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Report No: PAD1234

INTERNATIONAL BANK FOR RECONSTRUCTION AND DEVELOPMENT

PROJECT APPRAISAL DOCUMENT

ON A

PROPOSED STRATEGIC CLIMATE FUND (SCF) GRANT

IN THE AMOUNT OF US$ 9.25 MILLION

TO THE

RESEARCH DEVELOPMENT FOUNDATION
(*Fundação de Desenvolvimento da Pesquisa*)

FOR A

DEVELOPMENT OF SYSTEMS TO PREVENT FOREST FIRES AND MONITOR VEGETATION COVER IN THE BRAZILIAN CERRADO PROJECT

March 2, 2016

Environment and Natural Resources Global Practice
Latin America and Caribbean Region

CURRENCY EQUIVALENTS

(Exchange Rate Effective October 2015)

Currency Unit	=	BRL
BRL 3.8	=	US$ 1
0.27 US$	=	BRL 1

FISCAL YEAR

January 1 – December 31

ABBREVIATIONS AND ACRONYMS

ABC	Low Carbon Emissions Agriculture Program *(Agricultura de Baixa Emissão de Carbono)*
APP	Permanent Preservation Area on private land *(Área de Preservação Permanente)*
BIP	Brazil Investment Plan of the Forest Investment Program
CAR	Rural Environmental Registry *(Cadastro Ambiental Rural)*
CH_4	Methane
CIF	Climate Investment Fund
COP	Conference of the Parties
CPS	Country Partnership Strategy
CSR	Center for Remote Sensing (*Centro de Sensoriamento Remoto*) of the Federal University of Minas Gerais
DETER	Real-time deforestation detection system (*Sistema de Detecção do Desmatamento em Tempo Real*)
EMBRAPA	Brazilian Agricultural Research Corporation (*Empresa Brasileira de Pesquisa Agropecuária*)
FIP	Forest Investment Program
FISC	Fire Ignition, Spread and Carbon Model
FUNDEP	Research Development Foundation (*Fundação de Desenvolvimento da Pesquisa*)
GDP	Gross Domestic Product
GHG	Greenhouse gas emissions
GIS	Geographic Information System
GoB	Government of Brazil
IBAMA	Brazilian Institute of Environment and Renewable Natural Resources (*Instituto Brasileiro de Meio Ambiente e dos Recursos Naturais Renováveis*)
IBGE	Brazilian Institute for Geography and Statistics (*Instituto Brasileiro de Geografia e Estatística*)
ICMBio	Chico Mendes Institute for Biodiversity Conservation (*Instituto Chico Mendes de Conservação de Biodiversidade*)
IFR	Interim Financial Report
INPE	National Institute for Space Research (*Instituto Nacional de Pesquisas Espaciais*)
INPE-EM	INPE's greenhouse gas emissions estimation system
IPAM	Institute for Amazon Studies (*Instituto de Pesquisas Amazônicas*)
IRR	Internal Rate of Return
LAPIG	Laboratory for the processing of geographic images (*Laboratório de Processamento de Imagens e Geoprocessamento*) of the Federal University of Goiás
LCCS	Land Cover Classification System
LULUCF	Land Use, Land Use Change and Forestry

MAPA	Brazilian Ministry of Agriculture, Livestock, and Food Supply *(Ministério da Agricultura, Pecuária e Abastecimento)*
MCTI	Brazilian Ministry of Science, Technology, and Innovation *(Ministério da Ciência, Tecnologia e Inovação)*
MMA	Brazilian Ministry of Environment *(Ministério do Meio Ambiente)*
MODIS	Moderate Resolution Imaging Spectroradiometer
NAMA	Nationally Appropriate Mitigation Actions
NASA	National Aeronautics and Space Administration
NGO	Non-Governmental Organization
NPCC	National Policy on Climate Change
NPV	Net Present Value
OM	Project Operational Manual
PICC	Project Institutional Coordination Committee (*Comitê de Coordenação Institucional do Projeto*)
PPCDAM	Action Plan for the Prevention and the Control of Deforestation in the Amazon
PPCerrado	Action Plan to Prevent and Control Deforestation and Fires in the Cerrado Biome
PREVFOGO	National Center for (forest) Fire Prevention and Suppression
PROARCO	Program for the prevention of forest and grassland fires in the legal Amazon
PRODES	Program for Measuring Deforestation in the Amazon
REDD-plus	Reducing emissions from deforestation and forest degradation and the role of conservation, sustainable management of forests and enhancement of forest carbon stocks
RL	Legal Reserve on private land (*Reserva Legal*)
SCF	Strategic Climate Fund
tCO_{2eq}	Tons of Carbon Dioxide equivalent
UFG	Federal University of Goiás (*Universidade Federal de Goiás*)
UFMG	Federal University of Minas Gerais (*Universidade Federal de Minas Gerais*)
UNFCCC	United Nations Framework Convention on Climate Change

Regional Vice President:	Jorge Familiar
Country Director:	Martin Raiser
Senior Global Practice Director:	Paula Caballero
Practice Manager:	Raúl Alfaro-Pelico
Task Team Leader:	David Tuchschneider

BRAZIL
Development of Systems to Prevent Forest Fires and Monitor Vegetation Cover in the Brazilian Cerrado Project

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PAD DATA SHEET

Brazil

Development of systems to prevent forest fires and monitor vegetation cover in the Brazilian Cerrado (P143185)

PROJECT APPRAISAL DOCUMENT

LATIN AMERICA AND CARIBBEAN

ENVIRONMENT AND NATURAL RESOURCES

Report No.: PAD1234

Basic Information			
Project ID P143185	EA Category C - Not Required		Team Leader(s) David Tuchschneider
Lending Instrument Investment Project Financing	Fragile and/or Capacity Constraints [ ] Financial Intermediaries [ ] Series of Projects [ ]		
Project Implementation Start Date 23-May-2016	Project Implementation End Date 29-May-2020		
Expected Effectiveness Date 16-May-2016	Expected Closing Date 29-May-2020		
Joint IFC No			
Practice Manager/Manager Raul Ivan Alfaro-Pelico	Senior Global Practice Director Paula Caballero	Country Director Martin Raiser	Regional Vice President Jorge Familiar

Approval Authority
Approval Authority
Board/AOB Decision
please explain
This is a Strategic Climate Fund Grant under the Forest Investment Program (FIP).

Borrower: Fundacao de Desenvolvimento da Pesquisa (FUNDEP)
Responsible Agency: Ministerio da Ciencia, Tecnologia e Inovacao (MCTI)

Contact:	Andrea Ferreira Portela Nunes	Title:	Coordenadora Geral de Gestao de Ecossistemas
Telephone No.:	6133177918	Email:	aportela@mcti.gov.br

Responsible Agency: Fundacao de Desenvolvimento da Pesquisa

Contact:	Fabiano Melo Siqueira	Title:	Gerente de Projetos
Telephone No.:	3134094200	Email:	fabianosiqueira@fundep.ufmg.br

Project Financing Data(in US$ Million)

[ ]	Loan	[ ]	IDA Grant	[ ]	Guarantee
[ ]	Credit	[X]	Grant	[ ]	Other

Total Project Cost:	9.25	Total Bank Financing:	0.00
Financing Gap:	0.00		

Financing Source	**Amount**
Borrower	0.00
Strategic Climate Fund Grant	9.25
Total	9.25

Expected Disbursements (in US$ Million)

Fiscal Year	2016	2017	2018	2019	2020
Annual	0.20	2.25	2.60	2.40	1.80
Cumulative	0.20	2.45	5.05	7.45	9.25

Institutional Data

Practice Area (Lead)

Environment & Natural Resources

Contributing Practice Areas

Agriculture, Climate Change

Cross Cutting Topics

[X] Climate Change

[ ] Fragile, Conflict & Violence

[ ] Gender

[ ] Jobs

[ ] Public Private Partnership

Sectors / Climate Change

Sector (Maximum 5 and total % must equal 100)				
Major Sector	Sector	%	Adaptation Co-benefits %	Mitigation Co-benefits %
Agriculture, fishing, and forestry	Forestry	65		100
Agriculture, fishing, and forestry	General agriculture, fishing and forestry sector	20		100
Public Administration, Law, and Justice	Public administration-Agriculture, fishing and forestry	15		
Total		100		

☐ I certify that there is no Adaptation and Mitigation Climate Change Co-benefits information applicable to this project.

Themes

Theme (Maximum 5 and total % must equal 100)		
Major theme	Theme	%
Environment and natural resources management	Land administration and management	60
Environment and natural resources management	Environmental policies and institutions	20
Environment and natural resources management	Climate change	20
Total		100

Proposed Development Objective(s)

The objective of the Project is to enhance the Member Country's institutional capacity in monitoring deforestation, in providing information on fire risks, and in estimating related GHG emissions in the Cerrado.

Components

Component Name	**Cost (US$ Millions)**
Deforestation monitoring	4.39
Information systems on forest fire risk and GHG emissions estimation	3.31
Project management, monitoring and evaluation	1.55

Systematic Operations Risk- Rating Tool (SORT)	
Risk Category	**Rating**
1. Political and Governance	Moderate
2. Macroeconomic	Moderate
3. Sector Strategies and Policies	Low
4. Technical Design of Project or Program	Low
5. Institutional Capacity for Implementation and Sustainability	Moderate
6. Fiduciary	Moderate
7. Environment and Social	Low
8. Stakeholders	Low
OVERALL	Moderate

Compliance	
Policy	
Does the project depart from the CAS in content or in other significant respects?	Yes [ ] No [X]
Does the project require any waivers of Bank policies?	Yes [ ] No [X]
Have these been approved by Bank management?	Yes [ ] No [ ]
Is approval for any policy waiver sought from the Board?	Yes [ ] No [X]
Does the project meet the Regional criteria for readiness for implementation?	Yes [X] No [ ]

Safeguard Policies Triggered by the Project	**Yes**	**No**
Environmental Assessment OP/BP 4.01		**X**
Natural Habitats OP/BP 4.04	**X**	
Forests OP/BP 4.36	**X**	
Pest Management OP 4.09		**X**
Physical Cultural Resources OP/BP 4.11		**X**
Indigenous Peoples OP/BP 4.10		**X**
Involuntary Resettlement OP/BP 4.12		**X**
Safety of Dams OP/BP 4.37		**X**
Projects on International Waterways OP/BP 7.50		**X**
Projects in Disputed Areas OP/BP 7.60		**X**

Legal Covenants

Name	Recurrent	Due Date	Frequency
Schedule 2, I A 5. Project Institutional Coordination Committee		16-Aug-2016	

Description of Covenant

The Recipient shall cause Ministry of Science, Technology, and Innovation (MCTI) to establish, by no later than 90 days after the Effectiveness date, and thereafter operate and maintain at all times during Project implementation, the Project Institutional Coordination Committee (PICC), an advisory committee which shall consist of representatives of the Recipient, MCTI, National Institute for Space Research (INPE), Federal University of Goiás (UFG), and Federal University of Minas Gerais (UFMG).

Name	Recurrent	Due Date	Frequency
Schedule 2, I A 3. Key staff in FUNDEP	**X**		CONTINUOUS

Description of Covenant

At all times during Project implementation maintain professional staff in adequate numbers, and with terms of reference, qualifications and functions acceptable to the World Bank, including, but not limited to, a Project leader, and a procurement specialist.

Name	Recurrent	Due Date	Frequency
Schedule 2, II A 1. Project reports	**X**		Semi-Annual

Description of Covenant

The Recipient shall monitor and evaluate the progress of the Project, with MCTI's assistance and collaboration, and prepare Project Reports in accordance with the provisions of Section 2.06 of the Standard Conditions and on the basis of indicators acceptable to the World Bank.

Name	Recurrent	Due Date	Frequency
Schedule 2, I A 4. Project's Annual Operational Plan (POA)	**X**		Yearly

Description of Covenant

The Recipient shall, at least once a year during Project implementation on or about December 1, commencing on the first such date after the Effective Date, prepare and furnish to the Bank the POA, including financial management, in terms and conditions acceptable to the Bank, for the Project's operation during the following twelve months.

Conditions

Source Of Fund	Name	Type
SCF Grant	IV. 4.01 (a) The Operational Manual has been adopted by the Recipient	Effectiveness

Description of Condition

Adoption by FUNDEP of the Project's Operational Manual.

Source Of Fund	Name	Type
SCF Grant	IV 4.01 (b) The execution and delivery of the Technical Cooperation Agreement.	Effectiveness

Description of Condition

Execution and delivery of the Technical Cooperation Agreement on behalf of the Recipient, MCTI, INPE (as represented by MCTI), UFG, and UFMG, duly authorized or ratified, executed and delivered by all parties and by all necessary action.

Source Of Fund	Name	Type
SCF Grant	IV 4.01 (c) The execution and delivery of the Grant Agreement.	Effectiveness

Description of Condition

The execution and delivery of the Grant Agreement on behalf of the Recipient have been duly authorized or ratified by all necessary corporate action.

Source Of Fund	Name	Type
SCF Grant	IV 4.02 Legal opinions on the Grant and Technical Cooperation Agreements	Effectiveness

Description of Condition

Legal opinions to the effect that the Grant Agreement and the Technical Cooperation Agreement are legally binding upon each party in accordance with their respective terms.

Team Composition

Bank Staff

Name	Role	Title	Specialization	Unit
David Tuchschneider	Team Leader (ADM Responsible)	Sr Rural Development Specialist		GFA04
Danilo Pereira de Carvalho	Procurement Specialist (ADM Responsible)	Procurement Specialist		GGO04
Thiago De Oliveira Teodoro	Financial Management Specialist	Consultant		GGODR
Alberto Coelho Gomes Costa	Safeguards Specialist	Sr Social Development Specialist		GSU04
Gregor V. Wolf	Team Member	Program Leader		LCC5C
Gustavo de Montalvao G. Abath	Team Member	Program Assistant		GFA04

Maria Bernadete Ribas Lange	Safeguards Specialist	Sr Environmental Specialist		GEN04
Patricia Miranda	Counsel	Senior Counsel		LEGOP
Raquel Orejas Tagarro	Team Member	Consultant		GEN04
Stavros Papageorgiou	Team Member	Environmental Specialist		GENDR
Susana Amaral	Team Member	Sr Financial Management Specialist		GGO22
Tatiana Cristina O. de Abreu Souza	Team Member	Finance Officer		WFALN

Extended Team

Name	Title	Office Phone	Location
Pierre Werbrouck	Agribusiness specialist		Albuquerque

Locations

Country	First Administrative Division	Location	Planned	Actual	Comments
Brazil	Piauí	Piauí		X	
Brazil	Maranhão	Maranhão		X	
Brazil	São Paulo	São Paulo		X	
Brazil	Paraná	Paraná		X	
Brazil	Minas Gerais	Minas Gerais		X	
Brazil	Mato Grosso do Sul	Estado de Mato Grosso do Sul		X	
Brazil	Mato Grosso	Mato Grosso		X	
Brazil	Goiás	Goiás		X	
Brazil	Federal	Distrito Federal		X	
Brazil	Bahia	Estado da Bahia		X	
Brazil	Tocantins	Tocantins		X	

Consultants (Will be disclosed in the Monthly Operational Summary)

Consultants Required ? Consultants will be required

I. STRATEGIC CONTEXT

A. Country Context

1. **Brazil is a developing country with a complex and dynamic economy.** In 2014 it was the seventh largest economy in the world in Gross Domestic Product (GDP) terms (US$ 2.4 trillion), but only number 59 in terms of GDP per capita (US$ 11,384). Between 2000 and 2014 the average annual economic growth rate was 3.3 percent, but it is estimated to have declined by 3.7 percent in 2015. By population, it is the sixth largest country in the world, with 204 million inhabitants, of which 84 percent live in urban areas. Strong progress has been made in reducing poverty and increasing shared prosperity in recent years, with extreme poverty and poverty rates dropping to 2.8 percent and 7.4 percent, respectively. However, the extreme poverty rate is estimated at 7.5 percent among the rural population, and particularly among Indigenous People and Quilombola communities (PNAD, 2014)[1].

2. **Brazil's economy is partly anchored in the export of primary products, including agricultural commodities**. The country is ranked first as an exporter of sugarcane, beef, poultry, coffee, tobacco and ethanol. Brazil is also the second largest exporter of soybeans and corn, the fourth largest exporter of pork, and has the second largest cattle herd in the world. The country exports around 1,500 different agricultural products to over 200 markets in Europe, Asia, Africa, the Americas and the Middle East. Agriculture and livestock contribute to eight percent of GDP, account for 30 percent of the country's exports and for 19 percent of its employment. Much of this agricultural growth has occurred over the last decade, and much of it has taken place in the Brazilian savanna, known as the Cerrado Biome.

3. **The Cerrado.** The Cerrado biome covers approximately 2 million km^2 of the Brazilian Central Plateau (24 percent of the country's total area) and is the second largest phyto-geographic province in Brazil, sharing transitions with other Brazilian biomes: the Amazon Forest, Caatinga, Pantanal and Atlantic Forest. It is one of the richest and most diverse savannas in the world[2], with 23 types of vegetation consisting mostly of tropical savannas, grasslands, forests and dry forests. It is considered as one of the 34 global hotspots of biodiversity because of the high level of endemism and rapid loss of its original habitat[3].

4. **Until the late 1950s, the contribution of the Cerrado to Brazil's agricultural output was still low**, **at less than 10 percent of the national total**. However, the construction of Brasilia fostered an intense flow of migrants to the Cerrado region to work on infrastructure projects and colonization programs. In addition, the development of agricultural technologies in the 70s solved problems of soil fertility deficiencies. Thus productivity of soybean, maize and cotton in the Cerrado is among the highest in the world now, turning the Cerrado into Brazil's new agricultural frontier. There are now about 50 million head of cattle in the Cerrado, representing 33 percent of the national herd, with pastures being the most important form of land use in the region, covering over 60 million hectares. The Cerrado is also responsible for over half

[1] http://www.ibge.gov.br/english/estatistica/indicadores/trabalhoerendimento/pnad_continua/
[2] T. Lewinsohn and P. Prado, 2005, How many species are there in Brazil? Conservation Biology, 19-3, pp. 619-24.
[3] R.A. Mittermeier et al., 2005, A Brief History of Biodiversity Conservation in Brazil, Conservation Biology, 19-3, pp. 601-607.

of Brazil's soybean production, most of it for export. It is estimated that 50 to 60 percent of the pasture area shows some degree of degradation.

5. **Twenty two percent of Brazil's population (42.7 million[4]) lives in the Cerrado but only 14 percent of its population resides in rural areas.** Distributed over 11 Federative Units (Goiás, Tocantins, Mato Grosso, Mato Grosso do Sul, Minas Gerais, Bahia, Maranhão, Piauí, São Paulo, and Paraná States, and the Federal District), the Cerrado Biome is mostly occupied by private landholdings with a high concentration of smallholders: some 78 percent of about 1 million landholdings in the biome are small (up to 4 fiscal modules)[5] but they occupy only 15 percent of the area of all landholdings; 22 percent of the larger landholdings occupy 85 percent of the area.[6] Protected Areas represent 8.2 percent of the Cerrado Biome, while Indigenous Lands occupy 4.3 percent of the area. Poverty and extreme poverty rates in the rural areas of the States that encompass the Cerrado are 19.1% and 7.2% respectively, well above the national average of 7.4% and 2.8% (PNAD, 2014).

