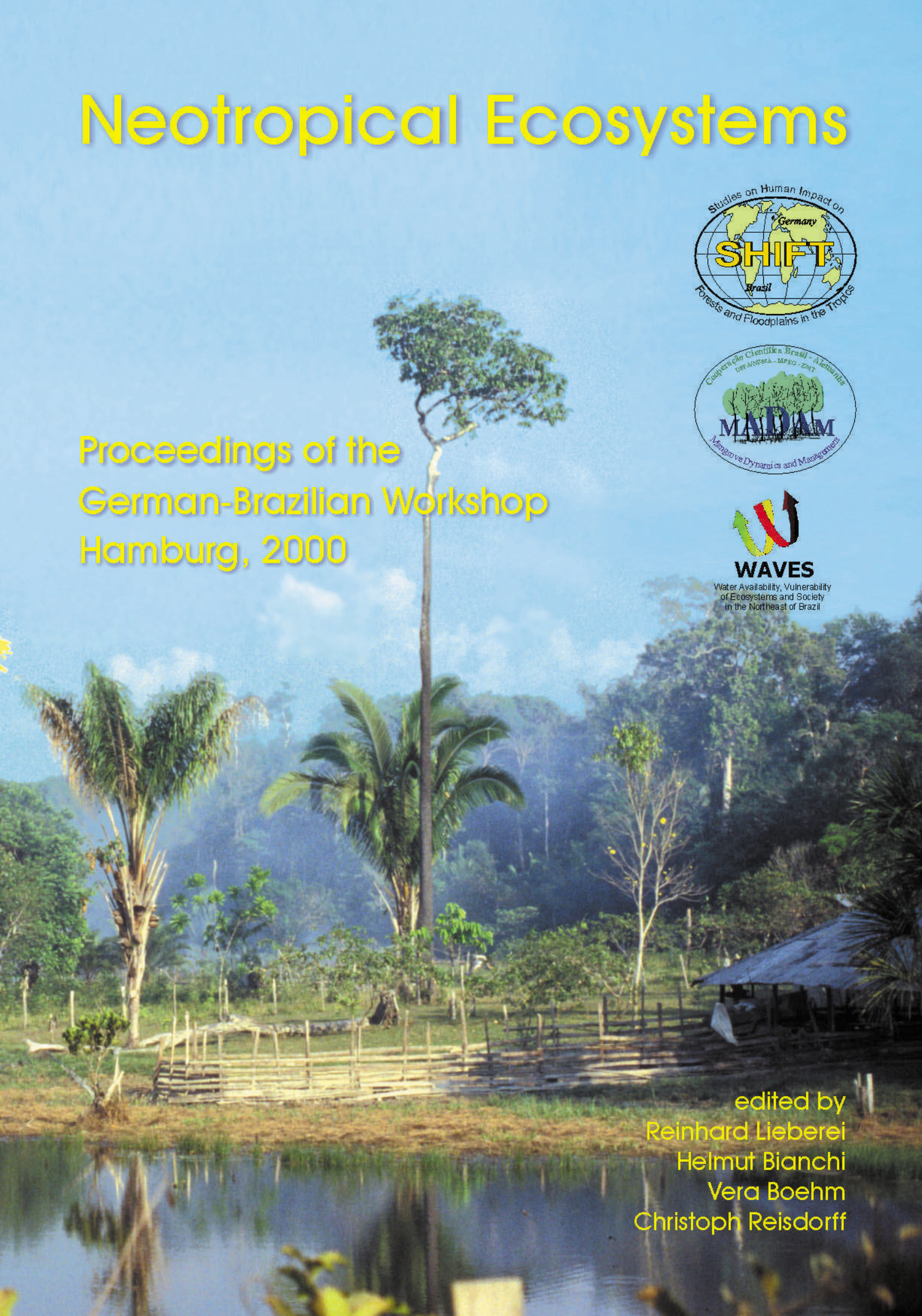
Neotropical Ecosystems



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

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Acclimation of Legume Tree Species to Light Changes During Establishment

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Improvement of fallow areas, with fast-growing legume tree species, helps accelerating biomass accumulation of secondary vegetation, shortening the fallow period and lessening human pressure over new agricultural areas. However, the successful use and management of these species, can be greatly improved with the basic knowledge of their ecophysiological responses to common environmental stresses found in these environments. We evaluated the capacity to respond to changes in light of three legume tree species, with potential of use in the improvement of fallow areas. Seedlings of *Acacia mangium* and *A. angustissima* were exposed to high (H) and low (L) photon flux density (PFD) for 40 days. After this period, half of the plants form H were transferred to L (HL), and half of the plants from L were transferred to H (LH) for another 20 days. In a similar trial, seedlings of *Clitoria racemosa* were also evaluated under the same conditions, however, the evaluation period was half of the one used in the *Acacia* spp. trial. On both trials, plants were cultivated outdoors in pots and received periodical fertilization. Low PFD was obtained by using a black polypropylene shade fabric. Light extinction by the shade fabric on a clear day was ca. 70%. Light response curve of photosynthesis, constructed at the end of the evaluation period with a portable photosynthesis system, showed that, under low PFD levels, *A. mangium* plants from the HL treatment displayed a typical photosynthetic behavior of plants from L, while this response in plants from the LH treatment was similar to H plants. *A. mangium* plants from HL showed a tendency for lower light compensation point and higher apparent quantum efficiency values than LH plants. Photosynthetic responses of *A. angustissima* followed the same patterns of *A. mangium*, suggesting a satisfactory acclimation capacity to changes in the light environment by both species. For *C. racemosa,* periodical evaluations showed that this species has a high photosynthetic capacity. *C. racemosa* plants form LH treatment showed a decrease through time in the photosynthetic capacity, while HL plants showed a gradual increase in photosynthesis. However, on both treatments, photosynthetic response was stabilized between the fourth and seventh days after light transfer. *C. racemosa* showed a high degree of photosynthetic plasticity in response to light changes during establishment. The photosynthetic response suggested that the transference of *C. racemosa* from low to high PFD caused more stress to this species than the transference of plants from high to low PFD. Based on the photosynthetic response to changes in the light environment, *C. racemosa* appears to have the ability to rapidly acclimate to a low light environment. Photosynthetic acclimation of this species to sudden increases in the PFD levels is, however, less apparent.

Spectral Irradiance in a Degraded Pasture in Restoration with *Acacia mangium* Willd.

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The scenario of the study was the family agriculture of eastern Amazonia, Brazil, where livestock became recently an attractive idea for the small holders who, however, without support to maintain the pasture and animals, end up losing this land for most purposes, after the pasture becomes degraded, and traditional crops no longer can be successfully grown due to low soil fertility and to the resource competition with the remaining grasses.

Management and manipulation of microclimate has largely been used as a tool to solve or mitigate problems found in land use systems and, in this case, the availability of solar energy, both quantitative and qualitative, was manipulated by planting trees, attempting to eradicate grass species in a degraded pasture under restoration, as described in this volume by Fernandes et al. This particular contribution focus on the spectral pattern of solar irradiance reaching the ground under different treatments tested to establish the trees.

The study was carried out in a typical family agriculture property in Igarapé-Açu, northeastern Pará State, where

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