Sustainable Agriculture Finance Facility

LAB INSTRUMENT ANALYSIS
September 2020

DESCRIPTION & GOAL —
The only credit vehicle tailored to scaling up the adoption of integrated crop-livestock-forest systems in Brazil, with potential to improve livelihoods and support the country's NDCs

SECTOR —
Land Use, Sustainable Agriculture

FINANCE TARGET —
Private debt investors, multilateral organizations, NGOs and philanthropies

GEOGRAPHY —
For pilot phase: South-Central and Northeast regions of Brazil
In the future: Entire Brazilian territory

The Lab identifies, develops, and launches sustainable finance instruments that can drive billions to a low-carbon economy. The 2020 Global Lab cycle targets four specific sectors across mitigation and adaptation: nature-based solutions; sustainable agriculture for smallholders in sub-Saharan Africa; sustainable energy access; and sustainable cities, as well as three regions: India, Brazil and Southern Africa.

AUTHORS AND ACKNOWLEDGEMENTS

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CLIMATE POLICY INITIATIVE

SUMMARY

The Sustainable Agriculture Finance Facility (SAFF) is the only credit fund and virtual marketplace that unlocks green capital to foster the adoption of Integrated-Crop-Livestock-Forest (ICLF) systems in Brazil. It provides customized bundled loans that match the farmers' reality on the ground, and takes into account social, environmental, and specific ICLF parameters.

The Lab secretariat recommends endorsing this instrument, based on the following criteria:

- **Innovation:** Though critical to Brazil's environmental and economic goals, the adoption of ICLF systems in the country is constrained by a credit system that is poorly adapted to the specific needs of sustainable agricultural practices. SAFF addresses this issue by providing loan products that cater to the risk and cash flow profile of ICLF systems, coupled with a unique specialized certification and technical assistance program;

- **Catalytic Potential:** The pilot will leverage approximately US $68 million to be deployed on 90 thousand hectares of land, mitigating 2.5 million tons of CO2 within 10 years and improving the livelihood of 900 farmers. At scale, the instrument has the potential to leverage up to US$ 1.4 billion in capital and abate 51 million tons of CO2. Moreover, ICLF allows for livelihood enhancement in safe, outdoor settings which are much needed to restart the Brazilian economy after the COVID-19 pandemic;

- **Financial Sustainability:** The instrument offers very competitive interest rates to farmers while providing market level returns to private investors. Private investors are expected to make up 63% of the capital and realize a 5.5% IRR;

- **Actionability:** Main partners are already aligned (MoUs to be signed shortly) and main target markets have been mapped (Cocamar and Rural Sustentável 2). Next steps will include fundraising and the execution of the already mapped pipeline. Proponents expect the Facility to be market-ready within a year.

TABLE OF CONTENTS

CONTEXT

ICLF can improve climate resilience and reduce carbon emissions of degraded land in Brazil, but the adoption rate is low due to lack of finance and technical knowledge.

Brazil has approximately 180 million hectares of pasture land, half of which is considered degraded and unproductive (IBGE, 2017). Because of this, the country's Nationally Determined Contributions (NDCs) include a strengthening of low-carbon agriculture practices with the goal of restoring 15 million hectares of degraded pastures and increasing the adoption of integrated-cattle-livestock-forest (ICLF) systems from 17 million hectares to at least 23 million by 2030.

ICLF is a strategy that combines different productive systems (agricultural, livestock and forests) in the same area through intercropping, succession or rotation, seeking synergistic effects between these components. The benefits of ICLF include more efficient use of land and inputs, restoration of degraded pastures, preservation of biodiversity, soil management, reduction of pressure on native vegetation and lower emission of greenhouse gases. This results in increased productivity, improving the income and livelihood of farmers. ICLF is extremely versatile and can be adapted to a large array of productive systems, biomes and property sizes.

However, despite its clear economic and environmental benefits, the adoption of ICLF in Brazil is still at a low 9.4% of the total rural area. The main reasons for this are a lack of

capacity and knowledge for implementation and a reliance on a combination of different credit lines, which are often bureaucratic, have low limits, and require high guarantees, especially for smallholders. Rural credit is very concentrated in Brazil with smallholders making up 74% of contracts of the largest subsidized public funding programs, but only 14% of the financial amount and 16% of the area.

