Economic Valuation of Business-Related Ecosystem Services

Case studies of Trends in Ecosystem Services (TeSE) initiative member companies

2014 Cycle

An initiative of:

FGV EAESP CENTRO DE ESTUDOS EM SUSTENTABILIDADE

TeSE INICIATIVA GVCES

In partnership with:

Por ordem do Ministério Federal do Meio Ambiente, Proteção da Natureza, Construção e Segurança Nuclear da República Federal da Alemanha

giz Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH

CNI Confederação Nacional da Indústria

CNI. A FORÇA DO BRASIL INDÚSTRIA

Ministério do Meio Ambiente

GOVERNO FEDERAL BRASIL PÁTRIA EDUCADORA

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

EPC INICIATIVA GVCES

Elaboration of business agendas to adapt to climate change, with the co-creation of a framework and a tool to support its implementation; operation of the Emissions Trading System (EPC ETS), a carbon market simulation; and joint work with Business Initiatives on Climate (IEC) in international negotiations.

Inovação e Sustentabilidade na Cadeia de Valor INICIATIVA GVCES

Joint work with Local ID on Innovation in Local Development. Construction of references and instruments to help companies incorporate sustainability in their management and relationship with suppliers.

ID Local INICIATIVA GVCES

Joint work with ISCV on Innovation in Local Development. Application of Business Guidance (BSC) for Full Protection of Children and Adolescents under the context of large projects, elaborated by the initiative in 2013.

TeSE INICIATIVA GVCES

Construction of the Corporate Guidelines for the Economic Valuation of Ecosystem Services and the Corporate Guidelines for the Report of Environmental Externalities; application of the methods on companies through pilot projects; and development of a calculation tool.

MASTHEAD

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Partnership
This work was developed in partnership with the TEEB R-L Project. The "Regional-Local TEEB Project: Biodiversity Conservation through the integration of Ecosystem Services into Public Policy and Business Action" has been carried out by the Brazilian government, under the coordination of the Ministry of the Environment (MMA), in conjunction with the National Industrial Confederation (CNI), in the context of Brazil-Germany Cooperation for Sustainable Development. Germany's Federal Ministry for the Environment, Nature Conservation, Building and Nuclear Safety (BMUB) supports the Project, in the ambit of the International Climate Initiative (IKI) and through its cooperation agency, Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH.

Graphic Design
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PRESENTATION

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 dependencies, impacts that affect businesses, and externalities caused by them when it comes to ecosystem services.

This present publication summarizes the results obtained up to this moment, through pilot projects that applied the Corporate Guidelines for the Economic Valuation of Ecosystem Services (DEVESE, its Brazilian Portuguese acronym), and their corresponding calculation tool – an Excel-based spreadsheet used to support DEVESE implementation.

TeSE goals upon developing pilot projects were:

- Assess whether the methodological procedures adopted are actually proper to represent business practical reality

- Assess whether those methodological procedures, even when proved to be proper, 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

The pilot projects are published with the goal to:

- 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.

So, pilot projects contribute to find DEVESE improvement opportunities, strengthening the ongoing extension and enhancement process for those tools, a commitment made by TeSE. Presented here in the format of case studies, they are actually a summary of the work performed by the businesses, with no further details about the data and methods used. In spite of that, they properly meet 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, available at TeSE website (www.tendenciasemse.com.br). Not all data used in the studies presented here is available in that publication, since part of the data is strategic for the businesses and is, therefore, confidential information.

FOREWORD

As one of the countries with the highest biological diversity in the world, Brazil naturally plays a leading role in the debates and actions regarding this topic. It should, therefore, make its best efforts to engage the society to understand the opportunities of conserving and using biodiversity in a sustainable way, raising awareness of the risks posed by ecosystems loss and degradation. This natural capital and ecosystem services associated to it, such as water provision, agricultural crop pollination, or protection against extreme climate events, are very important, not only for the Brazilian society and economy, but also for the ecological balance and for the well-being of the societies at a global level.

It is critical to understand the dependency relationships between productive activities and the services provided by ecosystems. Considering this, the Brazilian National Confederation of Industries (CNI) is working in partnership with the Ministry of the Environment (MMA) in the TEEB Regional-Local project in the context of Brazil-Germany Cooperation for Sustainable Development, through Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH. The project - which covers ecosystem economy and biodiversity, aiming at promoting biodiversity conservation through the integration of ecosystem services in public policies and business participation - supported the Trends in Ecosystem Services (TeSE) business initiative by the Center for Sustainability Studies of Sao Paulo Business Administration School at Getulio Vargas Foundation with the purpose of developing strategies and tools targeted at management of impacts, dependencies, risks and opportunities related to ecosystem services.

Balanced ecosystems produce benefits for the society as a whole. Therefore, CNI considers it is indispensable to build tools that help businesses understand how much they depend on biodiversity and ecosystem services, and enable them to valuate those services, so as to incorporate the values into their management.

Tools such as the Corporate Guidelines for the Economic Valuation of Ecosystem Services - DEVESE, developed within TeSE initiative, that aim at supporting business management in the valuation of environmental externalities, consist of a first step for biodiversity and ecosystem services to be taken into account in the business decision-making process. Information produced from the results obtained with this tool, as shown by the experiences reported in this document, will enable businesses to enhance their management in order to avoid potential economic vulnerability situations related to the dependency of their activities upon biodiversity and ecosystem services.

Knowing and incorporating the values of biodiversity and ecosystem services will help the business sector drive Brazil so the country leverages its competitive edge in having such a great biological diversity and positions itself as a leader in the debate.

Elisa Romano Dezolt
Environment and Sustainability Executive Manager
National Confederation of Industries - CNI

CASE STUDIES

ALCOA

Freshwater provision in Sao Luis, Maranhao State

Introduction

Global leader in technology, engineering and production of lightweight metals, Alcoa innovates in multi-material solutions that advance our world. Its technologies enable continuous enhancement of the transport segments - in the automotive, commercial transportation and aerospace sectors -, consumer electronics and industrial consumables. The business collaborates in the development of smart buildings, sustainable food and beverage packaging, high-performance air, sea and ground defense vehicles, oil and gas exploration in deep sea, and increasingly more efficient energy generation. Alcoa has been pioneer in the aluminum industry for 125 years and currently has 59,000 employees in 30 countries working with aluminum, titanium, nickel, bauxite, alumina and primary aluminum.

In Brazil, Alcoa operates along the entire aluminum production chain, from bauxite mining to high value transformed products. Alcoa employs about 5,700 people and has 6 production facilities, with distribution centers and offices in the States of Maranhao, Minas Gerais, Para, Pernambuco, Santa Catarina, Sao Paulo and the Federal District. The company is also a shareholder of Mineracao Rio do Norte (MRN) mining, plus four hydroelectric power plants: Machadinho, Barra Grande, Serra do Facao, and Estreito. In 2013, Alcoa's net income was BRL 2.7 billion from its operations in Brazil.

Aluminum production requires energy-intensive activities, particularly electric power for industrial processes. Water is also critical in the production process, and the plants have different sources of water, such as rainwater harvesting, collection of surface and underground resources. Other environmental aspect that can be highlighted is the production of waste (with a 59% rate of recycling and reuse in 2013) and wastewater, which, at the final treatment stage are directed to deposition lagoons.

Objective: Alcoa valuated the water provision ecosystem service, from an analysis focused on understanding the risks associated with hydrological demand, covering dependency, impact for the business and externality.

Scope of the Study

The study focused on Alumar plant (Aluminum Consortium in Maranhao State), one of the top alumina and primary aluminum production complexes, located in Sao Luis, Maranhao.

The ecosystem service assessed was water provision, applying an inventory approach for 2013. The activities covered were direct activities in the business, consisting of refining and reduction, in which bauxite is primarily converted into alumina and then into aluminum.

Methods

Quantification

Water provision was quantified based on the volume of water demanded by Alumar. Firstly, different sources of water that supply the production process were identified. The business dependency refers to the total volume demanded compared with the business production, in the period analyzed. In order to quantify the impact, a hydrological drought scenario was determined, and, for externality, they accounted for water collected from surface hydrological resources.

Valuation

The valuation method adopted is the Replacement Cost Method (RCM), which, in this case, estimates the costs of replacing the water used by importing water from other sources. To estimate the costs of replacing the demanded water, Alumar's team used data from 2010, when the business had to deal with water shortages, and needed to deploy infrastructure for temporary collection of alternate sources.

Data

Alcoa provided all necessary data, supported by Alumar's technical team. Costs for deploying the infrastructure for water supply were obtained from studies that were previously conducted by the business.

Results

Alumar's water supply comes from a number of sources. Most of the water used comes from harvested rainwater (about 67%), complemented with collected underground water (16%); leveraging wastewater treated at Sao Luis plant, from Ambev beverage company (12%), and from collected surface water (5%). In 2013, they used up about 8 million m^3 of water, obtaining for dependency a metric of 23.77 m^3 of water/t of alumina produced.

To estimate the replacement cost for the water demanded, the main alternative considered was to increase collected surface water from Pedrinhas River, located at about 3 miles (5 km) away from Alumar, and complement it by using sea water for part of the demand. They could also consider reusing Coca-Cola wastewater, whose infrastructure costs would be similar to the costs of collecting water from Pedrinhas River. The total value for replacing Aluma's water demand was estimated around BRL 1.3 million, considering costs with materials and services.

Regarding impact for the business and externalities, in 2013 there were no circumstances of hydrological drought for the business, or externalities affecting third-parties.

Lessons Learnt

Relying on the support of Alumar's team was critical both to gather data and to assess alternatives to be considered for water replacement scenarios. While the pilot was built, there were numerous meetings and, as the alternatives were designed and data was gathered, different areas of the company engaged in the process in a highly collaborative way.

AMAGGI

Global climate regulation, focused on avoided deforestation on a farm in Mato Grosso State, and biomass fuel provision in an industry in the Amazon

Introduction

Formed by four major business divisions – commodities, agribusiness, navigation and energy – AMAGGI operates in agricultural production and soybean seed production; grain origination, processing and trade; raw materials; energy; port management and river transportation. Established in 1977, it currently operates in all regions in Brazil, as well as Argentina, Paraguay, Holland, Norway and Switzerland. In 2013, its revenue was about US$ 5 billion.

As one of the top agribusiness companies worldwide, the nature of AMAGGI activities, particularly in this segment, requires a very close relationship with natural capital, influencing in factors such as land use, consumption of energy resources, and greenhouse gas emissions. With an agricultural production of over 900,000 tons (soybeans, corn and cotton) in 2012/2013 harvest, total planted area was about 225,000 hectares.

Objective: AMAGGI sought to estimate the economic value of global climate regulation ecosystem services in the context of a farm producing soybean and corn, and to estimate biomass fuel production in a processing plant, to make those two important ecosystem services more tangible, facilitating the incorporation of their dependencies and impacts into business decision making.

Scope of the Study

AMAGGI's study was subdivided into two different scopes.

