Title of UNDP supported GEF financed project	Effective Conservation and Sustainable Use of Mangrove Ecosystems in Brazil
PIMS#	3280
GEF project ID#	2703
TE time frame	December 2017-March 2018
date of TE report	April 2018
Region and countries included in the project	Brazil
GEF Operational Focal Area/Strategic Program	Biodiversity
Executing Agency	UNDP
Implementing Partner and other project partners	ICMBIO
MTR International Consultant	José Antonio CABO BUJÁN

Acknowledgements

The consultant would like to thank the community members of the RESEX Delta do Parnaíba for taking the time to share their vision, knowledge and understanding of the situation and vision of mangrove dwellers in Brazil. Special thanks also to the ICMBIO officials and Ministry of Environment for facilitating the conduct of interviews during the evaluation mission. Special thanks too to the UNDP country office team for their patience and support and the UNDP regional technical advisor for the thorough review, which has greatly improved this report.

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Acronyms and Abbreviations

APA	Área de Proteção Ambiental
ARIE	Área de Relevante Interesse Ecológico
AWP	Annual Work Plan
BAU	Business as Usual
BRL	Brazilian Real (LCU)
CBD	Convention for Biological Diversity
CDP	Country Programme Document
CDR	Combined Delivery Report
CE	State of Ceará
CIP	Cananéia-Iguapé-Peruíbe
DAC	Development Assistance Committee
EOP	End-of-project
FDG	Focus Discussion Group
FUNBIO	Fundo Nacional para a Biodiversidade
GADM	Global Administrative Areas Database
GEF	Global Environmental Facility
GOB	Government of Brazil
IBAMA	Instituto Brasileiro do Meio Ambiente e dos Recursos Naturais Renováveis
ICMBIO	Instituto Chico Mendes de Conservação da Biodiversidade
IUCN	International Union for Conservation of Nature
LCU	Local Currency Unit
LFA	Logical Framework Analysis
MA	Maranhão
M&E	Monitoring and Evaluation
METT	Management Effectiveness Tracking Tool
MMA	Ministério do Meio Ambiente
MPGO	Ministério do Planejamento, Desenvolvimento e Gestão
NIM	National Implementation Modality
PA	Protected Area/ State of Pará
PB	State of Paraíba
PI	State of Piauí
PIR	Project Implementation Review
PR	State of Paraná
RESEX	Reserva Extrativista
SC	Strict Conservation Management Category
SNUC	Sistema Nacional de Unidades de Conservação
SP	São Paulo
SU	Sustainable Use Management Category
UC	Unidades de Conservação
UNDAF	United Nations Development Assistance Framework
UNDP	United Nations Development Program
USD	Dollars of the United States of America
WCPA	World Commission on Protected Areas
WWF	World Wildlife Fund

Executive Summary

Project Information Table

Project title	Effective Conservation and Sustainable Use of Mangrove Ecosystems in Brazil		
UNDP Project ID (PIMS #)	3280	PIF approval date	01/06/2007
GEF Project ID (PMIS #):	2703	CEO endorsement date	28/05/2008
ATLAS Business Unit, Award # Proj. ID:	00055992	ProDoc signature date	31/07/2008
Country(ies):	Brazil	Date project manager hired	
		Inception workshop date	17/12/2014
Region:	LAC	MTR completion date	
Focal Area:	Biodiversity	Original planned closing date	31/07/2013
GEF Focal Area Strategic Objective:	Objective 1	Revised closing date	31/12/2020
Trust Fund	GEF TF		
Executing Agency/ Implementing Partner:	ICMBIO		
Other execution partners:			
Project financing	**At CEO endorsement (US$)**	**At terminal evaluation (US$)**	
[1] GEF financing	5,000,000	4,889,312	
[2] UNDP contribution	-	-	
[3] Government	14,900,000	45,700,000	
[4] Other partners	-	-	
[5] Total co-financing [2]+[3]+[4] :	14,900,000	45,700,000	
Project total costs [1+5] :	19,900,000	50,589,312	

Project Description

The project, Effective Conservation and Sustainable Use of Mangrove Ecosystem in Brazil was executed between 2008 and 2017. Originally planned to be closed in 2013, the need for consolidation of the then recently created implementation agency, ICMBIO delayed implementation for almost four years.

Mangroves in Brazil are estimated to cover 13,989.66 km^2 along the 6,800 km of Brazilian coast from the state of Amapá to Paraná. **Brazilian mangroves constitute 30% and 10% of the LAC and global mangroves** respectively. Brazilian mangroves also host globally significant biodiversity and sustain important artisanal fisheries that are the only or main source of sustenance for millions of households along the Brazilian coast. As most of the mangroves are contained within federal or state protected areas, the project strategy aimed to strengthen management effectiveness at federal protected areas while strengthening licensing processes that affect mangrove areas, such as upstream industrial activities, together with state and municipal environmental agencies. The project also expected to positively influence the socio-economic status of artisanal fishing households inhabiting sustainable use federal protected areas.

Project Progress Summary

The project needed four years to effectively take off, due to the consolidation of the project's implementing partner, which was only established on paper in 2007. Once a stable team was in place, the implementation of the project elapsed without any significant trouble. The project made important efforts to advance towards the over 21 targets of its logical framework, achieving some significant results, such as tracking changes in management effectiveness in 17 federal areas from 2012 to 2016, crafting fishery agreements in 8 federal sustainable use protected areas, establishing participatory biodiversity monitoring protocols and in general upgrading the relevance of mangrove ecosystems in the federal biodiversity governance structures.

Evaluation Rating Table

Rating Project Performance		
Criteria	**Rating**	**Comments**
Monitoring and Evaluation: Highly Satisfactory (HS), Satisfactory (S) Moderately Satisfactory (MS), Moderately Unsatisfactory (MU), Unsatisfactory (U), Highly Unsatisfactory (HU)		
Overall quality of M&E	MS	Despite the shortcomings of the indicator framework, the project did use the M&E system for adaptive management
M&E design at project start up	MS	The project's indicator framework had too many redundant indicators, making it not cost-effective
M&E Plan Implementation	S	The project regularly monitored and used the M&E system for adaptive management
IA & EA Execution: Highly Satisfactory (HS), Satisfactory (S) Moderately Satisfactory (MS), Moderately Unsatisfactory (MU), Unsatisfactory (U), Highly Unsatisfactory (HU)		
Overall Quality of Project Implementation/Execution	S	Disbursement and administration performed without problems
Implementing Agency Execution	S	UNDP provided sufficient technical and administrative support
Executing Agency Execution	S	IP engaged proactively to solve implementation challenges
Outcomes: Highly Satisfactory (HS), Satisfactory (S) Moderately Satisfactory (MS), Moderately Unsatisfactory (MU), Unsatisfactory (U), Highly Unsatisfactory (HU)		
Overall quality of project outcomes	MS	Project achievements may strengthen mangrove protected areas, but original targets only partially achieved
Relevance: relevant (R) or not relevant (NR)	R	Project supported national policies and MEA commitments
Effectiveness	S	Project brought mangrove forests to national attention and set up several fishery management agreements with some potential to enhance delivery of ecological and social outcomes of sustainable use protected areas
Cost-effectiveness	MS	Implementation over 9 years, with increasing implementation costs, but good general cost-effectiveness

Sustainability: Likely (L), Moderately likely (ML), Moderately Unlikely (MU), Unlikely (U)		
Criteria	**Rating**	**Comments**
Overall sustainability	ML	Average of the four risk dimensions. See below
Financial resources	ML	Budget allocations for PAs still very limited. State and municipal environmental agencies still weak. Need to mobilize new resources toward mangroves
Socio-economic	ML	Increased awareness of importance of PAs among mangrove stakeholders, but many resource users and managers still not sufficiently aware
Institutional framework and governance	ML	Environmental institutions at state level remain weak and ancillary economic interests
Environmental	L	Wildlife populations in PAs have the potential to recover, provided threat levels do not increase. Climate change will become an increasing threat for southern mangroves
Impact: Significant (S), Minimal (M), Negligible (N)		
Environmental status improvement	M	Mangrove cover and status remain the same
Environmental stress reduction	S	Increased awareness and ownership by resource users
Progress towards stress/ status change	S	Project mangrove forests to the attention of biodiversity institutions at federal level (ICMBIO and MMA)
Overall progress results: Highly Satisfactory (HS), Satisfactory (S) Moderately Satisfactory (MS), Moderately Unsatisfactory (MU), Unsatisfactory (U), Highly Unsatisfactory (HU)		
Overall progress results	MS	The project has made significant improvements over the business-as-usual scenario. However, it could not achieved all its targets within implementation period

Concise summary of conclusions

The project strategy was relevant and significantly raised the visibility and importance of mangrove forests in the eyes of national environmental institutions, formerly focused solely on inland biomes.

The project underwent a prolonged development phase, lasting from at least 2005 to 2008, which led to an "accumulation" of expected results, given the modest grant amount of USD 5 million, for a target area exceeding 5,000 km^2, dispersed over 6,000 km of coast. However, the project selected clusters of protected areas with different main threats, ecological and socio-economic conditions, which enabled different approaches to be tested. However, the project strategy underestimated the transaction costs (negotiations, travel) involved when dealing with multiple geographic areas AND multiple institutional partners.

The implementation phase was significantly delayed, due to the new creation of ICMBIO. The new organization needed time to build up its structure, and hence the project only really took off by 2011, three years later than planned, which forced a no-cost extension first until 2015 and finally to 2017. The fact that the project implementation extended over 9 years on the same original grant bears down on its efficiency, as the executing agency's cost kept mounting over time. Thus, the project focused its attention on instruments of national application, such as the national mangrove plan, while abandoning some of the most significant mangrove areas of the country (Reentrâncias Maranhenses).

While the project did not deliver all the originally intended products it was able to produce a consistent set of products, namely PA management plans, fishery management agreements, a new national management plan for *Ucides cordatus*, and a comprehensive atlas of Brazilian mangroves, as well as initiated an important biodiversity monitoring program, an environmental restoration plan, zoning agreements and set up the concept of a fund for coastal and marine biodiversity. During the implementation time, there were no significant changes in mangrove area or a worsening of the status of threatened or overexploited organisms associated with mangroves and/ or estuaries according to both national threatened lists and the IUCN Red List ®. Thus, the project has put mangroves in the forefront of environmental agencies at federal level.

However, protected area management effectiveness has not improved at most of the protected area supported by the project. Moreover, the limited resources available to protected area management councils hampers or downright out precludes the implementation of the very tools produced by the project.

Thus, expected ecological and social outcomes, namely, increases in population numbers for fishery species or improvement of socio-economic status of mangrove fishing communities did not materialize. Population status would depend on management effectiveness, which, as we have exposed has not yet sufficiently improved, but also on biological and abiotic factors that would have delayed the effect of effective implementation of any of the management instruments devised by the project. More importantly, socio-economic status of fishing communities may improve if the management plans developed by the project are effectively implemented and these communities succeed in keeping the fishery resources on which they depend closed to new entries or increases in effort. Even in ideal conditions, their monthly income still depends on a market dominated by few, much wealthier, and presumably much better connected buyers. Therefore, continuous support from transfer programs, such as the one administered by the Ministry of Environment (Bolsa Verde), as well as the updating of fishers´ registries and consequent access to social benefits is paramount for the well-being of coastal communities and, in return for the mangroves of Brazil. Weak finances for protected areas constitute the main risk for the sustainability of the project, together with the still suboptimal engagement of local governments and business operators in the management of drivers of mangrove degradation and destruction.

Recommendations

1. ICMBIO could elevate the mangrove biome to the same status as the other six current Brazilian biomes to enhance its visibility and raise issues about its importance and conservation. Mangroves risk not being given enough attention and fall between administrative divisions.

2. Financial sustainability of mangrove federal protected areas must be strengthened by increasing their current meagre budget allocation, as well as by posting more personnel and crafting agreements across agencies to strengthen enforcement.

3. ICMBIO and MMA should strengthen monitoring programs of biodiversity and specifically support the participatory monitoring program developed by the project. Knowledge on the status of biodiversity in mangroves is less than satisfactory, as shown by the challenges faced by the project and this terminal evaluation to gather information on the project's indicators. The participatory monitoring program has the potential to start bridging this gap.

4. Fishery management plans cannot be implemented in the absence of fishery data. ICMBIO and the MMA must both increase efforts to coordinate with state or federal fishery administrations and include monitoring of catch within federal protected areas of sustainable use. Moreover, catch and effort data must be incorporated in the participatory monitoring program established by the project.

5. UNDP must take a proactive role orienting executive agencies in the administration of tracking tools, especially METT and review results

Lessons Learned

1. Projects should not be implemented by recently created agencies, otherwise the project becomes inefficient due to long implementation times and cumulative costs on a constant grant.

2. Future projects should not underestimate the costs involved not only in setting up implementation of a geographically challenging project but more importantly the transaction costs involved in dealing with a multitude of actors

3. Socio-ecological systems are complex and there are rarely simple cause-effects relationships. For instance, projects that have the enhancement of management effectiveness of protected areas as a goal cannot deliver maintenance or increase of population numbers or of habitat quality for big areas. Project outcome indicators should be restricted to the immediate effect of the project

4. Project outcome indicators should not include overlapping and/ or output indicators at outcome level. Moreover, project design should evaluate the costs of collecting data on the relevant matter, for instance, whether or not there is sufficient information on populations for a certain habitat should be carefully assessed.

5. Management instruments, like PA management plans, or fishery management plans need resources to be implemented and to achieve the ecological and social benefits intended. The sustainability of this project's achievements is going to be determined by the ability of ICMBIO and its national and international partners to mobilize such resources for the execution and continuation of the plans and agreements developed and facilitated by the project.

1. Introduction

Purpose of the TE and objectives

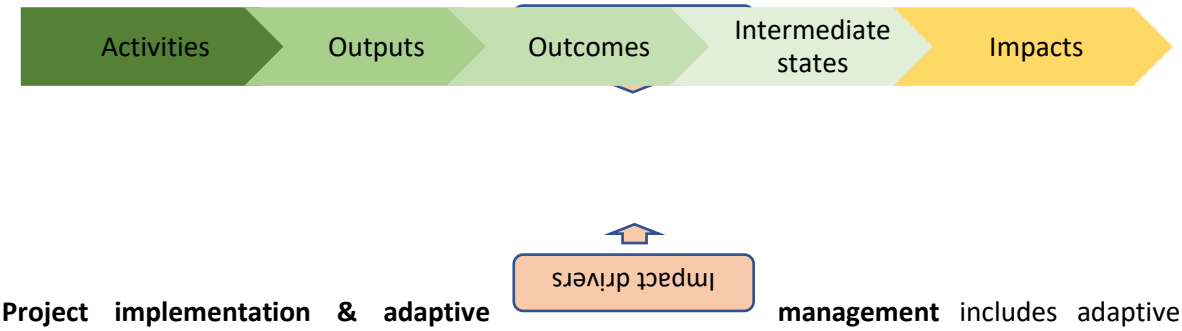
As mandatory for all GEF-funded, UNDP-implemented projects, a terminal evaluation conducted by an independent party was commissioned[1] in Brazil in November 2017, to produce a systematic, independent assessment of the project's relevance, effectiveness, efficiency, impact, and sustainability. Terminal project evaluations serve the dual purpose of disclosing project results and implementation processes, fostering transparency and accountability, and providing lessons learned for the improvement of design and implementation of future projects[2].

Scope & Methodology

The UNDP-GEF guidelines for the conduct of project terminal evaluation are aligned with the five DAC[3] evaluation criteria of relevance, effectiveness, efficiency, impact and sustainability, and along three dimensions: project formulation and strategy, project results, project implementation and adaptive management and sustainability.

Project strategy and formulation. This dimension comprises the project's logical framework and the project's national and local ownership (at design stage), linkages to past and current initiatives and UNDP comparative advantage. Examining the project logic entails examining the project's activities-impact pathway[4] (figure 1), thus analyzing the validity of the project assumptions and impact drivers, especially identified risks, as well as the likelihood of the necessary (implicit) intermediate states between outcomes and final impacts.

Figure 1. conceptual model of the activities-impact path and the conditioning factors that the project can influence (impact drivers) and the ones it cannot (assumptions). Based on the GEF Evaluation Office (2009) ROtI Handbook.



Project implementation & adaptive management includes adaptive management, partnership agreements, monitoring and evaluation (M&E) system, finances and co-

[1] (UNDP, 2012)

[2] (UNDP, 2012)

[3] Development Assistance Committee of the Organization for Economic Cooperation and Development

[4] (GEF Evaluation Office, 2009)

financing and implementing and executing agency performance will be evaluated. These concepts are defined and measured as described in the following table:

Construct	Operational definition and measurement
Adaptive management	Project management structures managed implementation challenges, risks and context changes, as documented in project reports
Partnership agreements	Extent to which all groups that are affected or can influence the project and its outcomes were included in the project governance structures
M&E system	Sensitiveness, cost-effectiveness and reliability of indicators, and degree to which the M&E system has guided project implementation as documented in work plans and steering committee minutes
Financial execution	Disbursement and expenditure conducted in timely, transparent manner (concordance of budgets and expenditure), reporting and accountability lines clear and in compliance with UNDP and national rules (audit reports) and degree to which the project has coordinated with co-financiers
Agency performance	Project agencies provided necessary technical and administrative support as shown in quality of reports (candidness and truthfulness) and work plans (compliance with logical framework)

Project results. This dimension refers to how the project results, or outcomes, comply with the evaluation criteria, as shown in the following table

Evaluation criteria	Operational definition and measurement
Relevance	Project supported specific, formal or informal, policy objectives at community, state and national level, together with concordance with GEF-4 results framework and UNDP's CDP
Effectiveness	Degree of achievement of targets defined in the project's LFA
Efficiency	The extent to which results have been delivered with the least costly resources possible.
Impact	Changes of status of populations and habitats and drivers of degradation, behavior and attitudes of stakeholders, as well as socio-economic impact of the project on coastal communities.
Sustainability	Trends of public budgets and/ or expenditure on mangrove protected areas, existence of legal instruments to sustain project outputs and interest of stakeholders, as well as viability of mangrove habitats considering likely impacts of climate change

Additionally, the terminal evaluation has examined the degree to which the project has produced public goods and the degree to which the project has contributed to broader development topics, including gender and indigenous issues.

Methods

This evaluation employed a mix of qualitative and quantitative research methods including, focus discussion groups (FDG) individual interviews, questionnaires (METT) and structured observation. Semi-structured, individual interviews and focus discussion groups (FDG) were held with representatives of the project's main stakeholders, Chico Mendes Institute for Biodiversity Conservation (ICMBIO), Ministry of Environment (MMA) and UNDP at national level, including the project team (ICMBIO) and project analyst (UNDP). Representatives of relevant departments of

the ICMBIO (Protected Areas, Research, Threatened Species and Knowledge Management) and the MMA (Biodiversity, Ecosystem Conservation) were also interviewed. At field level, three PA managers (ICMBIO) were interviewed at the sustainable use PAs of APA and RESEX Delta do Parnaíba (Maranhão) and APA and ARIE Rio Mamanguape (Paraíba). Also, six individual interviews and FDGs were held with local stakeholders in and around the two protected areas of the Delta do Parnaíba, including fishers and crab merchants. These interviews provided first-hand information on stakeholder perceptions and experiences in the implementation and results of the project. Structured observation was applied to assess ecosystem status, crab collection and value chain during the field visit to the protected areas at the Delta do Parnaíba.

