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## Standardized Protocol for Soil Survey and Archaeological Diagnosis for the DOPAMICS Research Program

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**We use this protocol and it's working**

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**Abstract**

We describe the protocol developed as part of the ERC-funded **DOPAMICS** research program for palm sampling in three forested pre-Columbian sites in French Guiana: MC87 near Régina, the "Grand plateau" in the CNRS Nouragues Research Station, and Mont Galbao near Saül.

This protocol follows the setting-up of the research transect (see "before start" section). It aims to carry out an extensive soil survey and archaeological diagnosis.

This protocol is made open access under the Creative Commons Attribution License (CC-BY). It details the sampling strategy and steps, and the material needed with the aim to encourage future reuses of this protocol for the same or similar research purposes, and to improve the reproducibility of the research conducted. Reuse of this protocol must credit the authors and mention its DOI and download link.

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Elodie Schloesing #DOPAMICS2022

## Materials

- Soil auger for hard and stony soils (gouge, edelman or riverside)



*Eijkelkamp riverside auger*  
<https://www.royaleijkelkamp.com>

- Measuring tape of 1 or 2 meter long
- Handling gloves
- Spatula
- 2L Zip-lock plastic bags (for soil samples)
- Sampling pots or zip-lock plastic bags (for soil artifacts)
- Large (bullet) tip permanent marker (to write on plastic bags)
- Sieve (5mm)
- Colorimeter



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*Colorimax Pantone Capture colorimeter*  
<https://www.pantone.com>

- 20 mL graduated cylinder
- Sieve (160 µm)
- Sodium hexametaphosphate ( $\text{Na}_6\text{P}_6\text{O}_{18}$ ) solution (40g/L)
- Orbital shaker
- Petri dishes
- Stereo microscope (8-40X)
- Manual clicker counter

## Safety warnings

- ❗ Working in isolated areas of the Amazonian rainforest can be dangerous. To ensure safety, it is important to carry a fully charged satellite phone and GPS device, and a first aid kit. It is also advisable to consult a doctor to undergo a health check-up before embarking on remote expeditions.

## Before start

### Protocol



NAME

**Standardized Protocol for Transect Set-up and Palm Inventory for the DOPAMICS Research Program**

CREATED BY

Louise Brousseau

[PREVIEW](#)

- Make sure the satellite phone and GPS batteries are fully charged.
- Gather all necessary materials.

## Foreword: Sampling Strategy

- Soils are sampled every 50 meters along the research transect spanning from the ring ditch hill (RH) to an adjacent hill or slope with no or sparse evidence of pre-Columbian occupation (i.e. adjacent Hill, AH), according to the position of the pickets (Cx= Cstart, C1, C2, etc.).  
→ see "Standardized Protocol for Transect Set-up and Palm Inventory for the DOPAMICS Research Program"

Additional pits are collected in the landscape surrounding the central line on the ring ditch hill (RHx = RH1, RH2, etc.) and, eventually, on the adjacent hill (AHx= AH1, AH2, etc.).

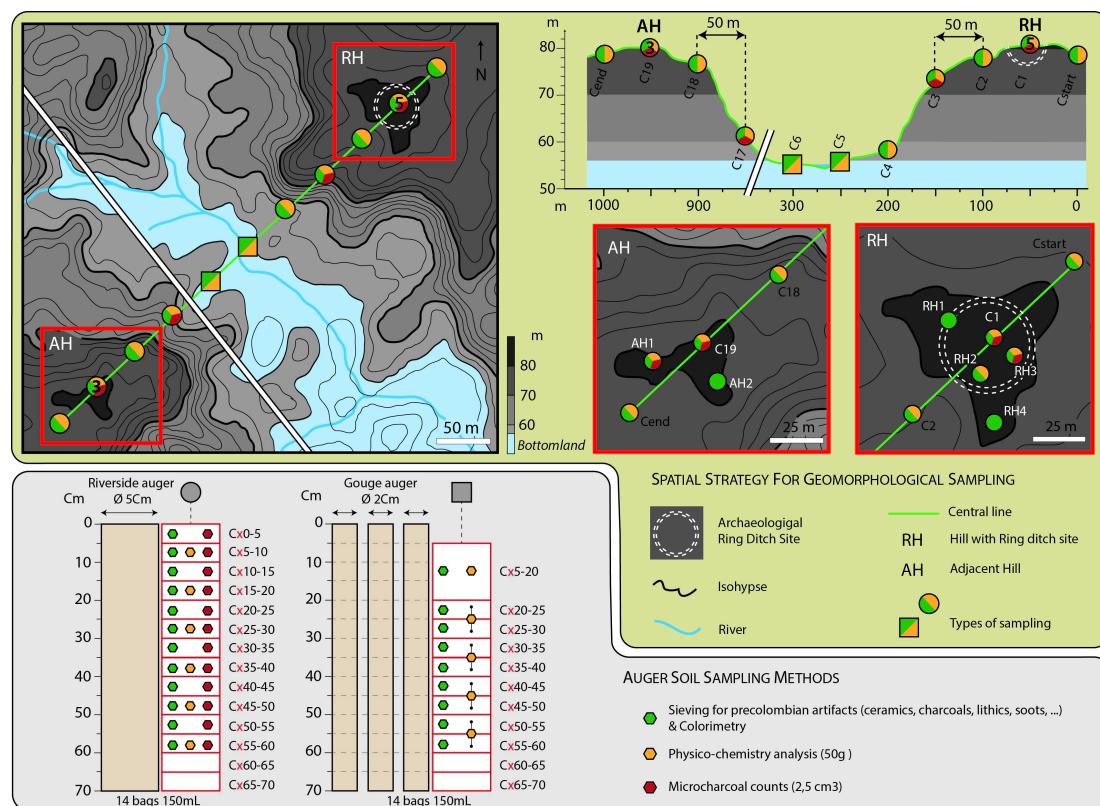


Figure 1. Sampling strategy.

