WRI BRASIL

TECHNICAL NOTE

VERENA INVESTMENT TOOL: VALUING REFORESTATION WITH NATIVE TREE SPECIES AND AGROFORESTRY SYSTEMS

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EXECUTIVE SUMMARY

Is reforestation with native tree species and Agroforestry Systems a viable business? The great challenge faced by reforestation with native Brazilian tree species, agroforestry systems and restoration lies in moving from the pilot project phase to a larger scale, and then to mainstreaming. To answer this question, we turn to the global capital market. There is a risk and return track record of more than 100 years for several asset classes and publicly traded companies. Moreover, it is possible to find and produce information on how these various asset classes correlate with each other, with economy and inflation, that is, the level of information is large enough for investment decision making given its profile risk and return. Although native Brazilian tree species have existed for thousands of years, and despite some good commercial experience with them, we have no history of this asset class from the capital market standpoint. In this way, building the ongoing business cases in Brazil with native trees and agroforestry systems is fundamental to create this track record and make it possible for reforestation with native species and agroforestry systems to gain scale and reduce risk perception.

This technical note presents the Economic Valuation of Reforestation with Native Species (VERENA) tool, a model framework based on 12 investment cases developed by WRI Brasil in partnership with UICN Brazil and contribution of several organizations and colleagues. The goal of the VERENA Project is to fill the gap of knowledge on reforestation and agroforestry systems and assess returns on investments and other relevant information, in order to better inform investors, policy makers and analysts interested in using

CONTENTS

WRI Technical Notes document methodology underpinning research publications, interactive applications, and other tools.

Suggested Citation: Batista, A., Prado, A., Pontes, C., Matsumoto, M,. 2017. "VERENA Investment Tool: Valuing Reforestation with Native Tree Species and Agroforestry Systems". Technical Note. São Paulo, Brasil: WRI Brasil. Available online at: www.wri.org/publication/verena-investment-tool.

native species and agroforestry systems for economic use. The Verena tool was developed with the support of several partners and audited by Amplix apps for business. The use of this tool may help to mainstream risk-adjusted returns investments into forest restoration and reforestation projects. The target users of the VERENA valuation tool are investment analysts, land owners, financial institutions, and policy makers. The model allows for the assessment of returns from any kind of biological asset, such as the reforestation with single or multiple native species and agroforestry systems with different combinations of tree species and permanent and annual crops.

This technical note is organized in three main parts: (a) introduction and main concepts, (b) methodology with the structure, the input data sources, model simulation and main results, and (c) Final remarks and conclusion.

1. INTRODUCTION

One of the objectives of the Paris Agreement on Climate Change in 2015 was to drive ambitious efforts to limit the average global temperature increase to 2.0°C by the end of this century. It is now more important than ever to capture carbon and reduce emissions through reforestation of degraded lands and forests, to move towards low carbon agriculture, and to reduce deforestation and forest degradation. These are among the most cost-effective ways to mitigate global warming[i;ii;] while ensuring biodiversity conservation, provision of environmental services, and jobs and income opportunities. Given this context, the time to act on this agenda is now.

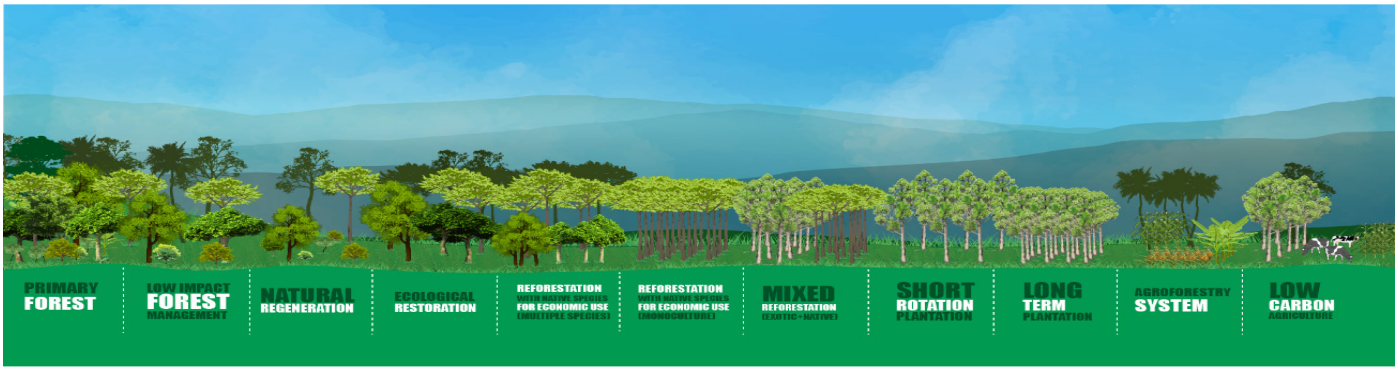
The Economic Valuation of Reforestation with Native Species (VERENA - "*Valorização Econômica do Reflorestamento com Espécies Nativas*"[1]) project aims to increase the scale and promote reforestation with native species and agroforestry systems, as one of the most cost-effective and short-term solutions to address climate change mitigation and adaptation. The VERENA project analyzes business opportunities with native tree species and agroforestry systems (AFS) in Brazil to create a portfolio of attractive economic models for investors.

Institutional investments in mainstream reforestation today represent an industry of US$ 100[iii] billion in the US and US$ 35 billion in Brazil. Despite the size of the mainstream reforestation industry, investment with native tree species is close to "zero". According to FAO[iv] data, of the 4 billion hectares of forests that cover 1/3 of the world's land area, only 264 million hectares are planted forests. To meet the growing demand for timber, 100 million hectares of forest plantations may be needed by the year of 2050, resulting in 2 billion cubic meters more than current production of 1.5 billion cubic meters per year. These figures are based on business as usual, with growth in demand for wood of 1.5% per year. In a low carbon economy scenario with replacement of the products of fossil origin[v] by wood, the growth may reach 4% per year, totaling a demand for wood of 10 billion m^3 per year in 2050[vi]. The demand for tropical tree species still faces a great uncertainty on the demand side due to the illegal commercialization of wood. It is estimated that 50% of tropical timber traded in the world comes from illegal origin, and in the Brazilian Amazon can reach 70%. Estimates of timber production in the Amazon according to the Brazilian Forest Service[vii] is 13 million m^3 per year, generating BRL 8 billion (1USD = 3,15 BRL) in annual revenue and 200 thousand jobs. Also, on the demand side, it was observed a reduction 40% in timber production in the last 10

years in the Brazilian Amazon. This scenario shows the enormous challenge for tropical forests, and a great opportunity to produce native tree species in silvicultural systems. However, to develop a new tropical forest economy, it is necessary to combat the illegal timber trade to prevent unfair competition regarding costs (tax evasion, labor costs, harvest, among others) and market price defined by the illegal loggers that represents 70%[viii] of the market. The good news is that the civil society and the private sector are engaged in stifling the illegal timber trade through the Brazilian Coalition on Climate, Forests and Agriculture[2].

All real assets can be valued and the key to investing and managing those assets is to understand the source of the value. In addition, the investment tool also provides a framework to value natural capital, internalizing the positive externalities of the business. Neglecting the value of natural capital is one of the greatest limitations on valuation methods today[ix], although there is a very prominent methodology to value ecosystem services, which has been developed by TEEB (The Economics of Ecosystem Services). In the case of VERENA, a valuation spreadsheet was designed to value forest-related assets. The different assets being evaluated in the VERENA project can be translated onto the "forest continuum" concept. The forest continuum presents the different typologies of land use (Figure 1), from primary forests to low carbon agriculture. Although it is not possible to establish a discrete line between the different typologies, it is important to understand that each one has a set of products and services with the greatest potential to meet the demands of society.

Figure 1 | **The forest continuum and typologies of VERENA business cases.**



2. Symbiosis
5. Faz. Santo Antônio

1. Amata
7. Jaíba II

3. Faz. Toca
4. TNC Cacau
6. Jaíba I
8. Futuro Florestal I
9. Futuro Florestal II
10. Sucupira
11 Ituberá
12. CAMTA

Henry Ford said, *"A Business That Makes Nothing but Money Is a Poor Business."* The novelty of the valuation tool is the ability to do a complete valuation of the financial *and* natural capital of such projects. The many valuation tools available for public use[x; xi; xii; xiii] allow users to assess only the financial capital. The assessment of the natural capital is ultimately important to stimulate new markets and mobilize policy makers and investors in the reforestation agenda.
The target users of the VERENA valuation tool are investment analysts, land owners, financial institutions, and policy makers. The main objectives of VERENA are to support investment decision-making and to mobilize equity and debt capital markets, contribute to the Brazilian NDC [Nationally Determined Contributions goals set in the Paris Climate Agreement in 2015] target to restore and reforest 12 million hectares of degraded lands and forests by 2030, and support landowners interested in investing in reforestation for economic use. For each different stakeholder, the valuation tool will provide different insights, and its use requires a reasonable level of skill in accounting and finance and good knowledge of this business segment.

2. METHODOLOGY

2.1 Source of information

The VERENA valuation tool was built and calibrated based on information from 12 (Table 1 and Appendix 1) different investment cases already established in Brazil, selected from a list of several cases based on a set of criteria (see below). Those 12 cases are among the most mature and large-scale experiences found in the country. Additionally, those responsible for the 12 business cases were willing to share all the information necessary to run the robust valuation model developed by the VERENA project team and make the results publicly available.

The criteria used to select the 12 investment cases followed the methodology to answer five key questions: i) Does it have a clear commercial purpose selling products with a established market?; ii) Is it scalable?; iii) Could it be replicated elsewhere, especially in degraded areas?; iv) Does it have positive externalities[3] for natural capital?; and v) Does it promote social and economic wellbeing?

Table 1 | **List of the 12 investment cases of Verena**

CASE		YEAR OF PROJECT INCEPTION	AREA (HA)	TIPOLOGY	SPECIES	LOCATION
1	AMATA	2008	3991	Reforestation Monoculture	Paricá (*Schizolobium amazonicum*)	AM/Paragominas/PA
2	SYMBIOSIS	2011	494	Reforestation Multispecies	Native sp (26)	MA/Porto Seguro/BA
3	FAZ. da TOCA	2012	5 (2012) + 265 (2018)	Agroforestry	Citrus + native sp (5) + crops (3)	MA/Itirapina/SP
4	TNC - SAF cacau	2014	312	Agroforestry	Cocoa + banana + native sp (5) + crops (2)	AM/São Félix do Xingu/PA
5	FAZ. SANTO ANTONIO	2013	13	Reforestation Multispecies	Native sp (11)	MA/Araras/SP
6	FAZENDA JAÍBA I	2007	15	Agroforestry	Brazilian mahogany + banana	CE/Jaíba/MG
7	FAZENDA JAÍBA II	2007	5	Reforestation Monoculture	Brazilian mahogany	CE/Jaíba/MG
8	FUTURO FLORESTAL I	2009	5	Agroforestry	Peach palm + native sp (4)	MA/Garça/SP
9	FUTURO FLORESTAL II	2010	8	Agroforestry	Coffee + native sp (4)	MA/Garça/SP
10	SUCUPIRA AGROFLORESTAL	2015	45	Agroforestry	Native sp (5) + crops (13)	MA/Valença/BA
11	AGRO INDUSTRIAL ITUBERÁ	2015	60	Agroforestry	Cocoa + rubber tree + banana	MA/Ituberá/BA
12	C.A.M.T.A	2008	39	Agroforestry	Cocoa + Açaí + native sp (4) + crops (4)	AM/Tomé-Açu/PA

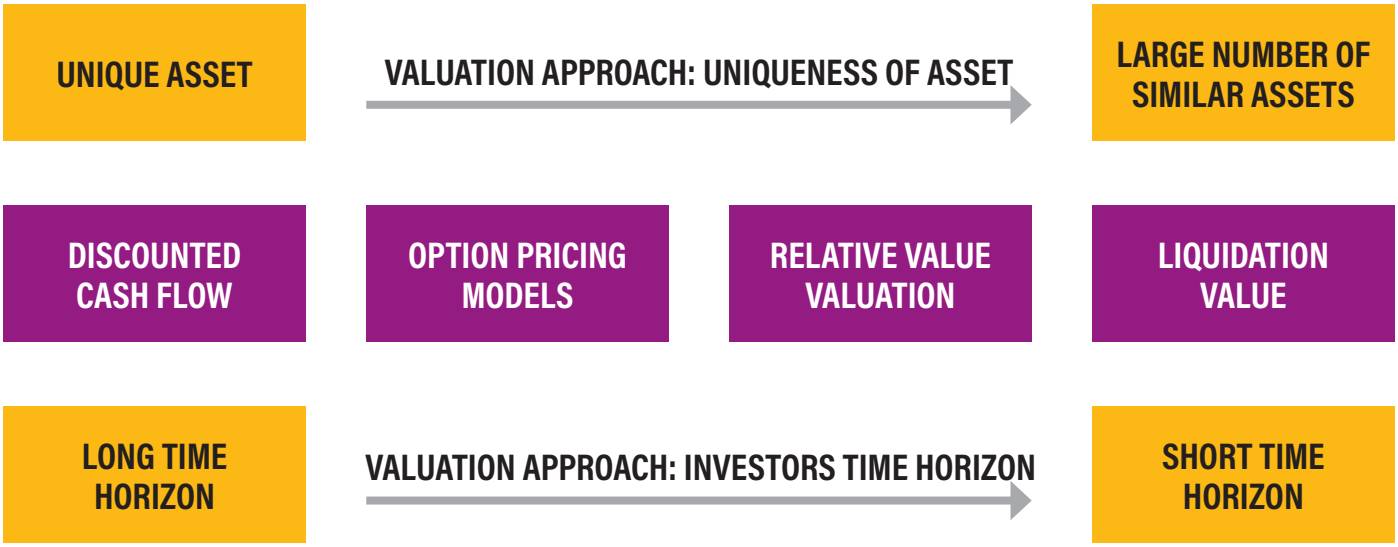
(case = name of the investor; Year of Project Inception column = date of the earliest operation; Area = the total planted area of the project; typology = describes the type of asset (monoculture = 1 native tree species; multispecies = more than 1 tree species; Agroforestry = at least 1 tree species combined with at least 1 crop); species = general information of name and number of species within the asset; and Biome / Municipality / State = AM for Amazon; MA for Atlantic Forest; CE for Brazilian Savana .

Source: authors.

2.2 Why valuation and how is performed

An asset can be valued for several reasons and the valuation approach will change as needed. The valuation approach proposed by Aswath Damodaran[xiv] at the New York University takes into consideration the uniqueness of the asset and time horizon (Figure 2).

Figure 2 | **The valuation method used (middle row) based on two constraints: the uniqueness of the asset and investors time horizon.**



Source: modified from Aswath Damodaran.

The liquidation value is useful to rapidly value distressed firms, whilst option pricing models and relative valuation models are simpler and less complex to use when compared to the discounted cash flow method. Additionally, discounted cash flow method is used when there is a lack of comparable firms and the asset being valued is a greenfield project. It means that the value will come incrementally from future cash flows, which should be discounted at the cost of capital.

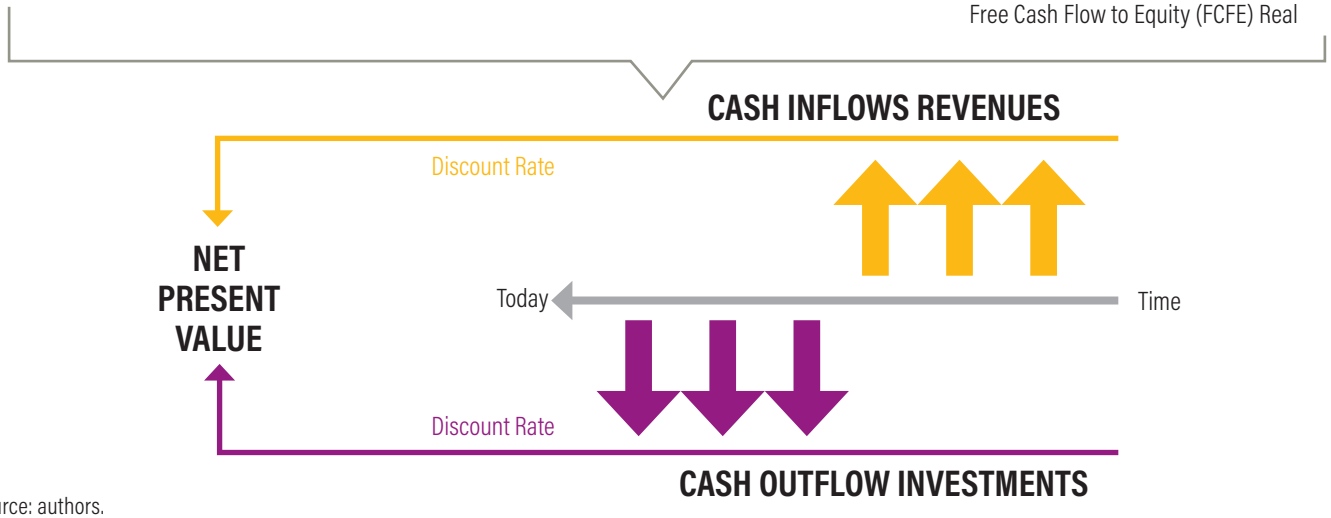
As the assets of the business cases described in this publication are remarkably unique and have a long time horizon (ranging from 7 to 35 years), we used the discounted cash flow method to build the "VERENA investment tool".

The tool consists of a spreadsheet to assess economic valuation of reforestation and agroforestry systems through the discounted cash flow (DCF) method (Figure 3). The DCF method creates forecasts of the income statement and the cash flow statement. These are shown in brief in Figure 3 below. The forecasts can go on for any length of time, and the cash flows are discounted back to the present day by using a discounted rate.

