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Factors of influences in legal reserve areas in the brazilian amazon

Fatores de influência em áreas de reserva legal na amazônia brasileira

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ABSTRACT

This work aims to analyze future trends through influence factors on the areas of Legal Reserve (RL). The modeling of the data was using the Statistical Package for Social Sciences (SPSS) based on Multiple Linear Regression analysis (RML) using a time series 2003-20023 between variables generating explanatory factors of future influences the area RL. The results of the coefficient of determination (R^2) showed 60%, demonstrating the existence of a relationship between the independent variables X1 to X25 with the variables A_RL response and analysis of variance with F = 76.519 with significance value of 0.000, indicating that ANOVA rejects the event there is no regression. Thus each factor of influence or explanatory acted in association with the variables and produced a RML equation with the response variable A_RL = 3.277 to 0.207 (p-0.023) use of traditional land - 0.346 (p-0.000) income / credit + 0 , 43 (p-0.000) occupation time + 2.007 (p-0.000) Hand effective work + 0.109 education (p-0.230 ** not significant) - 0.727 (p-0.000) area - 0.207 (p-0.024) agroecological practices + 0.343 (p-0.000) ownership. We conclude that most of the factors was significant indicating the need for improving the socioeconomic nature of factors, mainly the education, income / credit and titration which resulted in the adoption of more appropriate environmental conservation public policies combined with agricultural production more sustainable.

Keywords: Public policy; Education; Conservation; Title of Land

RESUMO

Este trabalho visa analisar as tendências futuras por meio de fatores de influência sobre as áreas de Reserva Legal (RL). A modelagem dos dados foi utilizando o Statistical Package for the Social Sciences (SPSS) com base na Análise de Regressão Linear Múltipla (RML) utilizando uma série temporal 2003-20023 entre variáveis geradoras de fatores explicativos das influências futuras da área RL. Os resultados do coeficiente de determinação (R^2) mostraram 60%, demonstrando a existência de relação entre as variáveis independentes X1 a X25 com as variáveis resposta A_RL e análise de variância com F = 76,519 com valor de significância de 0,000, indicando que a ANOVA rejeita o evento não há regressão. Assim cada fator de influência ou explicativo atuou em associação com as variáveis e produziu uma equação RML com a variável resposta A_RL = 3,277 a 0,207 (p-0,023) uso da terra tradicional - 0,346 (p-0,000) renda/crédito + 0,43 (p-0,000) tempo de ocupação + 2,007 (p-0,000) Mão de obra efetiva + 0,109 escolaridade (p-0,230 ** não significativo) - 0,727 (p-0,000) área - 0,207 (p-0,024) práticas agroecológicas + 0,343 (p -0,000) propriedade. Concluímos que a maioria dos fatores foi significativa indicando a necessidade de melhoria dos fatores de cunho socioeconômico, principalmente a educação, renda/crédito e titulação o que resultou na adoção de políticas públicas de conservação ambiental mais adequadas aliadas a uma produção agropecuária mais sustentável.

Palavras-chave: Políticas públicas; Educação; Conservação; Título da Terra

INTRODUCTION

In the last 10 years thousands of km2 of forest land and savannahs in the Amazon are at the mercy of the State's action or omission and can be incorporated into the agricultural productive sector or protected for conservation and sustainable use activities (BRONDÍZIO et al. 2007). In this scenario, emphasis is placed on the need to regulate productive activities in relation to their implications for environmental balance and preservation in the case of agriculture and livestock, as it is an activity that is so interrelated with the environment (BATISTELLA et al. 2003; RODRIGUES, 2008; BENATTI, 2003).

Thus, in the search for socioeconomic factors capable of better ordering this interrelationship associated with the legislation with its various legal devices that limit the right to property in favor of natural resources and the environment. Among these devices, emphasis is given to what imposes on the rural landowner the conservation of a percentage of the property as RL areas, as well as areas defined and protected by law (AHRENS, 2003; RODRIGUES, 2008). This discussion is relevant, above all, because the deficit of the RL area and absence in the States of the Legal Amazon, especially the State of Pará, was caused by processes of economic intervention that sought to transform natural resources into wealth, Of economic development, without considering acceptable and sustainable criteria of rationality (BATISTA et al., 2003; RODRIGUES, 2008 and BENATTI, 2003). Several factors have potentiated the growing wave of deforestation and environmental degradation, such as infrastructure projects and economic plans, expansion of the agricultural frontier, large-scale agriculture, and socioeconomic factors (education, credit and titling), among others.

