



**Forestry Department**

Food and Agriculture Organization of the United Nations

GLOBAL FOREST RESOURCES  
ASSESSMENT

COUNTRY REPORTS

BRAZIL

FRA2005/148  
Rome, 2005



## The Forest Resources Assessment Programme

Sustainably managed forests have multiple environmental and socio-economic functions important at the global, national and local scales, and play a vital part in sustainable development. Reliable and up-to-date information on the state of forest resources - not only on area and area change, but also on such variables as growing stock, wood and non-wood products, carbon, protected areas, use of forests for recreation and other services, biological diversity and forests' contribution to national economies - is crucial to support decision-making for policies and programmes in forestry and sustainable development at all levels.

FAO, at the request of its member countries, regularly monitors the world's forests and their management and uses through the Forest Resources Assessment Programme. This country report forms part of the Global Forest Resources Assessment 2005 (FRA 2005), which is the most comprehensive assessment to date. More than 800 people have been involved, including 172 national correspondents and their colleagues, an Advisory Group, international experts, FAO staff, consultants and volunteers. Information has been collated from 229 countries and territories for three points in time: 1990, 2000 and 2005.

The reporting framework for FRA 2005 is based on the thematic elements of sustainable forest management acknowledged in intergovernmental forest-related fora and includes more than 40 variables related to the extent, condition, uses and values of forest resources. More information on the FRA 2005 process and the results - including all the country reports - is available on the FRA 2005 Web site ([www.fao.org/forestry/fra2005](http://www.fao.org/forestry/fra2005)).

The Global Forest Resources Assessment process is coordinated by the Forestry Department at FAO headquarters in Rome. The contact person for matters related to FRA 2005 is:

Mette Løyche Wilkie  
Senior Forestry Officer  
FAO Forestry Department  
Viale delle Terme di Caracalla  
Rome 00100, Italy

E-mail: [Mette.LoycheWilkie@fao.org](mailto:Mette.LoycheWilkie@fao.org)

Readers can also use the following e-mail address: [fra@fao.org](mailto:fra@fao.org)

### DISCLAIMER

The designations employed and the presentation of material in this information product do not imply the expression of any opinion whatsoever on the part of the Food and Agriculture Organization of the United Nations concerning the legal status of any country, territory, city or area or of its authorities, or concerning the delimitation of its frontiers or boundaries.

The Global Forest Resources Assessment 2005 Country Report Series is designed to document and make available the information forming the basis for the FRA 2005 reports. The Country Reports have been compiled by officially nominated country correspondents in collaboration with FAO staff. Prior to finalisation, these reports were subject to validation by forestry authorities in the respective countries.

## Report preparation and contact person

The present report was produced by the National Forestry Program (NFP), with collaboration from:

Tasso Rezende de Azevedo	MMA/PNF	Director of National Forestry National Forestry Program
Joberto Freitas Veloso	MMA/PNF	Manager of Natural Forests
Alba Valéria Rezende	UNB	T6 – biomass stock T7 – carbon reserves
Carlos Roberto Sanquetta	UFPR	T5 – growing stock T6 - biomass stock T7 - carbon reserves
Cristian Bacelar Santos	MMA	T16 – forest certification
Frans Pareyn	APNE	T6 - biomass stock
Guilherme Gomide	MMA	T3 - designated functions of Forest and Other wooded land
Gustavo S. C. Pinho	IBAMA	T11 – wood removal T12 – value of wood removal
Iolanda Sorensini	Consultant	T11 – wood removal T12 – value of wood removal
José de Arimatéa Silva (*)	UFRRJ	T13 – removal of non wood forest products T14 – value of removal of non wood forest products
José Enilcio Rocha Collares	IBGE	T1 – extent of forest and other wooded land T4 - characteristics of forest and other wooded lands
Niro Higuchi	INPA	T6 – biomass stock T7 - carbon reserves
Sydney Carlos Saab	IBAMA	T11 – wood removal T12 – value of wood removal
Vinicius Castro Souza	USP	T9 – diversity of tree species
Yeda Maria Malheiros de Oliveira	EMBRAPA	T8 – Disturbances affecting forest health and vitality

(\*) Compilation and organisation of the report

Address: Ministério do Meio Ambiente  
Programa Nacional de Florestas  
Esplanadas dos Ministérios Bloco B – sala 722  
70 068-900 Brasília – DF Brasil  
Email: [pnf@mma.gov.br](mailto:pnf@mma.gov.br)

## Acronym List- Institutions

MMA	Ministry of the Environment	EMBRAPA	Brazilian Company for Agricultural Research
SBF	Secretary of Biodiversity and Forests	SBS	Brazilian Society of Silviculture
PNF	Nacional Forestry Program	ABIPA	Brazilian Association of Panel Wood Industries
UNB	University of Brasília	ABIMCI	Brazilian Association of the Mechanically Processed Wood Industry
UFPR	Federal University of Paraná	DIREC	Ecosystems Directorate
APNE	Plants of the Northeast Association	DAP	Protected Areas Directorate
UFRRJ	Federal University of Rio de Janeiro	CNRPPN	National Confederation of Private Heritage Reserves Owners
IBGE	Brazilian Institute of Geography and Statistics	UC's	Conservation Units
INPA	Amazon Research Institute	ISA	Social Environmental Institute
USP	University of São Paulo		

## Table of Contents

<b>1 - TABLE T1 – EXTENT OF FOREST AND OTHER WOODED LAND.....</b>	<b>6</b>
1.1 CATEGORIES AND DEFINITIONS.....	6
1.2 NATIONAL DATA .....	6
1.3 DATA PROCESSING AND ANALYSIS .....	7
1.4 DATA FOR THE NATIONAL REPORTING TABLE T1 .....	9
1.5 SOURCES AND REFERENCE LIST.....	9
<b>2 - TABLE T2 – OWNERSHIP OF FOREST AND OTHER WOODED LAND .....</b>	<b>10</b>
<b>3 - TABLE T3 – DESIGNATED FUNCTIONS OF FOREST AND OTHER WOODED LAND.....</b>	<b>11</b>
3.1 FRA 2005 CATEGORIES.....	11
3.2 NATIONAL DATA .....	11
3.3 NATIONAL DATA PROCESSING AND ANALYSIS .....	13
3.4 DATA FOR THE NATIONAL REPORT OF TABLE T3.....	16
3.5 COMMENTS OF THE NATIONAL REPORT OF TABLE T3 .....	16
3.6 SOURCES AND REFERENCES LIST.....	17
<b>4 - TABLE T4 – CHARACTERISTICS OF FOREST AND OTHER WOODED LANDS.....</b>	<b>18</b>
4.1 CATEGORIES AND DEFINITIONS.....	18
4.2 NATIONAL DATA .....	18
4.3 AREA ESTIMATES FROM 1990 TO 2005 .....	19
4.4 DATA FOR THE NATIONAL REPORT OF TABLE T4.....	19
4.5 SOURCES AND REFERENCE LIST.....	19
<b>5 - TABLE T5 – GROWING STOCK .....</b>	<b>20</b>
5.1 CATEGORIES AND DEFINITIONS.....	20
5.2 NATIONAL DATA .....	20
5.3 TOTAL AND COMMERCIAL STOCKS BY BIOME.....	21
5.4 DATA FOR THE NATIONAL REPORT OF TABLE T5.....	22
5.5 COMMENTS ABOUT THE INFORMATION TABLE T5 .....	22
<b>6 - TABLE T6 - BIOMASS STOCK .....</b>	<b>24</b>
6.1 CATEGORIES AND DEFINITIONS.....	24
6.2 NATIONAL DATA .....	24
6.3 NATIONAL DATA FOR THE INFORMATION TABLE T6 .....	28
6.4 COMMENTS ON INFORMATION TABLE T6 .....	28
<b>7 - TABLE T7 – CARBON RESERVES .....</b>	<b>30</b>
7.1 CATEGORIES AND DEFINITIONS.....	30
7.2 NATIONAL DATA .....	30
7.3 NATIONAL DATA PROCESSING AND ANALYSIS .....	31
7.4 NATIONAL DATA FOR THE INFORMATION TABLE T7.....	33
7.5 COMMENTS ON THE INFORMATION TABLE T7.....	33
<b>8 - TABLE T8 – DISTURBANCES AFFECTING FOREST HEALTH AND VITALITY .....</b>	<b>34</b>
8.1 CATEGORIES AND DEFINITIONS.....	34
8.2 NATIONAL DATA .....	34
8.3 NATIONAL DATA PROCESSING AND ANALYSIS.....	35
8.4 RECLASSIFICATION OF THE FRA 2005 CLASSES.....	35
8.5 NATIONAL DATA FOR THE INFORMATION TABLE T8.....	35
8.6 COMMENTS ON THE INFORMATION TABLE T8.....	36
8.7 SOURCES AND REFERENCE LIST.....	37
<b>9 - TABLE T9 – TREE SPECIES DIVERSITY .....</b>	<b>38</b>
9.1 CATEGORIES AND DEFINITIONS.....	38
9.2 NATIONAL DATA PROCESSING AND ANALYSIS.....	38

9.3	DATA FOR THE NATIONAL REPORT OF TABLE T9.....	39
9.4	TREE SPECIES CONSIDERED AS CRITICALLY ENDANGERED BY IUCN.....	39
9.5	SOURCES AND REFERENCE LIST.....	39
<b>10 -</b>	<b>TABLE T10 – STOCK COMPOSITION.....</b>	<b>40</b>
<b>11 -</b>	<b>TABLE T11 – WOOD REMOVAL.....</b>	<b>41</b>
11.1	CATEGORIES AND DEFINITIONS.....	41
11.2	NATIONAL DATA.....	41
11.3	DATA FOR THE NATIONAL REPORT OF TABLE T11.....	41
11.4	COMMENTS ON THE NATIONAL REPORT OF TABLE T11.....	42
11.5	SOURCES AND REFERENCE LIST.....	42
<b>12 -</b>	<b>TABLE T12 – VALUE OF WOOD REMOVAL.....</b>	<b>44</b>
12.1	CATEGORIES AND DEFINITIONS.....	44
12.2	NATIONAL DATA.....	44
12.3	DATA FOR THE NATIONAL REPORT OF TABLE T12.....	47
12.4	COMMENTS ON THE NATIONAL REPORT OF TABLE T12.....	47
12.5	SOURCES AND REFERENCE LIST.....	49
<b>13 -</b>	<b>TABLE T13 – NON-WOOD FOREST PRODUCTS REMOVAL.....</b>	<b>50</b>
13.1	CATEGORIES AND DEFINITIONS.....	50
13.2	NATIONAL DATA.....	50
13.3	DATA PROCESSING AND ANALYSIS.....	53
13.4	DATA FOR THE NATIONAL REPORT OF TABLE T13.....	53
13.5	ANIMAL PRODUCTS.....	54
13.6	SOURCES AND REFERENCE LIST.....	54
<b>14 -</b>	<b>TABLE 14 – VALUE OF NON-WOOD FOREST PRODUCTS REMOVAL.....</b>	<b>55</b>
14.1	CATEGORIES AND DEFINITIONS.....	55
14.2	NATIONAL DATA.....	55
14.3	DATA PROCESSING AND ANALYSIS.....	55
14.4	DATA FOR THE NATIONAL REPORT OF TABLE T14.....	56
14.5	SOURCES AND REFERENCE LIST.....	56
<b>15 -</b>	<b>TABLE 15 – EMPLOYMENT IN FORESTRY SECTOR.....</b>	<b>58</b>
<b>16 -</b>	<b>TABLE 16 – FOREST CERTIFICATION.....</b>	<b>59</b>
16.1	MAIN INTERNATIONAL INITIATIVES TO STANDARDISE FOREST CERTIFICATION.....	59
16.2	FOREST CERTIFICATION IN BRAZIL.....	59
16.3	METHODOLOGY.....	60
16.4	SOURCES AND REFERENCE LIST.....	60
	<b>ANNEX 1 - VEGETATION TYPES.....</b>	<b>62</b>
	<b>ANNEX 2 – ENDANGERED TREE SPECIES.....</b>	<b>64</b>
	<b>ANNEX 3 – SHORT NOTE ON TABLE 1.....</b>	<b>103</b>

## 1 - Table T1 – Extent of forest and other wooded land

### 1.1 Categories and definitions

Forest	Land greater than 0.5 hectares, with trees higher than 5 meters and a canopy cover of (more than) 10 percent, or trees able to reach these minimum limits in situ. It does not include land that is predominantly under agricultural or urban land use.
Other wooded land	Land not classified as “forest”, spanning more than 0.5 hectares; with trees higher than 5 m and a canopy cover of more than 5-10 percent, or trees able to reach these minimum limits in situ; with a combined cover of shrubs, bushes and trees above 10 percent. It does not include land that is predominantly under agricultural or urban land use.
Other land	All land that is not classified as “forests” or “other wooded land”.
Other land with tree cover (Subordinated to “Other land”)	Land classified as “other land”, spanning more than 0.5 hectares with a canopy cover of more than 10 percent of trees able to reach a height of 5 meters at maturity.
Inland water bodies	Inland water bodies generally include major rivers, lakes and water reservoirs.

### 1.2 National data

#### 1.2.1 Data sources

References of information sources	Quality A/M/B	Variable (s)	Year(s)	Additional comments
Vegetation map of Brazil – IBGE ed. 2004; scale: 1:5.000.000	M*	Forests Other lands Inland Waters	2004	This map was the primary source for calculating areas per vegetation type per federation unit (state) and per geographic region.
SBS, ABIPA, ABIMCI, ABRACAVE	M	Forest plantations	2000, 2003	Information obtained from the sites of those organizations

\*Although edited in 2004, the timing of the information contained in the map are different for each region:

North and Central-Western regions – reference (average) year 2000.

North-eastern and Southern regions – reference (average) year 1996.

South-eastern Region – reference (average) year 1982.

#### 1.2.2 Terms and Definitions

National Categories	Definition
Forests	Closed Forest (Da+Db+Ds+Dm) * Open Forest (Aa+Ab+As) Mixed Forest (Mm+MI) Semi deciduous Forest (Fa+Fb+Fs+Fm) Deciduous Forest (Cb+Cs+Cm)

	Campinarana (Ld+La) Cerradão and open Cerrado (Sd+Sa) Closed and open Caatinga (Td+Ta) Open Steppe (Ea) Restinga and Mangrove (Pm+Pf) Remaining Vegetation in ecotones (OM+ON+NP+LO+SO+SN+ST+SP+TN+EN+STN) Secondary vegetation in forestry areas Forest plantations
Other lands	Disturbed Forest areas (D+A+M+F+C+P) Disturbed field areas (S+T+E) Remaining field vegetation (Lb+Lg+Sp+Sg+Tp+Tg+Ep+Eg+Pa+rm+rl) Disturbed ecotones (OM.a +ON.a+ NM.a+ SO.a+ SM.a+ SN.a+ ST.a+ TN.a+EM.a+EN.a+STN.a)
Inland waters	Including rivers, lagoons, lakes and reservoirs

(\*) Annex 1 – Nomenclature of the vegetation

### 1.3 Data processing and analysis

These categories originated from the sum of the areas in table 1, taken from an intermediate grouping, according to the following table.

#### 1.3.1 Continuous updating of areas

Sources were researched to supply this omission, in order to establish an index of average annual change. For comparative effects, the data was grouped as to represent them, in addition to the areas of the included regions for their respective vegetation types.

Initially the areas were planed for the year 2000, using indexes obtained from the sources consulted and also, information from the specialists. The areas were established for the year 2000 and, utilizing the same correction indexes, the estimates for the years 1990 and 2005 were undertaken. The estimates obtained were compared with the data of the years 1990 and 2000, registered in FRA – 2000, for a verification of consistency. After analysis by specialists, the necessary adjustments were undertaken, at a team meeting in Brasilia (date 18/01/2005).

The area of each biome was obtained from IBGE's 2004 vegetation map. The data originating the map were collected in different years. Therefore, the forested areas in each biome were projected to year 2000, except for Amazonia and Cerrado, where this was the average date. Afterwards, projections back to 1990 and forward to 2005 have been done using available deforestation areas (or rate) in each biome, as follows:

- Amazonia: INPE/Prodes ([www.inpe.gov.br](http://www.inpe.gov.br)) estimates, but a correction has been done because Prodes gives estimates for Legal Amazon States, which includes part of the cerrado biome. The correction was necessary to avoid double-counting areas between Amazonia-Cerrado biomes;
- Cerrado and Pantanal: We used a rate of 1.5% (estimates from CI – Conservation International), but in areas covered by INPE/PRODES (part of the States Mato

Grosso, Tocantins and Maranhão ) the PRODES estimate was considered, as mentioned above;

- Caatinga: An average rate of 0.25 y-1 deforestation, based on available surveys;
- Mata Atlântica: Projections for 1990 and 2005 were made based on surveys from SOS Mata Atlantica Foundation. However, adjustments were made to match FAO forest definition, using estimates for initial, medium and advanced regeneration stages from available studies carried out within the biome.

The bibliographic references used for the projections are presented in item 6.4 of table 6.

### 1.3.2 National adjusted data

#### 1.3.2.1 Areas of vegetation types

Forest type	Area (hectares)		
	1990	2000	2005
<b>Forest plantations</b>			
Pinus spp.	1,769,000	1,840,050	1,875,575
Eucalyptus spp.	2,964,000	2,965,880	2,966,820
Araucaria angustifolia	18,000	13,341	11,012
Tectona	14,000	50,000	68,000
Mimosa scabrella	50,000	50,000	50,000
Populus	2,500	5,000	6,250
Acacia	100,000	150,000	175,000
Hevea	150,000	200,000	225,000
Others	3,000	5,048	6,072
<b>Total Forest plantations</b>	<b>5,070,500</b>	<b>5,279,319</b>	<b>5,383,729</b>
<b>Biomes</b>			
Atlantic forest	24,558,402	23,233,824	22,571,535
Pampa	598,017	574,096	562,136
Caatinga	49,645,485	48,421,244	47,820,492
Cerrado and Pantanal	80,582,255	69,673,303	64,115,125
Amazonian forest	359,572,643	346,031,128	337,245,053
<b>Total Natural Forests</b>	<b>514,956,802</b>	<b>487,933,596</b>	<b>472,314,341</b>
<b>TOTAL Forest area</b>	<b>520,027,302</b>	<b>493,212,915</b>	<b>477,698,070</b>

#### 1.3.2.2 Forest plantation areas

The forest plantation areas were obtained primarily from the SBS – Brazilian Society of Silviculture website ([www.sbs.org.br](http://www.sbs.org.br)). Other sources consulted to make the area table were, for example, websites of companies and company associations, and direct contacts with entity representatives, such as BRACELPA, ABRACAVE, ABIPA and ABIMCI. Existing information in the two FRA reports (FRA 1990 and FRA 2000) were

used as reference and when there was no more recent data, information from these reports was repeated for 2005.

### 1.3.3 Official area of Brazil

Brazil's extension area is 8.514.876,6 Km<sup>2</sup>, according to the "Resolução nr 05, 10/10/2002", from "Instituto Brasileiro de Geografia e Estatística – IBGE", based on the territorial map of 01/01/2001.

[www.ibge.gov.br/pub/Organizaçao\\_do\\_Territorio/Areas\\_e\\_Limites/Areas.zip](http://www.ibge.gov.br/pub/Organizaçao_do_Territorio/Areas_e_Limites/Areas.zip)

This data differs from the one published by FAOSTAT that refers to an anterior estimation. For this reason, it is suggested to FAO to update the data.

## 1.4 Data for the national reporting table T1

Category	1000 ha		
	1990	2000	2005
Forests	520,027	493,213	477,698
Other wooded lands			
Other lands	315,529	342,343	357,858
Other land with tree cover			
Inland waters	15,932	15,932	15,932
Country total	851,488	851,488	851,488

## 1.5 Sources and Reference list

IBGE. Vegetation map of Brazil, ed. 2004, scale: 1:5.000.000. Rio de Janeiro: IBGE, 2004.

IBGE. Current territorial table. Resolution nº 05 of 10/10/2002 of the Presidente of IBGE, according to current territorial table in 01/01/2001.

## **2 - Table T2 – Ownership of forest and other wooded land**

Data N/A – Not reported

### 3 - Table T3 – Designated functions of forest and other wooded land

#### 3.1 FRA 2005 categories

##### 3.1.1 Categories and definitions

Category	Definition
Primary function	A designated function is considered to be primary when it is significantly more important than other functions. This category includes areas that are legally or voluntarily set-aside for specific purposes.
Total area with function	Total area where a specific function has been designated, regardless whether it is primary or not.

##### 3.1.2 Categories of designated functions

Category/designated function	Definition
Production	Forest/other wooded land designated for production and extraction of forest goods, including both wood and non-wood forest products.
Soil and Water Protection Biodiversity conservation	Forest/other wooded land designated for protection of soil and water. Forest/other wooded land designated for conservation of biological diversity.
Social services	Forest/other wooded land designated for the provision of social services.
Multiple use	Forest/other wooded land designated to any combination of: production of goods, protection of soil and water, conservation of biodiversity and provision of social services and where none of these alone can be considered as being significantly more important than the others.
No or unknown function	Forest / other wooded lands for which a specific function has not been designated or where designated function is unknown.

#### 3.2 National data

##### 3.2.1 Data sources

Reference sources	Quality (A/M/B)	Variable(s)	Year(s)	Additional comments
IBAMA(1) – DIREC	M	UC's (5); year created; area	1990, 2000, 2005	
MMA(2) – DAP	M	UC's; year created; area	1990, 2000, 2005	Indigenous lands
ISA(3)	A	UC's; area	2005	
CNRPPN(4)	A	RPPN area	2004	

### 3.2.2 Terms and Definitions

National classes	Definition
Ecological Station	Objectives are nature preservation and undertake scientific research.
Biological reserve	Objective is the integral preservation of the biota and other natural features within the area, excluding direct human interference or modifications in the environment, except for recovery of degraded ecosystems and management actions needed for recovering and preserving the natural equilibrium, the biological diversity and the natural ecological processes.
National Park	Basic objective is the preservation of the natural ecosystems of great ecological relevance and scenic beauty, allowing the undertaking of scientific research and educational and environmental interpretation activities, in nature recreation and ecological tourism.
Natural Monument	Basic objective to preserve rare natural sites, unique or of great scenic beauty.
Wildlife Refuge	Objective to protect natural environments, which secure conditions for the existence or reproduction of species or communities of the local flora and fauna resident or migratory.
Environmentally Protected Area	An area in general extensive, with a certain degree of human occupation, endowed with abiotic, biotic, aesthetic or cultural characteristics especially important for the quality of life or well being of the human populations, and has as basic objectives to protect the biological diversity, order the process of occupation and secure the sustainable use of the natural resources.
Area of relevant ecological importance	In general a small area, with little or no human occupation, with extraordinary natural characteristics or have rare examples of the regional biota, and has as objective to maintain the natural ecosystems of regional or local importance and regulate the admissible use of these areas, in a compatible way with the objectives of nature conservation.
National Forest	Area with forest cover of mainly native species and has as a basic objective the sustainable multiple use of forest resources and scientific research, with emphasis on methods for sustainable exploration of native forests.
Extractivist Reserve	Area used by traditional extractivist populations, whose subsistence is based on extractivist activities, and complemented by subsistence agriculture and breeding of small sized animals, and has as an basic objective to protect the way of life and culture of these populations, and to secure the sustainable use of its natural resources.
Fauna Reserve	Natural area with populations of native animal species, land or aquatic, resident or migratory, and suitable for technical-scientific studies on the sustainable economic management of the fauna resources.
Sustainable Development Reserve	Natural area that shelters traditional populations whose existence is based on sustainable exploitation of natural resources, developed over generations and have a fundamental role in nature protection and maintenance of biological diversity.
Natural Heritage Private Reserve Permanent Preservation Area	Private area, with the objective of conserving its biological diversity for perpetuity. Protected area, covered or not by native vegetation, with the environmental function to preserve water resources, the landscape, the geological stability, the biodiversity, the gene flow of plants and animals, soil protection and assure the well being of the human populations.
Legal Reserve	An area within a rural property or holding, of permanent preservation, necessary for the sustainable use of natural resources, by conservation and rehabilitation of ecological processes, by biological conservation and shelter and protection of the native fauna and flora.

### 3.3 National data processing and analysis

Table 3 is complementary with Table 1 because, it subdivides the forestry areas according to the designated functions. The term function is used to specify the function or the purpose for which part of the forest was determined, by legal rules or by the decision of the landowner.

Table 3 requires information about the forestry areas that have a “primary function” and about “total area destined to a function”. An area is determined as “primary function” when it has a more relevant function than its other functions, and this category includes areas reserved to fulfil a specific purpose. The “total area destined to a function” is the total area that fulfils a specific function, this being of primary nature or not.

To classify the forestry areas inside the categories presented in Table 3 the written definitions in the National System of Conservation Units was used, the SNUC, as well as the Brazilian Forestry Code. The classification of Brazilian forestry areas in the Designated function Category, pre established by FAO, was done according to the functions of the Conservation Units (UC) described in SNUC.

To determine the total area of each category inside the Primary Function item, the areas of the CU that had the same principal function were added. The description of the categories established by FAO as well as their equivalents in the Brazilian classification, used in the calculation of the area, are described below:

**Production:** Forests designated for a production function and extraction of forest goods.:

National forests (FLONAS);  
Forest plantations;  
Sustainable development reserve (RDS);

**Soil and water protection:** Forests designated for soil and water protection.

Permanent Preservation Area (APP);

**Conservation of Biodiversity:** Forests designated for conservation of biological diversity.

Ecological station;  
Biological reserve;  
National Park Natural Monument;  
Wildlife refuge;  
Area of relevant ecological importance;  
Natural Heritage private reserve.

**Social Services:** Forests designated for provision of social services.

Extractivist Reserve;  
Indigenous Lands;  
Sustainable Development Reserve.

**Multiple use:** Forests designated to any combination of the following functions: production of goods, protection of soil and water, conservation of biodiversity and provision of social services. In these combinations none of the functions can be considered more important than the others.

Preservation area.

**Without function or function unknown:** Forests which have no designated function or whose function is unknown.

To calculate the category areas in the Total Areas with a function item, the unit areas that presented at least one objective in common were added. In this way, these units were counted more than once and were represented like this, in the Total Area item:

Production:

National Forests (FLONAS);

Forest plantations;

Sustainable Development Reserve (RDS);

Preservation area.

Soil and water protection:

Permanent Preservation Area (APP);

Biological conservation:

Ecological station;

Biological reserve;

National Park Natural Monument;

Wildlife Refuge;

Area of relevant ecological importance;

Natural Heritage private reserve,

National Forests;

Extractivist Reserve;

Indigenous Lands;

Sustainable Development Reserve;

Permanent Preservation Area.

Social services:

Extractivist Reserve;

Indigenous Lands;

Sustainable Development Reserve,

Environmental Protected Area.

Multiple use:

Environmental Protected Area.

To calculate the soil and water protection category, Permanent Preservation Area, the value of 15% of the total country area was considered, as there is no national survey of these areas. As it deals with a federal law that establishes these areas are preserved it was considered that there was little variation in the years stated in the Table.

Categories	Area (1000 hectares)		
	1990	2000	2005
National Forests;	15,639	18,426	20,808
Biological conservation	29,84	32,611	38,775
Environmental Protected Area.	6,362	13,110	14,826
Extractivist Reserve	2,345	3,777	8,098
Sustainable Development Reserve	2,437	3,840	3,840
Indigenous Lands	2,284	36,075	101,664

### 3.4 Data for the national report of Table T3

FRA 2005 Categories/Designated function	Area (1000 hectares)					
	Primary function			Total area with function		
	1990	2000	2005	1990	2000	2005
Forest						
Production	20,710	23,706	26,296	27,072	36,816	41,122
Soil and water protection	85,149	85,149	85,149	85,149	85,149	85,149
Biodiversity conservation	29,841	32,611	38,775	137,695	179,879	258,334
Social services	7,066	43,692	113,602	13,428	56,803	128,428
Multiple use	377,261	308,055	213,876	not applicable	not applicable	not applicable
No or unknown function				not applicable	not applicable	not applicable
<b>Total – Forest</b>	<b>520,027</b>	<b>493,213</b>	<b>477,698</b>	not applicable	not applicable	not applicable
Other Wooded lands						
Production						
Soil and water protection						
Biological conservation						
Social services						
Multiple use				not applicable	not applicable	not applicable
No or unknown function				not applicable	not applicable	not applicable
<b>Total – Other wooded land</b>				not applicable	not applicable	not applicable

### 3.5 Comments of the national report of Table T3

The dimension of the total area of conservation units is underestimated, because it does not include the municipal conservation units and not all are estimated at state level.

