



Tropentag, October 6-8, 2009, Hamburg

“Biophysical and Socio-economic Frame Conditions
for the Sustainable Management
of Natural Resources”

**Environmental Services in Agroforestry Systems. How to Assess
Them?: Functional Biodiversity in Tomé-Açú, Northern Brazil**

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Abstract

Agroforestry, combining agricultural with forestry components at plot, community and landscape level, through a component-specific management can satisfy a series of multiple demands, among them, biodiversity conservation and in general the provision of environmental services.

Since environmental services are proposed as compensation schemes to prevent and remediate negative environmental impacts, incentives that support ecologically sound agricultural management practices are therefore needed. These incentives (*e.g.*, compensation payments) have to be based on an adequate understanding and evaluation of the services provided by the agricultural systems.

For this purpose, the concept of biodiversity in land-use systems has been revised. ‘Functional biodiversity’, in contrast to traditional approaches, emphasises the system’s dynamics at various levels and the implications of these on its functioning as a whole. To operationalize such a concept, an assessment protocol based on multicriteria analysis has been developed. The approach combines productive, ecological and operational indicators to describe functional biodiversity, and aims at the identification of those management decisions and interventions that support this.

The suitability of the evaluation protocol was tested with 70 farms in the Brazilian Amazon region divided in three groups, which had been defined based on the time of settlement, property size, technological know-how, organisation and access to market, *i.e.*, ‘CAMTA partners’ long-ago established farmers, ‘immigrated’ some time ago and recently immigrated farmers ‘newcomers’.

The analyses reveal that the most relevant factors supporting functional biodiversity in agroforestry systems are: **(1)** the farmers’ technical qualification, **(2)** their preference for low impact techniques, **(3)** their capacity to adapt to environmental, social and political changes, **(4)** the diversification of species composition at plot level, **(5)** the increase in the use of perennial species; and **(6)** the financial profitability of the system. Concerning the differences among groups, the ‘CAMTA partners’ farmers are significantly superior to the two other groups only in agricultural practices related to production.

As the functional biodiversity concept is based on an integrative approach, its outputs provide a supportive platform for the proposed assessment framework. In turn, the developed protocol can be used to optimise biodiversity roles on farms and support decisions regarding compensation payments.

Keywords: Brazil, environmental services, functional biodiversity, multicriteria analysis, tropical agroforestry systems