



**F.F.T.**

**FUNDAÇÃO FLORESTA TROPICAL**

**FUNDAÇÃO FLORESTA TROPICAL ACTIVITIES  
TOWARDS SUSTAINABLE MANAGEMENT  
OF THE AMAZONIAN FOREST**

**1994 - 1999**

Cover page: Secondary road constructed with reduced impact harvesting techniques,  
used for harvest transport since 1996.

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May 2000

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## INTRODUCTION

The Fundação Floresta Tropical – FFT, is a non-governmental, non-profit organization based in Belém, Pará since 1994 and a subsidiary of the Tropical Forest Foundation - TFF, also a non-governmental organization, based in the state of Virginia (USA). One of the major objectives of the Foundation is to promote and disseminate sustainable management of tropical forests, principally in Brazilian Amazonia, through training of personnel and dissemination of information that contribute towards the sustainable use of forest resources, especially timber.

FFT, working in conjunction with loggers to implement Forest Management and Reduced Impact Logging – FM-RIL models, has developed an educational program that demonstrates both to timber companies as well as governmental and non-governmental institutions that these practices are efficient, economically feasible and that forestry must be done sustainably on the long term in order to ensure ecological balance and maintain the diversity of the forest. Over the years, FFT has carried out an intense program of training foresters, middle-level technicians and specialized equipment operators, as well as research directly applied to improving FM-RIL, disseminated through its extension program.

FFT's staff is made up of foresters, an economist, agricultural and forestry technicians, specialized equipment operators and personnel trained in traditional, community-based and/or small-scale forest products and activities. Furthermore, there are permanent consultants in areas including environmental legislation, tropical silviculture, workers safety etc.

This document briefly reports on the Foundation's activities for the last five years.

Johan Zweede  
Fundação Floresta Tropical - Director

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## ACKNOWLEDGMENTS

Fundação Floresta Tropical wishes to acknowledge the collaboration of the following institutions that have been fundamental in contributing towards the implementation of sustainable management models and training courses on low impact logging techniques: ITTO, USAID-BRAZIL, USAID-LAC, USFS, IITF, Caterpillar do Brasil Ltda, FORD Foundation, TINKER Foundation, MacArthur Foundation, the State of Mato Grosso (FEMA/PRODEAGRO), CIFOR, SUNY-WWF and STIHL Ltda. Moreover, we wish to thank our partner institutions for their contributions, CIKEL Brasil Verde S.A., Embrapa Eastern Amazonia, AMAZON, IBAMA, JARCEL S.A. and IPAM. Of equal importance has been the volunteer work provided by José Natalino Silva, Geoffrey Blate, Euclides Reckziegel, Roberto Bauch, Adalberto Veríssimo, Elisabeth van den Berg and Syglea Lopes. Lastly we wish to thank Carlos Fernando Guedelha Leão, José Carlos Damasceno and José Antonio Sepeda for their dedication to the Foundation while on its staff.



## ESTABLISHMENT OF FOREST MANAGEMENT AND REDUCED IMPACT LOGGING - FM-RIL MODELS

The models are conjunction with forestry projects (timber companies, small holders and communities) in areas of private, community and public forests, with the support of governmental and non-governmental institutions<sup>1</sup> as well as the forest equipment industry. FFT believes that there is no single correct form of forest management: **no off-the-shelf recipe for how to manage the forest**. Thus, when implementing and developing these models, the different types of forest and industry are considered, as well as the economic situation of the regions and the various consumer markets. Based on these parameters, FFT has developed eleven models of FM-RIL (Fig. 1): two in Mato Grosso (municipalities of Cláudia and Marcelândia) and nine in Pará (municipalities of Paragominas, Portel and Santarém – Tapajós National Forest). These models are used for training purposes as well as to demonstrate the differences and benefits of RIL in comparison to conventional logging as done in these regions.



Fig. 1 - Location of the FM-RIL projects and demonstrative models implemented by FFT in Brazilian Amazonia.

