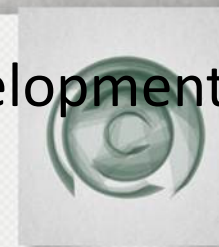


Science and Technology Partnership for Sustainable Development  
SATREPS: UFPR & CADAFA Seminar



# Carbon Dynamics of Amazonian Forests < CADAFA Project >

Curitiba, PR, November, 5, 2012



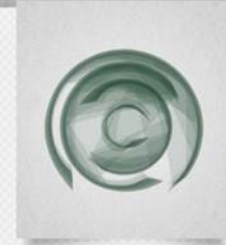
# Motivations

REDD is our main motivation, even though the last COPs rejections, i.e., it is not a formal mechanism under UNFCCC



# IPCC AR4

## Working Group III (Mitigation)



**2007**

### Chapter 9 - Forest Executive Summary

**Page 543:** In the short term, the carbon mitigation benefits of reducing deforestation are greater than the benefits of afforestation.

**P. 550 (9.4.2.1), 3rd. paragraph:** Reduced deforestation and degradation is the forest mitigation option with the largest and most immediate carbon stock impact in the short term per ha and per year globally

**P. 552, 2nd. Par.:** Reducing deforestation is, thus, a high-priority mitigation option within tropical regions.

September 2008



## About the UN-REDD Programme



The **UN-REDD Programme** is the UN Collaborative initiative on Reducing Emissions from Deforestation and forest Degradation (REDD) in developing countries. The Programme was launched in September 2008 to assist developing countries prepare and implement national REDD+ strategies, and builds on the convening power and expertise of the Food and Agriculture Organization of the United Nations (FAO), the United Nations Development Programme (UNDP) and the United Nations Environment Programme (UNEP).

### Support to Countries

The Programme currently supports 44 partner countries spanning Africa, Asia-Pacific and Latin America, of which 16 are receiving support to National Programme activities. These 16 countries are: **Bolivia, Cambodia, Democratic Republic of the Congo (DRC), Ecuador, Indonesia, Nigeria, Panama, Papua New Guinea, Paraguay, the Philippines, Republic of Congo, Solomon Islands, Sri Lanka, Tanzania, Viet Nam and Zambia**. To-date, the UN-REDD Programme's Policy Board has approved a total of US\$67.3 million for National Programmes in these 16 partner countries. These funds help to support the development and implementation of national REDD+ strategies.

UN-REDD Programme countries not receiving direct support to national programmes engage with the Programme in a number of ways, including as observers to the Programme's Policy Board, and through participation in regional workshops and knowledge sharing, facilitated by the Programme's interactive online workspace. These countries are: **Argentina, Bangladesh, Benin, Bhutan, Cameroon, Central African Republic, Chile, Colombia, Costa Rica, Ethiopia, Gabon, Ghana, Guatemala, Guyana, Honduras, Ivory Coast, Kenya, Malaysia, Mexico, Mongolia, Myanmar, Nepal, Pakistan, Peru, South Sudan, Sudan, Suriname and Uganda**.

<http://www.un-redd.org/AboutUNREDDProgramme/tabid/583/Default.aspx>



# Report of the Conference of the Parties on its fifteenth session, held in Copenhagen from 7 to 19 December 2009

## Addendum

### Part Two: Action taken by the Conference of the Parties at its fifteenth session

**COP 15**

**COP 15**

#### CONTENTS

#### Decisions adopted by the Conference of the Parties

<i>Decision</i>	<i>Page</i>
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4/CP.15 Methodological guidance for activities relating to reducing emissions from deforestation and forest degradation and the role of conservation, sustainable management of forests and enhancement of forest carbon stocks in developing countries .....	11
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+ 6 decisions	

## Copenhagen Accord

*Have agreed* on this Copenhagen Accord which is operational immediately.

6. We recognize the crucial role of reducing emission from deforestation and forest degradation and the need to enhance removals of greenhouse gas emission by forests and agree **on the need to provide positive incentives to such actions through the immediate establishment of a mechanism including REDD-plus**, to enable the mobilization of financial resources from developed countries.

