ANALYSIS OF THE DEFORESTATION PROBLEM IN TROPICAL LATIN AMERICA

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Abstract.—The driving forces of land use changes have been analyzed and discussed for a long time with different solutions proposed and implemented. Unfortunately the reduction of natural forest cover continues in the same direction, generating an increasing alarm all around the world among scientist and politicians, related to the climate change awareness and strategies for its reduction and mitigation. This paper discusses the causes of deforestation, causes and effects in tropical Latin America.

INTRODUCTION

This paper discusses the causes of deforestation in tropical Latin America.

Deforestation is an issue that has long been a concern of the international community, especially in the tropics. It is increasingly important to provide updated and reliable information based on accountable and transparent procedures. There is still much work to be done to develop standardization of terms, definitions, and procedures for the evaluation of changes in forested areas at the national and local levels.

The forest cover of any area is referred to as the physical presence at a particular time of continuous or fragmented vegetation, defined as forest, which is a type of woody vegetation with a minimum height of 5 m at maturity, with a minimum coverage of 10 percent of the canopy on the soil surface. Within this classification are dense forest (>40 percent coverage), open (between 10 and 40 percent coverage), or fragmented forest in isolated stands but which collectively cover extensions reaching a minimum of 0.5 ha.

In ecological terms, the most important concept is the forest's ability to meet minimum production of goods and services, i.e., the protection of soil, conservation of water sources, regulation of the water system, wildlife habitat, recreation, conservation of biological biodiversity (understood as the total variety of genetic strains), species and ecosystems that exist in the nature and are able to survive in a sustained way.

This document is only a part of this broad and complex problem of the relationship of deforestation to specific socioeconomic parameters. Once both aspects of definition and concepts of classification of forests are standardized or formalized for a particular purpose, the immediate problem is how to measure or evaluate the parameters that serve to integrate a reliable database that is structured for a particular purpose or agenda, such as the FRA, Kyoto, Convention of Biodiversity, Reducing Emissions from Deforestation and forest Degradation (REDD), and the sustainable forest management procedures, generating information of the first order, so the accuracy and reliability of the information may have fairly broad range of consistency and reliability.

METHODS

Based on information provided by 14 reporting countries for the FAO-FRA program (between 1980 and 2010), 71 references were pre-selected. Parameters for evaluating the information consistency (IC) were given a value from 0 to 5 and a specific weight or

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importance. Based on the calculation of coverage and/or changes of the forest cover, the following parameters were considered:

a: Quality of the source of information: P1 = 0.15
b. Detail information: P2.20
Consistency and back: P3, 40
d. Age: P4 0.25
IC. Weighted reliability index =
(a * b * p1 + p2 + + c * d * p3 + p4)

The sum of multiplying the score of each parameter by its specific weight gives a final score which can be up to 5. These final scores are grouped into three categories:

A: 0 to 3.0: low, removed or held in reserve in case there is no other better reference
B: 3.1 to 4.0: means, we choose the most recent or consistent
C: > 4: high is used directly

To do a quick analysis on the relationship of these parameters to annual deforestation rates, some major macroeconomic parameters at the country level for 14 countries of tropical Latin America were identified. However, to bring the analysis to smaller or manageable contexts, seven Brazilian states from the Amazon region were selected, with a total of 129 districts and about 60 socioeconomic parameters, out of which only 26 were considered significant. These 26 parameters were analyzed using linear and logarithmic correlation with the annual deforestation rates (2000-2005), yielding R^2 values, indicating the degree of correlation between deforestation rates recorded for each country and the seven Amazonian Brazilian states.

RESULTS

Of the 14 countries evaluated in terms of the reliability of the information provided (IC), 10 values were above 3.1. and 4 countries had rates above 4. This is an indication that there is still a lot of work to do to collect more reliable and consistent information regarding forest deforestation. The results of this analysis are expressed in terms of R^2 values.