6. **Carbon**. The structural diversity of vegetation types in the Cerrado involves a wide spectrum of biomass amounts. Total biomass (the sum of biomass above and below ground up to 2 meters deep) in Central Brazil varies from 21.8 Mg/ha in the *campo sujo* (parkland) to 77.8 Mg/ha in dense Cerrado (dry forest). The root/shoot ratio in all Cerrado vegetation types shows values above 1, ranging from 2.6 in the open Cerrado (woodland) to 7.7 in *campo limpo* (grassland)[7]. Organic matter in the soil represents the most substantial carbon stock in the Cerrado's ecosystems. The total estimated carbon stock amounts to 265 Mg/ha, with soil organic matter comprising 70 percent (185 Mg/ha), when considering the vegetation and the soil up to 1m depth.

7. **Deforestation.** Studies have shown that this biome is now severely threatened, as the rate of land cover change has been extremely high over the last decades – even higher than in the Amazon. It is estimated that only about 52 percent of the area covered by native vegetation remains (around 1 million km^2), compared to 82 percent in the Amazon. During the 2002-2008 period, the Cerrado biome lost 4.1 percent of its cover (14,200 km^2/yr), compared to 3.2 percent in the Amazon (18,954 km^2/yr). Deforestation however is on a declining trend in both biomes; in 2010, the area deforested in the Cerrado was similar to the area deforested in the Amazon (6,400 km^2), though still representing a higher percentage in relative terms (0.32 percent vs. 0.15 percent respectively). Continuing along such a path would threaten the long-term future of the Brazilian Cerrado Biome and its natural resources, and consequently the process of its economic growth and poverty reduction.

[4] Instituto Brasileiro de Geografia e Estatística (IBGE), Brazilian Census 2010.

[5] The fiscal module *(módulo fiscal)* is a land unit established by the National Institute of Colonization and Agrarian Reform (*Instituto Nacional de Colonização e Reforma Agrária*, INCRA) mainly for rural real estate taxation according to Federal Decree Nº 8.485/1980 and INCRA NIº 20/1980. The fiscal module in Cerrado municipalities varies from 0.04 to 0.1 km^2, with an average of 0.46 km^2 (46 ha).

[6] Statistics for the biome were derived from 2006 agricultural census data for municipalities that are located partially or wholly in the Cerrado. Absolute numbers (1,066,000 landholdings over 1.5 km^2) overstate the total number of landholdings and area actually in the Cerrado Biome.

[7] Castro, EA, & Kauffman, JB. 1998. Ecosystem structure in the Brazilian Cerrado: a vegetation gradient of aboveground biomass, root mass and consumption by fire. *Journal of Tropical Ecology*, vol. 14, no. 3, pp. 263–283.

8. **Fire.** The dynamics of natural vegetation of the Cerrado biome is often associated with fire. Whereas fires in the humid forests of Amazonia are a rare natural phenomenon, they occur more frequently in the Cerrado and play a key role in its ecological functioning. Nevertheless, human land use practices have altered the natural fire regime. Fires set by ranchers to induce regrowth of pastures in the dry season often get out of control and spread over wide areas, affecting protected areas, indigenous lands and remnants of natural vegetation. The widespread use of fire continues to be observed despite regulations and fines imposed by the authorities[8]. Consistent and reliable estimates of the burned surface for the Cerrado are not found in the literature. Preliminary data from the Ministry of Environment (MMA) using low resolution satellite imagery indicates an average of 410.000 km^2 for the 2005-2010 period, with extremes of 217.000 km^2 in the wet year of 2009 and 659.000 km^2 in the dry year of 2007[9]. Those values correspond to about 20 percent of the biome being affected by fire on average, and up to 32 percent on dry years, following a similar pattern of fire regimes in the African savannas.

9. **Anthropogenic climate change may further increase the frequency of fires**, not only because of longer dry seasons in some regions[10] but also due to an increase in extreme drought events, such as the ones that occurred in 2005 and 2010 in southern Amazonia and northern Cerrado[11]. Additionally, because fires are associated with deforestation and, especially, fragmentation, they are predicted to increase in frequency as native vegetation continues to be converted into croplands.

10. **GHG emissions.** According to the Second Brazilian Greenhouse Gas Inventory (Brazil, 2010), carbon emissions due to deforestation in the Cerrado increased from 0.05 petagrams of carbon per year (1988 to 1994) to 0.06 between 2002 and 2008. Recent estimates[12] indicate that deforestation and burning (including CH_4 and N_2O) in the Cerrado between 2003 and 2008 resulted in the emission of 1,450 $MtCO_{2eq}$, of which conversion to pastures corresponds to 819 $MtCO_{2eq}$ (or 136.5 $MtCO_{2eq}$/year).

B. Sector and Institutional Context

11. **Brazil has developed a suite of sector-specific greenhouse gas (GHG) mitigation actions that it estimates will result in a reduction of 36.1 to 38.9 percent below a projected baseline by 2020**[13]. During the 2009 15th Conference of the Parties (COP) to the United Nations Framework Convention on Climate Change (UNFCCC) in Copenhagen, Brazil announced its voluntary targets, followed by a communication of its Nationally Appropriate Mitigation Actions

[8] See INPE's Fires (*Queimadas*) website at : http://queimadas.cptec.inpe.br/~rqueimaimg/videos/ focosdeCalor_cerrado_1998a2014.mp4.

[9] See MMA's information at: http://www.mma.gov.br/florestas/controle-e-preven%C3%A7%C3%A3o-do-desmatamento/plano-de-a%C3%A7%C3%A3o-para-cerrado-%E2%80%93-ppcerrado/projetos-de-apoio-ao-ppcerrado.

[10] Nobre, C.A., P.J. Sellers, J. Shukla. 1991. Amazonian deforestation and regional climate change. Journal of Climate, 4, 957-988.

[10] Malhi, Y.J., T. Roberts, R.A. Betts, T.J. Killeen, W. Li, C.A. Nobre. 2008. Climate change, deforestation and the fate of the Amazon. Science, 319, 169-172.

[11] Philips et al. 2009; Lewis SL, Brando PM, Phillips OL, van der Heijden G-F, Nepstad D (2011) The 2010 Amazon drought. Science 331:554-554.

[12] Bustamante, MC, Nobre, C, Smeraldi, R, Aguiar, APD, Barioni, LG, Ferreira LG, Longo, K, May, P, Pinto, AS, Ometto, JPHB. 2012. Estimating Greenhouse GasEmissions from Cattle Raising in Brazil, *Climatic Change.*

[13] Equivalent to an estimated 1.17 to 1.26 billion tonnes CO2 equivalent reduction relative to the 2020 projection.

(NAMAs) to Annex II of the Copenhagen Accord[14]. In December 2009, shortly after the COP announcement, Brazil instituted this goal in Law N$^{o.}$ 12.187/2009, establishing the National Policy on Climate Change (NPCC). The NPCC defines the objectives and guidelines for domestic operations in Brazil for dealing with climate change, and is the main reference point for Brazil's REDD+ type actions. In December 2010, the Brazilian Government approved regulations of the NPCC[15], establishing specific targets for reducing GHG emissions through sectoral plans and initiatives.

12. **Sector plans.** For the agriculture, forestry, and other land use (AFOLU) sector, these initiatives include the Action Plan to Prevent and Control Deforestation in the Amazon (PPCDAm), the Action Plan to Prevent and Control Deforestation and Fire in the Cerrado (PPCerrado), and the Low-Carbon Agriculture Plan (ABC Plan). Decree 7,390 included the following targets: (i) 80 percent reduction of deforestation in the Amazon compared to the 1996-2005 average (19,535 km²/yr); (ii) 40 percent reduction of deforestation in the Cerrado compared to the 1999-2008 average (15,700 km²/yr); (iii) recovery of 15 million ha of degraded pastures; (iv) expansion of crop, livestock and forestry integrated systems by 4 million ha; (v) expansion of no-tillage farming systems by 8 million ha; (vi) expansion of planted forests by 3 million ha; (vii) increase the treatment of animal waste by 4.4 million m^3; and (viii) increased use of charcoal from planted forests in steelmaking.

13. **In addition to these sector plans, the Forest Code[16] is considered the most important land-use regulation in the country**, given its national scope and the constraints it imposes on private property for the purpose of protecting public goods such as forests and other vegetation. The code requires farmers to preserve the most fragile areas of their property such as riparian forests, steep slopes, mountain tops, etc. (Permanent Preservation Areas – APP), with an additional obligation to ensure that part of the original native vegetation is maintained (Legal Reserves –RL). The percentage to be held as RLs varies from 80 percent in the Amazon to 20-35 percent in the Cerrado (depending on location), to 20 percent in the rest of Brazil. Landowners must seek official authorization from the relevant state agencies to convert native vegetation (not already classified as RLs or APPs) to other uses permitted by law. Recent estimates show that the Cerrado is the biome with by far the vastest extent of native vegetation still available for legal deforestation, estimated at 88±6 million hectares, with a potential to emit 18±4 $GtCO_{2e}$ [17]. The Forest Code includes the creation of the Rural Environmental Cadaster (*Cadastro Ambiental Rural*, CAR), which sets a deadline for farmers to register APPs and RLs on their farms, and to submit proposals for restoring their degraded areas if they are not compliant with the legislation.

14. **The Action Plan to Prevent and Control Deforestation and Fires in the Cerrado Biome (PPCerrado)[18],** launched in September 2010, aims to promote a sustained reduction in

[14] See Annex II of Copenhagen Accord: Nationally Appropriate Mitigation Actions (NAMAs) by developing countries. Available at: http://unfccc.int/meetings/cop_15/copenhagen_accord/items/5265.php

[15] Decreto No 7.390, de 9 de Dezembro de 2010. Available at**:** http://www.planalto.gov.br/ccivil_03/_Ato2007-2010/2010/Decreto/D7390.htm

[16] Enacted by Federal Law 12.651, May 2012, as amended by Law 12.727 of October 2012 and Federal Decree 7.830 of October 2012.

[17] Soares-Filho et al., 2014. Cracking Brazil's forest code. Science Vol. 344 no. 6182 pp. 363-364

[18] The Plan can be found in: http://www.mma.gov.br/florestas/controle-e-preven%C3%A7%C3%A3o-do-desmatamento/plano-de-a%C3%A7%C3%A3o-para-cerrado-%E2%80%93-ppcerrado; and http://www.mma.gov.br/images/arquivos / florestas/controle_ e_prevencao/PPCerrado/PPCerrado_2fase.pdf

the rate of deforestation and forest degradation in the biome, as well as in the incidence of forest fires, through a coordinated set of actions organized around four major pillars: i) monitoring and control; ii) protected areas and territorial planning; iii) sustainable production activities; and iv) environmental education. It is managed by an executive commission comprising representatives from 17 ministries and coordinated by the Presidency of the Republic. It is based on the National Program for the Conservation and Sustainable Use of the Cerrado Biome - Sustainable Cerrado Program (PCS)[19], established by Decree No. 5.577/2005, which aims to promote conservation, recovery, and sustainable management of natural ecosystems in the Cerrado biome, as well as to revert the present negative socio-environmental impacts. Thus, the PPCerrado can be seen as a continuation of the PCS, although focused on the issue of deforestation and forest fires.

15. **Brazil has an institutional, normative and policy structure with proven capacity for reducing deforestation and promoting the sustainable use of natural resources**, and has set ambitious goals for reducing deforestation in the Amazonia and Cerrado biomes while increasing production and exports of cash crops and biofuels, and intensifying cattle production. In Amazonia, emissions peaked in mid-1990s and early 2000s, and have had a big drop since 2005 after the onset of the PPCDAm[20]. Data from the National Institute of Spatial Research (INPE) to present these achievements in Amazonian deforestation reduction has supported the Brazilian position in multilateral forums such as the UNFCCC[21] and backed bilateral agreements. The government wants to use its successful experience in controlling deforestation in Amazonia to increase control and protection of the Cerrado. However, while Brazil has set up in INPE a good monitoring infrastructure for land cover change in the Amazon, it lacks a similar information system for the Cerrado and the other biomes.

16. **One of PPCerrado's key challenges is to establish a monitoring system for deforestation and degradation in the Cerrado biome**. Unlike in the Amazon, attempts to monitor deforestation and degradation in the Cerrado are relatively new. A current effort by the Ministry of Environment to monitor forest cover change in the Cerrado, has limited resources, and does not measure deforestation and degradation in real time and with the same level of accuracy as is the case in the Amazon.

17. **Given the extent of land available for legal deforestation in the Cerrado and its potentially high productivity, it is expected that agriculture will continue to increase in the region for some time**. New technologies have been developed for tropical agriculture, which allow for significant productivity gains without expanding into new Cerrado areas. The challenges are to: (i) promote a broader adoption of such practices[22], and (ii) enable full implementation of the Forest Code and compliance with APP and RL requirements. In this context, the generation and provision of spatially and temporally consistent information on forest resources and change is needed to underpin the elaboration and implementation of strategies for improving land-use sustainability and efficiency. These actions would contribute to the

[19] See: http://www.mma.gov.br/biomas/cerrado/conservacao-e-uso-sustentavel
[20] Nepstad et al., 2014 Slowing Amazon deforestation through public policy and interventions in beef and soy supply chains. Science 344 (6188): 1118-1123.
[21] Brazil was recently the first country to submit a REDD+ Reference Emission Level to the UNFCCC, including the Amazon biome: http://www.mma.gov.br/redd/index.php/nivel-referencia
[22] A challenge taken up by the FIP-financed Sustainable Production in Areas Previously Converted to Agricultural Production (P143184), approved by the Bank on July 28, 2014.

maintenance of natural ecosystems, together with their biodiversity and associated environmental services.

18. **Brazil Investment Plan (BIP) under the Forest Investment Program (FIP)[23]**. The BIP seeks to promote sustainable land use and forest management improvement in the Cerrado Biome in order to reduce pressure on remaining forests, reduce GHG emissions and increase carbon dioxide (CO2) sequestration. The BIP's specific objectives are to: (i) improve environmental management in previously converted areas in the Cerrado Biome, and (ii) produce and disseminate environmental information at the biome scale. Figure 1 summarizes the activities financed by BIP; project 2.2 would be financed by this Project.

Figure 1. The Brazil Investment Plan under the FIP

<table>
<tr><th colspan="5">Brazil Investment Plan</th></tr>
<tr><td colspan="5">Project: Brazil Forest Investment Plan Management
Grant:US$1 million MDB: IBRD</td></tr>
<tr><td>Special window

Dedicated Grant Mechanism for Indigenous Peoples and Local Communities</td><td colspan="2">Theme 1: Management and Use of Already Anthropized Areas
Project 1.1. Environmental regularization of rural lands (based on Rural Environmental Cadastre, CAR)
MDB: IBRD
Project 1.2. Sustainable production in areas previously converted to agricultural use
MDB: IBRD
Improvement of producers' access to resources available for Low Carbon Emission Agriculture
Implementation of the Rural Environmental Cadastre in the entire biome</td><td colspan="2">Theme 2: Generation and Management of Forest Information
Project 2.1. Forest information to support public and private sectors in managing initiatives
MDB: IDB
Project 2.2. Implementation of an early-warning system for preventing forest fires and a system for monitoring the vegetation cover.
MDB: IBRD
Generation and availability of spatially and temporally consistent environmental information = forest inventory, remote-sensing monitoring and early-warning system for forest fires</td><td>Set-aside

Private concessional funds</td></tr>
</table>

19. **The continental size and environmental complexity of Brazil's Cerrado Biome and the need to ensure the consistency of the various instruments employed, coordinate efforts in the regions, and share timely and relevant information are all challenges that call for the building of synergies among the various actors and activities with a view toward securing cost-effective solutions.** Each of the projects in the BIP will contribute to this coordinated effort by funding investments and activities designed to support actions by the various executors and their working relationships with other government entities involved. The BIP will contribute to the efforts being undertaken by the GoB to reduce emissions and maintain the carbon stock of the country's second largest biome (Please refer to Annex 5 for detailed information regarding FIP and BIP).

C. Higher Level Objectives to which the Project Contributes

20. The Project is part of the Brazil Investment Plan (BIP) under the Forest Investment Program (FIP) managed by the World Bank (WB). The higher level objective of the BIP, to which the project contributes, is to promote sustainable land use and improved forest management in the Cerrado, the second largest biome in Brazil and South America, leading to reduced pressure on its remaining forests, reduced GHG emissions and increased CO2

[23] The FIP is a targeted program of the Strategic Climate Fund (SCF), which is one of two funds under the framework of the Climate Investment Funds (CIF) managed by the World Bank. The BIP was approved by the FIP Subcommittee in May 2012.

sequestration. The implementation of BIP is also expected to have a co-benefit in poverty alleviation, as it will have direct impacts on areas such as settlements and small agriculture farmers, and will provide improved environmental information in order to develop refined strategies on biodiversity use and conservation. The Project is part of thematic area 2, producing and disseminating environmental information at the biome scale.

21. The Project's objectives are fully in line with the World Bank Group Country Partnership Strategy (CPS 2012-2015), discussed by the Executive Directors on November 1, 2011 (Report No 63731 BR), under Strategic Objective 4: Improving sustainable natural resource management and climate resilience. The engagement in the biome seeks to: (i) support the mapping of degraded areas across all Brazilian biomes and help develop financial incentives to promote their rehabilitation; (ii) support increased sustainability of agricultural production and forestry in the Cerrado; (iii) support efforts by the Federal Government and selected subnational governments to further strengthen and integrate their environmental management systems, including those at the metropolitan level, and ensure environmental compliance in rural areas; (iv) help improve the efficiency and effectiveness of environmental licensing and monitoring systems, and (v) help the Federal Government and the private sector to implement Brazil's National Climate Change Plan.

22. The proposed Project's objectives and strategy are fully in line with the World Bank Group's twin global goals of boosting shared prosperity and ending extreme poverty. The Project will improve the Government's capacity to monitor and manage forest fires by providing data tools to environmental agencies improving control and management of out-of-control fires, which often crossover into indigenous lands, smallholder farms and protected areas. Forest fires have deleterious effects on health in a much wider area, through exposure to smoke. By improving fire management and deforestation control, the Project will provide the basis for enhanced management of soil, water and forest resources, which linked to the other FIP financed projects in Brazil is expected to lead to better productivity and higher incomes for small and medium farmers in the Cerrado.

II. PROJECT DEVELOPMENT OBJECTIVE

A. Project Development Objective (PDO)

23. The objective of the Project is to enhance the Member Country's[24] institutional capacity in monitoring deforestation, in providing information on fire risks, and in estimating related GHG emissions in the *Cerrado*.

B. Project Beneficiaries.

24. The beneficiaries of the proposed Project are the institutions and actors involved in the monitoring and conservation of the Cerrado Biome. They include the National Space Research Institute (INPE), the Brazilian Institute of Environment and Renewable Natural Resources (IBAMA), the National Center for (forest) Fire Prevention and Suppression (PREVFOGO), State and Municipal Environmental Organizations, the Federal Police, Municipal governments and their fire brigades, the National Institute for Colonization and Agrarian Reform (INCRA), the Ministry of the Environment (MMA), the Ministry for Rural Development (MDA), the Ministry of Agriculture, Livestock and Food Supply (MAPA), the Chico Mendes Institute for Biodiversity

[24] "Member Country" means the Federative Republic of Brazil.

Conservation (ICMBio), the Brazilian Indian Foundation (FUNAI), the Brazilian Forest Service (SFB), the Brazilian Institute for Geography and Statistics (IBGE), Protected Area managers, academic and training institutions, civil society organizations, farmer associations and landholders. More than 3,000 clients consult regularly (and some of them daily) the websites of the Project's participating entities.

