Environmental Assets Program

SUSTAINABLE LAND MANAGEMENT PLAN (SLMP)

CONCEPTUAL BASIS AND METHODOLOGICAL FRAMEWORK

COOPERAÇÃO TÉCNICA SBE VC RBMA

RBMA

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Technical Information

This work is an initiative between Technical/Financial Partnership and Mata Atlântica Biosphere Reserve (RBMA), Votorantim Cimentos (VC) and Brazilian Speleological Society (SBE).

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Mata Atlântica Biosphere Reserve
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- Eduardo Lopes Espinha – Independent consultant.

While celebrating the 25th anniversary of its recognition by UNESCO, the Mata Atlântica Biosphere Reserve also celebrates the first five years of a successful and innovative partnership with Votorantim Cimentos and the Brazilian Speleological Society. It is under the umbrella of this partnership that a new instrument was developed, aimed at the conservation and sustainable use of the natural and cultural heritage within properties of land-based companies: The Sustainable Land Management Plan – SLMP, whose conceptual basis and methodological framework are described here.

As it seeks to reduce environmental liabilities and risks and costs associated with them, the SLMP also targets the identification, conservation and sustainable use of environmental assets – often overlooked in the management of private areas – seeking to generate benefits for businesses, neighboring communities and society in general.

In this regard, the Environmental Assets program and the SLMP propose a new look at conservation-development relationships, in which the environment presents itself not as an obstacle to production, but rather as a real opportunity to promote economic growth, with sustainability and social responsibility.

Good reading, and let's get to work!

Clayton Ferreira Lino
President of the National Council
Mata Atlântica Biosphere Reserve

After much dialogue and willingness to seek common understanding and objectives, Votorantim Cimentos approached two entities working in environmental conservation: The Brazilian Speleological Society (SBE) and the Mata Atlântica Biosphere Reserve (RBMA). Despite often conflicting interests, the three organizations were able to find through dialogue the ideal path to address the challenge of mining in limestone areas – which comprise the vast majority of caves and important remaining forest areas – generating important benefits for each of the institutions and minimizing the negative impacts of mining activities.

One of the products of this Partnership is the "Environmental Assets Project", which provides the foundation for the Sustainable Land Management Plans for Votorantim Cimentos' properties. In 2015, two pilot projects were developed in our units in Ribeirao Grande (São Paulo) and Laranjeiras (Sergipe). Votorantim Cimentos aims to replicate this experience in other units.

The "Assets Project" has already shown positive results with its transformational methodology and exceeded expectations in benefiting biodiversity and sharing with the community the assets identified within Votorantim Cimentos' lands.

Based on this experience, we were able to develop, within the Technical Partnership, the content of this publication: A Sustainable Land Management Plan's Methodological Framework that could be applied to all land-based companies.

We hope you, the readers, can use this innovative approach in the management of your environmental assets, contributing to the conservation and sustainable use of the country's natural and cultural heritage.

Álvaro Lorenz
Global Technical Director at Votorantim Cimentos

The Technical Partnership between the Brazilian Speleological Society, Votorantim Cimentos and the Mata Atlântica Biosphere Reserve is an innovative initiative in the sense that it brings together such disparate entities for the sake of the common good. Throughout these five years of collaboration, we have developed unprecedented programs for the study and preservation of the environment, such as the Guide to Good Environmental Practices in Limestone Mining in Karst Areas and the Environmental Assets Program, among other equally important initiatives.

The Environmental Assets Program and the Sustainable Land Management Plan represent a new way of thinking and managing the environmental heritage. The tools presented here enable a comprehensive and integrated assessment of this common good, which is in the custody of large companies and is often relegated to the background because it is not the main object of their business.

Responsible companies no longer treat their liabilities as externalities, and increasing legal requirements and sectorial agreements have required greater attention to environmental issues. However, this is not enough. We can actually advance towards intelligent environmental heritage treatment, moving beyond the simple observance of minimum requirements, finding creative solutions and showing that it is possible to leave a legacy of reconciliation between development and conservation.