Figure 3 | **Income and cash flow statement. on the left side is described the accounting principles to build a cash flow from income statement to the statement of cash flows. The number from 1 through 20 can be used to seek the flow from the results all the way from revenues to free cash flow. On the botton, is a representation of what a discounted cash flow is..**

INCOME STATEMENT (DRE)	
(1)	Gross Revenue
(2)	Sale Taxes (PIS / COFINS)
(3) = (1) - (2)	Net Revenue
(4)	Cost of Goods Sold / Depletion/ Exhaustion (COGS)
(5)	Depreciation
(6)	Selling, General and Administrative Expense (SG&A)
(7)	Interest Payment
(8) = (3) - (4) - (6)	EBITDA
(9) = (8) - (5)	EBIT
(10) = (9) - (7)	EBT

CASH FLOW		
(11)		Taxes from Operating Profits
(12) = (10) - (11)		Net Operating Profit after Tax (NOPAT)
(13)		Land Sale
(5)		Depreciation
(14)		Exhausion / Depletion
(15)	(+/-) Δ	Working Capital
(16)		Capital Expenditure (Capex)
(17) = (12) + (13) + (5) + (14) ± (15) - (16)		Free Cash Flow to Firm (FCFF) Nominal
		Free Cash Flow to Firm (FCFF) Real
(18)		Debt
(19)		Amortization
(20) = (17) + (18) - (19)		Free Cash Flow to Equity (FCFE) Nominal
		Free Cash Flow to Equity (FCFE) Real



Source: authors.

The income statement reports on revenues and expenses of a firm over a period (in this case one year). Investors examine a firm's income statement for valuation purposes while lenders ascertain the firm's ability to fulfill interest and principal payments of its debt. The cash flow statement provides information beyond that available from the income statement: it states the cash used from the operating activity (e.g. payment of income taxes); cash for investment (e.g. acquisition of a fixed asset) and the cash for financing activities (e.g. principal payment). The free cash flow to firm (FCFF) is a measure of the cash available for discretionary purposes to all investors, both equity and debt holders. The free cash flow to equity (FCFE) is the cash available only to the equity investor, after debt obligations have been met.

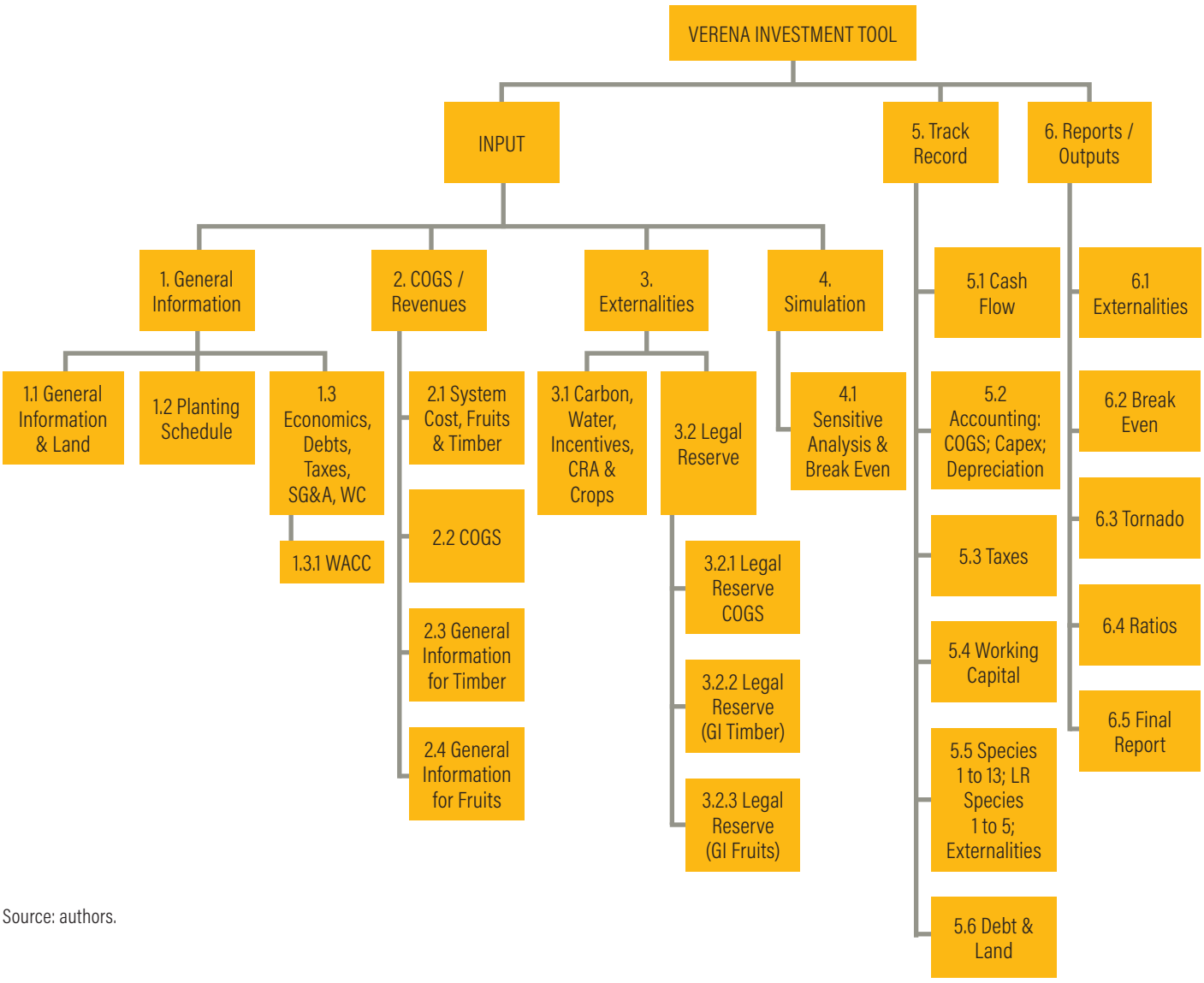
The cash flow statement is the heart of the discounted cash flow model. For example, costs for establishment and maintenance of the forest stand are examples of cash outflows; and revenues from timber sales are examples of cash inflow. It is important to follow accounting principles for the cost curve, such as capex, depreciation and depletion (for forest stands) because they have different flows through income statement and cash flow. All input variables in the model are used to fulfill the "*bottom line*" or net income.

Moreover, the income statement and the cash flow statement are used in capital budgeting. This is a process to make corporate decisions such as mergers and acquisitions, and investing in new projects. In the case of new projects, this process consists of finding the economic value (or risk-adjusted return) of new projects through the Net Present Value (NPV) discounted at the firm' s cost of capital. There are several indicators to support investment decisions that will be described in the following section.

2.3 The Model

The general inputs in the model are parametrized for the valuation of investment cases. Each step in the model is described in this section. The VERENA valuation model has an **input section** that feeds information to the income and cash flows statements. Additionally, in the track record section, it is possible to see every calculation and financial methods used, as well as the results in the **report section** (Figure 4). This is key to provide transparency in the calculation process to the users.

Figure 4 | **Flow of information used in the discounted cash flow model – the "verena investment tool" begins with: i) General Information and the cost of capital to use as discount rate; II) the inputs of costs and revenues; III) inputs of the positive externalities of the natural capital; IV); simulations; V) Track Record [all calculation records from inputs to reports]; and VI) Reports.**



Source: authors.

2.4 Model Description

The proposed methodology was used to build an interactive spreadsheet tool (Microsoft Excel©, 2013 – 32 bits or higher version, for Windows – IMPORTANT NOTE: this tool does not run on Mac). The interactive tool has an input interface (Figure 5) with four sections of inputs and one section for reports and results. Additionally, the user can navigate through the Excel spreadsheets to verify any calculation done from the inputs towards the cash-flow results. The details of every input, calculation, reports, and results are explained below with screenshots of examples of valuations.

The General Information section of the asset being evaluated includes the following information: [1.1] The time horizon; name of the company; project size in hectares; price of land leased or purchased; sale of the land asset at the end of the project; real appreciation of land. [1.2] Annual planning for planting operation and acquiring land. [1.3] Exchange rate for Brazilian Reais and US Dollars; discount rate; Sales, General and Administrative expenses; working capital; leverage; and taxes. [1.3.1] Expected return based on cost of capital models (Capital Asset Pricing and Weighted Average Cost of Capital).

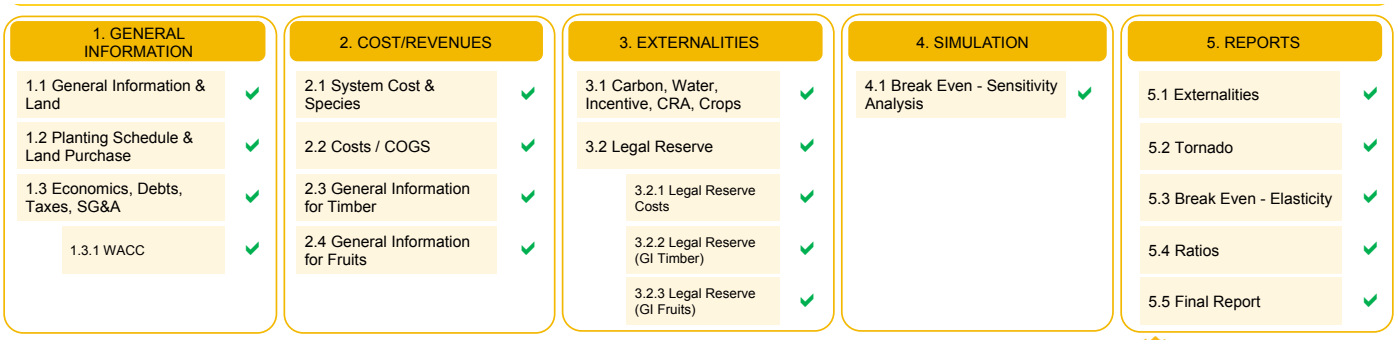
The Cost and Revenues section refers to information on costs and revenues for timber and fruits (non-timber such as annual crops; permanent crops; seeds; nuts and others). The analyst can add thinning in timber operations, but it is important to input the year and intensity in terms of volume as this information depletes the biological asset. For general information on fruits, it is important to specify correctly when the species starts and ends production, as this information is used to divide the cost curve of each species into Capex, Costs of Goods Sold and depreciation.

The Externalities section refers to the valuation of externalities from natural capital, which can be understood as new streams of revenues from natural capital, such as carbon credits, payment for water services; CRA easement (Environmental Reserve Quotas); and the economic and sustainable management of the Legal Reserve Area. The valuation of the natural capital and ecosystem services proposed by TEEB could trigger investments in forest restoration and reforestation by adding new streams of revenues and bringing income and diversification to the landowners. The proposed tool uses an Income Statement approach (revenues – costs – opportunity costs).

The sensitivity analysis section uses the maximum and minimum value of the Internal Rate of Return (IRR) from the changes made on each variable in the model in relation to the base values input in sections 1, 2, and 3. There is also break-even analysis, in which the model changes every variable individually until it reaches a desired IRR.

Section 5 includes all the results from the model: [5.1] Detailed information on returns, capital needs for the business case, for each positive externality from the

Figure 5 | **Interface of the VERENA Investment Valuation tool.**



Source: Authors.

natural capital, and a combined analysis for the business case and all variables of the natural capital, additionally there is a sensitivity analysis of Net Present Value over a range of discount rate; [5.2] Sensitivity analysis in a tornado diagram format, based on the inputs from section 4; [5.3] Break even results based on the results from section 4; [5.4] Profitability and performance ratios, solvency, and coverage ratios; and [5.5] Summary of all results in Brazilian Reais and in US dollars.

1. General Information

The general information section consists of input information regarding land, yearly planning for implementation of the project, economic assumptions and WACC (weighted average cost of capital). Throughout the model description, screenshots of the model are presented with examples. **Required cell inputs are in grey colors; optional inputs are in yellow and formulas are in green.** Before filling in information, the user must unprotect the sheet and then validate data to maintain consistency of the valuation.

1.1 GENERAL INFORMATION & LAND

In this section, the user provides the following information on (Figure 6):

i. Project name;
ii. Time horizon of the valuation; [one or more rotations, usually determined by the cycle of the forestry component];
iii. Size of the project in hectares, divided among gross area (total area), preservation area and net area (actual intervention area). This definition is important to comply with Brazilian Forest Code[4];
iv. The ratio between land leasing and land purchase, and its respective prices. In this input, the analyst can consider also 100% of the project being implemented on an area being leased, or simply consider buying 100% of the land; and
v. The terminal value allows for at the end of the project, the selling of land, which is a fixed asset. Additionally, the analyst can increase the price of the land to see the impact on the terminal value, as land assets usually have real valorization in price over time. Finally, it is possible to input sales and income taxes over the sale of land.

Figure 6 | **Interface for input variables on item 1.1.**

GENERAL INFORMATION	
Project Name	VERENA
Year 0	2018
Final Year	2048
Interval Years	30

LAND			
Gross Area	ha	80,00	
Preservation Area	ha	40,00	
Net Area	ha	40,00	
Use Area	%	50,00%	
Land Cost (Gross Area)	R$ / ha	2.300,00	
Land Leasing (Net Area)	R$ / ha / year	230,00	
Land Purchase	%	100,00%	Write a percentage here if are acquiring land, this will autamatically change land lease.
Land Lease	%	0,00%	By default land lease is always 100%.
Sales (land) at end	yes / no	Yes	If "yes" is chosen purchased land will turn into an income at last year of the project.
Real increase price of land	% / year	0,50%	
ITBI on sale (over revenue)	%	3,00%	Values by default, change as needed
IR on sale (over profit)	%	15,00%	

Required
Optional
Formula

One important concept is that cash flows are based on opportunity costs and should be included in the project costs. The broader concept in economics for opportunity costs is defined as the "next best option forgone". Also, the opportunity costs are cash flows that the firm will possibly lose by undertaking a project. For example, even if the firm owns the land, the cost of the land should be charged to the project because it could be sold if not used; or include a land leasing cost as opportunity costs for land, which the model also allows. Also, the landowner's opportunity cost of labor is also applied in the valuation. The landowner, by undertaking and managing the assets, is forgoing the opportunity to work for another firm and receive a salary payment. The VERENA model included opportunity costs in the valuation of all the 12 business cases, and we encourage the user to do the same.

1.2 LAND PURCHASING AND PLANTING SCHEDULE

There are two important inputs in this section (Figure 7). One is the planting schedule, which is estimated by dividing the amount of the total area being planted each year. This variable is directly impacted by operational constraints. For example, a project with a total area of 100,000 hectares is very unlikely to be completed in one year. In this section, the user can break down the total area per year, for example, first year with 5,000 ha; second year with 10,000 ha until fulfilment of the 100,000 ha. The second input is the timing of purchasing land. Based on the previous assumption, buying the total area of land in the first year of the project is unlikely, as cash could be wasted, as a large portion of land would be set aside awaiting plantation in the following years.

1.3 ECONOMICS, DEBTS, TAXES, SG&A & WC

Economic profile:

The investor profile can be chosen from a list of four profiles from the WACC model (Figure 8). The Profile 1 has high risk aversion and Profile 4 low risk aversion (more information about the profiles in section ***1.3.1 WACC)***. Choosing from the list will automatically complete the discount rates based on the cost of capital. A discount rate of "r" (from WACC – Weighted Average Cost of Capital) is used for FCFF (Free Cash Flow to Firm) and opportunity cost of equity capital "Ke" (from CAPM – Capital Asset Pricing Model) are used to discount the FCFE (Free Cash Flow to Equity). Additionally, there is a need to input the exchange rates from US dollars to Brazilian Reais and inflation that will result in the nominal cash flow.

Figure 7 | **Planning for acquisition of land and implementation.**

PLANTING SCHEDULE & LAND PURCHASE	
Total Net Area (ha)	40,00
Total Land Purchased (ha)	40,00
Total Planting Schedule (ha)	40,00
Total Land Purchased (%)	100,00%
Total Planting Schedule (%)	100,00%

YEAR	AREA OF LAND PURCHASED (HA)	ACCUM. AREA OF LAND PURCHASED (%)	PLANTING SCHEDULE (HA)	ACCUM. AREA OF PLANTING SCHEDULE (%)
Year 0	40,00	100,00%	40,00	100,00%
Year 1		100,00%		100,00%
Year 2		100,00%		100,00%
Year 3		100,00%		100,00%
Year 4		100,00%		100,00%
Year 5		100,00%		100,00%
Year 6		100,00%		100,00%
Year 7		100,00%		100,00%
Year 8		100,00%		100,00%
Year 9		100,00%		100,00%
Year 10		100,00%		100,00%

- Required
- Optional
- Formula

Debt:

It is used in the model to leverage cash flows and directly impacts the FCFE. If the analysts choose to value the leverage cash flow, it will retrieve the cost of debt and level of leverage from section ***1.3.1 WACC***. It is necessary to input the grace period and final period for payment of the principal.

Taxes:

It is divided in two sections, one for sales taxes and another for income taxes. This is an important input to go from the result operation to the cash flow statement. The model already presents by default the Brazilian accounting standards, which has two tax regimes (a) "presumed income revenues" and (b) "actual income revenues". If the firm is exporting the goods, then there might be tax exemptions. In this case, the analyst chooses 0% for sale taxes and consequently gross revenues will equal net revenues in the cash flow.

The "Presumed" regime has a limit on the amount of revenues (BRL 78,000,000.00 per year) and for the model we assumed the limit increasing BRL 10,000,000.00 every 10 years. Both sales and income taxes are lower (3.65% sales and 3.08% on income) compared to the "Actual" regime (9.25% sales and 34.00% income). These values come from the "*Brazilian IRS*" – *Receita Federal*, but the valuation model allows adjustment to any specific country. Also, the model allows the inclusion of state taxes. Taxes are further explained in the section ***5.3 Taxes***. Finally, if the limit of the "Presumed" is input as zero "0" the model will only work with the "Actual" regime and income taxes will always be charged at 34.0%.