There is a overlapping of around 18 million ha of indigenous lands and conservation units that were not taken in account in the calculations.

### 3.6 Sources and References List

Sistema Nacional de Unidades de Conservação – **SNUC**: Lei Nº 9.985, de 18 de julho de 2000; decreto nº 4.340, de 22 de agosto de 2002. 4.ed.. Brasília: MMA/SBF, 2004.52p.

Unidades de conservação. Disponível em: <http://www.ibama.gov.br> Acesso em 01 de março de 2005.

Departamento de áreas protegidas. Disponível em <http://www.mma.gov.br/port/sbf/dap/index.cfm> Acesso em 01 de março de 2005.

Ricardo, F. **Terras Indígenas e Unidades de Conservação** - O desafio das sobreposições. São Paulo: Ed: Instituto Socioambiental, 2005.

Código Florestal Brasileiro: Lei nº 4.771, de 15 de setembro de 1965, Institui o Novo Código Florestal.

## 4 - Table T4 – Characteristics of forest and other wooded lands

### 4.1 Categories and definitions

Category	Definition
Primary	Forest / Other wooded land of native species, where there are no clearly visible indications of human activities and the ecological processes are not significantly disturbed.
Modified Natural	Forest / Other wooded land of naturally regenerated native species where there are clearly visible indications of human activities.
Semi-natural	Forest / Other wooded land of native species, established through planting, seeding or assisted natural regeneration.
Productive Plantation	Forest / Other wooded land of introduced species, and in some cases native species, established through planting or seeding mainly for production of wood or non wood goods.
Protective Plantation	Forest / Other wooded land of native or introduced species, established through planting or seeding mainly for provision of services.

### 4.2 National data

#### 4.2.1 Data sources

Reference sources	Quality	Variable	Year	Additional Comments
Vegetation map of Brazil – IBGE ed. 2004; Scale : 1:5,000,000	M*	Forests Other lands Inland waters	2004	This map gives as primary information, areas of the vegetation types, by federation unit and geographical region.

#### 4.2.2 Terms and definitions

National Class	Definitions
Primary	Value established for forestry category (Table 1), less the areas with open caatinga, secondary vegetation and reforestation.
Modified Natural	Secondary vegetation plus the remnants of open caatinga + managed forests
Semi-natural	Plantations with native species
Productive Plantation	Reforestation with exotic species
Protective Plantation	n. a.

### 4.2.3 Calculation of Areas - 2000

The following Table synthesizes the intermediate groupings used to obtain the areas in Table 4.

Plantations and capoeiras (fallow)

Categories	Area (1000 ha)		
	1990	2000	2005
Forests	524,264	493,213	475,752
Forest plantations (1)	5,071	5,279	5,384
Open caatinga (2)		29,870	
Capoeira remaining + managed (3)		24,844	
Natural altered (2)+(3)		54,714	

- (1) According the composition in Table 1;  
 (2) Areas directly obtained from primary sources produced from the vegetation map;  
 (3) Estimated from the database of Natural Resources IBGE/CREN.

### 4.3 Area estimates from 1990 to 2005

Obtained proportionally based on the forest values available in Table 1.

### 4.4 Data for the national report of Table T4

FRA 2005 Category	Area (1000 hectares)		
	Forests		
	1990	2000	2005
Primary	460,512	433,220	415,891
Natural altered	54,444	54,714	56,424
Semi-natural			
Plantation for production	5,070	5,279	5,384
Plantation for protection (n.a.)	0	0	0
<b>Total</b>	<b>520,027</b>	<b>493,213</b>	<b>477,698</b>

### 4.5 Sources and Reference list

IBGE. Mapa de vegetação do Brasil, ed. 2004, escala: 1:5.000.000. Rio de Janeiro: IBGE, 2004.

IBGE. Quadro territorial vigente. Resolução no 05 de 10/10/2002 do Presidente do IBGE, segundo quadro territorial vigente em 01/01/2001.

## 5 - Table T5 – Growing stock

### 5.1 Categories and definitions

Growing stock	Volume over bark of all living trees more than X cm in diameter at breast height (or above buttress if these are higher). Includes the trunk from ground level or stump height up to a maximum diameter of Y cm, and may also include branches to a minimum diameter of W cm.
Commercial Growing stock	The part of the growing stock of species that are considered as commercial or potentially commercial under current market conditions, and with a diameter at breast height of Z cm or more.

### 5.2 National data

#### 5.2.1 Data sources

Reference sources	Quality (A/M/B)	Variable	Year	Additional Comments
Theses, dissertations, books, scientific papers, direct contact with producers and researchers.	M <sup>1</sup>	IMA** R***	2004	This map gives as primary information, areas of the vegetation types, by federation unit and geographical region.
Felfili, J. M. et al (1994)	A	Ind.ha <sup>-1</sup>	1988; 1992	This work contains information on plots of 0.1 ha randomly selected in wooded savana and tree savana. Plots were sampled both in Conservation units and areas not protected.
Felfili, J. M. & Silva Jr., M. C. (2001)	A	Ind.ha <sup>-1</sup>	1997; 2000	This work contains information on plots of 0.1 ha randomly selected in tree savanna. Plots were sampled both in Conservation units and areas not protected.
Felfili, J. M. et al. (1997)	A	Ind.ha <sup>-1</sup>	1988- 1996	This work contains information on plots of 0.1 ha randomly selected in wooded savana and tree savana. Plots were sampled both in Conservation units and areas not protected.
Cochrane, T. T. et al. (1985)	A	-	1985	Physiographic units in Central Brazil
Pereira, J. E. S.; Brasileiro, A. C. M.; Felfili, J. M. & Silva, J. A. ()	M <sup>2</sup>	Volume	1987	Volume equation (m <sup>3</sup> ) to estimate individual tree volumes in wooded savana.
Rezende, A V. (2002)	M <sup>2</sup>	Volume	1998	Volume equation (m <sup>3</sup> ) to estimate individual tree volumes in tree and wooded savana.

<sup>1</sup> Assuming an average rotation for genus \*\*Average annual increment \*\*\*Rotation

<sup>2</sup> The Quality of information is considered average because the allometric equation producing this work was obtained from data deriving from only a determined physiognomic area.

### 5.2.2 Terms and definitions

National classes	Definition
Tree Savana (Cerrado sensu stricto)	Savana that occupies the major area of the Cerrado biome and better reflects the predominant environmental conditions. Has semi deciduous characteristics, rich in species adapted to fire and drought, comprised of a tree layer formed by xeromorphic elements, 3-10 m high, shrubs also composed of xeromorphic elements and a herbaceous layer dominated by grasses. It is also known as cerrado sensu stricto.
Wooded Savana (Cerradão)	Savana endowed with a forest physiognomy and composed of semi deciduous tree species, with a canopy between 8 and 12 m high. Characterised by an association of cerrado species with species from the rest of the regional forests. It has a moderate frequency in the biome and its occurrence is generally linked to Latossolos in flat relief. It is also known as cerradão.
Transition Savana - Caatinga Steppe	Ecotonal area: transition Cerrado – Caatinga

### 5.3 Total and commercial stocks by biome

FRA 2005 Category	Millions of cubic meters over bark		
	1990	2000	2005
Plantations – total and commercial	786.69	941.95	1,019.59
Atlantic forest – total	6,026.12	5,854.29	5,768.38
Atlantic forest – commercial	1,205.22	1,170.86	1,153.68
Cerrado – total	6,440.27	5,547.75	5,110.93
Cerrado – commercial	4,769.66	4,108.66	3,785.15
Caatinga – total	3,204.53	3061.58	2990.40
Caatinga – commercial	2,243.17	2143.10	2093.28
Amazon – total	72,022.77	69,310.54	66,332.71
Amazon – commercial	7,202.28	6,855.80	6,633.27
Pampa – total	17.94	17.22	16.86
Pampa – commercial	3.59	3.44	3.38
<b>Total growing stock</b>	<b>88498.32</b>	<b>84733.33</b>	<b>81238.87</b>
<b>Commercial growing stock</b>	<b>16210.61</b>	<b>15223.81</b>	<b>14688.35</b>

#### Observations:

- Considered that 20% of the stock volumes of Atlantic forest are commercial, for legal and commercial reasons;
- Considered that 65% of the stock volumes of Cerrado in the greater Amazon are commercial and for other regions in the country, 80% of the stock volumes of Cerrado are commercial, for legal and commercial reasons;
- Considered that 70% of the stock volumes of the Caatinga are commercial, for legal and commercial reasons;
- Considered that 10% of the stock volumes of Amazon are commercial, for legal and commercial reasons;

- Considered that 20% of the stock volumes of the Pampa are commercial, for legal and commercial reasons.
- Considered Total and Commercial volume for Cerrado: 35.78 m<sup>3</sup> ya<sup>-1</sup> (Cerrado *sensu stricto* and Transition Savana-Savana steppe), and 126.13 m<sup>3</sup> ya<sup>-1</sup> (Cerradão)

#### 5.4 Data for the national report of Table T5

FRA 2005 Category	Volume (Millions of cubic meters over bark) Forests		
	1990	2000	2005
Growing stock	88 498.32	84 733.33	81 238.87
Commercial growing stock	16 210.61	15 223.81	14 688.35

#### 5.5 Comments about the information table T5

##### 1) Cerrado

For the cerrado *sensu stricto* category, the volume over bark of living trees was calculated considering a minimum diameter of 5 cm at the base of the trunk, that is, diameter at 0.30 m above ground level. In the case of cerradão, which has species that occur also in the cerrado *sensu stricto*, the volume over bark of living trees was calculated considering the following procedure:

- a) For species common in cerrado *sensu stricto* environments, a minimum diameter of 5 cm from the trunk base was adopted, that is, diameter at 0.30 m above ground level.
- b) For forest species a minimum diameter of 5 cm taken at DBH, that is, diameter taken at 1.30 m above soil level.

For the transition areas cerrado-caatinga there still are not surveys that permit estimation of the volume of individual trees. In this way, the average volume of trees in the cerrado-caatinga transition areas was considered the same as that recorded in areas of cerrado *sensu stricto*, taking into account that many species found in these areas are typical of cerradão environments and that the vegetation structure of the two environments are similar.

The branch volume was also included considering a minimum diameter of 3cm.

##### 2) Forest plantations

To obtain the stock volume of Brazilian forest plantations data on the average annual increment and the average rotation age of each species or genus planted were used. The increments were taken from theses, dissertations, books, scientific articles, and direct contact with producers and researchers, the same also for average rotation ages.

The stock volume of a determined species or genus was calculated by multiplying the planted area by the average stock volume by hectare calculated by the product of the

average annual increment (IMA) and the average rotation age divided by two. For example:

For the genus *Pinus* the area planted was 1,840,050 hectares in 2000, the IMA was 28 m<sup>3</sup>/ha.year<sup>-1</sup> and the average rotation age of 20 years. Thus:  
 $1,840,050 \text{ ha} \times 28 \times 20 \div 2 = 515.21$  million cubic meters

## 6 - Table T6 - Biomass stock

### 6.1 Categories and definitions

Category	Definition
Above-ground biomass	All the above ground live biomass including the trunk, stump, branches, bark, seeds, and leaves.
Below-ground biomass	All the live root biomass. The small roots of less than 2mm diameter are excluded because these often cannot be distinguished empirically, from the soil organic matter or leaf litter.
Dead wood biomass	All the dead wood biomass that does not form part of the leaf litter, standing or lying on the ground or in the soil. The dead wood includes wood lying on the surface, dead roots, and the stumps larger than or equal to 10 cm. diameter or any other diameter used in the country.

### 6.2 National data

#### 6.2.1 Data sources

Reference sources	Quality (A/M/B)	Variable(s)	Year(s)	Additional comments
Araújo et al. (1999)	A	above	1999	Alometric
Fearnside (1994)	M	various	1994	Biomass and C: above, litter
Higuchi et al. (1994)	M	above	1994	Biomass : above
Higuchi et al. (1997)	M	above and C	1997	Biomass : above
Higuchi et al. (1998)	A	various	1998	Alometric
Higuchi (2004)	M	various	2004	Biomass and C: above, below, litter
Irmão e Higuchi (1999)	M	above and C	1999	Biomass and C: above
Lima et al. (1999)	M	above and C	1999	Biomass and C
Lima (2001)	M	above and C	2002	Biomass and C: above in capoeiras (fallow)
Lima (2004)	M	above and C	2004	Biomass and C
MCT (2004)	M	various	2004	Biomass and C: emissions
Phillips et al. (1998)	A	above and C	1998	Alometric, Biomass and C above
Projeto (project) Chichuá (2004)	A	above and C	2004	Biomass and C: above
Salati (1994)	M	various	1994	C: soil and dead wood
Summers et al. (1997)	M	dead wood	1997	Biomass : dead wood
Rezende, A V. 2002.	M <sup>1</sup>	above.	1998	Dry biomass stock (trunks and branches)
Santos, J. <i>et al.</i> 2001	M <sup>1</sup>	Above	1998	Alometric
Castro, E. A. 1996.	M <sup>1</sup>	above/below/ litter/solo	1994	Carbon
Felfili, J. M. <i>et al.</i> 1994.	A	Above	88-92	Biomass stock
Felfili, J. M. & Silva Jr., M. C. 2001.	A	Above	97-00	Biomass stock
Felfili, J. M. <i>et al.</i> 1997.	A	above	88-96	Biomass stock
Castro, E. A. 1996.	M <sup>1</sup>	C in the soil and litter	1994	Carbon stock in soil and litter
Bodig, J.; Jayne, B. A. 1963.	M <sup>2</sup>	C level in wood		Basic information
Sanquetta et al., C.R.	A	Above/below	2002	Alometric and chemical analyses – Atlantic forest and Forest Plantations
Sanquetta et al., C.R.	A	Above/below	2004a	Alometric and chemical analyses

Reference sources	Quality (A/M/B)	Variable(s)	Year(s)	Additional comments
				– Atlantic forest and Forest Plantations
Sanquetta et al., C.R.	A	Above/below	2004b	Alometric and chemical analyses – Atlantic forest and Forest Plantations

## 6.2.2 Terms and Definitions

National classes	Definition
Cerrado sensu stricto	Savanna that occupies the major area of the Cerrado biome and better reflects the predominant environmental conditions. Has semi deciduous characteristics, rich in species adapted to fire and drought, comprised of a tree layer formed by xeromorphic elements, 3-10 m high, shrubs also composed of xeromorphic elements and a herbaceous layer dominated by grasses. It is also known as cerrado <i>sensu stricto</i> .
Cerradão	Savanna endowed with a forest physiognomy and composed of semi deciduous tree species, with a canopy between 8 and 12 m high. Characterized by an association of typical cerrado species, with species also from regional forests. Its frequency in the biome is moderate and its occurrence generally linked with latossolos in flat relief. It is also known as cerradão.
Transition Cerrado – Caatinga	Ecotonal area: transition Cerrado – Caatinga
T2 (PNUD/FAO)	Caatinga open tree-shrub
T3 (PNUD/FAO)	Caatinga closed tree-shrub
T4 (PNUD/FAO)	Caatinga closed tree
Td (IBGE)	Savana estépica florestada (wooded steppe savanna)
Ta (IBGE)	Savana estépica arborizada (tree steppe savanna)
Tp (IBGE)	Savana estépica parque (park steppe savanna)
Tg (IBGE)	Savana estépica gramínea-lenhosa (woody grass steppe savanna)

## 6.2.3 Indicators used for the biome

FRA 2005 Category	Biomass t. ha-1			
	Above ground	Below ground	Dead	TOTAL
Amazon forest	260.00	37.70	20.21	317.91
Amazon capoeira (fallow)	71.50	10.37	5.56	87.43
Caatinga	65.60	17.71	2.90	86.21
Campos Sulinos	34.65	6.24	0.94	41.82
Cerrado – Tree Savana	14.98	44.64	4.58	59.62
Cerrado – Wooded Savana	63.87	190.32	12.25	254.19
Cerrado – Steppe savana	14.98	44.64	4.58	59.62
Atlantic Forest	330.67	64.20	9.63	404.50
Forest Plantations	33.53	5.84	0.88	40.25

FRA 2005 Category	Area (1000 ha)		
	1990	2000	2005
Amazon	473,479	469,023	466,795
Caatinga	35,904	33,777	32,714
Pampa	598	574	562
Cerrado	59,647	51,371	47,632
Atlantic forest	23,963	23,233	22,572
Planted	4,905	5,253	5,384

## 6.2.4 National data processing and analysis

### Estimation and projection

#### 1) Amazônia:

The estimates of remaining forests were calculated as follow:

- Area of original forests (2000) minus deforested area, considering deforestation rates from INPE ([www.inpe.br](http://www.inpe.br)).
- ‘Capoeiras’ were also considered as forest, and its area calculated by IBGE basing on the estimate of the “anthropic” area
- The projections for 2004 and 2005 were done considering the average deforestation rate for years 2001, 2002 and 2003.

#### 2) Cerrado:

The estimates of biomass stock for the savanna formations (cerrado *sensu stricto*, cerradão and area of transition cerrado-caatinga), considering the different FRA 2005 categories, were undertaken using allometric equations developed by Santos et al. (2001) and Rezende (2002) as well as the proportions suggested by Castro (1994).

The projections were produced using the projected areas of each physiomy, whose values were produced for Table 1. For the savanic area determination, it was considered a 1.5% annual desforestation rate for Cerrado Biome. Therefore, the estimates were done by applying the 1,5% annual tax desforestation and using the relation  $A_t = A_0(1 \pm r)^n$ , where:  $A_t$ =forest cover area estimated for the Biome in an specific year;  $A_0$ =the Bioma forest cover area in the year considered as the baseline (available data);  $r$ =annual medium rate of desforestation considered for the Biome; and  $n$ =number of projected years), it was estimated the savanah forest cover area for the 3 years of reference of FRA 2005 (1990, 2000 and 2005).

Addionatly in the areas covered by INPE/PRODES (part of the States Mato Grosso, Tocantins and Maranhão ) the PRODES estimate was considered

For the projection of areas occupied by savana formations in the country, considered an annual deforestation rate of 1.5% indicated for the Biome. Reference consulted: Machado, R. B.; Ramos Neto, M. B.; Pereira, P. G. P.; Caldas, E. F.; Gonçalves, D. A.; Santos, N. S.; Tabor, K & Steininger, M. **Estimativas de perda da área do Cerrado**

**brasileiro** (Area loss estimates in the Brazilian Cerrado). Conservation International, Brasília, DF. Report available at:

<http://www.conservation.org.br/arquivos/RelatDesmatamCerrado.pdf>. 2004.

### 3) Caatinga:

The data and results of references for the evolution of forest cover estimates in the caatinga biome show conflicting results varying from increase of 1.29% per year to decreases of 2.57% per year.

The most recent surveys, however, show lower rates of increase or loss. Besides this, each survey used a different methodology, making whatever estimation of tendency or evolution very difficult.

Hence, for estimating the forest cover of the Caatinga biome for FRA 2005, a decreasing average rate of 0,25% per year was adopted (amongst the many encountered rates). The starting point for the absolute cover values was 40.7%, a result obtained from the IBGE (2004) Vegetation map of Brazil (base 1996).

Applying a rate of 0,25% per year, the forest cover of the caatinga was calculated for the three reference years of FRA 2005 as presented below. The total area of the caatinga biome according to IBGE is 850,809.58 km<sup>2</sup>.

### 4) Atlantic Forest:

To obtain the dry biomass estimates the stock volumes previously calculated were used and information on the basic wood density of each species or genus in g/m<sup>3</sup>.

By multiplying the stock volume by the respective density the bole biomass of each species or genus was obtained. Subsequently, to expand the bole biomass for the biomass above ground expansion factors were used, that represent a relation between the total aerial biomass (foliage, branches fine and thick, etc.) and the bole biomass. In the case of the genus *Pinus* this factor was calculated in 1.41, from 200 trees researched at UFPR for distinct species in this genus.

Thus, exemplifying in the case of *Pinus*:

stock volume x density x factor = biomass total area

515.21 millions m<sup>3</sup> x 0.47 x 1.41 = 341.43 million tons

Afterwards, to obtain the below ground biomass fraction the relation between this below ground biomass and the total aerial biomass was used for each genus in the average age of the plantations, in other words, the rotation age divided by two, in the case of *Pinus* 10 years.

Thus, the below ground biomass was obtained by multiplying the aerial biomass by the root / aerial biomass ratio (root/shoot ratio), that in the case of *Pinus* is:

341.43 million tons x 0.09 (factor) = 29.69 million tons

Additionally, information with respect to the percentage of dead wood biomass lying on the soil (necromassa) was taken in relation to below ground biomass in diverse plantations to obtain an estimate of this component.

Exemplifying again for *Pinus* :

29.69 million tons x 0.15 (factor) = 4.45 million tons

Adding the aerial and below ground biomass components the total living biomass was obtained. In this case, the sum of the total living biomass with the estimated value of dead wood resulted in the total amount of biomass components. These are the data required in Table 6 of FRA 2005.

### 6.3 National data for the information Table T6

FRA 2005 Category	Biomass (millions of dry metric tons)					
	Forest			Other wooded lands		
	1990	2000	2005	1990	2000	2005
Biomass above ground	86088	82677	79219			
Biomass below ground	24434	22857	22017			
Biomass of dead wood	6877	6557	6359			
TOTAL	117399	112091	107594			

### 6.4 Comments on information Table T6

#### 1) Amazon

The allometric equations developed in the Manaus region (Higuchi *et al.*, 1998) were checked in the Tomé-Açu region in Pará state (Araújo *et al.*, 1999). These equations were used to estimate the emissions through soil use in Brazilian Amazon (MCT, 2004) and to estimate the biomass from different sites in the Amazonian region (Philips *et al.*, 1998).

Specific inventories to obtain estimates of biomass and vegetation carbon, using the Manaus equations, were undertaken in various in the Brazilian Amazon: UHE Balbina, Trombetas, Rio Arinos, PDRI Acre and CEAM Manacapuru (Irmão and Higuchi, 1999), ZF-2 Manaus (Higuchi *et al.*, 1997), South of Pará and South of Roraima (Higuchi *et al.*, 1994), Autazes, Barreirinha, Boa Vista do Ramos, Borba, Maués, Nova Olinda do Norte, Parintins, Urucurituba and Tarumã Mirim (Lima *et al.*, 1999), Manacapuru, Resex Auti-Paraná and Resex Jutai (Projeto Chichuá, 2004) and Trombetas (Lima, 2004).

The average estimate of above ground biomass per hectare was obtained including other estimates in different sites supplied by Fearnside (1994), such as: Fazenda Dimona, Reserva Eglér, UHE Samuel, UHE Belo Monte, UHE Babaquara ciliar and UHE Babaquara terra-firme. Biomass estimates were considered from 31 different sites, 19 in

Amazonas state, 6 in Pará, 2 in Amapá and 1 in the states of Acre, Mato Grosso, Rondônia and Roraima.

Field truthing of biomass and carbon above and below ground in live vegetation, dead wood and litter (Higuchi et al., 1998 e Higuchi, 2004) was compared with studies realised in other regions (Fearnside, 1994, Salati, 1994 and Summers *et al.*, 1997). From these comparisons, emerged the factors and estimates utilised to estimate the biomass and carbon below soil level in living vegetation, dead wood and litter for filling in Tables 6 and 7.

## 2) Cerrado:

The average dry wood biomass for tree savanna was obtained from a sample of 244 plots of 0.1 ha (20x50 m) distributed in 24 localities selected in six physiographic units of Central Brazil (Cochrane et al. 1985), as: 1. "Pratinha" ("Chapada Pratinha"), 2. "Veadeiros" ("Chapada do Tocantins"), 3. "São Francisco" ("Espigão Mestre do São Francisco"), 4. Planície do Araguaia, 5. Complexo Xavantina, and 6. Bacia do Paranã, covering 10 degrees of latitude and 10 degrees of longitude in the cerrado biome.

There were sampled at least 10 plots per locality, randomly distributed in each area. Conservation Units in the region were included in the sampling. In total, six protected areas and 18 non-protected areas were selected. For a description of the areas see Felfili et al. (1994, 1997 and 2001).

The average dry wood biomass for the woody savanna was obtained from a sampling of 28 plots of 0.1 ha (20x50 m) distributed in 8 localities selected from one physiographic unit in Central Brazil (Cochrane et al. 1985), as: "Pratinha" ("Chapada Pratinha"). There was sampled at least 2 plots per locality, randomly distributed in each area. Conservation Units in the region were included in the sampling. In total one protected and seven non-protected areas were selected. For a description of the areas see Felfili et al. (1994).

The dead biomass was calculated considering trunk and roots of all the dead standing individuals with a diameter the same or superior to the minimum established for the living trees in each physiognomy (wooded savanna, tree savanna and transition area of savanna-savanna steppe).

Considering that for the areas of transition savanna-savanna steppe there still does not exist samples that permit estimate the biomass of individual trees, the average biomass value for the trees in the transition areas savanna-savanna steppe was considered the same as that registered in tree savanna areas, taking into account that many species found in these areas are typical of tree savanna environments and that the structure of the vegetation in the two environments are similar.

## 7 - Table T7 – Carbon reserves

### 7.1 Categories and definitions

Category	Definition
Carbon in the above ground biomass	Carbon in all the above ground live biomass including the trunk, stump, branches, bark, seeds, and leaves.
Carbon in the below ground biomass	Carbon in all the live root biomass. The small roots of less than 2mm diameter are excluded because these often cannot be distinguished empirically, from the soil organic matter or leaf litter.
Carbon in the dead wood biomass	Carbon in all the dead wood biomass that does not form part of the leaf litter, standing or lying on the ground. The dead wood includes wood lying on the surface, dead roots, and the stumps larger than or equal to 10 cm. diameter or any other diameter used in the country.
Carbon in litter	Carbon in all non-living biomass with a diameter less than a minimum diameter chosen by the country for dead wood (for example 10 cm), in various states of decomposition above the mineral or organic soil. This includes the litter, and humic layers.
Carbon in the soil	Organic carbon in the mineral and organic soils (including peat) to a specified depth chosen by the country and applied consistently through the time series.

### 7.2 National data

#### 7.2.1 Data sources

References	Quality (A/M/B)	Variable(s)	Year(s)	Additional comments
Araújo et al. (1999)	A	above	1999	Alometric
Fearnside (1994)	M	various	1994	Biomass and C: above, litter
Higuchi et al. (1994)	M	above	1994	Biomass : above
Higuchi et al. (1997)	M	above e C	1997	Biomass : above
Higuchi et al. (1998)	A	various	1998	Alometric
Higuchi (2004)	M	various	2004	Biomass and C: above, below, litter
Irmão e Higuchi (1999)	M	above and C	1999	Biomass and C: above
Lima et al. (1999)	M	above and C	1999	Biomass and C
Lima (2001)	M	above and C	2002	Biomass and C: above in capoeiras (fallow)
Lima (2004)	M	above and C	2004	Biomass and C
MCT (2004)	M	various	2004	Biomass and C: emissions
Phillips et al. (1998)	A	above and C	1998	Alometric, Biomass and C above
Projeto Chichuá (2004)	A	above and C	2004	Biomass and C: above
Salati (1994)	M	various	1994	C: soil and dead wood
Summers et al. (1997)	M	dead wood	1997	Biomass : dead wood
Rezende, A V. 2002.	M1	above.	1998	Dry Biomass stock (trunks and branches)
Santos, J. et al. 2001	M1	Above	1998	Alometric
Castro, E. A. 1996.	M1	above/below/ litter/solo	1994	Carbon
Felfili, J. M. et al. 1994.	A	Above	88-92	Biomass stock
Felfili, J. M. & Silva Jr., M. C. 2001.	A	Above	97-00	Biomass stock
Felfili, J. M. et al. 1997.	A	above	88-96	Biomass stock
Castro, E. A. 1996.	M1	C in soil and	1994	Carbon stock in soil and leaf

References	Quality (A/M/B)	Variable(s)	Year(s)	Additional comments
		litter		litter
Bodig, J.; Jayne, B. A. 1963.	M2	C level in wood		Basic information

### 7.2.2 Terms and Definitions

National classes	Definition
Cerrado sensu stricto	Savanna that occupies the major area of the Cerrado biome and better reflects the predominant environmental conditions. Has semi deciduous characteristics, rich in species adapted to fire and drought, comprised of a tree layer formed by xeromorphic elements, 3-10 m high, shrubs also composed of xeromorphic elements and a herbaceous layer dominated by grasses. It is also known as cerrado <i>sensu stricto</i> .
Cerradão	Savana endowed with a forest physiognomy and composed of semi deciduous tree species, with a canopy between 8 and 12 m high. Characterized by an association of typical cerrado species, with species also from regional forests. Its frequency in the biome is moderate and its occurrence generally linked with latossolos in flat relief. It is also known as cerradão.
Transition Cerrado – Caatinga	Ecotonal area: transition Cerrado – Caatinga
T2 (PNUD/FAO)	Caatinga arbustiva-arbórea aberta (open tree-shrub caatinga)
T3 (PNUD/FAO)	Caatinga arbustiva-arbórea densa (closed tree-shrub caatinga)
T4 (PNUD/FAO)	Caatinga arbórea densa (closed tree caatinga)
Td (IBGE)	Savana estépica florestada (wooded savana steppe)
Ta (IBGE)	Savana estépica arborizada (tree savana steppe)
Tp (IBGE)	Savana estépica parque (park savana steppe)
Tg (IBGE)	Savana estépica gramínea-lenhosa (woody-grass savana steppe)

## 7.3 National data processing and analysis

### 7.3.1 Estimation and Projection

1) Amazon:

2) Cerrado:

The estimates of carbon reserves for savanna formations (cerrado *sensu stricto*, cerradão and transition area cerrado-caatinga), considering the different FRA 2005 categories, were calculated based on the allometric equations developed by Santos et al. (2001) and Rezende (2002) for Biomass, and on the levels of carbon relations indicated by Castro (1994) and the level of carbon of 50% adopted for live Biomass.