Soils are sampled with a riverside auger (terra-firme, circles) or a gouge auger (bottomland, squares). "Cx" refer to pits made along the transect (Cstart, C1, C2, etc.). "RHx" and "AHx" refer to additional pits pits on the ring ditch hill (RH1, RH2, etc.) and on the adjacent hill or slope (AH1, AH2, etc.).

## Soil sampling

- 2 Every 50 meters along the central line (at the position of pickets "Cstart", "C1", "C2", etc.) and at the position of additional pits ("RH" and "AH"),
- Collect soil samples every 5 cm in depth, starting from the surface to 120 cm in depth
  - Put the soil samples in zip-lock plastic bags
  - With a large tip permanent marker, write down the sample ID on the plastic bag
  - Record the GPS position of the pit

#### Note

**Non-redundant soil sample ID formatting: "[SITE ID]\_[pit ID].[depth range]"**

- [site ID]= "MC87" (MC87), "NOUR" (Nouragues), "GALB" (Mont Galbao)
- [pit ID]= "Cstart", "C1", "C2", "C3", "RH1", "RH2", "AH1", "AH2", etc.
- [depth range]= "0-5", "5-10", "10-15", etc.

## Lab analyses

- 3 Samples from 0 to 60 cm are analyzed in the laboratory.  
The remaining samples (60 - 120 cm) are stored for further analyses.

## Soil samples preparation and artifact extraction

- 3.1
- Weigh wet soil samples
  - Dry the soil samples drying oven at 50°C
  - Sieve the soil (5 mm) to remove stones and roots and to extract archaeological artefacts (i.e. ceramic shards)
  - Extract macroscopic charcoals (>2mm) and soot deposits from the sieved fraction by hand
  - Transfer artifacts in sampling pots or zip-lock plastic bags
  - With a large tip permanent marker, write down the soil sample ID on the pot
  - Weigh dry soil samples
  - ⇒ **Note the wet and dry mass of the sample, the soil type (hydromorphic or ferralitic soil), presence/absence of stones, roots and artifacts in your lab book or in an excel spreadsheet**

## Selection of macroscopic charcoals for radiocarbon dating (subcontracted)

- 3.2 For each site,
- Identify soil layers with an increasing abundance of fragments of ceramics and charcoals in pits from the enclosure and slopes of the ring ditch (e.g. 0-45 cm deep)

- Select 10 charcoals >10mg (ideally between 20 and 100mg) for radiocarbon dating

## Soil colorimetry

- 3.3 With a colorimeter, measure the colour of each soil sample

⇒ Note the Munsell Color value in your lab book or in an excel spreadsheet

## Soil conditioning for physico-chemistry (subcontracted)

- 3.4

### Note

Physico-chemistry is carried out on the following samples (see Figure 1):

- Terra-firme (6 samples/pit): Cx.5-10 ; Cx.15-20 ; Cx.25-30 ; Cx.35-40 ; Cx.45-50 ; Cx.55-60
- Bottomland (5 samples/pit): Cx.5-20 ; Cx.20-30 ; Cx.30-40 ; Cx.40-50 ; Cx.50-60

- Weigh 100 - 200 mg of each dry soil sample from 5 to 60 cm deep
- Transfer the sub-sample in a plastic bag for soil granulometry and chemistry analysis (pH, C, N, P, K, Mg, Ca, Na, Al)
- Write down the sample ID on the plastic bag

## Abundance of microscopic charcoals (< 2 mm)

- 3.5 The remaining soil samples are used to extract micro-charcoals.

The abundance of microcharcoals was evaluated every 100 meters along the central line in soil samples from the surface to 60 cm deep.

### Note

The abundance of microcharcoals is evaluated on the following samples (see Figure 1):

- Terra-firme: Cx.5-10 ; Cx.15-20 ; Cx.25-30 ; Cx.35-40 ; Cx.45-50 ; Cx.55-60
- Bottomland: samples from bottomlands are excluded because of a high level of organics matter enrichment (due to a slower decomposition process), which makes it difficult to distinguish between charcoals and plant residues.

For each soil sample,

- Measure 2.5 cm<sup>3</sup> of soil sample with a graduated cylinder containing a solution of sodium hexametaphosphate ( $\text{Na}_6\text{P}_6\text{O}_{18}$ ) at 40g/L
- Transfer in a 50 mL Falcon tube and fill the tube with sodium hexametaphosphate (40 g/L) up to 50 mL

- Incubate the sample on an orbital shaker at ambient temperature for 12 hours
- Sieve the sample (160 µm)
- Transfer the sample in a Petri dish
- Oven dry the sample at 50° during 12 hours
- Put the Petri dish on a grid background composed of 0.25 x 0.25 cm squares
- Count the number of microscopic charcoal with a 40X stereo microscope and a manual clicker counter

⇒ **Note the Munsell Color value in your lab book or in an excel spreadsheet**

The remaining soil samples are stored in the plastic bags for further analyses.