Figure 8 | **Input information for section 1.3.**

DISCOUNT RATE - FROM COST OF CAPITAL MODELS		
Investor Profile*		Profile 1
Dicount Rate "r" real	WACC	11,14%
Dicount Rate "r" nominal	WACC	15,31%
Ke real (cost of equity)	Ke	17,99%
Ke nominal (cost of equity)	Ke	20,41%
Exchange rate	R$ => US$	3,30
Inflation	%	4,50%

DEBT		
Debt?	yes / no	No
Interest	%	3,43%
Grace Period	years	
Final Period	years	
Leverage	%	47,00%

TAXES			
Presumed PIS COFINS (Sales taxes)	%	3,65%	These aliquots reflect brazilian tax system. Values by default, if you are exporting goods sale taxes are exempt.
Actual PIS COFINS (Sales taxes)	%	9,25%	Values by default, if you are exporting goods sale taxes are exempt.
Presumed IR + CSLL (Income taxes)	%	3,08%	
Presumed Profit Limit	BRL	78.000.000	If zero, valuation model will only consider the Actual IR + CSLL (Income taxes) aliquot.
Limit Increases every 10 years	BRL	10.000.000	
Actual IR + CSLL (Income taxes)	%	34,00%	

SG&A AND WORKING CAPITAL			
SG&A	BRL / year	21.900	Sales, General and Administrative expenses.
WC - Accounts receivable	Days of Revenues	60	
WC - Accounts payable	Days of COGS	30	
WC - Inventory	Days of COGS	180	
WC - Suppliers	Days of COGS	30	
WC - Wages and Social Expenses	Days of SG&A	30	
WC - Advance Suppliers	Days of COGS	12	
WC - Taxes Payable	Days of Revenues	20	

- Required
- Optional
- Formula

* Choose from the list or build your own profile through 1.3.1 WACC

Figure 9 | **CAPM and WACC models and all assumptions to build the cost of capital to discount cash flows. Profiles from 1 to 4 are embedded by the default in the tool, but the user can build his own cost of capital in the last column.**

WACC - COMPANY PROFILE	
Own Profile?	No

	COST OF CAPITAL	METHOD WACC & CAPM					
	Capital Structure	Template Assumptions	Profile 1	Profile 2	Profile 3	Profile 4	Verena
E	Proportion of Equity	Optimal Capital Structure (Site Damodaran: "Paper/ Forest Products", Emerging Mkts)	53,0%	53,0%	53,0%	30,0%	100,0%
D	Proportion of Debt		47,0%	47,0%	47,0%	70,0%	0,0%
	Cost of Equity - CAPM	Template Assumptions	Profile 1	Profile 2	Profile 3	Profile 4	Verena
R_F	Risk Free rate	Annual Return on T-Bond 10Y US -(last 5 year Average)	3,50%	3,50%	3,50%	3,50%	
R_p	Premium rate	S&P 500; Russel 2000; S&P Global Timber & Forestry (last 5 years average)	10,60%	8,52%	7,50%	7,50%	
P_{RM}	Risk Premium - Market	Annual Return of Risk Premium - Risk Free	7,10%	5,02%	4,00%	4,00%	0,00%
P_{RB}	Risk-Brasil	JP Morgan EMBI+ (Average last 10 years)	2,46%	2,46%	2,46%	2,46%	
β_U	Unleaverage Beta	Damodaran paper and forest products	0,89	0,77	0,89	0,77	
T	Corporate Taxes		34%	34%	34%	34%	
k_E	Cost of Equity Nominal	US Dollars	16,02%	12,09%	11,63%	13,83%	0,00%
k_E	Cost of Equity Nominal	BRL Brazilian Reais	20,41%	16,33%	15,86%	18,14%	0,00%
I_{EUA}	Inflation	American Inflation, measured by CPI (10 years average)	2,06%	2,06%	2,06%	2,06%	
I_{br}	Inflation	Brazilian Inflation, mesured by IPCA (10 years average)	5,92%	5,92%	5,92%	5,92%	
k_E	**Cost of Equity real terms**	**US Dollars**	**13,69%**	**9,83%**	**9,38%**	**11,54%**	**0,00%**
k_E	**Cost of Equity real terms**	**BRL Brazilian Reais**	**17,99%**	**13,99%**	**13,52%**	**15,76%**	**0,00%**
	Cost of Debt	Template Assumptions	Profile 1	Profile 2	Profile 3	Profile 4	
C_R	Credit Risk	Average rate for BNDES loans (Interest Rate = financial cost of transaction + basic compensation of BNDES)	8,50%	12,50%	12,50%	8,75%	
$k_{D\ Bruto}$	Cost of Debt Nominal	Risk Free Rate + EMBI + Credit Risk	14,46%	18,46%	18,46%	14,71%	0,00%
β_L	Leaverage Beta	Leverage βU	1,42	1,22	1,42	1,97	0,00
k_D	Cost of Debt Nominal after Taxes	BRL Brazilian Reais	9,55%	12,19%	12,19%	9,71%	0,00%
k_D*	Cost of Debt in Real Terms	Discounted IPCA	3,43%	5,92%	5,92%	3,58%	0,00%
	Weighted Average Cost of Capital - WACC	Template Assumptions	Profile 1	Profile 2	Profile 3	Profile 4	
E	Proportion of Equity		53,00%	53,00%	53,00%	30,00%	100,00%
D	Proportion of Debt		47,00%	47,00%	47,00%	70,00%	0,00%
k_E*	Cost of Equity Real Terms	US Dollars	13,69%	9,83%	9,38%	11,54%	0,00%
k_E*	Cost of Equity Real Terms	BRL Brazilian Reais	17,99%	13,99%	13,52%	15,76%	0,00%
k_D*	Cost of Debt in Real Terms	BRL Brazilian Reais	3,43%	5,92%	5,92%	3,58%	0,00%
WACC	**after taxes real terms**	**US Dollars**	**8,86%**	**7,99%**	**7,75%**	**5,97%**	**0,00%**
WACC	**after taxes real terms**	**BRL Brazilian Reais**	**11,14%**	**10,20%**	**9,95%**	**7,23%**	**0,00%**
WACC	after taxes	Nominal (US Dollars)	12,98%	12,14%	11,89%	10,95%	0,00%
WACC	after taxes	Nominal (BRL Brazilian Reais)	15,31%	14,38%	14,13%	12,24%	0,00%

SG&A & WC (Working Capital)

The SG&A (Selling, General and Administrative) expenses are reported on the income statement as the sum of all direct and indirect selling expenses and all general and administrative expenses of the firm. In other words, SG&A are the costs not related directly to production or manufacturing. In all 12 cases evaluated by VERENA we used this concept, even for small farmers who do not work in a corporation, for example, but spend time managing their own assets. It is the same concept of opportunity costs described in the section ***1.1 General Information & Land***.

Working Capital is related to the firm's liquidity. The term refers to the firm's short-term obligations such as accounts receivable, payables, inventory and others. Because this is an issue related to the day-to-day operations of the company/asset, the "VERENA Investment tool" used an approach based on days of costs of goods sold and days of revenues, which has a major impact on the short-term financing. Generally, liquidity position improves when the firm has quick cash inflow and slow outflows (e.g. collecting cash faster from customers or paying suppliers more slowly). The opposite leads to a drag on liquidity.

1.3.1 WACC – WEIGHTED AVERAGE COST OF CAPITAL

To conduct a capital budget analysis, the analyst must identify an appropriate discount rate. The firm's discount rate is determined by the Weighted Average Cost of Capital (WACC), and is used to discount the Free Cash Flow of the Firm. From the investor's (shareholder) point of view, the proper discount rate for the Free Cash Flow to Equity is the cost of equity determined by the Capital Asset Pricing Model (CAPM). Both models are described in this section (Figure 9).

Equation 1 | **The CAPM model.**

$$K_e = R_f + \beta\left[(R_m) - R_f\right] + CRP$$

- Linear relation between risk and return;
- Very intuitive;
- Nevertheless, not all assets fit into this model;
- New projects should be compared with similar firms; not with the average return of multiple assets in a firm;

Table 2 | **Variables and assumptions used to build the expected return on VERENA assets.**

COST OF EQUITY - CAPM		TEMPLATE ASSUMPTIONS	PROFILE 1	PROFILE 2	PROFILE 3	PROFILE 4	VERENA
R_F	Risk Free rate	Annual Return on T-Bond 10Y US -(last 5 year Average)	3,50%	3,50%	3,50%	3,50%	
R_p	Premium rate	S&P 500; Russel 2000; S&P Global Timber & Forestry (last 5 years average)	10,60%	8,52%	7,50%	7,50%	
P_{RM}	Risk Premium - Market	Annual Return of Risk Premium - Risk Free	7,10%	5,02%	4,00%	4,00%	0,00%
P_{RB}	Risk-Brasil	JP Morgan EMBI+ (Average last 10 years)	2,46%	2,46%	2,46%	2,46%	
β_U	Unleaverage Beta	Damodaran paper and forest products	0,89	0,77	0,89	0,77	
T	Corporate Taxes		34%	34%	34%	34%	
k_E	Cost of Equity Nominal	US Dollars	16,02%	12,09%	11,63%	13,83%	0,00%
k_E	Cost of Equity Nominal	BRL Brazilian Reais	20,41%	16,33%	15,86%	18,14%	0,00%
I_{EUA}	Inflation	American Inflation, measured by CPI (10 years average)	2,06%	2,06%	2,06%	2,06%	
I_{br}	Inflation	Brazilian Inflation, mesured by IPCA (10 years average)	5,92%	5,92%	5,92%	5,92%	
k_E	**Cost of Equity real terms**	**US Dollars**	**13,69%**	**9,83%**	**9,38%**	**11,54%**	**0,00%**
k_E	**Cost of Equity real terms**	**BRL Brazilian Reais**	**17,99%**	**13,99%**	**13,52%**	**15,76%**	**0,00%**

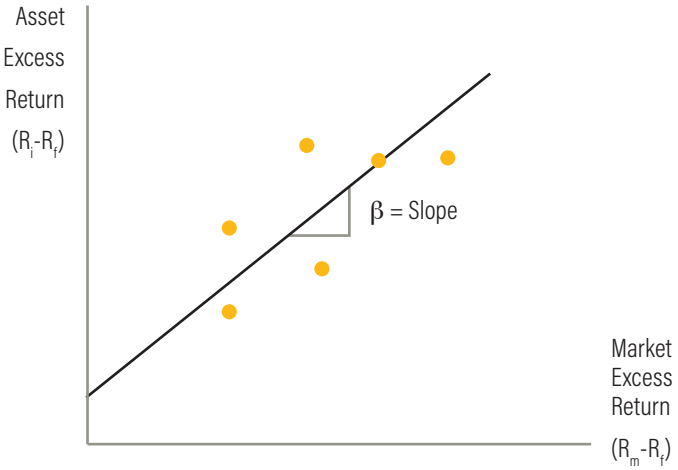
* find the sources of assumptions at the reference "CAPM" section.

The opportunity cost of equity capital "Ke" is the required rate of return on a firm's common stock, and is obtained through CAPM model (Equation 1 and Table 2). As there are no publicly traded companies in the business of reforestation with native species or agroforestry systems, we made some assumptions to estimate "Ke" (see below) to value the cost of capital or the expected return on VERENA assets given their risk. Additionally, by default the model has four profiles of cost of capital based on the perception of risk, and one profile that is left blank for the analyst to build the cost of capital and use as a discount rate (described in the section ***1.3 Economics, Debts, Taxes, SG&A & WC)***.

How to interpret beta and the cost of capital for a Project?

Because the risk of a specific project is not represented by a stock, such as the assets being evaluated by the VERENA valuation tool, it is not recommended to use beta values from publicly traded companies. One method that can be used is called the "***Pure-Play Beta***", in which we use the beta of a company or a group of companies that are in a business similar and comparable to the project being analyzed (industry category e.g. lumber/forest products). The beta of a firm is a function of its business risks and financial structure for leverage firms, so the greater the leverage, the greater the firm's equity beta. For this reason, to use the "Pure-Play Beta," it is necessary to un-lever a company's capital structure so that beta is not affected by capital structure. The goal is for the beta to be only affected by the company's business risk. The calculation for beta equity, beta asset and beta project are found in Figure 10 (Equation 2; Equation 3):

Figure 10 | **Beta equity by the regression of asset excess returns against market excess returns. Note that beta is simply the slope of this relationship. Source: authors.**



- Beta is the measure of risk – Regression of return on markets and return of a firm;
- Use unleveraged Beta to calculate risk on equity; If:
- Beta = 0 is "risk free project"
- Beta = 1 it carries the same risk as the market
- Beta > 1 is riskier than the market
- Beta < 1 less risky than the market

Equation 2 | **Calculation of the beta asset for a publicly traded security (from beta equity).**

$$\beta_{asset} = \beta_{equity}\left[\frac{1}{1+(1-t)\frac{D}{E}}\right]$$

Where: D/E debt to equity ratio of the comparable company, and t is the marginal tax rate. In this case, we have used a 34% tax rate.

Equation 3 | **Calculation of the beta project from a similar asset.**

$$\beta_{project} = \beta_{asset}\left[1+(1-t)\frac{D}{E}\right]$$

Basically, equation 2 un-levers and equation 3 re-levers.

For profile number 4, based on industrial group sector of Lumber and Wood production, we estimated "beta lumber/wood" of 0.77 (Appendix 2). Is important to remember that the estimate of beta is affected by:

- The index chosen to represent the market return (in this case it was used S&P 500).
- The use of historical data is very sensitive to time interval (e.g. one year; 5 or 10).

Finally, from the result of CAPM it is possible to calculate the WACC (Equation 4).

Equation 4 | **Calculation of The Weighted Average Cost Of Capital.**

$$WACC = \frac{D}{E} K_d [1 - T_c] + \frac{E}{D} K_e$$

	Cost of Debt	Template Assumptions	Profile 1	Profile 2	Profile 3	Profile 4	Verena
C_R	Credit Risk*	Average rate for BNDES loans (Interest Rate = financial cost of transaction + basic compensation of BNDES)	8,50%	12,50%	12,50%	8,75%	
$k_{D\ Bruto}$	Cost of Debt Nominal	Risk Free Rate + EMBI + Credit Risk	14,46%	18,46%	18,46%	14,71%	0,00%
βL	Leaverage Beta	Leverage β_U	1,42	1,22	1,42	1,97	0,00
k_D	Cost of Debt Nominal after Taxes	BRL Brazilian Reais	9,55%	12,19%	12,19%	9,71%	0,00%
k_D*	Cost of Debt in Real Terms	Discounted IPCA	3,43%	5,92%	5,92%	3,58%	0,00%
	Weighted Average Cost of Capital - WACC	Template Assumptions	Profile 1	Profile 2	Profile 3	Profile 4	Verena
E	Proportion of Equity		53,00%	53,00%	53,00%	30,00%	100,00%
D	Proportion of Debt		47,00%	47,00%	47,00%	70,00%	0,00%
k_E*	Cost of Equity Real Terms	US Dollars	13,69%	9,83%	9,38%	11,54%	0,00%
k_E*	Cost of Equity Real Terms	BRL Brazilian Reais	17,99%	13,99%	13,52%	15,76%	0,00%
k_D*	Cost of Debt in Real Terms	BRL Brazilian Reais	3,43%	5,92%	5,92%	3,58%	0,00%
WACC	**after taxes real terms**	**US Dollars**	**8,86%**	**7,99%**	**7,75%**	**5,97%**	**0,00%**
WACC	**after taxes real terms**	**BRL Brazilian Reais**	**11,14%**	**10,20%**	**9,95%**	**7,23%**	**0,00%**
WACC	after taxes	Nominal (US Dollars)	12,98%	12,14%	11,89%	10,95%	0,00%
WACC	after taxes	Nominal (BRL Brazilian Reais)	15,31%	14,38%	14,13%	12,24%	0,00%

* There are a several lines of credit from BNDES (The Brazilian National Development Bank) to finance restoration and reforestation. The Brazilian Forest Service (SFB "Serviço Florestal Brasileiro") has published a guide in 2016 (only in Portuguese) with various credit lines from public banks that can be used in reforestation and restoration projects. Retrieved at: < http://www.florestal.gov.br/documentos/publicacoes/1792-quadro-sintese-guia-de-financiamento-florestal-2016/file>

2. Costs & Revenues

This section is one of the most important regarding the specificities of the asset. Considering the whole picture of the valuation model, the most sensitive assumptions are input in this section, especially the costs, yields and prices.

2.1 SYSTEM COSTS FOR FRUITS (NON-TIMBER) AND TIMBER

In this section, the analyst will provide general information on the number of species (up to 13) used in the asset, classified by the type of use (timber products or fruit (in this case for non-timber forest products as well, and permanent crops) (Figure 11). The user can input any value in this section and go through the validation process to ensure consistency throughout the data input process. The selection of type of product and use is important for accounting purposes, which will be further explained in section ***5.2 Accounting: COGS [Costs of Good Sold]; Capex; Depreciation***. It is also possible to input general and system costs. The latter are the costs that are shared by all species in the asset, and not related to one single species (e.g. soil preparation).

Costs and yields are assessed throughout silviculture operational model and this methodology is focused in operational efficiency (example in Figure 12). In this case Silviculture is the activity of planting trees, as agriculture is the activity of planting crops.

With this pattern and methodology, it is possible to group costs yearly. This approach can assist management planning by understanding the operational activities that have the highest costs and the species with the higher cost within the asset.

Figure 11 | **Inputs for section 2.1. Important to choose from the dropdown list "Timber" or "Fruit" for accounting principles.**

SPECIES	SPECIES 1	SPECIES 2	SPECIES 3	SPECIES 4	SPECIES 5	SPECIES 6	SPECIES 7	SPECIES 8	SPECIES 9	SPECIES 10	SPECIES 11
Name	Pimenta do Reino	Cacau	Açai	Taperebá	Andiroba S	Andiroba M	Arroz	Abóbora	Maracujá	Mogno BRA	Ipê
Select - Timber or Fruit*?	Fruit	Fruit	Fruit	Fruit	Fruit	Timber	Fruit	Fruit	Fruit	Timber	Timber

SYSTEM COSTS		
System Costs?		Yes
System with Fruits?		Fruit
Machinery Investement	R$	
Useful Life	year	

System Costs - Are common costs to all species in the system, e.g. soil preparation. Is commonly used in mixed specie assets.

Use System Costs only for mixed systems (Timber + Fruits). Do not use if asset has only timber species.

Required
Optional
Formula

* Fruit - Consider fruit any species that is not timber (e.g. annual crops; permanent crops; seeds; nuts and others)

Figure 12 | **Costs for a single operational activity (per hectare).**

Forestry Worker	+	Input	+	Machinery	=	TOTAL
hour/man = 2 Price/hour = R$ 16,13		Qtd = 15 t Price/t = R$ 120,00		hour/machine = 1,8 Price/hour = R$ 55,00		
R$ 32,26	+	R$ 1.800,00	+	R$ 99,00	=	R$ 1.931,26

2.2 COSTS OF GOOD SOLD (COGS)

The COGS (Costs of Good Sold is a yearly cost of the asset (Figure 13). The density of plants per hectare and the beginning and end of the rotation are input variables necessary to break down these costs into Capex (capital expenditure), COGS, Depreciation (for permanent crops assets), and Exhaustion or Depletion of forestry assets. This concept is further explained in the section ***5.2 Accounting: COGS; Capex; Depreciation***.