The Sustainable Agriculture Finance Facility (SAFF) seeks to support ICLF adoption in Brazil through a combination of accessible credit lines, certification and specialized technical assistance. It has the potential to reach 13 million hectares of land within the next 10 years, leveraging the economic and environmental benefits of ICLF. Proponents ICLF Network and IABS[1] are long-standing non-profit entities that study and promote sustainable agricultural practices in Brazil. They are comprised of various private and public organizations in different tranches of the agricultural value chain.

CONCEPT

1. INSTRUMENT MECHANICS

SAFF provides a bundled credit offering that focuses on the challenges and benefits of ICLF implementation and a marketplace for certified sustainable suppliers

1.1 INSTRUMENT STRUCTURE

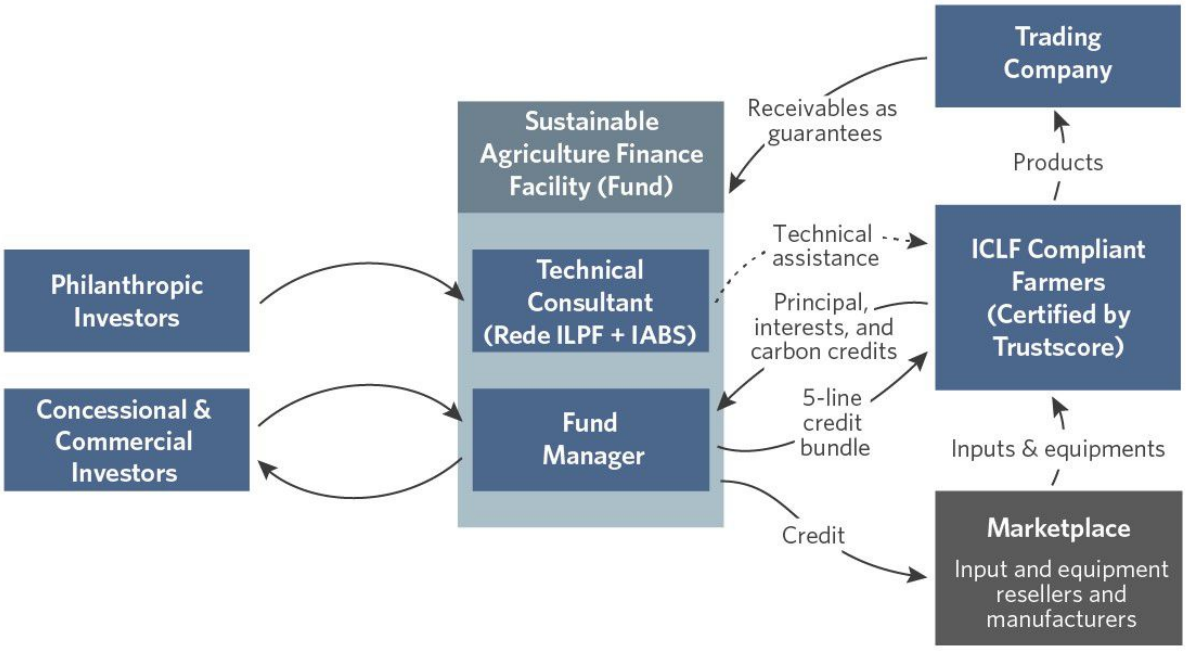

Figure 1 Instrument Structure

The instrument will consist of a credit fund to be managed by a third party. ICLF Network and IABS will act as Technical Consultants to the Fund, providing the necessary social and environmental parameters for credit deployment.

The fund will be capitalized by concessional and commercial investors, with the former assuming a "first-loss" position. Loans will be bundled into a combined credit offering,

[1] In Portuguese: Rede ILPF and Instituto Brasileiro de Desenvolvimento e Sustentabilidade

based on a management plan for ICLF implementation, developed by the Technical Consultants. This plan will be co-signed by the farmer and an accredited technical assistant, who will be co-responsible for the property's ICLF operation. The technical assistance will be funded by grants through ICLF Network and IABS.

Credit will be made available to farmers via a newly created marketplace, which will intermediate payments to ICLF-certified suppliers and resellers (see section 1.4). This prevents any transactions that are not included in the management plan, guaranteeing end-to-end traceability of invested resources. Interest rates will follow a "sliding scale" throughout the loan term in which the rate decreases as ICLF adoption increases.

