THE EFFECTS OF INVESTMENT DESIGN
ON EMISSIONS REDUCTION IN THE BRAZILIAN AMAZON

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Abstract

The United Nations Reducing Emissions from Deforestation and Forest Degradation (REDD+) framework is a public climate finance model designed to reduce net global greenhouse gas emissions by conserving forests in developing countries. As one of the world's most well-funded and widely dispersed structures for investing in nature to counteract global climate change, REDD+ has attracted frequent criticism and debate since its establishment in 2007. Chief among these questions: does REDD+ actually deliver emissions results? If not, why not – and what alternative investment structures could be designed in its place? This project evaluated the effects of investment design – i.e., the selection of objectives, instruments, terms which form an investment contract – on emissions reduction in Brazil's Amazon, as an entry point for understanding the most effective investment strategies for nature-based climate finance.

Biographical Sketch

Justine Sequeira is a master's student in Global Development at Cornell University and a researcher in the Cornell Atkinson Center for Sustainability's Conservation Finance working group. Prior to Cornell, she worked in agribusiness investment and operations management in East Africa, where she held leadership roles at cereal, cocoa, cotton, and vanilla companies and a rural impact fund. Previously, she was a management consultant at Booz Allen Hamilton in New York. She holds a BBA in Finance from the College of William and Mary.

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List of Terminology

Climate finance	A sub-field of sustainable investment in which capital is used to fund mitigative or adaptive actions to stabilize or counteract climate change, most commonly through strategies or models which reduce GHG emissions
Greenhouse gas (GHG) emissions	Used in this paper to refer to the total volume of all anthropogenic GHG emissions, normalized by CO_2-equivalent global warming potential (GWP)
Natural climate solutions (NCS)	Nature-based approaches for mitigating or adapting to global climate change by decreasing landscape GHG emissions and / or increasing landscape carbon sink capacity
Reducing Emissions from Deforestation and Forest Degradation (REDD+)	A United Nations NCS framework for reducing GHG emissions from deforestation by improving forest conservation, forest carbon stocks, and / or sustainable forest use

Executive Summary

Research Objective and Questions

This project evaluated the effects of investment design on emissions reduction in Brazil's Amazon in order to better design and select strategies for climate finance. The project studied three core questions: (1) how does the structure of a climate finance investment affect its emissions impact?; (2) are there more effective structures than the REDD+ framework for investing in nature to reduce climate risk?; and (3) if more effective structures do exist, why does REDD+ persist as one of the most dominant global mechanisms for investing in nature to stabilize global climate change?

Research Processes and Outline

The research questions were evaluated through two research processes. First, public data was used to evaluate the design and impact of REDD+ in Brazil's Amazon; this was intended to create a quantitative assessment of REDD+'s impact as the prevailing current-state paradigm for public climate finance. Second, interviews were conducted with climate finance practitioners to understand the comparative advantages and disadvantages of REDD+ vs. alternative or in-development investment structures in climate finance. Research outcomes are presented as follows: **Part I** explains the case for studying nature-based climate finance in Brazil's Amazon; **Part II** explains the context and objectives of the core research questions; **Part III** evaluates the structure and results of REDD+ in Brazil's Amazon; **Part IV** presents findings from practitioner interviews.

Part I: Research Context

Why is Brazil's Amazon a compelling case study in nature-based climate finance?

1.1 Brazil's Co-Development of Economy and Environment

The arc of nature-based economic development in Brazil is unique from that of most industrialized countries in terms of both its starting point and trajectory. Whereas Western models for conservation were founded on land protection schemes designed to preserve "wild" landscapes, Brazil's approach grew from the assumption that inhabited, productive landscapes can function as conservation areas, and vice versa (Hecht, 2012). In Brazil's modern political era since 1988, the stated goal – if not always the end result – of environmental policies is to achieve socioecological sustainability between natural ecosystems and human livelihoods, not to preserve untouched landscapes.

In a second departure from prototypical development patterns, Brazil has exhibited a significantly shorter lag time between economic globalization and environmental policy reform than most industrialized countries. In the United States and Western Europe, the development of global export economies predated scientific consensus and public action towards climate change by more than a century. As a result, policy and investment models in these regions must now be designed to retroactively mitigate or offset environmental damages from deeply ingrained industrial and economic systems. By contrast, Brazil's economy did not globalize until the late 1990s – at which point its leading export supply chains, beef and soybean, were met with near-immediate international scrutiny of their environmental impacts, especially in the Amazon biome (Hecht, 2012). While agroindustrial environmental degradation still persists throughout Brazil’s Amazon (**Figure 1**), the Brazilian economy has “grown up” with the norm of adapting to climate change.

Figure 1: What are the primary drivers of deforestation in Brazil's Amazon?

Beef Production | For the past 30 years, deforestation in the Brazilian Amazon has primarily been driven by the expansion of pasture and croplands. In the late 1990s, surging land use change was initially led by the growth of the Amazon cattle herd. As a result of improvements to the health, productivity, and traceability of Amazon cattle and growing global beef demand, industrial slaughterhouses began to replace traditional ranching systems across the Amazon. As prices for cleared land at the margins of the Amazon forest rose, ranchers were incentivized to sell their pasturelands to industrial processors or crop producers, then purchase new, inexpensive forest land to convert to more pasture (Dias et al., 2016; Nepstad et al., 2006).

Soybean Production | Similar to beef production, soybean cultivation did not expand into the Brazilian Amazon until the late 1990s, but is today regarded as a critical threat to the region’s intact forests. In the early 2000s, the combination of equatorial-adapted soybean varietals, a global shortage of feed protein, and low land prices spurred private sector infrastructure investment in the interior Amazon. The construction of deepwater ports and paved highways to support the soybean industry directly contributed to increased deforestation by providing access to vast areas of previously undisturbed forests for new agricultural development (Dias et al., 2016; Nepstad et al., 2006).