Figure 13 | **Cost for every species in the system based on the number of individuals and start and end of the rotation cycle (key variables to break down the cost curve in consistent accounting principles).**

SPECIES		SYSTEM COSTS	SPECIES 1	SPECIES 2	SPECIES 3	SPECIES 4	SPECIES 5	SPECIES 6	SPECIES 7	SPECIES 8	SPECIES 9	SPECIES 10	SPECIES 11
Name		System costs	Pimenta do Reino	Cacau	Açaí	Taperebá	Andiroba S	Adiroba M	Arroz	Abóbora	Maracujá	Mogno BRA	Ipê
Timber or Fruit?		Fruit	Fruit	Fruit	Fruit	Fruit	Fruit	Timber	Fruit	Fruit	Fruit	Timber	Timber
Beginning Rotation (if timber = End)	years	7	1	7	6	7	7	30	0	1	1	30	30
Rotation*	years	30	30	30	30	30	30	30	30	30	30	30	30
Density	plants / ha		2200	625	400	25	15	15	20000	625	416	10	13
Costs/COGS**	R$ / ha	163.180,72	41.817,77	148.227,83	24.367,85	101,13	53,05	-	-	-	3.883,63	-	-
COGS Year 0	R$ / ha	1.071,25			175,00				63,00				
COGS Year 1	R$ / ha	68,75	34.681,25						-	868,75	5.870,28	39,15	210,77
COGS Year 2	R$ / ha	11.564,25	9.655,25		2.758,25	101,13	53,05			-	2.057,30		
COGS Year 3	R$ / ha	5.466,25	9.655,25	4.314,40	1.350,60						1.826,33		
COGS Year 4	R$ / ha	6.104,25	9.655,25	2.364,85	1.350,60						-		
COGS Year 5	R$ / ha	5.466,25	9.655,25	4.574,54	1.350,60								
COGS Year 6	R$ / ha	694,25	2.379,64	4.968,29	1.350,60								
COGS Year 7	R$ / ha	5.516,25	320,00	5.500,24	1.350,60								
COGS Year 8	R$ / ha	6.154,25		5.500,24	1.350,60								
COGS Year 9	R$ / ha	5.516,25	497,14	5.500,24	1.350,60								
COGS Year 10	R$ / ha	6.154,25		5.500,24	1.350,60								
COGS Year 11	R$ / ha	5.516,25		5.500,24	1.350,60								
COGS Year 12	R$ / ha	6.154,25		5.500,24	1.350,60								
COGS Year 13	R$ / ha	5.516,25		5.500,24	1.350,60								
COGS Year 14	R$ / ha	6.154,25		5.500,24	1.350,60								
COGS Year 15	R$ / ha	5.516,25		5.500,24	1.350,60								
COGS Year 16	R$ / ha	6.154,25		5.500,24	1.350,60								
COGS Year 17	R$ / ha	5.516,25		5.500,24	1.350,60								
COGS Year 18	R$ / ha	6.154,25		5.500,24	1.350,60								
COGS Year 19	R$ / ha	5.516,25		5.500,24	-								
COGS Year 20	R$ / ha	6.154,25		5.500,24									
COGS Year 21	R$ / ha	5.516,25		5.500,24									
COGS Year 22	R$ / ha	6.154,25		5.500,24									
COGS Year 23	R$ / ha	5.516,25		5.500,24									
COGS Year 24	R$ / ha	6.154,25		5.500,24									
COGS Year 25	R$ / ha	5.516,25		5.500,24									
COGS Year 26	R$ / ha	6.154,25		5.500,24									
COGS Year 27	R$ / ha	5.516,25		5.500,24									
COGS Year 28	R$ / ha	6.154,25		5.500,24									
COGS Year 29	R$ / ha	5.510,00		5.500,24									
COGS Year 30	R$ / ha			5.500,24								-	-

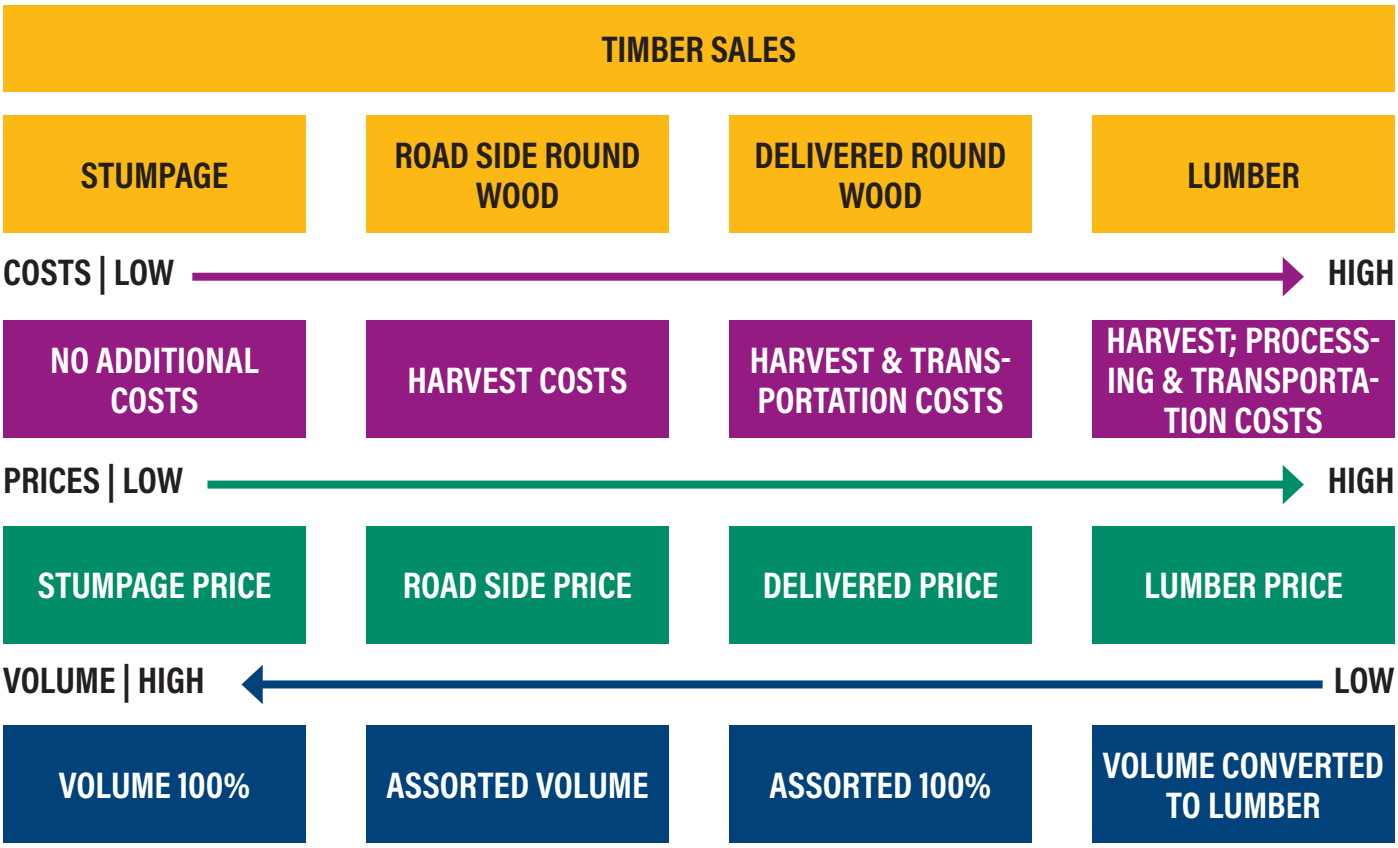
* If annual crops input 0

** Cost curve for each species. Upon species information; beginning and end rotation, accounting standards will distribute cost curve among: capex; COGS; depreciation and depletion/exhaustion.

2.3 GENERAL INPUTS FOR TIMBER

In this section, it is possible to input costs for specific timber operations (e.g. harvesting; transportation) and the source of revenues, such as yields and prices (Figure 14):

Figure 14 | **Approach for input variables in the model from stumpage to lumber business models.**



The first yield input is the volume that will be harvested at end of the rotation (or, clear cut). This input is required with the specific assortment class and price. The analyst has the option to include thinning during the life of the asset (Figure 15). Thinning is the selective or systematic removal of trees, primarily undertaken to improve the growth rate or health of the remaining trees. Overcrowded trees are under competitive stress from their neighbors. Thinning may be done to increase the resistance to environmental stress such as drought, pests, **and can provide early sources of revenues**. Thinning is optional and can add up to six instances of thinning in the model, with the volume produced under each one. The thinning will be removed from the clear-cut volume at the end of rotation.

It is very important to decide what kind of timber product to use. On figure 14 are some examples to guide the input of this section:

Stumpage sales: if selling round wood at stumpage price, leave the harvest and transportation costs blank.
Road side round wood timber: input harvesting costs, but use roadside timber price (higher than stumpage price) and leave transportation cost blank.
Delivered round wood timber: input harvesting and transportation costs, but use delivered round use timber price, which is higher than roadside price.

Lumber sales: similar to delivered round wood, but in this case a processing cost can be added to the harvesting cost. But more importantly, the volume output should have adequate lumber volume instead of round wood timber. This "conversion loss" can vary from 80% for trees from natural forests to 50% for trees in commercial plantation. For example, if you input 100 m^3/ha of round timber, for lumber you are most likely to input 50 m^3/ha or less.

Additionally, it is possible to break down the volume of timber produced by assortment class and its respective price. As trees are not perfect cylinders, but closer to a conical form, the price markets are taken for each section of the cone (assortment classes). Usually the larger the diameter, the higher the price as shown in the previous figure. Often this is the variable that has the largest impact on return of the 12 cases we have studied. The model also allows the breakdown of production within the four assortment classes for every thinning and final harvest (Figure 16). Additionally, is possible to input in this section a compound growth rate in timber prices.

Figure 15 | **Example for one tropical timber species of prices regarding different assortment class by diameter.**

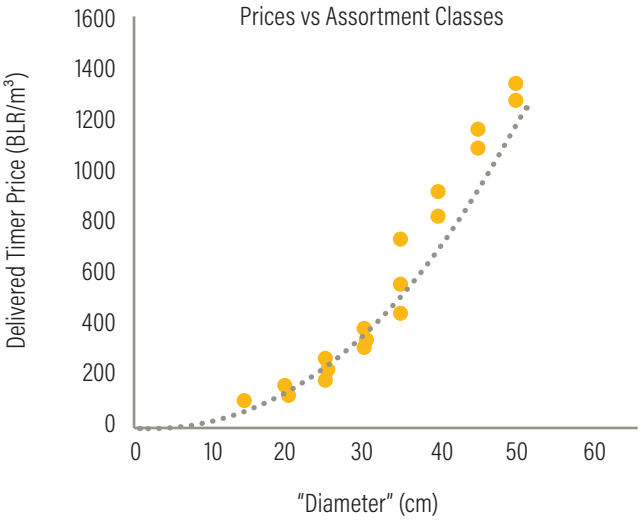


Figure 16 | **Example of revenues and volume for timber in the model. it is possible to input annual real increases in price of timber and up to 6 thinnings within the four assortment classes and respective prices.**

REAL INCREASE IN TIMBER PRICES	%/YEAR	2,20%

+/- Thinnings*

Required
Optional
Formula

SPECIES		1	2	3	4	5	6	7	8	9	10	11
Name							Adiroba M				Mogno BRA	Ipê
Timber or Fruit?							Timber				Timber	Timber
Beginning Rotation (if timber = End)							30				30	30
Rotation							30				30	30
Density							15				10	13
Harvest	R$ / m³						165				303	788
Transportation	R$ / m³ / km											
Distance	km											
Weighted MAI	m³ / ha / year						0,4				0,1	0,1
Total Volume Output*	m³ / há						11,00				4,00	2,00
Assortment 1	%						100%				100%	100%
Assortment 2	%											
Assortment 3	%											
Assortment 4	%											
Price 1	R$ / m³						2.000,00				2.500,00	2.000,00
Price 2	R$ / m³											
Price 3	R$ / m³											
Price 4	R$ / m³											
Weighted Price	R$ / m³	-	-	-	-	-	2.000,00	-	-	-	2.500,00	2.000,00
Thinnings 1	year											
Thinnings 1 Production	(m³ / ha)											
Thinnings 1 Assortment 1	%											
Thinnings 1 Assortment 2	%											
Thinnings 1 Assortment 3	%											
Thinnings 1 Assortment 4	%											
Thinnings 1 Price 1	R$ / m³											
Thinnings 1 Price 2	R$ / m³											
Thinnings 1 Price 3	R$ / m³											
Thinnings 1 Price 4	R$ / m³											

* Total volume of timber produced at the end of rotation. If thinnings are done, the volume harvested from thinnings will automatically be deducted from "Total Volume Output".

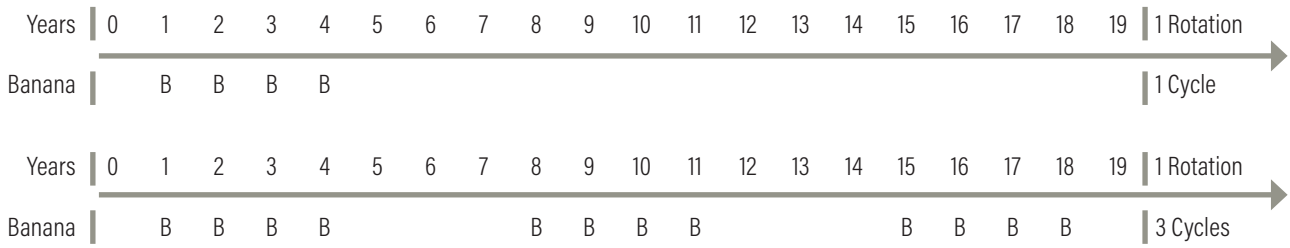
2.4 GENERAL INFORMATION FOR FRUITS

In this section the analyst will input the price and volume or weight for each species, and if possible, input the harvest and transportation costs. Note that the default unit is BRL and Kg, so the analyst should be aware and make the conversion if necessary. These inputs are similar to the ones discussed on section ***2.3 General Inputs for Timber*** (Figure 17).

Figure 17 | **Example of revenues and volume per individual, costs of harvest, and transportation for "Fruits" or non-timber products.**

SPECIES		1	2	3	4	5	6	7	8	9	10	11
Name		Pimenta do reino	Cacau	Açaí	Taperebá	Andiroba S		Arroz	Abóbora	Maracujá		
Timber or Fruit?		Fruta	Fruta	Fruta	Fruta	Fruta		Fruta	Fruta	Fruta		
Beginning Rotation (if timber = End)		1	7	6	7	7		0	1	1		
Rotation		30	30	30	30	30		30	30	30		
Density		2200	625	400	25	15		20000	625	416		
Price	R$ / kg	5,00	7,00	1,20	1,20	1,70		0,00	0,90	1,00		
Harvest Fruit	R$ / kg	2,23	1,38	0,45	0,16	0,04		-	0,02	0,01		
Transportation Fruit	R$ / kg / km											
Distance Fruit	km											
Production Year 0	kg / plant											
Production Year 1	kg / plant	0,80						0,20	44,00	18,00		
Production Year 2	kg / plant	1,50							20,00	25,00		
Production Year 3	kg / plant	2,50								30,00		
Production Year 4	kg / plant	2,00								18,00		
Production Year 5	kg / plant											
Production Year 6	kg / plant			3,50								
Production Year 7	kg / plant		0,30	4,50	100,00	10,00						
Production Year 8	kg / plant		0,50	4,50	200,00	18,00						
Production Year 9	kg / plant		0,80	7,00	300,00	23,00						
Production Year 10	kg / plant		0,80	9,00	380,00	35,00						
Production Year 11	kg / plant		1,00	14,00	450,00	53,00						
Production Year 12	kg / plant		1,50	16,50	500,00	71,00						
Production Year 13	kg / plant		1,50	19,50	520,00	80,00						
Production Year 14	kg / plant		1,50	21,00	520,00	80,00						
Production Year 15	kg / plant		1,50	21,00	520,00	80,00						
Production Year 16	kg / plant		1,50	21,00	520,00	80,00						
Production Year 17	kg / plant		1,50	21,00	520,00	80,00						
Production Year 18	kg / plant		1,50	16,50	520,00	80,00						
Production Year 19	kg / plant		1,50	16,50	520,00	80,00						
Production Year 20	kg / plant		1,50		520,00	80,00						
Production Year 21	kg / plant		1,50		520,00	80,00						
Production Year 22	kg / plant		1,50		520,00	80,00						
Production Year 23	kg / plant		1,00		520,00	80,00						
Production Year 24	kg / plant		1,00		520,00	80,00						
Production Year 25	kg / plant		1,00		520,00	80,00						
Production Year 26	kg / plant		1,00		520,00	80,00						
Production Year 27	kg / plant		1,00		450,00	71,00						
Production Year 28	kg / plant		1,00		380,00	53,00						
Production Year 29	kg / plant		1,00		380,00	53,00						
Production Year 30	kg / plant		1,00		380,00	53,00						

Figure 18 | **Example of a rotation of 20 years with 1 and 3 cycles of banana production.**



The major difference in this section when compared to the previous one is the estimation of yields, which is based on yearly production per plant. For this reason, it is crucial to correctly input the density (plants/hectare). The information on density is obtained through the technical planning phase of the project, usually done by a forester or agronomist, or the land owner. For building this yield curve, it is important to take into account the mortality rate and the productivity gains and losses over the years within the rotation cycle. Note that in the yield curve it is possible to have several cycles of a specific species within the rotation. For example, within a rotation of 20 years in an agroforestry system, it is possible to have one or three cycles of banana production (Figure 18), depending on management. In this case, it is necessary to change the inputs in the model.

3. Externalities and other incentives – New Streams of Revenues from the Natural Capital.

Externalities refers to situations when the effect of production or consumption of goods and services imposes costs or benefits on others which are not reflected in the prices charged for the goods and services being provided (OECD). We have divided "externalities" into two sections: one from the natural capital and another of new line of business. The idea is having the same income statement treatment for both, as a source of new streams of revenue. The section ***6. Reports***, commented the interpretation of these results will be discussed.

