



Economic Valuation of Business-Related Ecosystem Services

Case Studies of Trends in
Ecosystem Services (TeSE)
Initiative Member Companies

2015 Cycle

GVCES BUSINESS INITIATIVES

The Center for Sustainability Studies (GVces) of the Business Administration School at Getulio Vargas Foundation (FGV-EAESP) is an open arena for study, learning, insights, innovation, and knowledge production, formed by people with multidisciplinary background, engaged and committed, with an authentic desire to transform society. GVces activities are based on the development of public and private management strategies, policies and tools to promote sustainability for local, national and international scenarios, driven by four major pillars: (i) training activities; (ii) research and knowledge production; (iii) debates and exchange of information; and (iv) mobilization and communication.

Under this context, the Business for the Climate (EPC) Platform, Innovation and Sustainability in the Value Chain (ISCV), Local Development and Large Projects (Local ID), Trends in Ecosystem Services (TeSE), and Applied Life Cycle (CiVIA) are GVces **Business Initiatives** for networked co-creation of strategies, tools, and public and business policy propositions related to sustainability. We handle issues concerning local development, ecosystem services, climate, and value chain.

Here are GVces Business Initiatives in 2015:



In order to adapt to climate change, a new version of the tool to elaborate business strategies was developed, with three pilot projects. The simulation of the Emissions Trading System (EPC ETS) completed two years of operation. Additionally, a working group elaborated propositions for implementing the Low-Carbon Industry Plan.



Cycle targeted at identifying opportunities for innovation in sustainability in logistics processes of large enterprises, leveraging small and medium businesses. The Supply Management Working Group, also sponsored by the initiative, developed a protocol to build a Risk Matrix for the supply chain.



Development of business guidelines to monitor local development and assess impacts in territories where large projects and/or supply chains operate. A call for cases was conducted to identify experiences of large enterprises related to both topics covered throughout the year. Four initiatives were selected, in Brazil and in Latin America.



Development of guidelines for provisioning ecosystem services and guidelines for the noneconomic valuation of cultural ecosystem services (in partnership with Local ID). Besides, pilot projects were conducted with the companies, based on the Corporate Guidelines for the Economic Valuation of Ecosystem Services (DEVESE 2.0).



Training of managers on methods to quantify carbon footprint, with hands-on experience based on pilots. Development of a calculation tool to quantify the carbon footprint of products (goods and services), supported by an emission factor data base with over 200 processes adapted according to the Brazilian scenario.

MASTHEAD

An initiative of

Getúlio Vargas Foundation
Center for Sustainability Studies
Trends in Ecosystem Services (TeSE)

General Coordination

Mario Monzoni

Vice Coordination

Paulo Branco

Executive Coordination

Annelise Vendramini

Technical Coordination

Natalia Lutti Hummel

Team

GVces: Thais Camolesi Guimarães

GIZ: Luciana Mara Alves and Tomas Inhetvin

GIZ Consultant: Philippe Lisbona (Verdesa)



Partnership

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INTRODUCTION

Trends in Ecosystem Services (TeSE) business initiative was launched in 2013 by the Center for Sustainability Studies of Sao Paulo Business Administration School at Getulio Vargas Foundation (GVces/EAESP-FGV) with the mission to support the Brazilian business sector in the incorporation of natural capital into business decision-making processes. Since then, TeSE has been developing, jointly with its member companies, tools for quantification, economic valuation and reporting of externalities when it comes to ecosystem services.

In 2014, ten pilot projects were developed with the purpose to apply the Corporate Guidelines for the Economic Valuation of Ecosystem Services (DEVESE 2.0) and the corresponding calculation tool. In 2015, ten new business cases of ecosystem services valuation were developed, some of which based on the lessons learnt previously, extending the scope determined in 2014. The new cases took a step forward by reporting their results according to the Corporate Guidelines for the Reporting of Environmental Externalities (DEREA 1.0).

By developing and publishing economic valuation business cases, TeSE's objectives are:

- Assess whether the methodological procedures adopted are actually proper to represent business practical reality;
- Assess whether those methodological procedures are applicable by the business, i.e.; whether they require technical expertise and data collection efforts that can actually be implemented, at least partially,

with no need for external consultants;

- Train TeSE member companies to use DEVESE and its calculation tool; and
- Create a set of references on practical use of DEVESE and environmental economic valuation in the business context, in such a way that other businesses will be aware of the different situations for which this kind of analysis can be useful, as well as the numerous solutions that can be adopted to adapt DEVESE to specific circumstances they would not otherwise be aware of.

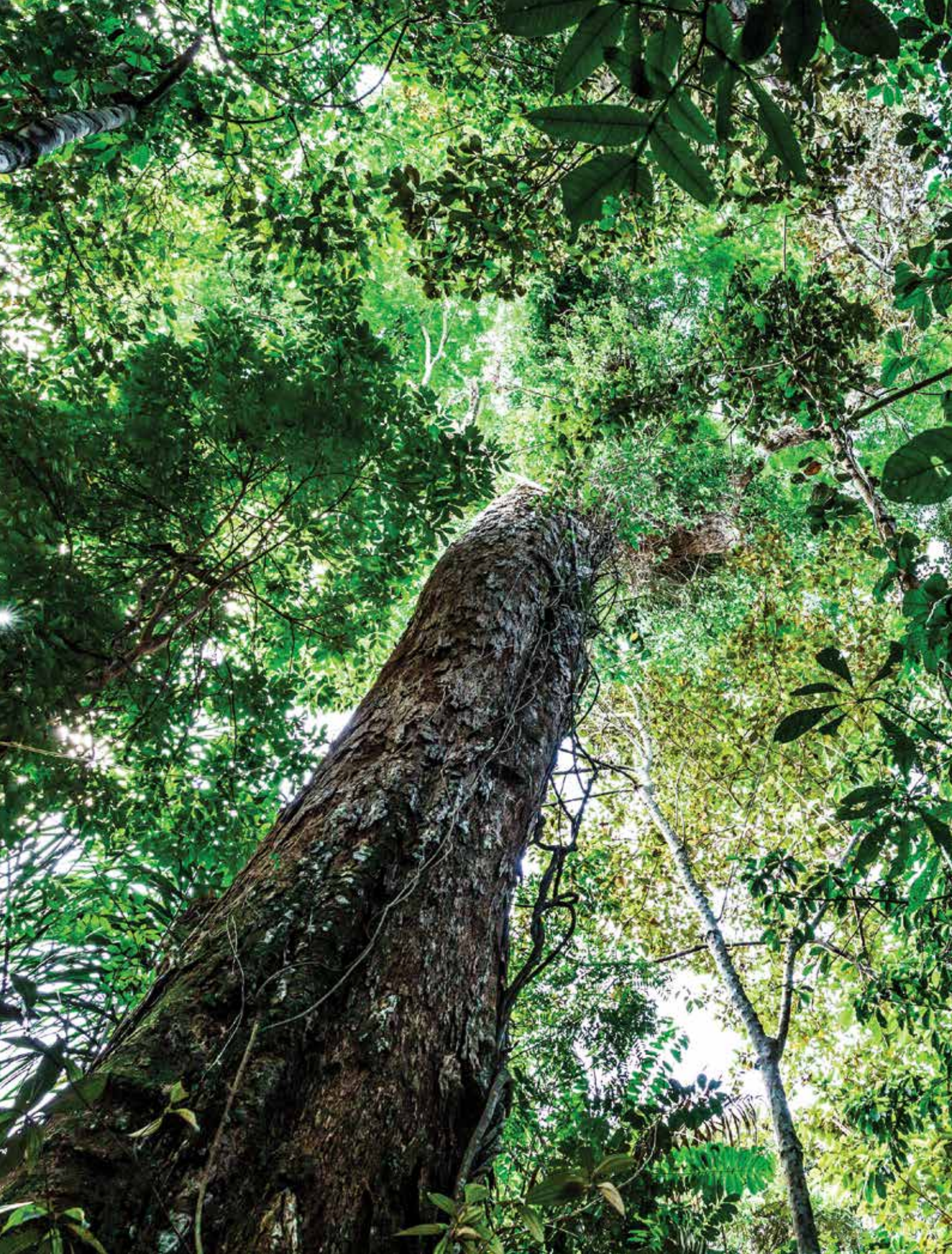
All in all, these business cases contribute to extend the list of business experiences in ecosystem services valuation and to diagnose enhancement opportunities for DEVESE guidelines and the corresponding calculation tool, both of which are TeSE's commitments.

In this publication, we present the summaries of the business cases, as well as the results reporting, according to a model based in DEREAA. This publication does not delve into details about the data and calculations used, given the complexity and the strategic nature of some of the information used by the companies. In spite of that, the data provided properly meets the goal of this publication.