The first scope was targeted at Tanguro farm, located at the town of Querencia, in Mato Grosso State. Using a retroactive approach, the global climate externality was assessed, focused on avoided deforestation, taking as a reference the 2000-2012 period.

In the second scope, the study focused on the soybean processing plant at Itacoatiara, in Amazonas State, and the ecosystem service studied was biomass fuel – main energy source for the business processing plants. They took into account aspects of dependencies, impacts and externalities, assessing them with a retroactive approach for 2013.

Methods

Quantification:

To quantify externalities associated with avoided deforestation on Taguro Farm, they calculated the areas with native vegetation cover on the farm and their corresponding biomass stocks (initially quantified in tC, then converted into carbon stock in tCO_2e, by multiplying the value times 44/12), as well as deforestation rates in the town and on the farm, according to data available for the 2000-2012 period.

Biomass fuel provision was quantified by calculating the types of biomass fuel and their corresponding amounts consumed at the plant analyzed in the study. Total biomass consumed in 2013, in tons, represents the plant dependency upon that ecosystem service. The impact associated with such dependency corresponds to the quantity of the most cost-effective alternative energy source that would be necessary to meet the energy demand – which is estimated comparing the calorific potential of the alternative source with the calorific potential of the biomass that is currently being used. Externality, on its turn, was quantified based on avoided greenhouse gas (GHG) emissions, since the alternative energy source analyzed is a fossil fuel.

Valuation:

Valuation of externalities caused due to avoided deforestation was performed based on the Replacement Cost Method (RCM), taking as a reference the Social Cost of Carbon (SCC), estimated by the U.S. government as US$38.00 t/CO_2e (IWGSCC 2013), converted into Brazilian Reais applying the exchange rate US$/BRL = 2.50.

The business dependency on biomass fuel was valued using the Market Price Method (MPMe), multiplying the amount of each type of biomass used by its corresponding market price, taking into account costs incurred with transportation. For valuation of impact and externalities, they applied the RCM method. The value of the impact is represented by the additional costs that would be generated to the company to purchase alternative fuels (i.e.; replace the biomass used), and the value of the externality is represented by the expenses that would be incurred to make up for potential harmful impacts caused by climate change on the society, if the biomass fuel consumed by the business were replaced with fossil fuels. The method proposed by the Corporate Guidelines for the Economic Valuation of Ecosystem Services (DEVESE) also estimates externalities considering potential land use change due to biomass production. However, as the biomass currently used in Itacoatiara plant operations comes from residues, there are no land use changes or replacement of other activities to produce biomass in this case.

Data:

For calculations regarding avoided deforestation, AMAGGI had the support of the Institute for Environmental Research in the Amazon (IPAM), which provided data from areas covered with native vegetation, their biomass stock, and deforestation rates in the region where Querencia is located. Carbon stock that would remain if the area were deforested

and not conserved was estimated using data from the Second Brazilian National Inventory of Anthropogenic GHG Emission and Removal (FUNCATE, 2010), considering the regional trend of converting the area into annual crop.

For biomass fuel provision service, data about biomass consumption, market prices - both for currently used biomass and for alternative sources -, as well as emission factors were obtained from the industrial supervision division, at Itacoatiara plant.

Results

Tanguro Farm owns a total area of native conserved vegetation of about 44,000 hectares. It is located in the Amazon biome, in a region of transition between the Ombrophilous (Rain) Forest and the Seasonal Forest, and characterized by a strong anthropic influence, particularly agricultural activities. The town deforestation rate for the 2000-2012 period was 12.5%, whereas the deforestation rate on the farm was less than 1%, and the value adopted was 0.5%. Based on native vegetation biomass stock, in quantitative terms the estimation was that Tanguro Farm avoided the emission of almost 3 million $tCO2_e$, the equivalent to a positive externality valued as over BRL 280.00.

For biomass fuel provision, the Itacoatiara plant used, in 2013, a set of biomass fuels consisting of soybean hull (42%), forest residues (34%), and sawmill residues (24%). Soybean hull does not represent costs for the business, since it is a residue from the production process. So, in order to assign a value to this part of the dependency, they chose to consider the weighing of costs for forest and sawmill residues, because, should the business lack soybean hull, it would probably use those two other energy sources on a larger scale. Thus, the economic value associated with the business dependency on the biomass provision ecosystem service was estimated at BRL 12 million. In the absence of biomass sources that are currently used, the business identified as alternative sources sugarcane bagasse briquettes and diesel oil. Replacing the biomass mix currently used with sugarcane bagasse briquettes could have an impact of about BRL 240,000 (cost reduction); however, this alternative is not available in the region yet. They need to conduct further studies concerning possibilities for supply. Besides, they haven't estimated eventual costs for adapting the fuel-burning equipment to the use of that new type of biomass yet. Replacement with diesel oil, on its turn, would have an impact of about BRL 35 million (cost increase), including costs to install the structure and equipment needed. For externalities, the use of biomass, compared with diesel oil, avoided the release of almost 60,000 tCO_e2, and the associated value would be over BRL 5 million.

Lessons Learnt

The economic valuation methodology for ecosystem services, applied by TeSE for both scopes studied, proved to be simple and easy to use.

All data needed for the study on biomass fuel provision are continuously monitored by the areas involved.

For the avoided deforestation service, it was possible to identify the need to monitor local rates, such as regional deforestation rates, as calculated by IPAM, through the partnership of this institute with AMAGGI for studies on Tanguro Farm.

ANGLO AMERICAN

Freshwater provision in a mining plant in Barro Alto, Goias State

Introduction

Anglo American has been operating in Brazil since 1973, creating over 4,000 direct jobs, and 10,000 indirect jobs. It currently has two business units in the country: Iron Ore and Nickel, Niobium and Phosphates, besides an Exploration division. It has two major global Anglo American investments in Brazil: Minas-Rio, that has been operating since the end of 2014, and Barro Alto plant, in Goias State, launched in the end of 2011. Since 2007, it has invested about US$ 14 billion in Brazil.

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. Due to changes in water distribution patterns, the business associates the availability of this resource as one of the key risks linked to natural capital. In Nickel operations, for instance, water is used for granulating the metal and the slag, and for cooling the furnaces.

Objective: Assess dependency, impacts and externalities caused due to the water demanded by the business, with the goal to have more in-depth knowledge about the economic aspects of managing hydrological resources.

Scope of the Study

Anglo American study focused on their nickel production plant in Barro Alto, Goias State. The ecosystem service assessed was water provision, applying an inventory approach for 2013.

Methods

Quantification

Water provision was quantified based on the volume of water demanded by Barro Alto plant. The business dependency refers to the total volume demanded compared with the business production, in the period analyzed. In order to quantify the impact, a hydrological drought scenario was determined, and, for externality, they accounted for water collected from surface hydrological resources.

Valuation

The valuation method adopted is the Replacement Cost Method (RCM), which, in this case, estimates the costs of replacing the water used with water imported from other sources.

Data

Data for hydrological demand and infrastructure cost for water supply was collected with Anglo American operational team. The water rate was informed by Goias water utility.[1]

Results

In 2013, Barro Alto plant operated at an average water recirculation rate of 95% (benchmark in operations of that nature), thanks to the modern water closed circuit that enables harvesting rainwater and all effluent generated during the process. Thus, water is consumed only to replace losses due to evaporation, generating a potential consumption of about 14,000 m^3/day. Out of the volume consumed to replace evaporated water, 80% are provided by collecting surface water from a stream, and the rest is from harvested rainwater. Anglo American dependency was quantified at about 200 m^3 of water/t of nickel produced. In order to eventually replace the water consumption, the alternative option considered by Anglo American would be to purchase water from the state water utility, Saneamento de Goias (SANEAGO), that currently charges BRL 6.31/m^3 supplied. Besides the price charged by the utility, the business would have infrastructure costs to connect the public network, something around BRL 12.5 million to install pipes, considering the distance equivalent to 50 km (31 miles) away from the closest location where SANEAGO supplies water to. The value estimated for water provision in the first year was BRL 45.2 million; for the other years, considering they have already paid for the structure deployment, that value would drop to BRL 32.7 million.

The river basin district where the studied plant is located is not affected by hydrological droughts, so, for impact analysis, the business decided to suppose a totally hypothetical scenario, just for tool testing purposes, in which pluviosity would be low and/or it is not possible to direct the water to the recirculation reservoir. In this case, the alternative option would also be SANEAGO's supply. Considering, therefore, unavailability of rainwater, equivalent to 20% of the demand, the hydrological drought would be about 85,000 m^3 - an impact valued at BRL 18.9 million in the first year, and BRL 6.4 million in the next years.

Externality was also calculated assuming a scenario analysis, since currently there is no scarcity for users of water downstream the location where the business collects water. As the business recirculates all collected water in-house, there is no return to the water spring. The hydrological balance of the water used by the business is, therefore, equivalent to the part of the demand that comes from water collection from Rio dos Patos. The value of the externality was estimated at BRL 38.8 million in the first year, and BRL 26.3 million in the next years.

Lessons Learnt

One of the difficulties had to do with terminologies, since the business adopts some concepts for the processes that refer to the classification of types of water, use and sources that slightly differ from environmental concepts. Another difficulty was to elaborate more realistic scarcity scenarios, because the scenario currently used is considered unlikely.

The good news is that the study, although hypothetical, helps to reflect on the financial issue related to natural resources upon which the business depends, regardless if they are priced by the market. This strengthens Anglo American internal policies in their search for water and energy efficiency in their processes.

1 Available at https://www.saneago.com.br/site/agencia/tabela.

BERACA

Water provision, water quality regulation and wastewater assimilation in Ananindeua (PA) industrial plant, and raw material provision, global climate regulation and inspiration cultural ecosystem service in a supplier community in Tome-Acu (PA)

Introduction

Beraca is a Brazilian business with expertise in the development of technologies, high-performance solutions and raw materials for water treatment, cosmetics, animal nutrition, food, beverage and sugar-alcohol industries. It supplies to the whole country and distributes its products in more than 40 countries worldwide. It has seven facilities in Brazil - in Ceara, Goias, Para, Pernambuco and Sao Paulo States -, as well as facilities in France and in the United States. In 2014, the business revenue was BRL 200 million.

Leader in the supply of natural and organic ingredients for the cosmetics industry from the Amazon and other Brazilian biomes, Beraca's activities establish a direct relationship with natural capital, both because of its industrial operations - that demand quality hydrological resources and generate waste, wastewater and atmospheric emissions -, and because of the production of inputs by suppliers, which, depending on the land use and management practices adopted, can positively or adversely interfere with the ecosystems quality.

Objective: Beraca sought to assess the relationship of its production processes with the natural capital under an economic point of view. So, it selected ecosystem services (ESs) that were relevant to its industrial activities and also included its value chain, studying the most relevant ESs to produce critical inputs directly from the Brazilian biodiversity in one of its supplier communities.

Scopes of the Study

For Beraca's case study, two scopes were determined.