As shown in Table 1, the factor that is the most influential in deforestation is the population density, particularly the rural population, which should be understood as the necessity of living space and food, which is stronger than the need to conserve the environment, especially in societies where there are no valid alternatives through job opportunities, income to fund the family basket, and so on. A second influential factor, but in a favorable manner to the preservation of forests, is the annual growth of gross domestic product, which means improved job opportunities for people, better prices for agricultural products, and increased consumption, particularly for rural populations.

At the Subnational Level

From the seven states of the Brazilian Amazon, numerous socioeconomic parameters were considered, including: total population from urban, rural, agricultural land, pastures, forests, secondary forests, production and productivity agricultural state investment in development projects, agricultural machinery, etc. These were analyzed for their relationship or correlation with the average rate of deforestation for the period 2000-2005; results are shown in Tables 2 and 3.

Table 1.—Factors related to forest conservation

Parameters	R^2 for Linear Correlation	Influence Over Forest Conservation
Rural Population Density	0.626	Negative
Gross Domestic Product (GDP)	0.2486	Positive
Percent of Rural Population	0.2103	Negative
Annual Growing Population Rate	0.1514	Negative

Table 2.—R^2 Values, parameters are positive for the conservation of the forest

		ACRE	AMAZONAS	M.GROSSO	PARA	RONDONIA	TOCANTINS	TOTAL
HA/FARMER (AGR & GL)	**V**	-0.322	-0.374	-0.297	-0.125	-0.583	-0.281	-0.142
HA/FARMER (AGR)	**U**	0.271	-0.383	0.029	-0.390	-0.506	-0.388	-0.040
PRODUCTION $/HA (AGR & GL)	**BJ**	0.163	-0.304	0.187	-0.436	0.271	-0.181	0.218
PRODUCTION $/HA (AGR)	**BK**	-0.333	0.238	0.032	0.059	-0.294	-0.640	0.110
PRODUCTION $/FARMER	**BL**	-0.237	0.108	0.164	-0.482	-0.204	-0.500	0.065
PRODUCTION AGR+GL $/FARMER	**BY**	-0.257	-0.074	-0.038	-0.273	-0.543	-0.231	-0.092
PRODUCTION AGR. $/FARMER	**BZ**	0.241	-0.024	-0.004	-0.273	-0.538	-0.243	0.062
PRODUCTION $/HA GL	**CA**	-0.250	-0.245	-0.179	-0.274	-0.542	-0.218	-0.137
ANNUAL INCOME $/FARMER	**BX**	-0.194	-0.447	-0.008	-0.261	-0.531	-0.237	0.060
MUNICIPAL INVESTMENT $/FARMER	**CB**	-0.110	0	0.023	0	0	-0.367	0
MUNICIPAL INVESTMENT $/RURAL HABITANT	**CC**	0.040	0	0.135	0	0	-0.268	0
POPULATION DENSITY HAB./KM^2	**F**	0.375	-0.370	0.231	-0.192	-0.249	-0.551	-0.130
ANNUAL YIELD $/AGR	**BR**	0.229	0.019	-0.113	0.125	-0.472	0.165	-0.027
ANNUAL YIELD $/AGRL	**BS**	0.220	0.061	0.181	-0.491	0.276	-0.175	0.138

Table 3.—R^2 values, parameters turn out to be negative for the conservation of the forest