You can find further details about the types of data and methodological procedures needed for those analyses directly at DEVESE and its corresponding calculation tool, both available at TeSE website (www.fgv.br/ces/tese).



CASE STUDIES





Nickel, Niobium and Phosphates Unit: "Comparison between the use of wood chips and metallurgical coal in kiln calciners for the production of ferronickel, in the municipality of Niquelandia, State of Goias"

Executive Summary

Anglo American activities hold a close relationship with natural capital and they depend on water and energy in their production process. Additionally, mineral exploration also produces externalities related to land use changes caused by removal of vegetation cover and waste generation.

For the case study, the company chose to evaluate its relationship with the biomass fuel provision ecosystem service, in the region of Niquelandia (State of Goias), in 2014. The scope was selected considering that, in this process, metallurgical coal was replaced with wood chips, as a way to mitigate the risks associated with natural capital.

In order to understand to what extent the business depends on the biomass provision ecosystem service, the amount of biomass currently needed for business activities was compared with the total amount of fuels used. The conclusion was that biomass accounts for 37% of total energy used by production processes in Niquelandia unit, which represents a value of about BRL 6.3 million/year. This value was estimated using the Market Price Method (MPMe), which considers the market price established for biomass fuel as an estimate of its economic value for the business.

In case the wood chips currently used became unavailable, the business would need to replace 37% of the energy used in its production process, which would be done using metallurgical coal and, in smaller quantities, oil and electric power, considered as alternatives that would meet the

necessary requirements so as not to interfere with the physicochemical processes that occur in kiln calciners. As metallurgical coal has a calorific potential that is higher than wood chips, a smaller amount would be required to supply the energy demand. Using the Replacement Cost Method (RCM), the costs needed for the business to replace wood chips with metallurgical coal were calculated, and they would be somewhere around BRL 2 million/year.

Although the cost associated with metallurgical coal in the production process is lower than using wood chips, the initiative would be justified if the negative externalities produced by fossil fuels were taken into account. This happens because using a renewable energy source to replace fossil fuels avoids the emission of about 12,000 tCO₂e, which, if we consider the costs estimated of potential impacts of releasing a ton of carbon into the atmosphere (the so-called Social Cost of Carbon – SCC), totals about BRL 470,000.

The results of the study indicate that, although metallurgical coal presents lower direct costs for the Nickel, Niobium and Phosphates Unit operation, the use of wood chips in production processes is justified by considering that this renewable alternative, besides avoiding greenhouse gas emissions, contributes to reduce the business dependency on fossil fuels. It is also worth pointing out that, in future complementary studies, it is important to analyze potential externalities that might be produced due to land use change derived from biomass production.

Reporting of Environmental Dependencies, Impacts and Externalities¹

Person in charge of filling out the report

Name: Izabela Ribeiro

DRIVERS FOR THE PROJECT

The business activities hold a close relationship with natural capital. Its key dependencies, besides ore, can be expressed in water and energy use, while externalities are related to land use changes and removal of vegetation cover for mineral exploration, and waste generation. As fossil fuels are finite resources, the business sees replacement in the use of those fuels with renewables as a way to mitigate risks associated with natural capital. In nickel operations, for instance, the metallurgical coal used in kiln calciners can be replaced with wood chips.

SCOPE OF THE PROJECT

Object of the project analysis: Use of wood chips in kiln calciners in the production of ferronickel – Niquelandia

Geographic area: Niquelandia – GO

Step(s) of the value chain included: Own operations

Type of approach: Retroactive

Time horizon: Monthly average in 2014

Ecosystem service: Biomass fuel provision

BIOMASS FUEL PROVISION

Ability of ecosystems to produce biomass that can be used as fuels, such as timber, charcoal, agricultural crop residues, etc.

Methods used: Replacement Cost Method (RCM) and Market Price Method (MPMe)

Results²

Dependency: BRL 6.3 million

Impact: BRL 1.9 million

Externality: BRL 470,000

Data used:

Dependency on biomass fuel: 37%

Alternative energy source: Imported metallurgical coal

Avoided emissions, in tCO₂e: 12,394.69

Type of data:

Primary, own data

Primary, own data

Primary, own data

Other info:

Results from physical metrics: In case biomass is unavailable, the alternative energy source would be imported metallurgical coal, since it meets the project specific requirements. The necessary amount for replacement was calculated according to the energy potential of each fuel. Because metallurgical coal has a lower energy potential, smaller quantities would be needed to supply the 37% of the process energy dependency.

According to the results, even though the amount of coal needed was much lower, an average emission of about 12,400 tCO₂e is avoided monthly when biomass is used.

Other pieces of information: all wood chips used are produced by the company itself, in reforested areas that also manage, maintain and preserve APPs and Legal Reserves.

1. This form was inspired by Version 1.0 of the Corporate Guidelines for the Reporting of Environmental Externalities (DEREA 1.0).

2. The results are reported in approximate values to give an idea of the dimension of ecosystem services value.



"Valuation of social and economic benefits obtained with the organic certification to produce açai in the community of Rural Farmers and Neighborhood Association of Nazarezinho do Meruu"

Executive Summary

Beraca is a Brazilian business with expertise in the development of technologies, solutions and high-performance raw materials for the pharmaceutical and cosmetic industries. Beraca's activities hold a strong relationship with natural capital, since it operates with elements from the Brazilian biodiversity as raw materials for its products. It is relevant to understand the relationship their raw materials suppliers have with the ecosystems, with the purpose to ensure long-term provisioning of the inputs needed for the business operations and also for income generation in the communities.

So, for the case study, the business decided to evaluate the ecosystem service of raw material provision related to açai in 2014, in the context of the community of Rural Farmers and Neighborhood Association of Nazarezinho do Meruu (municipality of Igarape-Miri, State of Para).

The scope was selected because the açai berry, used to obtain the oil sold by the company, has low yield, which therefore requires proper management of the berry picking so as to get the necessary volume for the desired production of oil.

To evaluate the business dependency on açai ecosystem provision, the method used was the Marginal Productivity Method (MPM), by calculating the amount of income the business would stop receiving from the sale of the product (oil, in this case) if there were no possibility for the ecosystem and/or

the community to supply açai, and the result was a reduction of about BRL 260,000 in its annual revenues.

After Beraca started operating with Nazarezinho community, they adopted organic cultivation in agroforestry system, which allowed for a 45% increase in production, thanks to enhancements and recovery of the local ecosystem. Higher açai productivity, enabled by a change in management techniques after Beraca started its operations in the region, increased the income to the supplier community in about BRL 59,000, which represents a positive externality.

The management techniques adopted contribute not only to generate local income, but also to ensure açai provisioning for the company to sell. This is explained by the fact that conventional management techniques present lower berry yields from the community to the company, which, on its turn, reduces Beraca's ability to produce and sell oil, generating a negative impact of about BRL 140,000 to the business.

The results of the study indicate the effectiveness of implementing the organic certification in the community (which, in practice, means the adoption of more sustainable management techniques), showing the importance of investing in socio-environmental practices in production, which, in this case, generated not only social benefits to the supplier community, but also economic benefits to the business.

Reporting of Environmental Dependencies, Impacts and Externalities³

Person in charge of filling out the report

Name: Érica Pereira

DRIVERS FOR THE PROJECT

Since the year 2000, Beraca's Sociobiodiversity Valuation Program (Programa de Valorização da Sociobiodiversidade® - PVSb) connects communities in the Amazon with the world by supplying Brazilian biodiversity inputs. Through the PVSb program, Beraca helps communities to start associations and cooperatives, offers trainings and courses, and provides resources for responsible management in the picking areas.

The Rural Farmers and Neighborhood Association of Nazarezinho do Meruu – known as Nazarezinho Association – is located in the municipality of Igarapé-Miri (Para State) and is one of Beraca's main suppliers of berries, among them açai. The Association is formed by 23 families that pick the açai sold to the company and offers benefits to the associate members and to the rest of the community through the capital that flows in their local economy.

Given this relationship between Beraca and Nazarezinho Association, our objective was to understand how the supply of açai berry influences in the community development through the income it generates.

SCOPE OF THE PROJECT

Object of the project analysis: Açai supply

Geographic area: Igarapé Miri – Para State

Step(s) of the value chain included: Value chain (supplier)

Type of approach: Retroactive, inventory

Time horizon: 2014

Ecosystem services: Other provisioning services

OTHER PROVISIONING SERVICES

Provision ecosystem services result from ecologic processes (or functions) that produce tangible/material goods which are somehow useful and produce well-being.