The present article intends to demonstrate the importance of variables (factors) influencing future trends in the RL area, based on the 400 family units of the Northeast region of the State of Pará. Education, research and extension agencies on the area of RL, but also to collaborate with the improvement of state environmental and agricultural public policies.

MATERIAL AND METHODS

The research was carried out in the mesoregion of the Northeast of Paraense, involving the municipalities of São Domingos do Capim, Mãe do Rio, Irituia and Concórdia do Pará.

The variable considered in the present study was that generated in the semi-structured interview. This variable was presented as response or dependent variable (Y1 - "legal reserve area" (A_RL) that was correlated with explanatory or independent variables (X1 to X25) grouped into 8 factors.

Initially the modeling of the data was by means of the Statistical Package for the Social Sciences (SPSS) for factorial analysis involving all variables, that is, both the response variables (Y1) and the explanatory variables (X1 .....; X25) in order to identify the factors.

The model of factorial analysis represented in the conformal matrix form (SANTANA, 2007; SANTANA, 2003; DILLON & GOLDSTEIN, 1984), where we have:

(Equation. 1)

At where:

Y é o p-dimensional vector of the observed variables, denoted by;

It's an array (p,k) each element express the correlation between the indicator correlation between the indicator and the factor , being named array of factorials loads with the number k of factors less than the number p of indicators;

F is the q- dimensional vector transpose of unobservable variables or latent variables called common factors dimensional, denoted by , being k>p;

is the p- dimensional transposed vector of random variables or unique factors, i.e., vector of residual components, denoted by.

In the factor analysis model assumes that specific factors are orthogonal to each other and with all common factors. To the test Kaiser-Meyer-Olkin Measure of Sampling Adequacy (KMO) It examines the data adjustment, taking all the variables simultaneously, and provides a synthetic information about the data and your value varies between zero and 1. the test Barlett Test of Sphericity (BTS) testing the hypothesis that the correlation matrix is an identity matrix, that is, that there is no correlation between the variables, since the null hypothesis that the explanatory variables are, against the alternative hypothesis that the variables are correlated with each other, i.e: H0: R = I ou H0: $\lambda\_1 = \lambda\_2 = ...\lambda\_p$,

As in the present study the KMO = 0,629 indicates that the data can be used to factor analysis, even if giving in relation to the test of Bartlett's that had p = 0,001 considered highly significant, indicating that correlations exist between the 25 variables are appropriate.

After completing the factor analysis we proceed with the implementation of Multiple Linear Regression analysis (RLM) having as response variable (A_RL) as explanatory variables (X 1.....; X 25).

To carry out analysis of RML was observed the tests p and variance inflation factors (VIF) defined by the equation VIF = (1/(1-R2 j)), where R2 j is the multiple coefficient of determination (R^2 is the multiple regression coefficient). Is a measure of the degree to which each independent variable is explained by other independent variables, that is, the higher the VIF, more severe will be the multicollinearity.

Para HAIR, et al (2006) the multicollinearity refers to the correlation between three or more independent variables. What needs to be done is to look for independent variables that have low multicollinearity with the other independent variables, but also exhibit high correlations with

the dependent variable. Hoffmann, 1998; Hair, et al, 2006 suggest that VIF should not exceed 4 or 5. As in the VIF was RML analysis 1.00 showing that there is multicollinearity in the present study.

The test Durbin-Watson is used to detect the presence of autocorrelation (dependence) in the waste of a regression analysis. This test is based on the assumption that the errors in the regression model are generated by a process of first order, detect if the test p shows if the independent variables X explain the dependent variable Y.

RESULTS AND DISCUSSION

For this study, we used the KMO test (0.629) which indicated the adequacy of Sample Media (BUT) factorial analysis. Bartlett's test (1165.407), significant at 1% (p <0.000) accept the alternative hypothesis that the variable "legal reserve area" (A_RL) as the other variables predictive or explanatory (X 1 ... X 25), as can be verified at Quadro1.

Quadro 1. KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		0,629
Bartlett's Test of Sphericity	Approx. Chi-Square	1165,407
	df	153
	Sig.	,000

In this way, it is intended to demonstrate the most relevant variables (factors) to be worked by public policies to mitigate the deforestation process in family units.

The analysis applied to the model for the year 2003 to 2023 allowed the extraction of factors with characteristic root 08 greater than unity and synthesising the information contained in the 25 original variables.

As table 1 one can see that the 08 selected factors explain, together, 65.314% of the total variance of the variables selected.

Table 1. Indicator, code/acronym 8 factors of variables for analysis .

