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The Amazon region has the largest drainage basin in the world, about 7,000,000km². It consists of a wide variety of different water bodies, not just large rivers and lakes, but also numerous streams that make up one of the densest water networks in the world. Aside from the larger white water rivers, whose sources are in the Andean mountains, many Amazonian rivers are an accumulation of the small streams that drain the forest producing acidic water rich in humic and fulvic acids and low in nutrients. Despite this these waters contain a rich and diverse fauna closely interconnected with the forest margins.

These forest streams occur in a wide range of climates, topographies, vegetation types and biogeographical combinations.

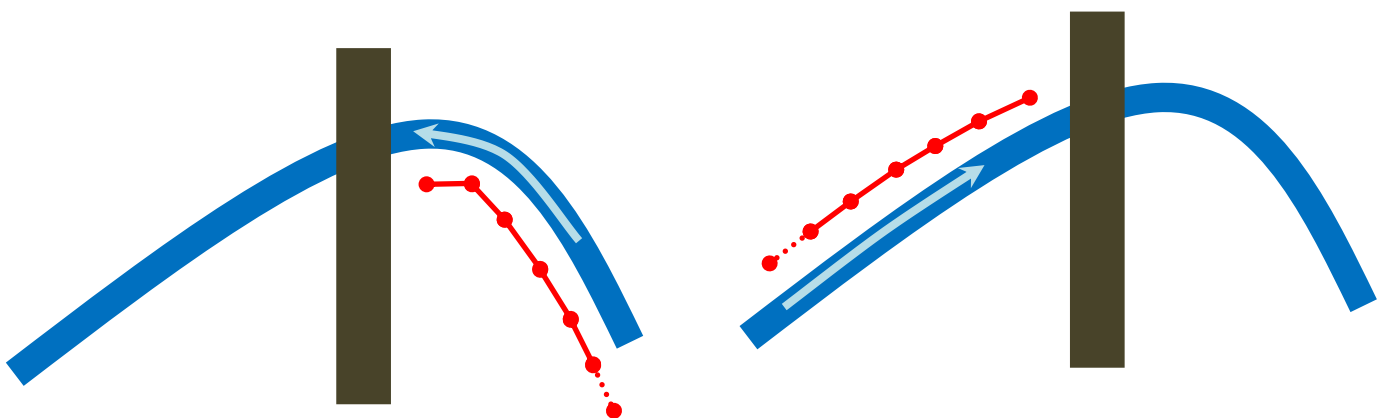
Plots installed along the edge of watercourses were designed to study the riparian vegetation and species that are not aquatic, but still closely associated with watercourses (eg frogs, snakes, alligators, turtles, etc.). Although his protocol was developed for streams in the Amazon basin, it can be easily be extended to other regions.

