Annex 6-1 Draft of the Revised PDM (Draft of PDM ver2)

Project Title: "Carbon Dynamics of Amazonian Forest" PDM Version 2 Date: August 24, 2012
Target Group: (1) Scholars and Researchers at the Related organizations in Brazil, including INPA and INPE(2) Related Organizations to REDD+, such as Ministry of Science and Technology, Ministry of Environment, Ministry of External Relations, State Governments, private sectors, NGOs
Target Area: Brazilian Amazon Forest*
Project Duration: 4 years (from May 19, 2010 to May 18, 2014) Implementing Organizations: INPA and INPE

Narrative Summary	Objectively Verifiable Indicators	Means of Verification	Important Assumptions
<Project Purpose> An evaluation technique on a large-scale carbon dynamics of Brazilian Amazon forests is developed.	a. By the Project end, a continuous evaluation of large-scale carbon stock and carbon-stock change, using field and remote sensing data becomes possible at INPA and INPE b More than 50% of the related organizations to REDD+ and environmental conservation in Brazil that participated in the final workshop/seminar organized by the Project, such as ICMBIO Embrapa, private sector, etc., recognize that the evaluation technique is useful c More than 50 % of the above organizations express their interests in utilizing the evaluation technique	a Results of Joint assessment by INPA, INPE and Japanese Expert Team based on agreed checklist b&c Results of questionnaire survey at the final workshop/seminar	The Brazilian Government continuously recognizes the importance of forest conservation in Amazon
<Outputs> 1 A continuous forest inventory (CFI) system to survey carbon dynamics in central Amazon** is established	1a By August 2013, more than 300 CFI plots are established in new sites in central Amazon by putting stakes and tags.– 1b By August 2013, forestry inventory data are collected in 8 existing and 2 new sites in central Amazon in accordance with the IPCC guideline 2006 1c By March 2014, result of test of a hypothesis on a common allometric equation model for the four (4) areas in Brazilian Amazon(i.e. Sao Gabriel da Cachoeria and Manaus (INPA ZF-2) in Amazonia, Amapa, and Tome-acu in Para) is available with uncertainty estimated based on a recommendation in the IPCC guideline 2006 1d By the Project end, forest inventory data from all existing and new sites in central Amazon, including information such as site photos, GPS information, and forest stand inventory information, forest type, and carbon stock is organized in a GIS-based forest inventory database 1e By the Project end, more than five (5) scientific research papers are submitted to international journals	1a Records of the project activities 1b Same as 1a 1c Scientific paper submitted on the subject 1d GIS-based database 1e Submitted papers	Trained GIS personnel in INPA do not stop working for the Project。
2. A relationship between forest types and carbon dynamics of primary and selectively logged forest in central Amazon is identified	2a By the end of 2013, specific figures of carbon stock-and stock change in primary and selectively logged forests before and after logging is are estimated at flooded-and plateau forests in central Amazon 2b By the Project end, more than five (5) scientific research papers are submitted to international journals	2a Table of figures 2b Submitted papers	
3 Carbon dynamics maps for Brazilian Amazon forest are developed, using the data from the CFI system, remote sensing techniques, and satellite images	3a By the end of 2012, a site environment map for Brazilian Amazon forest is developed 3b By June 2013, the forest inventory data is up-scaled using remote sensing data, including airborne LiDAR data, for each category of the forest site environment map with estimated accuracy 3c By the Project end, Brazilian Amazon forest's carbon stock maps for 2000, 2005, 2010 are-created with uncertainty estimated for each category. 3d By the Project end a Brazilian Amazon forest's carbon stock change maps for 2000-2005 and 2005-2010 are created with uncertainty estimated for each category 3e More than three (3) scientific research papers are submitted to international journals	3a, 3c, 3d Produced maps 3e Submitted papers	
4 Techniques developed and information obtained in Output 1 to 3 are shared with organization related to global climate change issues, including REDD+ and environmental conservation.	4a By the end of the Project, free access to a part of the forest inventory database (i.e. data collected in 2010-2012) is available at INPA/FFPRI's website. 4b By the end of the Project, free access to the remote sensing datasets produced by the Project is available at INPA/INPE/FFPRI/UT's website. 4c More than two workshops and/or seminars are organized by the Project in Brazil	4a&bDatabase presented in the web site 4b Records of the project activities 4c ditto	

Annex 6-1 Draft of the Revised PDM (Draft of PDM ver2)

<Activities>	<Inputs>	
1.1 To establish one hundred (100) new CFI plots per area at Central Amazon, including Atlanta do Norte, Sao Gabriel da Cachoeria, and Resex Pirus, and conduct forest inventory in accordance with IPCC guidelines 2006 1.2 To re-measure more than four hundred (400) CFI plots in existing eight (8) sites*** in central Amazon. 1.3 To determine above and below ground biomass and carbon contents of trees in Sao Gabriel da Cachoeira 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 Cachoeria, Manaus (INPA ZF-2), Amapa and Tome-acu 1.5 To develop a GIS-based forest inventory database for central Amazon. 2.1 To estimate forest carbon dynamics (i.e. carbon stock change) from the forest inventory data from Output 1 in accordance with IPCC guidelines 2006. 2.2 To survey and analyze temporal changes in forest characteristics-species composition, forest stand structure and carbon stock at flooded, eco-tone and plateau forests, based on large-scale inventory plots and long-distance belt-transects at primary forest (INPA ZF-2) 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 stock at chronologically different logged forest 3.1 To study and develop techniques on how to obtain site environmental map using remote sensing information and geographic information 3.2 To develop analytical techniques to obtain forest stand parameters, such as canopy height, leaf area index (LAI) and biomass, combining remote sensing information, including airborne LiDAR data, and the GIS-based forest inventory data from Activity 1.5 3.3 To develop remote sensing techniques to estimate large-scale forest stand parameters, and create Amazonian forest carbon stock change map 4.1 Provide free access to the forest inventory database at INPA's website 4.2 Provide free access to the remote sensing datasets produced by the Project at INPA/INPE/FFPRI/UT's website. 4.3 Organize workshops and/or seminars in Brazil	**●Brazilian side** (1) Project personnel& necessary staff 1) Project Director (INPA) 2) Project Manage for Output 1 &2 (INPA) 3) Project Manager for Output 3 (INPE) 4) Sub Project Manager for Output 1 &2 (INPA) 5) Sub Project Manager for Output 3 (INPE) 6) Specialists on forest inventory for Output 1 & Output 2 (INPA) 7) Specialists on remote sensing for Output 3 (INPA and INPE) 8) Supporting staff (2) Provision of Project land, facilities, and equipment 1) More than one thousand (1,000) CFI plots 2) Project offices in INPA and INPE 3) Vehicle for field work 4) Other necessary equipment and materials for project implementation (3) Local Operation Cost **●Japanese side** (1) Dispatch of Experts 1) Chief Advisor 2) Forest Inventory 3) Remote Sensing, 4) Coordination (2) Training of project personnel in Japan or the 3rd country 1) Total of eight (8) in four (4) years (3) Machinery, Equipment and materials 1) Forest inventory 2) Remote sensing 3) Other equipment if needed (4). Local operation cost 1) Operational cost for Japanese experts	1 Local communities do not oppose the Project **<Preconditions>** 4. Project personnel are properly assigned for the Project. 5. There is no security problems in the Project site 6. Local authorities and people are willing to support the Project

Abbreviation:
INPA: Instituto Nacional de Pequisas da Amazonia
INPE: Instituto Nacional de Pesquisas Espacia
ICMBIO: Instituto Chico Mendez de Conservacao da Biodiversidade
Embrapa: Empresa Brasil** de Pesquisa Agropecuaria
IPCC: Intergovenmental Panel on Climate Change

Footnotes
* Brazilian Amazon forests are Biome in Legal Amazon of Brazil **Central Amazon means Amazonas State and Acre State ***Existing eight (8)_sites are Itacoatiara, Fonte Boa, Jutai, Resex Baixo Jurua, Resex Auati-Parana, Resex Capana Grande, Maues, and Resex Pirus.

Annex 6-2 ***Modification made in the revised PDM*** *(Addition to the PDMe is shown as underlined and deletion as struck-through)*

Project Title: "Carbon Dynamics of Amazonian Forest" PDM Version ~~1~~ 2 Date: ~~February 5, 2010~~August 24, 2012

Target Group: (1) Scholars and Researchers at the related organizations in Brazil, including INPA and INPE(2) Related Organizations to REDD+, such as Ministry of Science and Technology, Ministry of Environment, Ministry of External Relations, State Governments, private sectors, NGOs

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<Outputs> 1 A continuous forest inventory (CFI) system to survey carbon dynamics in central Amazon** is established	1a By ~~the end of 2012~~ August 2013, more than ~~200~~ 300 CFI plots are established in new sites in central Amazon by putting stakes and tags. 1b By ~~the end of 2012~~ August 2013, forestry inventory data are collected in ~~6~~ 8 existing and 2 new sites in central Amazon in accordance with the IPCC guideline 2006 1c By March 2014, result of test of a hypothesis on a common allometric equation model for the four (4) areas in Brazilian Amazon(i.e. Sao Gabriel da Cachoeria and Manaus (INPA ZF-2) in Amazonia, Amapa, and Tome-acu in Para) is available with uncertainty estimated based on a recommendation in the IPCC guideline 2006 1d By the Project end, forest inventory data from all existing and new sites in central Amazon, including information such as site photos, GPS information, and forest stand inventory information, forest type, and carbon stock is organized in a GIS-based forest inventory database 1e By the Project end, more than five (5) scientific research papers are submitted to international journals	1a Records of the project activities 1b Same as 1a 1c Scientific paper submitted on the subject 1d GIS-based database 1e Submitted papers	Trained GIS personnel in INPA do not stop working for the Project。
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4 Techniques developed and information obtained in Output 1 to 3 are shared with organization related to global climate change issues, including REDD+ and environmental conservation.	4a By the end of the Project, free access to a part of the forest inventory database (i.e. data collected in 2010-2012) is available at INPA/FFPRI's website. 4b By the end of the Project, free access to the remote sensing datasets produced by the Project is available at INPA/INPE/FFPRI/UT's website. 4c More than two workshops and/or seminars are organized by the Project in Brazil	4a&bDatabase presented in the web site 4b Records of the project activities 4c ditto	

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Annex 7 Draft of the PO (Darft of PO ver1)

