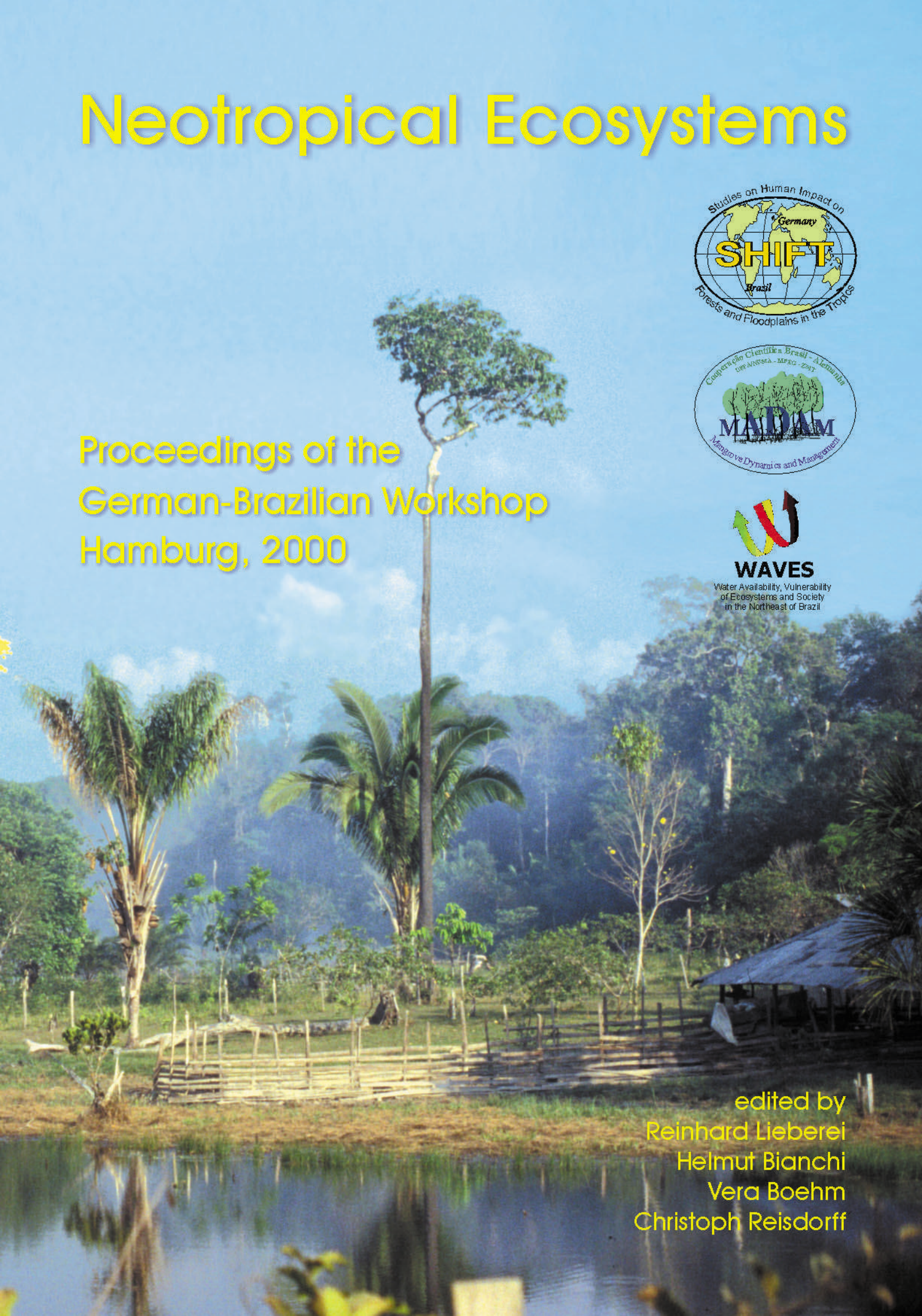
Neotropical Ecosystems



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WAVES
Water Availability, Vulnerability of Ecosystems and Society in the Northeast of Brazil

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Acacia mangium Willd. was planted in February 1997, at a spacing of 1 m x 1m, in plots of 10 x 10 m, under the following land preparation treatments, in a degraded pasture of Brachiaria humidicola: with burning (b); with ploughing (p); just weeding (w); and no treatment (n). In all plots where irradiance was monitored, the tree species were planted as seedlings.

The spectral irradiance was monitored with a portable spectroradiometer (Li-1800, Li-Cor, Inc., Lincoln, Nebraska) scanning from 330 to 1100 nm in 2 nm steps. Measurements were taken at ground level, replicated three times within each plot, from 1000 to 1400 hours, during April, June, September and October 1999. These measurements were followed by measurements taken in a nearby clearing, representing the spectral irradiance reaching the top of the canopy.

The light-quality analysis was based on the following radiation-related variables that may interfere in photosynthetic or morphogenetic responses of higher plants: Photosynthetically active radiation (PAR), phytochrome active radiation (PHYTAR), and blue active radiation (BAR). The wave band for PAR was 400 to 700 nm, and the wave band for BAR was 400 to 500 nm, while PHYTAR was the red: far red ratio (R:FR) where R= photon irradiance at 655 to 665 nm and FR= photon irradiance at 725 to 735 nm.

The results suggested a tendency to lower values of PAR, PHYTAR and BAR where the seedlings of A. mangium were planted after ploughing (b), indicating that under such conditions the trees were able to grow better, providing a more efficient control of the grasses, through light attenuation. These results agree with the observed values for three height and for covering by grasses.