The projections were calculated based on the projected areas for each physiognomy, whose values created Table 1. For the projection of the area occupied by savanna formations in the country, an annual rate of deforestation of 1,5% indicated for the biome. Reference consulted: Machado, R. B.; Ramos Neto, M. B.; Pereira, P. G. P.; Caldas, E. F.; Gonçalves, D. A.; Santos, N. S.; Tabor, K & Steininger, M. **Estimativas**

**de perda da área do Cerrado brasileiro** (Area loss estimates in the Brazilian Cerrado). Conservation International, Brasília, DF. Report available at: <http://www.conservation.org.br/arquivos/RelatDesmatamCerrado.pdf>. 2004.

### 3) Caatinga:

The information contained in the table below was used to fill in Table 7

Carbon level	Unit	0.5	Source: IPCC
C Biomass above	(t/ha)	32.8	
C Biomass below	(t/ha)	8.856	
Total C Live Biomass	(t/ha)	41.656	
C Dead Biomass	(t/ha)	1.45	
Average litter weight	(t/ha)		
C in litter	(t/ha)	1	Source: IPCC
C in soil	(t/ha)	35	Source: IPCC

### 4) Atlantic forest:

To obtain the carbon estimates the estimates of above and below ground biomass were calculated and their respective carbon levels in these fractions. The average levels of carbon in dry biomass were calculated from direct determinations in the laboratory for the principle species and genera planted in Brazil and data in the literature.

For example for the *Pinus* genus:

Carbon in above ground biomass: 341.43 million tons x 0.47 (average level of carbon in dry biomass) = 160.47 million tons

The same was done for the carbon in below ground biomass:

29.69 million tons x 0.47 = 13.95 million tons

and for the carbon in dead wood:

4.45 million tons x 0.47 = 2.09 million tons

Additionally the weight of the litter on the soil was estimated for each species or genus considered, namely its biomass. For the genus *Pinus* the average value was 8 tons per hectare, in 10-year-old plantations.

Again by multiplying this biomass fraction with average level of carbon the following value for the genus was calculated:

Carbon in litter: 8 t/ha x 0.47 x 1,840,050 ha = 6.92 million tons.

Finally, the organic soil carbon was estimated from average soil weights determined in 1 hectare in plantations of each species or genus considered. In the case of *Pinus* this value was 75 tons per hectare in the superficial organic soil levels.

This value was then multiplied by the average level of soil carbon for the respective species or genus to obtain the total carbon in the soil.

For the genus *Pinus* this value was estimated as:

Carbon in organic soil:  $75 \times 0.03$  (average level of carbon in soil)  $\times 1,840,050$  ha = 138.00 million tons.

These were the informations required in Table 7 of FRA 2005.

Note that the carbon stocks refer to carbon C and not CO<sub>2</sub> equivalent.

Reclassification of the FRA 2005 classes

#### 7.4 National data for the information table T7

FRA 2005 categories	Carbon (Million metric tonnes)					
	Forest			Other wooded lands		
	1990	2000	2005	1990	2000	2005
Carbon in above ground biomass	41825	40144	38480	s/d	s/d	s/d
Carbon in below ground biomass	12060	11272	10855	s/d	s/d	s/d
<b>Subtotal: Carbon in living biomass</b>	<b>53885</b>	<b>51416</b>	<b>49335</b>	<b>s/d</b>	<b>s/d</b>	<b>s/d</b>
Carbon in dead wood	3308	3152	3056	s/d	s/d	s/d
Carbon in leaf litter	2118	2018	1958	s/d	s/d	s/d
<b>Subtotal: Carbon in dead wood and leaf litter</b>	<b>5426</b>	<b>5170</b>	<b>5014</b>	<b>s/d</b>	<b>s/d</b>	<b>s/d</b>
Carbon in soil to 100 cm depth	55939	52284	50289	s/d	s/d	s/d
<b>TOTAL CARBON</b>	<b>115250</b>	<b>108870</b>	<b>104638</b>	<b>s/d</b>	<b>s/d</b>	<b>s/d</b>

#### 7.5 Comments on the information table T7

The references used for filling Table 6 are the same that were used for Table 7.

## 8 - Table T8 – Disturbances affecting forest health and vitality

### 8.1 Categories and definitions

Category	Definition
Disturbance by fire	Disturbance caused by fire, independently whether it broke out inside or outside the forest/other wooded lands.
Disturbance by insects	Disturbance caused by insect pests that are detrimental to tree health.
Disturbance by diseases	Disturbance caused by diseases attributable to pathogens, such as bacteria, fungi, phytoplasma or virus.

### 8.2 National data

#### 8.2.1 Data sources

Reference sources	Quality (A/M/B)	Variable(s)	Year(s)	Additional comments
IBAMA (1) Prevfogo Project/ Proarco Project	M	Area burnt (1)	1988-1992 1998-2002	Federal Conservation Units
INPE (2) CPTEC	M	Number of heat spots (2)	1998-2002	Heat spots within and outside of the forests / other wooded lands
EMBRAPA FLORESTAS (3)				
- Sirex noctilio	M	Affected area	1988-1992 1998-2002	
- Cinara spp.	H	Affected area	2002-2002	
- Armillaria spp.	M	Affected area	2001-2003	

(1) IBAMA – Brazilian Institute for Renewable Natural Resources and the Environment. Prevfogo – National System for Fire Fighting and Prevention of Forest Fires

Proarco – Program for the Prevention and Control of Forest Fires in the Greater Amazon

(2) INPE – National Institute of Space Research. CPTEC – Centre for Weather Forecasting and Climate Studies

(3) EMBRAPA- Brazilian Company for Agricultural research – National Centre for Forestry Research

#### 8.2.2 Terms and definitions

Category	Definition
Disturbance by fire	(1) Disturbance caused by fire, which broke out inside the Federal Conservation Units. (2) Heat spots detected inside and outside of forests/other wooded lands.
Disturbance by insects	(3) Disturbance caused by insect pests that are detrimental to tree health.
Disturbance by diseases	(3) Disturbance caused by diseases attributable to pathogens, such as a bacteria and fungi.

### 8.2.3 Original Data

#### 8.2.3.1 Disturbance by fire

In INPE (2), there exists a very organized system for data collection on fires in the country, with the data updated daily and made available on the Internet.

However, until August 2005, the information available is only heat spots. A national system is being developed for information on the area burnt (in forests and other lands) which could be made available. INPE uses the satellites NOAA, MODIS and GOES and works together with IBAMA (1) sending the data on heat spots in Conservation Units, which are verified by field teams and classified as forest fires or not.

#### 8.2.3.2 Disturbance by insects

The information was compiled by the Entomology team of EMBRAPA Florestas (3)

#### 8.2.3.3 Disturbance by diseases

The information was compiled by the Phytopathology team of EMBRAPA Florestas (3)

### 8.3 National data processing and analysis

This step is not necessary

### 8.4 Reclassification of the FRA 2005 classes

This step is not necessary

### 8.5 National data for the information table T8

FRA-2005 category	Average area affected annually(1000 hectares)			
	Forests		Other wooded lands	
	1990	2000	1990	2000
Disturbance by fire (1)	103.12	67.54	s/d	s/d
Disturbance by fire (2)	s/d	139,266.4		
Disturbance by insects	50.00	30.00	s/d	s/d
Disturbance by diseases	s/d	20.00	s/d	s/d

## 8.6 Comments on the information table T8

FRA-2005 category	Average area affected annually(1000 hectares)			
	Forests		Other wooded lands	
	1990	2000	1990	2000
Disturbance by fire (1) see 8.6.1	103.12	67.54		
Disturbance by fire (2) (*Heat spots detected inside and outside of forests/other wooded lands. see 8.6.1		139266.4(*)		
Disturbance by insects				
Sirex noctilio in Pinus spp	50	20		
Cinara spp in Pinus spp.		10		
Disturbance by diseases				
Armillaria spp in Pinus spp		20		

### Disturbance by fire

Fires in forested areas: Values only available for Federal Conservation Units (UCs). 63 Federal Conservation Units were monitored by the combined project INPE/IBAMA (a) Prevfogo – National System for Fire fighting and prevention of forest fires and (b) Proarco – Program for the Prevention and Control of Burning and forest fires in the Greater Amazon). These UCs represent 1.6% of the national territory.

IBAMA (1)						
Fires in Federal Conservation Units	1988	1989	1990	1991	1992	Average
Number of heat spots	16	19	43	113	50	48.2
Area (1000 ha)	59.05	33.66	53.88	311.27	57.73	103.12
Fires in Federal Conservation Units	1998	1999	2000	2001	2202	Average
Number of heat spots	56	75	150	276	337	178,8
Area (1000 ha)	40.68	41.13	46.31	51.93	157.66	67.54
INPE (2)						
Heat spots detected inside and outside of forests/other wooded lands.	1998	1999	2000	2001	2202	Average
	107007	107242	104122	145708	23253	139266.4

### 8.6.1 Disturbance by insects

*Sirex noctilio* (Hymenoptera: Siricidae)-: Insect that attacks *Pinus* spp. and was the cause of high losses in the 1990's, when the Control Fund (FUNCEMA) was organized and lead by EMBRAPA. Estimates around 350 to 400 thousand ha have been affected, in different degree of attack. The losses are estimated in **236,250 m<sup>3</sup>** of wood (US\$ 4.2 millions / year). The most aggressive levels occurred in the years 90 (1988-1992). The system of control was efficient and its result is reflected in the second period (1998-2002).

*Cinara* spp. (Hemiptera: Aphididae): Recently detected, only in the period 1998-2002. Insect that attacks young plantations of *Pinus* spp affecting the form of the trees and

reducing increments. The losses in height growth were estimated as 14%, in plantations to 2 years of age. The economic losses can be estimated in US\$ 3.8 millions/year.

### 8.6.2 Disturbance by diseases

*Armillaria* spp. : Disease found in *Pinus* spp. plantations from the 1990's. The mortality level is estimated at 5.1% per year. In the South and Southeast of Brazil, estimates of 10% of the total area planted with *Pinus* are affected by *Armillaria*, in different levels of attack. Losses could reach **190,000 m<sup>3</sup>** of wood, estimated in US\$ 3.4 millions / year.

### 8.7 Sources and Reference list

GOMES, N.S.B. **Armillaríose em *Pinus elliottii* e *P. taeda* no Brasil: etiologia, epidemiologia e controle.** 2005. 103 p. Tese (Doutorado em Ciências Florestais) - Setor de Ciências Agrárias, Universidade Federal do Paraná, Curitiba. (in press).

Iede, E.T.; Penteado, S.R.C.; Reis Filho, W. Uso do Entomopatógeno, *Deladenus siricidicola*, em *Pinus*. In: Congresso Brasileiro de Nematologia. *Embrapa CPATSA*. Petrolina, junho de 2003.

Rodighieri, H.R.; Gomes, N.S.B.; Auer, C.G. **Avaliação ambiental, econômica e social dos danos causados pela armillaríose em plantios de *Pinus* no sul do Brasil.** In: Seminário sobre Armillaríose em *Pinus* spp. *Embrapa Florestas*. Curitiba, 29 de Outubro de 2003. CD-Room.

Rodighieri, H.R.; Iede, E. T. Avaliação ambiental, econômica e social dos danos causados pelos pulgões-gigantes-do-pinus, *Cinara* spp. em plantios de *Pinus* no sul do Brasil. Colombo: EMBRAPA-CNPQ, 2004. 3p. (EMBRAPA-CNPQ. Comunicado Técnico, 110)

Queimadas – Vegetation Fires. Disponível em: <http://www.cptec.inpe.br/queimadas/>. Acesso em 12.12.2004

Ibama/Prevfogo. Disponível em: <http://www.ibama.gov.br/prevfogo/> Acesso em: 12.12.2004

Ibama/Proarco. Disponível em: <http://www2.ibama.gov.br/proarco/home.htm>. Acesso em: 12.12.2004

## 9 - Table T9 – Tree species diversity

### 9.1 Categories and definitions

Number of native tree species	The total number of native tree species that have been identified within the country.
Number of critically endangered tree species	The number of native tree species that are classified as “Critically endangered” in the IUCN red list.
Number of endangered tree species	The number of native tree species that are classified as “Endangered” in the IUCN red list.
Number of vulnerable tree species	The number of native tree species that are classified as “Vulnerable” in the IUCN red list.

### 9.2 National data processing and analysis

Despite being a mega diverse country and despite the strategic and economic importance of biodiversity conservation, Brazil is lacking recent studies that cover its flora, however a substantial amount of information exists in a disperse form in scientific articles, books, dissertations and theses. The present report is a result of a concentrated study during the month of November of 2004, for the compilation of native tree species of Brazil, based on available literature (see annex 1 – Bibliography consulted), highlighting the degree of threat of extinction in the year 2000, in accord with ION and IBAMA.

Few studies until the present have made an overall study of Brazilian tree diversity. One of the most relevant studies on this theme and was fundamental for the realisation of this present work was the “Tree Catalogue of Brazil”, whose second edition was published by IBAMA in 2001, presenting more than 4,000 tree species, between native and exotics, highlighting the common names and based on a wide bibliographic survey, concentrating on forestry studies. Of the 4,000 species names presented in the catalogue, approximately 600 refer to exotic species and around 800 represent synonyms or invalid or dubious binomials, in accordance with recent taxonomic treatments (annex 2). Therefore, only around 2,600 species were considered valid from a taxonomic point of view, however this does not in any way demerit this excellent work, as its objective, contrary to the present *checklist*, was not taxonomic.

The list presented here has about 7,800 Brazilian native tree species. The team responsible for its preparation estimate that this number represents 80-90% of the total tree species described to the present moment in this country (the total number, including unpublished taxa, is certainly much greater). Taxonomic groups that were recently revised or monographed, such as Rutaceae, Lecythidaceae or Sapotaceae have more complete data, but groups like Myrtaceae, Rubiaceae, Euphorbiaceae and Annonaceae lack more recent revisions which include data on size and geographical distributions, and thus their coverage is certainly incomplete. The lesser number of floristic surveys realized in the Amazon, could be compensated by the fact that “Flora Neotropica” concentrates on significant groups in the Amazon, and so the coverage of this list in terms of biomes is considered relatively homogenous.

The species presented followed the system adopted by A.P.G. II (2003), because it is considered the most coherent with the recent taxonomic studies in the Angiosperms.

In the main table, the fields referring to the biomes were based on consulted literature, frequently from more than one source. The common names were mainly based, but not exclusively, on the Tree Catalogue of Brazil and the item “Nomenclature reference” refers to a work that was a secure source for correct scientific names. It should be pointed out that the “Nomenclature reference” refers only the acceptability of the scientific name and not its occurrence in the biome or reference to the habit of the species, as these data are based from other sources.

The data presented here suggest a large concentration of Brazilian trees in the biomes Amazonian forest, which cover more than half of the Brazilian tree species (around 56% of the species) and Atlantic forest (around 46% of the species). The cerrado presented around 20% of the species, the caatinga with around 10% of the species, Pantanal with around 5% of the species and the Pampas, corresponding to the biome with the least richness of tree species, of around 4%. All these environments have floras that are still insufficiently known, and that while the absolute numbers are likely to substantially increase in the future, the proportions are unlikely to suffer significant changes.

The content and conclusions presented here are the exclusive responsibility of the authors and do not reflect, necessarily, the opinions of University of São Paulo.

### 9.3 Data for the national report of Table T9

FRA 2005 category	Number of species – year 2000
Native tree species	7880
Critically endangered tree species	34
Endangered tree species	100
Vulnerable tree species	187

### 9.4 Tree species considered as critically endangered by IUCN

Annex 2

### 9.5 Sources and Reference list

Annex 3

**10 - Table T10 – Stock composition**

There is insufficient information and data to complete this Table

## 11 - Table T11 – Wood removal

### 11.1 Categories and definitions

Industrial wood removal	The wood removed (volume of round wood over bark) for production of goods and services other than energy production (fuel wood).
Fuel wood removal	The wood removed for energy production purposes, regardless whether for industrial, commercial or domestic use.

### 11.2 National data

#### 11.2.1 Data sources

Reference sources	Quality A/M/B	Variable	Year	Additional Comments
FUNATURA/ITTO (1) (1 a) SBS 2003	M* M*	Round wood of native origin Round wood of forest plantations	1995 2003	Secondary Data
GEO Brasil 2002 (3, 3a, 4)	M*	Round wood of native origin and planted	2002	With data referring to 2000
IMAZON 2005 (5)	M*	Wood production in Amazônia	2004	
AMS– SILVIMINAS (6)	M*	Consumption of charcoal from native forests	2002	
ABRACAVE, STCP, ABIPA, ABIMCI, BRACELPA, SBS (1a, 2, 3a, 4)	M*	Industrial Round wood Production in Brazil	2001	Based on 2000

M – All the data is from secondary sources

#### 11.3 Data for the national report of Table T11

FRA 2005 Category	Volume in 1000 m3 of wood logs removed			
	Forests	1990	2000	2005
Industrial Wood	Native	52,065	63,850	29,914
Fuel wood		131,737	44,868	47,736
Sub-total (native)		183,802	108,718	77,650
Industrial Wood	Planted	53,616	93,636	138,177
Fuel wood		131,288	90,865	74,649
Sub-total (planted)		184,904	184,501	212,826
<b>Industrial Wood</b>		<b>105,681</b>	<b>157,486</b>	<b>168,091</b>
<b>Fuel wood</b>		<b>263,025</b>	<b>135,733</b>	<b>122,385</b>
<b>General Total</b>		<b>368,706</b>	<b>293,219</b>	<b>290,476</b>

#### **11.4 Comments on the national report of Table T11**

It should be considered that an exact survey of national production is made difficult by the lack of a better organization in the industrial sector; this timber sector does not provide precise information in real time, when available, the statistical data is dispersed, out-of-date, and in the majority of cases, is not readily comparable, because it refers to distinct concepts and methodologies.

In this context, IBAMA, the organ responsible for the control of production and commercialisation of products of forestry origin, recently developed and introduced in twenty two Brazilian states the System of Flux of Products and Sub products of the Flora (Sistema de Fluxo de Produtos e Subprodutos da Flora) - SISMAD. This computerized system allows the continuous collecting, the registering, the processing and the dissemination of data and information on production, consumption and commercialisation of wood and derived products. SISMAD should soon be integrated in the Control System of Forest Products - SISPROF. The information actually available in this control system is not sufficient to supply the respective volume extracted reports for the federation unit and the corresponding commercial log values from native origin.

In this way, the expectation of IBAMA is that in a short while, all the official statistics referring to the performance of the forestry sector will be available for all the Brazilian regions.

Exactly to complement the Tables referred to, there exists a series of surveys and varied sources of information for different class associations and annual statistics published in Brazil, relative to the consumption of round wood and charcoal, and its markets structured in segments such as: cellulose and paper, mechanically processed wood, furniture and related components, charcoal and fuel wood for domestic consumption, grain drying and various energy ends.

The vegetation types included in this survey to obtain the wood removal values in Brazil from native forests followed the IBGE classification. According to this classification there exists six great divisions of plant formations: Humid forest (Closed, Open and Mixed), Seasonal forest (Semi deciduous and Deciduous), Campinarana, Savana (Cerrado), Savana steppe (Caatinga) and Steppe.

As to the research methodology for the data corresponding to the Tables and their respective categories, diverse databases were used for the statistics of production and consumption of forest products. These informations were obtained from data and diverse records from official organs, non-governmental organizations, and class associations in national publications.

#### **11.5 Sources and Reference list**

Survey data in the FUNATURA/ITTO study and published in Prado 1995, pg.52. In 1990, the use of Round wood produced from native wood was 183,802 (mil m3)

(diverse uses), with a significant proportion of approximately 50,8% (93.373 m<sup>3</sup>) for fuel wood removed. The other uses were Logs/log sections totalling 52,065 (mil m<sup>3</sup>) and charcoal with 38,364 (mil m<sup>3</sup>).

(1 a) SBS 2003

(2) (1) Preliminary data surveys in the FUNATURA/ITTO study and published in Prado 1995.

(3) GEO Brasil 2002 – Perspectivas do Meio Ambiente no Brasil (Perspectives on the environment in Brasil). Editions IBAMA. Table 8 pg.106 – Consumption of logs for wood industries in Brazil 2000. Source: ABRACAVE, STCP, ABIPA, ABIMCI, BRACELPA, SBS – 2001.

(4) GEO Brasil 2002 – Perspectivas do Meio Ambiente no Brasil. (Perspectives on the environment in Brasil). Editions IBAMA. Fuel wood for various energy uses (principally domestic consumption and grain drying): equivalent to 36.4 % of the total consumption of native and planted forests of 132,408 10<sup>3</sup> m<sup>3</sup> in Brazil - Table 4 Consumption of Round wood in Brazil, 2000 pg.103. This subtotal was the sum of total charcoal 11,800 10<sup>3</sup> m<sup>3</sup> and industrial fuel wood 16,000 10<sup>3</sup> m<sup>3</sup>, information included in Table 8, pg 106, for consumption segment and supply source - Consumo de Madeira Industrial em Toras no Brasil 2000 (Consumption of round industrial wood in Brazil). Source: ABRACAVE, STCP, ABIPA, ABIMCI, BRACELPA, SBS, FAO – 2001.

(5) AMAZON 2005 – Wood production Profile in the Amazon in 2004. Log consumption of 24.5 millions m<sup>3</sup>/year refers to the volume removed in 2004. This total volume represents an equivalent production of 78% (Amazon Forestry Facts 2003) of the annual native wood removal in Brazil. Considering a percentual of 22% to add up the total extraction of that year).

(6) AMS – SILVIMINAS – Annual Statistics. Evolution of total consumption of native forest charcoal calculating the consumption increase and decrease index from 2000 to 2005. From 2002 the period was maintained as linear, calculated at 0.59%. In this way it was used as a parameter of the evolution of firewood consumption.

## 12 - Table T12 – Value of wood removal

### 12.1 Categories and definitions

Value of industrial wood removal	Value of the wood removed for production of goods and services other than energy production (fuel wood).
Value of fuel wood removal	Value of the wood removed for energy production purposes, regardless whether for industrial, commercial or domestic use.

### 12.2 National data

#### 12.2.1 Data sources

Reference Sources	Quality A/M/B	Variable	Year	Additional Comments
IMAZON (7)	M*	Amazon wood prices	2003	
ABRACAWE (8)	M*	Charcoal prices from native forest (ago/90)	1990	
IBAMA (9,11)	M*	Price of 4 species + marketed in Joara and Juína (MT)	2005	
ABRACAWE/BACEN (10)	M*	Charcoal prices from native forest	2000	
AMS (12)	M*	Prices from buying of native forest charcoal	2005	

#### 12.2.2 Criteria adopted for obtaining commercial values in use

To calculate the average value of the species in 1990, a table of average prices of log wood sales in the Amazon was used (refers to the average of the average value categories of low, medium and high commercial value species in the year 1998) researched by IMAZON. The price was corrected by the accumulated American inflation, whose index is 29.9%.

In 2000, the prices suffered deflation to the year 2005 from 2000. The average price equivalent to US\$ 36.19/m<sup>3</sup> and corrected by the GP-M FGV index. The four (4) species used as reference were those most marketed in the month of Feb/ 2005 in a survey undertaken in the Juína/MT region by IBAMA officials. The average exchange rate in 2000 was R\$ 1.83.

The total volume of fuel wood consumed for various energetic ends in the year 2000 for Brazil was 132,408 (1000 m<sup>3</sup>), for planted and native forests and 72.5% of this from native forests. According to information obtained from the database of consulting company STCP and confirmed by IBAMA Brasilia/DF researchers, there does not exist a publication with this value consolidated, apart from estimates between 70% and 75%. In this study, the average percentage was used.

For 2005, the values used in real time from the survey undertaken in Feb/2005, in Mato Grosso, where the average prices of the most marketed species varied from US\$ 32.10 to US\$ 64.20, establishing an average of US\$ 47.42/m<sup>3</sup>, related to the volumes established in T11.

The average price of fuel wood in US\$/ m<sup>3</sup> in the years 1990,2000 and 2005 represented 40% of the charcoal cost, according to information from AMS – Minus Association of Silviculture. The cost of charcoal was researched in the publications of ABRACAVE –Annual statistics 1990 and AMS for the years 2000 and 2005. The states in this sample are: Goiás, Mato Grosso do Sul, Minas Gerais, São Paulo, Rio de Janeiro, Bahia and Espírito Santo.

The species belonging to the low, medium and high commercial values were taken for the year 1990, using as parameter the price table of 1998, cited in the study “forest Facts” undertaken by IMAZON, where a species of mahogany is included, considered of high commercial value, indicating its extraction and commercialisation in the 1990 period (Table 1).

In the years of 2000 and 2005, the recent survey in February of the 4 most marketed species (Table 2) undertaken by IBAMA in Juína/Mt in the local sawmills was used. For the year 2000, the values suffered deflation to obtain the estimates of the prices, using the Central Bank GP-M (FGV) index.

Fiscal guidelines of the state Treasury secretaries were researched, however few significant commercial species were found in them and at the level of Brazil. In the fiscal guide lines of Mato Grosso were found prices inconceivable for “unprocessed wood./logs in m<sup>3</sup>” –extremely high values, for this reason they did not serve.

Table 12.1-A- Average Prices

Value	Common Name	Scientific Name
Low	Mandioqueira	Qualea spp.
	Abiu	Pouteria spp.
Average price:(US\$/m3) From 26.00 to 30.00	Cambará	Moquina polymorpha
	Quarauba	Vochisia maxima
	Tachi	Sclerolobium goeldianum
	Breu	Protium spp
	Cedrinho	Scleronema micranthum
	Copaíba	Copaífera spp
	Maçaranduba	Manikara huberi
	Acapú	Voucapoua americana
	Marupá	Simaruba amara
	Piquiarana	Caryocar glabrum
	Guajurá	Neoxythece robusta
	Andiroba	Carapa guianensis
	Jatobá	Hymenaea courbaril
	Piquiá	Caryocar villosum
	Sumaúma	Ceiba pentandra
	Angelim Pedra	Hymenolobium spp
	Muiracatiara	Astronium lecointei
Average	Curupixá	Micropholis meliniana
	Pau Amarelo	Euxylophora paraensis
Average Price (US\$/m3) From 55.00 to 79.00	Roxinho	Peltogyne maranhensis
	Tatajuba	Bagassas guianensis
	Cerejeira	Torresia acreana
	Angelim Vermelho	Dinizia excelsa
	Cumaru	Dipteryx odorata
	Freijó	Cordia sagoti
	Ipê	Tabebuia spp.
	Cedro	Cedrela odorata
	Louro	Nectandra pichurim
	Itaúba	Mezilaurus itauba
High Average Price: (US\$/m3) from 160.00 to 210.00	Mogno (Mahogany)	Swietenia macrophylla

Source: Amigos da Terra/IMAFLORA/IMAZON,1998/1999

In total there are approximately 350 species exploited in Greater Amazon. The species above are the most cited during interviews.

In 1998, the average prices of wood in logs in the states of Mato Grosso, Pará and Rondônia oscillated between US\$26 and US\$ 30 per cubic meter (white woods and species of low value) until values between US\$ 55 and US\$ 79 in each cubic meter (significant species such as cedro, ipê and freijó). The log prices of mahogany varied between US\$ 160 and US\$ 210 per cubic meter.