Method used: Marginal Productivity Method (MPM)

Results⁴

Dependency: BRL 260,000

Impact: BRL 143,000

Externality: BRL 59,000

Data used:

Type of data:

Target ecosystem good: Açai

Dependency on the good demanded: 69.65 Kg of açai/kg of oil

Alternate good: Not applicable

Environmental quality metric used for the analysis: kg of açai/ha

Primary, acquired

3. This form was inspired by Version 1.0 of the Corporate Guidelines for the Reporting of Environmental Externalities (DEREA 1.0).

4. The results are reported in approximate values to give an idea of the dimension of ecosystem services value.

Collateral information:

Results from physical metrics: the traditional method yields in average 148 kg/ha, whereas the organic method yields 328 kg/ha. Therefore, organic cultivation and the agroforestry system allowed for a 45% increase in production (data was obtained from reference sources; we were not able to measure production in the community).

Assumptions made in valuation estimates: Supply of organic açai generating a revenue flow to associate members. Calculations considered total açai supplied throughout the year, something that is previously agreed between Beraca and the community.

Explanatory notes:

Organic certification is considered an enhancement factor in environmental production and conservation; however, only the berry sales value, sustainable management and production are being considered, not the certification itself.

Data concerning average productivity of the traditional and organic methods was obtained from reference sources (Embrapa, 2006), since it was not possible to measure the average productivity specifically for Nazarezinho community.

Reference used: Embrapa Amazônia Oriental (Brazilian Agricultural Research Corporation, Eastern Amazon). Sistema de Produção do Açai (Açai Production System). Dec/2006. Available at:

<https://sistemasdeproducao.cnptia.embrapa.br/FontesHTML/Acai/SistemaProducaoAcai_2ed/paginas/coeficientes.htm>.

ANALYSIS OF THE RESULTS

The açai berry is used to obtain different products that are used in the cosmetics and pharmaceutical industries. Yield is about 1% of oil per kilo, thus a great volume is needed for the business to reach its desired production of oil from the berry.

Beraca's dependency is 69.65 kg of açai/kg of oil, and the impact in case this good is unavailable was valued as about BRL 140,000.00 per year. With the supply of açai, the positive externality generated was about BRL 60,000 in the region, also considering the income produced by the cultivation management.

MANAGING ENVIRONMENTAL EXTERNALITIES

The Sociobiodiversity Valuation Program (Programa de Valorização da Sociobiodiversidade®, or PVSb, in the Brazilian Portuguese acronym) offers social and environmental benefits to raw material suppliers. In order to improve environmental conservation results, PVSb encourages sustainable cultivation and extractivist practices, such as agroforestry systems, organic certification in supply areas, sustainable management in extractivist harvest areas, among other ways to operate without using crop protection or using it as little as possible, adopting more natural techniques. Aware of the results produced by the study, we can understand there is still need to compare them with other suppliers who do not work using the same model adopted by Nazarezinho Association, so we can apply the lessons learnt to understand the influence PVSb may have on the supplier community and also reduce our vulnerability when it comes to dependency on that supplier.





Valuation of the ecosystem services associated with the Riparian Forest Program in a power plant in Iguaçu River, State of Parana"

Executive Summary

Copel, a power plant in the State of Parana, operates in power generation, transmission and distribution areas, as well as telecommunications. The company has its own generation park, consisting of 17 hydroelectric power plants and a coal-fired thermoelectric power plant in the State of Parana, in addition to a hydroelectric that is under construction in the State of Mato Grosso, totalling 5,044 MW (megawatts) of installed capacity. It also jointly operates seven other hydroelectric power plants, a natural gas-fired power plant, and it operates three wind farm complexes, with 280 MW of installed capacity, and two others are under construction.

For the purposes of the case study, the selected hydroelectric power plant was Governador Bento Munhoz da Rocha Neto, with 1,676 MW. Located in Iguaçu River, it accounts for about 35% of the business total installed capacity.

Since 2006, Copel has been conducting the Riparian Forest Program with forest restoration activities in the plant reservoir neighboring areas. The Area of Permanent Preservation (APP) in that territory is 2,516 hectares. Through the Riparian Forest Program, the expectation is to recover an area equivalent to 1,000 hectares of Mixed Ombrophilous Forest. The objective of the case study is to value the results of the program for global climate regulation and erosion prevention ecosystem services.

For the global climate regulation ecosystem service, the calculations estimated the permanent CO₂e removal that the recovered area may present, considering forest growth in the reservoir APP. In 10 years, APP recomposition will remove about 60,000 tCO₂e. In order to value externalities, the Social Cost of Carbon was used – considering estimated costs of eventual impacts of releasing a ton of carbon into the atmosphere – and the resulting value was approximately BRL 9 million.

For the erosion prevention ecosystem service, physical metrics were calculated both using a baseline scenario – soil with pastureland – and a scenario with native vegetation after restoration. Using the Universal Soil Loss Equation (USLE), we got the amount of soil lost in both situations, and the result indicates avoided impact, sparing the erosion of about 160 ton/ha/year of soil. To value that impact, the Avoided Costs Method was used, considering the cost to dredge the reservoir – quoted in BRL 3,500.00/ton – totalling about BRL 5 million/year.

Thus, based on the calculations made in the case study, Copel was able to quantify the positive results obtained through the Riparian Forest Program over the last 10 years, being BRL 50 million in erosion prevention, and BRL 9 million of positive externality in global climate regulation. That value was compared to the cost to implement the program, allowing for assessing the program effectiveness and measuring its results.



Reporting of Environmental Dependencies, Impacts and Externalities⁵

Person in charge of filling out the report

Name: Vanessa Barreto da Silva

DRIVERS FOR THE PROJECT

Identify and analyze the main ecosystem services related to Copel's business, aiming at improving the management process and offering support for development and investments in environmental projects.

SCOPE OF THE PROJECT

Object of the project analysis: Riparian Forest Program in the neighboring areas of the reservoir in the Governador Bento Munhoz da Rocha Netto (GBM) hydroelectric power plant.

Geographic area: municipalities of Pinhao, Bituruna, Cruz Machado, Uniao da Vitória, and Porto Vitoria

Step(s) of the value chain included: Own operations

Type of approach: Prospective

Time horizon: 10 years

Ecosystem services: Global climate regulation and soil erosion regulation.

GLOBAL CLIMATE REGULATION

Role played by ecosystems in carbon and nitrogen biogeochemical cycles, thus influencing emissions of important greenhouse gases, such as CO₂, CH₄ and N₂O.

Method used: Replacement Cost Method (RCM)

Results⁶

Externality: BRL 9.1 million

Data used:

Type of data:

Actual emissions derived from deforestation or environmental degradation, in tCO₂e: 0

Actual removals derived from environmental recovery, in tCO₂e: 60,061.18

Primary/own data

Biome phytophysiology and land use: Montane Mixed Ombrophilous Forest

Primary

Area to be recovered, in ha: 1,006.75 ha

Primary/own data

Rate of deforestation with the project: zero (considering it is an APP)

Collateral information:

Exchange rate used to convert the Social Cost of Carbon (SCC) into Brazilian Reais: BRL 4.00

5. This form was inspired by Version 1.0 of the Corporate Guidelines for the Reporting of Environmental Externalities (DEREA 1.0).

6. The results are reported in approximate values to give an idea of the dimension of ecosystem services value.

SOIL EROSION REGULATION

Role played by ecosystems in controlling soil erosion processes – natural processes, which can be accelerated or retarded depending on the type of use and the soil management practices adopted.

Method used: Avoided Costs Method (ACM)

Results⁷

Dependency: not calculated

Impact: BRL 5.8 million

Externality: not calculated

Data used:

Type of data: primary/own data

Total area assessed in the erosion estimate: 1,006.75 ha

Different land uses: pastureland

Primary

Loss of soil nutrients (Method 1): 167.03 ton/ha/year

Other info:

Results from physical metrics:

Erosion of the exposed soil: 175.80 ton/ha/year

Soil erosion with vegetation cover: 8.78 ton/ha/year

Assumptions adopted in valuation estimates: value considered for the reservoir dredging: BRL 3,500/ton

Other pieces of information: For this calculation, only the reservoir area to be recovered was considered (1,006.75 ha). It is worth mentioning the total area of the APP is 2,516.88 ha.

Explanatory notes*: The Loss of Soil Nutrients calculation was used, considering erosion only. Nutrients are not relevant in this analysis.

ANALYSIS OF THE RESULTS

Recovery of the area proposed by the program will offer direct benefits to soil erosion regulation and global climate regulation. For soil erosion regulation, the positive impact will result in avoided costs equivalent to BRL 5,885,413.00 per year.

For global climate regulation, calculations indicate a positive externality, removing about 60,000 tons of CO₂e from the atmosphere.

This data corroborates how important the program is, and can be used as reference to proceed with the program.