C. PDO Level Results Indicators

25. The achievements of the PDO will be measured through the following PDO indicators:

(i) Information on deforestation in the Cerrado is regularly made available to the public and relevant institutions;

(ii) Improved information on forest fire risk is publicly available;

(iii) Near real-time information on potential fire spread in the Cerrado is publicly available;

(iv) GHG emissions estimates for the Cerrado are publicly available; and

(v) Government institutions in charge of policy, deforestation control and fire prevention use the information on deforestation and fire risk in the Cerrado.

26. Intermediate indicators are:

(i) Government institutions provided with capacity building support to improve management of forest resources [core sector indicator];

(ii) Annual deforestation maps on the scale of 1:250,000 are publicly available (PRODES[25]-Cerrado);

(iii) Deforestation data on the scale of 1:500,000 is delivered daily to deforestation control agencies and monthly to the public (DETER[26]-Cerrado);

(iv) New fire risk information products are available to users on INPE's Queimadas website and on interactive communication devices;

(v) On-line fire ignition and spread risk (FISC) data is published on INPE's website;

(vi) Off-line fire ignition and spread risk (FISC) model is piloted in selected conservation areas; and

(vii) Independent reports on the quality of the project products.

III. PROJECT DESCRIPTION

A. Project Components

27. The Project has three components: (i) deforestation monitoring; (ii) information systems on forest fire risk and GHG emissions estimation; and (iii) project management, monitoring and evaluation. The Project will be implemented over four years. The Project will not support direct firefighting activities or purchase of equipment for them.

[25] PRODES (Program for Measuring Deforestation in the Amazon) operated by the Instituto Nacional de Pesquisas Espaciais (INPE), produces the annual gross deforestation map of the Brazilian Amazonia.
[26] DETER (Real-time deforestation detection system) also led by INPE, works like an alert system to detect incipient deforestation in quasi-real time.

28. **Component 1: Deforestation monitoring** (US$4.39 million). The component will finance strengthening the monitoring of deforestation in the *Cerrado* by:

(a) designing and implementing a deforestation monitoring system of the *Cerrado*, including annual deforestation mapping and near real-time deforestation detection based on the PRODES and DETER systems;

(b) training selected stakeholders on access, interpretation and use of the information generated by the deforestation monitoring system for the *Cerrado*; and

(c) designing and implementing a data quality control system for the deforestation monitoring system for the *Cerrado*.

29. **Component 2: Information systems on forest fire risk and GHG emissions estimation** (US$ 3.31 million). The component will finance:

(a) Improving INPE's fire risk information system by designing, implementing and providing, *inter alia*, (i) localized fire risk warning barometers, (ii) applications for interactive fire risk updates, (iii) higher fire risk resolution maps, (iv) instruments for fire risk statistical analysis, and (v) automatic status updates.

(b) Adapting a fire ignition, spread and carbon model to the *Cerrado*, including the integration of daily-updated, on-line fire spread forecast information on INPE's *Queimadas* website, and applying such model in selected conservation units as a fire management tool.

(c) Adapting INPE's GHG emissions estimation system to the *Cerrado*; and

(d) Carrying out a program of hands-on training on the practical application of fire risk modelling tools to selected stakeholders.

30. **Component 3: Project management, monitoring and evaluation** (USUS 1.55 million). The component will provide support for managing the technical and administrative aspects of the Project, including financial management, procurement, the carrying out of audits, overall Project coordination, monitoring and evaluation of Project implementation.

B. Project Financing

31. **A US$ 9.25 million grant from the Strategic Climate Fund will finance the costs of the proposed Project.** The Project will involve important resources from the agencies involved, which will finance the costs of their existing staff and operations.

Table 1: Project Costs and Financing – Incremental costs (US$ million)

Project Components	Project cost	FIP	FIP Financing % of total
1. Deforestation monitoring	4.39	4.39	100%
2. Fire risk and emissions systems	3.31	3.31	100%
3. Project Management, Monitoring and Evaluation	1.55	1.55	100%
Total Base Costs	9.25	9.25	100%

Total Project Costs (US$ million)	**9.25**	**9.25**	**100%**

C. Lessons Learned and Reflected in the Project Design

32. **Information provided by the forest cover monitoring systems (PRODES-DETER) has enabled Brazil's reduction of deforestation rates in the Amazon.** The Project would adapt these systems, currently operated by INPE, to the Cerrado biome, creating the basis for securing similar achievements there.

33. **Brazil is a leader in monitoring and early-warning systems for fire forecasting in different biomes and forest areas and for monitoring land use, so it has the capacity and vision necessary for their improved application in the Cerrado**; however; institutional coordination is crucial for ensuring effective use of information. The successful collaboration between the three key ministries involved in land use regulation (MMA, MAPA and MCTI) in the design of the Project has allowed the development of a strategic approach capable to foster synergies not only among Brazil Investment Plan and its projects, but also with ongoing Cerrado government plans and policies already in implementation at federal, state and municipal levels (e.g. PPCerrado).

IV. IMPLEMENTATION

A. Institutional and Implementation Arrangements

34. The Federative Republic of Brazil through the Ministry of Science, Technology and Innovation (MCTI) endorsed the Project on May 13, 2013 and appointed the **Research Development Foundation (*Fundação de Desenvolvimento da Pesquisa* - FUNDEP)** as the Recipient and Project implementing agency. FUNDEP is a private foundation with extensive experience in project management. FUNDEP will sign a Technical Cooperation Agreement with MCTI and the three other participating institutions (see below), establishing the Project governance structure and its administrative procedures. FUNDEP will adopt an Operational Manual satisfactory to the Bank. Its responsibilities include: (i) procurement and financial administration; and (ii) monitoring and reporting (jointly with MCTI).

35. **The Ministry of Science, Technology and Innovation (*Ministério da Ciência, Tecnologia e Inovação* - MCTI)**, through the Secretariat for Policies and Research Programs and Development (SEPED), will approve the Project's Annual Operational Plans (POA) and budgets and will be responsible for institutional coordination, implementation monitoring, quality assurance and results evaluation. SEPED will appoint a staff member as project director and contract a project coordinator/manager with extensive experience to run day-to-day operations.

36. **A Project Institutional Coordination Committee (PICC) will be created through a MCTI Ministerial Ordinance (*portaría*)**, to ensure coordination between FUNDEP, MCTI and the three participating institutions: the National Institute for Space Research (INPE), the Federal University of Minas Gerais (UFMG) and the Federal University of Goiás (UFG). MMA will be invited to participate as needed to facilitate coordination at the level of the FIP Plan and PPCerrado. The PICC will be responsible for: (i) commenting on proposals to adjust the Operational Manual of the Project (MOP); (ii) validating POAs; (iii) reviewing the physical and financial implementation progress reports; (iv) ensuring that project execution and results are

timely, consistent and ultimately contribute to the attainment of the strategic objectives of the Project; and (v) providing strategic recommendations to strengthen project implementation.

37. **INPE**, a research institution linked to MCTI, will be in charge of PRODES/DETER Cerrado monitoring system development and implementation (and related sub-products and systems), improvements to the fire risk information system, GHG emissions estimations system and related training and dissemination. **UFMG** will be in charge of developing and adapting the FISC model, its application in four conservation units and training in the use of the model. **UFG** will be in charge of the PRODES/DETER data quality control system.

38. **Project execution**. FUNDEP will administer the Project and MCTI will be in charge of technical supervision. INPE, UFMG and UFG will be responsible for delivering the Project products respectively assigned to each of them. Activity execution will proceed as follows: (i) the POA will be inserted into FUNDEP's management system, (ii) INPE, UFMG and UFG will prepare the technical specifications of the goods to be procured as well as the terms of reference of the consultants to be recruited; (iii) INPE, UFG, UFMG will request the purchase of goods and services and hiring of consultants through FUNDEP's system; (iii) SEPED will review and approve these requests directly in the system; and (iv) FUNDEP will carry out the procurement and execute payments. Ownership of all goods purchased with project funds will be transferred to each institution at the end of the Project, in accordance with instructions from MCTI.

B. Results Monitoring and Evaluation (M&E)

39. FUNDEP will monitor implementation progress jointly with MCTI-SEPED and issue progress reports on a six-monthly basis. MCTI will also monitor results and impacts in two ways. The participating entities will provide intermediate product output reports in accordance with the POA and the Results Framework. MCTI will designate an independent technical evaluation group to review and assess the quality of the intermediate products and reports and to provide feedback to the PICC and the participating entities. MCTI will also contract an agency to carry out intermediate surveys on how useful the information generated under the Project is for the end-users and feedback the conclusions to the participating entities and the PICC. Such surveys will help improving the quality and effectiveness of the information. At the end of the second Project year, it will carry out a mid-term review together with the World Bank and at the end of the Project it will carry out a final evaluation based on user surveys.

C. Sustainability

40. INPE, UFMG and UFG are technically solid institutions that have significant budgets to update and maintain the information data banks generated under the Project. PPCerrado provides the legal framework to finance the operation of these systems and MCTI will present information maintenance budgets to be included in the national multi-annual budget allocations.

V. KEY RISKS AND MITIGATION MEASURES

A. Overall Risk Rating and Explanation of Key Risks

41. **The overall risk of the Project not achieving its development objective is Moderate.** The participating entities have state of the art experience with PRODES and DETER in the Amazon and there is no reason to suggest that they will have difficulties applying their

knowledge and experience to the *Cerrado*. There is a moderate risk with FUNDEP and MCTI, which will need to coordinate closely to ensure timely delivery between themselves and with the cooperating agencies (INPE, UFMG and UFG), for which they will participate in the Project Institutional Coordination Committee. This is the first Bank-financed project FUNDEP will manage and some teething management issues may arise. FUNDEP will reinforce its procurement staff and the Bank will provide training and implementation support. Fiduciary risks and mitigation actions are described below in the Appraisal Summary and in Annex 3.

VI. APPRAISAL SUMMARY

A. Technical

42. Brazil has set up in INPE a solid monitoring infrastructure for land cover change in the Amazon, but lacks a good information system for the Cerrado. The government wants to use its successful experience in controlling deforestation in Amazonia to increase control and protection of the Cerrado.

43. The deforestation monitoring system will be an adaptation of the existing systems in use in the Amazon (PRODES and DETER). These are already tested, validated and cited as best practice internationally[27]. In the case of the early warning systems for forest fires, the improvements will enhance the existing system to increase the capacity to predict the risk of forest fire and fire spread, one of the major threats to the Cerrado. Finally, the information generated will expand existing systems for estimating GHG emissions in the biome as an indicator of effectiveness of its mitigation actions. Together, these actions will ensure a steady flow of high quality information to policy makers and actors involved in ground operations, providing them with crucial support tools for planning, control and prevention of forest fires and deforestation activities.

B. Economic and Financial Analysis

44. The technical assistance nature of the Project does not lend itself to conducting a traditional economic and financial analysis. As an alternative, the analysis was based on a review of the costs and benefits related to deforestation and the use of fire in the Cerrado, based on research carried out in the country. The following aspects have been taken into account and confirm the economic and financial relevance of the Project.

45. Deforestation and fire are part of the Cerrado's farming system. Farmers and ranchers contribute to deforestation and use fire to extend pastures, increase short-term productivity and control pests and diseases. Without legal impediments, deforestation will continue, as it is financially profitable. In most smallholder situations, burning forest and pasture is more cost effective than agricultural intensification[28] (Alternatives to Slash-and-Burn in Brazil report, ICRAF, 2002). Deforestation and burning in the Cerrado is legal in up to 80 percent of the farm property, excluding protected sectors. Deforestation and managed burning permits are required, although most ranchers do not request them.

[27] See GOFC-GOLD, 2013. REDD+ Sourcebook, COP19 version. Available at: http://www.gofcgold.wur.nl/redd/
[28] http://www.asb.cgiar.org/publication/alternatives-slash-and-burn-programme-asb-brazil

46. From the environmental point of view, deforestation increases GHG emissions and negatively affects climate change. Controlled burning in the Cerrado has some positive environmental effects, such as reducing wood fuel, which in turn reduces wildfires. Many fires, however, get out of hand and burn more pasture than intended, extend to adjacent forests and, cumulatively, have negative respiratory health effects. This Project intends to strengthen institutions to reduce the unintended or illegal deforestation as well as the uncontrolled burning of the savannah. This will reduce the social and environmental costs of deforestation and fires and ultimately impact GHG emissions.

47. More precise, up-to-date, real-time and widespread information on (illegal) deforestation, risk of (wild) fires and GHG emissions have, potentially, the following economic and financial benefits.

(i) potential increases in the cost-efficiency and effectiveness of IBAMA and other environmental control agencies to reduce illegal deforestation;

(ii) forest fire prevention and firefighting agencies can intervene more rapidly and effectively, and thus reduce unintended forest fire damage;

(iii) protected and conservation areas can introduce controlled fires based on better calibrated fire ignition and spread models and reduce unintended forest fire damage and management costs;

(iv) federal, state and local policy makers can base their deforestation reduction and fire prevention policies on more accurate data and increase the policy efficiency and effectiveness;

(v) more accurate estimates of GHG emissions in Brazil can contribute to increased knowledge of climate change patterns and adaptation measures; and

(vi) improved information can enhance the management of Brazil's natural resources, and considering its size and economic importance, lead to world economic and financial benefits.

48. The main economic and financial benefits of deforestation and burning go to the private sector while the costs are borne by society in Brazil and elsewhere in the form of a negative externality. This justifies the international public financing of institutional strengthening to improve information generation and flows. Moreover, most direct beneficiaries of the information flows are national and international public institutions.

49. **Value Added**. The Bank is part of the management structure of the Forest Investment Program and the lead IFI supporting the Brazil Investment Plan. The Bank's international experience in project design and supervision as well as in climate change issues increases the quality and impact of this type of project. The Bank supervises the money flows and ensures that the funding is used efficiently to reach the Project's objectives.

C. Financial Management

50. The World Bank will disburse the grant to FUNDEP. FUNDEP will pay the suppliers of goods and services, consultants and for operational costs. INPE, UFMG and UFG will not receive or manage any funds.

51. A Financial Management (FM) Assessment for the Project was conducted in April 2015 at FUNDEP in accordance with OP/BP 10.00 and the Financial Management Practice Manual

and Guidelines. The objective of the assessment was to determine whether FUNDEP has acceptable FM and disbursement arrangements in place to adequately control, manage, account for and report on the use of project funds. The scope of the assessment included (i) an evaluation of existing financial management systems to be used for project monitoring, accounting and reporting; (ii) a review of the staffing requirements of the project; (iii) a review of the flow of funds and disbursement arrangements for the project; (iv) a review of the internal control mechanisms in place; (v) a review of the systems reports and their suitability to be used as IFR's; and (vi) a review of the internal and external audit arrangements.

52. The Bank's financial management assessment identified the following actions: (i) close coordination between FUNDEP and MCTI; (ii) FUNDEP will control the budgeting process for the Project, based upon a detailed Annual Operating Plan, Procurement Plan and related disbursement forecasts; and (iii) FUNDEP will be responsible for Project execution (financial management and procurement) with no funds flowing to the other entities.

53. Based on the assessment, FUNDEP has acceptable FM and disbursement arrangements in place to adequately control, manage, account for and report on the use of Project funds.

D. Procurement

54. Procurement for the proposed Project would be carried out in accordance with the World Bank's "Guidelines: Procurement under IBRD Loans and IDA Credits" January 2011 (revised July 2014); "Guidelines: Selection and Employment of Consultants by World Bank Borrowers" January 2011 (revised July 2014); and the provisions stipulated in the Grant Agreement.

55. The Bank's procurement capacity assessment of FUNDEP identified the following challenges: (a) lack of familiarity with the Bank's procurement policies; and (b) a lack of experience in implementing Bank-financed projects. FUNDEP will take mitigation measures in collaboration with the Bank, including (i) training of procurement and technical staff on Bank procurement policies; and (ii) maintaining a procurement specialist with qualifications and functions acceptable to the World Bank.

E. Social (including Safeguards)

56. The Project will not finance any physical construction, firefighting activities on the ground or the purchase of equipment thereof. The Project will not interfere with Indigenous Peoples and/or traditional communities as its activities focus on generating and providing information. The Project's Operational Manual will specify the procedures to be adopted if some unexpected negative social impact arising from the project is identified. Additionally, Project implementation will be supervised in accordance with the social policies of the World Bank and in accordance with its guidelines for the application of safeguard policies to Technical Assistance operations ("Interim Guidelines on the Application of Safeguard Policies to Technical assistance (TA) Activities in Bank-Financed Projects and Trust Funds Administered by the Bank").

57. **Consultations**. The BIP, of which this Project forms part, was prepared through an intensive consultation process with key stakeholders. The first stage involved two meetings and informative workshops – convening 161 participants. The second stage included a virtual consultation process carried out from January 25 to March 5, 2012, and three workshops carried out in Brasilia. The first workshop was held on February 7, 2012 and convened 52

representatives of Federal, State and Municipal government agencies and civil society organizations. The second workshop was held on February 15, 2012 and convened about 70 participants – including representatives of Indigenous Peoples – in two sections. The final round was held on March 5, 2012 and convened 22 participants, including representatives of Environment State Secretariats. The Program received strong support from the groups consulted because of its focus on the *Cerrado* biome, inter-institutional implementation arrangements and synergies with policies and programs already in place.[29]

F. Environment (including Safeguards)

58. The Project is expected to have an overall positive impact on the environment as it seeks to increase information on patterns of deforestation and fire risks in forests and grasslands. Environmental Category of the Project is C. The Operational Policies on Natural Habitats (OP / BP 4.04) and Forests (OP / BP 4.36) of the World Bank are triggered, as the Project is expected to have positive impacts in natural habitats and forests. The information generated by the project will be used to implement existing fire management regimes as well as introduce new management policies and methods. The monitoring system to be implemented under the Project should lead to positive impacts on natural habitats, including protected areas. The proposed systems will be used to monitor natural forests and enhance public policies' focus on protection. The Project's Operational Manual will include the Bank principles and guidelines for the application of safeguard policies to Technical Assistance operations ("Interim Guidelines on the Application of Safeguard Policies to Technical assistance (TA) Activities in Bank-Financed Projects and Trust Funds Administered by the Bank").

G. World Bank Grievance Redress

59. Communities and individuals who believe that they are adversely affected by a World Bank (WB) supported project may submit complaints to existing project-level grievance redress mechanisms or the WB's Grievance Redress Service (GRS). The GRS ensures that complaints received are promptly reviewed in order to address project-related concerns. Project affected communities and individuals may submit their complaint to the WB's independent Inspection Panel which determines whether harm occurred, or could occur, as a result of WB non-compliance with its policies and procedures. Complaints may be submitted at any time after concerns have been brought directly to the WB's attention, and Bank Management has been given an opportunity to respond. For information on how to submit complaints to the WB's corporate Grievance Redress Service (GRS), please visit www.worldbank.org/grs. For information on how to submit complaints to the World Bank Inspection Panel, please visit www.inspectionpanel.org.

[29] The Report on the Consultation Workshop remains publically disclosed at the following website: http://www.mma.gov.br/estruturas/252/_arquivos/fip_relatorio_consulta_presencial_20120215_252.pdf.

Annex 1: Results Framework and Monitoring

Brazil

Development of systems to prevent forest fires and monitor vegetation cover in the Brazilian Cerrado (P143185)

Results Framework

Project Development Objectives

PDO Statement

The project development objective is to enhance Brazil's institutional capacity to monitor deforestation, provide information on fire risks and estimate related GHG emissions in the Cerrado.