With knowledge comes responsibility. Now, we need to do our part!

Marcelo Augusto Rasteiro
President of the Brazilian Speleological Society

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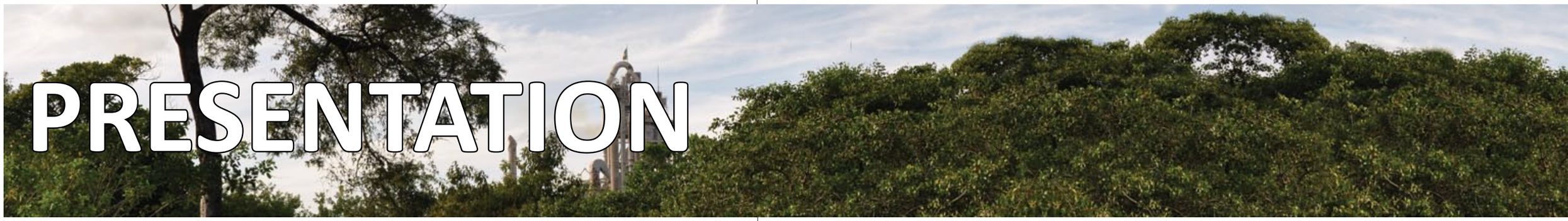

PRESENTATION

The Environmental Assets Program is an initiative of the Mata Atlântica Biosphere Reserve (RBMA) under the Technical/Financial Partnership between RBMA, Votorantim Cimentos (VC) and the Brazilian Speleological Society (SBE), and aims to contribute to conceptual and methodological advances in the planning and management of properties of land-based companies.

As a product of the program, this document presents the conceptual basis used in the evaluation of environmental assets of land-based companies – mining, forestry, agriculture, energy and others – integrated with the methodological framework for the development of the Sustainable Land Management Plan (SLMP). The highlighted terms are defined by the Assets Program, according to Box 1.

The conceptual and methodological development of the SLMP was based on the vision of UNESCO's Man and the Biosphere Programme and used the theoretical framework of Environmental Planning and Management in Brazil (SANTOS, 2004; SANCHEZ, 2013); references in the development of the Private Natural Heritage Reserves Management Plan (IBAMA, 2004); Experimental Farms Management Plans (OLIVEIRA, ROSOT & GATARRASTAZU, 2008); and international guidelines for the corporate sector, such those regulating mining-industrial activities in cement production and the Biodiversity Management Plan of the Cement Sustainability Initiative (CSI), especially its management, control and monitoring tools. In addition to these references, the study was based on the concepts of ecosystem services from the Millennium Ecosystem Assessment and specific literature (DE GROOT, 2002, CONSTANZA & DAILY, 1992, MEA 2003, MEA 2005), in addition to considering experiences in the evaluation and management of ecosystem services under the impact-dependency perspective (InVEST, 2014).

The SLMP is founded on concrete experience from pilot projects developed in two areas of Votorantim Cimentos (VC), which contributed important information and collaboration from the company's corporate and local teams. Among the 24 units of Votorantim Cimentos in the country linked to limestone extraction, ten were selected by the partnership, which then defined two priority units for the implementation of the Assets Project: The Ribeirao Grande Cement Company (CCRG) in Ribeirao Grande, SP, and Laranjeiras, in the state of Sergipe, as highlighted on Figure 1.

Figure 1. Location of pilot projects developed under the RBMA / VC / SBE technical partnership

ENVIRONMENTAL ASSETS: Environmental assets are the natural and cultural elements associated with local ecosystems that have special or potential importance in the provision of ecosystem services and contribute to the project's legal compliance and good relationship with its surroundings. For these reasons they are considered strategic to the company, and in maintaining the wellbeing and improving quality of life.

LAND-BASED COMPANIES: Companies whose main activity requires physical territories, whether these are owned, leased or acquired by other means. Examples include mining, agriculture, forestry, real estate and hydro and wind power generation companies, among others.

