LBA

Experimento de Grande Escala da Biosfera-Atmosfera na Amazônia

2ª Conferência Científica Internacional do LBA

07 a 10 de Julho de 2002

Centro de Convenções Studio 5,

Av. Rodrigo Otávio, 3555 - Distrito Industrial

Fone: (092) 216-3555 Manaus/AM

Organização:

Secretaria de Conferência

LBA - Escritório Regional de Manaus - INPE

Manaus - AM - Brasil

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Mechanisms of conservation and cycling of N and P in a chronosequence of secondary vegetation in Eastern Amazonia

Cláudio J. Reis de Carvalho[1], Elizabeth Ying Chu[1], Eric A. Davidson[2], Maria Tereza Primo dos Santos[3], Ricardo de O. Figueiredo[3], Geórgia S. Freire[4], Karina de Fátima R. Pantoja[4].

1- Embrapa Amazônia Oriental.

2- The Woods Hole Research Center MA, USA

3- Instituto de Pesquisa Ambiental da Amazônia (IPAM)

4- Bolsista DTI, CNPQ/LBA

Address of corresponding author:
Cláudio J. Reis de Carvalho
Embrapa Amazonia Oriental
Trv. Enéas Pinheiro s/n, Marco
Belém-PA, 66095-100 Brasil
Telephone: (91) 299-4505
E-mail: carvalho@cpatu.Embrapa.br

The availability of nitrogen and phosphorus may restrict rates of regrowth of Amazonian secondary forests. The dynamics of these nutrients was studied in a chronosequence of secondary forests (3, 6, 10, 20, 40, and 70 years) growing on highly weathered, acid, nutrient-poor soils of following traditional slash-and-burn agriculture. An abandoned, intensively cultivated pepper field and a remnant mature forest were also studied. In addition to C, N and P stocks in the litter layer and soil, the number of mycorrhizal fungal spores was counted and the activity of acid phosphatase was measured in the top 0-30 cm of soil. The lowest stocks of N and P in fine litter were in the pepper field (14 kg N ha^{-1} and 0.5 kg P ha^{-1}) and 3-year-old secondary forest (66 kg N ha^{-1} and 1.7 kg P ha^{-1}), but there was no clear pattern with age among the other forested sites (ranging from 93 to 130 kg N ha^{-1} and 1.4 to 2.7 kg P ha^{-1}). The stocks of nonwoody litter were equivalent to

the mature forest by about 6 years of succession. A similar trend was observed for soil C and N, although the mature forest had somewhat higher concentrations. Soil fungal spores measured at the end of the rainy season decreased with increasing age of the secondary forests. In contrast, acid phosphatase activity increased with forest age. Although N and P litter stocks recover quickly during succession, the mechanisms of P dynamics appear to change, with a greater importance of mycorrhizae in young forests and more extracellular production of phosphatase in older forests.