

Why monitor Ferns?

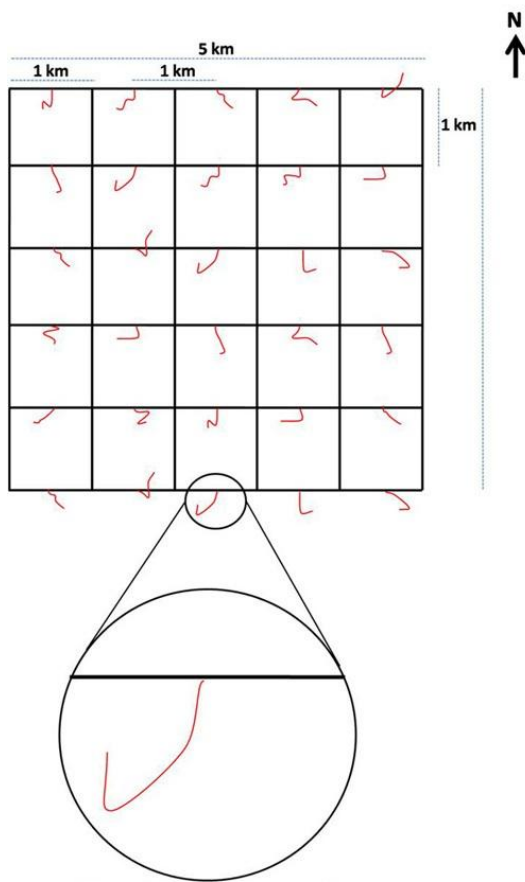
Ferns are a good biological group for monitoring because they have a wide distribution in the Amazon and are not very limited by dispersion.

They are very sensitive to environmental conditions soil, water and light and therefore are good indicators of these conditions or changes in them.

Furthermore, they are easier to identify than most angiosperms (flowering plants) and it is possible to identify individuals that are mature. The number of species throughout the Amazon is not high (about 300 species) and this also facilitates the study.

How is RAPELD structured?

The RAPELD grid and modules are standardized trails and permanent plots. The map shows a 5km square grid with red lines represent representing trails, which are usually 1 km apart (Fig.1).



250m survey plot following the same contour as the starting point on the grid.

The trails are marked with a picket every 50 meters with the track name and the distance along the track (Fig. 2).



Figure 2. Example of a trail marked with pickets. The picket has a metal plate that shows the track name and the position in meters (3,000 m in the example). Photos: Julio Valley.

The RAPELD has several types of permanent plot, but here only consider the uniformly distributed plots every 1 Km along the tracks, the first of which is 500 m from the trailhead.

The evenly distributed of plots have no fixed shape but follow the ground contour. (Fig. 3). The center line of the plot consists of 25 straight segments with 10 m each, marked by pickets.

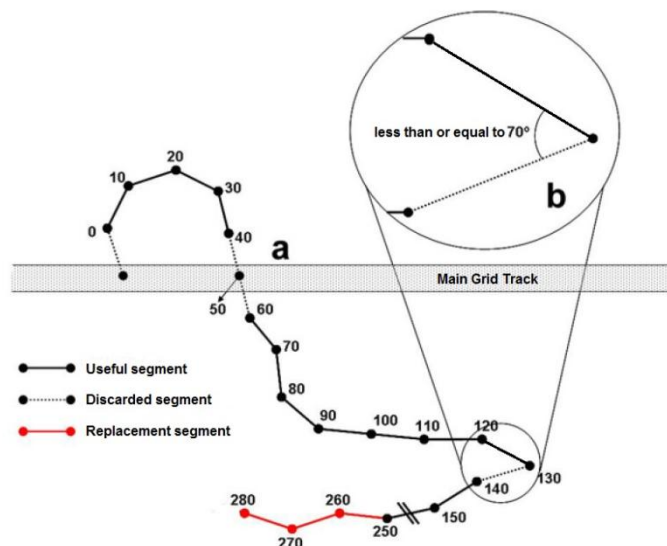


Figure 3. Plot following the contour with straight segments of 10 meters. The dotted lines indicate segments that must be discarded. Red segments indicate added segment. Design: Fabricio Baccaro.