The instrument will offer terms that are more favorable than the standard bank offering for rural credit, while still avoiding competition with subsidized lines (which offer very low-interest rates, but are virtually inaccessible to the majority of farmers). This will be achieved by focusing on unfinanced opportunities for farmers who have limited access to subsidized credit lines. ICLF-compliant farmers will repay part of their loans through carbon credits, which will be priced and marketed by SAFF or absorbed by end-investors.[2]

All transactions are monitored, time-stamped and tracked via blockchain (a peer-to-peer compliance protocol), ensuring real-time accountability. This technology has already been developed by CEPTIS Agro[3] and will be funded through grants.

1.2 CREDIT LINES

The credit bundle offered will consist of up to 5 different lines in each operation, all environmentally certified for ICLF implementation:

Table 1: Main characteristics of the 5 credit lines

Credit Lines			
Credit Line	**Product Example**	**Initial Interest Rate**	**Term**
Short-term Land Management	Fertilizers and seeds	9%	1 year
Soil Recovery	Limestone and calcium	7%	3 years / 1 year grace period
Formation of Livestock Inventory	Cattle heads	7%	3 years
Equipment	Tractors and harvesters	7.5%	4 year
Forestry Management	Seeds	5%	7 years / 3.5 years grace period

1.3 PARTNERSHIPS

The instrument has already secured partnership agreements with some of the largest input and equipment providers to set up a lean and effective distribution structure:

- **JGP Asset Management** will be responsible for managing the SAFF Fund's credit portfolio and for setting the terms of all credit operations;

[2] To estimate the potential emissions mitigation by ICLF systems, proponents utilized FAO's Ex-ACT methodology, adapted to tropical conditions and to the specificities of ICLF productive systems.

- **Bradesco**[3], **Brazil's third largest bank**, will act as a trustee to the fund;

- **Equipment suppliers, such as John Deere,** will receive credit for on-lending from the SAFF Fund, delivering its rural equipment directly to farmers. In the case of John Deer Group, SAFF will fit within its "*Troco na Troca*" program, which provides the opportunity for farmers to "sell back" their equipment after 4 years of use. This will help shorten the length of SAFF loans, improving return for end-investors;

- **Input Resellers, such as Araguaia Fertilizantes,** will receive payment from the SAFF Fund to relay barter operations that are on average 50% more favorable to farmers than standard operations. They will be compensated through a 0.5% loan spread and will take the initial loss from its operations. Resellers have very close ties to farmers, being one of the best positioned entities to distribute and evaluate credit;

- **Trading companies, such as NuTrade (Syngenta Group),** will enter into purchase agreements with farmers and relay the product receivables stemming from these agreements to SAFF as guarantees to the loan operation. This will help establish an important layer of collateral which will improve the risk profile of the instrument;

- **Rural cooperatives, such as Cocamar,** will work in a similar function to resellers and trading companies, leveraging on their relationships with their members to distribute SAFF credit products and entering into purchasing agreements.

1.4 ICLF COMPLIANCE

In order to properly assess ICLF adoption, ICLF Network (proponents) have developed the *ICLF Property Certification Protocol* that builds upon the main international standards for sustainable agriculture and introduces new elements that provide dynamic property monitoring throughout an entire cycle. With this, continued adhesion to ICLF is assured even after certification is issued, with potential deviations and improvements being constantly highlighted. The *Protocol* results in a *Trustscore*, a 0-100 confidence index that informs the level of ICLF adoption of a given property, as well as its compliance to environmental, social and economic criteria. See Annex 1 for a visual example of this tool.

2. INNOVATION

SAFF holds a unique market position in Brazil as the only credit vehicle to focus on ICLF adoption, while its integrated certification system brings an innovative component to addressing existing barriers to farmer credit

2.1 BARRIERS ADDRESSED: ACCESS TO CREDIT AND TECHNICAL CAPACITY

SAFF addresses two main barriers to farmers' access to credit and adoption of sustainable agricultural practices:

1. **Access to credit.** Brazil's rural credit system is poorly adapted to farmers' and ICLF needs, ignoring the economic advantages of sustainable agriculture. Commercial

[3] Members of the ICLF Network

and subsidized lines demand very high levels of institutionalization from farmers as well as high collateral volumes that usually reach 120% of loans. In order to address this, SAFF will provide a credit bundle with tailored timeframes for different ICLF uptake stages. It will also offer credit-scoring based on a certification system and unique *Trustscore*.