LAND MANAGEMENT: It is a dynamic process through which decisions are made on the use of resources, in order to facilitate the goal of preserving the socioenvironmental heritage and its ecosystem services, while also enabling productive activity and respecting any conditions established in the environmental licensing for such activity.

SUSTAINABLE LAND MANAGEMENT PLAN (SLMP): It is a planning and decision-making tool for land-based companies that encompasses the characterization, valuation, sustainable use and conservation of their environmental assets, and aims to contribute to the environmental compliance of the project as a way of increasing its competitiveness in socially and environmentally demanding markets and promoting the continuous improvement of the company's relationship with its surroundings and society as a whole. The SLMP proposes an integrated management of the land, using as tools the characterization of the Environmental Assets, Strategic Analysis, property Zoning and Action Proposals..

Box 1. Environmental Assets Program's definitions of environmental assets, land-based companies, land management and Sustainable Land Management Plan.

Regarding the VC units identified for the development of the SLMP, the study was premised on addressing the environmental aspects of the production process and management tools in the cement industry, which is why the examples used in this document are related to the cement sector. In the context of the theoretical framework from which the SLMP was designed, this far-reaching methodology is considered to be a tool for planning and management of environmental assets on private property in other productive sectors. With proper adaptation, the SLMP has significant potential for other land-based companies, in the spatial planning of their properties, including characterization, valuation, conservation and sustainable use of environmental assets thereby present, generating benefits for the company and society in general.

The expected benefits of the SLMP are:

- To contribute to legal compliance, liabilities recovery, assets valuation and improvement of the company's image, seeking to highlight the company's commitment to the prospect of sustainable development and to a more just and solidary market;
- To facilitate owners' decision-making, enabling Environmental Assets utilization strategies and reduction in investment of financial resources in the medium and long term with respect to environmental remediation and impact mitigation;
- To promote social benefits, both directly to the community that is involved with the project, and indirectly to the regional society, which could benefit from the ecosystem services provided and enhanced by the SLMP, contributing to a positive relationship between the company and its socioeconomic environment;
- To contribute to the integration of environmental management and control tools in a plan that can set broader strategies and, in the medium term, enable the company to align processes, to take advantage of opportunities and to avoid risks and conflicts;
- To contribute to biodiversity conservation, the balance of ecosystems and the maintenance of ecosystem services.

Although general in nature and addressed to all those involved with the environment and sustainability, this document is intended particularly for the corporate world – in particular for the management of their properties – and also for researchers and institutions dedicated to applied research on corporate territorial planning and management.

The document is divided into three parts, which correspond to the three basic stages of the SLMP development:

Part 1 - Encompasses the following steps: definition of the study area and its surroundings, selection of the Environmental Assets to be analyzed, analysis and initial interviews for understanding the study area context, definition of the activities, and work plan to establish the timeline and financial schedule.

Part 2 - Includes secondary data surveys, field recognition of the property, and liaison with government, associated private sector, community and other interest groups. This phase involves the assessment of cartographic databases, aerial photos and satellite images, preparation of the base map and continuous incorporation of spatial information into the Geographic Database, and focuses on the characterization of the selected Corporate and Environmental Assets. It is also a time for connecting with the company teams (presentation of the methodology, clarification of the Strategic Analysis of the project, mapping of information and primary data collection to cover identified gaps, and consolidation of diagnosis).

Part 3 - It focuses on the Strategic Analysis, preparation of the property zoning draft, and formulation of recommendations per property and based on corporate aspects. This phase includes the presentation of the draft SLMP to the company, discussion, adjustment and validation of the proposals and, the preparation texts and mapping.

Each of these phases, including their concept, will be addressed in this document.

It is important to note that the conceptual and theoretical framework cannot be dissociated from the SLMP methodology, given that the technical-scientific arguments can only be validated strictly within the methods and theoretical frameworks followed to produce it. Therefore, this methodology will be treated herein as Methodological Framework for the Development of Sustainable Land Management Plan (SLMP) and includes the sum of the parts here addressed: conceptual aspects and methodological development of the SLMP.

