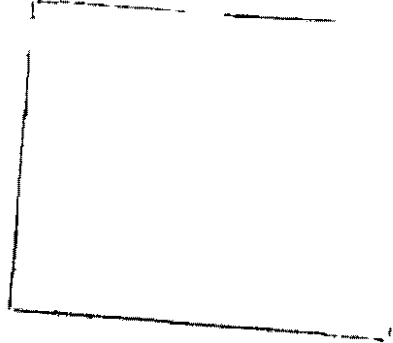


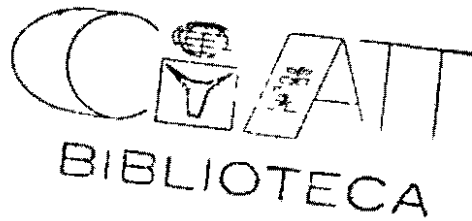


CHARACTERIZATION OF FOREST MARGIN AREAS
IN LATIN AMERICA FOR CIAT

Daniel M^{ex} Robison
Agroecological Studies Unit
CIAT



Working Draft - For Discussion.
January 1992



117861
20 ENE 1995

CONTENTS

Introduction	3
CIAT Definition of Forest Margins	3
Data Sources and Compilation	6
Results	10
Relation with Deforested Areas	10
Relation with Protected Areas	12
Summary by Country	12
Assessment of Cropping and Cattle Figures	12
Discussion	18
Modal Areas	18
Comparison for Site Selection	23
Bibliography	26
Appendix I Short Descriptions of Subzones	29
Appendix II Data Table	37

This study was possible thanks to years of data collection and digitization by the Agroecological Studies Unit. E Barona and M Rincon were instrumental in its execution

INTRODUCTION

Following a lengthy strategic planning process, CIAT identified the "Forest Margin" agroecosystem as high priority for future research (CIAT, 1991). According to this plan, the goal of the Forest Margin Research Program will be "To reduce the pressure on tropical forests by developing ecologically and economically sound production systems for already cleared land". In addition, the Forest Margin will pursue the following four objectives:

- 1 Assess the possible social and environmental impact of technological innovation on shifting cultivation.
- 2 Reduce the destructive effects of shifting cultivation.
- 3 Assist in the development of improved land use strategies in (tropical) forest areas.
- 4 Strengthen national capabilities for improving forest margin production systems.

The problem of tropical deforestation is well known and topical. Similarly, the goals and objectives above are generally accepted and agreed on in principal. However, to reach these objectives there are many problems to be overcome. A recent literature compilation found over 1400 references relevant to deforestation and the alternatives related to shifting cultivation alone (Robison and McKean, 1992). Clearly tropical deforestation has received and continues to receive much research attention yet the situation appears to worsen.

One of the first problems to be faced for agroecological research is diversity of ecological and soil conditions in areas that were formerly tropical forest. The work in this document describes the approach used to characterize forest margin areas to overcome such problems. The goal was to provide an information base, for CIAT and partner institutions, for a systematic selection of areas in which to concentrate their work. In the first instance this allows for selection of representative areas in ecological and social terms. However, in the long term it allows for more systematic extrapolation of research results when they become available.

CIAT DEFINITION OF FOREST MARGINS

In Latin America, Tropical Forest occurs from sea level to nearly 3000 m at the equator and from areas with less than 800 mm/yr rain to over 8000 mm/yr. It occurs on nutrient rich alluvial soils as well as on extremely poor, sandy soils. During the planning process, the CIAT Agroecological Studies Unit (AEU)

classified and mapped environmental classes using regularly gridded data sets (METGRID) of climate, soils and elevation (Jones, et al , 1991)— This environmental classification was based on the following criteria

1- Length of Growing Season
(No of months where precipitation \geq 60% Potential Evapotranspiration)

Humid	Over 9 months wet
Seasonally wet	6 to 9 months wet
Seasonally dry	3 to 5 months wet
Dry	2 or less months dry

2- Mean Growing Season Temperature

Lowland	Greater than 23.5 °C
Mid altitude	18 to 23.5 °C
Highland	13 to 18 °C
Cold	Less than 13°C

3- Annual Temperatures Range

Tropical	Less than 10°C range
Subtropical	Greater than 10°C annual range

4- Soil Acidity

Acid soils	pH less than 5.5
Less acid soils	pH greater than 5.5

The resulting environmental classes were mapped on the 10 minute METGRID and overlaid with selected social variables using a geographical analysis package, IDRISI (Eastman, 1988). Rural income per capita, total rural population and total urban population were estimated for each class by overlaying small scale digital maps of these variables. Next, using a digital road and navigable river map, the accessible area (within 30 Km of a permanent road or river) for each class was estimated. Finally, we extracted all legally protected areas by overlaying with a map of parks, reserves and other protected areas.

This analysis showed that the largest environmental class (total, accessible and legally accessible) was lowland, tropical, seasonally wet with acid soils (Fig 1). Surprisingly, this environmental class also has the largest total rural population and the largest rural poverty index (rural population/rural per capita income) (Jones et al , 1991).

Further analysis showed that by far the most common land use pattern in this environmental class was a combination of slash and

Lowland, Tropical, Seasonally wet, Acid soils



Unidad de
Estudios
Agroecológicos
C I A T

FIG 1

burn agriculture with extensive grazing. This combination of ecological conditions and agricultural was identified in 17 countries in Latin America. Based on this analysis the definition for CIAT's Forest Margin is: Those areas that are tropical, lowland, seasonally wet with acid soils where the land use is some combination of slash and burn agriculture with extensive cattle grazing.

DATA SOURCES AND COMPILATION

One of the problems inherent in frontier areas is the lack of recent and complete information on population and land use. While these areas share problems such as deforestation, burning, isolation and poverty, they differ in degree. Such important considerations as access to land and markets vary considerably. Therefore, the data below is the result of an attempt to gather available evidence and put it in a similar form. This enables comparisons and contrasts between zones and between countries. Figure 2 gives an illustration of the reliability of the data.

The first step was to reassess the climate and edaphic information. The FAO Soils Map (FAO/Unesco, 1974) formed the basis for soils information. For countries where more detailed and more recent information existed, this soils information was corrected if needed. In general, at the scale of 1:1,000,000 or smaller the main boundaries between acid and non-acid soils are similar.

The digital road map was checked and updated. For Brazil this implied digitizing the 1989 Road Atlas. The protected areas map was updated and currently includes 1080 protected areas. All this information was overlaid on the map in Figure 1 to arrive at final subzones. These are contiguous areas with similar climate, soils and land use (Fig. 3).

Large contiguous areas that were environmentally similar were sometimes divided along political boundaries to improve the resolution of the available data. Examples of this are the boundaries between Bragantinas and Paragominas or between Pindare and Imperatriz. Appendix I gives brief descriptions of each of the subzones.

During this step it was considered, using secondary data, whether or not the areas fit CIAT's land use definition. In most cases the areas were found to have shifting cultivation and/or extensive grazing. Some areas close to markets, plantation agriculture areas, and exclusive grazing areas were excluded.

The next step was to collect the best available population, land use and crop estimates. For example, for Brazil this implied using the 1980 census statistics for percentage land use, IBGE, 1984, the 1987 crop production estimates, IBGE, 1989, and the 1987 total population figures, IBGE, 1988, all at the municipio level. A further example is Bolivia where there is a 1985 census, but two important departments, Beni and La Paz, are not included. For Central America there are often ageing censuses available and these

