Document of
The World Bank

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Report No: PAD2004

INTERNATIONAL DEVELOPMENT ASSOCIATION

PROJECT APPRAISAL DOCUMENT

ON A

PROPOSED CREDIT
IN THE AMOUNT OF SDR48.40 MILLION
(US$65 MILLION EQUIVALENT)

AND

A PROPOSED GLOBAL ENVIRONMENT FACILITY (GEF) GRANT
IN THE AMOUNT OF US$13.7 MILLION

TO THE

REPUBLIC OF MADAGASCAR

FOR A
SUSTAINABLE LANDSCAPE MANAGEMENT PROJECT

MARCH 2, 2017

Agriculture Global Practice
Environment and Natural Resources Global Practice
Water Global Practice
AFRICA REGION

CURRENCY EQUIVALENTS

(Exchange Rate Effective December 31, 2016)

Currency Unit	=	Malagasy Ariary (MGA)
MGA 3,340	=	US$1
1 US$	=	SDR 0.74386497

FISCAL YEAR
January 1 – December 31

ABBREVIATIONS AND ACRONYMS

AFD	Agence Française de Développement (*French Development Agency*)
AfDB	African Development Bank
ANDEA	L'Autorité Nationale de l'Eau et de l'Assainissement
BC	Benefit-Cost
BVPI	Bassin versant – Périmètre irrigué *(Irrigation and Watershed Management Project)*
CAADP	Comprehensive Africa Agriculture Development Program
CAHW	Community Animal Health Workers
CASEF	Projet de Croissance Agricole et Sécurisation Foncière (*Agriculture Rural Growth and Land Management Project*)
CITES	Convention on International Trade in Endangered Species of Wild Fauna and Flora
COBA	Communautés de Base (*Local forest user groups*)
CNM	Commission Nationale des Marchés
CPF	Country Partnership Framework
CPGU	Cellule de Prévention et Gestion des Urgences
DPV	Direction de Protection de Végétaux (*Directorate of Plant Protection*)
CSA	Centres de Services Agricoles (*Agricultural Service Centers*)
CQS	Consultant Qualification
DA	Designated Account
DHSVM	Distributed Hydrology Soil Vegetation Model
DSS	Decision Support System
DTC	Decentralized Territorial Collectives
DTS	Deconcentrated Technical Services
ECA	Europe and Central Asia
EFA	Economic and Financial Analysis
EIRR	Economic Internal Rate of Return
ENPV	Economic Net Present Value
EOI	Expression of Interest
EP	Environment Program
ER	Emission Reduction
ERR	Economic Rate of Return
ERPA	Emission Reduction Purchase Agreement

ER-PIN	Emission Reduction Program Idea Note
ESMF	Environmental and Social Management Framework
ESSSs	Environmental and Social Safeguards Specialists
EU	European Union
EVI	Enhanced Vegetation Index
FAO	Food and Agriculture Organization
FBS	Fixed Budget Selection
FCPF	Forest Carbon Partnership Facility
FDA	Fonds de Développement Agricole (*Agriculture Development Fund*)
FIFATA	Fampivoarana ny Tantsaha *(Association for Progressive Farmers)*
FLEGT	Forest Law Enforcement, Governance and Trade
FM	Financial Management
FMS	Financial Management Specialist
FOFIFA	Centre National de Recherche Appliquée au Développement Rural (*National Agricultural Research Institute*)
FORMAPROD	Le Programme Formation Professionnelle et d'amélioration de la Productivité Agricole
FTM	Foiben-Taosarintanin' i Madagasikara *(Geographic and Hydrographic Institute of Madagascar)*
FRDA	Fonds Régional de Développement Agricole (*Regional Agriculture Development Fund)*
GCF	Gestion contractualisée des forêts (*Contract-Based Management of Forests*)
GDP	Gross Domestic Product
GEF	Global Environment Facility
GELOSE	Gestion Locale Sécurisée (*Local Management Framework*)
GDP	Gross Domestic Product
GHG	Greenhouse Gas
GIZ	German International Cooperation
GoM	Government of Madagascar
GRS	Grievance Redress Service
ICB	International Competitive Bidding
IDA	International Development Assistance
IFAD	International Fund for Agricultural Development
IFMIS	Integrated Financial Management System
IFPRI	International Food Policy Research Institute
IFRs	Interim Financial Reports
IGP	Indication géographique protégée (*Label of origin*)
ILM	Integrated Landscape Management
IMPACT	International Model for Policy Analysis of Agricultural Commodities and Trade
INDC	Intended Nationally Determined Contributions
IPCC AR5	Intergovernmental Panel on Climate Change Assessment Report
IPF	Investment Project Financing
IPMP	Integrated Pest Management Plan
IPSC	Inter-ministerial Project Steering Committee
ISP	Implementation Support Plan

ISR	Implementation Status and Results Report
LIFE	Lahasa Ifandrombonana ho Fampandrosoana ny ambanivohitra sy Enti-miaro ny tontolo iainana (*Series of community-based actions for rural development and environmental conservation*)
JICA	Japanese International Cooperation Agency
LAUREL	Land Use Planning for Enhanced Resilience of Landscapes
LAC	Latin America and Caribbean
LCS	Least Cost Selection
MAPS	Methodology for assessment of national procurement
MDP	Municipal Development Plan
MEAH	Ministry of Water, Sanitation and Hygiene
M&E	Monitoring & Evaluation
MEEF	Ministry of Environment, Ecology and Forests
METT	Management Effectiveness Tracking Tool
MFB	Ministry of Finance and Budget
MID	Ministry of Interior and Decentralization
MPAE	Ministry to the Presidency for Agriculture and Livestock
M2PATE	Ministry of Presidential Projects, Land Management and Equipment
MLMP	Municipal Land Management Plans
MODIS	Moderate Resolution Imaging Spectroradiometer
MoU	Memorandum of Understanding
MNP	Madagascar National Parks
MTR	Mid-Term Review
NAMA	National Appropriate Mitigation Actions
NCB	National Competitive Bidding
NDVI	Normalized Difference Vegetation Index
NDWI	Normalized Difference Water Index
NIHYCRI	Normes de construction des Infrastructures Hydroagricoles contre les Crues et les Inondations (*Anti-flood Hydrolic Infrastructures Construction Norms*)
NEAP	National Environmental Action Plan
NEPAD	New Economic Partnership for Africa's Development
NGO	Non-governmental Organization
NLMP	National Land Management Plan
NLTA	Non-Lending Technical Assistance
NoE	National Office of Environment
NPP	Net Primary Productivity
NPV	Net Present Value
NRM	Natural Resource Management
OECD	Organization for Economic Co-operation and Development
OIE	World Organization for Animal Health
O&M	Operations and Maintenance
OP	Operational Policy
PA	Protected Areas
PADAP	Projet d'appui à l'agriculture durable par une approche paysage (*Sustainable Landscape Management Project)*
PADR	Plan d'Action pour le Développement Rural

PAPRIZ	Projet d'Amélioration de la Productivité Rizicole sur les Hautes Terres Centrales
PDO	Project Development Objective
PES	Payment for Environmental Services
PIM	Project Implementation Manual
PIU	Project Implementation Unit
PLOF	Plans Local d'Occupation Foncière (*Local Land Occupancy Status Map*)
PND	Plan National de Développement (*National Development Plan*)
PPA	Project Preparation Advance
PPCR	Pilot Program for Climate Resilience
PPP	Purchasing Power Parity
PPL	Public Procurement Law
PRD	Plans Régionaux de Développement (*Regional Development Plans*)
PRMP	Personne Responsable des Marchés Publics
PSAEP	Programme Sectoriel Agriculture, Elevage et Pêche (*Agriculture, Livestock and Fishery Strategy)*
QBS	Quality Based Selection
QCBS	Quality and Cost Based Selection
REDD+	Reducing Emissions from Deforestation and forest Degradation
RDPs	Regional Development Plans
RF	Results Framework
RFP	Request for Proposals
RIU	Regional Implementation Unit
RLMS	Regional Land Management Plans
RMC	Regional Monitoring Committees
RPF	Resettlement Policy Framework
SAC	Schéma d'Aménagement Communautaire
SAPM	Système des Aires Protégées de Madagascar (*System of Protected Areas of Madagascar)*
SAR	South Asia Region
SCC	Social Cost of Carbon
SCD	Systematic Country Diagnostic
SDG	Sustainable Development Goal
SDSM	Small Dams Safety Manual
SER	Shadow Exchange Rate
SFM	Sustainable Forest Management
SIGMP	Secure Internet Group Management Protocol
SIS	Spatial Information System
SLMP	Sustainable Landscape Management Plan
SOE	Statement of Expenditures
SoPs	Series of Projects
SRA	Système de Riziculture Améliorée
SRAT	Schéma Régional d'Aménagement du Territoire (*Regional Land Management Plans*)
SRI	System of Rice Intensification
SSS	Single Source Selection

SRTM	Shuttle Radar Topography Mission
STD	Services Techniques Déconcentrés
SWAT	Soil and Water Assessment Tool
TA	Technical Assistance
ToR	Terms of Reference
TTL	Task Team Leader
UAV	Unmanned Aerial Vehicle
UN	United Nations
UNFCC	United Nations Framework Convention on Climate Change
USAID	United States Agency for International Development
VIC	Variable Infiltration Capacity
VOI	Vondron'Olona Ifotony ("*grassroots community*")
WAVES	Wealth Accounting and Valuation for Ecosystem Services
WUA	Water User Association

Regional Vice President:	Makhtar Diop
Country Director:	Mark R. Lundell
Senior Global Practice Directors:	Juergen Voegele, Julia Bucknall, Guang Zhe Chen
Practice Managers:	Dina Umali-Deininger, Benoit Bosquet, Jonathan Kamkwalala
Task Team Leaders:	Jan Joost Nijhoff, Giovanni Ruta, Shelley Mcmillan

Madagascar
Sustainable Landscape Management Project

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PAD DATA SHEET

Madagascar

Sustainable Landscape Management Project (P154698)

PROJECT APPRAISAL DOCUMENT

AFRICA

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Report No.: PAD2004

Basic Information			
Project ID P154698	EA Category B - Partial Assessment		Team Leader(s) Jan Joost Nijhoff, Giovanni Ruta, Shelley Mcmillan
Lending Instrument Investment Project Financing	Fragile and/or Capacity Constraints [ ] Financial Intermediaries [ ] Series of Projects [X]		
Project Implementation Start Date 23-Mar-2017	Project Implementation End Date 01-Aug-2022		
Expected Effectiveness Date 01-Aug-2017	Expected Closing Date 01-Aug-2022		
Joint IFC No			GEF Focal Area Biodiversity
Practice Manager/Manager Dina Umali-Deininger	Senior Global Practice Director Juergen Voegele	Country Director Mark R. Lundell	Regional Vice President Makhtar Diop

Borrower: Government of Madagascar			
Responsible Agency: PN-BVPI			
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Responsible Agency: Agriculture and Livestock			
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Responsible Agency: Ministry of Environment, Ecology and Forests			
Contact:	Hanta Rabetaliana	Title:	Secretary General
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Responsible Agency: Ministry of Water			
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Telephone No.:	0342051012	Email:	josyangele@gmail.com

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Project Financing Data(in USD Million)

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

Total Project Cost:	107.06	Total Bank Financing:	65.00
Financing Gap:	0.00		

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Financing Source	**Amount**
BORROWER/RECIPIENT	0.23
International Development Association (IDA)	65.00
FRANCE French Agency for Development	26.63
LOCAL BENEFICIARIES	1.50
Global Environment Facility - IBRD as Implementing Agency	13.70
Total	107.06

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Expected Disbursements (in USD Million)

Fiscal Year	2018	2019	2020	2021	2022	2023				
Annual	5.80	8.71	22.01	30.56	11.62	0.00				
Cumulative	5.80	14.51	36.52	67.08	78.70	78.70				

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Institutional Data
Practice Area (Lead)
Agriculture
Contributing Practice Areas
Climate Change, Environment & Natural Resources, Water
Project Development Objective(s)
The Project Development Objective is: To increase access to improved irrigation services and agricultural inputs, and strengthen the integrated management of natural resources in the Selected Landscapes by the local actors and, to provide immediate and effective response to an Eligible Crisis or Emergency.

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Global Environmental Objective(s)
The Global Environmental Objective is: To increase access to improved irrigation services and agricultural inputs, and strengthen the integrated management of natural resources in the Selected Landscapes by the local actors and, to provide immediate and effective response to an Eligible Crisis or Emergency.
Components

Component Name	**Cost (USD Millions)**
Component 1: Information and planning	4.88
Component 2: Investments and capacity building in the selected landscapes	93.80
Component 3: Project Management Coordination and M&E	8.37
Component 4: Contingency Emergency Response	0.00

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

8. Stakeholders	Substantial
9. Other	
OVERALL	High

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Compliance	
Policy	
Does the project depart from the CAS in content or in other significant respects?	Yes [ ] No [X]

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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 [ ]

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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**

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Legal Covenants

Name	**Recurrent**	**Due Date**	**Frequency**
Annual Work Plan and Budget for the first year of Project implementation		01-Sep-2017	

Description of Covenant

The annual work plan and budget for the Project for the first year of Project implementation, and the evidence which may be required for the implementation of the activities included in the annual work plan and budget for that period, shall be furnished to the Association, not later than one (1) month after the Effectiveness Date.

Name	Recurrent	Due Date	Frequency
Establishment of a Procurement complaint handling mechanism		01-Nov-2017	

Description of Covenant

The Recipient shall have established a procurement complaint handling mechanism acceptable to the Association not later than three (3) months after the Effectiveness Date.

Name	Recurrent	Due Date	Frequency
Irrigation infrastructure and large dams	**X**		

Description of Covenant

The Project shall not finance any new constructions or rehabilitation of large-scale irrigation facilities; nor shall it finance any dams above 15 meters or reservoirs of more than three (3) million cubic meter.

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Conditions

Source Of Fund	Name	Type
IDA	Co-financing Agreement	Effectiveness

Description of Condition

The Co-financing Agreement has been executed and delivered and all conditions precedent to its effectiveness or to the right of the Recipient to make withdrawals under it (other than the effectiveness of the Legal Agreement) have been fulfilled.

Source Of Fund	Name	Type
IDA	Project Implementation Unit and a Project Steering Committee	Effectiveness

Description of Condition

The Project Implementation Unit and the Inter-ministerial Project Steering Committee have each been established with staff and resources acceptable to the Association no later than the Effectiveness Date.

Source Of Fund	Name	Type
IDA	Project Implementation Manual	Effectiveness

Description of Condition

The Project Implementation Manual (PIM) has been adopted by the Recipient in form and content acceptable to the Association not later than the Effectiveness Date.

Source Of Fund	Name	Type
IDA	Withdrawal of Proceeds of Project Financing	Disbursement

Description of Condition

No withdrawal shall be made under Category (2), unless and until the Association is satisfied that the following conditions have been met:

(i) the Recipient has determined that an Eligible Crisis or Emergency has occurred, has furnished to the Association a request to include such activities the Project in order to respond to said Eligible Crisis or Emergency, and the Association has agreed with such determination, accepted said request and notified the Recipient thereof;

(ii) the Recipient has adequate staff and resources, in accordance with the provisions of Section I.B.1 of this Schedule 2 to the Legal Agreement, for the purposes of said activities; and

(iii) the Recipient has made the necessary revisions to the PIM in form, substance and manner acceptable to the Association.

Team Composition

Bank Staff

Name	Role	Title	Specialization	Unit
Jan Joost Nijhoff	Team Leader (ADM Responsible)	Sr. Agriculture Economist	Agriculture	GFA07
Giovanni Ruta	Team Leader	Sr. Environmental Economist	Environment Economist	GEN04
Shelley Mcmillan	Team Leader	Sr. Water Resources Spec.	Water Specialist	GWA01
Lova Niaina Ravaoarimino	Procurement Specialist (ADM Responsible)	Sr. Procurement Specialist	Procurement	GGO07
Enagnon Ernest Eric Adda	Financial Management Specialist	Sr. Financial Management Specialist	Financial Management	GGO31
Bodomalala Sehenoarisoa Rabarijohn	Team Member	Team Assistant	Administration	AFMMG

Erick C.M. Fernandes	Team Member	Adviser	Agriculture	GFA04
Irene Bomani	Team Member	Operations Analyst	Operations	GFA07
Maminiaina Solonirina Rasamoelina	Team Member	Natural Resources Management Specialist	Natural Resources Management	GEN07
Mampionona Amboarasoa	Team Member	Consultant	Agriculture	GEN07
Nagaraja Rao Harshadeep	Team Member	Lead Environment Specialist	Environment	GENDR
Nora Kaoues	Team Member	Sr. Agriculture Economist	Agriculture	GFA07
Paul-Jean Feno	Safeguards Specialist	Sr. Environmental Specialist	Environmental Safeguards	GEN07
Peter F. B. A. Lafere	Safeguards Specialist	Sr. Social Development Specialist	Social Safeguards	GSU01
Vohangitiana Josiane Rarivoson	Team Member	Team Assistant	Administration	AFMMG
Ziva Razafintsalama	Team Member	Sr. Agricultural Specialist	Agriculture	GFA07

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Locations

Country	First Administrative Division	Location	Planned	Actual	Comments

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Consultants (Will be disclosed in the Monthly Operational Summary)

Consultants Required? Consultants will be required

I. STRATEGIC CONTEXT

A. COUNTRY CONTEXT

1. **Madagascar is endowed with a climate favorable for agriculture, large amounts of arable land, extensive forested areas, vast deposits of mineral resources, abundant labor, and unparalleled biodiversity.** With adequate management of natural resources, complemented by investments in physical and human capital and effective governance, it would be a prosperous country. However, Madagascar's wealth, and consequently its development potential and productivity in the rural space where the majority of the population lives, is being severely eroded. Its total wealth declined by 10 percent in real terms between 2005 and 2011, and its natural capital by 26 percent. This drop was associated with a 33 percent drop in cropland potential, a 31 percent drop in pastureland, and a 42 percent drop in non-timber forest value.

2. **Madagascar remains among the poorest countries in the world, and has shown little improvement in indicators of the well-being of its population over recent years.** Despite its unique biodiversity and abundant mineral, water, and labor resources, it ranks among the relatively few countries in the world with real per capita Gross Domestic Product (GDP) in 2010 lower than it was in 1960. Madagascar's poverty rates are exceedingly high, and according to internationally comparable estimates are the highest in the world. Using the World Bank's international poverty line of US$1.90 per capita per day (in 2011 Purchasing Power Parity (PPP)), poverty in Madagascar is 77.8 percent. Close to 80 percent of Madagascar's population lives in rural areas, and rural poverty rates are more than twice as high as in urban areas[1]. Food insecurity now affects about 20 percent of the population. Development indicators for rural areas lag behind those for urban areas: incomes are lower, infant mortality rates are higher, life expectancy is shorter, illiteracy is more widespread, malnutrition is more prevalent, and greater proportions of people lack access to clean water and improved sanitation services.

3. **Weak institutions and political instability hamper the path to sustainable development.** The administration operates and takes decisions based on a thin knowledge base. Technical capacity in agencies and ministerial departments is weak at both national and local levels. The link between the central government and local administrations is tenuous.

B. SECTORAL AND INSTITUTIONAL CONTEXT

1. Sectoral Context

4. **Four out of five Malagasy nationwide depend directly on natural resources, particularly land, water and forests, for their livelihoods.** Agriculture is either a principal or secondary economic activity for 81 percent of all households (89 percent in rural areas). Most households engage in subsistence farming, with low levels of productivity. The reasons for low productivity include: unreliable water availability; limited uptake of improved technology, such as high-yielding seed, fertilizer, and agricultural machinery; insecure traditional land tenure arrangements; and inadequate access to markets. Livestock plays an important role in the livelihoods of rural households, with livestock keeping being an important economic activity within the landscapes covered by the project. However, livestock productivity is low due to

[1] World Bank: *Madagascar Employment and Poverty Analysis - Imperfect Information, Shocks, and Policy Responses*, June 26, 2016

inadequate fodder production and pasture management, poor animal health and ineffective disease control, and genetic depletion.

5. **The balance between natural resources and livelihoods is extremely fragile and on a downward spiral.** Over the period 2004 to 2014 annual agricultural GDP growth was 1.3 percent, far below peer countries and the average for sub-Saharan Africa. Most of the rural poor practice a traditional form of slash and burn agriculture known as "*tavy*." Tavy involves felling trees and burning the biomass, which not only clears the land but also adds nutrients to the soil[2]. Slash and burn agriculture persists, not only because it offers rural households the prospect of realizing production increases in the short run, but also because it allows them to establish a claim to the land that may persist over the longer term. However, cultivation of successive cycles of rice, cassava, and other tavy crops degrades the soil and often sets off large-scale erosion that contributes to siltation of watercourses, leading quickly to widespread land and water degradation.

6. Even in the most productive agricultural areas of the country, the situation is exacerbated by a chronic lack of infrastructure. In spite of abundant renewable water resources (estimated at 337 km³/year, which is almost 15 times the total water required for the development of the irrigation potential), water scarcity is widespread in all water-using sectors. Access to water is constrained primarily by lack of bulk water infrastructure. Less than 3 percent of the water used for irrigation is stored in dams and artificial lakes according to the Food and Agriculture Organization (FAO) estimates. In recent years, new dams have been built, but storage still lags far behind needs. Much of the existing irrigation infrastructure is obsolete, and many canals are full of sediment.

7. Population growth and climate change are likely to further compound the challenge of managing landscapes and sustaining their ability to deliver development benefits. The population of Madagascar has more than quadrupled since 1960 and currently stands at around 24 million. Population growth has eased but remains robust and, even under the most optimistic projections, the population is expected to double between now and 2050. In addition, floods and droughts are becoming increasingly unpredictable and severe, frequently disrupting agricultural production and livelihoods. The worsening climatic conditions projected in the coming decades are likely to have important impacts on many landscape functions, with potentially significant adverse impacts on crop yields and food security. Projections made using the International Model for Policy Analysis of Agricultural Commodities and Trade (IMPACT) suggest that compared to a no climate change reference case, the number of people at risk of hunger will increase progressively during the coming decades, with the increase by 2050 ranging between 20 and 40 percent, depending on the climate scenario considered.

8. **Despite these challenges, there are reasons to be optimistic about Madagascar's development prospects.** Large areas of the country are not degraded[3], and opportunities exist to reduce the pressure on the natural resource base associated with rapid population growth and rising demand for food. For example: (i) the productivity of areas that are only somewhat degraded can

[2] Although national deforestation rates decreased between 1990 and 2010, more recent estimates show increasing rates of deforestation, probably due to the break-down of law and order in the wake of the political crisis. In the Eastern Humid Forest ecoregion, deforestation increased from 22,800 ha/year (0.50 percent) in 2005-2010 to 41,900 ha/year (0.94 percent) in 2010-2013.

[3] Forests cover approximately 9.2 million hectares, representing about 16 percent of the national territory. The system of protected areas of Madagascar (SAPM) covers nearly two-thirds of the total forest area and it also hosts one of the most important biodiversity hotspots worldwide.

be restored through on- and off-site interventions; (ii) production of staple crops can be intensified to avoid further encroachment of agriculture into marginal areas; and (iii) markets for agricultural inputs and outputs can be better connected (e.g., through the building, rehabilitation or upgrading of roads) to improve productivity and profitability, and promote sustainable intensification of areas that are already being used for crop and livestock production.

2. Institutional Context

9. **Most land use planning decisions for agriculture, water and forests are taken by three sector ministries.** These are the Ministry to the Presidency for Agriculture and Livestock (MPAE); the Ministry of Water, Sanitation and Hygiene (MEAH); and the Ministry of Environment, Ecology and Forests (MEEF). Each of these Ministries has staff in regions and districts (the so called, Deconcentrated Technical Services, DTS, or STD[4] in French). Other key ministries include the Ministry of Presidential Projects, Land Management and Equipment (M2PATE) and the Ministry of Interior and Decentralization (MID), to which the regional chiefs and municipal majors (the so called Decentralized Territorial Collectivities, DTCs, or TDs[5] in French) report.

10. **The current institutional context in Madagascar presents important challenges when it comes to supporting better land use planning for agriculture, water and forests.** A case in point is the lack of institutional coordination both between sectors, and between levels of Government. Not many staff from the Ministries of Agriculture, Environment and Water report having seen or used the National Land Management Plan (NLMP, or SNAT in French) developed by the Ministry of Land Management for their intervention. This prevents an optimal allocation of the available resources and considerably limits the planning scope to the individual interventions' timeframe. At the same time, sector ministries and even the Ministry of Land Management at the central level seem to lack awareness of the extent of progress in the preparation of Municipal Land Management Plans (MLMP, or SAC in French). The Government, both at the central and local levels, also lacks technical capacity to carry out all the different steps required for land use planning (e.g., collecting data and putting in place the dynamic geospatial database, ensuring data quality, conducting the necessary analyses and developing the spatial models for scenario analysis).

11. Another challenge is the lack of an integrated decision support tool, lack of geospatial data, and lack of experience in managing dynamic data frameworks. Currently decision-making does not benefit from any integrated decision support tool that informs decision-makers about the possible options and scenarios for land use planning. As a consequence, the decisions made often do not yield optimal results. Producing geospatial data and managing dynamic data frameworks should normally be one of the roles of the national mapping agency (known by its Malagasy acronym as FTM[6]); however, despite the support provided by the World Bank to the institution during the second phase of the Environmental Program (1997-2003), the capacity of the agency has not been sustained, and it does not play its envisaged role.

12. **Resource constraints constitute a major barrier to overcome the current impasse.** As a result, the capacity of the public sector to invest in infrastructure, conservation and enforcement, as well as the capacity of local populations to access new techniques and more sustainable

[4] Services Techniques Déconcentrés
[5] Collectivités territoriales décentralisées
[6] Foiben-Taosarintanin' i Madagasikara

practices, and increase productivity, is extremely limited. Moreover, there are important technical capacity gaps. These can be addressed relatively quickly through training, but the constraints in terms of resources—both human and financial—will be more difficult to tackle. Indeed, a dynamic geospatial database requires regular maintenance, which can especially be difficult for government agencies.

C. HIGHER LEVEL OBJECTIVES TO WHICH THE PROJECT CONTRIBUTES

13. **The Project supports directly two of the five strategic axes of Madagascar's 2015-2019 National Development Plan (*Plan National de Développement* [PND])**, namely: (i) inclusive growth and territorial anchoring of development (axis 3); and (ii) conserving natural capital and strengthening resilience to risks and catastrophes (axis 5). Axis 3 calls for different parts of society, sectors, and territories to work in synergy and achieve optimal use of natural resources and physical assets, taking into account key constraints such as land, skills, and technical instruments. Axis 5 focuses on developing strategies targeted to protecting natural capital, to reducing the negative effects of climate change and to strengthening the resilience of the populations and areas concerned.

14. The project also supports several Madagascar sector strategies, including: (i) the Agriculture, Livestock and Fishery Strategy (*Programme Sectoriel Agriculture, Elevage et Pêche*, PSAEP), supported by the Comprehensive Africa Agriculture Development Program (CAADP) promoted under the African Union's New Economic Partnership for Africa's Development (NEPAD); (ii) law 2015-003, which updates the Malagasy Environment Charter establishing the general principles for environmental management in the country; and (iii) the upcoming Environmental National Policy for Sustainable Development, which will aim at promoting healthy livelihoods and at increasing the contribution of environmental services to the national economy.

15. The Project's approach embodies many of the Sustainable Development Goals (SDGs) and is aligned to the World Bank's Africa Climate Business Plan. The Project will enhance multi-stakeholder partnerships that mobilize and share knowledge, expertise, technology, and financial resources in the targeted landscapes while encouraging and promoting effective public, public-private, and civil society partnerships (SDG-17). It will promote the sustainable management of forests, water resources and reversal of land degradation while increasing the resilience of the rural population to climate change (SDG-6, SDG-13 and SDG-15). Overall, the Project's interventions will contribute to poverty reduction and inclusive and sustainable economic growth (SDG-1 and -8), and contribute to end hunger, achieve food security and improved nutrition, and promote sustainable agriculture (SDG-2).

16. The Project will contribute to removing key constraints identified in the 2015 Systematic Country Diagnostic (SCD) and will be a key element of the new Country Partnership Framework (CPF) for 2017-2021[7]. From the SCD, it is clear that rural growth, agriculture sector development, and the management of natural capital are crucial for reducing extreme poverty and promoting inclusive growth. The draft CPF priorities include rural development, including improvement of agricultural productivity and the development of spatial planning tools, to achieve sustainable poverty reduction. The Project contributes to improving the livelihoods of poor rural households and, by so doing, directly contributes to the World Bank Group's twin goals of ending extreme poverty and boosting shared prosperity.

[7] It is expected to be approved by June 30, 2017.

17. **The Project has been prepared in close collaboration with the French Development Agency (Agence Française de Développement [AFD]).** A credit of EUR 25 million will be provided by AFD to the Government of Madagascar to provide joint co-financing for the Project (see section III C below). The Project is fully aligned with the engagement of other development partners such as the European Union (EU), the Japanese International Cooperation Agency (JICA), the German International Cooperation (GIZ), the United States Agency for International Development (USAID), the International Fund for Agricultural Development (IFAD) and the African Development Bank (AfDB).

D. PROGRAMMATIC APPROACH AND CO-FINANCING

18. **The Project is the first in what is expected to be a 'Series of Projects' (SoPs)** for which the Program Goals are to: (1) reduce the degradation of natural resources; and (2) increase the value of output from productive sectors. The Program Goals are measured by the following indicators:

Targeted landscape in a state of degradation (percent); and

Value of crops and livestock produced in targeted landscape (USD)

19. Financing for the Project will include IDA (US$65 million), EUR25 million[8] from AFD, GEF (US$13.70 million), and carbon finance through an Emission Reduction Purchase Agreement (ERPA) with the Carbon Fund of up to US$50 million, provided Madagascar's program document meets the necessary quality requirements and is approved by the Carbon Fund Board.

20. The Project follows a 'proof of concept' approach that is expected to lead to scale up in subsequent phases by the Government and other development partners. It is expected that all projects under the SoPs will aim at blending multiple financing sources and donor contributions to expand implementation of the landscape approach developed under this Project. Additional resources for the SoPs could come from the TerrAfrica partnership, which supports innovative solutions to sustain landscapes, address land and water degradation and adapt to a changing climate, and from the Pilot Program for Climate Resilience (PPCR).

II. PROJECT DEVELOPMENT OBJECTIVES

A. PDO

21. The Project Development Objective is: "To increase access to improved irrigation services and agricultural inputs, and strengthen the integrated management of natural resources in the Selected Landscapes by the local actors and to provide immediate and effective response to an Eligible Crisis or Emergency".

22. As the first in the expected SoPs, the Project's main aim is to develop a model for integrated landscape management that can be replicated and scaled up in other parts of Madagascar and thus

[8] AFD financing will constitute joint co-financing, see section III C.

reach a large number of households. The crisis or emergency referred to in the PDO reflects a legal requirement that relates to the Contingency Emergency Response Component.[9]

B. PROJECT BENEFICIARIES

23. **The ultimate beneficiaries of the project are smallholder households in the targeted landscapes that depend on land and natural resources for their livelihoods.** These households and their communities will benefit from the improved management of the natural resources and improved access to productive inputs. The improvements include irrigation and land-linked interventions (e.g., hillside and gully stabilization, increase in tree and vegetative cover) and value chain interventions (e.g., improved seeds and technology, extension services, storage capacity, financing) and other services (e.g., land titling). Furthermore, community organizations, i.e., local forest user groups, or *Communautés de Base* (COBA) and water user associations (WUAs), will benefit from the project in terms of capacity building and equipment. Producer associations will benefit from access to good practices in terms of management tools, technology and the Sustainable Landscape Management Plans.

24. The government institutions responsible for delivering specific services and inputs to rural households will benefit from capacity building and equipment. These include Agricultural Extension Centers/Centres de Services Agricoles (CSA), the MPAE's Deconcentrated Agricultural Services and communal land offices ('*guichets fonciers*'). For local level government institutions, the preparation and validation of landscape management plans and ensuring their implementation, will build capacity in planning, budgeting, monitoring and evaluation (M&E) and execution of the landscape approach, including of protection of conservation areas and of biodiversity. Government institutions at the national level, especially the three participating ministries and their agencies and departments, will benefit from support to strategic planning, improving governance, technical assistance for policy implementation, support for operations and implementation of their programs, as well as a geospatial information system.

25. **The project targets a significant number of beneficiaries.** These include members of local water user and forest user associations, as well as farmers, totaling approximately 38,200. The project also targets 45 municipalities across four regions. Staff from sector ministries at the national and local level, totaling approximately 1,000, will also benefit from capacity strengthening. This is achieved through: (i) improved governance and sustainability in the forest and natural resources sectors; (ii) economic opportunities and improved livelihoods; and (iii) reduced deforestation and improved land and forest management, all of which enable more productive landscapes. At the global level, the population will benefit from public goods provision of reduced Greenhouse Gas (GHG) emissions, improved hydrological services and restored habitats for biodiversity.

C. PDO LEVEL RESULTS INDICATORS

- PDO Indicator 1: Area provided with new/improved irrigation or drainage services
- PDO Indicator 2: Clients who have adopted an improved agriculture technology promoted by the project

[9] The Contingency Emergency Component has been included to allow for a rapid response to a crisis or emergency. When triggered, resources from other components would be re-allocated to this component. It is a legal requirement to reflect this arrangement with this specific language in the PDO.

- PDO Indicator 3: Land area under sustainable landscape management practices
- PDO Indicator 4: Direct project beneficiaries (of which female)

III. PROJECT DESCRIPTION

A. PROJECT APPROACH

26. **For the purpose of the Project, a landscape is physically defined as the set of watersheds that are the source of water for a selected irrigation scheme.** The physical boundaries of the landscape are the irrigation scheme's furthermost downstream boundary and the ridge lines of the upstream watersheds. From an administrative point of view, each landscape will contain several municipalities but is typically found within a single administrative region. The reason for using the watershed as the basis for defining a landscape is that most externalities affecting agriculture are linked to the local hydrography. In fact, irrigation is highly threatened by sedimentation flowing through rivers draining on the irrigation scheme. At the same time, communities working on the irrigated scheme often use hill sides to practice rain-fed agriculture, mine forests for charcoal and construction timber, and clear land to obtain new land.

27. **A landscape is made up of land used for different purposes, such as agricultural land, pastoral land, forests, and protected areas.** As depicted in Figure 1, four main land types within a landscape have been identified. Land type 1 is the irrigated bottom of a valley with its rivers and main canals, where rice, horticulture and livestock are most prevalent. Land type 2 are the slopes where contours and terraces are (or should be) found, with livestock, various agriculture and tree fruit production. Land type 3 is the higher hillside where reforestation and afforestation through forestry and agroforestry are possible. Land type 4 harbors protected areas and pristine forest corridors. The landscape approach ensures that land uses in each land type are compatible across the landscape, while maximizing income generation opportunities for the population.

28. **For the selection of landscapes under the proposed Project, a number of key factors have been considered:** (1) the presence of large irrigated areas that are important for food crop production and therefore important for farm incomes and regional and national level food security; (2) the presence of highly threatened watersheds from which the irrigated areas draw their water supply; and (3) the potential for economic development derived from agriculture development and improved watershed management in an integrated and sustainable manner; (4) the potential to promote conservation in critical ecosystems and the protection of biodiversity. There are a number of landscape zones in Madagascar that are relevant from an agricultural production, food security perspective and ecosystem protection. Each of these zones, within which landscapes can be defined, has unique implications from an overall development, as well as an agricultural or agro-ecological perspective as shown in Annex 2. Based on the above-mentioned criteria of economic and environmental potential and development needs, five project sites have been selected for the proposed Project. The five landscapes have different agro-ecological environments, ecosystems, farming systems and social structure and institutions. The targeted sites are listed in Table 1 below. More details on these sites and a map are provided in Annex 5.

FIGURE 1. LAND USE TYPES

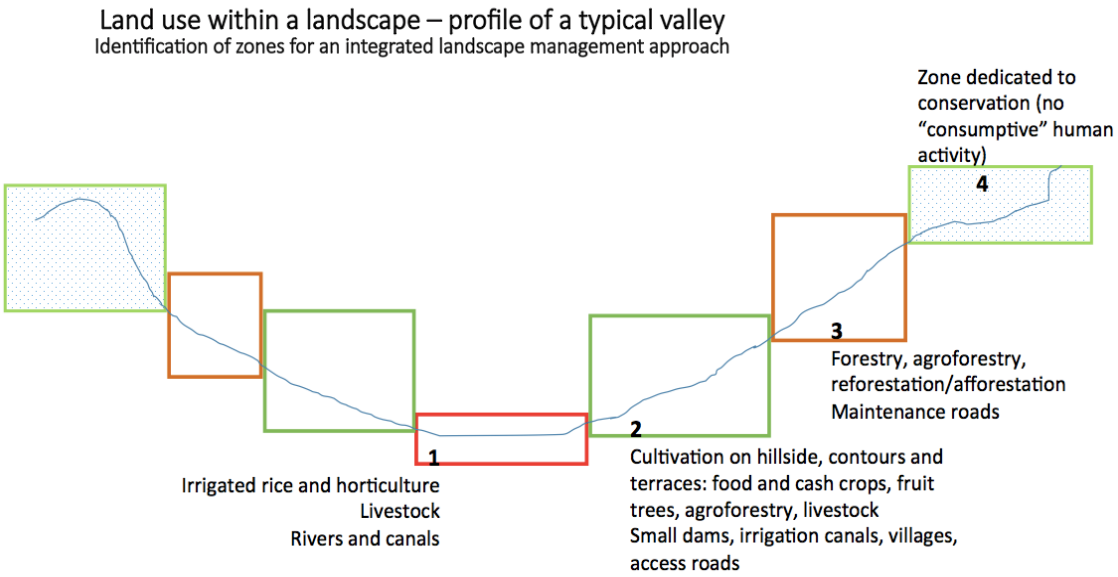
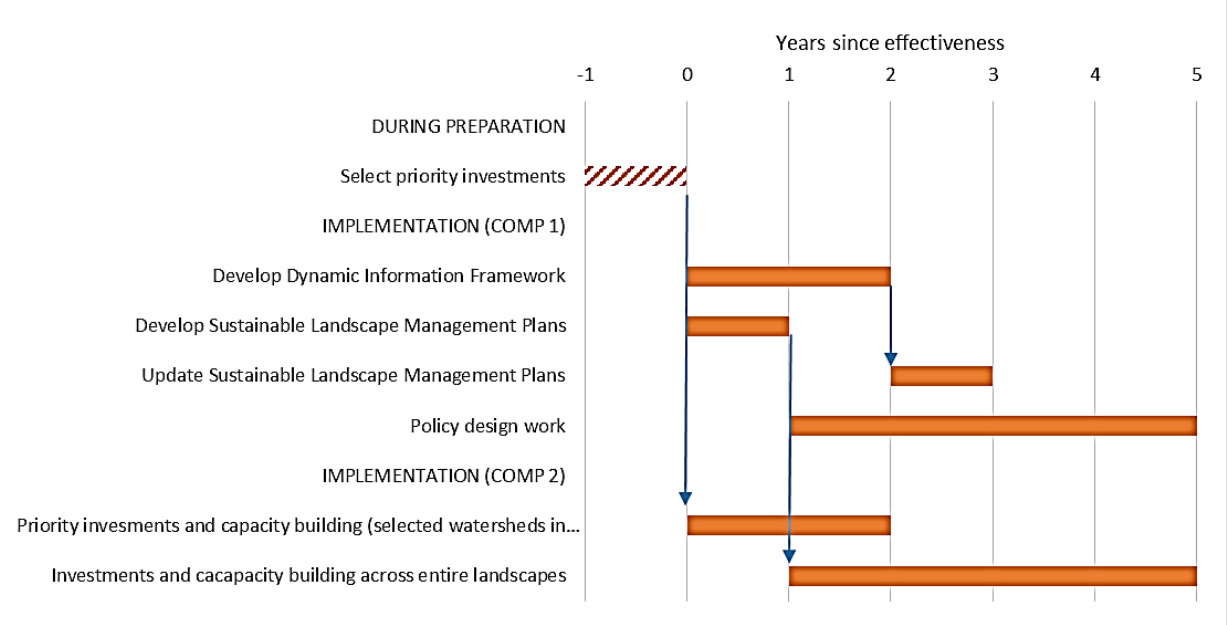


TABLE 1. SELECTED LANDSCAPES

Eastern coastal zone agro-ecoregion		North-Western low altitude plains agro-ecoregion	
SAVA Region	1. Andapa landscape	Sofia Region	4. Bealanana landscape
Analanjirofo Region	2. Iazafo landscape	Boeny Region	5. Marovoay landscape
	3. Soaneireana-Ivongo landscape		

29. **For each landscape, the project supports planning (Component 1) and implementation (Component 2).** Activities across components are phased in a way that balances the need for timely investments in priority areas with the need for integrated plans. The first component aims at developing the information base for planning and at strengthening the policy framework for implementing the landscape approach at the level of the selected landscapes and of the nation. The second component aims at implementing the approach in the selected landscapes with an emphasis on productive investments, conservation of key ecosystems and capacity building. The planning effort under Component 1 will help identify investments and capacity building in a comprehensive way for each landscape. However, to ensure benefits accrue to local populations early on, a number of no-regret investments (including rehabilitation of irrigation canals, reforestation, and slope stabilization) and capacity building activities have already been identified for selected watersheds. These will be undertaken under Component 2 while landscape plans are being completed. Figure 2 depicts the projects' phasing.

FIGURE 2. PROJECT PHASING



30. **In promoting and implementing the landscape approach, the Project will support the involvement of women.** Women represent a crucial resource in agriculture and the rural economy through their roles as farmers, laborers and entrepreneurs. Their activities typically include producing agricultural crops, tending animals, processing and preparing food, working for wages in agricultural or other rural enterprises, collecting fuel and water, engaging in trade and marketing, caring for family members and maintaining their homes. Many of these activities are not defined as "economically active employment" in national accounts but they are essential to rural development and successful implementation of the landscape approach.

B. PROJECT COMPONENTS

Component 1. Information and planning (US$4.9m [US$3.2m IDA; US$1.2m AFD; US$0.5m GEF][10])

Sub-component 1.1. Data collection and decision support tools (US$2.5m [US$1.6m IDA; US$0.6m AFD; US$0.3m GEF])

31. Activities under this component aim to build the analytical capacity, develop the planning tools, and promote a conducive policy environment that will allow for a landscape management approach to be developed in detail and take root in the key line Ministries (MPAE, MEEF, MEAH, M2PATE and MID). Through technical assistance (TA), the project will support the development of a Spatial Information System (SIS), an approach that has been used in other regions of the world to organize data and information, provide access to authorized users, and facilitate use of the data for planning and decision making. The SIS will support improved decision making for landscape

[10] Minor discrepancies are caused by rounding.

management at both the national project area level. Activities will include: (i) technical and institutional preparation for the development of an SIS; (ii) actual development of the SIS; and (iii) introduction of SIS outputs to decision makers. This activity will be complemented by the companion World Bank executed advisory service and analytics activity "Land Use Planning for Enhanced Resilience of Landscapes" (LAUREL)" which will facilitate access to high level experts on spatial modelling and planning, and support the development of methodological notes.

32. An important function that will be supported under this sub-component is the development of an institutional capability for knowledge management, learning, and program and policy planning. This would be relevant at the local landscape level during the life of the project, as well as the central level for the design of future operations within the Program.

Sub-component 1.2. Preparation of selected Sustainable Landscape Management Plans (SLMP) (US$1.6m [US$1.1m IDA; US$0.4m AFD; US$0.2m GEF])

33. This sub-component will finance the preparation of Sustainable Landscape Management Plans (SLMPs) for the selected landscapes. Terms of reference for landscape specific diagnostics were prepared during project preparation so as to inform project activities as early as possible during implementation. The ToR tasks include development of: (i) a guidance note on the elaboration of SLMPs; and (ii) the actual plans. It is expected that the SLMPs will be developed within the first two years of project implementation. The SLMPs will typically include a diagnostic of the landscape (physical, economic, social, and institutional); an analysis of existing planning effort at the decentralized level (region and municipality) and the sector level; an analysis of the threats to production, natural resources and livelihoods; an assessment of options for intervention; an intervention plan (with specific investments in agriculture, livestock, water resources management, agro-forestry, forestry, protected areas management); and a financing strategy.

Sub-component 1.3. Policies for landscape management (US$0.7m [US$0.5m IDA; US$0.2m AFD; US$0.1m GEF])

34. Aiming at capitalizing on the lessons learned from the project and at informing the uptake of the landscape approach to new areas of the country, this sub-component will contribute to the development of policy notes on landscape management best practices; natural resources management transfer to local communities; operations and maintenance of water infrastructure; value chain governance at the local level; payment for environmental services. The line ministries that will benefit from this activity are MPAE, MEEF, MEAH, MID and M2PATE.