Focused on the business internal operations, the first scope selected for the study was **Beraca's facilities in Ananindeua**, a town located in Belem metropolitan region, in Para State. In this plant, they process and refine vegetable oils, extracts, essential oils and active ingredients from natural raw materials, besides researching plants and developing new products. ESs assessed in this scope were targeted at the hydrological issue, including water provision and water quality regulation, as well as assimilation of wastewater, applying an inventory approach for 2013.

The second scope targeted the value chain, adopting as object of study the **Family Farming Rural Farmers Association in Tome-Acu Town (Aprafamta)**, another town located in the State of Para, about 111 miles (180 km) away from Ananindeua. Aprafamta Association produces and supplies Beraca with cupucau seeds, using an agroforestry production system. The ESs studied were: global climate regulation, raw material provision, and inspiration, the latter assessed under Aprafamta's perspective. It is worth noting that Beraca does not have any direct relationship or influence on those activities. Initially, inspiration ES was defined as recreation and tourism. Nevertheless, after having better analyzed the purpose of the visits, they came to the conclusion that the ES that actually drives visitation to the area is 'inspiration', i.e.; another cultural ES related to the lessons learnt from nature. As this ES can be economically valued using the same methods adopted for recreation and tourism ES, it was possible to perform the valuation without having to create a specific method for inspiration.

2 Inspiration cultural ecosystem services are services provided by ecosystems, either natural or cultivated, that inspire a number of cultural and artistic expressions, such as learning a new agricultural management technique (MA, 2005).

SCOPE 1: BERACA'S FACILITIES IN ANANINDEUA (PA)

Methods[3]

Quantification

Water provision was quantified based on the plant demand for freshwater, in m^3, representing the business dependency on the ES. To assess the impact, they determined if the business is affected by hydrological drought or if there is any future scenario that would reduce the amount of water available for the business. For externality, they assessed the water spring used by the business and the hydrological availability to meet other users' demands.

For water quality regulation ES, first they determined the parameters monitored by Beraca. Dependency was quantified calculating the difference between the minimum quality of water in a scenario of partial or total lack of ESs and the maximum water quality needed for business operation in the place where water is collected. To quantify the impact, the maximum quality of water is compared with the actual quality of water collected by the business. Externalities were not assessed, since there were no diffuse pollution sources identified in the area where the business is located.

For wastewater assimilation regulation, the parameters monitored by Beraca were also identified. There is no disposal of wastewater in the body of water, and the business does have a sewage treatment plant (STP) installed, which ensures wastewater release according to required legislation parameters.

Valuation

Water provision was valued using the Replacement Cost Method (RCM), estimating the costs to replace the water demanded by the business with purchase of water from the state sanitation company. Water quality regulation was also valued based on RCM, by estimating the costs to replace the demanded water quality with a water treatment plant (WTP). Wastewater assimilation, on its turn, was valued using the Avoided Costs Method (ACM), which estimates necessary expenditures to avoid degraded water quality if wastewater was released in the body of water.

3 Quantification and valuation of the ES in this scope were calculated according to the methods described in DEVESE 1.0, as of 2013.

Data

Key data used for analyses was provided by Beraca's sustainability managers, supported by other operational sectors. Costs for replacing the quantity of water included the price charged by Para Sanitation Company – Cosanpa (available at the business website), as well as costs to install the infrastructure to connect the supply network to the business network. To quantify dependency upon water quality, the reference used for minimum and maximum quality was CONAMA's Resolution #396, as of 2008, which regulates on underground water classification.

Results

In order to run its operations, the dependency of Beraca's plant upon water is about 0.1 m^3/kg of product. Most of the water used in 2013 was collected from underground resources, and a smaller portion, used for fire hydrants, was harvested from rainwater. The estimated value of the dependency was about BRL 1.3 million in the first year, combining the price that would be paid to Cosanpa for the water and the infrastructure installation costs. For the following years, considering the costs incurred in extending the water network already paid for, the dependency value is reduced to about BRL 430,000 per year. Located at Tocantis-Araguaia river basin district, more specifically at Guama River watershed, a wealthy region when it comes to both underground and surface hydrological resources, the business does not feel the impacts from water shortage and does not expect any restriction scenarios. Besides, it does not produce externalities to other users, so there are no impacts or externalities to be valued.

For the quality of the water demanded, Beraca performs monthly control of microbiological parameters in the collected underground water. Contribution of the ecosystem to the quality of the water used, which represents the business dependency, was estimated based on reference values established by CONAMA resolution #396 for classes 1 and 4. Quality replacement costs for those two levels summed up about BRL 160,000 per year, including full WTP installation and operation. For impact, the water collected by Beraca meets the business and the legislation requirements, and all they need to do is perform a chlorination preventive process. Therefore, the value of the impact was calculated considering the expenses the business had in 2013 to ensure the water quality in the necessary standards. The value was estimated at BRL 25,000.

Crude wastewater produced in the plant presents contamination with oil and grease. The treatment held in their own STP ensures such a quality level that enables about 40% of the wastewater to be reused in plant activities that are not so noble, and 60% are released in Consapa's sewage system. Therefore, there is no disposal of wastewater in a body of water. The cost associated with the treatment of that wastewater, which, in other words, are the costs needed to prevent degraded water quality if there were disposal in water, was used as the value estimated for ES, equivalent to BRL 1,200 per year, not taking into account STP installation.

SCOPE 2: APRAFAMTA COMMUNINITY IN TOME-ACU (PA)

Methods[5]

Quantification

Calculation for global climate regulation ES was performed for three types of land use in the system of the supplier community: i) agroforestry system (AFS); ii) natural regeneration zones; and iii) native vegetation area. Both AFS and regeneration zones were assessed according to the net emissions approach, i.e.; taking into account the system ability to remove atmospheric carbon dioxide (CO_2) from CO_2 fixation in the format of biomass. Quantification of removal was calculated from determining corresponding factors of carbon stock for each vegetation type, in tCO_2e/ha, and the size of each area, in ha. The area with native vegetation, on its turn, was assessed according to the deforestation avoided emission approach, preserving the natural vegetation area located at the supplier property.

Raw material provision ES was assessed under Beraca's perspective on demand for cupuaçu, supplied by the Family Farming Rural Farmers Association in Tome-Acu Town (Aprafamta). Quantification of Beraca's dependency considered the amount of cupuaçu seed used by the business, whereas impact quantification sought to determine whether the raw material was unavailable during the period analyzed, as well as the alternative product that could replace cupuaçu seed in the production process.

For recreation and tourism, the impact for Aprafamta was measured considering the area attractiveness metric only, since there is no effort for the community, and visitation activities are performed in the production area, thanks to the attractiveness of the agroforestry system. Quantification for both impact and externality was calculated based on the number of visitors in 2013.

Valuation

Valuation of positive externality caused due to CO_2 removal was performed based on the Replacement Cost Method (RCM), taking as a reference the Social Cost of Carbon (SCC), estimated by the U.S. government as US$38.00 t/$CO_2$e (IWGSCC 2013), converted into Brazilian Reais applying the exchange rate US$/BRL = 2.50.

Valuation of Beraca's dependency on raw material provision was based on the Market Price Method (MPMe), according to selling prices charged by Aprafamta. The impact on Beraca was valued using the RCM method, by searching the price of the raw materials considered for replacement of the unavailable portion of the total demand.

Inspiration was valued as a measurement of the impact produced on Aprafamta, by using the Travel Cost Method (TCM), considering the admission fee. Externality was also valued based on TCM, considering average cost of traveling to the visited area, plus average costs incurred in feeding and accommodation during the trip (out of the visitation area).

Data

For global climate regulation, the sizes of agroforestry production, forest restoration and native vegetation were provided by Beraca. Reference values for carbon stock in agroforestry systems, black pepper cultivation, and predominant phytophysiognomy in the study area were provided by Bolfe (2008), Puig (2005) and FUNCATE (2010), respectively.

For calculation of raw material provision and inspiration, all data was provided by Beraca.

Results

Located in the Amazon biome, in a region where native predominant phytophysiognomy is the Lowland Ombrophilous Dense Forest, Aprafamta area consists of 67 ha of AFS, 75 ha reserved for natural regeneration, and 152 ha of native forest. To calculate carbon stock in AFS area, they used Bolfe's study (2008), which classifies agroforestry systems (AFSs) into 4 categories using as reference parameters such as the number of cultivated species and their average age. Aprafamta's AFS has about 14 species, with predominantly arboreal physiognomy and average age of about 40 years. So, they chose to use AFS 2 classification, with carbon stock of 75.4 tC/ha, or 96.8 tCO_2e/ha. Land use ***ex-ante*** the project used to be for black pepper, a crop that, according to Puig (2005), presents carbon stock equivalent to 19.4 tCO_2e/ha. Hence, with a production area of 67 ha, the increase

4 Data used to estimate the infrastructure costs needed for water transportation was kindly provided by Camargo Correa builder member company, based on their experience and expertise in the civil construction industry.

5 Quantification and valuation of the ES in this scope were calculated according to the methods described in DEVESE 2.0, as of 2015.

in carbon stock since AFS was implemented, about 15 years ago, generated a removal of about 6,200 tCO_2e, whose externality, in economic terms, is valued at about BRL 586,000 for the entire period.

Moreover, Aprafamta has an area of 75 ha of natural regeneration, in a region classified as Lowland Ombrophilous Dense Forest, and the land use before the project was also classified as black pepper production. Since the area regeneration is a natural process, there is no project to implement and monitor regeneration in this area. Carbon removal in this area for a 20-year period since the black pepper cultivation was removed was estimated at about 15,000 tCO_2e, producing a positive externality that exceeds BRL 1 million.

Finally, they also took into account the 152 ha of native vegetation in the Lowland Ombrophilous Dense Forest within Aprafamta community, considering the presence of the community inhibits deforestation for agricultural purposes in this area. They used the deforestation rate for the baseline scenario - i.e.; without Aprafamta's presence -, which is 0.28% per year, whereas current deforestation rate within the community is 0%. Estimates were calculated for the period of one year. The area has no deforestation certification or monitoring. Besides, there are no land ownership conflicts. The volume of avoided carbon emissions in the area was estimated at about 60 tCO_2e, resulting in a positive externality of about BRL 5,000 per year.

In 2013, for raw material provision ES, Aprafamta was in charge of the production of 21 tons of cupuaçu seeds purchased by Beraca, accounting for about 30% of the potential total business demand for the ingredient, considering the company would buy more 50 tons of cupuaçu seeds, if available. Currently, Beraca has no other cupuaçu seed suppliers, so, in order to leverage its total seed processing capacity, it depends on an increase of Aprafamta's production. Considering that the business usually purchases cupuaçu seeds during the season, the price used was BRL 3,500/t to calculate Beraca's dependency upon this product. The result is about BRL 248,000/year, the equivalent to the income generated to the community for selling to Beraca.

For impact on Beraca, they used the amount of cupuaçu currently unavailable, considering cocoa as an alternative raw material, being the informed market price BRL 6,400/t. Considering cupuaçu yields 13.5%, and cocoa yields 57%, the impact of cupuaçu unavailability for Beraca is 11.8 tons of cocoa, which would account for about BRL 99,000 less to replace the amount of raw material available in the period. It is important to highlight that this valuation is essentially financial and does not capture the intrinsic value or eventual co-benefits of products made from cupuaçu, such as higher attractiveness for consumers.