QUALITY OF DATA

Legend



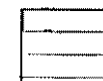
Reciente Completo



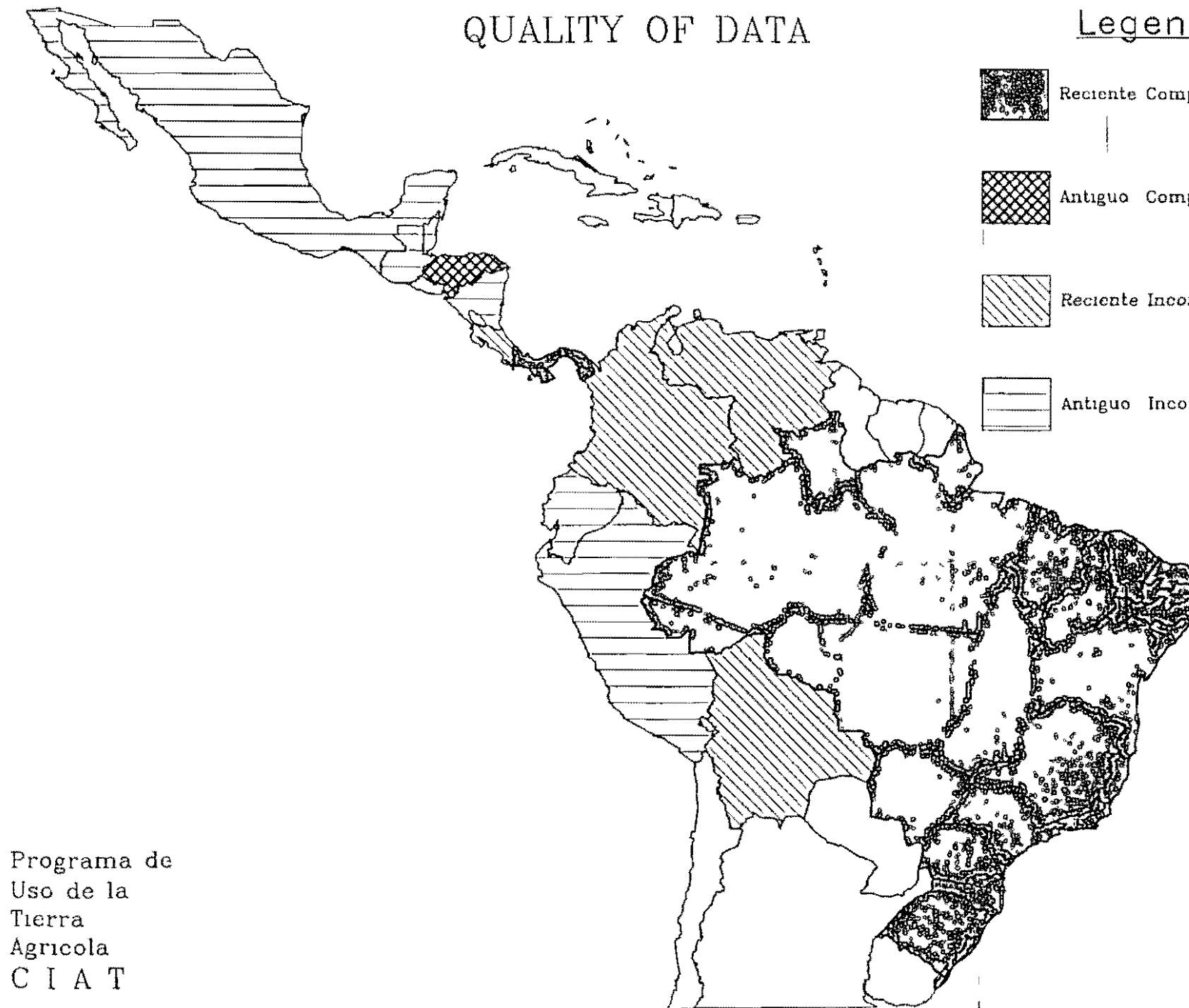
Antiguo Completo



Reciente Incompleto



Antiguo Incompleto



Programa de
Uso de la
Tierra
Agricola
C I A T

were used, attempting to correct for recent crop, population or cattle statistics. Where the information was insufficient the variable was left blank. Appendix II summarizes the data, including the information gaps.

One more concern is that land use in Forest Margins is inherently dynamic and appears to have been particularly so between 1965 and 1985. However, it is also apparent that the rates of road building, government sponsored colonization, etc generally dropped during the late 1980's. The purpose of this analysis is not to arrive at final conclusions about rates of deforestation and degradation but to help stratify the forest margins in terms of modal land use patterns. In Brazil for example, ISPN (1992) have identified four general processes in the Brazilian Forest Margin: Spontaneous colonization, government sponsored colonization, private colonization and large company concessions. It is possible to recognize discrete areas characterized by these processes. This fits quite well with the kind of data that we have gathered. Our interest is to identify similar patterns, but for the whole continent. Once these patterns have been identified, then we can suggest relevant areas on which to concentrate.

RESULTS

Relation with Deforested Areas

An important consideration is to know what relation the CIAT Forest Margin areas have with total deforested areas. Figure 4 is an overlay of the CIAT Forest Margin areas with one estimate, by the International Union for the Conservation of Nature (IUCN), of former lowland tropical forests in Latin America (Collins, 1990). It is reassuring to note that there is considerable agreement, though the methods used were completely different. The areas mapped by IUCN were done using vegetation maps and interpretation of satellite images. These were two variables not used by CIAT. The CIAT areas are more probabilistic areas where deforestation is likely to occur, based on access and environmental conditions. Comparison of CIAT's areas with detailed ongoing satellite analysis at Brazil's Instituto Nacional de Pesquisa Espacial (INPE), suggests that the access approach does not leave out significant areas (Alvarez, 1991). In fact, the CIAT areas are generally larger than those of IUCN or INPE. Both CIAT and IUCN appear to exclude much of the areas that were deforested over 40 years ago. The CIAT map excludes areas of deforestation on better soils, drier climates and higher altitudes. In figure 4, for example, the deforested areas in Colombia are mainly over 1000 m asl. Some of the deforestation at elevations above 1000 m will be a concern of the CIAT hillside program.

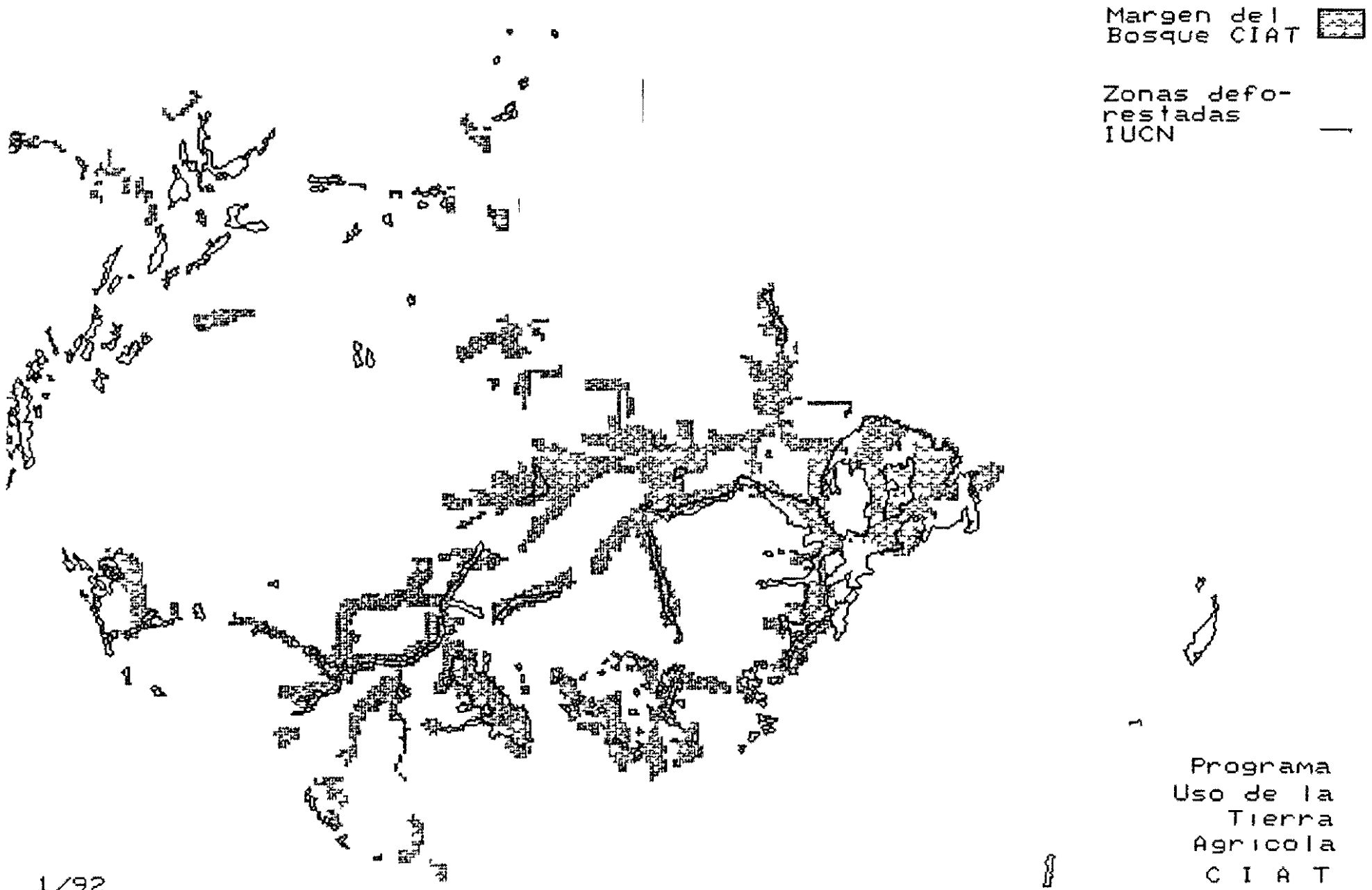


FIG 4

Relation with Protected Areas

Figure 5 illustrates an important point. There are relatively few areas of overlap between CIAT Forest Margin Areas and legally protected land. This is obviously because it is easier for governments to protect, on paper, land that is not easily accessible. It also appears that where there is an overlap, it is where protected areas come within 30 Km of a road, then degradation is likely to occur. Xingu in Mato Grosso and Gurupi in Maranhao, Brazil are two good examples of this occurrence.

CIAT intends to use this information in two ways. First, to know where the research areas are in relation to protected areas. Secondly, to identify areas of conflict or overlap as a subject of study in itself. The buffer concept.

Summary by Country

Table 1 illustrates the predominance of Brazil as defined by the CIAT Forest Margin. It is likely that in countries such as Nicaragua and Panama, the agriculture in the Forest Margin may represent a larger proportion of the GNP, but in terms of area and population, Brazil is overwhelming. Bolivia, Peru and Colombia came out next in terms of area, but the Central American countries appear to have a higher population density and are relatively more important in this sense.

The rural population figures are particularly unreliable. However, if for the missing countries we assume a population density of around 10 people/Km², it is still within 5 % of our estimate of a total population of 10.8 million. A fair percentage of this total is accounted for by Belem and Manaus alone.