<sup>1</sup>Teaching, research, extension and environmental monitoring.

To FFT, sustainable forest management - SFM and Reduced Impact Logging must be based on specific knowledge of the forest to be managed, the planning of all activities to be carried out, the use of trained and qualified personnel as well as suitable techniques and technology. Lastly, there must be continuous monitoring and care of the remaining stand, in order to ensure future harvests and lower costs, impacts and damage (Fig. 2).

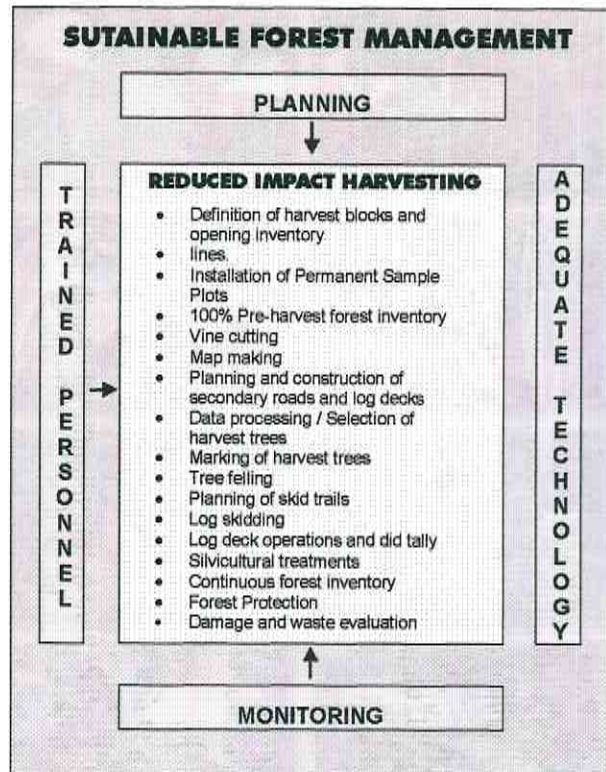


Fig. 2 - SFM principles and their relation to reduced impact logging activities

Reduced Impact Logging may be considered the first and foremost silvicultural treatment the forest is subjected to. It must therefore be done so as to provide a remaining stand (post harvest) that will enable future harvests. RIL is based on: 1- pre-harvest activities; 2-logging activities; 3- post-harvest activities. This division is only organizational and does not mean that the activities are carried out in the same sequence (Fig. 3).