Table 12.1-B – Average Prices in current use -

Common name	Scientific name	Value (US\$/m3)
Tauari	Couratari sp.	38.91
Ipê	Tabebuia sp.	64.20
Cedrinho	Scleronema micranthum	32.10
Jatobá	Hymenaea courbaril	54.47

Research IBAMA- Juína/MT (February of 2005)

Prices obtained from Forest plantations (industrial wood and fuel wood) were:

Average prices (US\$/m3) Forest plantations

Category	1990	2000	2005
Industrial wood	7.47	8.17	10.70
Fuel wood	2.50	2.74	3.59

Methodology: The data was obtained from an average of Pinus and Eucalyptus species standing in st and converted to m<sup>3</sup>.

The values equivalent in time were adjusted by the IGP-DI FGV for the respective years using the average exchange rate of that time:

For 1990 : 1 dollar = Cr\$ 68.55

For 2000: 1 dollar = R\$ 1.83

For 2005: 1 dollar = R\$ 2.57 (average for the month Feb./05).

### 12.3 Data for the national report of Table T12

FRA 2005 category	Value of round wood removal (1000 \$ USA)			
	Forests	1990	2000	2005
Industrial Wood	Native	3 406 092	1 304 649	1 418 522
Fuel wood		1 435 933	323 946	674 032
Sub-total (native)		4 842 025	1 628 595	2 092 554
Industrial Wood	Planted	400 513	765 006	1 478 497
Fuel wood		328 219	248 970	267 988
Sub-total (planted)		728 732	1 013 976	1 746 486
<b>Madeira Industrial</b>		<b>3.806.605</b>	<b>2.069.655</b>	<b>2.897.019</b>
<b>Lenha</b>		<b>1.764.152</b>	<b>572.916</b>	<b>942.020</b>
General Total		5 570 757	2 642 571	3 839 040

*The values of T12 are directly related to the volumes cited in T11.*

### 12.4 Comments on the national report of Table T12

The industrial wood sector does not have a tradition of collecting information, with the objective to create a statistical data bank. The data encountered could produce a wood volume greater or lesser due to different sources of information, and the number and sources researched in the different categories can be added generating discrepancies in volume. Follows an example:

The exploitation of logs is equal to the transport of unprocessed wood. These are controlled by the emission of a paper named ATPF's, given and monitored by environmental agencies. Can we be certain of such control? Surely not.

Sawn wood is processed wood, exploited and transport legally and each industry has a different usage whose product is different (boards and other sawn products for construction) accordingly to the requirements of the customers. Each product has a different industrial productivity. Another main factor is the type of machines used to process the logs whose potential capacity is not taken is consideration. Therefore we cannot have at least an approximate multiplying factor to estimate sawn wood from logs. We have a factor used in Tables long ago from the extinct Instituto Nacional do Pinho (National Pine Institute INP), and adopted by the also extinct IBDF that kept the factor and created two new ones, one the South-South-eastern region and another for the Amazonian broadleaf species.

Branches and small logs are energy sources and used as firewood. Depending where the logging takes place they are left in the forests without any use. That happens because the nearby market does not want such material.

It is important to note that industrial information, except for a few given by good professionals, is not reliable. Data on volume of wood consumed by the industry could trigger the action of environmental agencies charged with monitoring and controlling industrial activities and extraction. They could compare the information on extraction and transport to the volumes of consumed wood by the industries and find inconsistencies. This is a complex issue.

As the wood extraction in our country does not have an effective control system and the regulating legislation is so strict that leads the industrial consumer to act illegally to get raw wood supply it promotes in a way, the illegal and uncontrolled extraction. The country is so big; therefore an efficient control should have a sector of the environmental organization in each State, with the support of the class union, capable of building a database to supply the wood industry with information. This database should have information on the type of consumption of wood production in other countries, generating a better use in the industrial sector and better business opportunities in addition to data in wood production.

The information is mirrored on the data collected. The databases are in the footnote of the Tables.

## 12.5 Sources and Reference list

(7) IMAZON – Fatos Florestais da Amazônia (Amazonian forest facts), 2003. Average price of US\$ 65.42/m<sup>3</sup> research undertaken with a correction of US\$ 93.33 through the *Índice de Inflação Americana Acumulada (Accumulated American Inflation Index)* during the period, (29.9%). IPARDES – Revista Conjuntura Econômica São Paulo, SP: Foundation Getúlio Vargas – Brazilian Institute of the Economy, June 1997 / p. 59-63.

(8) ABRACAVE – Average prices used in the buying of charcoal of native origin (Ago/90). Average price used for fuel wood of US\$ 10.90/m<sup>3</sup> .(Prices without ICM).

(9) IBAMA survey in Joara/MT of the four most marketed species in 2005. Average price deflated by the value correction index GP-M FGV of 2005 for 2000 of US\$ 36.19/m<sup>3</sup> .

(10) ABRACAVE/BACEN for the Minus Association of Silviculture – AMS, 2000. Average prices of the charcoal of native origin. Average price used for fuel wood of US\$ 7.22/m<sup>3</sup> .

(11) IBAMA survey in Juína/MT of the four most marketed species in February of 2005 – Average Price of US\$ 47.42/ m<sup>3</sup> .

(12) Minus Association of Silviculture – AMS. Average prices used in the buying of charcoal of native origin, year base 2005 (months January/February). Average price for fuel wood of US\$ 14.12/ m<sup>3</sup> .(Price of CIF factory without ICMS).

## 13 - Table T13 – Non-wood forest products removal

### 13.1 Categories and definitions

Following the FRA 2005 Guidelines

### 13.2 National data

#### 13.2.1 Data Sources

Reference sources	Quality	Variable	Year	Additional Comments
IBGE	A	Production	1989	
ANUÁRIO ESTATÍSTICO DO BRASIL (IBGE)	A	Production	IBGE, 1976-80, 1984-87, 1990, 1991, v. 51; 1992, v. 52.	
IBGE.	A	Production	1990-2002	Statistic series (1990-2002) sent directly in digital medium, by Luis Celso of IBGE, for the preparation of Tables 13 and 14 of this report.
SILVA	A	Production	1993	Production series and Production value of non wood products 1980-1989 analysed and published
SILVA	A	Production	1996	Production series and non wood products production values 1980-1989 analysed and published (Doctoral thesis)
SILVA	M	Production	2003	Production series of non wood products 1980-89 and 1990-1999 compared

#### 13.2.2 National data classification

Table 13.2.2 contemplates the list of non wood forest products throughout Brazil from 1980, whose quantity and production value are collected annually by the Brazilian Institute of Geography and Statistics (IBGE) and published in **Producao da extração vegetal e da silvicultura** (Production of plant extraction and silviculture) and in **Anuário Estatístico do Brasil** (Annual Statistics of Brazil), each year. Various products were excluded from the list over time, in the degree that they became less important.

Table 13.2.2 Product groups and main extractive products in Brazil

<b>I. Rubber</b>	<b>VI. Oily products</b>
Caucho	Andiroba (nut)
Hevea (coagulated latex)	Babaçu (nut)
Hevea (liquid latex)	Copaíba (oil)
Mangabeira	Cumarú (nut)
	Licuri (coquillo)
<b>II. Non elastic gums</b>	Macaúba (nut)
Balata	Murumuru (seed)
Maçaranduba	Oiticica
Sorva	Pequi (nut)
Ucuquirana or coquirana	Tucum (nut)
	Ucuúba (nut)
<b>III. Waxes</b>	Others
Carnaúba (cera)	<b>VII. Food</b>
Carnaúba (pó)	Açaí palm (fruit)
Licuri ou ouricuri	Cashew nuts
Others	Brazil nuts
<b>IV. Fibers</b>	Erva-mate (cancheada)
Buriti	Mangaba (fruit)
Carnaúba	Palm heart
Caroá	Pinhão (fruit)
Cipó-imbé	Umbu (fruit)
Crina vegetal (butiá, etc)	
Guaxima	<b>(VIII). Aromatics, Medicins,</b>
Malva	Toxicants and Dyes
Paina	Ipecacuanha (root)
Piaçava	Jaborandi (leaf)
Taboa (or Tabua)	Jatobá (resin)
Tucum	Quina (bark)
Others	Timbó (root)
<b>V. Tannins</b>	Urucum (seeds)
Angico	Others
Barbatimão (bark)	<b>IX. Pine knot</b>
Mangrove (bark)	Nó-de-pinho
Others	

**Sources:** Brazilian annual statistics 1984, 1985, 1987 and 1992; Production of plant extracts and silviculture, 1987, v. 2. - **IBGE**

The rubber group (I), with the exception of mangabeira, is exclusively from the Amazon.

Regarding Gums (II), there is also a predomination of Amazonian products; balata and sorva gums are exclusive from that region; ucuquirana or coquirana, which was registered in 1980, extracted in Amazonas State was excluded.

In the Group III (Wax), licuri was excluded but a category others was created; the participation of the region in that group is null; the Group IV (Fibres), that contained 11

products at the beginning of the eighties, was reduced to three products plus the category others; Five of those products were extracted from Amazonian States.

In the Tannin Group (V) Mangrove was excluded but the category others appeared, Mangrove was probably transferred to this new category; two types are extract from the region.

In the Oily Products Group (VI) four products were excluded, two of them registered as having been extracted in the Amazon in 1980 and 1981 (andiroba and ucuúba); the category others was included and probably it included the harvest of some of those products; the region contributed with six of 11 products.

The Food group (VII) did not alter during the period; of the eight products, five were registered in the Amazonian states during the period; from eight products, five were registered in Amazonian States.

Finally in the Aromatic, Medicinal, Toxics and Dying plants Group, (VIII), three of six products were excluded, a new category, included in the category others; four products were registered in the Amazon during that period.

There are extractive products from the Amazon in all groups. From the 55 products of the Groups I to VIII, taken by IBGE in the eighties, the extraction of 29 of them was done in at least one Amazonian State, and from this subset 11 eleven products were extracted only in the Amazon.

### 13.2.3 Regrouping of FRA 2005 categories

Table 13.2.3 FRA 2005 Categories and correspondences with the IBGE groupings

1. Food	1. Food (Group VII – Table 13.2.2-A)
2. Fodder	2. Not available
3. Raw material for the fabrication of medicinal and aromatic products	3. Ipecacuanha+jaborandi (Group VIII – Table 13.2.2-A)
4. Raw material for the fabrication of colorants and dyes	4. Urucum+others (Group VIII – Table 13.2.2-A)
5. Raw material for the fabrication of utensils, handicrafts & construction	5. Fibers (Group IV – Table 13.2.2-A)
6. Ornamental plants	6. Not available
7. Exudates*	7. Rubber (Group I )+Gums (Group II – Table 13.2.2-A)
8. Other plant products	8. Waxes (Grupo III)+Tanins (Group V – Table 13.2.2-A)+ Oily products (Group V – Table 13.2.2-A)+ Pine knot** (Group V – Table 13.2.2-A)

\*Does not include plantation rubber or resin

\*\*Converted to tonnes: 1m3=1 tonne

### 13.3 Data Processing and Analysis

Year de 1990: calculated the average of the production categories for the period 1988-1992.

Year de 2000: calculated the average of the production categories for the period 1998-2002.

After calculating the quantities of the categories of the years 1990 and 2000, the rate of change of each category between 1990 and 2000 was calculated by the formula:

$$i = [(P_{2000}/P_{1990})^{(1/10)}]-1$$

where

$P_{2000}$  = Production in 2000

$P_{1990}$  = Production in 1990

$i$  = rate of change in the period.

This rate was then, applied on the data of 2000 to estimate the quantity of each category in 2005 by the formula:

$$P_{2005} = P_{2000} * (1 + i)^5$$

### 13.4 Data for the national report of Table T13

Category	Scale Fator	Unity	PFNM		
			1990	2000	2005
1. Food	1	ton.	450 857	379 553	348 249
2. Fodder	1	ton.			
3. Raw material for the fabrication of medicinal and aromatic products	1	ton.	1 472	1 280	1 194
4. Raw material for the fabrication of colorants and dyes	1	ton.	2 622	3 008	3 221
5. Raw material for the fabrication of utensils, handicrafts & construction	1	ton.	74 488	97 567	111 663
6. Ornamental Plants	1	ton.			
7. Exudates	1	ton.	24 116	5 264	2 460
8. Other plant products	1	ton.	364 912	428 931	289 928
Animal Products / raw material					
9. Live animals			n.a.	n.a.	n.a.
10. Hides, skins and trophies			n.a.	n.a.	n.a.
11. Wild honey and beeswax			n.a.	n.a.	n.a.
12. Bush meat			n.a.	n.a.	n.a.
13. Raw material for the fabrication of medicinal products			n.a.	n.a.	n.a.
14. Raw material for the fabrication of colorants			n.a.	n.a.	n.a.
15. Other edible animal products			n.a.	n.a.	n.a.
16. Other non-edible animal products			n.a.	n.a.	n.a.

### 13.5 Animal Products

In Brazil commercial hunting is prohibited. Only hunting for subsistence is permitted. For this there does not exist consolidated data in the country that allows filling in the Tables of FRA – 2005.

### 13.6 Sources and Reference list

IBGE. Production da extração vegetal e da silvicultura (Production of plant extracts and silviculture) - 1987. Rio de Janeiro, 1989. (2 v.)

ANUÁRIO ESTATÍSTICO DO BRASIL (Annual statistics of Brazil). Rio de Janeiro : IBGE, 1976-80, 1984-87, 1990, 1991, v. 51; 1992, v. 52.

IBGE. **Production da extração vegetal e da silvicultura (Production of plant extraction and silviculture – 1990-2002)**. Rio de Janeiro, 2004. Data sent directly by digital medium, by Luis Celso, for the preparation of Tables 13 and 14 of this report.

SILVA, José de Arimatéa. Non wood products from native forests. In: SÉTIMO CONGRESSO FLORESTAL BRASILEIRO E PRIMEIRO CONGRESSO FLORESTAL PANAMERICYEAR (7/1 : 1993 : Curitiba). **Anais...**, Curitiba : SBS/SBEF, 19 to 24 of setember 1993. p. 213-220 (v. 3).

SILVA, José de Arimatéa. Quali-Quantitative analysis of extraction and management of the forest resources of the Brazilian Amazon: a general and localized approach (State Forest of Antimari-AC). Análise quali-quantitativa da extração e do manejo dos recursos florestais da Amazônia brasileira: uma abordagem geral e localizada (Forest Estadual do Antimari-AC). Curitiba: UFPR, 1996, 547 p. (doctoral thesis).

SILVA, José de Arimatéa. **Quebrando castanha e cortando seringa (Breaking nuts and rubber tapping)**. Seropédica : EDUR, 2003. 132 p.

## 14 - Table 14 – Value of non-wood forest products removal

### 14.1 Categories and definitions

Following the FRA2005 Guidelines

### 14.2 National data

#### 14.2.1 Data sources

Reference sources	Quality	Variable	Year	Additional Comments
IBGE	A	Production value	1989	
ANUÁRIO ESTATÍSTICO DO BRASIL (IBGE)	A	Production value	IBGE, 1976-80, 1984-87, 1990, 1991, v. 51; 1992, v. 52.	
IBGE	A	Production value	1990-2002	Statistical series (1990-2002) Data sent directly by digital medium, by Luis Celso, for the preparation of Tables 13 and 14 of this report.
SILVA	A	Production value	1993	Series of Production and Production value of non wood forest products 1980-1989 analysed and published

#### 14.2.2 National data classification

The same procedure of item 13.2.2

#### 14.2.3 Regrouping of categories for FRA 2005

The same procedure of item 13.2.3

### 14.3 Data processing and analysis

IBGE takes annually the quantity and value of the production of non-wood products. The value of the production refers to the raw material, therefore, the price paid to the producer at source (in current money).

The values of the corresponding categories of the Table 13.2.2 (item 13.2.2) were converted in current dollar values (US\$), based on Tables of the periodical *Conjuntura Econômica*, published by the Getúlio Vargas Foundation, and checked against the values of the Tables given by FAO FRA-2005 Guideline, using the value of the exchange rate of each year.

#### 14.3.1 Calculation of values for 1990 and 2000

Proceeding with the calculations for 1990 and 2000, based on the same periods adopted for Table 13.2.2:

1990 = average value of period 1988-1992, for each category (US\$);

2000 = average value of period 1998-2002, for each category (US\$).

Then the average value per ton was calculated, for each category, based on the data from 2000:

Average value per ton = Production value / quantity produced (corresponding to Table 14 / Table 13).

The average value per ton obtained was then multiplied by the quantity estimated for 2005, thus obtaining the Production value for that year, for each of the categories.

#### 14.3.2 Value estimates for 2005

The average value per ton was calculated, for each category, based on the data from 2000:

Average value per ton = Production value / quantity produced (corresponding to Table item 14.4 / Table item 13.4).

The average value per ton obtained was then multiplied by the quantity estimated for 2005, thus obtaining the Production value for that year, for each of the categories.

#### 14.4 Data for the national report of Table T14

Category	Scale Factor	Unity	PFNM		
			1990	2000	2005
Plant Productos / raw material					
1. Food	1000	\$	224 495	105 050	96 386
2. Fodder	1000	\$			
3. Raw material for the fabrication of medicinal and aromatic products	1000	\$	1 188	766	714
4. Raw material for the fabrication of colorants and dyes	1000	\$	1 074	806	863
5. Raw material for the fabrication of utensils, handicrafts & construction	1000	\$	96 322	53 730	61 492
6. Ornamental plants	1000	\$			
7. Exudates	1000	\$	24 746	3 582	1 673
8. Other Plant products	1000	\$	75 827	41 657	32 003
Animal products / raw material					
9. Live Animals			n.a.	n.a.	n.a.
10. Hides, skins and trophies			n.a.	n.a.	n.a.
11. Wild honey and beeswax			n.a.	n.a.	n.a.
12. Bush meat			n.a.	n.a.	n.a.
13. Raw material for the fabrication of medicinal products			n.a.	n.a.	n.a.
14. Raw material for the fabrication of colorants			n.a.	n.a.	n.a.
15. Other edible animal products			n.a.	n.a.	n.a.
16. Other non edible animal products			n.a.	n.a.	n.a.

#### 14.5 Sources and Reference list

ANUÁRIO ESTATÍSTICO DO BRASIL (Annual Statistics of Brazil). Rio de Janeiro : IBGE, 1976-80, 1984-87, 1990, 1991, v. 51; 1992, v. 52.

CONJUNTURA ECONÔMICA. Rio de Janeiro : FGV, december 2004, v. 58, no. 12.

IBGE. Production da extração vegetal e da silvicultura (Production of plant extracts and silviculture) - 1987. Rio de Janeiro, 1989. (2 v.)

\_\_\_\_\_. **Production da extração vegetal e da silvicultura (Production of plant extraction and silviculture – 1990-2002.** Rio de Janeiro, 2004. Data sent directly by digital medium, by Luis Celso, for the preparation of Tables 13 and 14 of this report.

SILVA, José de Arimatéa. Non-wood products from native forests. In: SÉTIMO CONGRESSO FLORESTAL BRASILEIRO E PRIMEIRO CONGRESSO FLORESTAL PANAMERICYEAR (7/1 : 1993 : Curitiba). **Anais...**, Curitiba : SBS/SBEF, 19 to 24 of September 1993. p. 213-220 (v. 3).

**15 - Table 15 – Employment in forestry sector**

N/A

**16 - Table 16 – Forest Certification**

Certified area type	Certified area (1000 ha)		
	1990	2000	2005
Native Forests	-	182	1 565
Forest plantations	-	374	2 411
TOTAL	-	555	3 976

**16.1 Main international initiatives to standardise forest certification**

In the case of forest products, certification emerged in the beginning of the 1990's, as an alternative to the campaigns that promoted boycotts of tropical forest products. The initiative was based on the fact that boycotts could worsen deforestation in the tropics, once that the falling value of wood and forested areas would favour other potentially predatory land uses, such as pastures and agricultural activities. Instead of prejudicing all the class of products, it was proposed the recognition and use of forest products produced under suitable management (NARDELLI e GRIFFITH, 2003).

Worldwide, voluntary forest certification has developed in an uncoordinated way, with various systems, operating and competing with each other. Among them stand out: The Forest Stewardship Council FSC, or Forest Management Council, a international non government organization, founded in 1993 that does not give certificates but give credentials to certifiers worldwide seeking to guarantee that the certificates follow quality standards. Those certifiers develop a method for certification based on principles and criteria of the FSC, adapting those to the reality or system of production of the region (FREITAS et al, 2003).

At the Pan European Forest Certification PEFC – the council of PEFC was created in June of 1999, in a voluntary capacity, based on its own criteria defined in the resolutions of the Helsinki and Lisbon conferences, in 1993 and 1998, concerning Forest protection in Europe. The primary objective of this system is the recognition of the different country systems in the European community.

**16.2 Forest certification in Brazil**

In Brazil two systems operate that certify forest management: the FSC and Cerflor (Brazilian Program of Forest Certification).

The FSC began operating in the country in 1994, through the Working Group FSC – Br and in 1995, the first area under forest management was certified by the FSC. Actually who represents FSC in Brazil is the Brazilian Council of Forest Management (CBMF), created in September 2001 (FREITAS et al, 2003).

The National Program of Forest certification was called Cerflor and launched in 2002. Cerflor is linked with IMETRO – National Institute of Measures, Normalization and Industrial Quality and is a federal government organization. The forest certification system no IMETRO, is described in the Norma NBR 14789/2001.

IMETRO does not emit certificates directly and give credentials to entities to enable them to give certificates. The first Cerflor certification was obtained in 2003.

### 16.3 Methodology

Besides companies, this study considered groups of producers or community associations and owners of native forests or plantations of trees with FSC or CERFLOR certificates for wood and non-wood products.

To obtain the amount of the certified forest area until 2004 in the country, the information given by the certifiers was used, avoiding data overlapping.

The certified areas were divided by forest origin: natural or planted. Natural forests were those that naturally originated, primary or not, under a management regime. Forest plantations were defined as homogenous or not forest plantations with native or exotic species.

The year in which certification was obtained was also considered, and the data were displayed according to the periods suggested by FAO/FRA2005 (accumulated values till 1990, 2000 and expected data for 2005). The methodology described by FAO for FRA 2005 was used to estimate the numbers for 2005.

Example of the calculation used to estimate the values of certified area for 2005. In this case, the values of certified areas with Forest plantations to obtain woody products:

Area of forest plantations certified until 2000 = 373 310 ha

Area of forest plantations certified until 2004 = 2 003 670 ha

Area estimated for 2005 = [(373310 Ha – 2003670 Ha) / (2004 – 2000)] + 2003,67

Forest plantations certified area estimated for 2005 = **2 411 340 ha**

### 16.4 Sources and Reference list

BVQI DO BRASIL SOCIEDADE CERTIFICADORA LTDA, Consulta Pública: Certificação Florestal da Inpacel Agroflorestal Ltda, 2001.

BVQI DO BRASIL SOCIEDADE CERTIFICADORA LTDA, Relatório Sumário de Avaliação do Sistema de Manejo Florestal da Aracruz Celulose S/A no Sul Do Estado Da Bahia, 2004.

CERFLOR. Disponível em <<http://www.inmetro.gov.br/qualidade/cerflor.asp>>, acesso em março de 2005.

FREITAS, V. M. G., SUITER FILHO, M., ARMELIN, M. J. C., SIMÕES, L. L. Certificação Florestal. Conselho Nacional da Reserva da Biosfera da Mata Atlântica, n. 23, 2003.

FSC – Brasil. Disponível em <<http://www.fsc.org.br>>, acesso em março de 2005.

NARDELLI, Aurea M. B., GRIFFITH, J. J. Modelo teórico para compreensão do ambientalismo empresarial do setor florestal brasileiro. R. *Árvore*, Viçosa-MG, v.27, n.6, p.855-869, 2003.

## Annex 1 - Vegetation types

### D-Floresta Ombrófila Densa (Dense Humid Forest)

- Da – Floresta Ombrófila Densa Aluvial (Alluvial Dense Humid Forest)
- Db - Floresta Ombrófila Densa das Terras Baixas (Lowland Dense Humid Forest)
- Ds - Floresta Ombrófila Densa Submontana (Submontane Dense Humid Forest)
- Dm - Floresta Ombrófila Densa Montana (Montane Dense Humid Forest)

### A-Floresta Ombrófila Aberta (Open Humid Forest)

- Aa - Floresta Ombrófila Aberta Aluvial (Alluvial Open Humid Forest )
- Ab - Floresta Ombrófila Aberta das Terras Baixas (Lowland Open Humid Forest)
- As - Floresta Ombrófila Aberta Submontana (Submontane Open Humid Forest)

### M-Floresta Ombrófila Mista (Mixed Humid Forest)

- Mm - Floresta Ombrófila Mista Montana (Mixed Montane Humid Forest)
- MI - Floresta Ombrófila Mista Alto montana (Mixed High Montane Humid Forest)

### F-Floresta Estacional Semidecidual (Semi deciduous Seasonal Forests)

- Fa - Floresta Estacional Semidecidual Aluvial (Alluvial Semi deciduous Seasonal Forest)
- Fb - Floresta Estacional Semidecidual das Terras Baixas (Lowland Semi deciduous Seasonal Forest)
- Fs - Floresta Estacional Semidecidual Submontana (Submontane Semi deciduous Seasonal Forest)
- Fm - Floresta Estacional Semidecidual Montana (Montane Semi deciduous Seasonal Forest)

### C-Floresta Estacional Decidual (Deciduous Seasonal Forest)

- Cb - Floresta Estacional Decidual das Terras Baixas (Lowland Deciduous Seasonal Forest)
- Cs - Floresta Estacional Decidual Submontana (Submontane Deciduous Seasonal Forest)
- Cm - Floresta Estacional Decidual Montana (Montane Deciduous Seasonal Forest)

### L- Campinarana

- Ld – Campinarana Florestada (Forested Campinarana)
- La – Campinarana Arborizada (wooded Campinarana)
- Lb – Campinarana Arbustiva (Shrubby Campinarana)
- Lg – Campinarana Gramíneo – Lenhosa (Woody-grass Campinarana)

### S-Savana

- Sd – Savana Florestada (Forested Savana)
- Sa – Savana Arborizada (Wooded Savana)
- Sp – Savana Parque (Park savana)
- Sg – Savana Gramíneo – Lenhosa (Woody Grass Savana)

### T-Savana Estépica (Steppe Savana)

- Td - Savana Estépica Florestada (Forested Steppe Savana)
- Ta - Savana Estépica Arborizada (Tree Steppe Savana)
- Tp - Savana Estépica Parque (Park Steppe Savana)
- Tg - Savana Estépica Gramíneo – Lenhosa (Woody Grass Steppe Savana)

### E-Estepe

- Ea – Estepe Arborizada (Tree Steppe)
- Ep – Estepe Parque (Park Steppe)
- Eg – Estepe Gramíneo – Lenhosa (Woody Grass Steppe)

### P- Formacoes Pioneiras (Pioneer Formations)

- Pm – Vegetação com Influência Marinha (Marine Influenced Vegetation)
- Pf - Vegetação com Influência Fluviomarinha (Fluviomarine Vegetation)
- Pa - Vegetação com Influência Fluvial e/ou Lacustre (Fluvial and/or Lacustre)

### Areas de Tensão Ecológica (Transitional Zones)

- OM – Transition Floresta Ombrófila / Floresta Ombrófila mista
- ON - Transition Floresta Ombrófila / Floresta Ombrófila Estacional
- NM - Transition Floresta Estacional / Floresta Ombrófila mista
- NP - Transition Floresta Estacional / Formações Pioneiras (Restinga)
- LO – Transition Campinarana / Floresta Ombrófila
- SO – Transition Savana / Floresta Ombrófila
- SM - Transition Savana / Floresta Ombrófila mista
- SN - Transition Savana / Floresta Estacional
- ST - Transition Savana / Savana Estépica
- SP - Transition Savana / Formações Pioneiras (Restinga)
- TN – Transition Savana Estépica / Floresta Estacional
- EM – Transition Estepe / Floresta Ombrófila mista
- EN – Transition Estepe / Floresta Estacional
- STN – Transition Savana / Savana Estépica / Floresta Estacional
- r - Refúgios Vegetacionais (Vegetation Refuges)
  - rm – Refúgio Vegetacional Montano (Montane Vegetational Refuges)
  - rl – Refúgio Vegetacional Alto-Montano (High Mountain Vegetational Refuge)

## **Annex 2 – Endangered tree species**



**Tree species considered as critically endangered by IUCN**

## Arecaceae

*Astrocaryum gynacanthum* Mart.

## Chrysobalanaceae

*Couepia joaquinae* Prance

## Fabaceae-Caesalpinioideae

*Vouacapoua americana* Aubl.

## Fabaceae-Mimosoideae

*Chloroleucon tortum* (Mart.) Pittier ex Barneby & J.W.Grimes

*Inga enterolobioides* T.D.Penn.