2. **Technical capacity.** Farmers usually lack the capacity and knowledge to implement ICLF. Many of them work with a single culture, while ICLF is a multi-culture strategy. SAFF's technical assistance, along with the specialized credit bundle, will work to build the capacity of farmers to implement ICLF.

2.2 INNOVATION: ONLY VEHICLE TO FOCUS ON ICLF ADOPTION

SAFF is the only credit vehicle to focus on the adoption of ICLF practices in Brazil. While other existing rural credit lines offer competitive interest rates, they are highly bureaucratic, limiting farmer access, and do not offer technical assistance for sustainable agricultural practices. SAFF is also the only fund to have a certification system unique to ICLF, which works to evaluate/provide credit scores and monitor impact:

Table 2: Comparable Rural Credit Facilities

Comparable Instruments		
Similar Instruments	**Description**	**Differentiation**
ABC Program	Government subsidized credit line for low carbon technologies in Brazil with interest rates as low as 3%	Small producers (<400 ha) face a highly bureaucratic process and receive no technical assistance for ICLF implementation
Commercial Loans	Commercial credit from private banks, with avg. 9% interest rates	Limited offer, due to high collateral demands and need for maintaining relationship with various banks
PRONAF	Federal subsidized credit lines targeted at smallholder producers and enterprises	Highly bureaucratic process and guarantee requirements. No technical assistance for sustainable agriculture (or ICLF) implementation

2.3 CHALLENGES TO INSTRUMENT SUCCESS

As an innovative instrument in the rural credit space, SAFF may encounter some challenges and risks, mainly:

1. The risk of a **low uptake** of the credit lines, mainly due to the fact that many Brazilian farmers can be reluctant to depart from the standard agricultural and credit practices. SAFF will address this by avoiding competition with subsidized credit lines and focusing on unfinanced opportunities for small producers and partnering with rural cooperatives and equipment and input suppliers, entities that are very close to farmers and will support product distribution and credit analysis.

2. Credit lines may present **higher default rates** than expected (default rates for rural credit in Brazil are average ~1%). While the SAFF Fund's bundled structure will consist of five credit lines that stagger out and coincide with the ICLF cash flow profile, proponents ICLF Network and IABS will provide technical assistance to reduce the risk of production loss (lowering farmer revenue risk). The instrument will also have an

internal default provision, assuming default rates conservatively higher than historical ones (at 1.4%) and providing a cash flow buffer for investors. Moreover, a blended finance structure with concessional capital taking a "first loss" position will be utilized.

3. Products may **not reach the market** due to a lack of linkages and internal capabilities. To address this, the instrument will develop value added capabilities and partnerships with corporate off-takers and other market actors.

4. **Carbon credits** generated may fluctuate in price and/or face certification challenges. Firstly, the returns presented in this report do not account for the economic benefits of the carbon credits. Moreover, to mitigate this risk, proponents will fit the carbon methodology developed (see Annex 2) to the Verified Carbon Standard (VCS) and will then submit it to UNFCCC's Sustainable Development Mechanism (SDM), to ensure proper carbon certification.

MARKET TEST AND BEYOND

3. IMPLEMENTATION PATHWAY AND REPLICATION

The pilot will target 90 thousand hectares of land and mobilize USD 68 million in capital

3.1 PILOT CONTEXT

The pilot for the instrument will be developed in 2 distinct regions of Brazil to capture part of the diversity of biomes and the needs for ICLF implementation in the country. Initially, the instrument will target farmers that already have some area of ICLF implemented. Each region has its own natural and institutional characteristics, which are addressed by the instrument:

1. **States of Paraná, São Paulo and Mato Grosso do Sul.** This area is comprised mainly of the *Mata* Atlântica biome, a forest system that extends along the Atlantic coast of Brazil. It will be developed in partnership with Cocamar, one of the largest rural cooperatives in Brazil, with over 15 thousand farmers and 1.5 million hectares of pasture land. This is one of the most developed rural areas of Brazil, both technologically and institutionally. For this region, the pilot will target 600 farmers with 100 hectares of ICLF implementation each, totaling 60,000 hectares.

2. **States of Goiás, Minas Gerais and Mato Grosso.** This area is comprised mainly of the *Cerrado* biome, a vast tropical savanna ecoregion that occupies the central portion of Brazil. It will be developed in partnership with the Rural Sustentátavel 2 Program, a comprehensive sustainability program being implemented by ICLF Network and IABS. Farmers that have already adhered to the program are much more welcoming of ICLF practices and demonstrate high levels of sustainability and governance. For this region, the pilot will target 300 farmers for 100 hectares of ICLF implementation each, totaling 30,000 hectares.