MANAGING ENVIRONMENTAL EXTERNALITIES

The global climate regulation analysis points to significant positive externality, reinforcing the relevance of recovering degraded areas when it comes to removal of greenhouse gases.

7. The results are reported in approximate values to give an idea of the dimension of ecosystem services value.

CASE I

“Provision of water and biomass fuel – a valuation study for the business manufacturing unit in Botucatu/SP”

Executive Summary

Centroflora Group operates in the development and trade of plant extracts for the personal care, nutrition and healthcare industries. The group has technologies and processes that allow for isolating, extracting, concentrating and drying natural active ingredients. For the case study, they chose to evaluate their production plant in Botucatu, State of Sao Paulo.

The business relationship with natural capital occurs in many ways and, in this study, they decided to evaluate the water provision and the biomass fuel provision ecosystem services. In both cases, dependencies, impacts and externalities were calculated and valued.

For water provision, the dependency physical metric obtained was about 27 m³/ton of the finished product. For valuation, the method adopted was the Replacement Cost Method (RCM), considering a hypothetical replacement of the water currently collected in a well with the supply of water by the public network/utilities, and the value obtained was about BRL 1.5 million in the first year, and BRL 400,000/year in the following years. For impact, they considered the volume of water demanded, but currently unavailable, of about 13,000 m³, which resulted in an approximate value of BRL 1.2 million. The externality produced was calculated in about BRL 1.5 million, a value that refers to the amount of water

that becomes unavailable to other users because the business is using it.

For the biomass provision ecosystem service, Botucatu unit will start using pellet, from 2016 on, to generate heat for the industrial processes. Thus, the valuation calculations consider the Replacement Cost Method (RCM), replacing pellet with LPG. Dependency was calculated as about 1,400 tons of pellet/year and, if it needed to be replaced with LPG, the dependency would be about BRL 725,000. For impact, they considered a scenario in which 50% of that volume would be unavailable, and the resulting value was about BRL 280,000/year. Externality caused by the use of biomass was estimated in about 1,500 tCO₂e avoided/year, which, if we consider the costs estimated of potential impacts of releasing a ton of carbon into the atmosphere (the so-called Social Cost of Carbon – SCC), totals about BRL 215,000/year of positive externality.

The valuation results obtained by Centroflora allowed the business to understand some interactions its manufacturing plant has with natural capital, in a broader social context. This was an important first step for the business to be able to properly manage socio-environmental aspects in the unit, allowing for better understanding the previously mapped risks and opportunities.

Reporting of Environmental Dependencies, Impacts and Externalities⁸

Person in charge of filling out the report

Name: Milena Tomas

DRIVERS FOR THE PROJECT

Valuate natural capital in unit II of Centroflora Group with the purpose of identifying opportunities and potential impacts that may influence strategic business decision making.

SCOPE OF THE PROJECT

Object of the project analysis: Anidro do Brasil Extrações S.A. – Unit II

Geographic area: Botucatu/SP

Step(s) of the value chain included: Own operations

Type of approach: Retroactive (water provision) and prospective (biomass fuel provision)

Time horizon: 1 year: retroactive approach – 2014; prospective approach – 2016.

Ecosystem services: Water provision and biomass fuel provision

WATER PROVISION

Role of ecosystems in the hydrological cycle and their contribution in terms of water quantity, defined as total production of freshwater.

Method used: Replacement Cost Method (RCM)

Results⁹

Dependency: BRL 1.4 million

Impact: BRL 1.1 million

Externality: -BRL 1.5 million

Data used:

Type of data:

Dependency on water quantity: 27.16 m³/ton

Hydrological balance of the water used by the business: -36,237.00 m³/year

Secondary, autochthonous, and own data.

Watershed from where water is collected, name and classification of the water body: Formação Serra Geral Aquifer/Paranapanema Alto Watershed. The source of water is an artesian well.

Secondary, autochthonous, and acquired.

Watershed used for water replacement, name and classification of the water body: Water from the public network provided by the water utility.

Other info:

Results from physical metrics: 3,387 m³ of unavailable water; 32,850 m³ of collected water; and 0 m³ of water returned.

Assumptions made in valuation estimates: To valuate dependency and impact, the data used was the water actually consumed by the business, which corresponds to a fraction of what is collected from the well.

To valuate the externality, the data used was the total amount of water collected from the well, since it was stored in holding tanks and became unavailable to other users, regardless of whether it has been used or not.

Explanatory notes: Reference material used to find information concerning the watershed where the water is collected: Brazilian Water National Agency (ANA)

8. This form was inspired by Version 1.0 of the Corporate Guidelines for the Reporting of Environmental Externalities (DEREA 1.0).

9. The results are reported in approximate values to give an idea of the dimension of ecosystem services value.

BIOMASS FUEL PROVISION

Ability of ecosystems to produce biomass that can be used as fuels, such as timber, charcoal, agricultural crop residues, etc.

Method used: Replacement Cost Method (RCM)

Results¹⁰

Dependency: BRL 725,000

Impact: BRL 276,000

Externality: BRL 215,000

Data used:

Type of data:

Dependency on biomass fuel: 1,368 tons/year

Secondary, autochthonous, and own data.

Alternative energy source: LPG

Secondary, autochthonous, and own data.

Type and local productivity of the removed economic activity: N/A

Avoided emissions, in tCO₂e: 1,483.85 tCO₂e

Other info:

Results from physical metrics: biomass will account for over 85% of the total power used by production processes in Botucatu's manufacturing unit. Use of pellet instead of LPG will avoid the emission of 1,483.85 tCO₂e/year.

Assumptions made in valuation estimates: A scenario in which biomass fuel was 50% unavailable was created for calculation purposes only, in order to be aware of the consequences in case this actually happens. Since the unavailability valued in the impact is not real, the externality was valued based on the total biomass that will be used.

ANALYSIS OF THE RESULTS

Although water provision had been valued in the pilot project the business developed within TeSE initiative in 2014, we decided to run new calculations, making some adjustments: this year, there were enhancements in logistics costs estimates, and we considered a single alternative source (public utilities) because it is nearer the plant, if compared to other sources. Additionally, replicating the study with updated data contributes to create a history of data.

Analyzing the business dependency on the water provision ecosystem service, the replacement cost summed up about 1.5 million in the first year, and our production requires .27 m³ of water for each kilogram of the product.

The result of the dependency reaffirms the importance to consider feasible alternatives in case of shortage of the current sources.

For the biomass fuel provisioning service, besides financial gains, the replacement of the energy source will provide significant socio-environmental benefits. This is explained by the fact that replacing about 85% of LPG, currently the main source of emissions in unit II of Centroflora Group, with pellet (biomass) will avoid the emission of about 1,500 tCO₂e per year.

MANAGING ENVIRONMENTAL EXTERNALITIES

Since 2014, Centroflora has a working group formed to specifically manage the plant water consumption. Improvements in controls and in many sectors and activities are being analyzed and implemented with the goal to make our process more efficient. Ecosystem services economic valuation has contributed to these debates and to support strategic decision making.

10. The results are reported in approximate values to give an idea of the dimension of ecosystem services value.





CASE II

"Extractivism, raw material provision and global climate regulation ecosystem services"

Executive Summary

Centroflora Group operates in the development and trade of plant extracts for the personal care, nutrition and healthcare industries. The group has technologies and processes that allow for isolating, extracting, concentrating and drying natural active ingredients. For the case study, we selected quercetin, a flavonoid extracted from *Dimorphandra* sp – part of a Brazilian legume family mostly found in the savannah. In Centroflora, extractivism occurs in two conservation units (CU): Araripe National Forest – Apodi, and Chapada do Araripe Environmental Protection Area, both in the State of Ceara. The plant contains high levels of bioflavonoids and supplies one of Centroflora's production units located in Parnaíba, State of Piauí.

The ecosystem service valued was raw material provision, which refers to the amount of raw material produced by the ecosystem. For dependency, the provision risk was quantified as 22.5 tons of raw material/ton of the finished product. Valuated through the Marginal Productivity Method (MPM) and assuming 8 months of production, the dependency accounts for about BRL 6 million/year. In other words, this is the value the business would stop gaining annually with the product sale in a scenario where *Dimorphandra* sp would be totally unavailable in the ecosystem to the company.

Besides dependency, another scenario considered was shortage of *Dimorphandra* sp, based on changes in weather patterns. Considering climate change could make 30% of the volume of *Dimorphandra* sp currently supplied unavailable, production and trade of the active ingredient by Centroflora would be reduced, generating a negative impact of about BRL 1.9 million to the business.