## Lauraceae

*Aniba pedicellata* Kosterm.

*Nectandra debilis* Mez

## Lecythidaceae

*Cariniana kuhlmannii* Ducke

*Cariniana penduliflora* Prance

*Couratari asterophora* Rizzini

*Couratari asterotricha* Prance

*Couratari prancei* W.A.Rodrigues

*Eschweilera compressa* (Vell.) Miers

## Meliaceae

*Guarea sprucei* C.DC.

*Trichilia florbranca* T.D.Penn.

## Monimiaceae

*Mollinedia gilgiana* Perkins

*Mollinedia lamprophylla* Perkins

## Moraceae

*Perebea glabrifolia* (Ducke) C.C.Berg

## Myrtaceae

*Calycorectes schottianus* O.Berg

## Oleaceae

*Chionanthus fluminensis* (Miers) P.S.Green

*Chionanthus subsessilis* (Eichler) P.S.Green

*Chionanthus tenuis* P.S.Green

## Sapotaceae

*Chrysophyllum durifructum* (Rodrigues) T.D.Penn.

*Chrysophyllum superbum* T.D.Penn.

Micropholis caudata T.D.Penn.  
Micropholis grandiflora Aubrév.  
Pouteria pachycalyx T.D.Penn.  
Pouteria pallens T.D.Penn.  
Pouteria polysepala T.D.Penn.  
Pouteria subsessilifolia Cronquist  
Pradosia decipiens Ducke  
Pradosia verrucosa Ducke

Solanaceae

Cyphomandra ovum-fingillae Dunal

Violaceae

Rinorea maximiliani (Eichler) Kuntze

**Tree species considered as endangered by IUCN**

Annonaceae

Rollinia calcarata R.E.Fr.

*Rollinia ferruginea* (R.E.Fr.) Maas & Westra

Apocynaceae

Aspidosperma polyneuron Müll.Arg.

Tabernaemontana cumata Leeuwenberg

*Tabernaemontana muricata* Link ex Roem. & Schult.

Arecaceae

Syagrus macrocarpa Barb.Rodr.

Caryocaraceae

Caryocar coriaceum Wittm.

Combretaceae

Buchenavia igarataensis N.F.Mattos

Buchenavia rabelloana Mattos

Fabaceae-Caesalpinioideae

Caesalpinia echinata Lam.

Sclerolobium beaurepairei Harms

Sclerolobium pilgerianum Harms

Fabaceae-Cercideae

Bauhinia integerrima Mart. ex Benth.

Fabaceae-Faboideae

Amburana cearensis (Arr.Cam.) A.C.Sm.

Fabaceae-Mimosoideae

*Inga arenicola* T.D.Penn.  
*Inga blanchetiana* Benth.  
*Inga cabelo* T.D.Penn.  
*Inga exfoliata* T.D.Penn. & F.C.P.Garcia  
*Inga lanceifolia* Benth.  
*Inga maritima* Benth.  
*Inga mendoncae* Harms  
*Inga pedunculata* (Vinha) T.D.Penn.  
*Inga sellowiana* Benth.  
*Inga suberosa* T.D.Penn.

## Lauraceae

*Aniba rosaeodora* Ducke  
*Nectandra psammophila* Nees  
*Nectandra weddellii* Meissner  
*Ocotea basicordatifolia* Vattimo-Gil  
*Phyllostemonodaphne geminiflora* (Mez) Kosterm.  
*Urbanodendron bahiense* (Meissner) Rohwer  
*Urbanodendron macrophyllum* Rohwer

## Lecythidaceae

*Cariniana ianeirensis* R.Knuth  
*Cariniana pauciramosa* W.A.Rodrigues  
*Couratari atrovinosa* Prance  
*Couratari pyramidata* (Vell.) R.Knuth  
*Eschweilera rabeliana* Mori  
*Gustavia longepetiolata* Huber  
*Lecythis prancei* Mori

## Meliaceae

*Cedrela fissilis* Vell.  
*Cedrela lilloi* C.DC.  
*Guarea crispa* T.D.Penn.  
*Trichilia blanchetii* C.DC.  
*Trichilia discolor* A.Juss.  
*Trichilia elsae* Harms  
*Trichilia surumuensis* C.DC.  
*Trichilia tetrapetala* C.DC.

## Monimiaceae

*Mollinedia longicuspidata* Perkins  
*Mollinedia stenophylla* Perkins

## Moraceae

*Brosimum glaziovii* Taub  
*Ficus aripuanensis* C.C.Berg & F. Kooy  
*Ficus blepharophylla* Vásquez Ávila  
*Ficus cyclophylla* (Miq.) Miq.  
*Ficus ramiflora* Standl.

*Ficus roraimensis* Berg ex Vasquez Ávilla et al.  
*Ficus salzmanniana* (Miq.) Miq.  
*Ficus ursina* Standl.  
*Helicostylis heterotricha* Ducke  
*Pseudolmedia hirtula* Kuhlm.

## Myristicaceae

*Viola bicuhyba* (Schott) Warb.  
*Viola surinamensis* (Rol.) Warb.

## Myrtaceae

*Calycorectes australis* D.Legrand  
*Calycorectes duarteanus* D.Legrand  
*Calycorectes sellowianus* O.Berg  
*Campomanesia hirsuta* Gardner  
*Campomanesia laurifolia* Gardner  
*Campomanesia viatoris* Landrum  
*Gomidesia magnifolia* O.Berg  
*Myrcianthes pungens* (O.Berg) D.Legrand

## Rutaceae

*Balfourodendron riedelianum* (Engl.) Engl.

## Sapotaceae

*Chrysophyllum imperiale* (Linden ex Koch) Benth. & Hook.  
*Chrysophyllum subspinosum* Monachino  
*Manilkara bella* Monachino  
*Manilkara dardanoi* Ducke  
*Manilkara decrescens* T.D.Penn.  
*Manilkara elata* (Allemão ex Miq.) Monachino  
*Manilkara longifolia* (A.DC.) Dubard  
*Manilkara multifida* T.D.Penn.  
*Micropholis emarginata* T.D.Penn.  
*Micropholis retusa* (Spruce ex Miq.) Eyma  
*Micropholis submarginalis* Pires & T.D.Penn.  
*Pouteria amapaensis* Pires & T.D.Penn.  
*Pouteria andarahiensis* T.D.Penn.  
*Pouteria brevensis* Pires  
*Pouteria butyrocarpa* (Kuhlm.) T.D.Penn.  
*Pouteria coelomatica* Rizzini  
*Pouteria decussata* (Ducke) Baehni  
*Pouteria exstaminodia* Pires & T.D.Penn.  
*Pouteria fulva* T.D.Penn.  
*Pouteria juruana* K.Krause  
*Pouteria latianthera* T.D.Penn.  
*Pouteria macahensis* T.D.Penn.  
*Pouteria minima* T.D.Penn.  
*Pouteria oxypetala* T.D.Penn.  
*Pouteria psammophila* (Mart.) Radlk.

*Pouteria tarumanensis* Pires  
*Pradosia kuhlmannii* Toledo

Solanaceae  
*Solanum lycocarpum* A.St.-Hil.  
*Solanum paralum* Bohs

Violaceae  
*Rinorea bicornuta* Hekking  
*Rinorea villosiflora* Hekking

### 16.5 Tree species considered as vulnerable by IUCN

Annonaceae  
*Rollinia bahiensis* Maas & Westra  
*Rollinia pickelii* Diels

Aquifoliaceae  
*Ilex neblinensis* Edwin

Araucariaceae  
*Araucaria angustifolia* (Bert.) Kuntze

Arecaceae  
*Bactris pickelii* Burret  
*Butia eriospatha* (Mart.) Becc.  
*Butia purpurascens* Glassman  
*Syagrus glaucescens* Glaz. ex Becc.

Asteraceae  
*Verbesina clausenii* Sch.-Bip.

Bignoniaceae  
*Zeyheria tuberculosa* (Vell.) Bureau

Chrysobalanaceae  
*Couepia schottii* Fritsch  
*Licania conferruminata* Prance

Combretaceae  
*Buchenavia hoehneana* Mattos  
*Terminalia januarensis* DC.  
*Terminalia kuhlmannii* Alwan & Stace

Euphorbiaceae  
*Joannesia princeps* Vell.

## Fabaceae-Caesalpinioideae

*Arapatiella psilophylla* (Harms) R.S.Cowan  
*Caesalpinia paraguariensis* (D.Parodi) Burkart  
*Sclerolobium striatum* Dwyer

## Fabaceae-Faboideae

*Amburana acreana* (Ducke) A.C.Sm.  
*Dalbergia nigra* (Vell.) Allemão ex Benth.  
*Dipteryx alata* Vogel  
*Machaerium villosum* Vogel

## Fabaceae-Mimosoideae

*Abarema cochliocarpus* (Gomes) Barneby & J.W.Grimes  
*Abarema filamentosa* (Benth.) Pittier  
*Abarema obovata* (Benth.) Barneby & J.W.Grimes  
*Abarema turbinata* (Benth.) Barneby & J.W.Grimes  
*Albizia burkartiana* Barneby & J.W.Grimes  
*Inga aptera* (Vinha) T.D.Penn.  
*Inga bicoloriflora* Benth.  
*Inga bollandii* Sprague & Sandwith  
*Inga bullata* Benth.  
*Inga bullatorugosa* Ducke  
*Inga calantha* Ducke  
*Inga caudata* Killip  
*Inga exilis* T.D.Penn.  
*Inga grazielae* (Vinha) T.D.Penn.  
*Inga hispida* Schott  
*Inga lenticellata* Benth.  
*Inga lentiscifolia* Benth.  
*Inga microcalyx* Spruce ex Benth.  
*Inga pleiogyna* T.D.Penn.  
*Inga praegnans* T.D.Penn.  
*Inga salicifolia* T.D.Penn.  
*Inga santaremnensis* Ducke  
*Inga suborbicularis* T.D.Penn.  
*Inga unica* Barneby & J.W.Grimes  
*Inga xinguensis* Ducke  
*Leucochloron foederale* (Barneby & J.W.Grimes) Barneby & J.W.Grimes  
*Macrosamanea macrocalyx* (Ducke) Barneby & J.W.Grimes  
*Macrosamanea prancei* (Barneby) Barneby & J.W.Grimes  
*Mimosa caesalpinifolia* Benth.  
*Plathymenia foliolosa* Benth.

## Lauraceae

*Aiouea bracteata* Kosterm.  
*Aiouea macedoana* Vattimo  
*Aniba ferrea* Kubitzki  
*Aniba intermedia* (Meissner) Mez  
*Aniba santaladora* Ducke

Dicypellium caryophyllaceum (Mart.) Nees  
*Mezilaurus itauba* (Meissner) Taub. ex Mez  
*Mezilaurus navalium* (Allemão) Taub. ex Mez  
Nectandra barbellata Coe-Teixeira  
Nectandra grisea Rohwer  
Nectandra matogrossensis Coe-Teixeira  
Nectandra micranthera Rohwer  
Nectandra paranaensis Coe-Teixeira  
Ocotea catharinensis Mez  
*Ocotea porosa* (Nees) Barroso  
Persea glabra van der Werff  
Urbanodendron verrucosum (Nees) Mez

## Lecythidaceae

Bertholletia excelsa Humb. & Bonpl.  
Cariniana integrifolia Ducke  
Cariniana legalis (Mart.) Kuntze  
Cariniana pachyantha A.C.Sm.  
*Cariniana uaupensis* (Spruce ex Berg) Miers  
Couratari guianensis Aubl.  
Couratari longipedicellata W.A.Rodrigues  
Couratari tauari Berg  
Eschweilera alvimii Mori  
Eschweilera amazoniciformis Mori  
Eschweilera carinata Mori  
Eschweilera rhododendrifolia (R.Knuth) A.C.Sm.  
Eschweilera rionegrense Mori  
Eschweilera rodriguesiana Mori  
Eschweilera roraimensis Mori  
Eschweilera subcordata Mori  
Eschweilera tetrapetala Mori  
Gustavia acuminata Mori  
Gustavia erythrocarpa Mori  
Gustavia santanderiensis R.Knuth  
Lecythis barnebyi Mori  
Lecythis brancoensis (R.Knuth) Mori  
Lecythis parvifruca Mori  
Lecythis schomburgkii Berg  
Lecythis schwackei (R.Knuth) Mori

## Lythraceae

Laflorensia replicata Pohl

## Meliaceae

Cedrela odorata L.  
Guarea convergens T.D.Penn.  
Guarea cristata T.D.Penn.  
Guarea guentheri Harms  
Guarea humaitensis T.D.Penn.

Guarea juglandiformis T.D.Penn.  
Guarea trunciflora C.DC.  
Swietenia macrophylla King  
Trichilia areolata T.D.Penn.  
Trichilia bullata T.D.Penn.  
Trichilia casaretti C.DC.  
Trichilia emarginata (Turcz.) C.DC.  
Trichilia fasciculata T.D.Penn.  
Trichilia hispida T.D.Penn.  
Trichilia magnifoliola T.D.Penn.  
Trichilia micropetala T.D.Penn.  
Trichilia ramalhoi Rizzini  
Trichilia silvatica C.DC.  
Trichilia solitudinis Harms

#### Monimiaceae

Mollinedia engleriana Perkins  
Mollinedia glabra (Spreng.) Perkins  
Mollinedia marquetiana Peixoto sp. ined.

#### Moraceae

Ficus calyptroceras (Miq.) Miq.  
Ficus mexiae Standl.  
Ficus pakkensis Standl.  
Ficus pulchella Schott  
Naucleopsis oblongifolia (Kuhlm.) Carauta  
Sorocea guilleminiana Gaudich.

#### Myristicaceae

Iryanthera obovata Ducke  
Virola parvifolia Ducke

#### Myrtaceae

Campomanesia aromatica (Aubl.) Griseb.  
Campomanesia espiritosantensis Landrum  
Campomanesia neriiflora (O.Berg) Nied.  
Campomanesia phaea (O.Berg) Landrum  
Eugenia microcarpa O.Berg  
Eugenia prasina O.Berg  
*Myrceugenia bracteosa* (DC.) D.Legrand & Kausel  
*Myrceugenia brevipedicellata* (Burret) D.Legrand & Kausel  
*Myrceugenia campestris* (DC.) D.Legrand & Kausel  
*Myrceugenia franciscensis* (O.Berg) Landrum  
*Myrceugenia kleinii* D.Legrand & Kausel  
*Myrceugenia pilotantha* (Kiaersk.) Landrum  
*Myrceugenia rufescens* (DC.) D.Legrand & Kausel  
*Myrceugenia scutellata* D.Legrand  
*Myrcia almasensis* Nic Lughadha  
*Myrcia grandiflora* (O.Berg) D.Legrand

Myrcia lineata (O.Berg) Nied.  
Myrciaria cuspidata O.Berg  
Myrciaria plinioides D.Legrand  
Myrciaria silveirana D.Legrand  
Neomitranthes cordifolia (D.Legrand) D.Legrand  
Neomitranthes langsdorffii (O.Berg) Mattos  
Siphoneugena densiflora O.Berg  
Siphoneugena widgreniana O.Berg

## Oleaceae

*Chionanthus micranthus* (Mart.) Lozano & Fuertes

## Rubiaceae

*Guettarda velutina* Zahlbr.

## Rutaceae

*Esenbeckia leiocarpa* Engl.  
*Zanthoxylum flavum* Vahl

## Salicaceae

*Banara brasiliensis* (Schott) Benth.

## Sapotaceae

*Chrysophyllum acreanum* A.C.Sm.  
*Chrysophyllum paranaense* T.D.Penn.  
*Chrysophyllum splendens* Spreng.  
*Elaeoluma lancifolia* (Mart. & Eichler) Eyma  
*Manilkara cavalcantei* Pires & Rodrigues  
*Manilkara excelsa* (Ducke) Standl.  
*Manilkara maxima* T.D.Penn.  
*Micropholis compta* Pierre  
*Micropholis resinifera* (Ducke) Eyma  
*Pouteria bapeba* T.D.Penn.  
*Pouteria bullata* (S.Moore) Baehni  
*Pouteria crassiflora* Pires & T.D.Penn.  
*Pouteria furcata* T.D.Penn.  
*Pouteria krukovii* (A.C.Sm.) Baehni  
*Pouteria lucens* (Mart. & Miq.) Radlk.  
*Pouteria macrocarpa* (Mart.) Dietr.  
*Pouteria microstrigosa* T.D.Penn.  
*Pouteria nudipetala* T.D.Penn.  
*Pouteria oppositifolia* (Ducke) Baehni  
*Pouteria pachyphylla* T.D.Penn.  
*Pouteria petiolata* T.D.Penn.  
*Pouteria pubescens* (Aubrév. & Pellegrin) T.D.Penn.  
*Pouteria putamen-ovi* T.D.Penn.  
*Pouteria vernicosa* T.D.Penn.  
*Pradosia granulosa* Pires & T.D.Penn.  
*Pradosia subverticillata* Ducke

*Sarcaulus inflexus* (A.C.Sm.) T.D.Penn.

*Sarcaulus vestitus* (Baehni) T.D.Penn.

Urticaceae

*Coussapoa curranii* Blake

*Coussapoa floccosa* Akkermans & C.C.Berg

Violaceae

*Rinorea longistipulata* Hekking

*Rinorea ramiziana* Glaz. ex Hekking

**Annex 3 - Sources and Reference list (table 9)**

- Acevedo-Rodriguez, P. 2003. Melicocceae (Sapindaceae): *Melicoccus* and *Talisia*. In: *Fl. Neotr. Monogr.* 87. The New York Botanical Garden. New York. p.1-179.
- Acevedo-Rodrigues, P. & Ferrucci, M.S. 2002. *Averrhoidium dalyi* (Sapindaceae): a new species from western Amazonia. *Brittonia* 54: 112-115.
- Agra, M. F. 2000. *Revisão taxonômica de Solanum sect. Erythrotrichum Child (Solanaceae)*. Tese de doutorado. Inst. Bioc., Univ. S.Paulo. São Paulo.
- Al-Mayah, A.R.A.A. & Stace, C.A. 1989. New species, names and combinations in American Combretaceae. *Ann. Miss. Bot. Gard.* 76(4): 1125-1128.
- Altschul, S.R. 1964. A taxonomic study of the genus *Anadenanthera*. *Contr. Gray Herb.* 193: 3-65.
- Amorim, A.M. 1994. Malpighiaceae. In: Lima, M.P.M. & Guedes-Bruni, R.R. *Reserva Ecológica de Macaé de Cima, Nova Friburgo, RJ. Aspectos Florísticos das espécies Vasculares*, v. 1: 229-249.
- Andersson, L. 1992. A provisional checklist of Neotropical Rubiaceae. *Scripta Bot. Belg.* 1: 1-199.
- Andersson, L. 1995. Tribes and Genera of the Cinchoneae Complex (Rubiaceae). *Ann. Miss. Bot. Gard.* 82(3): 409-427
- Andersson, L. 1998. A revision of the genus *Cinchona* (Rubiaceae-Cinchoneae). *Mem. New York Bot. Gard.* 80: 1-75.
- Anderson, W.R. & Gates, B. 1981. *Barnebya*, a new genus of Malpighiaceae from Brazil. *Brittonia* 33(3): 275-284.
- Ariza-Espinar, L. 1979. The genus *Tessaria* (Compositae). *Kurtziana* 12/13(0): 47-62.
- Atkins, S. 1998. Verbenaceae. In: Dubs, B. *Prodromus Florae Matogrossensis*. Betrona Verlag. p. 294-297.
- Auler-Mentz, L. & Oliveira, P.L. 2004. *Solanum* (Solanaceae) na região Sul do Brasil. *Pesquisas, Bot.* 54: 1-327.
- Aymard, G.A. & Cuello, N. 1995. Two new species of the genus *Sterigmapetalum* (Rhizophoraceae) from the Venezuelan and Brazilian Amazonian Region. *Novon* 5: 223-226.
- Backes, P. & Irgang, B. *Árvores do Sul. Guia de identificação e interesse ecológico*.
- Badillo, V. M. 1971. *Monografía de la Familia Caricaceae*. Universidade Central de Venezuela, Maracay.
- Baehni, C. 1934. Revision du genre *Mollia* Mart. & Zucc. *Candollea* 5: 403-426.
- Baehni, C. & Weibel, R. 1941. Flora of Peru: Violaceae. *Field Museum of Natural History: Botany* 13: 56-82.
- Baitello, J.B. 2001. Novas espécies de Lauraceae para a Flora Brasileira. *Acta Bot. Bras.* 15(3): 445-450.

- Baitello, J.B. 2003. Lauraceae (Aniba, Endlicheria, Nectandra & Ocotea). In Wanderley, M.G.L. et al. Flora Fanerogâmica do Estado de São Paulo. Vol. 3. FAPESP/RiMA. 149-244
- Balslev, H. & Mori, S.A. 1981. *Qualea amapaënsis* (Vochysiaceae), a new and phytogeographically interesting species from Brazil. *Brittonia* 33: 5-8.
- Barbosa, A.V.G. & Amaral Jr., A. 2001. Flora dos Estados de Goiás e Tocantins, Coleção Rizzo: Erythroxylaceae. v. 29.
- Barboza, G.E. & Hunziker, A.T. 1989. Estudios sobre Solanaceae XXIX. Sinopsis taxonómica de *Athenaea*. *Bol. Soc. Argent. Bot.* 26(1-2): 91-106.
- Barkley, F.A. 1944. *Schinus* L. *Brittonia* 5(2): 160-198.
- Barkley, F.A. 1957. A study of *Schinus* L. *Lilloa* 28: 5-110.
- Barkley, F.A. 1957. Sapindaceae of Sothern South America. *Lilloa* 28: 111-179.
- Barneby, R.C. 1989. A review of *Lecointea* (Fabaceae: Swartzieae) in South America. *Brittonia* 41(4): 351-355.
- Barneby, R.C. 1991. Notes on *Swartzia* (Leguminosae: Swartzieae) preliminary to the Flora of the Venezuelan Guayana. *Ann. Miss. Bot. Gard.* 78(1): 177-183.
- Barneby, R.C. 1991. Sensitivae Censitae, a description of the genus *Mimosa* Linnaeus (Mimosaceae) in the New World. *Mem. New York Bot. Gard.* 65: 1-835.
- Barneby, R.C. 1992. Centennial Beans: A miscellany of American Fabales. *Brittonia* 44(2): 224-239.
- Barneby, R.C. 1994. A new purpleheart (*Peltogyne*, Caesalpinaceae) from South Bahian Atlantic forest (Brazil). *Brittonia* 46(4): 270-272.
- Barneby, R.C. 1996. Neotropical Fabales at NY: asides and oversights. *Brittonia* 48(2): 174-187.
- Barneby, R.C. 1999. Increments to genus *Chamaecrista* (Caesalpinaceae: Cassiinae) from Bolivia and from Atlantic Planaltine Brazil. *Brittonia* 51(3): 331-339.
- Barneby, R.C. & Grimes, J.W. 1984. Two new Mimosaceous trees from the American Tropics. *Brittonia* 36(3): 236-240.
- Barneby, R.C. & Grimes, J.W. 1984. Two leguminous forest trees new to the Flora of French Guiana. *Brittonia* 36(1): 45-50.
- Barneby, R.C. & Grimes, J.W. 1996. Silk tree, guanacaste, monkey's earring, a generic system for the sinandrous Mimosaceae of the Americas. Part I: *Abarema*, *Albizia* and allies. *Mem. New York Bot. Gard.* 74(1): 1-292.
- Barneby, R.C. & Grimes, J.W. 1997. Silk tree, guanacaste, monkey's earring, a generic system for the sinandrous Mimosaceae of the Americas. Part II: *Pithecellobium*, *Cojoba* and *Zygia*. *Mem. New York Bot. Gard.* 74(2): 1-161
- Barneby, R.C. & Grimes, J.W. 1998. Silk tree, guanacaste, monkey's earring, a generic system for the sinandrous Mimosaceae of the Americas. Part III: *Calliandra*. *Mem. New York Bot. Gard.* 74(3): 1-223.

- Barroso, G.M. & Maguire, B. 1973. A review of the genus *Wunderlichia* (Mutisieae, Compositae). *Revta. Bras. Bot.* 33(3): 379-406.
- Baumgratz, J.F.A. 1997. *Revisão taxonômica do gênero Huberia DC. (Melastomataceae)*. Tese de Doutorado. Inst. Bioc., Univ. S. Paulo. São Paulo. Páginas.
- Baumgratz, J.F.A. *et al.* 1995. Melastomataceae. In: Stannard, B. (ed.). *Flora of the Pico das Almas, Chapada Diamantina, Bahia, Brazil*. Royal Botanic Gardens, Kew. p. 433-483.
- Berg, C.C. 1972. Olmedieae - Brosimeae (Moraceae). In: *Fl. Neotr. Monogr.* 7. The New York Botanical Garden. New York. p. 1-228.
- Berg, C.C. 1978. Espécies de *Cecropia* da Amazônia brasileira. *Acta Amaz.* 8(2): 149-182.
- Berg, C.C. 1996. *Cecropia* (Cecropiaceae) no Brasil, ao sul da Bacia Amazônica. *Albertoa* 4(16): 213-221.
- Berg, C.C. 2001. *Moreae, Artocarpeae, and Dorstenia* (Moraceae). With introductions to the family and *Ficus* with additions and corrections to Flora Neotropica Monograph 7. In: *Fl. Neotr. Monogr.* 83 The New York Botanical Garden. New York. p.1-347.
- Berg, C.C. & Carauta, J.P.P. 2002. New species of *Ficus* (Moraceae) from Brazil. *Brittonia* 54: 236-243.
- Berg, C.C. & Dahlberg, S.V. 2001. A revision of *Celtis*, subg. *Mertensia* (Ulmaceae). *Brittonia* 53(1): 66-81.
- Berg, C.C. *et al.* 1990. Cecropiaceae: *Coussapoa* and *Pourouma*, with an introduction to the family. In: *Fl. Neotr. Monogr.* 51. The New York Botanical Garden. New York. p. 1-169.
- Bidá, A. 1995. *Revisão taxonômica das espécies de Symplocos Jacq. (Symplocaceae) do Brasil*. Tese de doutorado. Inst. Bioc., Univ. de S. Paulo. São Paulo.
- Bittrich, V. 2003. Clusiaceae In Wanderley, M.G.L. *et al.* Flora Fanerogâmica do Estado de São Paulo. Vol. 3. FAPESP/RiMA. 45-62
- Blake, S.F. 1925. On the status of the genus *Chaenocephalus*, with a review of the Section Lipactinia of *Verbesina*. *Am. Journ. Bot.* 12(10): 625-640.
- Bohs, L. 1994. *Cyphomandra* (Solanaceae). In: *Fl. Neotr. Monogr.* 63. The New York Botanical Garden. New York. p.1-175.
- Boom, B.M. 1984. A revision of *Isertia* (Isertieae: Rubiaceae). *Brittonia* 36(4): 425-457.
- Boom, B.M. 1985. A new species of *Gleasonia* (Henriquezieae: Rubiaceae) from Brazilian Guayana. *Brittonia* 37(3): 317-319.
- Brandbyge, J. 1986. A revision of the genus *Triplaris* (Polygonaceae). *Nordic. J. Bot.* 6: 545-570.
- Bricker, J.S. 1991. A revision of the genus *Crinodendron* (Elaeocarpaceae). *Syst. Bot.* 16(1): 77-88.
- Buchholz, J.T. & Gray, N.E. 1948. A taxonomic revision of *Podocarpus* IV: the American species of Sections C and D. *J. Arn. Arb.* 29: 123-151.