METT questionnaires and CDRs were analysed using descriptive statistics. Also, drivers of effects (METT scores and threat scores) were identified through correlation analysis, using Excel® software. Geographical information systems, QGIS® software and Google Earth® imagery were used to calculate locations, ecosystem cover and extension of protected areas, using data from WWF (mangrove ecosystem extension), WCPA (protected area location and extension) and GADM (administrative borders).

The project's performance against the five evaluation criteria was rated based on ordinal scales: two-point scale for relevance (relevant, non-relevant), 6-point scale for effectiveness and efficiency ("highly unsatisfactory" to "highly satisfactory"), three-point scale for impact and four-point scale (likely, moderately likely, moderately unlikely, unlikely) for sustainability.

Limitations

The vastness of the project area (nearly 7,000 km of coastal Brazil and 5,000 km^2 of mangrove) and the number of protected areas included (24) against a mission length of merely 15 days severely limited the reach of the first-hand information obtained for this evaluation. Thus, project actions outside the protected area visited were based on a limited number of interviews, an important amount of project publications, peer-reviewed literature and online databases, and, more importantly, the evaluation relies to an important degree on the METT and threat scores, which were administered by the project's coordination unit to draw conclusions.

Structure of the TE report

This report contains a description of the project, its context and strategy (section 2), a discussion of its strategy (section 3.1) implementation (3.2) and results (3.3) followed by conclusions and recommendations based on said discussions (section 4). Annexes including list of persons interviewed, evaluation matrix, documents consulted, progress against results framework indicators, summary of field visits and audit trail are attached to this report.

2. Project Description and Background Context

Project start and duration

The project concept was developed between 2005 and 2007. Implementation was planned for the period 2008-2012 with a GEF 4 grant amounting to US$ 5 million. However, the consolidation of the then newly created implementing partner, the Chico Mendes Institute for Biodiversity Conservation (ICMBIO) delayed the implementation phase that eventually extended from 2008 to 2017.

Problems that the project sought to address

Brazilian mangroves

Mangroves in Brazil are estimated to cover between 10 to 14,000 km^2[2,5], variations due to methodological factors. Earlier figures of 25,000 km^2 are now considered as gross overestimations[6]. The most recent estimations based on detailed satellite images and produced with the support of this project, assess the actual cover at nearly 13,989.66 km^2 above of the previous accepted figure of 11,144 km^2[(7)]. Mangroves are not equally distributed along the 6,800 km of Brazilian coast: over 85% or 9,250 km^2 of Brazilian mangroves occur at the Northern coast sector from Amapá to Maranhão, with the state of Pará accounting for half of the total national mangroves. This coastal area is characterized by humid, equatorial climate, and continuous, tall stands of mangrove along the coast and estuaries, interrupted only by the estuary of the Amazon river. The coastal sector from the states of Piauí to Rio de Janeiro (Northeast coast) comprises approximately 10% of the Brazilian mangroves (1,180 km^2) and has a climate ranging from semi-arid to sub-humid, being increasingly seasonal and humid towards the South. Mangrove forests in this sector consist of smaller, shorter fringing stands, which have a greater development in the more humid conditions from the state of Bahia towards the South. The last most southern sector comprises 670 km^2 of mangroves (5% of the total), with humid, seasonal climate[8]. These main sectors can be subdivided in finer 8 sections according to physical factors (tides, evapotranspiration and temperature) and forest structure (dominant species, zonation, stand dimension and average tree height)[9]. Typical for the South American Atlantic, four mangrove species dominate all sectors and their associated fauna is highly dependent on adjacent ecosystem both terrestrial (Amazonian or Atlantic tropical moist forest, Cerrado or Caatinga shrublands) and marine (tidal flats, seagrass meadows).

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[5] (Giri, et al., 2011) based on LANDSAT images from 2000 and (Kjerfve & Lacerda, 1993) based on local estimations from different authors

[6] (Kjerfve & Lacerda, 1993)

[7] (Magris & Barreto, 2010) based on 2007-09 LANDSAT images

[8] (Kjerfve & Lacerda, 1993), (Schaeffer-Novelli, et al., 2000) and (Magris & Barreto, 2010)

[9] (Schaeffer-Novelli, et al., 2000))

The importance of Brazilian mangrove at regional and global scale cannot be underestimated: accepting estimations of 40,623 km^2[10] for LAC mangroves and 137,760 km^2 [11], for global cover, **Brazilian mangroves (13,990 km^2) would constitute 30% and 10% of the LAC and global mangroves** respectively.

The National Protected Area System (SNUC)

The national protected area system, consolidated through a federal act and several decrees between 2000 and 2006[12] comprises 2,468,493 km^2 of land (28.94% of national land area) and 61,881 km^2 of marine area (1.68% of the Brazilian EEZ)[13]. The SNUC includes protected areas, named Unidades de Conservação (UC) at three governance levels: federal, state and municipal, divided among two broad management categories: sustainable use (IUCN categories IV-VI) and strict protection (IUCN categories I-III). Of these designations (table 1), the project worked with ESECs and PARES (strict conservation) and ARIEs, APAs, RESEX and FLOEs (sustainable development).

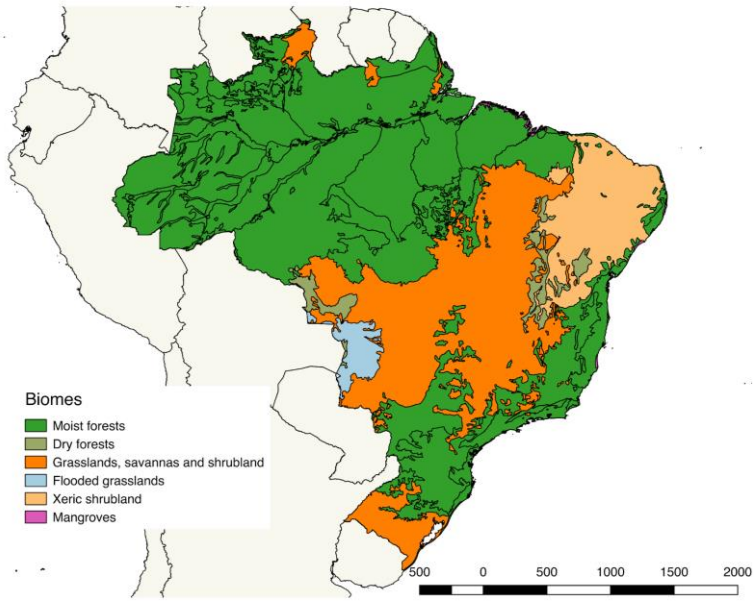


Figure 2. Biomes of Brazil. Moist forest corresponds to the Amazonian and Atlantic forest biomes, Xeric shrubland to the Caatinga biome, Grasslands comprise the Cerrado and Pampa biome, as well as a portion of the Llanos ecoregion in the North, while flooded grassland is the Pantanal biome. Mangroves are barely visible at this scale as a purple fringe in Pará and Maranhão (85% of the Brazilian mangroves) and spotted along the coast adjacent to the Caatinga and Atlantic forest biomes.
Data from (Olson, et al., 2001) , (Protected Planet, 2018) and (GADM, 2015)

Table 1. SNUC management categories[14]

Type	Management category (Abbreviation)	IUCN cat.
Strict conservation/ *Proteção Integral*	Ecological Station/ Estação Ecológica (ESEC)	Ia
	Biological Reserve/ Reserva Biologica (REBIO)	Ia

[10] (Lacerda, et al., 1993)

[11] (Giri, et al., 2011)

[12] Law # 9985, 18/07/2000 and Decrees # 4340 of 22/08/2002, # 5746 of 5/04/2006 and # 5758 of 13/04/2006 (Ministério do Meio Ambiente, 2011)

[13] (Protected Planet, 2018)

[14] ((Ministério do Meio Ambiente, n.d.)

	National/ State Park/ Parque Nacional/ Estadual (PARNA/ PARE)	II
	Natural Monument/ Monumento Natural (MONA)	III
	Wildlife Refuge/ Refúgio da Vida Silvestre (RVS)	III
Sustainable Use/ Uso Sustentável	Environmental Protection Area/ Área de Proteção Ambiental (APA)	V
	Area of Relevant Ecological Interest / *Área de Relevante Interesse Ecológico* (ARIE)	IV

The PRODOC reports 132 protected areas with mangroves, protecting between 56[15] to 87%[16, 17]of mangroves in Brazil under the different SNUC categories (21-17% of Integral Protection; 79[18]-83%[19] of Sustainable Use, especially APA and RESEX). Of the 132 mangrove PA, 44 are federal, 79 are declared and managed at 9 are municipal[20]. However, the total number of mangrove PA is estimated at 120 (55 federal, 46 state run and 19 municipal) in project reports by 2017[21]. Most mangrove PAs are in the Amapá-Pará-Maranhão sector, which accounts for at least 8,108 km^2 (88%) of protected mangroves, with just 2,717 km^2 (23%) and 520 km^2 (70%) for the northeastern and southeastern sectors respectively[22].

Project supported protected areas

The PRODOC includes 34 federal protected areas to be extended project support[23]. However, the terminal evaluation only found evidence of 24 PAs being supported at some point during the implementation of the project, extending over an area of 42,969 km^2 of which 9,254 km^2 corresponded to mangrove forests, fringes and patches[24]. Most project areas were designated as sustainable use (SU) areas (IUCN management categories V and VI), with 54 SU PAs (48 federal, 6 state PAs) against just 18 PAs (3 federal, 15 state PAs) in the strict conservation categories (SC). In terms of area, SU PAs extended over 125,004 km^2 against just 3,904 km^2 of strict conservation PAs.

By cluster, state and strict protection areas occurred mostly on the southern São Paulo/ Paraná cluster (figure 5), with 6 state PAs. While accepting the figure of 132 PAs containing mangroves nationwide[25], the project's 24 PA constitute just 20% in number, but **they would amount to 83% of mangrove cover in Brazil.** However, much of this was due to the inclusion of the enormous state PA Reentrâncias Maranhenses that expands over 26,809 km^2, of which **this report** estimates that 3,974 km^2 are covered by mangrove forest. As this PA dropped off the project, and discounting other PAs which had not been with the project throughout its implementation timeframe, the list is reduced to 17 PAs, expanding over 12,049 km^2 and containing 4,185 km^2 of

[15] (UNDP Brazil, 2008)

[16] (Magris & Barreto, 2010)

[17] (FUNBIO, 2016)

[18] (Magris & Barreto, 2010)

[19] (FUNBIO, 2016)

[20] (UNDP Brazil, 2008)

[21] (PMU, 2017), (FUNBIO, 2016)

[22] (Magris & Barreto, 2010)

[23] (UNDP Brazil, 2008)

[24] Calculated based on the interception of the PA with Olson, et al. (2001) data for mangrove ecoregions in Brazil. As the interception of Neotropical Atlantic mangrove ecoregions with GADM (2015) Brazil area yields 27,000 km2, a correction factor of 0.41 was applied to account for the more accurate estimation of Magris & Barreto (2010). For one area (Palmito FLOES) the mangrove area (just under 1 km^2) was estimated using Google Earth® images.

[25] (FUNBIO, 2016)

mangroves, in this report's estimation (a significant 30% of the national mangrove cover)[26]. The PRODOC however, estimated that the project's intervention PAs contained 5,680 km^2 of mangrove area (40% of Brazilian mangroves) and project reports put that figure at 4,975 km^2 (35%)[27].

Table 2. PAs by cluster, type and area

Cluster	State code	# PA	Federal PA	Sustainble Use PA	Km^2	Km^2 mangrove
Pará	PA	9	9	9	2,607	2,492
Maranhão	MA	2	1	2	28,659	4,759
Maranhão (1)	MA	1	1	1	1,850	410
Maranhão/Piauí/Ceára	MA/PI/CE	2	2	2	3,346	900
Paraíba	PB	2	2	2	207	58
São Paulo/ Paraná	SP/ PR	9	3	3	8,150	1,044
TOTAL		24	17	18	42,969	9,253

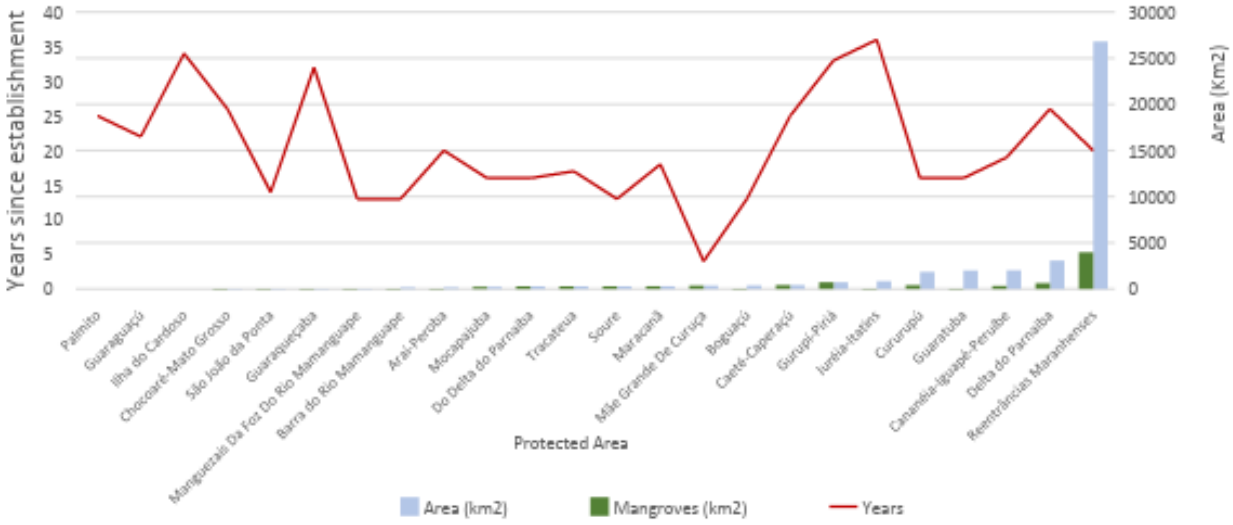
(1) Maranhão cluster without the PA Reentrâncias Maranhenses, which was later drop off the project.

Figure 3: PA clusters selected for the project.
Map scale approximately 1:16,000,000. Data from (Olson, et al., 2001), (Protected Planet, 2018) and (GADM, 2015)

Figure 3b. Project protected areas.

[26] That is, accepting the project's figure of 13,990 km2 of mangroves

[27] (FUNBIO, 2016)



Threats and barriers

While it is estimated that only 500 km^2 or 5% of Brazilian mangroves have been lost or degraded over the last 25 years[28], the drivers of mangrove destruction and degradation are expected to increase, pushed by a rising coastal population and economic growth[29]: conversion into shrimp or salt ponds, over-exploitation of timber and fishery resources, construction of road infrastructure, housing, tourism and industrial facilities, as well as diversion and pollution of freshwater sources. Moreover, and even as the misconception of mangroves as wastelands has been gradually changing among government and private actors, policy-making and spatial planning processes at national, state and municipal level have failed to grant mangroves a value according to the ecosystem services they provide[30].

Although mangroves in Brazil are protected under the Federal Forest Code and 132 PA[31], this has not been sufficient to prevent loss and degradation of mangrove forests[32]. The project document identifies 3 main barriers hampering effective conservation of mangrove forests:

- Failures in the design of protected areas and their buffer zones which exclude marginal, yet critical parts of mangrove forests and associated ecosystems, such as mudflats.

- Weak enforcement capacity by federal, state and municipal environmental actors due to insufficient financial resources for the management of PAs, but also due to unsatisfactory inclusion of resource users in decision-making processes.

- Failure to include impacts on mangrove forests in licensing and spatial planning processes,

[28] (Magris & Barreto, 2010)

[29] (UNDP Brazil, 2008)

[30] (UNDP Brazil, 2008)

[31] (Magris & Barreto, 2010), (Ferreira & Lacerda, 2016)

[32] (UNDP Brazil, 2008), (Magris & Barreto, 2010), (Ferreira & Lacerda, 2016)

as water rights, aquaculture, and infrastructure licenses and permits are granted by federal and state authorities with little or no recognition of the impacts[33].

Immediate and development objectives of the project

Several alternatives were considered to overcome the barriers, including increasing the area of mangroves under strict protection and mainstreaming biodiversity, and enhancing capacities to mitigate mangrove impacts across sectoral plans. However, these strategies where discarded considering the high costs of expanding strict conservation PAs and the complexities of mainstreaming biodiversity along almost 7,000 km of coast and multiple sectors at the coast and upstream that may have potential effects on mangrove forests[34]. Thus, the preferred strategy was to improve management effectiveness and representativeness of the current network of coastal protected areas and to include impacts on mangrove forests in spatial planning and licensing processes. Considering the complexities, diversity and dimensions of the Brazilian mangrove forests, the project was designed to test different models in five protected area clusters (figure 4).

Baseline indicators established

The project's framework provided 21 indicators, plus 7 sub-indicators for objective and outcome level. Indicators did not fit SMART criteria, many not being very sensitive to the constructs they intended to measure, had cost-effectiveness issues, overlap or measured the delivery of an output, instead of the outcome (see table 3, Quality Assessment of Project indicators). Moreover, three of the four objective indicators did not establish a baseline during the whole period of project implementation or only at the end of it (table 7).

Main stakeholders

The project's main stakeholders are ICMBIO and the resource users of mangrove federal protected areas, mainly RESEX. The project document planned for a relevant role of the Special Secretary of Fisheries and the State Environment and Protected Area agencies. However, the reorganization and later disappearance of the Secretary prevented any role in the project. State Agencies were involved in the implementation of the project but only marginally. The focus of the project was on federal protected areas, under full jurisdiction of ICMBIO. While IBAMA still maintains a role in the enforcement of environmental laws, including protected areas, it was not involved in this project, which focused rather on creating and disseminating knowledge on mangrove areas, crafting of fishery management agreements and development of the capacity of protected area managers.

Table 3. Main stakeholders

Stakeholder	Description
ICMBIO	Created in 2007, itis the government organization responsible for the management of biodiversity, as well as the management of the current 548 federal protected areas. It is managed independently "under special regime" but linked with the MMA and part of the National Environmental System (SINAMA).

[33] (UNDP Brazil, 2008)

[34] (UNDP Brazil, 2008)

MMA	The Ministry of Environment is the national government organization that proposes public policy and programs aiming to promote sustainability, restore and conserve ecosystems and reduce pollution
UNDP	UNDP in Brazil supports government programs and policies and develops capacities to improve service delivery, reduce inequality and poverty and improve management of natural resources, as well as ecosystem conservation
Mangrove resource users	Mostly marginalized fishers, mangrove communities live on subsistence, small-scale fisheries of crustaceans and finfish and depend on the sustainable delivery of mangrove ecosystem services for their dwellings and livelihoods.