Assessment of Cropping and Cattle Figures

In the Forest Margin, the most common crops are maize, rice and cassava. This is not surprising, as they are among the crops most suitable to shifting cultivation while at the same time are commercial. Rice, with approximately 1.6 million hectares in the forest margin, may have the largest area. There is not an overall estimate for maize, but it could be near the figure for rice. Records show approximately 400,000 hectares of cassava, but that is a likely underestimate as much of the rice, with or without maize, is intercropped with cassava.

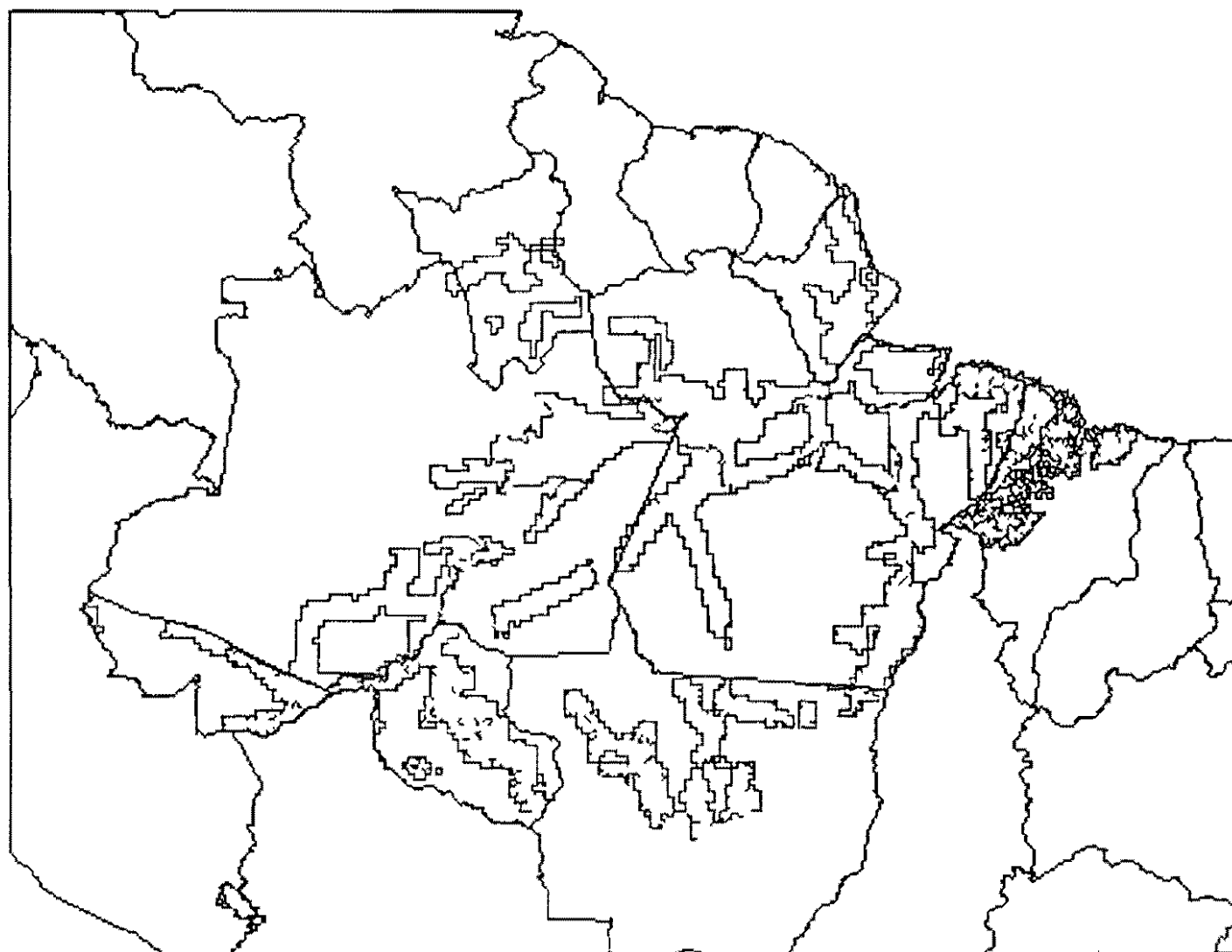
Figures 6, 7 and 8 show that there is a correlation between the density of these crops and the density of the rural population.

TABLE I

FOREST MARGIN AREA AND POPULATION ESTIMATES BY COUNTRY

Country	Area	% FM Area	Popula- tion (000)	% FM Popula- tion
Belice	2 9	0 2	N a	
Bolivia	67	4 8	282	2 6
Brazil	1170	82 3	8678	80 1
Colombia	36	2 6	249	2 3
Costa Rica	2 6	0 2	54	0 5
Ecuador	11	0 8	N a	
Guatemala	6 6	0 5	140	1 3
Honduras	6 5	0 5	70	0 5
Mexico	8 3	0 6	N a.	
Nicaragua	22 3	1 6	704	6 5
Panama	18 6	1 3	303	2 8
Peru	42 7	3 0	N a	
Venezuela	25 5	1 8	346	3 2
TOTAL	1421 7		10834	