For inspiration, the assessment pointed that Aprafamta received about 500 visitors in 2013, and each of them paid about BRL 30.00 for the visit, including lunch, which costs about BRL 20.00. Hence, the admission fee was estimated at BRL 10.00, and the value collected as additional income with exploration of services provided to visitors was BRL 20.00 (for feeding). The value of the impact for Aprafamta community, therefore, was estimated at BRL 15,000.00/year. Information gathered about the origin of Aprafamta's visitors pointed to many different towns, but did not determine their means of transportation and their distribution among the towns mentioned. It is known that visitors, regardless of their origin, are taken to the visitation area by entities such as Para Federal University (UFPA), Para Federal Rural University (UFRA), and the Brazilian Agricultural Research Corporation (EMBRAPA), all located in the city of Belem. Therefore, they calculated only the travel cost between Belem and Tome-Acu (round trip), which is equivalent to BRL 70.00, by road transportation. For average feeding and accommodation expenses outside Aprafamta, they estimated about BRL 50.00/person, generating a positive externality for the region estimated at BRL 60,000/year.

6 Fourteen species: cupuaçu, passion flower, açai, cocoa, macabi, acerola, black pepper, coconut, manioc, rice, beans, corn, pumpkin and watermelon.

7 Source: www.ceplac.gov.br/radar/cupuacu.htm.

8 Source: www.suframa.gov.br/publicacoes/proj_pot_regionais/cacau.pdf.

Lessons Learnt

The development of this case study showed that understanding the methodologies and gathering data are the most challenging stages, which require a lot of attention and are time-consuming. Those difficulties become even greater when the scope of the case study includes the value chain, meaning suppliers who have little or no control over information. Given this context, it is critical to train professionals involved, allowing them to have a better understanding of the methods and how to apply the collected data. Besides, there is a clear need to organize the gathering of necessary data, so quantification and valuation of ESs become a common and regular practice within the business.

Another lesson learnt with the study of the value chain was that it is important to understand the community as a whole, trying to go beyond the products provided by the business and include all the community production. This would enable a more in-depth analysis of the contribution of the business to the community in different aspects and would also show how important the community contributions are for the business. In that case, it is recommended to extend the ESs study not only to all products produced by the community, but also to include other producers from different regions, with different production sizes.

BUNGE

Biomass fuel provision in Nova Mutum, Mato Grosso State

Introduction

Bunge Brazil is one of the largest agribusiness and food companies in the country, operating also in the sugar and bioenergy industries. It has more than 120 facilities installed throughout Brazil, including factories, mills, manufacturing plants, distribution centers, silos and port facilities. In 2013, its gross revenue was BRL 38.1 billion, and exports exceeded US$ 8 billion. Bunge is the largest exporter in Brazil in the agribusiness industry. Worldwide, Bunge Limited operates in over 40 countries.

Business activities are based on a very close relationship with natural capital, and power consumption management is one of its main concerns. There is direct power consumption in many of their production processes, so it is critical to make boilers, generators and agricultural machinery and farm equipment work. Therefore, power supply is of great relevance both under the economic and environmental perspectives, in such a way that adopting an energy matrix that is 90% composed of renewable sources is a strategy that ensures benefits for both sides – reducing costs, as in the reduction of environmental impacts primarily associated with air quality, depletion of non-renewable resources, and worsening of climate change.

Objective: Bunge's study proposed to assess the economic value of the biomass fuel provision ecosystem service – being biomass fuel an important input to generate power from the use of wood chips to produce steam, both in terms of the business dependency upon that resource, and the potential impacts for the business and externalities linked to changes in the power matrix composition.

Scope of the Study

The scope determined by Bunge focuses on one of its soybean processing units, located in the town of Nova Mutum, in Mato Grosso State. The ecosystem service studied was biomass fuel provision, regarding dependency, impacts for the business, and externalities. The inventory approach was used for 2013, including only internal operations in the selected facilities.

Methods

Quantification

Biomass provision quantification started by determining the types of biomass used by the business and the corresponding amount needed to keep their production levels. In 2013, the total volume used by the facilities represented the physical metric for dependency, expressed in m^3 of wood chips.

The impact was calculated as the amount of the most cost-effective alternative energy source that would be needed to replace currently used biomass. Externalities, on their turn, were quantified as avoided GHG emissions, since the most cost-effective energy alternatives for the business, in case there is no biomass provision ES, are fossil fuels. So, they multiplied the consumption that would be needed from fossil fuel energy alternative by its GHG emission factor, in tCO_2e.

Valuation

In order to estimate the value associated with the business dependency on biomass fuel, the method adopted was the Market Price Method (MPMe), multiplying the quantity of each biomass fuel used by their corresponding price. The sum of all costs represents the value of the biomass provision service for the business.

Impact valuation was calculated using the Replacement Cost Method (RCM), which, in this case, estimates the additional cost that would be generated for the business to purchase alternative fuels.

Valuation of externalities was calculated based on the Replacement Cost Method (RCM), taking as a reference the Social Cost of Carbon (SCC), estimated by the U.S. government as US$38.00 t/CO_2e (IWGSCC 2013), converted into Brazilian Reais applying the exchange rate US$/BRL = 2.50.

Further details about quantification and economic valuation methods can be obtained in DEVESE 2.0 (TeSE 2015).

Data

Data about biomass fuel consumption and market prices was provided by Bunge's internal biomass management. Fossil fuel emission factors were obtained through Brazil GHG Protocol Program's calculation tool, available at the program website[9].

Results

In 2013, soybean processing operations at Nova Mutum facilities required the use of three types of vegetal biomass: eucalyptus wood chips, teak chips, and sawmill chips. The value to purchase these raw materials is significant if compared to the cost structure of the facilities.

In case there is no biomass provision, the most cost-effective alternative energy sources would be diesel oil and/or fuel oil. The economic impact of using those fossil fuels would double the costs to purchase power in case of replacement with fuel oil, and would produce a five-fold cost increase in case of diesel oil.

Externalities resulting from greenhouse gas emissions would reach values around BRL 7 million for fuel oil, and BRL 6 million for diesel oil. Hence, using fuel oil would be more cost-effective than using diesel oil. However, it would release more CO_2e, and, consequently, externality would be costlier.

Given the results obtained, it is clear how important the biomass fuel ecosystem service is for the business. Use of fossil fuels in Nova Mutum facilities, besides significantly increasing costs for the business, would also represent a major setback, considering Bunge international commitment to reduce greenhouse gas emissions.

Lessons Learnt

The quality of information and data needed to conduct the study directly influences the reliability of the results, so access to company departments that own this data was critical. Besides, data might not be readily available in the format expected for calculation purposes, which may require a lot of interaction with the sectors in charge, so they contribute both to enhance the quality of the data and to help in the analysis of the results.

9 Brazil GHG Protocol Program website: www.ghgprotocolbrasil.com.br

DURATEX

Freshwater provision in Botucatu, Sao Paulo State

Introduction

Duratex is a Brazilian company that manufactures industrial wood panels and floors, sanitary ware and metals, under Durafloor, Duratex, Deca, and Hydra brands. Leader in the Brazilian market, it is ranked among the top 10 global companies in its industry. It is headquartered in Sao Paulo and has 15 industrial facilities located in the States of Minas Gerais, Paraiba, Pernambuco, Rio Grande do Sul, Rio de Janeiro, Santa Catarina, and Sao Paulo. It also has participation in panel plants in Colombia. When it comes to financial performance, in 2013 the business net revenue was about BRL 3.8 billion.

In its production processes, water is a critical input, so the business has concentrated its efforts in monitoring collection metrics, reducing the amount of water used through recycling and reuse programs, and carrying out specific projects focused on the topic, as the study of sustainability analyses in watersheds where its facilities are located.

Objective: Assess financial consequences for the business in a scenario with limitation of sources of water collected by the company.

Scope of the Study

Duratex's study focused on production processes at their Panel Facilities in Botucatu, Sao Paulo State. Adopting an inventory approach, based on data from 2013, the ecosystem service assessed was water provision, considering business dependency and impact.

Methods

Quantification

The facilities' dependency upon the water provision ecosystem service was quantified from an assessment of the quantity of water demanded (in m^3), considering panel production in the analyzed period. In order to assess the impact of water shortage for the business, Duratex selected a scenario of grant restriction, simulating a situation of hydrological drought.

Valuation

Valuation in both cases adopted the Replacement Cost Method (RCM). To valuate dependency, two alternatives were considered to replace the total volume demanded by the facility: installation of pipes to collect water from another body of surface water, and installation of artesian wells to collect underground water. To valuate impact, the alternatives considered were the installation of artesian wells and supply from the water utility.

Data

Data about water collection was provided by the business operational department, and the grant restriction scenario was elaborated by the sustainability team. For valuation, they used the price charged by Sabesp for the water, and estimated the cost of the infrastructure needed to transport water and install the wells[12].

10 For more information, go to: www9.sabesp.com.br/agenciavirtual/pages/tarifas/tarifas.iface

11 Data used to estimate the infrastructure costs needed for water transportation was kindly provided by Camargo Correa builder member company, based on their experience and expertise in the civil construction industry.

12 Data used to estimate installation costs for wells was provided by Duratex, based on similar projects carried out by the business.

Results

In order to perform its operations, Duratex's panel facilities in Botucatu has a total water demand of about 5.6 m^3/panels produced. Most of the water used comes from surface collection in Pardo River, located at Tiete River Basin. In monetary terms, dependency reaches values around BRL 8.5 million, when water replacement is considered by alternatively collecting from Barra Bonita dam, located at about 22 miles (35 km) from the facilities (Figure 1), and BRL 3.7 million in case of replacement with underground water collection, basically considering infrastructure costs associated with building pipes to transport the water and with building wells.

In order to assess impacts for Duratex in case of water shortage, they selected a scenario with 20% grant restriction compared with the business current grant situation, the equivalent to a hydrological drought of about 260,000 m^3 per year. The value of the impact, combined, was about BRL 3.3 million when considering the purchase of water from Sabesp utility as an alternative to replace water that was not available. In that case, Duratex would pay a variable cost for the price charged by the utility for each m^3 of water used, besides the costs of the initial investment to implement about 3.7 miles (6 km) of pipes to connect the local network to the facilities analyzed. The value of the impact was also estimated, considering the option to collect underground water, which, in this case, reached a value of about BRL 400,000.

Lessons Learnt

The major challenge for the business while developing the pilot was to obtain data – such as costs associated with pipe installation to transport the water, and installation of wells to collect underground water – from third-parties. Besides, upon formulating scenarios to apply the RCM, many uncertainties emerged for the business:

- Risks associated with water availability and grant of concessions to collect water from other sources, underground water or other bodies of water.
- Authorization to install pipes in areas not owned by the business.
- Uncertainties related to the water flow in the installed well. The well may generate a volume that is lower than needed.
- Uncertainties related to the ability to provide water from wells located within the business area, due to difficulties in estimating potential flow.