1.2 Brazil’s Evolving Political Context and Constraints

In conjunction with its unique approach to conservation and early reform of key industries, Brazil’s political dynamics in the early 2000s are credited with transforming the Amazon region from a deforestation crisis zone to a globally lauded conservation success story. Under President Luiz Inácio da Silva’s administration (2003-2010), Brazil adopted progressive socialist policies to redistribute wealth from extractive agro-industries, which paved the way for political and civil society movements to improve landscape conservation and land use controls (Hecht, 2012). Following these reforms, as validated by publicly available satellite data, deforestation in Brazil's Amazon decreased steadily between 2004-2011: by 2011, annual deforestation by area was less than 1/3 of the previous average annual level during 1996-2005 (UNFCCC, 2012).

Despite past victories, deforestation in Brazil's Amazon has returned to a tipping point today. Since 2019, President Jair Bolsonaro's administration has attempted to defund and dismantle deforestation control agencies and programs, while introducing new policies to expand beef and soybean industries and infrastructure (Gebara et al., 2020). Within months of Bolsonaro's inauguration, the Norwegian and German governments, formerly the leading public donors to forest conservation in Brazil, rapidly suspended investment in the Amazon Fund, the world's largest dedicated vehicle for forest-based climate finance (Gebara et al., 2020). In 2020, satellite data reported annual deforestation in Brazil's Amazon of 11,000+ km^2, representing a 9.5% year-over-year increase and 12-year high in the rate of regional deforestation (UNFCCC, 2020).

1.3 Global Reliance on Brazil's Amazon to Stabilize Climate Change

The return of rising deforestation in Brazil's Amazon compromises both global capacity and global actions to counteract climate change. Due to its sheer scale, the Amazon is central to the strategy and implementation of global climate control measures, e.g., the Paris Agreement, which outline global targets and national commitments for reducing anthropogenic GHG emissions to stabilize climate change. These targets are designed under the assumptions that the Amazon forest will function as a net sink for global emissions and provide climate-regulating forest ecosystem services, as opposed to a net source of new emissions from increasing deforestation (**Figure 2**).

Figure 2: How does deforestation affect global climate change?

Increased GHG Emissions + Decreased Carbon Sink Capacity | Land use change in the Amazon contributes to global climate change by generating new carbon emissions and degrading the carbon sink capacity of intact forests. When forests are cleared, especially in swidden systems, CO_2 is immediately released into the atmosphere as vegetation is burned. However, carbon is also returned to the soil as slashed plant matter, which decomposes and slowly releases CO_2 over time. Due to these hysteresis effects, carbon emissions observed in deforested areas today may reflect land use change activities from decades ago, and may significantly underestimate the long-term emissions damages resulting from current deforestation (Malhi et al., 2008; Watson et al., 2018).

Temperature Warming | Local weather data from the Amazon demonstrates that deforested areas may experience warming up to 2°C and greater diurnal temperature variability relative to adjacent forested sites. These temperature effects in deforested low-altitude environments are caused by reduced transpiration efficiency and reduced land surface roughness. Canopy loss reduces transpiration by decreasing total leaf surface area available for rainfall interception, transpiration, and evaporation; this in turn reduces latent heat fluxes with the biosphere, resulting in land surface warming. Canopy loss also reduces land surface roughness, which similarly inhibits latent heat transfer with the biosphere and leads to land surface warming (Baker and Spracklen, 2019).

Water Cycle Disturbance | In addition to altering regional climate and local weather patterns, land use change in the Amazon may disrupt the water cycle by interfering with ecosystem controls of surface water runoff: a large-scale study in the eastern Amazon linked decreases in vegetative land cover between the 1960s-1990s to a 25% increase in river discharge, despite constant regional precipitation. Land use change also inhibits groundwater rechange in Amazon forest ecosystems: unlike forest trees, short-rooted agricultural vegetation cannot access and transpire deep groundwater. Climatic variances caused by reduced transpiration in deforested areas therefore become most extreme in drought periods with severely depleted soil moisture, particularly during Brazil’s dry season or El Niño patterns. Critically, these related transpiration, temperature, and seasonality effects are all demonstrated to accelerate as deforestation increases (Baker and Spracklen, 2019; Foley et al., 2007).

Part II: Research Approach

Why and how did this project study investment structures in climate finance?

2.1 Research Questions

2.1.1 How does the structure of a climate finance investment affect its environmental impact?

Measuring environmental impact in climate finance is commonly considered to be less complex vs. other sub-fields of sustainable investment due to the use of a single universal impact metric: reduced emissions volume. Regardless of sector or geography, the environmental effects of a climate finance investment can be measured in terms of decreased volume of greenhouse gas (GHG) emissions – i.e., the total emissions-savings generated by an investment. As a result of the near-universal adoption of this metric, the relative environmental impact of climate finance investments can be quantified and compared at a global scale despite highly varied funding sources and implementation conditions worldwide.

However, despite the theoretical simplicity of measuring environmental impact in climate finance, little to no research currently exists to codify which investment models and products work "best", i.e., deliver the highest rate of emissions-savings, in specific application contexts. An estimated USD 90 trillion in global investment is needed by 2030 to counteract climate change – but if we do not understand which investment structures yield the most positive results in a given environment, how can we ensure that we are optimizing the use of funds to achieve these goals? (World Bank, 2019) Can we assume that the per-dollar impact of a grant is equal to that of a loan, despite difference in the respective resources, systems, capacity, and time needed to implement each instrument?

2.1.2 Are there more effective structures than the REDD+ framework for investing in nature to reduce climate risk?

Leveraging the universal emissions-savings impact metric, the Reducing Emissions from Deforestation and Forest Degradation (REDD+) framework has become one of the most dominant global methodologies for designing nature-based climate finance initiatives. REDD+ was instated by the United Nations Framework Convention for Climate Change (UNFCCC) in 2008 to facilitate the development of public funding strategies for curbing deforestation emissions; its scope was later expanded to include preserving forest ecosystem services, enhancing forest carbon stocks, and improving sustainable forest use. As of 2021, REDD+ is centrally featured in the National Climate Plans (NCPs) of 65 countries, and more than USD 5 billion has been committed to funding REDD+ projects worldwide (UNFCCC,2021; Climate Funds Update, 2021).