Indicator	Variable code	Factors								Comunalidade
		1	2	3	4	5	6	7	8	
X_{12}	TUT	**0,895**								0,822
X_{24}	A_PAST	**0,793**								0,738
X_{25}	A_RCAP	**0,82**								0,802
X_{4}	E_SMA	**-0,665**								0,591
X_{13}	C_SAF		**0,778**							0,699
X_{9}	T_CRE		**0,833**							0,718
X_{14}	R_SAF		**0,944**							0,906

X_7	R_ENDA		**-0,507**							0,524
X_3	A_NOC			**0,789**						0,556
X_{19}	P_OUSIO			**0,645**						0,561
X_1	I_DMA				**0,837**					0,732
X_6	M_EFT				**0,679**					0,598
X_5	E_SES					**-0,506**				0,598
X_2	I_DES					**0,573**				0,509
X_{16}	M_APP						**0,764**			0,719
X_{17}	A_RL						**0,696**			0,610
X_{10}	A_REA						**-0,629**			0,567
X_{20}	AB_VERDE							**0,687**		0,573
X_{21}	EQ_CAP							**0,673**		0,516
X_{18}	P_AREA							**0,501**		0,509
X_{22}	Q_SAFs							**0,575**		0,501
X_8	SITU								**-0,715**	0,602
X_{15}	D_EVIT								**0,502**	0,528
X_{11}	O_RIGEM								**0,602**	0,580
X_{23}	M_PAST								**0,513**	0,517
	%Var explicada	**13,595**	**9,264**	**8,533**	**7,714**	**7,033**	**6,867**	**6,329**	**5,980**	
	%Var acumulada	**13,595**	**22,859**	**31,392**	**39,105**	**46,138**	**53,005**	**59,334**	**65,314**	

Extraction Method: Principal Component Analysis.
Rotation Method: Varimax with Kaiser Normalization
a.Rotation converged in iterations

X 1-"age of husband" (I_DMA), X 2-"old wife" (I_DES) X 3-"years of occupation on the lot" (A_NOC), X 4-"schooling of her husband" (E_SMA), X 5-"education of wife" (E_SES), x 6-"effective labor" (M_EFT), X 7-"income" (R_ENDA), X 8-"situation of the Earth" (SITU), X 9-"type and access to credit" (T_CRE), X 10-"size of area" (A_REA) , X 11-"origin" (O_RIGEM), X 12-"land use type" (TUT), X 13-credit project (FNO and/or Pronaf) "abandoned" and later implementation of SAFs-"CreditCards and SAFs" (C_SAFs), X 14-planting food crops (farm) followed both implementation of SAFs-"roça SAFs" (R_SAFs), X 15-"avoided deforestation" (D_EVIT), X 16-"permanent preservation area" (M_APP), X 17-"legal reserve area" (A_RL) , X 18-"running area s/fire and firebreak" (P_AREA), X 19-"fallow time" (P_OUSIO), X 20-"green manure" (AB_VERDE), X 21-"enrichment of capoeira" (EQ_CAP), X 22-"backyard and SAFs" (Q_SAFs), X 23-"management of pasture" (M_PAST), X 24-"pasture area" (A_PAST), X 25-farm-area "capoeira" (A_RCAP)

Mattos (2010) in your work in the Amazon biome demonstrates that the "origin of the family," "time of occupation of the lot", "education", "lot size", "ownership of the lot", "household income and" access to rural credit "are statistically significant deforestation of the legal reserve (P<0.100) and still Batistella et al. (2003) reported that these variables interrelate which the high number of events of deforestation caused by the practices of family agriculture Although relatively small in area, can also bring important implications for the environmental changes and the very sustainability of their production systems and the legal reserve, depending on the context of each local landscape

The results are presented in table 1 show the contents of the template, where it's up to stress the values of r = 0,781 that indicates a strong correlation between independent variables and the dependent variable.

In the present study the test Durbin-Watson (1,63) indicated absence of autocorrelation - DW < 2 (table 4)

table 1 – Contents of the variable "legal reserve area" (A_ RL)

r	R^2	R^2 Ajustado	Durbin-Watson
0,781	0,610	0,602	1,63

R^2 = 0,610 indicates how much of the variability of the dependent variable is explained by the dependent variable. However, when working with a large number of independent variables, follow the value of R^2 (0.602) which shows that there is a clear relationship between variables with legal reserve area

For the independent variables, Mattos (2010) raised as a possibility that the service to use ecological economic principles of the Earth comes from families originating in Legal Amazon due to your empirical ecological knowledge of the biome. The author's study demonstrates that units led by families originating in Amazon clearly stand out, the largest amount of legal reserve with regard to migrant families by.