	Activities	Targets	Schedule	Org in charge	Responsible Persons	Inputs: JICA Personnel	Inputs: JICA Others	Inputs: INPA / INPE Personnel	Inputs: INPA / INPE Others	Remarks
Output 1: A continuous forest inventory (CFI) system to survey carbon dynamics in central Amazon is established.				INPA FFPRI	Niro (INPA) Ishizuka (FFPRI)					
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 Resex Pirus, and conduct forestry inventory in accordance with IPCC guidelines 2006			INPA	Adriano Lima (INPA)		Equipments & Consumables	Forest inventory team of INPA		
1.1.1	Select new inventory sites	2 additional sites selected		INPA	dito	Ishizuka, Kajimoto, Suwa, Noguchi	Field survey costs -Boat rent, Oil -Labor costs Equipment -Laptop PC -GPS -VHF radio -Tree climbers & accessories			
1.1.2	Conduct plot setting and initial survey	Target sites		INPA	dito					
		a Sao Gabriel da Cachoeira		dito	dito	Ishizuka, Kajimoto, Suwa, Noguchi				
		b Atalaia do Norte		dito	dito	Kajimoto, Suwa, Noguchi				
		c Pirus		dito						
1.2	To re-measure more than four hundred (400) CFI plots in existing eight (8) sites in central Amazon			INPA	Adriano (INPA)		-Surveying equipments (compass, VX3ss, distance measure, etc.)	Forest inventory team of INPA		
1.2.1	Conduct second survey at the existing plots in each site	Sao Gabriel da Cachoeira								
		a Ilacoatiara (MIL)		INPA	dito	Ishizuka, Kajimoto, Suwa, Noguchi (FFPRI)				
		b Fonte Boa (ZFV)		dito	dito	Suwa, Noguchi (FFPRI)				
		c Jutai		dito	dito	Ishizuka, Suwa, Noguchi (FFPRI)				
		d Resex Baixo Juruá		dito	dito					
		e Resex Auati-Parana		dito	dito	Suwa, Noguchi (FFPRI)				
		f Resex Capana Grandei		dito	dito	Suwa, Noguchi				
		g Rio Uniri		dito	dito	Suwa, Noguchi (FFPRI)				
		h Maues		dito	dito					
1.3	To determine above and below ground biomass and carbon contents of trees in Sao Gabriel da Cachoeira			INPA	Joaquim (INPA)		Equipments & Consumables			
1.3.1	Measure biomass and carbon contents of trees in Sao Gabriel da Cachoeira	Biomass and carbon contents dataset					Field survey costs -Boat rent, Oil -Labor costs Equipment -Scales			
		a Biomass of trees (leaf, branch, stem and root) measured		INPA	Adriano (INPA)	Kajimoto, Suwa (FFPRI)		Giga (INPA)		
		b Carbon contents and specific density of woods analyzed		INPA	Adriano(INPA)	dito		dito		
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			INPA	Joaquim (INPA)		Consumables			
1.4.1	Analyze allometric relations for estimating above- and below-ground carbon of trees	The best allometric model(s) determined								
		a For Sao Gabriel da Cachoeira		INPA	Adriano (INPA)	Kajimoto, Suwa, Ishizuka(FFPRI)		, Giga (INPA)		
		b For Brazilian Amazon forest		INPA	Francisco (INPA)	dito		Aailano (INPA)		
1.5	To develop a GIS-based forest inventory database for central Amazon			INPA	Adriano Lima (INPA)		Equipments Database Software Consumables	Adriano Jose Nogueira Lima (Postgraduate)		
1.5.1	Develop the forest inventory database	The Amazonian forest inventory database developed		INPA	dito					
1.5.1.1	Develop a prototype database with geographic coordinates	Data collected in 2010-2011 organized in prototype GIS database		INPA	dito	Suwa, Noguchi (FFPRI)		Marcio (Master's student)		
1.5.1.2	Develop a GIS-based database	a New data (2010-2012)		INPA	Francisco (INPA)	Kajimoto, Suwa, Ishizuka(FFPRI)				
		b Existing data before the Project		INPA	Adriano (INPA)			, Giga (INPA)		
		c New data (2013)		INPA	Francisco (INPA)			Aailano (INPA)		

付属資料2

Annex 7 Draft of the PO (Darft of PO ver1)

	Activities	Targets	Schedule (BFY2010 – 14; JFY2010 – 14)	Org in charge	Responsible Persons	Inputs: JICA Personnel	Inputs: JICA Others	Inputs: INPA / INPE Personnel	Inputs: INPA / INPE Others	Remarks
Output 2: A relationship between forest types and carbon dynamics of primary and selectively logged forest is identified				FFPRI/ INPA	Ishizuka(FFPRI) Niro(INPA)					
2.1	To estimate forest carbon dynamics from forest inventory data in accordance with IPCC guidelines 2006			INPA	Adriano Lima (INPA)	Suwa, Kajimoto (FFPRI)	Equipments & Consumption			
2.1.1	Compile inventory dataset and allometry to estimate carbon stock of plots	Estimation of regional scale carbon stock from inventory data		INPA	dito	Suwa, Noguchi, Kajimoto (FFPRI)	PC system Software -Database -GIS	Adelia (INPA)		
2.1.2	Analyze carbon stock changes in remeasured plots	Estimation of regional scale carbon stock changes from remeasured plot data		INPA	dito	dito		dito		
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).			FFPRI	Kajimoto		Equipments & Consumption	Niro Higuchi (INPA) Adelia, Rosiane, Lucas		
2.2.1	Monitor changes in stand structure and carbon dynamics along topography	Changes in composition, structure and carbon stock in primary forest monitored		FFPRI	dito	Ishizuka, Kajimotom Suwa, Noguchi,,Tabuchi, Yagihashi, Iida, Sato	-Canopy Imager -Microclimate sensors -Water level sensors -Fine roots monitoring system (Scanner & software)	dito		
2.2.2	Analyze and develop model for changes of stand structure and carbon stock in relation to topography	Topographic differences in stand structure and carbon dynamics analyzed		FFPRI	dito	Ishizuka, Kajimotom Suwa, Noguchi, Sato		dito		
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			INPA/FPPRI	Niro Higuchi (INPA) Motiyoshi Ishizuka (FFPRI)		Equipments & Consumption	Adriano, Francisco		
2.3.1	Set detailed study subplots in selectively logged stands with different years after logging	Detailed study subplots to assess regeneration process in selectively logged forests installed		dito	dito	Suwa, Kajimoto (FFPRI)	-Canopy Imager	dito		
2.3.1	Monitor the changes in composition, structure and carbon stock in selectively logged stands	Changes in composition, structure and carbon stock monitored		dito	dito	Suwa, Kajimoto, Osani (FFPRI)		dito		
2.3.2	Evaluate selective logging impacts on carbon dynamics of managed forests	Reports published		dito	dito	dito		dito		

Annex 7 Draft of the PO (Darft of PO ver1)

	Activities	Targets	Org in charge	Responsible Persons	Inputs: JICA Personnel	Inputs: JICA Others	Inputs: INPA / INPE Personnel	Inputs: INPA / INPE Others	Remarks
	Output 3: Carbon dynamics maps are developed, using the data from CFI system and remote sensing information.		UT INPE	H.Sawada (UT) Dalton&Y.Shimabukuro(INPE)					
3.1	**To study and develop techniques on how to obtain site environmetal map using remote sensing information and geographic information**		UT INPE	H. Sawada(UT) Y.Shimabukuro (INPE)		RS and GIS Processing System, Satellite data (NOAA, Terra, Aqua, ALOS, etc.)	Y. Shimabukuro(INPE)	Forest map of INPE	
3.1.1	Vegetation indices and Thermal conditions in a long period of time	to distinguish the characteristics of natural condition of each pixel of MODIS in the Amazon River Basin, which may reflects the allometric parameters of forest stands.	ditto	H.Sawada (UT)	Y. Sawada, Tokunaga (UT)				
3.1.2	Dynamics of water level in the Amazon Basin	to monitor the water coverage in the Amazon							
		a Optical data	ditto	H.Sawada (UT)	Y.Sawada, Tokunaga (UT)				
		b Radar data	ditto	H.Sawada	ditto				
3.1.3	Site environment map of whole Amazon River Basin	to produce the site environmental map of the whole Amazon River Basin	ditto	H.Sawada (UT)	ditto				
3.2	**To develop analytical techniques to obtain forest stand parameters, such as canopy height, leaf area index (LAI) density and biomass, combining remote sensing information, including airborne LIDAR data, and forest inventory data**		UT INPA INPE	H. Sawada(UT) Niro Higuchi(INPA) Aral & Corina		Satellite Data (LANDSAT,ASTER, PRISM, TerraSAR-X, SRTM)		Satellite Data (CBERS)	
3.2.1	Correlation between field data and Lidar data on forest parameters	The forest parameters obtained from Lidar and field inventories will be mapped as the evaluation data for forest stand parameter estimation derived from satellite data.							
		a Preparation of field datasets for remote sensing analysis	UT	T.Endo (UT)	Y. Sawada,Ochi (UT)		Carlos Celes, Felipe (INPA)		
		b Lidar observation	UT	T.Endo (UT)					
		1) Airborne LIDAR (by Sep 2013)	UT	ditto	Y.Sawada (UT)	Cost for LIDAR observation	Carlos Celes, Felipe(INPA) Aral , M. Shimabukuro(INPE)		*Permission of Ministry of Defence needed in time
		2) UAV LIDAR observation at ZF2, Itacoatiara and ZF5 (by August 2013)	UT	ditto	Oki (UT)	UAV	ditto		UAV should be delivered by Mar 2013
		c Evaluation of Lidar with field data to identify forest stand parameters/forest structure	UT	T.Endo (UT)	Y. Sawada, Oki (UT)		ditto		GIS data from Activity 1.5 needed
		d Forest parameter mapping	UT	T. Endo (UT)	ditto		ditto		
3.2.2	Estimation of forest stand parameters/forest structure in wider area by using high-resolution satellite data and airborne radar data	to upscale the results of field inventory and Lidar information into certain broad areas.	UT	H. Sawada (UT)	Tokunaga , Ochi (UT), Suwa (FFPRI)	Satellite Data (LANDSAT,ASTER, PRISM, TerraSAR-X, SRTM)	Corina, Sidnei,Pires, Dutra (INPE) Moacir (INPA) for Landsat&PALSAR data	Airborne radar data	

Schedule: BFY2010, BFY2011, BFY2012, BFY2013, 14 / JFY2010, JFY2011, JFY2012, JFY2013 / Mar-Jun, Jul-Sep, Oct-Dec, Jan-Mar, Apr-Jun, Jul-Sep, Oct-Dec, Jan-Mar, Apr-Jun, Jul-Sep, Oct-Dec, Jan-Mar, Apr-May

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付属資料2

Annex 7 Draft of the PO (Darft of PO ver1)