Despite, or perhaps because of, its global adoption and deep funding, REDD+ has attracted criticism since its establishment. REDD+ prescribes a single funding sector, source, and instrument for forest-based investment: grants backed by public funds from developed countries. Further, REDD+ requires rigorous national planning and project reporting, and these process and control structures cannot be adapted to country- or project-level conditions. Given the emergence over the past 10+ years of private sector mechanisms for financing natural climate solutions (NCS), is multilateral grant financing still the most effective approach for investing in nature to reduce climate risk?

2.1.3 If more effective structures do exist, why does REDD+ persist as one of the most dominant global mechanisms for investing in NCS?

As argued above, the strategy and implementation approaches of REDD+ appear to present structural design weaknesses. Nevertheless, REDD+ is currently more widely adopted and better funded than most private sector NCS mechanisms. Can REDD+'s competitive advantage be credited to positive attributes in its own structural design (e.g., scalability or transparency) vs. other existing investment models and products – or is it simply the longest-standing or best-platformed NCS mechanism in climate finance today?

2.2 Research Hypothesis

The REDD+ framework puts forth standardized global requirements for the funding, design, and implementation of forest-based public climate finance investments; by design, these structural requirements are not intended to be customized for country- or project-specific objectives or conditions. The project hypothesis assumed that more agile private sector climate finance mechanisms could be shown to create greater emissions impact than REDD+. "Agile" mechanisms were defined as models or products which (1) can be tailored by country or project context, (2) are biased towards action vs. planning, (3) produce incremental results, and (4) emphasize iterative learning.

Part III: REDD+ Program Analysis

Evaluating the structure and results of REDD+ in Brazil's Amazon

3.1 Section Overview

Brazil's national REDD+ program is the largest and most advanced in the world in terms of funding, transactions, and progression to latter-phase implementation and results-based payment activities. I evaluated Brazil's REDD+ program as a best-in-class example of an externally funded public climate finance structure, and as a baseline for comparison to non-REDD+ investment mechanisms in climate finance. I analyzed three aspects of Brazil's REDD+ program: (1) program strategy and process design, (2) portfolio composition, and (3) emissions impact. The goal of this analysis was to identify strengths and weaknesses in the REDD+ structure, and to understand if its proposed benefits (e.g., mature process controls, transparent reporting, public data) translate to competitive advantages in emissions impact, knowledge-sharing, adoption, or scaling.

3.2 Background: Universal REDD+ Structural Constraints

Globally, REDD+ projects are characterized by six shared constraints for designing public climate finance investments (**Figure 3**): emissions impact, the "polluter pays" principle, additionality, affordability, funding continuity, and public accountability. In addition to adhering to project-level constraints, developing country implementors of REDD+ must also establish national program infrastructure (**Figure 4**), including: a national REDD+ strategy, carbon accounting systems, monitoring and evaluation (M&E) systems, and social and environmental safeguards. Establishing these systems and controls is referred to as "readiness-planning" – a mandatory capacity-building process designed to ensure that developing countries are equipped to measure and report emissions-savings from REDD+. Readiness-planning is the first of three phases in the REDD+ framework, and countries must meet all readiness requirements before implementing carbon market projects (Phase II) or receiving results-based payments (Phase III).

Figure 3: REDD+ Investment Requirements – Project Design

Requirement	Description
Emissions Impact	As is true across the climate finance industry, the environmental impact of REDD+ projects is measured through a single universal metric: reduced emissions volume. REDD+ projects aim to reduce GHG emissions in support of the Paris Agreement target to limit global warming to 1.5℃ above pre-industrial levels.
Polluter Pays	Country-specific climate action commitments are determined based on “differentiated responsibilities and respective capacities” – i.e., developed countries responsible for the highest levels of historic and current GHG emissions fund REDD+ activities in developing countries through multilateral and bilateral investment institutions.
Additionality	Public climate finance is required to be “additional” (spurring private sector action and investment in climate change which would not have occurred otherwise) and “new” (distinct from existing ODA commitments). This positions public investment as the cornerstone of REDD+ funding, and places private investment in a secondary role.
Affordability	Public climate funding must not create economic burdens on recipient countries. Given the high debt balances of many developing countries, all public funding under REDD+ in support of national climate action is provided through grant instruments.
Funding Continuity	Public climate finance is only allocated in multi-year, medium-term funding cycles to ensure sustained support for developing countries while planning and scaling their REDD+ strategies.
Public Accountability	Information on all REDD+ project financial data, funding structures, disbursements, and implementation results must be made publicly available in a timely and accurate manner to ensure transparency and accountability in the use of public funding.

Figure 4: REDD+ Investment Requirements – Program Design	
Requirement	**Description**
National REDD+ Strategies	Policy and control plans designed to achieve REDD+ goals; includes identifying measurable targets for emissions-savings, capacity and investment gap analysis, and stakeholder engagement needs.
Carbon Accounting Systems	Processes and technology used to measure forest carbon savings and losses; includes building National Forest Monitoring Systems (NFMS) to measure forest carbon, and establishing a Forest Reference Level (FRL), i.e., the baseline volume of annual emissions from forest cover and carbon loss prior to REDD+.
Monitoring and Evaluation (M&E) Systems	Processes and technology used to report REDD+ results, in compliance with public accountability standards; includes designing multi-scalar (national to community-level) measurement, reporting, and verification (MRV) systems.
Social and Environmental Safeguards	Policy and control plans designed to protect human rights and natural resources; includes conducting a Strategic Environmental and Social Assessment (SESA) to ensure compliance with global REDD+ environmental and social controls, creating an Environmental and Social Management Framework (ESMF) to manage compliance risks, and establishing a Grievance Redress Mechanism (GRM) to receive feedback and complaints from any REDD+ stakeholder.