## Decision 4/CP.15

Methodological guidance for activities relating to reducing emissions from deforestation and forest degradation and the role of conservation, sustainable management of forests and enhancement of forest carbon stocks in developing countries

1. *Requests* developing country Parties, on the basis of work conducted on the methodological issues set out in decision 2/CP.13, paragraphs 7 and 11, to take the following guidance into account for activities relating to decision 2/CP.13, and without prejudging any further relevant decisions of the Conference of the Parties, in particular those relating to measurement and reporting:

(d) To establish, according to national circumstances and capabilities, robust and transparent national forest monitoring systems and, if appropriate, sub-national systems as part of national monitoring systems that:

(i) Use a **combination of remote sensing and ground-based forest carbon inventory approaches** for estimating, as appropriate, anthropogenic forest-related greenhouse gas emissions by sources and removals by sinks, forest carbon stocks and forest area changes;

(ii) Provide estimates that are transparent, consistent, as far as possible accurate, and that reduce uncertainties, taking into account national capabilities and capacities;

(iii) Are transparent and their results are available and suitable for review as agreed by the Conference of the Parties;



# **National Forest GHG Inventories – A Stock Taking**

23-25 February, 2010, Yokohama, Japan

Task Force on National Greenhouse Gas Inventories



# Conclusions

**6.** The meeting agreed the following specific steps to tackle these issues:

a. Expert Meeting on Technical Issues in Forest GHG Inventories to be organized by TFI focusing on the following issues in forest GHG inventories:

i. design of forest monitoring systems including issues like inventory design, stratification, sampling, pools and accuracy/uncertainty assessment;

ii. combination of ground based inventories with remote sensing and modeling approaches;

iii. use of remote sensing data in forest GHG inventories including on stratification, change assessment and use of remote sensing methods for biomass estimation;

iv. guidance on selectively logged forests.

# Japan Aims to Start Bilateral Carbon Offset Program in 2013



*By Chisaki Watanabe and Takashi Hirokawa - Nov 29, 2011 5:23 AM GMT-0200*

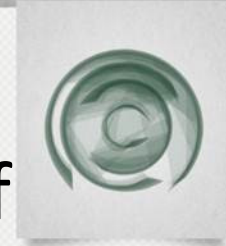
<http://www.bloomberg.com/news/2011-11-29/japan-aims-to-start-bilateral-carbon-offset-program-in-2013.html>

Japan aims to start a program to work with companies to reduce greenhouse gas emissions in developing countries in 2013, according to a new set of action plans to be introduced at the climate talks in Durban today.

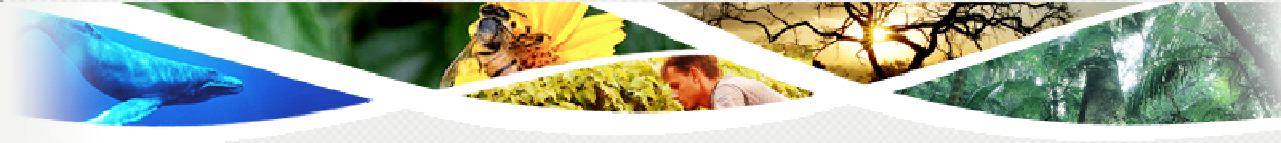
The government has been preparing the bilateral offset credit mechanism program to cut emissions by establishing energy management systems and forest protection projects with Japanese companies such as Toshiba Corp. and Marubeni Corp. in developing countries.

This is the first time that Japan has said when it wants to start the program.

We don't have yet a formal REDD program in Brazil, but the Ministry of Environment hosts a homepage exclusive for REDD<sup>+</sup>



<http://www.florestal.gov.br/redd/>



**REDD + Brasil**



# Inspiration?

Asner, G.P, Knapp, D.E, Broadbent, E.N., Oliveira, P.J.C., Keller, M. and Silva, J.N.M. [2005](#). Selective Logging in the Brazilian Amazon. [Science](#) 310: 480-482.