	Activities	Targets	Org in charge	Responsible Persons	Inputs: JICA Personnel	Inputs: JICA Others	Inputs: INPA/ INPE Personnel	Inputs: INPA/ INPE Others	Remarks
3.3	**To develop remote sensing techniques to estimate large-scale forest stand parameters, and create Amazonian forest carbon map**		UT INPE	H. Sawada(UT) Dalton (INPE)		RADAR Data Processing System, Satellite Data (NOAA, Terra, Aqua, ALOS, etc.)			
3.3.1	Create carbon stock maps of the Brazilian Amazon for 2000, 2005, and 2010	to map the forest stand biomass and its accuracy of the whole Amazon							
		a Creation of maps	UT INPE	H.Sawada (UT)	Y. Sawada (UT)		Y.Shimabukuro, Dalton, Samuel (INPE) Moacir (INPA)		GIS data (Activity 1.5) used
		b Evaluation of uncertainty	ditto	H.Sawada (UT)	Y. Sawada (UT)		ditto		ditto
3.3.2	Estimate carbon stock change in the Amazon and creation of carbon stock change maps for 2000-2005 and 2005-2010	to estimate the biomass loss of the Amazon River Basin						DETER, PRODES	
		a Deforestation and forest degradation maps	INPE	Dalton(INPE)	H. Sawada (UT) Y. Sawada (UT)	Cost for development of degradation maps for years 2000-2003, and 2005	Dalton (INPE) Moacir (INPA)	PRODES, DEGRAD/DETEX (2007-2011), annual deforestation maps since 2000 in digital format	
		b Estimation of carbon stock change and creation of maps	INPE UT	Dalton(INPE) H. Sawada	ditto		Dalton, Shimabukuro, Samuel, Eduardo(INPE) Moacir (INPA)		
	Output 4: Techniques developed and information obtained in Output 1 to 3 are shaed with organization related to global climate change issues, including REDD+ and environmental conservation		INPA INPE						
4.1	**Provide free access to a part of forest inventory database and the remote sensing datasets at INPA/INPE/FFPRI/UT's website**		INPA	Adriano(INPA) Arai (INPE)					
4.1.1	Design website	Design finalized by the end of 2013	INPA/INPE	Adriano (INPA) Arai (INPE)	Ishizuka, Noguchi, Suwa (FFPRI) H. Sawada, Y.Sawada (UT)		Francisco		
4.1.2	Upload the inventorydata (2010-2012) to INPA /FFPRI's website	The inventory data (2010-2012) uploaded by March 2014	INPA FFPRI	ditto	Ishizuka,, Noguchi, Suwa (FFPRI)		Francisco		
4.1.3	Upload the remote sensing data sets to INPA/INPE/FFPRI/UT sites	The remote sensing data sets uploaded by March 2014	UT/INPE	Arai (INPE)	H. Sawada (UT) Y. Sawada (UT)		Moacir(INPA) Arai (INPE)		
4.2	**Organize workshops and/or seminars in Brazil**		INPA INPE	Niro (INPA) Thelma (INPE)	Ishizuka (FFPRI) H. Sawada (UT)				
		a Initial Project workshop	INPA	Niro (INPA)	Ishizuka (FFPRI) H.Sawada (UT)				
		b Forest inventory seminar in Curitiba (Nov 2012)	INPA	Niro (INPA)	Ishizuka (FFPRI) H. Sawada (UT)		Joaquin (INPA)		
		c Project workshop at INPE (March 2013)	INPE INPA	Thelma (INPE) Niro (INPA)	Ishizuka (FFPRI) H. Sawada (UT)		Rosaine (INPE)		
		d Final Project workshop at INPA (March or April 2014)	INPA INPE	Niro(INPA) Thelma (INPE)	Ishizuka (FFPRI) H.Sawada (UT)		Joaquin (INPA)		

Schedule: BFY2010, BFY2011, BFY2012, BFY2013, 14; JFY2010, JFY2011, JFY2012, JFY2013, 14

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RM-A Record of Brazilian Inputs

A-1. List of Brazilian Personnel (F=Full time assignment, P=Part time assignment)

(1) Project Director

Name	Position in the Organization	F/P	Assignment Period
Adalberto Luis Val	Director, INPA	P	May 2010 - Present

(2) Project Managers

a Project Manager (INPA)

Name	Academic Background	Position in the Organization	F/P	Project Assignment Period	Remarks
Niro Higuchi	Forest engineering	Senior Researcher, Head of Forest Management Research Group & Forest Management Lab, CDAM (Coordination of Environmental Dynamics), CPAAF (Coordination of Research and Activity Monitoring), INPA	P	May 2010 -Present	-In charge of Output 1, Output 2

b Project Sub-Manager (INPE)

Name	Academic Background	Position in the Organization	F/P	Project Assignment Period	Remarks
Dalton Valeriano		Manager of Program of Satellite Monitoring of Amazon, INPE	P	May 2010 -Present	-In charge of Output 3

(3) Technical Personnel

a. Specialists on forest inventory (9 persons from INPA)

a-1 Current personnel

	Name	Academic Background	Position in the Organization	F/P	Project Assignment Period	Role in the Project
1.	Joaquim dos Santos	Forest Engineering	Senior Researcher, Forest Management Research Group/ CDAM/ CPAAF/ INPA	P	May 2010 -Present	-Responsible for Activity 1.3, 1.4
2.	Adriano J. N. Lima	Forest Engineering	Volunteer researcher, Forest Management Research Group/ CDAM/ CPAAF/ INPA	P	May 2010 -Present	-Responsible for Activity 1.1, 1.2, 1.5, 2.1
3.	Casilda Adelia S. Souza	Forest Engineering	PCI/INPA Scholar, Forest Management Research Group/ CDAM/ CPAAF/ INPA	P	May 2010 -Present	-Engaged in Activity 2.2
4.	Gabriel H.P.M. Ribeiro	Forest Engineering	Ph. D student, Forest Management Research Group/ CDAM/ CPAAF/ INPA	P	May 2010 -Present	-Engaged in Activity 1.3
5.	Marcio Rogerio	Forest Engineering	Master's student, Forest Management Research Group/ CDAM/ CPAAF/ INPA	P	May 2010 -Present	-Engaged in Activity 1.1, 1.2
6.	Rosiane da Silva	Forest Engineering	Master's student, Forest Management	P	May 2010 -Present	-Engaged in Activity 2.2

			Research Group/ CDAM/ CPAAF/ INPA			
7.	Fransisco Higuchi	Forest Engineering	Volunteer Research Assistant, Forest Management Research Group/ CDAM/ CPAAF/ INPA & Ph. D student, Federal University of Parana	P	May 2010 -Present	-Engaged in Activity 1.4, 1.5, 2.3, 4.1
8.	Lucas Ourique	Forest Engineering	Master's student	P	Jan. 2012 -Present	Engaged in Activity 2.1
9.	Alberto Carlos Martins Pinto		Professor, Department of Forestry, University of Amazonas	P	Apr. 2011 - Present	Forest Inventory

a-2 Former personnel

	Name	F/P	Project Assignment Period	Remarks
1.	Henrique Naciomento	P	May 2010 - Mar. 2011	Forest Inventory

b. Specialists on remote sensing (INPE and INPA)

b-1 Current personnel (10 persons from INPE and 3 persons from INPA)

	Name	Academic Background	Position in the Organization	F/P	Project Assignment Period	Role in the Project
1.	Thelma Krug		Head of International Cooperation Office	P	Aug. 2012- Present	Responsible for Activity 4.2
2.	Yasuo Shimabukuro	Forest Engineering	Senior Researcher, Remote Sensing Division/INPE	P	May 2010 -Present	Responsible for Output 3, Engaged in Output 3.3
3.	Edigo Arai	Computer Science	Researcher, Remote Sensing Division/INPE	P	May 2010- -Present	Engaged in Output 3.3
4.	Moacir A. Campos	Forest Engineering	Senior Researcher, Forest Management Research Group/ CDAM/ CPAAF/ INPA & Head of GIS laboratory/ CPAAF	P	May 2010 -Present	Engaged in Output 3.2
5.	Henrique Carlos Celes	Forest Engineering	Research Assistant on grant, Forest Management Research Group/ CDAM/ CPAAF/ INPA	P	May 2010 -Present	Engaged in Activity 3.2
6.	Monica Shimabukuro	Biology	Researcher, Remote Sensing Division/ INPE	P	Mar. 2012 -Present	Engaged in Output 3.3
7.	Felipe Souza	Forest Engineering	Research Assistant on grant Forest Management Research Group/ CDAM/ CPAAF/ INPA	P	Jul. 2012 -Present	Engaged in Activity 3.2
8.	Luciano Dutra	Remote Sensing	Senior Researcher, Division of Image Processing	P	Aug. 2012-	Engaged in Activity 3.2
9.	Corina da Costa Freitas	Remote Sensing	Senior Resercher, Division of Image Processing/ INPE	P	Aug. 2012-	Engaged in Activity 3.2
10.	Sidnei Joao Siqueira Santanna	Remote Sensing	Resercher, Division of Image Processing/ INPE	P	Aug. 2012-	Engaged in Activity 3.2
11.	Eduardo Gerbi	Spatial Statistics	Researcher, Division of Image Processing/ INPE	P	Aug. 2012-	Engaged in Activity 3.3

RM-A Record of Brazilian Inputs

12.	Samuel Coura	Remote Sensing	Ph. D student	P	Aug. 2012-	Engaged in Activity 3.2
13.	Capitao Carlos Alberto Pires de Castro Filho	Remote Sensing	Ph. D student	P	Aug. 2012-	Engaged in Activity 3.2

RM- B Record of Japanese Inputs

B-1. Assignment of Japanese Experts (12 persons in total)

(1) Dispatch of Japanese Experts

	Field	Name (Organization)	Dispatch Period	Responsible Outputs / Activities of PDM
1.	Chief Advisor	Moriyo ISHIZUKA (FPPRI)	22/5/2010 - 31/5/2010	-In charge of Output 1 and 2 -Responsible for Activity 2.3
2.			4/9/2010 - 17/9/2010	
3.			26/3/2011 – 30/3/2011	
4.			16/6/2011 – 30/6/2011	
5.			14/11/2011 – 28/11/2011	
6.	Remote Sensing	Haruo SAWADA (University of Tokyo)	19/5/2010 – 26/5/2010	-In charge of Output 3 -Responsible for Activity 3.1, 3.2, 3.3
7.			24/3/2011 – 30/3/2011	
8.			12/11/2011 – 24/11/2011	
9.	Forest Inventory	Ryuichi TABUCHI	20/11/2010 – 3/12/2010	-Engaged in Activity 2.2, 2.3
10.	Forest Inventory	Takuya KAJIMOTO (FPPRI)	14/8/2010 – 3/9/2010	-Responsible for Activity 2.2 -Engaged in Activity 1.3,1.4, 2.2
11.			20/11/2010 – 3/12/2010	
12.			15/5/2011 – 30/5/2011	
13.			14/11/2011 – 19/12/2011	
14.	Forest Inventory	Shigeo IIDA	13/11/2010 – 3/12/2010	-Engaged in Activity 2.2, 2.3
15.	Forest Inventory	Tamotsu SATO	20/11/2010 – 3/12/2010	-Engaged in Activity 2.2., 2.3
16.			25/11/2011 – 6/12/2011	
17.	Forest Inventory	Tsutomu YAGIHASHI	13/11/2010 – 3/12/2010	-Engaged in Activity 2.2, 2.3
18.	Forest Inventory	Renpei SUWA	22/5/2010 - 28/6/2010	-Engaged in Activity 1.1,1.5, 2.3
19.			14/8/2010 - 8/10/2010	
20.			13/11/2010 - 17/12/2010	
21.			15/5/2011 – 2/7/2011	
22.			12/8/2011 – 5/9/2011	
23.			14/11/2011 – 19/12/2011	
24.			7/5/2012 – 14/6/2012	
25.	Forest Inventory	Hideyuki NOGUCHI	22/5/2010 - 28/6/2010	-Engaged in Activity 1.1, 1.2, 1.3, 1.5, 2.1, 2.2, 2.3
26.			14/8/2010 - 8/10/2010	
27.			13/11/2010 - 17/12/2010	
28.			15/5/2011 – 2/7/2011	
29.			18/8/2011 – 30/9/2011	
30.			16/11/2011 – 25/12/2011	