3.3 Evaluation of Brazil's REDD+ Program Strategy and Process Design

Literature sources propose three central "pros" to the REDD+ structure for public climate finance: (1) a broad scope encompassing the objectives and activities of diverse stakeholders; (2) well-defined process controls which enable consistent and scalable program implementation; and (3) external international funding sources which can reliably withstand country-level barriers to meeting global climate change targets. However, the benefits of REDD+'s scoping, process controls, and funding channel design may be limited in practice. First, the catch-all scope of REDD+ has been demonstrated to confuse and alienate stakeholders: when people do not clearly understand the goals or impact of REDD+, they cannot connect it to their own work or objectives, and therefore are not incentivized to participate in program problem-solving or decision-making. Second, REDD+ has historically demonstrated the greatest emissions impact in developing countries with large forest areas and high rates of deforestation – unfortunately, countries which meet these specifications also tend to lack the policy infrastructure, enforcement mechanisms, and technical capacity needed to implement the REDD+ control framework. Finally, in the case of Brazil and the climate-denier agenda of President Jair Bolsonaro, REDD+'s "polluter pays" strategy has not succeeded in preventing key international funders, n.b. the governments of Norway and Germany, from suspending donations to counteract climate change in the Amazon.

In terms of positive design qualities, REDD+ is also positioned by literature sources as being more publicly transparent vs. privately funded strategies, due to the fact that its programs must adhere to rigorous reporting standards for the use of public funds. To test this perception, I used publicly available data from Brazil's REDD+ program to reconstruct its reported emissions impact between 2011-2015. I found that, at a process level, it is indeed possible to trace and verify the calculations of Brazil's reported REDD+ results using step-by-step methodological guides and datasets which are freely available online at the REDD+ Brasil Info Hub hosted by Brazil's Ministry of the Environment (MMA). In this regard, **process transparency requirements for REDD+ results reporting in Brazil have led to the creation of publicly available climate finance process tools, which could support capacity-building and knowledge transfer in other countries**.

While REDD+'s transparent reporting design may contribute to building and transferring global process knowledge, this lever for scale is somewhat undermined by fragmented data management. In Brazil, a straightforward formula is used to calculate emissions-savings: the impact of REDD+ in year *t* is equal to forest reference emission level (*FREL) – gross emissions from deforestation (t)*, in which FREL represents the historic baseline of average annual emissions from deforestation over a 5-10-year period. The FREL is calculated using satellite deforestation data and national greenhouse gas inventories; however, each of these datasets is stored on a different Brazilian government agency site, separate from the MMA site which houses the FREL how-to guides. Further, the Brazil REDD+ program data reported on the MMA site is more recent and complete than the information on the UNFCCC's central global REDD+ results database, the Lima REDD+ Info Hub. **Inconsistencies in REDD+ data management make it difficult to compare emissions impact over time in Brazil or between countries, which in turn impedes results-based learning and program improvement worldwide**.

3.4 Evaluation of Brazil's REDD+ Portfolio Composition

The MMA site provides publicly accessible data on REDD+ capital flows by international funding entity and Brazilian recipient entity between 2011-2017. However, the project-level goals, uses, and impact of REDD+ funding are not reported: some investment line items are specified as supporting the REDD Early Movers (REM) Program, a global REDD+ initiative led by Germany in cooperation with the UK and Norway, but no detail is provided for non-REM investment projects. Across all investments, **the MMA site does not report any data related to REDD+ funding instruments, funding terms, risk, or impact** – i.e., the public can see where Brazil's REDD+ funding came from and where it went at a funder / recipient entity level; we can't see how it was used, or how it contributed to country-level emissions-savings results.

Additionally, **the UNFCCC site does not provide dollar-value REDD+ funding data**. The Lima REDD+ Info Hub reports the volume of emissions-savings which were compensated by international funders through results-based payment schemes in each reporting period. However, the dollar value of these payments, or of any other REDD+ capital flows, is not reported in the site's country-level data tables. To access funding data related to Brazil's REDD+ program, users must access a separate UNFCCC site to download Brazil's Biennial Update Reports (BURs), comprehensive country-level REDD+ status reports. In contrast to the FREL datasets published in Excel, the project data published in the dense BUR PDF files is difficult to locate, use, and interpret. Analyzing Brazil's REDD+ investment portfolio is also complicated by the fact that **BUR project data does not segregate REDD+ investments or impact**, and instead reports investment value, instrument, sector, and funder for all climate finance projects in Brazil each year.

Data from Brazil's MMA site demonstrates that the funding and receipt of REDD+ financing in Brazil is highly concentrated in Norway and the Amazon Fund, respectively. However, given the aforementioned dataset limitations, further analysis of the portfolio composition or trends of REDD+ investment in Brazil is limited using this data source. The BUR data of all external climate finance projects in Brazil does not meaningfully complement or clarify the MMA site's data set, but it may point to patterns in deal flow and transaction costs in Brazil's REDD+ portfolio. In 2018, the number of public climate finance projects in Brazil funded through loans (13) was almost identical to the number funded through grants (14), but average loan value was > 6X larger than average grant value; this relationship was also seen in 2019.

3.5 Evaluation of Brazil's REDD+ Emissions Impact

The program-level impact of REDD+ in Brazil is determined on an annual basis as the difference between current emission levels vs. an FREL historic baseline. Brazil's MRV methodology assumes that all year-over-year changes in gross emissions from deforestation in the Amazon are attributable to REDD+, despite the fact that REDD+ project impact is not specifically measured or reported within Brazil's broader climate finance landscape. Admittedly, project-level impact attribution may be impossible or unfeasible in climate finance projects which do not engage with point-source pollution. Nevertheless, **the failure to connect project actions to emissions-savings means that Brazil cannot identify, prioritize, and scale its most effective REDD+ projects, or inversely decrease funding in projects with lower impact efficiency**.