RICE IN THE BRAZILIAN FOREST MARGIN
ESTIMATED FROM IBGE, 1980



HECTARES

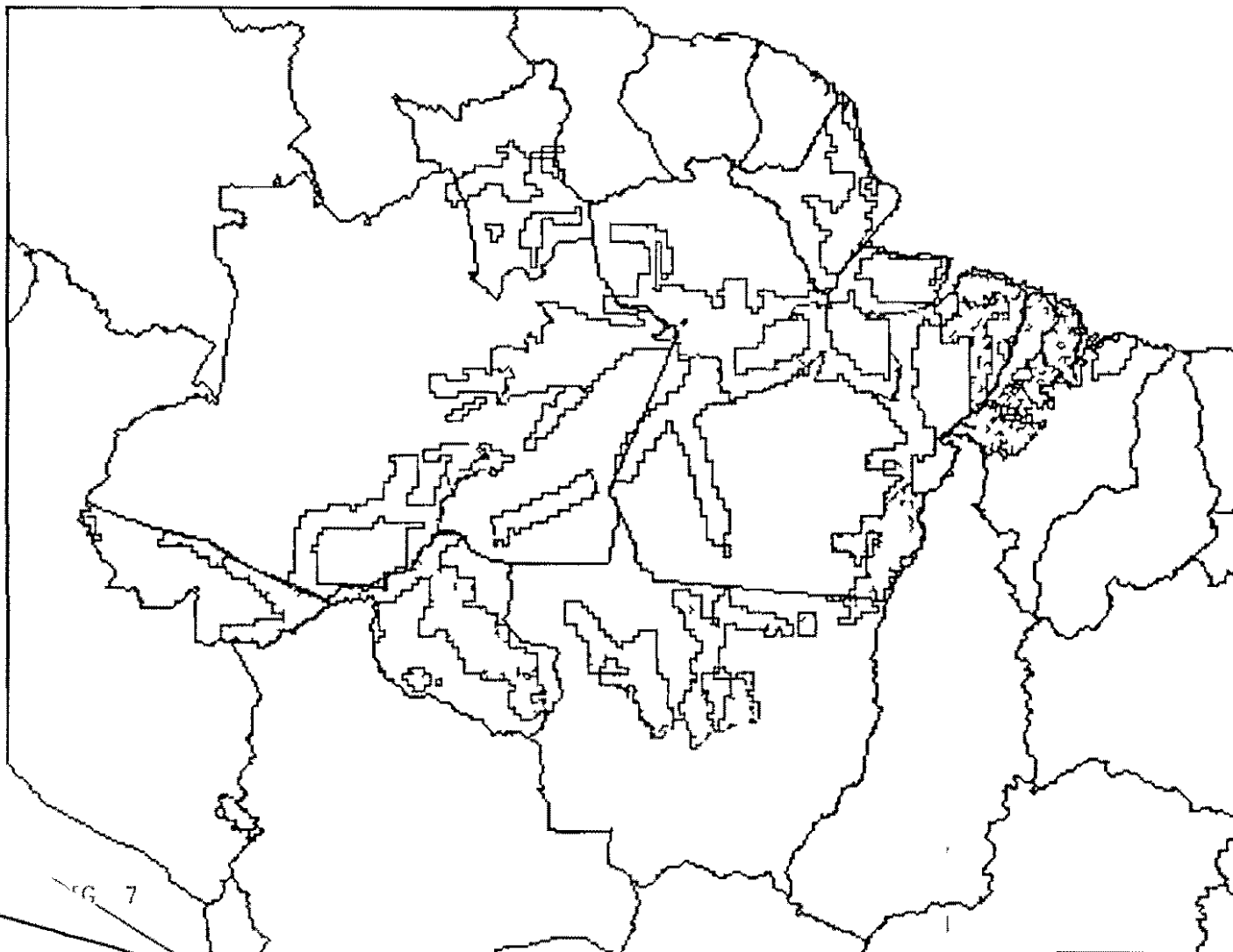
1 Dot = 500

CCN/AT
BIBLIOTECA

MAIZE IN THE BRAZILIAN FOREST MARGIN
ESTIMATED FROM IBGE, 1987

HECTARES

1 Dot = 500

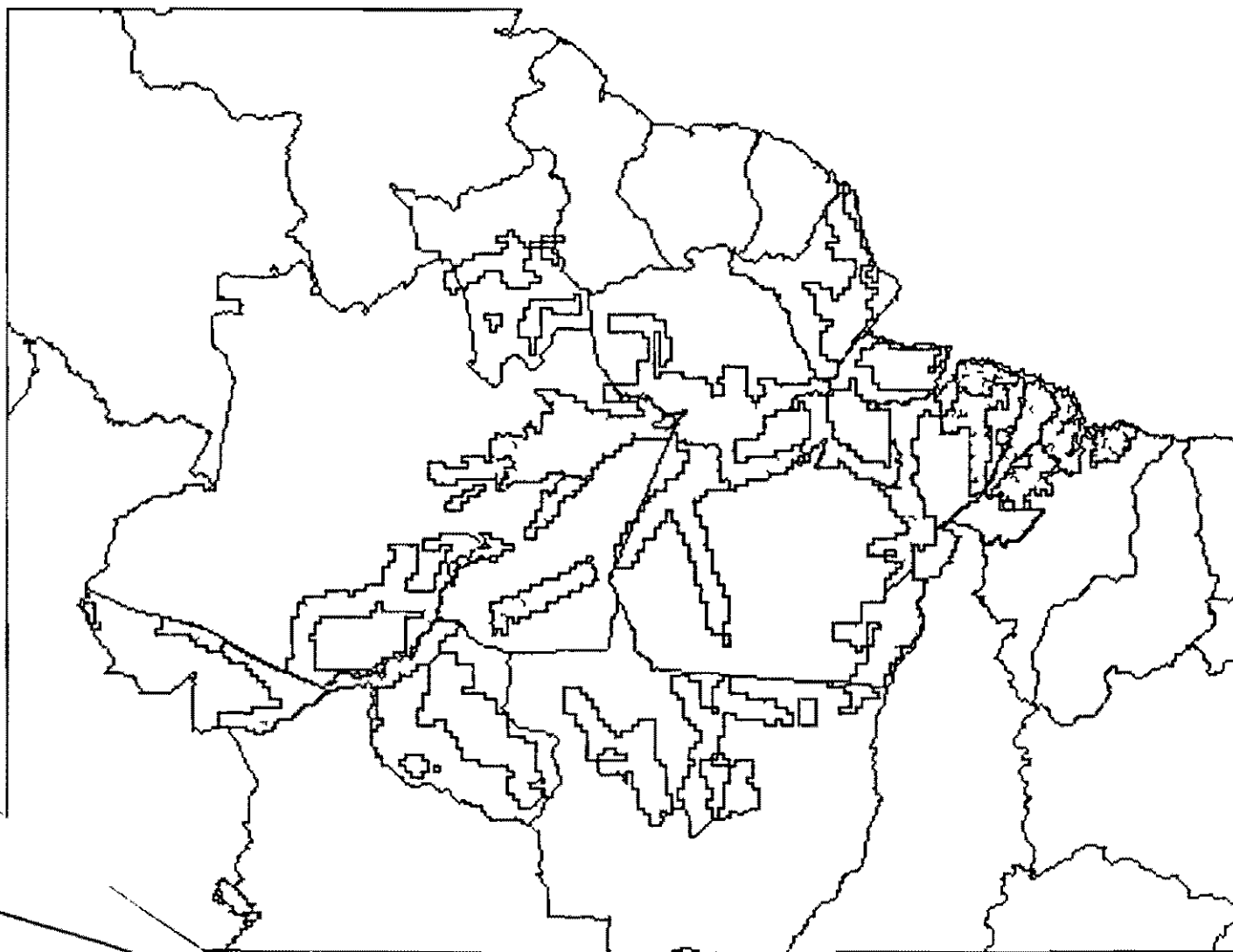


CASSAVA IN THE BRAZILIAN FOREST MARGIN

ESTIMATED FROM IBGE, 1987

HECTARES

1 Dot = 500



(Fig 9), and also the density of cattle rearing (Fig 10) By contrast, the distribution of perennial crops (Fig 11) is not correlated with either annual crops or cattle

For the purposes of this document draft, only the Brazilian subzones are mapped, but these patterns generally appear to hold true in other countries (Appendix I) In Panama, there is a high density of both annual crops and cattle in the Forest Margin areas However, there are some exceptions to these patterns outside Brazil In Caqueta, Colombia it is almost exclusively cattle country with annual crops and slash and burn agriculture at the true edge of the forest

The importance of cattle for the forest margin is self evident At least 10 5 million head of cattle are in the defined areas but there are possibly up to 20 % more Understanding the social and economic role of cattle and measuring the