All distance measurements in the plot are made relative to the center line, check that you are using the center line, with numbered pickets, not the line demarcating the right side of the center aisle which is used for movement.

Sampling

The sampling ranges differ depending on the sample group (Fig. 4). Small plants including ferns, are sampled within a range of 1.5 m wide to the left of the center line, considering the beginning of the portion toward the end. It must be marked with lines (polythene strips, strings, etc.) and sampling must be done without entering it, or only if necessary collect because other researchers also use this track to study other small and delicate organisms.

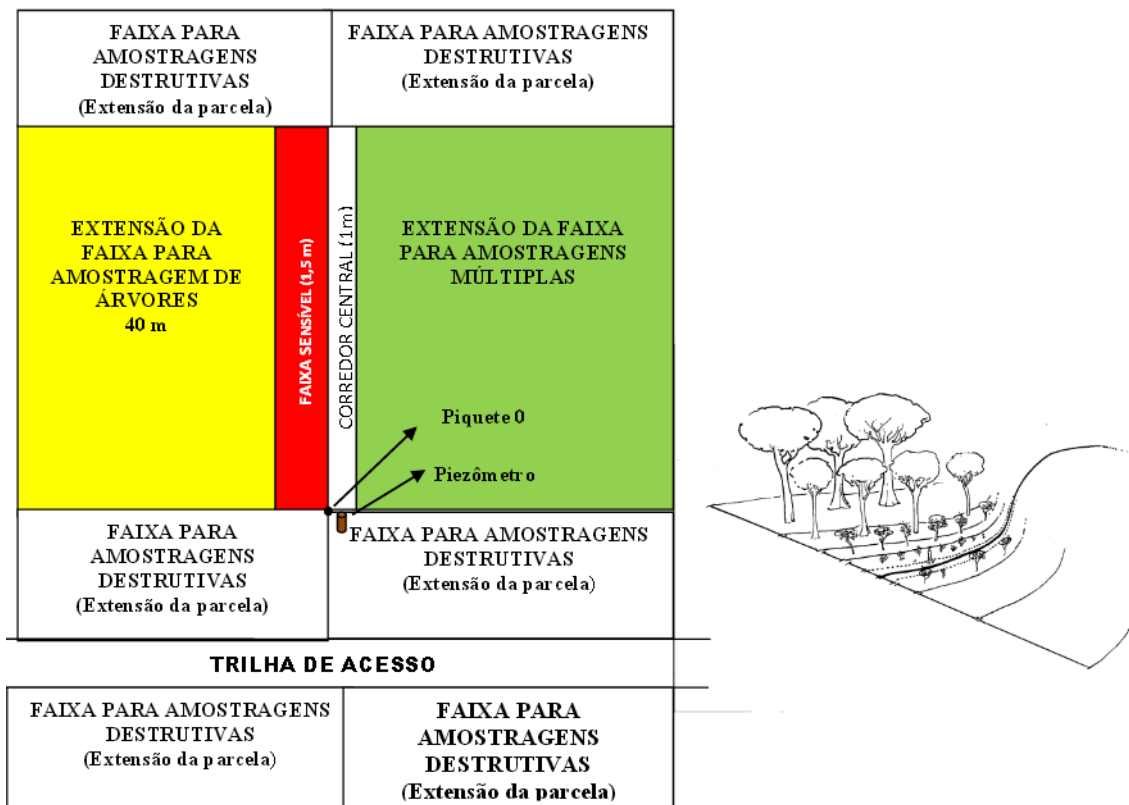


Figure 4. Sampling range of ferns and other herbs is "sensitive track" shown in the figure. This group also includes small trees, seedlings and fungi.

Drawings: Thaise Emilio and Karl Mokross

Before leaving for the field make sure you are with the field spreadsheets needed to record data (<http://ppbio.inpa.gov.br>). These include:

- Metadata tables that describe information about time, place and people involved in the work. (Annex 1)
- The plugs which you will write down the data on plants (Appendix 2).