Annual emissions levels from deforestation in the Amazon are measured using the same tools and processes used to calculate FRELs, then reported to the UNFCCC through Brazil's BURs, and ultimately published to the UNFCCC's Lima REDD+ Info Hub and Brazil's MMA site. The BURs capture program measurement, reporting, and verification (MRV) methods and systems in detail, but do not translate current-state activities to action items or lessons learned. The 2020 BUR explicitly acknowledges Brazil's stalled progress in emissions reduction during the 2018-2019 reporting period – but the political and economic contexts of this trend are not acknowledged, nor are any direct remedies proposed. This indicates that **REDD+ in Brazil may be subject to a classical pitfall of big data programs, in which data is extensively collected but not necessarily used to inform decisions**.

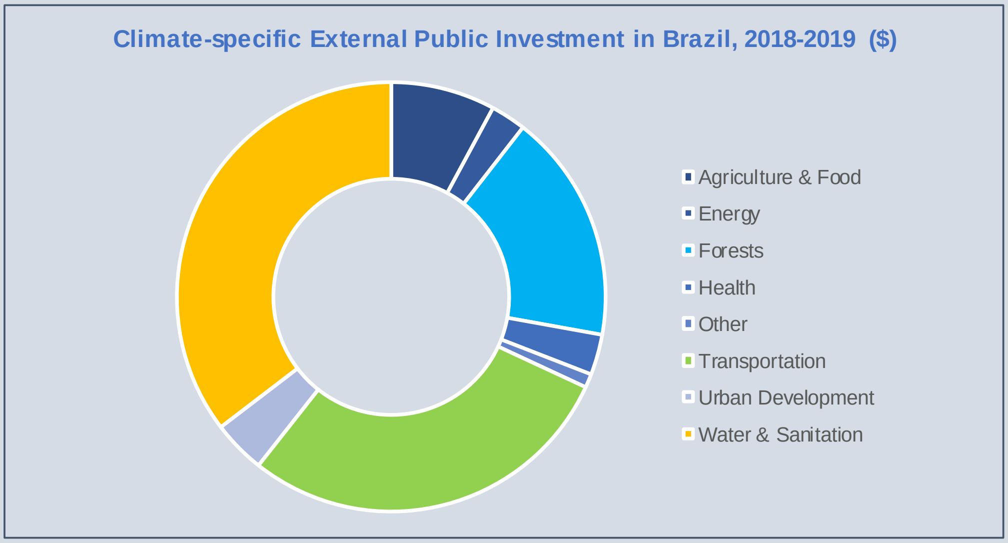
***Figure 5**: Transaction Summary of Public Climate Finance in Brazil (2018-2019)*

	2018	2019	Total	YOY Δ
Investor Type				
$ total from multilateral funds	908,812,800	884,957,900	1,793,770,700	-3%
$ total from bilateral funds	88,343,535	12,370,477	100,714,012	-86%
Total	**997,156,335**	**897,328,377**	**1,894,484,712**	**-10%**
Instrument Type				
$ total from loans	856,925,700	759,239,000	1,616,164,700	-11%
$ total from grants	140,230,635	134,089,377	274,320,012	-4%
$ total from equity	-	4,000,000	4,000,000	-
Total	**997,156,335**	**897,328,377**	**1,894,484,712**	**-10%**
Transaction Count				
# of loans	13	12	25	-8%
# of grants	14	16	30	14%
# of equity deals	-	1	1	-
Total	**27**	**29**	**56**	**7%**
Transaction Size				
$ avg loan size	65,917,362	63,269,917	129,187,278	-4%
$ avg grant size	10,016,474	8,380,586	18,397,060	-16%
$ avg equity deal size	-	4,000,000	4,000,000	-

Data Source:

Ministry of Foreign Affairs and Ministry of Science, Technology, Innovations and Communications. (2020). Fourth Biennial Update Report of Brazil to the United Nations Framework Convention on Climate Change. Federative Republic of Brazil.

***Figure 6**: Sector Summary of Public Climate Finance in Brazil (2018-2019)*



Instrument	Sector	Transaction Count (#)	Total Investment ($)	Climate-specific Investment ($)
Loan	Agriculture and food	4	342,140,000	127,440,700
	Energy	1	50,000,000	50,000,000
	Forests	1	103,000,000	99,910,000
	Health	3	201,200,000	57,796,000
	Transportation	6	1,211,100,000	537,937,000
	Urban development	4	355,700,000	73,676,000
	Water and sanitation	6	1,019,750,000	669,405,000
		25	**3,282,890,000**	**1,616,164,700**
Grant	Agriculture and food	5	21,786,928	21,786,928
	Energy	1	250,000	250,000
	Forests	8	227,857,371	227,857,371
	Other	9	28,699,713	19,571,813
	Transportation	1	2,080,000	2,080,000
	Urban development	1	2,000,000	2,000,000
	Water and sanitation	5	1,470,000	773,900
		30	**284,144,012**	**274,320,012**
Equity	Transportation	1	4,000,000	4,000,000
		1	**4,000,000**	**4,000,000**
		56	**3,571,034,012**	**1,894,484,712**

Data Source:

Ministry of Foreign Affairs and Ministry of Science, Technology, Innovations and Communications. (2020). Fourth Biennial Update Report of Brazil to the United Nations Framework Convention on Climate Change. Federative Republic of Brazil.