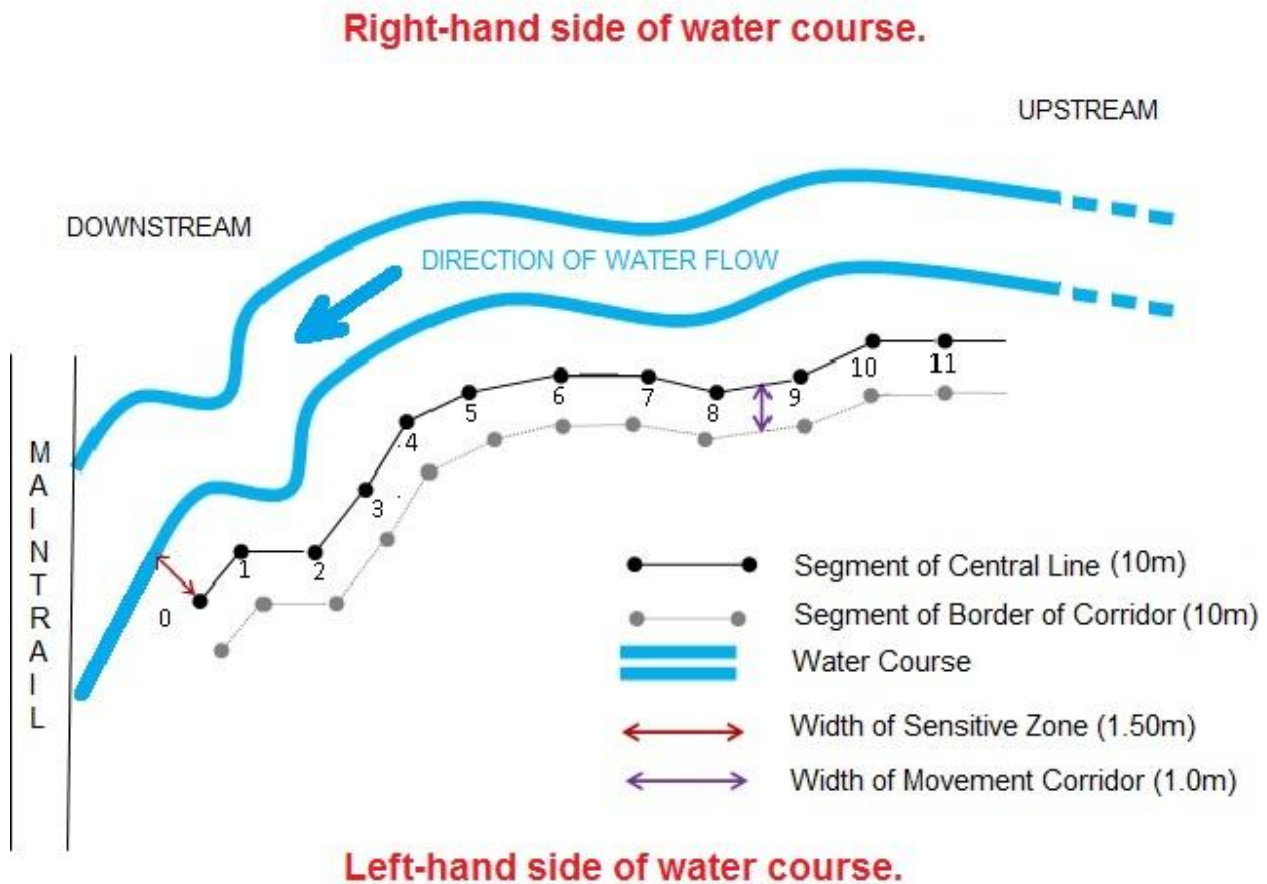
Where should these survey plots be installed?

A riparian plots is installed on the left bank of a (small) streams where the stream crosses a main grid or module trail. The first picket is located 10m from this point in order to avoid the effect of any disturbance to the survey caused by proximity to the trail. The riparian survey plot is 250m long and follows the left-hand side of the stream. The left-hand is determined by looking downstream.

The width of the area to be surveyed will depend on the width of the valley and/or the organism or environmental variable being studied. For example, soil fungi, are surveyed in plots 25 cm wide, and big trees (over 30 cm in diameter), in 40m wide plots.

The riparian plot will be located on the right or left-hand side of the trail according to the direction in which the stream is flowing.





esquema MAFreitas

Figura 1. Schematic of the first 110m of a riparian plot following the left-hand side of a stream with 10m straight segments. Esquema: MAFreitas.

To avoid trampling on the bank of the stream and damaging organisms or kicking soil into the water, there is a 1.50m sensitive zone between the 1m wide corridor and the water course.

How to install the survey plot.

The centerline of a riparian plot should be installed using at least two people.

The equipment list is as follows:

- ✓ 10m measuring tape;
- ✓ 1.5m graduated aluminium rod;
- ✓ A small flashlight with a focused beam;

- ✓ Plastic string or twine (nylon 48);
- ✓ ½ inch PVC pipes (50 cm long);
- ✓ aluminium tags;
- ✓ plastic coated wire to attach the tags;
- ✓ GPS for geo-referencing;
- ✓ Batteries;
- ✓ Camera;
- ✓ Compass for taking bearings;
- ✓ Clinometer for measuring the slope in the segments;
- ✓ Clipboard, pencil, eraser;
- ✓ Worksheets for the data and metadata to be recorded;
- ✓ Materials for protecting equipment and personnel when it rains.

The plot commences 10m from the main trail. Insert 20cm of a 50cm PVC pipe into the ground and tie a tag to identify the plot. The picket is located 1.50m from the water`s edge.

The tag should include sufficient information to identify the site; i.e. the module, the main trail, the type of plot (riparian in this case), the name of the plot and the distance along the survey plot.

The name of the plot is its distance along the trail and is taken from the nearest distance marker on the trail.