Figure 19 | **List of inputs used to evaluate natural capital**

CARBON		
Carbon?		Yes
Carbon Forestry (Revenues)	US$/ton	9,90
	ton	110
Cycles of	years	21
Payments Every	years	5
Project submission PDD (Costs)	BRL	0
	year	0
Certification (Costs)	BRL	0
	year	1
Compliance (Costs)	BRL	0
	every x years	5
REDD+ (Revenues)	US$/ton	3,30
	ton	255
Deforestation rate	%	1,03%
CRA - CVC (Revenues)	BRL/ton	0,52

WATER		
Water?		Yes
Precipitation	mm	2.400
Water Benefits (Infiltration)	m^3 / ha	700
Water Price	BRL/m^3	0,02
Net Area	ha	40

INCENTIVE		
Incentive?		Yes
Incentive Year 0	(USD)/seedling	1,80
Incentive Year 1	(USD)/seedling	1,60
Incentive Year 2	(USD)/seedling	1,40
Incentive Year 3	(USD)/seedling	1,20
Incentive Year 4	(USD)/seedling	1,10
Incentive Year 5	(USD)/seedling	1,00
Incentive Year 6	(USD)/seedling	0,90
Fee Over Revenues	%	0,00%

Figure 19 | **List of inputs used to evaluate natural capital** *(continue)*

CRA			
CRA?		Yes	Portuguese acronym for "Cotas de Reserva Ambiental"
CRA easement	BRL/ ha/year	190,00	
CRA area	ha	180,00	
Fee Over Revenues	%	0,00%	

CROPS			
Crops?		No	Use only for timber assets
Crops (area)	%	10,00%	if input is zero the result for crops will be zero
Cost Reduction (year 0)	%	83%	The value will be deducted from depoyment costs (year 0) from timber species.
Cost Reduction (year 1)	%	73%	The value will be deducted from maintenance costs (year 1) from timber species.
Crops 1 (year 0)	Crop	Soy	
Crops 1 (prod.)	kg/ha	58,00	
Crops 1 (cost)	R$/ha	2.222,00	
Crops 1 (price)	R$/kg	58,00	
Crops 2 (year 1)	Crop	Corn	
Crops 2 (prod.)	kg/ha	80,00	
Crops 2 (cost)	R$/ha	2.333,00	
Crops 2 (price)	R$/kg	45,00	

3.1 CARBON, WATER, CRA, CASH CROPS & OTHER REVENUE STREAMS

In this section we present the framework used in the valuation of the natural capital of the assets being evaluated by the VERENA project. The evaluation of the externalities followed an approach based on project experiences, research, and analysis already developed on the subject. Two sequential analyses were carried out, the first being a qualitative evaluation and the second being a quantitative and economic valuation of the ecosystem services. The latter will be the focus in this publication.

We divided the externalities of the natural capital in two blocks:

Environmental services:

- Carbon:
  - **Carbon Forestry:** Removal and emission of carbon in forestry activities;
  - **REDD+:** Reduction of Greenhouse Gas Emissions (GHG) from Deforestation and Forest Degradation, forest management, maintenance and increment of carbon stock; and
  - **CRA-CVC:** Quota of Environmental Reserve Voluntary Contributions to the Climate;
  - **CRA**: Environmental Reserve Quotas *("Cotas de Reserva Ambiental")*;
  - **Water**: Volume; infiltration and flow regulation; and
  - **Legal Reserve:** economic forest management of the legal reserve area;

Other potential revenue streams:

- **Incentives from CRM (Cause-related Marketing):** payment for planting native tree species; and
- **Additional revenue from cash crops:** annual crops planted in the lines of a silviculture stand during the early life stages of the trees;

The potential payment for the ecosystem services are analyzed and incorporated in the Income Statement. In other words, the goal is to evaluate the impact of new revenue streams in the valuation of these assets. It is worth mentioning that the valuation is very sensitive to the total area of the asset and the biome (e.g. Amazon vs "Atlantic Forest"), because of the compliance requirements and the level of protected areas in the biome. For example, the amount of Legal Reserve required under the Forest Code in Brazil that could be managed in the Amazon (80% of the area) and Atlantic Forest (20%) is quite different, which may have a major impact on the returns.

- Carbon:
  - **Carbon Forestry:** balance of emissions

The Calculation of the CO_2eq removal potential of each project was based on the methodology indicated by the Clean Development Mechanism - CDM for large-scale projects - AR-ACM0003, Afforestation and Reforestation of lands except wetlands. To estimate the pre-project carbon, it was assumed that the area was covered by *brachiaria* sp. (African grass species) and the greenhouse gas emissions was zero. Although the CDM rules only account for the carbon fluxes until the harvest of the trees, we assumed that end use of wood would be durable goods such as furniture and laminates, thus keeping stored carbon that was removed by the project for a longer period of time, compared to energy wood or paper.

The input variables were the following: stock volume of carbon in perpetuity, costs of project submission (PDD), certification and compliance, contract and payment cycles. The credit price used by default in the model was obtained with Forest Trends[5]. Nevertheless, it is worth mentioning that none of these methodologies considers carbon storage in the soil, which has a major potential upside for carbon sequestration.

  - **REDD+:** Avoided deforestation

The input variables for REDD+ were the rate of yearly deforestation rate[6,7], the amount of preservation area, the volume of stored carbon per hectare, and the price[2]. If the municipality where the project was located had no deforestation, the benefits from avoided deforestation was also zero.

  - **CRA-CVC:** Quota of Environmental Reserve Voluntary Contributions to the Climate

CRA-CVC are based on carbon stock in the preserved area of the asset. It is a voluntary instrument and information on prices and how it is traded can be found in BV - Rio[8]

- **CRA**: Environmental Reserve Quotas

CRA are instruments created to comply with the new Forest Code (Federal Law 12.651/2012). Each Quota represents 1 ha of natural vegetation preserved in rural properties for protection of biodiversity and water resources, improving the natural resources in agricultural regions. The approach used by the VERENA Investment tool is to lease the surplus of protected areas in the asset. The lessee pays yearly to the lessor to "rent" the environmental quota and to comply with the Brazilian Forest Code[1]. This is similar to a cap and trade market. Current prices for CRA can be found at BV Rio[9] and Biofílica[10].

- Water

The potential benefits from water services were assessed through the Water Fund Spreadsheet, which was developed by The Nature Conservancy (TNC)[xx] to estimate the impact of land use/landcover changes on water quantity at the project level. The assessment is based on a general framework proposed by the Soil Conservation Service (SCS), USDA (United States Department of Agriculture) for estimation of water surface runoff[11]. The model considers the rainfall associated with the potential runoff for different types of soil and land use/landcover, called Curve Number (CN). This CN calculates runoff over time according to the rainfall and the characteristics of each site. The Water Fund Tool estimates the potential water benefits, especially the reduction of runoff due to the land use/ landcover changes promoted by the project. The final result is an estimation of the potential water benefit per hectare on the project site after an area has been restored or reforested. the main assumptions in the Water Fund Spreadsheet model were the following: (a) Previous land use/land cover was pasture land (*brachiaria* sp.), (b) The average precipitation is based on the last 15 years in municipalities with meteorological stations close to the asset location, and (c) the net area of the asset is the area of the intervention). To monetize this service, we used the assumption proposed by Young[xxi], which is 1.5% of the price charged by the water utility companies in each municip ality to landowners as an environmental service for water.

- Incentives from CRM

From previous experience, we have learned that some companies and NGOs have provided incentives to plant native tree species. In terms of initiatives led by NGOs, the "Plant a Billion Tree Campaign"[12] of The Nature Conservancy and the "Click Árvore" campaign of SOS Mata Atlântica have been quite successful in supporting the planting of millions of trees and raising millions of dollars. In terms of the private sector, a campaign developed by SCA (Svenska Cellulosa Aktiebolaget), a Swedish paper company, supported the reforestation of native species in Pará state in partnership with AMATA. SCA is the third-most popular brand in the European market. The campaign consisted in cultivating three trees for each tree used in this toilet paper manufacturing process. They paid incentives for AMATA to plant those trees. Those examples show that there might be more incentives and new streams of revenue to support projects in the early stages. The inputs are price/seedling and number of trees/hectare (density).

- Additional revenue from cash crops

Planting annual crops in the early stages of a silviculture projects can increase revenues and mitigate costs. For example, the Paricá (*Schizolobiun amazonicum*) silviculture model in northern Brazil can allow for the cultivation of grains (soybean and corn) by changing the standard spacing of 3 x 3 meters to 5 x 2. This allows the use of machinery to plant and harvest those two crops between the tree lines. The mitigation costs are also possible because some of the operations during the first year of reforestation can be "charged" to the cost of the crop" (e.g. soil preparation, fertilization). The inputs are the amount of area (percentage of net area) that this method will be applied, the costs and revenues from the annual crops, and the percentage of silviculture cost that is reduced.

3.2 Sustainable Management of Legal Reserve

Legal reserve or set-asides are areas inside private properties that have two well-defined purposes: (a) to provide economic goods (timber and non-timber forest products) by employing sustainable practices and (b) to contribute to the conservation of biodiversity at the property and landscape level. In the VERENA investment tool, we used the same approach described in section ***2. COGS & Revenues***, in addition to the possibility of a new stream of revenue, there is also the value of the opportunity cost of the land because there is no need to invest in land acquisition or leasing.

4. Simulation

The VERENA investment tool can perform two simulation analyses: what-if worst and best-case scenarios. These are important to estimate the most sensitive variables in the model (Figure 20).

4.1 SENSITIVE ANALYSIS & BREAK EVEN

The Sensitivity analysis or "what if analysis" refers to a change in a single input variable at a time when compared to a given scenario. In the VERENA tool we define and compare the worst and the best scenario for each important variable of the model (Figure 21). It allows us to measure how sensitive the financial performance of a given project is to the fluctuation of key variables. With this information, it is also possible to assess the elasticity of each variable, which is the percentage change of the Net Present Value based on 1% change in the value of the variable. The information from the sensitivity analysis is used to build the tornado graphic. The analyst should provide the worst and best-case scenarios in this section, keeping in mind that for cost-related variable the best case is the smaller amount. The breakeven analysis has a goal-seek embedded function (Figure 22). The analyst should define the target IRR and the value of the variable will automatically change to meet the targeted IRR. The interpretation of the result is based on how much a variable can change by keeping the return on the asset break even. Usually the "targeted IRR" is the cost of capital.

Figure 20 | **Inputs to run the sensitivity analysis and Break even. "IRR wanted" is the necessary input to run the breakeven analysis and "max" and "min" values are used to run the sensitivity analysis. It is also possible to write the source of assumptions at the comment section.**

CALCULATE?	VARIABLE	UNITS	TYPE	BASE	MAX	MIN	WORST
Yes	Net Area	ha	The greater the better	40,00	48,00	32,00	32,00
Yes	Land Cost (Gross Area)	R$/ha	The fewer the better	2.300,00	2.760,00	1.840,00	2.760,00
Yes	Land Leasing (Net Area)	R$/ha/year	The fewer the better	230,00	276,00	184,00	276,00
No	Relation Land (Purchase/Leasing)	%	The fewer the better	1,00			0,00
Yes	SG&A	BRL/year	The fewer the better	21.900,00	26.280,00	17.520,00	26.280,00
Yes	System Costs COGS	R$/ha	The fewer the better	164.320,72	197.184,86	131.456,57	197.184,86
No	Pimenta do Reino - Price	R$/kg or R$/m^3	The greater the better	5,00	6,00	4,00	4,00
No	Pimenta do Reino - COGS	R$/ha	The fewer the better	76.499,02	91.798,82	61.199,22	91.798,82
No	Pimenta do Reino - Productivity	kg/plant or MAI	The greater the better	1,70	2,04	1,36	1,36
Yes	Cacau - Price	R$/kg or R$/m^3	The greater the better	7,00	8,40	5,60	5,60
Yes	Cacau - COGS	R$/ha	The fewer the better	148.227,83	177.873,39	118.582,26	177.873,39
Yes	Cacau - Productivity	kg/plant or MAI	The greater the better	1,16	1,40	0,93	0,93
Yes	Açai - Price	R$/kg or R$/m^3	The greater the better	1,20	1,44	0,96	0,96
Yes	Açai - COGS	R$/ha	The fewer the better	24.542,85	29.451,42	19.634,28	29.451,42
Yes	Açai - Productivity	kg/plant or MAI	The greater the better	13,96	16,76	11,17	11,17
Yes	Taperebá - Price	R$/kg or R$/m^3	The greater the better	1,20	1,44	0,96	0,96
Yes	Taperebá - COGS	R$/ha	The fewer the better	101,13	121,35	80,90	121,35
Yes	Taperebá - Productivity	kg/plant or MAI	The greater the better	450,00	540,00	360,00	360,00
Yes	Andiroba S - Price	R$/kg or R$/m^3	The greater the better	1,70	2,04	1,36	1,36
Yes	Andiroba S - COGS	R$/ha	The fewer the better	53,05	63,66	42,44	63,66
Yes	Andiroba S - Productivity	kg/plant or MAI	The greater the better	65,00	78,00	52,00	52,00
Yes	Andiroba M - Price	R$/kg or R$/m^3	The greater the better	2.000,00	2.400,00	1.600,00	1.600,00
Yes	Andiroba M - COGS	R$/ha	The fewer the better	0,00			0,00
Yes	Andiroba M - Productivity	kg/plant or MAI	The greater the better	0,37	0,44	0,29	0,29
No	Arroz - Price	R$/kg or R$/m^3	The greater the better	0,00			0,00
No	Arroz - COGS	R$/ha	The fewer the better	63,00			0,00
No	Arroz - Productivity	kg/plant or MAI	The greater the better	0,20			0,00
No	Abóbora - Price	R$/kg or R$/m^3	The greater the better	0,90			0,00
No	Abóbora - COGS	R$/ha	The fewer the better	868,75	1.042,50	695,00	1.042,50
No	Abóbora - Productivity	kg/plant or MAI	The greater the better	32,00	38,40	25,60	25,60
Yes	Maracujá - Price	R$/kg or R$/m^3	The greater the better	1,00	1,20	0,80	0,80

IRR	
IRR - Real	16,47%
IRR wanted	11,00%

BEST	COMMENTS
48,00	Heavily influenced by fixed costs, such as SG&A - Economies of scale.
1.840,00	Based on land assets for livestock use in the region of Paragominas in Pará State: Source: field research and FNP Agrianual, 2017
184,00	Based on land lease for cattle raching in the municipality of São Felix do Xingu - PA. Average of BRL 30 per animal, and 2.2 animals per hectare. Source: TNC, 2017
0,00	Long term projects usually requires acquisition of land
17.520,00	Based on the opportunity cost of labor ofr the smallholder. Based on 13 salaries of BRL 960.00 plus 76% of social and labour charges.
131.456,57	Based on empirical knowleage measured through agri silviculture modelling. Max and Min = +20% -20%
6,00	Based historical price volatility. Source: FNP Agrianual, 2017
61.199,22	Based on empirical knowleage measured through agri silviculture modelling. Max and Min = +20% -20%
2,04	Base value from empirical experience on operation. Max and Min from yields on monoculture plantation. Source: FNP Agrianual, 2017
8,40	Based historical price volatility. Source: FNP Agrianual, 2017
118.582,26	Based on empirical knowleage measured through agri silviculture modelling. Max and Min = +20% -20%
1,40	Base value from empirical experience on operation. Max and Min from yields on monoculture plantation. Source: FNP Agrianual, 2017
1,44	Based historical price volatility. Source: FNP Agrianual, 2017
19.634,28	Based on empirical knowleage measured through agri silviculture modelling. Max and Min = +20% -20%
16,76	Base value from empirical experience on operation. Max and Min from yields on monoculture plantation. Source: FNP Agrianual, 2017
1,44	Based historical price volatility. Source: FNP Agrianual, 2017
80,90	Based on empirical knowleage measured through agri silviculture modelling. Max and Min = +20% -20%
540,00	Base value from empirical experience on operation. Max and Min from yields on monoculture plantation. Source: FNP Agrianual, 2017
2,04	Based historical price volatility. Source: FNP Agrianual, 2017
42,44	Based on empirical knowleage measured through agri silviculture modelling. Max and Min = +20% -20%
78,00	Base value from empirical experience on operation.
2.400,00	Based historical price volatility for sawnwood of tropical timber in the state of São Paulo. Costs and Volume to produce sawntiber are considered. Top price is a proxy with Ipê species. Source: CEPEA Esalq/USP, 2016
0,00	Based on empirical knowleage measured through agri silviculture modelling. Max and Min = +20% -20%
0,44	Base from empirical knowleage, and growth models from ESALQ/USP consulting done by Hilton Thadeu. Change in 20% on yields. Expirence has shown a gain on 25% of yields with genetic improvement and management practices. Also 20% risk to fail yields
0,00	Based historical price traded in the region of project.
0,00	Based on empirical knowleage measured through agri silviculture modelling. Max and Min = +20% -20%
0,00	Base value from empirical experience on operation.
0,00	Based historical price traded in the region of project.
695,00	Based on empirical knowleage measured through agri silviculture modelling. Max and Min = +20% -20%
38,40	Base value from empirical experience on operation.
1,20	Based historical price traded in the region of project.