environmental impact will be one of the problems for the CIAT Land Use Program However, providing alternatives or even using cattle as a mechanism to improve productivity and aforesation will be a central problem for the Forest Margin Agroecosystem Program

DISCUSSION

Modal Areas

Based on patterns in the data, description in the literature and first hand experience, the subzones have provisionally been classed into four (Fig 12 and Table 2)

TABLE 2

Subzone type	Frequency	Area Km ²	Population	
			Rural	Urban
Old colonization	24	353	2906	4048
Recent colonization	24	455	1228	2780
Large Concessions	2	191	698	1438
Riverine Settlements	13	421	68	2566

These classes will have to be confirmed in the field, but generally speaking the older colonization areas have a higher proportion of deforested areas, but at the same time more fallow In these older areas there is a high density of annual cropping, slash and burn agriculture and cattle grazing The distribution of land is generally skewed with a fair number of landless agricultural laborers This kind of area accounts for the largest

ESTIMATED RURAL POPULATION DENSITY, 1980

FROM IBGE, 1980

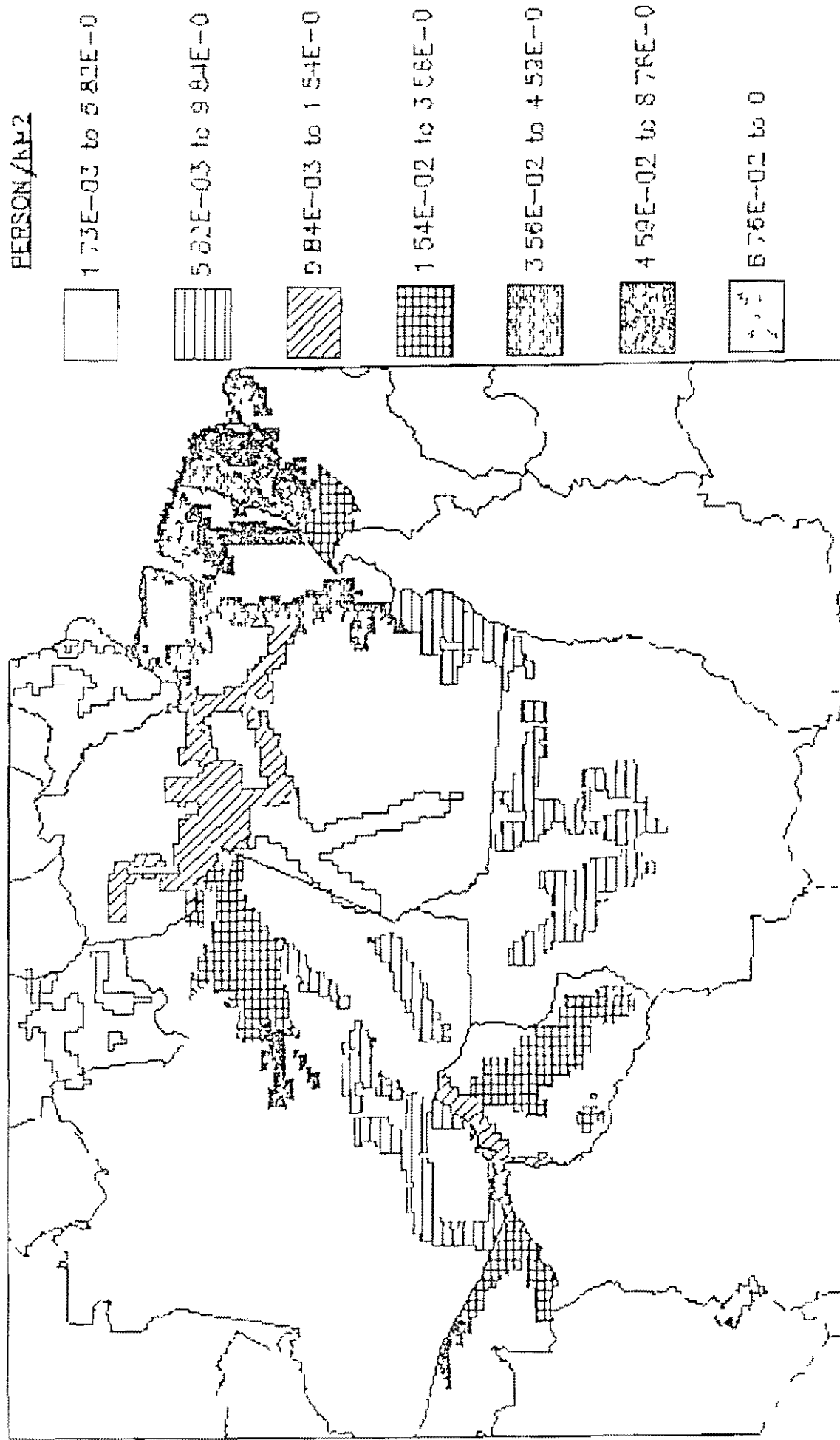
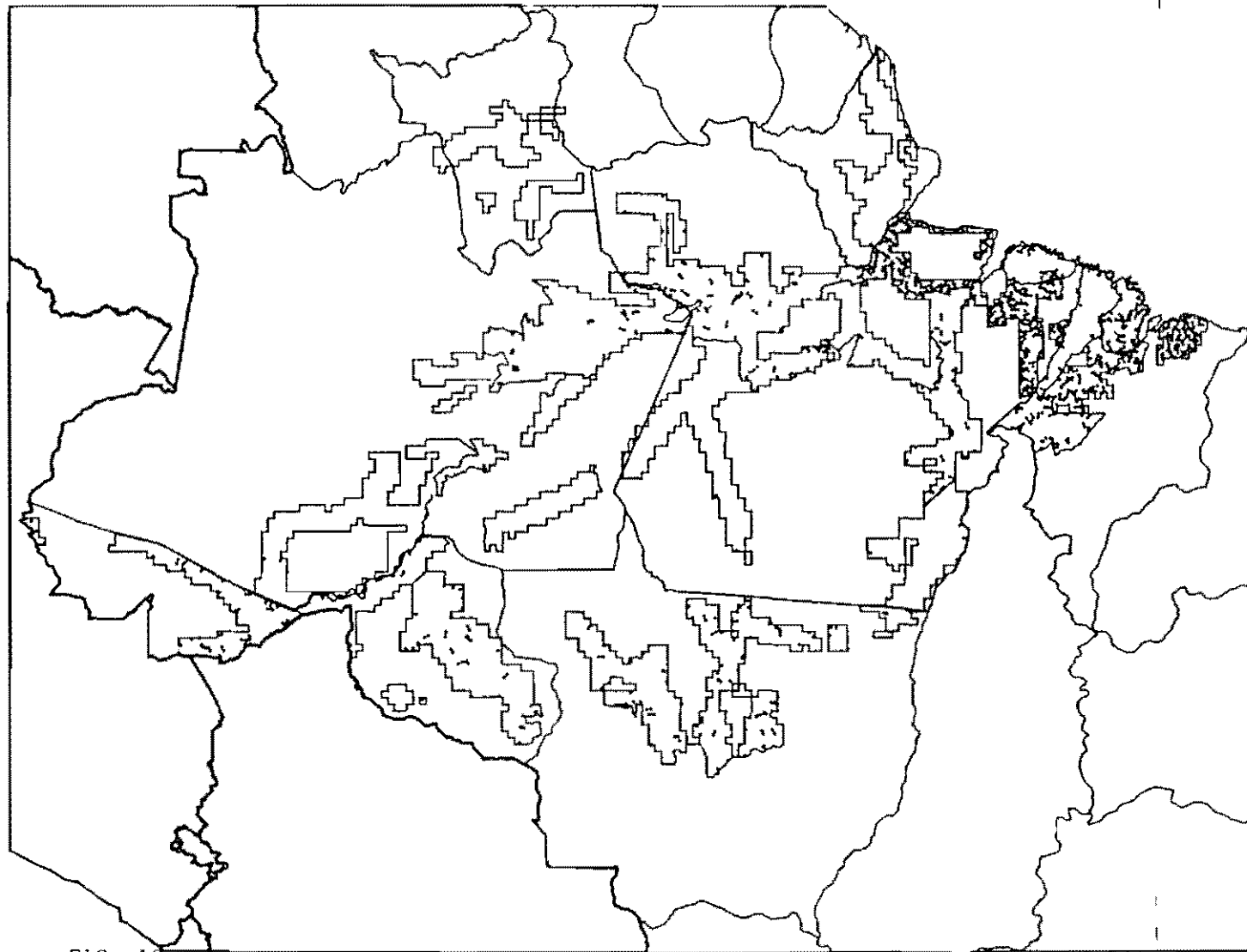