***Figure 7**: Annual Results of REDD+ in Brazil's Amazon (2006-2019)*

Year	Gross Emissions from Deforestation *(t CO2-eq/yr)*	Baseline Average Emissions (FREL) *(t CO_2-eq/yr)*	Emissions-Savings Results *(t CO_2-eq/yr)*	Results Compensated *(t CO_2-eq/yr)*
1996	979,523,618	1,106,027,617	*Pre-program*	*Pre-program*
1997	979,523,618	1,106,027,617	*Pre-program*	*Pre-program*
1998	979,523,618	1,106,027,617	*Pre-program*	*Pre-program*
1999	979,523,618	1,106,027,617	*Pre-program*	*Pre-program*
2000	979,523,618	1,106,027,617	*Pre-program*	*Pre-program*
2001	908,964,575	1,106,027,617	*Pre-program*	*Pre-program*
2002	1,334,458,299	1,106,027,617	*Pre-program*	*Pre-program*
2003	1,375,224,078	1,106,027,617	*Pre-program*	*Pre-program*
2004	1,380,142,199	1,106,027,617	*Pre-program*	*Pre-program*
2005	1,163,879,135	1,106,027,617	*Pre-program*	*Pre-program*
2006	576,136,731	1,106,027,617	529,930,490	25,453,690
2007	609,101,478	1,106,027,617	497,761,219	-
2008	669,215,058	1,106,027,617	440,022,301	-
2009	373,066,457	1,106,027,617	741,687,139	31,536,434
2010	362,507,087	1,106,027,617	761,621,104	37,368,791
2011	285,507,795	907,959,466	622,451,672	33,363,022
2012	236,684,154	907,959,466	671,275,312	33,733,224
2013	301,847,851	907,959,466	606,111,615	33,766,724
2014	273,591,601	907,959,466	634,367,866	34,979,518
2015	287,665,246	907,959,466	620,295,262	44,203,682
2016	*Unavailable*	751,780,503	377,344,006	*Unconfirmed*
2017	*Unavailable*	751,780,503	391,656,867	*Unconfirmed*
2018	*Unavailable*	751,780,503	372,968,058	-
2019	*Unavailable*	751,780,503	173,538,421	-

Data Sources:

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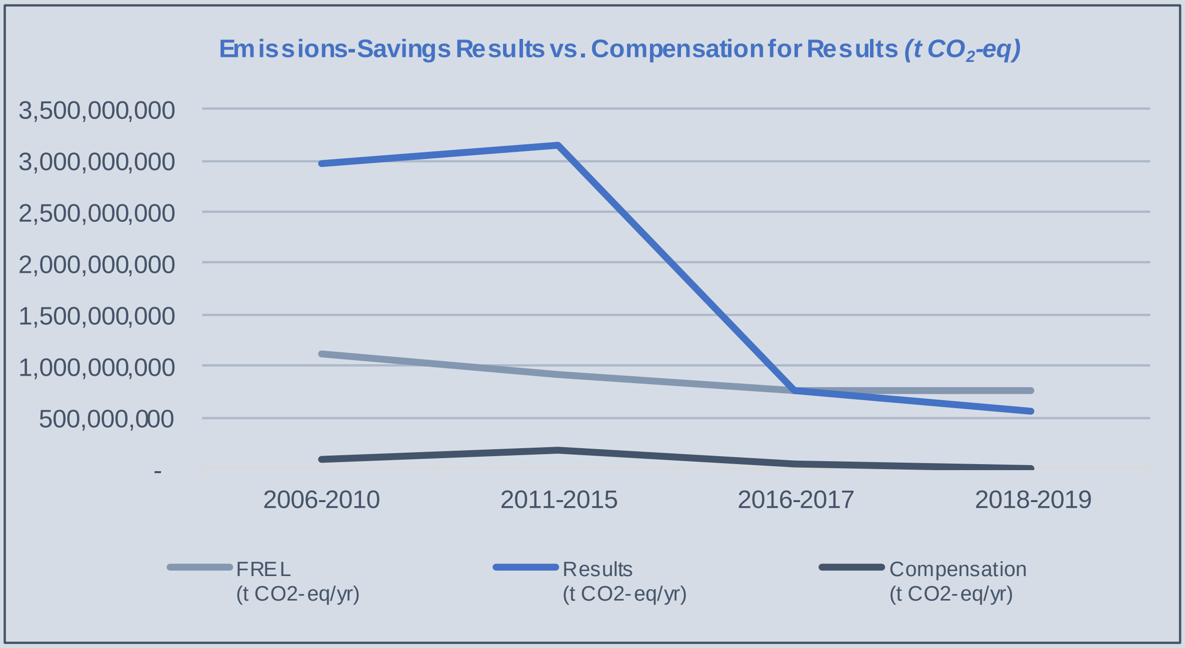
***Figure 8**: Reporting Period Results of REDD+ in Brazil's Amazon (2006-2019)*

Reporting Period	FREL *(t CO_2-eq/yr)*	Results *(t CO_2-eq/yr)*	Compensation *(t CO_2-eq/yr)*
2006-2010	1,106,027,618	2,971,022,254	94,358,916
2011-2015	907,959,466	3,154,501,727	180,046,170
2016-2017	751,780,504	769,000,873	43,174,086
2018-2019	751,780,503	546,506,479	-



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Part IV: Climate Finance Practitioner Interviews

Designing and selecting effective investment structures for climate finance

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Figure 9: Deconstructed Design of an Investment Model	
Strategy *What do you invest in and why?*	• What are the investment goals and objectives? • What type and scale of solution is targeted and why? • What levels of financial returns are required? • What levels of non-financial impact are required? • What levels of risk are accepted?
Implementation *How are investments made?*	• Who provides funding? • Who receives funding? • Where are funds spent? • What product types are used to invest? • What product terms are used to invest?
Monitoring, Evaluation, and Learning (MEL) *Are investments successful?*	• What reporting is required? • What performance metrics are used? • What monitoring systems are used? • What learning systems are used?

4.1 Section Overview

To complement the preceding desktop analysis of REDD+'s structural strengths and weaknesses, I also conducted interviews with climate finance practitioners to understand the comparative advantages and disadvantages of REDD+ vs. alternative climate finance investment structures. Target interviewees were conservation investors and investees with experience in forest-based NCS in tropical ecoregions; however, the availability of active investment practitioners in the Amazon region was limited by Brazil's current political administration, which has decreased and disincentivized investment in forest conservation by the private sector and domestic public sector. Following a brief overview of climate finance objectives and trends, interviewees' feedback on REDD+ is presented below according to three aspects of investment design: (1) strategy, (2) implementation, or (3) monitoring, evaluation, and learning (MEL) systems (**Figure 9**).