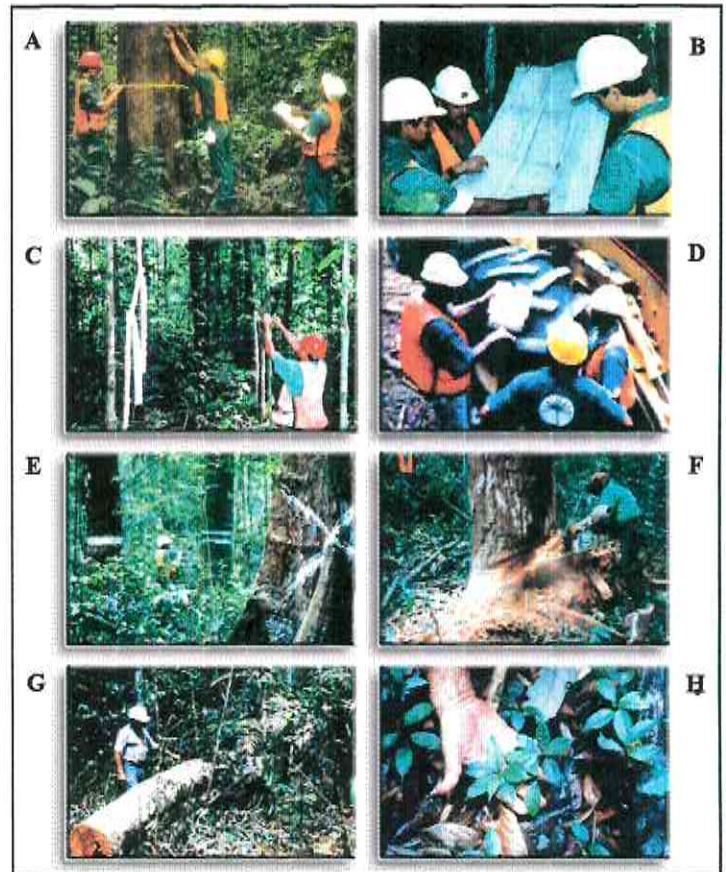


Fig. 3 - RIL activities: a,b) pre-harvest activities; c,d) planning activities; e,f) logging activities; g,h) post-harvest activities.



## RESEARCH CONCLUDED AND UNDERWAY

FFT's research is based on the sustainability of its FM-RIL demonstration models, and in particular innovative studies in forestry operations. FFT itself has conducted research and tested the applicability of all models implemented in terms of management activities (Table 1). This research is directly linked to innovating Reduced Impact Logging activities and the monitoring and managing of the residual forest.

TABLE 1 - Research applied to FM-RIL operational activities, conducted by FFT.

DESCRIPTION	STATUS
RIL operational activities	
100% INVENTORY	
• All species, DBH ≥ 35cm	Concluded*
• All species, DBH ≥ 45cm	Concluded*
• Commercial and potentially commercial species, DBH ≥ 30cm	Concluded*
• Commercial species and trees, DBH out (>45cm)	Concluded*
• Commercial and potentially commercial species, DBH ≥ 45cm	Concluded*
• Commercial and potentially commercial species, DBH ≥ 35cm and Trunk quality 1 and 2.	Concluded*
• Commercial and potentially commercial species, DBH ≥ 35cm	Concluded*
MARKING TREES FOR HARVEST, FUTURE HARVEST AND SEEDBEARERS	
• Marking tree before harvest	Concluded*
• No marking of trees	Concluded*
PLANNING SKID TRAIL	
• Before harvest	Concluded*
• After harvest	Concluded*

\*Preparing for publication

In 1997 FFT initiated a research project on the **financial costs and benefits of reduced impact forest management compared to conventional forest management in Eastern Amazonia**. The study sites were the Working Units-WU's of the FM-RIL model, located on the Cauaxi ranch. This case study provides a comparison between costs and revenues of an FM-RIL system and Conventional Forest Management and Logging – FM-CL in the region of Paragominas (Fig. 4). The study focuses on financial, operational and technical aspects of both systems. Although the study does not directly delve into biological or ecological questions, key parameters that will affect future forest productivity

were measured. These parameters represent future benefits of using FM-RIL. Later, we intend to expand research to other areas, such as modifying Forest Management and Reduced Impact Logging methods to optimize costs, considering characteristics of the type of forest, markets for purchase and sale of timber and scale of operations. The results of this research are being published in a scientific journal. The costs of FM-RIL are lower than FM-CL, with the added benefit that FM-RIL maintains the forest in conditions for future harvests, which is not the case with FM- CL.

FFT also conducts research in partnership with other institutions. Much of this research is of fundamental importance in contributing to the development of SFM (Table 2). Furthermore, other institutions conduct research in the areas where the FFT models are implemented (Table 3). These studies deal with a variety of themes related to SFM and the Environment.

TABLE 2 - Research applied to development of sustainable forest management, conducted by FFT.