Component 2. Investments and capacity building in the selected landscapes (US$93.8m [US$55.8m IDA; US$23.1m AFD; US$ 13.2m GEF; US$1.5m beneficiaries contribution; US$0.2m Borrower contribution])

35. This component will support on-the-ground implementation of the landscape approach. It will facilitate and finance preparation, implementation, monitoring, and scaling-up of investments to improve agricultural performance and effective natural resources management in a landscape context, as well as build local structures' capacity for effective and long-term adoption of improved practices. Effective adoption of the approach and its sustainability will depend on the capacity present in the very landscapes to implement it, but also on the tangible economic impacts that the approach yields.

Sub-component 2.1. Capacity building (US$10.7m [US$7.0m IDA; US$2.6m AFD US$1.2m GEF])

36. Through this sub-component the Project aims at establishing the capacity of decentralized authorities (namely, regions and municipalities) and deconcentrated authorities (the representatives of central ministries in the regions) to effectively manage the landscape in an integrated way. A key target for capacity building activities will be the Regional Monitoring Committees (RMCs) and the Regional Implementing Units (RIUs) to be established under the project's implementation arrangements (see Section IV). Key stakeholders targeted by this sub-component also include: (i) local communities managing natural resources; (ii) staff of the decentralized administration in selected municipalities, districts and regions; (iii) locally based and national sector staff from key line ministries; and (iv) researchers in specialized technical agencies, including academia, and private sector research organizations.

Sub-component 2.2. Productive investments (US$75.2m [US$48.8m IDA; US$20.5m AFD; US$4.6m GEF; US$1.0m beneficiaries contribution; US$0.2m Borrower contribution])

37. The need to adopt a landscape approach to agricultural intensification and natural resources management in Madagascar's watersheds is urgent, based on the inter-related nature of challenges in the upstream and downstream areas of the watershed. This approach should aim at: (i) putting in place more climate-resilient infrastructure to protect from recurrent damage caused by frequent floods and hurricanes; (ii) establishing an appropriate incentive and financing framework for efficient operation and maintenance of irrigation infrastructure; as well as (iii) soil and water conservation in upper watersheds. Activities under this sub-component therefore aim to address the constraints that cause low productivity and lack of resilience of systems. They include physical infrastructure for irrigation (US$26.6m), hillside stabilization through terracing, gully erosion control structures (US$14.5m), and feeder road maintenance (US$5.5m). Investments in green infrastructure through forest landscape restoration will also be undertaken using endemic species and if needed fast growing species. Activities will also support partnerships with the private sector to promote agricultural intensification, cash crop development, agroforestry and silvicultural approaches (US$7.4m). Finally, the activity will also support local producers (farmers and forest users) in the adoption of new techniques, agroforestry, community-based management of forests, including by improving decision making by women, and sustainable livestock practices (US$ 21.3m).

Sub-component 2.3. Management of critical ecosystems and protected areas (US$7.9m [US$7.4m GEF; US$0.5m beneficiaries contribution])

38. This sub-component will support sector agencies, decentralized authorities and protected areas management agencies in managing key conservation and protected areas in the selected landscapes. Protected areas management will entail: surveillance through patrolling missions, aerial and/or Unmanned Aerial Vehicle (UAV) flyovers, and satellite monitoring; construction and upgrading of conservation infrastructure including firebreaks, guard stations and park boundary markers; provision and renewal of essential equipment for park management, including vehicles and office equipment. The project will also support forest active and passive restoration activities for conservation purposes. These include transforming degraded, altered forest ecosystems to ecosystems where the physical integrity (structure), diversity, as well as the ecological functions of the original ecosystem are re-established. Finally, activities under this sub-component will

support piloting Payments for Environmental Services (PES) in select locations within the five landscapes. Implementing PES will require four parallel sets of activities: (1) understanding the linkages between land use and the desired environmental services; (2) putting in place financing arrangements; (3) putting in place field arrangements to contract providers, monitor compliance, and make payments; and (4) putting in place the institutional framework. Annex 7 reviews the challenges faced by these activities in Madagascar, in light of the experience of the few existing PES pilots in the country, experience with PES implementation worldwide, and country characteristics. It also indicates the activities that the PADAP project will undertake to meet these challenges.

Component 3. Project Management Coordination and M&E (US$8.4m [US$6.0m IDA; US$2.4m AFD])

39. This component covers the project management by the Project Implementation Unit (PIU) and the RIUs. The component will support all aspects of project management, including fiduciary management, Monitoring & Evaluation (M&E), knowledge generation and management, communication, and monitoring mitigation measures related to safeguards. Specifically the following activities are included: (i) operating costs for the project, the bulk of which relates to salaries of consultants, field supervision, transport and IT support; (ii) financial management including external audits and accounting; (iii) M&E, including financing the baseline and final impact assessment surveys, as described in Section IV B of the PAD; (iv) safeguards compliance including dam safety and the dissemination of the pesticide management plan at the community level, among other measures; and (v) training.

Component 4. Contingency Emergency Response (US$0m)

40. This component establishes a disaster response contingency funding mechanism that could be triggered in the event of an eligible crisis or emergency, such as a natural disaster involving a formal declaration of a national or regional state of emergency, or a formal request from the Government of Madagascar in the wake of a disaster. In that case, funds from other project components could be reallocated to this component to facilitate rapid financing of a positive list of goods and services related to Components 1 and 2, and that would still be relevant to the achievement of the PDO. Eligible activities would include clearing and rehabilitating road and irrigation infrastructure, purchasing construction materials, agricultural inputs, or contributing to pest/plague control (e.g., locust control).

C. PROJECT FINANCING

41. The Project is designed as an investment project financing (IPF) operation to be implemented over five years starting in 2017. The total base project cost is US$105.3 million with US$65 million IDA credit, US$13.7 million GEF grant, and Euro 25 million ($26.6 million equivalent AFD credit). IDA and AFD will provide funds as joint co-financing on a *pari-passu* basis[11]. AFD joint co-financing will be subject to World Bank policies and procedures including procurement, financial management and safeguards. GEF will provide funds as parallel co-financing. In addition, up to US$50 million through an ERPA with the Carbon Fund is anticipated, provided Madagascar's program document meets the necessary quality requirements and is

[11] *Pari passu* in this case refers to joint financing of IDA and AFD resources. For each dollar used by the project approximately 70 percent will be financed by IDA and 30 percent by AFD.

approved by the Carbon Fund board. Contributions by beneficiaries are estimated at US$1.5m. The Government of Madagascar would also contribute approximately US$230,000 to cover compensation costs for resettlement (land acquisition costs; compensation on crops, trees, shelter, habitat, structures, etc.) that may occur as a result of implementation of the Project. This would bring the total amount of project financing to approximately US$107.05 million. The Project is also expected to leverage private financing from agribusinesses involved in agricultural value-chains that will be channeled towards capacity-building and technology transfer.

D. PROJECT COST AND FINANCING

42. Table 2 below summarizes the indicative costs by component.

TABLE 2. PROJECT COSTS AND FINANCING

Project Components	Project Cost (US$ million) [12]	Project Financing (US$ million)					% Financing
		IDA	AFD[13]	GEF [14]	Beneficiaries contribution	Borrower contribution[15]	
1 Information and planning	**4.88**	**3.17**	**1.17**	**0.54**	**0.00**	**0.00**	**4.6%**
1.1 Data collection and decision support tools	2.53	1.64	0.61	0.28			2.4%
1.2 Preparation of selected Sustainable Landscape Management Plans (SLMPs)	1.64	1.07	0.39	0.18			1.5%
1.3 Policies for landscape management	0.71	0.46	0.17	0.08			0.7%
2. Investments and capacity building in the selected landscapes	**93.80**	**55.81**	**23.11**	**13.15**	**1.50**	**0.23**	**87.6%**
2.1 Capacity building	10.72	6.97	2.57	1.18			10.0%
2.2 Productive investments	75.23	48.84	20.54	4.62	1.00	0.23	70.3%
2.2.1 Infrastructure	*46.58*	*30.22*	*13.66*	*1.47*	*1.00*	*0.23*	*43.5%*
2.2.1.1 Water Resources Management and Irrigation	*26.63*	*18.64*	*7.99*				*24.9%*
2.2.1.2 Hillside stabilization and forest landscape restoration	*14.46*	*8.68*	*3.20*	*1.47*	*1.00*	*0.11*	*13.5%*
2.2.1.3 Feeder road maintenance	*5.49*	*2.90*	*2.47*			*0.12*	*5.1%*
2.2.2 Support to partnerships with the private sector	*7.38*	*4.80*	*1.77*	*0.81*			*6.9%*
2.2.3 Support to local producers	*21.26*	*13.83*	*5.09*	*2.34*			*19.9%*
2.3 Management of critical ecosystems and protected areas	7.86			7.36	0.50		7.3%
3. Project management, coordination and M&E	**8.37**	**6.02**	**2.35**				**7.8%**
4. Contingency Emergency Response (zero budget)	**0.00**	**0.00**					**0.0%**
Total Project Costs	**107.05**	**65.00**	**26.62**	**13.70**	**1.50**	**0.23**	**100.0%**

[12] Small discrepancies occur due to rounding.
[13] AFD funding will be in the form of joint financing.
[14] Total GEF grant amount of US$13,699,083 is rounded to US$13.70 million
[15] Borrower contribution of approximately US$230,000 is to cover any compensation costs for resettlement that may occur as a result of implementation of the Project.

E. SERIES OF PROJECTS OBJECTIVE AND PHASES

43. The Program Goals of the SoPs are to: (1) reduce the degradation of natural resources; and (2) increase the value of output from productive sectors. A model for good governance to achieve these objectives will be developed over time, based on action learning. In addition, a monitoring mechanism to measure the program goals will be identified during the course of project implementation, in tandem with the development of a subsequent project that will be based on the proof of concept achieved during the first few years of implementation.

44. The SoPs are expected to consist of three projects (or phases of one project) to be implemented over 20 years. The first phase, through the proposed Project, will aim at building capacity, strengthening institutions and supporting investments at the level of the five selected landscapes. The Project will also build capacity at the central level to generate and use information for decision making at the landscape level and capacity for scaling up the landscape concept to new areas in subsequent phases of the SoPs. The second phase will consolidate the information base and institutional framework to promote integrated agriculture and natural resources optimal use and will expand investments to new landscapes. The third phase will consolidate investment in landscapes already supported and undertake additional investments. It is expected that, over time, the attention will gradually move from setting up the information base, planning and capacity building toward progressively scaled-up investments. Annex 2 provides a description of how the SoPs to which the proposed Project will contribute could evolve over the course of 20 years.

F. LESSONS LEARNED AND REFLECTED IN THE PROJECT DESIGN

45. **The World Bank and other development partners have collaborated since 1990 in support of Madagascar's National Environmental Action Plan (NEAP).** The Bank-financed Environment Program has allowed learning of important lessons that need to be taken into account moving forward, among them: (i) a shift towards a more integrated approach of conservation and development partnership is necessary; (ii) Governance constraints require an engagement with Government at the national and local levels, placing environmental issues more squarely at the center of the Government agenda; (iii) Community participation in natural resources management has been underutilized; and (iv) there is a largely unexploited potential for generating carbon credits from avoided deforestation and degraded forests restoration.

46. Experience from the first Sustainable Land Management Project in Ethiopia suggests that a local demand-driven and participative approach to improved natural resource management is highly relevant. However, such an approach should be accompanied by technical support and capacity building at the local level, and appropriate reward and incentive schemes. Continuous knowledge sharing and learning among targeted project areas also contributed positively to a continuing sensitization of (often changing) local leadership.

47. Experience from the Madagascar Irrigation and Watershed Management Project suggests that watershed projects **should be cautious in seeking to achieve significant downstream impact when it is unattainable during the life of the project.** While broad scale erosion control and soil conservation measures would always be technically desirable, there is a large opportunity cost associated with achieving these outcomes, in terms of competing public expenditure. A more realistic approach with limited resources would be to learn from pilots about how best to improve watershed management selectively and efficiently to enable strategic thinking for later broader, longer term, interventions.

48. **Experience from the first Loess Plateau Watershed Management Rehabilitation Project in China confirms the importance of incorporating livestock management in project design.** As in Madagascar, poorly managed livestock keeping is an important cause of soil degradation and erosion. The project promoted sustainable grazing practices and generally improved livestock management and planning.

49. A farming systems approach to agricultural intensification that recognizes labor and financial constraints and that takes into account incentives is more important than simply ensuring that inputs are readily available. Experience from the Bassin versant – Périmètre irrigué/Irrigation and Watershed Management Project (BVPI) showed that a matching grant approach proved to be ineffective for agricultural intensification, with the exception of the initial demonstration effect. Initially in the first year, farmers took advantage of the opportunity to use heavily subsidized new technologies, but due to risks, lack of labor or lack of access to finance, they opted for stepping down to less capital intensive practices in the second and third year. A more systems focused approach would be appropriate, using a combination of realistic demonstration plots exhibiting moderate resource scenarios with parallel targeted extension support.

50. At the global level, the World Bank Group (WBG) is supporting clients to enhance and sustain ecosystem and agroecosystem productivity. Based on lessons learned from WBG operations in other regions, common priorities and considerations for climate resilient and productive landscapes have been included in the Project design. These lessons, priorities and considerations are presented in Annex 4.

IV. IMPLEMENTATION

A. INSTITUTIONAL AND IMPLEMENTATION ARRANGEMENTS

51. The project's coordination and management structure will be based on four main bodies: the Inter-ministerial Project Steering Committee (IPSC) (*Comité de Pilotage Interministériel*), four Regional Monitoring Committees (RMCs) (*Comités Régionals de Suivi*), the PIU at the central level (*Agence d'Exécution*), and the four RIUs (*Cellules Régionales d'Exécution*).

52. The **IPSC** will provide strategic oversight of the project and will include representation from the key stakeholders including the Secretary Generals or representatives of the MPAE, MEEF, MEAH, M2PATE, MID, the Ministry of Finance and Budget (MFB); as well as the Heads of Region (4); the Representative of the COBA Federation; and the Representative of the Tranoben'ny Tantsaha (national chamber of farmers). The IPCS will be chaired on a rotating basis by the Secretary General of MPAE, the Secretary General of MEEF and the Secretary General of MEAH.

53. The **four RMCs** will be chaired by the Head of Region and will ensure consistency of project activities with regional development policies and planning processes (regional land use and development planning, commune-level planning), and monitor project progress.

54. The **PIU**, with staff drawn from the MPAE, MEEF and MEAH, will be based within the MPAE and will manage the Project's day-to-day activities, project M&E, and policy dialogue on integrated landscape management. The PIU staff will be responsible for all procurement, disbursement, accounting, financial and technical reporting, monitoring and evaluation of the project, including the environmental and social safeguards aspects, and ensuring the auditing of the Project accounts.

55. The **four RIUs** will be responsible for day-to-day implementation of activities at the regional level. Duties will include procurement, disbursement, financial and technical reporting, project M&E, including the environmental and social safeguards aspects. They will report to the PIU at the national level and the RMCs.

56. A Project Implementation Manual (PIM) will be prepared to guide project implementation. Development of the PIM is an effectiveness condition. Annex 8 provides further details and an illustration of the Project implementation arrangements.

B. RESULTS MONITORING AND EVALUATION

57. Project M&E is undertaken to: i) strengthen local level planning, budgeting and execution in the targeted landscapes (under Component 1); ii) establish a common environment for information sources describing the landscapes (spatial information system) (under Component 1); iii) develop a tool for results-based management of the project; and iv) meet routine reporting requirements as part of the WBG project cycle. The Project Results Framework (RF) is intended to provide a framework for accountability of progress towards local, regional and national objectives in management of natural resources in Madagascar. This includes accountability of the three participating ministries. In terms of accountability towards citizens, demand-side social accountability of interventions will be captured through a citizen engagement indicator that will also measure gender aspects. The citizen engagement framework is based on a perception survey and a strong feedback loop. The range of sources of data include: perception survey (citizen engagement), field survey (value chain aspects, e.g. access to inputs, storage capacity; infrastructure; biological parameters) and institutional survey (e.g. planning; Management Effectiveness Tracking Tool [METT]). Data collection will be carried out annually. Central to the M&E approach is a platform for communication of results including dissemination and communication products. The Project will put special emphasis on mapping of project interventions and results through geocoding of activities and overlay with key indicators.

58. The PIU will have the overall coordinating role in M&E. The PIU will hire one international M&E specialist and two national M&E specialists who will ensure that quality data and information from all landscapes and institutions is produced and collected on time. The M&E activities will be to: (i) generate information on project progress per the results framework in Annex 1; (ii) analyze and aggregate data generated at local and regional level; and (iii) document and disseminate key lessons to all stakeholders.

C. SUSTAINABILITY

59. The degree to which the Project will be deemed sustainable will be determined by: (i) public investments in the rural sector and the promotion of commercially viable value chains; (ii) cost reductions and efficiencies brought about by cross-sectoral (landscape-wide) synergies; and (iii) future Reducing Emissions from Deforestation and Forest Degradation in Developing Countries (REDD+) co-financing.

60. The Project will aim at increasing production and productivity in the selected landscapes through physical investments and the promotion of economic value chains in staple crops, cash crops, livestock, agro-forestry and forestry. Better managed assets (in agriculture, water and forestry) are expected, in turn, to increase the incentives for maintenance and conservation.

Moreover, the project will aim at building capacity for improved recovery of the costs of operation and maintenance of key infrastructure (e.g. hydraulic infrastructure).

61. The synergies brought about by simultaneous investments in agriculture, water and forestry, and across the landscapes' slopes will ensure that investments and improved techniques downstream will be less impacted by sub-optimal land uses upstream, making them more sustainable. At the same time, investments, improved techniques and improved natural resources management upstream will be less impacted by the pressure from communities moving upwards because of increasingly unproductive land downstream.

62. To the extent that the four[16] Project landscapes (Andapa, Bealanana, Soanierana Ivongo and Iazafo) are included in the Emission Reduction (ER) Program Area's jurisdiction boundaries, the performance-based payments from the Carbon Fund generated between 2019 and 2023 (on the basis of avoided deforestation, enhanced carbon stock, and sustainable forest management) will also contribute to the sustainability of the work initiated under the Project in those four landscapes.

63. Some investments, e.g. combatting soil degradation and erosion, will take more than five years of dedicated effort to yield results. Institutional change and behavior change at the local level may also take longer to develop. For these reasons, the Project is designed as the first in a SoPs. The second phase of the SoPs, which will start after 4 or 5 years, will aim at consolidating the Projects investments, continuing strengthening the various institutions on the basis of a strong legal framework, strengthening the M&E capacity at all levels, continuing public awareness and continuing and eventually upscaling investments to new landscapes.

V. KEY RISKS

A. OVERALL RISK RATING AND EXPLANATION OF KEY RISKS

64. The focus is on risks to development results associated with the Project, mainly failure to achieve the intended results and unintended (possibly negative) project results. Table 3 summarizes and rates the major risks associated with the proposed project. Risks rated "High" and "Substantial" and mitigation measures are as follows.

65. The overall implementation risk is "High", reflecting the multi-sectoral nature of the project and the need for strong institutional collaboration in a challenging environment. Political and governance risk is rated "Substantial", due to the unstable political situation and the potential negative impact of poor governance on environmental management and agriculture value chain development. Macroeconomic risk is rated "Substantial", consistent with other Bank operations and reflecting various factors such as a poor investment climate; low levels of coping capacity and resilience to climate related shocks, such as cyclones, droughts and floods; and fiscal management challenges. Risk associated with sector strategies and policies is rated "Substantial", mostly reflecting the risks of multi-sectoral policy and planning being complex and demanding in terms of policy dialogue. These risks will be mitigated by the implementation of multi-ministerial oversight and project management structures, project support to policy analysis, dialogue and regulatory capacity, and support to integrated planning processes. The technical design of the Project and institutional capacity for its implementation are both rated "High" as a result of the multi-sector nature of the Project that involves various Government ministries, agencies and

[16] The Marovoay Landscape is not included in the ER program area.

regional authorities for implementation. These risks are mitigated by multi-sector implementation and coordination arrangements and the use of service providers combined with a focus on capacity building. Fiduciary risk is rated "Substantial" reflecting areas of significant weaknesses in financial management and procurement. This risk will be mitigated by the recruitment of qualified fiduciary staff in the PIU and RIUs, and adoption of an implementation manual to provide detailed guidance for effective fiduciary oversight. Forest conservation may result in disputes, posing a "Substantial" stakeholder risk. This is mitigated by project support to a payment-for-environmental-services system designed to compensate local communities and create "win-win" agreements.

TABLE 3. SUMMARY RATINGS OF MAJOR RISKS

Risk category	Rating
1. Political and governance	Substantial
2. Macroeconomic	Substantial
3. Sector strategies and policies	Substantial
4. Technical design of project	High
5. Institutional capacity for implementation and sustainability	High
6. Fiduciary	Substantial
7. Environment and social	Moderate
8. Stakeholders	Substantial
Overall	High

VI. APPRAISAL SUMMARY

A. ECONOMIC AND FINANCIAL ANALYSIS

66. The Economic and Financial Analysis (EFA) includes: (i) a literature overview of potential benefits and costs that can be derived by the project, even though not all can be quantified in this analysis; (ii) financial analysis on farm level to assess the financial viability of project interventions for selected crops; and (iii) an economic analysis to evaluate the project's benefits and costs to the national economy and derive the economic return on investment of the project (Economic Net Present Value [ENVP] of incremental benefits and the Economic Internal Rate of Return [ERR]).

67. The financial analyses compare "with" and "without" project scenarios, and assume improvements in productivity and associated production cost for irrigated rice, and crops grown on the hillsides, such as rainfed rice, cassava, onions, beans and vanilla and cloves, as well as zebu production. The models show positive incremental net benefits throughout, and confirm the financial viability of the proposed investment for households.

68. The economic analysis is based on the aggregation of economic benefits from: (i) improving crop productivity; (ii) reducing siltation in irrigated perimeters, which could result in incremental net benefits of more than US$435,000 over 20 years; and (iii) benefits related to the project's net carbon balance, (see Annex 10), which is valued at a social cost of carbon of US$30/tCO2e and could result in a value[17] to society of US$10 million per year.

[17] Defined as the avoided losses and damages associated with reducing tCO2e emissions.

69. The economic analysis spanning 20 years and assuming a discount rate of 6 percent results in an Economic Net Present Value (ENPV) of incremental net benefits of US$207 million and an EIRR of 26.6 percent. Sensitivity analysis demonstrates that the results are largely robust against changes to key variables. Changes in environmental benefits have the largest impact on the EIRR. However, for all changes, the project's EIRR is well above the deposit interest rate which was on average 11 percent between 2011 and 2014.

B. TECHNICAL

70. The project approach and design are technically sound and sustainable. The proposed project supports several categories of key activities: (i) investments in data management and multi-sector integrated decision making as a tool for policy development and planning; (ii) enhancing local capacities at the project sites for integrated landscape management; (iii) hard investments in water management infrastructure and other rural infrastructure; (iv) investments in agriculture, agroforestry, forestry and livestock productivity enhancements; (v) investments in value chain development; and (vi) investments in the management and restoration of hillsides and protected areas. As the first in a series of projects, the proposed Project aims to develop and test a landscape management approach and methodology that can be implemented by subsequent projects at a sub-national or national scale.

C. FINANCIAL MANAGEMENT

71. The proposed financial management and disbursements arrangements comply with the Financial Management Manual for World Bank-financed Investment Operations dated March 1, 2010.

72. The project's coordination and management structure will be based on three main bodies: the Inter-Ministerial Project Steering Committee (*Comité de Pilotage*), the Project Implementation Unit at the central level (*Agence d'exécution*), and four Regional Implementation Units (*Cellules Régionales d'Exécution*). The project coordination, management, implementation, monitoring and evaluation procedures will be detailed in a Project Implementation Manual (PIM) to be prepared by the PIU by project effectiveness.

73. The Ministries' Public Finance Management (PFM) and PIU within the MPAE systems have been assessed to determine whether: (i) the financial management arrangements are adequate to ensure that the project funds will be used for the intended purposes in an efficient and economical way; (ii) the financial reports will be prepared timely, with accuracy and reliability; and (iii) the project's assets will be safeguarded. The assessment concludes that the Ministries and PIU within the MPAE financial management systems, subject to the effective implementation of the mitigation measures described in the paragraph below, are adequate and comply with the Bank's minimum requirements under OP/BP10.00.

74. The overall FM risk for the Project is "Substantial" and the proposed mitigation measures are: (i) the recruitment of one qualified accountant and one Financial Management specialist at central and regional level per ToRs to be agreed on with the World Bank; (ii) the design of a financial and administrative procedures manual (as part of the operational manual) which will describe the role and responsibility of each implementing entity and the applicable fiduciary procedures; the reporting relationship between the central and the regional level, the funds flow arrangements and budget management cycle and procedures; (iii) the installation of a multi-site

and decentralized accounting system with the ability to consolidate the regional and central level financial transactions; (iv) the audit of the annual financial statements carried out by a reputable auditing firm as per the ToRs to be agreed upon with the World Bank; and (v) the internal audit department of the MPAE will be involved in the project activities and the recruitment of one Internal auditor to support the improvement of the effectiveness and efficiency of the internal control system.

75. More details on financial management and disbursement arrangements are provided in Annex 8.

D. PROCUREMENT

76. The procurement capacity assessment, was conducted at the level of the MPAE, within which the PIU will be based. The procurement assessment focused specifically on the Public Procurement Management Unit (*Unité de Gestion de Passation des Marchés Publics*) of the entire Ministry. The Head of Public Procurement (*Personne Responsable des Marchés Publics*, PRMP) and the team within the ministry are technically proficient and are involved in procurement activities of several projects financed by different donors (IFAD, ADB, WB, and Government). The PIU will be staffed with a proficient and highly qualified procurement officer to be hired from the market during the Project Preparation Advance (PPA) implementation. Before project effectiveness, four highly qualified procurement officers will be recruited for the four RIUs based respectively in Fenerive-Est, Sambava, Antsohihy, and Mahajanga/Marovoay. All procurement officers will operate under the overall guidance and control of the PRMP of the MPAE.

77. The PIU and RIUs will carry-out all the project procurement activities. The PIU will sign Memorandums of Understanding (MOUs) with other sectoral ministries to define activities, responsibilities, accountabilities, budget for technical support to be provided to the project. Procurement for the AFD financing will also be carried-out by the PIU in accordance with Bank procurement procedures. However, disbursement will be on a pari-passu basis.

78. The following mitigation measures are proposed: (i) carry-out procurement processes for the first year under the PPA; (ii) a project operational manual to be prepared shall include inter alia a detailed description of the overall procurement arrangements and responsibility of each entity; (iii) basic procurement training to be provided to all staff involved in the project before project effectiveness; and (iv) continuous procurement hands-on support to the PIU staff.

79. A fiduciary risk assessment review of Madagascar's public procurement system conducted in April 2015 identified procurement weaknesses. However, the review concluded that the *Commission Nationale des Marchés* (CNM) can be used to carry-out prior and post procurement reviews on Bank-financed project activities. The use of national documents for National Competitive Bidding (NCB) presents a moderate risk provided that the Project inserts additional provisions/exceptions (approved by Legal Operations or LEGOP), which are outlined in Annex 8 of the PAD. Finally, the review highly recommends the use of the *Système Intégré de Gestion des Marchés Publics* (SIGMP, translated as Integrated System for Public Procurement Management) to increase transparency during procurement processes.

E. SOCIAL (INCLUDING SAFEGUARDS)

80. Based on the selected activities in Components 1 and 2, the environmental and social risks and impacts may be moderate, site specific and easily manageable with specific mitigation

measures, and in most cases, reversible. Therefore, the Project is rated a Category B project. The proposed operation has triggered seven World Bank safeguard policies, namely Environmental Assessment (OP 4.01); Natural Habitats (OP 4.04), Pest Management (OP 4.09); Involuntary Resettlement (OP 4.12); Forests (OP 4.36); Physical Cultural Resources (OP4.11) and Safety of Dams (OP/BP 4.37). The Recipient has recruited a consultant to prepare four safeguards documents: an Environmental and Social Management Framework (ESMF), a Resettlement Policy Framework (RPF), an Integrated Pest Management Plan (IPMP), and an updated Small Dam Safety Manual.

81. **OP 4.12 Involuntary Resettlement.** The activities under subcomponent 2.2 Productive Investments in Selected Landscapes such as the construction of physical infrastructure for irrigation, hillside stabilization through terracing, construction of gully erosion control structures, feeder road maintenance and forest landscape restoration may result in negative social impacts covered under OP 4.12 Involuntary Resettlement. Potential impacts include loss of land and/or structures; the temporary or permanent loss of livelihoods, loss of crops and crop trees; and the temporary or permanent displacement of people. The exact nature and location of the investments are not yet known but it is expected that up to 12,700 ha of land will be required either temporarily or permanently. To mitigate negative impacts, activities will be planned according to the agricultural calendar in order to minimize loss of crops. A number of community investments will be able to benefit from voluntary land donation, often in conjunction with access to agricultural intensification activities, and assistance for cash crop development. Expropriation or imposition of easements is estimated for up to 1,300 ha affecting approximately 570 households. A Resettlement Policy Framework has been developed to guide the mitigation of negative impacts.

82. The management of critical ecosystems and protected areas will not lead to new restrictions for the use of natural resources in the Project's protected areas. The Payment for Environmental Services (PES) to be piloted under the Project in select locations will be implemented on a voluntary basis. Any involuntary restrictions that may be required for the long term conservation of the protected areas would be consulted and enforced as part of the national REDD+ strategy and in accordance with the Resettlement Process Framework that is currently being developed under the Forest Carbon Partnership Facility Readiness Fund Grant (P124655).

83. **Social and gender inclusion, and beneficiary engagement.** The landscape[18] approach ensures the social inclusion of socio-economic different communities within the landscape and ensures that income generation opportunities for the population under each land type are compatible and maximized. Women are key stakeholders in the landscape economy and were consulted separately during Project preparation. Their participation in project activities, including those that have attracted more male participation in earlier projects such as participation in producer organizations, water user associations, and landscape conservation patrols will be encouraged and monitored under this project. The bi-annual perception surveys that will monitor beneficiary engagement will also be designed to monitor women's satisfaction on the application of the integrated landscape approach and capture their feedback so that the project can be modified if necessary to respond appropriately to women's development needs and requirements.

[18] As defined under the Project Approach section.

F. ENVIRONMENT (INCLUDING SAFEGUARDS)

84. **Environmental and Social Management Framework (ESMF).** An ESMF with provisions for the preparation of an Environmental and Social Management Plan (ESMP) has been prepared. It includes the activities to be financed under a Category B project and a list of negative activities that are classified as Category A activities.

85. **Screening process**. Prior to Project commencement, as soon as the implementation sites are identified, each activity will be screened per the established environmental and social screening procedures detailed in the ESMF. The screening and classification of eligible activities will be carried out by the PIU's Safeguards environmental and social focal points. The results of the screening will be processed according to the national regulations and Bank requirements. The ESMF and the RPF include institutional arrangements outlining the roles and responsibilities of the various project stakeholder groups for screening, review, approval of activities, as well as implementation and monitoring of their mitigation measures.

86. **Integrated Pest Management Plan (IPMP).** Project funds will be used to purchase and distribute agrochemicals to project beneficiaries. Agribusinesses may also encourage farmer groups to use more inorganic fertilizers and pesticides. To ensure safe pest management, the Project has prepared an IPMP which includes: (i) a survey on the local bio-pesticides and agronomic technical practices to reduce the impacts of pests on the agriculture value chains in the project areas; (ii) appropriate actions to reduce the exposure of farmer groups to pesticides used in agricultural production systems; (iii) guidelines to be adopted on the possibility of agrochemical application and disposal; (iv) training sessions to strengthen the capacity of different actors (farmers, local vendors, regional agricultural agents, etc.) on the use, storage and disposal of agrochemical products; and (v) a budget and monitoring system and indicators.

87. Safety of Dams (OP 4.37) is triggered because of the proposed rehabilitation of small irrigation infrastructures and the replacing of old hydraulic equipment/material. The Project will not finance any new construction or rehabilitation of large-scale irrigation facilities and dams above 15 meters, or reservoir of more than 3 million cubic meter. It will however finance small check-dams to treat lavakas (gully erosion). The current Small Dams Safety Manual (SDSM) prepared in 2012 has been updated for the Project. The revised SDSM is sufficient and relevant to manage and reduce the potential risks and impacts that could be generated by the proposed project in the existing irrigation perimeters and hydraulic infrastructures to be financed.

88. **Disclosure of safeguard documents**. The ESMF includes a public consultation approach and comprehensive and clear grievance mechanism to be adopted during project implementation. The PIU will initiate public consultations as early as possible and provide, in a timely manner prior to consultation, all the relevant materials in the form and language(s) needed to be understandable and accessible to the groups being consulted. All the Borrowers' safeguards instruments (ESMF, IPMP & RPF) were approved by the World Bank's Regional Safeguards Advisor (RSA) in December 2016 and disclosed in-country on January 7, 2017 and on January 9, 2017 at the World Bank Infoshop in compliance with the World Bank safeguards and national policies and Disclosure Policy.

Environmental and Social Safeguards Policies Triggered

Safeguard policies triggered	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]

G. WORLD BANK GRIEVANCE REDRESS

89. Communities and individuals who believe that they are adversely affected by a World Bank 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 World Bank's attention, and Bank Management has been given an opportunity to respond. For information on how to submit complaints to the World Bank's corporate Grievance Redress Service (GRS), please visit http://www.worldbank.org/GRS. For information on how to submit complaints to the World Bank Inspection Panel, please visit www.inspectionpanel.org.

ANNEX 1. RESULTS FRAMEWORK AND MONITORING

Program Goals: (1) Reduce the degradation of natural resources; and (2) Increase the value of output from productive sectors.											
Project Development Objective (PDO): Increase access to improved irrigation services and agricultural inputs and strengthen the integrated management of natural resources in the targeted landscapes by local actors, and to provide immediate and effective response to an Eligible Crisis or Emergency											
PDO Indicators	Core	**Unit of Measurement**	**Base line**	**Targets**					**Frequency**	**Data source and methodology**	**Responsible**
				YR1	**YR2**	**YR3**	**YR4**	**YR5**			
PDO Indicator 1: *Area provided with new/improved irrigation or drainage services*	☒	Ha	0	0	5,000	8,000	12,000	14,000	Annual	Field survey	PIU M&E function
PDO Indicator 2: *Farmers adopting improved agricultural technology (of which female)*	☒	Number	0	0	5,000 (2,000)	7,500 (3,000)	10,000 (4,000)	12,500 (5,000)	Annual	Field survey	PIU M&E function
PDO Indicator 3: *Land area under sustainable landscape management practices*	☒	Ha	0	0	50,000	250,000	400,000	550,000	Annual	Spatial Information System	PIU M&E function Calculation of total area based on above sub-indicators
PDO Indicator 4: *Direct project beneficiaries (of which female)*	☒	Number (%)	0	0	10,200 (40)	26,000 (40)	36,000 (40)	38,200 (40)	Annual	Project and activity records	PIU M&E function
Intermediate results											
Component 1: Information, planning and strategy design for a landscape approach											
IR Indicator 1.1: Landscape management plans approved by the National Steering Committee and Regional Monitoring Committees	☐	Number	0	0	5	5	5	5	Annual	Review of approval documentation and landscape management plans	PIU M&E function
IR Indicator 1.2: Spatial Information System established and operational	☐	Yes/No	No	No	Yes	Yes	Yes	Yes	Annual	Review of Spatial Information System standard and customized reports	PIU M&E function
IR Indicator 1.3: Policy Briefs prepared, validated and disseminated to stakeholders	☐	Number	0	1	2	4	4	5	Annual	Review of Policy Briefs Review of workshop proceedings and reports of dissemination	PIU M&E function
IR Indicator 1.4: Share of target beneficiaries with score 'Satisfied' or above on application of integrated landscape approach in targeted landscapes (disaggregated by sex)	☐	%	N/A	20	40	65	65	65	Annual	Perception survey	PIU M&E function
Female				20	40	65	65	65			
Male				20	40	65	65	65			

Component 2: Increase investments and capacity for application of the landscape approach in the selected landscapes											
IR Indicator 2.1 : COBA operational	☐	Number	0	0	10	30	70	100	Biennial	Institutional survey	PIU M&E function
IR Indicator 2.2 : Irrigation systems managed by Water User Associations	☐	Number	0	0	12	18	25	25	Biennial	Institutional survey	PIU M&E function
IR Indicator 2.3 : CSAs, STDs and CTDs operational (disaggregated by institution)	☐	Number	0	0	7	14	21	28	Biennial	Institutional survey	PIU M&E function
CSA			0	0	1	2	3	4			
STD			0	0	1	2	3	4			
CTD			0	0	5	10	15	20			
IR Indicator 2.4: Producer associations which have adopted good practices according to defined criteria	☐	Number	0	0	5	10	15	20	Annual	Review of producer associations' charter	PIU M&E function
IR Indicator 2.5: Pilot Payment for Environmental Services mechanisms established	☐	Number	0	0	0	2	4	4	Annual	Review of PES contracts between local communities and government authorities	PIU M&E function
IR Indicator 2.6: Area under conservation with a management plan	☐	Ha	0	0	50,000	150,000	300,000	400,000	Annual	Review of management plans	PIU M&E function
IR Indicator 2.7: Area in protected areas in the targeted landscapes with Management Effectiveness Tracking Tool (METT) score over 70	☐	Ha	0	0	30,000	75,000	110,000	150,000	Annual	Field survey	PIU M&E function
IR Indicator 2.8: Farmers reached with agricultural assets and services (disaggregated by sex)	☒	Number	0	0	10,000 (4,000)	15,000 (6,000)	20,600 (8,000)	20,600 (8,000)	Annual	Field survey	PIU M&E function

Indicators, their definition, description and significance

PDO: Increase access to improved irrigation services and agricultural inputs and strengthen the integrated management of natural resources in the targeted landscapes by the local actors and, to provide immediate and effective response to an Eligible Crisis or Emergency.		
Indicators	**Definition**	**Significance**
PDO Indicator 1: *Area provided with new/improved irrigation or drainage services*	**Corporate results indicator.** Annual target and due to interventions under the project. This indicator measures in hectares the total area of land provided with new or improved irrigation or drainage services in operations supported by the World Bank. The underlying indicators include: (i) the area provided with new irrigation or drainage services (ha); and (ii) the area provided with improved irrigation or drainage services (ha) *Irrigation or drainage services* refers to the better delivery of water to, and drainage of water from, arable land, including better timing, quantity, quality, and cost-effectiveness for the water users. *New irrigation or drainage services* refers to the provision of irrigation and drainage services in an area that has not had these services before. The area is not necessarily newly cropped or newly productive land, but is newly provided with irrigation and drainage services, and may have been rain-fed land before. *Improved irrigation or drainage services* refers to the upgrading, rehabilitation, and/or modernization of irrigation or drainage services in an area with existing irrigation and drainage services.	Access to irrigation in the five targeted landscapes is critical to improved rice production and hence related to the Program Goal of increased value of outputs.
PDO Indicator 2: *Farmers adopting improved agricultural technology*	**Corporate results indicator.** Cumulative target and due to interventions under the project. This indicator measures the number of farmers who have adopted an improved agricultural technology promoted by operations supported by the World Bank. *Adoption* refers to a change of practice or change in use of a technology that was introduced or promoted by the project. *Technology* includes a change in practices compared to currently used practices or technologies (seed preparation, planting time, feeding schedule, feeding ingredients, postharvest storage/ processing, etc.). If the project introduces or promotes a technology package in which the benefit depends on the application of the entire package (e.g., a combination of inputs such as a new variety and advice on agronomic practices such as soil preparation, changes in seeding time, fertilizer schedule, plant protection, etc.), this counts as one technology. *Farmers* are people engaged in farming activities or members of a farming business.	Access and use of a palette of agricultural inputs in the five targeted landscapes is critical to improving crop and livestock production and hence related to the Program Goal of increased value of outputs.
PDO Indicator 3: ***Land area under sustainable landscape management practices***	**Corporate Results Indicator**. Cumulative target and due to interventions under the project. This indicator measures in hectares the land area for which new and/or improved sustainable landscape management practices have been introduced through the operation. *Land* is the terrestrial biologically productive system comprising soil, vegetation, and the associated ecological and hydrological processes. *Adoption* refers to change of practice or change in the use of a technology promoted or introduced by the project. *Sustainable landscape management (SLM) practices* refers to a combination of at least two technologies and approaches to increase land quality and restore degraded land—for example, agronomic, vegetative, structural, and management measures that, applied as a combination, increase the connectivity between protected areas, forest land, rangeland, and agriculture land. The following are the "win-win" SLM practices that should be promoted in combination (but may not all apply to PADAP): *Conservation agriculture* is a system characterized by three basic principles: minimum soil disturbance, a degree of permanent soil cover, and crop rotation. For example: soil cover management, crop rotation, minimum tillage, intercropping. *Agroforestry systems* is a collective name for land use systems and practices in which woody perennials are deliberately integrated with agricultural crops and/or animals on the same land management unit. For example: intercropping with trees, alley cropping with trees, improved tree/bush fallows, shelterbelts, hedgerows, parklands, multistory cropping. *Fertility-*	This indicator is primarily measures the range of outputs under the project.

	boosting technologies aim to improve soil fertility and while enhancing soil structure and water infiltration through organic manures, compost, green manure, or mineral fertilizers. For example: green manure, legume inter-planting, inorganic fertilizers, integrated soil fertility management. *Terraces* refers to the practice of reducing slope steepness and/or length. This term also includes permanent vegetative strips, which can develop into terraces over time. For example: terraces, bunds, ditches, vegetative strips. *Irrigation management technologies* primarily enhance water use efficiency, reduce water loss, and prevent salinization or ground water depletion. For example: drip irrigation, improved spate irrigation. *Rainwater harvesting* is the collection and concentration of rainfall runoff for crop production—or for improving the performance of grass and trees—in dry areas where moisture deficit is the primary limiting factor. For example: micro-catchments (planting pits, half-moons, V-shaped), diversion/drainage ditches, cut-off drains. *Pastoralism and rangeland management* refers to managing livestock through free grazing on open-access natural or semi-natural grassland, grassland with trees, and/or open woodlands. The animal owners may have a permanent residence, but the animals are moved to distant grazing areas; the movement is adapted to the availability of resources. For example: grazing on natural or semi-natural grassland, grassland with trees, open woodlands; movement adapted to availability of resources, including temporal overlap with cropland. *Improved grazing land management* refers to the management of cropping systems and livestock on farmland, changing control and regulation of grazing pressure through rotation, (temporal) enclosure, cut and carry, pasture enrichment, and species and fire management. For example: rotational grazing, temporal enclosure (fencing), cut and carry, enrichment planting/improved pastures, eradication of invasive species. *Integrated crop livestock systems* refers to producing both crops and livestock in a coordinated framework that includes livestock management, fodder production, and controlled grazing. For example: fodder production/cut and carry, controlled grazing on cropland, manuring, residue, livestock management. *Natural resource management* refers to all technologies that ensure the sustainable use of natural areas, either by regenerating or protecting them. For example: enclosure, enrichment planting, selective felling, fire management, and extraction of renewable resources (e.g. timber, fiber, nuts, and saps).*Plantations and re-/afforestation* refers to the production of woody and non-woody forest products for themselves and/or for erosion control. For example: production-oriented plantations (commercial; often exotic species), woodlots/belts for protection of catchments, erosion control; bank stabilization. *Catchment management* encompasses a set of different dependent measures in a certain area, with overall planning and management. For example: combinations of technologies, including shelterbelts (wind erosion), dams (macro-catchments), sand dune stabilization, and gully stabilization. *Protected Areas Management* refers to the assessment of how well protected areas are being managed considering context and planning, appropriateness of management systems and processes, and delivery of protected area objectives.	
PDO Indicator 4: Direct project beneficiaries, (of which female)	**Corporate Results Indicator.** Cumulative target. This is an activity indicator that measures the number of beneficiaries that directly derive benefits from the project for example seeds, fertilizer, training etc.	
Component 1: Strengthen information systems and development of landscape management plans		
IR Indicator 1.1: Landscape management plans approved by the National Steering Committee and Regional Monitoring Committees	Cumulative target and due to interventions under the project. 'Landscape management plans' are defined as plans that integrate sectors and zonation as well as biophysical, social and economic factors. Landscape management plans will be approved by the National Steering Committee and Landscape Steering Committees.	The landscape management plans are foundational to the integrated landscape management in the five targeted landscapes and thus related to the two impacts of the Program.

