



# Soil fauna management in Amazonia: Making use of *ecological services* in agroecosystems

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Figure 1: Canopy shots from four study sites (Exp. 1) and termite density analyzed using CART



Figure 2: Example of earthworm biomass from four study sites (Experiment 1)



Figure 3: Experiment 2: Slash-and-mulch, slash-and-pile, slash-and-burn, and views down on the topsoil to illustrate the litter depth in these sites

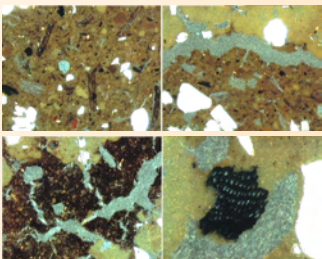


Figure 4: Organic matter deposits in animal burrows: earthworms (top) and termites (bottom)

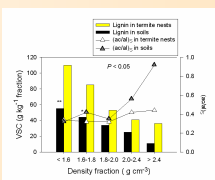


Figure 5: Differentiated degradation of lignin occurs in termite mounds and soil

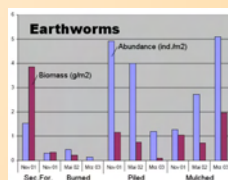


Figure 6: Earthworm densities affected by the treatments in experiment 2

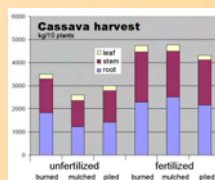


Figure 7: Cassava yields in experiment 2 reveal the effect of 1) the treatments and b) fertilization

Plot	Aggregate size (mm)	Aggregates >2mm (%)	Bulk density (mg m <sup>-3</sup> )	Pore volume (%)
Mulched	4.04 a	87.2 a	1.02 a	60.0 a
Secondary Forest	3.65 ab	83.3 ab	1.00 a	61.8 a
Piled	3.07 b	75.2 ab	0.97 a	63.0 a
Burned	2.84 b	73.1 b	1.03 a	60.1 a

Table 1: Soil physical parameters affected by treatments in experiment 2

## The Setting

- Amazonian rain forests are threatened by deforestation due to traditional slash-and-burn agriculture (and logging)
- Sustainable tree plantations (agroforestry) are one alternative to slash-and-burn; they are expected to make use of 'ecosystem services' on degraded former forest land and help reducing logging pressure on primary rain forest
- This study looked specifically at the role of soil organisms in this context
- The aim was to answer two questions:
  - Question A: Do soil organisms have measurable effects?
  - Question B: Can soil organisms be managed to enhance these effects?

## The Approach

- A 6-year international research program with mainly two large experiments:
  - Experiment 1: Monitoring of soil organisms (microorganisms, soil meso- and macrofauna) in primary rain forest, secondary forest and two tree plantation sites (1996-2000)
  - Experiment 2: Comparison of slash-and-burn, slash-and-mulch, slash-and-pile (2000-2003)

## Selected Results

- Here we can only mention some selected results
- Regarding Question A:
  - The treatments differ considerably in factors such as amount of litter and canopy closure (Figures 1, 3), which affects fauna density and diversity (Figures 1, 2 for termites and earthworms)
  - Mulching affects soil fauna (Figure 6), soil parameters (e.g. aggregate size; Table 1) and yields (Figure 7)
- Regarding Question B:
  - Deep-dwelling soil fauna distributes organic matter in the mineral soil (Figure 4) which affects soil physics and nutrient status
  - Soil fauna affects also the quality of organic matter in the soil (Figure 5: here, termite mound material that is later incorporated in the soil)

## Conclusions

- Regarding Question A: Ecological services from soil fauna provide multiple quantitative and qualitative effects
  - Turnover of large quantities of litter possible
  - Chemical role in organic matter formation still little understood
  - Urgent need for research to understand tropical SOM building better
- Regarding Question B: Fauna reacts to elements which can be managed:
  - Agroforestry system structure can be managed
    - Canopy closure should be maximized
    - Resource availability may have influence
    - Stand diversity seems to have little effects
  - Mulch can be managed
    - Enhances soil organisms, and soil fertility parameters
    - Initially reduced decomposition rates under wood mulch help retain OM

→ Soil fauna management in tropical agro-ecosystems seems possible and beneficial