CALCULATE?	VARIABLE	UNITS	TYPE	BASE	MAX	MIN	WORST
Yes	Maracujá - COGS	R$/ha	The fewer the better	9.753,91	11.704,69	7.803,13	11.704,69
Yes	Maracujá - Productivity	kg/plant or MAI	The greater the better	22,75	27,30	18,20	18,20
Yes	Mogno BRA - Price	R$/kg or R$/m^3	The greater the better	2.500,00	3.000,00	2.000,00	2.000,00
Yes	Mogno BRA - COGS	R$/ha	The fewer the better	39,15	46,98	31,32	46,98
Yes	Mogno BRA - Productivity	kg/plant or MAI	The greater the better	0,13	0,16	0,11	0,11
Yes	Ipê - Price	R$/kg or R$/m^3	The greater the better	2.000,00	2.400,00	1.600,00	1.600,00
Yes	Ipê - COGS	R$/ha	The fewer the better	210,77	252,92	168,62	252,92
Yes	Ipê - Productivity	kg/plant or MAI	The greater the better	0,07	0,08	0,05	0,05
Yes	Harvest Timber	R$ / m^3	The fewer the better	418,67	502,40	334,93	502,40
Yes	Harvest Fruit	R$ / kg	The fewer the better	0,54	0,64	0,43	0,64
Yes	CRA sales	BRL/ha/year	The greater the better	190,00	228,00	152,00	152,00
Yes	Carbon Forestry (Revenues)	US$/ton	The greater the better	9,90	11,88	7,92	7,92
Yes	Carbon REDD (Revenues)	US$/ton	The greater the better	3,30	3,96	2,64	2,64
Yes	Water Price	BRL/m^3	The greater the better	0,02	0,02	0,02	0,02
Yes	Water Benefits (Infiltration)	m^3 / ha	The greater the better	700,00	840,00	560,00	560,00
Yes	Incentive	USD/seedling	The greater the better	1,29	1,54	1,03	1,03
No	System LR COGS	R$/ha	The fewer the better	164.320,72	197.184,86	131.456,57	197.184,86
No	LR Cacau - Price	R$/kg or R$/m^3	The fewer the better	7,00	8,40	5,60	8,40
No	LR Cacau - COGS	R$/ha	The fewer the better	148.227,83	177.873,39	118.582,26	177.873,39
No	LR Cacau - Productivity	kg/plant or MAI	The fewer the better	1,16	1,40	0,93	1,40
No	LR Açai - Price	R$/kg or R$/m^3	The greater the better	1,20	1,44	0,96	0,96
No	LR Açai - COGS	R$/ha	The fewer the better	24.542,85	29.451,42	19.634,28	29.451,42
No	LR Açai - Productivity	kg/plant or MAI	The greater the better	13,96	16,76	11,17	11,17
No	LR Taperebá - Price	R$/kg or R$/m^3	The greater the better	1,20	1,44	0,96	0,96
No	LR Taperebá - COGS	R$/ha	The fewer the better	101,13	121,35	80,90	121,35
No	LR Taperebá - Productivity	kg/plant or MAI	The greater the better	450,00	540,00	360,00	360,00
No	LR Andiroba S - Price	R$/kg or R$/m^3	The greater the better	1,70	2,04	1,36	1,36
No	LR Andiroba S - COGS	R$/ha	The fewer the better	53,05	63,66	42,44	63,66
No	LR Andiroba S - Productivity	kg/plant or MAI	The greater the better	65,00	78,00	52,00	52,00
No	LR Andiroba M - Price	R$/kg or R$/m^3	The greater the better	2.000,00	2.400,00	1.600,00	1.600,00
No	LR Andiroba M - COGS	R$/ha	The fewer the better	0,00	0,00	0,00	0,00
No	LR Andiroba M - Productivity	kg/plant or MAI	The greater the better	0,37	0,44	0,29	0,29
No	LR Harvest Timber	R$ / m^3	The fewer the better	165,00	198,00	132,00	198,00
No	LR Harvest Fruit	R$ / kg	The fewer the better	0,51	0,61	0,40	0,61

BEST	COMMENTS
7.803,13	Based on empirical knowleage measured through agri silviculture modelling. Max and Min = +20% -20%
27,30	Base value from empirical experience on operation.
3.000,00	Based historical price volatility for sawnwood of tropical timber in the state of São Paulo. Costs and Volume to produce sawntiber are considered. Top price is a proxy with Ipê species. Source: CEPEA Esalq/USP, 2016
31,32	Based on empirical knowleage measured through agri silviculture modelling. Max and Min = +20% -20%
0,16	Base from empirical knowleage, and growth models from ESALQ/USP consulting done by Hilton Thadeu. Change in 20% on yields. Expirence has shown a gain on 25% of yields with genetic improvement and management practices. Also 20% risk to fail yields
2.400,00	Based historical price volatility for sawnwood of tropical timber in the state of São Paulo. Costs and Volume to produce sawntiber are considered. Top price is a proxy with Ipê species. Source: CEPEA Esalq/USP, 2016
168,62	Based on empirical knowleage measured through agri silviculture modelling. Max and Min = +20% -20%
0,08	Base from empirical knowleage, and growth models from ESALQ/USP consulting done by Hilton Thadeu. Change in 20% on yields. Expirence has shown a gain on 25% of yields with genetic improvement and management practices. Also 20% risk to fail yields
334,93	Based on semi-mechanized harvest system (chainsaw + forwarder). Costs considers, processing from timber to sawnwood R$ 75,00 [Manhiça et al. 2013]; harvest + skidding R$ 75,00; trasport to sawmill [50 km] R$ 50,00. All cost per m^3.
0,43	Average costs for harvesting all non timber forest products. Notice that sensitivity analysis uses a factor, that will change harvest costs proportionally for every species
228,00	Transactions trough BVRio platform, prices for Amazon-PA, 2017. BV Rio and Biofílica are specialized on CRA credits trade. Website from both has info on prices.
11,88	From Forest Trends, transaction from agorforestry projects: Source: http://www.forest-trends.org/documents/files/doc_5242.pdf
3,96	From Forest Trends, avoided deforestation transaction from REDD+ projects. Deforestation rate for the municipality from MapBiomas: Source: http://www.forest-trends.org/documents/files/doc_5242.pdf
0,02	Based on 1.5% of Municipal water fare (suggested by Young, C. E. F.), as PES for land owners. Source: SABESP
840,00	Based on local precipitation in Paragominas - PA (2,400 mm), and infiltration based Water Fund model from TNC - Change of land use from pasture to forest.
1,54	Based on empirical knowleage measured through agri silviculture modelling. Max and Min = +20% -20%
131.456,57	Suitability for annual crops in the project
5,60	Based historical price volatility. Source: FNP Agrianual, 2017
118.582,26	Based on empirical knowleage measured through agri silviculture modelling. Max and Min = +20% -20%
0,93	Base value from empirical experience on operation. Max and Min from yields on monoculture plantation. Source: FNP Agrianual, 2017
1,44	Based historical price volatility. Source: FNP Agrianual, 2017
19.634,28	Based on empirical knowleage measured through agri silviculture modelling. Max and Min = +20% -20%
16,76	Base value from empirical experience on operation. Max and Min from yields on monoculture plantation. Source: FNP Agrianual, 2017
1,44	Based historical price volatility. Source: FNP Agrianual, 2017
80,90	Based on empirical knowleage measured through agri silviculture modelling. Max and Min = +20% -20%
540,00	Base value from empirical experience on operation. Max and Min from yields on monoculture plantation. Source: FNP Agrianual, 2017
2,04	Based historical price volatility. Source: FNP Agrianual, 2017
42,44	Based on empirical knowleage measured through agri silviculture modelling. Max and Min = +20% -20%
78,00	Base value from empirical experience on operation.
2.400,00	Based historical price volatility for sawnwood of tropical timber in the state of São Paulo. Costs and Volume to produce sawntiber are considered. Top price is a proxy with Ipê species. Source: CEPEA Esalq/USP, 2016
0,00	Based on empirical knowleage measured through agri silviculture modelling. Max and Min = +20% -20%
0,44	Base from empirical knowleage, and growth models from ESALQ/USP consulting done by Hilton Thadeu. Change in 20% on yields. Expirence has shown a gain on 25% of yields with genetic improvement and management practices. Also 20% risk to fail yields
132,00	Based on semi-mechanized harvest system (chainsaw + forwarder). Costs considers, processing from timber to sawnwood R$ 75,00 [Manhiça et al. 2013]; harvest + skidding R$ 75,00; trasport to sawmill [50 km] R$ 50,00. All cost per m^3.
0,40	Average costs for harvesting all non timber forest products. Notice that sensitivity analysis uses a factor, that will change harvest costs proportionally for every species

Figure 21 | **Example of a tornado graph. Blue bar corresponds to the IRR of the base case; green bar is the incremental IRR based on best assumptions; red bar is the decremental IRR change based on worst assumptions.**

IRR	
IRR - Real	16,47%

VARIABLE	UNITS	WORST	BASE	BEST
Business Case				
Net Area	ha	32,00	40,00	48,00
Land Cost (Gross Area)	R$/ha	2.760,00	2.300,00	1.840,00
SG&A	BRL/year	26.280,00	21.900,00	17.520,00
System Costs COGS	R$/ha	197.184,86	164.320,72	131.456,57
Cacau - Price	R$/kg or R$/m^3	5,60	7,00	8,40
Cacau - COGS	R$/ha	177.873,39	148.227,83	118.582,26
Cacau - Productivity	kg/plant or MAI	0,93	1,16	1,40
Açai - Price	R$/kg or R$/m^3	0,96	1,20	1,44
Açai - COGS	R$/ha	29.451,42	24.542,85	19.634,28
Açai - Productivity	kg/plant or MAI	11,17	13,96	16,76
Taperebá - Price	R$/kg or R$/m^3	0,96	1,20	1,44
Taperebá - COGS	R$/ha	121,35	101,13	80,90
Taperebá - Productivity	kg/plant or MAI	360,00	450,00	540,00
Andiroba S - Price	R$/kg or R$/m^3	1,36	1,70	2,04
Andiroba S - Productivity	kg/plant or MAI	52,00	65,00	78,00
Maracujá - Price	R$/kg or R$/m^3	0,80	1,00	1,20
Maracujá - COGS	R$/ha	11.704,69	9.753,91	7.803,13
Maracujá - Productivity	kg/plant or MAI	18,20	22,75	27,30
Harvest Fruit	R$ / kg	0,64	0,54	0,43
CRA sales	BRL/ha/year	152,00	190,00	228,00
Carbon Forestry (Revenues)	US$/ton	7,92	9,90	11,88

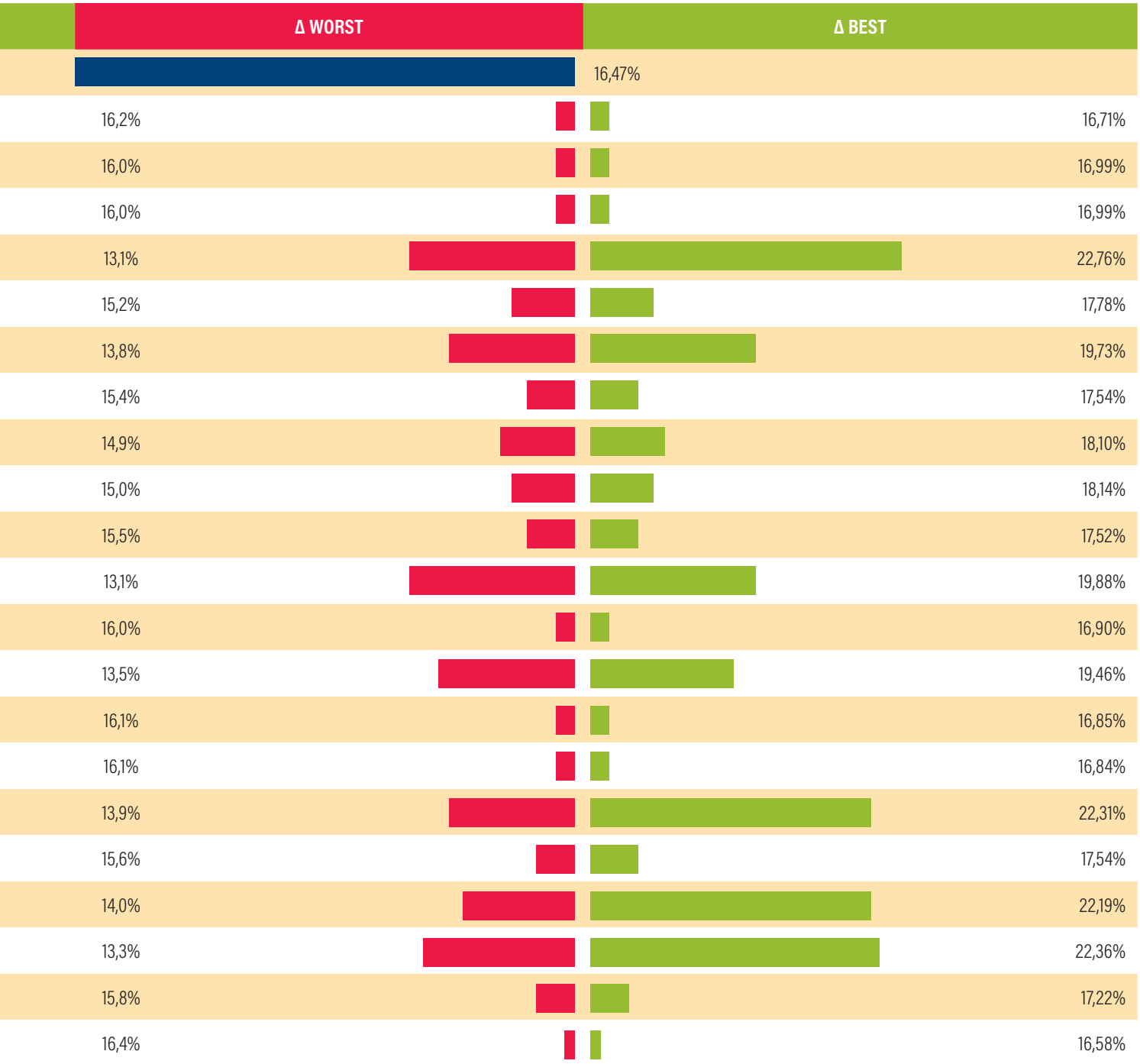

Δ WORST
Δ BEST
16,47%
16,2%
16,71%
16,0%
16,99%
16,0%
16,99%
13,1%
22,76%
15,2%
17,78%
13,8%
19,73%
15,4%
17,54%
14,9%
18,10%
15,0%
18,14%
15,5%
17,52%
13,1%
19,88%
16,0%
16,90%
13,5%
19,46%
16,1%
16,85%
16,1%
16,84%
13,9%
22,31%
15,6%
17,54%
14,0%
22,19%
13,3%
22,36%
15,8%
17,22%
16,4%
16,58%

Figure 22 | **Result of break even and elasticity for each individual variable.**

IRR	
IRR - Real	16,47%

VARIABLE	UNITS	*BREAK EVEN	**ELASTICITY Δ NPV
Net Area	ha	6,96	0,04%
Land Cost (Gross Area)	R$/ha	9.692,51	0,03%
Cacau - Price	R$/kg or R$/m^3	2,03	0,07%
Cacau - COGS	R$/ha	204.127,15	0,15%
Cacau - Productivity	kg/plant or MAI	0,14	0,06%
Açai - Price	R$/kg or R$/m^3	0,43	0,08%
Açai - COGS	R$/ha	43.400,52	0,08%
Açai - Productivity	kg/plant or MAI	0,02	0,05%
Taperebá - Price	R$/kg or R$/m^3	0,87	0,18%
Taperebá - COGS	R$/ha	316,57	0,02%
Taperebá - Productivity	kg/plant or MAI	310,50	0,16%
Andiroba S - Price	R$/kg or R$/m^3	-2,42	0,02%
Andiroba S - Productivity	kg/plant or MAI	-96,14	0,02%
Maracujá - Price	R$/kg or R$/m^3	0,50	0,19%
Maracujá - COGS	R$/ha	26.726,81	0,05%
Maracujá - Productivity	kg/plant or MAI	11,31	0,19%
Harvest Fruit	R$ / kg	-	0,21%
CRA sales	BRL/ha/year	-	0,04%
Carbon Forestry (Revenues)	US$/ton	-	0,01%

*Embedded "Goal Seek" tool. Changes the value of each variable until the desired IRR is reached.
** Is the percentage variation in NPV given a 1% change in the value of each variable.

5 Track Record

This section includes the track record for all the calculations and results generated through the VERENA tool, fed by the input variables.

5.1 CASH FLOW

The VERENA tool generates two types of outputs for the income statement and cash flow: a more concise version (Figure 3) and an extended version with every variable. The extended mode can be seeing by clicking number 2 on the left top corner, close to 'row 1' and 'column A' (Figure 23).

5.2 ACCOUNTING: COGS, CAPEX, DEPRECIATION

In this section, it is possible to visualize the accounting standards that will distribute the costs in the sections ***2.1 System Cost, Fruits & Timber*** and ***2.2 COGS***, based on the type of species (fruit or timber) and end of the rotation period. This feature is very important for tax reasons because we can know what goes before or after the "bottom line" or before or after the "net income". We have divided this section in two pieces, one for fruit and one for timber. For fruits, we used the same concept used for orchards, which uses depreciation. For timber, we used the concept of exhaustion/depletion.

Fruits and system costs:

The concept consists of accumulating the costs incurred (from input section ***2.2 COGS***) until fruit production starts as a Capex (or investment) and goes into the statement of cash flow. After production starts, we can depreciate the total Capex through the remaining life of the asset. We decided to use straight line depreciation. Depreciation is subtracted in the Income Statement and added back in the statement of Cash Flow. During the depreciation period, the costs incurred are considered as production costs and flows to the Income Statement as COGS. Example on Figure 24.

Timber:

The concept consists in accumulating the costs incurred (from input section ***2.2 COGS***) until harvest (thinning or final harvest) starts as a Capex (or investment) and goes into the statement of cash flow. After harvest, the accumulated Capex is exhausted/depleted and at the time of that operation is subtracted in the Income Statement and added back in the statement of Cash Flow. For thinning, the depletion should be proportional because just a portion of the investment is depleted (the biological asset), which still leaves a portion of asset invested. Example on Figure 25.

5.3 TAXES

The assumptions for tax purposes are explained in the section ***1.3 Economics, Debts, Taxes & SG&A***. In the model, it is possible to see the decision-making tree between the "actual" and "presumed" tax regime, based on the previous year rate and revenues.

5.4 WORKING CAPITAL

Track record of working capital management is based on days of revenues, COGS and SG&A.

5.5 SPECIES 1 TO 13; LR SPECIES 1 TO 5; EXTERNALITIES

The mode also allows a track record for each individual species and externalities from the natural capital, including yearly planting schedule input, costs, and revenues.