RM- B Record of Japanese Inputs

	Field	Name (Organization)	Dispatch Period	Responsible Outputs / Activities of PDM
31.			7/5/2012 – 14/6/2012	
32.	Remote Sensing	Takahiro ENDO (University of Tokyo)	19/5/2010 – 2/6/2010	-Engaged in Activity 3.1,3.2
33.			25/6/2011 – 5/7/2011	
34.			5/9/2011 – 27/9/2011	
35.			12/11/2011 – 23/11/2011	
36.	Remote Sensing	Yoshito SAWADA (University of Tokyo)	19/5/2010 – 2/6/2010	-Engaged in Activity 3.1,3.3
37.	Remote Sensing	Kazuo OKI (University of Tokyo)	25/6/2011 – 5/7/2011	-Engaged in Activity 3.2
38.			12/11/2011 – 28/11/2011	

(2) Assignment of Other Experts in Japan (2 persons in total)

	Field	Name (Organization)	Responsible Outputs / Activities of PDM
39.	Remote Sensing	Shiro OCHI (University of Tokyo)	-Engaged in Activity 3.2, 3.3
40.	Remote Sensing	Kanya TOKUNAGA (University of Tokyo)	-Engaged in Activity 3.2, 3.3

RM- B Record of Japanese Inputs

B- 2. List of Brazilian Personnel trained in Japan (6 person in total)

	Name	Position/Organization	Training Period	Title of Training Course	Remarks
1.	Moacir Campos, Ph. D.	Senior Researcher & Head of GIS Laboratory, INPA	1 Feb-15 Mar, 2011	Forest Inventory Sensing	Conducted at University of Tokyo
2.	Adriano J. N. Lima, Ph. D	Volunteer Researcher, INPA	12 Feb-13 Mar, 2011	Forest Inventory and Database Analysis	Conducted at FPPRI
3.	Casilda Adelia S. Souza	PIC/INPA scholar, INPA	ditto	Fine Root Research of Forest Trees	ditto
4.	Gabriel H.P.M. Ribeiro	Ph. D student, INPA	25 Feb-25 Mar, 2012	Forest Biomass and Data Analysis	ditto
5.	Marcio R.M. Amaral	Master's student, INPA	ditto	Forest Inventory and Database Analysis	ditto
6.	Carlos H. Celes	Research Assistant, INPA	21 Mar-9 May, 2012	Forest Monitoring and Remote Sensing	Conducted at University of Tokyo

RM- B Record of Japanese Inputs

B-3 (1) List of Equipment provided by Japan thorough (procured in Brazil)

JFY	No.	Item	Specification	Qn	Unit Price	Total Price	Total Price Equivalent JPY	Location	Responsible Person	Responsible Organization	Date of Delivery	# of available eqpt
2010	1	Laser printer	HP Laserjet P1005	1	390.00	390.00	JPY 19,500	INPA V8	Sakurai	INPA	2010/6/1	1
	2	Satelite telephone	IRIDIUM 9555	1	5,500.00	5,500.00	JPY 275,000	INPA V8	Sakurai	INPA	2010/8/9	1
	3	Cellular phone	Samsung Duo	1	699.00	699.00	JPY 34,950	INPA V8	Sakurai	INPA	2010/8/9	1
	4	Cellular phone	Nokia N85	1	750.00	750.00	JPY 37,500	INPA V8	Sakurai	INPA	2010/8/12	1
	5	Chaine saw	Sthill MS381	1	1,917.00	1,917.00	JPY 95,850	ZF2	Sakurai	INPA	2010/8/19	1
	6	Balance		1	500.00	500.00	JPY 25,000	ZF2	Sakurai	INPA	2010/8/19	1
	7	Printer	Samsung SCX-4300	1	400.00	400.00	JPY 20,000	INPA V8	Sakurai	INPA	2010/8/21	1
	8	GPS	Garmin GPSMAP60CS x	1	1,461.00	1,461.00	JPY 73,050	INPA V8	Sakurai	INPA	2010/12/9	1
2011	9	GPS	Garmin GPSMAP60CS x	3	1,485.00	4,455.00	JPY 222,750	INPA V8	Sakurai	INPA	2011/1/6	3
	10	Laser range finder	Trupulse 360B	2	7,675.00	15,350.00	JPY 767,500	INPA V8	Sakurai	INPA	2011/1/6	2
	11	Pickup car	L200 Outdoor	1	79,550.00	79,550.00	JPY 3,977,500	INPA	Sakurai	INPA	2011/2/4	1
	12	Soil moisture sensor	Decagon	6	3,290.83	19,745.00	JPY 987,250	ZF2	Sakurai	INPA	2011/2/28	6
	13	5ch datalogger for soil moisture sensor	Decagon	30	919.58	27,587.50	JPY 1,379,375	ZF2	Sakurai	INPA	2011/2/28	30
	14	Note PC	Acer Aspire Timeline	1	1,948.00	1,948.00	JPY 97,400	INPA V8	Sakurai	INPA	2011/4/6	1
	15	Software	Microimages TNTMps	1	14,850.00	14,850.00	JPY 742,500	SIGLAB	Moacir	INPA	2011/5/10	1
	16	Software	Opencadd Matlab	1	15,139.47	15,139.47	JPY 756,974	SIGLAB	Moacir	INPA	2011/5/11	1
	17	Software	GIS information sistem(ArcGIS)	1	3,845.01	3,845.01	JPY 192,251	SIGLAB	Moacir	INPA	2011/5/30	1
	18	Software	Red hat	1	823.97	823.97	JPY 41,199	SIGLAB	Moacir	INPA	2011/5/30	1
	19	VHF receiver	Cobra Marine HH330	2	350.00	700.00	JPY 35,000	INPA V8	Sakurai	INPA	2011/6/6	2
	20	Nobrake	Powerware UPS 5119RM	5	908.00	4,540.00	JPY 227,000	INPA V8	Sakurai	INPA	2011/6/9	5
	21	Desktop PC	Linux Workstation	1	7,835.47	7,835.47	JPY 391,774	SIGLAB	Sakurai	INPA	2011/6/24	1
	22	Desktop PC	Windows Worktation	1	7,835.47	7,835.47	JPY 391,774	SIGLAB	Sakurai	INPA	2011/6/24	1
	23	Desktop PC	Desktop PC	3	6,337.19	19,011.58	JPY 950,579	SIGLAB	Sakurai	INPA	2011/6/24	3
	24	Display 24inch LCD	DELL	5	675.68	3,378.41	JPY 168,921	SIGLAB	Sakurai	INPA	2011/6/24	5
	25	Software	Adobe Photoshop	1	2,496.00	2,496.00	JPY 124,800	SIGLAB	Sakurai	INPA	2011/7/6	1
	26	Digital camera with GPS	Sony Cyber-shot DSC-HX7V	4	1,039.00	4,156.00	JPY 207,800	INPA V8	Sakurai	INPA	2011/10/26	4
	27	Diameter tape	Forestry Suppliers	2	185.00	370.00	JPY 18,500	INPA V8	Sakurai	INPA	2011/10/28	2
2012	28	GPS	Garmin GPSMAP62s	3	1,311.00	3,933.00	JPY 196,650	INPA V8	Sakurai	INPA	2012/1/13	3
	29	Digital balance	Shimadzu AUY-220	1	2,350.00	2,350.00	JPY 117,500	INPA V8	Sakurai	INPA	2012/1/13	1
	30	Desktop PC	Dell Optiplex 790	2	3,086.10	6,172.15	JPY 308,608	INPA V8	Sakurai	INPA	2012/1/13	2
	31	Oven	Tecnal TW-394/3	1	9,580.00	9,580.00	JPY 479,000	INPA V8	Sakurai	INPA	2012/1/17	1
	32	Note PC	Panasonic Toughbook CF-53	2	6,990.00	13,980.00	JPY 699,000	INPA V8	Sakurai	INPA	2012/1/30	2
	33	Software	Windows office(PRO)	1	1,199.00	1,199.00	JPY 59,950	INPA	Sakurai	INPA	2012/1/31	1
	34	L200 Triton XB(car)	Mitsubishi L200 TRITON XB	1	90,950.00	90,950.00	JPY 4,547,500	INPA	Sakurai	INPA	2012/2/7	1
	35	Outboard motor	Yamaha 40XMHS	3	8,666.00	25,998.00	JPY 1,299,900	INPA	Sakurai	INPA	2012/2/7	3
	36	Base for outboard motor		3	189.00	567.00	JPY 28,350	INPA V8	Sakurai	INPA	2012/2/7	3
	37	Bed for domitory	Triliche	2	990.00	1,980.00	JPY 99,000	INPA V8	Sakurai	INPA	2012/2/7	2
	38	Diameter tape	Forestry Suppliers	5	161.17	805.85	JPY 40,293	INPA V8	Sakurai	INPA	2012/2/8	5
	39	Mill	4L-739	1	455.00	455.00	JPY 22,750	INPA V8	Sakurai	INPA	2012/2/24	1
	40	Binocular	ProMariner 7x50	1	390.00	390.00	JPY 19,500	INPA V8	Sakurai	INPA	2012/2/29	1
	41	Tire	BFGoodrich All Terrain	4	550.00	2,200.00	JPY 110,000	INPA V8	Sakurai	INPA	2012/3/5	4
	42	Canopy Imager	CID CI-110-24P	1	37,500.00	37,500.00	JPY 1,875,000	INPA V8	Sakurai	INPA	2012/3/14	1
	43	Diameter tape	Forestry Suppliers	10	181.31	1,813.14	JPY 90,657	INPA V8	Sakurai	INPA	2012/3/16	10
	44	Cabinet	Casa das Correias	2	500.00	1,000.00	JPY 50,000	INPA V8	Sakurai	INPA	2012/3/19	2
	45	Cover for rear deck ($WD)	Pick-up Total	1	5,000.00	5,000.00	JPY 250,000	INPA V8	Sakurai	INPA	2012/3/29	1
	46	Refringerator	Eletrolux	1	704.62	704.62	JPY 35,231	INPA V8	Sakurai	INPA	2012/3/29	1
	47	Soil moisture sensor	Decagon	6	3,946.00	23,676.00	JPY 1,183,800	ZF2	Sakurai	INPA	2012/3/29	6
	48	5ch datalogger for soil moisture sensor	Decagon	30	778.00	23,340.00	JPY 1,167,000	ZF2	Sakurai	INPA	2012/3/29	30

RM- B Record of Japanese Inputs

(2) Annual Provision of Equipment (as of August 2012)

Unit=YEN

	JFY 2010	JFY 2011	JFY 2012	Total
International Procurement	JPY 0	JPY 0	JPY 0	JPY 0
Local Procurement	JPY 580,850	JPY 11,680,844	JPY 12,679,688	JPY 24,941,382
Total	JPY 580,850	JPY 11,680,844	JPY 12,679,688	**JPY 24,941,382**