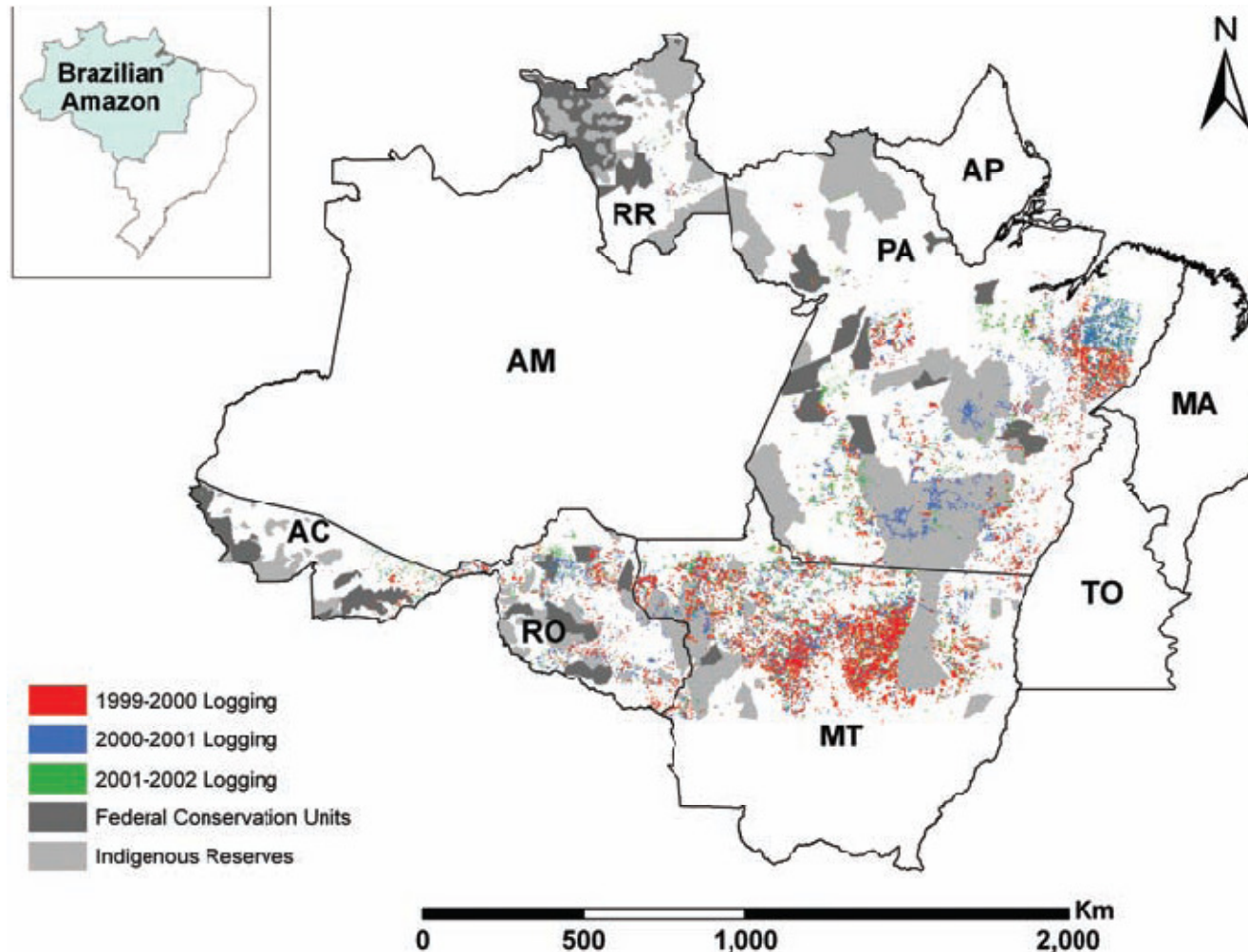
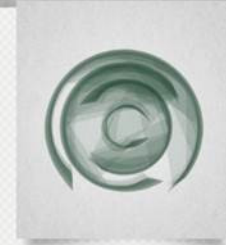


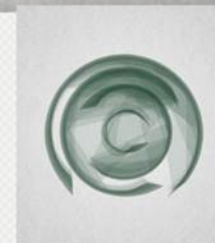
Fig. 1. Spatial distribution of selective logging in five timber-production states of the Brazilian Amazon for the year intervals 1999–2000 (red), 2000–2001 (blue), and 2001–2002 (green). The states of Amazonas (AM), Amapá (AP), Tocantins (TO), Maranhão (MA), and the southern nonforested part of Mato Grosso were not included in the analysis. Light gray areas show the extent of indigenous reserves; dark gray areas delineate federal conservation lands as of 1999 (29). RR, Roraima; PA, Pará; MT, Mato Grosso; RO, Rorondônia; AC, Acre.