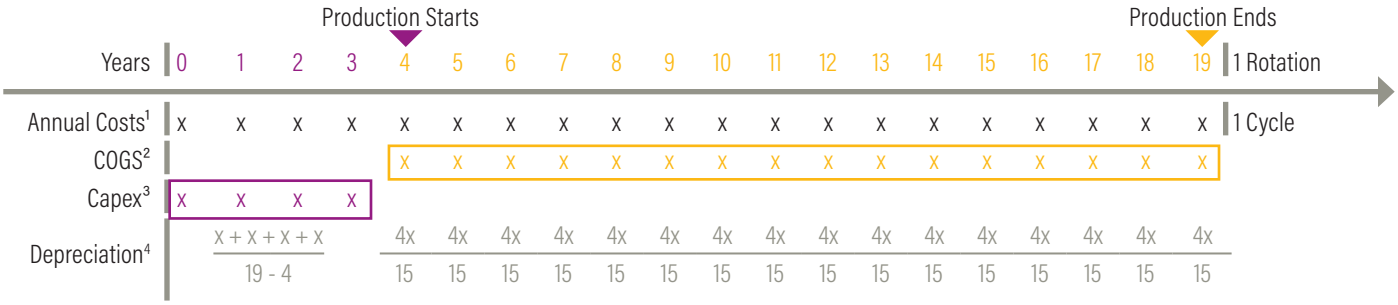
5.6 DEBT & LAND

It is possible to access the debt inflow, the outflows of amortization (for principal payment), and financial expenses outflows (interest payment). To calculate the debt inflow, the capital required to implement the project (lowest accumulated value of Free Cash Flow) is subtracted from the Capex spent with land purchase and the result multiplied by the level of leverage from the WACC model. We assumed that the capital used to purchase the land comes from equity.

Figure 23 | **Summary of a cash flow.**

			YEAR 0	YEAR 1	YEAR 2
			2018	2019	2020
INCOME STATEMENT (DRE)					
(1)		Gross Revenue	43.789	1.676.282	1.560.760
(2)		Sale Taxes (PIS / COFINS)	(1.598)	(61.184)	(56.968)
(3) = (1) - (2)		Net Revenue	42.191	1.615.097	1.503.792
(4)		Cost of Goods Sold / Depletion/Exhaustion (COGS)	(2.520)	(1.841.432)	(777.971)
(5)		Depreciation	-	-	-
(6)		Selling, General and Administrative Expense (SG&A)	(21.900)	(21.900)	(21.900)
(7)		Interest Payment	-	-	-
(8) = (3) - (4) - (6)		EBITDA	17.771	(248.235)	703.921
(9) = (8) - (5)		EBIT	17.771	(248.235)	703.921
(10) = (9) - (7)		EBT	17.771	(248.235)	703.921
CASH FLOW					
(11)		Taxes from Operating Profits	(1.349)	(51.629)	(48.071)
(12) = (10) - (11)		Net Operating Profit after Tax (NOPAT)	16.422	(299.864)	655.850
(13)	0,3%	Land Sale	-	-	-
(5)		Depreciation	-	-	-
(14)		Exhausion / Depletion	-	-	-
(15)	(+/-) Δ	Working Capital	(10.443)	1.483.531	(680.535)
(16)		Capital Expenditure (Capex)	(246.313)	(13.434)	(723.834)
(17) = (12) + (13) + (5) + (14) ± (15) - (16)		Free Cash Flow to Firm (FCFF) Nominal	(240.334)	1.170.232	(748.519)
		Free Cash Flow to Firm (FCFF) Real	(240.334)	1.170.232	(748.519)
(18)		Debt	-	-	-
(19)		Amortization	-	-	-
(20) = (17) + (18) - (19)		Free Cash Flow to Equity (FCFE) Nominal	(240.334)	1.170.232	(748.519)
		Free Cash Flow to Equity (FCFE) Real	(240.334)	1.170.232	(748.519)

Figure 24 | **Accounting procedure for a hypothetical permanent crop orchard (fruit).**

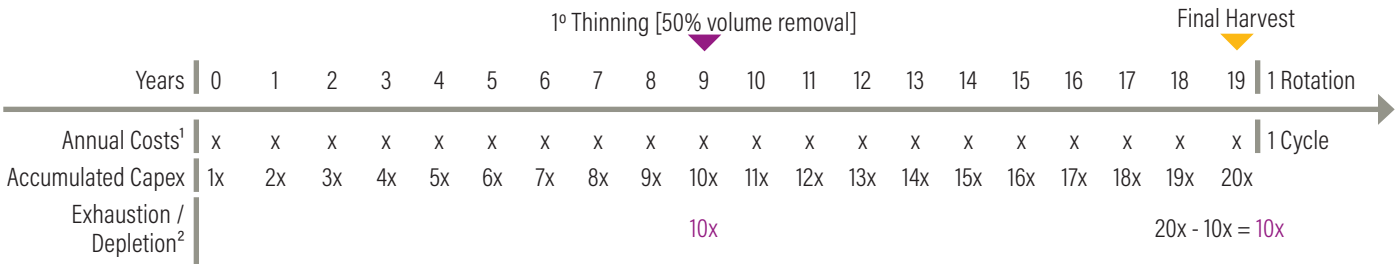


[1] Cost curve used in section 2.4 of the model.
[2] Based on information in which year production begins, flows to the income statement.
[3] Based on information in which year production begins, flows to the statement of cash flow.
[4] Biological asset depreciation is strait line over the remaining life of asset and is subtracted from income statement and added to the cash flow.

Year 0	2018	IRR - Real	16,47%
Final Year	2048	NPV WACC	643.095

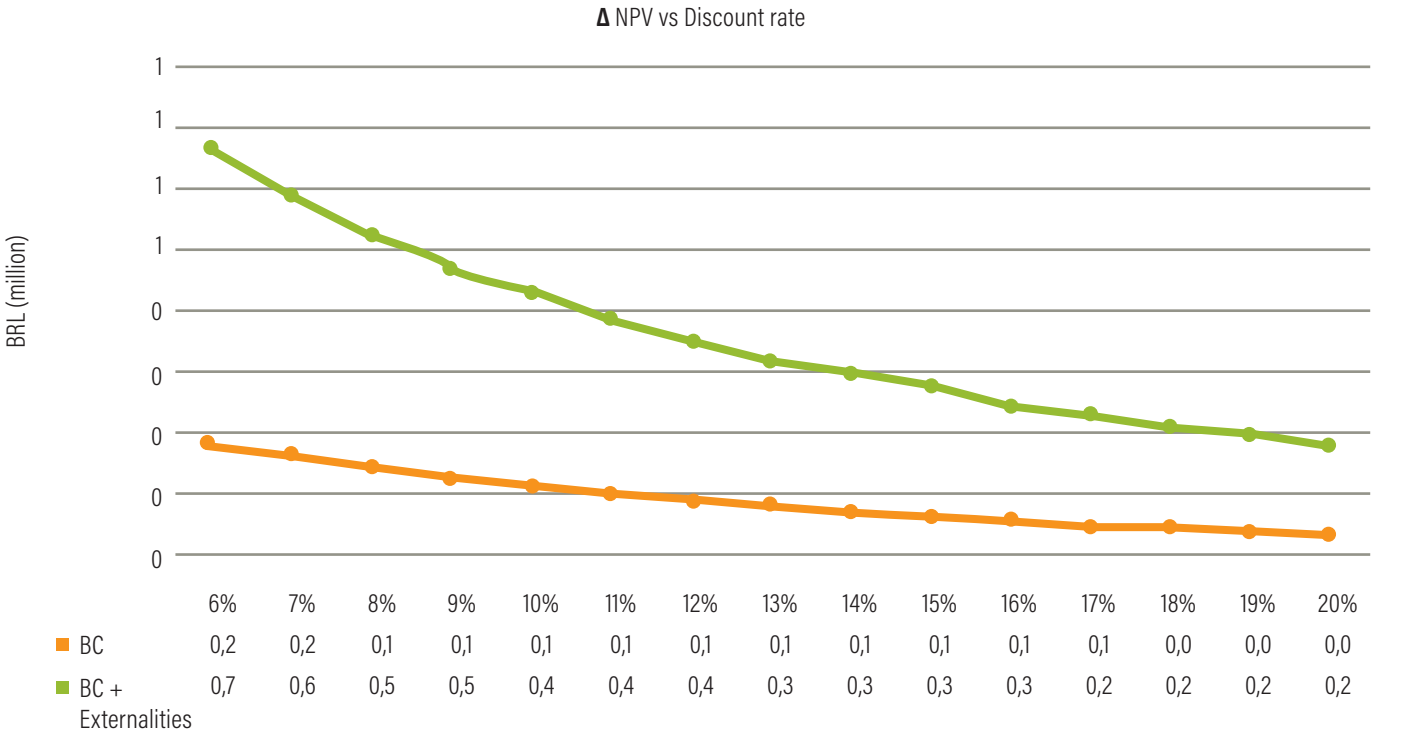
YEAR 3	YEAR 4	YEAR 5	YEAR 6	YEAR 7	YEAR 8	YEAR 9	YEAR 10
2021	2022	2023	2024	2025	2026	2027	2028
1.633.960	1.280.746	34.760	118.760	371.135	575.085	923.551	1.040.385
(59.640)	(46.747)	(1.269)	(4.335)	(13.546)	(20.991)	(33.710)	(37.974)
1.574.320	1.233.999	33.491	114.425	357.589	554.094	889.842	1.002.411
(954.244)	(781.140)	(386.210)	(193.965)	(704.275)	(751.948)	(795.053)	(841.048)
-	-	-	(14.552)	(116.316)	(116.316)	(116.316)	(116.316)
(21.900)	(21.900)	(21.900)	(21.900)	(21.900)	(21.900)	(21.900)	(21.900)
-	-	-	-	-	-	-	-
598.177	430.959	(374.619)	(101.440)	(368.586)	(219.754)	72.889	139.463
598.177	430.959	(374.619)	(115.992)	(484.902)	(336.070)	(43.427)	23.146
598.177	430.959	(374.619)	(115.992)	(484.902)	(336.070)	(43.427)	23.146
(50.326)	(39.447)	(1.071)	(3.658)	(11.431)	(17.713)	(28.445)	(32.044)
547.851	391.512	(375.689)	(119.650)	(496.333)	(353.783)	(71.873)	(8.898)
-	-	-	-	-	-	-	-
-	-	-	14.552	116.316	116.316	116.316	116.316
-	-	-	-	-	-	-	-
124.374	(182.375)	(510.319)	(100.566)	368.727	73.067	101.192	53.379
(556.563)	(490.985)	(569.569)	(283.127)	-	-	-	-
135.816	(349.159)	(1.902.382)	(673.965)	(16.423)	(252.302)	235.797	274.666
115.663	(281.847)	(1.455.578)	(488.790)	(11.290)	(164.400)	145.635	160.798
-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-
135.816	(349.159)	(1.902.382)	(673.965)	(16.423)	(252.302)	235.797	274.666
115.663	(281.847)	(1.455.578)	(488.790)	(11.290)	(164.400)	145.635	160.798

Figure 25 | **Accounting procedure for a hypothetical tree species (timber) with one thinning.**



[1] cost curve used in section 2.3 of the model, flows to the statement of cash flow.
[2] Biological asset depletion is at once, based on the volume depleted in thinning or final harvest from the accumulated capex of the forestry asset. Is subtracted from income statement and added to the cash flow.

Figure 26 | **Sensitivity analysis of the NPV over discount rates of the business cases and the business cases plus the natural capital. "y" axis NPV in million Brazilian Reais; "x" axis are the different discount rates.**



6 Reports

The report section includes the results from the analysis and simulations and are represented by financial indexes.

6.1 RESULTS FROM BUSINESS CASES AND NATURAL CAPITAL

In this sheet, it is possible to see the most important return indicators, such as **IRR,** for the firm and equity (real and nominal). The IRR is the discount rate that makes the present value of the expected cash inflows equal to the initial cost of the project. If the IRR is higher than the cost of capital, the project should be undertaken. One example is the sensitivity analysis of the NPV over different discount rates (Figure 26).

The **NPV** for the firm and equity holders are discounted by WACC and "K_e", respectively. If the NPV value is positive, the project should be undertaken as it increases the shareholder's wealth. If projects are mutually exclusive, the NPV rule should be preferred over the IRR rule because it shows how much in monetary terms the project is increasing shareholders' wealth.

The **payback** period is the time (months, years) it takes to recover the initial investment. The drawback with discounted payback is that it does not consider any cash flows beyond the payback period, which makes payback a poor measure of profitability. The payback, however, is good to measure liquidity of the asset. It is calculated through the accumulated free cash flow and the year with the first positive cash flow mark, which is the period necessary to recover cash investment.

Necessity of capital (**NEC**) – It is the lowest value of the accumulated free cash flow to the firm.

6.2 BREAK EVEN

The report includes the break even (goal seek) simulation for all variables used in the model. (See figure 22).

6.3 SENSITIVITY ANALYSIS – "TORNADO CHART"

The report also shows a graphic representation of the sensitivity analysis, and simplifies the view of the most important variables in the model. (See figure 21).

6.4 RATIOS

In this section, it is possible to see the statement of cash flow over time (operating; financing and investing) and the share of each species in the Capex, Costs, and Revenues. Additionally, it is possible to visualize the profitability ratios (1 to 4), performance ratios (5 to 7), solvency, and coverage ratios (8 and 9). Finally, the ratios can be compared with the ratios of the mainstream forest assets (eucalyptus, for example) (Figure 28). The ratios allow for comparisons over time (time-series analysis) and across firms (cross-sectional analysis). The ratios also allow an assessment of the firm's strategy. For example, a higher gross profit margin may change over time due to technology innovation. (Figure 29).

6.5 FINAL REPORT

The combination of all reports and results presented throughout this section are central to inform decisions to be made by the investors and landowners.

3. FINAL REMARKS AND CONCLUSION

In general, an investment analyst often applies spreadsheet modeling, such as the "VERENA investment tool", to analyze the fundamentals of future cash flows and prospects. The drawback when using this type of model is that the complexity might give the impression that the results are precise and reliable. The quality of the results, however, depends on the quality of the user's inputs. Therefore, the user should be able to explain the assumptions used in the model, and make use of the sensitivity analysis to determine which are the important factors that could affect the valuation.

Investing in real assets, such as the ones shown here, often provides income, tax advantages, and diversification benefits. However, they entail high management costs (SG&A) that are usually illiquid due to the uniqueness of the investment, and which may only be attractive to a limited pool of investors. Due to the characteristics of these assets, an investor needs to conduct detailed due diligence before making an investment.

The "VERENA investment tool" is an attempt to make this new asset class known and credible, with solid and transparent information. With this tool and the results of the business cases we expect to encourage some current investors to increase the scale of their projects. We also expect to attract mainstream investors who may earn risk adjusted returns by investing in a class of assets that provide a range of social and environmental benefits.

WRI Brazil, with the support of its partners, promotes and encourages the application of the VERENA tool in Brazil and any other country interested in promoting a low-carbon forest economy based on reforestation with native species for economic use and agroforestry systems. Through the dissemination and publication of results, we hope to continue building a solid track record of this asset class, so that in the next 10 years we can expect a reduction in the cost of capital and an increase in investment and scale of restoration and reforestation. Moreover, in the case of Brazil, we should expect landowners and companies in the agribusiness sector (e.g. beef, sugar cane, soy, forestry) to use the VERENA business cases and tool to help them comply with the Forest Code and to diversify their sources of revenue.

This work was made possible thanks to the vision and support from CIFF (Children's Investment Fund Foundation) and several partners who donated their time and data to build a robust and credible tool.

Figure 27 | **Results for one business case and each externality, and the combination of the business case and all externalities.**

VARIABLES	UNIT	BASE CASE	INCENTIVE	CRA	WATER	CROP	CARBON	LEGAL RESERVE	BC + EXTERNALITIES
IRR - Real	%	14,31%	14,38%	19,99%	14,37%	15,62%	15,53%	12,75%	17,85%
NPV WACC	BRL	323.483	328.232	622.278	328.376	401.227	421.102	237.039	720.839
IRR - Real Equity	%	14,31%	14,38%	19,99%	14,37%	15,62%	15,53%	12,75%	17,85%
NPV Ke	BRL	(151.865)	(147.015)	48.803	(148.579)	(81.275)	(93.336)	(344.098)	(6.176)
Dicounted Payback	Years	17	16	12	16	15	15	21	12
NEC	BRL	(1.903.097)	(1.898.542)	(1.623.335)	(1.898.516)	(1.810.791)	(1.841.104)	(2.454.416)	(2.011.218)
NPV WACC / ha	BRL/ha	8.087	8.206	15.557	8.209	10.031	10.528	5.926	18.021
NEC / ha	BRL/ha	(47.577)	(47.464)	(40.583)	(47.463)	(45.270)	(46.028)	(61.360)	(50.280)
Gross Margin (COGS/Revenue)	%	29,29%	29,31%	31,54%	29,33%	29,62%	30,16%	29,72%	32,59%
Operating Margin (EBITDA/Revenue)	%	20,03%	20,06%	22,59%	20,08%	20,37%	21,02%	20,52%	23,75%
Net Margin (NOPAT/ Revenue)	%	16,95%	16,98%	19,51%	17,00%	17,29%	17,94%	17,44%	20,67%
IRR - Nominal	%	19,45%	19,53%	25,39%	19,52%	20,82%	20,73%	17,82%	23,15%
IRR - Nominal Equity	%	19,45%	19,53%	25,39%	19,52%	20,82%	20,73%	17,82%	23,15%
Payback	Years	11	11	10	11	10	10	12	10

Figure 28 | **Common size ratios for income statement and cash flow.**

PROFITABILITY RATIOS	1	GROSS MARGIN	(Gross Profit/Revenue)
	2	OPERATING MARGIN	(EBITDA/Revenue)
	3	PRETAX MARGIN	(EBT/Revenue)
	4	NET PROFIT MARGIN	(Net Income/Revenue)
PERFORMANCE RATIOS	5	CASH FLOW OP. TO REVENUE	(CFO/Net Revenue)
	6	CAPITAL INTENSITY	(Capex/Net Revenue)
	7	CASH FLOW TO CAPEX (X)	(CFO/Capex)
SOLVENCY AND COVERAGE RATIOS	8	INTEREST COVERAGE (X)***	(EBITDA/Interest Payment)
	9	LEVERAGE (X)***	(Total Debt/EBITDA)

Figure 29 | **Example of ratios calculated in the model.**

BEGGINING - END ROTATION		
Rotation	Years	30
Beg	Years	2018
End	Years	2048

Benchmark*

NRO.	PROFITABILITY RATIOS	VERENA	BEST	WORSE	AVERAGE
1	Gross Margin	32,32%			
2	Operating Margin	30,54%	51,70%	16,50%	34,86%
3	Pre-tax Margin	23,47%	33,30%	7,50%	21,94%
4	Net Profit Margin	20,39%			