IR Indicator 1.2: Spatial Information System established and operational	Annual target and due to interventions under the project. The spatial information system is a common environment for information sources describing the landscapes (and at national level) organized in a systematic geospatial-explicit fashion to facilitate analyses and to visualize changes in landscapes and outcomes. The framework is organized according to landscape and hydrologic principles at the intersection of biophysical processes and environmental stressors.	The information system provides the evidence platform for the integrated management, and is – amongst others – integrated in to landscape management plans, and hence foundational to the integrated landscape management in the five targeted landscapes and related to the two impacts of the Program. It is also used for some of the indicators in the project results framework. It is established and operational when it receives from the five key ministries (1) agriculture (2) water (3) environment and forests (4) interior (5) meteorology. The data sets to be contributed must be delivered timely and include core data defined for each of the five entities. Examples of required data sets are forest cover, forest area change and soil maps. Required data sets for other agencies will be defined during project implementation. The contributions on environment and forest are crucial and needed to start to the system.
IR Indicator 1.3: Policy Briefs prepared, validated and disseminated to stakeholders	Cumulative target and due to interventions under the project. Policy Briefs: 1 : Transfer of natural resources management responsibilities 2 : Management and maintenance of hydrological infrastructures 3: Payment for Environmental Services 4: Value chain policies 5: Scale up of the landscape approach	Policy briefs are foundational for the many of the interventions under the application of the integrated landscape management approach including the scale up of the approach and related to the two impacts of the Program.
IR Indicator 1.4: Share of target beneficiaries with score 'Satisfied' or above on application of integrated landscape approach in targeted landscapes (disaggregated by sex)	Annual target and related to interventions under the project. The indicator captures demand-side social accountability of the project and the totality of project interventions. It also captures the integrated management of the natural resources and gender aspects.	The citizen engagement indicators on perception of satisfaction of application of the landscape approach. It captures at the level of target beneficiaries the results of the landscape approach as well as gender dimensions. It captures governance in respect of Program Goal.
Component 2: Increase investments and capacity for application of the landscape approach in the selected landscapes		
IR Indicator 2.1 : COBA operational	Annual target and due to interventions under the project. *Communauté de Base* (COBA) are local user groups for transfer of management rights from the state to communities. It *consists of two types of organization: VOI Vondron'Olona Ifotony* ('grassroots community') – local natural resources management group with delegated management responsibility especially in forestry and GCF *Gestion contractualisée des forêts* (Contract-Based Management of Forests). 'Operational' means that COBAs manage forests and other resources according to an agreed upon plan.	The COBA are key to the delivery of forest management outcomes as well as other outcomes in natural resources management by local communities. It is related to the governance and land degradation impact of the Program Goal.
IR Indicator 2.2: Irrigation systems managed by Water User Associations	Annual target and due to interventions under the project. The term 'managed' is defined to include recovery of costs for maintenance and operation of 80%, regular maintenance of irrigation infrastructure and regular meetings of the associations who benefit from improved water management.	Management of irrigation is critical for the sustainability of interventions in this area and relates to the Program Goal on value of outputs from productive sectors.

IR Indicator 2.3: CSAs, STDs and CTDs operational (disaggregated by institution)	Annual target and due to interventions under the project. CSA : Centre de Services Agricoles (agricultural extension centres), status of NGO) STD: Services Techniques Déconcentrés (deconcentrated agricultural services) CTD Collectivités territoriales décentralisées (Decentralized Territorial Units). 'Operational' means that these institutions provide extension services and input to improve value chains.	These institutions are part and parcel of the delivery of agricultural input to the target beneficiaries -especially farmers as extension, technology transfer and access to input will be channeled through them. The indicator relates to the impact of income from productive sectors and livelihoods of the Program Goal.
IR Indicator 2.4: Producer associations which have adopted good practices according to defined criteria	Cumulative target and due to interventions under the project. Good practices are defined in relation to management tools, technology and 'schéma d'aménagement'	The indicator addresses the constraints of producer associations' lack of knowledge on good practices example: harvesting of green vanilla) and relates to the governance aspect of the Program Goal.
IR Indicator 2.5: Pilot Payment for Environmental mechanisms established	Cumulative target and due to interventions under the project.	Establishment of PES pilots is a strategic investment and will based on the lessons learned from the first phase be scaled up in the next phase. It potentially relates to both impacts under the Program Goal.
IR Indicator 2.6: Areas under conservation with a management plan	Cumulative target and due to interventions under the project. Areas under conservation includes protected areas as well as other areas.	Same significance as the landscape management plans but focus specifically on conservation.
IR Indicator 2.7: Area in protected areas in the targeted landscapes with Management Effectiveness Tracking Tool (METT) score over 70	Annual target and due to interventions under the project. Targets is based on a simple average of METT scores for the protected areas in the five landscapes. The Management Effectiveness Tracking Tool (METT) is a simple and rapid assessment of a site's management, and designed specifically for protected but can be used for other managed areas as well. It is a set of questions that have been designed to be easily answered by those managing the protected area without any additional research. The target of a METT score of 70 compares to the average METT score from 30 protected areas under the Third Environmental Program Support Project (P07235).	The METT score captures the improved management of protected areas and is a proxy for conservation of biodiversity.
IR Indicator 2.8: Farmers reached with agricultural assets and services	**Corporate results indicator.** Annual target and due to interventions under the project. This indicator measures the number of farmers who were provided with agricultural assets or services as a result of World Bank project support. Assets include property, biological assets, and farm and processing equipment. Biological assets may include animal agriculture breeds (e.g., livestock, fisheries) and genetic material of livestock, crops, trees, and shrubs (including fiber and fuel crops). Services include research, extension, training, education, ICTs, inputs (e.g., fertilizers, pesticides, labor), production-related services (e.g., soil testing, animal health/veterinary services), phyto-sanitary and food safety services, agricultural marketing support services (e.g., price monitoring, export promotion), access to farm and post-harvest machinery and storage facilities, employment, irrigation and drainage, and finance. Farmers are people engaged in farming activities or members of a farming business.	Access and use of a palette of agricultural inputs in the five targeted landscapes is critical to improving crop and livestock production and hence related to the Program Goal of increased value of outputs.

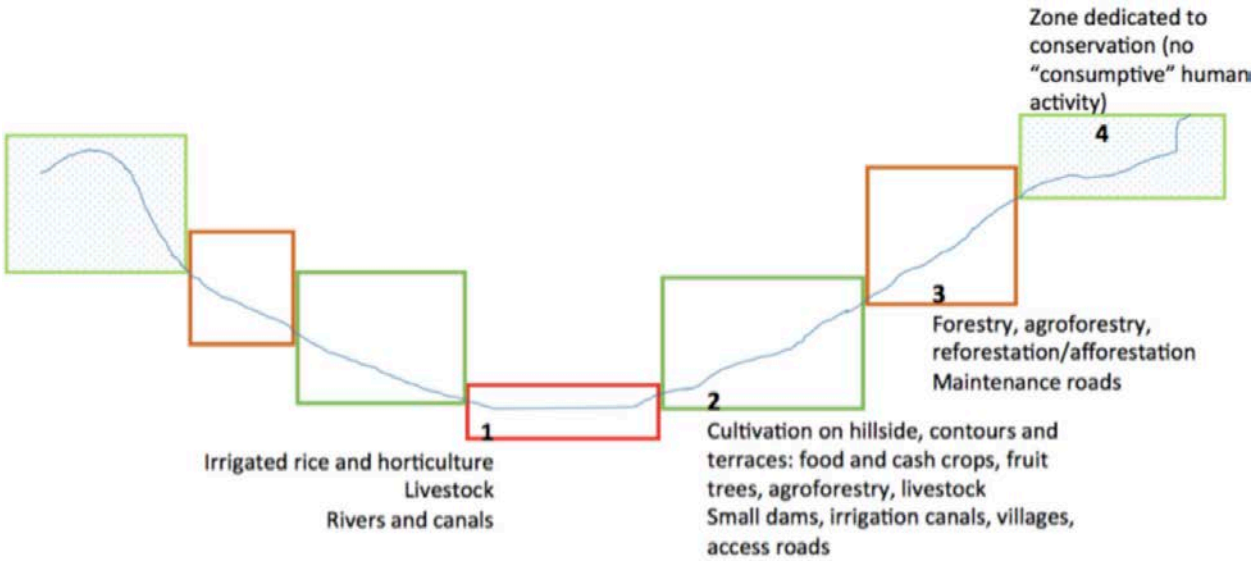
ANNEX 2. DETAILED PROJECT DESCRIPTION

1. Project approach

1. For the purpose of the Project, a *landscape* is physically defined as the set of watersheds that are the source of water for a selected irrigation scheme. Hence, the physical boundaries of the landscape are the scheme's furthermost downstream boundary and the ridgelines of the watersheds. The reason for this definition of landscape is that most externalities affecting agriculture and the irrigation schemes are linked to the local hydrography. In fact, irrigation is threatened by high sediment loads in the rivers which then clog the irrigation canals. The sedimentation is caused by deforestation in the upper watershed as populations use hillsides to practice rain-fed agriculture, mine forests for charcoal and timber and clear land for cattle grazing and agriculture.

2. A landscape is made up of several land uses for different purposes, such as agricultural land, pastoral land, forests, and protected areas. As depicted in Figure 3, Land type 1 is the irrigated bottom of a valley with its rivers and main canals, where rice, horticulture and livestock are most prevalent. Land type 2 are the slopes where contours and terraces are (or should be) found, with livestock, various agriculture and tree fruit production. Land type 3 is the higher hillside where reforestation and afforestation through forestry and agroforestry are possible. Land type 4 represents the protected area where no human activity should take place. The landscape approach ensures that land uses in each land type are compatible across the landscape, while maximizing income generation opportunities for the population.

FIGURE 3. MAIN LAND USE TYPES IN A LANDSCAPE



3. The landscapes targeted by the Project include: Andapa (SAVA region); Iazafo and Soaneireana-Ivongo (Analanjirofo Region), in the Eastern coastal zone agro-ecoregion; and Bealanana (Sofia Region); and Marovoay (Boeny Region), in the North-Western low altitude plains agro-ecoregion. More details on these sites and a map are provided in Annex 5.

4. For each landscape, the project supports planning (Component 1) and implementation (Component 2). Activities across components are phased in a way that balances the need for integrated planning with the need for immediate investments in priority areas. The first component aims at developing the information base for planning and at strengthening the policy framework for implementing the landscape approach at the level of the selected landscapes and nationally. The second component aims at implementing the approach in the selected landscapes with an accent on productive investments, conservation of key ecosystems and capacity building. The planning effort under Component 1 will help identify investments and capacity building in a comprehensive way for each landscape. However, to ensure benefits accrue to local populations early on, a number of no-regrets investments (including rehabilitation of irrigation canals, reforestation, and slope stabilization) and capacity building activities have already been identified and these will be undertaken in parallel to the development of the landscape management plans.

5. Effective landscape management requires a range of instruments. Many improvements in landscape management are win-win, and can be induced with traditional instruments (Technical Assistance [TA], support to inputs, value chain improvements, etc). Some land use changes, however, are desirable because of their downstream (water services) or global (carbon sequestration, biodiversity) benefits, and are not necessarily in the landholders' own interests. To achieve these changes, traditional instruments will thus be complemented with Payments for Environmental Services (PES) (see Annex 7).

2. Description by component

Component 1. Information and planning (US$4.9m [US$3.2m IDA; US$1.2m AFD; US$0.5m GEF][19])

6. Activities under this component aim to build the analytical capacity, develop the planning tools, and promote a conducive policy environment that will allow for a landscape management approach to be developed in detail and take root. Component 1 forms a foundation on which the landscape management approach will be tested and implemented, and scaled up during subsequent phases of the program.

7. Component 1 will be measured by five intermediate indicators: 'Landscape management plans approved by the National Steering Committee and Regional Monitoring Committees', 'Spatial Information System operational', 'Policy Briefs prepared, validated and disseminated to stakeholders' and 'Share of target beneficiaries with score 'Satisfied' or above on application of integrated landscape approach in targeted landscapes'. Further details are provided in Annex 1.

Sub-component 1.1. Data collection and decision support tool (US$2.5m [US$1.6m IDA; US$0.6m AFD; US$0.3m GEF])

8. In Madagascar, a large amount of natural resource, social, political, and economic data are needed for effective planning and decision making in the face of a growing population, changing land use, and climate change drivers. Through TA, the project will support the development of a Spatial Information System, an approach that has been used in other regions of the world to organize data and information, provide access to authorized users, and facilitate use of the data for planning and decision making. The SIS will cover the entire country. It will inform strategic

[19] Minor discrepancies are caused by contingencies that have been applied.

planning at the national level (e.g. options for achieving selected development or environmental targets at the national level); and inform, at a higher level of spatial resolution, the development of landscape management plans in the project areas. The companion LAUREL TA activity[20] will provide access to high level experts on spatial modelling and planning, and support the development of the methodology for the decision support tool at both the national and landscape level of decision making, including through the development of a prototype SIS prior to project effectiveness.

9. **Technical and institutional preparation for the development of an SIS.** Preparation in year 1 of project implementation, a national expert team of 10-15 persons will be established, with 2 or 3 focal points from each key line Ministry (MPAE, MEEF, MEAH and M2PATE), and additional focal points from academia and national research centers that are active on the domain of geo-spatial analysis. An initial workshop early in project implementation to be facilitated by the LAUREL expert team, will be a key starting point. The workshop will: (a) define the expected outputs of the SIS at the national level and the data inputs required for generating those outputs; (b) confirm landscape boundaries (including scale); (c) define initial key landscape level questions and goals: historical/futures scenarios of land use change; (d) initiate compilation of available data layers[21]; (d) evaluate available hydrology models in use in Madagascar (commercial and open-source e.g. Soil and Water Assessment Tool [SWAT], Variable Infiltration Capacity [VIC], Distributed Hydrology Soil Vegetation Model [DHSVM], others), decide on the suite of models that will form the core of the SIS and Component 2.1, and identify the institutional hosts for the SIS data compilation and hydrological modeling activities; and (d) allocate responsibilities among the SIS focal points for data layer acquisitions.

10. **Construction of an SIS.** During the first two years of project implementation, the SIS will be assembled by the national expert team, with the assistance of an international team. Activities will include: (a) demonstration and evaluation of the SIS prototype developed as part of the LAUREL NLTA; (b) data quality evaluation; (c) identification of data gaps; (d) planning and programming of additional and/or new data acquisition (global and local data sets); (e) parameterizing selected hydrological models (basin scale/watershed scale) and running the model for historical condition (back casting); (f) running the routing model; and (g) calibrating and validating initial results.

11. **Introduction of SIS outputs to decision makers.** Once the SIS is sufficiently constructed, it will be used to run "managed" scenarios, including: (a) scenarios of projected evolution of selected development and environmental variables at the national level; and, at the level of the landscapes in the project area; (b) land cover land use change; (c) the contribution of such changes to climate change, following Intergovernmental Panel on Climate Change Fifth Assessment Report (IPCCAR5) methods, including changes in emissions and changes in vulnerability to climate change (e.g. reduced vegetation cover can make landscapes more vulnerable to more intense

[20] Land Use Planning for Enhanced Resilience of Landscapes (LAUREL), a Bank-funded Non-Lending Technical Assistance program.

[21] Including (i) Shuttle Radar Topographic Mission (SRTM 90 and/or 30m conditioned digital elevation models); (ii) National soils map, with soil properties /default FAO soil map; (iii) Landsat-derived data layer of land cover and land use; (iv) Biodiversity maps, forest carbon and disturbance, infrastructure (roads, rail, dams, canals) maps; (v) River stage and discharge time series from stream gauge network (if available); and (vi) Precipitation and temperature time series data from meteorological station network (local and WMO).

rainfall); (d) land degradation rehabilitation; and (e) paired catchments. The PADAP-SIS will also provide information on what landscape management interventions are most likely to contribute to improved livelihoods and climate resilience, thus providing key inputs for the update of landscape management plans and policy and investment choices at national level decision making. The results will be visualized for resource managers, local government, and national policy makers. National workshops to discuss and disseminate SIS outputs and to inform project activities will be held at regular intervals. As needed, the national expert team will update the SIS data layers, refine simulations, and run new simulations.

12. **Knowledge management and planning capability.** An important function that will be supported under this sub-component is the development of institutional capability for knowledge management, learning, and program and policy planning. This would be relevant at the local landscape level during the life of the project, as well as at the central level for the design of future operations within the Program. It requires the M&E function and other qualitative implementation learnings of Project activities to feed back into the SIS and subsequent planning processes, both in the short (Project) term and in the longer (Program) term.

Sub-component 1.2. Preparation of selected Sustainable Landscape Management Plans (US$1.6m [US$1.1m IDA; US$0.4m AFD; US$0.2m GEF])

13. This sub-component will finance the preparation of SLMPs. Activities under this component will be initiated before project effectiveness under the project preparation advance so that they can then inform subsequent project activities.

14. **Development of a guidance note for the preparation of SLMPs.** The guidance note is intended to help preparation of the first five SLMPs. It will be subject to updates as new lessons are learned during preparation and implementation of the SLMPs. The guidance note will describe a process for taking into account information from existing Municipal Land Management Plans (MLMPs), Municipal Development Plans (MDPs), Regional Land Management Plans (RLMS) and Regional Development Plans (RDPs). It will provide details on how to integrate key aspects of sector plans and strategies into the SLMPs. Examples of sector plans include the Integrated Water Resources Management strategy, the plan for forest restoration, afforestation and reforestation and the Protected Areas Management Plans. It will describe a process for the use of the information produced under the SIS and the available information on hydrological stresses, deforestation, erosion risk, land productivity, and for the identification of key agricultural development zones, the development of communal pastures, and the development of community forest schemes, among others. It will also include the instruments needed to induce land use changes, including identifying the need for PES and other non-traditional instruments if needed.

15. **Development of five SLMPs.** Based on the guidance note, SLMPs will be prepared for the five selected landscapes. It is expected that the SLMPs will be developed within the first two years of project implementation. The SLMPs will typically include a diagnostic of the landscape (physical, economic, social, and institutional); an analysis of existing planning efforts at the decentralized level (region and municipality) and the sector level; an analysis of the threats to production, natural resources and livelihoods; an assessment of options for intervention; an intervention plan (with specific investments in agriculture, livestock, water resources management, agro-forestry, forestry, protected areas management); and a financing strategy.

Sub-component 1.3. Policies for landscape management (US$0.7m [US$0.5m IDA; US$0.2m AFD; US$0.1m GEF])

16. **National landscape management practice note.** The preparation of a landscape management methodology that would ultimately contribute to a national strategy is an important deliverable of the Project. It will be based on the guidance note and subsequent landscape management plans prepared for the five existing landscapes (under Sub-component 1.2) and will allow application of the project concept to new regions and areas of the country. The methodology will describe the process by which rural development and natural resources management should be approached in new landscapes. The note, targeted mainly at the MPAE, MEEF, MEAH and M2PATE, will detail: (i) data needs, describing the use of a functional SIS that integrates multi-sector, geospatially referenced data layers (agriculture, biodiversity, climate, forests, water, and infrastructure); and (ii) procedures for preparing SLMPs, regional development plans and municipal development plans. The note will be prepared starting from year 3 of project implementation, to allow lessons learned during years 1 and 2 to inform the document.

17. **Policy on the transfer of management of natural resources.** This activity is expected to take place in year 1 of project implementation. Through its *Gestion Locale Securisée* (GELOSE), and in the specific case of forests, *Gestion contractualisée des forêts* (GCF) or *Contract-Based Management of Forests* laws, Madagascar has in many cases transferred the management of natural resources to local community organizations COBA. These organizations constitute critical partners in implementing the landscape approach. There is extensive literature on the strengths, weaknesses and scope for improvement of the management transfer legal framework. Consultants will be recruited to take stock of such literature and propose specific changes to the legal and regulatory frameworks to increase their effectiveness. This will include the development of regulatory measures in application of GELOSE for other relevant natural resources (e.g. water bodies).

18. **Policy on operation and maintenance of water infrastructure.** This activity is planned for the second year of project implementation. In order to improve the sustainability of public water infrastructure such as dams, weirs, canals, and pumping stations, the project will provide technical assistance to develop a policy and an institutional and regulatory framework. In particular, the TA will allow the development of regulatory measures in application of Law 2014-042 of 9 January 2015 on the Restoring, Management, Maintenance, Preservation and Policing of Hydro-Agricultural Networks). The basic premise would be that water user charges will cover the cost of operation and maintenance (O&M) of public infrastructure in conformity with the Law. In addition, this activity will support the revision of the national standards for climate resilient infrastructure (Normes de construction des Infrastructures Hydroagricoles contre les Crues et les Inondations [NIHYCRI]).

19. **Policy notes on value chain governance at the local level.** Poor governance within a number of value chains is a key constraint in the agriculture sector in that product quality and safety is negatively affected.[22] Unless value chain actors take corrective action in a consistent and unified manner, the future of these value chains is in doubt. The project will support key value

[22] For example, early harvesting of vanilla is increasingly encouraged by local buyers, leading to a general decline of the quality of Madagascar's vanilla in key export markets. Similarly, the quality of clove oil has deteriorated due to contamination with other oil-like substances that increase volume and weight, with negative consequences for Madagascar's reputation in key export markets.

chains in improving governance by establishing a code of conduct and by sensitizing farmers, traders and processors on the risks. The diagnostic work will be carried out by value chain specialists during the first year of implementation.

20. **Policy on payment for environmental services (PES).** This activity is expected to commence in the second year of project implementation. PES would provide an important tool to encourage adoption of land use practices that benefit downstream water users and others but that are not profitable from the perspective of local landholders. Based on experiences in the landscapes covered by the Project and elsewhere, a policy framework for PES will be developed that is realistic and effective. This framework would be highly complementary to the water infrastructure policy and regulatory framework in which water charges would contribute to ensuring the sustainability of irrigated areas.

Component 2. Investments and capacity building in the selected landscapes (US$93.8m [US$55.8m IDA; US$23.1m AFD; US$13.2m GEF; US$1.5m beneficiaries contribution; US$0.2m Borrower contribution])

21. This component will support on-the-ground implementation of the landscape approach. It will facilitate and finance preparation, implementation, monitoring, and scaling-up of investments to improve agricultural performance and effective natural resources management in a landscape context, as well as build local structures' capacity for effective and long-term adoption of improved practices. Effective adoption of the approach and its sustainability will depend on the capacity present in the very landscapes to implement it, but also on the tangible economic impacts that the approach yields.

22. Investments and capacity building under this component are operationally divided into two groups: (1) no-regrets investments and capacity building in priority watersheds; and (2) investments and capacity building in remaining watersheds and scaling up in line with the SLMPs. No-regrets activities have already been identified during project preparation using spatial tools and field missions to identify watersheds, within the selected landscapes that have the following features: (i) high levels of degradation in upstream areas; (ii) highly degraded irrigation networks in downstream areas; and (iii) institutional readiness, as measured by the existence of planning exercises and organized local communities. No regrets investments and capacity building in the selected watersheds will include: (i) rehabilitation of irrigation canals; (ii) reforestation with indigenous species of erosion prone areas; (iii) reparation of terraces; (iv) training to local authorities and decentralized staff from line ministries; and (v) developing activities plans of local community organizations.

23. Component 2 will be measured through the following intermediate indicators: (1) 'Number of COBA operational'; (2) 'Irrigation systems managed by Water User Associations'; (3) 'CSAs, CTDs operational'; (4) 'Producer associations which have adopted good practices according to defined criteria'; (5) Pilot Payment for Environmental mechanisms established'; (6) 'Area under conservation with a management plan'; (7) 'Area in protected areas in the targeted landscapes with a METT score over 70; (8) 'Farmers reached with agricultural assets and services'.

Sub-component 2.1. Capacity building (US$10.7m [US$7.0m IDA; US$2.6m AFD US$1.2m GEF])

24. Through this component the Project aims at establishing the capacity of decentralized authorities (namely regions and municipalities) and deconcentrated authorities (the representatives of central ministries in the regions) to effectively manage the landscape in an integrated way. A key target for capacity building activities will be the RMCs and the RIUs. Other key stakeholders targeted by this sub-component include: (i) local communities managing natural resources; (ii) staff of the decentralized administration in selected municipalities, districts and regions; (iii) locally based and national sector staff from key line ministries; and (iv) researchers in specialized technical agencies, including academia, and private sector research organizations.

25. Coordination among the individuals and structures responsible for forest, water, agriculture, and land management will be a key element for effective implementation of the Project. Today, coordination is rare, and the use of spatial tools such as maps and satellite information is virtually inexistent. The main aim of this sub-component is to correct these weaknesses so as to support fast and sustainable development and build a strong base for subsequent phases of the Program. This will require significant capacity building. The project will therefore finance capacity building activities at different levels mainly through TA.

2.1.1. Local community organizations capacity building

26. Capacity building will be provided to strengthen the supervision of local community organizations responsible for natural resource management (COBA; Water User Associations [WUAs]; villages at large etc.) and other community associations so that they can fully assume their responsibilities related to natural resources management, and particularly for water resources management and O&M of irrigation systems; forest conservation; agroforestry; and fire management (bush and forests). The project will also support the establishment of relevant community associations if needed. This capacity building will be undertaken under the GELOSE framework, which allows the management transfer of a range of natural resources (pasture land, forest, water, etc.). The project will also aim at replicating successful approaches adopted elsewhere such as the JICA supported LIFE approach.[23]

27. **Natural resources users associations, or COBA:** The project will finance capacity strengthening of existing natural resources (including forests and other renewable natural resources) users associations. It will specifically finance four main areas: (i) technical support: planning and work plan implementation, providing support to the COBA to undertake ecological monitoring of resources, apply improved techniques for water management, logging/timber processing, use of improved stoves, charcoal production, among others; (ii) rules/law enforcement: providing support to regulating access, effectively implement customary laws (or Dina), reporting infractions to higher instances if necessary; (iii) resources management (finance, human, equipment): training on transparency and accounting, in order to address one of the main causes of COBA dissolution such as the mismanagement of the group's resources; and (iv) strengthening partnerships with stakeholders, including the DTDs/DTCs. The project will also finance the

[23] LIFE refers to "Lahasa Ifandrombonana ho Fampandrosoana ny ambanivohitra sy Enti-miaro ny tontolo iainana" (Series of community-based actions for rural development and environmental conservation). The approach is a model for supporting rural development and soil conservation through capacity building, by means of mass training events to local communities, and promotion of long-term sustainability, by training trainers to reproduce the capacity building and the monitoring of actions.

establishment of new COBA. Establishment will involve: information/awareness campaign on the local benefits of sustainable resources use, group structuring, consultations for delineating the area or natural resource to be transferred, conducting socio-economic studies, forest/ecologic inventories, zonings, establishing the Dina, developing documents related to the natural resources management transfer from the Government to the community. This will be done by hiring consulting firms, typically Non-governmental organizations (NGOs), and individual consultants, to be recruited both locally and from outside the community.

28. **Water users associations (WUAs):** The Project will finance the development of an incentive framework for efficient operations, maintenance and sustainability of the irrigation schemes by the WUAs, including where appropriate contribute to compensating upstream landholders who maintain conservation practices that protect those schemes, and the costs of operating the PES programs. Until the early 2000s, the central Government was responsible for O&M of irrigation schemes. However, decentralization of the O&M function to WUAs and federations of WUAs has not resulted in significantly improved O&M. The capacity and performance of the WUAs across the landscapes vary; some are reasonably well established and functioning, while others are informal or completely defunct. Contributions in cash for the O&M costs vary from one WUA to the other, but remain generally weak, with recovery rates rarely exceeding 60 percent of costs. This is partly because of: (i) the rapid degradation of infrastructure which requires frequent rehabilitation; (ii) low willingness to pay by the WUAs; (iii) low capacity of WUAs to carry out O&M; and (iv) lack of support from local authorities. It is also important to note that the erosion of upstream watersheds is weighing heavily on the O&M costs. In some areas, WUAs have not been collecting O&M fees for several years, since the majority of users refuse to pay, as they are no longer benefiting from water infrastructure. This sub-component will therefore help to clarify the respective roles and responsibilities of stakeholders for O&M and specifically build the capacities (technical, managerial, financial) of the WUAs; and establish the right incentive framework for efficient operations, maintenance and sustainability of the irrigation schemes by the WUAs. This component will also strengthen the collaboration between WUAs and COBAs. Where appropriate, WUAs will contribute to the efforts to maintain conservation practices upstream of the irrigation schemes.

29. **Livestock producer groups: Promotion of improved livestock grazing and water points to avoid soil erosion.** The Project will finance capacity building for the local administration in charge of land use and to the leadership of livestock producers and farmers located in target areas. This capacity building will focus on the need to control animal grazing and watering in order to reduce grass and bush burning that is one of the main causes of soil erosion and major downstream siltation of rivers and canals in some of the landscapes. Cultivation of fodder crops and better management of common pastures and animal watering points would provide alternative feeding solutions. A service provider will be required for this activity at field level with the participation of Government animal production experts.

30. **Social protection and erosion control.** The Project will support a cash-for-trees program that will provide incentives for smallholders to reforest lands in the watersheds surrounding the irrigated areas, combining the dual objective of social protection in the poorest communities with erosion control. Public land parcels have not had a successful history of reforestation in Madagascar. To ensure the sustainability of investments made under this subcomponent, the Project will support a rapid and low-cost conditional cash-for-trees approach. The service provider for the cash-for-trees approach, selected from among a group of agencies or NGOs specialized in

this type of programs, will be responsible for monitoring planted trees and paying the incentive amounts. The incentive will be reasonably priced according to the daily agricultural wage in each region and will be offered to communities living upstream of the irrigation schemes rehabilitated by the project (in other words, it will be properly targeted). Details of the design and implementation of this activity will be included in the PIM.

2.1.2. Municipal, district, and regional level capacity building (decentralized territorial units)

31. **Regional public service planning capacity.** The Project will finance capacity building activities (through TA) to encourage/induce regional heads of Government, mayors and their teams to apply a landscape lens to inform territorial planning through Municipal/Regional Land Management Plans, and Municipal/Regional Development Plans. Consequently, the project will also work to ensure that water resources management, forest management and conservation areas management aspects are integrated into the land use and other territorial plans and vice-versa. This is an endeavor that will be supported throughout the project life and is expected, over time, to contribute to the long term sustainability of project activities.

32. **Natural resources management.** One River Basin Agency, under the responsibility of the MEAH, will be established as a pilot in the Boeny Region. A feasibility study will assess the financial and staffing requirements, and identify the necessary financing sources. The agency will be staffed, to the extent possible, through reassignment of ministerial staff, and technical assistants will be hired as required. Support will be provided for the development of the river basin plan for this area. A hydrological model to help the River Basin Agency with integrated land-water use planning will also be developed. The River Basin Agency will be responsible for managing the water resources within the given river basin and ensuring the availability of water resources across the water-using sectors. The development of further River Basin Agencies would be based on lessons learned during this first project. In addition, the ability of regions and municipalities to supervise the implementation of contracts for the transfer of management of natural resources, such as forests, to local communities will be strengthened through the provision of technical assistance (individual consultants), the preparation of manuals, the provision of equipment and the financing of operational costs.

33. **Local land administration.** Using the methodology and implementation modalities developed under the World Bank funded Agriculture Rural Growth and Land Management Project/*Projet de Croissance Agricole et Sécurisation Foncière (CASEF)* project, support will be provided to communal land offices in the project areas to strengthen local capacity for implementation of land rights registration and land administration. The following activities are planned: (i) updating land archives and consolidation of "local land occupancy status maps" *Plans Local d'Occupation Foncière* (PLOFs). Technical support will be provided to regional land administration services to complete the PLOFs at the local level and make them more reliable; and (ii) Issuing land certificates by Communal Land Offices by expanding the local land titling process through field operations by private service providers that combine systematic land census and land rights certification and supporting municipalities to improve the capacities of their Municipal Land Offices.

2.1.3. Sector level capacity building (including national and deconcentrated ministerial units)

34. **Agriculture and forestry technology developers and service providers.** TA will be provided to key agriculture service delivery providers. CSA have been identified as a key institution with a local presence to assist producers to identify product-market combinations and introduce producers to new crops, crop varieties, and input technologies. Linkages between the existing CSA network and Madagascar's National Center for Applied Research and Rural Development, FOFIFA, will also be supported for the promotion and adoption of new technologies. The Agriculture Development Fund/*Fonds de Développement Agricole* (FDA), including its regional branches *Fonds Régional de Développement Agricole* (FRDA) are beginning to develop capacity for managing local projects and could be supported under the project, starting with capacity building. TA to CSA, FOFIFA, and FDA/FRDA will therefore strengthen extension, advisory, technology transfer services and local project management capacity. The focus will be on market linkages, productivity improvements, and the promotion of climate smart agriculture technology to enhance resilience. TA will be provided to university and research institutions to develop identification tools and taxonomic references for timber species so as to provide the information base for sustainable exploitation and international trade that is non-detrimental to the species' survival. TA will also be provided to identify options for harnessing the value of genetic species under the Nagoya Protocol framework.

35. **Agencies in charge of forest and natural resources management.** The Project will finance TA and equipment to the relevant sector agencies to implement the SLMPs, and forest management plans as applicable, in collaboration with decentralized authorities; conduct participatory monitoring activities and inventories (and ensure quality of data collection); conduct patrols, and report infractions. This will include technical assistance to strengthen regulations for managing forest resources and management transfers under the GELOSE framework, including allowing the functioning of the law enforcement and justice system. The activity will also support forest resources surveillance and monitoring, including through satellite, aerial and maritime means. Peer learning through exchanges with other stakeholders from other landscapes will also be emphasized.

36. **Water resources management agencies.** Technical assistance will be provided to review the roles and responsibilities of *L'Autorité Nationale de l'Eau et de l'Assainissement* (ANDEA) including the functioning of the National Fund and capacity building to complete the inventory of water resources and ensure coherence of the Master Plan with the SLMPs. ANDEA is responsible for policy development and the following aspects among others : (i) coordination of the integrated management of water resources; (ii) making an inventory of water resources; (iii) coordinating the implementation of the Master Plan for Water Resources by watershed in collaboration with the related Ministries and agencies; (iv) coordination of the activities of the Basin agencies in relation to the development of the Master Plan and for the execution of the work and studies programmed within river basins; and (v) mobilization and management of the National Fund for water resources management. However little progress on these aspects has been made to date and the country still faces many challenges including very limited integrated management of water resources; insufficient sector coordination; a multiplicity of national actors and proliferation of institutions with fragmentation and overlap of activities. These factors lead to the dispersion of effort and irrational spending of the financial means available, with disappointing results.

Sub-component 2.2. Productive investments (US$75.2m [US$48.8m IDA; US$20.5m AFD; US$4.6m GEF; US$1.0m beneficiaries contribution; US$0.2m Borrower contribution])

37. The need to adopt a landscape approach to agricultural intensification and natural resources management in Madagascar's watersheds is urgent, based on the inter-related nature of challenges in the upstream and downstream areas of the watershed. This approach should aim at: (i) putting in place more climate-resilient infrastructure to protect from recurrent damage caused by frequent floods and hurricanes; (ii) establishing an appropriate incentive and financing framework for efficient operation and maintenance of irrigation infrastructure; and (iii) soil and water conservation in upper watersheds. Activities under this sub-component therefore aim to address the constraints that cause low productivity and resilience of systems.

2.2.1. Infrastructure

38. **Water Resources Management and Irrigation (US$26.6m).** Many irrigation systems used for the production of rice and other staples have deteriorated, and as farmer incomes have declined, many farmers are unable to invest in the maintenance needed to keep the water and irrigation infrastructure in good working condition. In the targeted landscapes, a significant portion of the water storage and conveyance infrastructure is silted up, and combined with changes in the flow regime of the rivers (especially the reduction of dry-weather flows), about 30-50 percent of rice fields are no longer adequately irrigated. To reverse the decline in irrigation capacity and preserve the country's food production capacity, this subcomponent will support the rehabilitation and maintenance of water and irrigation infrastructure and systems. All infrastructure rehabilitation will follow a "build back better" approach and NIHYCRI standards for climate-resilience.

39. Approximately 14,000 ha will be rehabilitated. Activities in land types 1 and 2 will include: (i) recalibrating, reshaping and compacting canals, drains and intakes supplying irrigated areas; (ii) construction and rehabilitation of small dams (walls, gates, diversion canals, etc.); (iii) installing or rehabilitating hydrological monitoring equipment; (iv) installing or rehabilitating pumping stations using solar technology; and (v) improving water-use efficiency, including land-leveling and piloting drip irrigation systems where appropriate. Small agricultural equipment and machinery will also be provided to the WUAs for regular maintenance of the irrigation schemes. Technical design studies, civil works, and construction supervision as well as supply and installation of equipment will be financed. Investments will be determined in a competitive way such that the better performing WUAs (in terms of O&M cost recovery) will be prioritized for investment. To reduce the risk of destruction of irrigation infrastructure by free roaming livestock, watering points will also be constructed in strategic locations. Box 1 and Table 4 show a typical irrigation scheme and the estimated area in each of the landscapes to be rehabilitated respectively.

Box 1: Andapa Irrigation Scheme: The Andapa basin has a potential cultivable area of 12,000 ha subdivided in 26 perimeters, half of which are small traditional perimeters between 50 and 250 ha cultivated either as rain-fed or partially irrigated. The existing irrigation networks comprise small dams or diversion weirs (2m or 3m high) with limited water flow control. Many of the perimeters are no longer operational because several canals are completely silted due to degradation in the upper watersheds. There are 9 formal WUAs; but most are informal. A few perimeters have benefited from other WB projects but some complementary interventions, such as land-leveling, improved water flow control and strengthening WUAs are necessary to ensure the proper functioning and sustainability of the scheme.

40. **Hillside stabilization and forest landscape restoration (US$14.5m).** All the selected landscapes are characterized by degraded hillside. In areas featuring land types 2 and 3, the Project will support community-led activities to improve the management of hillside agriculture, including the construction of terraces and contours (totaling 6,000 ha across the five landscapes), and the stabilization of gullies (500 ha across the five landscapes). The construction of terraces and contours, and when needed water management systems, will be undertaken either through specialized firms working under contract or through cash-for-work programs, depending on the complexity of the work needed. Diagnostics will be financed through landscape-specific studies and will be followed, as required, by feasibility studies. The activities under this sub-component will also finance work to stabilize active gullies in selected watersheds. The works will include sand barriers (in concrete or with local materials, as appropriate) and planting of endemic species that will allow to halt erosion processes.

41. Forest landscape restoration will include the protection of river banks and the stabilization of gullies (lavakas), aimed at restoring critical ecosystem services. The Project aims to arrest and eventually reverse the ongoing land conversion and degradation in the area in a manner that will maximize ecological connectivity and hydrological function in the landscape. The Project will also demonstrate the potential and inform future implementation of forest friendly land rehabilitation approaches to leverage the much larger land husbandry investment programs being led by the agriculture sector, as well as any potential future investment programs in the water resources or forestry sectors that may also be interested in adopting the approach. The planting of endemic species of trees and complementary activities which may include mechanical stabilization structures, to protect river banks is expected to cover about 1,500 ha of land. It will also include the mobilization of local communities for reforestation campaign targeting particularly sensitive areas in each of the five selected landscapes. The activity will target 37 municipalities across the five landscapes and will include 50 training events aimed at training local communities and local government authorities in forest landscape restoration options. These activities will be implemented at the community and communal level using participatory methods to secure buy-in from beneficiaries. Equipment and tree planting inputs will be provided for each of the five landscapes.

TABLE 4: EXPECTED AREAS TARGETED BY WATERSHED MANAGEMENT INVESTMENTS

Region	Landscape	Irrigation area to be rehabilitated (ha)	Hillside stabilization area (ha)	Gully treatment (ha)	Erosion control in river banks (ha)
SAVA	Andapa	3,000	357	81	89
Analanjirofo	Iazafo Vavatenina	2,000	107	10	143
	Soanierana-Ivongo	5,000	2,701	95	889
Boeny	Marovoay	2,000	123	100	56
Sofia	Bealanana	2,000	3,009	228	381
TOTAL		**14,000**	**6,297**	**514**	**1,559**

42. **Feeder road maintenance (US$5.5m).** The Project will finance rehabilitation of critical spots on economically strategic existing feeder roads. The criteria for road selection are related to the potential economic return (production potential of catchment area, number of producers, real market linkages). In addition, the Project will finance: (i) TA for the establishment of maintenance financing schemes; (ii) tailored pilots for local feeder road maintenance programs in targeted areas, including the identification of stakeholders' responsibilities and mechanisms for local financing, governance, and accountability; and (iii) provision of training and equipment for the project managers (*maîtres d'ouvrages*).

2.2.2. Support to partnerships with the private sector (US$7.4m)

43. **Strengthening market linkages in agriculture.** In collaboration with the CSA network, the Directorate of Plant Protection (Direction de Protection de Végétaux, DPV), and the various value chain organizations (e.g., value chain organizations for vanilla, clove, ginger, rice, and other tradeable commodities) and individual market players in the project areas, the Project will provide TA to enhance linkages between producers and the market. TA will focus on technical and logistical aspects of aggregation and post-harvest quality control with the aim of improving the ability of local farmers to respond to the requirements of the industry and improve their position in the supply chain. It will also focus on mechanisms to favor the establishment of input providers in production areas. The main delivery mechanism will be TA in close collaboration with CSA, other agriculture support institutions, and value chain organizations.

44. **Value chain governance mechanisms and regulatory enforcement.** Based on the needs identified by value chain stakeholders, TA will be provided to implement stakeholder-led governance mechanisms and regulatory service provision, including implementing mechanisms to enforce quality standards, where possible using public-private arrangements, and supporting the use of laboratory equipment where possible. This activity will complement similar efforts under the CASEF project and provide implementation support at the local level in the Project areas and respective regional market centers where appropriate.

45. **Storage and processing facilities.** In partnership with the private sector, the Project will support the rehabilitation or construction of agriculture storage facilities, crop processing units, and livestock holding and processing facilities, and pilot processing units for precious and non-precious timbers. Support will be provided based on demand by value chain actors and may take the form of TA and equipment. Where commercial financing is required, the Project will provide TA for the preparation of loan proposals in close collaboration with the Partial Credit Guarantee Agriculture window operated by the fund manager SOLIDIS (financed by CASEF).

46. **Developing silviculture approaches in forestry.** The project will: (i) pilot forest plantations of native species for exploitation of wood products (hardwood, including precious woods, and energy wood); (ii) establish an *Indication géographique protégée* (IGP) label for the iconic chains areas; (iii) strengthen regulations and information dissemination for managing forest concessions in compliance with Forest Law Enforcement, Governance and Trade (FLEGT) standards; (iv) develop identification tools and taxonomic references for timber species so as to provide the information base for sustainable exploitation and international trade that is non-detrimental to the species' survival; (v) establish and implement a mechanism for inventorying, grading and tracing stockpiles of timber, including those under the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) Action Plan for precious woods; (vi) identify the most relevant model for engaging the private sector to help regenerate forest

resources; and (vii) steer the approach in precious woods management (including site identification, monitoring and stock assessment, and establishing a pilot transformation unit). In addition, the Project will support a plan to transparently manage precious wood stockpiles accumulated during the 2009-2013 crisis, and still held by private sector operators, with the objective of supporting compliance with the CITES action plan on precious woods and help establish the conditions for sustainable trade in precious timber species to resume.

2.2.3. Support to local producers (US$ 21.3m)

47. **Agricultural intensification.** Project activities will aim to address the constraints that cause low productivity and resilience of agriculture production systems. This includes important agriculture crops such as rice, horticulture, and other food commodities (typically cultivated on land types 1 and 2), agroforestry value chains such as vanilla, clove, cacao, coffee, and lychee (typically cultivated on land types 2 and 3), and livestock-based value chains (on land types 1, 2, and 3). In close collaboration with agriculture support institutions, the Project will provide technical and financial support to: (i) introduce new technology to improve on-farm productivity and climate resilience; and (ii) strengthen technical capacity and skills to produce improved quality of selected commodities and to aggregate production for the market. Support would be aimed at farmers, using TA with a demand-driven approach and with close consideration of lessons learned during the implementation of BVPI. The role of women in the implementation of all relevant activities will be strengthened including improving their access to production resources, knowledge, and technologies. Women are typically involved in planting seedlings, fertilizer application, weeding, and post- harvest activities. Therefore, targeting capacity strengthening (e.g., stress-tolerant rice varieties and improved pre- and post-harvest crop management practices) can increase gender equity and improve the lives of the women, their families, and the communities.

48. In collaboration with FOFIFA, private sector, and other relevant technology centers, the Project will facilitate the transfer of productivity and efficiency enhancing technologies at the local level. The main delivery mechanisms will be TA and demonstration plots, in some cases with community-led implementation, and may include cost sharing. Technology priorities will be identified by farmers and other value chain actors. Technologies to be rolled out in various value chains would include: seed of improved climate-resilient rice varieties; fertilizer; other rice productivity enhancing inputs; and improved planting material for vanilla, clove, cocoa, coffee, lychee, and other priority crops. Technical support to improve post-harvest practices will be provided to farmer groups and collectors. In most cases training will be an integral part of technology development and roll-out.