Another ecosystem service valued was global climate regulation, considering that, when the business purchases raw materials, it contributes to structure a sustainable extractivist chain, reducing deforestation in the target area (636 hectares). That avoided deforestation was calculated as about 480 tCO₂e/year. Valuation was performed based on the Replacement Cost Method (RCM), taking as a reference the Social Cost of Carbon (SCC), which represents the necessary cost to restore the impacts caused by releasing a ton of carbon into the atmosphere. Given this context, the positive externality derived from the avoided deforestation was valued as about BRL 70,000/year.

With the calculations made in the case study, Centroflora can manage risks related to obtaining raw materials – understanding its dependency on the main input of its production process – as well as measure one of the environmental benefits derived from supporting the *Dimorphandra* sp production chain, the avoided emissions.

Reporting of Environmental Dependencies, Impacts and Externalities¹¹

Person in charge of filling out the report

Name: Milena Tomas

DRIVERS FOR THE PROJECT

Understand interactions between ecosystem services and quercetin production, as well as quantify the risks and positive impacts of that activity.

SCOPE OF THE PROJECT

Object of the project analysis: Dimorphandra sp value chain for Unit III.

Geographic area: Cariri region/State of Ceara

Step(s) of the value chain included: Value chain (suppliers)

Type of approach: Prospective

Time horizon: 1 year

Ecosystem services: Other provisioning services and global climate regulation.

OTHER PROVISIONING SERVICES

Provision ecosystem services result from ecologic processes (or functions) that produce tangible/material goods which are somehow useful and produce well-being.

Method used: Marginal Productivity Method (MPM)

Results¹²

Dependency: BRL 6.1 million

Impact: BRL 1.8 million

Externality: not calculated

Data used:

Type of data:

Target ecosystem good: Dimorphandra sp

Dependency on the good demanded: 450 tons

Alternate good: N/A (there is no alternative)

Environmental quality metric used for the analysis: N/A (the calculation of the externality was not made)

Other info:

Results from physical metrics: A scenario in which the target ecosystem good is 30% unavailable (aligned with the Sustainable Finance project).

Assumptions made in valuation estimates: extreme climate event. For valuation, they considered the loss of productivity and consequent reduction in finished product sales due to the lack of raw material. In order to estimate the plant maximum capacity, the data used was maximum capacity per month (2.5 tons) and production over eight months a year, considering the production of another product in the remaining months (a more current scenario).

11. This form was inspired by Version 1.0 of the Corporate Guidelines for the Reporting of Environmental Externalities (DEREA 1.0).

12. The results are reported in approximate values to give an idea of the dimension of ecosystem services value.

GLOBAL CLIMATE REGULATION

Role played by ecosystems in carbon and nitrogen biogeochemical cycles, thus influencing emissions of important greenhouse gases, such as CO₂, CH₄ and N₂O.

Method used: Replacement Cost Method (RCM)

Results¹³

Externality: BRL 69.5 million

Data used:

Type of data:

Avoided deforestation

Biome phytophysiognomy and land use: Submontane Seasonal Semideciduous Forest; FLONA.

Primary and acquired.

Area of avoided deforestation, in ha: 636

Secondary, autochthonous, and own data.

Deforestation rate considered as baseline: 0.5

Primary and acquired

Deforestation rate with the project: 0

Secondary, autochthonous, and own data

Avoided emissions, in tCO₂e: 477.84

Other info:

Exchange rate used to convert the Social Cost of Carbon (SCC) into Brazilian Reals: BRL 3.83

Assumptions made in valuation estimates: Maximum plant capacity, species population density and ratio. In order to calculate the area of influence, we used the species population density (number of individuals and estimated average productivity), in which for each ton of *Dimorphandra* sp, an area of 1.4 hectare is needed.

Explanatory notes: Source for exchange rate – OANDA website: www.oanda.com/lang/pt/currency/converter/

ANALYSIS OF THE RESULTS

Having valued the raw material provisioning service, we were able to prove the close relationship between biodiversity and our business. Lack of supply of a given plant to the manufacturing unit directly affects the business revenue, since it is really challenging to replace a natural ingredient with another presenting the same characteristics and functions.

When it comes to the global climate regulation service, we could measure the positive externality we generate to society by indirectly avoiding the emission of 477.84 tCO₂e due to forest management, fostering local development and valuing the standing forest.

13. The results are reported in approximate values to give an idea of the dimension of ecosystem services value.



Executive Summary

As a manager of highway concessions, the relationship the Ecorodovias Group holds with ecosystem services occurs mainly through control of land use impacts in its linear projects. In operations, it is worth highlighting the topic of soil erosion prevention in embankment and cut slopes.

Thus, for this case study, the business selected to value the use of a specific technology, the application of coconut coir mat, in one of its business units, Ecopistas, which manages Ayrton Senna/Carvalho Pinto highway. A 100-hectare area was selected, formed by cut and embankment slopes, located at Carvalho Pinto highway (Vale do Paraiba, SP), where the mat was applied. The purpose of the mat is to avoid entrainment of seeds during the wet season and conserve soil humidity, substantially reducing the need for irrigation during the day (especially in the Winter), as well as to make it easier to germinate seeds in soils that are poor in nutrients. Over time, the mat degrades, since it is biodegradable.

In order to understand the impact caused on the ecosystem services by the use of the mat, the erosion physical metric was calculated for a baseline scenario (exposed soil) and for a scenario where the material was applied. Using the Universal Soil Loss Equation (USLE), we got the amount of soil lost in both situations, and the result indicates a positive impact

when the mat is applied, sparing the erosion of about 100 ton of soil/ha/year.

To value the soil erosion regulation ecosystem service provided by the mat, the Avoided Costs Method (ACM) was used, measuring the cost to remove soil in case of mudslide, quoted as BRL 50/ton. To calculate dependency, the business used the same metrics, but compared a scenario of exposed soil (minimum regulation) with a scenario with native vegetation (maximum regulation).

With those values, the estimate to get the payback for the mat application would be 11 years. The payback time was considered appropriate by the business, since the conservative calculation did not take into account other potential costs, such as desilting bodies of water, disposal in landfills, environmental fines, accidents, as well as the highway interdiction, causing loss of revenues and social impact. If those other costs had been calculated and embedded, the payback time would have been reduced.

The results of the study point that the business will keep applying the mat in other areas of risk along the highway.

Reporting of Environmental Dependencies, Impacts and Externalities¹⁴

Person in charge of filling out the report

Name: Silvio Souza

DRIVERS FOR THE PROJECT

Show how important it is to use coconut coir mat to recover degraded areas. The technique reduces soil erosion, silting in bodies of water, and their corresponding physical and economic impacts on the highway operation.

After many unsuccessful attempts to recover the slopes in the Ayrton Senna/Carvalho Pinto highway, an environmentally-sound technique was developed to enable the concessionaire to get improved results: using the coconut coir mat.

The key benefits offered by the mat are: it has lower cost, compared to other mats; it protects the seeds from being dragged along with the rain; it keeps soil stability and humidity, besides being a biodegradable material that decomposes over time.

SCOPE OF THE PROJECT

Object of the project analysis: Own business unit, a concessionaire of Ayrton Senna and Carvalho Pinto S.A. highways – Ecopistas.

Geographic area: A linear road transport project, an area under concession that crosses nine municipalities in Sao Paulo, Alto Tiete and Vale do Paraiba.

Step(s) of the value chain included: Own operations.

Type of approach: Prospective per project.

Time horizon: Project cycle, 15 years.

Ecosystem services: Soil erosion regulation

SOIL EROSION REGULATION

Role played by ecosystems in controlling soil erosion processes – natural processes, which can be accelerated or retarded depending on the type of use and the soil management practices adopted.

Method used: Avoided Costs Method (ACM)

Results¹⁵

Dependency: BRL 9,000/ha/ year in areas with slopes.

Impact: BRL 5,000/ha/ year in areas with slopes.

Externality: not calculated

Data used:

Type of data:

Total area assessed in the erosion estimate: 100 ha

Different land uses: Exposed soil and soil with mat

Secondary, own data, and acquired

(X) Loss of soil nutrients (Method 1): 99.7 ton/ha/year in loss of soil

14. This form was inspired by Version 1.0 of the Corporate Guidelines for the Reporting of Environmental Externalities (DEREA 1.0).

15. The results are reported in approximate values to give an idea of the dimension of ecosystem services value.

Other info:

Results from physical metrics: 191.82 ton/ha/year in exposed soil, and 92.07 ton/ha/year using the mat (a 52% reduction in soil entrainment).