# CADAF Project

## 2010 - 2013

# MASTER PLAN



## Project Title

Carbon Dynamics of Amazonian Forest (CADAFA Project)

## Project Purpose

An evaluation technique on a large-scale carbon dynamics of Brazilian Amazon forests is developed.

## Outputs

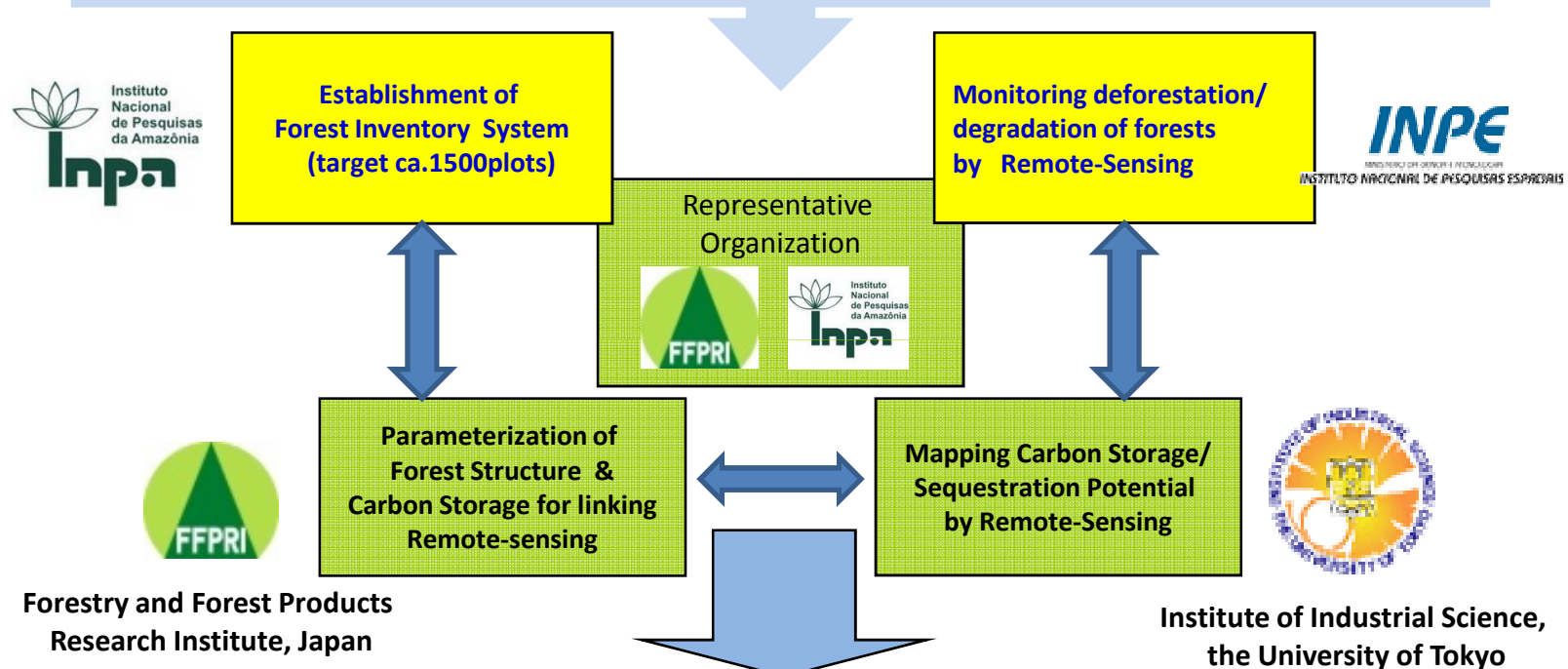
1. A continuous forest inventory (CFI) system to survey carbon dynamics in central Amazon is established.
2. A relationship between forest types and carbon dynamics of primary and selectively logged forest is identified.
3. Carbon dynamics maps are developed, using the data from CFI system and remote-sensing information.