4.2 Background: Climate Finance Strategies, Solutions, and Capital Flows

"Climate finance" refers to capital used to reduce global climate change risk. Risk can be understood as the product of probability and impact; climate finance strategies are therefore typically classified as "mitigative" (i.e., reducing the likelihood of global warming greater than 2°C above pre-industrial levels) or "adaptive" (i.e., reducing the severity of impacts from climate change on humans and the environment). Within the sub-field of climate mitigation finance, the primary tactical approach to stabilizing global warming is to reduce anthropogenic GHG emissions. By volume and transactions, investment in climate mitigation finance has historically targeted emissions-saving solutions in renewable energy systems and infrastructure. In the past decade, however, natural climate solutions (NCS), i.e., actions which reduce GHG emissions or increase carbon sequestration capacity at a landscape scale, have emerged as a complementary climate change mitigation strategy. REDD+ can be classified as a mitigative NCS approach, nested within the broader fields of climate finance, environmental finance, and sustainable investment.

Given the global scale of its mission, climate finance is typically invested through multilateral and bilateral public investment channels. Investment capital from public institutions flows from developed countries, which demonstrate the highest historical national contributions to global GHG emissions, to developing countries, which frequently face disproportionately high risks of socioeconomic damages from climate change (i.e., the “polluter pays” principle). At a regional scale, USD 4.2 billion in multilateral climate finance has been approved for 500+ projects in Latin America since 2003 – compared to USD 5.7 billion for 500+ projects across Asia, and USD 5.9 billion for 800+ projects in Sub-Saharan Africa. Climate finance in Latin America is geographically concentrated: nearly half of financing approved by public climate funds is allocated to Brazil, Mexico, or Columbia. Climate finance in Latin America is also strategically concentrated: in the last 20 years, climate mitigation activities in the region, including forest protection and restoration, have received 6X more public investment than climate adaptation projects.

4.3 Evaluation of REDD+ Strategy Design

The strategic design of an investment model requires financial managers to identify: (1) investment goals and objectives, (2) type and scale of solutions or projects to target for investment, (3) expectations for financial returns, (4) expectations for non-financial impact, and (5) risk tolerance levels (**Figure 9**).

4.3.1 Segregated Fields of Climate Finance vs. Conservation Finance

On paper, the stated strategy of REDD+ calls for investment actions which jointly serve to counteract climate change and to preserve forest ecosystems. In common practice, however, these dual goals are associated with two distinct sub-fields of sustainable investment: climate finance vs. conservation finance, respectively. This distinction is not merely semantic: at an organizational level, investment teams or entire funds tend to build core strategies and expertise in alignment with one field or the other, not both equally. At an industry level, many market-level factors – including relevant investors, focal investment geographies, reporting conventions, disclosure requirements, and technology – may differ significantly between climate finance vs. conservation finance. In the case of one interviewee organization, a national or local fund may even be accredited as a target recipient of REDD+ financing from multilateral institutions, despite limited experience in designing and implementing projects which meet the goal scope of REDD+.

4.3.2 Climate Finance Solutions Outside of the LULUCF Sector

The REDD+ theory of change seems to imply that forest preservation and restoration are the most important, or only, NCS strategies. However, despite broad public awareness and corporate focus on forest-based NCS and tree-planting projects, the most effective and scalable climate finance solutions are arguably being developed outside of the land use, land-use change, and forestry (LULUCF) sector. As reported by one interviewee organization, blue carbon strategies may currently be the most promising solutions in climate finance: these solutions aim to increase marine carbon sequestration (i.e., climate change adaptation) by protecting and restoring coastal ecosystems, as opposed to the REDD+ approach of reducing emissions (i.e., climate change mitigation) by preserving forests. For Small Island Developing States (SIDS) in particular, investments to restore coastal ecosystems provide critical protection against rising sea levels, and can be financed through carbon credit programs. To this end, The Nature Conservancy (TNC) has developed the Blue Carbon Resilience Credit, a premium carbon credit program which uses mangrove restoration to increase marine carbon sequestration and improve coastal protection.

4.4 Evaluation of REDD+ Implementation Design

The implementation design of an investment model includes identifying: (1) funding sources, (2) funding recipients, (3) investment geographies, (4) investment product offerings, and (5) accompanying product terms (**Figure 9**).

4.4.1 Multiple High-Risk Deforested Ecosystems in Brazil

The Amazon biome is widely regarded as the foremost global hotspot for environmental degradation due to forest conversion, rising carbon emissions, and biodiversity loss. However, emissions from land cover change in Brazil since the 1990s have primarily been driven by the extensification of industrial beef and soybean production systems – causes and damages which are not contained to the Amazon rainforest ecosystem. According to an interviewee organization, over the past 5-10 years, climate finance models in Brazil have increasingly shifted and expanded to implement climate change mitigation and adaptation projects in other high-risk ecosystems facing extensive vegetation loss, namely the Caatinga (dry forest) and Cerrado (tropical savanna) biomes.

4.4.2 Lack of National Carbon Markets in Brazil

The REDD+ framework calls for countries to complete extensive program planning measures before implementing any results-based payment projects, to ensure that adequate control systems and technology are in place to meet requirements for results reporting and verification. The REDD+ framework phases are also constructed based on the assumption that projects will be implemented in conjunction with national carbon market schemes; however, the development of carbon market infrastructure and policies is not included in the fundamental REDD+ readiness-planning requirements. According to one interviewee organization, in light of climate change denial by Brazil's current federal government administration, the burden of self-organizing to establish sub-national carbon markets – even as projects are currently being implemented – has now fallen to individual Amazon states.

4.5 Evaluation of REDD+ MEL Design

The monitoring, evaluation, and learning (MEL) design of an investment model is comprised of: (1) reporting requirements, (2) performance metrics, (3) monitoring systems, and (4) learning systems (**Figure 9**).