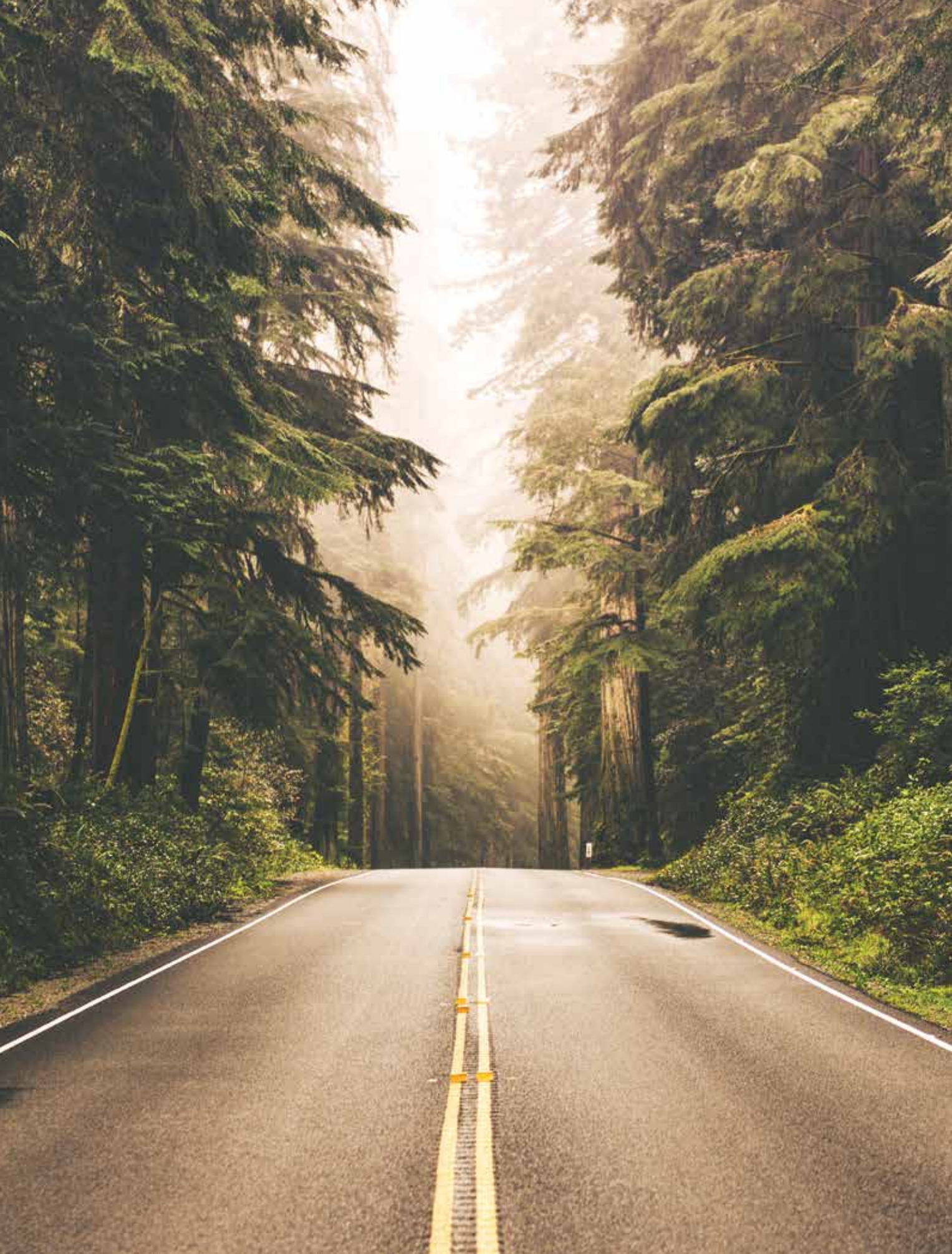
Assumptions adopted in valuation estimates: mat cost, labor cost, and cost to remove actual soil per m³ and per ton.

Adjustments or derivation applied to the methods and tools adopted: Calculated based on the avoided cost of removing soil from the highway.

Other pieces of information: 100 ha recovered with coconut coir mat, out of which:

- 80 ha in cut slope area (ramp height: 49 ft/15 m; height: 36.7 ft/11.18 m);
 - 20 ha in embankment slope area (ramp height: 65 ft/20 m; height: 56.8 ft/17.32 m).
-

Explanatory notes: In order to gather the data, we assumed the costs of ton/ha/year incurred to repair mudslides in the hill located at km 106 on the East side, which costed BRL 2,515,589.00, not considering other costs for desilting bodies of water, disposal in landfills, or total interdiction of the highway, which would possibly represent higher costs, due to losses in revenue.





"Valuation of the dependency on water availability for the industrial process of a cleaning product industry as an instrument to foster risk management measures"

Executive Summary

Ki-Jóia Indústria e Comércio is a small business with an industrial plant in the municipality of Aparecida de Goiania (State of Goiás) that manufactures cleaning products such as fabric softener, disinfectant and liquid soap. Its relationship with natural capital, more specifically with water resources, occurs in two ways: on one side, it consumes water as an input in its production process and, on the other side, in its product life cycle, if the wastewater generated by the use of its products is not treated, it can contaminate bodies of water.

For the case study, the business chose to analyze its dependency on the water provision ecosystem service in 2015, considering the region where it is located has been recently affected by prolonged drought periods.

To value dependency on this ecosystem service, the Replacement Cost Method (RCM) was used, calculating the cost Ki-Jóia would have to pay to replace all the water demanded in its production process. Currently, the water is collected from an artesian well located within the industrial plant and the most operationally and financially feasible replacement option would be to purchase water from the State water utility,

Saneamento de Goiás (SANEAGO), which would require building pipes to connect to the system. Considering current dependency of 1.2 m³ of water per liter of cleaning product manufactured, if all the water were unavailable, the value to replace it would be about BRL 316,000 in 2015. Considering the business cost structure, this is a significant amount and would account for a 3.5% reduction in the operational margin.

The results obtained show how important it is to invest in risk management measures that help reduce the business dependency on the water provision ecosystem service.

Given this context, one of the measures the company adopted was to implement a sewage treatment plant, with capacity to treat 5,000 liters of water daily, allowing the water to be later reused in the industrial plant. Therefore, the business can reduce part of the volume collected (about 10%) and, consequently, reduce its dependency.

Reporting of Environmental Dependencies, Impacts and Externalities¹⁶

Person in charge of filling out the report

Name: Jaime Canedo

DRIVERS FOR THE PROJECT

Establish our annual dependency on water and the impact if we need to import water from another watershed.

SCOPE OF THE PROJECT

Object of the project analysis: Water provision

Geographic area: Goiás – Polo Empresarial Goias – municipality of Aparecida de Goiania

Step(s) of the value chain included: Own operations

Type of approach: Inventory

Time horizon: 2015

Ecosystem services: Water provision

WATER PROVISION

Role of ecosystems in the hydrological cycle and their contribution in terms of water quantity, defined as total production of freshwater.

Method used: Replacement Cost Method (RCM)

Results¹⁷

Dependency: BRL 316,000

Impact: not calculated

Externality: not calculated

Data used:

Type of data:

Dependency on water quantity: about 16 million liters/year

Hydrological balance of the water used by the business: about 16 million

Primary, own data

Watershed from where water is collected, name and classification of the water body: artesian well located within the business area, with capacity to collect 8,000 liters/hour.

Primary, own data

Watershed used for water replacement, name and classification of the water body: there is no replacement/wastewater

Other info:

Results from physical metrics: all the water needed for production and different uses is available.

Assumptions made in valuation estimates: market value of the water treated by the local water utilities – Saneago – with cost of BRL 7.50/m³, besides an investment of BRL 200,000 to connect the network.

Other pieces of information: Our expectations are that the aquifer where our well is located will support demands that are three times bigger than current use and demand for the next five years. However, we are concerned with potential shortages and with the need to import water and/or enhance our treatment processes and have larger quantities for water reuse.

16. This form was inspired by Version 1.0 of the Corporate Guidelines for the Reporting of Environmental Externalities (DEREA 1.0).

17. The results are reported in approximate values to give an idea of the dimension of ecosystem services value.



"Valuation of the relationship between mining activities and the water provision ecosystem service as a tool to support risk and opportunities management."

Executive Summary

Minerita Minérios Itaúna Ltda. operations hold a direct relationship with natural capital, since feasibility of the business operation is subject to the availability of water resources, which are a fundamental input to exploit and process iron ore.

In this context, for the case study, the company chose to value its relationship with the water provision ecosystem service at Lagoa das Flores unit, in the municipality of Itatiaiuçu (State of Minas Gerais), considering water consumption in a one-year-period (base year 2014).

In order to understand how much the business depends on this ecosystem service, the Replacement Cost Method (RCM) was used, analyzing the cost the business would have to pay to replace all water demanded in its production process for a year, having to build new pipes to collect water in another body of water and pay to use that resource. In this sense, the value obtained was about BRL 2.3 million/year.