- Cabrera, A.L. 1957. El género *Senecio* (Compositae) en Brasil, Paraguay y Uruguay. *Arch. Jard. Bot. Rio de Janeiro* 15:163-329.
- Cabrera, A.L. 1959. Revision del género *Dasyphyllum* (Compositae). *Revta. Mus. La Plata* 9(38): 21-117.
- Cabrera A.L. & Klein, R.M. 1973. Compostas. Tribo Mutiseae. In: Reitz, R. *Flora Ilustrada Catarinense*. I Parte.
- Cabrera, A.L. & Klein, R.M. 1980. Compostas (Tribo Vernoniae). In: Reitz, R. *Flora Ilustrada Catarinense*. 408p.
- Cabrera, A.L. & Klein, R.M. 1989. Compostas (Tribo Eupatorieae). In: Reitz, R. *Flora Ilustrada Catarinense*. 760p.
- Camargos J.A.A.; Coradin, V.T.R.; Czarneski, C.M.; Oliveira, D.; Meguerditchian, I. 2001. Catálogo de árvores do Brasil. Brasília: IBAMA. 886p.
- Carauta, J.P.P. 1971. Notas sobre o gênero *Phyllostylon* (Ulmaceae). *Revta. Brasil. Biol.* 31(4): 513-518.
- Carauta, J.P.P. 1974. Índice das espécies de Ulmaceae do Brasil. *Rodriguésia*. n.39, p.99-134.
- Carauta, J.P.P. 1989. *Ficus* (Moraceae) no Brasil: conservação e taxonomia. *Albertoa* 2: 1-365.
- Carvalho, A.M. 1997. A synopsis of the genus *Dalbergia* (Fabaceae: Dalbergieae) in Brazil. *Brittonia* 49(1): 87-109.
- Carvalho, A.M. & Barneby, R.C. 1993. The genus *Zollernia* (Fabaceae: Swartzieae) in Bahia, Brazil. *Brittonia* 45(3): 208-212.
- Carvalho, L.A.F. 1991. New taxa of *Solanum* (Solanaceae) from Brazil, Colombia, Central America and Venezuela. *Ann. Miss. Bot. Gard.* 78(1): 224-244.
- Carvalho, L.A.F. 1996. Espécies de *Solanum* das seções *Cernuum* Carv. & Sheph. e *Lepidotum* (Dun.) Seithe v. Hoff. (Solanaceae). *Pesquisas Bot.* 46: 5-83.
- Carvalho, L.A. & Bovini, M.G. 1995. *Aureliana darcyi*, a new species of Solanaceae from Brazil. *Novon* 5: 257-258.
- Carvalho-Okano, R.M. 1992. *Estudos taxonômicos do gênero Maytenus Mol. emend. Mol. (Celastraceae) do Brasil extra-amazônico*. Tese de doutorado. Univ. Estadual de Campinas. Campinas.
- Castañeda, M.D.A. 1981. Revisão taxonômica do gênero *Sloanea* Linnaeus (Elaeocarpaceae) na Amazônia Brasileira. Dissertação de mestrado. FUA/INPA. 256p.
- Cavalcante, P.B. 1963. Nova contribuição ao conhecimento do gênero *Diospyros* Dalech. (Ebenaceae) no Brasil. *Bol. Mus. Par. Emilio Goeldi*, N.S., Bot. 21:1-15.
- Cavalcante, P.B. 1966. Duas novas espécies do gênero *Diospyros* Dalech (Ebenaceae) da Amazônia. *Bol. Mus. Par. Emilio Goeldi* 22: 1-5.
- Cavalcante, P.B. 1983. Revisão taxonômica do gênero *Simaba* Aubl. (Simaroubaceae) na América do Sul. *Publ. Avulsas Mus. Goeldi* 37. 85p.

- Cavalcante, P.B. & Carvalho, M.J.C. 1971. O gênero *Poraqueiba* (Icacinaceae) na Amazônia. *Bol. Mus. Par. Emílio Goeldi Hist. Nat.* 39: 1-10.
- Cavalcanti, T.B. 1995. *Revisão de Diplusodon Pohl (Lythraceae)*. Tese de doutorado. Inst. Bioc., Univ. de São Paulo. São Paulo.
- Chatrou, L.W. 1998. Changing Genera. Systematic Studies in Neotropical and West African Annonaceae. 183
- Cocucci, A.E. 1961. Revision del genero *Ruprechtia* (Polygonaceae). *Kurtziana* 1: 217-269.
- Coe-Teixeira, B. 1975. Espécies novas de *Nectandra* (Lauraceae) da Flora do Brasil. *Acta Amaz.* 5(2): 157-179.
- Cordeiro, I. 1995. Euphorbiaceae. In: Stannard, B. (ed.). *Flora of the Pico das Almas, Chapada Diamantina, Bahia, Brazil*. Royal Botanic Gardens, Kew. p. 300-317
- Cowan, R.S. 1953. A taxonomic revision of the genus *Macrobium* (Leguminosae-Gard. 8: 257-Caesalpinioideae). *Mem. New York Bot. Gard.* 8: 257-342.
- Cowan, R.S. 1967. *Swartzia* (Leguminosae, Caesalpinioideae, Swartzieae). In: *Fl. Neotr. Monogr.* 1. The New York Botanical Garden. New York. p. 1-228.
- Cowan, R.S. 1975. A monograph of the genus *Eperua* (Leguminosae: Caesalpinioideae). *Smithsonian Contr. Bot.* 28: 1-45.
- Cowan, R.S. 1976. A taxonomic revision of *Elizabetha* (Leguminosae-Caesalpinioideae). *Proc. Kon. Ned. Acad. Wetensch.* 79(4): 335-346.
- Cowan, R.S. 1979. *Harleyodendron*, a new genus of Leguminosae (Swartzieae). *Brittonia* 31(1): 72-78.
- Cowan, R.S. 1981. New taxa of Leguminosae - Caesalpinioideae from Bahia, Brazil. *Brittonia* 33(1): 9-14.
- Cowan, R.S. 1985. Studies in Tropical American Leguminosae IX. *Brittonia* 37(3): 291-300.
- Cristóbal, C.L. 2001. Taxonomía del género *Helicteres* (Sterculiaceae). *Bonpl.* 11(1-4): 1-206.
- Cronquist, A. 1944. Studies in Simaroubaceae IV. Resume of the American Genera. *Brittonia* 5(2): 128-148.
- Cuatrecasas, J. 1961. A taxonomic revision of the Humiriaceae. *Contr. U. S. Nat. Herb.* 35(2): 25-214.
- Cuatrecasas, J. 1961. Burseraceae Brasiliae Novae. *Bol. Mus. Par. Emílio Goeldi, sér. Bot.* 11: 1-10.
- Cuatrecasas, J. 1964. Cacao and its allies: a taxonomic revision of the genus *Theobroma*. *Contr. U. S. Nat. Herb.* 35(6): 379-614.
- Cuatrecasas, J. 1993. Miscellaneous notes on Neotropical Flora XXI. A new species of *Humiriastrum* from Brazil. *Phytologia* 75(3): 235-238.
- Daly, D.C. 1987. Studies in Neotropical Burseraceae I. A synopsis of the genus *Crepidospermum*. *Brittonia* 39(1): 51-58.

- Daly, D.C. 1989. Studies in Neotropical Burseraceae II. Generic limits in New World Protieae and Canarieae. *Brittonia* 41(1): 17-27.
- Daly, D.C. 1991. Studies in Neotropical Burseraceae. IV. The unifoliolate species of *Protium* (Burseraceae). *Bol. Mus. Par. Emílio Goeldi, sér. Bot.* 7(2): 249-262.
- Daly, D.C. 1992. New taxa and combinations in *Protium* Burm.f. Studies in Neotropical Burseraceae VI. *Brittonia* 44(3): 280-299.
- Daly, D.C. 1993. Notes on *Bursera* in South America, including a new species. Studies in Neotropical Burseraceae VII. *Brittonia* 45(3): 240-246.
- Daly, D.C. 1998. Two new species of *Protium* from French Guiana. Studies in Neotropical Burseraceae VIII. *Brittonia* 50(4): 517-523.
- Daly, D.C. & Martínez-Habibe, M.C. 2002. Notes on *Dacryodes* Vahl, including a new species from the Rio Negro in Amazonia. Studies in Neotropical Burseraceae XI. *Brittonia* 54(4): 266-274.
- D'Arcy, W.G. 1978. *Dystovomita*, a new genus of Neotropical Guttiferae. *Ann. Miss. Bot. Gard.* 65(2): 694-697.
- Delprete, P.G. 1997. Revision and typification of Brazilian *Augusta* (Rubiaceae, Rondeletieae), with ecological observations on the riverine vegetation of the cerrado and Atlantic forests. *Brittonia* 49(4): 487-497.
- Delprete, P.G. 1999. Rondeletieae (Rubiaceae) Part. I. In: *Fl. Neotr. Monogr.* 77. The New York Botanical Garden. New York. p.1-226.
- Delprete, P.G. 1999. *Riodocea* (Rubiaceae, Gardenieae), a new genus from the Brazilian Atlantic forest. *Brittonia* 51(1): 15-23.
- Di Maio, F.R. & Peixoto, A.L. 2003. Novos sinônimos de *Ixora* L. (Rubiaceae) do Brasil. *Bradea* 9(15): 93-97.
- Dias, M.C. & Kinoshita, L.S. 1998. A new species of *Xylopia* L. (Annonaceae) from Bahia, Brazil. *Kew Bull.* 53(2), 471-474.
- Du Bocage, A.L. & Sales, M.F. 2000. A família Bombacaceae Kunth no estado de Pernambuco, Brasil. *Acta Bot. Bras.* 16(2): 123-134.
- Ducke, A. 1934. *Recordoxylon*: A new genus of Leguminosae-Caesalpinioideae. *Trop. Woods* 39: 16-1.
- Ducke, A. 1941. Revision of the *Macrolobium* species of the Amazonian Hylaea. *Trop. Woods* 65: 21-31.
- Ducke, A. 1947. *Trop. Woods* 90.
- Dwyer, J.D. 1943. The taxonomy of the monogeneric tribe Elvasieae (Ochnaceae). *Bull. Torrey Bot. Club* 70(1): 42-49.
- Dwyer, J.D. 1944. *Philacra*, a new genus of the Ochnaceae. *Brittonia* 5(2): 124-127.
- Dwyer, J.D. 1946. The taxonomy of *Godoya* R. and P., *Rhytidanthera* van Tieghen, and *Cespedesia* Goudot (Ochnaceae). *Lloydia* 9: 45-61.
- Dwyer, J.D. 1951. The Central American, West Indian and South American species of *Copaifera* (Caesalpinaceae). *Brittonia* 7(3): 143-172.

- Dwyer, J.D. 1954. Further studies on the New World species of *Copaifera*. *Bull. Torr. Bot. Club* 81(3): 179-187.
- Dwyer, J.D. 1954. The Tropical American genus *Tachigalia* Aubl. *Ann. Miss. Bot. Gard.* 41(2): 223-261.
- Dwyer, J.D. 1957. The Tropical American genus *Sclerolobium* Vogel. *Lloydia* 20: 67-118.
- Dwyer, J.D. 1957. *Androcalymma*, a new genus of the tribe Cassieae (Caesalpinaceae). *Ann. Miss. Bot. Gard.* 44(4): 295-297.
- Dwyer, J.D. 1958. The New World species of *Cynometra*. *Ann. Miss. Bot. Gard.* 45(4): 313-345.
- Dwyer, J.D. 1965. The Amazonian genus *Wallacea* Spruce ex Hook.f. *Bull. Jard. Bot. Bruxelles* 35: 85-90.
- Ebinger, J.E. *et al.* 2000. Taxonomic revision of South American species of the genus *Acacia* subgenus *Acacia* (Fabaceae: Mimosoideae). *Syst. Bot.* 25(4): 588-617.
- Edwards, K.S. & Prance, G.T. 2003. Four new species of *Roupala* (Proteaceae). *Brittonia* 55: 61-68.
- Eichler, A.W. 1871. Violaceae. *In*: Mart., C.P.F. & Eichler, A.W (eds.). *Flora brasiliensis*. 13(1): 345-396.
- Emmerich, M. 1981. Contribuição ao estudo das Euphorbiaceae brasileiras I. Duas espécies novas. *Bol. Mus. Nacional* 62: 1-7.
- Emmerich, M. 1981. Revisão taxonômica dos gêneros *Algernonia* e *Tetraplandra*: Euphorbiaceae-Hippomaneae. *Arq. Mus. Nac., N. S., Bot.* 56: 91-110.
- Epling, C. 1949. Revisión del género *Hyptis* (Labiatae). *Revta. Mus. La Plata* 11. Sec. 7, Bot. 30: 153-497.
- Esser, H.J. 1993. *Dendrothrix*, a new generic concept in Neotropical Euphorbiaceae. *Novon* 3(3):245-251.
- Esser, H.J. 1993. New species and a new combination in *Mabea* (Euphorbiaceae) from South America. *Novon* 3: 341-351.
- Esser, H.J. 1999. *Rhodothyrsus*, a new genus of Euphorbiaceae from tropical South America. *Brittonia* 51(2): 170-180.
- Esser, H.J. 1999. Taxonomic notes on Neotropical *Maprounea* Aubl. (Euphorbiaceae). *Novon* 9:32-35.
- Ewan, J. 1962. Synopsis of the South American species of *Vismia* (Guttiferae). *Contr. U. S. Nat. Herb.* 35(5): 293-377.
- Exell, A.W. & Stace, C.A. 1963. A revision of the genera *Buchenavia* and *Ramatuella*. *Bull. Brit. Mus. (Nat. Hist.), Bot.* 3: 3-46.
- Farjon, A. 1998. World Checklist and Bibliography of Conifers. Richmond, UK. Royal Botanic Gardens, Kew

- Feres, F. 2001. *O gênero Luxemburgia A.St.-Hil. (Ochnaceae): revisão taxonômica e estudo cladístico*. Dissertação de mestrado. Instituto de Biologia, Univ. Estadual de Campinas. Campinas.
- Fernandes, A. 1994. Novitates florae Nordestinae Brasiliensis. *Bradea* 6(33): 280-292.
- Fernandes, A. 1996. O táxon *Aeschynomene* no Brasil. Editora Universidade Federal do Ceará.
- Ferrucci, M.S. 1998. Sapindaceae. In: Dubs, B. *Prodromus Florae Matogrossensis*. Betrona Verlag. p. 263-268.
- Fiaschi, P. 2002. *Estudo taxonômico do gênero Schefflera J.R.Forst & G. Forst (Araliaceae) na região sudeste do Brasil*. Dissertação de mestrado. Instituto de Biociências, Univ. São Paulo. São Paulo.
- Fiaschi, P. 2003. Revisão Manuscrita da família Araliaceae. Checklist Plantas do Nordeste, <http://umbuzeiro.cnip.org>.
- Fleig, M. 1987. Anacardiaceae. Flora Ilustrada do Rio Grande do Sul 18. Anacardiaceae. Bol. Inst. Bioc. 42: 1-75
- Forero, E. 1983. Connaraceae. In: *Fl. Neotr. Monogr.* 36. The New York Botanical Garden. New York. p. 1-208.
- França, F. 2003. *Revisão de Aegiphila Jacq. (Lamiaceae) e seu posicionamento sistemático*. Tese de doutorado. Inst. Bioc., Univ. São Paulo. São Paulo.
- Francey, P. 1935. Monographie du genre *Cestrum* L. *Candollea*. 6: 46-398.
- Francey, P. 1936. Monographie du genre *Cestrum* L. *Candollea*. 7: 1-132.
- Franco, R.P. 1990. The genus *Hyeronima* (Euphorbiaceae) in South America. *Bot. Jahrb. Syst.* 111(3): 297-346.
- Freire, F.M.T. 1994. *Revisão taxonômica do gênero Cenostigma Tul. (Leguminosae-Caesalpinioideae) para o Brasil*. Dissertação de mestrado. Univ. Federal de Pernambuco.
- Freire, L.A. & Schnoor, A. 1997. *Sessea* Carvalho & Schnoor - nova seção para o gênero *Cestrum* (Solanaceae). *Rodriguésia* 45/49(71/75): 15-25.
- Freitas, M.F. 2003. *Estudos taxonômicos das espécies de Myrsine L. (Myrsinaceae) nas regiões Sudeste e Sul do Brasil*. Tese de Doutorado. Instituto de Biologia, Univ. Estadual de Campinas. Campinas.
- Freytag, G.F. 1951. A revision of the genus *Guazuma*. *Ceiba* 1(4): 193-223.
- Fritsch, P.W. 1997. A revision of *Styrax* (Styracaceae) from western Texas, Mexico, and Mesoamerica. *Ann. Miss. Bot. Gard.* 84(4): 705-761.
- Frodin, D.D. & Govaerts, R. 2003. World Checklist of Araliaceae. *Royal Botanic Gardens, Kew*. 444p.
- Fryxell, P.A. 1999. *Pavonia* Cavanilles (Malvaceae). In: *Fl. Neotr. Monogr.* 76. The New York Botanical Garden. New York. p. 1-284.
- Fryxell, P.A. 2001. *Talipariti* (Malvaceae), a segregate from *Hibiscus*. *Contributions from the University of Michigan Herbarium*. 23: 225-270.

- Fuks, R. 1982. O gênero *Quillaja* Molina (Rosaceae) no Brasil. *Arq. Jard. Bot. Rio de Janeiro* 26: 61-67.
- Furlan, A. 1996. *A tribo Pisonieae Meisner (Nyctaginaceae) no Brasil*. Tese de doutorado. Inst. Bioc., Univ. São Paulo. São Paulo.
- Garcia, F.C.P. 1998. *Relações sistemáticas e fitogeográficas de Inga Miller (Leguminosae-Mimosoideae) nas florestas da costa Sul e Sudeste do Brasil*. Tese de Doutorado. Inst. Bioc., Univ. Estadual Paulista. Rio Claro.
- Gates, B. 1982. *Banisteriopsis, Diplopterys* (Malpighiaceae). In: *Fl. Neotr. Monogr.* 30. The New York Botanical Garden. New York. p. 1-238.
- Gentry, A.H. 1984. New species and combinations in Apocynaceae from Peru and adjacent Amazonia. *Ann. Miss. Bot. Gard.* 71(4): 1075-1083.
- Gentry, A.H. 1992. Bignoniaceae – Part II (Tribo Tecomeae). In: *Fl. Neotr. Monogr.* 25(2). The New York Botanical Garden. New York. p. 1-370.
- Gentry, A.H. & Steyermark, J. 1987. A revision of *Dilodendron* (Sapindaceae). *Ann. Miss. Bot. Gard.* 74(3): 533-538.
- Gillespie, L.J. 1993. Euphorbiaceae of the Guianas: Annotated species checklist and key to the genera. *Brittonia* 45(1): 56-83.
- Gillett, J.B. 1980. *Commiphora* (Burseraceae) in South America and its relationship to *Bursera*. *Kew Bull.* 34(3): 569-587.
- Glassman, S.F. 1999. *A taxonomic treatment of the Palm subtribe Attaleinae (tribe Cocoeae)*. Illinois Biological Monographs 59, University of Illinois Press. 415p.
- Goldberg, A. 1967. The genus *Melochia* L. (Sterculiaceae). *Contr. U.S. Nat. Herb.* 34(5): 191-363.
- Gomes, M. 1996. Rubiaceae. In: Lima, M.P.M. & Guedes-Bruni, R.R. *Reserva Ecológica de Macaé de Cima, Nova Friburgo, RJ*. Aspectos Florísticos das espécies Vasculares, Vol. 2: 345-426.
- Gomes, M. 2003. Novas espécies de *Coussarea* Aubl. e *Faramea* Aubl. (Rubiaceae, tribo Coussareae). *Acta Bot. Bras.* 17(3): 439-448.
- Gomes, M. 2003. Reavaliação taxonômica de algumas espécies dos gêneros *Coussarea* Aubl. e *Faramea* Aubl. (Rubiaceae, tribo Coussareae). *Acta Bot. bras.* 17(3): 449-460.
- Green, P.S. 1994. A revision of *Chionanthus* in South America and the description of *Priogymnanthus*, gen. nov. *Kew Bull.* 49(2): 261-286.
- Grimes, J.W. 1993. *Calliandra anthoniae* (Leguminosae, Mimosoideae, Ingeae), a new species, and a new combination in *Pseudopiptadenia* Rauschert (Leguminosae, Mimosoideae, Mimoseae). *Brittonia* 45(1): 25-27.
- Grimes, J.W. & Barneby, R.C. 1985. A new *Acacia* (Mimosaceae) from Tropical Southeast Brazil. *Brittonia* 37(2): 186-187.
- Guedes M.L. & Orge M.D. Checklist das espécies vasculares do Morro do Pai Inácio (Palmeiras) e Serra da Chapadinha (Lençóis) Chapada Diamantina, Bahia, Brasil. Salvador. 68f.

- Guimarães, P. J. F. 1997. *Estudos taxonômicos de Tibouchina sect. Pleroma (D. Don) Cogn. (Melastomataceae)*. Tese de doutorado. Inst. Biologia, Univ. Estadual de Campinas. Campinas.
- Gustafsson, L. G. R. 1998. The Neotropical *Rosenbergiodendron* (Rubiaceae, Gardeneae). *Brittonia* 50(4): 452-466.
- Harley, R.M. 1995. Labiatae. In: Stannard, B. (ed.). *Flora of the Pico das Almas, Chapada Diamantina, Bahia, Brazil*. Royal Botanic Gardens, Kew. p. 336-363.
- Harley, R.M. 1998. Labiatae. In: Dubs, B. *Prodromus Florae Matogrossensis*. Betrona Verlag. p. 132-136.
- Harley, R.M. & Simmons, N.A. 1986. Flórua de Mucugê. Royal Botanic Gardens, Kew. 228p.
- Hayden, S. M. & Hayden, W. J. 1996. A revision of *Discocarpus* (Euphorbiaceae). *Ann. Miss. Bot. Gard.* 83(2): 153-167.
- Hayden, W.J. 1990. Notes on Neotropical *Amanoa* (Euphorbiaceae). *Brittonia* 42(4): 260-270.
- Hekking, W.H.A. 1988. Violaceae. In: *Fl. Neotr. Monogr.* 46. The New York Botanical Garden. New York. p. 1-207.
- Henderson, A. 2000. *Bactris* (Palmae). In: *Fl. Neotr. Monogr.* 79. The New York Botanical Garden. New York.
- Hiepkco, P. 2000. Opiliaceae. In: *Fl. Neotr. Monogr.* 82. The New York Botanical Garden. New York. p. 1-53.
- Hind, D.J.N. 1999. A new species of *Lasiolaena* (Compositae: Eupatorieae: Gyptidinae) and a synopsis of the genus. *Kew Bull.* 54: 915-925.
- Hoehne, F.C. 1941. Leguminosae – Papilionadas (Dalbergia e Cyclobium) In: Hoehne, F.C. *Flora Brasílica*. Vol. 25(3):126-127. 39 (+40 tab.).
- Hopkins, H. C. 1986. *Parkia* (Leguminosae-Mimosoideae). In: *Fl. Neotr. Monogr.* 43. The New York Botanical Garden. New York. p. 1-128.
- Howard, R. A. 1942. Studies in the Icacinaceae III: a revision of *Emmotum*. *J. Arn. Arb.* 23: 479-494.
- Howard, R. A. 1942. Studies of the Icacinaceae. IV. Considerations of the New World genera V: a revision of the genus *Citronella* D. Don. *Contr. Gray Herb.* 142: 3-92.
- Hunziker, A. T. & Barboza, G. E. 1990. Estudios sobre Solanaceae XXX, revision de *Aureliana*. *Darwiniana* 30(1-4): 95-113.
- International Plant Names Index. [www.ipni.org](http://www.ipni.org). Acessado em 15 de novembro de 2004.
- Irwin, H.S. & Arroyo, M.T.K. 1974. Three new legume species from South America. *Brittonia* 26(3): 264-268.
- Irwin, H.S. & Barneby, R.C. 1982. The American Cassinae: a synoptical revision of Leguminosae Tribe Cassieae subtribe Cassinae in the New World. *Mem. New York Bot. Gard.* 35(1-2): 1-918.

- Irwin, H.S. & Barneby, R.C. 1985. A new species of *Senna* (Caesalpiniaceae) from coastal Northern Bahia, Brazil. *Brittonia* 37: 192-194.
- Jablonski, E. 1967. Synopsis of South American *Sapium*. *Phytologia* 14: 441-456.
- Jablonski, E. 1969. Monograph of the genus *Actinostemon*. *Phytologia* 18: 213-240.
- Jansen-Jacobs, M.J. & Westra, L.Y.T. 1995. A new species of *Apeiba* (Tiliaceae) from the Venezuelan-Brazilian border. *Brittonia* 47(3): 335-340.
- Johnson, D.M. & Murray, N.A. 1995. Synopsis of the tribe Bocageae (Annonaceae), with revisions of *Cardiopetalum*, *Froesiodendron*, *Trigynaea*, *Bocagea*, and *Hornschurchia*. *Brittonia* 47(3): 248-319.
- Joly, C.A. *et al.* 1980. Taxonomic studies in *Magonia* St.-Hil. (Sapindaceae). *Brittonia* 32(3): 380-386.
- Jonhston, M.C. 1971. Revision of *Colubrina* (Rhamnaceae). *Brittonia* 23(1): 2-53.
- Jung-Mendaçolli, S.L. & Bernacci, L.C. 1997. *Rapanea hermogenesii* Jung-Mendaçolli & Bernacci (Myrsinaceae): uma nova espécie da mata Atlântica, Brasil. *Bol. Bot. Univ. São Paulo* 16: 31-35.
- Kaastra, R.C. 1982. Pilocarpinae (Rutaceae). In: *Fl. Neotr. Monogr.* 33. The New York Botanical Garden. New York. p.1-198.
- Kallunki, J.A. 1987. A new species of *Raveniopsis* (Rutaceae), a genus new to Brazil. *Brittonia* 39(4): 409-411.
- Kallunki, J.A. 1992. A revision of *Erythrochiton* sensu lato (Cuspariinae, Rutaceae). *Brittonia* 44(2): 107-139.
- Kallunki, J.A. 1994. Revision of *Raputia* (Cuspariinae, Rutaceae). *Brittonia* 46(4): 279-295.
- Kallunki, J.A. 1998. *Andreadoxa flava* (Rutaceae, Cuspariinae): a new genus and species from Bahia, Brazil. *Brittonia* 50(1): 59-62.
- Kallunki, J.A. 1998. Revision of *Ticorea* (Rutaceae, Galipeinae). *Brittonia* 50(4): 500-513.
- Kallunki, J.A. & Pirani, J.R. 1998. Synopses of *Angostura* Roem. & Schult. and *Conchocarpus* J.C.Mikan (Rutaceae). *Kew Bull.* 53(2): 257-336.
- Kawasaki, M.L. 1996. A new species of *Calyptranthes* (Myrtaceae) from Southeastern Brazil. *Brittonia* 48(4): 508-510.
- Kawasaki, M.L. 1998. Systematics of *Erisma* (Vochysiaceae). *Mem. New York Bot. Gard.* 81: 1-40.
- Kawasaki, M.L. 2002. *Myrtaceae no sudeste da Mata Atlântica, Brasil*. The Field Museum. Chicago.
- Kawasaki, M.L. & Holst, B.K. 1994. New species and a new combination in Myrtaceae from Northeastern South America. *Brittonia* 46(2): 137-143.
- Kawasaki, M.L. & Holst, B.K. 2002. Two new species of *Plinia* (Myrtaceae) from coastal forests of Brazil. *Brittonia* 54: 94-98.

- Kinoshita-Gouvêa, L.S. 1979. *Estudos taxonômicos e fitogeográficos da família Ericaceae do Brasil*. Tese de doutorado. Inst. Bioc., Univ. São Paulo. São Paulo.
- Kirkbride Jr., J.H. 1997. Manipulus Rubiacearum VI. *Brittonia* 49(3): 354-379.
- Kirkbride Jr., J.H. 1999. *Barnebydendron*, a new generic name (Fabaceae, Caesalpinioideae, Detarieae, Brownea group). *Sida* 18: 815-818.
- Klitgaard, B.B. 1999. A new species and nomenclatural changes in neotropical *Platymiscium* (Leguminosae: Papilionoideae: Dalbergieae). *Kew Bull.* 54: 967-972.
- Knapp, S. 2002. Solanum sect. Geminata (Solanaceae). In: *Fl. Neotr. Monogr.* 84. New York Botanical Garden. New York. 404p.
- Knapp, S. *et al.* 1997. A phylogenetic conspectus of the tribe Juanulloeae (Solanaceae). *Ann. Miss. Bot. Gard.* 84: 67-89.
- Kobuski, C.E. 1942. Studies in the Theaceae XII: notes on the South American species of *Ternstroemia*. *J. Arn. Arb.* 23: 298-343.
- Kobuski, C.E. 1948. Studies in the Theaceae - XVII: a review of the genus *Bonnetia*. *J. Arnold Arbor.* 29: 393-413.
- Koeppen, R. C. 1967. Revision of *Dicorynia* (Cassieae, Caesalpinaceae). *Brittonia* 19(1): 42-61.
- Koeppen, R.C. & Iltis, H.H. 1962. Revision of *Martiodendron* (Cassieae, Caesalpinaceae). *Brittonia* 14(2): 191-209.
- Kostermans, A.J.G.H. 1937. Revision of the Lauraceae II. The genera *Endlicheria*, *Cryptocarya* (American species) and *Licaria*. *Recueil Trav. Bot. Néerl.* 34(2): 500-609.
- Kostermans, A.J.G.H. 1961. The New World species of *Cinnamomum* Trew. (Lauraceae). *Reinwardtia* 6: 17-24.
- Kruijt, R.C. 1989. Monographic studies on *Sapium* (Euphorbiaceae, Hippomaneae) and related genera. Dissertation, 238p.
- Krukoff, B.A. 1972. American species of *Strychnos*. *Lloydia* 35(3): 193-271.
- Krukoff, B.A. & Barneby, R.C. 1974. Conspectus of the species of the genus *Erythrina*. *Lloydia* 37(3): 332-459.
- Kubitzki, K. 1969. Monographie der Hernandiaceen. *Bot. Jahrb. Syst.* 89: 78-205.
- Kubitzki, K. & Renner, S. 1982. Lauraceae I (*Aniba* and *Aiouea*). In: *Fl. Neotr. Monogr.* 31. The New York Botanical Garden. New York. p.1-125.
- Kurz, H. 2000. Revision der Gattung *Licaria* (Lauraceae). *Mitt. Inst. Allg. Bot. Hamburg* 28-29: 89-221.
- Landrum, L.R. 1982. *Myrceugenia* (Myrtaceae). In: *Fl. Neotr. Monogr.* 29. The New York Botanical Garden. New York. p.1-138.
- Landrum, L.R. 1986. *Campomanesia*, *Pimenta*, *Blepharocalyx*, *Legrandia*, *Acca*, *Myrrhinium* and *Luma* (Myrtaceae). In: *Fl. Neotr. Monogr.* 45. New York Botanical Garden. New York. p.1-180.
- Landrum, L.R. 1987. A new species of *Campomanesia* (Myrtaceae) from Brazil. *Brittonia* 39(2): 245-247.