49. **Agro-ecological practices** will be implemented on land types 2 and 3 through TA and will consist of: (i) forest farming: planting understory cash crops and apiculture in support of value chains that preserve the ecosystem yet have a high return; (ii) introducing practices that aim primarily at preventing/limiting erosion while enhancing soil fertility, including hedge rows (rows of crops with nitrogen-fixer trees or shrubs); (iii) developing riparian buffer and/or live fences to protect river and canal banks from cattle and subsidence; and (iv) strip-cropping or alley-cropping: associating fruit and timber trees with food crops on land types 2. These practices of diversified commodity range can help the farmers' resilience to internal and external economic and climate shocks.

50. **Community forestry.** Activities under this component will aim at strengthening the capacity of COBA and villages more in general to manage productive forests and plantations. The activities will aim at: (i) establishing about 3,500 hectares of plantations to meet local populations' fuelwood needs and about 1,000 hectares of construction timber plantations; (ii) preparing sustainable use plans and monitoring capacity; (iii) strengthening the capacity of tree producers to access markets within and outside the landscape, including technical assistance for fuelwood and timber products transformation; and rehabilitation of infrastructure for better access to markets. Fuelwood and construction timber plantations will be limited to areas already meant to be under productive forest use, thus without need for resettlement, and where fuelwood and timber demand is particularly high. The activities under this component will support areas in which women's participation is particularly important for agro-forestry long-term development impacts. Research in Africa shows that women are more likely than men to take into account food security and conservation in their decisions. Male motivation to incorporate trees on the farm is largely conditioned by financial factors, whereas females are concerned with soil conservation and household food consumption. Rural women in African countries have traditionally been the primary domesticators of forest-based food and medicinal plants; they have highly specialized knowledge on trees and forests, species diversity, management, use and conservation practices. Because their participation in tree domestication is often hindered by their limited access to and control over land and trees, lack of information, and heavy household workloads the project shall look at mechanisms to increase women's participation.

51. **Livestock grazing.** With livestock practices in a number of the selected landscapes having a detrimental effect on soil erosion, support will be provided at the regional level to undertake an assessment of stocks and pressures on land, and to improve the management of livestock. The project will support the improvement of animal nutrition and feeding through the introduction of innovations in forage production and conservation, and the utilization of crop residues. In addition, the Project will facilitate the process of identification, recognition, improvement, and joint management of common natural grazing lands located in the targeted landscapes by the local communities themselves.

Sub-component 2.3. Management of critical ecosystems and protected areas (US$7.9m [US$7.4m GEF; US$0.5m beneficiaries contribution])

52. This sub-component will support sector agencies, decentralized authorities and protected areas management agencies in managing key conservation and protected areas in the selected landscapes. These areas will typically correspond to land type 4 in the landscape's transect, i.e. zones of relatively higher altitude, presenting natural forest cover, not readily suitable for agricultural production and whose natural vegetation provide key ecological services.

53. **Protected areas and conservation site management.** The activities in this sub-component will include: (i) surveillance of an estimated 5,000 grids[24] through 1,000 patrolling missions, 50 aerial flyovers and/or Unmanned Aerial Vehicle (UAV) surveillance missions, periodic satellite images which will involve updating surveillance plans and ranger patrols to document site-specific patrol regimes including description of routine foot patrols, community surveillance activities and liaison and awareness raising activities with local communities; (ii) construction and upgrading of conservation infrastructure including the updating of technical

[24] For the purpose of surveillance, each PA is divided into a mosaic of surveillance grids of 500 m x 500 m.

manuals for the construction and maintenance of infrastructures, the actual construction and maintenance of 1,500 km of firebreaks, 200 guard stations, 5,000 km of park boundary markers and other essential conservation infrastructure; (iii) provision and renewal of essential equipment for park management, including vehicles, UAV and office equipment.

54. **Restoration in conservation sites.** The project will support forest restoration activities for conservation purposes. These consist in transforming a degraded, altered forest ecosystem to an ecosystem where the physical integrity (structure), diversity, as well as the ecological functions of the original ecosystem are re-established. Forest restoration activities can for instance reconnect forest fragments, allowing biodiversity circulation and preventing long-term risk of species inbreeding, protect water sources, prevent soil erosion, etc. The project will implement both active and passive restoration methods to restore the degraded forests in its landscapes of intervention:

- Active restoration consists of planting native species from the original forest, implying for the project an identification of priority sites to restore, followed by a consultation/negotiation with the local people to convert the land back to forest for the long term. Active restoration will involve: a) putting in place nurseries (terracing and soil preparation if needed, fencing from cattle), along with providing the equipment needed (plastic bags, shade, seeds); b) training local people to ensure the nurseries are properly managed (e.g. different species may require different pre-germination that can vary greatly, the techniques have to be mastered by the locals in order to optimize the germination rate); c) mobilizing local communities for planting (which will involve cash-for tree) and d) apart from producing plants from nurseries, restoration activities will also involve seedlings transplanting (implying seedlings collection and plantation), and direct sowing; and
- Passive restoration consists in letting the natural regeneration process take place and minimizing the eventual pressures that would hamper it. Activities include preventing access to the areas selected for passive restoration: signs will be used to physically delineate the limits of the passive restoration area, firebreaks will also be put in place to protect the restoration area from fire, especially on the forest outskirt.

55. The project will also strengthen local structure to ensure proper monitoring and sustainable management of the restored areas, as well as enforcing the locally-developed customary laws.

TABLE 5. ESTIMATED SURFACE OF CONSERVATION SITE RESTORATION

Region	Landscape	Area under active restoration (ha)	Area under passive restoration (ha)
SAVA	Andapa	342	583
Analanjirofo	Iazafo Vavatenina	300	1,177
Analanjirofo	Soanierana-Ivongo	1,116	2,231
Boeny	Marovoay	900	--
Sofia	Bealanana	1,200	22
Total		3,858	4,013

56. **Sustainable financing mechanisms and Payment for Environmental Services.** Based on the activities under 2.1 this activity will support piloting PES in select locations within the five landscapes. Effective landscape management requires a range of instruments. Many improvements in landscape management are win-win, and can be induced with traditional instruments (TA, support to inputs, value chain improvements, etc.). Some land use changes, however, are desirable because of their downstream (water services) or global (carbon sequestration, biodiversity) benefits, and are not necessarily in the landholders' own interests. To achieve these changes, traditional instruments will thus be complemented with PES (see Annex 7).

Component 3. Project Management Coordination and M&E (US$8.4m [US$6.0m IDA; US$2.4m AFD])

57. This component covers the project management by the PIU and the RIUs. The component will support all aspects of project management, including fiduciary management, Monitoring & Evaluation (M&E), knowledge generation and management, communication, and monitoring mitigation measures related to safeguards. Specifically the following activities are included: (i) operating costs for the project, the bulk of which relates to salaries of consultants, field supervision, transport and IT support; (ii) financial management including external audits and accounting; (iii) M&E, including financing the baseline and final impact assessment surveys, as described in Section IV B of the PAD; (iv) safeguards compliance including dam safety and the dissemination of the pesticide management plan at the community level, among other measures; and (v) training.

Component 4. Component 4: Contingency Emergency Response (US$0m)

58. This component establishes a disaster response contingency funding mechanism that could be triggered in the event of an eligible crisis or emergency, such as a natural disaster involving a formal declaration of a national or regional state of emergency, or a formal request from the Government of Madagascar in the wake of a disaster. In that case, funds from other project components could be reallocated to this component to facilitate rapid financing of a positive list of goods and services related to Components 1 and 2, and that would still be relevant to the achievement of the PDO. Eligible activities would include clearing and rehabilitating road and irrigation infrastructure, purchasing construction materials, agricultural inputs, or contributing to pest/plague control (e.g. locust control).

Proposed Series of Projects Phasing

Program Focus Areas:

- Information: *Improved collation, processing, communication, and use of information for decision support*
- Institutions & Policy: *Improved policy frameworks and capacity for modern shared-vision planning & mgmt.; institutional infrastructure and equipment modernization*
- Investments: *Preparation and implementation of a pipeline of integrated agriculture, landscape, and ecosystem investments; enhanced community adoption of improved land & water mgmt. practices*

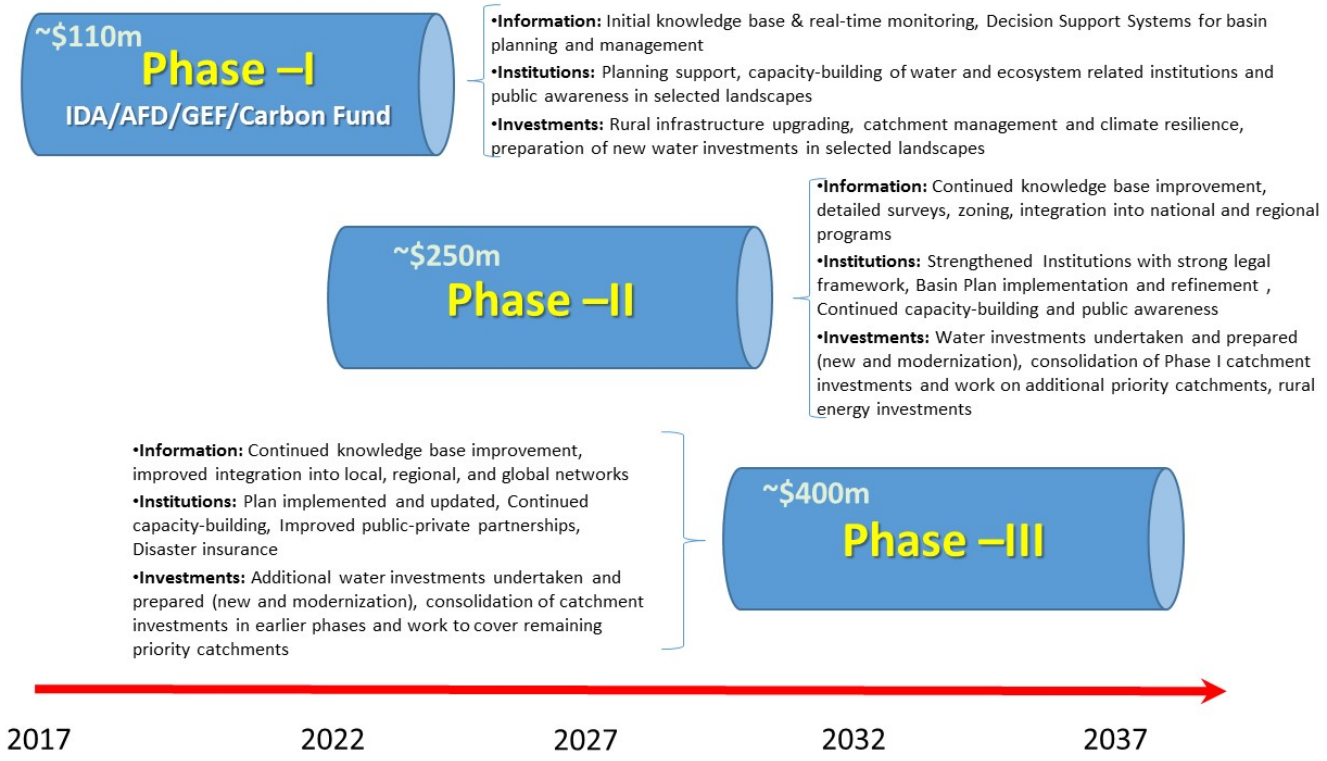


TABLE 6. TYPOLOGY OF LANDSCAPES IN MADAGASCAR BASED ON AGRO-ECOLOGICAL ZONING

Agroecological zoning (and landscape in this Project)	Development Context	Drivers of land/ ecosystem degradation	Agriculture
Eastern coastal zone[25] **(Iazafo, Soanierana-Ivongo)**	Could support NRM-based export-led growth pole. Productivity (<2t/ha except for Andap with 2.7t/ha) 0 to 4 dry months/year 1500<rainfall>2000 mm	- subsistence slash & burn agriculture (tavy); - cash-crops; - small-scale mining; - illegal logging (precious and non-precious wood) - fuelwood collection & charcoal production[26] - fire for pasture renewal	Low productivity (traditional - low technological update, poor land and water management) - Low diversification (mostly rice, although export potential for cash crops is high / commodity crops and organic products is high: litchis, banana, spices, cloves, cinnamon,) - Inland fisheries threatened
North-Western[27] **low altitude plains zone** **(Bealanana, Marovoay)**	Main rice bowls with low productivity (<2.5 t/ha) 2-6 dry months/year 1000<rainfall>2000 mm	- subsistence slash & burn agriculture; - small-scale mining; - illegal logging; - fuelwood collection; - fire for pasture renewal; - Riparian vegetation removed (reducing filter and ecosystem services)	
Highlands[28]	2-6 dry months/year 1000<rainfall>2000 mm	- Illegal logging ; - wild fires - impact of eucalyptus on water tables - invasive species (pines, etc.)	
Southwestern and South, low altitude plains zone [29]	Highest poverty levels Climate vulnerability 7 to 11 dry months/yr rainfall <600mm	- subsistence slash and burn agriculture (hatsake); - commercial agriculture (e.g.: sisal) - fuelwood collection - charcoal production. - fire for pasture renewal; - Climate shocks causing more variable rainfalls and rising temperatures.	Similar to above Livestock (fodder) Potential for other products (e.g. improved arid zone crops, branded honey)
Humid high altitude[30] **zone**	N/A 1-2 dry months/year rainfall>2000mm	- fires	Not suitable for agriculture

[25] Eastern coast excluding Taolagnaro.
[26] Mainly for the SAVA and Atsinanana regions.
[27] This zoning also includes Lac Alaotra.
[28] Central high lands and their western flancs, above 500m.
[29] The zone below the Maintirano-Ambovombe line.
[30] The highest zones of the Ankaratra.

TABLE 7. ON-GOING DEVELOPMENT PROGRAMS & INVESTMENTS RELEVANT TO PADAP

Program	Amount	Donor	Year	Implementer
Land Use Planning for Enhanced Resilience (LAUREL) ASA	300,000	WBG	2016 -2017	WBG
Sustainable Landscapes in Eastern Madagascar	$69.8 million	Green Climate Fund, European Investment Bank	2016-2026	Conservation International & Bureau National de Coordination des Changements Climatiques (BNCCC)
Adapting Coastal Zone Management to Climate Change in Madagascar Considering Ecosystems and Livelihoods	$17.3 million	UNEP, GEF	2014–2019	MEEF
Enabling Climate Resilience in the Agriculture Sector of Southwestern Madagascar	$39.4 million	AfDB, GEF	2014–2018	MPAE, Regional Unit of Tulear and Rural Engineering Unit; MEEF.
Enhancing the Adaptation Capacities and Resilience to Climate Change in Rural Communities in Analamanga, Atsinanana, Androy, Anosy, and Atsimo Andrefana	$67.4 million	UNDP, GEF	2016–2021	National Climate Change Coordination Office
Agriculture Rural Growth and Land Management Project (CASEF)	$53 million	WBG	2016-2021	MPAE
Strengthening the resilience of the rural population in South Madagascar	€7.7 million	GIZ	2012–2017	MPAE
IARIVO (Disaster risk reduction for flood–prone areas)	$835,000	USAID/CARE	2015	Urban commune of Antananarivo

ANNEX 3. ECONOMIC AND FINANCIAL ANALYSIS

1. Introduction

1. An economic and financial analysis (EFA) was conducted for the Project based on available data and assumptions in terms of expected benefits and project coverage, and follows World Bank guidelines.[31] The EFA includes: (i) an overview of the range of benefits that can potentially be achieved by the project, even though not all can be quantified in this analysis; (ii) farm level financial analysis to assess the financial viability of project interventions for selected crops; and (iii) an economic analysis to evaluate the Project's benefits and costs to the national economy. The economic analysis includes net incremental benefits derived by farming household and environmental benefits - quantified on-site environmental benefits (i.e. the reduction of siltation) and global environmental benefits (i.e. the potential mitigated greenhouse gas emissions and net carbon sequestration) to assess the economic return on investment of the Project.

2. The EFA aims to answer the following three questions: (i) Is public sector provision or financing the appropriate vehicle? (ii) What is the World Bank's value added? and (iii) What is the project's development impact?

3. **Rationale for public sector financing.** One of the core function of government is to supply public goods and handle externalities that markets fail to or cannot provide efficiently. Throughout Madagascar, irrigated rice fields are affected by high levels of siltation, which are essentially an externality of unsustainable land management practices on the adjacent hillsides. No institutional or economic mechanism exists for rural populations to take socially optimal land use decisions to factor in these externalities. The project incentivizes the adoption of sustainable land management practices throughout targeted watersheds. At the same time, the interventions aim at increasing beneficiaries' private benefits in the irrigated perimeters and increases in crop productivity.

4. **Value added of the World Bank Group support.** World Bank support for the project is justified for many reasons: (i) by allocating IDA resources to the agriculture, environment and water sectors, the World Bank is signaling its readiness to support the priorities identified in Madagascar's CPF and the National Development Plan; (ii) World Bank involvement is critical as the government needs financing support to bring the country back to the path of economic growth after years of political and economic crises; and (iii) the proposed integrated landscape approach will contribute to bringing positive impact on households' economics and support household and ecosystem resilience.

5. **Development impact.** The investment component of the proposed project will: (i) improve the livelihoods and income of direct and indirect project beneficiaries involved in agriculture, land restoration, sustainable forest management and conservation. Household's potential net benefit of participating in the project are outlined in the financial analysis below; (ii) reduce deforestation, generate provision of forest ecosystem-related goods and services such as hydrological services, timber and non-timber forest products, and opportunities for forest carbon financing[32]; (iii) and increase value added and tax revenue for Government.

[31] World Bank (2014): Investment Project Financing. Economic Analysis. OPSPQ, October 9th, 2014.

[32] Madagascar has submitted a proposal to the Carbon Fund for entering the preparation pipeline of a national emissions reductions program

6. **GEF Incremental Reasoning.** The proposed projects aligns with the GEF-6 focal area objectives.[33] The incremental GEF support will generate environmental benefits by promoting the uptake of sustainable land use management and biodiversity conservation practices by agro-pastoral communities. The proposed project will build upon results and lessons of previous engagements to link community driven initiatives with the need for safeguarding biodiversity, enhancement of carbon stocks in forest and non-forest lands and other ecosystem services at appropriate scales, through both investments and technical assistance. The project will also contribute to building an enabling environment for the country's readiness to implement REDD+.

7. **Cost effectiveness of the landscape approach.** The cost effectiveness of the integrated landscape approach vis-à-vis sectoral approaches (i.e. separate sector projects) is based on the qualitative assumption that environmental degradation and agricultural productivity interact closely in Madagascar. Over the period 2004 to 2014 annual agricultural GDP growth was 1.3 percent, far below peer countries and the average for sub-Saharan Africa. Most of the rural poor practice a traditional form of slash and burn agriculture known as "tavy." Tavy involves felling trees and burning the biomass, which not only clears the land but also adds nutrients to the soil. Slash and burn agriculture persists, not only because it offers rural households the prospect of realizing production increases in the short run, but also because it allows them to establish a claim to the land that may persist over the longer term. However, cultivation of successive cycles of rice, cassava, and other tavy crops degrades the soil and often sets off large-scale erosion that contributes to siltation of watercourses, leading quickly to widespread land and water degradation.

8. As a result, a landscape approach seems to offer more opportunities for sustained livelihood improvements than sector approaches. More specifically, the proposed integrated approach would be more cost-effective than other approaches because: (i) it aims at maximizing gains in terms of multiple benefits and minimizing losses at the entire landscape level (this would not necessarily be the case if 3 stand-alone projects, focusing on specific sectoral benefits were implemented); (ii) it will be done via an optimization of the institutional arrangements and the governance systems in place within and outside the landscape; and (iii) a combination of clear guidance from both the central and decentralized level is combined with strengthened capacity of local, grassroots structures to conduct proper participatory monitoring at the local level, providing reliable information to allow adaptive management. This approach would help ensure the appropriation of the approach by the local stakeholders (i.e. ensuring sustainability), while not losing sight of the Government's orientation, which, in the long term would be cost-effective compared to individual and isolated projects.

2. Literature review: Potential Benefits and Cost of the Project

9. The Project adopts a landscape approach and targets a range of land uses such as agricultural land, pastoral land, forests and protected areas. The project has the potential to provide a range of partly interlinked, tangible and intangible benefits. While not all can or will be quantified in this analysis, this overview indicates the type of benefits that can accrue due to project intervention.

[33] Alignment of the project to GEF6 focal area objectives include: for biodiversity (Obj BD2, BD3, BD4), land degradation (Obj LD1, LD2, LD3), climate change (Obj CC3), and sustainable forest management (Obj SFM1, SFM3, SFM4).

10. **Private benefits from agricultural interventions**. At household level, the Project promotes interventions to improve crop and water management practices, commodities with enhanced market potential, supports farmers' access to markets through infrastructure and agro-processing and storage facilities, provides technical training to increase the quality of export products, and potentially leads to increased prices, builds farmers' capacity to improve negotiation, marketing and collective action skills, which leads to economies of scale and improved prices. It will promote activities to reduce inefficiencies along the value chain which are particularly related to governance and institutional challenges, thus reducing farmers' transaction cost. In addition, enhanced land tenure security can enhance land and labor productivity and livelihood improvement (housing improvements, etc.).

11. These activities have the potential to lead to *private benefits to the farmers* in the form of: (i) increased income from agriculture due to increased asset and labor productivity, reduction of production cost, expansion of production due to improved market opportunities and access, and increased prices due it improved quality and timing; (ii) improved agricultural practices have the potential to decrease variability in production, and halt productivity and production losses due to adverse weather ad climate change related events; and (iii) increased food and nutrition security, which can have effects on farmers' productivity and income. For instance, childhood stunting, reflected in a 1 percent loss in adult height, is associated with a 1.4 percent loss in productivity.[34] In Zimbabwe, the effect of malnutrition on schooling has been calculated to reduce lifetime earnings by 12 percent.[35]

12. At the *value chain level*, the Project strengthens linkages between farmers, traders, collectors, and processors, and strengthens value chain governance. This can improve technical and operational efficiency along the value chain, enhance quality, higher overall productivity and production volumes and thus profitability and competitiveness.

13. **Environmental benefits.** The Project has the potential to provide *environmental on-site and global public benefits* related to reducing land degradation and subsequent reduction of CO_2 equivalent Greenhouse Gases (GHG) emissions, reducing soil erosion and subsequent sedimentation and siltation of agricultural land and irrigation infrastructure.

14. *On-site public benefits* are externalities related to, e.g. the ecological function of the forest which produces on-site benefits as well as transboundary public benefits. The importance of the ecological functions of forests and watershed protection is widely recognized, but is usually difficult to quantify. Forest and watershed protection are key determinants of: (i) soil conservation, resulting in decreased on-site and off-site sedimentation; (ii) water flow regulation including flood and storm protection. Studies in Cameroun and Columbia find a watershed's value for flood protection to be between US$3 and 24 per hectare[36]; and (iii) microclimate regulation, in particular provided by humid rainforests, which is a natural protection against fire. In Brazil, the probability of fire in an intact forest was assessed at 0.2 percent/year and 2 percent/year in a cleared forest,

[34] Hunt, JM. (2005): The Potential Impact of Reducing Global Malnutrition on Poverty Reduction and Economic Development. Asia Pac. J. Clin. Nutr. 14(S): 10–38.
[35] Behrman, J R., Alderman, H., Hoddinott, J. (2004). Nutrition and Hunger. In: Global Crises, Global Solutions, Bjorn Lomborg (ed) Cambridge, UK: Cambridge University Press.
[36] Pearce, DW (2003): The Economic Value of Forest Ecosystem. Commentary. CSERGE-Economics, University College London, London, UK; Cavatassi, R. (2004): Valuation methods of Environmental Benefits in Forestry and Watershed Investment projects. ESA Working Paper No. 04-01. Agricultural and Development Economics Division.

resulting in a valuation of forest of US$6 per ha/year.[37] While the economic value of watershed protection per hectare is often relatively small, it needs to be considered as watersheds can cover large areas and have the potential to accrue to an even larger number of beneficiaries.

15. *Indirect private benefit.* Benefits of improved ecological functioning of watersheds and forests can be valued in terms of indirect private benefits such as reduced loss of agricultural production due to reduced sedimentation, flooding or water shortages or enhancement of agricultural productivity due to sustainable upstream, or forest and soil management. In the Northeastern region Maroantsetra, farmers' willingness to pay to avoid sedimentation and inundation in small irrigated perimeters was assessed at a value of US$5 per hectare, which, at that time, was equivalent to 30 kg of paddy rice. Two recent evaluations in irrigated perimeters indicated a production loss valued at US$40 in Maroantsetra and US$80 at Lac Alaotra per hectare. With an average productivity of 2.5 t/ha and a producer price of US$160/t of paddy, the loss of revenue of US$40 per hectare of irrigated perimeters corresponds to a production loss of 10 percent (250kg). Thus, the loss of production is 8 times higher than rice farmers' willingness to pay in Maroantsetra. This indicates that farmers tend to underestimate the benefits of watershed protection.[38] The economic analysis considers a similar example to estimate reduced siltation in the project target area.

16. *Global environmental benefits – Greenhouse Gas (GHG) emission mitigation and carbon sequestration* have become the most important public good externalities of forest and watershed conservation. At global scale, soils store more than double the carbon of the total of atmosphere and biomass combined, making sustainable land and soil conservation practices ever more important.[39] To assess the value of emission avoided, the shadow price of carbon, or social cost of carbon (SCC) is used. It presents the marginal damage cost of carbon emission, estimated as the present value of the stream of future economic damages of increased GHG emissions. The World Bank proposes a social cost of carbon of US$30.[40] The net carbon balance will be assessed with EX-ACT and included in the economic analysis.

17. **On-site private benefits and opportunity cost of watershed protection.** Despite the global, on-site public and indirect private benefits of conservation and watershed protection, the

[37] Andersen, LE (1997): A cost–benefit analysis of deforestation in the Brazilian Amazon. Discussion Paper 455. Rio de Janeiro, IPEA/DIPES (http://www.ipea.gov.br/agencia/images/stories/PDFs/TDs/td_0455.pdf; accessed December 2016). The valuation of US$6 /year in 1997 translates in US$2 /year based on current exchange rate between Brazilian real and US$ (December 2016).

[38] Cavatassi, R. (2004).

[39] United Nations Convention to Combat Desertification (UNCCD) (2015): Science-Policy Notes. Pivotal Soil Carbon. Available: http://www.unccd.int/Lists/SiteDocumentLibrary/Publications/2015_PolicyBrief_SPI_ENG.pdf (January 2016).

[40] The SCC is an estimate of the economic damages associated with a one ton increase in carbon dioxide (CO2) emissions in a given year. The dollar figure represents the value of damages avoided for a small emission reduction. The climate change damages includes changes in net agricultural productivity, human health, property damages from increased flood risk, and changes in energy system costs, such as reduced costs for heating and increased costs for air conditioning. Given current modelling and data limitations, not all important damages are assessed. The SCC is assessed with three integrated assessment models; estimates for 2020 for discount rates between 5 percent and 2.5 percent are US$12, US$43, and US$62 per ton of CO_2-equivalent emission (United States Environmental Protection Agency Technical documentation available in: http://www3.epa.gov/climatechange/EPAactivities/economics/scc.html; January 2016). World Bank (2014): Technical guidance note on the social value of carbon; or: http://www.worldbank.org/en/topic/climatechange/brief/integrating-climate-change-world-bank (Accessed January 2016).

establishment and management of protected areas has substantial opportunity cost for residents. Ferraro (2002) assessed the household's cost of establishment of the Ranomafana National Park in Southeastern Madagascar. Households that depended on forest resources for subsistence and commercial activities had a loss of US$19 to US$70 over a 60-year horizon. These cost are substantial relative to regional household income, but quite small relative to national and global benefits from protecting rainforests.[41] Another study in the Mantadia National Park estimated the mean value of losses for the local villagers who are dependent on the forest for their livelihoods at US$91 per household per year. It was assessed that an average compensation of US$108 per household/year would make the household as well off with the park as without.[42]

18. To incentivize conservation of the forests and watershed' ecological functions, compensation to cover these cost needs to be ensured, e.g. by providing *on-site private benefits* from e.g. sustainable timber, fuelwood and non-timber forest products, tourism, education and recreation and agro-forestry products.[43] Thus, in the buffer zones of protected areas, COBA are formed which are responsible for forest management and granted forest use right as incentive.[44] Hockley and Andriamarovololona (2007) report on the estimated net benefit of COBA activities: Non-use values of biodiversity protection could lead to US$42 per year and hectare protected and carbon sequestration to US$15. The estimated cost of establishing and supporting a COBA are US$4.6 and operating and patrolling cost are US$0.08, resulting in a net benefit of US$54 per ha/year. Rasolofoson et al. (2016) find the impact of COBA on households' well-being, in terms of average per capita consumption expenditures, to be positive, but non-significant (varying from US$50 to US$60 per household). Impacts decline with increasing distance to the forest and increase with increasing education levels (maximum level of US$110).[45] Thus, COBA have a potential to lead to notable benefits on household level and broader environmental level, if the scheme is set up in a feasible way.

19. Further benefits from forest conservation on the national as well as community level stem from ecotourism, through entrance fees and related activities (transportation, hotels, restaurants, and guides). In 2001 there were 100,000 visitors in Malagasy national parks, which provided an added value (direct and indirect benefits) of US$55 per visitor, resulting in national benefits of protected areas of US$4 per ha/year. The revenue per visitor could even increase to up to US$15 or US$55 per ha/year if the conditions in the protected areas improve, specialized tourism (e.g. bird watching) takes up, and tourists are willing to pay more.[46]

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[41] Ferraro, PJ. (2002): The local costs of establishing protected areas in low-income nations: Ranomafana National Park, Madagascar. Ecological Economics 43: 261- 275; Converting the presented values (US$19 to US$70) into current US$-terms results in US$7.38 and US$27 (December 2016).

[42] Kramer, R. (1996): Slowing Tropical Forest Biodiversity Losses: Cost and Compensation Considerations. http://economics.iucn.org. http://hdl.handle.net/10919/67025; the values US$91 and US$108 were assessed at 1996 exchange rate; converting the values with the current exchange rate (US$1 to MGA3,344) translates into US$22 and US$26 (December 2016).

[43] Cavatassi, R (2004): Valuation methods of Environmental Benefits in Forestry and Watershed Investment projects. ESA Working Paper No. 04-01. Agricultural and Development Economics Division.

[44] Hockley and Andriamarovololona (2007).

[45] Rasolofson, RA., Ferraro, PJ, Ruta, G., Rasamoelina, MS, Randriankolna, PL., Larsen, HO, Jones, Jpg. (2016): Impacts of Community Forest Management on Human Well-being across Madagascar. Conservation Letters. Doi: 10.1111/conl.12272.

[46] Carret, JC, Loyer, D (2003): Comment financer durablement les aires protégées à Madagascar. Apport de l'analyse économique. Banque Mondial et Agence Française de Développement. Converting the presented values (US$55 and US$4) in current US$ terms results in US$21.38 and US$1.55 (December 2016).

20. **Intangible cost and benefits**. Land use and land cover changes as proposed by the project can have hidden cost and behavior changes with positive and/or negative impacts. Intra-household effects seem to be important as loss of access to forests affects men and women differently. Anecdotal evidence shows that men tend to be involved in *tavy* and forest product collection and will be proportionally more affected by impeding these activities. Loss of access to forest and changing cropping patterns could have impact on household's diet – through loss of wild proteins – and health. Studies in the late 90s found that hillside rice, which may be the consequence of *tavy*, had more protein and calcium than rice from irrigated paddies. Another advantage of *tavy* was cited to be the ability to plant several crops at different maturity stages, which allows to smooth income and consumption. This in addition to forest products allow households to smooth exposure production risk, e.g. in light of cyclones. In addition, *tavy* was cited to have cultural and social functions which could be lost.[47] These costs need to be kept in mind when designing project activities.

3. Financial analysis

3.1 Crop models – per hectare

21. **Assumptions.** To capture the private benefits of agriculture interventions, the EFA assesses several crop models for a "without project" (WOP) and "with project" (WP) scenario to assess the incremental net benefits of a typical household in the project area. The financial models are conducted for a period of 20 years, at a discount rate of 12 percent to reflect the rural rate of borrowing. The rural wage rate is assumed MGA3,500 per day. Family labor is valued in all models. Unless otherwise indicated, it is assumed that yield increases are phased over the first years, with full development in the third year. WOP yields remain constant. Markets are assumed to be competitive, and home consumption is valued at market price.

22. Information for the financial models was obtained from several sources: From farmers and extension officers during project preparation field visits, crop budgets obtained from the MPAE and related projects (*Le Programme Formation Professionnelle et d'amélioration de la Productivité Agricole* [FORMAPROD] from IFAD), *Projet d'Amélioration de la Productivité Rizicole sur les Hautes Terres Centrales* (PAPRIZ) from JICA; the World Bank's Emergency Food Security and Social Protection Project (PURSAPS) staff, evaluation report of the BVPI project, as well as the feasibility study conducted by consultants BRL Ingénierie for the project site Bealanana, and conversation with technical experts and researchers from FOFIFA and related literature. Information on vanilla and cloves financial model was obtained from field visits, the World Bank CASEF PAD, and experts from the *Centre Technique Horticole de Tamatave*. Time series of prices of rice and cassava were provided by the *Plan d'Action pour le Développement Rural (PADR)/L'Observatoire du Riz.*

23. The project areas have different agro-ecological zones and suitability for crops. The main commodities of importance across regions, which are also covered in the analysis are irrigated and upland rice; beans, tomatoes, onion and cassava for offseason production, cloves and vanilla for hillsides and livestock. Each crop model is assessed for one hectare cultivation, only one season per year is assumed. The model assumptions are described below and results are presented in Tables 8 and 9. Evaluation criteria are the NPV of incremental net benefits over 20 years and

[47] Ferraro, PJ (2002): The local costs of establishing protected areas in low-income nations: Ranomafana National Park, Madagascar. Ecological Economics 43: 261-/275.

discount rate of 12 percent, IRR, a Benefit-Cost (BC) ratio based on discounted benefits and cost streams over 20 years of the "WP" scenario and switching valued for benefits and cost, which indicate decreases/increases in benefits and cost for the NPV become zero.

24. **Irrigated rice**. It is assumed that without the project, farmers will continue traditional, irrigated rice cultivation practices. They would be using recycled, low quality seeds, broadcast planting, and manure but no synthetic fertilizer. It is assumed that irrigation systems supply water irregularly and don't allow a precise wetting and drying management which is needed to increase rice yields. With the project, *Système de Riziculture Améliorée* (SRA) will be introduced. SRA adheres to several, but not all principles of the System of Rice Intensification (SRI) and is considered a feasible production technique for farmers. With the project, it is expected that farmers use improved seeds and synthetic fertilizer. Labor time is expected to increase by approximately 50 percent, due to transplanting of seedlings in lines, increased weeding and harvesting and irrigation management. It is assumed that farmers pay an irrigation maintenance fee of MGA20,000 per year.

25. In the "WOP" scenario, productivity of 2.5 t/ha is assumed, which can double to 5 t/ha with the project. The assumption of potential yield increase is informed by literature, past projects and expert consultation.[48] Between November 2005 and December 2014 the average national paddy prices was MGA617 per kg, two models are used – one with an average price of MGA700 per kg for Andapa and Marovoay regions which had higher price than national average over the past years, one with an average price of MGA650 per kg for Bealanana and Analanjirofo. The analyses yield a NPV of incremental net benefits of US$1,364 and US$1,127 over a period of 20 years. The "with" project scenario shows a BC ratio of 2.13 and 1.98 respectively.

26. **Rainfed rice.** Rainfed rice is typically cultivated on hillsides, and is an important practice for farmers without or with limited access to the irrigated perimeters. With the project farmers may be supplied with improved seed, improved access to synthetic and organic fertilizer. A moderate yield of 1.1 t/ha is assumed without the project, which can increase by 60 percent due to project interventions. For all regions an average price of MGA600 per kg is assumed. The results show an NPV of incremental net benefits of US$141 over 20 years and for the "WP" scenario a BC ratio of 1.29.

27. **Cassava**. Nationally cassava is the second most important crop, and the most important in the south. In the project areas, it is grown frequently and serves as a substitute for rice in the lean season. A small household survey in Analanjirofo showed that approximately 80 percent of

[48]The Ministry in charge of Agriculture states that under optimal conditions, the adoption of SRA and SRI practices can result in crop yields of 6.3 t/ha and 8 t/ha, respectively, leading to a gross margin of US$418 and US$546 per year, respectively. In Lac Alaotra, the country's main rice production area, ca. 56 percent of agricultural households apply SRA practices, 8 percent SRI practices and 33 percent traditional practices and achieve following average yields (coefficient of variation): 3.9 t/ha (19 percent), 3.8 t/ha (3 percent) and 3.6 t/ha (24 percent); rainfed rice systems achieve average yields of 1.8 t/ha (39 percent). The project evaluation of BVPI shows that as a consequence of improved management irrigated paddy yields increased from 2.7 t/ha to on average 4.4 t/ha, and 5 t/ha for intensified production. Similarly, the project PAPRIZ reported increases from 1.5t/ha to 4.6 t/ha. Selected project beneficiaries even achieved a paddy rice yield of 6.5 t/ha, resulting in a net income of US$802/year. Source: Bélières, JF, Andriamanohy, F, Razafimahatratra, HM, Rakotondravelo, JC (2015): Chapitre 1.5 Les grandes exploitations agricoles du Lac Alaotra: systèmes de production, innovations techniques et performances. In «Processus d'innovation et résilience des exploitations agricoles à Madagascar»; BVPI ICR report (2016); JICA/Min Agri (2015): Main activities and achievements of the Rice Productivity Improvement Project in the Central Highland of Madagascar (PAPRiz) 2009-2015.

households grow cassava. The average cassava yield is around 7 t/ha.[49] Cassava provides several additional benefits, for instance cassava roots can be stored in the soil and harvested as needed, thus contributing to household's food availability during extended periods.[50] If the hillsides affected by *tavy* are not reforested, cassava is frequently grown there, as cassava has a low demand for and efficient use of water and nutrients, and can be cultivated on poor soils. However, cassava is subject to the two viral diseases, the cassava mosaic disease and cassava brown streak disease, which severely affect production.

28. The "WP" scenario assumes the introduction of resistant or tolerant cultivars and virus-free planting material. In addition, management practices to increase soil fertility are recommended such as mulching with crop residues and the use of synthetic fertilizer. In addition, increased labor requirements are assumed in the "WP" scenario, in particular related to weeding, harvesting and processing. The analysis assumes a yield increase from 6 t/ha in the "WOP" to 9.6 t/ha. Cassava yield is produced from the second year onwards. Between 2009 and 2014, the monthly average price for fresh and dried cassava was MGA448 and MGA 542/kg at the national level; for the project areas, the average price for dried cassava was MGA850 per kg, which is used in this analysis. The analysis demonstrates an NPV of incremental net benefit of US$851; and a BC ratio in the "WP" scenario of 1.57.

29. **Green beans**. In project areas, green beans are mainly planted as a second crop in the off-season and cultivated for home consumption. It is assumed that the project introduces input packages related to improved seeds, fertilizer and insecticide; labor time would increase due to fertilizer application and increased harvest. A study in Bealanana found an average yield of 0.8 t/ha, while in Andapa an average yield of 0.5 t/ha was suggested, which could increase by up to 140 percent. We assumed a moderate yield increase from 0.8 t/ha to 1.3 t/ha with the project, and market price of MGA1,500 per kg. The results show an NPV of incremental net benefit of US$316; and BC ratio of 1.5 in the "WP" scenario.

30. **Onion.** Onion is another important product for the off-season. In particular in Bealanana it could constitute an important key value chain that can be further intensified and the area under production could be expanded. The current average yield in Bealanana is suggested at 10t/ha and can be achieved under semi-intensive cultivation. It is assumed that "WP" improved seed, and fertilizer will be introduced, which will affect and increase labor time, but can increase yields from 5 t/ha to 10 t/ha, as observed in Bealanana. One kilo of onions is sold between MGA500 and 1,000, a conservative price of MGA700 is assumed in this analysis. This results in an NPV of incremental net benefits of US$2,633 over 20 years and a BC ratio of 1.7 in the "WP" scenario.

31. **Vanilla.** Madagascar is the world's leading vanilla exporter, with annual amounts ranging between 1,800 and 2,000 tons. In early 2000, the sector involved about 80,000 small farmers, 6,000 processors and about 30 exporters in the Sava region, on about 30,000 ha.[51] But these numbers vary considerably[52] and are dependent on price variations and disasters such as cyclones, which caused about 40 percent of losses in production in 2000 and 2003, and are difficult to determine. One kg of green vanilla can yield 250g of prepared (washed and stewed in hot water, then dried)

[49] FEWSNET (2012): Madagascar desk review

[50] FAO (2013): Cassava Farmer Field Schools. Resource material for facilitators in sub-Saharan Africa. FAO Plant production and protection paper 218.

[51] IFAD (2006).

[52] Randrianarison (2014) reports based on the Recensement Agricole 2004/5 that the annual production of vanilla is about 7,900 tones, produced by 160,444 farmers on 37,226 ha land.

vanilla. This can result in 300-400 kg/ha for small-scale producers and up to 1,000-1,400 kg/ha for plantations.[53] Producers in the SAVA region state that vanilla yields of about 2-7 kg/ha of green vanilla can be assumed. Yields are often of low quality due to low quality of planting material and production techniques. With the project, the management techniques will be improved and replanting can lead to increases in yield, to 1 t/ha after 4 years, as well as increased quality. The price varies notably between seasons and quality, and ranged between MGA10,000 and 70,000 per kg between 2014-1016. For this analysis, MGA10,000 per kg is assumed and a daily rural wage rate of MGA5,000. Vanilla needs to be guarded against theft between March and August. Typically 2 people, who are paid at a monthly rate of MGA200,000 are assumed. The results reveal that over a period of 20 years the project can lead to a NPV of incremental net revenue of US$6,989 with a BC ratio of 2.

32. **Cloves**. Madagascar is the leading exporter of cloves with annual amounts ranging from 11,000 to 19,000 metric tons and 1,500 metric tons of essential oil. The cloves subsector involves approximately 60,000 farmers and the production of essential oil involves approximately 500,000 people.[54] The level of production is heavily influenced by annual precipitation, where dry conditions favor the growth of cloves and disadvantage the growth of leaves and vice versa. The annual production of fresh cloves per tree is thus estimated between 6 and 16 kg. Production is irregular and a good harvest can be expected once every three to four years. About 350 kg of leaves are required to produce 6-7 kg of essence with 85-88 percent of eugenol.[55] The financial analysis takes into account the replanting of new trees to replace old and damaged trees (by cyclones). It takes into account that a good clove production year (yield of 7 kg/tree) is followed by a medium (3 kg/tree) and weak production (1 kg/tree) year in the "with project scenario", valued at MGA4,200/kg. Production starts in year five with full development in year 10. Leaf yield of 30 kg/tree is assumed from year five onwards, valued at MGA200 per kg. The NPV of incremental net benefits is US$441, with a BC ratio in the "with project" scenario of 1.51.

33. **Livestock-zebu**. Zebus are critical in many Malagasy communities and have a range of societal and cultural values. The source of return for many farmers is from agricultural work (traction and paddy rice fields) rather than meat production. The livestock production system is largely extensive; on national average, households owned 8 zebus in 2010.[56] In the project area a larger average size of 11 heads was observed. The project introduces improved pasture management, which costs US$70 per hectare. It is assumed that a farmer plants improved forage crops on 0.5 hectare of his land. It is expected that due to improved feeding, the average weight per animal increases, so that animals achieve a higher price of approximately 15 percent compared to the "without project" scenario. The herd dynamics over 20 years are modeled with the ECORUM model. The results show that project interventions have a potential to generate a NPV of incremental net benefits compared to the "without project" situation of US$287, and a BC ratio of 1.05.

[53] MinAgri, 2004.
[54] World Bank (2016): Agriculture and Rural Development in Madagascar. Report.
[55] Demangel, A (2011): Faisabilité de la mise en place d'une Indication Géographique sur le clou de girofle à Madagascar. Memoire de fin d'études. ISTOM Ecole supérieure d'Agro-Développement International.
[56] Institute National de la Statistique (2010): Enquete periodique aupres des menages (EPM).