CENTROFLORA GROUP

Water provision, water quality regulation, wastewater assimilation and inspiration cultural ecosystem service in industrial facilities; and water and raw material provision, loss of nutrients due to soil erosion, climate regulation and inspiration of ***Passiflora incarnata's*** *supplier, both in Botucatu*

Introduction

Established in 1957, in the city of Sao Paulo, Centroflora Group operates in the development and trade of plant extracts, essential oils and isolated active ingredients of vegetal origin for the pharmaceutical, cosmetic and food industries. Currently, it has four production facilities in the towns of Botucatu (SP) and Paranaiba (PI), as well as commercial offices in Barueri (SP, Brazil) and Los Angeles (California, USA) that manage the product distribution in over 40 countries. Raw materials used are cultivated in areas that belong to the business and to supplier partners throughout Brazil. As far as economic performance is concerned, Centroflora Group net sales reached, in 2013, about BRL 61 million, with net equity of BRL 31 million.

Their products, which come from biodiversity resources, rely on a healthy relationship with natural capital, in such a way that agricultural production follows organic agriculture principles, thus reducing impacts, particularly those related to land use. For industrial processes, we highlight water and electric power consumption, generation of solid waste, wastewater, and direct and indirect emissions of greenhouse gases.

Objective: Given the relevance of both the industrial plant and the production process that uses plant raw materials, Centroflora Group's study seeks to better understand their relationship with ecosystem services (ES), both in their main industrial plant and in one of the products in their value chain, through the analysis of a direct supplier of organic products.

Scope of the Study

To handle industrial activities and agricultural production, Centroflora Group's study assessed two scopes.

The first scope focuses on Unit II of Plant Extracts, located in Botucatu, Sao Paulo State. So, they studied internal business operations using an inventory approach for 2013. The pilot assessed water use management, including water provision, water quality regulation, and regulation of wastewater assimilation ESs. Additionally, they also valuated the inspiration ES in the Project entitled 'The School Goes to the Forest' ('A escola vai à mata'), coordinated by Floravida Institute, that receives students from public and private schools located in Botucatu and neighboring regions, in an environmental education program developed in the business areas with preserved native vegetation, as well as the organic vegetable garden and the medicinal garden. Initially, this ES was determined as recreation and tourism. However, after a more careful assessment of the purpose of those visits, they came to the conclusion that the ES that actually drives visitation to the area is 'inspiration', i.e.; another cultural ES related to the lessons learnt from nature. As this ES can be economically valued using the same methods adopted for recreation and tourism ES, it was possible to perform the evaluation without having to create a specific method for inspiration.

The second scope covered their value chain, focused on a family farm property also located in Botucatu, dedicated to the production of ***Passiflora incarnata***, a passion fruit species whose leaves, after drying, are used to make extract. Its chemical compound is Vitexin, used as sedative, soothing medicine, medicine for headaches, antispasmodic and tonic for nerves. ***Passiflora incarnata*** is considered strategic for the business, as it was the best-selling product in 2014, and saw its demand double in 2015. The ESs assessed in this scope were water provision, raw material provision, loss of nutrients due to soil erosion, global climate regulation, and inspiration.

Quantification and valuation of the ESs in this scope were calculated according to the methods described in DEVESE 2.0, as of 2015. The methods and results for each scope of this study will be individually described below.

13 Inspiration cultural ecosystem services are services provided by ecosystems, either natural or cultivated, that inspire a number of cultural and artistic expressions, such as learning a new agricultural management technique (MA, 2005).

14 Floravida Institute is a non-profit organization founded in 2002 by Centroflora Group.

SCOPE 1: UNIT II OF PLANT EXTRACTS, IN BOTUCATU

Methods

Quantification

Centroflora Group's dependency upon water provision ES was quantified according to the volume of water needed to keep maximum levels of production, in m^3, whereas for the impact felt by the business they calculated the difference between the volume demanded and the volume actually used, also in m^3. In order to assess if the water consumed by the business produces externalities to other users, they first checked the hydrological availability of the water spring used, then calculated the difference between total water collected and the volume returned to the same body of water.

For water quality, firstly they identified the parameters considered at CONAMA resolution # 396/2008, which regulates on underground water. To quantify dependency, they estimated the levels of water quality degradation in a scenario where ecosystems would have low ability to perform their functions (CONAMA resolution # 396/2008, Class 4), compared with the levels required by the business to keep its operation (Directive 2914 of the Ministry of Health). For impact,

the levels required by the business were compared to the levels of water quality actually collected by the company.

Considering Centroflora treats all wastewater that is produced and reuses it for garden irrigation, one can conclude the business replaces the water quality and, therefore, wastewater assimilation ES is understood and calculated in this study as avoided externality. In order to quantify the wastewater assimilation service, they identified the parameters monitored by Centroflora and their concentration in the treated wastewater.

For inspiration ES, both the impact produced on the business and the externalities were quantified according to the number of visitors received by the business through 'The School Goes to the Forest' project.

Valuation

Water provision and water quality regulation ESs were valued using the Replacement Cost Method (RCM), i.e.; costs associated with replacement of the quantity of water demanded by the business due to changes in the water spring, in the first case, and costs associated with replacement of the water quality through chemical treatment, in the second case. For wastewater assimilation, they applied the Avoided Costs Method (ACM), using expenses associated with prevention of water quality degradation from wastewater treatment. Inspiration cultural ES was valued using the Travel Cost Method (TCM), based on the admission fee to visit the area and on the travel costs incurred by visitors, in order to calculate the impacts and externalities, respectively.

Data

Data for quantifying water provision was obtained from the business operational area. For valuation, the following data was used: the price paid to purchase water from the State of Sao Paulo Basic Sanitation Company (Sabesp), and the cost of the infrastructure needed to transport water. For water quality and wastewater assimilation, they used water analyses ran by Centroflora. Treatment-related costs were obtained with the business operational area. For inspiration, visitation data was obtained with Floravida Institute.

Results

Unit II of Plant Extracts currently uses underground water resources from Formacao Serra Geral Aquifer. In order to keep maximum levels of production, the unit demands about 0.03 m^3 of water per kilogram of the product. The cost to replace water was assessed considering a couple of alternatives: i) supply from the State of Sao Paulo Basic Sanitation Company (Sabesp), and ii) water imported from Barra Bonita reservoir, located at about 22 miles (35 km) away from the company. In the first scenario, it would be necessary to interconnect Sabesp's supply network to the business, which would produce costs related to the infrastructure and payment for the service, according to the rates charged by Sabesp. In the second scenario, costs are related only to the infrastructure for water collection and transport. Considering the business dependency upon water provision ES, in the first scenario the economic value summed up about BRL 1.1 million, and, in the second scenario, BRL 4.5 million, since the water spring is more distant than the public supply network.

15 For more information, go to: www9.sabesp.com.br/agenciavirtual/pages/tarifas/tarifas.iface

16 Data used to estimate the infrastructure costs needed for water transportation was kindly provided by Camargo Correa builder member company, based on their experience and expertise in the civil construction industry.

To calculate the impact, they used a scenario with higher productivity, considering water availability could be a limiting factor. That scenario calculates a potential need to increase water consumption in about 50%, resulting in an impact of about 18,000 m^3/year, in such a way that for the first scenario the estimated value was BRL 880,000 and, for the second scenario, the value was BRL 4.5 million (since in this case there is no cost per m^3 of water used, and the infrastructure is the same that was considered in case of dependency, the values for impact and dependency end up being the same).

Part of the water collected by Centroflora is returned to its original location, because they use treated wastewater to irrigate the facilities' gardens. However, as part of the irrigated water is absorbed by the plants and the return to the aquifer is slow, and occurs after the water is collected, one can consider that this quantity of water is unavailable to be granted to other actors, characterized as an externality in the quantity of water, so the accrued value for the first scenario was about BRL 1 million, and for the second scenario was about BRL 4.5 million.

As the water collected by Centroflora is of good quality and meets the required parameters, the business performs only one chlorination process to ensure it is proper for drinking, generating costs of about BRL 2,800.00 per year, which represents the value of the water quality estimated impact for the business.

To treat wastewater, which, at the end of the production process presents high organic loading rates, Centroflora relies on a sewage treatment plant that reduces the BOD load to acceptable levels for irrigation, at a cost of about BRL 80,000/year, representing the externality value for this ES.

Inspiration

For inspiration ES, it is worth pointing out the education aspect of activities developed within 'The School Goes to the Forest' project, when an admission fee is charged to reimburse costs incurred by the business to serve a meal during visitation. Public school students, which account for over 90% of the visitors, however, are exempt from the admission fee, so the impact of the activity for the business represents a symbolic value equivalent to about BRL 800.00 per year. For externalities, it was determined that the towns where visitors come from are located within 44 miles (70 km) from the area studied, and the most used means of transport is a microbus. As visitors travel specifically for the visit, expenses related to feeding and accommodation were not considered. The value of the externalities (fuel consumption, etc.), considering the total number of visitors (those who have to pay and those who do not) is about BRL 25,000.00. It is worth noting that opportunity costs were not taken into account, since areas conserved by business would not allow for alternative economic use, because they are located in an area protected by Federal Law # 11.428/2006, where the Cerrado (Savanna) and the Atlantic Forest biomes meet, with Seasonal Semideciduous Forest vegetation formation.

17 The value for dependency, impact and externality is the same in the second scenario, since there are no variable costs related to variations in the volume collected, because costs refer to infrastructure implementation only.

SCOPE 2: *PASSIFLORA INCARNATA* SUPPLIER'S PROPERTY

Methods

Quantification

Water provision ES was quantified based on water consumption for irrigation of *Passiflora incarnata* at the supplier's property. The water used by the plant during development cannot be quantified, as it would require a more in-depth study of the cultivation green footprint.

Soil erosion regulation was quantified in terms of dependency and impact under the perspective of losing nutrients to the agricultural area reserved for *Passiflora incarnata* production – an area that depends upon soil fertility and is, hence, vulnerable to erosion processes. Quantification was measured using the Universal Soil Loss Equation (USLE). To calculate dependency, they found soil erosion (in t/ha.year) from the difference between maximum level of erosion (exposed soil) and minimum level (native vegetation cover). For impact, quantification is obtained from the difference between current level of erosion (considering land use and management) and minimum level. In both cases (dependency and impact), after determining relevant nutrients for production and their current concentration in the soil, they calculated the loss of nutrients (in t/ha.year) due to soil loss in each case.

Raw materials ES was analyzed based on Centroflora's demand for *Passiflora incarnata*. Quantification of Centroflora's dependency considered total demand of the business for the raw materials purchased, meaning the sum of raw materials quantity currently used plus raw materials to be replaced due to unavailability, being the latter used to calculate impact.

Global climate regulation ES was quantified using the deforestation avoided emission approach, considering the natural vegetation area located at the supplier's property.

For inspiration, the impact for the supplier's family was measured considering the area attractiveness metric only, since there is no conservation effort, and visitation activities are mainly performed in the production area, thanks to the attractiveness of the agroforestry system. Quantification for both impact and externality was calculated based on the number of visitors in 2013.