These results are at | Project Level

Project Development Objective Indicators

Indicator Name	Baseline	Cumulative Target Values				
		YR1	YR2	YR3	YR4	End Target
Information on deforestation in the Cerrado is regularly made available to the public and relevant institutions (Yes/No)	No	No	No	Yes	Yes	Yes
Improved information on forest fire risk is publicly available (Yes/No)	No	No	No	No	Yes	Yes
Real-time information on potential fire spread in the Cerrado is publicly available (Yes/No)	No	No	No	No	Yes	Yes
GHG emissions estimates for the Cerrado available are publicly available (Yes/No)	No	No	No	Yes	Yes	Yes
Government institutions in charge of policy,	0.00	0.00	10.00	15.00	15.00	15.00

deforestation control and fire prevention using use the information on deforestation and fire risk in the Cerrado (Number)						

Intermediate Results Indicators

Indicator Name	Baseline	Cumulative Target Values				
		YR1	YR2	YR3	YR4	End Target
Government institutions provided w/ capacity building to improve management of forest resources (Number) - (Core)	0.00	0.00	5.00	10.00	15.00	15.00
Annual deforestation maps on the scale of 1:250.000 are publicly available (PRODES-Cerrado) (Number)	0.00	1.00	2.00	3.00	4.00	4.00
Deforestation data on the scale of 1:500,000 is delivered daily to deforestation control agencies and monthly to the public (DETER-Cerrado) (Number)	0.00	0.00	4.00	8.00	12.00	12.00
New fire risk information products are available to users on interactive communication devices (Number)	0.00	0.00	10.00	20.00	26.00	26.00
On-line fire ignition and fire spread risk (FISC) data is published on INPE’s website. (Percentage)	0.00	20.00	40.00	60.00	100.00	100.00
Off-line fire ignition and spread risk (FISC) model is piloted in selected conservation areas (Number)	0.00	0.00	1.00	2.00	4.00	4.00
Independent reports on the quality of the project products (Number)	0.00	0.00	1.00	2.00	3.00	3.00

Indicator Description

Project Development Objective Indicators

Indicator Name	Description (indicator definition etc.)	Frequency	Data Source / Methodology	Responsibility for Data Collection
Information on deforestation in the Cerrado is regularly made available to the public and relevant institutions	Inventory of deforestation published annually (PRODES-Cerrado) and near-real time deforestation detection information (DETER-Cerrado) made available to relevant institutions (daily) and the general public (quarterly).	Bi-annually	Technical reports, statistics, images and digital maps available on INPE's web portal.	INPE-MCTI
Improved information on forest fire risk is publicly available	New and improved fire products (n=26) are available on INPE's Queimadas website and automatically delivered to registered users.	Bi-annually	Digital products published in INPE's Fire System (Sistema Queimadas); INPE's user database	INPE-MCTI
Real-time information on potential fire spread in the Cerrado is publicly available	Online FISC-Cerrado system operating and making near-real time information on potential forest fire spread in the Cerrado biome publicly available through INPE's Queimadas website.	Bi-annually	Project implementation monitoring reports; INPE's Fire System (Sistema Queimadas)	UFMG,INPE - MCTI
GHG emissions estimates for the Cerrado available are publicly available	INPE-EM system for the Cerrado developed and fully operational, generating and making publicly available (on the INPE-EM website) annual information on gross and net emissions of greenhouse gases (CO2, CH4, N2O, NOx, and CO) from deforestation and forest fires in the Cerrado biome in tabular and map format.	Bi-annually	Project implementation monitoring reports with data from INPE; INPE-EM website	INPE-MCTI

Government institutions in charge of policy, deforestation control and fire prevention using use the information on deforestation and fire risk in the Cerrado	Number of target institutions (as referenced in Table 3 of Annex 2) using the information on deforestation and fire risk in the Cerrado	Bi-Annually	Project implementation monitoring reports with data from INPE and UFMG.	MCTI

Intermediate Results Indicators

Indicator Name	Description (indicator definition etc.)	Frequency	Data Source / Methodology	Responsibility for Data Collection
Government institutions provided w/ capacity building to improve management of forest resources	No description provided.	Annually	Activity reports from INPE and UFMG	MCTI
Annual deforestation maps on the scale of 1:250.000 are publicly available (PRODES-Cerrado)	Number of PRODES-Cerrado deforestation maps available at INPE´s Cerrado web portal, for the following years: 2014 (YR1), 2015 (YR2), 2016 (YR3), 2017 (YR4). The reporting will also include progress reports on the development and operationalization of the PRODES-Cerrado system as a whole.	Annually	INPE's web portal	INPE-MCTI
Deforestation data on the scale of 1:500,000 is delivered daily to deforestation control agencies and monthly to the public (DETER-Cerrado)	Number of deforestation detection layers delivered to deforestation control agencies and made available to the public. The reporting will also include progress reports on the development and operationalization of the DETER-Cerrado system as a whole.	Annually	INPE's web portal	INPE-MCTI

New fire risk information products are available to users on interactive communication devices	No description provided.	Annually	INPE's Fire System (Sistema Queimadas)	INPE
On-line fire ignition and fire spread risk (FISC) data is published on INPE's website.	Number of completed steps required to develop the system, as follows: (each step representing a 20% progress towards the cumulative target): Step 1. Offline operational version of the system for a sub-area of the Cerrado; Step 2. Offline operational version of the system for the entire Cerrado biome based on historical data; Step 3. Alfa version of the system online using near-real time data; Step 4. Beta version of the system online tested for a selected group of users; Step 5. Operational version of the system online publicly available.	Annually	UFMG implementation reports; INPE's Fire System (Sistema Queimadas)	UFMG,INPE - MCTI
Off-line fire ignition and spread risk (FISC) model is piloted in selected conservation areas	Number of selected conservation areas where the off-line FISC model has been piloted.	Annually	UFMG implementation reports	UFMG and MCTI
Independent reports on the quality of the project products	Number of new and improved products available on INPE's Queimadas website and automatically delivered to registered users including through interactive communication devices.	Annually	Technical reports by independent specialists designated by MCTI	MCTI- MCTI

Annex 2: Detailed Project Description

BRAZIL
Development of Systems to Prevent Forest Fires and Monitor Vegetation Cover in the Brazilian Cerrado Project

1. The rationale for the Project's focus on enhancing the institutional capacity of Brazilian institutions to monitor deforestation and provide improved information on forest fires and GHG emissions in the Cerrado stems from: (i) the economic and ecological importance and size of the Cerrado; (ii) the huge risks that fires pose to the economy, ecology, GHG emissions and forest cover; and (iii) the significance of the remaining Cerrado forest in terms of biodiversity and carbon stocks.
2. The Project does not include direct action to either combat forest fires or the provision of equipment thereof. Through the information provided, it will set a framework to allow improved monitoring, measurement, reporting and enforcement of land use change activities and fire. Thus, while it will not lead directly to GHG emissions reductions, the Project will help to establish the foundations for policies and measures to reduce deforestation and emissions.
3. The project will have three components.
   (i) Component 1: Deforestation monitoring
   (ii) Component 2: Information systems on forest fire risk and GHG emissions estimation
   (iii) Component 3: Project management, monitoring and evaluation

Component 1: Deforestation Monitoring (FIP US$4.39 million)

4. The expected result of this component is the design and implementation of a deforestation monitoring system for the Cerrado biome, consistent with the one used for the Amazon. Since 1988, Brazil has systematically monitored changes in vegetation cover in Amazonia, generating annual deforestation data with the PRODES (Project for the estimation of deforestation in Amazonia) remote sensing system, as well as near real-time alerts for rapid control intervention actions (DETER system). Both systems were developed and are operated by Brazil's National Space Research Institute - INPE. Surveys of vegetation cover are periodically conducted in other Brazilian biomes such as the Cerrado, Caatinga and Pantanal; however, the Brazilian Government does not currently have the same capacity installed to monitor deforestation in these biomes at the same level as in the Amazon.

5. The component will finance strengthening the monitoring of deforestation by:
   (a) designing and implementing a deforestation monitoring system of the *Cerrado*, including annual deforestation mapping and near real-time deforestation detection based on the PRODES and DETER systems;
   (b) training selected stakeholders on access, interpretation and use of the information generated by the deforestation monitoring system for the *Cerrado;* and
   (c) designing and implementing a data quality control system for the deforestation monitoring system for the *Cerrado*.

6. **Subcomponent 1.1. Deforestation monitoring in the Cerrado.** The subcomponent will generate the following products:

a. **Land Cover Classification System (LCCS).** INPE will modify the existing land cover classification system for the Cerrado developed by IBGE on the basis of the Food and Agriculture Organization's (FAO) Land Cover Classification System (LCCS) framework[30]. The effort will combine remote sensing, techniques, geospatial tools, and ecological knowledge of the Cerrado's ecosystem. It will allow to discriminate forest from non-forest vegetation within the Cerrado's spectrum of structural complexity. This will allow for a more precise monitoring of deforestation dynamics and carbon accounting across the biome, while providing better land cover data for applications in land use planning, biodiversity protection, and water resources management. In addition, the LCCS will permit international benchmarking and comparison.

b. **On-line geographical data management platform (TERRABRASILIS).** To provide a basis for both deforestation measurement and mapping, and for measuring GHG emissions, INPE will develop a geographical data management system for vegetation cover in the Cerrado (TerraBrasilis), similar to the one that exists for the Amazon[31]. Using its geospatial technology, all geographical data and models generated by INPE and other relevant institutions and research entities will be integrated into a "knowledge platform". The platform will also allow interested researchers to access each other's data and scientific studies, replicate INPE's work and tailor it to their own needs for research on the evolving land use in the Cerrado or elsewhere. INPE will build a website to support the platform. The website will contain all data collected by the Project, including large remote sensing data sets and also models and algorithms that were developed with project funds. All such data and software will be available as open access and open source.

c. **Deforestation mapping on the 1:250,000 scale and near-real time deforestation detection.** INPE will apply its experience from the PRODES and DETER systems in the Amazon to build deforestation maps and early alert systems for the Cerrado. PRODES[32] uses wall-to-wall mapping to get yearly data on the spatial distribution and extent of the deforestation in the Brazilian Legal Amazon, an area of 5 million km^2. It uses remote sensing data with 20 to 30 meter resolution and produces annual deforestation maps in the 1:250.000 scale with a 6.25 ha and 1 ha minimum mapping unit (MMU) at the representation and working scales respectively. Its products include deforestation maps, the images used, and the derived statistics at the level of the biome, states, municipalities, protected areas, and indigenous territories. Since 2003, INPE makes PRODES data freely available through the internet, with a dataset extending back to 2000. It is cited as best practice in forums such as the Global Forest Observation Initiative and GOFC-GOLD.

[30] http://www.fao.org/docrep/003/x0596e/X0596e01.htm
[31] http://terraamazon.org/index.php
[32] PRODES (Project for the satellite monitoring of the Brazilian Amazon forest): www.obt.inpe.br/prodes/index.php

7. PRODES-Cerrado will maintain the same technical characteristics as PRODES-Amazonia in order to maintain consistency and comparability across biomes and within states covering more than one biome. This will also support the country's commitment to build a consistent forest monitoring system at the national level. Brazil is the first country to have recently submitted a (subnational) Forest Reference Emission Level (FREL) to the UNFCCC covering the Amazon biome as an interim measure, while transitioning to a national scale through a step-wise approach[33]. The intention is to advance in the development of FREL submissions for the other biomes in order of emissions importance, the Cerrado biome being the second in this respect[34].

8. INPE will produce a Cerrado deforestation map for 2014 with a 30 meter resolution in the first semester of the Project. Further deforestation information for 2015 and 2016 will be produced in time to be presented by the GoB during subsequent Conference of the Parties to the UNFCCC as deemed appropriate.

9. DETER[35] has been operating since 2005 as a near-real time deforestation alert system for the Amazon. It uses TERRA/MODIS and CBERS-2/WFI images with a spatial resolution of 250m to map the location associated with deforestation events larger than 25 ha on a daily basis, with delays of 1 to 5 days between data acquisition and product delivery to its main user, IBAMA. DETER reports data at the municipality, state, IBAMA field office, and protected area level in order to support enforcement activities by the competent authorities. It presents some limitations as it captures only part of the actual deforestation occurring due to the lower resolution of the images used, while there might be a time lag between the time of occurrence and detection of a deforestation event, due to cloud cover or to the time needed for the area deforested to reach the scale needed in order to be interpreted and mapped.

10. INPE will draw on DETER's experience in the Amazon to create an early alert system for the Cerrado. The system is expected to detect deforestation accurately for all events larger than 100 ha, with a target MMU of 25ha. TERRA/MODIS images will be used as the de facto option, though given the particularities of the biome's vegetation cover a higher resolution (below 100m) might be needed. INPE is currently considering options based on the availability of other sensors, such as ResourceSat-2/AwiFS, UK-DMC 2, and CBERS-4/AWFI. It plans to produce monthly deforestation detection information within the first semester of the Project, biweekly products by the end of 2015 and daily information in 2016. After the first year of operation, INPE will make available all images, maps and statistics of DETER-Cerrado in the internet and will establish a schedule to update public disclosure of all DETER-Cerrado data.

11. DETER has been designed mainly as a system to support enforcement activities aimed at controlling deforestation. Given Cerrado's treatment within the Forest Code (requirement to preserve 20-35% of native vegetation as a Legal Reserve, in comparison with 80% in the Amazon), coordination with the Environment Registry (CAR) and with state environmental authorities in charge of emitting deforestation permits will be key in order to be able to distinguish between legal and illegal deforestation. IBAMA deforestation control staff will

[33] http://www.mma.gov.br/redd/index.php/en/informma/item/71-entrega-frel-bonn

[34] See Annex 3 of the Amazon FREL submission, where FIP is specifically mentioned as one of the initiatives supporting the Cerrado FREL

[35] DETER (Real time deforestation detection system in the Amazon): http://www.obt.inpe.br/deter/

closely assist the development of DETER-Cerrado through regular meetings with INPE staff.

Table 2 – Expected outputs of subcomponent 1.1

Products	Description	Potential Users	Use	Potential impact
LCCS-CERRADO	A hierarchical structure of vegetation types and harmonization of the existing terminology into this structure	Universities and research centers Environment Ministry MCTI	Studies on Cerrado vegetation and ecology Inventory of the Cerrado ecosystems Inventory of GHG emissions for land use and land use change	Increased knowledge of Cerrado vegetation and its evolution Policy decisions based on uniform information Improved reporting for UNFCCC
TERRA BRASILIS	Web portal for the dissemination and analysis of the deforestation monitoring products	Academia Researchers General public	Access to deforestation data and use of analytical instruments	Improved understanding of landscape transformation processes in the Cerrado
PRODES-CERRADO	Annual deforestation maps (natural and human induced vegetation conversion) with maps covering of minimum 6 ha and the production of annual deforestation statistics	Academia IBAMA OEMAS Territorial managers Ministry of the Environment MCTI	Analytical capacity on deforestation Policy implementation effectiveness indicators Deforestation control management indicators Identification of critical areas for biodiversity protection Information for GHG reporting	Improved understanding of the factors affecting deforestation Improved deforestation control planning and reduced deforestation Improved environmental management of the Cerrado including biodiversity More detailed and accurate reporting
DETER CERRADO	Deforestation alerts mapping (monthly, weekly and daily) on areas of 25ha or more.	IBAMA OEMAS Territorial managers	Planning of deforestation control operations	Illegal deforestation reduction

13. **Subcomponent 1.2. Dissemination and training.** To facilitate adequate use of the products generated by the component, this activity will finance training sessions and working meetings with the prime users of the systems, principally environmental authorities with a mandate to control illegal deforestation (see Table 3). At least eight courses will be organized by INPE for prime users. INPE has already experience in building the capacity of such institutions through its work in the Amazon. This interaction will be maintained for the implementation of the DETER-Cerrado system. Given the particular legal framework of the Cerrado with regards to deforestation permits, strong coordination will be required with the CAR and state agencies that emit deforestation permits to allow distinguishing between legal and illegal deforestation. PRODES has a wider audience and INPE will develop web-based tutorial courses in the use of PRODES and will organize PRODES seminars in the Cerrado States. For both systems, the Cerrado States with the highest deforestation rates will be given priority.

Table 3 - Prime users of INPE's information

Institution	Function	Use of project information
Instituto Brasileiro de Meio Ambiente e Recursos Naturais Renováveis (IBAMA) and its state superintendencies	The Ministry of the Environment's (MMA) administrative arm in charge of the execution, regulation, and control of environmental policies in the country.	Uses deforestation, fire risk and occurrence data on their inspection activities; support for the implementation of PPCerrado
Instituto Chico Mendes de Conservação da Biodiversidade (ICMBio)	MMA's agency responsible for the administration of federal protected areas and conservation of biodiversity in Brazil.	Uses deforestation, fire risk and occurrence data with a focus on conservations units.
Ministério da Agricultura (MAPA)	The MAPA is in charge of the planning and implementation of the agricultural policies in the country	Uses deforestation, fire risk and occurrence data with a focus on preservation of planted crop areas. Potential link to ABC Program.
Secretarias Estaduais de Agricultura	Institutions in charge of coordinating the formulation, approval and execution of environmental policies and actions at their corresponding levels.	Use deforestation, fire risk and occurrence data with a focus on preservation of planted crop areas. Potential link to ABC Program.
Centro Nacional de Prevenção e Combate aos Incêndios Florestais (PrevFogo)	A specialized center under IBAMA, established to promote, support, coordinate and monitor forest fire prevention and control.	Uses fire risk and occurrence information at their local activities to fight forest fires.
Centro de Monitoramento e Alerta de Desastres Naturais (CEMADEN)	MCTI's branch in charge of developing, testing and implementing an early warning system for natural disasters.	Uses deforestation, fire risk and occurrence data as supplementary information to help the assessment of vulnerability to natural disasters.
Serviço Florestal Brasileiro (SFB)	The Forest Service's mission is to promote economic and sustainable use of forests. It is also in charge of managing forest concessions.	Uses deforestation, fire risk and occurrence data with a focus on forests preservation.

Institution	Function	Use of project information
Secretaria Nacional de Proteção e Defesa Civil (SEDEC)	Under the Ministry of National Integration, SEDEC is responsible for coordinating the actions of protection and civil defense (disaster prevention, mitigation, preparedness, response and recovery) throughout the national territory.	Uses deforestation, fire risk and occurrence data to help coordinate actions with other federal government agencies.
Secretarias Municipais e Estaduais de Meio Ambiente	Institutions in charge of coordinating the formulation, approval and execution of environmental policies and actions at their corresponding levels.	Use deforestation, fire risk and occurrence data to establish local policies, for territorial planning and environmental management.
Fundação Nacional do Índio (FUNAI)	Federal agency in charge of protecting interests of indigenous groups, including land demarcation and defense of rights.	Uses deforestation, fire risk and occurrence data with a focus on indigenous land management.
Operador Nacional do Sistema Elétrico (ONS)	Autonomous organization responsible for coordinating and controlling energy generation and transmission in the National Interconnected System.	Uses fire risk information to ensure a well-functioning energy system (mainly regarding transmission).
Instituto Nacional de Colonização e Reforma Agrária (INCRA)	Federal agency responsible for land reform.	Uses deforestation, fire risk and occurrence data for inspections activities to evaluate potential areas for land distribution.
Ministério do Meio Ambiente (MMA)	Federal ministry in charge of the environment, promotion of sustainable use of natural resources, the valuation of environmental services and sustainable development.	Uses deforestation, fire risk, occurrence and emissions estimates on its national policies, policy tools and actions plans to promote sustainable development.
Ministério do Desenvolvimento Agrário (MDA)	Federal ministry responsible for promoting family farming development and land reform.	Uses deforestation, fire risk and occurrence data on their inspection activities on preservation of planted crop areas.
Ministério da Ciência, Tecnologia e Inovação (MCTI)	Federal ministry responsible for the formulation and implementation of the National Science and Technology Policy.	Uses deforestation, fire risk, occurrence and emissions estimates in national communications with the UNCCCF and as layers within the SiBBr (Information system on Brazilian Biodiversity).