Taking into account the current legislation in the State of Minas Gerais, which establishes a 30% reduction in the volume of water collected for industries, Minerita calculated the impact generated for the business if this percentage of water volume becomes unavailable in

its operations. In this case, the business would have to pay about BRL 790,000/year to replace that water. As the business recirculates 80% of the water used in its production process, it can currently enable production in spite of the restriction imposed, which shows the importance of investing in eco-efficient measures.

Finally, the business also analyzed the relationship it has with the water resources in the region, under the perspective of interactions with other users in the region (externality). Because it is a water-intensive activity, the iron ore produced by the business makes a total amount of 215,844 m³ of water unavailable per year.

The valuation results obtained by Minerita allowed the business to understand the interactions of its activities with natural capital and also in a broader social context. This was an important first step for the business to be able to properly manage socio-environmental aspects in its activities, allowing for better understanding the previously mapped risks (such as water shortage and conflicts generated by water use) and opportunities (such as new water reuse technologies).

Reporting of Environmental Dependencies, Impacts and Externalities¹⁸

Person in charge of filling out the report

Name: Gustavo Freitas

DRIVERS FOR THE PROJECT

What led the company Minerita Minérios Itaúna Ltda. to estimate the ecosystem service economic values was the importance that the ecological goods represent to the company operations, being a vital input to exploit and process iron ore. With this information, we seek to optimize and organize the entire production chain associated with mineral exploration using ecosystem goods.

SCOPE OF THE PROJECT

Object of the project analysis: Minerita Minérios Itaúna Ltda. – Lagoa das Flores Unit

Geographic area: Municipality of Itatiaiuçu MG – Serra Azul

Step(s) of the value chain included: Own operations

Type of approach: Prospective, inventory

Time horizon: 2014

Ecosystem services: Water provision

WATER PROVISION

Role of ecosystems in the hydrological cycle and their contribution in terms of water quantity, defined as total production of freshwater.

Method used: Replacement Cost Method (RCM)

Results¹⁹

Dependency: BRL 2.2 million

Impact: BRL 789,000

Externality: -BRL 862,000

Data used:

Type of data:

Dependency on water quantity: 645,480 m³ year

Hydrological balance of the water used by the business: 3,016,656 m³ year

Primary, own data

Watershed from where water is collected, name and classification of the water body: Mota Stream – Class II

Secondary, acquired (IGAM)

Watershed used for water replacement, name and classification of the water body: Rio Manso Reservoir – Class II

Secondary, acquired (Copasa)

Other info:

Results from physical metrics: 30% of water unavailable

Assumptions made in valuation estimates: Building of new pipes for collection; power; and payment for the use of water resources.

Other pieces of information: The scenario adopted was shortage of 30% of water resources, considering the existing legislation in the State of Minas Gerais.

18. This form was inspired by Version 1.0 of the Corporate Guidelines for the Reporting of Environmental Externalities (DEREA 1.0).

19. The results are reported in approximate values to give an idea of the dimension of ecosystem services value.



"Economic valuation of the positive externality generated by the use of SEIKIN technology as a commercial strategy and product value attribute"

Executive Summary

SEIKIN is an Amazon-based company that develops solutions to treat wastewater, with operations distributed throughout the Brazilian territory. Its relationship with natural capital occurs through its products, since the adoption of its solutions minimize pollution aspects in bodies of water.

Given this context, for the case study, the business chose to assess the relationship between the use of its technology and the wastewater assimilation ecosystem service in a selected customer – a food industry located on the Rio Negro riverside, in Manaus. The externality refers to degradation in the quality of bodies of water downstream the spot where wastewater is released by the business.

In order to quantify the externality, the BOD (Biochemical Oxygen Demand) was selected as the parameter for the analysis. Gross non-treated

wastewater presents a BOD of 270 mg/L of O₂, whereas treated wastewater presents a BOD of 66 mg/L of O₂. According to CONAMA legislation, maximum BOD concentration to make sure there will be no significant change in water quality is 120 mg/L of O₂. Therefore, the externality in case the technology is not available corresponds to a negative BOD value of -150 mg/L of O₂. With the project, the externality becomes positive, represented by a BOD of 54 mg/L of O₂.

For valuation, the Avoided Costs Method was used, to estimate the costs incurred to prevent the loss of water quality at the spot where wastewater is released, i.e.; the cost of SEIKIN technology itself. Considering the volume of wastewater annually released, the resulting value was about BRL 200,000/year.

The results obtained highlight the environmental benefit generated by the use of the technology proposed by SEIKIN, providing for an additional selling point.

Reporting of Environmental Dependencies, Impacts and Externalities²⁰

Person in charge of filling out the report

Name: Osmarina Godoy

DRIVERS FOR THE PROJECT

SEIKIN is a business that develops technologies targeted at preserving the environment, among them solutions and innovations for the sanitation industry.

Sewage release should only occur according to release standards, as established by CONAMA resolution #430, as of May 13, 2011.

SEIKIN decided to participate in this project because the company understood that valuating and especially communicating the great results of the analytical reports when it comes to the efficiency of a Sewage Treatment Plant (STP) manufactured by it and installed in a customer site will contribute to attract new customers.

SEIKIN main focus is to produce and provide high-quality sanitation equipment, fostering recycling of post-consumer natural resources, thus contributing to preserve nature and produce social well-being.

20. This form was inspired by Version 1.0 of the Corporate Guidelines for the Reporting of Environmental Externalities (DEREA 1.0).

SCOPE OF THE PROJECT

Object of the project analysis: Sewage Treatment Plant (STP)

Geographic area: Manaus

Step(s) of the value chain included: Value chain (customer)

Type of approach: Inventory

Time horizon: 2014

Ecosystem services: Regulation of wastewater assimilation

REGULATION OF WASTEWATER ASSIMILATION

Ability of ecosystems to degrade, reduce or eliminate toxicity, disinfect or dilute pollutant loads.

Method used: Avoided Costs Method (ACM)

Results²¹

Externality: BRL 204,000

Data used:

Type of data:

Pollutants considered in the analysis: Biochemical Oxygen Demand – BOD

Primary, own data

Body of water that will receive the wastewater, and class: Rio Negro – Class 2

Secondary, acquired

Type of treatment applied before wastewater is released into the body of water:
Biological

Primary, own data

Other info:

Results from physical metrics: -204 mg/L O₂

Assumptions made in valuation estimates: 0.30 mg/L O₂

Other pieces of information: In this case study, we used C_{pmax} from the analytic report result concerning the current STP.

Explanatory notes:** According to CONAMA 430/11, Art. 21: To directly release wastewater from sewage treatment plants, the following specific conditions and standards must be observed: [...] d) Biochemical Oxygen Demand – BOD 5 days, 69.8 °F/20 °C: maximum of 120 mg/L. In this case study analyzed, the Biochemical Oxygen Demand – BOD 5 days, 69.8 °F/20 °C was 66 mg/L.

ANALYSIS OF THE RESULTS

The efficiency of that STP was much higher than what CONAMA resolution # 430/11 establishes.

MANAGING ENVIRONMENTAL EXTERNALITIES

Basic sanitation represents a vital factor both for economic and socio-environmental sustainability, because inefficiencies in sewage treatment pollute the environment, causing a number of environmental damages that may produce short- and long-term effects, putting production sectors, such as fishing and tourism, at stake, directly affecting the key actors that live in the neighborhood of the target industry. With the installation of the Sewage Treatment Plant (STP) and particularly with the high efficiency of the station, we come to the conclusion there was a positive externality directly influencing the health and well-being of the actors that live in the neighboring areas of that industry.

21. The results are reported in approximate values to give an idea of the dimension of ecosystem services value.



"Measuring externalities related to environmental recovery and preservation activities performed by a business in the pulp and paper industry"

Executive Summary

Veracel Celulose S.A. is a business that operates in the pulp and paper industry; its relationship with ecosystem services occurs mainly through land use in the Southern area of Bahia State, where its presence spans over 210,000 hectares distributed through 10 municipalities.

Besides managing planted forests, the business also operates in native vegetation areas – by restoring areas of permanent preservation, legal reserves and other privately-owned protected areas, as well as fighting deforestation in areas where the business has influence.

For the case study, the business chose to focus on native vegetation areas and understand their relationship with the ecosystem services provided by the company. The ecosystem services selected were global climate regulation, and recreation and tourism, and they had their externalities calculated and valued.

For global climate regulation, restoration actions were considered, both for actions conducted from 2005 through 2014 in the business privately owned areas and areas where the business has influence, and for actions to be performed in the next 10 years in the business privately owned areas. Additionally, the avoided deforestation in the region was also quantified, considering the presence of the company contributes

to discipline land use and reduce deforestation rates. Similarly to restoration actions, avoided deforestation was also calculated for the 2005-2014 period in the business privately owned areas and areas where the business has influence, and for the next 10 years in the business privately owned areas only.