		ACRE	AMAZONAS	M.GROSSO	PARA	RONDONIA	TOCANTINS	TOTAL
AGR&G LINVESTMENT $/HA	BN	0.475	0.080	0.131	0.058	-0.012	0.040	-0.010
AGR INVESTMENT $/HA	BO	-0.143	0.057	-0.112	0.500	-0.390	0.391	-0.027
GL INVESTMENT $/HA	BP	0.526	0.593	0.128	-0.086	0.096	0.043	0.266
AGRI & GL ANNUAL YELD $/HA	BQ	0.623	-0.103	0.202	-0.256	0.114	0.100	0.060
NUMBER OF TRACTORS/HA AGRI & GL	BT	0.043	0.187	0.322	-0.070	-0.199	0.108	0.086
NUMBER OF TRACTORS/HA AGR	BU	-0.259	0.184	-0.104	0.358	-0.408	0.170	-0.039
NUMBER OF TRACTORS/GL	BV	-0.115	-0.055	0.267	-0.158	-0.156	0.085	0.062
% OF FALLOW FOREST/ AGR	W	-0.397	-0.091	0.096	0.609	-0.247	0.618	0.086
% OF FALLOW FOREST/AGRIC & GL	X	-0.135	-0.022	0.149	-0.255	-0.140	0.264	0.068
POPULATION ANNUAL GROWTH	G	-0.067	0.251	0.336	0.155	0.295	-0.131	0.157
% OF RURAL POPULATION	J	-0.322	0.117	0.183	0.370	0.564	0.274	0.163
LIFE STOCK INVESTMENT $/HA	BM	0.226	0.423	0.106	-0.344	0.153	-0.070	0.018

Figures 1 and 2 show that some socioeconomic indexes are highly significant for forest conservation, particularly those related to the per capita National Gross Product (NGP) and the productivity of income-generating activities, to benefit the local population.

On the other hand, population density, type of investments, and population growth are working against forest conservation and actually stimulating deforestation.

DISCUSSION

There is no single cause for deforestation. In any case this does not occur in isolation but there are several factors that together establish a context quite complex, including:

- Extreme poverty and lack of job opportunities and family income sufficient for economically disadvantaged people
- Lack of policies and legislation and strategies or policy mistakes of the occupation of forest areas in the humid tropics
- Insufficient capacity in decisionmaking of the forest authority in the occupation and use of the forest land
- Lack of planning on land use, use of inappropriate technologies, and deficiencies in the use of land and forest.

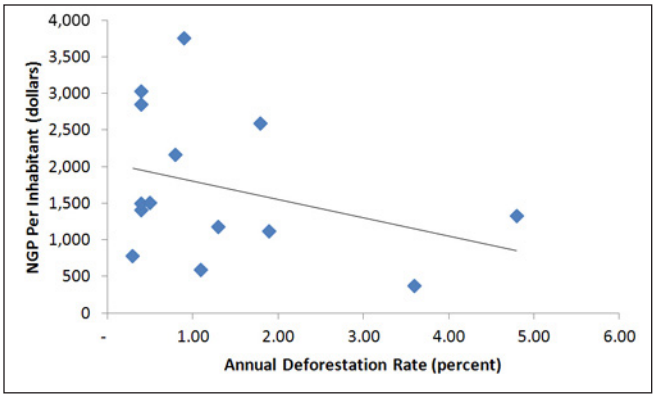

Figure 1.—National gross product per inhabitant by annual deforestation rate.

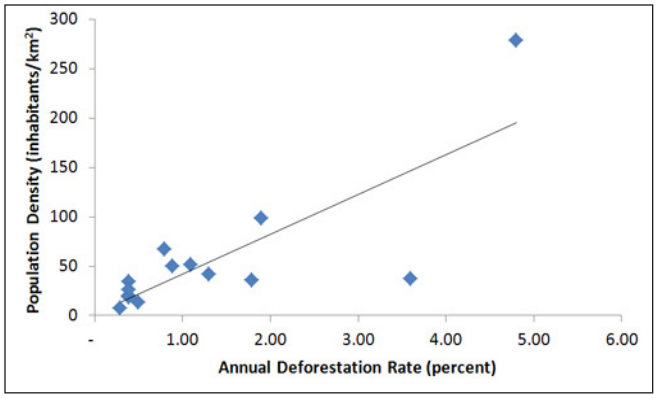

Figure 2.—Population density by annual deforestation rate.

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