14. **Subcomponent 1.3. PRODES and DETER Cerrado Quality Control**. This activity aims at building a computational tool for automatic estimation of the associated uncertainty of all the polygons generated under PRODES and DETER-Cerrado. These estimates will also be used in models of error propagation to estimate the accuracy and precision of GHG emissions data generated by INPE-EM, while serving as a feedback for the continuous improvement in deforestation detections generated by PRODES and DETER.

15. The Federal University of Goiás (UFG) will develop and implement a set of metrics from which a score will be assigned for every possible deforestation event detected through PRODES and DETER. The output of this software (results) will be presented in vector formats (maps), with each polygon (PRODES or DETER) represented by a set of colors/tones (as well as a number in its table of attributes), whose variation (blue to red) indicates the probability/reliability level that a given polygon effectively corresponds to a deforestation. This tool will allow for continuous improvement of the PRODES and DETER systems in the Cerrado, The software will be open source, and available to all other products and users of the project (for example, in models of error propagation to estimate the accuracy and precision of GHG emissions data generated by INPE-EM). The experience of the UFG in the development of other free systems (e.g. LAPIG Maps, SIAD Cerrado)[36] underpins the maintenance and continuity of new releases of the tool post-project.

Component 2: Information systems on forest fire risk and GHG emissions estimation (FIP US$ 3.31 million).

16. The component will finance consultants, services, information equipment and incremental operational costs of INPE and the Center for Remote Sensing (CSR) of the Institute of Geosciences of the Federal University of Minas Gerais to carry out the following:

(a) Improving INPE's fire risk information system by designing, implementing and providing, *inter alia*, (i) localized fire risk warning barometers, (ii) applications for interactive fire risk updates, (iii) higher fire risk resolution maps, (iv) instruments for fire risk statistical analysis, and (v) automatic status updates.

(b) Adapting a fire ignition, spread and carbon model (FISC)[37] to the *Cerrado*, including the integration of daily-updated, on-line fire spread forecast information on INPE's *Queimadas* website[38], and applying such model in selected conservation units as a fire management tool.

(c) Adapting INPE's GHG emissions estimation system[39] to the *Cerrado.*

(d) Carrying out a program of hands-on training on the practical application of fire risk modelling tools to selected stakeholders.

17. **Subcomponent 2.1. Improvement of INPE's fire risk information system ("Queimadas").** This activity aims to improve the existing fire risk model used by INPE, which currently includes mainly climatic variables, and provide a series of new information products on fire risk to be available at INPE's *Queimadas* website. The existing system is comprised of four components: (i) detection of active fires obtained from 250 images/day from nine different satellites; (ii) estimates of fire risk using weather data from the last 120 days and numerical five-day forecasts (and on a monthly basis); (iii) ad-hoc support for users with specific fire control

[36] http://www.lapig.iesa.ufg.br/lapig/
[37] Originally developed and tested for the Xingu area. See: Soares-Filho et al., 2012. Forest fragmentation, climate change and understory fire regimes on the Amazonian landscapes of the Xingu headwaters. Landscape Ecology, Vol. 27 Issue 4, p585
[38] www.inpe.br/queimadas/abasFogo.php
[39] www.inpe-em.ccst.inpe.br

and prevention responsibilities through Special Operational Products (e.g. IBAMA, ICMBio, CIMAN, state environmental agencies, fire brigades, etc.); and (iv) automatic estimates of burned area in images with low (~1 km) and medium (~ 30 m) spatial resolution[40].

18. The Queimadas system has been in continuous development since the mid-1980s, with dozens of different products generated, including e-mail alerts of detected fires in protected areas and daily reports of the vegetation fire situation, and state/country level statistics. Among the thousands of registered users are PrevFogo, IBAMA, MMA, ICMBio, MMA, FUNIA, ONS, the Ministry of Health, IBGE, SIPAM, State Environmental Departments, several research groups and NGOs. In addition to standard products, these users receive alerts of fire outbreaks in conservation areas every three hours41. Special users such as IBAMA, ICMBio and ONS have access to near-real-time detection of outbreaks. Comparisons of fire occurrences with the weather are updated daily. Fire risks are forecasted by the system on a daily, weekly, and seasonal scale.

19. The INPE fire risk method (the second component of the Queimadas system)42 is based on an algorithm that calculates risk based on a hypothetical sequence of dry days, vegetation type, air temperature, relative humidity, and fire occurrence[43]. The project will help INPE to upgrade this fire risk model and associated operational products. The new system will integrate new variables such as terrain elevation, latitude and inclination, vegetation cover maps at the highest resolution available, and monthly vegetation status updates from satellite imagery with 500 m resolution.

20. New tools for the production and dissemination of fire risk information will also be incorporated. The graphics of the current web pages will be redesigned, and will include daily maps of fire risk, one-to-five-day forecasts, firegrams, clock displays, and graphs and tables for continuous assessment of the model's performance. The email alerts will be expanded and its graphic displays will be adapted to enable interactive use in new communication devices (smartphones, tablets, etc.).

21. In conclusion, the resources of the proposed Project will enhance INPE's fire risk information system through the inclusion of new variables in the existing fire risk model, the availability of new fire information products and an increase in the accuracy and resolution of the graphics for modern communication devices. This will significantly increase the quality and effectiveness of the products, resulting in more time and cost effective results from the user's perspective.

[40] This activity will also be supported through another project with GIZ support.
[41] http://www.inpe.br/queimadas/sitAreaProt.php
[42] http://www.inpe.br/queimadas/abasFogo.php
[43] http://queimadas.cptec.inpe.br/~rqueimadas/documentos/RiscoFogo_Sucinto.pdf

Table 4 – Expected outputs of subcomponent 2.1

Products	Description	Potential Users	Use	Potential Impact
New method of analysis and seven-day forecast calculation for fire risk.	Additional variables included: topography and terrain elevation, detailed vegetation maps, and latitude.	All the users of INPE's Queimadas/ Incêndios System, including special products for preferential users such as MMA, IBAMA, ICMBio, ONS, SFB, Ciman, SEMA, SUDAM.	A more accurate estimate and forecast of fire risk at varied scales.	Greater capacity and certainty for planning field activities. Better quality data for technical and scientific publications, and for vegetation fire management.
New operational maps for analysis and seven-day forecasting of the Fire Risk for Brazil.	More accurate and complete fire risk maps generated automatically in response to the local individual needs of users.	Same as above.	Same as above.	Same as above.
New graphics formats of fire risk products for continuous display on compu-ters, tablets and smartphones. New online graphic interfaces for selection of products.	A new visual presentation of risk maps and firegramas and interactive applications.	Same as above	More efficient visual and communicative analysis of information	Improved understanding and ease of use of fire risk products by technicians and the general population.
Statistical summaries of risk values of fire and weather conditions with dynamic queries for states, municipalities, conservation areas and any point in Brazil.	Online access with display options of statistical summaries for instant analysis of fire risk in relation to current and past conditions, indicating the relative severity of risks and past performance. Data will be available for download.	Same as above, and also technicians and researchers searching data for reports and surveys.	For the comparative analysis of meteorological and climatic conditions of fire risk, including the values and performance of generated.	Continuous improvement in analysis and forecasts through analysis of past performance.

22. **Subcomponent 2.2. Development of a system to predict the risk of fire spread in the Cerrado**. The detection of fire outbreaks and estimation of fire risk are two basic tools for supporting both fire prevention and active combat operations. Modelling the direction, intensity, and speed of fire propagation under different atmospheric, terrain, and land management conditions can help to fully understand the potential for fire spread which determines the extent of the burned area and, ultimately, the extent of economic losses, biodiversity impacts and CO2 emissions. To this effect, INPE will partner with the Remote Sensing Centre (CSR) of the Federal University of Minas Gerais (UFMG) to develop two products:

a. an on-line, daily system with high spatial and temporal resolution for the continuous prediction of fire spread risk, based on terrain and meteorological conditions and on the current monitoring of fire outbreaks. The information generated will be integrated in the *Queimadas* platform in visual formats that facilitate interpretation of the data by users, such as maps, tabular data and infographics; and

b. an off-line fire spread simulation tool developed for use by both government and non-governmental agencies that directly work in the prevention and active combat of forest fires on the ground.

23. Both products will be based on the Fire Ignition, Spread and Carbon (FISC) model developed at UFMG[44], which was successfully applied in the Cerrado/Amazon transition zone at the headwaters of the Xingu basin in Mato Grosso[45]. The model simulates the effects of land use, forest fragmentation, and fire prevention activities on the probability and extent of fire spread. It allows predicting, given a certain ignition source (hotpixel), the direction of fire propagation, the total area burned, the fire duration, biomass consumption and resulting CO2 emissions. The model incorporates the effect of a number of anthropogenic factors, including land zoning, proximity to highways and urban areas, and climatic conditions to predict ignition sources[46].

24. With Project resources, UFMG will adapt, improve and expand the FISC to the Cerrado biome. This effort will rely on series of data production steps for calibrating the model, which includes generating a time series of fire scar maps, intensive field work for collecting data on fire dynamics, local and regional meteorological parameters, vegetation status including fuel load, and detailed land cover and use maps. Specifically, the following activities will be carried out as part of this subcomponent:

a. characterization of the spatial and temporal dynamics of fire in the Cerrado, which includes generating a time series of fire scar maps[47] and field data collection on fuel loads and biomass consumption from burning;

b. adaptation of the FISC model to the Cerrado biome, which includes calibration and validation of the model through field data and improving the model's performance;

c. operationalization of the online FISC-Cerrado system, which includes development of an online interface on the *Queimadas* website of fire spread risk maps, tabular data and infographics, as well as operation and maintenance of the online system and regular support for online system users;

d. operationalization of the off-line FISC-Cerrado system in four pilot conservation areas[48],

[44] See: Soares-Filho et al., 2012. Forest fragmentation, climate change and understory fire regimes on the Amazonian landscapes of the Xingu headwaters. Landscape Ecology, Vol. 27 Issue 4, p585

[45] www.aliancadaterra.org.br

[46] Silvestrini RA, Soares-Filho BS, Nepstad D, Coe M, Rodrigues HO, Assunção R (2011) Simulating fire regimes in the Amazon in response to climate change and deforestation. Ecological Applications 21(5):1573–1590.

[47] For this, the UFMG team will use 30m resolution Landsat scenes and a classification algorithm for burned area developed by Alencar et al. (2011), calibrated and validated for the Cerrado. (Alencar A, Asner GP, Knapp D et al. (2011). Temporal variability of forest fires in eastern Amazonia. Ecol Appl 21(7):2397-2412).

[48] Provisionally, four National parks have been selected for piloting the off-line FISC-Cerrado tool, based on the frequency of fire occurrence and existing operational capacity. These are Serra da Canastra, Serra do Cipo, Chapada das Mesas, Grande Sertao Veredas.

which includes development of a user-friendly interface for the offline FISC-Cerrado system for use by end users such as protected area managers, development of educational and outreach material (e.g. manual, booklet, CDs), and training of key potential users (eight 3-day trainings provided, delivered by two members of the CSR/UFMG team).

25. Both products will constitute strategic tools for supporting fire management operations in protected areas, state and local environmental agencies, the National Center for Prevention and Control of Forest Fires (PrevFogo) as well as local fire prevention and management programs. The online model, which will be integrated with the online *Queimadas* platform through a WebGIS interface, will constitute the first initiative in Brazil to regularly monitor the risk of fire spread. The off-line model, as a tool for ex-ante simulation of the risk and impact of fire spread under different environmental conditions and fire management options, will enable users to gain an in-depth understanding of local fire dynamics (e.g. extent of burned areas, vegetation type affected, cycles of fire recurrence), assess the effectiveness and improve the design of current local fire prevention and management strategies.

26. **Subcomponent 2.3. Extension of INPE's GHG emission estimation system (INPE-EM) for the Cerrado.** This activity will contribute to one of the central objectives of the Brazil Investment Plan; namely, providing a set of tools for estimating and monitoring GHG emissions from deforestation and related processes with an increased level of accuracy. The results will also be used as an input for the SMMARE system (Modular System for Monitoring Actions and GHG Emission Reductions), currently under development by the Brazilian Government to provide a framework for monitoring the effectiveness of the actions and potentially emissions reductions achieved by its different sectoral mitigation plans under the National Plan on Climate Change, such as the PPCerrado and the PPCDAm[49].

27. Operating since 2012, the current application of the model provides annual CO_2 emissions and removals estimates from clear cutting of primary forest and secondary vegetation dynamics in the Amazon biome since 2012, based on the annual deforestation data provided by PRODES[50]. Estimates of reduced deforestation are also provided after 2006, taking the average deforestation rate between 1996 and 2005 as a baseline. The INPE-EM results for the Amazon will be presented in Brazil's Third National Communication to the UNFCCC under the National Circumstances chapter as a potential for improvement of the current GHG estimates.

28. FIP resources will support INPE's efforts to advance the methodological developments necessary to improve and extend the system to the Cerrado, in order to generate detailed GHG emissions estimates for the Amazonia and Cerrado biomes. For the latter, the system will use the deforestation maps generated by PRODES-Cerrado (component 1 of the Project), combined with the biomass maps for the Cerrado developed by the Brazilian Forest Service under another FIP-financed project. The proposal includes several improvements and new features to make the system more flexible and adapt it to the needs of different users. In particular, INPE will develop three products:

a. **INPE-EM/PRODES:** annual estimates of GHG emissions from clear-cutting of primary forest and secondary vegetation dynamics, and made available on the INPE-EM website.

[49] See: https://unfccc.int/files/focus/mitigation/application/pdf/brazil_namas_and_mrv.pdf
[50] In combination with the biomass map provided by Saatchi, SS, Houghton RA, Alvalá R, Soares JV, Yu Y (2007), Distribution of aboveground live biomass in the Amazon basin, Global Change Biology, 13(4), 816-837.

The current information will be improved to include the following options, displayed as results to be chosen by the user: first/second order estimates; gross/net emissions; different GHG (CO_2, CH_4, N_2O, NO_x, CO); tabular statistics by biome, state, and municipality; and maps for every gas considered.

b. **INPE-EM/DISTURBANCES:** annual estimates derived from fire and degradation processes available on the INPE-EM website. These estimates will constitute an extension of the current INPE-EM system and will include data on occurrence of disturbances and representation of post-disturbance regeneration processes. In the Cerrado, where fire is the most significant disturbance, data on burned area produced by INPE will be aggregated annually; in the Amazon, data from the DEGRAD/DETEX[51] will be considered. The process of post-disturbance regeneration will be modelled through the integration of INPE-EM with INLAND[52], allowing the estimation of net emissions from such processes.

c. **INPE-EM/IPCC:** this component will support the calculations of the estimates included in the National GHG Inventory and in the Biannual Update Reports, through the development of a separate module covering all the LULUCF transitions considered in the National Communications to the UNFCCC, based on the 2006 IPCC Guidelines. This module will be initially tested based on the land use maps generated for the second and third National Communication, as well as with data from the INPE/Terra-Class system[53], assessing its compatibility. Its results (data and codes) will be made available for use by the MCTI.

29. **Subcomponent 2.4. Capacity building and training in the use of the systems and products generated by the component**.

30. At least twelve training courses will be delivered to key users in the practical application of the fire risk modelling products. The courses will be aimed at prime users (see Table 3, above), differentiated by the relevance of specific content to their institutional mandates. The courses will be taught in person and delivered by two instructors for about 20 participants, using real data and situations, allowing for the configuration of individual products by incorporating meteorological and climatic conditions for each region.

31. The duration of each course will be of three days, preferably at the end of May of each year for the duration of the project, anticipating the period of most intense use of fire in the central and southeast regions of the country, and southern Amazon. The courses will also be made more widely available through a series of online tutorials.

[51] http://www.obt.inpe.br/degrad/

[52] The Integrated Model of Land Surface Processes (INLAND) is the land surface package for the Brazilian Earth System Model, developed by INPE/CCST and other partner institutions based on the IBIS model (Integrated Biosphere Simulator, Foley et al., 1996 and Kucharik et al., 2000). It is a model of surface processes and natural and agricultural ecosystems representing the surface effects on climate, as well as climate effect on surface processes, including vegetation growth. Its integration with INPE-EM is already underway in CCST.

[53] Terra-Class is an INPE project aiming at classifying the post-deforestation land cover and use of the areas mapped by PRODES. It is currently operational for the Amazon and under development for the Cerrado. See: http://www.inpe.br/cra/projetos_pesquisas/terraclass2010.php

Component 3. Project management, monitoring and evaluation (US$1.55 million).

32. The component will provide support for managing the technical and administrative aspects of the Project, including financial management, procurement, the carrying out of audits, overall Project coordination, monitoring and evaluation of Project implementation.

33. This component includes all activities related to project implementation, encompassing the management, coordination, financial management, monitoring of the project and its results. The objective is to ensure project implementation within deadlines, efficient resource management and achievement of the intended results. The component includes the following activities:

a. **Administrative and financial management**. FUNDEP will be responsible for the administrative and financial management of the project including procurement and physical and financial monitoring.

b. **Institutional coordination.** MCTI will coordinate Project implementation and lead the Project Institutional Coordination Committee, which will meet on a regular basis to ensure alignment of all involved institutions, resolve arising issues and coordinate activities with other sector and FIP-financed activities.

c. **Technical evaluation of developed products**. Technical evaluations of key products developed under the Project will be conducted regularly from the end of the first year of implementation by an independent group of experts designated by MCTI. These assessments aim to ensure the technical quality of products.

d. **Monitoring and evaluation**. MCTI will develop a monitoring system based on the Project's Results Framework to monitor project progress and to measure the achievement of results. This system aims to give the project coordinator an accurate view of the progress of each activity and the project as a whole. This will also enable the MCTI and FUNDEP to intervene to ensure the timely delivery of products and the achievement of goals and expected results. Both the design and the implementation of the monitoring system are the responsibility of MCTI, with data provided by the implementing partners.

e. **Reporting**. Bi-annual reports will document and report on the project's technical implementation. These reports will be based on an analysis of the progress vis-a-vis planning contained in the Annual Operational Plans and Indicator Matrix for Monitoring and Evaluation activities. MCTI will be responsible for preparing the technical reports, with inputs provided by the implementing partners.

f. **Mid-term and final project evaluation of the project**. Independent evaluations will be hired to conduct the mid-term evaluation and final evaluation of the implementation. The main purpose of the assessments is to measure the overall achievement of results and indicators designed by the Project.