- Landrum, L.R. 1990. *Accara*: A new genus of Myrtaceae, Myrtinae from Brazil. *Syst. Bot.* 15(2): 221-225.
- Lay, K.K. 1949. A revision of the genus *Heliocarpus*. *Ann. Miss. Bot. Gard.* 37(3): 315-395.
- Lee, Y.T. & Langenheim, J.H. 1975. Systematics of the genus *Hymenaea* L. (Leguminosae, Caesalpinioideae, Detarieae). *Univ. Calif. Publ. Bot.* 69: 1-109.
- Leeuwenberg, A. J. M. 1994. *A revision of Tabernaemontana, two. The New World species and Stemnadenia. Series of revision of Apocynaceae. XXXVI.* Royal Botanic Gardens, Kew.
- Legrand, C.D. 1962. Sinopsis de las especies de *Marlierea* del Brasil. *Comunic. Bot. Mus. Hist. Nat. Montevideo* 40(3): 1-41.
- Legrand, C.D. & Klein, R.M. 1969. Mirtáceas In: Reitz, R. *Flora Ilustrada Catarinense*.
- Legrand, C.D. & Klein, R.M. 1971. Mirtáceas 6. *Calyptranthes* Sw. In: Reitz, R. *Flora Ilustrada Catarinense*.
- Legrand, C.D. & Klein, R.M. 1972. Mirtáceas 7. *Calycorectes* Berg. In: Reitz, R. *Flora Ilustrada Catarinense*.
- Legrand, C.D. & Klein, R.M. 1977. Mirtáceas, suplemento I. In: Reitz, R. *Flora Ilustrada Catarinense*.
- Leitão-Filho, H.F. 1972. Contribuição ao conhecimento taxonômico da tribo Vernonieae no Estado de São Paulo. Tese de Doutorado.
- Leuenberger, B.E. 1986. *Pereskia* (Cactaceae). *Mem. New York Bot. Gard.* 41: 1-141.
- Levin, G.A. 1992. Systematics of *Paradrypetes* (Euphorbiaceae). *Syst. Bot.* 17(1): 74-83.
- Lewis, G.P. 1987. *Legumes of Bahia*. Royal Botanic Gardens, Kew. 1-402.
- Lewis, G.P. 1998. *Caesalpinia: a revision of the Poincianella - Erythrostemon Group*. Royal Botanic Gardens, Kew.
- Lewis, G.P. & Barneby, R.P. 1998. Leguminosae-Mimosoideae. In: Dubs, B. *Prodromus Florae Matogrossensis*. Betrona Verlag. p. 148-153.
- Lewis, G.P. & Lima, M.P.M. 1991. *Pseudopiptadenia* Rauschert no Brasil (Leguminosae-Mimosoideae). *Arq. Jard. Bot. Rio de Janeiro* 30: 43-67.
- Lewis, G.P. & Owen, P.E. 1989. *Legumes of the Ilha de Maracá*. Royal Botanic Gardens, Kew. 95p.
- Lima, D.A. 1989. *Plantas das Caatingas*. Academia Brasileira de Ciências. p. 1-243.
- Lima, H.C. 1980. Revisão taxonômica do gênero *Vataireopsis* Ducke (Leguminosae-Faboideae). *Rodriguésia* 32(54): 21-40.
- Lima, H.C. 1981. Contribuição ao estudo do gênero *Diplotropis* Bentham (Leguminosae-Faboideae). *Bradea* 3(34): 187-192.
- Lima, H.C. 1982. Revisão taxonômica do gênero *Vatairea* Aublet (Leguminosae-Faboideae). *Arch. Jard. Bot. Rio de Janeiro* 26: 173-214.

- Lima, H.C. 1985. *Diploptropis* Bentham (Leguminosae-Faboideae) - Estudo dos táxons infragenéricos. *Acta Amaz.* 15(1/2): 61-75.
- Lima, H.C. 1995. Leguminosas da Flora Fluminensis - J.M. da C. Vellozo - Lista atualizada das espécies arbóreas. *Acta Bot. Bras.* 9(1): 123-146.
- Lima, L.R. & Pirani, J.R. 2003. O gênero *Croton* L. (Euphorbiaceae) na Cadeia do Espinhaço, Minas Gerais, Brasil. *Bol. Bot. Univ. São Paulo* 21(2): 299-344.
- Lima, M.P.M. & Lima, H.C. 1984. *Parapiptadenia* Brenan (Leguminosae-Mimosoideae), estudo taxonômico das espécies brasileiras. *Rodriguésia* 36(60): 23-30.
- Lima, R. B. 2000. *A família Rhamnaceae no Brasil, diversidade e taxonomia*. Tese de Doutorado. Inst. Bioc., Univ. São Paulo. São Paulo. 292 p.
- Lleras, E. 1976. Revision and taxonomic position of the genus *Euphronia* Mart. ex Mart. & Zuccarini (Vochysiaceae). *Acta Amaz.* 6(1): 43-48.
- Lleras, E. 1978. Trigonaceae. In: *Fl. Neotr. Monogr.* 19. The New York Botanical Garden. New York. p. 1-73.
- Lombardi, J.A. 2002. *Martiodendron fluminense* (Leguminosae, Caesalpinioideae), a new species from the Atlantic coast rainforest of Brazil. *Brittonia* 54: 327-330.
- Lombardi, J.A. 2004. Three new species of Celastraceae (Hippocrateoideae) from southeastern Brazil, and a new combination in *Peritassa*. *Novon* 14 (3): 315-321.
- Lombardi, J.A. & Lara, A.C.M. 2003. Hippocrateaceae In Wanderley, M.G.L. et al. Flora Fanerogâmica do Estado de São Paulo. Vol. 3. FAPESP/RiMA. 109-122
- Lorea-Hernández, F.G. 2003. Lauraceae (Cinnamomum) In Wanderley, M.G.L. et al. Flora Fanerogâmica do Estado de São Paulo. Vol. 3. FAPESP/RiMA. 149-223
- Lorenzi, H. 1992. *Árvore Brasileiras*. Manual de identificação e cultivo de plantas arbóreas nativas do Brasil. Vol. 1. Nova Odessa. Editora Plantarum. 352p.
- Lorenzi, H. 1998. *Árvore Brasileiras*. Manual de identificação e cultivo de plantas arbóreas nativas do Brasil. V.2. Nova Odessa. Editora Plantarum. 352p.
- Lorenzi, H.; Souza, H.M.; Medeiros-Costa, J.T.; Cerqueira, L.S.C.; von Behr, N. 1996. *Palmeiras no Brasil nativas e exóticas*. Nova Odessa, SP: Editora Plantarum. 303p.
- Lorenzi, H.; Souza, H.M.; Costa, T.M.; Cerqueira, L.S.C.; Ferreira, E. 2004. *Palmeiras brasileiras e exóticas cultivadas*. Nova Odessa, SP: Editora Plantarum. 416p.
- Lughadha, E. N. 1994. Notes on the Myrtaceae of the Pico das Almas, Bahia, Brazil. *Kew Bull.* 49(2): 321-329.
- Lupo, R. & Pirani, J.R. 2002. Theophrastaceae. In: Wanderley, M.G.L. et al. Flora Fanerogâmica do Estado de São Paulo. Vol. 2. FAPESP/Hucitec. 327-329
- Luteyn, J.L. et al. 1995. Ericaceae-Part II. In: *Fl. Neotr. Monogr.* 66. The New York Botanical Garden. New York.
- Maas, P.J.M.; Mennega, E.A. & Westra, L.Y.T. 1994. Studies in Annonaceae. XXI. Index to species and infraspecific taxa of neotropical Annonaceae. *Candollea* 49, p.389-481.

- Maas, P.J.M.; Noorman, K. & Westra, L.Y.Th. 1993. Studies in Annonaceae. XVIII New species from the Neotropics and miscellaneous notes. *Bot. Jahrb. Syst.* 115(1): 77-95.
- Maas, P.J.M. & Westra, L.Y.T. 1984. Studies in Annonaceae I: A monograph of the genus *Anaxagorea*. Part I. *Bot. Jahrb. Syst.* 105: 73-134.
- Maas, P.J.M. & Westra, L.Y.T. 1985. Studies in Annonaceae. II A monograph of the genus *Anaxagorea* A. St. Hil. *Bot. Jahrb. Syst.* 105 (2): 145-204.
- Maas, P.J.M. & Westra, L.Y.T. 2003. Revision of the neotropical genus *Pseudoxandra* (Annonaceae). *Blumea* 48: 201-259.
- Maas, P.J.M.; Westra, L.Y.Th.; Chatrou, L.W. *et al.* 2003. *Duguetia* (Annonaceae). In: *Fl. Neotr. Monogr.* 88. The New York Botanical Garden. New York.
- Maas, P.J.M. & Westra, L.Y.T. *et al.* 1992. *Rollinia*. In: *Fl. Neotr. Monogr.* 57. The New York Botanical Garden. New York. p. 1-188.
- Mabberley, D.J. 1987. *The Plant Book*. 2a. Ed. Cambridge University Press. 858p.
- Macbride, J.F. 1943. Leguminosae, Flora of Peru. *Field Mus. Nat. Hist.*, Bot. ser. 13(3/1): 1-506.
- Macbride, J.F. 1951. Euphorbiaceae, Flora of Peru. *Field Mus. Nat. Hist.*, Bot. ser. 13(3A/2): 3-200.
- MacLeish, N.F.F. 1987. Revision of *Eremanthus* (Compositae - Vernoniaceae). *Ann. Miss. Bot. Gard.* 74: 265-290.
- Madriñán, S. 1996. New species of *Rhodostemonodaphne* (Lauraceae) from Northeastern South America. *Brittonia* 48(1): 45-66.
- Mansano, V.F. & Tozzi, A.M.G.A. 1999. The taxonomy of some Swartzieae (Leguminosae, subfam. Papilionoideae) from southeastern Brazil. *Brittonia* 51(2): 149-158.
- Mansano, V.F. & Tozzi, A.M.G.A. 2001. *Swartzia* Schreb. (Leguminosae-Papilionoideae-Swartzieae): a taxonomic study of the *Swartzia acutifolia* complex, including a new name and a new species from Southeastern Brazil. *Kew Bull.* 56: 917-929.
- Marchioretto, M.S. & Siqueira, J.C. 1993. O gênero *Phytolacca* L. (Phytolaccaceae) no Brasil. *Pesq. Bot.* 44: 5-40.
- Marcondes-Ferreira, W. 1988. *Aspidosperma* Mart. *nom. cons.* (Apocynaceae): *Estudos taxonômicos*. Tese de doutorado. Inst. Biologia, Univ. de Campinas. Campinas.
- Martins, A.B.; Semir, J.; Golbenberg; Martins, E. 1996. O gênero *Miconia* Ruiz & Pav. (Melastomataceae) no Estado de São Paulo. *Acta Bot. Bras.* 10(2): 267- 317.
- Martins, E. 1997. *Revisão taxonômica do gênero Trembleya* DC. (Melastomataceae). Tese de doutorado. Inst. Biologia, Univ. Estadual de Campinas, Campinas.
- Martins, H.F. 1981. *O gênero Callisthene* (Vochysiaceae). *Ensaio para uma revisão taxonômica*. Dissertação de Mestrado. Universidade Federal do Rio de Janeiro. Rio de Janeiro.
- Martius, C.F.P. 1858-1879. *Flora Brasiliensis*. v. II-XV. Munique.

- Mattos, J.R. 1989. *Myrtaceae do Rio Grande do Sul*. EMBRAPA. Porto Alegre.
- Mattos, N.F. 1979. O gênero *Andira* Lam. (Leguminosae Papilionoideae) no Brasil. *Acta Amaz.* 9(2): 241-266.
- Mattos, N.F. 1979. O gênero *Hymenolobium* Bth. (Leguminosae) no Brasil. *Roessléria* 3: 13-53.
- McVaugh, R. 1958. Flora of Peru - Myrtaceae. *Field Mus. Nat. Hist., Bot. Ser. Vol. 13 - part 4 - n. 2*: 569-819.
- Melchior, H. 1924. Beiträge zur Kenntnis der Violaceae. I. Revision der Gattung *Gloeospermum* Trian. & Planch. *Notizblatt des Botanischen Gartens und Museums zu Berlin-Dahlem* 8 (71-80): 617-624.
- Mello Filho, L.E. & Andrade, A.G. 1967. Espécies Amazônicas do gênero *Zollernia* Maximil. & Nees (Caesalpinaceae). *Atas Simp. Biota Amaz.* 4(Bot.): 153-166.
- Mello-Silva, R. & Pirani, J.R. 1994. *Guatteria rupestris* (Annonaceae), a new species from Minas Gerais, Brazil. *Novon* 4: 146-150.
- Melo, E. 2003. *Revisão das espécies do gênero Coccoloba P.Browne nom. cons. (Polygonaceae) do Brasil*. Tese de Doutorado. Inst. de Bioc., Univ. São Paulo. São Paulo.
- Mendonça Filho, C.V. 2002. *Citotaxonomia de Machaerium Pers. e revisão taxonômica de Machaerium sect. Oblonga (Benth.) Taub. (Leguminosae - Papilionoideae)*. Tese de Doutorado. Inst. Biologia, Univ. Estadual de Campinas. Campinas.
- Mendonça, J.O. 1999. *A família Erythroxylaceae no Estado de São Paulo, Brasil*. Tese de doutorado. Inst. Bioc., Univ. Estadual Paulista. Botucatu. 248p.
- Meyer, T. & Barkley, F.A. 1973. Revisión del género *Schinopsis* (Anacardiaceae). *Lilloa* 33(2): 207-258.
- Miralha, J.M. 1989. Contribuição ao estudo taxonômico das espécies de *Unonopsis* Fries (Annonaceae) na Amazônia Legal. *Bol. Mus. Par. Emílio Goeldi, sér. Botânica*, 5(2), p.207-244.
- Mitchell, J.D. 1992. Additions to *Anacardium* (Anacardiaceae), *Anacardium amapaense*, a new species from French Guiana and Eastern Amazonian Brazil. *Brittonia* 44(3): 331-338 (com chave revisada).
- Mitchell, J.D. 1993. *Tapirira obtusa* comb. nov. (Anacardiaceae). *Mem. New York Bot. Gard.* 3:66.
- Mitchell, J.D. & Daly, D. 1991. *Cyrtocarpa* Kunth (Anacardiaceae) in South America. *Ann. Miss. Bot. Gard.* 78(1): 184-189.
- Mitchell, J.D. & Daly, D. 1993. A revision of *Thyrsodium*. *Brittonia* 45(2): 115-129.
- Mitchell, J.D. & Daly, D.C. 1998. The “tortoise’s cajá” - a new species of *Spondias* (Anacardiaceae) from Southwestern Amazonia. *Brittonia* 50(4): 447-451.
- Mitchell, J.D. & Mori, S.A. 1987. The cashew and its relatives (*Anacardium*: Anacardiaceae). *Mem. New York Bot. Gard.* 42: 1-76.
- Mohlenbrock, R.H. 1963. A revision of the Leguminous genus *Sweetia*. *Webbia* 17: 223-263.

- Monachino, J. 1945. A revision of *Hancornia* (Apocynaceae). *Lilloa* 11: 19-48.
- Moraes, P.L.R. 2003. Lauraceae (Cryptocarya) In Wanderley, M.G.L. et al. Flora Fanerogâmica do Estado de São Paulo. Vol. 3. FAPESP/RiMA. 149-223
- Morales, J.F. 2003. Studies in Neotropical Apocynaceae III: A revision of the genus *Secondatia* A.DC., with discussion of its generic classification. *Candollea*. 58(2). p.305-320.
- Mori, S.A. 1992. *Eschweilera pseudodecolorans* (Lecythidaceae), a new species from central Amazonian Brazil. *Brittonia* 44(2): 244-246.
- Mori, S.A. & Lepsch-Cunha, N. 1995. The Lecythidaceae of a Central Amazonian Moist Forest. *Mem. New York Bot. Gard.* 75: 1-55.
- Mori, S.A. & Prance, G.T. 1990. Lecythidaceae. In: *Fl. Neotr. Monogr.* 21(II). The New York Botanical Garden. New York. p. 1-376.
- Morley, T. 1976. Memecyleae (Melastomataceae). In: *Fl. Neotr. Monogr.* 15. The New York Botanical Garden. New York. p. 1-295.
- Morley, T. 1985. Five new taxa of New World Memecyleae (Melastomataceae). *Ann. Miss. Bot. Gard.* 72(3): 548-557.
- Morley, T. 1989. New species and other taxonomic matters in the New World Memecyleae (Melastomataceae). *Ann. Miss. Bot. Gard.* 76(2): 430-443.
- Morley, T. 1993. Memecyloideae. In: Gorts-van Rijn, A.R.A. (ed.). *Flora of the Guianas*.
- Müller, C. 1984. *Revisão taxonômica do gênero Poiretia Vent. (Leguminosae) para o Brasil*. Dissertação de Mestrado. Inst. Biologia, Univ. Estadual de Campinas. Campinas.
- Munhoz, C.B.R. 1996. *Melastomataceae no Distrito Federal, Brasil: Tribo Miconieae A.P. DC.* Inst. de Ciências Biológicas, Univ. de Brasília. Brasília.
- Murray, N. A. 1993. Revision of *Cymbopetalum* and *Porcelia* (Annonaceae). *Syst. Bot. Monogr.* 40: 1-121.
- Nee, M. 1994. A new species of *Talauma* (Magnoliaceae) from Bolivia. *Brittonia* 46(4): 265-269.
- Nee, M. 1996. A new species of *Acanthosyris* (Santalaceae) from Bolivia and a key to the woody South American Santalaceae. *Brittonia* 48(4): 547-579.
- Nic Lughada, E. 2003. Myrtaceae. In: Zappi, D. et al. Lista das plantas vasculares de Catolés, Chapada Diamantina, Bahia, Brazil. *Bol. Bot. Univ. São Paulo* 21(2): 345-398.
- Nishida, S. 1999. Revision of *Beilschmiedia* (Lauraceae) in the Neotropics. *Ann. Miss. Bot. Gard.* 86(3): 657-701.
- Occhioni-Martins, E.M. 1974. *Stryphnodendron* Mart. (Leg.Mim.), as espécies do Nordeste, Sudeste e Sul do Brasil: 2. *Leandra* 3-4(4-5): 53-66.
- Occhioni-Martins, E.M. 1981. *Stryphnodendron* Mart. (Leguminosae-Mimosoideae) com especial referência aos taxa amazônicos. *Leandra* 10-11 (10-11): 3-100.
- Oliveira, A.A. & Mori, S.A. 1999. A central Amazonian terra firme forest. I. High tree species richness on poor soils. *Biodiversity and Conservation* 8: 1219-1244.

- Otegui, M. 1998. Sinopsis del género *Myrsine* (Myrsinaceae) em el Cono Sur de América del Sur. *Candollea* 53(1): 133-158.
- Paula, J.E. 1969. Estudos sobre Bombacaceae - I: Contribuição para o conhecimento dos gêneros *Catostemma* Benth. e *Scleronema* Benth. da Amazônia Brasileira. *Ci. & Cult.* 21(4): 697-719.
- Paula, J.E. 1976. *Antonia ovata* Pohl var. *excelsa* Paula ex Paula (Loganiaceae). *Acta Amaz.* 6(1): 41-42.
- Paula, J.E. & Alves, J.L.H. 1978. Contribuição para o conhecimento dos gêneros *Caperonia* St. Hil., *Stigmaphyllon* A.Juss. e *Vochysia* Juss. *Rodriguésia* 46:163-201.
- Peixoto, A.L. 1987. *Revisão taxonômica do gênero Mollinedia Ruiz. & Pavon (Monimiaceae, Monimioideae)*. Tese de doutorado. Inst. de Biologia, Univ. Estadual de Campinas. Campinas.
- Peixoto, A.L. 2002. Monimiaceae (Hennecartia, Macrotorus e Mollinedia). In: Wanderley et al. Flora Fanerogâmica do Estado de São Paulo. Vol. 2. FAPESP/Hucitec. 189-207.
- Peixoto, A.L. & Pereira, M.V.L. 1996. Monimiaceae. In: Lima, M.P.M. & Guedes-Bruni, R.R. *Reserva Ecológica de Macaé de Cima, Nova Friburgo, RJ*. Aspectos Florísticos das espécies Vasculares, v. 2. 299-331.
- Peixoto, A.B.F. 1982. Araliaceae. In: Rizzo, J.A. *Flora do Estado de Goiás e Tocantins*. v.3.
- Pennington, T.D. 1981. Meliaceae. In: *Fl. Neotr. Monogr.* 28. The New York Botanical Garden. New York. p. 1-472.
- Pennington, T.D. 1990. Sapotaceae. In: *Fl. Neotr. Monogr.* 52. The New York Botanical Garden. New York. p. 1-770.
- Pennington, T.D. 1997. *The genus Inga*. Royal Botanic Gardens, Kew. London. 844p.
- Pereira-Moura, M.V.L. 2001. *Revisão taxonômica do gênero Alseis Schott (Rubiaceae, Cinchonoideae)*. Tese de doutorado. Inst. Bioc., Univ. São Paulo. São Paulo.
- Pereira-Moura, M.V.L. 2002. Monimiaceae (Siparuna). In: Wanderley et al. Flora Fanerogâmica do Estado de São Paulo. Vol. 2. FAPESP/Hucitec. 189-207.
- Perkins, J.R. 1901. Monographie der Gattung *Siparuna*. *Bot. Jahrb.* 28: 660-705.
- Persson, C. 2003. *Agouticarpa*, a new Neotropical genus of tribe Gardenieae (Rubiaceae). *Brittonia* 55: 176-201.
- Pipoly, J.J. 1983. Contributions toward a monograph of *Cybianthus* (Myrsinaceae): III. A revision of subgenus *laxiflorus*. *Brittonia* 35(1): 61-80.
- Pipoly, J.J. 1993. Notes on *Cybianthus* subgenus *Cybianthus* (Myrsinaceae) in Southeastern Brazil. *Novon* 3: 459-462.
- Pipoly, J.J. 1995. A new *Tachigali* (Fabaceae: Caesalpinioideae) from Western Amazonia. *SIDA* 16(3): 407-411.
- Pipoly, J.J. & Graff, A. 1995. A synopsis of the genus *Clusia* sections *Criuvopsis* and *Brachystemon* (Clusiaceae) in Northern South America. *Sida* 16(3): 505-528.

- Pirani, J.R. 1990. As espécies de *Picramnia* Sw. (Simaroubaceae) do Brasil: uma sinopse. *Bol. Bot. Univ. São Paulo* 12: 115-180.
- Pirani, J.R. 1999. *Estudos taxonômicos em Rutaceae*. Tese de livre-docência. Inst. Bioc., Univ. de São Paulo. São Paulo.
- Pirani, J.R. 1999. Two new species of *Esenbeckia* (Rutaceae, Pilocarpinae) from Brazil. *Bot. Journ. Linn. Soc.* 129: 305-313.
- Pirani, J.R. 2004. Three new species of *Galipea* (Rutaceae, Galipeinae) from Brazil. *Bot. Journ. Linn. Soc.* 144: 365-373.
- Pirani, J.R. & Carvalho-Okano, R.M. 1999. *Maytenus rupestris* (Celastraceae), a new species from Minas Gerais, Southeastern Brazil. *Novon* 9: 95-97.
- Plana, V. & Prance, G.T. 2004. A synopsis of the South American genus *Euplassa* (Proteaceae). *Kew Bull.* 59(1): 27-45.
- Plowman, T. 1986. Four new species of *Erythroxylum* (Erythroxylaceae) from Northeastern Brazil. *Brittonia* 38(3): 189-200.
- Plowman, T. 1998. A revision of the South American Species of *Brunfelsia* (Solanaceae). *Fieldiana Bot.* 39: 1-135.
- Plowman, T. C. & Hensold, N. 2004. Names, types, and distribution of neotropical species of *Erythroxylum* (Erythroxylaceae). *Brittonia* 56(1): 1-53.
- Plumel, M.M. 1991. Le genre *Himatanthus* (Apocynaceae). Revisión taxonomique. *Bradea* 5: 1-118.
- Pontes, A.F.; Barbosa, M.R.V.; Maas, P.J.M. 2004. Flora Paraibana: Annonaceae Juss. *Acta Bot. Bras.* 18(2): 281-284.
- Poppendieck, H.H. 1981. Cochlospermaceae. In: *Fl. Neotr. Monogr.* 27. The New York Botanical Garden. New York. p. 1-34.
- Pott, A. & Pott, V.J. 1994. *Plantas do Pantanal*. EMBRAPA/CPAP. Corumbá. 320p.
- Prance, G.T. 1971. New species of Phanerogams from Amazonia. *Brittonia* 23(4): 438-445.
- Prance, G.T. 1972. Dichapetalaceae. In: *Fl. Neotr. Monogr.* 10. The New York Botanical Garden. New York. p. 1-21.
- Prance, G.T. 1989. Chrysobalanaceae. In: *Fl. Neotr. Monogr.* 9S. The New York Botanical Garden. New York. p. 1-267.
- Prance, G.T. 1994. Two new species of neotropical Chrysobalanaceae. *Kew Bull.* 49(2): 359-363.
- Prance, G.T. 1996. *Tapura* (Dichapetalaceae) from the Mata Atlantica of Brazil. *Biollania* ed. esp. 6: 491-496.
- Prance, G.T. & Mori, S.A. 1979. Lecythidaceae. In: *Fl. Neotr. Monogr.* 21(I). The New York Botanical Garden. New York. p. 1-272.
- Prance, G.T. & Silva, M.F. 1973. Caryocaraceae. In: *Fl. Neotr. Monogr.* 12. The New York Botanical Garden. New York. p. 1-75.