The average area for ICLF implementation for each region is estimated at 100 ha (25% of the average total area of 400 ha). While the volumes for each line may vary between operations, it is expected that, on average, each hectare will demand US$ 690 for the implementation of ICLF. This leads to a total loan portfolio of US$ 62 million, plus a technical assistance budget of US$ 6 million, adding up to a total capitalization of US$ 68 million.

3.2 IMPLEMENTATION PATHWAY

The pilot is expected to reach full implementation within one year, with the following events as main milestones:

1. Set-up of SAFF Fund structure and closure of supporting contracts (management, back-office etc.)
2. Set-up of technical assistance plan by ICLF Network and IABS
3. Closure of agreements with key partners
4. First round of funding for SAFF Fund with concessional and philanthropic investors
5. Second round of funding with private investors (concessional capital assumes a first-loss position)
6. Phase-out of concessional capital

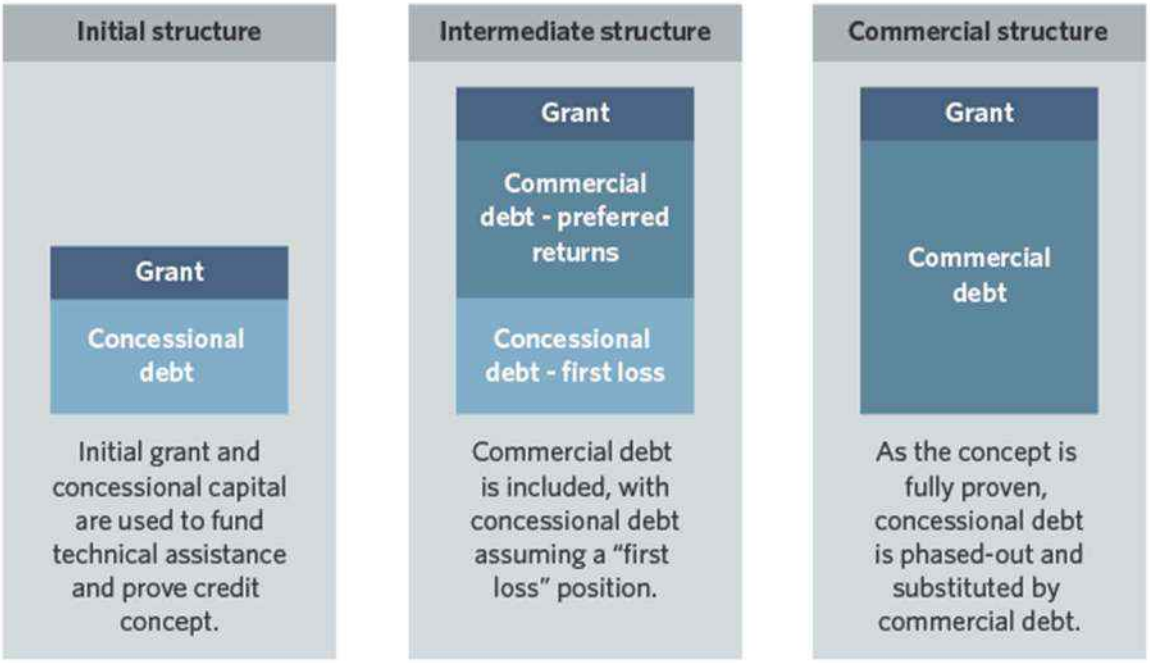

Figure 2 Pathway to financial sustainability

The main challenges for the implementation of the pilot relate to:

1. Its adaptation to various biomes and ICLF scenarios in Brazil. The instrument seeks to address this by matching key information provided by local rural cooperatives to Embrapa's (Brazilian Agricultural Research Corporation) own database and experience in ICLF implementation techniques.

2. A risk of low client adoption. This issue is being addressed through the set-up of various partnerships and different levels of the instrument, which will help ensure that its value proposition is heard and understood by potential clients.

3. The COVID-19 pandemic, which might cause delays in securing partnerships and funding. So far the proponents have been successful in developing partnerships and are in advanced conversation with multiple funding sources (see section 3.3). The instrument addresses multiple aspects of a green recovery for Brazil, which could help fundraise in the current challenging environment.