You should always take a map field or the grid module and maps of the center lines of the plots to be sampled. The map is important because centerlines can not be continuous in some

situations, and you need to know this in advance to find out which segments should be sampled and which to disregard. Check out the maps of your site in the PPBio site (<http://ppbio.inpa.gov.br>) or the site of your project.

To measure and locate the plants, you should have the following materials:

- A tape of at least 15 meters.
- Metal rod of 2 mm diameter and at least 1 meter long. Sticks of this type are used for welding and are available in building stores. It is advisable to take extra sticks and store them in a PVC pipe to prevent entortem (Fig 5)



Figure 5. Metal rods for measuring coverage stored in PVC pipe.

- A stick of 2 meters of light and strong material that does not bend and do not crumple easily. This stick should have a mark at the position of 50 cm, to assist in the sampling line demarcation.
- Large and resistant plastic bags for bigger plants and smaller plastic bags for fragile plants.
- Masking tape to mark the plants and permanent marker to write down the collection of data on the tape.
- Pencils, eraser, sharpener, ruler of at least 10 cm, board, plastic bags to protect the drawing board and chips.
- Pruning shear.
- Identification Guides printed ferns and album

Reference to the region;

- Camera with macro lens.

Before you start sampling is important to become familiar with the most common species that occur in their region. It is recommended to take a walk along a trail of 5 km. One day is usually sufficient to record the most species in the area. Sample should be collected from each species and assemble a reference album.

To assemble the album, secure the still green leaf on white paper, size A4, using tape. It should have a sheet or foil of the fixed and the other with the exposed upper face exposed to bottom.

Crush the sheet mounted between sheets of newspaper and let it dry in an oven or air conditioning. Pay attention to collect samples of plants of each species at different stages of development in many species the young are very different from adults. Compare the young individual *Metaxya rostrata* with the adult in Fig.6.



Figure 6. (A) of young individual leaves and (B) adult *Metaxya rostrata*.

Mount the board in file folder with plastic sheets (Fig 7). We should try to identify all species collected, and you can not assign a provisional morphotype name as "place name - The" For species of dubious identification and morphotypes, other herbarium specimens should be sent to experts. New species found during the surveys will be added to the album. You do not need definitive identifications before starting the survey in installments.



Figure 7. Reference album, samples containing species and morphotypes the study site.

In the Amazon, the guide ferns and lycophytes of REBIO Uatumã can be used to identify species with larger distributions and often allows to reach gender to the other. Collections of unidentified species may be sent to the Botanical Institute of Sao Paulo, but duplicates of herbarium specimens should be deposited in local herbaria.

The species included in ferns guide can also be consulted on the website of PPBio. You can download the Complete Guide.

([Http://ppbio.inpa.gov.br/Port/guias/GuiaSamambaiasUatumaFINAL.pdf/download](http://ppbio.inpa.gov.br/Port/guias/GuiaSamambaiasUatumaFINAL.pdf/download))

The Quick Guide (http://ppbio.inpa.gov.br/Port/guias/Guia_pteri_UAT.pdf/download)

And access to interactive key (<http://www.sci.utu.fi/projects/amazon/fernkey>).

From now on we are ready to begin our survey in the field. The survey can be done by one person, but it is much safer and more efficient work in pairs.

Walk the trail to the paddock (usually a multiple of 500 meters) that marks the position of the portion that will be sampled. The share is generally 10 meters from the track right in the same contour as the picket.

We will make two types of sampling for ferns:

- The presence / absence (or occurrence) of species in segments of the plot.
- The coverage of species along the plot.

The presence / absence of species is useful to record the occurrence, but is less quantitative. How species are recorded by a 10 m segment, you can calculate the frequency of each species in the plot, such as:

Frequency = Number of segments in which the species was found / Number of sampled segments.

