



# ZEF A Biophysical Approach to the Environmental Services by Land-Use Systems Assessment; Functional Biodiversity in Tropical Agroforestry Systems (The Case of Tomé-Açu Community, Northern Brazil)



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## Antecedents

**Environmental management**, like most of human activities in current times is progressively covered by **market-based approaches**, in the aim to make the judgements and decisions related more "efficient" and "rational". The product of this elucidation is the concept of **environmental services (ES)**, and its executive branch the **payment of environmental services (PES)** focused on the resources assessment, generally biophysical, and compensation mechanisms, generally economic.

## Biodiversity conservation by Agroforestry Systems (AFS)

As other land-use-management paradigms agroforestry has been considered as an option for biodiversity conservation. Its comparative **advantages** against other technical alternatives lean on three basic issues: 1. Its higher structural diversity, 2. Its higher dynamic of natural succession, and 3. The reduction of deforestation as outcome of its implementation.

Some examples are found in the study of the ability of **home-gardens** to maintain a high inter and intra-specific diversity and constant yields; the **agroforests** that emulate the structure and functionality of natural forests, integrating many species neither spatial nor temporal static arrangements; and **buffer strips** around intangible zones, offering the best simulation option without affecting the production functions.

## Functional biodiversity

**Functional biodiversity** basis in the heterogeneity and dynamism of the community components and the feedback of the biophysical and socioeconomic variation, consequently assign more weight on components that provide sustainability to the system through the encouragement and intensification of the processes. In the case of anthropogenic systems should be special remarks on the generation of useful outputs.

## Objective

To assess the factors that influence in the biophysical processes that determine the Agroforestry system capabilities to maintain functional biodiversity underlining the management as a key factor in the aim to improve the systems toward to make them more productive and sustainable (case study: municipality of Tomé-Açu, Pará State, Northern, Brazil).



Small farmer interview, Miritipitanga, Tomé-Açu.

## Conceptual and Methodological tools

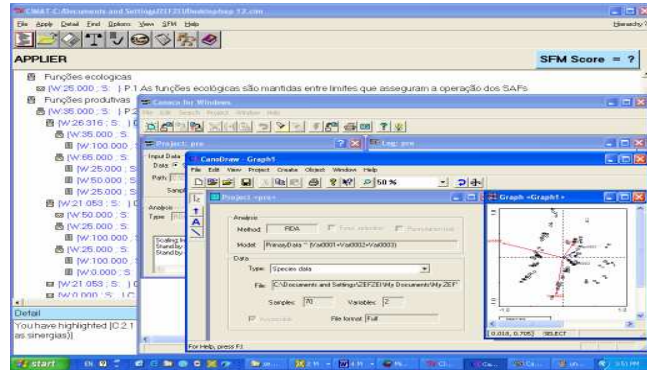
### Multi Criteria Analysis (MCA)

It is a series of methods designed to give an integrative approach to interdisciplinary problems, including different sources of data, different expert positions and different groups of interest. Its main advantages are: a. Covers a great range of inputs and outputs addressed under different perspectives, b. Allows the analysis of qualitative and quantitative data, c. Involves the participation of multiple interest groups and try to achieve their agreement and d. The analysis may be interactive with the assessments (feedback mechanism).



MCA is operationalized by the **Criteria and Indicators (C&I)** concept and terminology, structuring the systems in a increasing complexity level by successive steps: Principles, Criteria, Indicators (and Verifiers).

**CIMAT (Criteria and Indicators Modification and Adaptation Tool)**, it is a specific software that allows the creation, modification, on-site assessment and navigation on C&I sets, assisting in the construction of hierarchies and consequently ranking and rating processes.



## Multivariate Analysis (MVA)

Multivariate methods focuses on interaction of different factors coincident in the same moment and space, and how they influence among each other on the "direction of the outputs". In spite its results are not categorical, determine the influence spots or trends where one wants to go via other type of analysis or even investigations.

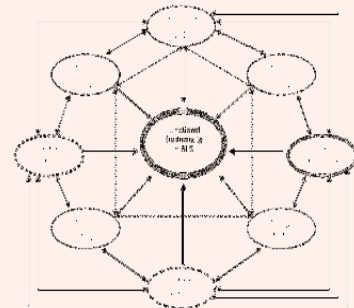
**CANOCO (Canonical Community Ordination)** it is a software designed for the analysis of ecological communities, applying techniques that relate the communities qualities composition to its environmental conditions, allows the detection of key factors and design of alternative scenarios in response to inputs change.

## Preliminary results

**Definition of C&I set.** For the biophysical evaluation of AFS in general and for its functional biodiversity assessment in particular. Such set is refined successively according to the following filters: a. Its conceptual re-evaluation, b. Consultation with experts, and c. Workshops with stakeholders. The election of the criteria will be according to: its representativity, application feasibility, flexibility for extrapolation, degree of integration, etc.

**Interactive model.** That considers the definition of inter-relations, ranks and rates assignment for every stage of analysis, specially on the "first-hard data" indicators and verifiers set developed.

The **interactive model** and the **sustainable use index (CIMAT output)** should give us in one hand the understanding of processes and indication of key factors, on which the successive steps should stress: multivariate analysis (CANOCO) and the generation of a sensitivity model, which would drive us to the finding of an equilibrium between production and environmental services generation.



Local AF System: Acai (*Euterpe oleracea*) +Cupuacu (*Theobroma grandiflorum*)

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