- Prance, G.T. *et al.* 1975. Revisão taxonômica das espécies amazônicas de Rhizophoraceae. *Acta Amaz.* 5(1): 5-22.
- Prance, G.T. *et al.* 1976. Inventário florestal de um hectare de mata de terra firme km 30 da estrada Manaus-Itacoatiara. *Acta Amaz.* 6(1): 9-27.
- Proença, C. 1990. A revision of *Siphoneugena* Berg. *Edinb. J. Bot.* 47(3): 239-271.
- Queiroz, L.P. *et al.* 1999. A revision of the genus *Moldenhauera* Schrad. (Leguminosae-Caesalpinioideae). *Kew Bull.* 54(4): 817-852.
- Rao, A.S. 1956. A revision of *Rauvolfia* with particular reference to the American species. *Ann. Miss. Bot. Gard.* 3(43): 253-354.
- Reitz, R.; Klein, R.M. & Reis, A. 1983. Projeto Madeira do Rio Grande do Sul. *Sellowia* 34-35: 1-525.
- Renner, S.S. 1989. Systematics studies in the Melastomataceae: *Bellucia*, *Loreya*, *Macairea*. *Mem. New York Bot. Gard.* 50: 1-95.
- Reynel, C. 1995. Systematics of neotropical *Zanthoxylum* (Rutaceae) with an account on the wood anatomy of the genus. 657p.
- Ribeiro, J.E.L.S.; Hopkins, M.J.G.; Vicentini, A.; Sothers, C.A.; Costa, M.A.S.; Brito, J.M.; Souza, M.D.A.; Martins, L.H.P.; Lohmann, L.G.; Assunção, P.A.C.L.; Pereira, E.C.; Silva, C.F.; Mesquita, M.R.; Procópio, L.C. 1999. *Flora da Reserva Ducke: guia de identificação das plantas vasculares de uma floresta de terra-firme na Amazônia central*. Manaus: INPA. 799p.
- Rizzini, C.T. 1961. Clitorieae Brasilienses (Leguminosae). *Arch. Jard. Bot. Rio de Janeiro* 17: 171-198.
- Rizzini, C.T. & Mattos Filho, A. Sobre *Luetzelburgia*. *Arch. Jard. Bot. Rio de Janeiro*.
- Robinson, H. 1991. Two new species of *Stiffia* with notes on relationships of the genus (Asteraceae: Mutisieae). *Syst. Bot.* 16(4): 685-692.
- Robson, N.K.B. 1990. Two new species and a new combination in *Vismia* (Guttiferae-Hypericoideae). *Ann. Miss. Bot. Gard.* 77(2): 410-411.
- Rodrigues, W. 1974. Subsídios para o estudo das Leguminosae da Amazônia. *Acta Bot. Amaz.* 4(2): 7-13.
- Rodrigues, W.A. 1980. Revisão taxonômica das espécies de *Virola* Aublet (Myristicaceae) do Brasil. *Acta Amaz.* 10(1), supl. 1: 1-127.
- Rodrigues, W.A. & Lima, H.C. 1989. Notas sobre os gêneros *Paloue* Aublet e *Paloveopsis* R.S.Cowan (Leguminosae: Caesalpinioideae) no Brasil. *Acta Amaz.* 19: 147-155.
- Rodrigues, W.A. & Mattos, N.F. 1980. *Hymenolobium discolor* W.Rodrigues & N.Mattos, nova espécie de Leguminosae da Amazônia. *Acta Amaz.* 10(4): 743-745.
- Roe, K.E. 1972. A revision of *Solanum* Section *Brevantherum* (Solanaceae). *Brittonia* 24(3): 239-278.
- Rogers, D.J. 1951. A revision of *Stillingia* in the New World. *Ann. Miss. Bot. Gard.* 38(3): 207-259.

- Rogers, D.J. & Appan, S.G. 1973. *Manihot* - Manihotoides (Euphorbiaceae). In: *Fl. Neotr. Monogr.* 13. The New York Botanical Garden. New York. p. 1-272.
- Rogers, G.K. 1984. *Gleasonia*, *Henriquezia* and *Platycarpum* (Rubiaceae). In: *Fl. Neotr. Monogr.* 39. The New York Botanical Garden. New York. p. 1-135.
- Rohwer, J. 1982. A taxonomic revision of the genera *Seguieria* Loefl. and *Gallesia* Casar. *Mitt. Bot. Staatssamml. München* 18: 231-288.
- Rohwer, J.G. 1986. Prodrômus einer Monographie der Gattung *Ocotea* Aubl. (Lauraceae) sensu lato. *Mitt. Inst. Allg. Bot. Hamburg* 20 Band.
- Rohwer, J.G. 1988. The genera *Dicypellium*, *Phyllostemonodaphne*, *Systemonodaphne* and *Urbanodendron* (Lauraceae). *Bot. Jahrb. Syst.* 110(2): 157-171.
- Rohwer, J.G. 1993. *Nectandra* (Lauraceae). In: *Fl. Neotr. Monogr.* 60. The New York Botanical Garden. New York. p. 1-332.
- Rohwer, J.G., Richter, H.G. & van der Werff, H. 1991. Two new genera of Neotropical Lauraceae and critical remarks on the generic delimitation. *Ann. Miss. Bot. Gard.* 78(2): 388-400.
- Romão, G.O. 2003. *Flora da Serra do Cipó*: Ericaceae. Dissertação de Mestrado. Inst. Bioc., Univ. de São Paulo. São Paulo.
- Romero, R. & Goldenberg, R. 1999. A new species of *Miconia* (Melastomataceae) from Serra da Canastra National Park, Minas Gerais, Brazil. *Novon* 9(1): 98-100.
- Rossi, L. 1997. *Revisão Taxonômica das Espécies da Família Thymelaeaceae do Brasil*. Tese de Doutorado. Inst. Bioc., Univ. São Paulo. São Paulo.
- Rudd, V.E. 1965. The American species of *Ormosia* (Leguminosae). *Contr. U. S. Nat. Herb.* 32(5): 279-379.
- Rudd, V.E. 1981. Two new species of *Paramachaerium* (Leguminosae) and a brief resume of the genus. *Brittonia* 33(3): 435-440.
- Sanders, R.W. 1984. Provisional synopsis of the species and natural hybrids in *Duranta* (Verbenaceae). *Sida* 10(4): 308-318.
- Santin, D.A. 1989. *Revisão taxonômica do gênero Astronium Jacq. e revalidação do gênero Myracrodruon Fr. Allem. (Anacardiaceae)*. Dissertação de mestrado. Inst. de Biologia, Univ. Estadual de Campinas. Campinas.
- Santos, I.S. & Peixoto, A.L. 2001. Taxonomia do gênero *Macropelplus* Perkins (Monimiaceae, Monimioideae). *Rodriguésia* 52(81): 65-105.
- Sartori, A.L.B. & Tozzi, A.M.G.A. 2004. Revisão taxonômica de *Myrocarpus* Allemão (Leguminosae, Papilionoideae, Sophoreae). *Acta Bot. Bras.* 18(3): 401-699.
- Sastre, C. 1995. Novelty in the Neotropical genus *Ouratea* Aubl. (Ochnaceae). *Novon* 5: 193-200.
- Schultes, R.E. 1990. Malaysian Rubber Res. & Developm. Board Monogr., p. 28.
- Secco, R.S. 1990. Revisão dos gêneros *Anomalocalyx* Ducke, *Dodecastigma* Ducke, *Pausandra* Radlk., *Pogonophora* Miers ex Benth. e *Sagotia* Baill. (Euphorbiaceae-Crotonoideae) para a América do Sul. *Bol. Mus. Par. Emílio Goeldi Publ. Avulsa.* 133 p.

- Secco, R.S. 1997. *Revisão taxonômica das espécies neotropicais da tribo Alchorneae (Euphorbiaceae)*. Tese de doutorado. Inst. Bioc., Univ. de São Paulo. São Paulo.
- Secco, R.S. 2001. Notas adicionais sobre a taxonomia e a distribuição geográfica dos gêneros *Alchorneopsis* Müll.Arg., *Cleidion* Blume e *Polyandra* Leal (Euphorbiaceae - Acalyphoideae). *Acta Bot. Bras.* 15(1): 45-56.
- Secco, R.S. & Silva, S.M.B. 1990. Contribuição à sistemática das Linaceae da Amazônia brasileira. *Bol. Mus. Par. Emílio Goeldi* 6(1): 113-135.
- Secco, R.S. & Webster, G.L. 1990. Materiais para a flora amazônica IX: ensaio sobre a sistemática do gênero *Richeria* Vahl (Euphorbiaceae). *Bol. Mus. Par. Emílio Goeldi, ser. Bot.* 6(2): 141-158.
- Semir, J. 1991. *Revisão taxonômica de Lychnophora Mart. (Compositae)*. Tese de doutorado. Inst. Biologia, Univ. Estadual de Campinas. Campinas.
- Senna-Valle, L. 1989. Espécies de *Sapium* P.Br. (Euphorbiaceae) que ocorrem no estado de Mato Grosso. *Bradea* 5(18): 196-204.
- Silva, A.S.L. 1990. Contribuição ao estudo sistemático das espécies do gênero *Acacia* Mill. (Leguminosae-Mimosoideae) ocorrentes na Amazônia Brasileira. *Bol. Mus. Par. Emílio Goeldi, sér. Bot.* 6(2): 159-226.
- Silva, M.F. 1976. Revisão taxonômica do gênero *Peltogyne* Vog. (Leguminosae-Caesalpinioideae). *Acta Amaz.* 6(1): 1-61.
- Silva, M.F. 1986. *Dimorphandra* (Caesalpiniaceae). In: *Fl. Neotr. Monogr.* 44. The New York Botanical Garden. New York. p. 1-127.
- Silva, M.F. & Correia, L.M.M. 1994. Leguminosas da Amazônia Brasileira III - *Heterostemon* Desf. (Leguminosae-Caesalpinioideae). *Bol. Mus. Par. Emílio Goeldi* 10(2): 189-220.
- Silva, M.F. & Graham, A. 1980. *Jacqueshuberia* Ducke (Leguminosae-Caesalpinioideae), um gênero exclusivamente neotropical. *Acta Amaz.* 10(4): 747-754.
- Silva, N.M.F. & Valente, M.C. 1996. *Flora dos Estados de Goiás e Tocantins*, Coleção Rizzo: Combretaceae. v. 19.
- Silva, T.R.S. 1999. *Redelimitação e revisão taxonômica do gênero Lantana L. (Verbenaceae) no Brasil*. Tese de doutorado. Inst. Bioc., Univ. de São Paulo. São Paulo.
- Skorupa, L.A. & Pirani, J.R. 2004. A new species of *Pilocarpus* (Rutaceae) from Northern Brazil. *Brittonia* 56: 147-150.
- Sleumer, H. 1954. Proteaceae americanae. *Bot. Jahrb. Syst.* 76: 139-211.
- Sleumer, H. 1967. Monografia *Clethracearum*. *Bot. Jahrb. Syst.* 87(1): 36-116.
- Sleumer, H. 1968. Die Gattung *Escallonia* (Saxifragaceae). *Verh. Kon. Ned. Akad. Wetensch., Afd. Natuurk.* 58: 1-146.
- Sleumer, H. 1980. Flacourtiaceae. In: *Fl. Neotr. Monogr.* 22. The New York Botanical Garden. New York. p. 1-499.
- Sleumer, H.O. 1984. Olacaceae. In: *Fl. Neotr. Monogr.* 38. The New York Botanical Garden. New York. p. 1-197.

- Smith, A.C. 1940. The American species of Hippocrateaceae. *Brittonia* 3: 341-555.
- Smith, A.C. 1943. The American species of *Drimys*. *J. Arn. Arbor.* 24(1): 1-33.
- Smith, A.C. & Woodhouse, R.P. 1937. The American species of Myristicaceae. *Brittonia* 2: 393-510.
- Smith, L.B. & Downs, R.J. 1966. Solanáceas. In: Reitz, R. (ed.). *Flora Illustrada Catarinense*.
- Smith, L.B. & Fernández-Pérez, A. 1954. Revisio Violacearum Colombiae. *Caldasia* 6 (28): 83-182.
- Smith-Jr., C.E. 1954. The New World species of *Sloanea* (Elaeocarpaceae). *Contr. Gray Herb.* 175: 1-114.
- Soares-Silva, L.H. & Mansano, V.F. 2004. A new species of *Exostyles* (Leguminosae, Papilionoideae, Swartzieae s.l.), from Paraná State, Brazil. *Bot. Journ. Linn. Soc.* 146: 103-106.
- Sobral, M. 1988. Duas novas Mirtáceas do litoral da Bahia, Brasil. *Napaea* 4: 11-15.
- Sobral, M. 1993. Sinopse de *Myrciaria* (Myrtaceae). *Napaea* 9: 13-41.
- Sobral, M. 2003. A família Myrtaceae no Rio Grande do Sul. Coleção Fisionomia Gaúcha. Editora Unisinos. 215p.
- Somner, G.V. & Ferrucci, M.S. 2004. A new species of *Cupania* sect. *Trigonocarpus* (Sapindaceae) from Brazil. *Bot. Journ. Linn. Soc.* 146: 217-221.
- Souza, J.P. 2002. *Levantamento das espécies de Hybanthus Jacq. (Violaceae) do Brasil*. Dissertação de Mestrado. Instituto de Biociências, Universidade de São Paulo. São Paulo.
- Souza, J.P. & Souza, V.C. 2002. Violaceae in Wanderley, M.G.L. et al., Flora Fanerogâmica do Estado de São Paulo. São Paulo. Vol. 2. FAPESP/Hucitec. 353-363.
- Stace, C.A. 1968. A revision of the genus *Thiloa* (Combretaceae). *Bull. Torr. Bot. Club* 95(2): 156-165.
- Stafleu, F.A. 1948. A monograph of the Vochysiaceae I. *Salvertia* and *Vochysia*. *Recueil Trav. Bot. Neerl.* 41: 397-540.
- Stergios, B. 1996. Contributions to South American Caesalpinaceae. II. A taxonomic update of *Campsiandra* (Caesalpinieae). *Novon* 6: 434-459.
- Steyermark, J.A. & Bunting, G.S. 1975. Revision of the genus *Froesia* (Quinaceae). *Brittonia* 27: 172-178.
- Steyermark, J.A. & Liesner, R. 1983. Revision of the genus *Sterigmapetalum* (Rhizophoraceae). *Ann. Miss. Bot. Gard.* 70: 179-193.
- Struwe, L. & Albert, V.A. 2004. A monograph of neotropical *Potalia* Aublet (Gentianaceae: Potalieae). *Systematic Botany* 29(3):670-701.
- Swart, J.J. 1942. A monograph of the genus *Protium* and some allied genera. *Rec. Trav. Bot. Neerl.* 71.
- Taroda, N. 1984. A revision of the Brazilian species of *Sterculia*. *Notes Roy. Bot. Gard. Edinburgh* 42(1): 121-129.

- Taroda, N. 1984. Taxonomic studies on Brazilian species of *Cordia* L. (Boraginaceae). Ph. D. thesis.
- Tavares, A.S. 1989. Uma nova espécie do gênero *Cynometra* L. (Caesalpiniaceae) para a Amazônia. *Acta Amaz.* 19: 155-157.
- Taylor, C.M. 1992. Revision of *Cosmibuena* (Rubiaceae). *Ann. Miss. Bot. Gard.* 79: 886-900.
- Taylor, C.M. 1994. Revision of *Hillia* (Rubiaceae). *Ann. Miss. Bot. Gard.* 81: 571-609. The New York Botanical Garden. [www.nybg.org](http://www.nybg.org). Acessado em 15 de novembro de 2004.
- Thomas, W.W. 1984. A new species of Simaba (Simaroubaceae) from Pará, Brazil, with a key to the species north of the Amazon river. *Brittonia* 36: 244-246
- Thomas, W.W. 1988. A conspectus of Mexican and Central American *Picramnia* (Simaroubaceae). *Brittonia* 40(1): 89-105.
- Thomas, W.W. 1997. A new species of *Picramnia* (Picramniaceae) from the Atlantic coastal forest of Southern Bahia, Brazil. *Brittonia* 49: 380-383.
- Todzia, C.A. 1988. Chloranthaceae. In: *Fl. Neotr. Monogr.* 48. The New York Botanical Garden. New York. p. 1-139.
- Todzia, C.A. 1989. A revision of *Ampelocera* (Ulmaceae). *Ann. Miss. Bot. Gard.* 76(4): 1087-1102.
- Tozzi, A.M.G.A. 1989. *Estudos taxonômicos dos gêneros Lonchocarpus Kunth e Deguelia Aubl. no Brasil*. Tese de doutorado. Inst. de Biologia, Univ. Estadual de Campinas. Campinas.
- Tozzi, A.M.G.A. 1994. Espécies novas de *Deguelia* Aubl. (Leguminosae-Papilionoideae-Milletieae). *Revta. Bras. Bot.* 17(1): 45-52.
- Turner, B.L. & Mendenhall. 1993. A revision of *Malvaviscus* (Malvaceae). *Ann. Miss. Bot. Gard.* 80(2): 439-457.
- van den Berg, M.E. 1975. Nota prévia sobre uma Guttiferae nova da Amazônia. *Acta Amaz.* 5(3): 285.
- van den Berg, M.E. 1979. Revisão das espécies brasileiras do gênero *Rheedia* L. (Guttiferae). *Acta Amaz.* 9(1): 43-74.
- van der Werff, H. 1987. A revision of *Mezilaurus* (Lauraceae). *Ann. Miss. Bot. Gard.* 74: 153-194.
- van der Werff, H. 1993. A revision of the genus *Pleurothyrium* (Lauraceae). *Ann. Miss. Bot. Gard.* 80(1): 39-118.
- van der Werff, H. 1997. A new species of *Ocotea* (Lauraceae) from French Guiana. *Brittonia* 49(2): 189-191.
- van der Werff, H. 1997. *Sextonia*, a new genus of Lauraceae from South America. *Novon* 7: 436-439.
- van der Werff, H. 2002. A synopsis of *Persea* (Lauraceae) in Central America. *Novon* 12(4): 575-586.

- van der Werff, H. & Richter, H.G. 1985. *Caryodaphnopsis* Airy-Shaw (Lauraceae), a genus new to the Neotropics. *Syst. Bot.* 10(2): 166-173.
- Vattimo, I. O gênero *Ocotea* Aubl. (Lauraceae) no sul do Brasil. II. Espécies dos estados de São Paulo e Rio Grande do Sul. *Arch. Jard. Bot. do Rio de Janeiro* 23: 199-228.
- Vaz, A.M.S.F. 2001. *Taxonomia de Bauhinia sect. Pauletia (Leguminosae: Caesalpinioideae: Cercideae)*. Tese de Doutorado. Inst. de Biologia, Univ. Estadual de Campinas. Campinas.
- Vaz, A.M.S.F. 2003. Flora dos Estados de Goiás e Tocantins, Coleção Rizzo: Leguminosae Caesalpinioideae: Cercideae: Bauhinia. Ed. UFG.
- Vaz, A.M.S.F. & Andreato, R.H.P. 1981. *Diatenopteryx grazielae* Vaz & Andreato, uma nova espécie de Sapindaceae da Bahia. *Bradea* 3(17): 123-128.
- Vaz, A.M.S.F. & Tozzi, A.M.G.A. 2003. *Bauhinia* ser. *Cansenia* (Leguminosae: Caesalpinioideae) no Brasil. *Rodriguésia* 54(83): 55-143.
- Vieira, C.M. & Silva, A.G. 1994. Clusiaceae. In: Lima, M.P.M. & Guedes-Bruni, R.R. *Reserva Ecológica de Macaé de Cima, Nova Friburgo, RJ. Aspectos Florísticos das espécies Vasculares*, v. 1: 113-127.
- Vieira, M.G.G. 1990. Contribuição ao estudo taxonômico do gênero *Crudia* Schreber (Caesalpinioideae) na Amazônia Brasileira. *Bol. Mus. Par. Emilio Goeldi*, sér. Bot. 6(1): 83-112.
- W3TROPICOS. Missouri Botanical Garden.  
<http://mobot.mobot.org/W3T/search/vast.html>. Acessado em 15 de novembro de 2004.
- Webster, G. L. 1979. A revision of *Margaritaria* (Euphorbiaceae). *J. Arn. Arb.* 60(4): 403-443.
- Webster, G.L. 1984. *Jablonskia*, a new genus of Euphorbiaceae from South America. *Syst. Bot.* 9(2): 229-235.
- Webster, G. L. 1992. A revision of *Astrocasia*. *Syst. Bot.* 17(2): 311-323.
- Webster, G.L. 2003. A synopsis of *Phyllanthus* section *Nothoclema* (Euphorbiaceae). *Lundellia* 6:19-35.
- Whalen, M.D. 1984. Conspectus of species groups in *Solanum* subgenus *Leptostemonum*. *Gentes Herb.* 12(4): 179-282.
- Woodgyer, E.M. et al. 2003. Melastomataceae. In: Zappi, D. et al. *Lista das plantas vasculares de Catolés, Chapada Diamantina, Bahia, Brazil*. *Bol. Bot. Univ. São Paulo* 21(2): 345-398.
- Wurdack, J.J. 1962. Melastomataceae of Santa Catarina. *Sellowia* 14: 109-218.
- Wurdack, J.J. 1980. Flora of Ecuador: Melastomataceae.
- Wurdack, J.J. 1981. Three species of *Tibouchina* (Melastomataceae) from Bahia, Brazil. *Brittonia* 33(3): 304-308.
- Wurdack, J.J. 1999. Melastomatoideae. In: Gorts-van Rijn, A.R.A. (ed.). *Flora of the Guianas*. Melastomataceae.

- Yakovlev, G.P. 1976. A survey of the genera *Zollernia* Nees and *Lecointea* Ducke (Fabaceae). *Bot. Zhurn. U. S. S. R.* 61(9): 1304-1308.
- Yasuda, S. 1996. A new species of *Ocotea* (Lauraceae) from the Serra do Espinhaço, Brazil. *Novon* 6(4): 484-486.
- Yuncker, T.G. 1972. The Piperaceae of Brazil I: *Piper* - Group I, II, III, IV. *Hoehnea* 2: 19-366.
- Yuncker, T.G. 1973. The Piperaceae of Brazil II: *Piper* - Group V, *Ottonia*, *Potomorphe*, *Sarcorhachis*. *Hoehnea* 3: 29-284.
- Zappi, D. 1995. Guttiferae In: Stannard, B. (ed.) *Flora of the Pico das Almas, Chapada Diamantina, Bahia, Brazil*. Royal Botanic Gardens, Kew. p. 329-333.
- Zappi, D. 2003. Revision of *Rudgea* (Rubiaceae) in Southeastern and Southern Brazil. *Kew Bull.* 58: 513-596.
- Zappi, D.C. et al. 2003. Lista das plantas vasculares de Catolés, Chapada Diamantina, Bahia, Brasil. *Bol. Bot. Univ. São Paulo.* 21(2): 345-398.
- Zarucchi, J.L. 1987. A revision of the tribe Ambelanieae (Apocynaceae-Plumerioideae). Series of revisions of Apocynaceae part XXIV. *Agric. Univ. Wageningen Papers* 87(1): 1-106.
- Zickel, C.S & Leitão Filho, H.F. 1993. Revisão taxonômica de *Lamanonia* Vell. (Cunoniaceae). *Revta. Bras. Bot.* 16(1): 73-91.

### Addendum

- Berg, C.C. 2004. Two new species of *Pourouma* (Cecropiaceae) from South America. *Brittonia* 56: 255-259
- Grosso Jr., M. & Pirani, J.R. 2002. Aquifoliaceae. In: Wanderley, M.G.L. et al. *Flora Fanerogâmica do Estado de São Paulo*. Vol. 2. FAPESP/Hucitec. 31-37.
- Lima, L.R. & Pirani, J.R. 2002. Caricaceae. In: Wanderley, M.G.L. et al. *Flora Fanerogâmica do Estado de São Paulo*. Vol. 2. FAPESP/Hucitec. 79-82.
- Mendonça, J.O. & Amaral Jr., A. 2002. Erythroxylaceae. In: Wanderley, M.G.L. et al. *Flora Fanerogâmica do Estado de São Paulo*. Vol. 2. FAPESP/Hucitec. 107-119.
- Rodrigues, W.A. 2002. Myristicaceae. In: Wanderley, M.G.L. et al. *Flora Fanerogâmica do Estado de São Paulo*. Vol. 2. FAPESP/Hucitec. 209-212.
- Bittrich, V. & Weitzman, A.L. 2002. Theaceae. In: Wanderley, M.G.L. et al. *Flora Fanerogâmica do Estado de São Paulo*. Vol. 2. FAPESP/Hucitec. 323-326.
- Kiyama, C.Y. & Bianchini, R.S. 2003. Rosaceae. In: Wanderley, M.G.L. et al. *Flora Fanerogâmica do Estado de São Paulo*. Vol. 3. FAPESP/RiMA. 285-293.
- Souza, B.M. & Esteves, G.L. 2002. Tiliaceae. In: Wanderley, M.G.L. et al. *Flora Fanerogâmica do Estado de São Paulo*. Vol. 2. FAPESP/Hucitec. 331-341.
- Lima, M. P. M. de & Guedes-Bruni, R. R. 1994 (organizadoras). *Reserva Ecológica de Macaé de Cima, Nova Friburgo, RJ: Aspectos flor[ísticos das espécies vasculares, v. 1. Jardim Botânico do Rio de Janeiro, RJ. 404 p.*

Lima, M. P. M. de & Guedes-Bruni, R. R. 1996 (organizadoras). Reserva Ecológica de Macaé de Cima, Nova Friburgo, RJ: Aspectos flor[ísticos das espécies vasculares, v. 2. Jardim Botânico do Rio de Janeiro, RJ. 465 p.

Pequi, Pesquisa e Conservação do Cerrado. [www.pequi.org.br](http://www.pequi.org.br). Acessado em novembro/2004.

Floristics and Economic Botany of Acre, Brazil. [www.nybg.org/bsci/acre/title.html](http://www.nybg.org/bsci/acre/title.html). Acessado em novembro/2004.

Listagem de espécies arbóreas ocorrentes na Mata Atlântica. [www.bdt.fat.org.br/mata.atlantica/flora/especies](http://www.bdt.fat.org.br/mata.atlantica/flora/especies). Acessado em novembro/2004.

Diversidade , dinâmica e conservação em florestas do Estado de São Paulo: 40 ha de parcelas permanentes. [www.lerf.esalq.usp.br/parcelas](http://www.lerf.esalq.usp.br/parcelas). Acessado em novembro/2004.

### **Annex 3 – Short note on Table 1**

#### FRA 2005 – Brazil Short Note on Table 1

Among all tables in FRA2005, Table 1 (Extent of forest and other wooded land) assumes relevant importance once it refers to the estimate country forested area and also is the main base for calculations in other tables. For large extension countries like Brazil, Table 1 is an additional challenge because not always there will be available recent information, produced with similar methodologies, or the available surveys were made in the same year and on a national scale.

This note aims at relating the main procedures adopted to fill up Table 1 for Brazil Country Report FRA2005, as the report has been made by a different team from FRA2000, using different methodologies, which may eventually need clarification on data presented in FRA2005.

The FRA2005 Brazil Country Report has been made by a collaboration group of people from 10 Brazilian institutions, most of them being researchers. Differently from previous years, the intention was to form a team with expertise in the different themes of FRA2005, therefore stimulating a permanent group engaged with information on the Brazilian forest resources. The team counted with researchers from different biomes and background, and led the procedures to project areas backward and forward in Table 1, as well as produced estimates for Tables 6 and 7 (Biomass stocks and Carbon reserves) based on studies in Brazil.

The main difference between the procedures adopted in FRA2005 is that area estimates were made based on available information from a unique map, instead of on information from different published documents in the last decades, as in FRA2000. Additionally, the FRA2005 team opted for calculate forested areas for each biome, instead of use intermediary estimates for states or region as in FRA2000.

The procedures to generate the estimates of forested areas were led by a researcher from IBGE (Geography and Statistics Brazilian Institute), but also have received contributions and criticism from the whole team engaged in the FRA2005 Brazil Country Report. Forested areas were calculated from a main database, the national map of vegetation published by IBGE in 2004. The map has a scale of 1:5000.000 and it was available in digital form, which made possible to calculate areas of each forest typology considered adequate to each FAO definition and category.

The IBGE vegetation map comprises data from surveys made in different years. Therefore, a first step was to find out the survey dates (average) used to compose the whole map, and then to project the areas up to a common (FRA) year (2000) using available deforestation rates for each biome.

The correspondences between national and FAO definitions and categories were made by analysing the description of IBGE vegetation classes in order to identify which of

them could be included in FAO categories. These analysis were made by the researcher from IBGE and then validated by the whole FRA2005 team. They are described in the Country Report (see Annex I). In some cases the team uneasily had to decide, based on the available database, what could be the best correspondance between national and FAO categories. This was the case for Table 4, where most of the area was assigned to Primary category because there was no clear IBGE category representing Natural altered including tropical forests of Amazonia. However it was considered that in most of these areas the ecological processes are not significantly disturbed after selective logging.

The changes in forested areas for the 3 different years of FRA2005 (1990, 2000 and 2005) were resulted from projections backward and forward based on deforestation rates available for each biome. Details about the procedures and rates used are also described in the country report (item 6.4) for each biome. For example, in Amazonia biome's case, deforestation rates provided by INPE (Spatial Research National Institute) in the last 15 years were used. However, because INPE results are for the Legal Amazon region, whose area is bigger than Amazonia biome and because of that includes some are of (parts of Mato Grosso, Tocantins and Maranhão, we estimate the correspondent area to be discounted based on the States proportional area of Cerrado according to IBGE Biomes. In the Cerrado case, although a unique annual rate of deforestation (1.5%) was available, for those areas covered by INPE we used Prodes deforestation estimates counting for Cerrado biome. Furtermore, when estimates were made for stock, biomass and carbon, the different forest types existings within each biome were taken into account to make the calculations.

Brasilia-DF/Brazil, October 2005.