FIG 9

CATTLE IN THE BRAZILIAN FOREST MARGIN
ESTIMATED FROM IBGE, 1987



1 Dot = 4000

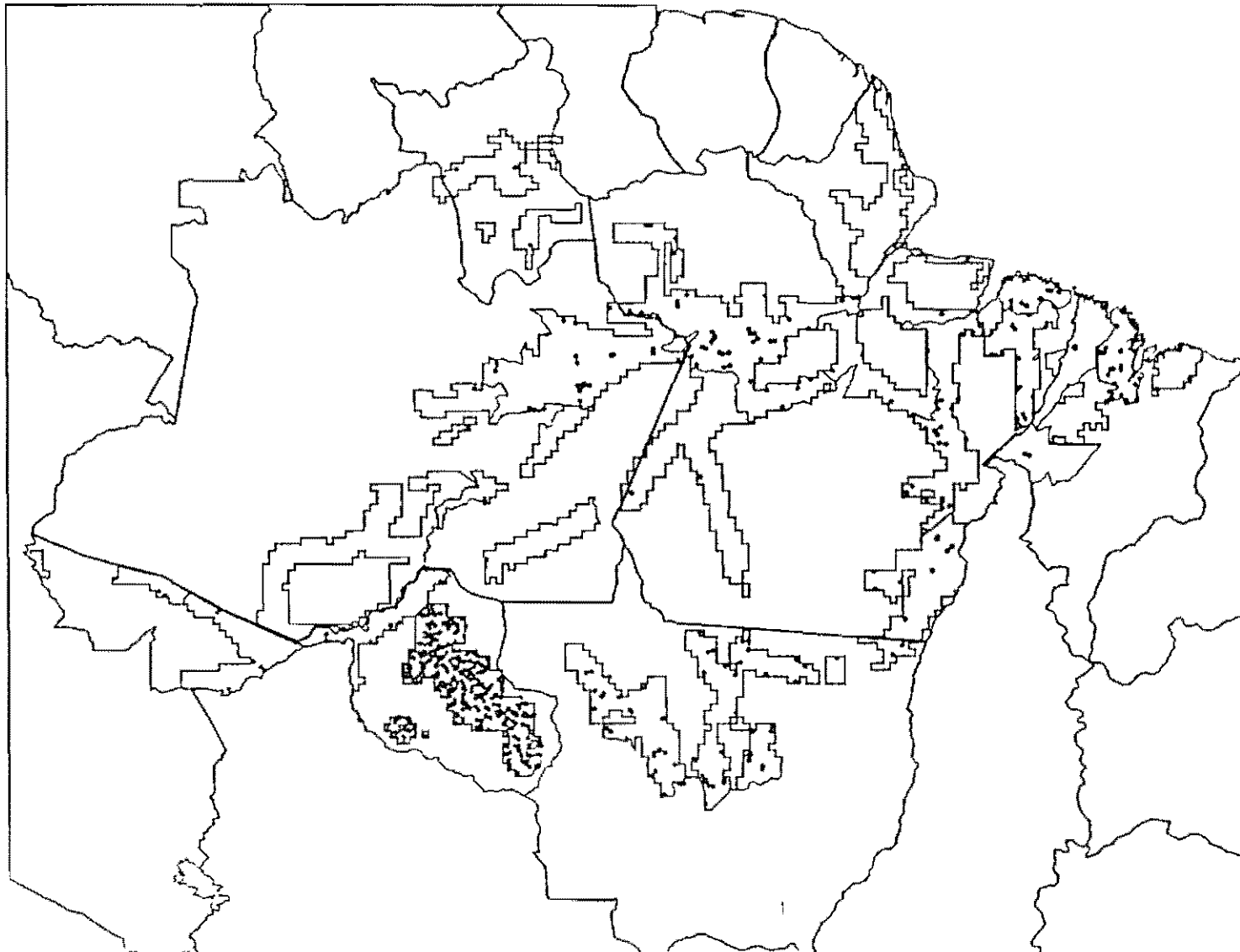
FIG 10

AREA OF PERENNIAL CROPS

ESTIMATED FROM IBGE, 1987





HECTARES

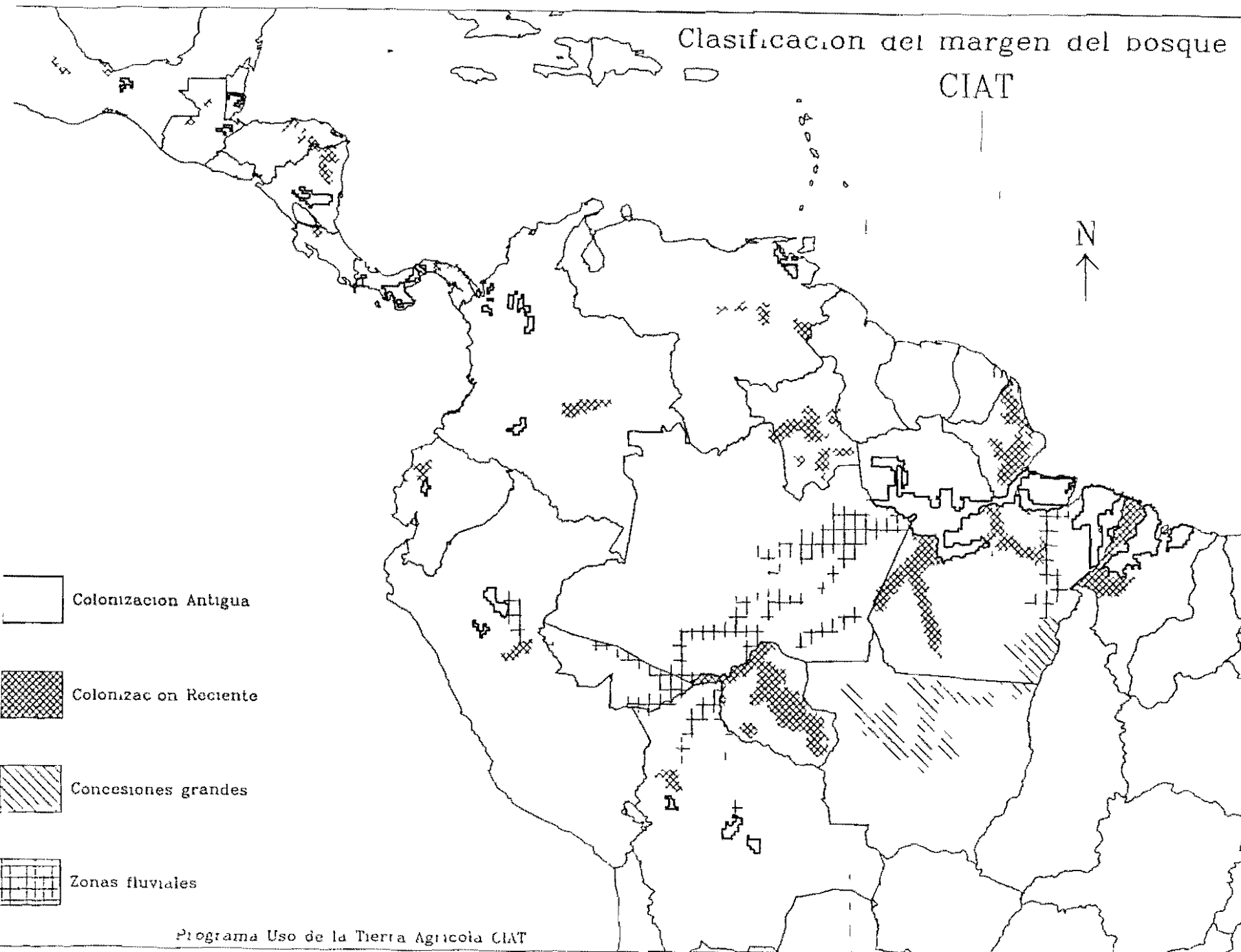
1 Dot = 400



Clasificación del margen del bosque CIAT



-  Colonización Antigua
-  Colonización Reciente
-  Concesiones grandes
-  Zonas fluviales



The more recently colonized areas, including government sponsored colonization, generally have better land distribution but can also have considerable land degradation, such as in Rondonia. This kind of subzone represents the largest proportion of the area and is second in rural and total population. Many of the problems may be similar to those of the older areas, but potential solutions may differ.

The areas characterized mainly by large business concessions, such as northern Mato Grosso appear to occur only in Brazil. They have a lower rural population density but account for a significant proportion of the area and a high proportion of the deforested area. Certainly the per capita deforestation is highest here.

Finally some of the oldest areas are riverine zones, or areas where the main form of access is by river. These include some of the oldest settlements, the highest urban population (e.g. Manaus) but continue to have relatively low rural population density and relatively low rates of land degradation.

These classes differ slightly from those proposed by ISPN (1992). The latter proposed areas of "private" colonization and did not distinguish riverine classes. However, the two are generally compatible and appear to be useful classes for grouping forest margin areas in other countries.

Comparison for Site Selection

There are many possible criteria for site selection for further, more detailed research. At the highest level, the areas and subjects of research must be mutually identified and of mutual interest to national institutions. However, several important criteria are aided by data bases such as the one analysed here. One criteria would be that it represent a modal situation such as those mentioned above. Another, that it represent the largest possible area in agroecological terms. Towards that end, Table 3 lists a number of likely places, in order of the proportion of the Forest Margin area that they represent in climatic terms. Since all the CIAT Forest Margin area is supposed to be on predominantly acid soils, these areas can be taken as indices of environmental similarity.

Figure 13 represents a climatic similarity map generated using CIAT's METGRID. For each 10 minute grid, a Markov model of monthly rainfall and temperature is generated and compared to the one for the station in question, in this case Porto Velho. Values of 1 through 3 have climates very similar to the point in question, while values of 4 to 6 are less so.

Comparacion de Climas Porto Velho



FIG 13

Table No 3

Areas de comparacion de Climas (km2) usando METGRID C I A T

Calificadas su semejanza en rango de 1 – 5

ESTACION	Climas muy semejantes			Moderadamente semejantes		SUMATORIA 1 – 3	SUMATORIA 1 – 5
	1	2	3	4	5		
PORTO VELHO	35323 17	133178 2	470077 6	380361 3	225693 2	638578 98	1244633 5
MANAUS	50696 36	155384	403618 4	272502 3	238904 5	609698 67	1121105 5
IMPERATRIZ	19473 97	137925 6	394997 6	478467 9	2355733	552397 1	3386598 2
GRAJAU	12645 1	60416 6	344046 9	536953 9	250929 9	417108 6	1204992 4
TURIACU	9942 44	32552 96	354169 1	356521 7	242511 1	396664 53	995697 32
BELEM	3771 52	65817 18	290047 8	386940 4	332688	359636 5	1079264 9
GUAYARAMERIM	8431 21	43468 83	189459 1	513276 4	269595 6	241359 12	1024231 2
BELTERRA	342 7	57920 63	151047 1	302022 1	303971 7	209310 43	815304 19
BARRA DA CORDA	0	10589 98	108855 3	321334 4	484923 9	119445 23	925703 56
TURBO	0	680 24	56034 9	472938 9	446751 1	56715 14	976405 1
SAAVEDRA	0	2293 96	41727 31	68533 92	261218 6	44021 27	373773 76
PUTUJU	0	983 42	10952 12	69921 8	259133 6	11935 54	340990 96
CHEPO	0	1015 97	9494 46	510713 6	434976 7	10510 43	956200 73
SAN JOSE	2740 51	3083 27	4453 04	3082 76	18118 78	10276 82	31478 36
PTO CABEZA	0	332 6	6356 6	34058 5	286317 8	6689 2	327065 5
FORMOSA	0	0	2340 86	26116 35	76000 07	2340 96	104457 38
TURRIALBA	0	0	680 97	22001 77	203430 1	680 97	226112 8
LA CEIBA	0	0	329 7	231116 6	429982 6	329 7	661428 9
PTO ARMUL	0	0	0	3764 6	248291 5	0	252056 1
GOLFITO	0	0	0	0	339 22	0	339 22

BIBLIOGRAFIA

- Alves, D 1991 Projeto de monitoreo ambiental da Amazonia Instituto Nacional de Pesquisas Espaciais Personal Communication
- Anon (1978) Belize Cattle Census 1978 Department of Agriculture Belice, 1978
- CIAT 1991 CIAT in the 1990s and Beyond A Strategic Plan Cali, Colombia pp78
- Collins, M 1990 The Last Rain Forests A world conseration atlas (General Editor) Oxford University Press 200 pp
- Costa Rica Direccion General de Estadistica y Censos Estimaciones y Proyecciones de Poblacion Cantonal por Sexo y Grupos de Edades 1975-2000 pp 127-129, 139-140
- Costa Rica Ministerio de Economia, Industria y Comercio Direccion General de Estadistica y Censos Censo Agropecuario 1984 San Jose, Costa Rica 1987 pp 4-9, 45-50, 121-122.
- Eastman, R J (1988) IDRISI A Grid Based Geographic Analysis System Manual to version 2.24 Clark University Worcester Massachusetts
- Ecuador. Instituto Nacional de Estadistica y Censos II Censo Agropecuario, 1974 Bolivar, Guayas, Los Rios, Manabi, Pichincha Cuadros 11, 19, 20, 23 INEC, 1979 (Pichincha - 1977) Quito, Ecuador 1979
- FAO/Unesco 1974. Soil Map of the World
- Guatemala Direccion General de Estadistica Ministerio de Economia Republica de Guatemala, 1979 Uso de la Tierra, Numero y Superficie de Fincas III Censo Nacional Agropecuario Volumen I Tomo I, Guatemala, Diciembre 1982 PP 45-103, 87-125, 127-159, 215-332
- Guatemala Direccion General de Estadistica Ministerio de Economia Republica de Guatemala, 1979 Ganado Vacuno, III Censo Nacional Agropecuario Volumen III Tomo I Guatemala, Febrero 1983 PP 11-49
- Guatemala Direccion General de Estadistica Ministerio de Economia Republica de Guatemala, 1979 Cultivos y produccion Agricola y Forestal, III Censo Nacional Agropecuario Volumen II Tomo II Guatemala, Febrero 1984
- Guatemala Direccion General de Estadistica Ministerio de Economia Republica de Guatemala 1981 Poblacion Analfabeta Censos Nacionales IV Habitacion IX Poblacion Guatemala, Febrero 1984

Honduras Ministerio de Economia Direccion General de Estadística y Censos Censo Nacional Agropecuario 1974 Cultivos Anuales y Permanentes Tomo VI

Honduras Ministerio de Economia Direccion General de Estadística y Censos Censo Nacional Agropecuario 1974 Uso de la Tierra Tomo III 1978

Honduras Ministerio de Economia Direccion General de Estadística y Censos Censo Nacional Agropecuario 1974 Ganado Bovino y Porcino Tomo VII 1978

Honduras SECPLAN (Secretaria de Planificación, Coordinación y Presupuesto) Censo Nacional de Población y Vivienda 1988 Población Total y Numero de Viviendas por Departamento y Municipio Honduras, Tegucigalpa D C 1988

IBGE (1984) IX Recenseamento Geral de Brasil 1980 Censo Agropecuario Fundacao Instituto Brasileiro de Geografia e Estatística - IBGE Rio de Janeiro, Brazil

IBGE (1988) Anuario Estatístico do Brasil 1987 Fundacao Instituto Brasileiro de Geografia e Estatística IBGE Rio de Janeiro, Brazil.