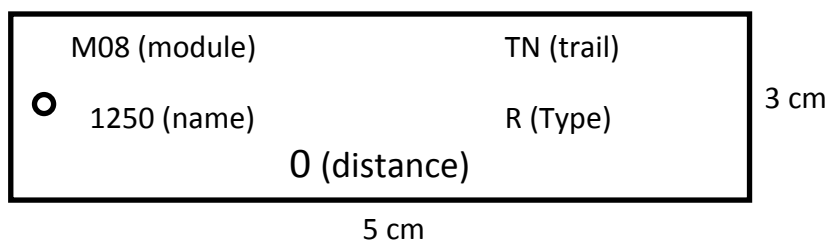


Figura 2 – A tag for the the first picket on a riparian survey plot.

Note that this is the first picket and contains the full information for the plot, the rest of the pickets just need to be sequentially numbered every 10m for a total distance of 250m.

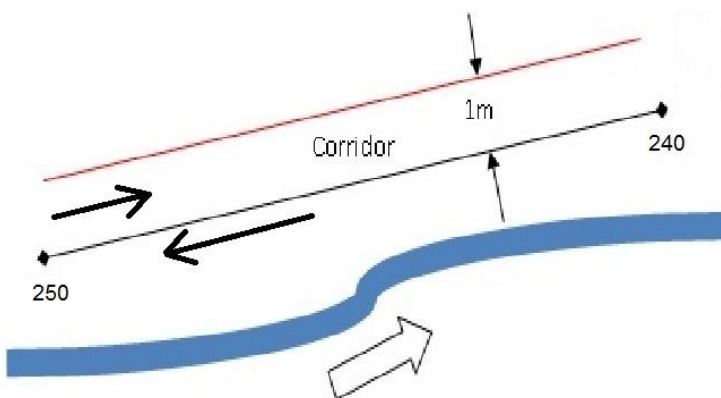
After georeferencing the first picket, a team-member takes the tape for 10m alongside the water course maintaining a distance of at least 1.50m. The second picket has a tag tied on to it with the number 1 (or 10).

The bearing from the first to second picket is recorded so that the plot can be mapped out and the survey area calculated. Remember to avoid taking bearing in close proximity to metal equipment that may affect the compass.

The slope of the plot is measured with a clinometer every 0, 50, 100, 150, 200 and 250m

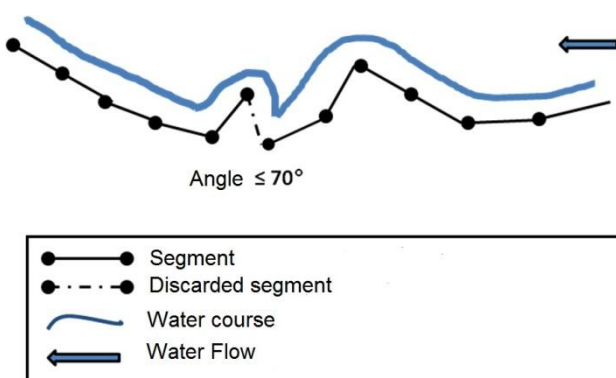
The process continues for a distance of 250m and all the pickets are connected together by nylon string.

Next, clear a 1m wide corridor so that people can move along the length of the survey plot more easily. This corridor is located to the right of the center line when you turn to face the start after finishing the centre-line. All vegetation less than 1 cm in diameter should be cut down to ground level, laid flat and left in the corridor, except for large palm tree leaves which have to be taken out of the way. Never cut lianas, epiphytes, hemi-epiphytes or roots.



When to discard a segment.

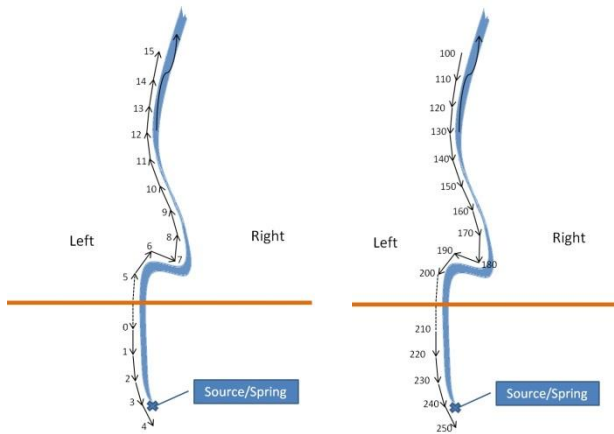
When the angle between two pickets is less than to equal to 70° .



Some survey plots extend 20m to either side of the central line. When the angle between two segments is small, the amount of overlapping becomes unacceptable. For this reason the second of the two segments is discarded and replaced with an extra segment at the end of the survey plot.