Unit=Brazilian Real

	JFY 2010	JFY 2011	JFY 2012	Total
International Procurement	BRL 0.00	BRL 0.00	BRL 0.00	BRL 0.00
Local Procurement	BRL 11,617.00	BRL 233,616.88	BRL 253,593.76	BRL 498,827.64
Total	BRL 11,617.00	BRL 233,616.88	BRL 253,593.76	**BRL 498,827.64**

B-4. Disbursement of Local Activity Cost (as of August 2012)

Unit=R$

Major Budget Item		JFY 2010	JFY 2011	JFY 2012	Total
1	Local Staff Cost	79,343.35	260,999.70	86,844.06	427,187.11
2	Travel Cost	23,018.66	46,423.80	22,212.12	91,654.58
3	Communication	1,339.19	2,510.32	882.41	4,731.92
4	Equipment/ Material	44,638.82	38,306.66	1,265.60	84,211.08
5	Seminars	0	14,287.00	0.00	14,287.00
6	Inventory	224,205.33	847,468.76	399,090.04	1,470,764.13
7	Others	4,500.54	5,003.13	1,183.19	10,686.86
Total in Local Currency		377,045.89	1,214,999.37	511,477.42	2,103,522.68
Total in Japanese Yen (1R$= 50 Yen)		JPY 18.852.294	JPY 60.749.968	JPY 25.573.871	JPY 105.176.134

RM- C Data related to Indicators

C-1 Data related to Indicator 4b of Output 4
Seminars organized by the Project

(1) Date of the workshop
11/18/2011

(2) Title of the workshop
Seminário Dinâmica do Carbono da Floresta Amazônica

(3) Location of the workshop
INPA

(4) Approximate number of participants
250

(5) Name of organizations that participated in the seminar

- Research institutions / Government institutions / Public service institutions

INPA - Instituto Nacional de Pesquisas da Amazônia (National Institute for Amazonian Researches)
EMBRAPA - Empresa Brasileira de Pesquisa Agropecuária (Brazilian Agricultural Research Corporation)
SPF - Secretaria de Estado de Política Fundiária (State Secretary of Land Policy)
Secretaria de Estado do Meio Ambiente e Desenvolvimento (State Secretary of Environment and Development)
SIPAM CR/MN – Sistema de Proteção do Amazonas (Amazon Protection System)
SEDUC – Secretaria do Estado de Educação do Amazonas (Amazon State Secretary of Education)
Eletrobrás Amazonia Energia(Amazon Energy Company)
Tribunal de Justiça do Amazonas (Amazon State Justice Tribunal)

- Universities and educational institutions

UFAM-Universidade Federal do Amazonas
IFAM-Instituto Federal de Educação, Ciência e Tecnologia do Amazonas
Universidade Nilton Lins
Fundação Desembargador Paulo Feitoza
Universidade Presbiteriana Mackenzie
UNIP - Universidade Paulista
Faculdade Catedral de Boa Vista
Centro de Educação Tecnológica do Amazonas
ULBRA – Universidade Luterana do Brasil
UNINORTE
IDAAM

- Private enterprises and companies

Instituto Brasileiro de Avaliações e Perícias de Engenharia
COOPFAS - Cooperativa de Produção Florestal do Alto Solimões
Moto Honda da Amazônia Ltda.
BIOME - Planejamento e Sistema de Gestão Ltda.
CBA - Centro de Biotecnologia da Amazônia
D5 Assessorias e Serviços Ltda.
W.R. Assessoria e Consultoria de Empresas e Soluções
Espaço Verde Consultoria Ambiental
Instituto Amazonia Livre
Biofílica Investimentos Ambientais S.A.

D-1. List of Project Deliverables

Overall

1) Teaching Materials (CADAF Outline/ Basic Lessons for Remote Sensing) (2011)

Output 1/ Output2

1) Video for introduction of inventory survey in Sao Gabriel da Cocheira (CD-ROM) (2010)
2) Forest Inventory database ver.1 (Dataset) (2012)
3) Lima JNA., Suwa R., Ribeiro HPGM., Kajimoto T., Santos J., Silva PR., Souza SAC., Barros CP., Noguchi H., Ishizuka M., Higuchi N. (2012) Allometric models for estimating above- and below-ground biomass of tropical rainforests at São Gabriel da Cachoeira in upper Rio Negro, Brazilian Amazon. Forest Ecology and Management 277: 163–172 (Article)
4) Suwa R., Sakai T., Santos J., Silva R.P., Kajimoto T., Ishizuka M., Higuchi N.. Significance of topographic gradient in stem diameter - height allometry for precise biomass estimation of a tropical moist forest in central Amazon. JARQ. (Article) (in press)

Output 3

1) Cloud Free MODIS MDVI dataset (Dataset) (2010)
2) Cloud Free Daytime/Nighttime Temperature dataset for whole Amazon (Dataset) (2011)
3) GPUPU LMF (Software) (2011)
4) Site Environment Map ver.1 (2011)
5) Clustering Software for numerical and categorical data ver.1 (Software) (2011)
6) GIS database (Software) (2011)
7) LiDAR Simulator (Software) (2012)
8) TERRAIN detection for full wave form LiDAR (Software) (2012)
9) Endo T., Sawada H. (2010) Development of a LiDAR simulation system for forest. Seisankenkyu 62: 445-448 (Article)
10) Sawada Y., Sawada H. (2010) Development of Land Cover Change Automatic Detection System by using satellite data. Seisankenkyu 62: 449-453 (Article)
11) Sawada Y., Endo T., Sawada H. (2011) Development of forest environmental datasets and software for classification of forest environments. Seisankenkyu 63: 431-435 (Article)

RM-D List of Project Deliverables

D-2. Abstract of a published scientific article in an international journal

Forest Ecology and Management 277 (2012) 163–172

Contents lists available at SciVerse ScienceDirect

Forest Ecology and Management

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Allometric models for estimating above- and below-ground biomass in Amazonian forests at São Gabriel da Cachoeira in the upper Rio Negro, Brazil

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ABSTRACT

Precise estimation of biomass at a regional scale is required for evaluating forest carbon stocks throughout the Amazon. We examined six types of allometric models to identify the best estimator of biomass in primary forests (*terra firme*) in the northwestern sector of the Brazilian Amazon. We also tested six regression models for estimating tree height. We developed each allometric model using measurements of 101 trees excavated in a primary forest distributed along the upper Rio Negro. A simple power function with stem diameter at breast height *D* as a single variable was selected as the best model for estimating each biomass component, i.e. above-ground total mass *AGW*, below-ground total mass *BGW*, and whole individual mass. Among models developed to estimate tree height *H* from *D*, we selected a regression model with a coefficient corresponding to an asymptotic height as the best fit. The *D–AGW* relationship at our study site differed significantly from models developed previously for other regions of the Amazon. We explain this regional variation in part by regional differences in *D–H* relationships of sample trees. The *D–BGW* relationship at our site also differed significantly from that in the central Amazon. However, *AGW–BGW* relationships were consistent between the upper Rio Negro forest and other forests in the central Amazon, in that the *BGW–AGW* ratio was constant as 0.136 regardless of tree size. On the basis of *D*-based allometry and census data from 23 plots established in the upper Rio Negro region, we estimated a stand-level total biomass (dry mass) of 252.6 Mg ha^{-1}. This estimate is at least 73% lower than the potential stand biomass for the region previously suggested by several meta-analyses.

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1. Introduction

The Amazon is a focal region in research on the effects of climate change on environments and carbon flux. Amazonian forests account for a substantial portion of carbon stock and net primary production among global terrestrial ecosystems (e.g. Melillo et al., 1993; Malhi et al., 2006). However, large-scale estimates of forest biomass in the Amazon still include uncertainty (Houghton et al., 2001; Eva et al., 2003; Fearnside and Laurance, 2003; Chave et al., 2008) because regional-scale variation in biomass, possibly caused by heterogeneity in vegetation structure among different forest types and environments, is not yet fully understood. For example, previous studies have reported that total biomass (dry mass) of Amazonian forests can range from 155 to 425 Mg ha^{-1} (Houghton et al., 2001), 303 to 385 Mg ha^{-1} (Nogueira et al., 2008a), and 285 to 401 Mg ha^{-1} (Lima, 2010).

Tree biomass can be estimated using allometric relationships between stem diameter at breast height *D* and tree mass. Past studies developed allometric models of Amazonian forests, primarily for above-ground biomass (Overman et al., 1994; Santos, 1996; Higuchi et al., 1998; Araújo et al., 1999; Chambers et al., 2001; Nogueira et al., 2008a), and there are few allometric models for below-ground biomass (Sierra et al., 2007; Silva, 2007). Allometric models should be selected carefully by considering forest type (e.g. Brown, 1997; Chave et al., 2005; Kenzo et al., 2009, 2010). For example, Silva (2007) found that allometric models for estimating biomass differed between secondary and primary forests near Manaus in Amazonas State, Brazil. Furthermore, allometric models may vary by region (Malhi et al., 2006; Nogueira et al., 2008b), regardless of forest type.

Allometric models for estimating above-ground biomass in Amazonian forests have been developed in various sectors of the region, such as the central (Chambers et al., 2001; Silva, 2007), eastern (Araújo et al., 1999), and southern (Nogueira et al., 2008a) Amazon in Brazil, as well as the northwestern Amazon in

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Minutes of Meeting

CADAF JCC meeting

Brasília, August 24, 2012

Ministry of External Relations of Federative Republic of Brazil (hereinafter referred as "MRE"), Ministry of Science, Technology and Innovation (hereinafter referred as "MCTI"), National Institute for Research in the Amazon (hereinafter referred as "INPA"), National Institute for Spatial Research (hereinafter referred as "INPE"), Forestry and Forest Products Research Institute (hereinafter referred as "FFPRI"), Institute of Industrial Science of University of Tokyo (hereinafter referred as "IIS-UT") and Japan International Cooperation Agency (hereinafter referred as "JICA") met in Brasilia for the second Joint Coordinating Committee (hereinafter referred as "JCC") of the Carbon Dynamics of Amazonian Forests Project (hereinafter referred as "CADAF"), which was chaired by the representative of MCTI. The main objective of the second JCC meeting was to receive, analyze and discuss the CADAF midterm review report.