# Implementation structure

## Global Issue

- Evaluation of CO<sub>2</sub> emission from the deforestation/degradation of forests
- Evaluation of carbon sequestration potential of Amazon forests



Methodology MRV to evaluate the large-scale C stock & dynamics in Amazon forests

Contribution to Carbon projects of Amazon forests

# Sites of the Amazonas Continuous Forest Inventory

Site	Project	year	n
Manacapuru	Chichuá	2004	32
Fonte Boa	Chichuá	2004	72
Jutaí	Chichuá	2004	64
ST Manejo de Florestas Ltda (Lábrea)	Chichuá	2005	87
EMBRAPA (Rio Preto da Eva)*	Chichuá	2005	15
Floresta Estadual de Maués (Maués)	PPOPE/Chichuá	2005	100
Resex do Baixo Juruá (Juruá)	ICMBio/Chichuá	2006	83
Mil Madeireira Ltda (Itacoatiara)	Chichuá	2006	204
Resex Auati Paraná (Fonte Boa)	ICMBio/Chichuá	2007	107
BIONTE – Testemunha (Manaus)*	Chichuá	2007	3
Resex Lago do Capanã Grande (Manicoré)	ICMBio/Chichuá	2008	82
RDS do Amapá (Manicoré)	SDS/Chichuá	2008	61
FLONA do Pau-Rosa (Maués)	ICMBio/Chichuá	2009	81
Resex do Rio Unini	Pronex/Chichuá	2009	90
RDS do Juma (Novo Aripuanã)	FAS/SDS/Chichuá	2009	115
Floresta Estadual de Maués (Maués)	SDS/Chichuá	2010	76
<b>Before CADAF</b>			<b>1272</b>
São Gabriel da Cachoeira	CADAF/Pronex	2010	100
Mil Madeireira Ltda (Itacoatiara)	CADAF/Pronex	2010	119
Benjamin Constant and Atalaia do Norte	CADAF	2011	105
Jutaí	CADAF	2011	104
EMBRAPA (Rio Preto da Eva)*	CADAF	2011	18
Resex Lago do Capanã Grande (Manicoré)	CADAF	2012	118
Resex Rio Unini	CADAF	2012	136
<b>Under CADAF</b>			<b>700</b>

1-1. To establish one hundred (100) new CFI plots per area at central Amazon, including Atalaia do Norte and Sao Gabriel da Cachoeira, and conduct forestry inventory in accordance with IPCC guidelines 2006.