Stakeholder	Description
OEMAS	State and municipal environmental agencies were foreseen to have a more important role in the project document than they did, as the project focused on protected areas (PA) under federal jurisdiction. The Maranhão state environmental agency (SEMAR) stopped being relevant to the project when the PA Reentrâncias was excluded from the project. Moreover, there is potential for future conflict as it maintains an area, APA Pequenos Lençois that greatly overlaps with two federal, project-supported PAs: RESEX and APA Delta do Parnaíba. The Paraíba state environmental agency (SUDEMA) was involved in the discussions and study that were intended to lead to the implementation of an environmental management plan in the Mamamguape river PAs, but did not committed itself to its development and implementation.
IBAMA	The crucial role of IBAMA foreseen in the project document was not realized as jurisdiction over federal protected areas was transferred to ICMBIO. However, IBAMA still maintains a role in the enforcement of environmental laws, including protected areas and management plans, such as as the Ucá crab management plan. Moreover, the remote sensing centre of OBAMA participated in the crafting of the Mangrove Atlas produced by the project.
Academic organizations	Staff from the Federal University of Piaui (UFPI), the Federal University of São Paulo (USP), the Federal University of Pará (UFPA) were trained by the project. Federal University of Para, the Federal University of Piaui and the Federal University of São Paulo will be involved in the participatory monitoring scheme of federal PAs set up by the project. The Federal University of Paraiba monitored water quality in the Mamamguape river on behalf of the project.
EMBRAPA	The Brazilian Agricultural Research Corporation (EMBRAPA) could implement its 2006-proposed crab transport system, as the project tested and supported its adoption for captures from the RESEX Delta do Parnaíba.

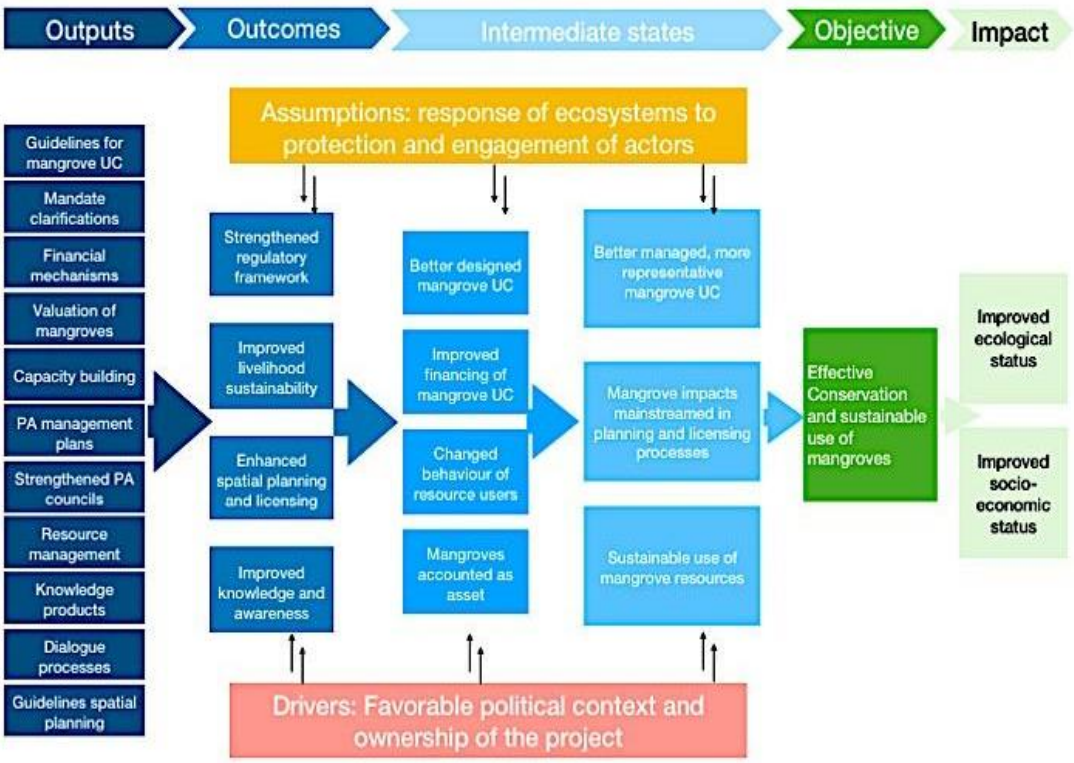
Expected results

The project strategy included the delivery of studies on economic valuation of mangrove ecosystem services, strengthening of community organizations and participatory planning, fostering dialogue processes, review and proposal of more effective regulatory instruments, as well as building individual and institutional capacity at several levels, from community to federal organizations. The project deliverables were expected to result in three outcomes:

1. Strengthened regulatory framework for mangrove PAs, with specific guidelines and clarification of mandates among government organizations, as well as enhanced financial management.
2. Improved sustainability of coastal livelihoods through enhanced participatory resource management plans.
3. Enhanced spatial planning and licensing processes that acknowledge and curtail negative direct and upstream impacts on mangrove forests.

4. Improved knowledge management and awareness on the importance of mangroves, across the public and institutional actors

Figure 4. Project strategy, from outputs (left, dark blue) and outcomes to impacts (right, bright green), through (assumed) intermediate stages



3. Findings

3.1 Project design/ formulation

Analysis of LFA/Results Framework

The project, *Effective Conservation and Sustainable Use of Mangrove Ecosystems in Brazil* had the goal of enhancing conservation of mangrove ecosystems through improved management effectiveness of protected areas that include mangroves in five clusters along the coast of Brazil. Specifically, (purpose, immediate objective), the project *would contribute to the maturation and sustainability of the Brazilian Protected Area System (SNUC) by increasing the currently under-represented mangrove ecosystem in the SNUC, defining appropriate management categories and practices for mangrove protected areas and by supporting national, state, municipal and community level regulatory structures required for effective management of this complex ecosystem*[35]. Thus, the project logic fits within GEF-4's program of providing new and additional funding to enable sustainable and effective systems of protected areas, particularly in the coastal and marine domain. Moreover, the project strategy also follows the established quality standards of UNDP project design, following a LFA structure that links activities to outputs to outcomes to objectives (figure 4).

Assumptions and risks

The project explicitly assumed a response of mangrove ecosystems to improved management effectiveness. Thus, it expected increases in population densities of key mangrove-associated species. Beyond the fact that the project eventually chose species that do not serve as indicators of the health of mangrove ecosystems and were not monitored nor have baseline data, responses of biological populations to improvements of management effectiveness, all other things equal, would exceed the planned implementation period of the project. Positive social outcomes were also assumed, which is to be expected, but not necessary, from better managed fisheries. More importantly, the project did (rightly) assume a continuation of the weak financing of protected areas, but did not think it would affect management effectiveness. However, weak finances of protected areas could well preclude the implementation of the project's outputs, and severely affect management effectiveness.

The project strategy also assumed stability of the environmental institutional and regulatory framework and the interest of key stakeholders, including the federal fisheries entity and state environmental agencies, which did not hold true throughout project implementation. Thus, the assumptions of integration of project outputs into the national regulatory framework were only possible at federal level, and applicable to areas under ICMBIO jurisdiction. Private actors, which were in principle attracted to cooperation as they saw benefits in the better regulation of potentially polluting effluents did not commit to non-binding resolutions, which would allow free riders to continue harmful behaviour. Moreover, the project strategy underestimated the transaction costs involved in dealing with a great number of actors across a vast area. This is also partially contradictory with the project strategy, which called on a focus on federal protected

[35] (PMU Project PIMS 3280, 2017)

areas, to avoid, precisely, jurisdictional conflicts. However, mangrove communities maintained a keen interest in the effective enforcement of protected area rules throughout the implementation period.

Finally, the project rightfully assumed the continuation of social programs benefiting mangrove-dwelling population, e.g. Bolsa Verde, a conditional transfer program, which constituted the bulk of this project's co-finance.

The project strategy explicitly considered the risk of its assumptions not holding true, but assumed that the project strategy was robust enough even to maintain commitments from actors which it could not influence.

Lessons from other relevant projects

The project strategy, although with some unrealistic assumptions (see above), employed lessons learned from protected area projects implemented in Brazil and other areas. Thus, it stressed:

1. Community participation and empowerment as key to success
2. Importance of improving management effectiveness of protected areas to deliver social and ecological benefits
3. Working in protected area geographical clusters to optimize project resources and attend the different social and ecological characteristics of the mangroves along the Brazilian coast.

Planned stakeholder participation

The project strategy identified 27 different groups and organizations that should be involved to different degrees in the implementation of the project. These included the federal environmental administration, the Ministry of Environment (MMA), ICMBIO, and IBAMA and, critically, state and municipal environmental agencies.

While ICMBIO, as implementing partner and MMA were indeed key project partners, the involvement of IBAMA was marginal, due to the expanded role of ICMBIO, which took some functions assigned to IBAMA at the time of the project formulation, notably ICMBIO's role as manager of extractive reserves through its traditional populations directorate. Other federal entities which were to be involved in the project, such as the Secretary of Fisheries and Agriculture and the Department of Tourism or the National Water Agencys did not participate in the implementation of the project. International conservation NGOs cited in the project strategy also did not take part in project activities.

Participation of state and municipal agencies did take part along the lines suggested by the project strategy, but to a much lesser degree. The role in the whole strategy also declined after the abandonment of the large mangrove protected area of Reentrâncias Maranhenses (state-managed) in favour of the federal CIP protected area.

Several research organizations, notably federal universities and the Brazilian Agricultural Research Corporation (EMBRAPA) were successfully engaged by the project to conduct studies and project outputs.

The project also managed to engage with private sector and fisherfolk/ community representatives, albeit more in a local manner rather than dealing with national associations as provided for in the project strategy. Dealing with local communities individually and facilitating workshops and conferences to craft fisheries managements was time-consuming but also constitute some of the best project outputs.

Replication approach

The project based its replication strategy on the assumption by the federal government of regulatory instruments and knowledge products developed by the project, the permanence of capacities of protected area managers developed by the project and the crafting of improved coordination mechanisms between federal and state/ municipal protected area/ environmental agencies. While the latter did not work out as planned, the knowledge and regulatory products of the project, notably the mangrove atlas, fishery studies, monitoring programs and fishery agreements do have a high replication potential, and have been assumed by ICMBIO institutionally. Their weak financial allocation, however, is an important risk for successful replication.

UNDP comparative advantage

The UNDP comparative advantage in the implementation of the GEF project lies in its *global network of country offices, its experience in integrated policy development, human resources development, institutional strengthening, and non-governmental and community participation*[36].

UNDP is a relatively minor player in the implementation of GEF projects in Brazil, which is dominated by the World Bank with larger projects, dedicated thematically to the larger terrestrial biomes, with an investment dimension: of the over US$ 661 millions GEF grants invested in Brazil, UNDP has implemented 19% of the total and 14% of GEF projects of the biodiversity focal area. This project offered an opportunity for the UNDP to apply its regional and global expertise to a smaller, yet dispersed biome; the project team could have profited from strengthened support in the administration of tracking tools. However, a new financial tool for marine protected areas now being developed under the World Bank-implemented Marine and Coastal Protected Area project (ID# 4637) had its origin in the studies of finances of mangrove protected areas, under this project. Biodiversity funds have been actively promoted and developed by GEF-funded, UNPD-implemented projects worldwide.

Linkages with other interventions in the sector

The project is well framed within the biome-based biodiversity GEF projects implemented and being implemented in Brazil: of the 214 million GEF-grants that have funded biodiversity projects in Brazil to date, 38% have been for the implementation of biome-wide projects, including the Marine and Coastal Protected Areas (World Bank-implemented), Sustainable Cerrado Initiative (UNDP-implemented), and the extensive World Bank-implemented Amazon Region Protected Area Program. This project had close links with the Amazonian and Coastal GEF projects, which include its executing agency, ICMBIO, reflecting also the close link of the mangrove biome with the other two large Brazilian biomes.

[36] (GEF Council, 2007)

Management arrangements

The project was implemented by the United Nations Development Programme (UNDP), under its National Implementation (NIM) modality under the direction of the MMA, and governed by a project board presided by the MMA and composed of representatives of ICMBIO, the Brazilian Institute for the Environment (IBAMA), the (disappeared) Special Secretariat for Fisheries and Aquaculture (SEAP)[37] and UNDP, as well as state environmental agencies and local stakeholders. The project was executed by ICMBIO through an implementation structure composed of a centrally located project management unit (PMU) and five field-located pilot site technical coordination units[38] which were staffed by the project PA managers and staff.

[37] The SEAP was upgraded to Ministry of Fisheries in 2008 to be absorbed into the Ministry of Agriculture by 2015. The changes profoundly affected the organization, which not only did not take part in the project, but has not been providing fishery data since 2008. Its status is still being debated (Senado Federal, 2017) (Sganzerla, 2017)

[38] (UNDP Brazil, 2008)

3.2 Project Implementation

Adaptive management

The project was intended to be implemented between 2008 and 2012 (five years), however, actual implementation extended from 2009 to 2017 (nine years). The project concept was first approved by the GEF council in 2007, after being modified from a concept originally endorsed by the GOB in 2005[39]. The project was approved for implementation by the GEF Council on May 2008, and the project document was signed by its stakeholders in July that year[40]. However, the rearrangements of competencies and functions between the MMA, the IBAMA and the ICMBIO, which was only created in August 2007[41] meant that actual implementation began in 2009 and only took off in 2011, when the delivery rate[42] had merely attained 12%.

Between late 2012 and early 2013 the project underwent its midterm review as delivery was just nearing 25%. The midterm review process did not prompt any significant changes and was not cited as groundwork for the substantive revision of the project outputs and intervention areas finalized in January 2014, which included the concentration on the Para, Parnaiba (MAPICE) and São Paulo-Paraná clusters, abandoning direct interventions at the Maranhão cluster. The increased focus on federal-managed areas responded to the limited interest and resources of state environmental agencies.

The project also had to adapt to the restructuring and partial dissolution of the federal fisheries entity. Thus, in crafting fishery management plans, the project team interacted directly with communities in extractive reserves (RESEX).

Partnership arrangements

The project was governed as foreseen in the project document, except for the composition of the board, as political changes at the Secretary of Fisheries and Aquaculture prevented it from participating in the project board or providing the committed co-financing. As cited in section planned stakeholder participation, the project strategy foresaw a wide array of stakeholders and project partners, which were eventually reduced. Critically, the project could not develop a strong partnership with municipal and state environmental agencies nor with private sector operators, as foreseen in the strategy.

However, the project established successful partnerships with the Federal University of Paraiba and the Federal Institute to monitor water quality in the Foz of Mamamguape protected area (PB), the Federal University of Piaui (UFPI), the Federal University of São Paulo (USP), the Federal University of Pará (UFPA), for the implementation of the National Strategy for Participatory Monitoring of Mangroves and with EMBRAPA to develop and implement better transportation solutions for captured mangrove crabs. The project also developed strong partnerships with communities within the federal RESEX in Pará and Maranhão.

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[39] (MPOG, 2005)

[40] (UNDP Brazil, 2014)

[41] (Presidência da República, 2007)

[42] Delivery rate is the rate of expenditure of the project GEF grant

Feedback from M&E activities used for adaptive management

The PMU conducted regular monitoring and duly reported accomplishments and challenges in the project implementation reports (PIR). Moreover, adjustments to the project framework were based on monitoring results: by 2014 a substantive review of the project was undertaken, resulting in the abandonment of direct intervention in the Maranhão cluster, due to the remoteness and vastness of the area, and the numerous, yet dispersed actors the project actions in that area entailed. Instead, actions on spatial planning and zoning integrating mangroves impacts were directed to the more compact APA Cananéia-Iguapé-Peruíbe (APA CIP). Also, the review directs the project to focus on the development of a National Mangrove Plan and management instruments at the individual PA level as a means to achieve improvements in the socio-economic conditions of mangrove communities.

The great number and numerous overlaps among indicators meant that reporting was repetitive. For instance, the 2017 PIR report reports without much detail on the four basic accomplishments of the project: The National Mangrove Plan, the *Ucides Cordatus* Management Plan, the Fisheries Agreement in PAs in Pará and the Coastal Biodiversity Fund over 57 pages, mostly by repeating the same accomplishments. More importantly, the absence of a monitoring program for the selected species and the fact that the participatory mangrove protected area monitoring program was only established during the last year of implementation, means that the project team struggled, mostly unsuccessfully, to provide figures for key indicators such as populations of key species and mangrove cover. Moreover, the key species chosen do not reflect changes in drivers of destruction or degradation of mangroves. The unwieldy monitoring framework was not addressed by the midterm review (MTR). The MTR process was plagued with problems and the usefulness of the MTR report, even after its consolidation into a GEF format is questionable. The project report do not mention it and it is not cited as the basis for the important substantive review conducted in 2014.

Project finance and co-finance

1 Financial execution

The implementation rate increased during the 2014-2015 period, stabilizing during a "consolidation phase" (2016-2017) leading to the final closure of the project in 2017, having attained virtually 100% delivery of the GEF grant (figure 5 and 6).

The project was budgeted with a total cost of USD 20,345,692, funded by a GEF-4 grant of USD 5,000,000 and co-funding of 15,345,692. Financial execution of the project started in 2009 under its first annual work plan. Delivery rate was low for the first two years of implementation, but took off by 2013 and had virtually exhausted its budget by the end of 2017.

There were deviations from the original budget, notably in terms of personnel costs, as the PRODOC foresaw those costs mostly under the national and international consultant categories, while severely underestimating travel costs, especially considering the vast project area. Personnel costs were re-distributed during implementation among contractual services (the PMU team) and travel, thus not affecting project operations. There were some minor adjustments too between

accounting categories between annual work plan budgets and actual expenditures, which did not affect the execution of the work plan (figure 8). Moreover, budgets were adjusted yearly according to the rate of execution of output activities, all based on the original and 2014-adjusted logical framework, thus not deviating from the originally planned outputs and outcomes.

In terms of outcomes, there were no major differences between what was budgeted and what was implemented, except for some redistribution between outcomes 1, 3 and 4. Miscellaneous costs were kept under 5% of total expenditure (2% only) and management costs were almost identical to the original budget for project management, in both cases not exceeding 10%. Outcomes 1 and 2 were the costliest, demanding 60% of total expenditure (table 4).

Figure 5. Annual budget (2009-2012 from PRODOC, 2013-2017 from AWP) and expenditure (from CDR) and cumulative expenditure. All figures in USD

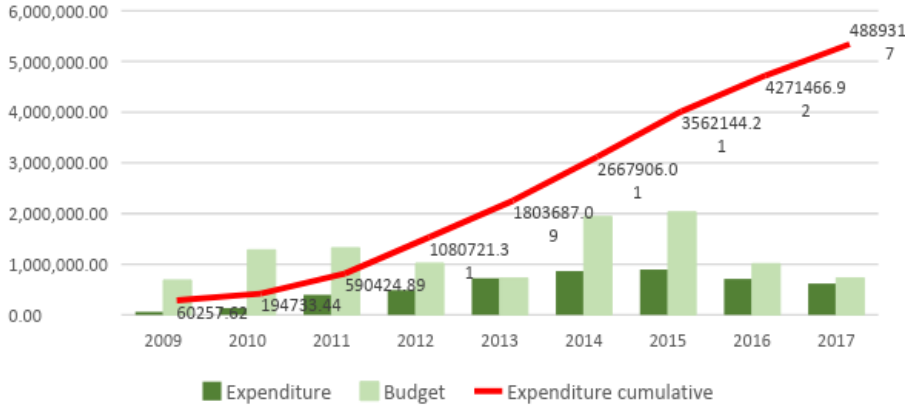


Figure 6. Delivery rate, as % of expenditure over year budget (column) and cumulative delivery against total GEF grant (red line).