Annex 3: Implementation Arrangements

BRAZIL
Development of Systems to Prevent Forest Fires and Monitor Vegetation Cover in the Brazilian Cerrado Project

A. Project Institutional and Implementation Arrangements

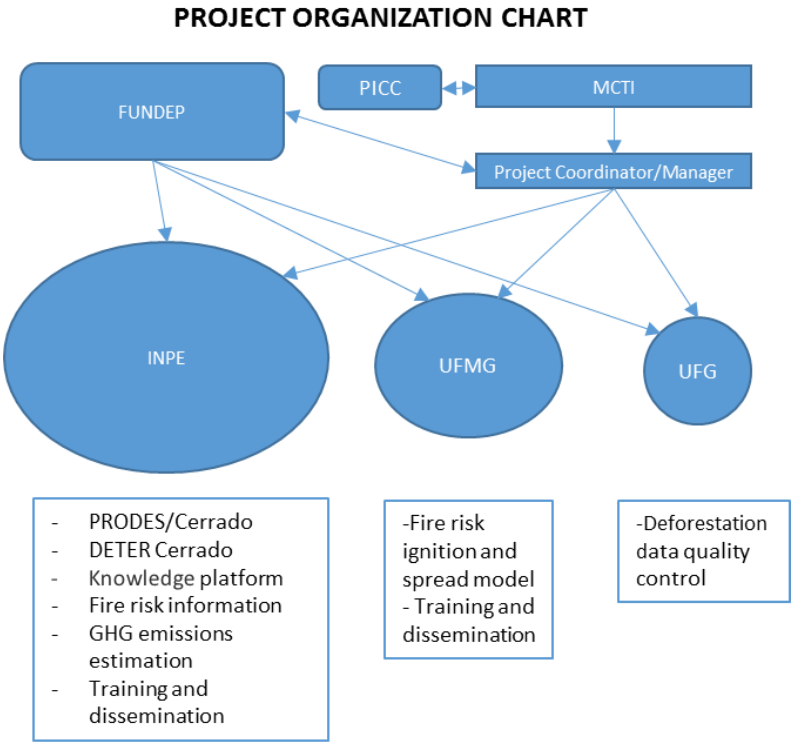
1. The Federative Republic of Brazil through the Ministry of Science, Technology and Innovation (MCTI) endorsed the Project on May 13, 2013 and appointed the **Research Development Foundation (***Fundação de Desenvolvimento da Pesquisa* **- FUNDEP)** as the Recipient and Project implementing agency. FUNDEP is a private foundation with extensive experience in project management. FUNDEP will sign a Technical Cooperation Agreement with MCTI and the three other participating institutions (see below), establishing the Project governance structure and its administrative procedures. FUNDEP will adopt an Operational Manual satisfactory to the Bank. Its responsibilities include: (i) procurement and financial administration; and (ii) monitoring and reporting (jointly with MCTI).

2. FUNDEP will be responsible for the financial and fiduciary administration of the Project including, among others: (i) the project accounting system; (ii) the planning and financial monitoring systems; (iii) all procurement activities for goods and services contained in each of the Project's components; (iv) the introduction of control systems to ensure the efficiency and transparency in the management of the Project's physical and financial resources; (v) the management of a bank account for the exclusive administration of the project resources; (vi) preparing the disbursement requests and submitting them to the World Bank, along with all the supporting documentation; (vii) coordination with the participating entities, verifying the quality of the goods and services provided by contractors and vendors; (viii) preparing the financial progress reports of the project; and (ix) ensuring compliance with the grant agreement with the World Bank

3. The Project will benefit from FUNDEP's capacity for integrated procurement, financial administration and reporting, as well as project management and monitoring systems. FUNDEP will ensure the compatibility of its systems with Bank's norms, procedures and control and reporting systems requirements. FUNDEP will designate a Project Leader and will allocate additional technical and administrative human resources as needed.

4. The **Ministry of Science, Technology and Innovation** (*Ministério da Ciência, Tecnologia e Inovação* - **MCTI),** through the Secretariat for Policies and Research Programs and Development (SEPED), will approve the Project's Annual Operational Plan (POA), the procurement plan and budget. It will also be responsible for institutional coordination, implementation monitoring, quality assurance and results evaluation. SEPED will appoint a staff member as project director and contract a project coordinator/manager with extensive experience to run day-to-day operations.

Figure 2.



5. A **Project Institutional Coordination Committee (PICC)**, will be created through an MCTI Ministerial Ordinance (*portaría*), to ensure coordination between FUNDEP, MCTI and the three participating institutions: the National Institute for Space Research (INPE), the Federal University of Minas Gerais (UFMG) and the Federal University of Goías (UFG). The PICC will be composed of representatives of all these institutions and also of the Ministry of Environment (MMA), to facilitate coordination at the level of the Brazil FIP Plan and PPCerrado. The PICC will be responsible for: (i) reviewing the Project Operational Manual (OM); (ii) support the formulation of the POA and procurement plan; (iii) reviewing the physical and financial implementation progress reports; (iv) ensuring that project execution and results are timely, consistent and ultimately contribute to the attainment of the strategic objectives of the Project; and (v) providing strategic recommendations to strengthen Project implementation.

6. **Project execution**. FUNDEP will administer the Project and MCTI will be in charge of technical supervision. INPE, UFMG and UFG will be responsible for delivering the Project products and results respectively assigned to each of them. Activity execution will proceed as follows: (i) the POA will be inserted into the system FUNDEP's management system, (ii) INPE, UFMG and UFG will prepare the technical specifications of the goods to be procured as well as the terms of reference of the consultants to be recruited; (iii) INPE, UFG, UFMG will request the purchase of goods and services and hiring of consultants through FUNDEP's system; (iii) SEPED will review and approve these requests directly in the system; and (iv) FUNDEP will carry out the procurement and execute payments.

7. The **National Institute for Space Research** (*Instituto Nacional de Pesquisas Espaciais* - **INPE**), an institution linked to MCTI, will be in charge of PRODES/DETER Cerrado development and implementation (and related sub-products and systems), improvements to the fire risk information system, GHG emissions estimations and related training and dissemination.

8. Three units of INPE are involved in the Project: the Directorate for Earth Observation (OBT), responsible for the land cover monitoring activities; the Center for Weather Forecast and Climate Research (CPTEC) and the Center for Earth System Science (CCST). INPE has been working in satellite remote sensing activities since the late 1960s, combining research and applications in earth observation with satellite data reception, processing, archival and distribution. Currently, INPE's Directorate for Earth Observation has three Divisions: the Remote Sensing Division (DSR), the Image Processing Division (DPI) and the Remote Sensing Data Center (CDSR). The focus of DSR is on remote sensing research and applied research on earth sciences such as geology, forestry, ecology, oceanography, and on cultural features such as agriculture, land use, and urbanization. The skills of the DPI are in research in remote sensing image processing and geo-informatics. DPI's team develops state of the art software for handling large-scale environmental data. The CDSR handles Brazil's remote sensing data archive, including LANDSAT images going back to 1973. CDSR's full archive is openly accessible on the internet. To date, it has delivered more than 2 million images to users worldwide. INPE's Directorate for Earth Observation is a unique group that brings together all the skills needed for advanced earth observation research and applications.

9. INPE's Earth System Science Center (CCST) develops research on regional and global climate change, including the generation of future climate change scenarios. This center coordinates the activities linked to the Brazilian Earth System Model (BESM), and hosts the headquarters of the Executive Secretary of the Brazilian Climate Change Network and a program on Global Climate Change.

10. There are strong interactions between INPE and the Ministry of Environment (in particular PrevFogo / IBAMA and ICMBio) in the development of products related to monitoring burnings and wildfires. For example, INPE generates the daily reports PrevFogo-Cerrado54 and INPE data feature heavily in ICMBio bulletins55. INPE has multiple users its information system in a universe of more than 3,000 registered users and hundreds of thousands of accesses annually.

11. The **Federal University of Minas Gerais** (*Universidade Federal de Minas Gerais* – **UFMG**) will be in charge of further developing the FISC model, its on-line application for the Cerrado and its application in four conservation units. It will also carry out training in the use of the model. In 1990 UFMG, in association with FUNDEP, founded the Center for Remote Sensing (CSR) at the Institute of Geosciences. CSR has executed major research projects in the Amazon region, focusing on land-use changes and their effects on the regional environment, human health and local economies. In collaboration with other institutions, CSR has developed a modeling system for conducting integrated (economic and ecological) assessment of policy scenarios for the Amazon (SimAmazonia). As a result, CSR has become a worldwide reference for integrated simulation of land-use changes in tropical forest regions and assessment of

[54] http://peassaba.cptec.inpe.br/queimada/boletim_cerrado/cerrado.pdf
[55] http://www.icmbio.gov.br/portal/index.php

associated impacts on climate, river regime, carbon balance, agriculture and forestry rents, and biodiversity.

12. The **Federal University of Goiás** (*Universidade Federal de Goiás* – **UFG**) will be in charge of the PRODES/DETER data quality control system.

13. The Image Processing and GIS Lab of the Federal University of Goiás (LAPIG/UFG) is a major reference center in Brazil for the processing and analysis of moderate spatial resolution satellite imagery for environmental monitoring and territorial governance. Primarily focused on the Cerrado biome, LAPIG has either led or actively participated in many different research and operational projects related to the regional mapping of the Cerrado land cover and land use dynamics and understanding of the ecosystem processes in natural and converted landscapes. Currently, LAPIG's efforts are mostly concentrated in the development of metrics and protocols for pasture quality assessments, modeling land conversion trends with respect to sugarcane expansion and estimation of regional water balance through a synergistic approach based on the use of optical, thermal, microwave and gravimetric (GRACE) remote sensing data.

14. **Project Operational Manual** (OM). FUNDEP and the participating institutions will implement the project in accordance with a Project Operational Manual, satisfactory to the World Bank and adopted by FUNDEP, which shall include the rules, methods, guidelines, standard documents and procedures for the carrying out of the Project, including the following: (a) the detailed description of project implementation activities and the detailed institutional arrangements of the project; (b) the Project administrative, accounting, auditing, reporting, financial, procurement and disbursement procedures; (c) the monitoring indicators for the Project; (d) the Project evaluation strategy; (e) the procedures to be adopted if some unexpected negative social impact arises during Project implementation; and (f) the Interim Guidelines on the Application of Safeguard Policies to Technical assistance (TA) Activities in Bank-Financed Projects and Trust Funds Administered by the Bank.

B. Financial Management, Disbursements and Procurement

Financial management

15. A Financial Management Assessment (FMA) was carried out in accordance with OP/BP 10.00 and the Financial Management Practice Manual and Guidelines. This section details the arrangements related to (a) budgeting; (b) flow of funds; (c) accounting and maintenance of accounting records; (d) internal controls; (e) periodic financial reporting, and (f) arrangements for external audits, to effectively execute the financial management and monitoring of this project financed by the Bank.

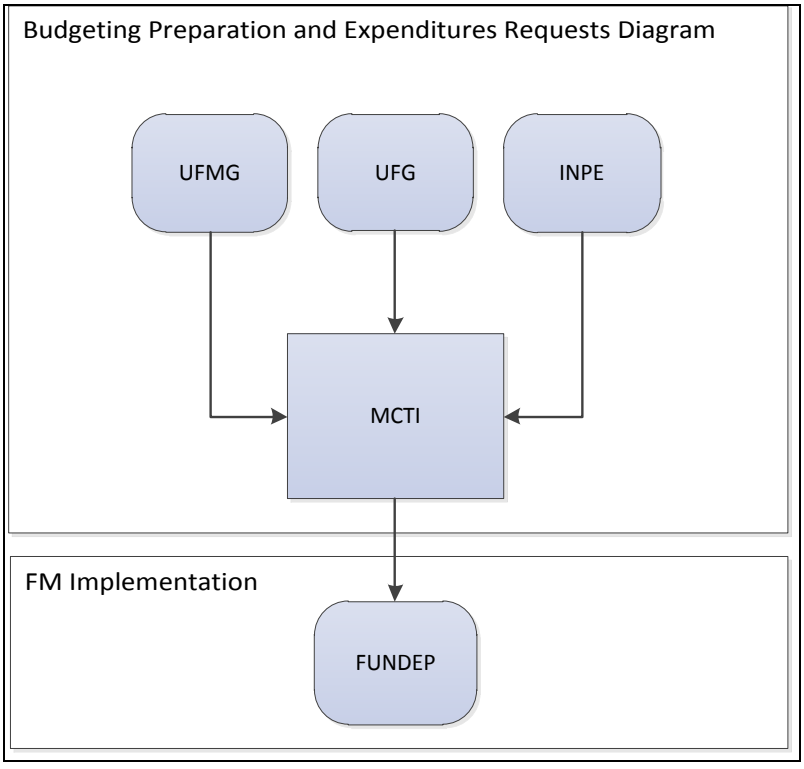
16. In accordance with the requirements of OP/BP 10.00, FUNDEP will maintain financial management arrangements that are acceptable to the Bank and that, as part of the overall arrangements that the Recipient has in place for implementing the operation, provide reasonable assurance that the proceeds of the grant are used for the purposes for which it was intended. FUNDEP will prepare the Project Operational Manual (OM), which will describe the financial management, accounting and reporting responsibilities of each entity.

17. Grant disbursements will be made for goods, consulting services, non-consulting services, operating costs and training on a transaction basis and expenditures will be documented

to the Bank using Statements of Expenditure (SOEs), as specified in the Disbursement Letter. The Direct-Payment disbursement method will not be used. The Advance and Reimbursement disbursement methods will be used, with the Advance method being the primary disbursement method. The Bank will disburse the proceeds of the grant to a segregated Designated Account in Brazilian Reais (R$) held and managed by the FUNDEP at a commercial bank (Banco do Brasil, Branch 1.615-2, Account 955.220-0) acceptable to the Bank. Payments for project goods and services will be made directly from this account. The Designated Account will have a fixed ceiling of R$2.800.000. The frequency for documenting eligible expenditures paid from Designated Account will be at least once a quarter. The Minimum Application Size will be R$560,000 equivalent. The Project will also have a four-month grace period after the closing date, during which the Bank will accept withdrawal applications documenting eligible expenditures incurred prior to the closing date.

18. MCTI will consolidate and approve each request for project expenditure before submitting it to FUNDEP for preparation/capturing/contracting and payment. FUNDEP will not maintain any petty cash for small project payments.

Figure 3.

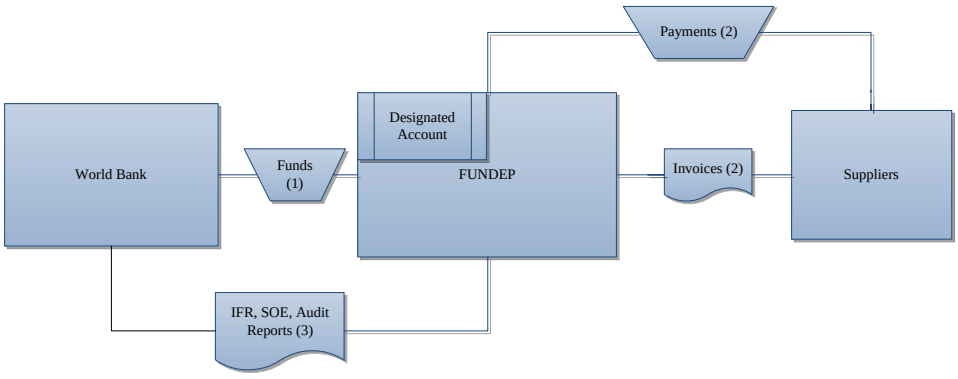


19. MCTI will be responsible for approving the general budget that will consolidate the financial needs /requests of the Federal University of Goiás (UFG), National Institute for Space Research (INPE), and University of Minas Gerais (UFMG).

20. Flow of Funds to the Designated Account. The following diagram indicates the flow of funds mechanism to be used for the project:

Figure 4. Flow of Funds

Disbursement Diagram



(1) Funds will be transferred to a specific/segregated bank account for the Project maintained by the FUNDEP. The account will be maintained in Brazilian Reais (R$).
(2) Project activities will be registered in the information system "GPF.net" administered by FUNDEP. Goods and services will be requested by INPE/MCTI, UFMG and UFG to MCTI, who in turn will centralize and consolidate theses requests and then submit them on-line to FUNDEP. Upon receiving the requests from MCTI, FUNDEP will prepare the acquisition procedure/capturing/contracting and make the payments.
(3) The IFR's and SOE's will be prepared in MS Excel and they will be supported by the accounting reports and data available at the GPF.net. The supporting documents will be retained at FUNDEP for up to two years after the completion of the project.

21. FUNDEP will be responsible for preparing and sending withdrawal applications to the Bank. Project expenditures will be reported on after they are approved by FUNDEP and fully documented, ensuring that the grant proceeds were exclusively used for eligible expenditures.

22. FUNDEP will have access to the Bank's Client Connection system for up to date information relating to the disbursement of the proceeds of the grant. The Project's records will be reconciled on a regular basis with this information in Client Connection.

23. For monitoring purposes, the FUNDEP will prepare semi-annual Project Interim Financial Reports and submit them to the Bank within 45 days after the end of each semester. Interim Unaudited Financial Reports (IFRs) will be prepared on a cash-basis and will show the budgeted and expenditure figures by semester, accumulated for the year and accumulated for the Project. A specific ledger will be created in the system to record all grant transactions, and will be aligned with the structures of the grant cost and disbursement tables to record transactions by category and component/subcomponent. The following semi-annual IFRs will be prepared for management purposes and submitted to the Bank:

(a) IFR 1-A – Source and application of funds by cost category, cumulative (project-to-date, year-to-date), and for the period
(b) IFR 1-B – Uses of Funds by project components, cumulative (project-to-date, year-to-date) and for the period, showing budgeted amounts versus actual expenditures, (i.e., documented expenditures), including a variance analysis;
(c) IFR 1-C – Disbursements reconciliation with the Bank's Client Connection site; and

24. The external auditing will be conducted annually by an independent audit firm acceptable to the Bank and carried out under TORs acceptable to the Bank and in accordance with the Bank's audit policy. The audit will be due no later than six months after the end of the fiscal year. Auditors will be required to issue a single opinion on the Project's financial statements and the Designated Account, as well as to produce a management letter in which relevant internal control weaknesses will be identified.

25. Internal Auditing. FUNDEP has an Internal Audit Department. Project transactions may be selected by the Internal Audit Department as part of their normal review, but they will not adjust their workplans to specifically focus on the Grant activities.

26. The table below specifies the categories of eligible expenditures that may be financed out of the proceeds of the Project and the percentage of expenditures to be financed for eligible expenditures in each category:

Category	**Amount Allocated (US$)**	**Percentage of Expenditures to be Financed**
(1) Goods and Non-Consulting Service, Consulting Services, Training, and Operating Costs.	9,250,000	100%
Total Amount	9,250,000	100%

27. "Training" means expenditures (other than those for consultants' services) incurred by the Recipient in connection with the carrying out of training, seminars, and workshops, including the reasonable travel costs (e.g. accommodations, transportation costs and *per diem*) of trainees and trainers (if applicable), catering, rental of training facilities and equipment, logistics and printing services, as well as training materials and equipment under the Project.

28. "Operating Costs" means the reasonable incremental operational costs (which would not have been incurred absent the Project) under the Project, including, *inter alia*, (i) operation and maintenance of vehicles; (ii) incremental office equipment and supplies; (iii) shipment costs (whenever these costs are not included in the cost of goods); (iv) rent for office facilities; (v) utilities; (vi) travel and per diem costs for technical staff; (vii) communication costs including advertisement for procurement purposes; and (viii) administrative and operational support staff.

Procurement

29. The Project will be technically implemented by MCTI, INPE, UFMG and UFG while FUNDEP will be responsible for procuring goods, works and services as well as for selecting consultants, in accordance with the Bank's procurement policies. FUNDEP will also be responsible for contract management. MCTI and INPE will provide the necessary technical inputs (TORs, technical specifications, etc.) to allow FUNDEP to carry out the procurement process with due diligence.

30. Procurement for the proposed Project would be carried out in accordance with the World Bank's "Guidelines: Procurement under IBRD Loans and IDA Credits" dated January 2011 (revised July 2014); "Guidelines: Selection and Employment of Consultants by World Bank

Borrowers" dated January 2011 (revised July 2014); and the provisions stipulated in the Grant Agreement.

31. The project includes the following types of purchases: (i) individual consultants and consulting firms; (ii) equipment and software; (iii) training costs and operational costs; and (iv) non-consultant services.