Results – per hectare, household aggregate

34. Tables 8 and 9 present the results of the financial models for 1 hectare cultivation. The interventions are financially viable for all selected commodities and generate an annual incremental net benefit between US$38 for rainfed rice and US$1,061 for green vanilla production. The focus commodity of the project – irrigated rice – can generate between US$158 and US$236 incremental net benefits compared to the "WOP" scenario. It is notable that cassava and horticulture production can generate similar net incremental benefits and could play an important role for households in the target areas.

TABLE 8. RESULTS OF FINANCIAL MODELS

Commodities	Yield (kg/ha)			Gross Revenue (USD/ha)		Net benefits (USD/ha)		
	WOP	WP	Change	WOP	WP	WOP	WP	Incremental net benefits
Irrigated rice Boeny, Analanjirofo	2,500	5,000	100%	507	1,013	305	548	244
Irrigated rice Andapa, Bealanana	2,500	5,000	100%	546	1,091	344	626	283
Rainfed rice	1,100	1,760	60%	206	329	51	89	38
Cassava (dried)	2,400	3,840	60%	636	1,018	211	439	228
Beans	800	1,600	70%	374	636	162	263	101
Onion	5,000	10,000	100%	1,091	2,183	535	989	454
Green vanilla	600	1200	100%	1,590	2,544	990	2,006	1,061
Clove (70 trees)	-	1-7kg/tree			352		215	215
Zebu – meat	29 animals sold/20 years	33 animals sold/20 years	13%	1,013	1,163	159	330	171

TABLE 9. RESULTS OF FINANCIAL MODELS

Commodities	NPV	IRR	Switching values cost	Switching values benefit	B/C ratio
Irrigated rice Boeny, Analanjirofo	1,127	53%	98%	-49%	1.98
Irrigated rice Andapa, Bealanana	1,346	61%	113%	-53%	2.13
Rainfed rice	141	-	29%	-23%	1.29
Cassava	851	28%	57%	-36%	1.57
Beans	316	-	55%	-35%	1.55
Onion	2,633	-	57%	-36%	1.7
Green Vanilla	6,989	197%	100%	-50%	2.00
Cloves	441	24%	51%	-34%	1.51
Zebu	287	32%	5%	-5%	1.05

3.2 Aggregation of financial accounts and household models

35. For the aggregation, the following assumptions are used: 14,000 hectare of irrigated perimeter will be brought under improved irrigation, with phasing aligned to the phasing in the COSTAB. It is further assumed that 12,500 beneficiaries are reached with project activities related

to improvement of vanilla and cloves which are cultivated on the same hectare area, and another 7,500 beneficiaries are reached with inputs and extension services for horticulture production – 50 percent for beans and 50 percent for onion. Beneficiaries are assumed to apply the practices on one hectare. It is assumed that these 7,500 beneficiaries will intercrop horticulture production with improved rainfed rice and cassava (50 percent with rice, 50 percent cassava). 600 beneficiaries are also assumed to own livestock and engage in improved pasture management. Total project costs are US$107.05 million. The GEF grant of US$13.7 million is excluded, resulting in an investment cost of US$87.4 million and recurrent costs of US$5.8 million. Recurrent costs are assumed from year 6 to year 20 of approximately 50 percent of the project's recurrent costs (between year 1 and 5). At a discount rate of 12 percent and over 20 years this results in an NPV of incremental financial net benefits of US$25 million and an IRR of 16 percent.

TABLE 10. NUMBER OF HECTARES/BENEFICIARIES CONSIDERED FOR THE AGGREGATION.

Activities	Hectare area	Beneficiaries
Irrigated rice (Land use type 1)	14,000 ha (one cultivation season)	26,900 beneficiaries Several of beneficiaries in irrigated perimeter may participate in activities in Land use type 2 and 3
Vanilla and cloves (Land use type 3)	12,500 ha vanilla jointly with cloves	12,500 beneficiaries
Horticulture intercropped with staples (Land use type 2, 3)	3,750 ha onion 3,750 ha beans	7,500 beneficiaries
	3,750 ha rainfed rice 3,750 ha cassava	
Livestock (Land use type 2)	average 11 animals per beneficiary	600 beneficiaries

36. **Expected impact on model farms.** At the national level, the average household land area is 1.4 ha with a median of 1 ha. In the project areas, the average/median land areas are: SAVA 1.2 ha/1 ha; Boeny 2 ha/1.5 ha, Analanjirofo 1.5 ha/1.1 ha; Sofia 1.3 ha/1 ha. Nationally on average 80 percent of households cultivate rice, but about 88 percent of households have diversified production systems, including cultivation of cassava, maize, potatoes or beans and cash crops. Based on results of the crop models, the Project's impact on two exemplary households is assessed:

Household A owns 1.2 hectare agricultural land who diversifies production to 1/3rd irrigated rice (2 seasons), 1/3rd rainfed rice, with project intercropped with beans, and 1/3rd vanilla production could achieve an annual incremental benefit of US$752 ("WOP" US$691 and "WP" US$1,444). This cropping pattern could help the household to earn an additional daily income of US$2.10.

Household B owns 1 hectares agricultural land and 5 zebus who diversifies production 50% irrigated rice (2 seasons), 30 percent horticulture, 20 percent cassava and 5 zebus, and would achieve an annual incremental net benefit of US$542 ("WOP" US$618 and "WP" US$1,161), thus an additional US$1.50 per day.

37. Given an average household size of 5 people and a poverty line of US$1.92 per capita per day, the Project interventions may not be sufficient to lift the entire household above the poverty line, however they decrease the vulnerability of the household. This finding emphasizes the challenges of small land sizes that households are facing. The assessment does not consider

increased revenues from enhanced market linkages and other intangible benefits. In addition the crop models are based on rather conservative assumptions.

4. Economic analysis

38. The analysis consists of an economic analysis of the investments to rehabilitate the irrigated perimeters under Sub-component 2.2 (sub-section 4.1), as well as a cost benefits analysis of the entire project (sub-section 4.2).

39. **Data and prices.** For the economic analysis, economic prices have been calculated using standard conversion factors for exported agricultural commodities and imported inputs in order to correct distortions due to taxation, public subsidies and other market imperfections.[57] An economic cost of labour was used, factoring in the rural unemployment rate of 40 percent. The incremental benefits calculated in local currency were converted into US$ using a shadow exchange rate (SER) to take into account the opportunity cost of foreign exchange and was applied to all traded goods. A discount rate of 6% as recommended by the World Bank[58] is used.

4.1 Economic analysis for Investment to rehabilitate irrigated schemes

40. Among the productive investments under Sub-component 2.2, irrigation perimeters will be rehabilitated at a total economic cost of US$26.2 million, which is approximately 25 percent of the total project investment of US$107 million. The analysis considers the incremental net benefits per hectare that can be derived if irrigation systems are rehabilitated, and aggregates it over 14,000 hectare that will be rehabilitated. The increment stems from an increase in productivity from approximately 2.5 t/ha to 5t/ha and the ability to cultivate two seasons. The incremental net benefits for irrigated rice production were derived from the financial models presented in sub-section 3.1 (see Table 8 and 9). The phasing of benefits and costs is aligned with project's COSTAB; the analysis if conducted for 20 years, at a discount rate of 6 percent. The resulting economic NPV is US$17 million and an EIRR of 12 percent. Sensitivity analyses shows that value remains robust. For instance an increase of project costs by 30 percent, or a decrease of incremental net benefits by 30 percent, decreases the EIRR to 9.2 percent or 8.2 percent, respectively.

4.2 Economic analysis of project

41. **Project economic cost**. The economic costs of the project were obtained using the COSTAB software and by removing taxes and duties and sum to US$104.5. The analysis considers beneficiaries' contributions and deducts the GEF grant. Thus, investment costs and recurrent costs result in US$91.1 million. The phasing of the project costs is assumed according to the COSTAB, between year one and 5. Recurrent costs at 50 percent of recurrent costs between year 1 and year 5 are considered, and result in US$0.57 million per year.

42. **Project economic benefit streams.** The analysis was conducted over a period of 20 years. The economic benefits including in the project economic analysis are: (i) economic benefits related to improving crop productivity. This is captured by the incremental net benefits of crop models presented in the financial analysis but valued at economic prices. The aggregation across beneficiaries and hectare areas was conducted as suggested in Table 10; (ii) economic benefits

[57] For agricultural outputs, economic prices have been used only for the value chains where there are a lot of distortions (vanilla, clove, pepper), not for green beans or locally traded products for which the market prices reflect the opportunity cost of these goods.

[58] Technical Note on Discounting Costs and Benefits in Economic Analysis of World Bank Projects (World Bank, 2015).

from reducing siltation; and (iii) economic benefits related to the net carbon emission balance of the Project. (ii) and (iii) are described in following paragraphs:

43. *(i) Economic benefits from improved crop productivity:* These benefits are captured by the incremental net benefits of crop models presented in the financial analysis but valued at economic costs and prices. The aggregation across beneficiaries and/or hectare area is aligned to phasing of project activities presented in COSTAB and described in sub-section 3.2 and Table 10.

44. *(ii)* Economic *benefits stemming from the Project's GHG mitigation and carbon sequestration potential:* The GHG emission mitigation potential and carbon sequestration potential for a range of project activities was calculated (see Annex 10) using the EX-ACT tool. The resulting net carbon balance is approximately -13,752,996 tCO2e emission over 20 years, or -687, 650 tCO2 emission per year, implying that the Project constitutes a sizeable carbon sink, due to e.g. agro-forestry and forest plantations on currently degraded land and reducing deforestation rate. A recent World Bank guideline recommends to value carbon emission in the economic analysis at a shadow price of carbon, or SCC, which presents the marginal damage cost of carbon emission. It was estimated as the present value of the stream of future economic damages of increased GHG emissions. The World Bank proposes using a SCC of US$30/t.[59] For the base scenario a conservative approach was used, and only 50 percent of the Project's net carbon balance was considered in the analysis (approximately-344,000 tCO2e/year), valued from year 3 onwards.

45. *(iii) Economic benefits stemming from reduced siltation in irrigated perimeters*. To reduce soil erosion and reduce siltation in the irrigated perimeters, several activities are proposed upstream. There is little information available regarding the current extent of siltation in irrigated perimeters, the trajectories of impact, a forecast for the next years without any further intervention, the impact on operations and maintenance cost, productivity or production area. The below results should therefore be interpreted with caution. The impacts of avoided soil erosion on downstream rice fields can be measured in different ways.[60] In this analysis the avoided loss of aggregate production due to avoided loss of land area is used. Assumptions about the extent of siltation are derived from scarce literature and expert consultation:

- Marovoay is most affected by siltation, with 1.3 percent of rice fields lost to siltation per year. "Without the project" it is assumed that from year 5 onwards, siltation could gradually

[59] The existing carbon prices vary significantly—from less than US$1 per tCO2e to US$130 per tCO2e. 85% of emissions are priced at less than US$10 per tCO2e, which is considerably lower than the price that economic models have estimated is needed to meet the 2°C climate stabilization goal recommended by scientists (World Bank (2015): State and Trends of Carbon Pricing 2015 (September). Washington, DC). The SCC is an estimate of the economic damages associated with a small increase in carbon dioxide (CO2) emissions, conventionally one metric ton, in a given year. This dollar figure represents the value of damages avoided for a small emission reduction. The climate change damages includes changes in net agricultural productivity, human health, property damages from increased flood risk, and changes in energy system costs, such as reduced costs for heating and increased costs for air conditioning. Given current modelling and data limitations, not all important damages are assessed. The SCC is assessed with three integrated assessment models; estimates for 2020 for discount rates between 5 percent and 2.5 percent are US$12, US$43, and US$62 per ton of CO_2-equivalent emission (United States Environmental Protection Agency Technical documentation available on:
http://www3.epa.gov/climatechange/EPAactivities/economics/scc.html; January 2016).

[60] (i) Avoided loss of aggregate production due to avoided loss of land area; (ii) avoided decrease in crop yields per hectare – though the relation between sedimentation and productivity is difficult to detangle as crop yields are impacted by many factors; (iii) reduced maintenance cost of the irrigation infrastructure.

approach 2.5 percent, which is the current rate of siltation in Lac Alaotra. The Project targets approximately 2,000 ha in Marovoay.

- In Analanjirofo, siltation is not yet alarming. Currently rice fields could be affected to an extent of 0.5 percent per year; without project interventions, this rate is expected to increase to 1 percent by year 20. A gradual increase is assumed between year 10 and 20. Ca. 7,000 hectare are targeted in Analanjirofo.
- In Andapa, 24 ha of rice fields are estimated to be affected in Ankaibe, which translates into 1.15 percent of the entire perimeter (2,100 ha); about 0.22 percent of rice fields per year could be affected. While siltation is not yet a large problem, it is estimated that without project interventions the rate of siltation could gradually increase similar to the other regions: PY5-10 to 0.5 percent; from PY10 onwards to 1.3 percent as in Marovoay.

46. It is assumed that on areas affected by siltation irrigation water cannot be (sufficiently) supplied, and rainfed rice is cultivated, with a relatively low yield of 1.1t/ha and a net benefit of approximately US$51 per hectare. With the Project, the area would be restored and irrigated rice cultivation could be implemented, which can achieve up to 5t/ha and an annual net benefit of US$424 and US$580 per hectare (depending on the region). The Project targets an irrigation perimeter of 14,000 ha. The NPV of incremental net benefit, over a period of 20 years, at a discount rate of 6 percent, of reducing siltation could be around US$435,335. This benefit stream is included in the economic analysis from year 3 onwards. However, these benefits may be underestimated as reduced siltation due to project activities is likely to affect larger areas in the perimeter, beyond those areas targeted by the Project.

47. **Time period**. The economic analysis was conducted over a 20-year period reflecting the full lifetime of most of the costs and benefits. Only the benefits stemming from clove production could occur over a longer period of time since clove trees can remain productive up to 50 and 100 years.

Results and sensitivity analysis

48. **Results.** Based on the above assumptions, the Project economic analysis yields an ENPV of benefits of *US$207 million and an EIRR of 26.6 percent* (Table 11). The EIRR compares favorably to the deposit interest rate which was on average 11 percent between 2011 and 2014. The results may be underestimated, as several potential project benefits have not been quantified or included in a conservative manner, for instance environmental benefits related to conservation, maintained biodiversity, ecological functions and related values of maintained forest resources and improved watershed management, decreased yield variability and vulnerability, increased availability, production and sale of forest and agro-forestry products, increased food security and nutrition benefits and reduced maintenance cost and restoration cost due to reduced sedimentation.

49. **Sensitivity analysis** (Table 12) demonstrates robust results against changes to key variables. The most notable change stems from changes in environmental benefits. If the net carbon balance is reduced by another 30 percent, or the social cost of carbon is reduced to US$10/tCO2e emission, the EIRR is reduced to 24 or 20 percent respectively. As is evident from Table 8 and 9, vanilla production achieves the highest incremental net revenue for producers and is thus considered explicitly in the sensitivity analysis. The results show that a decrease in area under vanilla production by 30 percent could decrease the EIRR to 22 percent. For all changes, the

EIRR remains well above the discount rate of 6 percent and the average deposit rate of 11 percent (between 2011 and 2014).

TABLE 11. PROJECT'S ECONOMIC BENEFITS AND COST, IN MILLION US$.

	PY1	PY2	PY3	PY4	PY5	PY6	PY7	PY8	PY9	PY10	PY11-20
Project benefits:											
Incremental net benefits from improved irrigation, crop and livestock management	-1.95	-1.63	-0.05	4.81	11.66	18.79	21.47	23.78	25.92	26.05	26.27
Carbon emission valued at US$30/tCO2e	0.00	0.00	10.31	10.31	10.31	10.31	10.31	10.31	10.31	10.31	10.31
Reduced siltation in irrigated perimeters	-0.00	0.01	0.03	0.03	0.03	0.03	0.04	0.04	0.04	0.04	0.04
Sum of benefits:	-1.95	-1.63	10.25	15.13	22.00	29.13	31.81	34.13	36.27	36.4	36.62
Project cost:											
Total inv. cost	21.08	24.38	24.48	9.58	5.94						
Recurrent cost	1.12	1.15	1.13	1.14	1.14						
Total project cost	22.21	25.53	25.61	10.72	7.09	0.57	0.57	0.57	0.57	0.57	0.57
Net benefits	-26	-29	-17	3	14	29	31	34	36	36	36

TABLE 12. SENSITIVITY ANALYSIS

Changes	ENPV (US$)	EIRR (%)	Changes	ENPV (US$)	EIRR (%)
Base scenario	207,645,350	26.6%			
Change in adoption rate			**Change in incremental net benefits**		
-10%	188,540,868	25%	-10%	178,571,745	24%
-20%	169,436,387	24%	-20%	149,498,141	22%
-30%	150,331,906	23%	-30%	120,424,536	20%
10%	226,749,831	28%	10%	236,718,954	29%
20%	245,854,312	29%	20%	265,792,559	31%
30%	264,958,793	30%	30%	294,866,163	33%
Change in project cost			**Change in net carbon balance**		
-10%	215,954,419	29%	-10%	197,676,226	26%
-20%	224,263,489	32%	-20%	187,707,103	25%
-30%	232,572,558	35%	-30%	177,737,980	24%
10%	199,336,280	25%	10%	217,614,473	28%
20%	191,027,210	23%	20%	227,583,596	29%
30%	182,718,141	21%	30%	237,552,719	30%
Decrease in vanilla cultivation area			**Decrease in social cost of carbon (US$/tCO2e emission)**		
-10%	194,577,587	26%	US$20	174,530,026	23%
-20%	181,509,825	25%	US$10	141,414,703	20%
-30%	168,442,063	24%	US$0	108,299,380	17%

ANNEX 4. WORLD BANK GROUP OPERATIONS FROM WHICH LESSONS LEARNED FOR THIS PROJECT HAVE BEEN DRAWN

1. At the global level, the World Bank is supporting clients to enhance and sustain ecosystem and agroecosystem productivity. Based on lessons learned from World Bank operations in other regions, some common priorities and opportunities for sustainably managing climate resilient and productive landscapes include:

a. **Projected agroecosystem shifts** will offer opportunities to re-zone food & forest production priority areas both nationally and regionally.

b. **New crop varieties** that are both high temperature and drought tolerant and animal varieties that are heat and disease tolerant must be urgently developed and deployed globally.

c. **High efficiency irrigation** could buy a decade or two of time against the devastating impacts of frequent and prolonged droughts and rising temperatures.

d. **Ground water aquifers** need to be urgently mapped and assessed for subsurface water storage potential and surface flood control via infiltration capture zones to collect and hold water flows (floods) from extreme events from local to national and sometimes regional, transboundary scales.

e. **Climate Smart Landscapes and agroecosystem design** to reduce surface water flows and promote greater infiltration will significantly add resilience against high intensity rainfall events (especially important where the models project increased hurricane & rainfall intensity).

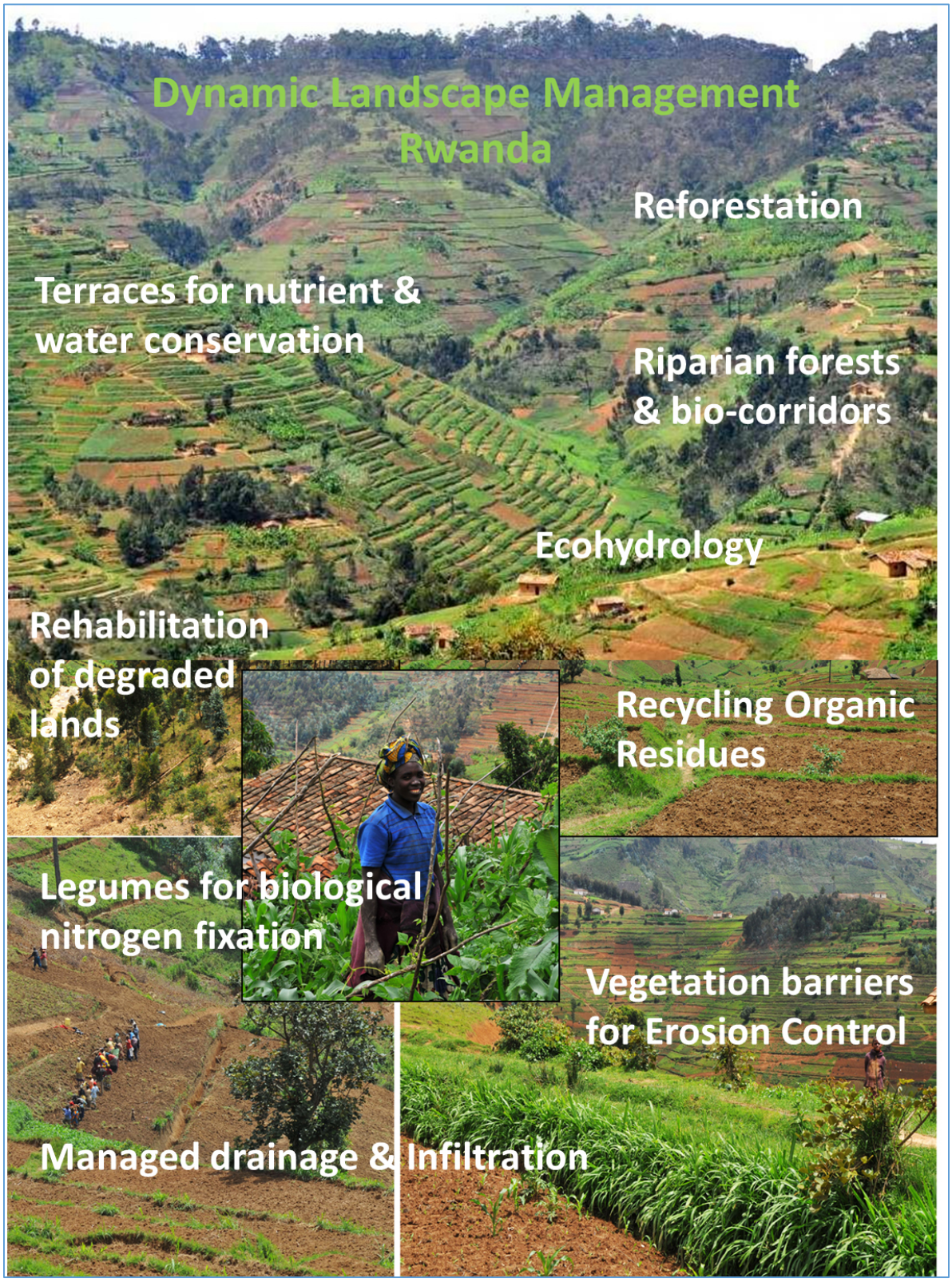
f. **Previous and Evolving El Niño & La Niña and other extreme events (e.g. cyclones)** should be analyzed for reference baselines to assess adaptation needs to make human settlements, agriculture, and infrastructure more resilient to climate shocks.

g. **Insurance options** can help buffer against short to medium term economic losses but will be increasingly dependent on data systems (h and i below).

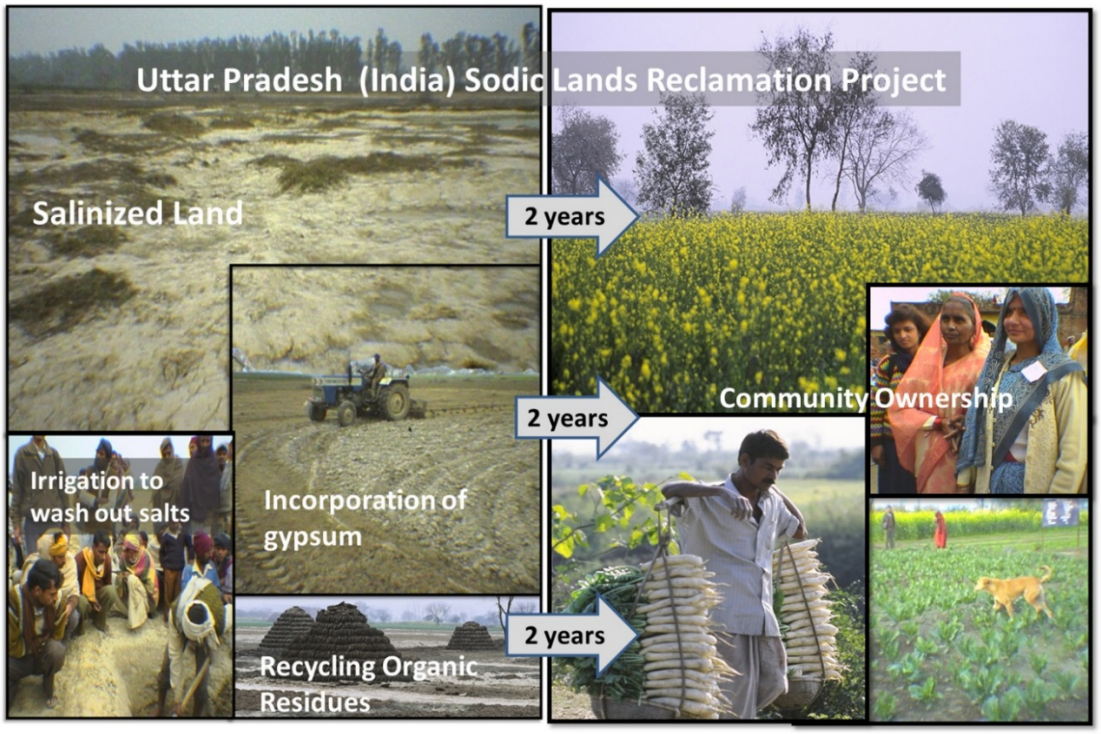
h. **Terrain mapping and distributed hydrological modeling** can identify hotspots for flooding and actions, including relocation of highly vulnerable populations or appropriate protective infrastructure put in place to protect critical assets.

i. **Functional decision support systems (DSS)** – there is urgent need for all nations to assemble high quality & long term climate, terrain, land cover & land use, infrastructure, population & settlement data sets and to couple these data layers into DSSs.

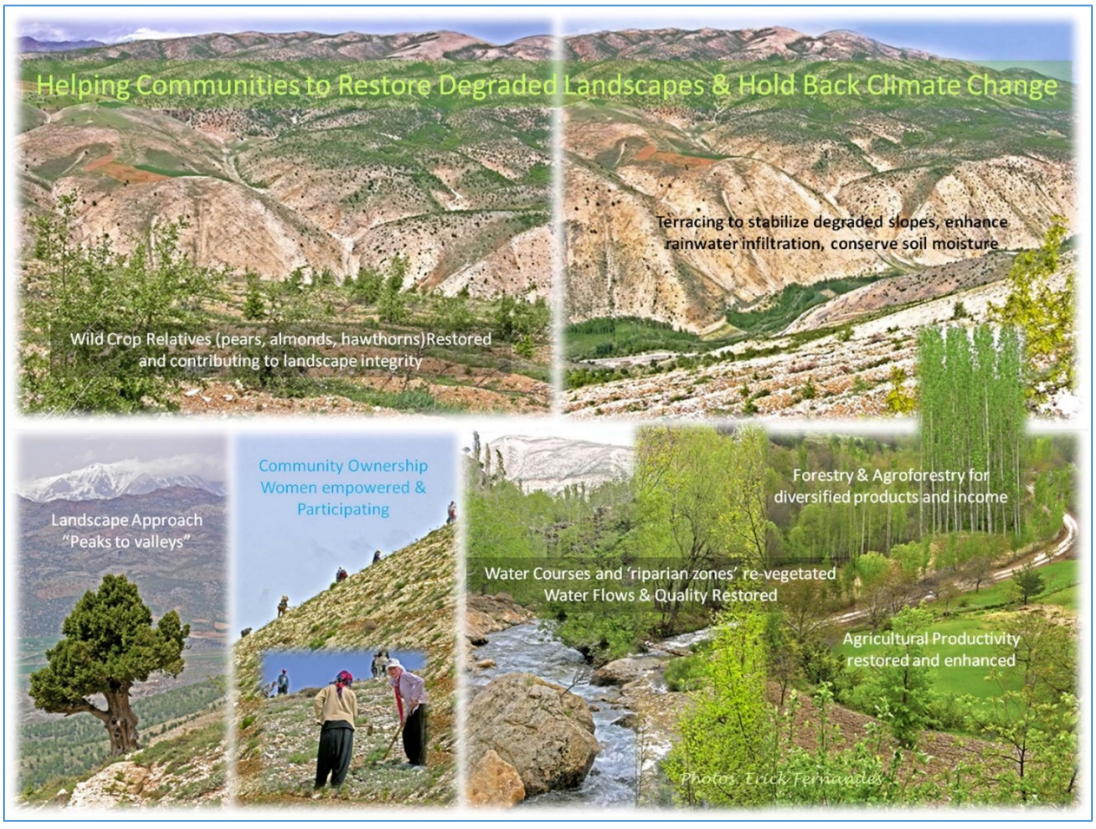
j. **Re-Zoning and/or reinforcement to existing infrastructure** - Based on outputs of above DSS, cost-benefit analyses and prioritization of the significant reinforcement to existing infrastructure (roads, bridges, canals, dam spillways, sea walls, high capacity pumps) is needed.


Dynamic Landscape Management
Rwanda
Reforestation
Terraces for nutrient &
water conservation
Riparian forests
& bio-corridors
Ecohydrology
Rehabilitation
of degraded
lands
Recycling Organic
Residues
Legumes for biological
nitrogen fixation
Vegetation barriers
for Erosion Control
Managed drainage & Infiltration

UTTAR PRADESH SODIC LANDS RECLAMATION PROJECT

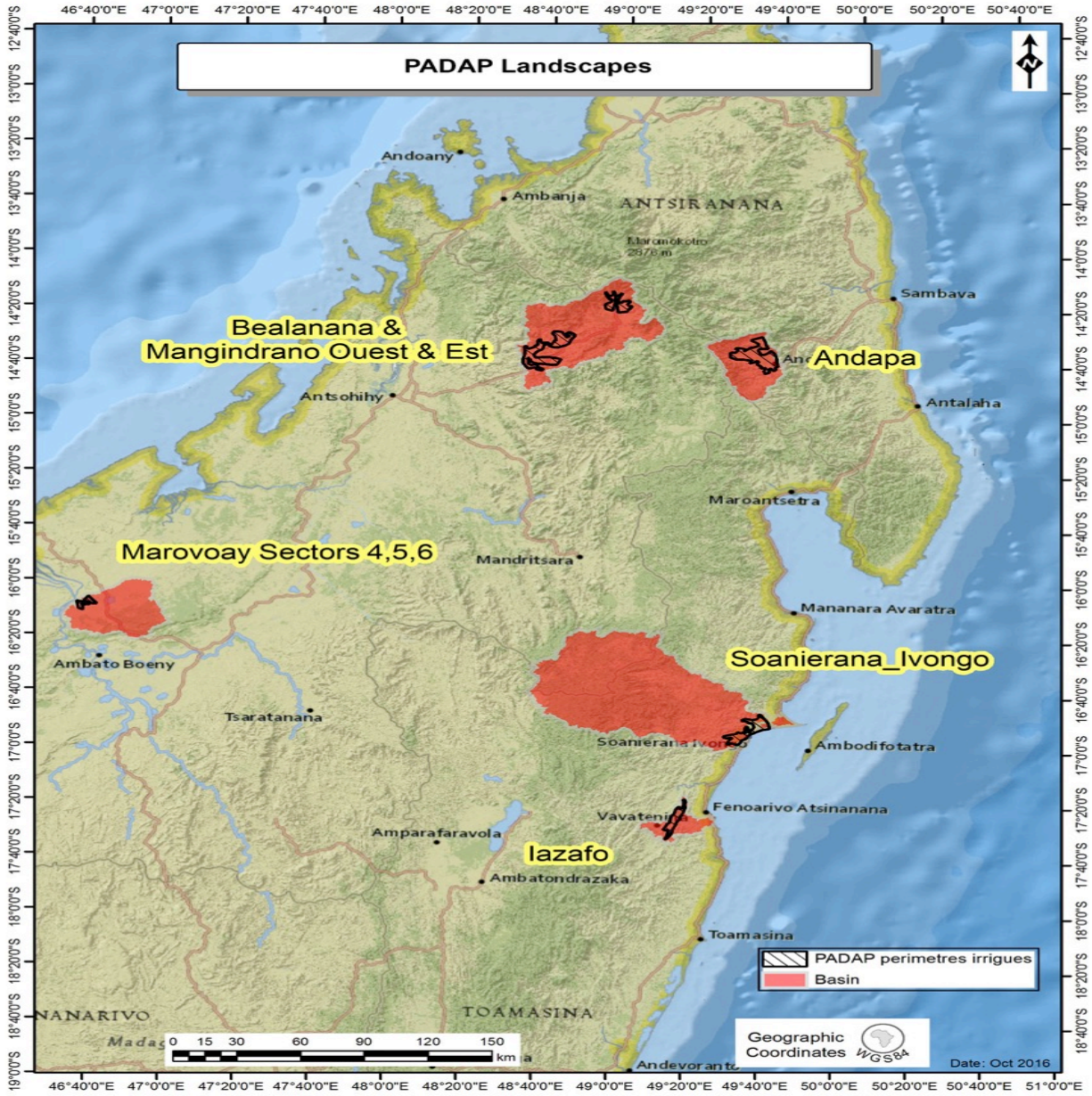


TURKEY - EASTERN ANATOLIA WATERSHED REHABILITATION PROJECT

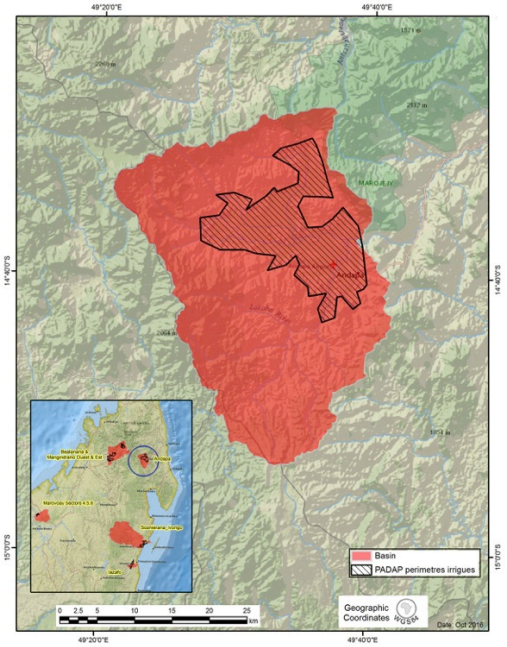


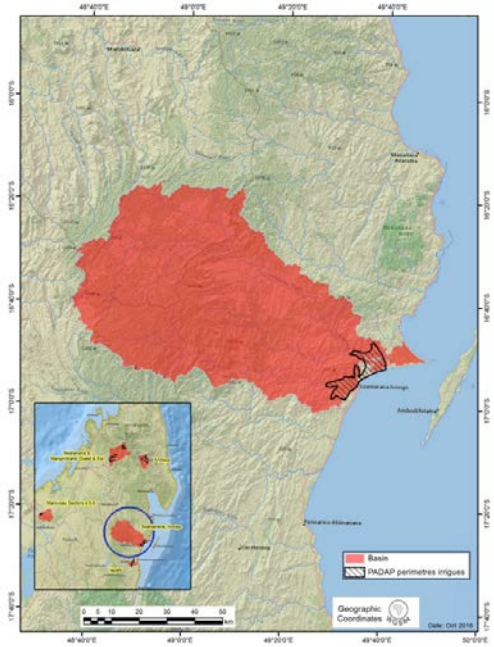
ANNEX 5. PROFILES FOR SELECTED LANDSCAPES AND GEF INCREMENTAL LOGIC

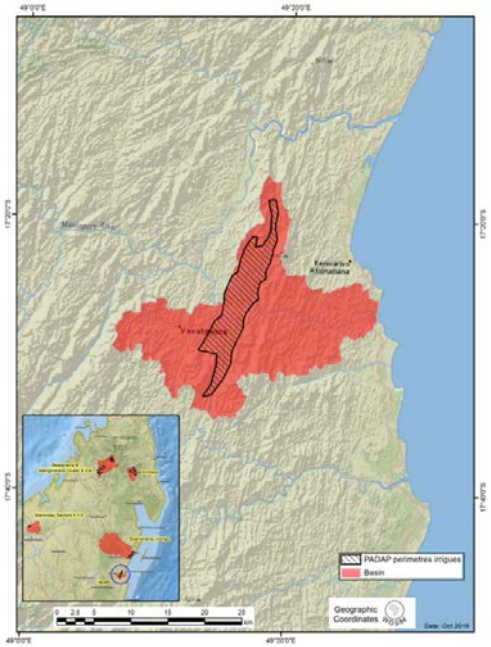
1. The project will be implemented in 5 landscapes: 3 on the eastern part of the country, and 2 on the western part, as depicted in the following map, the outer boundary of the individual landscapes, as well as the irrigated perimeters of interest for the Government. In total, the five landscapes account for 1.3 million ha of land.



EASTERN LANDSCAPES: Andapa, Soanierana Ivongo and Iazafo







Andapa

Total landscape area (ha)[b]	**107,677**
Number of communes[a]	14
Number of communes with Land tenure office[b]	0
Number of Households[b]	12,800
Intact forest cover[d,b]	**44%**
Roads (Km)[e]	93.58
Hydrography network (Km)[e]	313.24
Main crops	
- Vanilla[f] and rice	
- Average rice yield (t/ha)[a]	2.7
Main animal production (headcount)	
- Cattle population[g]	23,665
- Goat population	1,289
Potential area for Irrigated perimeter[a] (ha)	**9,545**

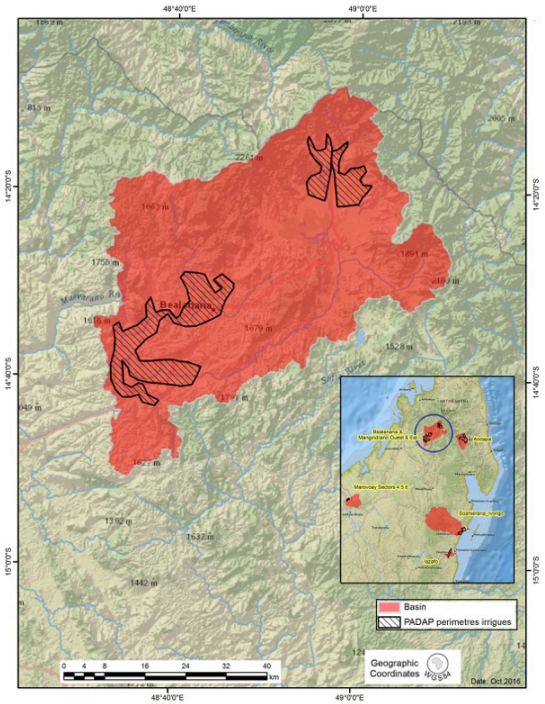
Soanierana Ivongo

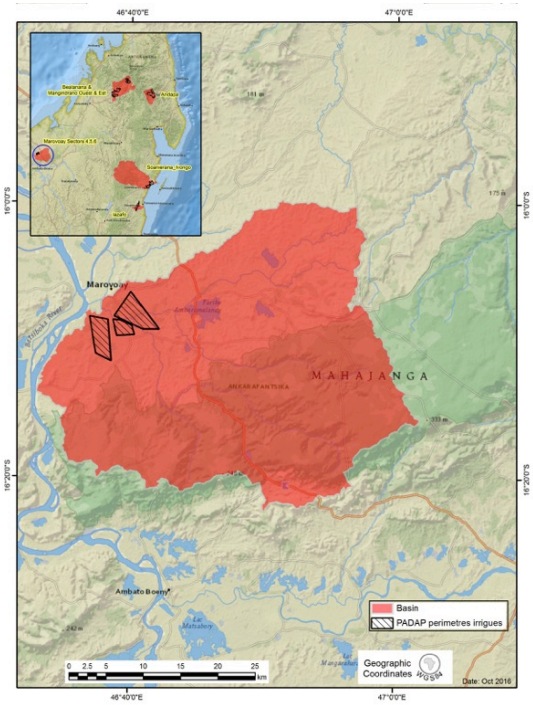
Total landscape area (ha)[b]	**573,554**
Number of communes[a]	09
Number of communes with Land tenure office[b]	04
Number of Households[b]	34,000
Intact forest cover[d,b]	**45%**
Roads (Km)[e]	81.38
Hydrography network (Km)[e]	1729.3
Main crops	
- Clove[f], Lychee[f] and Rice[a]	
- Average rice yield (t/ha)[a]	1.3
Main animal production (headcount)	
- Cattle population[g]	21,710
Potential area for Irrigated perimeter[a] (ha)	**10,682**

Iazafo

Total landscape area (ha)[b]	**45,970**
Number of communes[a]	06
Number of communes with Land tenure office[b]	07
Number of Households[b]	7,600
Intact forest cover[d,b]	**0.15%**
Roads (Km)[e]	77.93
Hydrography network (Km)[e]	133.21
Main crops production (tons)	
- Lychees[f], Clove[f], coffee and rice	
- Average rice yield (t/ha)[a]	1.7
Main animal production (headcount)	
- Cattle population[g]	64,300
Potential area for Irrigated perimeter[a] (ha)	**5,500**

WESTERN LANDSCAPES: BEALANANA & MAROVOAY





Bealanana Landscape

Total landscape area (ha)[b]	**277,498**
Number of communes[a]	13
Number of communes with Land tenure office[b]	0
Number of Households[b]	9,200
Intact forest cover[d,b]	**23%**
Roads (Km)[e]	150.41
Hydrography network (Km)[e]	823.94
Main crops: cassava[f] , Onion[f] and rice[a]	
Average rice yield (t/ha)[a]	2.4
Main animal production (headcount)	
- Cattle population[g]	104,058
- Goat population[g]	1,047
Potential area for irrigated perimeter[a]	**10,980**

Marovoay Landscape

Total landscape area (ha)[b]	**133,635**
Number of communes[a]	06
Number of communes with Land tenure office[b]	0
Number of Households[b]	5,600
Intact forest cover[d,b]	**29%**
Roads (Km)[e]	135.62
Hydrography network (Km)[e]	421.58
Main crop: rice	
Average rice yield (t/ha)[a]	2.0
Main animal production (headcount)	
- Cattle population[g]	104,579
- Goat population[g]	1,657
Potential area for Irrigated perimeter (sectors 4,5 & 6)[a]	**6,919**

1. Incremental reasoning for the use of GEF funds

2. The integrated approach at a landscape level adopted by the Project suggests the necessity of fostering an enabling environment for sustaining production, and economic development in the targeted landscapes. This enabling environment is ensured by a combination of sustainable management of the upstream landscape units (land types 4 and 5) for it to continue providing the critical ecosystems goods and services that are necessary for downstream economic activities, and a range of activities necessary to optimize productivity and economic benefits in the downstream units (land types 1, 2 and 3).

3. The GEF funds will be invested in activities that would ensure or/restore the integrity of the upstream units in the landscape, through four windows: (1) sustainable forest management; (2) land degradation; (3) climate change; and (4) biodiversity conservation. The rationale, justifying the use of the GEF funds in the integrated approach framework is based on the four following dimensions:

a. Long term benefits. Both the IDA and the AFD funds are credits for the GoM; it is then logical that the GoM primarily uses them for activities that are likely to yield short to mid-term economic returns; those activities are mainly related to land types 1, 2, and 3. Investments related to land types 4 and 5, essentially for biodiversity conservation, sustainable forest management, and partly on land type 3 for agroforestry practices will not bring immediate benefits, but rather will help ensure the sustainability over time of the positive impacts. The GEF grant is crucial to ensure the long term impacts and benefits of the Project while not compromising the economic return rate of IDA and AFD investments.

b. Risks. The Project will implement pilot activities, including silviculture of precious wood species for sustainable forest management (SFM) and PES. These pilot activities, if successful, could be a game changer for the development of local communities; however, there is a high uncertainty that they would be successful, which means, there is a high risk that they would not yield any revenues. Without the GEF funds, these pilot activities would not be undertaken by the GoM.

c. Survival for the most vulnerable: As mentioned, the Project aims at having a sustainable, productive landscape; which suggests behavioral and practices change: e.g. moving from using unsustainable slash-and-burn cultivation to adopting agricultural practices using terracing, agroforestry practices on land type 3. The issue is that the most vulnerable people in the community (whose survival entirely depends on those mid-slope lands) cannot afford to adopt those new practices immediately even if they are convinced of their benefits, because they cannot wait for the terraces to be stabilized to eat. The GEF funds will thus be used to engage those people in natural resources management activities, including tree planting, labor for the terracing work, so as to sustain their short term livelihood needs while longer term benefits from the project kick in.