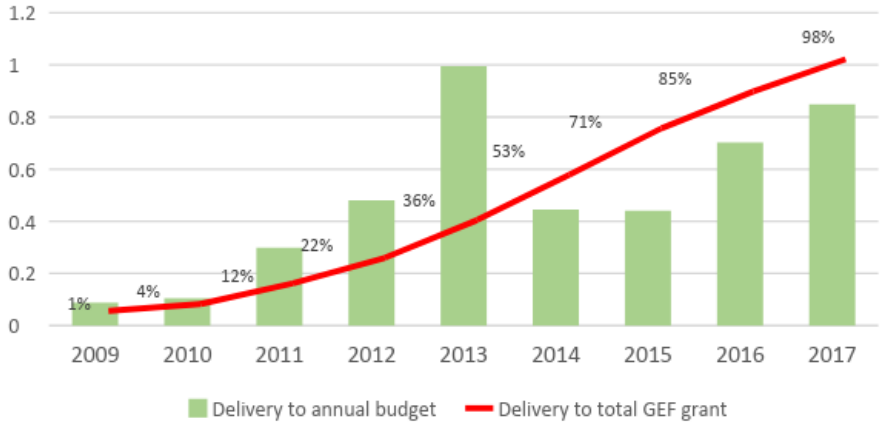


Figure 7. Expenditure and budget per accounting categories. Main differences are due to the budget lines used, the change of categories not affecting implementation.

Figure 8. Example of budget categories in the AWP 2014 and actual expenditure for the same year. The main differences are that the work was accounted as "companies" instead of under individual "local consultants".

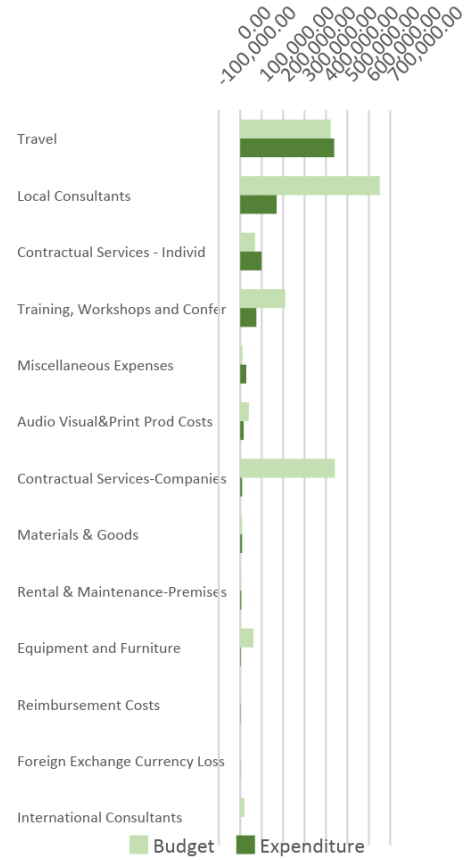


Table 4. Expenditure per outcome. All figures in USD

Year	Outcome 1	Outcome 2	Outcome 3	Outcome 4	Outcome 5	Expenditure
2009	200.00	43,216.35	10,993.34	5,847.93		**60,257.62**
2010	26,871.01	11,895.94	4,107.54	43,890.91	47,710.42	**134,475.82**
2011	35,977.59	66,634.24	35,123.06	179,126.73	78,829.83	**395,691.45**
2012	162,510.02	170,422.19	30,898.04	52,381.84	74,084.33	**490,296.42**
2013	148,202.16	282,059.69	15,997.92	206,396.28	70,309.73	**722,965.78**
2014	315,721.71	238,203.68	39,165.10	168,197.72	102,930.71	**864,218.92**
2015	266,557.41	263,007.68	177,562.81	112,129.73	74,980.57	**894,238.20**
2016	343,364.47	187,869.67	94,093.06	62,366.06	21,629.45	**709,322.71**
2017	71,426.48	252,551.28	182,290.76	111,577.33		**617,845.85**
TOTAL	**1,370,830.85**	**1,515,860.72**	**590,231.63**	**941,914.53**	**470,475.04**	**4,889,312.77**

2 Co-finance

Co-funding was to be provided mostly by the national government through the Ministry of Environment (MMA), the executing agency, Chico Mendes Institute for Biodiversity Conservation (ICMBIO), as well as the Secretariat for Fisheries and Aquaculture (SAP) (84% of the total, 48% cash), the governments of the states of Ceará, Paraíba and São Paulo (13%, 17% cash) and the international non-government organisation Conservation International (3%, 16% cash)[43]. SAP underwent several transformations and did not participate in the project. Co-financing from ICMBIO consisted in its regular budget allocation for federal PAs, the costs of the facilities used by the project team and fully funding both the positions of project national director and project coordinator.

The MMA co-financing related to the programs "Bolsa Verde" and ATER was destined for communities in protected areas. "Bolsa Verde", is a subsidy paid to communities living within federal, sustainable use protected areas, such as RESEX, FLONAS and RDS, and under the national poverty line as payment for ecosystem services, in recognition of their role in the preservation of ecosystems. The program is financially supported by Conservation International. ATER is a household subsidy granted by the Ministry of Rural Development in three northern states, including Pará, for the development of "forest communities", including communities using RESEX resources. These programs operated in the project's pilot areas.

Finally, the UNDP, with its Biodiversity Conservation and Social Development project (BRA/08/023) supports households residing within federal, sustainable use protected areas to have access to social services. This project assisted families in the Mamanguape PA (Paraíba cluster). Information on the execution of this program for the project area only exists up to 2013, but, as the government programs and PA budget allocation have been implemented without interruption to date, it is assumed here that disbursement continued as it was in 2013. Under this assumption, total disbursement under identified co-finance programs would have reached USD 45,734,944, well over the committed total co-finance of 15,345,692 (table 6).

Table 5. Co-finance calculations[44]

Co-finance source	2008	2009	2010	2011	2012	2013	2014	2015	2016	TOTAL
Federal PA budget	167,789	654,099	693,681	1,557,926	1584757	1,584,757	1,584,757	1,584,757	1,584,757	10,997,282
Bolsa Verde					7,953,600	7,689,600	7,689,600	7,689,600	7,689,600	38,712,000
ATER						16,914,117	16,914,117	16,914,117	16,914,117	67,656,469
Cadastro						610,214				610,214
TOTAL BRL	167,789	654,099	693,681	1,557,927	9,538,357	26,798,689	26,188,475	26,188,475	26,798,689	118,586,180
Total USD	91,499	327,143	394,310	931,313	4,883,780	12,429,305	11,130,051	7,871,724	7,675,819	45,734,944
BRL per USD[45]	1.84	2.00	1.76	1.67	1.95	2.16	2.35	3.33	3.49	

[43] (UNDP Brazil, 2008)

[44] Data provided by PMU till 2013, from which point figures have been extrapolated. Figures have been rounded after summing and/ or transforming them.

[45] (World Bank, n.d.)

Table 6. Project co-finance table

Co-financing (type/ source)	UNDP own financing (mill. US$)		Government (mill. US$)		Partner agency* (mill. US$)		Total (mill. US$)	
	Planned	actual	Planned	actual	planned	actual	planned	actual
Grant	-	-	2.6	34.7	4.0	11.0	6.6	45.7
Credits	-	-	-	-	-	-	-	-
Equity	-	-	-	-	-	-	-	-
In-kind	-	-	3.8	No data	5.0	No data	8.8	No data
Non-grant Instruments	-	-	-	-	-	-	-	-
Other Types	-	-	-	-	-	-	-	-
Total	-	-	6.4	45.7	9.0	11.0	15.4	45.7

Monitoring and evaluation: design at entry and implementation

The project's 21 indicators, plus 7 sub-indicators for objective and outcome level did not all fit SMART criteria: some of them were not very sensitive to the construct they intended to measure, had cost-effectiveness issues, overlap or measured the delivery of an output, instead of the outcome as detailed in the following table (table 7).

Table 7. Quality assessment of project indicators

LFA level	Indicator and target	Issues
Objective	Populations of threatened and overexploited species remain stable	The project was expected to enhance management effectiveness of mangrove PAs so this outcome could be expected for species strongly associated with those PAs. This indicator would have needed very solid baselines, and either an existing monitoring program or the capabilities, within the project to set up one. However, the indicator species eventually chosen, *Eudocimus ruber* and *Ucides cordatus* did not have monitoring programs and the former is not a good indicator of mangrove ecosystems in Brazil (see section 3). Moreover, populations´ responses depend on several factors including generation time, and changes in the range of occurrence. The project established a monitoring program for RESEX which has yet to produce first results.
	Vegetation cover of mangroves in project PA remains stable	A good indicator of the performance of the project which, however, would have needed a very solid baseline. However, measuring how much mangrove cover exists presents many methodological complexities and this was only settled by the project's final product: the Atlas of Brazilian Mangroves. Thus, only the baseline value is known.

LFA level	Indicator and target	Issues
Objective	Proportion of protected mangroves in SU or SC management categories	The project originally had different protected area increase targets for the VIII mangrove units identified in Brazil. However, costs of expansion of protected areas into not yet protected mangroves are very different in the extensive northern mangrove belts and in the constrained southern mangrove patches, where population density is also much higher. Moreover, there are jurisdictional issues as ICMBIO has limited control on the declaration of protected areas over state or even municipal authorities. Thus, the project simply reported on mangrove areas under protection. However, the estimation of this is limited by the same methodological issues of the previous indicators.
	70% of project PA with good or excellent METT scores	No issues. Excellent indicator of project performance. However, administration of METT was not optimal, as many questionnaires were not completed and lacked enough justification of the scores. Moreover, the protected area sample varied greatly during project implementation making cross-section comparison challenging or impossible.
	Half of pilot PAs testing 1 or more of financing strategies developed in the project	No issues. However, no direct testing of any financial mechanism was ever conducted by the project. Instead, the project tallied the development of a proposed fund for coastal and marine protected areas as the project's one financial mechanism
	80% of all sub-national agencies with jurisdiction in the project clusters agreed to and signed the Mangrove Plan	High transaction costs in terms of negotiations and limited political leverage of ICMBIO to move state or municipal environmental agencies to agree to a mangrove plan to be developed by the project.
Outcome 1	80 % of "Mangrove" states with a set of norms and guidelines agreed with and coordinated between federal, state and municipal agencies on the management of mangroves	Same as above. Both indicators are very similar and overlapping: a comprehensive "mangrove plan" would have included coordinated guidelines or norms, presumably voluntary, to which the "mangrove states", that is, those with jurisdiction of project cluster's mangroves would have to agree.
	Existence of a core group of trained staff members at national and subnational environmental agencies capable of implementing and using those norms and regulations	Good **output** indicator, hardly an indicator for an outcome.
	1 regulation tailored to mangroves for each of the following topics: PA management categories, management plans guidelines, financing mechanisms, water planning, fisheries management	This indicator is redundant with several others: #4 objective indicator and #4 outcome 1 indicator on financial mechanisms, #1 outcome 1 indicator, #1, #2 and #4 outcome 2 indicators, #1, #2 outcome 3 indicators

LFA level	Indicator and target	Issues
Outcome 1	PA funding to increase 30% through project design mechanisms in the states of Bahia and São Paulo	This target makes the fourth objective indicator useless, as it goes beyond the requirement of "testing financial mechanism". This indicator may be a "fossil" of the long project development phase, as the state of Bahia appears nowhere else in the project strategy.
	Existence of a national mangroves plan in Brazil's Wetland Plan	Redundant with the fourth objective indicator.
Outcome 2	1. 700 km^2 of mangrove area under integrated fisheries resource plan 2. Establishment of 3 no-take areas in the 3 pilot UCs	No issues
	Reduction of capture rates and mortality of *Ucides cordatus* to 45% of those captured	No issues
	1. 100 potential local small entrepreneurs trained in the preparation of a business plan 2. 100 families in the pilot UCs involved in sustainable alternatives including women and youth	First sub-indicator is an output indicator. Number 2, no issues
	25 PA management councils reaching agreement on harvesting levels and enforcement	No issues
Outcome 3	2 water management instruments agreed upon by the Mamanguape watershed committee that consider the water quantity and quality for mangroves	No issues
	1. Degree that mangrove conservation is incorporated in Zoning of the APA Reentrâncias Maranhenses 2. Zoning restriction on main sectors reflected in PA management plan 3. 16 municipalities agreed to APA zoning 4. 50% of the key actors in the APA sign formal document of adherence to zoning regulations	No issues, in 2014 changed to the APA Cananéia-Iguapé-Peruíbe (CIP)

LFA level	Indicator and target	Issues
Outcome 4	30% awareness among private and public stakeholders on the management of mangrove PA and the ecosystem services they provide.	Verification of this indicator would have required a survey for which funds were not allocated. Conduct of a survey would have been expensive and the project's main objective was not to raise awareness among the public.
	Frequency and quality of monitoring of mangrove land cover	No definition of what "frequent" and "quality" mean. Qualification would be needed for this indicator to become operative
	6 instances in which adaptive management takes place considering M&E results	This indicator refers not to results but to project implementation processes
	3 replications of the project pilots in another mangrove PA	It would need further clarification of what replication means.

UNDP and Implementing Partner Implementation/ Execution, coordination and operational issues

Both the implementing (UNDP) and executing agencies (ICMBIO) proactively supported the implementation of the project.

UNDP carried on its duties providing administrative and assistance for the implementation of the activities of the annual work plans and the delivery of the project outputs. UNDP administrative support was considered critical considering the rigidity and cumbersome nature of government budgets and procedures. The role of UNDP was perceived very positively and as facilitating for project implementation by the national government agencies involved: ICMBIO and MMA.

However, UNDP managed the MTR process weakly, thus losing the opportunity to modify a cumbersome, non-SMART and overlapping indicator framework. Also, UNDP regional and global expertise should have oriented administration of the METT, included the capacity development scorecard in the indicator framework and promote a more energetic development of financial sustainability solutions to be applied in individual PAs, rather than just a general concept for the development of a proposal for a fund. This notwithstanding, UNDP adequately provided support to reorient the project in the 2014 substantive review. Moreover, UNDP's role is perceived as positive by stakeholders and compares well with other GEF implementing agencies of projects also executed by ICMBIO.

The project developed institutional, organizational and individual capacities at ICMBIO, with UNDP support. UNDP was also intimately involved in the development of the project strategy. However, UNDP could have better strengthened the administration of the tracking tools, particularly METT, and provide better insights on financial sustainability of protected areas, which are some of UNDP strengths.

ICMBIO implemented the project as one of its core programs. ICMBIO provided both the facilities for the PMU and allocated two top officials from its Social and Environmental Actions in Protected

Areas[46] department to serve as national director and project manager, as well as engaging protected area staff in project activities. The PMU coordinated and shared results and efforts with other ICMBIO units and departments and the results of the project are rated very positively by the Research and Biodiversity Monitoring and Establishment, Planning and Management of Protected Areas[47] divisions of ICMBIO as stepping stones to achieve the monitoring, knowledge management and PA establishment targets of the institution.

The time needed for the establishment of this new agency and the learning curve for the implementation of UNPD-GEF projects unnecessarily delayed the implementation of the project four years, extending the planned end-of-project date from 2012 to 2017. However, once the agency had established itself, it appropriated and properly managed this and other projects, dedicating a team embedded in its structure and physically housed at its headquarters, also providing adequate national direction and project management decisions.

[46] The official designation is Diretoria de Ações Socioambientais e Consolidação em Unidades de Conservação

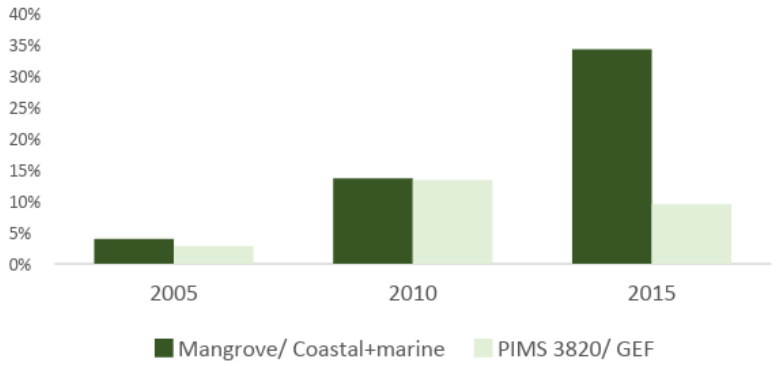
[47] Officially the Diretoria de Pesquisa, Avaliação e Monitoramento da Biodiversidade and Coordenação Geral de Criação, Planejamento e Avaliação de Unidades de Conservação

3.3 Project Results

Relevance

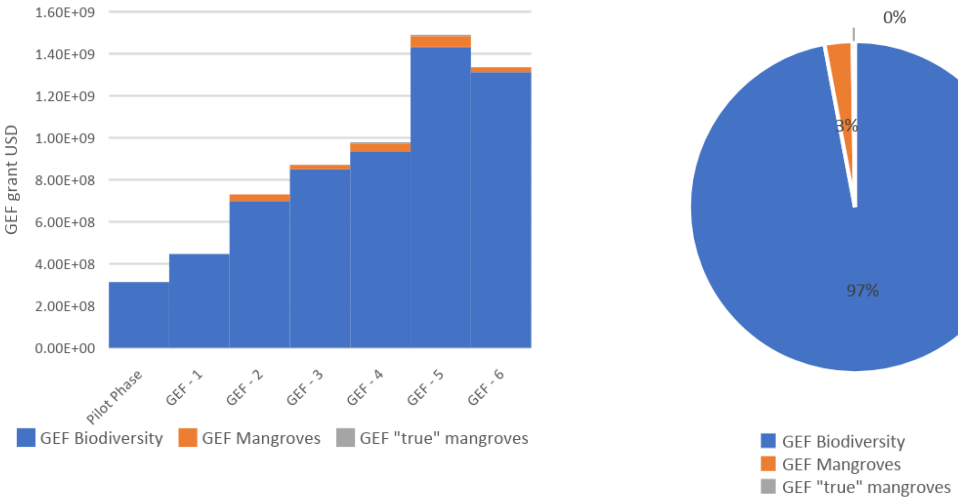
The project is relevant to the National Biodiversity Strategy and Action Plan and is one of the key projects for Brazil to achieve its conservation targets, aligned with the Aichi targets and contributing to the Convention's Program of Work on Protected Areas. Thus, it has contributed to consolidate protection of critical coastal ecosystems, a crucial issue considering the low level of protection given to marine and coastal ecosystems in Brazil. The significance of the project for the national biodiversity policy was confirmed by environmental officials both at the MMA and ICMBIO and is reflected in national policy documents (Figure 9).

Figure 9. Quotes of mangrove ecosystems and the project itself in national communications to the CBD show the increasing relevance of the project. Quotes expressed as percentage of mentions of the mangrove ecosystem relative to the quotes of coastal/ marine ecosystems and the percentage of project quotes relative to the times GEF projects are mentioned in the communications.



Moreover, the project development itself responded to the increasing momentum in international attention gained by mangrove ecosystems in the post 2004 Asian tsunami context. This is also reflected in the amount of GEF funding for mangrove-related projects since the early 2000s (Figure 10).