32. **Procurement of goods**. Procurement of goods will be done using the national Standard Bidding Documents (SBD) agreed with or satisfactory to the World Bank for all national competitive bidding (NCB). Small value contracts not to exceed US$ 100,000 would follow shopping procedures. The *pregão eletrônico* (e-reverse auction) defined in Brazilian law 10,520/2002 would be used as an alternative to shopping and NCB methods. Direct contracting may be used when the conditions of paragraph 3.7 of the guidelines are met. Goods contracts estimated to cost less than US$ 2,000,000 would follow NCB procedures. The first process under NCB method and all contracts estimated to cost more than US$ 1,500,000 equivalent per contract would be subject to prior review by the Bank. The first process based on Shopping, regardless of the amount involved, would be subject to prior review by the Bank. Prior review procedures would be applied for procurement of goods under Direct Contracting method only if one these conditions are in place: (i) for the first process of direct contracting regardless the amount involved; and (ii) all contracts estimated to cost more than US$ 50,000.

33. **Special provision for NCB**: only the competitive procurement method *pregão eletrônico* (e-reverse auction) as defined in law 10,520/2002 may be used as an alternative method to NCB. Provisions of the Bank's guidelines would apply to all other aspects of the procurement carried out following NCB procedures. Only standard bidding documents previously accepted by the Bank will be used for the *pregão eletrônico*. Bidding documents must include anticorruption and right to audit clauses, acceptable to the Bank, and the legal agreement will include a provision that the NCB bidding documents shall be acceptable to the Bank.

34. **Procurement of non-consultants services**. Procurement of non-consulting services will be done using the national SBD agreed with or satisfactory to the Bank for all NCB. Small value contracts not to exceed US$100,000 may follow shopping procedures. Direct contracting may be used when the conditions of paragraph 3.7 of the guidelines are met. Non-consulting services contracts estimated to cost less than US$ 2,000,000 would follow NCB procedures. Only the competitive procurement method *pregão eletrônico* (e-reverse auction) as defined in law 10,520/2002 may be used as alternative method to NCB. Provisions of the Bank's guidelines would apply to all other aspects of the procurement carried out following NCB procedures. Only standard bidding documents previously accepted by the Bank would be used for the *pregão eletrônico*. Bidding documents must include anticorruption and right to audit clauses to be considered acceptable to the Bank. The first process under NCB or *pregão eletrônico methods and* all contracts estimated to cost more than US$ 1,500,000 equivalent per contract would be subject to prior review procedures. The first process on Shopping basis, regardless of the amount involved, would be subject to Bank's prior review procedures. Prior review procedures would be applied for procurement of non-consulting services under Direct Contracting method only if one these conditions are in place: (i) for the first process of direct contracting regardless the amount involved; and (ii) all contracts estimated to cost more than US$ 50,000.

35. **Selection of consultants**. Consulting services from firms and individuals required for the project include a wide array of technical assistances and advisory services. Short lists of

consultants for services estimated to cost less than US$ 1,500,000 equivalent per contract may be composed entirely of national consultants in accordance with the provisions of the consultant guidelines. All contracts estimated to cost more than US$ 500,000 equivalent per contract and the first process under each selection method regardless amount involved would be subject to prior review procedures. The first process under Single Source Selection method and all estimated to cost more than US$ 100,000 would be subject to prior review by the Bank. Quality and cost based selection (QCBS) would be the default method for the selection of firms, but quality-based selection (QBS), least-cost selection (LCS), selection under a fixed budget (FBS), selection based on the consultants' qualifications (CQS), and single source selection (SSS) could also be used if the requirements of the guidelines are met. Individual consultants will be selected in accordance with procedures of section v of the Bank's Consultant Guidelines.

36. **Assessment of the agency's capacity to implement procurement**. A procurement assessment of FUNDEP's capacity to implement procurement transactions was carried out in October 2014. The assessment reviewed FUNDEP's organizational structure and the current operation environment available for implementing the project. Risks concerning the procurement function for implementation of the project have been identified and include: (a) lack of familiarity by FUNDEP staff with procedures to select consultants and procure goods and services in accordance Bank's procurement policies; (b) lack of experience in implementing Bank-financed projects. In view of FUNDEP's established capacity and the small number of potential situations which could involve issues/risks for the procurement function, the overall risk for procurement is rated as MODERATE. Below is a list of proposed mitigation measures.

Table 5: Procurement Risk Assessment and Mitigation Matrix

	Risk Assessment				**Risk Mitigation Measures**	**Residual Risk**
	H	S	M	L		
Project Level			X		• Bank staff will train FUNDEP's procurement and technical staff on Bank-procurement policies; • FUNDEP will appoint from its own staff or hire an external procurement specialist to prepare documents, supervise and support FUNDEP and other agencies regarding procurement aspects and to strengthen FUNDEP's procurement capacity. • FUNDEP prepared a detailed procurement plan through the SEPA System by Negotiations	M
Overall Rating			X			M

37. **Frequency of Procurement Supervision.** In addition to the prior review supervision to be carried out by the Bank, the capacity assessment of the Implementing Agencies suggests the need for yearly supervision missions to visit the field to carry out post-review of procurement actions.

38. A yearly external procurement audit satisfactory to the Bank or yearly Independent Procurement Reviews (IPR) would be a covenant in the grant agreement and would be required to assess and verify a sample of processes procured under project.

Procurement Plan. The procurement plan for implementation of the proposed project was presented through the SEPA system and approved by the Bank on October 26, 2015. During project execution the plan may be updated annually or as required to reflect the actual project implementation needs and improvements in institutional capacity. The recommended thresholds for the use of the procurement methods specified in the grant agreement are identified in the following table.

Table 6: Thresholds for Procurement Methods and Prior Review

Expenditure category	Contract value threshold (US$ thousands)	Procurement method	Processes subject to prior review
Goods	< 2,000	NCB	First process and all those above US$ 1,500,000
	<100	Shopping	The first process
Non-consulting services	< 2,000	NCB	First process and all those above US$ 1,500,000
	< 100	Shopping	Three first processes
Consulting Services (firms)	≥ 200	QCBS / QBS	First process for each selection method regardless the amount involved and all processes above US$ 500,000
	< 200 ≥ 100	LCS / FBS	
	< 100	CQS	
Individual consultants	Section V in the Guidelines		
Single Source Selection (firms)	Any	Any	First process regardless the amount involved and all contract estimated to cost more than US$ 100,000
Direct contracting of goods or non-consulting services			First process regardless the amount involved and all contract estimated to cost more than US$ 50,000

Note: NCB = National Competitive Bidding; QCBS = Quality- and Cost-Based Selection; QBS = Quality-Based Selection; FBS = Fixed Budget Selection; LCS = Least-Cost Selection; CQS = Selection Based on Consultants' Qualifications.

C. Environmental and Social (including safeguards)

39. Operational policies OP 4.10 (Indigenous Peoples) and OP 4.12 (Involuntary Resettlement) are not triggered. The project will not interfere with Indigenous Peoples and/or traditional communities as its activities focus on providing information. No physical construction will take place. The Project's operational manual will specify what procedures will be adopted if some unexpected negative social impact arising from the project is identified. Additionally, Project implementation will be supervised in accordance with the social policies of

the World Bank and in accordance with its guidelines for the application of safeguard policies to Technical Assistance operations ("Interim Guidelines on the Application of Safeguard Policies to Technical assistance (TA) Activities in Bank-Financed Projects and Trust Funds Administered by the Bank").

40. Gender. The Project has a neutral gender strategy as there is no on the ground activity that specifically favors gender. Consultants will be selected based on the Bank's guidelines that do neither discriminate against nor favor gender issues.

41. Environment. The Project is essentially an environmental information enhancement project with environmental category C. The Project is expected to have an overall positive impact on the environment as it seeks to increase information on patterns of deforestation and forest and grassland fire risks. The Natural Habitat Operational Policies (OP / BP 4.04) and Forests (OP / BP 4.36) of the World Bank are applicable. The Project's operational manual will include the Bank principles and guidelines for the application of safeguard policies to Technical Assistance operations ("Interim Guidelines on the Application of Safeguard Policies to Technical assistance (TA) Activities in Bank-Financed Projects and Trust Funds Administered by the Bank").

D. Monitoring & Evaluation

42. FUNDEP will monitor implementation progress jointly with MCTI-SEPED and issue progress reports on a six-monthly basis. MCTI will also monitor results and impacts in two ways. The participating entities will provide intermediate product output reports in accordance with the POA and the Results Framework. MCTI will designate an independent technical evaluation group to review and assess the quality of the intermediate products and reports and to provide feedback to the PICC and the participating entities. MCTI will also contract an agency to carry out intermediate surveys on how useful the information generated under the Project is for the end-users and feedback the conclusions to the participating entities and the PICC. Such surveys will help improving the quality and effectiveness of the information.

43. Reporting. Six-monthly reports will document and discuss the Project's implementation. These reports will be based on an analysis of progress in relation to planned activities and disbursements as indicated in the annual operational plans (POA), approved by the Bank, and indicator matrix for monitoring and evaluation activities. MCTI will be responsible for preparing the technical reports, with inputs provided by FUNDEP (physical and financial progress) and the implementing partners.

44. Mid-term and final project evaluation. At the end of the second Project year, it will carry out a mid-term review together with the Bank and at the end of the Project it will carry out an impact evaluation based on user surveys. These evaluations will be conducted with the support of independent consultants. Their main purpose is to measure the overall achievement of results and indicators designed by the project.

45. Technical evaluation of developed products. Technical evaluations of key products developed under the Project will be conducted regularly from the end of the first year of implementation by an independent group of experts designated by MCTI. These assessments will help to ensure the technical quality of the products.

Annex 4: Implementation Support Plan

COUNTRY: BRAZIL
Development of Systems to Prevent Forest Fires and Monitor Vegetation Cover in the Brazilian Cerrado Project

1. The Project will require support at the technical and fiduciary levels. Disbursement and financial management at the project level will follow standard FUNDEP procedures and will not require extraordinary attention, except in the beginning of the Project. Procurement may require some more attention, all procurement goes through shopping procedures and selection of consultants will mostly be based on quality.

2. Safeguards management will not require specific interventions or mitigation actions besides regular monitoring of compliance.

3. The WB office in Brasilia will be the main source of project support as it has qualified safeguards and fiduciary staff available to follow-up on the Project's implementation. Every year two specific support missions will be required to assist with the yearly planning, analysis of project progress and implementation quality.

Table 1: Implementation support focus, skills, resources and origin

Time	Focus	Skills needed	Resource Estimate
Year 1	- Project planning and programming - Fiduciary processes	- Project management - Fiduciary Management - Monitoring and evaluation	- 2 specific support missions - intense support from country office
Year 2- 3	- Project implementation - Monitoring - Reporting	- Project management - Carbon forestry - Monitoring specialist - Training specialist - Fiduciary (FM, Procurement, Safeguards)	- 2 yearly support missions - support from country office at the technical and fiduciary level
Year 4	- Monitoring and evaluation	- Project management -Carbon forestry - Monitoring and evaluation	- 2 follow-up missions by monitoring and evaluation specialists

Table 2: Skills Mix Required

Skills Needed	Number of Staff Weeks	Number of Trips
Project management	- six staff weeks per year	- 2 per year
Operational specialist	- 8 staff weeks per year	- In country office
Fiduciary Specialists (FM and Procurement)	- 2 x 3 weeks per year	- In country office
Technical Specialists including M&E	- 8 weeks per year and 12 weeks in year 4	- 2 trips per year

Annex 5: Relationship with the Forest Investment Program

COUNTRY: BRAZIL
Development of Systems to Prevent Forest Fires and Monitor Vegetation Cover in the Brazilian Cerrado Project

A. The Forest Investment Program

1. The Forest Investment Program (FIP) is a targeted program under the Strategic Climate Fund (SCF), one of the two Climate Investment Funds (CIF) managed by the World Bank. The SCF provides financing for developing or up-scaling activities that seek to respond to specific challenges related to climate change or to provide a sector response through directed programs.

2. The main purpose of FIP is to support developing countries' REDD-plus efforts[56], providing up-front bridge financing for readiness reforms and public and private investments identified through national REDD readiness strategy building efforts, while taking into account opportunities to help them adapt to the impacts of climate change on forests and to contribute to multiple benefits such as biodiversity conservation, protection of the rights of indigenous peoples and local communities, poverty reduction and rural livelihoods enhancements. FIP finances efforts to address the underlying causes of deforestation and forest degradation and to overcome barriers that have hindered past efforts to do so.

3. The FIP was designed to achieve four specific objectives[57]: (i) initiate and facilitate steps towards transformational change in developing countries' forest related policies and practices; (ii) pilot replicable models to generate understanding and learning of the links between the implementation of forest-related investments, policies and measures and long-term emission reductions from REDD-plus; (iii) facilitate the leveraging of additional financial resources for REDD, including through a possible UNFCCC forest mechanism; and (iv) provide valuable experience and feedback in the context of the UNFCCC deliberations on REDD.

4. To achieve these objectives, the FIP supports and promotes, inter alia, investments in the following areas: (a) institutional capacity, forest governance and information; (b) investments in forest mitigation measures, including forest ecosystem services; and (c) investments outside the forest sector necessary to reduce the pressure on forests.

B. The Brazil Investment Plan (BIP)

5. **Overall objective.** The Brazil Investment Plan under the FIP seeks to promote sustainable land use and forest management improvement in the Cerrado, the second largest biome in Brazil and South America, contributing to reducing pressure on the remaining forests, reducing GHG emissions and increasing CO_2 sequestration. It was approved by the FIP Sub-

[56] REDD-plus stands for "Reducing Emissions from Deforestation and forest Degradation, and the role of conservation, sustainable management of forests, and the enhancement of forest carbon stocks in developing countries". It is a policy mechanism being negotiated under the UNFCCC.

[57] See FIP Design Document, available at: www.climateinvestmentfunds.org/cif/keydocuments/FIP

Committee in May 2012, agreeing to a range of funding for US$$50-70 million in FIP resources.

6. **Thematic areas.** BIP covers two thematic areas and includes four interrelated projects, as listed below. Theme 1: Management and Use of previously anthropized areas, aims at supporting producers in the biome comply with the Rural Environmental Cadaster (CAR) and access resources under the Low Carbon Emission Agriculture (ABC) Plan. Theme 2: Production and Management of Forest Information, aims at generating and making available spatially and temporally consistent environmental information for the biome.

Table 7. Project and program concepts in the context of the Brazil Investment Plan (US$ million)

Theme	Project Title	Agency	Requested FIP amount		Expected co-financing	TOTAL
			Grants	Loan		
Theme 1 – Management and Use of previously anthropized areas	1.1- Environmental regularization of rural lands (based on the CAR).	IBRD	1.00	32.48	17.50	50.98
	1.2- Sustainable production in areas previously converted to agricultural use (based on the ABC Plan).	IBRD	10.72	0	25.00	35.72
Theme 2 – Production and Management of Forest Information	2.1- Forest information to support public and private sectors in managing initiatives focused on conservation and valorization of forest resources.	IDB	16.55	0	8.00	24.55
	2.2- Implementation of an early-warning system for preventing forest fires and a system for monitoring the vegetation cover.	IBRD	9.25	0	6.50	15.75
TOTAL			37.52	32.48	57.00	127.00

7. **Relationship with the specific objectives of the FIP.** The BIP clearly complies with the four specific objectives of the FIP. It builds on existing climate change related policies and practices in Brazil and supports the instruments that guide federal and state financing policies in the land use sector, particularly the CAR, ABC Plan, Mais Ambiente Program, and PPCerrado, overcoming key barriers to their implementation. As such, the BIP invests in replicable models that will catalyze transformational changes in the AFOLU sector in the Cerrado biome, generating new knowledge and building the foundations for leveraging additional financial resources under an eventual future REDD+ mechanism under the UNFCCC.

8. **Relationship with the FIP investment areas.** The BIP strategy mainly targets the following FIP investment areas: investments outside the forest sector necessary to reduce the pressure on forests, including agricultural intensification; and institutional capacity, forest management and information. As a complementary measure, the Plan also focuses on the third FIP investment area by supporting mitigation actions related to forests, such as encouraging

forest recovery of Legal Reserves (RLs) and Permanent Preservation Areas (APPs) in landholdings[58].

9. **Relationship with the FIP results framework.** The results expected from the implementation of the BIP are: sustainable management adopted in previously converted areas; environmental information produced and disseminated and forests and forest landscapes managed in a sustainable way in order to address the drivers of deforestation and forest degradation; capacity for tackling the immediate and underlying causes of deforestation and increased degradation; new and additional resources for forests and projects related to forests; Incorporation of learning through the development of stakeholders thoroughly familiar with REDD-plus. The BIP therefore is fully consistent with and well in place to contribute to the FIP results framework at the programmatic level[59].

C. Project Relationship with the BIP and FIP Investment Criteria

10. **Relationship with the BIP.** The objective of the BIP is to promote sustainable land use and forest management in the Cerrado biome, contributing to reducing pressure on the remaining forests, reducing GHG emissions and increasing CO2 sequestration. The Project's objective is to enhance Brazil's institutional capacity to monitor deforestation, provide information on fire risks and estimate related GHG emissions in the Cerrado biome. The Project thus is fully in line with the overall objective of the BIP and falls under theme (2) Production and Management of Forest Information. The Results Framework of the project will be integrated at the Program (BIP) level contributing to the annual reporting requirements under the FIP.