Coverage is quantitative, but can not register species with little coverage. The percentage of each type of coverage is calculated as:

% Coverage = (number of points where the species has been recorded / Number of sampled points) x 100.

Coverage of the sampling

To avoid stepping usually happens near the center line, sampling the cover is made along a line parallel to the centerline 50 cm to the left side thereof. This line is marked with tape.

The roof line begins at zero picket the plot. The final position for the segment is its intersection with the coverage of the next line segment which is parallel to and 50 cm from the centerline. The next segment begins at this point (Fig. 8).

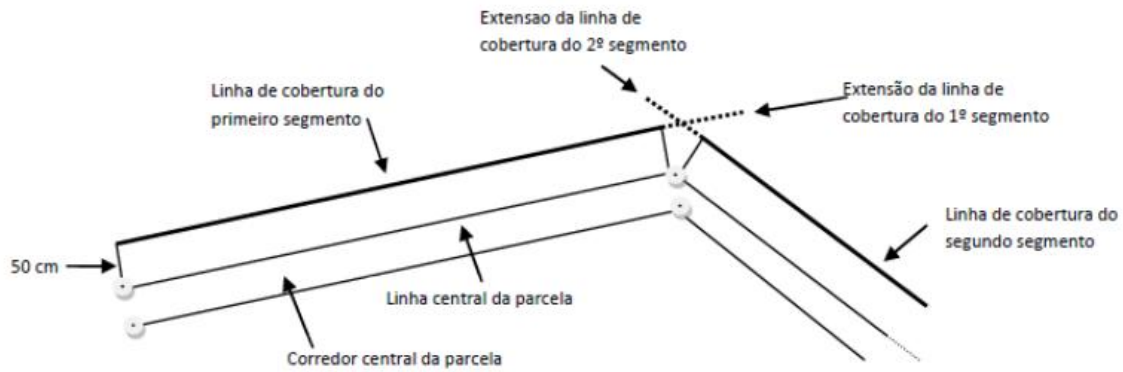


Figure 8. Definition of segments for coverage measures. Segment 1 extends to the point of intersection of the extension of coverage of the first lines and second segments. The coverage of the second line segment begins at the intersection of the extensions of coverage of the first line and second segments.

Only individuals with more than 5 cm in length of the leaf blade will be counted. They will be considered only the individuals rooted within the plot and we will not consider epiphytes that are rooted in the trees.

The tape must be stretched along the roof line high enough not to contact the ferns, no more than 50 cm above them.

The 2 mm metal rod should be suspended vertically every 10 cm along the tape and species touched by the stick are registered. If the rod does not touch any fern, this also and registered with the number zero (0).

You need to take care that the rod down vertically and only then record the played species. Field workers often need training to not divert stick making touch too close plants to stick, it has the wrong impression that the goal is to maximize the number of rings. One should also take care not to bend the rod.

If the stick repeatedly touching the same point on the same species, the species is recorded only once for this point. Regardless of the number of individuals that played species.

If the rod play more than one species at the same point, each species is recorded on different lines on the data sheet.

If the rod touch only the dead part of a plant, the species is not recorded to that point.

If the rod passing through a hole in a sheet touch is not registered for that point if the rod does not touch the plant.

The goal is to calculate the coverage area. So if the stick touches the same individual at different sampling points, the touches are recorded for each point.

If you failed to identify the species and the morphotype is not already included within the reference album, you should collect a sample. As the parcel is permanent, no whole plant should be collected. A full sheet, taking care not to harm the rest of the plant can be collected. Preferably, a set of non-fertile fertile and leaves should be collected, such as in many species differ (Fig.9). Often a single sheet is not enough to identify the type and characteristics of habit, branching and rhizome should be recorded.