Carbon removals performed and yet to be performed total about seven million tons of CO₂e, whereas deforestation that was and will be avoided in the region was calculated as five million tons of CO₂e. Valuation was performed taking as a reference the Social Cost of Carbon (SCC), which represents the necessary cost to restore the impacts caused by releasing a ton of carbon into the atmosphere. Positive externality was estimated as about BRL 975 million for removal balance, and as BRL 740 million for avoided deforestation in the region.

For the recreation and tourism ecosystem service, calculations were made based on visitation data for Veracel Station, a 6,000-hectare Private Reserve of Natural Heritage created by the business, which is visited by about 5,000 people/year for environmental education activities. The positive externality was valued in approximately BRL 100,000/year for the externality concerning transportation expenses.

The valuation results obtained by Veracel allowed to assess the performance of some of the socio-environmental actions conducted by the business, thus providing content that can support the business communication with its stakeholders.

Reporting of Environmental Dependencies, Impacts and Externalities²²

Person in charge of filling out the report

Name: Humberto Justo Amoedo

DRIVERS FOR THE PROJECT

Veracel is an agroindustrial enterprise integrating forest and industrial operations and logistics, resulting in average annual production of 1.1 million tons of pulp. At Veracel's properties, for each hectare with planted eucalyptus, one hectare is dedicated to environmental preservation.

Veracel, because of the characteristics of its operations, has great influence on the region socioeconomic dynamics. Therefore, we link our search for productivity and cost reduction to actions that contribute to economically, socially and culturally strengthen the regions, also keeping in mind that the environment needs to be preserved and conserved.

The company vision is to become 'a world reference in sustainability'. Thus, being able to estimate the economic values of the ecosystem service associated with Veracel existence and operation was one of the key reasons that led Veracel to participate in this project.

SCOPE OF THE PROJECT

Object of the project analysis: Forest Process – Atlantic Forest Restoration Area Program.

Geographic area: An area of approximately 215,000 hectares located within a 1.5-million hectare area distributed through 10 municipalities.

Step(s) of the value chain included: Own operations

Type of approach: Both prospective and retroactive

- Global climate regulation: prospective and retroactive

- Recreation and tourism: retroactive

Time horizon: - Global climate regulation: 10 years (2005 through 2014, and 2015 through 2025)

- Recreation and tourism: 1 year (2014)

Ecosystem services: Global climate regulation, and Recreation and tourism

GLOBAL CLIMATE REGULATION

Role played by ecosystems in carbon and nitrogen biogeochemical cycles, thus influencing emissions of important greenhouse gases, such as CO₂, CH₄ and N₂O.

Method used: Replacement Cost Method (RCM)

Results²³

Externality: BRL 1.7 billion

Data used:	Type of data:
(X) Net emissions	
Actual emissions derived from deforestation, or environmental degradation, in tCO ₂ e: zero	Primary
Actual removals derived from environmental recovery, in tCO ₂ e: 6,758,363.93	Primary
(X) Avoided deforestation	
Biome phytophysiognomy and land use: Lowland Dense Ombrophilous Forest; Pastureland.	Primary
Area of avoided deforestation, in ha: 26,073.4242	Secondary
Deforestation rate considered as baseline: 6%	Secondary
Deforestation rate with the project: 0%	Primary
Avoided emissions, in tCO ₂ e: 5,104,346.67	Primary

22. This form was inspired by Version 1.0 of the Corporate Guidelines for the Reporting of Environmental Externalities (DEREA 1.0).

23. The results are reported in approximate values to give an idea of the dimension of ecosystem services value.

Other info:

Exchange rate used to convert the Social Cost of Carbon (SCC) into Brazilian Reais: BRL 3.80

Assumptions made in valuation estimates: -

Adjustments or derivation applied to the methods and tools adopted: -

Other pieces of information: In the retroactive approach, all areas recovered with direct planting of native species and isolation with natural regeneration were considered to the current date. The prospective approach considers a 10-year period, according to Veracel's project to recover 400 hectares/year, combined with the business existing native vegetation areas and the areas that are expected to be recovered through natural regeneration.

Explanatory notes:

- Primary data was collected based on georeferenced spatial information available at the company and classification of Veracel's high-resolution images.
 - Bibliographic reference used to calculate the baseline deforestation rate: SOS Mata Atlântica (value calculated for the State of Bahia).
 - Land use and occupation data in the municipalities where the business operates: Monitoring regardless of the vegetation cover in the municipalities under Veracel's influence in the Southernmost part of Bahia State (Ibio, September/2015).
 - Exchange rate used to convert the Social Cost of Carbon (SCC) based on the quotation for November 2015.
-

RECREATION AND TOURISM

Role of ecosystems as places where people can find opportunities for rest, relaxation and recreation.

Method used: Travel Cost Method (TCM)

Results²⁴

Impact: BRL 12,000

Externality: BRL 102,000

Data used:**Type of data:**

Total area conserved: 6,070

Primary

Alternative economic use of the area: Extensive grazing

Primary

Number of visitors per year: 4,779

Primary

Origins of visitors and their corresponding representativeness compared with other origins (percentage of total visitors for each origin): From schools in the region

Primary

Other info:

Assumptions made in valuation estimates: The calculations consider only one year of project, based on the number of visitors registered in 2014.

24. The results are reported in approximate values to give an idea of the dimension of ecosystem services value.



ANALYSIS OF THE RESULTS

The values obtained in Global Climate Regulation show the importance that the business has in the region. The project is clearly aligned with the business vision to be 'a world reference in sustainability' and with the business model that considers sustainability as a pillar for the company. The valuation of ecosystem services corroborated to show that, although studies point to a loss of native vegetation areas in the State of Bahia, in the areas where Veracel operates the dynamic is different, with an increase in native vegetation areas.

MANAGING ENVIRONMENTAL EXTERNALITIES

Communicating the results obtained, in other words, presenting to society the environmental externalities produced by Veracel's business model, is critical to support the dialogue with the government, mass media, shareholders, suppliers, service providers, as well as governmental organizations and the civil society. This dialogue is critical to manage conflicts and find solutions to ensure effectiveness in investment decisions. Moreover, it minimizes risks of image caused by the business operations and enhances reputation, based on transparency and communication of the results.

FINAL REMARKS

In 2015, the second cycle of the Corporate Guidelines for the Economic Valuation of Ecosystem Services (DEVESE 2.0) was conducted. Altogether, nine companies developed their case studies, covering different aspects of their business relationship with natural capital in Brazil.

This publication summarizes the work conducted by these companies, seeking to objectively and didactically report the case development process, in an executive summary format. The publication also shows a pilot of the 'reporting of environmental dependencies, impacts and externalities' template, inspired by the Corporate Guidelines for the Reporting of Environmental Externalities (DEREA 1.0).

It is worth noting that, in the second cycle of business case development, the difficulty for the companies to apply DEVESE guidelines was much reduced. Training in ecosystem service valuation and especially the lessons learnt with the previous cycle were essential to facilitate this process in the companies, making it clearer how important it is to publish these cases and use them as a reference to later apply ecosystem service valuation to the business reality.

In this context, it is possible to highlight the lessons learnt by the businesses, such as the importance of enhancing internal data management. The businesses that demonstrated more advanced management of environmental and economic data related to their operations, as well as easy access to data, showed it was easier and less expensive (working hours) to develop their valuation projects. It is worth pointing out that generation and control of the data required by the DEVESE guidelines can benefit the business

when managing other projects and studies beyond the scope covered in TeSE.

Additionally, we have noticed the engagement of different business areas to elaborate the study as something very beneficial, facilitating collection of the necessary data and, particularly, understanding and interpreting the results obtained from the analyses.

For the companies that assessed their value chain, it was challenging to obtain external data, especially when it comes to identifying the sources of this data. Such difficulty is expected to decrease as the analyses are updated, since the processes to obtain data are already known. However, a great benefit generated by this process is to promote closer relationships with suppliers and/or customers and, consequently, improve their management.

For the lessons learnt in TeSE initiative, the elaboration of the studies enabled a practical assessment of DEVESE guidelines and showed some improvement opportunities for the proposed methodological procedures, as well as for the calculation tool that supports their execution. It was also possible to estimate the challenges businesses would address in the elaboration of similar studies.

Among them, we highlight the challenge to actually apply the results obtained in valuation to their internal management. This challenge was clear throughout both DEVESE execution cycles and, for this reason, TeSE proposes to cover the ecosystem services management topic with member companies in its 2016 cycle.



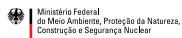


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