3.3 SAFF – FUNDO VALE

In parallel to the pilot presented above, SAFF is discussing an exclusive facility for Fundo Vale, an investment fund owned by Brazilian mining company Vale do Rio Doce that has the goal of restoring 100 thousand hectares of degraded land in 10 years. The same methodology and structure of the pilot will be applied, with a higher focus on the forestry component, in compliance with Fundo Vale's mandate.

4. FINANCIAL IMPACT AND SUSTAINABILITY

4.1 QUANTITATIVE MODELING

4.1.1 COMPARISON TO BUSINESS AS USUAL SCENARIO (BAU)

A typical hectare of productive pasture land in the Cerrado and Mata Atlântica regions of Brazil has 0.8 cattle heads and generates US$ 36.80 every year. The practice of extensive cattle ranching without forest management leads to the degradation of pasture lands, with CO2e emissions reaching 2.5 tons/ha/year.

Farmers who seek to improve on this condition, either by simply recuperating degraded pastures or fully implementing ICLF, find extensive bureaucracy and high collateral requirements in local credit products. Barter operations (advancement of future production in return for agricultural inputs) typically embed 20% yearly interest rates, whereas Brazil's current treasury-rate is 2%.

Table 3: Comparison of Different Rural Productive Systems

Item	Business-as-Usual	Restoration of Degraded Pasture	ICL Integrated Crop-Livestock	ICLF Integrated Crop-Livestock-Forest
Revenues (R$/ha/year)	193.80	624.67	937.01	960.72
Revenues (US$/ha/year)	36.8	118.5	177.8	182.3
% of Livestock Area	100.0%	67%	50%	50%
Cattle heads/ha	0.80	1.20	2.40	2.40
Beef Production/ha/year (kg)	57.08	208.15	179.38	179.38
Crop Production/ha/year (kg)	-	-	975.08	975.08
Wood Production/ha/year (kg)	-	-	-	490.31
CO2 Emission/ha/year (t)	2.50	-1.35	-2.02	-2,83

Although the increase in cattle productivity, from 0.8 to 2.4 heads per hectare, may lead to higher emissions in itself, the proper management of the pasture area leads to a high amount of carbon being sequestered from the atmosphere and stored in the soil. In many cases the concentration of carbon in ICLF pastures is higher than in indigenous forests under the same natural conditions.

4.1.2 MODEL INPUTS AND METHODOLOGY

The instrument is modelled as a 10-year revolving credit facility with 5 lines of credit, one for each type of product being financed (see section 1.2). The average loan sizes and terms for each line reflect the specific needs of the rural cooperative as well as the requirements for ICLF implementation, according to Embrapa (Brazilian Agricultural Research Corporation).

The interest rates are set to provide competitive terms to farmers, while fulfilling the return expectations of private and concessional investors. Farmers have the opportunity to decrease these rates as their *Trustscore* improves, demonstrating increased adoption of ICLF practices. Expected default rates were obtained from a research of sector averages, with specific considerations for ICLF adoption and contributions from input providers and resellers. The main inputs used for each of these lines are described in the table below:

Table 4: Main Inputs of the Financial Model

	Short-term Land Management Loans	Soil Recovery Loans	Formation of Livestock Inventory Loans	Equipment Loans	Forestry Management Loans
Avg. Loan Size (US$/ha)	346	94	283	94	755
Term (years)	1	3	3	4	7
Initial Interest Rate to Producers (% p.a.)	9.0%	7.0%	7.0%	7.5%	5%
Final Interest Rate to Producers (% p.a.)	7.4%	5.7%	5.7%	6.1%	4%
Avg. *Trustscore* (year 1)	50	50	50	50	50
Avg. *Trustscore* (year 10)	95	95	95	95	95
Default Rate (% p.a.)	1.4%	1.4%	1.4%	1.0%	0.5%
Technical Assistance Cost (US$/ha)	7.6	7.6	7.6	7.6	7.6
Initial Portfolio Size (US$)	31 million	2.8 million	17 million	8.5 million	2.7 million

4.2 PRIVATE FINANCE MOBILIZATION AND REPLICATION POTENTIAL

The fund is expected to raise USD 68 million, 25% from concessional investors, 63% from private investors and 12% from philanthropic entities. While private and concessional investors are expected to fund the loan portfolio, grants will be targeted to fund the technical assistance program managed by IABS, that will accompany all loan operations. With COVID-19 putting considerable pressure on public budgets, it is more crucial than ever for the climate-finance sector to develop instruments that are be able to mobilize private finance.