Figure 3 – A meander in the stream creates an angle in the central line of less than 70°. The second segment of the angle is discarded.

- Truncated Plots



Heading 250m upstream may occasionally lead you the source. If this happens, the plot has to be completed on the other side of the main trail and the pickets renumbered accordingly.

Note that segments that include the main trail should be discarded and replaced at the **beginning** of the plot and the pickets renumbered.

Remember to record all changes on the metadata worksheet.

- Special Locations

Floods, heavy rain, frequent fires, steep or rocky terrain; these conditions may require alternative strategies for marking out and labeling the plots. For example: long, metal pickets if the soil is very soft, or, where the ground is very hard, mark the trees along the plot.

- Taking bearings

A 1.5m rod is positioned vertically on the picket at the end of the segment. The observer stands at the beginning of the segment and lines up the compass with the rod.

Be careful to avoid proximity to metal equipment that may divert the compass from true.

- Measuring the slope.

The slope is measured with a clinometer.

Before starting to measure the slope, we need to set both rods to the same height. The rod with clinometer must be positioned on the picket while the other rod is positioned on the next picket (figure 4). Then the slope value can be entered on the worksheet.

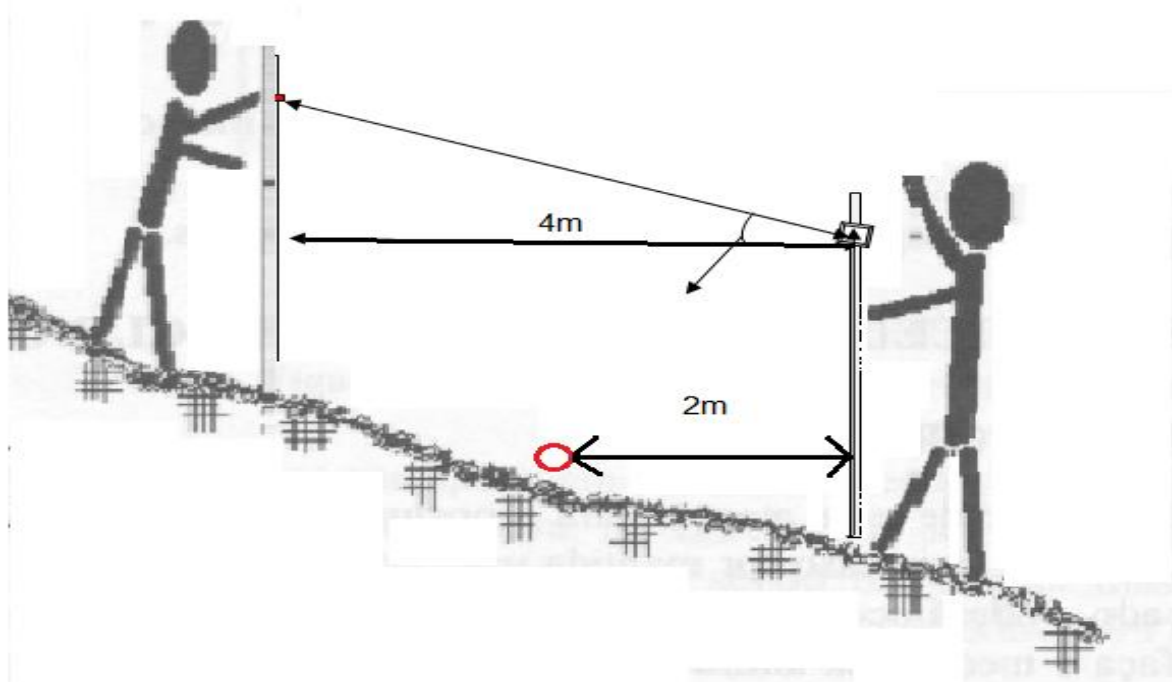


Figure 4 – Illustration of how to measure the slope between 10 meters segments.

- The perpendicular slope

The perpendicular slope is measured every 50 meters along the central line. To measure it, one person needs to take the target rod 1.5 meters on the right side of the central line, taking care to not step on the sensitive zone. Then the other person takes the clinometer 2 meter the left hand side of the central line and measure the slope. The perpendicular slope of the plot is recorded on the worksheet in degrees.

- After the survey

After finishing the survey remember to upload all the data to the on line data base as quickly as possible, if you don't do this, your work will be in vain.