Image 1. Paiva Cave, Reserva Votorantim Cimentos, alongside Parque Estadual Intervales, Ribeirao Grande/SP municipality.

Introduction

The way the corporate world sees environmental issues has changed significantly over the past decades. Initially these issues were treated only as a burden to companies, and any environmental legislation implementation had a merely punitive and mandatory nature.

However, the need to incorporate sustainability initiatives in production processes and land management is indisputable, given that in some respects the demand for environmental sustainability is non-negotiable: we cannot change the laws of physics and climate, but we can change economic and social systems (EHRLICH, KAREIVA & DAILY, 2012). In this sense, sustainability has become a high-priority item on the international agenda, since discussions about limiting economic growth began in the late 1970s.

The public – and therefore the market – perception of the subject changes the business perception of these issues: concepts such as eco-efficiency and resource utilization became key factors in the current perception of the relationship among enterprise, environment, and society. It is possible to conclude that a proactive business attitude will increasingly be the key factor in the recognition of environmental and social responsibility (KEIJZER, 2000). In addition to meeting direct and measurable targets (such as emission or waste reduction), ever-broadening concepts of proactivity – including voluntary initiatives and innovation projects – will be part of future practices in the environmental arena.

Pressure for a cleaner environment led to business sectors with particularly highly polluting processes – such as mining, chemical, petroleum, steel, pulp and paper, power generation and transport companies – having to disclose their commitment to the environment in a different way (EPELBAUM, 2013). The responses of these industries to this new disclosure scenario imply different approaches toward environmental management and can be classified in two groups. The first group appears reactive – or those characterized by isolated reaction to specific issues. The second group appears more proactive – those who sought a way to organize environmental management to reduce risks, identify opportunities and improve their image (Id., 2013).

A proactive approach – in which the commitment to and responsibility for the environment matters – presents a great challenge in reconciling productive activities with the conservation of the environmental heritage from a sustainability standpoint. Those who choose this path understand that the best conservation and sustainable use of a natural resources strategy is to decrease negative mediations and promote positive synergies (MEA, 2004).

It is in this context that the Sustainable Land Management Plan (SLMP) in land-based companies' properties comes to play. The Plan has as its starting point the integrated view of the property and is based on instruments of environmental planning and management, to promote the conservation and sustainable use of its Environmental Assets.

Such integrated planning and management include all the socioenvironmental heritage of the property and its correlations, since the environment cannot be considered in isolation, but rather as a system that permeates or spans across all activities that take place on the territory. Using the concept of ecosystem – of landscape and flows that coexist – to address environmental issues is a concise way of applying the integrated approach to land, waters and living resources management from a sustainable perspective (MEA, 2005).

Among the natural resources that the SLMP aims to protect are the Environmental Assets, which should guide specific management strategies and that, once put in place, will preserve the entire socioenvironmental heritage of the property.

It is important to note that the SLMP focuses on sustainability in the environmental, social and economic dimensions. It takes into account the international reporting protocols of the analyzed business sector, and aligns to the company's environmental policy, as well as to its internal environmental management strategy, which is used as the starting point for determining the vision property.

The methodology developed for the SLMP applies primarily to companies' properties that extend over large areas or areas of significant environmental importance, due to their location or to the possible environmental assets they can house – for example, forests, water resources, caves, historical or archaeological sites, species richness, unique ecosystems, among others – whether the operational unit is located on the property or not.

The SLMP is also a tool for properties that require work pertaining to area compliance, due to environmental liabilities that the company may have. It employs four instruments:

1. Characterization of the Environmental and Corporate Assets;
2. Strategic Analysis;
3. Property Zoning;
4. Action Proposals per zone, per property and per corporate aspect.