Description	Status
<b>Research</b>	
• Thinning of crowns by ringing.	Underway
• Comparative study of post-harvest damage, in managed and unmanaged forests.	Underway
• Comparative study of the wasted timber in CL x RIL.	Underway
• Costs and benefits of the Reduced Impact Logging compared to conventional logging practices in Brazilian Amazonia.	Underway
• Comparative study of the precision of different techniques for estimating trunk height during forest inventory.	Underway
• Adaptation of techniques for routing water courses during road, drain and bridge construction).	Underway
• Study of growth and succession in forests: natural, conventionally logged and those logged using reduced impact techniques using permanent plots)	Underway
• Implementation of enrichment planting in areas of low timber potential of harvested forests.	Underway
• Skidding tests of logs over broken terrain.	Underway
• Adaptation of log skidding systems for communities and small holders, using trucks.	Underway
• Planning and development of reduced impact logging techniques in rough terrain.	Underway



Logging Characteristics	(A) FM-RIL	(B) FM-CL
Trees felled	331 trees	425 trees
Trees not skidded	1 tree	16 trees
Trees skidded	328 trees	397 trees
Volume logged	25.32 m <sup>3</sup> /ha	26.23 m <sup>3</sup> /ha
Timber wasted	1.92 m <sup>3</sup> /ha	6.05 m <sup>3</sup> /ha
<b>Soil affected</b>		
Secondary roads	0.65%	1.35%
Log decks	0.63%	1.05%
Skid trails	3.90%	7.66%
<b>Logging Costs</b>	<b>\$13.64/m<sup>3</sup></b>	<b>\$15.68/m<sup>3</sup></b>

Fig. 4 – WU's air view of cutting blocks – a) reduced impact harvest; b) conventional logging.



Table 3 - Research concluded and underway by other partner institutions of FFT.

Description	Status	Institute
• Carbon sequestration in natural forest - logged and control.	Concluded	Winrock
• Use of habitat by <i>Kentropyx calcarata</i> under conventional and reduced impact logging in Eastern Amazonia. (Masters Thesis).	Underway	IPAM
• Study of habitat and elementary behavior of <i>Colleodactylus parker</i> , 1929 (Reptilia: Squamata : Gekkonidae) in logging area.(Initial studies project).	Underway	IPAM
• Ecological and behavioral studies of the <i>Alouatta belzebul</i> monkey (Atelidae, Primates) in logging areas (Masters Thesis).	Underway	IPAM
• Seed germination in six forest species attacked by ants in logging areas.	Underway	IPAM
• Adaptive strategies of tadpoles in areas altered by logging in Eastern Amazonia. (Masters Thesis)	Underway	IPAM
• Logging, impact on fauna - Ants	Underway	IPAM
• Logging, impact on fauna - Amphibians	Underway	IPAM
• Logging, impact on fauna - Birds	Underway	IPAM
• Logging, impact on fauna - Mammals	Underway	IPAM
• Eating habits of hawks ( <i>Harpya harpygia</i> )	Underway	IPAM
• Assessment of impact of logging on amphibians and reptiles	Underway	IPAM
• Utilization of GIS in monitoring logging	Underway	IMAZOM-FFT
• Analysis of the behavior of commercial timber species in managed and unmanaged forests	Underway	Pennsylvania State University
• Planted growth in clearings caused by logging.	Underway	IMAZOM-IPAM-WHRC
• Data collection on logging productivity and costs (Doctoral Thesis).	Concluded	UFPA/NAEA
• Data collection on damage caused by logging (Doctoral Thesis).	Concluded	FCAP-DRESDEN(Germany)
• Micro-environment and flammability of native and logged forests	Underway	IMAZOM-IPAM-Pennsylvania State University
• Research on impact and gaps created by RIL and convention logging as compared to undisturbed forest over time using GIS.	To begin	LBA

There is currently a high demand on the part of forestry and environmental science masters and doctoral degree students, to obtain data and gain access to areas of FM-RIL models implemented by FFT, for preparation of monographs, dissertations and theses.

In general, all research concluded or underway in the areas of FFT models are directly applicable to improving management practices and conservation of the Amazonian forest, be it in the academic, industrial, operational area, or regardless of being in the field of botany, silviculture, ecology, physiology, sociology, anthropology and other areas of science (Fig. 5).