Table 5: Types of Capital Targeted and Returns

Type of Capital	Amount for Pilot (US$)	Return Rate (% p.a.)[4]	Use of Proceeds
Concessional Debt	18.3 million	12.2%	Loan portfolio
Private Debt	43.5 million	5.5%	Loan portfolio
Grants	6.2 million	-	Technical Assist. + Monitoring and Certification
Total	**68 million**	-	-

Once a proof of concept has been reached and the pilot is able to provide suitable returns for both concessional and private investors, the instrument will be replicated in other areas of Brazil, such as the North and Northeast, where conversations with local rural cooperatives, such as Cooperativa Nordestina, have already begun. At scale the instrument would reach 500 thousand hectares with a total capitalization of US$ 380 million. Brazil is expected to add at least another 13 million hectares of ICLF land over the next few years. Considering that ~15% of this land fits within the profile of the fund leads to a replication potential of 1.8 million hectares and a portfolio of US$ 1.4 billion. Moreover, because of ICLF's versatility, SAFF can be easily exported outside of Brazil.

5. ENVIRONMENTAL AND SOCIAL IMPACT

SAFF is expected to mitigate 2.5 million tons of CO2 in 10 years and increase farmer income by more than 130%

5.1 ENVIRONMENTAL IMPACT

The emission rates for a typical cattle ranching property in Brazil (BAU) are 2.5 tCO2e per hectare per year (see section 4.1 and Annex 2), leading to 250 tCO2e per year for 100 ha. By adopting an integral ICLF system, instead of emitting these 250 tons, the integration will turn the property into a net sequester of 2,400 tCO2e every year. Partial adoption of the ICLF systems that do not include the Forestry component would result in a mitigation of 283 tCO2e per year.

Considering that the pilot portfolio of US$ 68 million will be able to convert 90,000 hectares of land to ICLF practices, the instrument would abate 2.5 million tCO2e in 10 years, with each 1 thousand dollars of investment (public and private) leading to 41 tCO2e abated. The environmental benefits of ICLF also include more efficient use of land and inputs, restoration of degraded pastures, preservation of biodiversity and a reduction of pressure on native vegetation.

5.2 SOCIAL AND ECONOMIC IMPACT

The adoption of ICLF systems leads to higher agricultural yields, growing revenues almost 5-fold, from US$ 37 to US$ 178 per hectare per year. It is expected that farmers will be able to apply ICLF on up to 25-35% of their average 400-hectare properties, which leads to a potential income increase of 134%. Moreover, the diversification and sustainable agriculture practices applied in ICLF systems help lower production risk and ensure a more stable source

4 Real IRR per annum in Brazilian R$

of income for farmers. Brazil's economy has suffered amidst COVID-19, and systems that allow for livelihood enhancement in safe, outdoor settings are much needed.

The social structure and functioning of small and medium properties rely heavily on the participation of women. The instrument will enhance women's participation through specific communication activities.

By promoting environmentally sustainable agricultural practices while also improving the income levels and livelihoods of rural populations, the instrument mainly addresses the Sustainable Development Goals (SDGs) numbers 2 – Zero Hunger, 13 – Climate Action, 15 – Life on Land and 5 – Gender Equality.

NEXT STEPS

The instrument will move on to securing the appropriate funding for its initial pilot, as well as closing the partnership agreements mentioned above, with the goal of developing the pipeline. Proponents are in advanced conversations with funding sources and partners, with more work needed on the set-up of day-to-day operations. The closure of the first SAFF Fund should happen within a year, along which the proponents will finish setting up the structure for the instrument.

Brazil's economy has been severely affected by COVID-19. Due to its multiple environmental and social benefits (addressing 4 SDGs), SAFF has the potential to help the country promote a green recovery.