The synthesis of midterm review report was presented by H. Takata, Director of JICA Forestry and Nature Conservation Division 2. After the presentation, the report was discussed with the Brazilian concerned authorities with the implementation of CADAF, and with all JCC members as well. The second JCC was composed of: (1) Chairperson - Reinaldo F.F. Lourival, MCTI Secretariat of Policies and Programs in Research and Development, General Coordinator; (2) CADAF Project Manager, Niro Higuchi, INPA; (3) CADAF Project Manager, Dalton M. Valeriano, INPE; (4) Fabrício G. Araújo, Representative of Division of Science and Technology (hereinafter referred as "DCTEC") of MRE; (5) M. Ishizuka, FFPRI; (6) H. Sawada, IIS/UT and (7) Milton Sakurai, CADAF Project Coordinator; (8) I. Sato, JICA Brazil representative. Observers: (1) Y. Saito, Japan Embassy representative; (2) Julio A. Inoue, JICA Brazil Project Coordinator; (3) M. Ishida, JST - Washington. The evaluation team was composed of: (1) H. Takata, Leader, JICA Japan; (2) T. Sekiguchi, JICA Japan Officer; (3) Rodrigo da Silva, UFOPA; (4) Fabrício G. Araújo, MRE/DCTEC; (5) Maria Cordélia Machado, MCTI International Cooperation Office; (6) Y. Hirouchi, consultant; (7) Silvia N. Kaneyasu, translator; the JST evaluation team was composed of: (1) T. Nakashizuka, Tohoku University; (2) M. Ishida, JST – Washington; (3) T. Iwaki, JST – Japan.

As a result of the discussions, by the unanimous decision JCC members approved the report of the joint midterm review and its annexes on the CADAF project, modification of Master Plan, implementation system and Project Design Matrix (PDM) approved on 5th February, 2010 by Brazilian and Japanese representatives, and Plan of Operation which are attached hereto. Moreover JCC members agreed on necessity of development of annual Plan of Operation (APO).

Reinaldo FF. Lourival	Fabrício G. Araujo	I. Sato
MCTI Representative	MRE/DCTEC Representative	JICA Brazil Representative

Niro Higuchi	Dalton M. Valeriano
INPA Representative	INPE Representative

ANNEX I Modification of MASTER PLAN and Implementation System

Modification of MASTER PLAN and Implementation System

A midterm review survey team made series of discussions with Brazilian relevant personnel and Japanese experts during the midterm review. Through discussions, it has proved necessary to reorganize the MASTER PLAN which was approved on 5th February, 2010 by Brazilian and Japanese representatives. In addition, rearrangement of implementation system in terms of assignments of Project Manager and Sub Project Manager are also considered to be necessary. The main points of modification are compiled here.

1. Modification of MASTER PLAN

The main points of modification of MASTER PLAN are shown in a below table.

Item	Existing MASTER PLAN	Modified points
Outputs	None of equivalent output	Output related to share of the Project deliverables is compiled as Output4. 4 Techniques developed and information obtained in Output 1 to 3 are shared with organization related to global climate change issues, including REDD+ and environmental conservation.
Activities of Output1	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 [1] guidelines 2006. 1-2 To re-measure more than four hundred (400) CFI plots in existing six (6) sites [2] in central Amazon. 1-5 To develop a forest inventory database for central Amazon.	1.1 To establish one hundred (100) new CFI plots per area at Central Amazon, including Atlanta do Norte, Sao Gabriel da Cachoeria, and Resex Pirus, and conduct forest inventory in accordance with IPCC guidelines 2006 1.2 To re-measure more than four hundred (400) CFI plots in existing eight (8) sites in central Amazon. 1.5 To develop a GIS-based forest inventory database for central Amazon.
Activities of Output2	2-1 To estimate forest carbon dynamics from forest inventory data in accordance with IPCC guidelines 2006.	2-1 To estimate forest carbon dynamics (i.e. carbon stock change) from the forest inventory data in accordance with IPCC guidelines 2006.
Activities of	3-2 To develop analytical techniques to obtain forest stand parameters, such as canopy height, leaf area index (LAI) and biomass,	3-2 To develop analytical techniques to obtain forest stand parameters, such as canopy height, leaf area index (LAI) density and

[1] Intergovernmental Panel on Climate Change (IPCC)
[2] Itacoatiara, Fonte Boa, Jutai, Resex Baixo Jurua, Resex Auati-Parana, and Resex Capana Grande.

ANNEX I Modification of MASTER PLAN and Implementation System

Output3	combining remote sensing information and forest inventory data. 3-4 To share developed techniques and information, obtained in output 1 to 3, with organizations related to global climate change issues, including REDD, through workshops and/or seminars.	biomass, combining remote sensing information, including airborne LiDAR data, and the GIS-based forest inventory data from Activity 1.5 3-4 (To be reorganized.)
Activities of Output4	3-4 To share developed techniques and information, obtained in output 1 to 3, with organizations related to global climate change issues, including REDD, through workshops and/or seminars.	4.1 Provide free access to the forest inventory database at INPA's website 4.2 Provide free access to the remote sensing datasets produced by the Project at INPA/INPE/FFPRI/UT's website. 4.3 Organize workshops and/or seminars in Brazil

2. Modification of Project implementation system

The Project is jointly implemented by INPA and INPE. Director of INPA is the Project Director. Dr. Niro Higuchi, Senior Researcher of INPA, is the Project Manager: Dr. Dalton de Morisson Valeriano, is the Project sub-Manager.

Considering that full-fledged involvement of INPA is expected in the second half of the Project, the above implementation system may need to be revisited. Simultaneously members of Joint Coordination Committee (JCC) will be rearranged in accordance with the rearrangement. The implementation system is modified as following:

Item	R/D	Modified version
Project Manager	・Project Manager for Output 1 &2: Dr. Niro Higuchi, Senior Researcher of INPA	・Project Manager for Output 1 &2: Dr. Niro Higuchi, Senior Researcher of INPA ・Project Manager for Output 3: Dr. Dalton de Morisson Valeriano Senior Researcher, INPE
Sub Project Manager	(Project Sub-Manager) ・Dr. Dalton de Morisson Valeriano, Senior Researcher, INPE	・Sub Project Manager for Output 1&2: Joaquin dos Santos, Senior Researcher of INPA ・Sub Project Manager for Output 3: Yoshio Shimabukuro, Senior Researcher of INPE

MASTER PLAN

Project Title

Carbon Dynamics of Amazonian Forest (CADAF 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[3]. 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.

4. Techniques developed and information obtained in Output 1 to 3 are shared with organization related to global climate change issues, including REDD+ and environmental conservation.

Activities

1-1 To establish one hundred (100) new CFI plots per area at Central Amazon, including Atlanta do Norte, Sao Gabriel da Cachoeria, and Resex Pirus, and conduct forest inventory in accordance with IPCC guidelines 2006

1-2 To re-measure more than four hundred (400) CFI plots in existing eight (8) sites in central Amazon.

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

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.

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

2-1 To estimate forest carbon dynamics (i.e. carbon stock change) from the forest inventory data in accordance with IPCC guidelines 2006.

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).

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.

3-1 To study and develop techniques on how to obtain site environmental map using remote sensing information and geographic information.

3-2 To develop analytical techniques to obtain forest stand parameters, such as canopy height, leaf area index (LAI) density and biomass, combining remote sensing information, including airborne LiDAR data, and the GIS-based forest inventory data from Activity 1.5

3-3 To develop remote sensing techniques to estimate large-scale forest stand parameters, and create Amazonian forest carbon map.

[3] Central Amazon means Amazonas State and Acre State.

ANNEX II Modified MASTER PLAN

4-1 Provide free access to the forest inventory database at INPA's website
4-2 Provide free access to the remote sensing datasets produced by the Project at INPA/INPE/FFPRI/UT's website.
4-3 Organize workshops and/or seminars in Brazil

In case in which the Master Plan should be changed due to the situation of the Project, JICA and the Government of the Federative Republic of Brazil will agree to and confirm the changes by exchanging Minutes of Meeting.

LIST OF BRAZILIAN COUNTERPARTS AND ADMINISTRATIVEPERSONNEL

1. Project Director

Director, INPA

2. Project Manager

Project Manager for Output 1 &2: Dr. Niro Higuchi, Senior Researcher, INPA
Project Manager for Output 3: Dr. Dalton de Morisson Valeriano Senior Researcher, INPE

3. Sub Project Manager

Sub Project Manager for Output 1&2: Joaquin dos Santos, Senior Researcher of INPA
Sub Project Manager for Output 3: Yoshio Shimabukuro, Senior Researcher of INPE

4. Counterpart Personnel

INPA and INPE staffs. (In detailed Counterpart Personnel refer to Plan of Operation.)

5. Administrative Personnel

Administrative and clerical personnel, drivers and others to support the implementation of the Project.

Note: And other personnel as mutually agreed upon.

ANNEX IV JOINT COORDINATING COMMITTEE

JOINT COORDINATING COMMITTEE

1. Functions

The Joint Coordinating Committee shall;

(1) discuss and decide overall strategies in the management and coordination of the Project,
(2) review and endorse the annual plan of the Project,
(3) monitor and evaluate the progress of the Project, and
(4) make decisions relevant to the overall management of the Project.

2. Compositions

The Joint Coordinating Committee shall be composed of:

(1) Chairperson: Executive Secretary of the Ministry of Science and Technology

(2) Members:

- Project Director (INPA)
- Project Manager (INPA, INPE)
- Sub Project Manager (INPE, INPE)
- Representative of Division of Science and Technology, Ministry of External Relations
- Head of Tropical Forestry Department of INPA
- Head of Institutional Relations of INPA
- Representative of Earth Observations Coordination of INPE
- Representative of Institutional Relations of INPE
- JICA experts of the Project
- Coordinator for technical cooperation of Japan in Brazil (JICA Brazil)
- Others appointed by the Chairperson

(3) Observers:

- Official(s) of Embassy of Japan
- Representative(s) of Japan Science and Technology Agency

3. The Secretariat of the Committee

Both INPA and INPE will act as the Secretariat of the Committee. The Secretariat will coordinate matters pertaining to the administration of the Committee.

ANNEX V PDM ver.2

Project Title: "Carbon Dynamics of Amazonian Forest" PDM Version 2 Date: August 24, 2012
Target Group: (1) Scholars and Researchers at the Related organizations in Brazil, including INPA and INPE(2) Related Organizations to REDD+, such as Ministry of Science and Technology, Ministry of Environment, Ministry of External Relations, State Governments, private sectors, NGOs
Target Area: Brazilian Amazon Forest*
Project Duration: 4 years (from May 19, 2010 to May 18, 2014) Implementing Organizations: INPA and INPE