11. **Relationship with the FIP investment areas and criteria.** The project targets mainly the following FIP investment area: (a) institutional capacity, forest governance and information. It fully complies with the FIP investment criteria, as illustrated below[60]:

Climate change mitigation potential	The deforestation monitoring system will provide near-real time information as well as more accurate, yearly figures, on land use changes in the Cerrado. In the case of the early warning systems for forest fires, the improvements will enhance the existing capacity to predict the risk of forest fires and spread, one of the major threats to the Cerrado. Finally, the information generated will expand existing systems for estimating GHG emissions in the biome as an indicator of effectiveness of the GoB's mitigation actions. Together, these actions will ensure a steady flow of high quality information to policy makers and actors involved in ground operations, providing them with crucial support tools for their planning, control and prevention of forest fires and deforestation activities. The project thus will not result in a direct generation of GHG emissions reductions. Rather, by promoting investments in the establishment and improvement of these key forest information systems in the Cerrado it will create the enabling conditions for land use institutions to monitor, measure, and enforce regulations in the future, leading to emissions reductions. A detailed calculation of

[58] See FIP Design Document, available at: www.climateinvestmentfunds.org/cif/keydocuments/FIP
[59] See FIP Results Framework, available at: www.climateinvestmentfunds.org/cif/keydocuments/FIP
[60] See FIP Investment Criteria and Financing Modalities, available at: www.climateinvestmentfunds.org/cif/keydocuments/FIP

	potential GHG emissions reductions attributable to the project as compared to a business as usual scenario is therefore not applicable to this operation. For information, recent estimates[61] indicate that emissions from deforestation and burning (including CH_4 and N_2O) in the Cerrado between 2003 and 2008 resulted in the emission of 1,450 $MtCO_{2eq}$, of which conversion to pastures corresponds to 819 $MtCO_{2eq}$ (or 136.5 $MtCO_{2eq}$/year).
Demonstration potential at scale	The proposed FIP investment will cover the entire Cerrado biome, the second largest phyto-geographic province in Brazil, covering an area of approximately 2 million km^2 of the Brazilian Central Plateau (24% of the country's total area) with about 52% of its original vegetation cover still remaining (as opposed to 82% in the Amazon). The proposed FIP investment clearly represents a REDD+ priority in the country as it is closely linked with the PPCerrado, the GoB's Action Plan to Prevent and Control Deforestation and Forest Fires in the Cerrado (Decree 5.577/2005). The Plan directly supports the National Policy on Climate Change (Law 12.187/2009 and Decree 7.390/2010), whereby the GoB made a voluntary commitment to reduce by 40% the annual rates of deforestation in the biome based on the average deforestation rates between 1999 and 2008 (15,700 km2/yr). Improving the biome's forest monitoring systems is a clear goal expressed in the PPCerrado[62]. In addition, the outputs of the project will also support Brazil's submission of a Forest Reference Emission Level (FREL) for the Cerrado biome to the UNFCCC, as specified in Brazil's Amazon FREL submission[63]. The systems supported by the FIP investment will largely represent an adaptation and/or improvement of the existing systems already in use in the Amazon and in the country (PRODES, DETER, INPE's Fire Risk model, and INPE-EM), already tested, validated and cited as best practice internationally[64]. The participating entities have state of the art experience in the application of such systems in the Amazon and the FIP investment will not only allow their expansion in the Cerrado, but will also form the basis for their future expansion in the rest of Brazil's biomes (Caatinga, Pantanal, and Atlantic Forest), based on the experience generated with the application of the systems in the transition zones of such biomes with the Cerrado.
Cost-effectiveness	A number of public and private sector institutions (mainly academia) are involved in the implementation of the project. The National Institute for Space Research (INPE) will be in charge of land cover classification, PRODES/DETER Cerrado development and implementation, the land use knowledge platform, fire risk information, GHG emissions estimation and training and dissemination. The Federal University of Minas Gerais (UFMG) will be in charge of developing and adapting the fire spread model (FISC), its application in four conservation units, and training in the use of the model. The Federal University of Goías (UFG) will be in charge of the PRODES/DETER data quality control system. INPE, UFMG

[61] Bustamante, MC, Nobre, C, Smeraldi, R, Aguiar, APD, Barioni, LG, Ferreira LG, Longo, K, May, P, Pinto, AS, Ometto, JPHB. 2012. Estimating Greenhouse GasEmissions from Cattle Raising in Brazil, *Climatic Change.*

[62] http://www.mma.gov.br/florestas/controle-e-preven%C3%A7%C3%A3o-do-desmatamento/plano-de-a%C3%A7%C3%A3o-para-cerrado-%E2%80%93-ppcerrado

[63] http://unfccc.int/methods/redd/items/8414.php

[64] See GOFC-GOLD, 2013. REDD+ Sourcebook, COP19 version. Available at: http://www.gofcgold.wur.nl/redd/

	and UFG are financially solid institutions that have significant budgets to maintain the information data banks generated under the Project. The Action Plan to Prevent and Control Deforestation and Fires in the Cerrado Biome (PPCerrado) provides the legal framework to finance the maintenance of these systems in the Cerrado and MCTI will present information maintenance budgets to be included in the national multi-annual budget allocations. If necessary, the fire risk information system can generate localized advertising revenue from the website. A calculation of the costs per ton of CO2eq avoided is not presented here as the project represents a public investment in institutional strengthening to improve information generation and flows, mostly to national and international institutions. However, the provision of more precise, up-to-date, real-time and widespread information on (illegal) deforestation, risk of (wild)fires and GHG emissions have, potentially, the following economic and financial benefits: (i) potential increases in the cost-efficiency and effectiveness of IBAMA and other environmental control agencies to reduce illegal deforestation; (ii) forest fire prevention and firefighting agencies can intervene more rapidly and effectively, and thus reduce unintended forest fire damage; (iii) protected and conservation areas can introduce controlled fires based on better calibrated fire ignition and spread models and reduce unintended forest fire damage and management costs; (iv) federal, state and local policy makers can base their deforestation reduction and fire prevention policies on more accurate data and increase the policy efficiency and effectiveness; (v) more accurate estimates of GHG emissions in Brazil can contribute to increased knowledge of climate change patterns and adaptation measures; and (vi) improved information can enhance the management of Brazil's natural resources, and considering its size and economic importance, lead to world economic and financial benefits.
Implementation potential	Brazil has an institutional, normative and policy structure with proven capacity for reducing deforestation and promoting the sustainable use of natural resources, and has set ambitious goals for reducing deforestation in the Amazonia and Cerrado biomes while increasing production and exports of cash crops and biofuels, and intensifying cattle production (See section D. REDD+ Background in Brazil for further details on the policy framework). In Amazonia, emissions peaked in mid-1990s and early 2000s, and have had a big drop since 2005 after the onset of the PPCDAm[65]. Data from the National Institute of Spatial Research (INPE) to present these achievements in Amazonian deforestation reduction has supported the Brazilian position in multilateral forums such as the UNFCCC[66] and backed bilateral agreements for results-based payments. Since 2008, the country receives payments for results through the Amazon Fund, which is a REDD+ demonstration fund managed by the National Bank for Economic and Social Development (BNDES). The GoB wants to use its successful experience in controlling deforestation in the Amazon to increase control and protection of the Cerrado. INPE has state of the art experience with PRODES and DETER in the Amazon and there is no reason to suggest that they will have difficulties applying their knowledge and experience to the Cerrado. The FIP investment thus will help

[65] Nepstad et al., 2014 Slowing Amazon deforestation through public policy and interventions in beef and soy supply chains. Science **344** (6188): 1118-1123

[66] Brazil was recently the first country to submit a REDD+ Reference Emission Level to the UNFCCC, including the Amazon biome: http://www.mma.gov.br/redd/index.php/nivel-referencia

	overcome a key barrier to the implementation of the PPCerrado, such as the generation of timely and high quality information required for public institutions to monitor, measure, and enforce applicable land use regulations. In addition, the FIP investment will support Brazil's submission of a FREL for the Cerrado biome to the UNFCCC, possibly opening the door for performance-based payments for the results obtained in the Cerrado. The GoB has set up strong institutional coordination mechanisms to manage the BIP. Since the beginning of the design phase, the successful collaboration between the three key ministries involved in land use regulation (MMA, MAPA and MCTI) has allowed the development of a strategic approach capable to foster synergies not only among the BIP and its projects, but also with ongoing Cerrado government plans and policies already in implementation at federal, state and municipal levels (e.g. PPCerrado). To ensure effective implementation of the operation, a Project Institutional Coordination Committee (PICC) will be created through a MCTI Ministerial ordinance (*portaría*), to ensure coordination between FUNDEP, MCTI and the three participating institutions: the National Institute for Space Research (INPE), the Federal University of Minas Gerais (UFMG) and the Federal University of Goiás (UFG). The PICC will be composed of representatives of all these institutions and also of the Ministry of Environment (MMA), to facilitate coordination at the level of the FIP Plan and PPCerrado. The PICC will be responsible for: (i) reviewing the Operational Manual of the Project (MOP); (ii) validating POAs; (iii) reviewing the physical and financial implementation progress reports; (iv) ensuring that project execution and results are timely, consistent and ultimately contribute to the attainment of the strategic objectives of the Project; and (v) providing strategic recommendations to strengthen project implementation. In addition, the project includes a strong emphasis on capacity building of local and national institutions on the use of the systems, with specific indicators included in the results framework. INPE has already experience in building the capacity of such institutions as part of the Amazon Monitoring systems, which includes training sessions and frequent meetings to answer any emerging systems. This interaction will be maintained for the implementation of the Cerrado systems.
Integrating sustainable development (co-benefits)	The Cerrado is considered as one of the 34 global hotspots of biodiversity because of the high level of endemism and rapid loss of its original habitat[67]. Given the extent of land still available for legal deforestation in the biome (estimated at 88±6 Mha[68]) and its potentially high productivity, it is expected that agriculture will continue to increase in the region for some time. New technologies have been developed for tropical agriculture, which allow for significant productivity gains without expanding into new Cerrado areas. The challenges are to: (i) promote a broader adoption of such practices[69], and (ii) enable full implementation of the Forest Code and compliance with APP and RL requirements. In this context, the generation and provision of spatially and temporally consistent information on forest resources and change is needed to underpin the elaboration and implementation of strategies for improving land-use sustainability and efficiency.

[67] Mittermeier et al., 2005
[68] Soares-Filho et al., 2014. Cracking Brazil's forest code. Science Vol. 344 no. 6182 pp. 363-364
[69] A challenge taken up by the FIP-financed Sustainable Production in Areas Previously Converted to Agricultural Production (P143184), approved by the Bank on July 28, 2014.

	These actions would contribute to the maintenance of natural ecosystems, together with their biodiversity and associated environmental services. In particular, the main co-benefits of the project are: Environmental: a) Increased conservation of biodiversity and carbon stocks in the remaining forest areas through the reduction of the frequency and intensity of forest fires, thereby resulting in increased integrity of the forest ecosystems; b) Protection of soil and water resources; c) Promotion of the maintenance of the natural fertility of the soil which suffers less degradation from the high temperatures produced by fires, thereby reducing costs arising from the use of agrochemicals; d) Detection of areas that are vulnerable to socio-economic and environmental pressures, thereby lessening the risks of fragmentation and degradation of the Protected Areas and indigenous territories. Socio-economic: a) Enhanced capacity for land use planning and management in Brazil by generating environmental information at biome scale; b) Reduction of drivers of forest degradation and conservation of soil nutrients, thereby reducing the costs involved in restoring them in the Protected Areas and on private land, specially to small and medium farmers; c) Reduction of material and human losses resulting from uncontrolled fires and reduction of the risk of losses faced by conservation, agricultural, forest producers and public health; d) Updating legislation and policies related to controlled fires. Institutional: a) Development and management of existing initiatives for conservation and sustainable development.
Safeguards	The project will make a key contribution to strengthening forest governance and safeguarding the integrity of natural forests in the Cerrado by providing essential, timely and high quality information to policy makers and other stakeholders for monitoring, measuring, and enforcing land use regulations across the biome. It is expected to have an overall positive impact with minimal environmental and social risks as it is essentially an environmental information enhancement project with environmental category C. The Project will not finance any physical construction, firefighting activities on the ground or the purchase of equipment thereof, and will not interfere with Indigenous Peoples and/or traditional communities as its activities focus on generating and providing information. Project implementation will be supervised in accordance with the operational policies of the World Bank and in accordance with its guidelines for the application of safeguard policies to Technical Assistance operations. The application of World Bank Safeguards Policies should be sufficient to promote and support the REDD-plus safeguards agreed in Cancun under the UNFCCC (Decision 1/CP.16, appendix I), as noted in a recent note by the Facility Management Team of the FCPF[70]. Detailed information on the safeguards to be applied to the project are provided in sections VI-E and VI-F of the PAD. The BIP, including this project, has been widely and publicly submitted for the consideration of a diverse range of stakeholders (including representatives of the private sector, academia, NGOs, social movements and State environmental agencies, as well as indigenous peoples and traditional communities).

[70] FMT Note CF-2013-3 "World Bank Safeguard Policies and the UNFCCC REDD+ Safeguards". August 28, 2013. Available at: https://www.forestcarbonpartnership.org

13. **Current Brazil FIP portfolio**. The following table summarizes the projects and implementations arrangements agreed under the BIP.

Table 8. FIP Portfolio

	Project	MDB	Gov't Agency	FIP Grant	FIP Loan	Others	Total US$ M
Brazil Investment Plan	Environmental regularization of rural lands	IBRD	MMA		32.48	26.43	58.91
	Sustainable production in areas previously converted to agricultural use	IBRD	MAPA	10.62	--	0.50	11.12
	Forest information to support public and private sectors in managing initiatives	IDB	MMA/ Forest Service	16.55	--	8.00	24.55
	BIP Coordination	IBRD	MMA	1.00	--	--	1.00
	Implementation of an early-warning system for preventing forest fires and a system for monitoring	IBRD	MCTI	9.25	--	00	9.25
DGM	Brazil Dedicated Grant Mechanism	IBRD	--	6.50	--	--	6.50
Private set-aside	Brazil: Macaúba Palm Oil in Silvicultural Systems	IDB	--	--	3.00	3.00	6.00
	IFC allocation	IFC	--	--	15.00	97.00	112.00
	Total			44.02	50.48	134.9	**229.33**

D. REDD-plus background in Brazil

14. Brazil's commitment with respect to climate change has been constant since 1992, when the country hosted the United Nations Conference on Environmental and Development in Rio. In the context of the 15th Conference of the Parties to the UNFCCC in Copenhagen in 2009, Brazil voluntarily committed to a GHG emissions reduction target between 36.1% and 38.9% of projected emissions by 2020, implying a reduction in emissions of around 1.2 billion tCO_{2eq}[71]. Shortly thereafter, Brazil instituted this goal in Law N°. 12,187, December 2009, establishing the National Policy on Climate Change (NPCC). The NPCC, which includes the National Plan as one of its instruments, defines the objectives and guidelines for domestic operations in Brazil for dealing with climate change, and is the main reference points for Brazil's REDD+ type actions.

15. The set of mitigation actions stipulated by the NPCC to achieve its targets include reducing the rates of deforestation by biome, and initiating alternative processes in the agricultural, energy and steel manufacturing sectors. Decree No. 7,390, December 2010, which regulates the NPCC, establishes specific targets for reducing GHG emissions, such as: (i) 80% reduction of deforestation in Amazon compared to the 1996-2005 average (19,535 km²/yr); (ii) 40% reduction of deforestation in the Cerrado compared to the 1999-2008 average (15,700 km²/yr); (iii) recovery of 15 million ha of degraded pastures, (iv) expansion crop, livestock and

[71] See Annex II of Copenhagen Accord: Nationally Appropriate Mitigation Actions (NAMAs) by developing countries. Available at: http://unfccc.int/meetings/cop_15/copenhagen_accord/items/5265.php

forestry integrated systems in 4 million ha, (v) expansion of no-tillage farming systems in 8 million ha, (vi) expansion of planted commercial forests in 3 million ha, (vii) increase in 4.4 million m^3 the treatment of animal waste and (viii) increased use of charcoal from planted forests in steelmaking.

16. The instruments stipulated by the NPCC for reducing deforestation build on the previous work under the Action Plan for the Protection and Control of Deforestation in the Legal Amazon (PPCDAm), and stipulate the launch of a new plan focused on the Cerrado region: the Action Plan to Prevent and Control Deforestation and Fires in the Cerrado Biome (PPCerrado). The PPCDAm, launched in March 2004, aims to promote the reduction of deforestation in the Amazon by focusing on land and territorial planning, monitoring, control and sustainable production activities. The PPCerrado, launched in September 2010, aims to promote sustained reduction in the rate of deforestation and forest degradation (including fires) in the biome by improving monitoring and control capabilities of federal agencies, while promoting the regularization of rural properties, sustainable production activities, and the restoration of degraded lands[72].

17. Complementary to these plans, the Forest Code is considered the most important land-use regulation in the country, given its national scope and the constraints it imposes on private property for the purpose of protecting public goods such as forests and vegetation. The code requires farmers to preserve the most fragile areas of their property (Permanent Preservation Areas – APP), with an additional obligation to ensure that part of the original native vegetation is maintained (Legal Reserves –RL). The Forest Code involves the creation of the Rural Environmental Cadastre (CAR), which sets a deadline for landholders to register APPs and RLs on their land, and to submit proposals for restoring their degraded areas if they are not compliant with the legislation. It is estimated that nearly 30 million hectares of APP and RL across the country require restoration to comply with the Forest Code; and currently over half of Brazilian landholdings (about 2.5 million farmers) are thought to be illegal[73]. Compliance with the environmental legislation in the Forest Code is a prerequisite for small and medium producers to access rural credit available in the ABC Program.

18. Smallholders, land reform settlers, family farmers and traditional peoples/communities are special beneficiaries of the Forest Code and receive, free of charge, government support to restore the degraded APPs and RLs on their lands, through technical assistance, environmental education, provision of seeds/seedlings and appropriate training.

19. In addition, the NPCC also provides for the preparation of sectoral plans for mitigating and adapting to climate change, with a view to consolidate a low carbon economy and meeting the national voluntary commitments announced under its policy. As part of the objectives of reducing GHG emissions, some of these sector plans are also expected to make a direct or indirect contribution to reducing deforestation and increasing the value of standing forests. The Sector Plan for the Mitigation and Adaptation of Climate Change for a Low Carbon Emission Agriculture (ABC Plan), for example, seeks to ensure continuous and sustainable improvement of management practices which reduce greenhouse gas emissions and enhance atmospheric CO_2 uptake on vegetation and land used by the Brazilian farming sector. The plan is expected to

[72] The PPCerrado is supported by a separate, but related, Bank-executed project as part of the FIP Brazil Investment Plan.
[73] The regularization of rural properties under the CAR in 47 municipalities in the Cerrado is supported by a separate, but related, Bank-executed project as part of the Brazil Investment Plan under the FIP.

help reduce pressure on forests by promoting greater productivity of existing agricultural systems, sustainable management practices and recovery of degraded areas.

20. The NPCC also provides financial mechanisms aimed at supporting the implementation of the planned initiatives. The Amazon Fund (*Fundo Amazônia*), launched in August 2008, shows that Brazil is a pioneer at world level in the development of mechanisms to support actions aimed at REDD-plus in developing countries. The Amazon Fund is a financial instrument aimed at raising grant funds, in Brazil and abroad, to help maintain the reduction of GHG emissions from deforestation in the Amazon. This initiative is a result of the Brazilian proposal to provide positive incentives for reducing deforestation emissions in developing countries presented at the 12th UNFCCC CoP, held in Nairobi in 2006. In 2008, Norway, which had already committed US$ 244 million, announced its intention to contribute a total of US$ 1 billion to the Amazon Fund. In December 2010, a new financial contribution worth EUR 21 million was received from the Federal Republic of Germany.

21. The National Fund on Climate Change was established to secure resources to support projects and studies aimed at climate change mitigation and adaptation to its effects. The Fund's income derives from 60% of the tax on crude oil production and sales designated to the Ministry of the Environment (MMA). This is an innovative financial arrangement in developing countries. In the first two years of its implementation, the initial budget was BRL 620 million (approximately US$ 355 million). Of this total, BRL 560 million is from loans destined to the production sector, managed by the BNDES. The remaining BRL 60 million will be managed and invested by the MMA, and could be transferred to States, municipalities research institutions and non-governmental institutions on the basis of cooperation agreements and contracts. The Fund has already had projects approved in areas of sustainable forest management to the region of Caatinga. This year, the Fund will support the development of environmental management plans for Indigenous Lands in Caatinga and Cerrado, as well as more projects dealing with sustainable forest management in Caatinga biome. Those target areas are susceptible to desertification.

22. Brazil is not a member of the Forest Carbon Partnership Facility (FCPF) or the UN-REDD program. Nonetheless, the actions proposed under the BIP are a sub-set of the Brazil's National Climate Change Plan and are consistent with activities being considered under those two international initiatives, as well as under the REDD-plus mechanism under the UNFCCC.

23. The country is currently in the process of finalizing the assembly of all its existing initiatives around a National REDD-plus Strategy (ENREDD, for its acronyms in Portuguese)[74]. Since June 2010, the MMA launched a participatory process where about 150 actors contributed with recommendations, summarized in the "Document summarizing recommendations of multiple actors to prepare for the National Strategy on REDD+" available on the MMA's REDD-plus Portal[75]. Since then, the draft ENREDD has been subject to discussion at the ministerial level as well as within the Executive Group of the Interministerial Committee.

[74] http://www.mma.gov.br/informma/item/9053-em-defesa-da-amazonia
[75] http://www.mma.gov.br/redd/

Annex 6: Map of Brazil (IBRD 41777)

COUNTRY: BRAZIL
Development of Systems to Prevent Forest Fires and Monitor Vegetation Cover in the Brazilian Cerrado Project