Figure 10. *GEF grants to biodiversity and mangrove projects. This project is one of the very few "true" mangrove projects, i.e. projects with their sole focus on protected areas within the mangrove biome. Other GEF projects do dedicate some partial attention to mangroves*[48]



At local level, interviews with resource users revealed the importance attached by this sector to the continuation of protection within the Extractive Reserves where they operate. Maintenance of protection and support from ICMBIO is deemed to be a determinant for the maintenance of their livelihoods and improvement of their socio-economic conditions, and, more importantly as the only viable mechanism to impede the entry of outsiders and the conversion of sustainable fisheries into open commons bound for degradation. While conceding that conservation objectives do sometimes counter their livelihoods options, respondents of this terminal evaluation considered that the costs imposed onto them in terms of catch restriction and cooperation with management tasks, including reporting and monitoring are compensated by the benefits obtained by their **exclusive access to the fishery resources contained in the RESEX**.

While not directly consulted in the frame of the terminal evaluation, the agro-industrial sector, in this case operators of sugar cane plantation around the lower watershed of the Mamanguape river have signalled their interest in cooperation agreements to develop more efficient production methods and pollution abatement measures which they would see in their benefit, **if it creates a set of standards that prevent the entry of "rogue players" and improves their acceptance and standing in the communities where they are based**.

[48] (GEF, 2018)

Effectiveness and efficiency

Overall results (attainment of objectives)

The following section follows the objective indicators of the project.

No change in status of population of threatened and overexploited species

The project document exposes a scenario in which several mangrove-associated species are threatened by habitat destruction/ conversion: *Eudocimus ruber*, scarlet ibis (guará), two primates: *Alouatta belzebul ululata*, red-handed Howler Monkey, (guariba-de-mãos-ruivas) and the manatee, *Trichecus manatus* (peixe-boi marinho). *Eudocimus ruber* is not included in the 2003 or the 2014 Brazilian threatened species list and has been consistently classified as least concern by the IUCN red list since its populations are large, and widely distributed from Argentina to the Caribbean[49]. In fact, the project document also indicated that this species was only considered threatened at the southern end of its Brazilian range[50]. The fact that this species is not threatened and its lack of economic importance, if we make exception of its role as a tourist attraction, accounts for the lack of an official monitoring program for this species. **The project team tried to obtain data for its populations, to no avail.** However, this species is included in the list of critical species of the national mangrove plan produced with project support, as it is classified as threatened in the southern states of Rio de Janeiro, São Paulo and Paraná**.** *Alouatta belzebul* is associated with moist tropical forests, such as the Amazon forests and Atlantic moist forests and its destiny is tied to those two ecosystems. Thus, their population status does not depend on the health of mangrove ecosystems. A. *belzebul* is included in both the 2003 and 2014 versions of the Brazilian threatened species list and the IUCN Red List as vulnerable[51]. *Trichetus manatus* is strongly dependent on seagrass meadows and it would occur in mangrove forests if seagrass is present and the salinity not too high. The threatened status of this species has not been modified over the last 10 years in Brazil and throughout its range, and it remains endangered and vulnerable in the national and IUCN threatened lists respectively[52].

The project document also included a list of "key species associated with mangroves in Brazil" that included 112 animals: 34 crustaceans[53], 12 mollusks[54], 15 bony fishes, 6 elasmobranchs, 6 reptiles and 39 birds. However, of these, only 44 (39%), mostly crustaceans, half of them *Uca sp*. (fiddler crabs, catanhão-tesoura) and bivalves, show a strong association with mangroves. Of the species strongly associated with mangroves, only 3, two exploited mangrove crabs, *Ucides cordatus*, *Cardisoma guanhumi* and a shark, *Isogomphodon oxyrinchus* (daggernose shark, cação-quati) were included in the threatened species list of 2003-4[55]. Of them, only *Cardisoma guanhumi* and, *Isogomphodon oxyrhyncus* are still included in the 2014 list of threatened species, both classified as critical (CR). The daggernose shark, endemic to the coastal waters of South America is also

[49] (BirdLife International, 2016)

[50] (MMA and UNDP, 2008)

[51] (Veiga, et al., 2008), (Ministério de Meio Ambiente, 2003), (Ministério de Meio Ambiente, 2014)

[52] (Deutsch, et al., 2008), (Ministério de Meio Ambiente, 2014)(Ministério de Meio Ambiente, 2003)

[53] 32 Decapoda (crabs and shrimps), 1 Sessilia (acorn barnacles) and 1 Tanaidaceae (tanaid, shrimp-like creature)

[54] 11 Bivalvia (mussels, oysters, cockles and shipworms) and 1 gastropod (bean snail)

[55] (Ministério do Meio Ambiente, 2004)

classified a critically endangered in the IUCN Red List of threatened species, due to large population declines compounded by a restricted distribution[56]. To these species listed in the project document, this report adds two threatened and exploited fish species which depend strongly on mangrove areas as nurseries for their young: *Epinephelus itajara* (Atlantic goliath grouper, mero) and *Megalops atlanticus* (tarpon, camaripim). While none of the two are listed in the threatened list of 2004, they appear in the 2014 list as critically endangered and vulnerable respectively, which is also their classification under the IUCN Red List[57]. See complete list of species at annex 9.

Table 8. Threatened species assessed by the IUCN Red List that have some degree of dependence on Brazilian mangroves

Species	Threatened status (2018)	Change in status (2004-2018)
Alouatta belzebul	VU	No
Trichechus manatus	EN	No
Isogomphodon oxyrinchus	CR	No
Epinephelus itajara	CR	No
Megalops atlanticus	VU	No

The national action plan for mangrove habitats of 2015 developed with project support intends to protect 74 species[58], including 19 threatened species and 49 commercially significant species. 15 species included in the mangrove plan were also listed in the PRODOC.

Crabs of economic importance

The project document adds to the concern expressed by authors in the first part of the 2000s about the stocks of two economically important crustacean species, *Cardisoma guanhumi* (blue land crab, guaiamum) and *Ucides cordatus* (mangrove crab, carangejo uçá)[59]. These assessments prompted a series of federal and state regulations on the fishery, including gear limitations and closed seasons, which were, however, largely disregarded, both within and outside protected areas**. Both crab species were included in the 2004 list of threatened species, as exposed above, but in the newest list (2014) published by the MMA, *Ucides cordatus* was excluded.** The project, based on data provided by federal universities[60] estimated that populations are stable and growing. This is confirmed by the review of the most recent scientific literature on the matter: despite the intense fishing pressure, populations of *Ucides cordatus* assessed between 2003 and 2011 seem to remain healthy and stable in from Pará to São Paulo[61,62, 63, 64]. **None of the two**

[56] (Lessa, et al., 2006)

[57] (Adams, et al., 2012), (Craig, 2011)

[58] 7 plants (all mangrove species), 5 bivalves (oysters and mussels), 13 decapods (shrimps and crabs), 5 elasmobranchs (sharks and rays), 30 bony fishes, 9 birds and 6 mammals

[59] (De Oliveira, et al., 2013)

[60] UFSB in Bahia; UFPA in Pará; EMBRAPA in Delta do Parnaiba; UEPB in Paraiba; UNESP in São Paulo; FAPESP in Paraná

[61] (Glaser & Diele, 2004) with data from 1997-2001

[62] (Silva, et al., 2013) with data from 2010-12

[63] (De Oliveira, et al., 2013) with data from 2008-09

[64] (Duarte, et al., 2014) with data from 2010-11

crustaceans have been yet assessed for the Red List, but their wide distribution makes it unlikely that they would meet the threatened criteria.

No change in vegetation cover of mangroves in project intervention PA

Estimations of mangrove cover in Brazil show that it has changed little over the last two decades, particularly at the extensive northern mangrove belt. The project self-reported baseline for hectares of mangrove forest in the project's protected areas varies between of 5,680 km^2 and 5,285 km^2 [(65)]. However, this value refers to the total mangrove area under federal protection and the indicator refers to project-supported PAs. The number of areas supported by the project has changed during the implementation period, as described in section 2. This report estimates the mangrove area in protected areas supported by the project by EOP at 3,725 km^2, which would increase to 8,879 km^2 if all areas supported by the project at one time or another are counted (Reentrâncias Maranhenses alone is estimated to have 3,973 km^2 of mangroves)[66]. While methodological factors very likely account for these differences, we can take Magris & Barreto's estimation of 4,253 km^2 of mangroves under protected areas of any category as a baseline[67]. On this baseline, the project did support the declaration of three additional marine RESEX, Mocapajuba, Mestre Lucindo, Cuinarana, that account for an additional 585 km^2 of protected area[68] (IUCN VI) of mostly mangroves with some small *restinga* pockets[69]. Moreover, the project has given impulse to the move to declare the whole, continuous northern mangrove belt, from the states of Amapá to Maranhão as a single RAMSAR site, which is expected to attract national and international attention toward mangroves and the need to invest in their conservation.

The project itself has contributed to the newest and most accurate estimation of area covered by mangroves and the proportion of the area under protected areas: together with the remote sensing center of IBAMA, the project has co-produced the Atlas of Brazilian Mangroves. While the final product was not yet ready by the time of the terminal evaluation, its main results are known.

Proportion of protected mangrove ecosystems under SU or SC management categories

At the PRODOC stage, the project intended to create a representative sub-system of mangrove protected areas within the SNUC and thus was given explicit targets for protected areas to be created in sustainable use and strict conservation categories for each of the eight morphological units of Brazilian mangroves. However, the project then faced the fact that 1) it did not have the power to extend PA over areas beyond federal jurisdiction 2) the costs of extending protected areas differ drastically between the sparsely populated, mangrove rich northern belt (PA, MA) and the densely populated, mangrove poorer South. Thus, the project did not attempt to attain the targets stated in the PRODOC but limited itself to recalculating the mangrove area protected by federal PA, resulting in 55 federal PAs covering 5,285.2 km^2, which is less than the mangrove area protected given in the PRODOC but more than Magris & Barreto and this report's estimates (see above and annex 10). The project does not report the proportion of SU and SC protected areas at those 55-federal mangrove PA. However, the project did support the creation of three additional RESEX PA in Pará, accounting for 585 additional km^2 of mangrove forest under protection, in the SU category.

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[65] The PRODOC baseline, included in the PIRs is of 5,680 km^2 as project protected area, as the project intended to support all federal PAs with mangroves. At the 2017 PIR, the total value of mangrove under protection (federal or local) is reported as 5,285 km^2.

[66] This report's estimations can be consulted in Annex 10

[67] (Magris & Barreto, 2010)

[68] (MMA, n.d.)

[69] (Protected Planet, 2018) and (Google Earth V 7.3.1.4507 (64-bit), 2018)

70% of pilot PAs achieve Management effectiveness (METT) of good or excellent

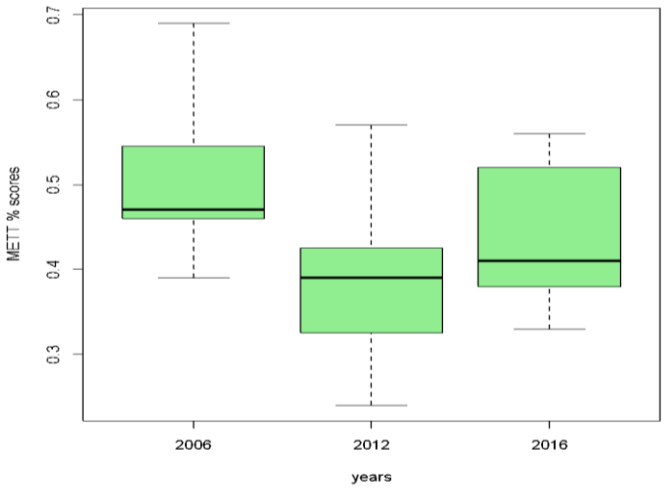
Of the project's 24 PAs, seven, all from the São Paulo-Parana cluster, only have a one year value (2012) and two PAs from the Maranhão cluster dropped off in 2014 and one, Mãe Grande, from the Pará cluster, does not have METT scores for 2016. Thus, only 11 of the 24 project PAs, for the Pará, Maranhão Piauí and Parnaíba clusters counted with METT records for 2006 (prior to project start), 2012 (midterm) and 2016 (project end).

Figure 11 shows a brusque inflexion point in the scores, abruptly descending between 2006 and 2012 from relatively high values of 0.7-0.5 to 0.2-0.4. Considering that the METT questionnaire used in 2006 was different from the one used in 2012 and 2016, we conclude that 2006 values are not comparable with the 2012-2016 series. Thus, the analysis of METT scores will only be considering 12 PAs that have applied METT in 2012 and 2016. Moreover, the period 2012-16 marks the influence of the project as implementation was delayed and only started effectively in 2011-12.

METT questionnaires were not completed for all questions for all years, and although they include some comments to justify the scores, most scores were left unjustified. None of the comments makes references to this project, so the project's effects will be inferred by the changes in the METT components (planning, inputs, outputs, processes, outcomes), rather than by direct reference.

On average, project PA with METT scores presented a moderate increase, of merely 4% (table 8). However, this 4% is not statistically significant but the negative difference between the 2006 and 2012 score is indeed statistically significant (figure 11). Thus, we cannot conclude that there has been any real increase in management effectiveness[70]. All clusters experiment modest increases except for the two PAs at the estuary of the Mamanguape river, in Paraíba. Both Mamanguape river PAs share the same mangrove area and differ just in the inclusion of the coastal area and Restinga habitats outside the estuary.

Figure 11. Standardized METT score for baseline (2006), midterm (2012) and EOP (2016). Boxes represent interquartile range; dark line is the median and error bars the range.



[70] Change between 2012 and 2016: mean (2012)=0.40 mean(2016)=0.45, t(paired)=-1.69, p>0.10, df=13

Table 8. METT scores. The protected areas of these sample are different from the ones included in figure 11 as not all counted with 2006 scores.

Cluster	Designation	Name	METT 2012	METT 2016	ΔMETT
PA	RESEX	Tracuateua	24%	37%	13
PA	RESEX	Soure	39%	51%	12
PA	RESEX	Maracanã	30%	41%	11
PA	RESEX	Arai-Peroba	24%	34%	10
PA	RESEX	Chocoaré	40%	45%	5
PA	RESEX	Caeté-Taperaçú	41%	41%	0
PA	RESEX	Gurupi-Piriá	35%	33%	-2
PA	RESEX	São João da Ponta	57%	39%	-18
MAPICE	APA	Delta do Parnaiba	44%	53%	9
MAPICE	RESEX	Delta do Parnaiba	38%	55%	7
PB	ARIE	Foz do Mamanpague	56%	56%	0
PB	APA	Barra do Mamanguape	60%	57%	-3
SPPR	APA	Cananéia-Iguapé-Peruíbe (CIP)	48%	44%	-4
SPPR	ESEC	Guaraqueçaba	34%	42%	8

5 out 14 (35%) PAs have achieved a score beyond 50% or "good", 20 points short of the target. Also, changes in score have been minimal, except for the RESEX and APA Delta do Parnaiba. This protected area, visited during the terminal evaluation mission owes its difference in score to project activities. Also, other areas with strong project interaction show significant increases. Score increases are driven mostly by the "planning" and "processes" dimensions of METT, which is consistent with the work of the project. However, the strongest factor driving the management effectiveness score is the years of existence of the PA. PA denomination or budget do not influence the score, but difference in the score of inputs and processes are the strongest predictors of the total effectiveness score, **indicating that budget, staff, and equipment, but also how capable the PA management is to utilize these inputs are the strongest drivers of management effectiveness**. The project has not caused any significant changes in the financial sustainability of federal mangrove protected areas, also reflected in the METT scores (figure 12).

Project support to protected areas differed according to cluster: fisheries management in Pará and Parnaíba and spatial zoning in Paraíba and São Paulo Paraná, including the facilitation of meetings, workshops and trainings. But the project also supported the development of the management plans for two protected areas: APA CIP and ARIE *Foz do Mamanpague*. Through the interaction with communities at and around federal protected areas, the project has likely contributed to the remarkable increase in scores related to local and indigenous communities (figure 12).

The field visits to protected areas confirmed the METT results in that:

- Enforcement of rules and agreements is still very weak
- Awareness is low on importance and benefits of protected areas among private (e.g. tourist, energy operators) and institutional actors (municipal councils), and still seen widely as a hindrance to development
- Capacities of PA management are extremely low, plagued by chronic shortages or no budget, equipment and training

Figure 12. METT scores differences between 2016 and 2012 per indicator. Negative values indicate worsening and positive values improvement of the score.

Half of pilot PAs testing 1 or more of financing strategies developed in the project

For the 24 project PAs, staff numbers ranged between 1 and 107, with the 2006-2016 average being 6 staff members (permanent and temporary). Federal areas tended to have less staff, with average staff of 21 at state PAs, against an average of three for federal PAs and just 1 or two permanent staff was common (9 PAs). The annual operational budget, i.e., excluding personnel costs, allocated to state PAs averaged USD 40,403 against an annual average of just USD 11,943 for federal PAs. However, these annual averages hide the fact that annual budget allocation was very variable from year to year and from PA to PA. Moreover, the operational budget, particularly for federal areas, was, and is still dependent on external projects. In this regard, the PAs with the highest budgets corresponded to the São Paulo-Paraná cluster, which includes the second (SP) and fifth (PR) states with the highest income per capita in Brazil after the Federal District[71].

[71] (UNDP, n.d.)

The project completed the groundwork for the financial sustainability of mangrove protected areas. Together with the Brazilian Fund for Biodiversity (FUNBIO), the project funded a series of technical reports that revealed costs and benefits for mangrove protected areas, which served as a basis for the conception of a sinking fund, patterned on the fund developed for the Amazonian biome by the GEF-funded ARPA project. This new fund, the Blue Fund, that expects to receive donations from national, sub-national and international organizations is now being developed by the GEF-funded project Marine Protected Area project implemented by FUNBIO with the World Bank.

Based on a sample of 28 federal mangrove PA, the FUNBIO study estimated annual operational costs of US$ 4.7 million, with additional US$ 4.5 million for personnel costs, that is total financial needs of US$ 9.3 million or US$ 93 million for the period 2016-2025[72].

Actual staff costs were given at US$ 3.6 million for 2015 and actual operational costs estimated at US$ 1.6 million, that is a total of US$ 5.2 million, for federal mangrove PA, with the budget coming exclusively from ICMBIO. Over the 2016-2015 10-year period, assuming all remains the same, the total budgetary allocations for federal mangrove PA would be of US$ 52 million, subtracted from the estimated financial needs above gives a financial gap of US$ 41 million or US$ 4.1 million annually. Alternatively, based on figures reported in the METT for federal mangrove PA (n=6) we estimated average budget allocation, excluding personnel, at US$ 0.012 million, which multiplied by the 55 federal mangrove PA would put actual operational expenses at US$ 0.66 million. Adding the given personnel expenditures amounting to US$ 3.6 million annually[73], actual expenditures would amount to US$ 4.3 million or US$ 43 million over the 10 period, or a financial gap of US$ 4.3 million annually.

The technical studies that gave rise to the idea of the sinking fund were released in 2016, together with a course for 25 ICMBIO officials. The Blue Fund is to be developed under the GEF-5 project Coastal and Marine Protected Areas implemented by FUNBIO and ICMBIO. The Blue Fund is expected to reach US$ 140 million by 2022, which is by far more than the estimated mangrove PA financing gap. However, the fund is intended mostly to support reaching protection of 10% of the Brazilian marine area from the current 1.4 %, so we assume that most of the fund´s intended US$ 140 million will be dedicated to support the establishment and consolidation of marine protected areas covering mostly coral reefs and other marine habitats, rather than existing mangrove PA. This notwithstanding, the fund would also support the expansion of the protected area system over an additional 6,087 km^2 of mangroves on the Maranhão and Pará coast[74].