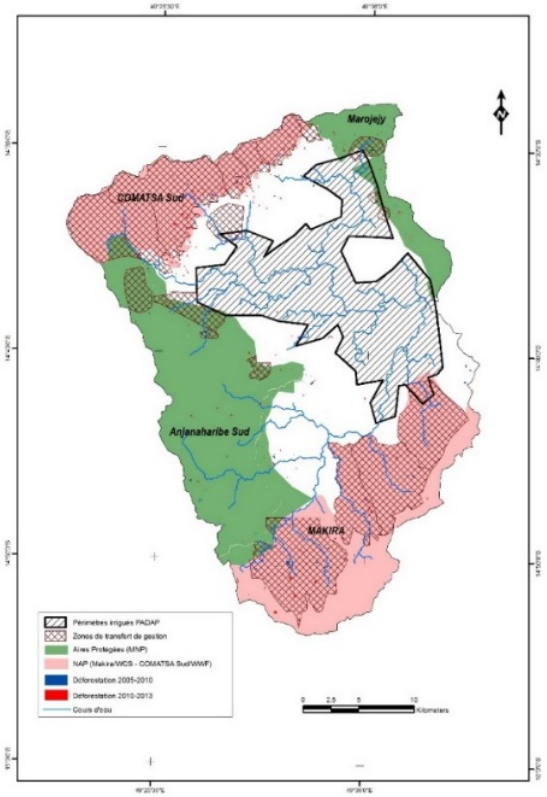
d. Global benefits: Aside from the above dimensions, the GEF-funded activities, especially forest restoration and reforestation, but also sustainable forest management and biodiversity conservation, will contribute to global benefits for its climate change mitigation and adaptation aspects. In addition the biodiversity funding from the GEF is

expected to contribute to the Aichi Targets[61] of the Convention on Biological Diversity, specifically goals A (Address the underlying causes of biodiversity loss by mainstreaming biodiversity across government and society); B (Reduce the direct pressures on biodiversity and promote sustainable use) and E (Enhance implementation through participatory planning, knowledge management and capacity building).

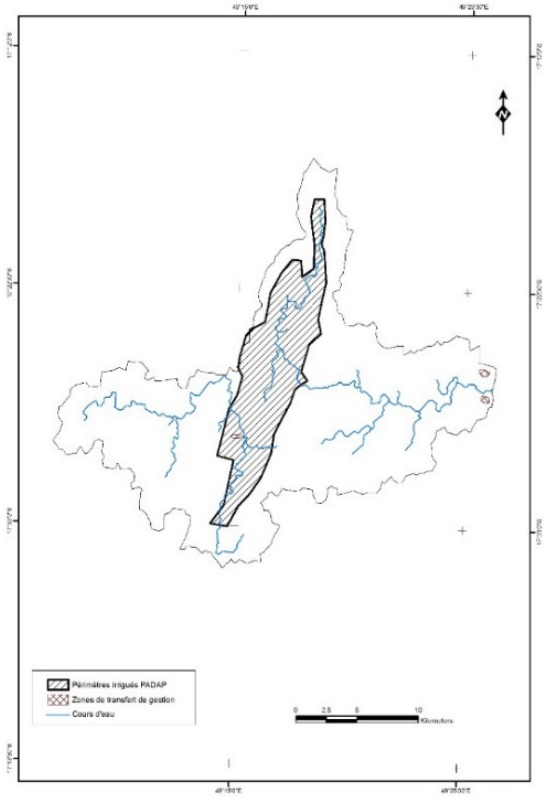
2. Existing protected areas and current interventions

4. Four out of the five Project landscapes have at least a portion of existing protected areas within their boundary, with a total of 10 protected areas involved in the Project. There are 4 types of protected areas: National Parks and Special Reserves managed by Madagascar National Parks and New Protected Areas that are managed institutions through management delegation issued by the MEEF. The following series of maps depict these protected areas within each landscape.

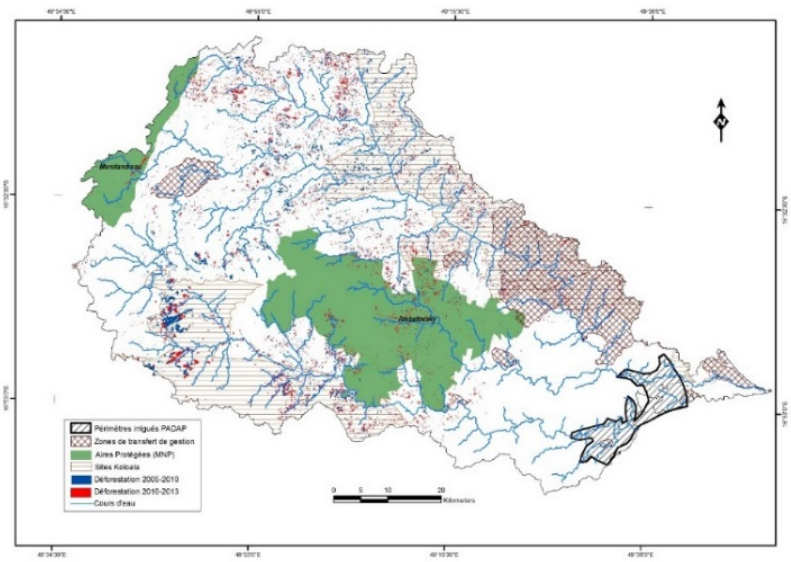
Andapa landscape (4 PA)



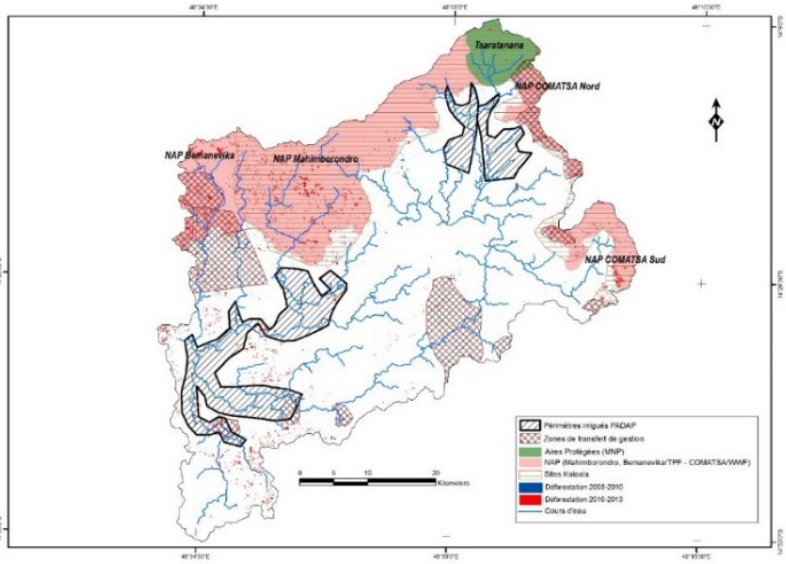
Iazafo landscape (no PA)



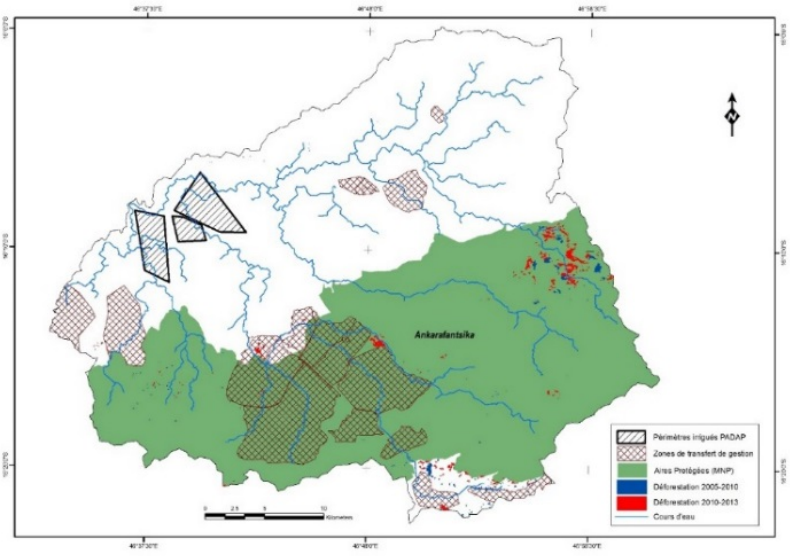
[61] See https://www.cbd.int/sp/targets/.



Soanierana Ivongo Landscape (2 PA)



Bealanana landscape (4 PA)



Marovoay landscape (1 PA)

5. Table 13 summarizes the information available to date, related to the protected areas involved in the Project's landscapes, along with the current interventions conducted by either MNP, the delegated manager and/or the other stakeholders involved in the areas. The protected areas system in Madagascar is currently facing critical funding constraints. GEF financing under the project will allow to sustain a number of critical activities while responding to the landscape logic, i.e. conservation activities will be targeted to maximize ecological functions in those parts of the protected areas that are in the upstream zones of the selected landscapes. In this sense, GEF financing will be highly complementary to the IDA and AFD financing in areas further downstream in the same landscapes.

TABLE 13. PROTECTED AREAS IN THE PROJECT LANDSCAPES

Protected areas	Support currently provided and already planned
ANDAPA LANDSCAPE **Marojejy (National Park)** - Managed by MNP - PA accounts for 5.07% of total landscape area - 7.25% of PA inside landscape - Deforestation rates: - 2005-2013: 0.01% - 2010-2013: 0.01% **Anjanaharibe Sud (Special Reserve)** - Managed by MNP - PA accounts for 21.57% of total landscape area - 61.78% of PA inside landscape - Deforestation rates: - 2005-2013: 0.01% - 2010-2013: 0.02%	- PA-related activities (patrolling, surveillance, ecologic monitoring, research, active biodiversity conservation, conservation infrastructures); - Support to local communities (environmental sensitization for communities surrounding the PA, support to local structures, and provision of alternatives to the PA buffer zones); - Investment into ecotourism: rehabilitation of infrastructures, camping sites, etc.
Makira (New Protected Area: Natural Park) - Managed by WCS - PA accounts for 21.39% of total landscape area - 3.19% of PA inside landscape - Deforestation rates: - 2005-2013: 0.13% - 2010-2013: 0.19%	- Patrolling (monitoring and surveillance), including conjoint (WCS and local communities) patrolling; - Physical delineation (for titling purpose) of the Natural Park boundaries; - Restoration of the Besariaka forest; - Sensitization campaigns (radio programs, village reunions; communication about forest carbon), and production of didactical tools, as well as festivals; - Trainings provided to conservation groups; - Provide education programs to school kids (including school reforestation program); - Professional development programs for COBAs for sustainable natural resources management; - Development programs and community health.
South COMATSA (New Protected Area) - Managed by WWF - PA accounts for 12.60% of total landscape area - 16.91% of PA inside landscape - Deforestation rates: - 2005-2013: 0.11% - 2010-2013: 0.75%	- Support to COBAs through management transfer schemes (georeferenced patrols, participatory ecologic monitoring); - Passive and active forest restoration, with diffusion of native species' nurseries; - Diffusion of individual and community reforestation for energy; - Environmental sensitization and communication; - Structuring of group of farmers to have more negotiation power against other stakeholders for economic transactions; - Diffusion of income-generating activities (fish farming, rice-growing, cash-crops), along with provision of technical assistance; - Implementation of compensation activities according to the Environmental and Social Management plan (PGESS); *- Physical delineation of the New Protected Area and the Community-based forest management area;* *- Conjoint patrolling;* *- Trainings to COBAs for sustainable natural resources management, including monitoring and technical assistance;*

Protected areas	Support currently provided and already planned
	- Development of management tools (local monitoring of deforestation, conservation targets,); *- Capacity building for local civil society in order to improve environmental governance;* *- Renewal of management transfer contracts;* *- Introduction of climate-smart agricultural practices;*
SOANIERANA IVONGO LANDSCAPE **Ambatovaky (Special Reserve)** - Managed by MNP - PA accounts for 16.21% of total landscape area - 100% of PA inside landscape - Deforestation rates: - 2005-2013: 0.19% - 2010-2013: 0.45%	- PA-related activities (patrolling, surveillance, ecologic monitoring, research, active biodiversity conservation, conservation infrastructures) - Support to local communities (environmental sensitization for communities surrounding the PA, support to local structures, and provision of alternatives to the PA buffer zones). - Investment into ecotourism: rehabilitation of infrastructures, camping sites, etc.
Marotandrano (Special Reserve) - Managed by MNP - PA accounts for 4.07% of total landscape area - 51.80% of PA inside landscape - Deforestation rates: - 2005-2013: 0.09% - 2010-2013: 0.41%	
BEALANANA LANDSCAPE **Bemanevika (New Protected Area)** - Managed by TPF - PA accounts for 4.17% of total landscape area - 32.49% of PA inside landscape - Deforestation rates: - 2005-2013: 0.19% - 2010-2013: 2.36%	- Implementation of safeguards-related activities and livelihood improvement (subsistence agriculture, short-cycle livestock farming, and equipment provisions: seeds, plow, harrow, etc.) - Diffusion of improved cookstoves, - feeder road rehabilitation - PES-related activities: development of a system for valorization of ecosystem services (creation of public/community infrastructures such as hydropower).
Mahimborondro (New Protected Area) - Managed by TPF - PA accounts for 15.86% of total landscape area - 58.54% of PA inside landscape - Deforestation rates: - 2005-2013: 0.07% - 2010-2013: 1.47%	- Implementation of safeguards-related activities and livelihood improvement (subsistence agriculture, short-cycle livestock farming, and equipment provisions: seeds, plow, harrow, etc.) - Diffusion of improved cookstoves; - Wildfires prevention activities (soft: sensitization, structuring of fire committee; and hard: fire breaks); - Development of degraded forest restoration program to prevent further erosion.
North COMATSA (New Protected Area) - Managed by TPF - PA accounts for 3.72% of total landscape area - 4.33% of PA inside landscape - Deforestation rates: - 2005-2013: 0.11% - 2010-2013: 0.75%	- Support to COBAs through management transfer schemes (georeferenced patrols, participatory ecologic monitoring); - Passive and active forest restoration, with diffusion of native species' nurseries; - Diffusion of individual and community reforestation for energy; - Environmental sensitization and communication; - Structuring of group of farmers to have more negotiation power against other stakeholders for economic transactions; - Diffusion of income-generating activities (fish farming, rice-growing, cash-crops), along with provision of technical assistance; - Implementation of compensation activities according to the Environmental and Social Management plan (PGESS); *- Physical delineation of the New Protected Area and the Community-based forest management area;* *- Trainings to COBAs for sustainable natural resources management, including monitoring and technical assistance;* *- Development of management tools (local monitoring of deforestation, conservation targets,);* *- Capacity building for local civil society in order to improve environmental governance;* *- Renewal of management transfer contracts;* *- Introduction of climate-smart agricultural practices;*

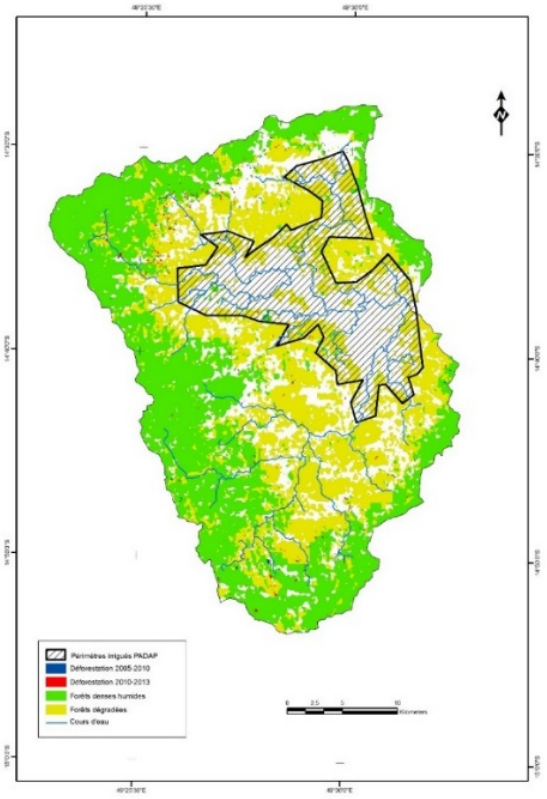
Protected areas	Support currently provided and already planned
MAROVOAY LANDSCAPE	
Ankarafantsika (National Park) - Managed by MNP - PA accounts for 56.35% of total landscape area - 55.13% of PA inside landscape - Deforestation rates: - 2005-2013: 0.15% - 2010-2013: 1.36%	- PA-related activities (patrolling, surveillance, ecologic monitoring, research, active biodiversity conservation, conservation infrastructures) - Support to local communities (environmental sensitization for communities surrounding the PA, support to local structures, and provision of alternatives to the PA buffer zones). - Investment into ecotourism: rehabilitation of infrastructures, camping sites, etc.

COBA: Local communities; COMATSA: Marojejy-Anjanaharibe-Sud-Tsaratanana Corridor; TPF: The Peregrine Fund; WCS: Wildlife Conservation Society; WWF: World Wide Fund for Nature; MNP: Madagascar National Parks.

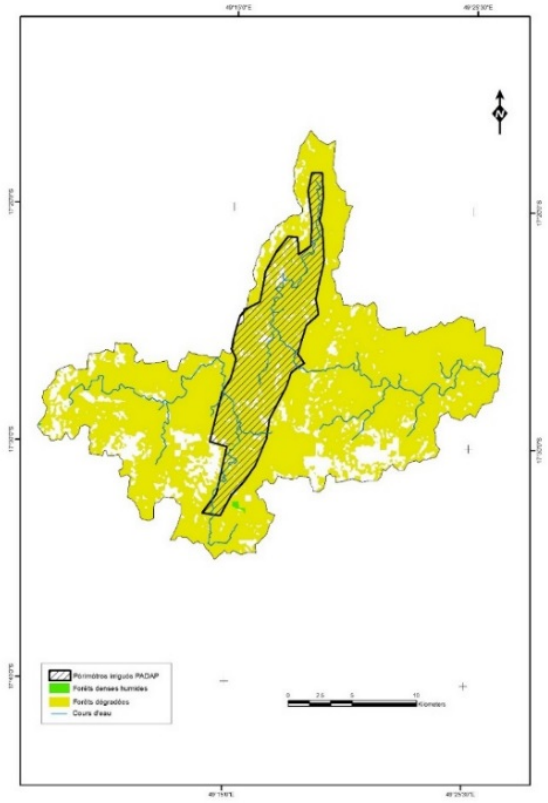
3. Forests outside Protected Areas

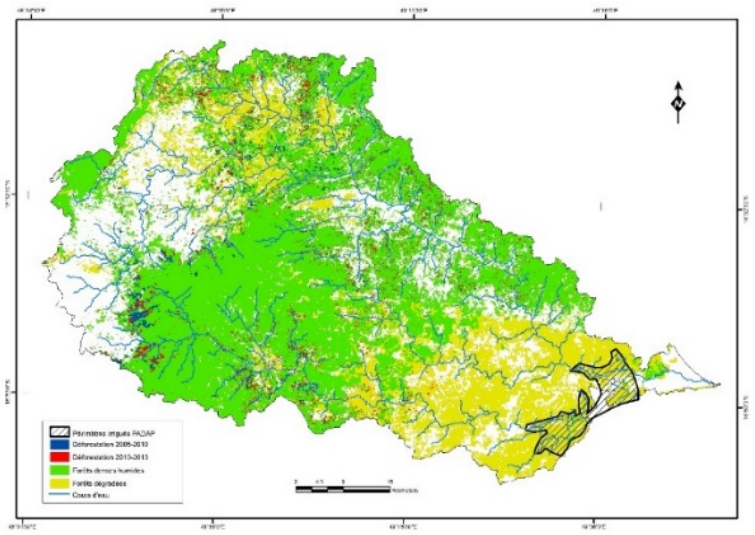
6. There are two main types of forest ecosystems involved in the Project's landscapes: the eastern rainforest ecosystem, which is located in three landscapes (Andapa, Soanierana Ivongo and Iazafo, and Bealanana; and the western dry forest, involving the Marovoay landscape. The following series of maps provide an overview of the extent of the deforestation between 2005 and 2013, and forest degradation (proportion between the intact and the degraded forests), as well as the relative importance of the forest cover the different landscapes. One crucial element that is missing from the below maps are the extent of the degraded forests for the Marovoay landscape; this information gap will still need to be filled during project implementation.

Andapa (IF: 44%, DF: 34%)

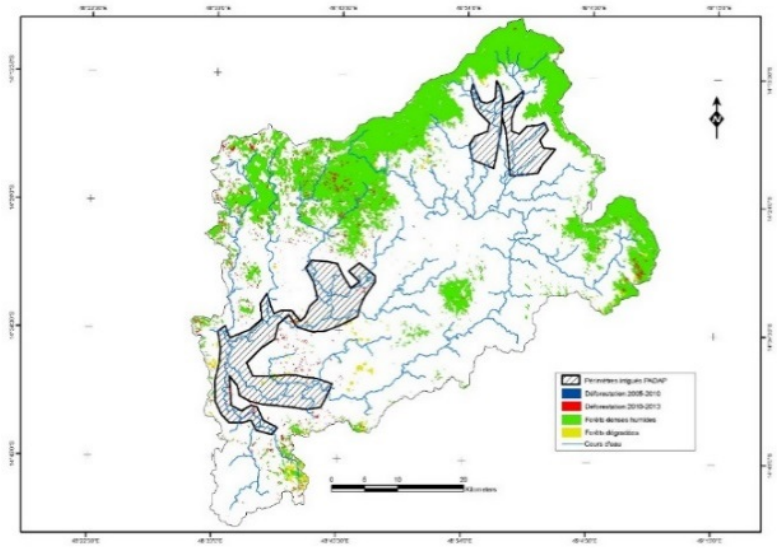


Iazafo (IF: 0.15%, DF: 86%)

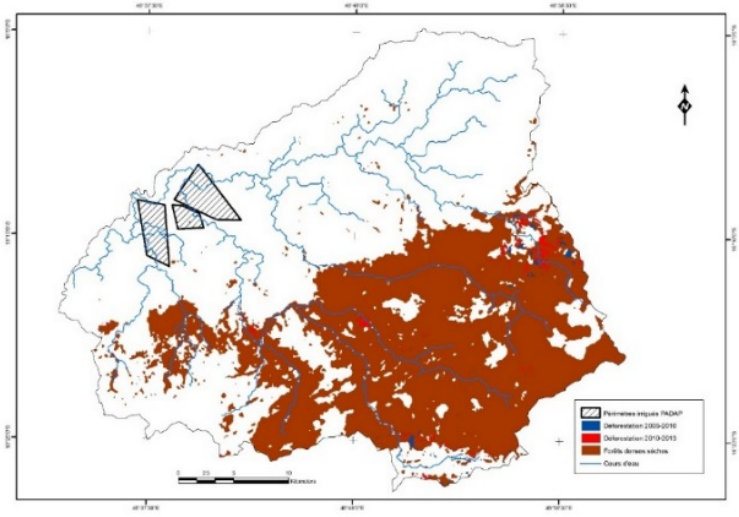




Soanierana Ivongo (IF: 45%, DF: 23%)



Bealanana (IF: 23%, DF: 0.65%)



Marovoay (IF: 29%)

IF: Intact forest cover (% total landscape area); **DF**: degraded forest cover (% total landscape area)

4. The Community-based forest management areas

7. Apart from the protected areas, there are also existing community-managed forests. The management of these forests have been transferred to the local communities (COBA) under the GELOSE law of 1996. These community-managed forests were intended to form a belt on the outskirts of the protected areas, (suggesting that there is a high proportion of degraded forests as part of the community-managed forests) in order to reduce the pressure inside the protected areas. In the long term, these community-managed forests are expected to be sustainably managed and will be used both for conservation purposes, but also for economic benefits. The distribution of community-managed forests is summarized in table 14 below.

TABLE 14. COMMUNITY-MANAGED FORESTS IN THE PROJECT LANDSCAPES

Landscape	Andapa	S. Ivongo	Iazafo	Bealanana	Marovoay
Forest area under CBFM management (ha)	23,081	31,753	79	8,428	9,347
Proportion of forested area managed by COBA compared to total forest area in the landscape (%)	30.20%	7.71%	0.20%	14.18%	44.98%

8. The GoM, through the project will put strong emphasis on providing support to the existing COBA, but also on creating new ones, especially in the landscapes of Bealanana and Soanierana Ivongo, where the potential for community-based forest management schemes for economic purposes through timber harvesting is still substantial.

5. List of climate-smart agriculture practices already in place in the selected landscapes

To date, five categories of CSA have been identified in the landscapes of intervention of the SLMP project as depicted in the Table 15 below. A more refined and detailed inventory of the practices may be undertaken during project implementation.

TABLE 15. LIST OF CLIMATE-SMART AGRICULTURE PRACTICES CATEGORIES ALREADY IMPLEMENTED BY FARMERS IN THE PROJECT LANDSCAPES OF INTERVENTION

List of practices	Andapa	S. Ivongo	Iazafo	Bealanana	Marovoay
Soil Management (conservation agriculture: cover crop, no-tilling, etc.)	X	X	X	X	X
Crop production (use drought-tolerant varieties, varieties with shorter cycle, pest-tolerant varieties, substitution of vulnerable annual crops with more hardly perennials, etc.)	X	X	X	X	X
Water management in irrigated perimeters (SRI)	X	X	X	X	X
Livestock Management (improved forage)		X	X	X	
Agroforestry	X	X	X	X	X

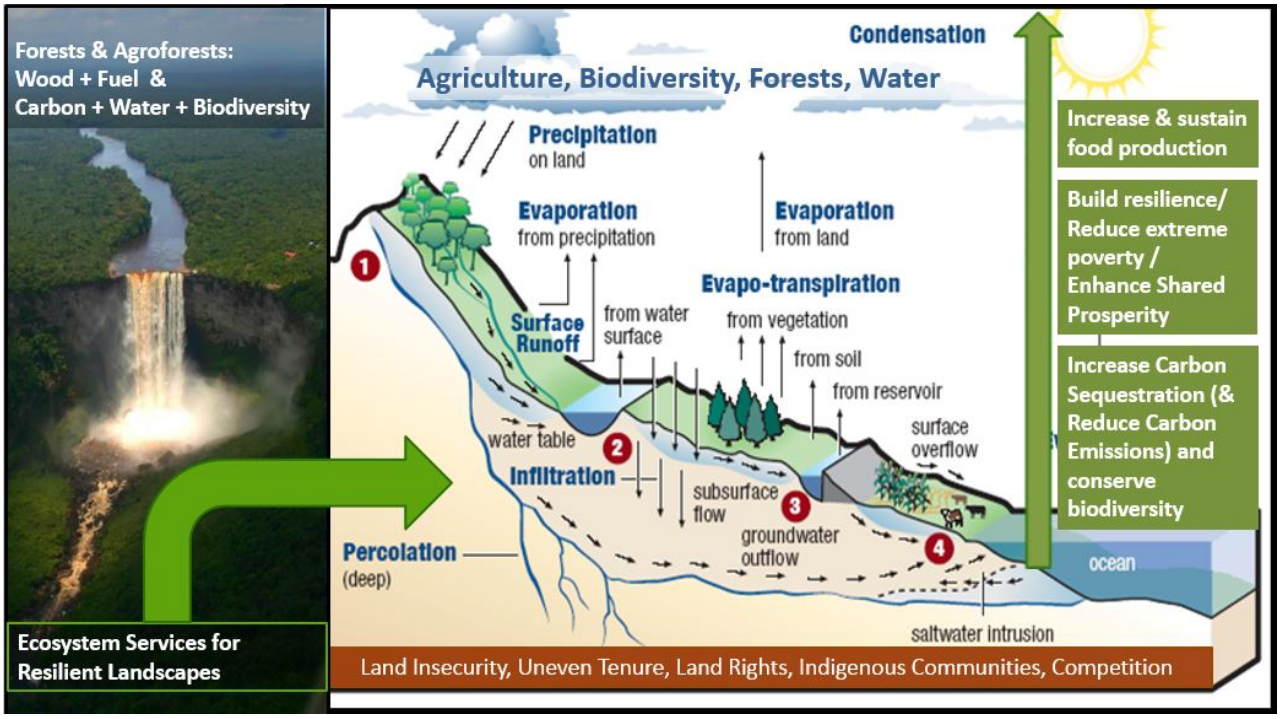
Source: Project inter-ministerial committee.

ANNEX 6. SPATIAL INFORMATION SYSTEM

1. Madagascar has a large amount of natural resource, social, political, and economic data that are needed for effective planning and decision making in the face of a growing population, changing land use, and climate change drivers. A tested approach in many regions to organize, enhance access by authorized users, and to use the data for planning and decision making is via the development of Spatial Information Systems.

2. The objective of the SIS is to provide: (i) an integrated geospatial repository for existing but disaggregated and diffusely distributed data from different Ministries and government agencies, and (ii) a gateway for dynamic understanding, planning and management of any landscape (Figure 4). The goal is to deliver actionable information, as the foundation for a high-level decision support system by providing (quantitative) analyses of complex, systemic interdependent environmental problems.

FIGURE 4. SCHEMATIC OF THE BIOPHYSICAL COMPONENTS OF ANY LANDSCAPE INCLUDING THE CARBON, ENERGY, AND WATER CYCLES THAT CONTRIBUTE TO THE PRODUCTION AND ENVIRONMENTAL SERVICES ESSENTIAL FOR SUSTAINABLE DEVELOPMENT



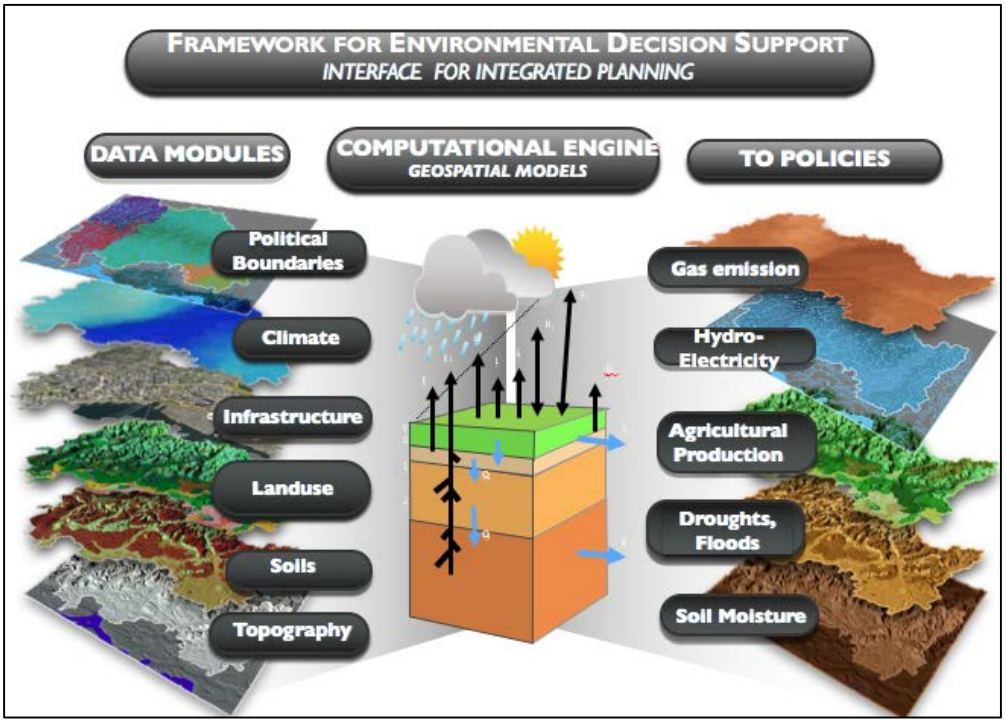
Source: Adapted from Fernandes (2006), "Sustainable Land Management: Challenges, Opportunities & Tradeoffs".

3. The SIS approach draws on the emergence of Earth Systems Sciences based on the rapidly evolving capabilities for addressing global change issues through the use of satellites, new generations of dynamic computer models, and field measurements/observations.

4. The architecture of the SIS computing framework consists of streaming information from multiple sources (e.g. satellites, weather records and operational climate models, soil profiles, stream gauges, species lists) and rendering them into data layers identified as the required inputs for the geospatial hydrology and landscape models (Figure 5). The core of the information framework is built by targeting the outputs required for decision support; for example, targets of

soil moisture, floods and drought, agricultural production, or hydropower. These geospatial targets can be derived from computational tools, such as land surface models. These models in turn require information from multiple sectors, which in turn can serve multiple purposes.

FIGURE 5. FRAMEWORK FOR MULTISECTOR DECISION SUPPORT



1. SISs for Decision Support from local to landscape scales

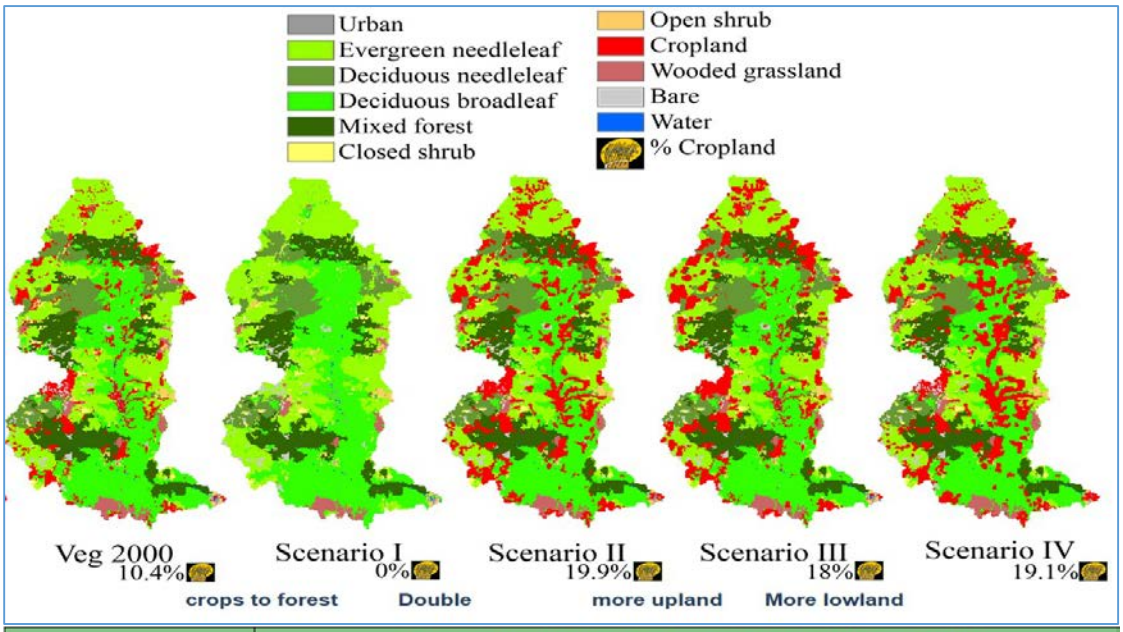
5. The overarching "framework" component of the SIS is to place the data layers and computational tools within the context of decision-making requirements and visualization of results in a format useful to resource managers. The approach is to coordinate the ensemble of data products that span a wide spatial and temporal range in a single, centralized location.

6. There are three main data modules categories based on their function in relation to the computational model: static input data, dynamic input data, and observed data. Even in very remote, data-sparse regions, global coverages can provide at least first-order estimates (viz. Google Earth). These datasets include: digital elevation maps from Shuttle Radar Topography Mission (SRTM) to delineate the river network and watershed boundaries, remotely sensed land cover maps from MODIS, soil distributions and parameters from the Food and Agricultural Organization, observed streamflow from the Global Runoff Data Centre, and terrestrial water storage observations from the Gravity Recovery and Climate Experiment satellite mission to validate against the water balance.

7. The "dynamic" component of the SIS is based on two concepts. First, it is a decision platform that can analyze historical, current, and future patterns so that outputs are dynamic in time. Second, the components of the SIS platform are dynamic in that the key pieces used for assessment might change as a project and stakeholder needs evolve. The initial SIS applications

have emphasized hydrologic modeling as the computational engine that integrates the climate and biophysical data layers SIS to generate the dynamic outputs and scenarios shown in Figure 6.

FIGURE 6. FRAMEWORK FOR MULTISECTOR DECISION SUPPORT



Landcover scenarios		Average hydrologic components (1995 – 2000)			
		Annual yield, mm (m^3/s)	High flow, m^3/s^a	Low flow, m^3/s	Annual evapotranspiration, mm
Veg 2000	I	215 (26.2)	54.7	7.6	762
	NI	249 (30.5)	58.6	12.0	727
Scenario I	NI	223 (27.2)	53.3	11.1	752
Scenario II	I	202 (24.7)	53.6	5.8	781
	NI	261 (31.8)	61.2	12.5	715
Scenario III	I	220 (25.6)	56.8	7.0	759
	NI	269 (32.8)	63.1	12.7	707
Scenario IV	I	193 (23.6)	51.6	5.6	786
	NI	251 (30.7)	59.1	12.2	724

8. The existing core computational model(s) used in SIS are open source (code freely available) "land-surface models," representing the flow of water across the landscape. Ideally, for broader scales (15kmx15 km) a semi-distributed, grid-based macroscale model that explicitly represents the effects of vegetation, topography, and soils on the exchange of moisture and solar energy between land and atmosphere is needed. For higher resolution applications (5kmx5km or less), fully-distributed models that recognize the spatial heterogeneity of the watershed are recommended if adequate local data can be accessed. Currently available SIS model components are powerful enough and of sufficient resolution to provide simulations and scenario options for the PADAP Landscape profiles presented in Annex 5. Figure 6 shows one example of landscape scale land cover and land use scenarios and associated surface flows generated for landscapes in EAP.

9. Because the SIS models integrate rainfall, temperature, evapotranspiration variables they can also be parameterized to incorporate projected climate change and thereby can provide outcome scenarios that are essential for objectively designing climate smart land management plans. For PES, the SIS could be used to select several candidate pairs of catchments at each of the sites. Monitoring paired catchments (one treated, one not) can help assess the effect of treatments and to verify that the land use interventions and hydrological models make reliable predictions of these effects. Some of these candidate catchment pairs will be selected (based on planned interventions) for close monitoring and re-calibration of the SIS modules.

10. The SIS could be coupled with additional data simulation and/or analytical modules. For example:

Collect Earth, an open source analytical platform developed by FAO that geo-synchronizes the visualization and use of imagery of varying spatial and temporal resolutions, including DigitalGlobe, SPOT, Sentinel 2, Landsat and MODIS imagery within Google Earth, Bing Maps and Google Earth Engine. Images from multiple years are supplemented by seasonal and multi-year graphs of several indices (e.g., Landsat 8 32-day Normalized Difference Vegetation Index (NDVI), Normalized Difference Water Index (NDWI), Enhanced Vegetation Index (EVI), Moderate Resolution Imaging Spectroradiometer (MODIS) 16-DAY NDVI and Landsat 7 Monthly NDVI Composite).

NDVI and Land Degradation: Use of satellite data for assessment of land degradation is a big improvement from past land degradation assessments, which heavily relied on expert opinion. A global study led by the International Food Policy Research Institute (IFPRI) created a new product derived from NDVI, which captures the intensity of greenness of land cover, inferring net primary productivity (NPP), i.e. the net biomass produced by the soil and other natural resources – after controlling for soil fertility amendment (e.g. application of fertilizers and manures) and rainfall variability. The corrected NDVI is used as a quantitative indicator for land degradation. Household surveys are used to ground truth the NDVI-derived outputs.

Dinamica EGO is an open source simulation platform developed by researchers at the University of Minas Gerais, Brazil. One module, OTIMIZAGRO, is a spatially explicit model that simulates land-use, land-use change, forestry, deforestation, regrowth, and associated CO_2 emissions, under various scenarios of agricultural land demand and deforestation/forest restoration policies. OTIMIZAGRO models nine annual crops, including single and double cropping (soy, sugarcane, corn, cotton, wheat, bean, rice, cassava, tobacco) and five perennial crops (arabica coffee, Robusta coffee, oranges, cocoa, and banana), and forest plantations. Such a model could and will need to be parameterized for Madagascar based on local policies and biophysical conditions.

2. Steps for implementing the development of a PADAP-SIS

11. Through previous SIS development processes in World Bank operations in Europe and Central Asia (ECA), Latin America and Caribbean (LAC), and South Asia Region (SAR), feedback from local stakeholders has pointed to three main components that are necessary to make the SIS a viable decision support tool:

i. Assembling a local, cross sector expert team that will be engaged in assembling the SIS is critical for empowering national agencies, enhancing local capacity, and ensuring the short to long-term national commitment to a sustainable and functional SIS. The local agency

buy-in via their experts improves both the access to and the transparency of data use as well as encouraging reproducibility of modeled outcomes.

ii. Complex modeled outcomes and scenarios need to be presented in compelling and easy to understand formats via user interfaces that are comparable with local needs and culture. Increasingly, web-based and ICT-based visualization tools are being used by a range of stakeholders (including farmers in many African countries) to access information in near real-time.

iii. The lack of computing and multi-sector data infrastructure can be a barrier to utilizing the tools within an SIS. To address this challenge, the SIS modules can be deployed using cloud services in order to reduce the need for each Ministry requiring expensive and not easy to maintain computing infrastructure, especially in countries where computing resources are limited.

12. The development of an effective PADAP-SIS will require investments that address the constraints identified above. A key starting point is the assembly of a multi-sector SIS team (Ministry, local government agencies, and local academia) that forms the core for an initial capacity enhancement workshop. The outcome of such a workshop is an empowered national and multisector SIS team with specific responsibilities for data access and acquisition and institutional participation in the SIS building process. Once the SIS data layers are assembled, the SIS becomes a valuable tool for the multitude of capacity enhancement activities identified in the project components.

13. Based on work in other World Bank regions developing a functional PADAP-SIS with strong local participation is expected to cost about US$400,000-500,000 depending on: (i) the extent and quality of local data: (ii) the quality of available local data, (iii) the need for new data acquisitions: and (iv) the adequacy of existing data and cyber infrastructure and potential to transform local server-based resources to more secure cloud-based platforms.

ANNEX 7. PAYMENTS FOR ENVIRONMENTAL SERVICES

1. Payments for Environmental Services (PES) will be an important tool for the PADAP project, since it will allow the conservation or restoration of landscape elements that are important for hydrological services, biodiversity, and/or carbon but which are not profitable for the local population. This annex explains the rationale for the use of PES in the Project, and the challenges it will face in doing so. It also identifies the ways in which the Project's activities will lead to the design and implementation of PES pilots, as these activities are part of several sub-components rather than being grouped together.

1. Rationale for the use of PES in PADAP

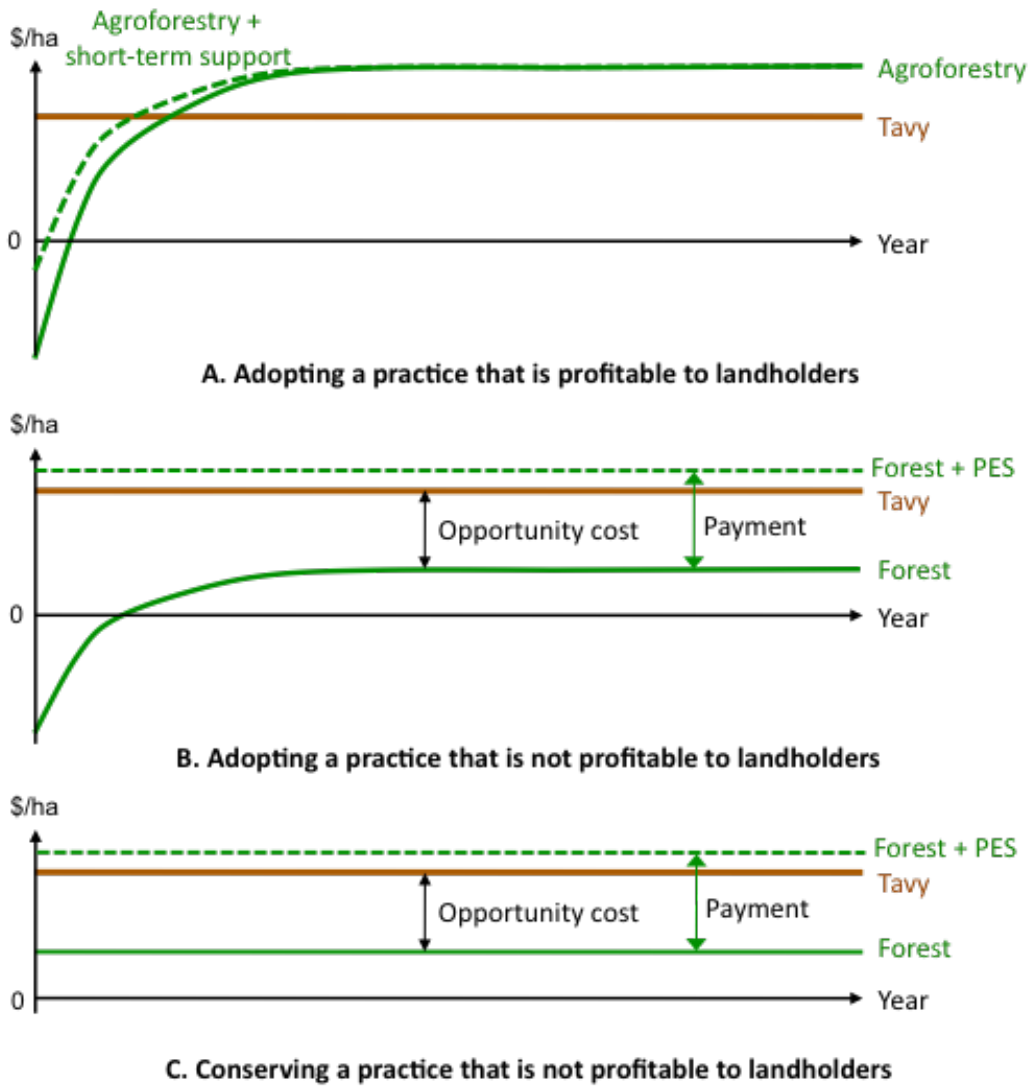
2. Depending on how they are used, landscapes can provide a wide variety of benefits. In addition to producing agricultural products, they can produce hydrological services, conserve biodiversity, and sequester carbon, for example. However, the landholders who actually manage the landscape generally only receive a small part of these benefits, while others benefit downstream water users such as irrigation systems, domestic water supply systems, and hydroelectric power producers, in the case of hydrological services, and the global community in the case of biodiversity conservation and carbon sequestration. As a result, landholders don't take these broader benefits into account in their land use decisions, and many valuable parts of the landscape have been lost, replaced by much less environmentally friendly land use practices, while others are under severe threat of conversion.