Narrative Summary	Objectively Verifiable Indicators	Means of Verification	Important Assumptions
<Project Purpose> An evaluation technique on a large-scale carbon dynamics of Brazilian Amazon forests is developed.	a. By the Project end, a continuous evaluation of large-scale carbon stock and carbon-stock change, using field and remote sensing data becomes possible at INPA and INPE b More than 50% of the related organizations to REDD+ and environmental conservation in Brazil that participated in the final workshop/seminar organized by the Project, such as ICMBIO Embrapa, private sector, etc., recognize that the evaluation technique is useful c More than 50 % of the above organizations express their interests in utilizing the evaluation technique	a Results of Joint assessment by INPA, INPE and Japanese Expert Team based on agreed checklist b&c Results of questionnaire survey at the final workshop/seminar	The Brazilian Government continuously recognizes the importance of forest conservation in Amazon
<Outputs> 1 A continuous forest inventory (CFI) system to survey carbon dynamics in central Amazon** is established	1a By August 2013, more than 300 CFI plots are established in new sites in central Amazon by putting stakes and tags.– 1b By August 2013, forestry inventory data are collected in 8 existing and 2 new sites in central Amazon in accordance with the IPCC guideline 2006 1c By March 2014, result of test of a hypothesis on a common allometric equation model for the four (4) areas in Brazilian Amazon(i.e. Sao Gabriel da Cachoeria and Manaus (INPA ZF-2) in Amazonia, Amapa, and Tome-acu in Para) is available with uncertainty estimated based on a recommendation in the IPCC guideline 2006 1d By the Project end, forest inventory data from all existing and new sites in central Amazon, including information such as site photos, GPS information, and forest stand inventory information, forest type, and carbon stock is organized in a GIS-based forest inventory database 1e By the Project end, more than five (5) scientific research papers are submitted to international journals	1a Records of the project activities 1b Same as 1a 1c Scientific paper submitted on the subject 1d GIS-based database 1e Submitted papers	Trained GIS personnel in INPA do not stop working for the Project。
2. A relationship between forest types and carbon dynamics of primary and selectively logged forest in central Amazon is identified	2a By the end of 2013, specific figures of carbon stock-and stock change in primary and selectively logged forests before and after logging is are estimated at flooded-and plateau forests in central Amazon 2b By the Project end, more than five (5) scientific research papers are submitted to international journals	2a Table of figures 2b Submitted papers	
3 Carbon dynamics maps for Brazilian Amazon forest are developed, using the data from the CFI system, remote sensing techniques, and satellite images	3a By the end of 2012, a site environment map for Brazilian Amazon forest is developed 3b By June 2013, the forest inventory data is up-scaled using remote sensing data, including airborne LiDAR data, for each category of the forest site environment map with estimated accuracy 3c By the Project end, Brazilian Amazon forest's carbon stock maps for 2000, 2005, 2010 are-created with uncertainty estimated for each category. 3d By the Project end a Brazilian Amazon forest's carbon stock change maps for 2000-2005 and 2005-2010 are created with uncertainty estimated for each category 3e More than three (3) scientific research papers are submitted to international journals	3a, 3c, 3d Produced maps 3e Submitted papers	
4 Techniques developed and information obtained in Output 1 to 3 are shared with organization related to global climate change issues, including REDD+ and environmental conservation.	4a By the end of the Project, free access to a part of the forest inventory database (i.e. data collected in 2010-2012) is available at INPA/FFPRI's website. 4b By the end of the Project, free access to the remote sensing datasets produced by the Project is available at INPA/INPE/FFPRI/UT's website. 4c More than two workshops and/or seminars are organized by the Project in Brazil	4a&bDatabase presented in the web site 4b Records of the project activities 4c ditto	

ANNEX V PDM ver.2

<Activities>	<Inputs>	
1.1 To establish one hundred (100) new CFI plots per area at Central Amazon, including Atlanta do Norte, Sao Gabriel da Cachoeria, and Resex Pirus, and conduct forest inventory in accordance with IPCC guidelines 2006 1.2 To re-measure more than four hundred (400) CFI plots in existing eight (8) sites*** in central Amazon. 1.3 To determine above and below ground biomass and carbon contents of trees in Sao Gabriel da Cachoeira 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 Cachoeria, Manaus (INPA ZF-2), Amapa and Tome-acu 1.5 To develop a GIS-based forest inventory database for central Amazon. 2.1 To estimate forest carbon dynamics (i.e. carbon stock change) from the forest inventory data in accordance with IPCC guidelines 2006. 2.2 To survey and analyze temporal changes in forest characteristics-species composition, forest stand structure and carbon stock at flooded, eco-tone and plateau forests, based on large-scale inventory plots and long-distance belt-transects at primary forest (INPA ZF-2) 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 stock at chronologically different logged forest 3.1 To study and develop techniques on how to obtain site environmental map using remote sensing information and geographic information 3.2 To develop analytical techniques to obtain forest stand parameters, such as canopy height, leaf area index (LAI) density and biomass, combining remote sensing information, including airborne LiDAR data, and the GIS-based forest inventory data from Activity 1.5 3.3 To develop remote sensing techniques to estimate large-scale forest stand parameters, and create Amazonian forest carbon stock change map 4.1 Provide free access to the forest inventory database at INPA's website 4.2 Provide free access to the remote sensing datasets produced by the Project at INPA/INPE/FFPRI/UT's website. 4.3 Organize workshops and/or seminars in Brazil	**●Brazilian side** (1) Project personnel& necessary staff 1) Project Director (INPA) 2) Project Manage for Output 1 &2 (INPA) 3) Project Manager for Output 3 (INPE) 4) Sub Project Manager for Output 1 &2 (INPA) 5) Sub Project Manager for Output 3 (INPE) 6) Specialists on forest inventory for Output 1 & Output 2 (INPA) 7) Specialists on remote sensing for Output 3 (INPA and INPE) 8) Supporting staff (2) Provision of Project land, facilities, and equipment 1) More than one thousand (1,000) CFI plots 2) Project offices in INPA and INPE 3) Vehicle for field work 4) Other necessary equipment and materials for project implementation (3) Local Operation Cost **●Japanese side** (1) Dispatch of Experts 1) Chief Advisor 2) Forest Inventory 3) Remote Sensing, 4) Coordination (2) Training of project personnel in Japan or the 3rd country 1) Total of eight (8) in four (4) years (3) Machinery, Equipment and materials 1) Forest inventory 2) Remote sensing 3) Other equipment if needed (4). Local operation cost 1) Operational cost for Japanese experts	1 Local communities do not oppose the Project **<Preconditions>** 1. Project personnel are properly assigned for the Project. 2. There is no security problems in the Project site 3. Local authorities and people are willing to support the Project

Abbreviation:
INPA: Instituto Nacional de Pequisas da Amazonia
INPE: Instituto Nacional de Pesquisas Espacia
ICMBIO: Instituto Chico Mendez de Conservacao da Biodiversidade
Embrapa: Empresa Brasil** de Pesquisa Agropecuaria
IPCC: Intergovenmental Panel on Climate Change

Footnotes
* Brazilian Amazon forests are Biome in Legal Amazon of Brazil **Central Amazon means Amazonas State and Acre State ***Existing eight (8)_sites are Itacoatiara, Fonte Boa, Jutai, Resex Baixo Jurua, Resex Auati-Parana, Resex Capana Grande, Maues, and Resex Pirus.

ANNEX VI PO ver1

Activities	Targets	Schedule (BFY2010 – 14; JFY2010 – JFY2013; May-Jun, Jul-Sep, Oct-Dec, Jan-Mar, Apr-Jun, Jul-Sep, Oct-Dec, Jan-Mar, Apr-Jun, Jul-Sep, Oct-Dec, Jan-Mar, Apr-Jun, Jul-Sep, Oct-Dec, Jan-Mar, Apr-May)	Org in charge	Responsible Persons	Inputs: JICA Personnel	Inputs: JICA Others	Inputs: INPA / INPE Personnel	Inputs: INPA / INPE Others	Remarks
Output 1: A continuous forest inventory (CFI) system to survey carbon dynamics in central Amazon is established.			**INPA FFPRI**	**Niro (INPA) Ishizuka (FFPRI)**					
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 Resex Pirus, and conduct forestry inventory in accordance with IPCC guidelines 2006			INPA	Adriano Lima (INPA)		Equipments & Consumables	Forest inventory team of INPA		
1.1.1 Select new inventory sites	2 additional sites selected		INPA	ditto	Ishizuka, Kajimoto, Suwa, Noguchi	Field survey costs -Boat rent, Oil -Labor costs Equipment -Laptop PC -GPS -VHF radio -Tree climbers & accessories -Surveying equip-mints (compa+V33ss, distance measure, etc.)			
1.1.2 Conduct plot setting and initial survey	Target sites		INPA	ditto					
	a *Sao Gabriel da Cachoeira*		ditto	ditto	Ishizuka, Kajimoto, Suwa, Noguchi				
	b Atalaia do Norte		ditto	ditto	Kajimoto, Suwa,Noguchi				
	c *Purus*		ditto						
1.2 To re-measure more than four hundred (400) CFI plots in existing eight (8) sites in central Amazon			INPA	Adriano (INPA)			Forest inventory team of INPA		
1.2.1 Conduct second survey at the existing plots in each site	*Sao Gabriel da Cachoeira*								
	a Itacoatiara (MIL)		INPA	ditto	Ishizuka, Kajimoto, Suwa, Noguchi (FFPRI)				
	b Fonte Boa (ZFV)		ditto	ditto	Suwa, Noguchi (FFPRI)				
	c Jutai		ditto	ditto	Ishizuka, Suwa, Noguchi (FFPRI)				
	d Resex Baixo Jurua		ditto	ditto					
	e Resex Auati-Parana		ditto	ditto	Suwa, Noguchi (FFPRI)				
	f Resex Capana Grandei		ditto	ditto	Suwa, Noguchi				
	g Rio Unini		ditto	ditto	Suwa, Noguchi (FFPRI)				
	h *Maues*		ditto	ditto					
1.3 To determine above and below ground biomass and carbon contents of trees in Sao Gabriel da Cachoeira			INPA	Joaquim (INPA)		Equipments & Consumables			
1.3.1 Measure biomass and carbon contents of trees in Sao Gabriel da Cachoeira	Biomass and carbon contents dataset					Field survey costs -Boat rent, Oil -Labor costs Equipment -Scales			
	a Biomass of trees (leaf, branch, stem and root) measured		INPA	Adriano (INPA)	Kajimoto, Suwa (FFPRI)		Giga (INPA)		
	b Carbon contents and specific density of woods analyzed		INPA	Adriano(INPA)	ditto		ditto		
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			INPA	Joaquim (INPA)		Consumables			
1.4.1 Analyze allometric relations for estimating above- and below-ground carbon of trees	The best fit allometric model(s) determined								
	a For Sao Gabriel da Cachoeira		INPA	Adriano (INPA)	Kajimoto, Suwa, Ishizuka(FFPRI)		, Giga (INPA)		
	b For Brazilian Amazon forest		INPA	Francisco (INPA)	ditto		Asriano (INPA)		
1.5 To develop a GIS-based forest inventory database for central Amazon			INPA	Adriano Lima (INPA)		Equipments Database Software Consumables	Adriano Jose Nogueira Lima (Postgraduate)		
1.5.1 Develop the forest inventory database	The Amazonian forest inventory database developed		INPA	ditto					
1.5.1.1 Develop a prototype database with geographic coordinates	Data collected in 2010-2011 organized in prototype GIS database		INPA	ditto	Suwa, Noguchi (FFPRI)		Marcio (Master's student)		
1.5.1.2 Develop a GIS-based database	a New data (2010-2012)		INPA	Francisco (INPA)	Kajimoto, Suwa, Ishizuka(FFPRI)				
	b Existing data before the Project		INPA	Adriano (INPA)			, Giga (INPA)		
	c New data (2013)		INPA	Francisco (INPA)			Asriano (INPA)		