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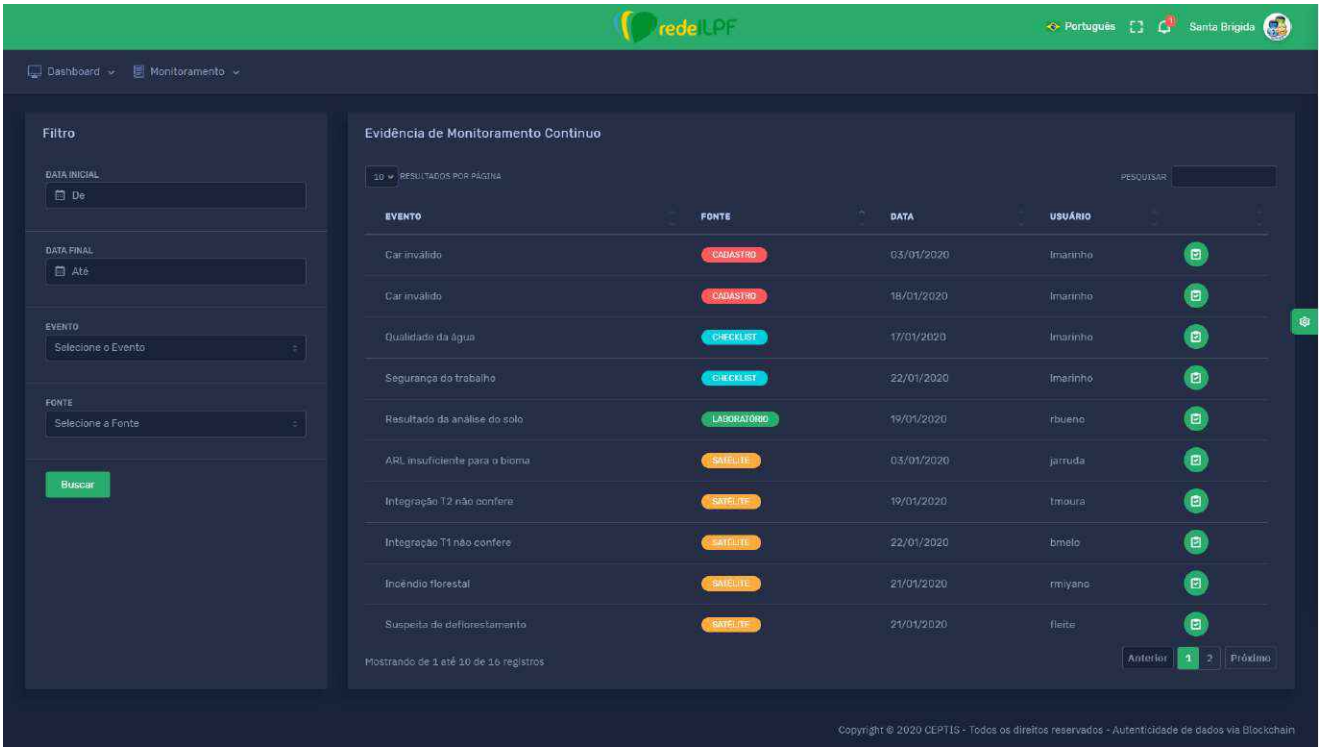
ANNEX 1 – EXAMPLES OF TRUSTSCORE SYSTEM



ANNEX 2 – CARBON METHODOLOGY

The carbon calculation for the instrument is taken from different methodologies and reference tools provided by the Intergovernmental Panel for Climate Change (IPCC) and the Clean Development Mechanism (CDM). These methodologies establish detailed procedures, providing the necessary guidance to help project developers determine the limits of carbon quantification, define baselines, evaluate additionality and, at last, quantify mitigated GHG emissions.

These reductions stem from sustainable land management practices, including variations of carbon stored in soil, aerial biomass (grass and trees), restoration of degraded pastures, among other components based on applicable biogeochemical models. However, none of the existing methodologies are applied to tropical biomes and/or focuses on Integrated-Livestock-Forest (ICLF) technologies.

Thus, in order to provide a comprehensive carbon assessment, the calculations involving ICLF systems must group different methodologies and reference tools, that are specific to each ICLF component. The main tools used are listed below and were grouped using the statistical programming software R (example in figure below):

- General Guidelines for Sampling and Surveys for Small-scale CDM Project Activities;
- Tool for Estimation of Carbon Stocks and Change in Carbon Stocks of Trees and Shrubs in A/R CDM Project Activities;
- Tool for Identification of Degraded or Degrading Lands for Consideration in Implementing CDM A/R Project Activities;
- Tool for the Demonstration and Assessment of Additionality in VCS Agriculture, Forestry and Other Land Use (AFOLU) Project Activities.