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Impact of pasture management on regeneration of secondary vegetation in north-eastern Pará state, Brazil

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Abstract

For north-eastern Para it was proposed to integrate pastures into the traditional slash-and-burn cycle. The cultivation period would be followed by pasture use after which the woody fallow vegetation would fully regenerate. In this study the response of secondary vegetation to different use intensities of pastures was compared. A site abandoned directly after pasture establishment represented light use intensity, a five year old and an eleven year old site that were continuously grazed and received annual weed control were chosen for medium and high use intensity respectively. Biomass was measured by vegetation groups and the woody species and their cover recorded. There was an inverse relationship between woody vegetation biomass and use intensity which was significant for the three cases studied. The distribution and relative contribution of woody vegetation biomass on the medium use pasture resembled the light rather than the high use intensity site. Grasses dominated the high use intensity site with 92 % of the total biomass, but the forage grass was reduced to 33 % by invader grasses.

Introduction

The traditional agricultural system of north-eastern Pará state, Brazil, involves the slash-and-burn of a woody fallow to provide nutrients for cropping. The fallow cycle is being shortened by human population pressure and the land reduced by the formation of cattle pastures.These pastures degrade within four to eight years, necessitating further excisions of land from the fallow cycle. To make better use of limited land resources Loker (1994) proposed a model which integrated the pastures into the fallow cycle. The model envisaged a pasture phase between the periods of cultivation and woody fallow. The cycle was supposed to take ten years consisting of one year cropping, six years grazing under special management and three years fallow. During the grazing period the potential for woody regeneration had to be maintained. The objective of this study was to see if this woody regeneration was possible by examining the response of secondary vegetation to different levels of pasture use in a small holder situation.

Methods

Three sites representing different levels of use were selected, based on the intensity and duration of management. The light use level was represented by a pasture abandoned directly after establishment seven years ago. For the medium use level a five year old pasture was chosen that was continuously grazed and received annual weed control, the last burning

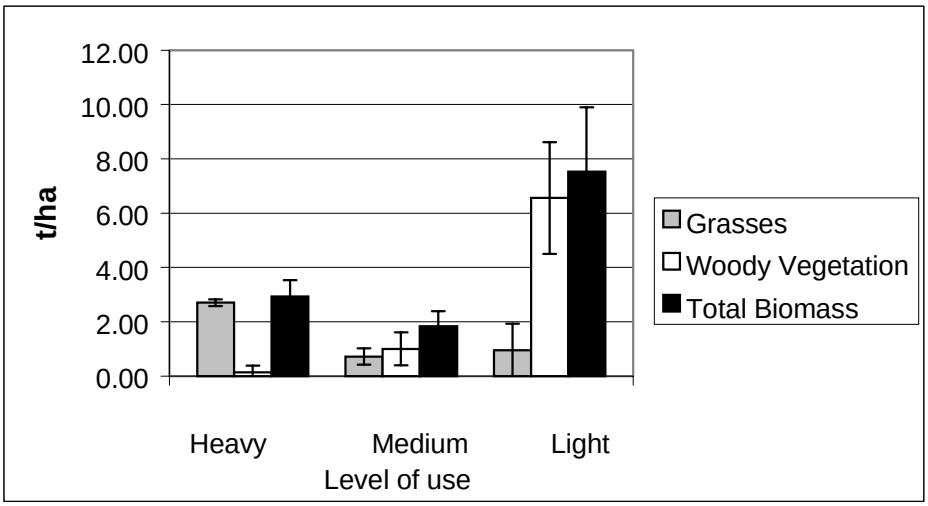
occurred at the end of 1997. An eleven year old pasture, that received nearly the same management as the medium use site, represented the level of heavy use.

The biomass of woody regeneration was measured and compared with that of three other vegetation types (forage grass, invader grasses including c*yperaceae*, and forbs) by cutting 2 m² plots at 10 m intervals along three transects at each site. The transects were located to represent the characteristics of each field. Additionally the occurring woody species were identified and their cover recorded.

Results

The woody biomass fraction differed significantly ($p<0.05$) (Table 2) between the three sites, being inversely related to the level of use (Figure 1). The amount of woody biomass varied from 6.56 t/ha on the light use site to 0.15 t/ha on the heavy use site.

Figure 1. Estimated biomass [t/ha] according to level of use of main vegetation types



The highest number of woody species was counted on the light use site (48), followed by the medium (42) and the heavy (28) use sites. On the medium and the heavy use sites only 5 % and 8 % respectively of woody cover were species classified as indicator species of the regions typical woody fallow vegetation (Capoeira) compared to 53 % on the light use site (Table1).

Table 1. Effect of land use level on the presence of certain Capoeira indicator species (Baar, 1997)

	Heavy use; n = 30	**Medium use; n = 30**	**Light use; n = 14**
	Cover (%)*	**Cover (%)**	**Cover (%)**
Banara guianensis	1.0	0.7	3.9
Casearia grandiflora			
Cissampelos.c.f. andromorpha	0.4		
Davilla rugosa	0.4		4.7
Lacistema pubescens		0.5	10.4
Myrcia bracteata			4.4
Myrcia deflexa			0.2

Myrcia sylvatica	0.9		10.4
Myrciaria floribunda			1.3
Rollinia exucca		0.2	4.9
Rourea ligulata	2.4	0.3	11.0
Smilax aequatorialis			0.4
Vismia guianensis	2.4	3.5	0.9
Total	7.5	5.2	52.5

* cover was calculated as percentage of total woody cover per site.

Forage grass was reduced to 8 % and 40 % respectively on the light and medium used sites, being replaced largely by woody vegetation. On the heavy use site the reduction to 33 % was primarily due to invader grasses (Table 2).

Table 2. Average biomass [%] of vegetation types according to level of pasture use

	Heavy use; n = 30		**Medium use; n = 30**		**Light use; n = 14**	
	Mean	**sd**	**Mean**	**sd**	**Mean**	**sd**
Woody vegetation	4.5[a]	3.8	48.6[b]	30.7	91.3[c]	15.6
Forage grass	33.0	39.6	40.0	34.1	7.6	16.0
Invader grasses	62.0	40.5	6.4	9.1	0.9	1.2
Forbs	0.5	1.7	5.0	7.7	0.2	0.4

[a] equal letters indicating no significant difference ($p<0.05$); effect of site on woody biomass fractions
(%) per plot tested by Kruskal-Wallis test

Discussion

The inverse relationship between pasture use and woody regeneration, well documented for abandoned pastures (e.g. Uhl *et al.*, 1988), also applied to active pastures. The amount of woody biomass on the abandoned site was 68 % less than that reported by Denich (1989) on woody fallow sites of the same age. It was severely reduced on medium and heavy use sites due to burning, weed control and grazing.

Quality of woody vegetation was poor considering the prevalence of the typical woody fallow species described by Baar (1997) on the heavy and especially on the medium use site. On this site 46 % of the woody cover was *Borreria verticillata* which was classified as woody vegetation in this study, but is also referred to as semi-shrub and as an indicator of degradation by Baar (1997).

The value of management and grazing practices (heavy use) designed to maintain open pastures was compromised by the invasion of native Amazon grasses which have only about one tenth the nutritional value of the planted pasture (Faminow, 1998). The strong dominance of grasses also indicates that this duration and intensity of use is clearly too long for a successful integration into the Loker model.

Although the selected sites were not managed as recommended by Loker, the results indicate that the inclusion of pastures will extend the fallow phase beyond the time scale envisaged by his model.

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