The methodological framework presented in this document does not exhaust the diversity and complexity of interactions between projects and their territories, considering that in the development of any environmental planning and management strategy deep singular context analysis will always encounter unforeseen issues, which should be evaluated case by case. This dialogic interaction can be used as an opportunity for the adaptation of this methodology to specific cases, including the selection of assets to be analyzed or the definition of priorities for the implementation of the Management Plan.

Given the above, the purpose of this document is to provide a conceptual and methodological basis on which to lay the foundation for the planning and management of private properties, contributing to advances in the environmental, social and economic perspectives of the project.

Conceptual Aspects

As mentioned in the introduction, the SLMP is based on a theoretical framework for environmental planning and management, and land use. The main elements of this conceptual framework, as well as the main actions that make up the SLMP, will be presented below.

ENVIRONMENTAL PLANNING AND MANAGEMENT AS A TOOL FOR THE CONSERVATION AND SUSTAINABLE USE OF THE SOCIOENVIRONMENTAL HERITAGE

Corporate Environmental Planning activities result from a comprehensive process of strategic analysis of the project's entire life cycle. These activities must be updated according to the phases they are in; for example, steps of preliminary studies, analysis of alternatives, implementation, any extensions and conclusion of activities in a particular area. In turn, environmental management implies the implementation of preventive measures, mitigation and other environmental programs during a project's three main phases (implementation, operation and decommissioning) (SANCHÉZ, 2013). Environmental planning and management are therefore closely related and must be contextualized territorially and temporally.

For Santos (2004), the structure and procedures of an environmental plan are defined according to a guiding ideology of the whole process, which takes the concepts and development assumptions to a certain space at a certain time. For the aforementioned author, environmental planning as a process is continually developing and involves the systematized collection, organization and analysis of information, through procedures and methods, aimed at making decisions or choices based on the best alternatives for the use of available resources in order to achieve specific goals in the future, leading to the improvement of a given situation and promoting a closer relationship between society and local and regional authorities.

It is important to note that the planning emphasizes decision-making, founded on a diagnosis that identifies the best possible use of the resources of the planned environment and should enable minimal knowledge of the dynamic nature of the systems that make up that environment (SANTOS, 2004). This knowledge about the study area and the identification of conflicts for its preservation or use must be spatially represented in the diagnosis.

Therefore, the environmental planning process consists of sequential activities aimed at meeting planning objectives in terms of time and space (SANTOS, 2004). These phases reflect the recognition of scenarios and the logical sequence of possible events, in order to define the conduct for the type of proposed development (Figure 2).