3. The improvements to be undertaken at the project sites will often be 'win-win' in the sense that they will benefit both the landholders themselves and environmental service users. Replacing unsustainable upland rice (*tavy*) production with a sustainable agroforestry system, for example, would increase income for landholders while reducing erosion, increasing carbon sequestration, and providing a more biodiversity-friendly habitat. In cases in which the new practices to be adopted are more profitable to landholders than their current practices, short-term support should be sufficient to stimulate their adoption sustainably. This support might take many forms, such as the financial support to the necessary investment, TA, and/or provision of required inputs, depending on the nature of the obstacles to adoption of the practice.

4. However, all elements of the desired landscape are not necessarily 'win-win'. Some of the practices that generate environmental services such as watershed protection, biodiversity conservation, and/or carbon sequestration are less profitable to individual landholders than alternative, less environmentally friendly practices. Landholders are unlikely to be willing to adopt these practices voluntarily. Short-term support might persuade them to do so, but they are then likely to abandon them once the short-term support ends. Such practices are only likely to be adopted sustainably if landholders are offered long-term support that compensates them for the opportunity cost of foregoing more profitable (but less environmentally friendly) practices.

5. The various possible cases are shown in figure 7. In each case, the benefits shown are the net benefits to landholders of undertaking a given activity. The benefits to downstream users or the global community of undertaking activities such as forests or agroforestry are not shown, and neither are the costs imposed on others by environmentally harmful activities such as *tavy*.

FIGURE 7. TYPES OF LAND USE CHANGES IMPLEMENTED IN A LANDSCAPE



6. In Panel A, *tavy* is replaced by productive practices such as agroforestry or silvopastoral practices, which are more profitable for landholders than *tavy* once established. Their profitability mean that landholders are likely to adopt them readily, once obstacles to their adoption have been removed, and then retain them even after the project ends. This is the 'win-win' case. Most of the land use practices supported under component 2 are likely to be of this kind. Because short-term support is sufficient, efforts to induce adoption of these practices can easily be financed by the project itself.

7. Panel B shows a case in which *tavy* is replaced by a conservation practices such as forest, which generates limited or no returns to landholders, either because of its nature or because of restrictions on its use (for example, if the land is located inside a protected area). In this case, net returns to landholders may well be lower than those of tavy (if that were not the case, the forest would not have been cleared for *tavy*). On addition to the initial investment cost, there would thus be an opportunity cost for landholders from foregoing income from *tavy*. A sufficiently large short-

term subsidy might induce landholders to adopt such practices, but they will abandon them in favor of the more profitable *tavy* once the subsidies end. Landholders are only likely to retain such practices if they receive a payment sufficient to offset the opportunity cost of foregoing *tavy*. Crucially, this payment must be made annually, and indefinitely. As such, it cannot be financed by the project itself beyond the first few years (although the project can certainly finance the initial cost of reforestation).

8. Panel C shows a case in which a forest remnant is being conserved to avoid it being cut down for *tavy*. Maintaining the forest would impose an opportunity cost to landholders in the form of foregoing income from *tavy*. Landholders are thus unlikely to retain forest unless they receive a payment sufficient to offset this opportunity. Here, too, this payment must be made annually, indefinitely, and so cannot be financed by the project itself beyond the first few years.

9. There are thus likely to be at least some elements of the landscape that would be desirable because of their hydrological, carbon sequestration, or biodiversity conservation benefits that will not voluntarily be adopted by landholders in the absence of long-term payments. Because such payments must last far beyond the end of the project, however, they cannot be financed by the project itself.[62]

10. One approach to avoiding this problem is to try to increase the returns that landholders receive from forests. Developing ecotourism, for example, could generate an income stream for landholders. Developing new value chains for forest products could have the same effect. The project will support such efforts, wherever possible, under Component 2. In some cases, these efforts will be sufficient to make forests more valuable than the alternatives, thus converting a case such as that shown in Panel B of Figure 7 to one similar to that shown in Panel A. In some cases, however, such efforts will either be impractical (for example, areas where access is too limited for commercialization of forest products to be viable), disallowed (for example, forests within protected areas), or insufficient (ecotourism and/or forest products may not enough generate additional income to compensate for the opportunity cost of foregoing *tavy*). There will thus remain some practices whose presence in the landscape would be desirable that would not be adopted (or retained) by landholders.

11. Providing long-term compensation to landholders who adopt environmentally friendly land use practices is precisely the objective of PES, which are contingent payment to those who manage natural resources so as to benefit others. The World Bank has supported PES programs in a large number of projects.[63]

2. PES experiences in Madagascar

12. Although use of PES has been concentrated in Latin America, there is growing interest in and use of the approach in other regions, including Africa. Several PES pilots are being implemented in Madagascar, including several programs aimed at improving hydrological services

[62]. The Project could finance long-term payments if it established a trust fund, as was done in the *Costa Rica Mainstreaming Market-Based Instruments for Environmental Management Project (P093384/P098838).*

[63] There are currently ten projects under implementation with PES components (in Brazil, Colombia, Mexico, Nicaragua, Ghana, Kenya, Albania, and Bhutan) and one under preparation (in Kenya), in addition to this one

(at Andapa and Tolongoina), several focusing on carbon sequestration (in Makira and the Corridor Ankeniheny-Zahamena - CAZ), and some focusing on biodiversity (for example, at Menabe).[64]

13. Despite these pilots, the track record of PES in Madagascar to date has been limited. The few efforts that have been made to convince service users to pay to conserve the ecosystems that benefit them (at Andapa and Tolongoina) have only yielded nominal funding, more important for their symbolic value than for their monetary value. On the supplier side, there have been few efforts to implement truly conditional payments, with the Durrell Trust's project in Menabe being the only exception. Neither has there been any significant effort to make actual payments: most 'PES' projects have followed the standard approach of most rural development projects in Madagascar of financing specific activities.

3. Challenges to implementing PES in Madagascar

14. Implementing PES generally requires four parallel sets of activities: (1) understanding the linkages between land use and the desired environmental services; (2) putting in place financing arrangements; (3) putting in place field arrangements to contract providers, monitor compliance, and make payments; and (4) putting in place the institutional framework. This section reviews the challenges faced by these activities in Madagascar, in light of the experience of the few existing PES pilots in the country, experience with PES implementation worldwide, and country characteristics. It also indicates the activities that the PADAP project will undertake to meet these challenges.

15. **Links between land use and service generation.** As in many countries, the understanding of how different land uses affect the various environmental services of interest is imperfect. However, advances in the use of remote sensing imagery and hydrological modeling make this much less of an obstacle than it once was. Moreover, the P4GES initiative has been carrying out research on impacts of land uses change on hydrological ecosystem services in Madagascar.

16. The Spatial Information System developed under Component 1 will provide the basis for the hydrological modeling necessary for the development and implementation of PES pilots. These hydrological models will be developed under Component 2, as part of the preparation of river basin plans for the PADAP project sites. They will identify critical hydrological areas in the target watersheds, the land uses that could contribute to protecting downstream water users, and estimate the potential impacts of their adoption on downstream water services.

17. **Working with service users.** As noted, conserving or restoring landscape elements such as forests that are important for hydrological services, biodiversity, and/or carbon but which are not profitable for local landholders, requires long-term compensation to landholders and, therefore, long-term financing sources. In some countries, such as Costa Rica and Mexico, the government provides such financing (usually through dedicated income sources to avoid year-to-year variations in funding levels). Given its fiscal constraints and other pressing demands, however, the Government of Madagascar is unlikely to be able to provide such financing. In the case of PADAP, the obvious source of financing required for PES would be those who benefit from these activities: farmers in irrigated areas, whose productivity is substantially increased through upstream

[64]. Pagiola (2017), "Challenges to implementation of Payments for Environmental Services in Madagascar", discusses these pilots in detail.

conservation activities.[65] It is in their interest to ensure that these improvements are adopted and maintained. Their contribution to the compensation of those who adopt conservation practices upstream would be an investment in their own future productivity, similar to expenditures on O&M of the irrigation system itself.

18. Although there is a strong logic to having service users pay for conservation, securing the cooperation of farmers in irrigated areas will not be easy. Despite the benefits they derive from irrigation, such farmers are often accustomed to paying little or nothing for irrigation water. In Madagascar, this problem is exacerbated by the fact that farmers in irrigated areas are poor. While it is true that farmers in irrigated areas are often poor, however, they tend to be relatively better off than farmers in upstream areas, and the improvements offered by the PADAP project will increase their income even further. As shown in Annex 3, yields/returns in irrigated areas are expected to increase substantially thanks to PADAP. More to the point, the losses farmers in irrigated areas would sustain in terms of reduced productivity if watershed degradation deteriorates the efficiency of irrigation would be far greater than the payments needed to avert this threat.[66]

- Efforts to obtain financing from producers in irrigated areas would be incorporated into management efforts to ensure that water user associations pay for the O&M of the irrigation system itself—indeed, watershed conservation is simply another form of maintenance. Under this sub-component, the project will help design rules for the operation of the irrigation systems that it will help improve under which farmers using irrigation water will be responsible for paying for all operations and maintenance (O&M) costs of the system, including (a) the costs of providing compensation to upstream landholders who maintain conservation practices that protect those systems, (b) the costs of operating the PES program itself.
- Efforts to obtain financing from producers in irrigated areas would be incorporated into efforts under Component 2 to ensure that water user associations pay for the O&M of the irrigation system itself—indeed, watershed conservation is simply another form of maintenance. Under this sub-component, the project will help design rules for the operation of the irrigation systems that it will help improve under which farmers using irrigation water will be responsible for paying for all operations and maintenance (O&M) costs of the system, including (a) the costs of providing compensation to upstream landholders who maintain conservation practices that protect those systems, (b) the costs of operating the PES program itself.
- To ease the burden on producers of making payments, the cost of payments for conservation and of the administrative costs of the PES program, would initially be borne by the project, with the producer contribution being gradually phased in until producers bear 100 percent of the costs at end of project.
- To emphasize the links between the productivity improvements resulting from PADAP's activities, payments for O&M (including conservation) could be made proportional to increases in yield above the baseline level.

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[65] Proper water management is critical for improved productivity in irrigated areas. Moreover, erosion resulting from upstream degradation would substantially increase O&M costs in irrigated areas.

[66] Solonitompoarinony (2001), for example, found that rice yields in areas that were moderately affected by upstream erosion were only 60 percent as high as yields in areas that were not affected, while those in areas heavily affected by erosion were only 50 percent as high.

19. In some cases, there will also be other water users (drinking water systems, hydroelectric, etc.) that will benefit from improvements in upstream landscapes, and so could also contribute to financing them.

- Where opportunities to include other water users are encountered, the projects will seek to incorporate them into plans for the pilot.
- A study undertaken under Component 1 will help identify administrative, bureaucratic, and legal obstacles that might constrain the participation in PES of such water users.[67]

20. Carbon payments from the REDD+ program could also contribute to payments for forest conservation. Madagascar recently signed an Emission Reduction Purchase Agreement (ERPA) with the Carbon Fund for the purchase of up to US$50 million of carbon credits.

- The project will work with the national REDD+ coordination office (BNC-REDD) to examine options for channeling part of REDD revenues to landholders who conserve or restore forests on their lands.

21. **Working with landholders.** To achieve the desired conservation outcomes, a PES program must make payments to the actors that manage areas at risk of degradation or degraded areas that need restoring in ways that induce them to adopt the desired land uses. An immediate challenge in the PADAP sites, as in much of Madagascar, is that most of the affected areas are not individually owned. Moreover, the threats come primarily from shifting cultivation, making it difficult to identify who is actually managing any given piece of land at a given time. Under these conditions, there is a danger offering payments for conservation of particular areas may, perversely, attract more people to vulnerable areas, thus increasing rather than decreasing pressure.

- A study undertaken under Component 1 will evaluate the lessons of other PES programs that have worked in areas where tenure is weak or uncertain, such as the Bolsa Floresta program in the Brazilian state of Amazonas.

22. On the other hand, many of the areas affected are managed by local communities. There is a long experience with community forest management (CFM) in Madagascar. Under the GELOSE and GCF laws, management of many areas has been devolved to local organizations known as *Communautés de Base* (COBA, or VOI in Malagasy).[68] In the existing PES pilots at Andapa and Tolongoina, associations of upstream landholders were established specifically to act as interlocutor with the downstream service users. These local groups, whether COBAs or ad hoc associations, could act as service providers, managing the entire area under their purview, and then distributing the payments received among its members as necessary to compensate them for their opportunity costs. There is considerable experience with making PES payments to communities rather than individual households (in Brazil's Bolsa Floresta program, Costa Rica's PSA program,

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[67] Such as the inability to add extra fees to its water bills that JIRAMA cited as a reason not to participate in Andapa PES project.

[68] In some cases, COBAs will include both farmers from irrigated areas and farmers from upland areas—indeed, they are sometimes the same people. The development of PES programs may prove easier in such cases. In other cases, downstream and upstream farmers will belong to different communities. The Social Safeguards study will provide an initial indication of community organizations found at the project sites. More in-depth surveys will carried out during the first year of implementation.

and Mexico's PSAB program, for example, in addition to some of the Malagasy PES pilots), that the project will be able to draw on:

- The efforts undertaken under Component 2 to establish and strengthen COBAs will contribute to efforts to develop PES pilots in their areas. In turn, payments received under a PES program could help further strengthen the COBAs by providing them with additional resources and incentives to work together.
- The project will work with existing and new COBAs, or with ad hoc organization of landholders, to develop appropriate rules for land management and the corresponding compensation.[69]

23. **Institutional arrangements.** The institutional arrangements required for a PES program include the logistical arrangements to contract participants, monitor compliance, and make payments; the rules under which the program works; and the broader legal and policy framework.[70] If PES programs work through local community organizations, such as COBAs, many of the logistical problems would be greatly simplified, as there would a single contract and a single payment. The biggest challenge is likely to be that of monitoring the areas receiving payments, to ensure that they are under the agreed land uses. The community would carry out its own monitoring, but this would have to be verified by a third party. Advances in the use of remote sensing imagery and/or drones for such monitoring are likely to make this task much less onerous than it would have been in the past.

- The project will evaluate various options to conduct monitoring of land use in the areas covered by the PES pilots, with emphasis on methods that could be easily replicated or scaled up.

24. The challenges to developing PES pilots in Madagascar are thus significant, but far from insurmountable.

25. The case of Marovoay provides an example of how PES might be undertaken. The Marovoay irrigation scheme is heavily affected by degradation in the Ankarafantsika National Park, including several large *lavakas* caused by clearing vegetation, burning, and pasturing livestock. In addition to consolidating the existing *lavakas*, the areas around them (and areas vulnerable to the creation of new *lavakas*) need to be reforested (to reduce both surface and sub-surface flow), and livestock needs to be excluded. The communities who currently use the Park for pasture (under traditional use rights) could be compensated annually for (a) keeping their livestock out of vulnerable areas, and (b) maintaining the newly planted vegetation. Payments would be conditional on a complete absence of burning, a complete absence of livestock, and a specified minimum survival rate of planted trees, all of which would be easily verified through annual site visits, or in the case of vegetation cover, satellite imagery. Contracts would be with communities as a whole, so that every member would have the incentive to monitor the land use

[69] The Bolsa Floresta program in the Brazilian state of Amazonas (Viana and others, 2013) offers one possible model. Rather than making payments per hectare conserved, as most PES programs do, it makes payments to individual households who agree not to deforest, as well as separate payments to finance the adoption of sustainable land use practices on areas that have already been cleared. In addition, it makes payments to local communities (based on the number of participating households within the community) to finance social investments and to support community associations. As monitoring the actions of individual households would be impractical, penalties for non-compliance are based on reducing or withholding the community payments.

[70] The MEEF is coordinating a committee to assess the need for, and possible approaches to, a national PES policy.

behavior of other members and to report encroachment by non-members. These annual payments would be financed by contributions from the water user associations, who would benefit from the resulting lower levels of sedimentation in the irrigation scheme.

- The project could finance the initial costs of reforestation, as well as investments designed to reduce the need for local communities to bring their livestock into the Park (for example, by supporting the establishment of cut-and-carry systems outside the Park), and the costs of *lavaka* consolidation.
- The project could support the establishment of appropriate agreements/contracts between the communities that currently use the Park for pasture, the water user associations, and the Park administration, the design of an appropriate monitoring framework, and it could partially finance the initial payments to upstream communities.

ANNEX 8. IMPLEMENTATION ARRANGEMENTS

1. Project Institutional and Implementation Arrangements

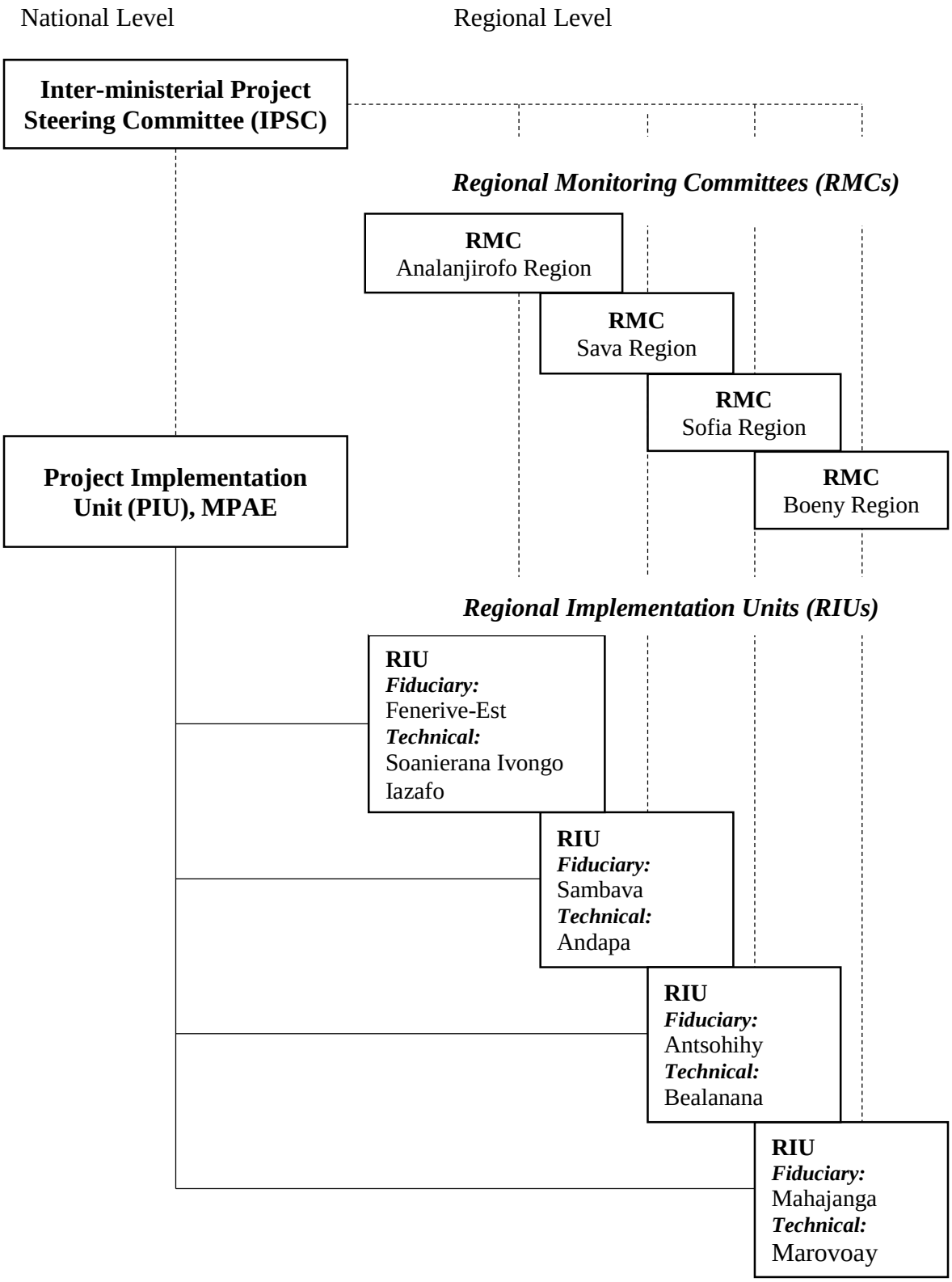
1. Three principles underlie the selection of the project's institutional and implementation arrangements: (i) strengthening the existing capacity within the Ministries of Agriculture, Environment and Water respectively to avoid the creation of ad hoc arrangements that could dissolve after Project closure; (ii) capitalizing on existing structures that meet the requirements of the World Bank to avoid unnecessary additional administrative burden; and ensuring maximum ownership and involvement by stakeholders in project implementation.

2. Overall responsibility for project implementation will lie with the Ministry to the Presidency for Agriculture and Livestock (MPAE). Given the Project's multi-sectoral scope and nature, various other ministries in particular the MEEF and the MEAH, as well as other government agencies at the local, national and regional levels, the private sector, CSOs and farmer organizations will also be involved in implementation. This will require the strong coordination of activities and consultations among all actors at all levels and will be the responsibility of MPAE as the lead ministry.

3. The Inter-Ministerial Project Steering Committee (IPSC) will be chaired on a rotating basis by the Secretary General of MPAE, the Secretary General of MEEF and the Secretary General of MEAH, and include representatives of each of these three Ministries and representatives of the Ministry of Presidential Projects and Land Use Planning (M2PATE); the Ministry of the Interior and Decentralization (MID); the Ministry of Finance (MFB); as well as the Heads of Region (4); the Representative of the COBA Federation; and the Representative of the Tranoben'ny Tantsaha (national chamber of farmers). The IPSC will meet at least twice a year and will be responsible for approving the annual work plans and related budgets, Project progress reports and providing strategic direction. The IPSC may participate in annual field visits as needed. The Project Implementation Unit will act as the Secretariat of the IPSC and will be responsible for preparing the meetings, including the logistics, documents and minutes.

4. The four RMCs will be chaired by the Head of Region and will ensure consistency of project activities with regional development policies and planning processes (regional land use and development planning, commune-level planning), and monitor project progress. The RMC will be chaired by the Head of Region or his representative, and will include the 'Préfet', the heads of relevant districts, representatives from technical departments, the mayors of the municipalities in the landscape, CSO representatives, farmers' organizations and private sectors platforms. The Project will provide resources to CSOs and farmers' organizations to follow and assess progress made by various project activities. The RMCs will meet at least twice a year.

FIGURE 8. INSTITUTIONAL DIAGRAM OF THE PROJECT'S MANAGEMENT STRUCTURE



5. The PIU will be based within the MPAE and will manage the Project's day-to-day activities including monitoring and evaluation (M&E), and coordination on the integrated landscape approach. The PIU staff will be responsible for procurement, disbursement, accounting, financial and technical reporting, monitoring and evaluation of the project, including the environmental and social safeguards aspects, and ensuring the auditing of the Project accounts. The PIU will be composed of the following staff: (i) a coordinator; (ii) six technical experts (agriculture, livestock, environment, social development, water and irrigation, cartography); (iii) a procurement specialist; (iii) a financial management specialist; (iv) an accountant; (v) a national monitoring and evaluation specialist supported by an international monitoring and evaluation specialist hired part-time and an assistant in monitoring and evaluation; (vi) an environmental and social safeguards specialist; (vii) an internal auditor; and (viii) three assistants. Additional staff with specific expertise may be recruited as and when needed. The PIU will prepare bi-annual reports recording project progress and participate in bi-annual joint support missions with the World Bank and AFD (and GEF, as and when appropriate).

6. Four RIUs, located in the regional capitals Sambava, Antsohihy, Mahajanga, and Fenerive Est, will be in charge of project implementation at the regional and landscape levels. Duties will include procurement, disbursement, financial and technical reporting, monitoring and evaluation, including the environmental and social safeguards aspects. Each of these units will include: (i) a coordinator (one of the Regional Directors for agriculture, environment or water); (ii) regional technical experts (the other Regional Directors for agriculture, environment or water); (iii) an operations officer (assistant technique en operations, ATOP); (iv) a procurement specialist; (v) an accountant; (vi) a monitoring and evaluation specialist; (vii) technical assistants based at the project sites; (viii) a social development expert based at the project sites. The RIUs will be accountable to the national PIU and the RMCs.

2. Financial Management

Introduction

7. The Ministries' PFM and PIU within the MPAE systems have been assessed to determine whether: (i) the financial management arrangements are adequate to ensure that the project funds will be used for the intended purposes in an efficient and economical way; (ii) the financial reports will be prepared timely, with accuracy and reliability; and (iii) the project's assets will be safeguarded. The assessment concludes that the Ministries and PIU within the MPAE financial management systems, subject to the effective implementation of the mitigation measures described in the paragraph below, are adequate and comply with the Bank's minimum requirements under OP/BP10.00.

Country PFM situation and Use of Country System

8. The project will be implemented in an environment where the overall country fiduciary risk, including fraud and corruption risks, is high. The Government intends to implement the project within Ministries; as such the implementing entity system mirrors the central level PFM system and its weaknesses result in the risk of lack of transparency and accountability in the use of public funds. Given the weaknesses in the PFM system, the project will opt for the gradual use of the country PFM systems using a risk-based approach (disbursement process, designated account opened at the Central Bank). Additional mitigation measures include: (i) the development of a project manual which will provide clarity of role and responsibility as well as the process to

implement and report on project activities, (ii) the strengthening of the control environment, and monitoring and evaluation systems, and (iii) the frequency of the Bank implementation support.

Financial Management Arrangements for the project

9. **Staffing**. The central level implementation Unit and the Regional level Unit will be adequately staffed with one financial management specialist and one accountant recruited according the ToRs agreed with the World Bank. For the regional FM staff, given the risk of turnover, the workplace location will be clearly mentioned in the expression of interest advertising and discussed during the contract negotiation to build consensus. The World Bank Financial Management Specialist will provide training to the project's fiduciary staff on the World Bank financed project financial procedures at the project launching but also during the monthly FM review meeting.

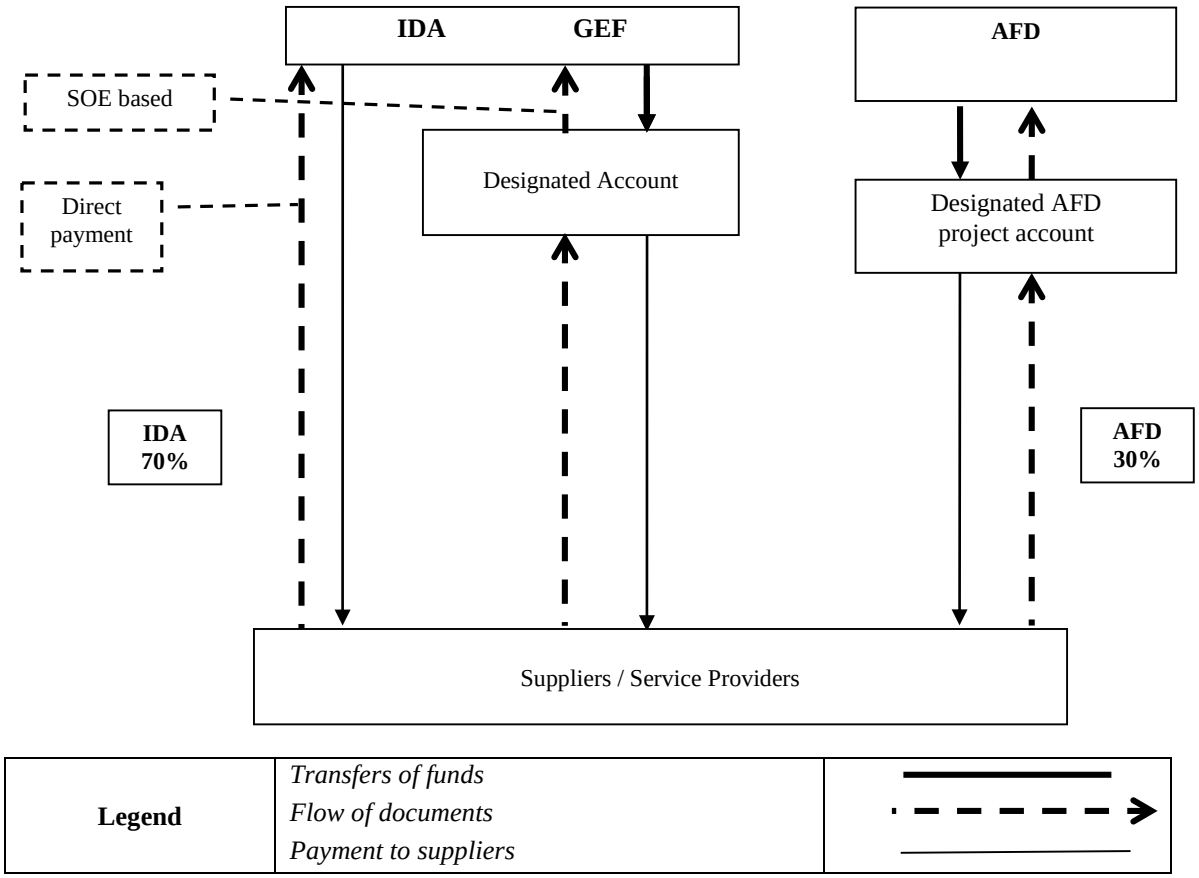
10. **Budgeting**. The implementing entity (central and regional) will prepare the project annual work plan and budget. The budget information will be prepared in line with the regular Government annual budget preparation cycle. Each regional unit will send contributions of the region's work program and budget which will be consolidated by the FMS at the central level. The budget execution will be monitored on a monthly and quarterly basis. The budget execution report will be part of the Interim Financial Reports (IFRs) and any variances will be explained and remedial measures indicated. The budget forecast shall be reliable and based on the best assumptions, and aligned with the work program, technical constraints and the procurement plan. Finally, the annual budget will be included in the Government annual budget and thus, classified according to the Government chart of accounts. Periodic regularization of budget execution will be performed. The procedures governing the budget preparation, execution and monitoring cycle will be developed in the project's financial and administrative procedures manual.

11. **Accounting**. The project accounting system will be maintained on a modified accruals cash basis with disclosure of commitments. All information on the budget execution will be entered ex post in the Government GFP. To that end, the implementing entity will send the budget execution report to the Ministry of Finance and Budget. An accounting system will be acquired and tailored to manage the Project's accounts and reporting. The detailed procedures governing the budget execution report preparation and monitoring will be developed in the Project's financial and administrative procedures manual.

12. **Disbursement**. Disbursements will be made in accordance with the *World Bank Disbursement Guidelines for Projects*, dated May 1, 2006. The financing proceeds will be disbursed using one or more of the four disbursement methods available to the Project – reimbursement, advance, direct payment and special commitment. Two designated accounts (DAs) denominated in US$ will be opened at the central bank of Madagascar. The first DA will be used for advances from the IDA credit and will receive an initial advance of up to the ceiling amount of US$3.25 million, equivalent to three months of forecasted expenditures. The second DA will be used for advances from the GEF Grant and will receive an initial advance of up to the ceiling amount of US$7 million. Both accounts will be replenished regularly through monthly Withdrawal Applications supported with Statements of Expenditures (SOEs). Project accounts will be opened at the central and regional level. Both accounts will be managed by the Project team (coordinated jointly with the FMS). Direct payments may be made to service providers at the request of the Recipient. The funds flow diagram is below. The Recipient may also request reimbursements for pre-financed expenditures or payments pursuant to special commitments

entered into by the Recipient. For activities under the Contingent Emergency Response component (CERC) (Component 4), disbursements will be subject to the conditions precedent to accessing the CERC funds, namely that the Recipient has provided, and the Bank has accepted, evidence of the occurrence of an eligible crisis or emergency and the Recipient has prepared and adopted the PIM. Disbursements under this component will follow procedures described in the PIM, including supporting documentation.

Flow of Funds



13. **Disbursement arrangements AFD and IDA.** The World Bank and AFD agreed to co-finance this project. The World Bank and AFD will finance jointly all activities agreed. The World Bank will finance 70 percent of expenditures and the AFD 30 percent of eligible expenditures. Funds will be managed under two separate DAs. The expenditures approval mechanism for the Designated Accounts replenishment will be agreed between the AFD and the World Bank and reflected in the project design.

14. The GEF grant proceeds will be channeled in a parallel manner whereby its proceeds will be used to finance 100 percent of contracts or activities other than those financed by IDA and AFD financing.

15. **Disbursements by category.** The tables below set out the expenditure categories to be financed out of the IDA Credit proceeds and GEF Grant. These tables take into account the

prevailing Country Financing Parameter for Madagascar in setting out the financing levels, which show there will be no counterpart funds to cover the project expenditures.

IDA Credit

Category	Amount of the IDA Credit Allocated (expressed in SDR)	Percentage of Expenditures to be Financed (inclusive of taxes)
(1) Goods, works, consulting services and non-consulting services, Training and Operating Costs under Parts 1, 2 and 3 (except for Part 2.3) of the Project	46,900,000	70%
(2) Goods, Operating Costs, Training, works, non-consulting services, and consultants' services for Emergency Expenditures under Part 4 of the Project		70%
(3) Refund of Preparation Advance	1,500,000	Amount payable pursuant to Section 2.07 of the General Conditions
TOTAL AMOUNT	**48,400,000**	

GEF Grant

Category	Amount of the GEF Financing Allocated (expressed in US$)	Percentage of Expenditures to be financed (inclusive of Taxes)
(1) Goods, works, consulting services and non-consulting services, and training under Parts 1 and 2 (except for Part 2.2 (ii)) of the Project	US$13,699,080	100%
TOTAL AMOUNT	**US$13,699,080**	

16. **Internal controls and Internal audit**. Internal controls will comprise, but not be limited to the following: division of responsibilities between the central and regional level entities, clear segregation of duties, monthly reconciliation of accounting, frequent reporting and internal audit missions. The internal controls system and procedures will be detailed in the project financial and administrative manual. The '*Département de l'Audit Interne'* within the MPAE will be involved supported by an internal auditor to be recruited based on ToRs agreed with the Bank. The internal

audit unit will carry out a risk based audit covering project activities. Given the risk of fraudulent withdrawals in the sector, the use of an electronic payment system with strong security features will be part of the payment procedures and a prior confirmation process with the bank hosting the DA or Project accounts will be agreed on in the contractual agreement with the bank.

17. **Reporting**. The Recipient will prepare Quarterly Interim Unaudited Financial Reports (IFRs) whose format has been agreed on by the World Bank. The IFRs will be submitted to the World Bank within 45 days after the end of each reporting period and will comprise: (i) the statement of resources and use of funds; (ii) the statement of use of funds per component or activity; (iii) the designated account reconciliation statement; and (iv) the budget execution report. The annual financial statements for the Project will incorporate all activities, and include: (i) a Statement of Sources and Uses of Funds showing funds from IDA and their application; (ii) a Summary of Expenditures analyzed by both Component and Category; (iii) supporting notes in respect of significant accounting policies and accounting standards adopted by management; (iv) the Designated Account Activity for the year showing deposits and replenishments received, payments substantiated by withdrawal applications, interest that may be earned on the account and the balance at the end of the fiscal year; (v) the summary listing of withdrawal applications by reference number, date and amount; and (vi) the management assertion that IDA funds have been expensed in accordance with the intended purposes as specified in the relevant financing agreement.

18. **External financial Audit**. The external audit of the project financial statements will be carried out by the contracted auditors based on the audit ToRs agreed with the World Bank. The Court of Accounts may be involved for information and capacity building purposes. The audit will comply with the International Standards on Auditing. The audit report will comprise the auditor's opinion on the financial statements, the findings on the internal controls and recommendations to strengthen the internal controls system. The auditors for the project will have to be selected no later than six (6) months after effectiveness. In line with the new access to information policy, the Project will comply with the World Bank disclosure policy of audit reports (e.g. make publicly available, promptly after receipt of all final financial audit reports (including qualified audit reports).

19. **Conclusions of the FM Assessment.** The overall residual FM risk is considered **Substantial**. The proposed financial management arrangements for the Project are considered adequate subject to the implementation of the mitigation measures, and meet the Bank's minimum fiduciary requirements under OP/BP10.00.

20. **Implementation Support and Supervision Plan.** Financial management implementation support intensity and frequency will be in line with the risk-based approach, and will involve a collaborative approach with the entire Task Team. The first implementation support mission will be performed three (3) months after project effectiveness. Afterwards, the missions will be scheduled by using the risk based approach model and will include the following diligences: (i) monitoring of the financial management arrangements during the supervision process at intervals determined by the risk rating assigned to the overall FM Assessment at entry and subsequently during implementation; (ii) integrated fiduciary review on key contracts; (iii) review of the IFRs; (iv) review of the audit reports and management letters from the external auditors and follow-up on material accountability issues by engaging with the task team leader, Client, and/or Auditors; the quality of the audit (internal and external) is to be monitored closely to ensure that it covers all relevant aspects and provide enough confidence on the appropriate use of funds by recipients; and,

(v) other assistance to build or maintain appropriate financial management capacity and efficient internal control system. The World Bank Financial Management Specialist will perform periodic field missions at central and regional level to review the FM performance and risks and provide adequate advice and recommendations. FM meetings on a regular basis will be organized to follow up on FM progress.

3. Procurement

21. Madagascar's new Public Procurement Code passed by Law no.2016-055 of January 2017 is complemented by new regulations and procedures manuals, as well as standard bidding and other procurement documents. In accordance with the Code, the Public Procurement Oversight Authority (*Autorité de Régulation des Marchés Publics*) oversees the National Tender Board (*Commission Nationale des Marchés*) which conducts procurement reviews and the Regulatory and Appeals Committee (*Commission de Régulation et de Recours*) which handles norms and complaints. In addition, there are Public Procurement Management Units (*Unités de Gestion des Marchés Publics*) under the leadership of a Head of Public Procurement (*Personne Responsable des Marchés Publics* or PRMP), as well as a Tender Commission (*Commission d'Appel d'Offres*) in each Ministry and in the decentralized departments of national public institutions.

22. The New Procurement Code is largely consistent with good public and international practices and includes provisions for: (i) far-reaching and effective advertising of upcoming procurement opportunities (issuance of general procurement notices for each procuring entity and their inclusion on the Public Procurement Oversight Authority website); (ii) open public bidding; (iii) pre-disclosure of all relevant information, including clear and transparent bid evaluation and contract award procedures; (iv) clear accountabilities for decision making; and (v) an enforceable right to review for bidders when public entities breach the rules.

23. The fiduciary risk assessment review of the Madagascar public procurement system (April 2015) identified procurement weaknesses. However, the review concluded that fundamentally nothing stands in the way of using the CNM (Commission Nationale des Marchés) to carry-out prior and post procurement reviews on World Bank financed project activities. The review also highly recommended the use of the SIGMP to increase transparency during procurement processes.

24. An assessment of Madagascar's procurement system using the Methodology for assessment of national procurement (MAPS) tool developed by the Organization for Economic Co-operation and Development (OECD) was conducted in 2016. The assessment provides a set of strategic axes for new policy implementation and a capacity development strategy for public procurement in Madagascar.

Guidelines

25. ***General observations***. Procurement for the proposed project will be carried out in accordance with: (i) the World Bank's Guidelines: Procurement under IBRD Loans and IDA Credits, dated January 2011 and revised in July 2014; (ii) Guidelines: Selection and Employment of Consultants by World Bank Borrowers, dated January 2011 and revised in July 2014; and (iii) the provisions of the Financial Agreement.

26. ***Anti-corruption guidelines***. The Guidelines on Preventing and Combating Fraud and Corruption in Projects Financed by IBRD Loans and IDA Credits and Grants, dated October 15, 2006 and revised in January 2011, will apply to this project.

27. **Procurement documents**. Procurement transactions will be carried out using the Bank's standard bidding documents for all International Competitive Bidding (ICB) and standard Requests for Proposals (RFPs) for selecting consultants using the Quality and Cost based Selection (QCBS) method. For National Competitive Bidding (NCB), the use of national documents for NCB presents a moderate risk provided that the borrower inserts some additional provisions called exceptions (approved by Legal Operations or LEGOP) which are provided at the end of this section. The borrower may submit a sample form of bidding documents to the World Bank for prior review, which will then be used for the duration of the project if it is approved. The World Bank's sample form of evaluation reports will also be used.

Advertising Procedures

28. General procurement notices, specific procurement notices, requests for Expression of Interest (EOI), invitations to bid, results of the evaluation, and awards of contracts should be published in accordance with the advertising provisions in the Guidelines: Procurement under IBRD Loans and IDA Grants, dated January 2011 and revised in July 2014, and Guidelines: Selection and Employment of Consultants by World Bank Borrowers, dated January 2011 and revised in July 2014.

29. For ICB and RFPs that involve international consultants, the contract awards will be published in United Nations (UN) Development Business online within two weeks of receiving IDA's "no objection" to the contract award recommendation.

Procurement Methods

30. ***Procurement of works***. Works to be financed by IDA will include construction and rehabilitation works of small infrastructure, irrigation schemes, and feeder roads. Works estimated at or above US$5,000,000 per contract will be procured using ICB. Contracts estimated at less than US$5,000,000 may be procured using NCB. Contracts estimated at less than US$500,000 may be procured using prudent shopping procedures. The borrower should solicit at least three price quotations to formulate a cost comparison report. Direct contracting may be used to extend an existing contract or to award new contracts in response to disasters. For such contracting to be justified, the World Bank should be satisfied that the price is reasonable and that no advantage would have been obtained by further competition. The direct contracting may be from contractors or NGOs that are already mobilized and working in the affected area.

31. ***Procurement of goods***. Goods to be financed by IDA will include acquisition of inventory materials, surveillance equipment, IT equipment, and vehicles. Goods that can be provided by a single vendor will be grouped in bid packages estimated to cost at least US$1,000,000 per contract and will be procured using ICB. Contracts estimated at less than US$1,000,000 may be procured using NCB. Readily available off-the-shelf goods with a value of less than US$300,000 per contract may be procured using prudent quotation procedures. For shopping, contracts will be awarded following an evaluation of bids received in writing following a written solicitation issued to several qualified suppliers (at least three) who have a physical shop carrying the goods concerned. The award will be made to the supplier with the lowest price but only after comparing a minimum of three quotations at the same time and determining that the supplier has the

experience and resources to execute the contract successfully. For shopping, the Recipient's procurement officer will keep a register of suppliers to be updated at least every six months. Goods may also be procured through United Nations agencies. A framework agreement acceptable by the Bank may be used for procurement of goods.

32. ***Selection of consultants***. The project will finance consultant services such as technical and financial audits, technical assistance, program impact evaluations, engineering, designs, and supervision of works, and capacity-building activities. Consultant firms will be selected using the following methods: (i) Quality and Cost-based Selection (QCBS); (ii) Quality-based Selection (QBS); (iii) Consultant's Qualifications Selection (CQS) for specialized assignment contracts to cost less than US$200,000; (iv) Least Cost Selection (LCS) for standard tasks such as financial and technical audits; (v) Fixed Budget Selection (FBS); and (vi) Single Source Selection (SSS) with prior approval of the World Bank for services in accordance with paragraphs 3.8–3.11 of the Consultant Guidelines. Individual consultants will be hired in accordance with paragraphs 5.1–5.6 of the World Bank Guidelines.

33. Lists of shortlisted consultants for services estimated at less than US$300,000 per contract may be composed entirely of national consultants in accordance with paragraph 2.7 of the Consultant Guidelines as long as a sufficient number of qualified individuals or firms are available. However, if foreign firms express an interest, they will not be excluded from consideration.