80% of all sub-national agencies with jurisdiction in the project clusters agreed to and signed to the Mangrove Plan

Patterned after the existing 332 actions plans for the conservation of threatened species, the project developed and got approval by 2015 of a national action plan for mangrove habitats (PAN Manguezal), which includes actions for the conservation of 74 key mangrove-associated species, described above.

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[72] Exchange rate for 2015 used for all conversions: US$ 3.327 per BRL (World Bank, n.d.)

[73] Extrapolating data from 2015 (FUNBIO, 2016)

[74] (Maretti & Manfrinato, 2017)

The plan was developed through consultations and trainings and released in January 2015[75]. It applies to 30 "strategic areas", including all the PA supported by the project, across the VIII mangrove units of Brazil, and includes protected areas under federal jurisdiction (27 PA), state (19 PA, 9 states) and municipal (2 PA, 2 municipalities). However, the action plan is to be implemented by ICMBIO through its Traditional Populations and Research and Biodiversity Monitoring directorates[76] and there is no formal agreement with the state and municipal authorities implicitly included in the plan. Moreover, no annual reports or review on the implementation of the plan have been published yet.

Table 9. PA included in the National Action Plan for Mangrove

Mangrove units	PA Type	Name	Governance
I-III	PARNA	Cabo Orange	ICMBIO
I-III	ESEC	Maracá Jipioca	ICMBIO
I-III	RESBIO	Piratuba	ICMBIO
I-III	RESEX	Soure	ICMBIO
I-III	RESEX	Mocapajuba	ICMBIO
I-III	RESEX	Mae Grande De Curuça	ICMBIO
I-III	RESEX	Chocoaré-Mato Grosso	ICMBIO
I-III	RESEX	Tracuateua	ICMBIO
I-III	RESEX	Caetétaperaçu	ICMBIO
I-III	RESEX	Arai-Peroba	ICMBIO
I-III	RESEX	Gurupi-Piriá	ICMBIO
IV-VI	PARNA	Lenções Maranhenses-Rio das Preguiças	ICMBIO
IV-VI	APA	Delta do Parnaiba	ICMBIO
IV-VI	APA	Barra do Mamanguape	ICMBIO
IV-VI	RESEX	Acau-Goiana	ICMBIO
IV-VI	APA	Costa dos Corais	ICMBIO
IV-VI	Reserva Particular	Caju	ICMBIO
IV-VI	RESEX	Baia de Iguape	ICMBIO
IV-VI	RESEX	Canavieiras	ICMBIO
IV-VI	RESEX	Cassurubá	ICMBIO
IV-VI	RESEX	Corumbau	ICMBIO
VII-VIII	RESEX	Guapi-Mirim	ICMBIO
VII-VIII	APA	Guaraqueçaba	ICMBIO
VII-VIII	APA	Cananéia-Iguape-Peruíbe	ICMBIO
VII-VIII	APA	Baleia Franca	ICMBIO
VII-VIII	APA	Anhatomirim	ICMBIO
VII-VIII	RESBIO	Arvoredo	ICMBIO
VII-VIII	PARES	Acarai	Fundação de Meio Ambiente de Santa Catarina
VII-VIII	APA	Litoral Norte	Fundação para Conservação e a Produção Florestal do Estado de São Paulo
VII-VIII	APA	Litoral Centro	Fundação para Conservação e a Produção Florestal do Estado de São Paulo
VII-VIII	ESEC	Juréia-Itatins	Fundação para Conservação e a Produção Florestal do Estado de São Paulo

[75] (ICMBIO, 2015)

[76] (ICMBIO, 2015)

VII-VIII	APA	Litoral Sur	Fundação para Conservação e a Produção Florestal do Estado de São Paulo
Mangrove units	**PA Type**	**Name**	**Governance**
VII-VIII	ESEC	Ilha Do Mel	Instituto Ambiental do Paraná
VII-VIII	APA	Guaratuba	Instituto Ambiental do Paraná
I-III	APA	Ilha do Marajó	Instituto de Desenvolvimento Florestal e da Biodiversidade do Pará
IV-VI	RDS	Ponta Do Tubarão	Instituto de Desenvolvimento Sustentável e Meio Ambiente do Rio Grande do Norte
IV-VI	APA	Conceição Da Barra	Instituto Estadual de Meio Ambiente e Recursos Hídricos do Espírito Santo
VII-VIII	Reserva Particular	Fazenda Caruara	Instituto Estadual do Ambiente do Rio de Janeiro
VII-VIII	RESBIO	Guaratiba	Instituto Estadual do Ambiente do Rio de Janeiro
VII-VIII	RDS	Aventureiro	Instituto Estadual do Ambiente do Rio de Janeiro
IV-VI	APA	Baía De Todos Os Santos	Secretaria do Meio Ambiente da Bahia
IV-VI	APA	Baía De Camamu	Secretaria do Meio Ambiente da Bahia
IV-VI	APA	Santo Antonio	Secretaria do Meio Ambiente da Bahia
IV-VI	APA	Caraíva/ Trancoso	Secretaria do Meio Ambiente da Bahia
I-III	APA	Reentrancias Maranhenses	Secretaria de Meio Ambiente e Recursos Naturais, Maranhão
IV-VI	APA	Upaon-Açu / Miritiba / Alto Preguiças	Secretaria de Meio Ambiente e Recursos Naturais, Maranhão
IV-VI	APA	Manguezal Da Barra Grande, Icapuí (CE)	Secretaria de Desenvolvimento e Meio Ambiente de Icapuí - CE
VII-VIII	APA	Suruí	Secretaria Municipal de Turismo e Meio Ambiente de Magé - RJ
IV-VI	NA	Foz Rio Coreaú and Tatajuba (CE)	NO PA
IV-VI	NA	Estuário do rio Jaguaribe (CE)	NO PA
IV-VI	NA	Mucuri (BA)	NO PA

The plan is articulated around 11 objectives: spatial planning, participatory management/ co-management, fisheries management, mitigation of pollution and alien species effects, participatory monitoring of mangrove biodiversity, prevention of harmful spills and other accidents, reforms to licensing processes, mitigation of harm from private developments, including shrimp farming, as well as capacity development and communication.

Spatial planning includes actions to map, zone and develop management plans for federal mangrove PA, **co-management** includes strengthening participation of local communities and resource users, including private sector to solve use conflicts, **fisheries management** includes development of studies and agreements of fishery regulations and species management plans, **pollution mitigation** includes control and monitoring of effluents and invasive species coordinated licensing processes.

The plan includes a budget amounting to US$ 31 million over a period of 5 years, i.e. till 2020 or approximately US$ 6 million annually, which amounts to just 6% of the average annual budget of ICMBIO[77]. Some actions included in the plan have been executed by the project, including efforts

[77] The average ICMBIO budget for the period 2012-2017 amounts to BRL 254.3 million (MMA, n.d.), or, by the year exchange rates (World Bank, n.d.), US$ 94.4 million.

to strengthen licensing processes in the APA and ARIE Mamamguape, together with the consolidation of the management plan for the same APA, strengthening spatial planning in the APA CIP (SP), development of a management plan for mangrove fisheries for the Pará RESEX, development of a management plan for the fishery of *Ucides cordatus* in all mangrove areas, and development and adoption of a monitoring plan for mangrove biodiversity. However, there are no implementation reports available for the whole plan. Moreover, as the plan applies only to federal PA, it has not yet been adopted by state-level and municipal-level agencies as explicit in the indicator.

Cost-effectiveness

Estimation of the project cost-effectiveness is based on the following elements:

- Compliance with the incremental cost criteria (costs beyond normal expenditure to achieve global environmental benefits) and securing co-funding and associated funding
- Completion of planned activities and achievement of global environmental benefits according to schedule and as cost-effective as planned
- Benchmark or comparison approach: the project did not exceed the cost of similar projects
- Cost-effectiveness of acquisition of goods and services

Incremental cost criteria

The project complied with the incremental cost criteria: actions implemented in mangrove protected areas would not have taken place without the GEF grant and the committed co-financing amount has been accounted for (see co-financing, page 32). Several project alternatives were considered during the project design phase,

Completion of planned activities and achievement of global environmental benefits as cost-effective as planned

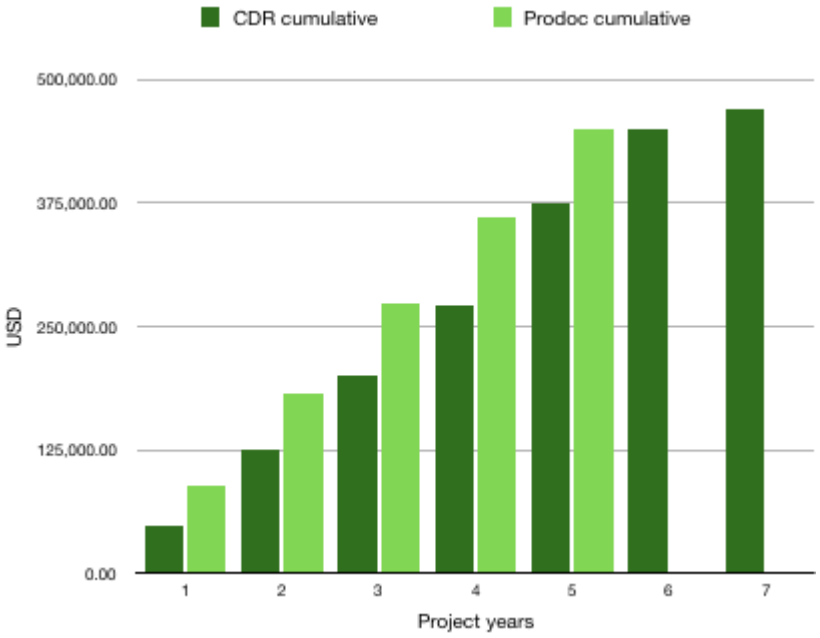
As the project implementation period has extended over 7 years (2010-2017), **costs borne by both the UNDP and ICMBIO in terms** of own resources dedicated to the project, not paid by the GEF grant: use **of facilities, staff time, supplies and utilities** (not quantified) have increased with each additional implementation year.

In terms of the project's own management costs (costs accounted under outcome five in the CDRs) the project has exceeded the management cost foreseen in the project document by just 5%, hence not significantly affecting the amount of management costs (figure 13).

Comparison with similar projects

GEF has funded several "biome" biodiversity projects in Brazil that involved expansion and/ or improve the management of protected areas since the early 2,000s. Nine projects, including this project, had been evaluated and given overall ratings. For those projects evaluated, the average cost per km^2 of protected area (in terms of GEF grant) has been of USD 1,436, against just USD 415 for this project (29%), and constituting the median of the nine projects. However, the project stands out for its cost per km^2 of target biome, amounting to USD 357, or 630% of the average value. This may accounted for the wide, patchy distribution of the mangrove biome compared to other terrestrial biomes. Also note that there seems to be a weak trend towards more cost-effective projects from GEF 2 to 4 (Table 10 and figure 14).

Figure 13. Project management costs (outcome 5) according to the project document budget (Prodoc cumulative) and actual expenditure (CDR cumulative)



Cost-effectiveness of acquisition of goods and services

Projects implemented through a external agency, in this case UNDP constitute an important part of the budget for implementation of environmental agencies in Brazil and they are as well considered by the implementing partners as an agile yet rigorous manner of implementing needed actions compared to the rigidity and cumbersome nature of government budgets and procedures.

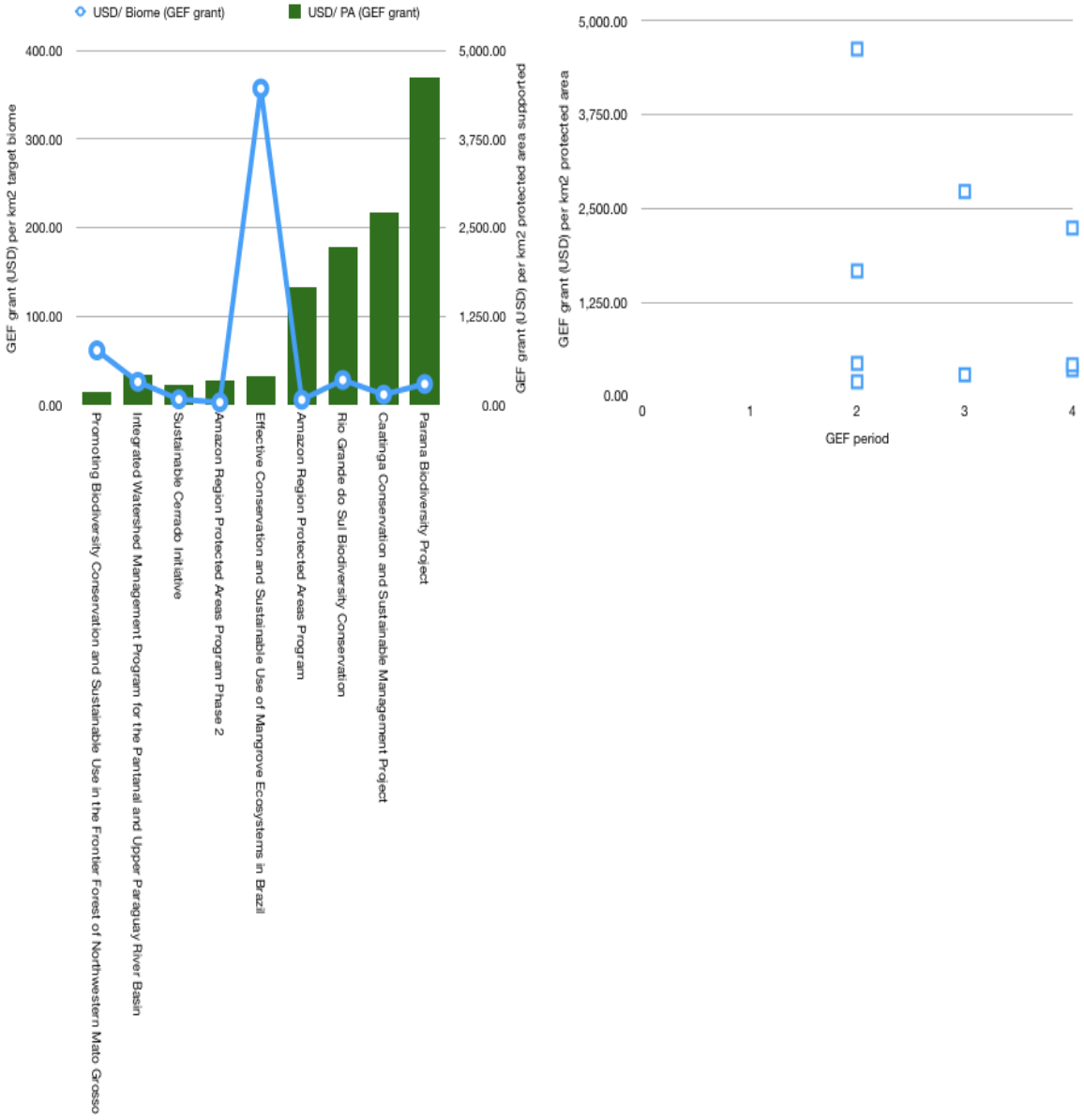
In this project, all good and services were procured through UNDP, the main cost categories can be seen in figures 7 and 8, page 30 (project finances). There were no significant issues with procurement or recruitment processes.

Table 10. Cost-effectiveness of GEF-funded "biome" projects in Brazil in terms of cost per unit protected area and biome

Project title	GEF period	GEF agency	GEF Grant (USD)	Rating	PA area (km2)	Biome area (km2)	USD/ Biome (GEF grant)	USD/ PA (GEF grant)
Promoting Biodiversity Conservation and Sustainable Use in the Frontier Forest of Northwestern Mato Grosso	2	UNDP	6,704,000	MS	35,500	108,624	61.72	188.85
Integrated Watershed Management Program for the Pantanal and Upper Paraguay River Basin	2	UNEP	13,000,000	S	30,000	496,000	26.21	433.33
Sustainable Cerrado Initiative	3	World Bank	13,000,000	MS	46,000	2,000,000	6.50	282.61
Amazon Region Protected Areas Program Phase 2	4	World Bank	15,890,000	MS	45,500	5,000,000	3.18	349.23
Effective Conservation and Sustainable Use of Mangrove Ecosystems in Brazil	4	UNDP	5,000,000	MS	12,049	14,000	357.14	414.97
Amazon Region Protected Areas Program	2	World Bank	30,000,000	S	18,000.	5,000,000	6.00	1,666.67
Rio Grande do Sul Biodiversity Conservation	4	World Bank	5,000,000	S	2,234.00	176,496	28.33	2,238.14
Caatinga Conservation and Sustainable Management Project	3	World Bank	10,000,000	MS	3,670.00	844,000	11.85	2,724.80

Parana Biodiversity Project	2	World Bank	8,000,000	MS	1,730.00	336,000	23.81	4,624.28
Average			**11,843,778**	**MS**	**21,631**	**1,552,791**	**58.30**	**1,435.87**

Figure 14. A. Comparison with other biome projects in terms of cost per unit biome and protected area. B. Cost per km2 protected area (GEF grant) against GEF period.



Outcome Effectiveness

Outcome 1. The enabling environment for a sub-system of mangrove ecosystem protected areas is in place, including policy, regulatory, and financial mechanisms

80% of mangrove states with a set of norms and guidelines agreed with and coordinated between federal, state and municipal agencies on the management of mangroves.

The project reports accomplishment of the target by the approval of the following instruments:

1. Normative Instruction 09/07/2013 dealing with transportation and revision of national normative framework and elaboration of normative proposals on *Ucides cordatus*
2. Qualified management agreements in "Salgado Paraense" (coastal strip of the state of Pará)
3. National Action Plan for Mangrove conservation (discussed above)
4. Management Plan of the APA Cananéia-Iguape-Peruíbe
5. Guidelines for the evaluation of the impact of shrimp culture on mangrove areas
6. Environmental Regularization Plan in Mamanguape

The normative instruction of the Ministry of Agriculture and Fisheries number 9 of July 2013[78], was issued with project support after findings of the Brazilian Agricultural Research Corporation in 2006[79], on high mortality of captured mangrove crabs (*Ucides cordatus*) during transport to markets. The measure is applicable in the **states of Pará, Maranhão, Piaui and Ceará**. The terminal evaluation checked in situ the application of this measure at the landing point of Tatús, Piauí, where crabs captured in the project-supported RESEX Delta do Parnaíba are selected and readied for transport. The cages have reduced mortality by 25% at destination, thus reducing demand for crabs. The value chain for *Ucides cordatus* is dominated by few wholesalers that controlled supply to the main demand zones, namely growing coastal tourist centers, especially Fortaleza for the Parnaíba Delta region. Fishing effort on crabs is determined mostly by seasonal demand, as bulk buyers commission crab collectors for precise amounts of crabs. Crabs are also sold locally to cover local demand by both restaurants and a smaller proportion is directly sold to consumers by peddling or at the local market. Wholesalers are supportive of the improved transport standard as it considerably sinks their costs. Ironically, **crab collectors interviewed**, while acknowledging the positive effect on fishing effort and understanding the need to keep effort low to prevent population collapse, **have seen their income reduced as demand for crabs subsided**. Wholesalers can earn over 10 times more than an individual crab collector monthly. For both groups, **the main threat to the fishery is the unregulated collection of crabs, using illegal gear and disrespectful of closed seasons (during the crab's mating season, when they are most vulnerable).** Formal crab collectors in the protected area visited collect crabs by hand, and complete their assigned catch within four hours, averaging 40 crabs in this period. Low prices have already discouraged some interviewed households from the fishery, while other, better off households have started to engage in the growing tourism industry at the delta of Parnaiba. Judging by the amount of travel

[78] (MAP, 2013)

[79] (Legat, et al., 2006)

articles in national newspapers (see below), and the observations and interviews made in the framework of the terminal evaluation, mangrove areas are becoming increasingly attractive as leisure and gastronomic destinations.