Fig. 5 - Research conducted in the areas of FFT models - a) Enrichment planting in gaps; b) conservation of fauna (ex: *Harpya harpygia*)

## EXTENSION AND TRAINING

In order to disseminate efficiently the results of its projects and research, FFT over time has intensified its extension and training program.

### Courses

FFT training courses are the major tools for dissemination of forest management and Reduced Impact Logging practices. The program receives support from the productive sector<sup>2</sup>, the forestry equipment industry and several other institutions that provide financial support, including: USAID-Brasil; USAID-LAC; USFS; Caterpillar do Brasil Ltda; FORD Foundation; TINKER Foundation; MacArthur Foundation; CIFOR, SUNY-WWF and STIHL Ltda. FFT held 14 FM-RIL management courses in Paragominas-PA, FLONA-Tapajós, Cláudia-MT and Marcelândia-MT, between 1996-1999, to a broad public including student foresters, practitioners, researchers, government agency officials (IBAMA, State

<sup>2</sup> Forest Product Industry, wood workers unions, and other sector associations.

Environmental Secretariats), managers of timber industries and technicians from non-governmental organizations working in community and/or industrial management projects. These courses receive participants from different states in Brazil and other countries within the Amazon region or that have tropical forests. (Table 4). To date, FFT has trained a total of 195 people in sustainable forest management techniques (Table 5 and Fig. 6 and 7). In the period from 1998 to 1999, nine such courses were held with a total of 138 participants, through the project PD 45/97 Rev. 1 (F), sponsored by the International Tropical Timber Organization - ITTO, under the auspices of the Brazilian Institute of the Environment and Natural Renewable Resources – IBAMA. FFT believes that these training courses are contributing towards adoption of FM-RIL practices in Amazonia.

### Internships

Parallel to its program of courses, providing greater integration with institutions that train technical personnel (middle- and higher learning institutions), FFT has been offering internships to forestry students since 1996, and has, to date, received 22 middle- and university-level forestry students (Table 6).

TABLE 4 - Participant institutions of courses held by FFT, to 1999.

	States													
Brazil	PA	AM	MA	RR	RO	AC	SP	BA	MT	PR	RS	AP	Σ	
Timber Industry	8	1	1						2				12	
Equipment Industry											1		1	
Higher learning Institution	1	1				1	2		1				6	
Middle-level learning Institution	1	1								1			3	
Government Research Institution	3			1		1			1				6	
Non-Government Research Institution	6	1			1	1							9	
Professional Assoc.(industry)	1								1				2	
Professional Assoc.(labor)	1								3				4	
OEMA's	1	1	1	1	1	1		1	1			1	9	
Government extension institution	1				1	1							3	
Profissionais autônomos	3				3				2				8	
Subtotal	26	5	2	2	6	5	2	1	11	1	1	1	63	
Abroad	Peru	Venezuela	Colombia	Ecuador	Guyana	Suriname	Ghana	Σ						
Timber industry		1		1	4		1					1	7	
Higher learning institution	1				1								2	
Non-Government Research Institution								2		1			3	
Environmental monitoring agencies								2					2	
Practitioners			1										1	
Subtotal	1	1		1	2		8		1		1		15	

TABLE 5 - Breakdown of number of participants in the courses

Sector		COURSE 96			COURSE 97			COURSE 98			COURSE 99			Total
		SEX		Σ	SEX		Σ	SEX		Σ	SEX		Σ	
		M	F		M	F		M	F		M	F		
BRASILINOS	Timber industry	1	1	12	1	13	2	1	3	3		3	20	
	Higher learning institution	1	1	5	3	8	1		1	2	1	3	13	
	Middle-level learning institution	1	1				27	9	36	26	13	39	76	
	Government Research Institution	1	1	5		5	2		2	2	1	3	11	
	Non-Government Research Institution	3	1	4	6	4	10			2	3	5	19	
	Professional associations (industry)		1	1									1	
	OEMA's				8		8	4		4	10	4	14	26
	Practitioners				4		4	1	1	2	4	1	5	11
ESTRANGEIROS	Timber industry									6	1	7	7	
	Higher learning institution									1		1	1	
	Non-Government Research Institution							1	1	3		3	4	
	Environmental monitoring agencies									5		5	5	
	Practitioners									1		1	1	
Total		7	2	9	40	8	48	37	12	49	65	24	89	195



Fig. 6 - Training in management and Reduced Impact Logging - a) students receiving guidance in field before beginning practical activity; b) group of students, FFT staff and support team from partner Cikel Brasil Verde S.A.