34. ***Operational costs***. Operating costs financed by the project are incremental expenditures such as office supplies, vehicle operation and maintenance, maintenance of equipment, communication costs, and office rental costs; supervision costs (that is, transport, accommodation, and per diems); and the salaries of locally contracted staff. These items will be procured using the procurement procedures specified in the World Bank-approved procedures manual of the PIU.

Procurement Capacity and Risk Assessment of Implementing Agencies

35. The procurement capacity assessment, was conducted at the level of the MPAE, within which the PIU will be based. The procurement assessment focused specifically on the Public Procurement Management Unit (*Unité de Gestion de Passation des Marchés Publics*) of the entire Ministry. The Head of Public Procurement (Personne Responsable des Marchés Publics, PRMP) and the team within the Ministry are technically proficient and are involved in procurement activities of several projects financed by different donors (IFAD, ADB, WB, and Government). The PIU will be staffed with a highly proficient procurement officer to be hired from the market. Before project effectiveness, four highly qualified procurement officers will be recruited for the four Regional Implementation units (RIU) based respectively in Fenerive-Est, Sambava, Antsohihy, and Mahajanga/Marovoay. All procurement officers will operate under the overall guidance and control of the PRMP of the MPAE.

36. The PIU and RIUs will carry-out all procurement activities under the project. The PIU will sign MOUs with other sectoral ministries to define activities, responsibilities, accountabilities, budget for technical support that these latter would provide to the project.

37. Procurement for the joint financing provided by the French Development Agency will entirely be carried-out by the PIU in accordance with Bank guidelines and the present project's procurement arrangement. However, disbursement will be on a pari-passu basis.

38. Risks/issues identified during the assessment include: (a) delays in procurement processes, (b) technical aspects of procurement (development of TORs and technical specifications) not

properly handled by the implementing agency due to weak coordination with sectorial ministries. The following mitigation measures are proposed: (i) carry-out procurement processes for the first year during implementation of the Project Preparation Advance (PPA); (ii) a project operational manual to be prepared shall include inter alia a detailed description of the overall procurement arrangements and responsibility of each entity; (iii) basic procurement training to be provided to all staff involved in the project before project effectiveness; and (iv) continuous procurement hands-on support to the project's staff.

TABLE 16. RISK ASSESSMENT AND RISK MITIGATION MEASURES

Designation	Concerns	Risk Mitigation	Due Date
Capacity of the procurement officers of the PIU and RIUs	Insufficient procurement capacity	- Recruit PIU procurement officer as early as possible - Recruit (4) regional procurement officers - Hands-on support to be provided by the Bank local procurement specialist - The procurement officers will attend procurement training provided by the World Bank country office procurement specialist	Prior to effectiveness Prior to effectiveness Continuous Prior to effectiveness
	Delays in procurement processes and ultimately disbursement	- Prepare procurement documents and processes during PPA.	Prior to effectiveness
	Technical aspects of procurement (TORs, Technical specification, evaluation) not properly handled due to weak coordination with sector ministries	- Strong coordination between technical and procurement staff	Continuous
Fraud and corruption	Increase of suspended/debarred medium-sized firms in Madagascar lately due to forged documents.	- There will be rigorous due diligence by World Bank staff and continuous client sensitization and information on debarred firms. - Systematic authentication of bid security to issuing bank and/or of any doubtful official documents.	Constantly
Market-specific risk	Project covers several regions: lack of bidders' participation; lack of competition.	Advertisements about the bidding process will be widely disseminated. The client will be given some flexibility in terms of the qualifications criteria for bidders but will need ensure	As needed

		close supervision by technical staff/experts with deep knowledge of the market.	

39. The overall procurement risk assessment rating is "Substantial". Table 16 summarizes the risk assessment and corresponding mitigation measures incorporated into the Project's design.

40. Other mitigation measures. No additional mitigation measures can be identified at this point. The World Bank's procurement specialist is based in Madagascar, and therefore close supervision and hands-on support will be provided.

Frequency of Procurement Reviews and Supervision

41. The World Bank's prior and post reviews will be carried out in accordance with the thresholds described in Annex Table 17 and as displayed in the approved procurement plan. The World Bank will conduct frequent supervision missions and annual post procurement reviews of 20 percent of the contracts. The World Bank may also conduct an independent procurement review at any time up to two years after the closing date of the Project.

TABLE 17. PROCUREMENT AND SELECTION REVIEW THRESHOLDS

Expenditure Category	Contract Value (Threshold) (US$)	Procurement Method	Contract Subject to Prior Review
Works	≥10,000,000	ICB	ALL
	>5,000,000	ICB	
	≤ 5,000,000	NCB	
	≤ 500,000	QUOTATION	
Goods, and non-consulting services	≥ 2,000,000	ICB	ALL
	> 1,000,000	ICB	
	<1,000,000	NCB	
	< 300,000	QUOTATION	
Consulting firms	≥1,000,000	QCBS	ALL
	<1,000,000	QCBS, QBS, CQS, FBS, LCS	
Individuals consultants	≥300,000		ALL
Firms and individuals (single source)			ALL
Note: **All terms of reference regardless of contract value are subject to prior review.**			

42. All contract amendments that raise the initial contract value by more than 15 percent of the original amount or above the prior review thresholds will be subject to IDA's prior review. All contracts not submitted for prior review will be submitted to IDA for post review in accordance with Annex 1, paragraph 5, of the World Bank's Consultant Selection Guidelines and the World Bank's Procurement Guidelines.

Procurement Plan

43. All procurement activities will be carried out in accordance with the original or updated approved Procurement Plans. The project shall use the World Bank's online procurement planning and tracking tool (STEP) to prepare, clear and update its procurement plans and conduct all procurement transactions. All Procurement Plans should be published at the national level and on the World Bank website as stated by the guidelines. The Procurement Plan shall set forth those contracts which shall be subject to the Association's prior review. All other contracts shall be subject to post review by the Association.

Procurement Filing

44. Procurement documents must be maintained in the project files and archived in a safe place until at least two years after the closing date of the project. Procurement staff within each implementing agency will be responsible for properly filing procurement documentation.

Madagascar NCB Exceptions
(Based on the Procurement Guidelines as revised January 2011)

General

i. The procedures to be followed for National Competitive Bidding (NCB) shall be those set forth in "Law no.2016-055 of January 2017"—the Public Procurement Law (PPL)—with the modifications described in the following paragraphs.

Eligibility

ii. The eligibility of bidders shall be as defined under Section I of the Procurement Guidelines; accordingly, no bidder or potential bidder shall be declared ineligible for contracts financed by the Association for reasons other than those provided in Section I of the Procurement Guidelines. The requirement of producing a registration number (*Numéro d'Immatriculation*) for any bidder to participate in the bidding process, shall not be interpreted as a prior requirement to any sort of local registration, license, or authorization.

iii. Government-owned enterprises or institutions of the Republic of Madagascar shall be eligible to participate in the bidding process, only if they can establish that they are legally and financially autonomous, operate under commercial law, and are not dependent agencies of the Borrower or Sub-Borrower.

Bidding Documents

iv. Standard bidding documents acceptable to the Association shall be used so as to ensure economy, efficiency, transparency, and consistency with the provisions of Section I of the Procurement Guidelines.

Participation by Joint Ventures

v. Participation shall be allowed from joint ventures on condition that such joint venture partners will be jointly and severally liable for their obligations under the Contract. Therefore, the "*Groupement Conjoint,*" as set forth in the PPL, shall not be allowed under NCB.

Preferences

vi. No domestic/regional preference, or any other kind of preferential treatment, shall be given for domestic/regional bidders, and/or for domestically/regionally manufactured goods, and/or for domestically/regionally originated related services.

Applicable Procurement Method

vii. Subject to these provisions, procurement shall be carried out in accordance with the "Open Competitive Bidding" method (Appel d'offres ouvert) set forth in the PPL.

Qualification

viii. Qualification criteria shall entirely concern the bidder's capability and resources to perform the contract, taking into account objective and measurable factors. The qualification criteria shall be clearly specified in the bidding documents, and all criteria so specified, and only such criteria so specified shall be used to determine whether a bidder is qualified. Qualification criteria shall be assessed on a "pass or fail" basis, and merit points shall not be used. Bidders' qualifications shall be assessed by post-qualification.

Fees for Bidding Documents

ix. If a fee is charged for the bidding documents, it shall be reasonable and reflect only the cost of their typing, printing or publishing, and delivery to prospective bidders, and it shall not be so high as to discourage bidders' participation in the bidding process. Bids may be submitted by electronic means only provided that the Association is satisfied with the adequacy of the system, including, inter alia, that the system is secure, maintains the integrity, confidentiality, and authenticity of the bids submitted, and uses an electronic signature system or equivalent to keep bidders bound to their bids.

Bid Validity and Extension of Bid Validity

x. The bid validity period required by the bidding documents shall be sufficient to complete the evaluation of bids and obtain any approval that may be required. If justified by exceptional circumstances, an extension of the bid validity may be requested in writing from all bidders before the original bid validity expiration date, and it shall cover only the minimum period required to complete the evaluation and award of the contract. The extension of the bid validity requires the Association's no objection for those contracts subject to prior review, if it is longer than four (4) weeks, and for all subsequent requests for extension, irrespective of the period.

Bid Evaluation

xi. (a) Evaluation of bids shall be made in strict adherence to the evaluation criteria declared in the bidding documents. Evaluation criteria other than price shall be quantified in monetary terms, and the manner in which they will be applied for the purpose of determining the lowest evaluated bid shall be established in the bidding documents. A weighting/scoring system shall not be used. (b) A contract shall be awarded to the qualified bidder offering the lowest-evaluated and substantially responsive bid. No negotiations shall be permitted. (c) Bidders shall not be eliminated on the basis of minor, non-substantial deviations. (d) In case of requests for clarifications, bidders shall not be asked or permitted to alter or complete their bids.

Rejection of All Bids and Re-bidding

xii. All bids shall not be rejected, the procurement process shall not be cancelled, and new bids shall not be solicited without the Association's prior concurrence.

Securities

xiii. Securities shall be in the format included in the bidding documents. No advance payment shall be made without a suitable advance payment security.

Publication of Contract Award

xiv. Information on contract award shall be published at least in a national newspaper of wide circulation within two (2) weeks of receiving the Association's no objection to the award recommendation for contracts subject to prior review, and within two (2) weeks from the award decision for contracts subject to post review. Publication shall include the following information: (a) the name of each bidder which submitted a bid; (b) bid prices as read out at bid opening; (c) evaluated prices of each bid that was evaluated; (d) the names of bidders whose bids were rejected and the reasons for their rejection; and (e) the name of the winning bidder, the final total contract price, and the duration and summary scope of the contract.

Contract Modifications

xv. In the case of contracts subject to prior review, the Association's no objection shall be obtained before agreeing to: (a) a material extension of the stipulated time for performance of a contract; (b) any substantial modification of the scope of services or other significant changes to the terms and conditions of the contract; (c) any variation order or amendment (except in cases of extreme urgency) which, singly or combined with all variation orders or amendments previously issued, increases the original contract amount by more than 15 percent; or (d) the proposed termination of the contract. A copy of all contract amendments shall be furnished to the Association for its records.

Right to Inspect/Audit

xvi. In accordance with the Procurement Guidelines, each bidding document and contract financed from the proceeds of the Financing shall provide that bidders, suppliers, and contractors, and their subcontractors, agents, personnel, consultants, service providers or suppliers, shall permit the Association, at its request, to inspect their accounts, records and other documents relating to the submission of bids and contract performance, and to have them audited by auditors appointed by the Association. Acts intended to materially impede the exercise of the Association's inspection and audit rights constitute an obstructive practice as defined in the Procurement Guidelines.

Fraud and Corruption

xvii. Each bidding document and contract financed from the proceeds of the Financing, and as deemed acceptable by the Association, shall include provisions stating the Bank's policy to sanction firms or individuals found to have engaged in fraud and corruption as defined in the Procurement Guidelines.

Debarment under National System

xviii. The Association may recognize, if requested by the Borrower, exclusion from participation as a result of debarment under the national system, provided that the debarment is for offenses

involving fraud, corruption, or similar misconduct, and further provided that the Association confirms that the particular debarment process afforded due process and the debarment decision is final.

4. Environmental and Social (including safeguards)

45. The project proposes in Component 1 to strengthen the policy framework, to elaborate landscape management plans which are mainly of technical assistance and studies to prepare strategic management tools for the five selected landscapes. In addition, the project has selected in its Component 2 to build capacity and conduct civil works to rehabilitate existing irrigation perimeters, to improve mobility on existing strategic feeder roads, to rehabilitate existing dams less than 10 meters high and the downstream channel in the selected existing irrigation perimeters; to rehabilitate reservoirs of less than 2 million cubic meters, to promote reforestation, forest plantation with native species and agroforestry in project zones to reduce and stabilize erosion. With the intensification, diversification of agriculture and improvement of agriculture value chains to increase agricultural performance, this may lead of extensive use of pesticides to boost agriculture productivity and using of pharmaceutical products for animals to improve animal health. With the proposed activities, the environmental and social risks and impacts may be moderate, site specific and easily manageable with specific mitigation measures and in most cases, reversible.

46. **Project Category.** With the above activities, the Project remains a Category B project as proposed at concept stage. The proposed operation has triggered seven World Bank safeguard policies, namely Environmental Assessment (OP 4.01); Natural Habitats (OP 4.04), Pest Management (OP 4.09); Involuntary Resettlement (OP 4.12); Forests (OP 4.36); Physical Cultural resources (OP4.11) and Safety of Dams (OP/BP 4.37). To address the triggered safeguard policies, the Recipient has prepared four safeguard documents: an Environmental and Social Management Framework (ESMF), a Resettlement Policy Framework (RPF), an Integrated Pest Management Plan (IPMP) and an updated Small Dam Safety Manual.

47. **Environmental and Social Management Framework (ESMF).** An ESMF with provisions for the preparation of an Environmental and Social Management Plan (ESMP) is available to guide the screening and mitigation of any negative impacts from the Project. It includes the activities of a Category B project and a list of negative activities that are classified as Category A activities. Potential environmental and social impacts and risks in the project zones as a result of the Project are identified along with relevant mitigation measures. The ESMF also outlines an environmental and social screening process for future activities to ensure that they are environmentally and socially sound, sustainably implementable, and in line with GoM and World Bank policies and guidelines on environmental and social impact management. The ESMF provides the compliance principles and mitigation measures for the triggered policies (OP 4.04, OP4.36, and OP 4.11) and includes the costs for implementation of the safeguard measures.

48. **Integrated Pest Management Plan (IPMP).** Project funds will be used to purchase and distribute agrochemicals through matching grants to the local farmer beneficiaries of the project. Agribusinesses may also encourage farmer groups to use more inorganic fertilizers and pesticides. To ensure safe pest management, the Project has prepared an Integrated Pest Management Plan which includes: (i) a survey on the local bio pesticides and agronomic technical practices to reduce the impacts of pests on the agriculture value chains in the project areas; (ii) appropriate actions to reduce the exposure of farmer groups to pesticides used in agricultural production systems; (iii) guidelines to be adopted on the possibility of agrochemical application and disposal; (iv) training sessions to strengthen the capacity of different actors (farmers, local vendors, regional agricultural agents, etc.) on the use, storage and disposal of agrochemical products; and (v) a coherent budget available in the project financing with coherent monitoring system and indicators.

49. **Screening process.** Prior to its commencement, as soon as the implementation sites are identified, each activity will be screened per the established environmental and social screening procedures detailed in the ESMF. The screening and classification of eligible activities will be carried out by the PIU's environmental and social safeguards focal points. The results of the screening will be processed according to the national regulations and Bank requirements. The ESMF and the RPF include institutional arrangements outlining the roles and responsibilities for the various stakeholder groups involved, for screening, review and approval of activities, as well as implementation and monitoring of their mitigation measures. The environmental and social mitigation measures summarized in the ESMF, as well as the specific mitigation measures approved for the activities, will be executed, monitored and reported in the Environmental and Social Safeguards section of the overall project periodic report. The PADAP National Coordination Unit of the MPAE is the implementing agency. It has proven experience managing Bank projects, though it would need some additional support to strengthen the technical capacity on both social and environmental safeguards management. Following the ESMF assessment, five full-time Environmental and Social Safeguards Specialists (ESSSs) were recruited to strengthen safeguard environmental and social aspects and ensure day-to-day safeguard works to ensure project activities are in compliance with the prepared frameworks documents. The project ESSSs will work collaboratively with the National Office of Environment (NoE), the national authority responsible for environmental and social management and also ensure compliance with national regulation and safeguards document reviews. Both the PADAP National Coordination Unit and the Bank recognize that in general, the PADAP National Coordination Unit capacity in both environmental and social management is weak and needs further enhancement by the understanding and management of social and environmental safeguards policies and the frameworks documents of PADAP project. The ESMF proposes that the safeguards training workshops be iterative and open to other key stakeholders including beneficiary communities, private sector (Consultant firms, etc.) with the aim of reinforcing the grounding of public consultation and participation to foster more engagement, ownership and social accountability for the sustainability of project implemented activities throughout the PADAP targeted areas.

50. **Safety of Dams (OP 4.37)** is triggered because of the proposed rehabilitation of small irrigation infrastructures and the replacing of old hydraulic equipment/material. PADAP would not finance any new constructions or rehabilitation of large-scale irrigation facilities and dams above 15 meters or reservoir more than 3 million cubic meter; but rather small check-dams to treat lavakas (gully erosion). The Small Dams Safety Manual (SDSM) prepared in 2012, approved by the Bank and publicly disclosed both in-country on May 25, 2012 and at the InfoShop on May 29, 2012 has been updated for the Project. It was approved by the World Bank's Regional Safeguards Advisor in December 2016 and disclosed in-country on January 07, 2017 and at the World Bank InfoShop on January 09, 2017. The SDSM's main objective is to harmonize and improve project operations in the agriculture sector on the existing irrigation perimeters to be funded. It provides the basic characteristics of the type of dams, irrigation equipment, hydraulic materials, the forms of management of irrigation schemes, the institutional arrangement and the social and environmental clauses to be respected by construction companies during rehabilitation and exploitation of the above hydro-agriculture infrastructure. The revised SDSM is sufficient and relevant to manage and reduce the potential risks and impacts that could be generated by the proposed project in the potential existing irrigation perimeters and hydraulic infrastructures to be financed.

51. **Disclosure of safeguard documents.** The ESMF includes a public consultation approach and comprehensive and clear grievance mechanism to be adopted during project implementation. The PADAP PIU will initiate public consultations as early as possible and provide, in a timely manner prior to consultation, all the relevant materials in the form and language(s) needed to be understandable and accessible to the groups being consulted. All the Borrowers' safeguards instruments (ESMF, IPMP & RPF) have been approved by the World Bank and were disclosed in-country on January 7, 2017 and on January 9, 2017 at the World Bank InfoShop in compliance with the World Bank safeguards and national policies and Disclosure Policy.

5. Monitoring & Evaluation

52. **Objective.** M&E in PADAP is primarily (1) an end to itself under Component 1 and will be strengthened through targeted interventions at local level and through linking M&E to budgeting and local landscape planning and development of the Spatial Information System; (2) a tool for results-based management and to ensure that data and information of the progress of the project - or lack of progress - towards achievement of the outcomes under the PDO feed into management, i.e. the PSC and the PIU and that corrective measures can be taken in time if necessary; (3) a framework for accountability of progress towards local, regional and national objectives in management of natural resources in Madagascar and between the three participating ministries, i.e. the PSC. Under this framework, demand-side social accountability of project interventions will also be captured through an citizen engagement indicator (a corporate requirement); (4) an approach to monitor performance of different landscapes to ensure a certain level of coherence; (5) a platform for communication of results of the project and benefits delivered to local people, institutions and the environment; and (6) to meet the World Bank's routine reporting requirements, i.e. the six monthly progress report, Implementation Status and Results (ISR) report which is developed for each country and publicly disclosable, and data and information requirements for the mid-term review (MTR) of the project.

53. **Context and capacity.** M&E capacity has been assessed to be low at local and regional levels as well as at the level of participating ministries. Signs of weak capacity include (but not limited to) M&E not being linked to budgeting and planning in the government sector including local level planning and not being used for evidence-informed decision-making. In more technical terms, signs of low capacity field-level data not being validated, incomplete data sets, missing information, inconsistent reporting and data and information is delivered but not reported.

54. **Design of the Results Framework**. The main instrument for M&E in PADAP is the results framework (Annex 1). It consists of the PDO statement, and four PDO indicators and 12 intermediate indicators. It includes the four of the new corporate results indicators. Included in the results framework is also the required corporate indicator on citizen engagement. It is formulated as a perception indicator on the satisfaction with application of the landscape approach. It captures the demand-side social accountability of the project. It is further disaggregated by sex and thus captures the gender aspect of the project. There is no indicator related to the crisis response window of the project. While Madagascar has been hit by a range of crisis in recent years, including for instance locust attacks and cyclones, it has not established a crisis response system to capture the different types. Without that response mechanism in place (and it is not the objective of the project to support one), it is difficult to find a useful indicator. All indicators have baselines and targets. The RF includes the frequency for data collection, data sources, methodologies for calculating baselines and progress indicator values, and responsibilities for data collections. Baselines for the

indicators have been established based on available information from a variety of sources (e.g. key informants' interviews, one-off field surveys by donors, etc.) and will need to be verified and updated by the first year data collection. The RF also includes the definition of indicators and remarks. In addition, there is a separate table with a full definition/description of the indicators and their significance.

55. **Data sources**. Targeted technical assistance will be provided under component 1 as part of the fulfillment of the PDO and under component 3 to strengthen the M&E capacity. Sources of data include perception survey (citizen engagement), field survey (value chain aspects, e.g. access to inputs, storage capacity; infrastructure; biological parameters) and institutional survey (e.g. planning; METT).

56. **M&E arrangements and activities**. The PIU will have the overall coordinating role of the M&E function and will hire one international M&E specialist and two local M&E specialists who will ensure that data and information from all landscapes and institutions are produced and collected on time and of sufficient and necessary quality. The frequency of data collection is annual. The M&E activities will: (i) generate information on progress of the project; (ii) analyze and aggregate data generated at local regional and local levels; and (iii) document and disseminate key lessons to all stakeholders in Madagascar together with the communication function of the PIU. PADAP will put special emphasis on mapping of project interventions and results through geocoding of activities and overlay with key indicators. This information will be accessible through platforms along the lines of the Mapping for Results initiative.

57. **Citizen engagement**. The project explicitly seeks to support engagement of stakeholders and beneficiaries through consultative processes, engagement in local level planning and feedback mechanisms to elaborate and adjust the integrated landscape management approach and access to agricultural inputs thus contribute to achieving sustainability and project outcomes. Feedback mechanisms will be developed in the project design to ensure transparency, accountability and learning as well as a continuous dialogue with local level beneficiaries and other stakeholders. Particular attention will be given during implementation to the capacity of the local structures to close the feedback loop and report on action taken in this regards. The specific elements of the framework for citizen engagement include: (a) support to engagement of local rural and urban communities in the planning and development of planning instruments at large including budgeting and monitoring (b) support community engagement in determining local investment in irrigation and land- and agriculture based investments and establishment of service standards including proposed payment for environmental services; (c) support to a feedback mechanism from stakeholders and beneficiaries to be designed to process concerns and questions from beneficiaries and other stakeholders at different levels (regional to local), with a view to resolving these concerns and questions within stipulated service standards (to be monitored in the Results Framework); and (d) specific third-party monitoring of project activities will be supported three times during project implementation(in the first year, at mid-term and at completion) to ensure transparency and feedback on these activities. The protocol and mechanisms for elements of this citizen engagement framework will be detailed in the Project Operational Manual. Quality of its implementation and progress will be monitored both at regional and national levels through supervision and dialogue.

TABLE 18. CITIZEN ENGAGEMENT FRAMEWORK

Contribution to PDO: to increase access to improved irrigation and agricultural inputs and to improve integrated natural resources management by local actors in targeted landscapes - and, in the event of an eligible crisis or emergency in Madagascar, to provide immediate and effective response to said eligible crisis or emergency.	Relevant citizen engagement activities	Citizen engagement results and approach to management
PDO is supported by citizen engagement as: (1) an integrative tool for social accountability towards rural households across the targeted landscapes and range of interventions (proof of concept: landscape approach) (2) as a means to provide a voice and engage with local actors and ultimately beneficiaries to ensure that local and regional institutional capacity in planning and implementation and local improvements respond to local problems, demands and needs.	A. Feedback mechanism across landscapes (third-party monitoring) and closing of the feedback loop through fora for engagement (focus group discussions) B. Capacity building of local government structures in landscape management (agriculture, irrigation, agro-forestry etc.) and delivery of interventions to take account of feedback	PDO indicator: *Share of target beneficiaries with score 'Satisfied' or above on application of integrated landscape approach in targeted landscapes* (disaggregated by sex) (%) Data source: field-based perception survey based on a sample in all five landscapes implemented by a third party

ANNEX 9. IMPLEMENTATION SUPPORT PLAN

1. Strategy and approach for implementation support

1. An implementation support plan (ISP) has been prepared to ensure timely and effective project implementation. The goal is to ensure that implementation support activities provide effective mitigating measures against the Project's key risks and increase the likelihood of achieving the expected results.

2. The ISP focuses on the key implementation risks identified in the risk assessment and describes actions to mitigate them. The ISP also includes a detailed schedule summarizing the planned implementation support missions, collaboration with other partners including development partners (DPs), and the required human and financial resource commitment by the World Bank needed to ensure effective and successful implementation of the Project.

2. Implementation Support Plan

3. The ISP approach entails close monitoring of the Project's technical design and implementation aspects, governance, fiduciary, and safeguards issues. Given the overall design and scope of the project, a multi-disciplinary team comprised of technical specialists, along with fiduciary, environmental and social, and operations specialists will be needed to support the Government of Madagascar in implementing the Project. A number of technical specialists are based in the region, sub-region, and country office. This will facilitate overall implementation and timely communication with the client and the various stakeholders involved in implementation and allow for timely follow-up on specific issues and/or areas of concern when needed.

4. One challenge will be to coordinate the actions agreed in the ISP with operational activities on the ground, ensuring that information flows effectively and on a timely basis between all the project implementing entities. Critical to the Bank's effective implementation support will be its coordination and timing, aligned with key stakeholders/points in the planning and implementation of project activities.

5. **Implementation.** To ensure that project resources are being used effectively in pursuit of achievement of the PDO, the World Bank will undertake biannual implementation support missions. In addition, a mid-term review (MTR) of the Project is envisaged. The Bank team will include staff from the Agriculture, Environment and Water Global Practices as well as staff for financial management, procurement and environmental and social safeguards. Other Bank specialists will be included as needed. The skill sets represented by the core staff cover the range of issues being addressed under the Project, namely institutional strengthening needs, decision-support development, irrigation infrastructure, forestry, value chain development, land tenure, livestock rearing, etc. Presently the co-TTLs are all based in field offices and can therefore more readily support the clients as needed. The first implementation support mission will take place as soon as possible after effectiveness to provide direct and timely feedback on the quality of implementation plans and their likely soundness and acceptability. The first mission is therefore expected to include all team members (i.e., technical, environmental, social, fiduciary and operational specialists). Subsequent implementation support will focus on verification/M&E skills and technical implementation expertise, per the actual needs as specified in the ISP.

6. **Technical.** A number of potential risks have been identified in the design of the Project, among them are potential challenges associated with the level of actual collaboration between the different ministries and other institutions. Another risk is possible limited technical project implementation capacity at the local level. The Bank team will ensure the availability of the appropriate technical skills mix and experience to support and guide project implementation.

7. **Governance.** Governance aspects of the Project will be monitored during the biannual implementation support missions.

8. **M&E.** The World Bank will complement the Project's M&E activities by carrying out biannual implementation support missions during which performance indicators will be closely monitored. Field visits will be undertaken to verify data in M&E reports and to ensure that the M&E system is generating a complete and accurate picture of project performance.

9. **Environmental and social safeguards.** Potential risks may include negative impacts on the environment and/or human populations living in the Project target areas as a result of the potential increased use of fertilizers, herbicides and pesticides in some of the project activities and land related activities. An ESMF, PPMP and RPF for the Project have been developed and disclosed. Implementation of these safeguards instruments will require rigorous screening of the project target areas and close follow up on the related implementation issues. The Bank's safeguards team will consist of the Environmental and Social Safeguards specialists who will be core members of the bi-annual support missions. They will guide the project team and client in applying the agreed on safeguards instruments and ensure compliance.

10. **Fiduciary.** Financial management risk has been assessed as "substantial". Procurement capacity risk has also been assessed as "substantial". Proposed mitigation measures for both FM and procurement are detailed in Annex 8. As part of its bi-annual implementation support missions, the World Bank's FM and Procurement Specialists will conduct reviews to ensure the adequacy of systems and capacity over the course of project implementation, provide advice and guidance on related issues, and recommend/arrange for training and capacity strengthening when needed.

TABLE 19: SUMMARY OF PROJECT IMPLEMENTATION SUPPORT

Time	*Focus*	*Skills Needed*	*Resource Estimate Per Year*	*Partner Role*
0-12 months	❖ Project effectiveness & implementation start-up ❖ Finalization of PIM ❖ Implementation support ❖ Review of progress made in year 1	❖ Agriculture Specialist ❖ Land Specialist ❖ Private Sector/Agri-business Specialist ❖ Food and Export Crop Value Chains Specialist ❖ Livestock Specialist ❖ Irrigation Engineer ❖ Forestry Specialist ❖ PES Specialist ❖ Financial Management Specialist ❖ Procurement Specialist ❖ Environmental and Social Safeguards Specialists ❖ Finance/Disbursement ❖ Operations ❖ Project Administrative Support	US$150,000	FAO/CP
12-48 months	❖ Implementation of planned activities/review of annual work plans & budgets, & cross-checking linkages between planning, budgeting, and results ❖ Conducting of ISM missions ❖ Monitoring, evaluation of ongoing activities ❖ Assessment of implementation of safeguards instruments ❖ MTR conducted in year three	Same as above	US$150,000	

49-60 months	❖ Implementation of planned activities/review of annual work plans & budgets ❖ Conducting of ISM missions ❖ Monitoring, evaluation of ongoing activities ❖ Assessment of implementation of safeguards instruments ❖ Project completion and ICR preparation	Same as above	US$150,000	

TABLE 20: REQUIRED SKILLS MIX FOR IMPLEMENTATION SUPPORT

Skills Needed	***Number of Staff Weeks Per year***	***Number of Trips Per year***	***Comments***
Lead/Senior Agriculture Specialist (TTL)	12	3	Mozambique-based
Lead/Senior Environmental Specialist (co-TTL)	12	3	Antananarivo-based
Lead/Senior Water Specialist (co-TTL)	12	3	Mozambique-based
Private Sector/Agri-business Specialist	4	2	Washington-Based
Food and Export Crop Value Chains Specialist	4	2	Washington-Based
Livestock Specialist	4	2	Washington-Based
Irrigation Engineer	8	2	Washington-Based
Forestry Specialist	8	2	Washington-Based
PES Specialist	8	2	Washington-Based
Financial Management Specialist	6	2	Country Office-based
Procurement Specialist	6	2	Country Office-based
Environmental Specialist	4	2	Country Office-based
Social Safeguards Specialists	4	2	Country Office-based
Disbursement Officer	4		Washington-Based
Legal	2		Washington-Based
Operations	8	2	Washington-Based
Project Administrative Support	8	2	Country Office-based

ANNEX 10. ANALYSIS OF THE PROJECT'S NET CARBON BALANCE WITH EX-ACT

1. The following analysis assesses the Project's net carbon balance, which project activities have the largest potential to reduce emissions and sequester carbon, and provides an understanding of the Project's contribution to the country's mitigation goals.

National climate change adaptation and mitigation policy context

2. **Madagascar's adaptation and mitigation strategy.** In 2010 and 2013, Madagascar adopted the National Climate Change Policy and the National Strategy to Face Climate Change in Agriculture-Livestock-Fishery for 2012-2015, respectively. Both strategies promote adaptation strategies as well as the need for climate change mitigation. In 2010, Madagascar submitted its National Appropriate Mitigation Actions (NAMA) to the United Nations Framework Convention on Climate Change (UNFCCC), covering the energy, forestry, energy/waste, agriculture and transport sectors. The Second National Communication to the UNFCCC reported the key sources of GHG emission for the baseline year 2000. Agriculture and energy were the main emitting sectors.[71] The Third National Communication of Madagascar is currently under preparation.[72]

3. Madagascar's proposed mitigation goals until 2030. In September 2015, Madagascar's Intended Nationally Determined Contributions (INDC) were published, presenting proposed climate actions under the new international climate agreement. By 2030, Madagascar aims to reduce 30 MtCO2 of its greenhouse gas emission, representing 14 percent of national emissions, and aims for a GHG absorption of 61 $MtCO_2$ in 2030, which represents 32 percent compared to the business as usual scenario which is based on inventory from 2000 to 2010. The cost of mitigation is estimated at about US$6 billion and the international community encouraged to support these objectives through the UNFCCC or other financial mechanisms.

World Bank mandate and accounting methodology

4. In its 2012 Environment Strategy, the World Bank adopted a corporate mandate to conduct greenhouse gas (GHG) emissions accounting for investment lending. The quantification of GHG emission is an important step in managing and ultimately reducing emissions, and is becoming common practice for many international financial institutions.

5. The World Bank has adopted the Ex-Ante Carbon-balance Tool (EX-ACT) developed by FAO in 2010,[73] to assess a project's net carbon-balance. This is the net balance of tons of CO_2 equivalent (tCO_2e) GHGs that were emitted or carbon sequestered as a result of project implementation compared to a "without project" scenario compared to the "initial" scenario. EX-ACT thus estimates the carbon stock changes as well as GHG emissions per unit of land, expressed in tCO_2e per hectare and year.

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[71] In particular due to following activities: Agricultural soils emitting N_2O, and accounting for 58 percent of Madagascar's total CO_2-equivalent emissions; livestocks' enteric fermentation emitting mainly CH_4 constituting 17 percent of total CO2-equivalent emissions; manure management emitting N_2O, 12 percent of total CO_2-equ emission; combustion of transport and other activities accounted for 5 percent of CO2-equ emission; and rice farming for 1.7 percent.[71] Madagascar has lost ca. 40 percent of its forest cover in the last 50 years. Controlled fires in agriculture and conversion of forest and grasslands accounted for ca 30 percent of the CO emission.

[72] Nachmany M et al. (2015): Climate Change Legislation in Madagascar. An Excerpt from the 2015 Global Climate Legislation Study A Review of Climate Change Legislation in 99 Countries.

[73] http://www.fao.org/tc/exact/ex-act-home/en/

Data inputs to EX-ACT

6. **Climate and soil regimes.** The project areas are largely in a Warm Temperate Moist climate and moisture regime. The soil type is largely High Activity Clay Soil. The project duration is 5 years; the capitalization period is assumed to be 15 years to allow changes in soil carbon to materialize. Dynamics of evolution are assumed to be linear. Default "Tier 1" coefficients are used.

7. The project adopts a landscape approach and covers four main land use types (Figure 3 "Main land use types in a landscape" in Annex 2). Interventions in each land use type have potential to reduce GHG emission and carbon sequestration in soil and biomass. The project is expected to have a sizable mitigation potential through:

- Land use type 1: represents the irrigated bottom of a valley where rice, horticulture and livestock are most prevalent. It is expected that improved irrigated rice management practices – alternate wetting and drying and reduction of methane emission, improved livestock management (impacting GHG intensity by increasing productivity) and improved input use can reduce GHG emissions.
- Land use type 2: On the slopes where contours and terraces are, farmers typically engage in livestock, diverse agricultural and agroforestry production. The project introduces improved agronomic practices for horticulture and crop production.
- Land use type 3: This land type represents higher hillside where reforestation and afforestation through forestry and agroforestry are possible. The project plans to introduce agroforestry plantations, reduced use of fire, reduced deforestation; afforestation of plantations; reduced land degradation which will have a high carbon sequestration and GHG mitigation potential.
- Land use type 4: This land type represents protected area, where it is expected that project supports the reduction of deforestation.

8. **Target intervention area and activities in EX-ACT.** The analysis takes following interventions, which are in line with the project's cost tables, into account (see Table 21):

Crop and pasture management:

- *Improved irrigated rice cultivation*. The irrigation schemes will be rehabilitated and improved rice management practices will be introduced on 14,000 ha land, which was already under irrigated rice cultivation. Without project, the perimeter would allow only one season and remain flooded for the largest part of the season.
- *Improved crop management practices.* 7,500 beneficiaries who engage in the horticulture value chain will be targeted. It is assumed that with the project, they adopt improved crop management practices on about 0.5 ha. Without the project, these beneficiaries would continue to engage in traditional cultivation practices.
- *Inputs use.* The project will enable improved access to inputs for project beneficiaries in irrigated rice (14,000 ha) and horticulture value chains (3,750 ha).[74] This results in 750 tons of nitrogen per year and 616 tons of phosphorous for irrigated rice and 41 tons/nitrogen

74 It is assumed that beneficiaries apply ca. 200 kg/ha of NPK 11-22-16 with min of 11 percent nitrogen content and 22 percent phosphorus content and 100 kg/ha Urea with 46 percent nitrogen content for irrigated rice production on 14,000 ha land. This is recommended by the Ministry of Agriculture for Système de Riziculture Améliorée (SRA) practices. For commodities in land use type 2 (for instance rainfed rice, cassava, vegetables) an average of 100 kg of fertilizer per hectare, is assumed, with same nitrogen and phosphorus ratio as for rice, on 3,750 ha land.

and 82 tons/phosphorous for vegetable production. It is assumed that surface irrigation systems will be installed on 14,000 ha land.

- moderately degraded and will remain moderately degraded without the project, with project the area is restored to be non-degraded.
- *Reduced deforestation.* In addition to above activities, which are captured in EX-ACT, the project expects to reduce deforestation. Based on the assumption that, the project will reduce deforestation on average by 15 percent, which results in approximately 4,700 hectare forest saved, which would otherwise become degraded area.

TABLE 21. ACTIVITIES AS IMPLEMENTED IN EX-ACT FOR CURRENT STATE, WITH AND WITHOUT PROJECT SCENARIO

Type of interventions	Current scenario | Without project	With project
Irrigated rice	14,000 ha: 150 day cultivation, continuously flooded, non-flooded pre-season < 180 days.	14,000 ha: 300 day cultivation, intermittently flooded, non-flooded pre-season > 180 days.
Improved crop management	3,750 ha traditional crop management	3,750 ha: improved agronomic practices, nutrient management no tillage residue retention
Fertilizer use	No fertilizer use	Irrigated rice: 750 t N/year; 616 t P /year; Other crop production: 41 t N; 82 t P/year.
Irrigation system	No rehabilitation	14,000 ha rehabilitation of surface irrigation schemes.
Agroforestry	Degraded land	12,000 ha agroforestry
Forest plantations	Degraded land	7,377 ha plantation
	2,981 ha degraded perennials	2,981 ha plantation for enrichment
Hillside restoration	12,000 ha moderately degraded land	12,000 ha non-degraded land
Reduction of deforestation	Deforestation as usual, resulting in degraded land area.	Reduction of deforestation ate by 15 percent, saving 4,650 ha subtropical humid forest and 59 ha subtropical dry forest.

Results

9. Based on the above activities, the project has a potential to achieve a net carbon balance of -13,752,996 tCO2e emission over 20 years, or -687, 650 tCO2 emission per year. The Project thus constitutes a sizable carbon sink. Table 22 provides an overview of contribution of each activity. Afforestation and plantation activities on degraded land have the largest mitigation potential and contributes ca. 41 percent to the net carbon balance. This is followed by introducing agro-forestry, 29 percent and reducing deforestation, 25 percent. Comparably, improving pasture management, improving irrigated rice management and improve crop management have a relatively small share of 3, 2 and 1 percent respectively. Increased fertilizer use and rehabilitation on-farm irrigation systems are the only carbon source, and have a relatively small share to the entire net carbon balance of 1 percent.

10. The analysis has shortcomings related to emission sources that cannot be included in the analysis, such as increased transportation and processing activities due to strengthening value

chains and market linkages; also the increased energy consumption due to increased irrigation use was not yet factored in, and infrastructure development could constitute a carbon source. On the other hand, not all benefits on the landscape level, such as the reduced use of fire have been factored in.

TABLE 22. GROSS FLUXES AND NET CARBON BALANCE BY PROJECT ACTIVITY AND FOR THE ENTIRE PROJECT. ALL GHG IN tCO_2e (NEGATIVE VALUES CONSTITUTE A NET CARBON SINK; POSITIVE VALUES A NET CARBON SOURCE), CALCULATED WITH EX-ACT

Project Interventions	**Gross fluxes**			**Result per year**		
	Without	**With**	**Balance**	**Without**	**With**	**Balance**
Deforestation (as in EX-ACT)	3,427,503	0	3,427,2503	-171,375	0	-171,375
Afforestation	0	-5,597,978	-5,597,978	0	-279,899	-279,899
Agro-forestry	0	-2,318,360	-2,318,360	0	-115,918	-115,918
Agro-forestry growth	-41,734	-1,723,017	-1,681,283	-2,087	-86,151	-84,064
Improved crop management	0	-180,497	-180,497	0	-9,025	-9,025
Improved irrigated rice management	1,365,000	1,080,261	-284,739	68,250	54,013	-14,237
Improved pasture management	0	-360,638	-360,638	0	-18,032	-18,032
Increased input use/irrigation infrastructure	0	98,002	98,002	0	4,900	4,900
Total	4,750,769	-9,002,227	**-13,752,996**	237,538	-450,111	**-687,650**
Per hectare	79	-149	-227			
Per hectare per year	3.9	-7.4	-11.4	3.9	-7.4	-11.4

ANNEX 11. CLIMATE RISKS AND POTENTIAL IMPACTS

1. The recent IPCC 5th Assessment Report projects a greater number of the more extreme events and highlights the following eight major climate risks, all of which are likely to significantly impact Madagascar: 1) Death or harm from coastal flooding; 2) Harm or economic losses from inland flooding; 3) Extreme weather disrupting electrical, emergency, or other systems; 4) Extreme heat, especially for the urban and rural poor; 5) Food insecurity linked to warming, drought, or flooding; 6) Water shortages causing agricultural or economic losses; 7) Loss of marine ecosystems essential for fishing and other communities; and 8) Loss of terrestrial and inland water ecosystems. 23 provides specific climate risks and potential impacts across agriculture, water, and fisheries sectors and also impacts on coastal ecosystems given that Madagascar has >4,000 km of coastline.

TABLE 23. CLIMATE RISK AND POTENTIAL IMPACTS

Climate Risks and Potential Impacts AGRICULTURE PRODUCTION

Climate Risk	Potential Impacts
Increased temperatures	Crop damage and reduced yields
Increased precipitation during the rainy season	Higher rates of evapotranspiration, reducing soil moisture and increasing soil degradation
	Increased need for irrigation, particularly for rice cultivation
Reduced rainfall in the dry season and increased drought conditions	Increase in pests and diseases
	Increased sedimentation, soil erosion and siltation, compromising flat lowland areas
	Increased livestock mortality (especially cattle)
Increased cyclone intensity	Damage to crops, supply chains and infrastructure from cyclones

Climate Risks and Potential Impacts WATER RESOURCES

Climate Risk	Potential Impacts
Increased temperatures	Reduction of key water points; draining of swamps and rivers during the dry season
Reduced rainfall and increased drought conditions	Reduced river flows, resulting in reduced access to water supplies for drinking, sanitation and energy generation, and reduced water quality
Increased intensity of cyclones	Cyclone-induced destruction of water infrastructure and flood-induced water quality reductions due to increased sedimentation

Climate Risks and Potential Impacts COASTAL ECOSYSTEMS

Climate Risk	Potential Impacts
Increased temperatures	Increased sea surface temperatures and ocean acidification, impacting coral reefs and undersea coastal ecosystems
Increased cyclone intensity	Destruction of marine habitats and biodiversity loss
Sea level rise	Increased coastal erosion and inland soil erosion and saltwater intrusion
	Reduced water quality and increased flooding in densely populated coastal urban areas

Climate Risks and Potential Impacts FISHERIES

Climate Risk	Potential Impacts
Sea level rise	Reduced productivity due to increased sedimentation and runoff, and reduced water quality
Rise in sea surface temperature	Temperature-induced shifts in the ranges and populations of fish; changes in reproduction cycles
Increased cyclone intensity	Destruction of fish habitat and ecosystem (e.g., coral reefs and mangroves); migration of fish away from historical fishing areas
Increased frequency of extreme events	Increased production costs due to destruction of infrastructure and interruption of supply chains

Source: Adapted from USAID Factsheet (2016)

ANNEX 12. MAP OF MADAGASCAR