The project conducted extensive consultations throughout all clusters, with participation of resource users to elaborate a national plan for the management of the *Ucides cordatus* fishery. The socio-economic importance of this crustacean in mangrove areas of Brazil cannot be understated. Most mangrove communities, especially in Pará and Maranhão depend to a very high degree on the fishery. The management plan still needs to be implemented, but its existence and their participation in the process leading to its development was rated very positively during interviews conducted in the context of this terminal evaluation. Moreover, the management plan for *Ucides cordatus* is setting the basis for the development of a management plan for the endangered blue land crab *Cardisoma guanhumi,* which is an important fishery species from Paraíba towards the south of the country.

Attempts to regulate the fishery of *Ucides cordatus* date back to at least 2003. At least four instruments have been enacted since 2003 that imposed closed seasons (during mating periods), prohibition to capture female crabs, gear limitations and minimum sizes for the states of Espirito Santo, Rio de Janeiro, São Paulo, Paraná and Santa Catalina[80], Pará, Maranhão, Piauí, Ceará, Rio Grande do Norte, Paraíba, Pernambuco, Alagoas, Sergipe e Bahia[81]. For C. guanhumi, two legal instruments regulating its fishery were enacted in 2003 (Southeast and Southern coasts) and 2006 (Northeast coast) in similar terms to *U. cordatus* [82]. In 2011, with the support of the UNDP-implemented project[83] on fisheries management, IBAMA developed a proposal for the sustainable fishery of *Callinectes sapidus* (blue crab), *C. guanhumi* and *U. cordatus*. However, this proposal did not contain any specific measures, and, indeed there are no continuous records or monitoring of the fishery for any of the three crustaceans after 2008. While there is virtually no enforcement of fishery regulations, even within protected areas[84], the project enabled the conduct of participatory workshops culminating in a proposal for self-regulation of the crab fishery in one protected area: RESEX Delta do Parnaíba (270 km^2). However, fishery agreements crafted with project support (see below) include regulations for the crab fishery (*U. cordatus*). The management plans for the U. cordatus fishery includes regulations akin to the existing legal instruments, monitoring of biodiversity, socio-economics and effort, as well as proposals for declaring temporary no-take zones. While local stakeholders have great expectations from the implementation of the plan, as it restricts use of the resources to the registered inhabitants/ users of the PA, the plan has not yet been officially sanctioned and approved.

Management Agreement Salgado Paraense. The project supported a participatory and scientific assessment of the state, challenges and socio-economics of the finfish fisheries at nine sustainable use protected areas of the state of Pará[85], covering 2,607 km^2. Based upon the result of the

[80] (IBAMA, 2003)

[81] (IBAMA, 2003)

[82] (IBAMA, 2011)

[83] Project *BRA/01/037 – Projeto de Gestão e Conservação da Fauna e dos Recursos Pesqueiros*

[84] Interviews with stakeholders and (Saint-Paul, 2006)

[85] RESEX Soure, São João da Ponta, Curuçá, Maracanã, Chocoaré-Mato Grosso, Tracateua, Caeté-Taperaçu, Araí-Peroba and Gurupi-Piriá

diagnostics, five years later, in 2017, legally binding management plans (porterias) were proposed for the nine PA. The regulations prohibit commercial fishery and aquaculture, but allows sport fishery and reserves the fishery within the PA to the registered PA dwellers. The regulations include limitations for the crab fishery along the lines of the national regulations, and gear limitations (e.g. mesh size and prohibited gears) for the finfish fishery. Moreover, 29 no-take zones are defined for the fishery agreement of the RESEX Maracanã (300 km^2, total, no information on the size of the no-take zones)[86].

The plans allow extraction of timber and mud for construction purposes, exclusively for registered residents. These legal instruments (porterias) must yet be enacted and duly signed and approved.

Management Plan of the APA Cananéia-Iguape-Peruíbe. Its management plan was developed with project support in 2015. The APA CIP, which covers 2,500 km^2, is located in the state of São Paulo. The plan was elaborated in consultation with representatives of local communities, other federal organizations (e.g. FUNAI), NGOs and representatives of five of the six municipalities whose territories are within the PA, contains an exhaustive description of the legal, social and ecological context relevant to the three habitats encountered within the PA: Atlantic Rainforest (2,340 km^2), Restinga and Mangroves (95 km^2)[87]. In terms of regulations, the plan does not go beyond the existing legal instruments for effluents and solid waste. Only sport fisheries and navigation are regulated while the management of artisanal and commercial fishery is left for a comprehensive agreement to be reached later, in a participatory manner. The plan also includes a zoning scheme, including mangrove protection zones, restricted-access zones, and cetacean protection zones. In mangrove protection zones, artisanal fishing, and "low impact" native species aquaculture is allowed. Restricted access zones are limited to the Atlantic rainforest, and permit access through established trails.

Guidelines for the evaluation of the impact of shrimp culture on mangrove areas. A study commissioned by the project was conducted in two sustainable use protected areas: RESEX Delta do Parnaíba (MA) and RESEX Canavieiras (BA) in 2017. The study estimates damages to mangrove ecosystem services, including recreational and research values, carbon sink, fishery, coastal protection and biodiversity conservation, based on the monetary value needed to, at least partially, restore said services. This value per hectare is taken from the literature for the USA, and assumed to be US$ 9,318 per hectare to which the researchers add fishery losses estimated by the value of forfeited *U. cordatus*, estimated at US$ 2,320 per hectare resulting in an estimation of monetary losses of US$ 114,812 per mangrove hectare destroyed or degraded summed over a period of 20 years. This value is consistent with economic valuations performed in other mangrove areas worldwide[88]. However, the study does not consider the opportunity costs of maintaining mangrove areas, and there are important uncertainties associated with the unit price estimations for mangrove services. This notwithstanding, the study offers a baseline economic value for the mangrove ecosystem which can be compared with expected benefits from shrimp farming or other undertakings that degrade and/ or destroy mangroves. The results of the study could be applied to any mangrove area in Brazil. However, the method and/ or its results have not been officially assumed in any official policy document to date. Also, the project supported the

[86] The Fishery Agreement of the RESEX Chocoaré-Mato Grosso also includes non-take zones but these coincide with the ones of the adjacent, and 10 times bigger RESEX Maracanã.

[87] Page 111 of (ICMBIO, 2015)

[88] (Salem & Mercer, 2012)

establishment of an Aquaculture Technical Group within ICMBIO to elaborate a plan to monitor and reduce the impact of aquaculture which is still being developed at the time of the terminal evaluation.

Environmental Regularization Plan in Mamanguape. The project initiated and facilitated the development of an environmental regularization plan for the protected estuary and lower watershed of the Mamanguape river. Industrial agricultural activities, mostly sugar cane plantations, municipal actors and indigenous communities contribute pollution loads and modifications of banks that affect the hydrology of the ecosystem. The agro industrial sector (ethanol producers) was attracted to the idea of cooperation with local universities and the ICMBIO to enable more efficient production that would reduce pollution loads. However, other sectors, including the state environmental agency, which has jurisdiction over environmental monitoring and licensing, as well as indigenous actors did not show the same degree of engagement. Moreover, the study commissioned by the project disclosed the existence of unlicensed operations that pollute the watershed by undetermined magnitudes. Thus, the project developed a plan which includes monitoring of water quality by local universities, a process which is still ongoing at the time of the terminal evaluation. The last values for water quality known were taken by the Environmental Administration (SUDEMA) of the state of Paraíba in 2012[89].

Thus, measures supported by the project were developed for implementation, and, in the case of the national action plan for mangroves and transport regulations for *U. cordatus*, approved, for 12 of the 15 mangrove states[90] or 80% of the states. However, there is no confirmation of the actual involvement of the state environmental offices (OEMAS) or their adoption of the instruments and proposals developed by the project.

Existence of a core group of trained staff members (of IBAMA/ICMBIO, OEMAs and/or municipal agencies) capable of implementing and using those norms and regulations

Trainings conducted by the project involved mostly ICMBIO officials. While undoubtedly capacities for mangrove conservation have been created at central ICMBIO level and federal-managed PA, there is no evidence of the existence of a "core group of staff members trained" at each OEMA involved.

Regulations tailored to mangroves in at least: PA management categories, management plans guidelines, financing mechanisms, integrating water planning to mangroves, fisheries management plans for mangrove PA

The indicator's target specified that the regulations should have been 1 regulation for each PA management category, 4 PA management plans, one resolution presented to National Water Resources Council (CNRH) linking classification of water bodies upstream from mangroves to needs of these ecosystems and one resolution outlining rules and procedures for ecosystem-

[89] (ICMBIO, 2014)

[90] Mangrove states: AM, PA, MA, PI, CE, RN, PB, AL, SE, BA, ES, RJ, SP, PR, SC. States included in the *U. cordatus* transport regulation: PA, MA, PI, CE. States included in the PAN: MA, RN, ES, RJ, SP, PR, SC. States included in the fishery agreements: 0 (only federal units). States included in the economic valuation of mangrove areas: in principle all, but based on a sample of two federal areas, and not yet used elsewhere. States included in the strengthening of licensing procedures: PB.

based, integrated fisheries resources management. The project considered the targets achieved, based on the delivery of the following products:

1. Seven Management Agreements for RESEX category and two Management Plans for APA and ARIE categories (agreements for different PA management categories)
2. Management Plan of the APA CIP and the Mamanguape APA and ARIE have been approved (four management plans guidelines)
3. Blue Fund initiative was developed by the Project as a financial mechanism for coastal-marine conservation units
4. Environmental Regularization Plan in Mamanguape (resolution presented to National Water Resources Council (CNRH) linking the classification of water bodies upstream of mangroves to needs).
5. Collaboration agreement with Rio de Janeiro State University to develop guidelines for the economic evaluation of the environmental impact of shrimp production (procedures for ecosystem-based, integrated fisheries resources management).

All products, except for the management plan of the APA and ARIE Foz do Mamanguape have been discussed above. The plan for both areas, which occupy virtually the same physical space[91] was developed with project support in 2014. The plan contains a description of the regulatory, and ecological context: the area is notable for the presence of manatees, which serves as one of the main reasons for the existence of the protected area. The situational analysis includes a description of threats, which in the case of these two protected areas include shrimp farming in adjacent indigenous lands, presence of effluents from sugar cane, agro- and textile industries, and overfishing. The plan includes a zoning scheme and allows only artisanal fishery (boats of less than 12 meters) by registered fisherfolk, with provisions to ensure safety for the manatees. The plan acknowledges conflict between its zoning scheme and actual land uses, particularly on zones of the PA that overlap with indigenous lands. The main partners identified in the plan are several federal and state universities, the Agricultural Development Institute (EMBRAPA) and NGOs.

The products, except for the management plan for the APA and ARIE Mamanguape have already been reported for other indicators. The products reported do not completely match the indicator's targets, but the project has produced agreements in several categories of PA, although they still need to be implemented. The management plans supported by the project are critical for the success of the PA, and may constitute guidelines for similar areas. However, they lack information about budget and expenditures. Attempts supported by the project have been made in terms of achieving some sort of binding regulation and monitoring for mangrove watersheds in the case of Mamanguape, but these have not been completed nor any proposal elevated to any national body.

[91] The ARIE is contained within the APA, and excludes the coastal area, which is included in the APA

Outcome 2. Replicable models are in place for the management of mangrove resources in SNUC sustainable-use protected areas

70,000 ha under ecosystem-based, integrated fisheries resource plan.

260,700 hectares of RESEX in Pará under yet to be approved fishery management agreements (see above) together with additional 27,000 ha and 14,900 ha under crab fishery and finfish fishery agreements in the RESEX Delta do Parnaíba and APA Barra do Rio Mamanguape for a total of 302,600 hectares. The fishery management plans include gear regulations but no allowable catch as catch and effort are not known.

Three no-take zones established in pilot PAs

Over 29 no-take zone defined for two adjacent RESEX in Pará: Chocoaré-Mato Grosso and Maracanã. No information on size of the no-take zones. Temporary no-take zones (0.5-1 year) are defined for the RESEX Delta do Parnaíba

25% decrease in mortality and harvesting at levels [established] in resource plan

EMBRAPA designed cages have reduced mortality by 25% at destination. There is no actual data on the crab fishery as total catch and effort are not known. The U. cordatus fishery management plan for RESEX Delta do Paranaíba, and fishery agreements for RESEXs in Pará include gear regulations, but no total allowable catches.

100 potential local small entrepreneurs trained in the preparation of a business plan

Trainings on business plans did not take place. Instead the project proposes that the indicator would be covered by the development of fishery agreements (described above), as they could contribute to more sustainable catch. Thus, fishery agreements and crab fishery regulations could potentially increase income for registered fisherfolk, **but only if** they can exclude outsiders, and there are no other externalities (e.g. pollution) or abiotic factors affecting the fishery stocks. However, enforcement levels are still low and there is a fundamental lack of catch, effort and household income data.

25 PA management councils reaching agreement on harvesting levels and enforcement

The project considers the nine fishery agreements drafted for Pará RESEX and the fishery regulations for the RESEX Delta do Paranaíba (adding the APA Delta do Parnaíba, which encompasses the former; however, the latter has yet to formulate a management plan and it overlaps with a state-managed APA, also without management plan). Together with the fishery regulations contained in the management plan of the APA and ARIE at the Mamanguape river, the total number of councils adopting some sort of regulations on fishery would ascend to 11. However, not one of these agreements contains catch limits. Other than scattered data for some Pará RESEX compiled by mostly German academic researchers, there is no data on catch and effort for any mangrove PA.

Outcome 3. Conservation of mangroves is improved by piloting the alignment of PA management with sectors and spatial planning

6 water management instruments agreed upon by the Mamanguape water basin committee that take into account the water quantity and quality for mangroves

For this indicator, the project includes two agreements to conduct water quality monitoring signed with the Federal University of Paraíba, included in the environmental adjustment plan for the Mamaguape estuary described above. However, the latest monitoring of water quality dates back to 2012, conducted by the Paraiba State Environmental Administration. The monitoring scheme designed with project support is yet to be implemented.

APA Cananéia-Iguape-Peruibe management plan reflects zoning and limits of all main economic activities

As standard for management plans for protected areas in Brazil[92], the management plan of the APA CIP divides the PA in the following zones: overlaps (with other PAs), recovery, sustainable use (terrestrial), sustainable use (rivers and estuary), sustainable use (marine) and cetacean conservation zone, restricted use zone and mangrove conservation zone. Activities permitted in the mangrove conservation zone include artisanal fishery and aquaculture, and bird watching. In terms of economic activities affecting mangrove areas within the PA, the management plan introduces regulations for the sport fishery, while a general management plan for fisheries must still be developed. The rules for the sport fishery include monitoring by registered tourist operators, minimum sizes and total allowable catch per boat.

6 municipalities (200,000 persons) in the APA have agreed on the zoning

The management plan cites the participation of the six municipalities (145,000 persons in 2010)[93] in the PA governance. The APA CIP covers between 3 and 43% of the six municipalities. However, the planning methodology of the management plan only acknowledges consultations with 5 of the six municipalities, excluding the municipality of Miracatu (7.45% of its territory within the PA 20,606 people in 2010)[94].

50% of the key actors in the APA sign formal document of adherence to zoning regulations

The management plan cites 35 organizations which act and have influence within the territory of the APA CIP: 10 NGOs, 9 people's organizations (e.g., fisherfolk association), five state government departments, 3 federal government agencies, 3 municipal agencies, 3 private sector associations, 1 academic institution and 1 watershed management committee. During the plan development, representatives of 12 organizations (34%) were present: 2 federal government agencies (ICMBIO and FUNAI), 1 state agency (Fisheries and Forest Department), 3 municipal agencies (Iguape and Ilha Comprida and Peruíbe) and four people's organizations. While the management plan assigns

[92] (CEAMP, 2015)

[93] (ICMBIO, 2015)

[94] (ICMBIO, 2015)

roles and responsibilities to further organizations in the implementation of its zoning rules it is not clear to what extent they would be bound by the plan.

Outcome 4. Mangrove-related outreach, dissemination and adaptive management is increased

Awareness among private and public stakeholders on the management of mangrove PA and the ecosystem services they provide increase by 30%.

The project has developed a national protocol for the monitoring of biodiversity in (federal) mangrove protected areas, which includes participatory monitoring of fishery resources and vegetation cover through self-reported catches and transect-quadrat methods. This protocol is being applied already at least in the RESEX delta do Parnaíba. The research and knowledge management divisions of ICMBIO rate this development as highly positive, as they acknowledge the very limited information and data on mangrove areas. For the community members involved in the data collection, it is an important endeavor, but they raise concerns about the local significance of the methods and the time and resources they would have to volunteer.

Additionally, the project supported the dissemination in Brazil of the SocMon participatory method of monitoring social outcomes of protected areas by organizing trainings and translating manuals into Portuguese.

The project also supported general awareness measures including the preparation and online launching of videos on the work of the project and the livelihood of PA communities. These videos have been available through UNDP webpages and the Youtube® platform, but they have achieved a very limited diffusion, with their views well below 500. In this regard, and while this project, as the only mangrove project of national scope implemented in the last decade, has increased awareness among local stakeholders, there is no evidence of the project exerting any influence beyond actors living or making a living at or around mangrove areas. The project intended to conduct a survey among the public to assess the level of increased awareness about mangrove areas. However, this survey was never conducted. Moreover, without a solid baseline, the survey would only inform about the current understanding or awareness of the public on mangrove areas. A small survey of online publications and articles referring to mangroves, mangrove protected areas, and this very project in Brazil conducted for this evaluation yielded no general trend. While there is certainly interest in mangroves and outcry about their degradation, there is no linkage between the number of yearly publications and the project. While this does not mean that the project has not been a significant influence on the national environmental institutions, as shown in the relevance section, determination of the actual influence of the project cannot be determined as the opinion survey committed in the ProDoc was not conducted.

Figure 15. Online references to mangroves in Brazil and to the project, 2010-2017. Project scores on the right axis and mangrove scores on the left[95].

