is cold)
- notebooks, pencils (not pens), indelible marker
- field identification books (optional)
- hand lens (optional)

Basic Method

1. The LTER sampling locations have already been established (Fig. 1). There are at least three sites in each of the treatment reaches, as follows:

    a. RERERENCE: 0, 0.33, 0.5 km
    b. RECOVERY: 1.00, 1.10, 1.15 km
    c. FERTILIZED: 1.95, 2.06, 4, 5.5 (or 6) km.

2. At each site, one person (the 'caller') wades the stream with the viewscope. Attach the free end of the field tape to one handle of the viewscope. The other person (the 'recorder') plays the tape out at 20cm intervals and simultaneously records the 'hit' identified by the caller. (Alternatively you can stretch a field tape across the stream to define a transect and use the view scope to move along the tape at regular intervals to identify the species beneath the target dot on the view scope. However, in wider reaches the tape sags and gets caught in the stream flow.)

    a. Record the date, the start time (HH:MM), the site name, the interval (20cm for all sites in the Kuparuk), the direction of movement (TR>TL or TL>TR), and the relative location of the transect above the immediate previous transect (e.g. +5m or +4 m).

    b. Do not 'search' for a plant. Rather, record whatever you first see under the target dot. Include 'bare' or 'unvegetated' as one of your categories.

    c. Resist the temptation to record 'mixed' scores (i.e., always record the dominant cover).

    d. Develop a simple alphanumeric key so that you can efficiently record species without having to write down a lengthy name. It is most efficient if two people work in the field as a team, with one person moving across the stream calling out the observed cover types and one person on the shore to record the observations.

    e. Record the 'hit' codes in a Rite 'n Rain field book in columns. Start recording down the page then jump up and to the right, going down a new column until the transect is completed.

    f. At each site, do a minimum of 5 (five) transects across the stream, spaced evenly along the riffle. A spacing of 4-5 m works well for most sites.

3. Note that if most sites are on the order of 20 m wide, a 20 cm interval along transects will produce 100 points per transect and 500 points for a site with 5 transects. This is a desirable sampling density.

4. The point observations must be converted to percent cover (C%), as follows:

$$C\% = (N_i / N_t) * 100$$

where N_i is the number of observed points that match the class type i (hits) and N_t is the total number of points observed. We use an Excel spreadsheet to organize and automatically analyze the data.

Example summary of point transect data from a single station in the Kuparuk River, Alaska (2003). In this case, 8 observable classes were categorized. At an interval of 20 cm along 5 transects across the river, the dominant class of cover on the river bottom was selected from among these 8 classes. This table is a summary of the number of times each class was observed ('hit') in each transect (top panel) and the percent of total 'hits' in each transect represented by each class (bottom panel). The width of each transect is simply the total number of hits per transect, times the observation interval (20 cm in this case). In the suggested protocols, this data would represent a single data point (the mean value) for each class in one reach. At least three similar data points (transect sets) should be collected for each reach type in the study. Verify that the cover of epilithic diatoms (microalgae on top of rocks) is similar to that of Hygrohypnum spp. at 47% and 44%, respectively and that Schistidium is absent from this station.

	Number of 'hits' per class by transect				
	Transect number				
Class	1	2	3	4	5
Epilithic diatoms	38	49	33	24	24
Filamentous algae A	0	0	4	0	0
Filamentous algae B	0	0	0	0	0
Filamentous algae C	0	0	0	2	0
Hygrohypnum	28	22	27	32	41
Schistidium	0	0	0	0	0
Detritus	1	9	11	0	0
Unknown	2	2	1	2	0
Total 'hits' per transect	69	82	76	60	65
Width (m)	13.8	16.4	15.2	12.0	13.0

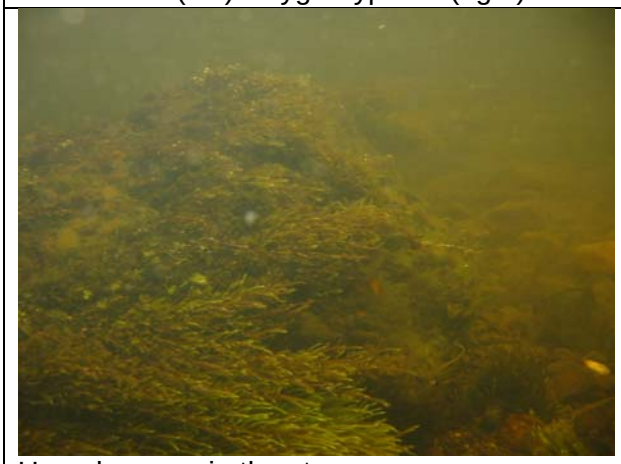
	Percent 'hits' per class by transect total				
	Transect number				
Class	1	2	3	4	5
Epilithic diatoms	55%	60%	43%	40%	37%
Filamentous algae A	0%	0%	5%	0%	0%
Filamentous algae B	0%	0%	0%	0%	0%
Filamentous algae C	0%	0%	0%	3%	0%
Hygrohypnum	41%	27%	36%	53%	63%
Schistidium	0%	0%	0%	0%	0%
Detritus	1%	11%	14%	0%	0%
Unknown	3%	2%	1%	3%	0%
Sum	100%	100%	100%	100%	100%

Moss point transect locations as surveyed by Breck Bowden (June 2007). See associated Google Earth KMZ file for GPS locations.

Useful photos

Schistidium (left). Hygrohypnum (right)

Lemanea under the viewscope



Hygrohypnum in the stream

Hygrohypnum in very low water

Upstream	Across	Downstream
5.5km		
4km 		
2km		
1.95km 		
1.15km 		
1.10km 		

1.00km 		
0.5km 		
0.3km 		
0km