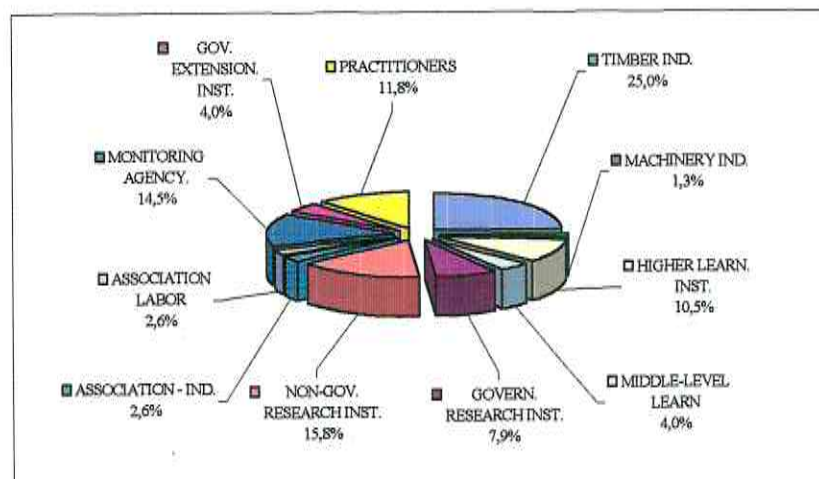


Fig. 7 - Percentile breakdown of institutions that sent participants to FFT courses to 1999.

TABLE 6 - Breakdown / number of interns per gender and education level.

LEVEL	YEAR	SEX		TOTAL
		M	F	
MIDDLE	1996	4	-	4
	1997	3	-	3
	1998	1	-	1
	1999	5	1	6
HIGHER	1996	1	1	2
	1997	-	-	-
	1998	2	2	4
	1999	1	1	2
TOTAL		17	5	22



### Transference of technology

In 1997, through a project with FEMA and private enterprise in the State of Mato Grosso, FFT provided on-site training to foresters, technicians and operators (chainsaw operators, machinery operators and tree-spotters), with timber companies in the municipalities of Claudia and Marcelândia. In 1999 alone, 77 people were trained within the companies Juruá Madeira Ltda, CIKEL Brasil Verde S.A., GETHAL S.A. and Agropecuária Treviso (Table 7).

TABLE 7 - Breakdown of the number of personnel trained per activity, within companies in 1999.

Activity	Cikel	Juruá	Gethal	Total
Pre-harvest	25	2	-	27
Harvest planning	11	5	2	18
Harvesting	20	4	8	32
<b>Total</b>	<b>56</b>	<b>11</b>	<b>10</b>	<b>77</b>

### Seminars, technical meetings and workshops

Another venue utilized by the Foundation to disseminate its results is through participation in Workshops promoted by other institutions. In such events, FFT's representatives share their experiences, contributing with suggestions and ideas. Over the last five years, FFT has participated in some 20 workshops or smaller technical meetings. There is a growing demand by professional associations of laborers and companies (unions, associations etc), NGO's, OEMA's and learning institutions, for FFT to present lectures explaining sustainable forest management and Reduced Impact Logging. These lectures, besides disseminating FM-RIL, permit FFT to present the results of its research and training courses. FFT has given over 30 such lectures and has participated in many other seminars throughout Brazilian Amazonia and neighboring countries. In 1999 FFT sponsored and coordinated a Technical Meeting on Sustainable

Forest management in Brazilian Amazonia, in which governmental and non-governmental institutions participated, as well as independent consultants. The principal objective of this meeting was to discuss sustainable forest management and its application in Brazilian Amazonia. At the meeting, **technical, economic and ecological aspects of Reduced Impact Logging - RIL** were discussed, as well as the establishment of a center of forestry training for Amazonia (CTFA).