IBGE (1989) Producao Agricola Municipal 1987 Fundacao Instituto Brasileiro de Geografia e Estatística - IBGE Rio de Janeiro, Brazil

INE (Instituto Nacional de Estadística) (1987) II Censo Nacional Agropecuario Resultados provisionales. Instituto Nacional de Estadística Ministerio de Planeamiento y Coordinación Republica de Bolivia (7 volúmenes)

INEC (1985) Anuario Estadístico de Nicaragua 1985 Instituto Nacional de Estadísticas y Censos Managua, Nicaragua Instituto Nacional de Estadística y Censos 1985 Anuario Estadístico de Nicaragua pp 96

ISPN, 1992. Resultado provisional del estudio de las areas de savana y margen del bosque Instituto Sociedad, Populacao e Natureza Brasilia, Brasil

Jones, P G , Robison, D M and Carter, S E. 1991 Section 4 in CIAT in the 1990s and Beyond A Strategic Plan. Supplement Cali, Colombia pp 125

Panama Cuarto Censo Nacional Agropecuario Volumen III Características de las explotaciones agropecuarias Direccion de Estadística y Censo 1981

Panama Direccion de Estadistica y Censo 1985 Estadistica Panameña Republica de Panama Proyecciones de Poblacion por Provincia y Distrito, segun sexo y edad Años 1980-90 Boletin No 970, pp 3-4, 6-7

Panama Contraloria General de la Republica 1980 Direccion de Estadistica y Censo Censos Nacionales IV Censo Nacional Agropecuario Volumen I pp 21-30

Panama Contraloria General de la Republica 1980 Direccion de Estadistica y Censo Censos Nacionales Cuarto Censo Nacional Agropecuario Volumen II pp 43-55

Panama Contraloria General de la Republica 1980 Direccion de Estadistica y Censo Censos Nacionales Cuarto Censo Nacional Agropecuario Volumen III pp 9-33

Robison, D M and McKean, S J 1992 Shifting Cultivation and its Alternatives on Tropical Soils A Bibliography of Abstracts 1972 1989 CAB International, Wallingford, UK pp 287 In print

APPENDIX I SHORT DESCRIPTION OF SUBZONES

BOLIVIA

TITULO	Yapacani
SUBZONA	fm2BOL100
DESCRIPCION	Zona entre Santa Rosa, Puerto Grether y Buena Vista Datos Provincia Ichilo y parte de Gutierrez
TITULO	Alto Beni
SUBZONA	fm2BOL101
DESCRIPCION	Zona de Colonizacion en ladera en el Rio Alto Beni y Rio Kaka Partes de Nor Yungas, Murillo y Larecaja
TITULO	Yucumo-Ixiamas
SUBZONA	fm2BOL102
DESCRIPCION	Zonas de Colonizacion entre Yucumo y Rurrenabaque y entre San Buenaventura e Ixiamas Las bandas del Rio Tuichi
TITULO	Riberalta
SUBZONA	fm2BOL106
DESCRIPCION	Area de influencia de Riberalta y Guayara-mirin, Provincias de Abuna, Gral Federico Poma, Madre de Dios y Vaca Diez
TITULO	Cobija
SUBZONA	fm2BOL107
DESCRIPCION	Area Fronteriza de Pando Accesible por el Rio Abuna
TITULO	Rio Beni
SUBZONA	fm2BOL108
DESCRIPCION	Zonas accesibles al Rio Beni de las provincias de Iturralde y Jose Ballivian
TITULO	Rio Mamore
SUBZONA	fm2BOL109
DESCRIPCION	Zonas accesibles al Rio Mamoré en las provincias de Mamore y Yacuma
TITULO	Chapare
SUBZONA	fm5BOL100
DESCRIPCION	Zona de Colonizacion de las provincias de Chapare y Carrasco

TITULO Alto Mamore
SUBZONA fm2BOL105
DESCRIPCION Area entre Puerto Villareal y Loreto Datos de
Provincia Marban, Beni

BRASIL

TITULO Baixada Occidental Maranhense (30)
SUBZONA fm2BRA57
DESCRIPCION Norte de Maranhao, municipios de Pinheiro y
Gurupi Zona costera baja arenosa y mal drenada
Zona de colonizacion antigua

TITULO Baixada Oriental Maranhense
SUBZONA fm2BRA58
DESCRIPCION Valle bajo del rio Itapicur entre Rosario y
Cantanhede Rodeado por tierras bajas mal drenadas
del estero del rio Mearim Incluye tambien el
Municipio Urbano Santos de la microregion Alto
Munim 37-7

TITULO Madeira Amazonas
SUBZONA fm2BRA405
DESCRIPCION Zonas Accesibles del Rio Madeira (MR7), excepto
Humaita

TITULO Manaus Amazonas
SUBZONA fm2BRA209
DESCRIPCION Zonas Accesibles microregion 10

TITULO Solimoes Amazonas
SUBZONA fm2BRA210
DESCRIPCION Zonas Accesibles al Rio Solimoes (MR9)

TITULO Amapa
SUBZONA fm2BRA403
DESCRIPCION Zonas Accesibles de Amapa (MR27 y MR28)

TITULO La Transamazonica
SUBZONA fm2BRA205
DESCRIPCION Areas Accesibles a la BR230 y BR163 incluyendo
Altamira (15,1), Tapajos (MR13) y Humaita (7,2-
Amazonas)

TITULO Santarem
SUBZONA fm2BRA211
DESCRIPCION Zonas Accesibles del Rio Amazonas y Para 254
Microregion 12 y 14(1,3)

TITULO Pindare
SUBZONA fm2BRA401
DESCRIPCION Zonas Accesibles de microregion 34

TITULO Gurupi (29)
SUBZONA fm2BRA57-1
DESCRIPCION Zona Norte del Estado de Maranhao parte preamazonica de la microregion Gurupi

TITULO Paragominas
SUBZONA fm2BRA145
DESCRIPCION Zonas afectadas por la BR010, Pa252 y Pa251 de San Miguel hasta Itinga y Jacunda al oeste Microregion Guajarina (MR22) y Tome Açu (MR21)

TITULO Delta de Marajo (Para)
SUBZONA fm2BRA146
DESCRIPCION Areas accesibles de la Isla de Marajo Toda la microregion 16 (excepto los municipios 7 y 9) y microregion 17

TITULO Baixo Rio Xingu
SUBZONA fm2BRA144
DESCRIPCION Zonas a ambos lados del Rio Xingu siguiendo RR230 hasta Repartimiento, municipios (16,7), (16,9) y (14,2)

TITULO Baixo Tocantins (18) y Maraba (19)
SUBZONA fm2BRA141
DESCRIPCION Zonas Accesibles cerca del rio Tocantins y BR452

TITULO Imperatriz
SUBZONA fm2BRA402
DESCRIPCION Zonas apropiadas de la microregion 38 municipios Amarate do Maranhao (1), Joao Lisboa (3) y Açailandia

TITULO Conceição do Araguaia
SUBZONA fm5BRA144
DESCRIPCION Zonas Accesibles por PA150 y entre Conceição y Sao Felix do Xingu, microregion 20 y (15,2)

TITULO Bragantina (24) y Salgado (23)
SUBZONA fm2BRA142
DESCRIPCION Zona Poblada al este de Belem

TITULO Alto Purus
SUBZONA fm2BRA406
DESCRIPCION. Zona Fronteriza con Bolivia y BR364 (MR3) Acre

TITULO Rio Jurua
 SUBZONA fm2BRA407
 DESCRIPCION Frontera con Peru y BR364 (MR2) Acre

TITULO Labrea
 SUBZONA fm2BRA901
 DESCRIPCION Zonas accesibles al Rio Purus (microregion 6)

TITULO J1-Parana
 SUBZONA fm2BRA409
 DESCRIPCION Zonas Accesibles cerca del BR164

TITULO Porto Velho
 SUBZONA fm2BRA408
 DESCRIPCION Zonas accesibles entre Guajara-Mirim y Porto Velho

TITULO Caracari
 SUBZONA fm2BRA141
 DESCRIPCION Zonas accesibles del Bosque de Roraima

TITULO Norte Matogrossense
 SUBZONA fm2BRA410
 DESCRIPCION Area entre Puerto Villareal y Loreto Datos de Provincia Marban, Beni

COLOMBIA

TITULO Florencia
 SUBZONA fm2COL3
 DESCRIPCION Piedemonte de Caqueta

TITULO Rio Nechi
 SUBZONA fm2COL5
 DESCRIPCION Zonas Rio Arriba de Cauca en el Cauca y cerca de El Bagre en el Rio Nechi

TITULO San Jose del Guaviare
 SUBZONA fm2COL8
 DESCRIPCION

TITULO Turbo/Uraba
 SUBZONA fm2COL9
 DESCRIPCION

ECUADOR

TITULO El Carmen
 SUBZONA fm2ECU11
 DESCRIPCION, Zona entre Santa Domingo, Rosa Zarate y El Carmen

TITULO Velazco Ibarra
SUBZONA fm2ECU12
DESCRIPCION Zona del Alto Rio Daule

PERU

TITULO Tarapoto
SUBZONA fm5PER1
DESCRIPCION Area montañosa alrededor del Alto Huallaga
Incluye los poblados de Chasuta, Tarapoto y
Yurimaguas