Valuation

Water provision ES was not valued, because it was not possible to estimate *Passiflora incarnata's* green footprint, and the volume of water used for irrigation was not deemed significant and could be easily replaced with rainfall.

The valuation method adopted for soil erosion regulation was the Replacement Cost Method (RCM), estimating the necessary expenses to replace nutrients lost due to erosion processes in dependency, and using current expenses to replace nutrients in impact.

Valuation of Centroflora's dependency on raw material provision from the supplier analyzed was based on the Market Price Method (MPMe), according to selling prices charged by the supplier. For impact, i.e.; lack of raw material for Centroflora from that specific supplier, it was also necessary to use the Market Price Method (MPMe), because, as informed by Centroflora, there is no alternative product to replace ***Passiflora incarnata***, which prevents using the RCM method.

Inspiration ES was valued according to the impact produced on the property, using the Travel Cost Method (TCM), based on the income earned by the family for visitation activities. Externality was also valued based on TCM, considering average cost of traveling to the visited area, plus average costs incurred in feeding and accommodation during the trip (out of the visitation area).

Data

To calculate water provision, they informed the water used for irrigation came from a water spring located in the neighborhood. The supplier does not make use of systematic irrigation throughout the period; it is rather an ad-hoc type of irrigation only to transplant seedlings from the nursery to the field.

For soil erosion regulation, to measure the length of the slope (LS factor), they measured in the field the distance between the beginning and the end of the slope and their corresponding altitudes, relying also on the support of a map of the property. The property basically has only one slope direction (in a ramp). Rainfall erosivity factor (R) was based on Moreti et al. (2003), with a study of Sao Manuel town, located about 19 miles (30 km) away from Botucatu. Data about soil classification and nutrient concentration in the location was provided by Centroflora.

For deforestation avoided emissions ES, they considered only areas consisting of APP, LR and forest fragments, which sum up 0.762 ha. Deforestation rate at baseline was calculated based on data found in the Atlantic Forest Biome Monitoring and Deforestation Technical Reports (IBAMA and MMA, 2002- 2008; and 2009-2010). Phytophysiognomy was determined as Seasonal Semideciduous Submontane Atlantic Forest. For raw material provision and inspiration, data was provided by Centroflora and by the family who owns the analyzed farm, during a visit to the field.

Results

Water provision ES considered, as informed by the producer, 40 m^3 of collected water during the production cycle, which accounts for 13.3 m^3 per year. Supposing this volume is not significant and can easily be replaced with planting during the wet season, dependency, impact and externalities were not estimated.

To assess soil erosion regulation, the LS factor obtained was approximately 3.8499 (dimensionless), considering the property is a long ramp along the slope. Soil classification is Typical Dystrophic Yellow Latosol, A prominent, medium texture, for which the K factor considered was 0.057. Rainfall erosivity factor (R) obtained for Sao Manuel municipality is 7,487 MJ.mm/ha.h.year). For the UM factor, they considered maximum and minimum levels of retention for dependency: 1.0 and 0.1, respectively. The balance of soil losses resulted in dependency, i.e.; under maximum levels of erosion, that would be about 34 t/ha.year of phosphor, and 171 t/ha.year of potassium. For impact, current UM considered was 0.5, a factor for traditional management of greenery; they determined an annual loss of about 17t/ha of phosphor and 85t/ha of potassium. The cost to replace nutrients for dependency was about BRL 13,500 per year, and the impact was about BRL 6.7 per year.

For raw material provision, current area reserved for ***Passiflora incarnata*** production is 2 ha, with average production of 1,000 kg/ha. Nevertheless, this production is not sufficient to meet Centroflora's demand, so for the next crop year the area dedicated to production of raw material will be extended to 4 ha. Traded at BRL 9.00/kg, total dependency of the producer upon the raw material provision ES, considering both the quantity currently purchased and the quantity that is currently unavailable is, therefore, BRL 36,000.00. The impact was estimated at BRL 18,000.00, concerning the amount of raw material unavailable at the period.

For deforestation avoided emissions, given the small size of the property, and because the baseline deforestation rate is null, the volume of avoided carbon is zero.

For inspiration, in 2013, the property received 30 visitors from UNESP and FATEC (both institutions located in Botucatu), for research and education purposes. The family does not charge any admission fee, but reported earnings from sales of organic products to visitors, so the value of the impact for the producer in 2013 was estimated at BRL 2,000.00. For externality, it was determined that almost half of the visitors went from Botucatu to the property driving their own cars, and half took a bus to get there. Thus, to calculate the value of the externality, they used average values for driving an economic vehicle - considering that in each vehicle there were five people -, and the values for taking a bus from downtown Botucatu to the property (about 13 miles / 20 km), considering 15 people used that means of transportation. There are no costs incurred in chartering a bus or renting a car, because the educational institutions own the vehicles. As visitors come from the town of Botucatu, there are no accommodation or feeding expenditures outside the area where the business is located. The value of the inspiration service externality was estimated at about BRL 400.00.

Lessons Learnt

During the elaboration of this case study, it was clear that the stage that demanded more effort was the one to collect data, including understanding the necessary data for calculation in the business specific context and data provided by their operational teams. The greatest challenge was to search data that was not owned by the business, information that was out of the reach of the corporate boundaries, that depended on other companies. For instance: cost estimates to build the water treatment plant (WTP), or infrastructure cost to transport water. During this work, it was possible to notice the lack of accuracy in some data controlled by the business, such as the native forest area, or the amount of water used to irrigate gardens.

Given this context, it is critical to train professionals involved, allowing them to have better understanding of the methods and how to apply the collected data. Besides, there is a clear need to organize the gathering of necessary data, so quantification and valuation of ESs become a common and regular practice for the business.

An important lesson learnt from the study of a supplier's property was that it is a complex task to understand the value chain of a product, because it requires different types of information that is often unavailable. Moreover, it was crystal clear that studying a supplier property is relevant to understand the reality of small producers, but may present data that is not significant at all for the business context. In this case, it is recommended to extend the study of ecosystem services to other producers in different regions, with different production sizes.

NATURA

Global climate regulation in Mato Grosso, Rondonia, Para and Sao Paulo

Introduction

Natura is the largest Brazilian company in the personal care, fragrances and cosmetics industry, as well as in the direct sales segment. It has solid presence in Latin America, with operations in Argentina, Chile, Mexico, Peru, Colombia, and France. It is a leader company in its industry, being the favorite of 44% of consumers. In 2013, its net revenue was BRL 7.01 billion (Natura, 2013).

Natura has a close relationship with biodiversity, since it uses specimens from the Brazilian flora as ingredients for its cosmetic products. Sustainable use of biodiversity is Natura's main technological platform and one of the socio-environmental practices implemented in its production chain. Fostering sustainable chains directly or indirectly interferes with local socioeconomic development patterns, natural resources and land use exploration models, and environmental conservation in different regions of the country.

Connected with its vision of generating value for everyone, Natura announced a new Vision of Sustainability, with guidelines for the business until 2050, ambitions and commitments until 2010. The company believes it will generate positive social, environmental, economic and cultural impacts, delivering value to its whole relationship network, in all businesses, brands and geographies it operates, through its products, services and trading channels. So, looking at externalities valuation as more than a management tool to reduce the impact of their business activities, Natura believes it should support the building of a new economic model towards positive impact and can help accounting for social and environmental impacts, whether positive or negative, produced along its value chain.

Objective: Natura seeks to measure impacts, both positive and negative, that its business practices generate for natural capital and society. Currently, it seeks to explore the potential of economic valuation as an ancillary tool in the decision-making process to purchase raw materials and is aligned with the ambition to develop sustainable supply chains.

Scope of the Study

This study assesses the economic value of externalities associated with the global climate regulation ecosystem service in five of Natura's raw material suppliers that produce Brazil nuts, cupuaçu, palm, and sugarcane (conventional and organic management). In all cases, the analyses adopt a retroactive approach, assessing past emissions since the beginning of the production up to date.

Brazil nut (*Bertholletia excelsa*) is used by Natura to formulate bars of soap, oils, lotions and fragrances. The supplier analyzed is a cooperative in Juruena region, Mato Grosso State. Brazil nut management is performed in native forests, although farmers also produce nuts in agroforestry systems (AFS), recovering degraded areas.

Cupuaçu (*Theobroma grandiflorum*) is used by Natura in the formulation of moisturizers, bars of soap, oils and fragrances. It is produced in agroforestry systems (AFS) by an agricultural cooperative in Porto Velho region, in the State of Rondonia.

Palm (*Elaeis guineensis*) is produced in a monoculture system, in Tailandia municipality, State of Para. The oil derived from the pulp of the fruit, known as palm oil, and the oil derived from the palm seed, known as palm kernel oil, are two basic inputs in the manufacturing of bars of soap.

Sugarcane (*Saccharum officinarum*) is produced in a monoculture system and used to make alcohol, a basic ingredient for fragrances and other cosmetics. Sugarcane was analyzed in two different types of production: conventional management, in Piracicaba, SP, and organic management, in Sertaozinho, SP.

Methods

Quantification

CO_2 emissions and removals, whether real or avoided, were quantified using dry biomass from local forestry types and from the production systems analyzed. Dry biomass was converted into carbon (C) and then into CO_2. Cupuaçu and Brazil nut are considered sociobiodiversity products and are purchased in agricultural cooperatives. For both chains, emission data was provided directly in tC/ha in Nunes (2011) and IDESAM (2013) reports. Estimates were weighted according to the time period Natura makes use of those chains in its supply. For palm, organic sugarcane and conventional sugarcane production chains, estimates were calculated according to the percentage Natura buys them from the companies.

Avoided deforestation emissions were estimated for cupuaçu, Brazil nut and palm. In all three cases, the baseline, or the current trend in land use change for those areas that supply to Natura, would be conversion into pastureland. For areas under control of those suppliers, they assumed as deforestation rate the target of 10% of the baseline. For palm, which is a perennial species, because it is a monoculture production, the analysis focuses on avoided deforestation in areas of permanent preservation (APP) and legal reserve (LR), highlighting that the supplier reports production areas have been associated with deforestation since 2001. For sugarcane, they did not calculate avoided deforestation, because, according to assessments made in 2005 and 2010 in Sao Paulo State Forest Inventory, there was no deforestation in Piracicaba and Sertaozinho municipalities, which is the equivalent to a 0% deforestation baseline.

Some adjustments were necessary to determine biomass, or directly the carbon content in some of those production systems:

For Brazil nut and cupuaçu, the carbon stock in the secondary forest fraction was adjusted to 35% of the value of the primary forest, as anticipated in the Brazilian National Inventory of Anthropogenic GHG Emission and Removal (FUNCATE, 2010).

For cupuaçu, AFS also generates durable wooden products, used in construction, furniture, utensils and others. In order to discount the biomass from scrap lumber, which will eventually decompose and generate GHG emissions, they estimated the carbon content in timber species based on the estimate of the quantity of carbon obtained from AFS as a whole (IDESAM 2013) and on the portion that represents timber species in AFS composition (Sa et al. 2000).