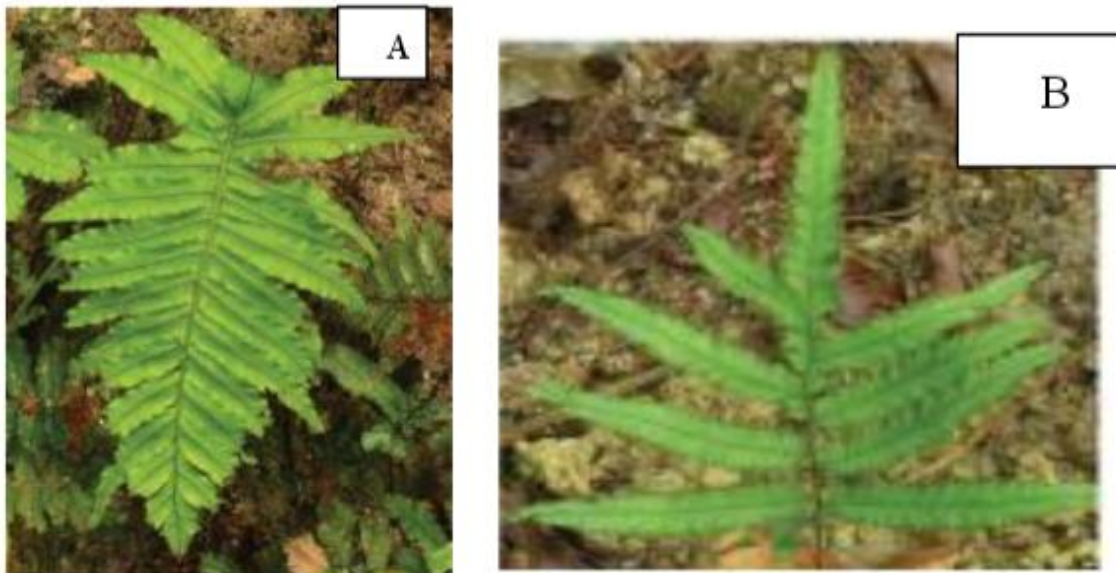


Figure 9. (A) vegetative Sheet (non-breeding) of *Trichomanes pinnatum* and (B) fertile sheet.

Whenever possible one should photograph the entire plant in the field and the potentially important details for identification, as the aforementioned structures and sora (spore clusters).

When the plant has only one sheet or can not be collected, you should check the same species outside the sampling area ferns, but preferably in the immediate vicinity thereof, is to ensure that the same species.

Collection procedure: Collected leaves should be labeled and the identification number included in the field sheet. The leaves collected should be kept in sealed plastic bags to prevent the plant wilt before being pressed. It should complement the collection made within the plot to the collection of a whole plant of the same species outside the plot, and these pickups are to receive codes that relate.

Occurrence of sampling segments of the parcel

After measuring coverage should back along the central aisle of the recording portion of which species occurring in each segment of 10 m. Now you must use the portion at a distance of 1.5

meters from the same side of the portion used to evaluate coverage. The rod of 1.5 m is placed horizontally perpendicular to the axis (Fig. 10). This is used to determine whether the individual is in or out of 1.5 m from the track center line.

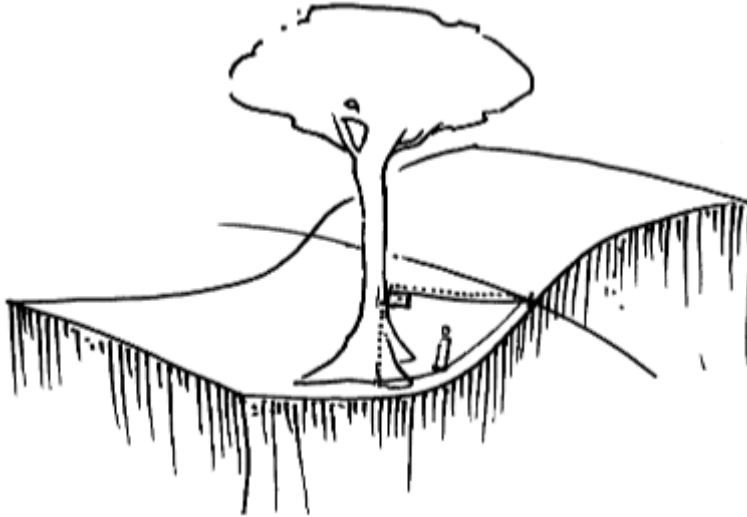


Figure 10. Although this design represents a tree, the same logic is applied to any type of plant. The distance measurement to the center line of the plant is made horizontally as shown in Fig. Design: Karl Mokross.