# CFI sites remeasured under CADAFA

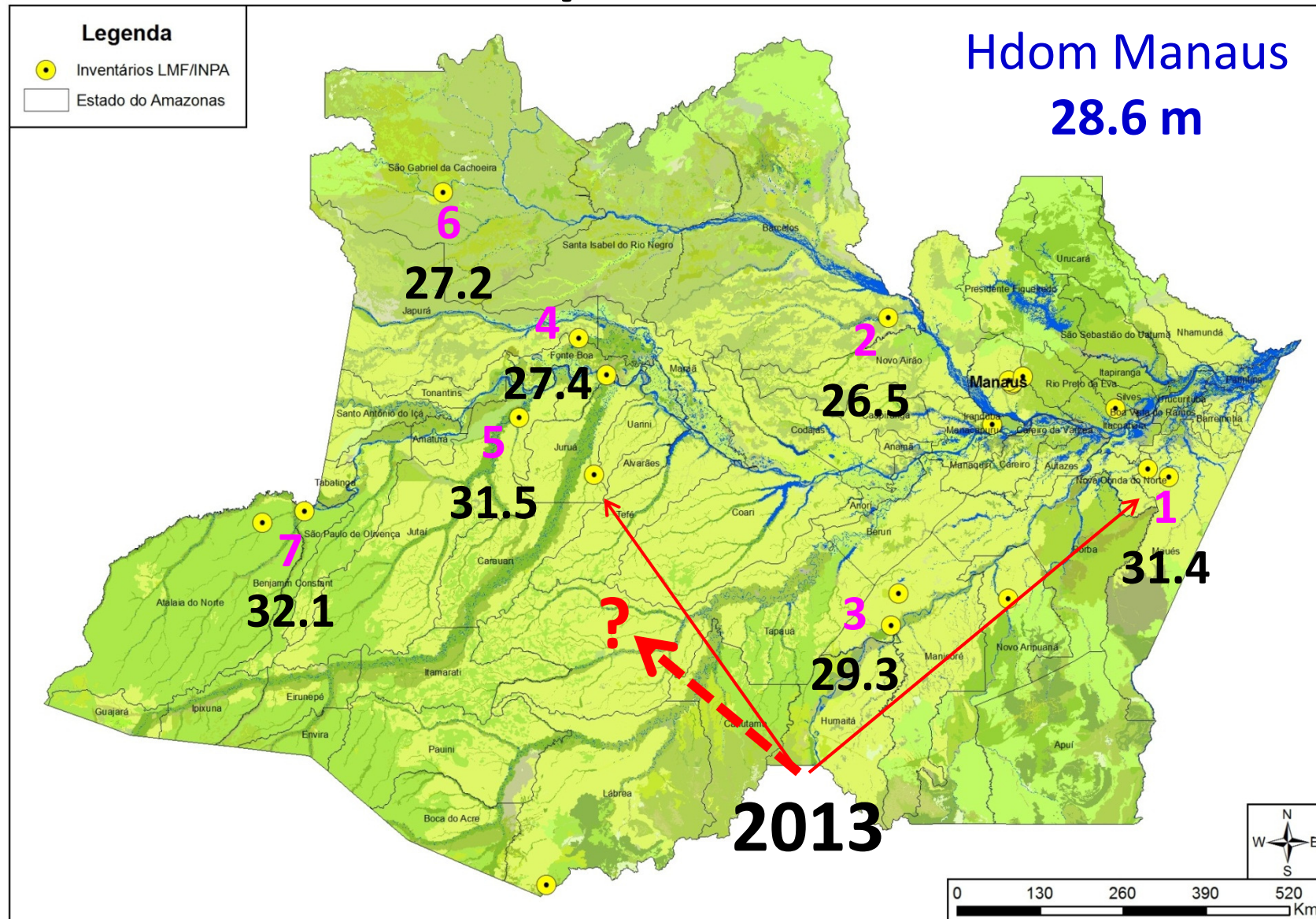
Sites	1st.	2 nd.	PP	TP	n
Jutaí	2004	2012	28	36	64
R Preto da Eva (Embrapa)	2005	2011	15	-	15
Resex Auati-Paraná	2007	2012	36	72	108
Resex Capanã Grande	2008	2012	40	42	82
Resex Rio Unini	2009	2012	28	62	90
MIL Madeireira	2005	2010	-	119	100
Total (n)			147	324	471

**1st.** = first occasion; **2nd.** = second occasion; **PP** = permanent plot; **TP** = temporary plot

1-2. To re-measure more than four hundred (400) CFI plots in existing six (6) sites in central Amazon.



# Spatial distribution of CFI-AM sites and volume equations & hdom



# Allometry data set for fresh below- and above-ground biomass

Forest type	n	DBH min	DBH max	FB min	FB max
Old growth ZF2	131	5.0	85.0	1,26	2.709
Old growth Amapá	105	5,1	74,5	0,9	1.921
Old growth campinarana	100	5.0	50.2	1,9	758
Regrowth 14 years old	30	5.0	33.1	0,52	79
Regrowth 23 years old	35	5.0	37.2	0,68	72
Old growth SGC – CADAF	101				
Total	502				

**DBH min** = minimum diameter at breast height in cm; **DBH max** = maximum DBH in cm; **FB min** = minimum fresh biomass in kg; **FB max** = maximum FB in kg.

1-3. To determine above and below ground biomass and carbon contents of trees in Sao Gabriel da Cachoeira.

# Water and Carbon contents

## Water contents – 774 samples

Tree parts	contribution	water (%)	% weighted
Trunk	0.5802	38.8	22.5
Coarse branches	0.1248	40.6	5.1
Fine branches	0.1278	44.9	5.7
Leaves	0.0269	59.7	1.6
Fine roots	0.0306	48.9	1.5
Coarse roots	0.1159	44.5	5.2
Weighted mean			41.6

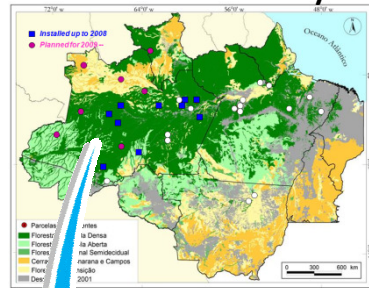
## Carbon contents – 256 samples

Parts	contribution	C (%)	weighted (%)
Trunk	0.8598	48.5	41.7
Coarse roots	0.1159	47.0	5.4
Fine roots	0.0306	45.7	1.4
Weighted mean			48.5