#### **Field days**

FFT regularly holds field days to its FM-RIL demonstrative models for industrialists, local and scientific community, foresters, technicians and forest laborers, politicians and other individuals or institutions interested in forestry issues. On such field days, FFT demonstrates the feasibility of FM-RIL, shares the techniques developed in these areas and creates awareness amongst the public regarding forest management and its importance to Amazonia.

#### **PARTNERSHIPS**

In order to support and expedite its activities, FFT has established partnerships with institutions from a variety of sectors that have linkages to the forest sector. Cooperation agreements are already in place with governmental and non-governmental institutions such as Embrapa Eastern Amazonia, SUDAM, MPEG, FCAP, SECTAM, FEMA, ISA, CIFOR, FNS-IEC, IPAM, AIMEX and IMAZON. In the private sector, FFT has established partnerships with CIKEL Brasil Verde S.A., Caterpillar do Brasil Ltda., STIHL Ltda, Juruá Madeira Ltda., Angeli Madeira, Madeireira Bacaeri, Gethal S.A.

## LOOKING AHEAD

The practices currently developed and disseminated by FFT have demonstrated that adequate techniques already exist for application of FM-RIL. Studies by FFT regarding costs and those of other institutions have proven the economic feasibility of FM-RIL, and ecological studies have demonstrated that adoption of FM-RIL techniques are completely feasible for maintaining the forest productive, while maintaining its ecosystem. One of the major constraining factors, however, to application of management in Amazonia is the lack of qualified and skilled human resources to undertake the activities such management requires. It is for this reason that FFT's goal is to further intensify its training courses in the next few years.

Labor unions and timber company associations have sought out FFT requesting training in operational management activities. This in itself demonstrates that the forest sector is beginning to mature and to understand the necessity of utilizing trained and qualified human resources for forest management.

## LIST OF ABBREVIATIONS

AIMEX	Association of Timber Exporters of the State of Pará
CIFOR	International Center for Forest Research
CTFA	Center for Forestry Training in Amazonia
EMBRAPA	Brazilian Enterprise of Agricultural/Cattle-raising Research
FCAP	Faculty of Agrarian Sciences of Pará
FEMA	State Environment Foundation - MT
FFT	Fundação Floresta Tropical
FLONA	National Forest
FNS	National Health Foundation
IBAMA	Brazilian Institute of the Environment and Renewable Natural Resources
IEC	Institute Evandro Chagas
IITF	International Institute of Tropical Forestry
IMAZON	Institute of Man and the Environment in Amazonia
IPAM	Institute of Environmental Research of Amazonia
ISA	Socio-Environmental Institute
ITTO	International Tropical Timber Organization
JARCEL	Jari Cellulose S.A.
LBA	Large-scale Biosphere-Atmosphere experiment in Amazonia
FM-RIL	Forest management – Reduced Impact Logging
SFM	Sustainable forest management
MMA	Ministry of the Environment
MPEG	Emílio Goeldi Museum of Pará
NAEA	Center for Higher Amazonian Studies
OEMA	State environmental agency
ONG	Non governmental organization
SECTAM	Secretariat of Technology and Environment
GIS	Geographic Information System
SUDAM	Superintendence of Development of Amazonia
SUNY	State University of New York
UFPA	Federal University of Pará
USAID	United States International Development Agency
USFS	United States Forest Service
WHRC	Woods Hole Research Center
WWF	Worldwide Wildlife Fund
STIHL	Andreas Stihl Motosserras Ltda.



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