That estimate took into account annual increments in diameter (DBH - diameter at breast height) of each existing species in AFS, calculating the proportion of lumber species compared to total species. They assumed 50% of the carbon present in lumber species will be residue after exploration of those species, and will become GHG emissions.

Regarding Brazil nut, in order to account for emissions derived from decomposition, they considered existing white wood species in AFS with Brazil nut tree will be converted into coal (Nunes, 2011) and burned during the nut drying process. They used as a model Parica (Schizolobium amazonicum) biomass data (Rondon, 2002).

In palm calculations, they used internal data concerning supply of palm oil and palm kernel oil. To estimate the production area and, proportionally, their corresponding APP and LR, they used productivity data for the culture per hectare (Agropalma, 2013). As palm oil and palm kernel oil are produced from different parts of the plant, their areas overlap, so, for calculation purposes, they considered the largest area needed to meet Natura's demand, which in this case was the palm kernel oil production area.

For sugarcane, they considered that the largest portion of its biomass will be released as CO_2, and only the fraction corresponding to the straw, which accounts for 31% (Paula, 2010), will be incorporated into the soil. Data about sugarcane produced using organic methods as well as traditional methods was taken into account. Because of the methodology adopted, which did not account for fertilizer life cycle analysis, it was not possible to show the difference in emissions released by both management practices. Thus, the benefits of organic production were not valued, even though it is a low-carbon agriculture.

Valuation

Economic valuation was calculated based on the Replacement Cost Method (RCM), taking as a reference the Social Cost of Carbon (SCC), estimated by the U.S. government as US$38.00 t/$CO_2$e (IWGSCC 2013), converted into Brazilian Reais applying the exchange rate US$/BRL = 2.50. The rate used to monetarily adjust estimates obtained for future years was arbitrarily determined as 0% per year, which means not to discount future values associated with ecosystem services when comparing them with the current value estimated.

Data

Dry biomass data was collected from technical studies carried out by Natura (IDESAM, 2013), as well as from secondary data that characterize the production chains for the raw materials studied. CO_2 emission and removal estimates were based on factors published in Federal Decree # 7390/2010 (Brazil, 2010). Deforestation rates were researched at PRODES[18].

Results

For cupuaçu, CO_2 net emissions released by AFS were estimated at about 376,198 tCO_2e, in an area of about 4,000 ha. Total valuation was BRL 35.7 million. Avoided deforestation, considering a total area of 14,275 ha, was 50,000 of tCO_2e, which corresponds to a valuation of BRL 4.7 million.

For Brazil nut, net removals generated by the AFS, in a 45-ha area, were estimated at about 61 tCO_2e, being valued at BRL 5,750. Avoided deforestation was estimated at about 10,600 tCO_2e, considering the total area of 7,245 ha, which means a valuation of BRL 1.008 million.

Palm, when compared with pastureland, which in theory would be the type of land use if palm were not being produced in the area, presented net removals of about 600,000 tCO_2e, in an area of about 6,000 ha, the equivalent to a valuation of BRL 55.8 million. Avoided deforestation in the context of preserved areas (about 12,550 ha) was estimated at 12,000 tCO_2e, which corresponds to BRL 1.1 million.

As explained previously, for sugarcane, only generated net emissions were calculated. For traditionally produced sugarcane, in a total area of 117 ha, the estimate was about 2,200 tCO_2e, and, for organic sugarcane, in an area of about 1,124 ha, estimate was about 21,000 tCO_2e, corresponding, respectively, to BRL 211,000 and BRL 2 million.

By analyzing the results produced from the valuation process, it is possible to conclude that the palm production chain is the one that generates the highest value, when it comes to the ecosystem service studied (almost 57 million) because of the large volumes purchased by Natura and, consequently, the large areas involved.

If the estimated values are weighed by the corresponding areas, we get a reference value for each production chain (BRL/ha): Brazil nut – BRL 22,400 per hectare; cupuaçu – BRL 10,000 per hectare; palm – BRL 9,700 per hectare; organic sugarcane – 1,800 per hectare, and conventional sugarcane – BRL 1,800 per hectare.

Therefore, Brazil nut production chain is the one that generates the most positive impacts when we consider the climate regulation ecosystem service, followed by cupuaçu, palm and (organic and conventional) sugarcane. We come to the conclusion that sociobiodiversity product chains, such as Brazil nut and cupuaçu, have great potential to generate ecosystem services.

Lessons Learnt

The major challenge was to select the specific location and time period for each production chain, given the complexity of interrelationships and potential influences of ecosystem services.

A suggestion to evolve DEVESE is to determine factors that enable differentiating numerous production techniques. We say that because, as the results showed, using current methodological procedures it was not possible to quantify the difference between carbon emissions in traditional cultivation and organic cultivation. It is known that fertilizers are one of the top CO_2 emitters in agriculture, but this information was not taken into account in the calculation. Therefore, it is critical to observe the life cycle analysis of all production processes, so all emission sources are incorporated.

Both aspects presented here are important, because, given the goal to help in the stakeholders' decision-making process, there is a risk to convey the wrong message.

18 PRODES: www.dpi.inpe.br/prodesdigital/prodesmunicipal.php.

SUZANO

Recreation and tourism at Parque das Neblinas, in Sao Paulo State

Introduction

Suzano Pulp and Paper operates in the eucalyptus pulp and paper industry, in numerous countries. It is headquartered in Sao Paulo (SP) and has six industrial plants in the States of Sao Paulo, Bahia and Maranhao; out of Brazil, it keeps a commercial office in China and subsidiaries in the United States, Switzerland, the UK and Argentina. Its forest areas exceed 800,000 hectares, with planted forests in Bahia, Espirito Santo, Sao Paulo, Minas Gerais, Maranhao, Tocantins, and Piaui. With over 300,000 hectares for Areas of Permanent Preservation (APP), Legal Reserves (LR) and others, 39% of its areas are for environmental preservation. Concerning business performance, its net revenue was higher than BRL 5 billion, and the sales volume accounted for 3.2 million tons of pulp and paper, in 2012.

Pulp and paper production involves a close relationship with the environment, both in the forestry stage – which demands large areas of homogeneous forests, leading to habitat simplification, with species produced in a monoculture system, hindering regeneration of native vegetation – and in the industrial stage – linked to aspects such as water consumption and other renewable and non-renewable raw materials, wastewater and waste generation, and power consumption.

Objective: Suzano seeks to assess the economic aspect associated with the sociocultural aspect of its activities, through the study of the recreation and tourism ecosystem service developed in a private reserve kept by the company.

Along with Ecofuturo Institute, Suzano seeks to valuate recreation and tourism activities developed in Parque das Neblinas (Mist Park), enhancing information for its management in a way that is aligned with conservation principles adopted by both of them.

Scope of the Study

Suzano selected as the scope of the study the Parque das Neblinas, a 6,100-hectare reserve managed by Ecofuturo Institute. Located in the border of Mogi das Cruzes and Bertioga municipalities (SP), it is close to Serra do Mar State Park, and is in a region recognized as a World Heritage Site by Unesco (the United Nations Educational, Scientific and Cultural Organization). The park is within Sertao dos Freires and Pedra Branca farms, properties of Suzano Pulp and Paper, and has been recognized, since 2006, as an Outpost of the Atlantic Forest Biosphere Reserve. Given the demand for leisure and ecotourism opportunities provided in the area, the recreation and tourism ecosystem was studied, using an inventory approach for 2013. Impact and externality aspects were assessed, under the area attractiveness perspective.

Methods

Quantification

Quantification of impact for the business and externality was calculated based on the area attractiveness metric, considering the number of visitors that went to the park in 2013.

19 Ecofuturo Institute is a Civil Society Organization of Public Interest (OSCIP), and Suzano Pulp and Paper is its main sponsor.

Valuation

The financial impact value was calculated based on the Travel Cost Method (TCM), considering different revenues obtained by Ecofuturo Institute as a result of tourism activities, including fees per type of activity and feeding costs. The effort metric to preserve the area was not calculated due to the park characteristics. As it is a reserve located in the Atlantic Forest area, the only viable economic option is actually visitation, since it does not require removing vegetation. For externality, the method used was also the TCM, which is based on costs associated with visitation to a certain place, assuming expenses incurred with the trip are at least equivalent to the benefits expected by visitors. Variables adopted were individual average costs with travelling to the visited area (fuel consumption and car tolls paid in the round trip).

Data

All necessary data was provided by Ecofuturo Institute. Data about the number of visitors, as well as information about direct revenues are controlled and annually monitored by the Institute.

Results

In 2013, Parque das Neblinas attracted a total of 2,743 visitors, out of which 90% participated in monitored hiking activities, 6% dedicated to canoeing, and 4% took part in the thematic program, events or meetings. The value charged for each activity varies: for canoeing, the cost for each participant is BRL 120.00; for monitored hiking, it is BRL 35.00; and, for the thematic program, events and meetings, it is BRL 60.00. The park also has a restaurant with a revenue of BRL 52,065.67 in 2013. Therefore, the financial impact for the Institute was about BRL 164,000 in 2013.

In 2013, for externality, 49.7% of visitors were from the region close to the park, within a 25-mile (40-km) range, and 50.3% were from the city of Sao Paulo. Visitors' main means of transport is by car. For those who come from the city of Sao Paulo, they estimated an average of 3.25 passengers per vehicle, and the travel cost of BRL 0.80/km. Besides, there is a toll fee on the road, and the cost is BRL 5.80 per vehicle (round trip). They usually stay in the park for the whole day, and the survey did not determine feeding or accommodation expenses outside the park area. The value of the externality was estimated at BRL 107,00.

Lessons Learnt

For externalities, proposed guidelines enabled determining different values associated with indirect expenses incurred by visitors. Hence, both the Institute and Suzano understand there are additional benefits - associated with image and reputation, as well as with the relationship with stakeholders -, which are not directly captured by the economic valuation based on expenses made by visitors.

20 Thematic programs are activities involving an expert on a certain topic, such as orchid watching, environmental awareness, photography, etc.

WALMART

Global climate regulation and soil erosion regulation in Sao Felix do Xingu (PA)

Introduction

Walmart Brazil, the third largest supermarket chain in the country, is formed by over 500 stores and warehouse clubs in 215 municipalities in the Northeast, Middle West, Southeast and South regions, in addition to the online store that serves the entire Brazilian territory. Headquartered in Barueri, Sao Paulo metropolitan region, its revenue was BRL 28.5 billion in 2013.

The business global platform establishes sustainability strategies based on three pillars: climate and energy, with the goal of reaching 100% renewable energy supply; waste management, focused on eliminating waste destination to landfills; and more sustainable products, seeking to offer products with a lower socio-environmental impact for their customers. Concerning the third pillar, one of the initiatives that is worth mentioning is the monitoring of beef cattle in the Amazon area, in order to ensure it does not come from deforestation areas, Conservation Units, Indigenous Land, land used for slave labor and/or with some kind of embargo.