[95] Search with Google® engine, search parameters: mangue OR manguezal OR manguezais for Brazil for year: 2010-2017. Date of search: 01/03/2018

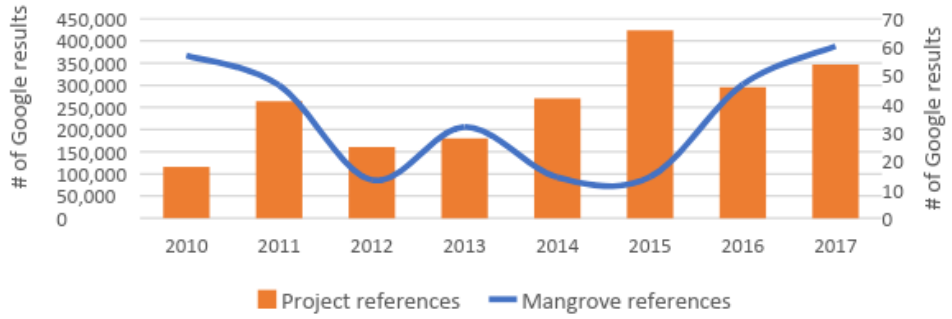
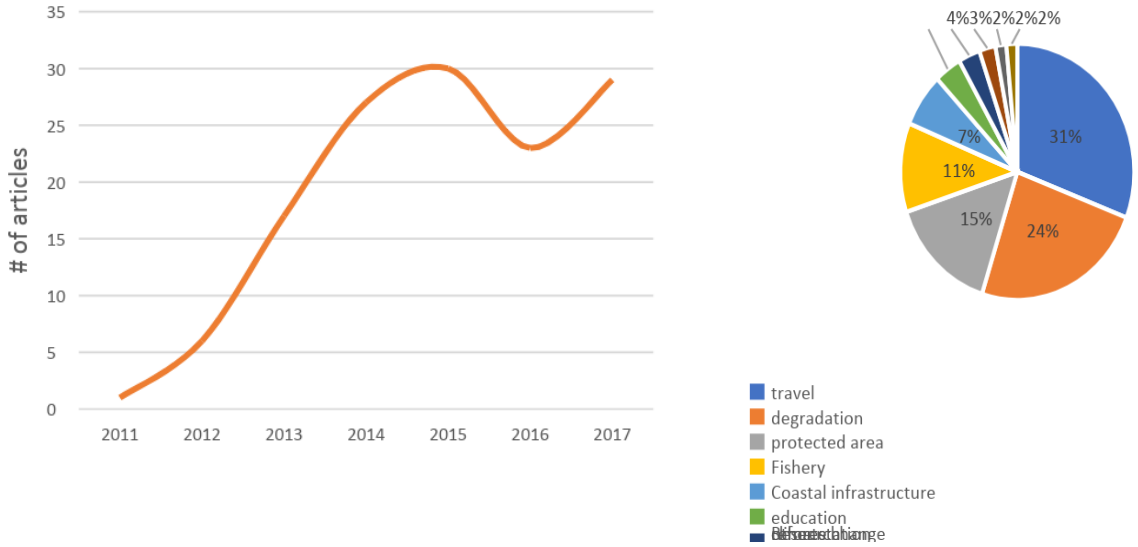


Figure 16. A, globo.com online articles on mangroves 2011-2017. B, Topics of the articles[96]



Mangrove biodiversity monitoring programs coordinated and linked to national system

A participatory monitoring protocol has been developed and tested in four RESEX. The monitoring protocol is rated as a very significant and positive development by the monitoring division of ICMBIO. Local actors at the PA level acknowledge the usefulness of the protocols, but are worried about the support needed and costs in terms of time and resources. Actual data has yet to start flowing.

Country ownership

Elements of country ownership include project concept has its origin within the national sectoral and development plans, project results incorporated into the national sectoral and development plans or regulatory framework, country representatives actively involved in project identification,

[96] Search with globo.com search engine conducted on 01/03/2018

planning and/or implementation, and maintenance of financial commitment to the project by the government.

While the project concept had its origin in a regional project, and not in national policies, it has secured the adoption of a national policy on mangrove forests (the Mangrove Plan) and several regulatory instruments (Normative Instruction 9/7/13 and two protected area management plans), together with the fishery management agreements (Uçá crab and Salgado Paraense) which are likely to be approved for protected areas under federal jurisdiction. Interest of the government agencies concerned (ICMBIO and MMA) is notable and the participatory monitoring program, the visibility given to the mangrove biome and its federal sustainable use protected areas, as well as the ground idea for the marine protected area fund are specially appreciated by both agencies. Finally, the project has been implemented as a ICMBIO project, with the project management unit completely embedded into its structure.

Mainstreaming

Mainstreaming refers to the extent that the project has successfully mainstreamed other UNDP priorities, including poverty alleviation, improved governance, the prevention and recovery from natural disasters, and women's empowerment, which are part of the United Nations Development Agreement Framework (UNDAF) and the aligned Country Program Action Plan (CPAP) of the UNDP. The project started implementation during the 2007-11 CPAP cycle in a context where economic growth, which was not benefiting vast tracts of Brazilian society and high inequality were the main concerns. In terms of environmental sustainability, the CPAP's main concerns were housing, and access to water and sanitation[97]. The emphasis of the CPAP was on achieving the MDGs at disaggregated level, i.e. beyond national and state averages, focusing on human development at municipal level. Thus, the CPAP intended to 1) promote access to basic public services (education, health, housing, water and sanitation), 2) reduce racial inequalities, 3) reducing vulnerability to violence, 4) promoting transparent policies and human rights and 5) promoting more efficient use of resources for an environmentally sustainable economic development, including cash transfers and sustainable management of biodiversity.

The project has made a significant contribution to the outcome 5 of the CPAP 2006-2011, by establishing regulatory instruments and policy and knowledge products (monitoring, mangrove atlas, management plans) and, indirectly, it may have set conditions for the improvement of living conditions, including housing, of mangrove communities. To have an impact, the fisheries management plans must be approved, adopted and implemented and access to the fishery must be effectively limited to mangrove communities currently inhabiting sustainable use federal extractive reserves.

[97] (UNDP, 2010)

Sustainability

Financial sustainability

The project succeeded in developing several management instruments, including protected area management plans, one water management plan and several fisheries management plans. However, additional budget allocation for federal protected areas for the implementation of these plans by the national government is very unlikely, based on past trends and the opinion of key informants. Management of federal protected areas will still depend to a high degree on external investments. GEF is a major part of those investments, and it is currently supporting several initiatives, notably the USD 18 million project on marine protected areas, which will continue the development of the coastal biodiversity fund, "Blue Fund". However, this project explicitly excludes protected areas that have been supported by the present project.

Institutional sustainability

Brazil possesses sufficient legal instruments at national, state and municipal level to sustain protection of mangrove areas, namely, protected areas, environmental impact assessment processes and fishery regulations. However, and although the project has initiated the integration of downstream impacts on mangroves in two spatial planning and licensing processes (Estuary of the Mamanguape, and CIP), this it is still far from being mainstreamed. The only incentives for stakeholders to continue the process towards a comprehensive management of the estuary is increased efficiency, compliance with environmental regulations and improved image by sugar cane industry actors and funding for research in water quality for the academic actors. Municipal and state actors have shown limited interest in the continuation of the process.
The federal forest code was recently modified to allow for commercial operation in mudflats and landward boundary of mangrove forests. While this does not mean that it opens a door for degradation, as, legally, all environmental safeguards would apply for these potential commercial operations, including habitation and aquaculture, it is feared that it exposes a "flank" of mangrove forests to an increased threat level, considering the current capacity weaknesses of environmental institutions at subnational level and the general low level of enforcement of regulations, including impact assessments, fishery regulations and protected areas. These threats could be exacerbated by population growth and affluence, especially in growing coastal centers, driving demand for space, fishery products, and energy.

Socio-economic sustainability

Population growth and affluence will be likely drivers of degradation for natural ecosystem and mangrove areas as a larger, more affluent population would have bigger demands of space, water, energy and other resources.

We consider here evaluation of population and wealth, measured as income per capita for mangrove states, that is, all coastal states except the Southern Santa Catarina and Rio Grande do Sul[98], as well as population evaluation in some key coastal cities that directly drive demand for

[98] That is: Maranhão (MA), Alagoas (AL), Amapá (AP), Bahía (BA), Ceará (CE), Espírito Santo (ES), Pará (PA), Paraíba (PB), Pernambuco (PE), Piauí (PI), Paraná (PR), Rio de Janeiro (RJ), Rio Grande do Norte (RN), Sergipe (SE) and São Paulo (SP)

mangrove resources: Belem (PA), Fortaleza (CE), Recife (PE), Rio de Janeiro (RJ), Salvador (BA) and São Paulo (SP).

Wealth, measured as income per capita has experienced a modest increase by BRL 38 per capita or 7% between 2011 and 2015 on average for the 15 states considered. The effects of the economic crisis can be seen in the downward inflexion of the curve from 2014 onwards (Figure 16). In terms of population, there has been also a significant, yet moderate 7% rise in the population of the "mangrove states" for the same period (Figure 17). Also, important coastal cities have experienced moderate population increases and changes in affluence commensurate with their states.

Figure 17. Average per capita income of mangrove states, as compared with the national trend[99]

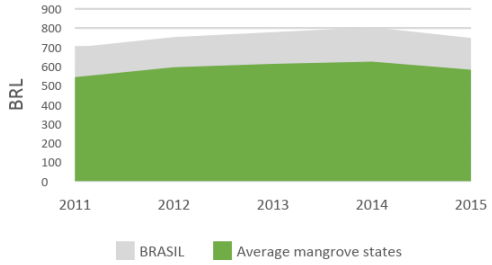
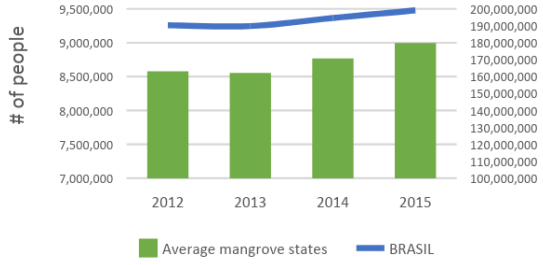


Figure 18. Change in population in mangrove states (left vertical axis), compared with the total national population change (right vertical axis)[100]



Environmental sustainability

The vast expansions of mangrove forest in the states of Amapá, Pará and Maranhão, combined with relatively low population densities in those areas are grounds for confidence that mangrove forests and their associated fauna would survive unscathed the next decades if protection is maintained at the same level. In fact, neither mangrove cover nor status of threatened species has recently worsened.

However, this is not necessarily true for the constraint mangroves forest of the south and southeastern sections, which are also located in densely populated areas and near thriving coastal urban centers. Considering that climate change will cause gradual rise of sea level and the limited possibilities for the gradual migration of southern mangrove forest, the threats facing them will only increase over the next decades.

Impact

As described in the previous section, the project has not yet had any significant impact on ecological parameters: even if the project had succeeded in significantly improving the management effectiveness of all mangrove protected areas, the effects on population densities or

[99] (UNDP, n.d.)

[100] (UNDP, n.d.)

vegetation cover would need at least half a decade to materialize. This notwithstanding, the project has contributed to increase awareness and confidence of primary resource users, namely fishers and crab collectors in some sustainable use protected areas. Moreover, the project has facilitated the crafting of fishery management plans, which, if ever implemented, could potentially not only ease drivers of overexploitation, but also provide social benefits in terms of increased income to mangrove dwelling populations.

3 Conclusions and Recommendations

The project strategy was very relevant and significantly raised the visibility and importance of mangrove forest in the eyes of national environmental institutions, formerly focused solely on inland biomes. The project has contributed to the increased attention given by the Brazilian government to coastal areas and mangrove forests.

The project underwent a prolonged development phase, lasting from at least 2005 to 2008, having its origins in an early project proposal for a regional project. The long preparation led to an "accumulation" of expected results. The ensuing project strategy was ambitious for the modest grant amount of USD 5 million, for a target area exceeding 5,000 km^2, dispersed over 6,000 km of coast, solely considering the project's pilot areas. As a comparison, the GEF-funded marine protected area project counts with a GEF grant amounting to USD 18.2 million, and the goal of strengthening protection over 9,300 km^2 of marine area. Even with a conservative estimate 5000 km^2 (mangrove area only) for this project's intervention area, the cost/km^2 is just USD 1,000/km^2 against the USD 1,950/km^2, almost double, in the case of the new marine protected areas project.

However, the project was efficiently designed, as it selected clusters of protected areas with different main threats, ecological and socio-economic conditions, which enabled different approaches to be tested. This notwithstanding, the logistical complexities and high transaction costs of a project involving such a vast area and an important number of institutional and private actors forced the project management to refocus their attention toward instruments of national application, such as the national mangrove plan, while abandoning some of the most significant mangrove areas of the country (Reentrâncias Maranhenses). This shows both the complexity and ambition of the project design and the capabilities of the project management to achieve tangible results with limited resources. However, the project indicator framework was not modified and remained burdensome and redundant. Moreover, the indicator framework did assume the existence of a comprehensive database both for mangrove cover and area, which was far from reality. In fact, the project has significantly contributed to knowledge on the mangrove areas of Brazil through the development of management instruments and the mapping exercise conducted with IBAMA.

The implementation phase was significantly delayed, due to the new creation of ICMBIO. The new organization needed time to build up its structure, and hence the project only really took off by 2011, three years later than planned, which forced a no-cost extension first till 2015 and finally to 2017. The fact that the project implementation extended over 10 years on the same original grant bears down on its efficiency, as the executing agency's cost kept mounting over time. Moreover, the project strategy underestimated the transaction costs (negotiations, travel) involved when dealing with multiple geographic areas AND multiple institutional partners, i.e., the state and environmental agencies. Eventually the project struggled to deliver its outputs on time, some of them, e.g. the flagship product of the Atlas of Brazilian Mangroves not yet released at the time of the terminal evaluation. However, the overall cost-effectiveness of the project was in line with similar GEF-funded projects.

The project did not deliver all the originally intended products but was able to produce a consistent set of products, namely PA management plans, fishery management agreements, national management plan for *Ucides cordatus*, and the new mangrove atlas, as well as initiated

an important biodiversity monitoring program, an environmental restoration plan, zoning agreements and set up the concept of a fund for coastal and marine biodiversity. While the history of non-enforcement or implementation of previous enacted/ developed management plans and legal instruments does not allow much optimism about the fate of the ones developed by the project, project stakeholders at the implementing agencies and local stakeholders stress the participatory nature of the plans developed under the project, which, in their view, will guarantee their successful implementation.

During the implementation time, there was no significant changes in mangrove area or a worsening of the status of threatened or overexploited organisms associated with mangroves and/ or estuaries by both national threatened lists and IUCN Red List ®. What would have happened if the project was not there? The terminal evaluation concludes that, in terms of biological indicators there would not be much difference. However, we would not know the extent of Brazilian mangroves and protected areas containing them, and we would not have initiated programs for the management and monitoring of mangrove biodiversity.

It is the assessment of the terminal evaluation that, had the project not been implemented, mangrove ecosystem would have continued to be marginalized in national biodiversity management plans and policies. The project may not have contributed to raise the attention of the public on mangroves, but has put mangroves in the forefront of environmental agencies at federal level.

However, and despite being implemented by the national protected area agency, we see no significant improvement of management effectiveness scores. As we have seen, the limited resources available to protected area management councils hampers or outright precludes the implementation of the very tools produced by the project. Moreover, the expected ecological and social outcomes, namely, increase in population numbers for fishery species or improvement of socio-economic status of mangrove fishing communities did not materialize. Population status would depend on management effectiveness, which, as we have exposed has not yet sufficiently improved, but also on biological and abiotic factors that would have delayed the effect of effective implementation of any of the management instruments devised by the project. More importantly, socio-economic status of fishing communities may improve if the management plans developed by the project are effectively implemented and these communities succeed in keeping the fishery resources on which they depend closed to new entries or increases in effort. Even in ideal conditions, their monthly income still depends on a semi-oligopolistic market dominated by few, much wealthier, and presumably much better connected buyers. Therefore, continuous support from transfer programs, such as the one administered by the Ministry of Environment (Bolsa Verde), as well as the updating of fishers´ registries and consequent access to social benefits is paramount for the well-being of coastal communities and, in return for the mangroves of Brazil.

Weak finances for protected areas constitute the main risk for the sustainability of the project, together with the still suboptimal engagement of local governments and business operators in the management of drivers of mangrove degradation and destruction.

Thus, the terminal evaluation recommends:

1. ICMBIO could elevate the mangrove biome to the same status as the other six current Brazilian biomes (Amazônia, Caatinga, Cerrado, Mata Atlântica, Pampa and Pantanal), and separate from other "coastal ecosystems", to enhance its visibility and raise issues about its importance and conservation. Mangroves risk not being given enough attention and fall between administrative divisions.

2. Financial sustainability of mangrove federal protected areas must be strengthened by increasing their current meagre budget allocation, as well as by posting more personnel and crafting agreements across agencies to strengthen enforcement. Currently, many areas count with only one or two staff allocated to areas expanding over hundreds of square kilometres, making enforcement nearly impossible.

3. ICMBIO and MMA should strengthen monitoring programs of biodiversity and specifically support the participatory monitoring program developed by the project. Knowledge on the status of biodiversity in mangroves is less than satisfactory, as shown by the challenges faced by the project and this terminal evaluation to gather information on the project's indicators. The participatory monitoring program has the potential to start bridging this gap.

4. Fishery management plans cannot be implemented in the absence of fishery data. ICMBIO and the MMA must both increase efforts to coordinate with state or federal fishery administrations and include monitoring of catch within federal protected areas of sustainable use. Moreover, catch and effort data must be incorporated in the participatory monitoring program established by the project.

5. UNDP must take a proactive role in inducing and orienting application of tracking tools, including METT and the capacity development scorecard.

Additionally, the terminal evaluation draws the following lessons learned:

1. While government restructuring seeking efficiencies or new synergies are unavoidable, projects should not be implemented by recently created agencies, otherwise the project becomes inefficient due to long implementation times and cumulative costs on a constant grant.

2. National scope should not mean trying to include all possible actors and habitat sub-types, particularly when the biome concerned, Brazilian mangroves, is of such dimensions. Future projects should not underestimate the costs involved not only in setting up implementation of a geographically challenging project but more importantly the transaction costs involved in dealing with a multitude of actors. This transaction costs should be seriously studied and a convenient standard of investment per area considered.

3. Socio-ecological systems are complex and there are rarely simple cause-effects relationships. For instance, projects that have the enhancement of management effectiveness of protected areas as a goal cannot deliver maintenance or increase of population numbers or of habitat quality for big areas. Project outcome indicators should be restricted to the immediate effect of the project.

4. Indicator frameworks should not exceed three-four indicators per outcome, and the existing knowledge on the relevant matter, for instance it should be carefully assessed if there is sufficient information on populations for a certain habitat. A project could also attempt to produce new knowledge or a monitoring program, but the cost of gathering and processing information should be considered, i.e. cost-effectiveness must be an elimination criterion for the selection of indicators.

5. Management instruments, like PA management plans, or fishery management plans need resources to be implemented and to achieve the ecological and social benefits intended. The sustainability of this project's achievements is going to be determined by the ability of ICMBIO and its national and international partners to mobilize such resources for the execution and continuation of the plans and agreements developed and facilitated by the project.

4 5. Annexes

1. Terms of Reference
2. Itinerary
3. List of persons interviewed
4. Summary of field visits
5. List of documents reviewed
6. Evaluation Question Matrix
7. METT questionnaire used and summary of results
8. Evaluation Consultant Agreement Form
9. Project progress table
10. Audit trail
11. Species list