On the other hand, Mattos (2010) and Brondízio et al. (2009) recognize that deforestation rates are not only related with the different times of occupation of the lot and with the changes in family composition, but also with the availability of capital and technology and the strategies of land use and natural resources.

In several studies point out that "years of occupation", evolves with time from the birth of the new family members or concurrent building families other generations within the same family unit with area and limited natural resources (VASCONCELOS, 2014; MATTOS, 2010; BRONDÍZIO et al., 2009). As changes occur in natural resources, primarily through the traditional practice of slash-burn, the consumer needs (determined by the number of members of the family unit, particularly, by the number of dependants) and the strength of her work available also change (MATTOS, 2010).

As regards test Durbin-Watson indicates whether or not there is autocorrelation when the waste is correlated with the values of the dependent and independent variables, are, preceding or following the same series. Bad specification of regression model on the basis of waste in the form of the model or by exclusion of independent variables important for analysis is one of the causes of autocorrelation with the dependent variable "legal reserve area" (A_RL) that corroborates with understanding of the authors Brondízio et al. (2009), Van Wey et al. (2009) e Walker (2003), and that family units evolve, generally, from nuclear units with small children for units with teens and young adults, who leave home in search of their own units. As changes occur, the consumer needs (determined by the number of unit members, particularly by the number of dependants) and the workforce available (determined by the number of members in economically active age) also change. In this conceptual model, the first unit focuses on toppling and in the cultivation of annual

crops, for in stages following devote to land uses that provide smaller short-term dividends and higher, without worrying about legal reserve replacement.

In this same direction Brondízio et al (2009) brings similar results and, the process of land use change tends to be more intense during the first five years in the family unit, due to the need to establish the traditional land use, namely, annual production systems (roca), but after a few years, the rate tends to decrease, returning to rise with the introduction of the pasture/livestock and to stabilize or decrease slightly with the consolidation of perennial crops in areas of secondary forest within the family unit.

Moran et al. (2009) found that after five years (on average), while the family farms consolidate and use areas already cleared, there is a second increase in deforestation, given by a new expansion phase of activities in family units. For authors Moran et al. (2009) and Vasconcelos et al. (2014) in this new stage can lead to new areas of annual crops, perennials and pastureland, depending on the capital-labor relationship and the availability of land that may affect the legal reserve, both for increasing deforestation as for your replacement.

Na table 1 shows the F test, indicating that the regression model is significant ($p < 0.001$) and that the regression equation is significant, demonstrating that the independent variables together explain the dependent variable (A_RL), as can be seen below.

Table 1 – Analysis of variance of the variable "legal reserve area" (A_RL)

Model	Square Sum	GL	Mean Square	F	P*
Regression	2,026,325	8	253,291	76,519	0,000
Residue	1,294,270	391	3,310		
Total	3,320,595	399			

* The p value or descriptive level is the probability of obtaining a test statistic equal or more extreme than that observed in a sample, under the null hypothesis.

The Multicollinearity is a problem in the adjustment of the model which can cause reflections in the estimation of parameters. For this study the multicollinearity was diagnosed through the. $$VIF_j = \frac{1}{1 - R_j^2}$$ R^2 is the multiple regression coefficient.

As in this model, all values of VIF = 1.000 showing that there is multicollinearity (Table 5)

The analysis of the coefficients of the regression model (table 2) where each coefficient has a value of p and all are significant with the exception of the variable factor 5. This means that the independent variables have significant regression with the dependent variable and the value VIF indicated that there is multicollinearity among the independent variables.

Table 2 – Analysis of the response variable coefficients "legal reserve area" (A_RL) with the factors of influence

Model	Non standard Coefficients			t	p	VIF
	B	Standard Error	Beta			
Constant	3,277	0,091	-	36,025	0,000	-
Factor 1-traditional land use	-0,207	0,091	-0,072	-2,276	0,023	1,000
Factor income/credit	-0,346	0,091	-0,12	-3,802	0,000	1,000
Factor 3-time occupation	0,431	0,091	0,149	4,734	0,000	1,000
Factor 4- effective work	2,007	0,091	0,696	22,037	0,000	1,000
Factor 5- schooling	0,109	0,091	0,038	1,201	0,230^{ns}	1,000
Factor 6- area	-0,727	0,091	-0,252	-7,982	0,000	1,000
Factor 7- agroecological practices	-0,207	0,091	-0,072	-2,273	0,024	1,000
Factor 8- title of the Earth	0,343	0,091	0,119	3,761	0,000	1,000

^{ns}Non-significant

The regression equation is presented with almost every significant influence factors, with exception to the 5 factor, as can be seen below:

A_RL = 3.277-0.207 (p-0.023) use of traditional land-0.346 (p-0.000) income/credit + 0.43 (p-0.000) time of occupation + 2.007 (p-0.000) effective work + 0.109 schooling (p-0.230 ** not significant) – 0.727 (p-0.000) 0.207 area (p-0.024) agroecological practices + 0.343 (p-0.000) title of the Earth

In relation to this data, Mattos (2010) and Vasconcelos et al. (2014) in their studies indicate that the higher the educational level (factor 5) of leaders of family units (man or women), the greater the tendency for opening new areas of forest, and in the case of women, this trend is less marked, showing the influence of the social division of work in the units because the food cultivation and livestock farming is a type of activity more masculine, while women lead the creation of small animals and cultivation of backyard, and points out that schooling is not demonstrated a variable relevant to legal reserve area.

Oliveira (2009) e Vasconcelos *et al* (20014) revealed in your study the importance that farmers give the schooling of their children and the expectations they have in relation to the role of the school to the improvement in the management of natural resources of the family unit. Nevertheless emphasizes that the school does not take care of the everyday life of the field and student "doesn't speak your language", suggesting changes in the role of the school. As an example, several successful experiences under way, as the Rural Family House project (CFR) as central subjects the children of farmers who adopt the pedagogy of alternation (OLIVEIRA, 2009), characterized by a pedagogical project which brings together school activities and other productive activities of innovative nature to be performed on the student's family unit.

In relation to the Factors 1 e 4, Romeiro (1998) e Mattos (2010), drew typology of family farmers and indicated that at the beginning of the occupation of the lot (factor 3) related to the use of traditional land (factor 1)-annual crops of subsistence (farm pure)-have the role to prepare the ground for the opening and expansion of future grazing areas and creation of large animals (farm + cattle), resulting in a continuous process of devaluation of the primary forest and decreasing "legal reserve".

Also noted that there is no relationship between titration (factor 8) of family units with the legal reserve, thus the title of the Earth by itself does not ensure protection to natural resources as puffed in the literature of environmental law, the annual family income is slightly higher than in lots cleared, but the greatest impact of regularisation do not get on the use on land but in the resale value of the family unit (MATTOS, 2010). For many authors, the issuance of securities of the family unit can effectively reduce rates of deforestation and promote forms of "land use type" less damaging to natural resources. According to this hypothesis, the security of the rights of the family unit are well set allows a long-term planning, once farmers have greater confidence that their decisions will be implemented and that they will enjoy the returns of your investments (WOOD *et al*, 2002; MATTOS,2010).

On the other hand, farmers don't have title would tend to opt for immediate consumption of available resources instead of investing in the long run and adopt measures aiming at sustainable production practices. If these deductions are correct, an effective way to reduce environmental degradation would eliminate the uncertainty through the issuance of title and property rights enforcement (WOOD *et al*, 2002).

With regard to income (factor 2) for growth of annual crops between lower levels of annual family income and decrease in intermediate levels to highest, so units with annual household income highest aim lower portion of area (6 Factor) for annual crops, an activity that is characterized by generating low value, so it is more directed to the family's food security. The higher the annual household income, the lower the occupancy of the family unit (factor 3) with legal reserve, given that illustrates the reverse situation between legal reserve and livestock, even if those families with lower incomes also show inability to retain legal reserve, this end exposes the great need, again, to develop productive policy options with environmental sustainability because compliance with environmental legislation as regards the legal reserve demonstrates commitment to annual household income generation.

Finally, the results show that the main limiting factors of family units studied are: lack of titration of the areas, precludes obtaining credit to family units, the absence of a school that meets the everyday reality of farmers, and the size of the area and the time of occupation of the household becomes inconsistent because of the traditional use of the land made with cut/burn followed by fallow land reduced to recomposing of forest biomass.

CONCLUSION

The results obtained from the RML feature almost exclusively positive signs and significant as exception "schooling" factor for response variable A_RL in this case, these results point to an indirect relationship and not significantly referenced variable. In the response variable (A_RL) and the factors were significant and direct, this implies the need for improved socioeconomic nature factors (education, income/credit and titration) resulting also in the adoption of public policies better suited to environmental preservation combined with agricultural production more sustainable.

According to the results, the study identified the importance of forest legislation, and instruments for the restoration of RL area, under the environmental functions performed by area, but also the complexity of your application and interpretation on practice relating to the eight factors of influence on the response variable (A_RL). Given this, it turns out that other biophysical variables, always linked to the eventual reform of social forestry code that meets the reality of family units and could be incorporated into legislation, creating new instruments to make sustainable uses with social demands that would enhance the standards without affecting environmental quality.

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