If the plant overlaps the range of 1.5 m limit, it will be included only if it is rooted within the plot.

As the parcel is not straight, there are areas within 1.5 m of the center line that are obviously not part of either segment. In these cases the segments are defined as follows (Fig. 11):

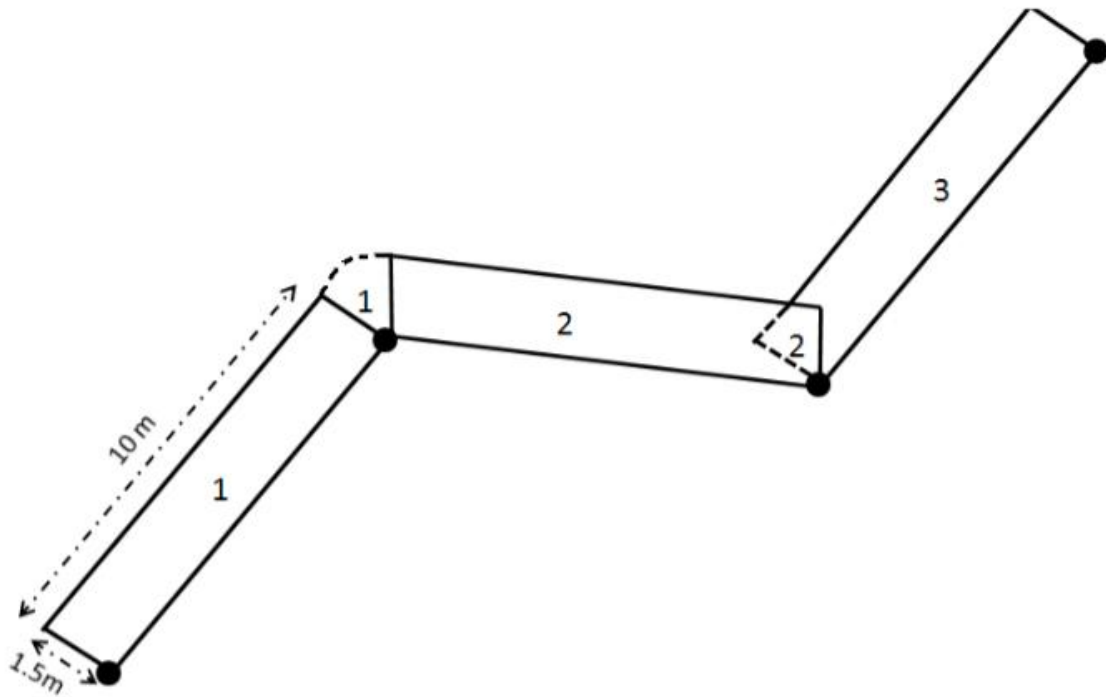


Figure 11. Setting the areas of occurrence of sampling segments of the species of ferns.

Design: Fernanda Coelho

- When a segment is a convex angle with the following, there will be a semi-circular area between the two segments to be included in the sample the angle of the anterior segment. In Fig. 11, the area over between segments 1 and 2, is included in the sampling of the first segment.

- When the segments has a concave angle to each other, there will be an overlap in their areas. The overlapping area will be included in the previous segment. In Figure 11, the area of overlap between the segments 2:03 is included in the sample segment 2. One should be careful not to write down again to segment 3 species of this area. Care should be taken to keep this arrangement in relation to the beginning of the plot, even if the survey is being done from the end of the plot to the beginning.

Happy Birthday! You now collected useful data to evaluate changes in your site, or make comparisons with other sites. However, be sure to put the data in a public database, otherwise your efforts in the field will have been useless.