Rainfall Partitioning in Natural and Enriched Secondary Vegetation Under Fallow in Eastern Amazonia: a Quantitative Overview

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Rainfall partitioning is a key component of water and nutrient balances and its understanding is relevant to interpret so diverse biological an biophysical aspects of ecosystems, such as soil fauna and floristic diversity and the contribution of the direct evaporation of rainwater intercepted by the leaves, to the water balance.

Along the last eight years much effort has been done in SHIFT Project Env-25 to quantify rainfall partitioning in chronosequences of spontaneous secondary vegetation under fallow to support studies of water and nutrient balances, as well as in experimental areas where the enriching fallow and slash/mulch techniques are being tested toward improving sustainability of the system practiced by family agriculture. Results of these series of measurements, as compared to those found in studies done elsewhere in Amazonia, are presented.

All measurements were carried out, in a weekly basis, in the municipality of Igarapé-Açu, in small holder areas, and refer to: 1) Rainfall partitioning between throughfall (**T**) and stemflow (**S**) measured from 1992 to 1996, in a diverse (**A**) and in an almost mono specific (dominated by *Phenakospermum guyannense*) stand of secondary vegetation (**B**), respectively around 2.5-year-old and 10-year-old at the beginning of the study; 2) **T** measured during 1997 to 1998 in a spontaneous stand of secondary vegetation 2-year-old at the beginning of the measurement (**C**); 3) **T** measured during six months (May to November 1997) in plots of 2-year-old fallow vegetation enriched with fast growing leguminous trees (*Acacia mangium, Acacia angustissima, Inga edulis, Clitoria racemosa* and non enriched fallow vegetation) (**D**); and 4) **T** measured during seven months in the early phase of fallow in plots of secondary vegetation growing after the cropping phase (maize followed by cassava) under slash/mulch land preparation, at the same area where enriched trees were planted during the fallow phase (**E**).

The results of the long lasting measurement in **A** and **B** have permitted to follow the effect of secondary succession in rainfall partitioning. There was a tendency of decreasing **T** values in **A** (78,5± 2,8 to 57,6± 2,1 % of gross rainfall) and increasing in **B** (35,8± 2,2 to 67,7± 1,5 % of gross rainfall), and an opposite trend was observed with **S**. This pattern was associated in **A**, to a decrease in herbaceous components and increase in woody components, and in **B**, to a reduction in the density of the banana-like species *P. guyannense*, which has the ability to funnel rainwater. Vegetation **C** behaved similarly to **A** at the same age.

No difference was found in **T** values among the enriched

fallow vegetation plots (**D**), an these were similar to the values found in **A** and **C**.

The values of **T** found in all secondary vegetation studied were generally bellow those reported for primary forests and old secondary fallow vegetation in Amazonia, as a result of the higher stemflow contribution and of the clumpy nature of the leaf layers, peculiar to these early stages of secondary vegetation succession.

Microcosm Experiments in Studies of Tropical Agriculture Systems Under Mulch Management

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The work reported here is planned for the SHIFT project "Management of plant residues and its effect on decomposition and soil fauna in central Amazonian agro-ecosystems". Microcosms may provide an useful tool for the experimental assessment of ecological processes under standardized and controlled conditions. Hypotheses, defined according to observations obtained from the experimental field studies and monitoring may be tested by the use of microcosms, applying an experimental design that takes the factors of interest into account. Due to replication of experimental units, statistical evaluation of the data is possible. Beside natural factors, plant protection products or fertilizers may be included as important anthropogenic factors.

The results on litter decomposition obtained within SHIFT ENV52 indicated that the loss of litter from the litter bags was mainly caused by the soil macrofauna. One hypothesis is that for the decomposition process earthworms were most important in the primary forest whereas in the investigated polyculture forest systems diplopods and isopods seemed to be most important. One of the main questions therefore is whether the decomposition process driven by worms or diplopodes and isopods differs quantitatively and qualitatively with regards to the amount and time scale of plant nutrient release? To answer this question, the following aspects will be investigated in detail:

- Nutrient content and the microbial activity of feces from worms and diplopods/isopods.
- Decomposition rates of various litter types.
- Decomposition of various litter types and its effect on the N and P status of the soil.
- Litter preference of earthworms, diplopods and isopods.
- Effects of pesticides or/and fertilizer on the decomposition process.

According to the specific question posed, terrestrial microcosms will be designed in various ways concerning the dimension (e.g. volume), the components (e.g. soil, litter, animals), the climatic conditions (e.g. temperature, moisture) and anthropogenic factors (e.g. pesticides, fertilizers). Within a first step, the use of a factorial design may help to define relevant factors for the decomposition process. Results can be obtained in a relatively short period of time (2 - 8 weeks). For example, a 24-factorial design (16 microcosms) allows for the assessment of four different factors at two intensity levels. On the basis of these results, refined experimental designs may be applied (e.g. a more replicated microcosm test for the answer of one particular question).

Two types of microcosms may be useful: (1) Small microcosms (volume up to 0.5 L) that fit into the soil respiration device for continuously measuring the CO_2 release; the IRGA may be used to measure the total release of CO_2 from microcosms as a measure of mineralization activity of the mesofauna and/or microorganisms and/or macrofauna within the decomposition process. (2). Larger microcosms (Volume up to 20 L) that can be installed outside the lab to measure litter decomposition under various standardized conditions in the field.