Objective: Focused on its supply chain, Walmart sought to assess the economic value of ecosystem services that will be lost or recovered due to land use changes caused by a project that fosters a more sustainable production of beef cattle, developed in pilot properties in the Amazon.

Scope of the Study

Walmart study focused on its value chain, analyzing beef cattle producer farms that participate in the 'Sustainable Meat: from the Field to the Table' project, located in Sao Felix do Xingu, Para State. The project consists of a partnership between The Nature Conservancy – TNC, Marfrig Group, Walmart Brazil, Moore Foundation, Rural Union of Sao Felix do Xingu, and Sao Felix do Xingu city administration. Within the project framework, Walmart, in partnership with TNC, offers technical support to producers in order to adjust to the environmental legislation and enhance pastureland management practices, aiming at reducing impacts on the soil and increasing productivity. Given the goals established, the most relevant ecosystem services were global climate regulation, including balance between greenhouse gas (GHG) emissions and removals and avoided deforestation, and soil erosion regulation, focused on the loss of nutrients (dependency and impact). For climate regulation, 18 farms that participate in the project were selected, and the time horizon was 20 years, taking into account the time to implement forest restoration measures. For soil erosion regulation, the study scope was limited to a one-year period and to one single property, since local data had to be used, so it can be replicated to the other properties, following the same methodology.

Methods

Quantification

Global climate regulation ecosystem service was quantified by mapping land use in the farms analyzed. To calculate balance between GHG removals and emissions, they considered the areas that are being restored with native vegetation to recover Areas of Permanent Preservation (APP) and Legal Reserve (LR). In order to account for avoided deforestation, conserved areas were considered, including APP, LR and native vegetation surplus. Then, those areas were multiplied by the carbon stock contained in recovered (for balance between removals and emissions) and conserved (for avoided deforestation) vegetation biomass, in tCO_2e/ha.

For soil erosion regulation service, dependency and impact aspects were analyzed under the perspective of nutrients loss in the agricultural area of the property (consisting of pastureland and annual croplands), which is directly dependent on soil fertility and, therefore, vulnerable to erosion processes. Quantification was measured using the Universal Soil Loss Equation (USLE). Dependency represents the maximum erosion retention that can be assured by natural ecosystems, in such a way that quantification was calculated with two soil erosion estimates: one considering the maximum level of soil erosion (i.e.; soil loss due to exposed soil) and the other considering the minimum level of soil loss (native vegetation cover). The difference between maximum and minimum (in t/ha) erosion multiplied by the concentration of soil nutrients results in the physical metric for loss of nutrients, which in this case used as a reference phosphor (P) concentration. The impact for the business represents the difference between the actual level of soil erosion (considering current land use and management practices) and the minimum level (the same figure obtained for dependency). Since one of the objectives of the analyzed project is to adopt sustainable management practices, calculation for impact was performed twice in order to estimate reduction potential in soil loss due to more sustainable management practices. Thus, the calculation of current erosion level represents the difference between soil loss before and after the project, that is, conventional management and sustainable management of pastureland and cultivation, respectively.

Valuation

Valuation of global climate was performed based on the Replacement Cost Method (RCM), taking as a reference the Social Cost of Carbon (SCC), estimated by the U.S. government as US$38.00 t/CO_2e (IWGSCC 2013), converted into Brazilian Reais applying the exchange rate US$/BRL = 2.50.

For soil erosion regulation, the method used was also RCM. For valuation of dependency and impact, replacement costs of lost nutrients due to erosion processes were estimated taking as a reference phosphor concentration and the average price of MPK fertilizer (concentration of 20% of P_2O_5), at a cost of BRL 1,660.00/t.

Data

Data related to land use in the properties was obtained with Walmart along with TNC team. For global climate regulation ES, they also obtained the deforestation rate in the municipality of Sao Felix do Xingu, estimated by the Brazilian National Institute of Spacial Research (INPE) / Ministry of Science, Technology and Innovation (MCTI), available at the Watersheds Clean Up Program (PRODES) website. The region phytophysiognomy was obtained from the Brazilian Vegetation Map, produced by the Brazilian Institute of Geography and Statistics (IBGE). For soil erosion regulation ES, TNC provided an analysis of the property soil containing phosphor concentrations, and the price of fertilizers was obtained from a supplier, considering the cost per ton of fertilizer plus the cost of freight for transportation to the farm. R, K and UM factors were obtained from reference values shown in DEVESE calculation tool. LS factor was also estimated using the calculation tool, using as reference the topographic map of the property to estimate length and ramp inclination.

Results

Located in the Amazon biome, the predominant type of vegetation in the properties analyzed is the Submontane Ombrophilous Dense Forest. Mapping of the properties land use identified a total area of about 3,000 hectares to be restored, including APP and Legal Reserve, whose land use before the restoration project was mainly for pastureland. As in the specified time horizon there was no deforestation, and there was no expectation in that sense, they considered carbon removal only. Total carbon removed during the project in the area determined was estimated at about 500,000 tCO_2e, generating a positive externality of about BRL 47 million.

Regarding avoided deforestation, total area of native vegetation in the properties summed up about 25,000 hectares. Considering the deforestation rate in the municipality of Sao Felix do Xingu equivalent to 0.26% p.a. for the 2012-2013 period, and the 0% rate proposed by the project, since participants have formally committed not to deforest their areas, the total avoided carbon exceeded 159,000 tCO_2e, valued at about BRL 15 million.

For soil erosion regulation, dependency indicated maximum soil erosion at about 520 t/ha, compared with a minimum level of 5 t/ha. For R, UM and K factors, the data used came from support tables in DEVESE calculation tool. For R factor, they used as reference the value for Conceicao do Araguaia municipality, which is 11,487.5 MJ.mm/ha.h.year; for K factor, they used as reference the value for Red-Yellow Argisol soil classification, which is 0.0466 t.ha.h/ha.MJ.mm. For UM factor, they used as reference the value of native vegetation/ dense reforestation, which is 0.01, to calculate the minimum level of soil erosion; and they used the maximum level 1.00, in a scenario where the is soil exposed, to calculate the maximum level of erosion. LS factor was calculated for a 0.9 mile (1,500 m) ramp distance, and a 49 ft (15 m) difference in altitude. Considering average phosphor (P) concentration of 0.006 t/ha, according to soil analysis, those erosion levels represent a potential of nutrients loss of about 3 t/ha of phosphor. Taking into account the price found for MPK fertilizer, the total value of the business dependency is about BRL 125 million.

21 www.obt.inpe.br/prodes/index.php

Regarding impact for the farm, land use and management before the project - characterized by predominantly degraded pastureland and conventional cultivation of manioc and corn - leads to an estimated soil loss of 140 t/ha. In this case, for UM factor, they used as reference the values for degraded pastureland (0.25), and the average values for crop and manioc (0.44).

In order to compare soil erosion levels resulting from management practices adopted before the project with a scenario of sustainable management of pastureland and cropland, calculation was performed using UM values adopted for conservation practices, and the resulting soil loss was 60 t/ha.

According to the assessment, adoption of conservation practices can reduce phosphor loss to about 0.5 t/ha, with a value of BRL 19 million – a 85% reduction potential.

Lessons Learnt

To Walmart team, it was a really interesting study because it enabled a first valuation scenario of some results that were already expected in the project. Besides enriching discussions, the study also encouraged inclusion of new metrics in the project, so next year they can run calculations more accurately, reduce estimates and secondary data, then compare the results and start building a data history.

FINAL REMARKS

In 2014, there was the first round of tests to apply the Corporate Guidelines for the Economic Valuation of Ecosystem Services – DEVESE, developed in joint collaboration with TeSE members. Altogether, 13 companies developed pilots of DEVESE application, covering different aspects of their business relationship with natural capital in Brazil. This publication brings a summary of the work performed by 10 of those companies.

Elaboration of those pilots allowed for a practical assessment of DEVESE and indicated lots of opportunities for improvement of the methodological procedures proposed. It was also possible to revise some initial ideas about the challenges businesses face while elaborating studies like that. So, lessons learnt with the implementation of the pilots contributed with significant material for TeSE to enhance its operating strategy and more effectively perform its mission to support the Brazilian business sector in the incorporation of values associated with ecosystem services into their business decision-making processes.

Below, you will find the most relevant comments about the results from this first DEVESE test round.

- Implementation of pilots encouraged some businesses to revise the way they deal with natural capital and, particularly, with ecosystem services. This revision of the relationship between business and natural capital is directly related with TeSE objectives.

- DEVESE can and should be enhanced and extended. Many pilots pointed out opportunities for improvement. Some of those improvements have already been incorporated into DEVESE 2.0 version; others will be incorporated in future versions. In fact, DEVESE was conceived as a document to be continuously improved, so it can represent, more accurately, the diversity of relationships between the Brazilian business sector and natural capital.

- TeSE face to face meetings and DEVESE methodological procedures revision process, in 2014, were not sufficient to clarify details about the necessary methods and database to perform economic valuation studies. In some cases, the companies felt they needed to revise DEVESE procedures with TeSE team while developing their pilots. Thinking of that, TeSE decided to offer, from 2015 on, training classes on how to use DEVESE and its corresponding calculation tool, so businesses will be able to actually perform practical tests of the methods, and debate with TeSE team about the characteristics of the data they have. The goal of the training is to give autonomy to businesses so they can use the tools themselves.

- Management (or generation and control) of in-house data is critical to apply DEVESE - as well as any other framework of this nature. Businesses who showed to have more advanced management of environmental and economic data related to their operations, besides having easy access to it even when data was produced in different business departments, were the ones who found it easier and less expensive (hours of work) to develop their pilots. It is worth highlighting that generation and control of data required by DEVESE can benefit the business in other projects and studies besides the scope covered in TeSE. For this reason, the efforts made to enhance in-house data management are an investment likely to offer numerous benefits for the business.

- Engagement of different business areas to elaborate the study, as recommended in DEVESE chapter about planning, proved to be very beneficial. Some companies pointed out that the engagement of areas directly associated with the scope of the study contributed a lot to obtain the data needed and to understand the results obtained from the analyses.

- It was quite challenging to obtain external data, particularly to determine the sources for the data. This difficulty was expected, but it is likely to decrease as analyses are updated. As the business determines and maps the data sources it needs for future versions of the analyses, all it will have to do is access the same sources to update the data, which should considerably reduce the time spent in the first study – that included this process of identifying and mapping the sources.

- Conducting valuation studies along their value chains is usually more complex than valuating their own operations. This is particularly true when the value chain includes smaller suppliers that, often, have poor control of their own data. So, our recommendation, according to DEVESE guidelines, is that businesses should first apply DEVESE to their own operations, so they can have a better understanding of the demand for data related to the ecosystem services they intend to value, and then it will be easier to engage their value chains and guide them on how to produce the data needed for analyses.

- Still according to what is discussed in DEVESE guidelines, some businesses pointed out that the economic value estimates obtained correspond only to one of the value dimensions, or importance, associated with natural resources as ecosystem services. Therefore, other values, many of which are intangible, are also relevant and, whenever possible, should be taken into account in business decision-making processes.

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