# Develop methods to upscale C stock & dynamics from plot to regional-scale, using remote-sensing techniques.

## Forest Inventory

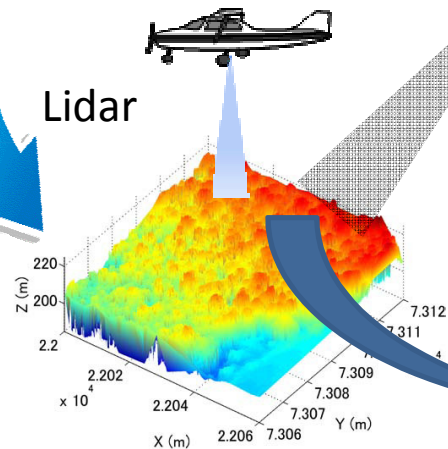


PALSAR  
TerraSAR-X

LANDSAT TM , MODIS, NOAA



Lidar



Inventory data  
(plot scale)  
20m x 125m

Watershed scale 2~5km x 2~5km

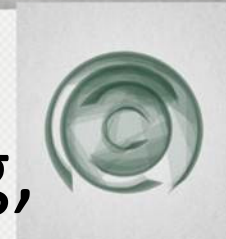
regional scale



# Added value to CADAFA



# Training “on service” in designing, implementing and monitoring projects REDD+ for Latin America countries



**Baseline**

## 4 weeks at ZF-2

Project approved by  
Third Country Training Program (TCTP)  
Japan-Brazil Partnership Program (JBPP)  
ABC and JICA  
2011, 2012 and 2013

<http://www.abc.gov.br/treinamentos/DetailamentoCurso.aspx>



Concluding ....

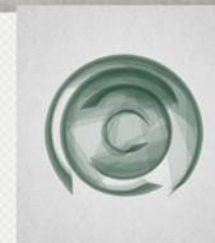
CADAF has become an important bargaining chip for LMF (Laboratory of Forest Management)

New staff member, 2 new “bolsistas”, new building, new dormitory at ZF-2, new international projects (MPIB and DOE), new vehicles, more undergraduate and graduate students





# Obrigado!





# Output 1 - Activities



1-1. To establish one hundred (100) new CFI plots per area at central Amazon, including Atalaia do Norte and Sao Gabriel da Cachoeira, and conduct forestry inventory in accordance with IPCC guidelines 2006.

**ACCOMPLISHED**

1-2. To re-measure more than four hundred (400) CFI plots in existing six (6) sites in central Amazon.

**ACCOMPLISHED**

1-3. To determine above and below ground biomass and carbon contents of trees in Sao Gabriel da Cachoeira.

**ACCOMPLISHED**

1-4. To develop precise allometric equation model(s) for estimating above and below ground carbon amount in Brazilian Amazon forest based on data collected in Sao Gabriel da Cachoeira, Manaus (INPA ZF-2), Amapa and Tome-acu.

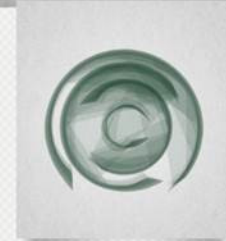
**TO BE ACCOMPLISHED IN 2012**

1-5. To develop a forest inventory database for central Amazon.

**TO BE ACCOMPLISHED IN 2013**



## Output 2 - Activities



2-1 To estimate forest carbon dynamics from forest inventory data in accordance with IPCC guidelines 2006.

### TO BE ACCOMPLISHED IN 2013

2-2 To survey and analyze temporal changes in forest characteristics - species composition, forest stand structure and carbon stock - at flooded, eco-tone slope and plateau forests, based on large-scale inventory plots and long-distance belt-transects at primary forest (INPA ZF-2).

### TO BE ACCOMPLISHED IN 2013

2-3 To establish CFI plots at selectively logged forest stands at Itacoatiara, and survey and evaluate human impacts and temporal changes in forest species composition, structure, carbon storage at chronologically different logged forest.

### TO BE ACCOMPLISHED IN 2013