ANNEX VI PO ver1

	Activities	Targets	Schedule (BFY2010 / JFY2010: May-Jun, Jul-Sep, Oct-Dec, Jan-Mar; BFY2011 / JFY2011: Apr-Jun, Jul-Sep, Oct-Dec, Jan-Mar; BFY2012 / JFY2012: Apr-Jun, Jul-Sep, Oct-Dec, Jan-Mar; BFY2013 / JFY2013: Apr-Jun, Jul-Sep, Oct-Dec, Jan-Mar; 14: Apr-May)	Org in charge	Responsible Persons	Inputs: JICA Personnel	Inputs: JICA Others	Inputs: INPA / INPE Personnel	Inputs: INPA / INPE Others	Remarks
Output 2: A relationship between forest types and carbon dynamics of primary and selectively logged forest is identified				FFPRI/INPA	Ishizuka(FFPRI) Niro(INPA)					
2.1	**To estimate forest carbon dynamics from forest inventory data in accordance with IPCC guidelines 2006**			INPA	Adriano Lima (INPA)	Suwa, Kajimoto (FFPRI)	Equipments & Consumption			
2.1.1	Compile inventory dataset and allometry to estimate carbon stock of plots	Estimation of regional scale carbon stock from inventory data		INPA	ditto	Suwa, Noguchi, Kajimoto (FFPRI)	PC system Software -Database -GIS	Adeila (INPA)		
2.1.2	Analyze carbon stock changes in remeasured plots	Estimation of regional scale carbon stock changes from remeasured plot data		INPA	ditto	ditto		ditto		
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).**			FFPRI	Kajimoto		Equipments & Consumption	Niro Higuchi (INPA) Adelia, Rosiane, Lucas		
2.2.1	Monitor changes in stand structure and carbon dynamics along topography	Changes in composition, structure and carbon stock in primary forest monitored		FFPRI	ditto	Ishizuka, Kajimotom Suwa, Noguchi,,Tabuchi, Yagihashi, Iida, Sato	-Canopy Imager -Microclimate sensors -Water level sensors -Fine roots monitoring system (Scanner & software)	ditto		
2.2.2	Analyze and develop model for changes of stand structure and carbon stock in relation to topography	Topographic differences in stand structure and carbon dynamics analyzed		FFPRI	ditto	Ishizuka, Kajimotom Suwa, Noguchi, Sato		ditto		
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**			INPA/FPPRI	Niro Higuchi (INPA) Moriyoshi Ishizuka (FFPRI)		Equipments & Consumption	Adriano, Fransisco		
2.3.1	Set delailed study subplots in selectively logged stands with different years after logging	Detailed study subplots to assess regeneration process in selectively logged forests installed		ditto	ditto	Suwa, Kajimoto (FFPRI)	-Canopy Imager	ditto		
2.3.1	Monitor the changes in composition, structure and carbon stock in selectively logged stands	Changes in composition, structure and carbon stock monitored		ditto	ditto	Suwa, Kajimoto, Otani (FFPRI)		ditto		
2.3.2	Evaluate selective logging impacts on carbon dynamics of managed forests	Reports published		ditto	ditto	ditto		ditto		

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	Activities	Targets	Schedule (BFY2010 / JFY2010: May-Jun, Jul-Sep, Oct-Dec; BFY2011 / JFY2011: Jan-Mar, Apr-Jun, Jul-Sep, Oct-Dec; BFY2012 / JFY2012: Jan-Mar, Apr-Jun, Jul-Sep, Oct-Dec; BFY2013 / JFY2013: Jan-Mar, Apr-Jun, Jul-Sep, Oct-Dec; 14 / 14: Jan-Mar, Apr-May)	Org in charge	Responsible Persons	Inputs: JICA Personnel	Inputs: JICA Others	Inputs: INPA / INPE Personnel	Inputs: INPA / INPE Others	Remarks
Output 3: Carbon dynamics maps are developed, using the data from CFI system and remote sensing information.				UT INPE	**H.Sawada (UT) Dalton&Y.Shimabukuro(INPE)**					
3.1	**To study and develop techniques on how to obtain site environmetal map using remote sensing information and geographic information**			UT INPE	H. Sawada(UT) Y.Shimabukuro (INPE)		RS and GIS Processing System, Satellite data (NOAA, Terra, Aqua, ALOS, etc.)	Y. Shimabukuro(INPE)	Forest map of INPE	
3.1.1	Vegetation indices and Thermal conditions in a long period of time	to distinguish the characteristics of natural condition of each pixel of MODIS in the Amazon River Basin, which may reflects the allometric parameters of forest stands.		ditto	H.Sawada (UT)	Y. Sawada, Tokunaga (UT)				
3.1.2	Dynamics of water level in the Amazon Basin	to monitor the water coverage in the Amazon								
		a Optical data		ditto	H.Sawada (UT)	Y.Sawada, Tokunaga (UT)				
		b Radar data		ditto	H.Sawada (UT)	ditto				
3.1.3	Site environment map of whole Amazon River Basin	to produce the site environment map of the whole Amazon River Basin		ditto	H.Sawada (UT)	ditto				
3.2	**To develop analytical techniques to obtain forest stand parameters, such as canopy height, leaf area index (LAI) density and biomass, combining remote sensing information, including airborne LiDAR data, and forest inventory data**			UT INPA INPE	H. Sawada(UT) Niro Higuchi(INPA) Arai & Corina		Satellite Data (LANDSAT,ASTER, PRISM, TerraSAR-X, SRTM)		Satellite Data (CBERS)	
3.2.1	Correlation between field data and Lidar data on forest parameters	The forest parameters obtained from Lidar and field inventories will be mapped as the evaluation data for forest stand parameter estimation derived from satellite data.								
		a Preparation of field datasets for remote sensing analysis		UT	T.Endo (UT)	Y. Sawada,Ochi (UT)		Carlos Celes, Felipe (INPA)		
		b Lidar observation		UT	T.Endo (UT)					
		1) Airborne LiDAR (by Sep 2013)		UT	ditto	Y.Sawada (UT)	Cost for LiDAR observation	Carlos Celes, Felipe(INPA) Arai , M. Shimabukuro(INPE)		*Pemission of Ministry of Defence needed in time
		2) UAV LiDAR observation at ZF2, Itacoatiara and ZF5 (by August 2013)		UT	ditto	Oki (UT)	UAV	ditto		UAV should be delivered by Mar 2013
		c Evaluation of Lidar with ifeld data to identify forest stand parameters/forest structure		UT	T.Endo (UT)	Y. Sawada, Oki (UT)		ditto		GIS data from Activity 1.5 needed
		d Forest parameter mapping		UT	T. Endo (UT)	ditto		ditto		
3.2.2	Estimation of forest stand parameters/forest structure in wider area by using high-resolution satellite data and airborne radar data	to upscale the results of field inventory and Lidar information into certain broad areas.		UT	H. Sawada (UT)	Tokunaga , Ochi (UT), Suwa (FFPRI)	Satellite Data (LANDSAT,ASTER, PRISM, TerraSAR-X, SRTM)	Corina, Sidnei,Pires, Dutra (INPE) Moacir (INPA) for Landsat&PALSAR data	Airborne rader data	

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	Activities	Targets	Schedule (BFY2010 / JFY2010: May-Jun, Jul-Sep, Oct-Dec; BFY2011 / JFY2011: Jan-Mar, Apr-Jun, Jul-Sep, Oct-Dec; BFY2012 / JFY2012: Jan-Mar, Apr-Jun, Jul-Sep, Oct-Dec; BFY2013 / JFY2013: Jan-Mar, Apr-Jun, Jul-Sep, Oct-Dec; 14: Jan-Mar, Apr-May)	Org in charge	Responsible Persons	Inputs: JICA Personnel	Inputs: JICA Others	Inputs: INPA / INPE Personnel	Inputs: INPA / INPE Others	Remarks
3.3	**To develop remote sensing techniques to estimate large-scale forest stand parameters, and create Amazonian forest carbon map**			UT INPE	H. Sawada(UT) Dalton (INPE)		RADAR Data Processing System, Satellite Data (NOAA, Terra, Aqua, ALOS, etc.)			
3.3.1	Create carbon stock maps of the Brazilian Amazon for 2000, 2005, and 2010	to map the forest stand biomass and its accurasy of the whole Amazon								
		a Creation of maps		UT INPE	H.Sawada (UT)	Y. Sawada (UT)		Y.Shimabukuro, Dalton, Samuel (INPE) Moacir (INPA)		GIS data (Activity 1.5) used
		b Evaluation of uncertainty		ditto	H.Sawada (UT)	Y. Sawada (UT)		ditto		ditto
3.3.2	Estimate carbon stock change in the Amazon and creation of carbon stock change maps for 2000-2005 and 2005-2010	to estimate the biomass loss of the Amazon River Basin							DETER, PRODES	
		a Deforestation and forest degradation maps		INPE	Dalton(INPE)	H. Sawada (UT) Y. Sawada (UT)	Cost for development of degradation maps for years 2000-2003, and 2005	Dalton (INPE) Moacir (INPA)	PRODES, DEGRAD/DETEX (2007-2011), annual deforestation maps since 2000 in digital format	
		b Estimation of carbon stock change and creation of maps		INPE UT	Dalton(INPE) H. Sawada	ditto		Dalton, Shimabukuro, Samuel, Eduardo(INPE) Moacir (INPA)		
	Output 4: Techniques developed and information obtained in Output 1 to 3 are shaed with organization related to global climate change issues, including REDD+ and environmental conservation			INPA INPE						
4.1	**Provide free access to a part of forest invntory database and the remote sensing datasets at INPA/INPE/FFPRI/UT's website**			INPA	Adriano(INPA) Arai (INPE)					
4.1.1	Design website	Design finalized by the end of 2013		INPA/INPE	Adriano (INPA) Arai (INPE)	Ishizuka, Noguchi, Suwa (FFPRI) H. Sawada, Y.Sawada (UT)		Francisco		
4.1.2	Upload the inventorydata (2010-2012) to INPA /FFPRI's website	The inventory data (2010-2012) uploaded by March 2014		INPA FFPRI	ditto	Ishizuka,, Noguchi, Suwa (FFPRI)		Francisco		
4.1.3	Upload the remote sensing data sets to INPA/INPE/FFPRI/UT sites	The remote sensing data sets uploaded by March 2014		UT/INPE	Arai (INPE)	H. Sawada (UT) Y. Sawada (UT)		Moacir(INPA) Arai (INPE)		
4.2	**Organize workshops and/or seminars in Brazil**			INPA INPE	Niro (INPA) Thelma (INPE)	Ishizuka (FFPRI) H. Sawada (UT)				
		a Initial Project workshop		INPA	Niro (INPA)	Ishizuka (FFPRI) H.Sawada (UT)				
		b Forest inventory seminar in Curitiba (Nov 2012)		INPA	Niro (INPA)	Ishizuka (FFPRI) H. Sawada (UT)		Joaquin (INPA)		
		c Project workshop at INPE (March 2013)		INPE INPA	Thelma (INPE) Niro (INPA)	Ishizuka (FFPRI) H. Sawada (UT)		Rozaine (INPE)		
		d Final Project workshop at INPA (March or April 2014)		INPA INPE	Niro(INPA) Thelma (INPE)	Ishizuka (FFPRI) H.Sawada (UT)		Joaquin (INPA)		

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