NRO.	PERFORMANCE RATIOS	VERENA	BEST	WORSE	AVERAGE
5	Free Cash Flow to Revenue	21,46%	42,60%	3,60%	22,29%
6	Capital Intensity	37,14%	7,90%	64,10%	23,27%
7	Cash Flow to Capex (x)	4,27	2,20	0,40	1,26

NRO.	SOLVENCY AND COVERAGE RATIOS	VERENA	BEST	WORSE	AVERAGE
8	Interest Coverage (x)	0,00	10,90	1,40	4,87
9	Debt to EBITDA	0,00	2,80	9,70	5,00

1. (Gross Profit / Revenue)
2. (EBITDA / Revenue)
3. (EBT / Revenue)
4. (Net Income / Revenue)
5. (FCF / Net Revenue)
6. (Capex / Net Income)
7. (CFO / CAPEX)
8. (EBITDA / Interest Payment)
9. (Total Debt / EBITDA)
10. Fitch Ratings - Comparação de Pares do Setor de Celulose, Papel e Produtos Florestais na América Latina, Outubro de 2016
11. Only biological Assets; Benchmark considers Plant investments
12. First rotation only

Figure 29 | **Example of ratios calculated in the model.** (continue)

Model Share

VARIABLES	REVENUE	COSTS	CAPEX	REVENUE R$/HA
Pimenta do Reino	7,86%	18,02%		55722,13
Cacau	12,82%	25,60%	22,50%	20354,25
Açai	9,86%	8,61%	9,69%	22492,49
Taperebá	34,04%	6,99%	0,14%	52698,80
Andiroba S	4,18%	0,15%	0,07%	6060,91
Andiroba M	2,31%	0,30%		924,46
Arroz	0,00%	0,01%		0,04
Abóbora	3,78%	0,29%		31375,66
Maracujá	3,98%	1,67%		29153,38
Mogno BRA	1,05%	0,21%	0,05%	420,21
Ipê	0,42%	0,29%	0,29%	168,08
System Costs		21,97%	42,22%	
System LR		5,49%	10,55%	
Cacau	3,21%	6,40%	5,63%	5088,56
Açai	2,46%	2,15%	2,42%	5623,12
Taperebá	8,51%	1,75%	0,04%	13174,70
Andiroba S	1,04%	0,04%	0,02%	1515,23
Andiroba M	0,58%	0,07%		231,12
Incentive	0,02%	0,00%	0,00%	225,72
CRA	2,78%	0,00%	0,00%	8205,16
Water	0,05%		0,00%	134,35
Carbon	1,05%	0,00%	0,00%	2542,03
Purchase of land		0,00%	6,38%	

Figure 30 | **Final report: combination of most important information from previous reports**

Base Case Vs Externalities

VARIABLES	UNIT	BASE CASE	BC + EXTERNALITIES
IRR - Real	%	14,31%	17,85%
NPV WACC	BRL	323.483	720.839
IRR - Real Equity	%	14,31%	17,85%
NPV Ke	BRL	(151.865)	(6.176)
Dicounted Payback	Years	17	12
NEC	BRL	(1.903.097)	(2.011.218)
NPV WACC / ha	BRL/ha	8.087	18.021
NEC / ha	BRL/ha	(47.577)	(50.280)
Gross Margin (COGS/Revenue)	%	29,29%	32,59%
Operating Margin (EBITDA/Revenue)	%	20,03%	23,75%
Net Margin (NOPAT/Revenue)	%	16,95%	20,67%
IRR - Nominal	%	19,45%	23,15%
IRR - Nominal Equity	%	19,45%	23,15%
Payback	Years	11	10

Figure 30 | **Final report: combination of most important information from previous reports**

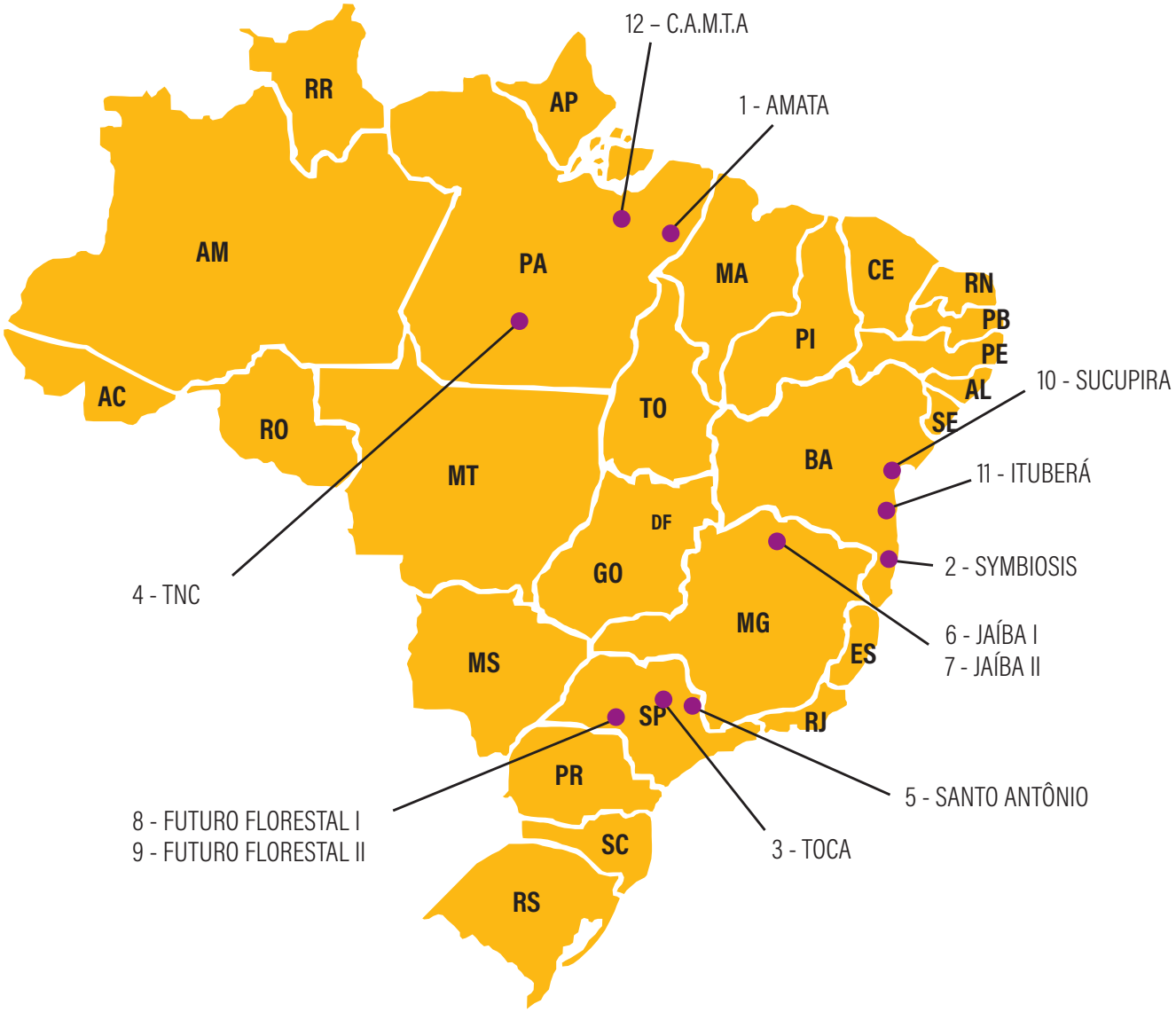
(Continue)

Tornado / Break Even & Elasticity

VARIABLE	UNITS	WORST	BASE	BEST	Δ WORST
Business Case					
System Costs COGS	R$/ha	197.184,86	164.320,72	131.456,57	13,1%
Harvest Fruit	R$ / kg	0,64	0,54	0,43	13,3%
Maracujá - Price	R$/kg or R$/m³	0,80	1,00	1,20	13,9%
Maracujá - Productivity	kg/plant or MAI	18,20	22,75	27,30	14,0%
Taperebá - Price	R$/kg or R$/m³	0,96	1,20	1,44	13,1%
Taperebá - Productivity	kg/plant or MAI	360,00	450,00	540,00	13,5%
Cacau - COGS	R$/ha	177.873,39	148.227,83	118.582,26	13,8%
Açai - Price	R$/kg or R$/m³	0,96	1,20	1,44	14,9%
Açai - COGS	R$/ha	29.451,42	24.542,85	19.634,28	15,0%
Cacau - Price	R$/kg or R$/m³	5,60	7,00	8,40	15,2%
Cacau - Productivity	kg/plant or MAI	0,93	1,16	1,40	15,4%
Açai - Productivity	kg/plant or MAI	11,17	13,96	16,76	15,5%
Maracujá - COGS	R$/ha	11.704,69	9.753,91	7.803,13	15,6%
CRA sales	BRL/ha/year	152,00	190,00	228,00	15,8%
SG&A	BRL/year	26.280,00	21.900,00	17.520,00	16,0%
Land Cost (Gross Area)	R$/ha	2.760,00	2.300,00	1.840,00	16,0%
Taperebá - COGS	R$/ha	121,35	101,13	80,90	16,0%
Andiroba S - Price	R$/kg or R$/m³	1,36	1,70	2,04	16,1%
Andiroba S - Productivity	kg/plant or MAI	52,00	65,00	78,00	16,1%
Net Area	ha	32,00	40,00	48,00	16,2%
Carbon Forestry (Revenues)	US$/ton	7,92	9,90	11,88	16,4%

	Δ BEST	*BREAK EVEN	**ELASTICITY Δ NPV
16,47%			
22,76%	-	0,22%	
22,36%	-	0,21%	
22,31%	-	0,19%	
22,19%	-	0,19%	
19,88%	-	0,17%	
19,46%	-	0,15%	
19,73%	-	0,14%	
18,10%	-	0,08%	
18,14%	-	0,08%	
17,78%	-	0,07%	
17,54%	-	0,05%	
17,52%	-	0,05%	
17,54%	-	0,05%	
17,22%	-	0,04%	
16,99%	-	0,02%	
16,99%	-	0,02%	
16,90%	-	0,02%	
16,85%	-	0,02%	
16,84%	-	0,02%	
16,71%	-	0,01%	
16,58%	-	0,01%	

APPENDIX 1 – LOCATION OF THE BUSINESS CASES.



APPENDIX 2 – CALCULATION "BETA LUMBER / WOOD.

TIMBER AND LUMBER COMPANIES	LEVERED BETA	D/E RATIO	EFFECTIVE TAX RATIO	UNLEVERED BETA	
Boise cascade Company (BBC)	1,86	2,06	34%	0,79	http://finance.yahoo.com/quote/BCC/key-statistics?p=BCC
Deltic Timber Corporation (DEL)	0,93	0,49	34%	0,70	http://finance.yahoo.com/quote/DEL/key-statistics?p=DEL
Pope Resources, A Delaware Limited Partnership (POPE)	0,9	0,71	34%	0,61	http://finance.yahoo.com/quote/POPE/key-statistics?p=POPE
Weyerhaeuser Co. (WY)	1,55	1,1	34%	0,90	http://finance.yahoo.com/quote/WY/key-statistics?p=WY
Canfor Corp. (CFP TO)	1,6	1,71	34%	0,75	http://finance.yahoo.com/quote/CFP.TO/key-statistics?p=CFP.TO
Conifex Timber Inc. (CFF TO)	1,94	1,7	34%	0,91	http://finance.yahoo.com/quote/CFF.TO/key-statistics?p=CFF.TO
Universal Forest Products Inc. (UFPI)	1,85	2,55	34%	0,69	http://finance.yahoo.com/quote/UFPI/key-statistics?p=UFPI
Mean	**1,52**	**1,47**	**34%**	**0,77**	

Note:
Levered Beta: The Beta used is Beta of Equity. Beta is the monthly price change of a particular company relative to the monthly price change of the S&P500. The time period for Beta is 3 years (36 months) when available.
D/E ratio: Total Current Assets / Total Current Liabilities
Industrial Goods: Lumber and Wood production
Source: yahoo finance

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1. More information available at: <www.projetoverena.org) >
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4. The Forest Code provides two types of legally-binding protection instruments for conservation on private lands: Permanent Preservation Areas (Áreas de Preservação Permanente) and the Legal Forest Reserve (Reserva Legal). This protected percentage varies from 20% (e.g. Mata Atlântica biome) to 80% (e.g. Amazon biome) depending on the type of vegetation present and the property's geographical location in the country.
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ASSUMPTIONS OF THE CAMP MODEL.

i) Ideally use default risk free debt such as U.S. T-bill. Nevertheless, the most appropriate maturity in the case of reforestation assets are T-bonds (10 YTM or 30 YTM). Annualized return on T-bills and T-bonds can be found at Damodaran Online:
<http://pages.stern.nyu.edu/~adamodar/New_Home_Page/spreadsh.htm>

ii) These indexes can be found on financial mainstream websites such as: Morningstar; Yahoo Finance; Bloomberg, and others. Is important to note that profile 1 has the highest risk perception and 4 the lowest, the risk premium reflects this perception, the higher the risk the higher the expected return.
Profile 1: Annualized Return (last 5 years) on the Russell 2000 stock index.
Profile 2: Annualized Return (last 5 years) on the S&P 500 stock index.
Profile 3: Annualized Return (last 5 years) on the S&P 500 stock index.
Profile 4: Annualized Return (last 5 years) on the S&P Global Timber and Forestry stock index.

iii) The estimation of cost of equity can be problematic in developing countries as beta parameter do not capture country risks, such as political risk among others. To reflect this reality a country risk premium is added to the model. For example, if you are an American investor investing in Brazil, CRP should be added in the model, otherwise the analyst when operating the model can use "zero" value. To understand this variable further and find country risk premiums you can visit:
< http://www.ipeadata.gov.br/ExibeSerie.aspx?serid=40940&module=M>.

iv) Beta is the measure of risk, and can be found by the regression of return on markets and return of a firm stock. The use of beta will be further discussed below.
Profile 1: Unleveraged beta for Paper/Forest Products companies. Source: Damodaran Online:
<http://people.stern.nyu.edu/adamodar/New_Home_Page/data.html>
Profile 2: Unleveraged beta for Paper/Forest Products companies. Source: Damodaran Online:
<http://people.stern.nyu.edu/adamodar/New_Home_Page/data.html>
Profile 3: Unleveraged beta for Farming/agriculture companies. Source: Damodaran Online:
<http://people.stern.nyu.edu/adamodar/New_Home_Page/data.html>
Profile 4: Unleveraged beta for lumber companies calculated through the method described below for VERENA assets.

v) Source: <http://www.usinflationcalculator.com/inflation/current-inflation-rates/>

vi) Source: IBGE, Diretoria de Pesquisas, Coordenação de Índices de Preços, Sistema Nacional de Índices de Preços ao Consumidor.

ACKNOWLEDGMENTS

We are pleased to acknowledge our institutional strategic partners, who provide core funding to WRI: Netherlands Ministry of Foreign Affairs, Royal Danish Ministry of Foreign Affairs, and Swedish International Development Cooperation Agency.

IUCN and WRI Brasil developed the VERENA investment tool with the financial support of Children's Investment Fund Foundation (CIFF).

Special thanks to:
Ana Yang from CIFF for financial support, and partnership.
Roberto Waack, a Brazilian businessman who also inspired and conceived the project.

Our acknowledgements to those who contributed directly or indirectly to the implementation of this project:
Miguel Calmon, Rachel Biderman, Suzanna Lund; Bruno Mariani, Renato de Jesus, Samir Rolim; Daniel Piotto; Pedro Diniz, Otavio Negrelli, Osvaldo Serrano, Matheus Zonete, Luciano Schaaf, Dario Guarita, Alexsandro Holanda; Rodrigo Ciriello; Eduardo Ciriello; Valéria Ciriello; Gustavo de Mattos; Rodrigo Freire; Thaís Maier; Charles Pryl; Gilberto Terra; Guilherme Madalosso; Pedro Brancalion; Michinori Konagano; Nicole Lazari; Roberto Miranda; Murilo Menezes; Aurélio Padovezi, Miguel Moraes, Maurício Boff, Fernanda Boscaini, Caroline Donatti, Mariana Oliveira and Renata Marson.

Thanks also to the internal and external reviewers : Sofia Faruqi, Rene Zamora, Rafael Barbieri, Marcio Macedo; Otávio Negrelli; Andrew Wu and Rohini Chaturvedi.

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CIFF CHILDREN'S INVESTMENT FUND FOUNDATION

IUCN

ABOUT WRI

World Resources Institute is a global research organization that turns big ideas into action at the nexus of environment, economic opportunity and human well-being.

Our Challenge
Natural resources are at the foundation of economic opportunity and human well-being. But today, we are depleting Earth's resources at rates that are not sustainable, endangering economies and people's lives. People depend on clean water, fertile land, healthy forests, and a stable climate. Livable cities and clean energy are essential for a sustainable planet. We must address these urgent, global challenges this decade.

Our Vision
We envision an equitable and prosperous planet driven by the wise management of natural resources. We aspire to create a world where the actions of government, business, and communities combine to eliminate poverty and sustain the natural environment for all people.

Our Approach
COUNT IT
We start with data. We conduct independent research and draw on the latest technology to develop new insights and recommendations. Our rigorous analysis identifies risks, unveils opportunities, and informs smart strategies. We focus our efforts on influential and emerging economies where the future of sustainability will be determined.

CHANGE IT
We use our research to influence government policies, business strategies, and civil society action. We test projects with communities, companies, and government agencies to build a strong evidence base. Then, we work with partners to deliver change on the ground that alleviates poverty and strengthens society. We hold ourselves accountable to ensure our outcomes will be bold and enduring.

SCALE IT
We don't think small. Once tested, we work with partners to adopt and expand our efforts regionally and globally. We engage with decision-makers to carry out our ideas and elevate our impact. We measure success through government and business actions that improve people's lives and sustain a healthy environment.

ABOUT CIFF:

The Children's Investment Fund Foundation (CIFF) is an independent philanthropic organization based in London (UK), with offices in Nairobi (Kenya) and New Delhi (India). The foundation works with a wide network of partners to transform the lives of vulnerable children in developing countries.

ABOUT IUCN:

The International Union for Conservation of Nature (IUCN) is the largest and oldest network of environmental organizations and has been operating since October 1948 to promote nature conservation and the sustainable use of natural resources. Through its constituents (member organizations, thematic committees and secretariat), IUCN participates in scientific research and promotes and supports the implementation of legal instruments, policies and conservation practices nationwide. It operates or manages thousands of projects worldwide.