TITULO Puerto Maldonado
SUBZONA fm5PER4
DESCRIPCION

TITULO Contamana
SUBZONA fm5PER10
DESCRIPCION Areas accesibles al Medio Rio Ucayali en el
departamento de Loreto

TITULO Juanjui
SUBZONA fm5PER11
DESCRIPCION Zona de colonizacion de Alto Huallaga

TITULO Pucallpa
SUBZONA fm5PER2
DESCRIPCION Zona de Tierra Firme cerca de Pucallpa y en la
carretera hacia Tingo Maria

VENEZUELA

TITULO El Dorado
SUBZONA fm2VEN101
DESCRIPCION Zona baja al oeste del departamento de Bolivar

TITULO Maturin
SUBZONA fm2VEN102
DESCRIPCION Zona entre Maturin y Tucupita en el departamento
de Monagas

TITULO Maripa
SUBZONA fm2VEN103
DESCRIPCION

CENTROAMERICA

BELICE

TITULO Stan Creeke
SUBZONA fm2BEL2
DESCRIPCION Faldas Norte y este de la montañas Maya

COSTA RICA

TITULO Los Chiles - Upala
SUBZONA fm2COS1
DESCRIPCION Zona en la frontera con Nicaragua y en las carreteras a Upala y Los Chiles Se tomaron los datos de Los Chiles, Upala y Guatuso

GUATEMALA

TITULO Lago Izabal
SUBZONA fm2GUA1
DESCRIPCION Zonas pendientes alrededor del Lago Izabal municipio (293) Los Amates y (127) El Estor

TITULO Sayaxche
SUBZONA fm5GUA3
DESCRIPCION Area de Suelos acidos en el municipio de Sayaxche (Se tomaron las cifras de todo el municipio)

TITULO El Quiche
SUBZONA fm5GUA2
DESCRIPCION Zonas Bajas en la frontera con Mexico. Incluye los municipios (110) Chajul y (111) Uspantan

HONDURAS

TITULO Trujillo
SUBZONA fm2HON2
DESCRIPCION Area cerca de la carretera Trujillo-Sonaguera y la carretera Trujillo-Rio Tinto, Sico, departamentos de Colon Datos de los municipios de Trujillo, Santa Rosa de A y Bonito Oriental

TITULO Ahuasbila
SUBZONA fm2HON1
DESCRIPCION Tierras al borde del Rio Coco y del Rio Patuca Parte del municipio de Puerto Lempira se tomaron datos generales del municipio de Puerto Lempira (Provincia de Gracias a Dios)

MEXICO

TITULO Rio Tonto
SUBZONA fm5MEX1
DESCRIPCION Zona de cabecera y ladera del Rio Tonto (Se encuentra entre Fostin y Coatzapan)

TITULO Pajapan
SUBZONA fm5MEX2
DESCRIPCION Falda sur y laderas de los volcanes San Martin Pajapan y Pelon

TITULO San Jose del Carmen
SUBZONA fm5MEX3
DESCRIPCION Una Zona de pie de monte y ladera entre San Jose del Carmen y el Lago Chiapa en el suroeste y Cahuapa en el oeste

NICARAGUA

TITULO Piedemonte Zelaya Norte
SUBZONA fm2NIC3
DESCRIPCION Zonas cerca de la carretera entre Puerto Cabezas y Waspan en la frontera con Honduras Tambien comprende una tira entre el Rio Grande, Alamicamba, Rosita y Bonanza (Datos de Zona Especial I)

TITULO Juigalpa - Bluefields
SUBZONA fm2NIC2
DESCRIPCION Zona cerca a la carretera entre estos dos pueblos

TITULO San Carlos y El Castillo
SUBZONA fm2NIC1
DESCRIPCION Zona fronteriza con Costa Rica a ambos lados del Rio San Juan Se usan los datos del departamento del Rio San Juan (o de la Zona Especial III)

PANAMA

TITULO Comarca San Blas
SUBZONA fm2PAN33
DESCRIPCION Parte de las provincias de Colon, Panama y La Comarca de San Blas

TITULO Chiriqui
SUBZONA fm2PAN31
DESCRIPCION Zona en la frontera con Costa Rica (parte occidental de la Prov Chiriqui) Se tomaron los datos de los distritos Alanje, Boqueron, Dolega y Boquete

TITULO Peninsula Azuero
SUBZONA fm2PAN32
DESCRIPCION Zona que comprende las provincias Los Santos,
Veraguas, Cocle (Se tomaron los datos de toda la
provincia)

APPENDIX II SUBZONE DATA

Subzone	Area	Area T C Census	Annuals %	Perenn %	Pastures %	Forest %	Fallow %	Past P %	Natural % Forest	Total Population	Rural Pop	Cattle No
fm2BKL2	2900		5	10	5				4 5			
fm2BOL100	1944		48*		18	2	2			51803	35826	50105
fm2BOL101	3312									25000	23000	
fm2BOL102	10328									10000	10000	
fm2BOL105	3824									15101	15101	
fm2BOL106	25786		1*		1	40				81280	35216	72537
fm2BOL107	8505		2 3*		2 7	94 4				16733	11744	7813
fm2BOL108	7645											
fm2BOL109	5198									13168	6867	
fm2BRA141	56454	37135 98	2	2	19	0	10	18	64 5	670515		325710
fm2BRA142	16040	11103 14	8 4	2 7	9 4		47	7 3	27	621708		94529
fm2BRA144	33357	9124 73	4 2	36	10			8	71	81789		12023
fm2BRA145	34060	38666 04	3	1 3	26		13 5	22 7	53 05	380782		1058107
fm2BRA146	27940	19746 31	3	1	41 2	02	4	5	45 3	255453		1004207
fm2BPA205	73550	9361 49	4 3	1 5	10		9 4	8	72	184862		43424
fm2BPA209	93080	17657	3 3	3 4	17	3	16	6	49 4	1121096		365049
fm2BRA210	20590	2055 93	12 4	5	2 2		16 5	1 1	53 8	114835		4370
fm2BRA211	122200	37405 68	4	1	14	4	20	6	49	548507		585990
fm2BRA401	22550	1888 89	9	4	33	7	24	27	30 7	422048		386973
fm2BRA402	26660	14110 41	6	2	35		19	32	38	375991		291006
fm2BRA403	52350	7351 29	2	1	26 3	3 4	18	2	36 2	217027		70271
fm2BPA405	48760	13185 48	2	7	1 5	06	6	1 1	89 3	82012		4262
fm2BRA406	36020	33566 85	1	5	7		2 5	5	87 5	246194		274692
fm2BRA407	11690	23228 47	7	25	1 51		2	9	93 5	119909		39345
fm2BRA408	28060	8658 44	2 7	8	21 6		3 4	11 4	67 3	279251		55159
fm2BRA409	82730	25230 14	4 7	5 4	10 3		2 5	9 4	74	463616		331811
fm2BRA410	136800	170653 1	3 7	4	37	2	15	14 4	48	198793		690890
fm2BPA411	44930	3980 15	2 5	3	10 3		3 4	8 1	80 5	16346		4552
fm2BRA57	23720	2832 06	16	6	29	0	34	8	13	600216		469048
fm2BRA57	28090	4579 84	14	1	33	0	33	13	31	178191		83671
fm2BPA58	12980	2832 06	17	2	17 3	4	41	1 3	17 4	174243		409842
fm2BRA901	83260	27436 78	8	3	2		6 3	1 3	86	85748		21889
fm2COL3	4790		5		75					214467	107077	1145500
fm2COL5	11252		10		30		50					
fm2COL8	15322									35305	22376	
fm2COL9	5136											
fm2COS1	2611		14 4	1 4	53		9			57776		137049
fm2ECU11	8277		3	22 7	35		1					111803
fm2ECU12	2727		5	18	23		4 2					46643
fm2GUA1	2320		29	3 6	42			23		68669	61997	52791
fm2HON1	3203		18	17 2	39 5		8 3	14 7		25353		7434
fm2HON2	3307		11	4	59 4		4	48 3		44870		32291
fm2NIC1	1273		2 3	4	26		50	13		35359	28136	
fm2NIC2	10064		2 2	4	51		21	32		419764	284005	
fm2NIC3	11016		50	4	8		31	5 1		243272	177139	
fm2PAN31	2203		20 5	10 3	114		4	45		9106		65856
fm2PAN32	16104		11 4	2 7	45 4		8	31 6		135194		809266
fm2PAN33	342		46 5	77 5	25 6		18 2	13		158485		99288
fm2VEN101	7500									259681		170000
fm2VEN102	8806									45095		77095
fm2VEN103	9197									43418		19 77
fm5BOL100	1296		83*		10	1	5			73304	65289	11434
fm5BRA144	54330	37646 45	2 3	5	27 5		10	19	56	1239535		519798

fm5GUA2	1952	25	6 4	8 5		2	58398	51724	13703
fm5GUA3	2304	22 5	6	11 2		8	11766	9630	10472
fm5MEX1	2929								
fm5MEX2	2123								
fm5MEX3	3276								
fm5PER1	9992	44	25	25		5			43826
fm5PER10	20883	89	6	4 8		4 7			5824
fm5PER11	3405	43	18	19 5		19 5			8666
fm5PER2	3700	21	15	34		20			6357
fm5PER4	4800	5		15		10			6357