4.5.1 Limited Transparency and Controls in Project-Level Governance

In a case example provided by an interviewee, the organization developed a trust fund to manage carbon credit programs in indigenous lands in the Amazon state of Rondônia. The fund and its management processes were designed in alignment with the REDD+ framework, with emphasis on community-driven land stewardship and traditional governance systems. Following the first sale of carbon credits to an international cosmetics company, tribal leaders were accused of nepotism in distributing proceeds from the sale to community projects; attempts to investigate these claims via tribal councils were met with further accusations of family-related conflicts of interest. Despite two years of pre-implementation planning, due to these community conflicts, the project lost its Climate, Community, and Biodiversity (CCB) Standards certification following its first audit by an external entity. The interviewee noted that, while project systems should be designed in alignment with preexisting community governance structures, consistent and independent project-level oversight appears to be necessary in order to meet and maintain REDD+ requirements for transparent and verifiable results.

Part V: Conclusion

My initial hypothesis assumed that the financial instrument chosen to structure a climate finance investment could affect the investment's results in terms of reduced GHG emissions. This assumption was made on the basis that financial instruments do not carry the same expectations of risk or return, and are therefore attached to different contractual mandates for the uses and outputs of funding. The hypothesis proposed that the external public finance structure of REDD+, tied to deep cost, time, and capacity implications for investees, leads to relatively low emissions impact. Conversely, private sector non-grant mechanisms with lean pre-implementation requirements were expected to result in greater emissions impact.

The hypothesis was not directly supported by my findings. Countries which receive REDD+ funding are required to measure, monitor, and publicly report national GHG emissions from deforestation prior to and during REDD+ project implementation. However, in the case of Brazil, I found that the top-down calculation of annual national emissions before and after launching REDD+ is not publicly reported in connection with any project-level actions or investments. Further, I found that the emissions impact of REDD+-dedicated funding is not publicly traced or reported as a distinct program amongst all other external public climate finance investments made annually in Brazil. Without public data on the sub-national project- or program-level results of REDD+, I was not able to codify which of the financial instruments used to structure REDD+ investments in Brazil may be more or less impactful, or how effective the REDD+ model is compared to other NCS and non-NCS approaches to climate finance.

In response to each of the core research questions, findings are as follows:

Question 1: How does the structure of a climate finance investment affect its emissions impact?

In its REDD+ program status updates to the UNFCCC, Brazil publicly reports the financial instrument attached to every external public climate finance investment it receives each year. However, as stated in the above hypothesis response, I could not quantitatively identify the most effective financial instruments or investment activities within Brazil's REDD+ program because emissions impact is only reported at a national level.

Question 2: Are there more effective structures than the REDD+ framework for investing in nature to reduce climate risk?

Comparing the efficacy of two REDD+ programs or projects, or the efficacy of REDD+ vs. non-REDD+ investment models, is complicated by three factors. First, REDD+ investments are implemented through local or regional projects, but results are only captured at a national level. Second, REDD+ investments are most commonly evaluated in terms of their opportunity costs (i.e., the benefits of forest conservation vs. the costs of foregone agricultural production), with limited consideration of transaction and implementation costs. At national and global scales, this leads to underestimation of costs and overestimation of impact when investing with REDD+ vs. other climate finance models. Third, the environmental and social benefits of forest conservation beyond carbon offset schemes are difficult to valuate and inconsistently measured.

Question 3: If more effective structures do exist, why does REDD+ persist as one of the most dominant global mechanisms for investing in NCS?

Despite these challenges in comparing the efficacy of climate finance investments, structural differences between financial instruments may still affect the adoption, scaling, and impact of climate finance models. In my original hypothesis, I expected that REDD+'s extensive pre-implementation requirements could be shown to decrease impact, and, inversely, that "agile" investment models characterized by lean planning, incremental results, and iterative learning could be shown to increase impact. Ultimately, my research did not indicate any measurable link between the depth or duration of REDD+'s readiness-planning requirements vs. its end results. However, my research did highlight that REDD+ reporting structures in Brazil omit feedback channels for results-based learning to increase the impact, efficacy, and scale of REDD+ projects.

Appendix

6.1 Sanitized List of Organizations Interviewed

Organization A	Pooled multilateral fund established as an operating entity of the Financial Mechanism of the UNFCCC to assist developing countries in mitigating and adapting to climate change. Contacts: Climate Investment Officer, Private Sector Facility and Resource Mobilization & Outreach Officer. May 2021.
Organization B	National REDD+ fund established to raise donations for non-reimbursable investments to prevent, monitor, and combat deforestation and to promote the preservation and sustainable use of the Brazilian Amazon. Contact: Fund Director (fmr). July 2021.
Organization C	National fund established to finance biodiversity conservation in Brazil with a focus on ecosystem preservation, sustainable land use, and forestry. Contact: Fund Manager (fmr). July 2021.
Organization D	Venture-funded forestry company specializing in reforestation through decentralized smallholder tree plantations in tropical regions. Contact: VP, Corporate Finance & Strategy. June 2021.
Organization E	Venture-funded agroforestry company specializing in the sustainable production, processing, and export of forest-based commodities sourced from tropical rainforests. Contact: CEO / Founder. June 2021.

6.2 Guide for Semi-Structured Interviews

Interviewee organization	
Interviewee name + title	
Interviewee email	
Date of interview	
Time of interview	
Recorded? (Y/N)	
Available for follow-up? (Y/N)	

A. Introduction

As mentioned over email, our conversation today will focus on the financial products you use to invest in tropical forests. I'll start with a few brief background questions, but our main discussion will cover 3 topics: (1) the financial tools and strategies you use today, (2) lessons learned from your initial approach to climate finance, and (3) your outlook on the future of climate finance. As a reminder, all of your responses today will be anonymized.

B. Interview

1. Background	
Name	
Organization	
Title	
Description of role / team	
2. Current-State Review	
• What products do you use and why? • What products don't you use and why? • What product attributes are most important to you? • How do you define "effective"? How do you measure it?	•

3. Past Lessons Learned	
• If you could go back in time, what would you do differently in terms of designing or selecting products?	•
4. Future-State Analysis / Outlook	
• What attributes would your ideal product have? • What products are new or in development? • What's still missing?	•
5. Conclusion	
Is there anything else you would like to share which we did not cover?	•
Is there anyone else you recommend I speak with? (+ contact info / intro)	•
Can I contact you with follow-up questions?	•
Do you have any other questions for me?	•

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