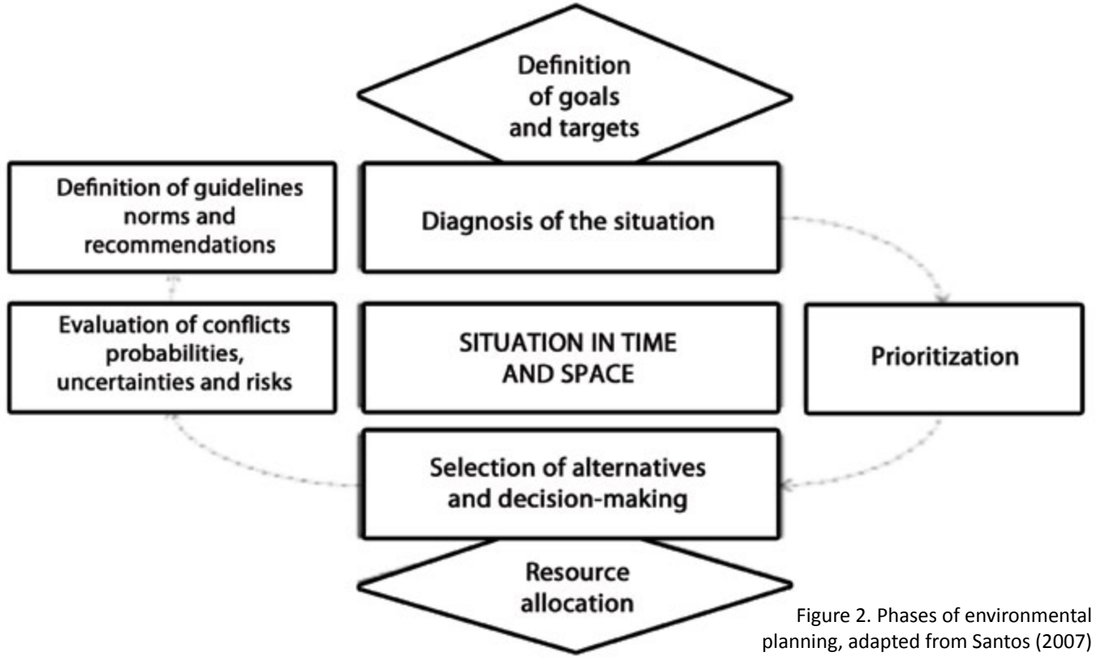

Figure 2. Phases of environmental planning, adapted from Santos (2007)

It is important to note that, according to this perspective, the project's systemic feedback is a critical dimension. It will become a mark of SLMP in that it proposes sustainable use associated with the conservation of environmental assets and intends to achieve not only environmental sustainability but also management process sustainability.

Several tools have been developed in recent decades to meet the environmental planning and management needs; some of these tools have become legal requirements – such as environmental impact assessment, risk analysis, environmental licensing and, in some cases, environmental audits – while others are voluntary – such as environmental management systems, environmental performance evaluation, research and evaluation of environmental liabilities, life cycle assessments, environmental labeling and demonstration of social responsibility (SANCHEZ , 2013).

In the context of business management, for example, global demands on environmental sustainability contributed to companies adopting standards of quality (ISO 9000), environment (ISO 14001), health and safety (OHSAS18000) and social responsibility (SA 8000), seen by BORELLA & NAIME (2012) as a competitive advantage opportunity for companies, not only because they meet new demands but also because they support and integrate their environmental management dynamic.

Despite the scenario in which many efforts are made to mitigate, compensate and monitor the impacts of a given project, we noticed that many companies have an environmental heritage whose protection and sustainable use are often not included in the company's strategic and/or property management planning.

Even when this environmental heritage is not related to an environmental risk derived from the entrepreneurial activity, there is a need to manage that heritage, which is under a private owner's responsibility, as well as an opportunity to utilize such heritage as an important environmental asset for the company.

From the perspective of territorial analysis, properties of land-based companies require a new management approach on strategies for the conservation of their environmental heritage, targeting not only the environmental

conservation of the property, but also the use of their Environmental Assets. This focus contributes to the company's image strengthening, environmental compliance and optimization of its environmental management processes and improving its relationship with neighboring communities, external audiences, consumers and shareholders. In this context, the SLMP should be an important component of the Company's Strategic Plan.

Environmental planning is widely employed and applied in the context of environmental governance in Brazil, especially as a tool for land use planning and Protected Areas management. Here, we highlight the Methodological Framework for the Development of Management Plans in Integral Protection Units (IBAMA, 2002) intended primarily for government use. Its use in private areas is considerably smaller and restricted to specific cases.

Among private property environmental planning experiences, we highlight the Sustainable Forest Management Plan, the Private Natural Heritage Reserves Management Plan (RPPN) and the Experimental Farms Management Plan.

The Sustainable Forest Management Plan is a technical document that establishes zoning and standards that should govern area usage and natural resources management, including the implementation of the physical structures necessary for management. It is used as a technical or organizational tool for future processes that can optimize actions to achieve the objectives proposed for the area. It must include zoning standards and outlines forest management recommendations. It also covers the guidelines and information for the proper development of the activities and actions. This plan will be the primary document the area manager will utilize to guide his/her management work.

The Private Natural Heritage Reserves (RPPN) is ranked among the Sustainable Use Conservation Units by SNUC and is intended for land owners who aim to promote perpetual conservation of biological diversity. The owner of a RPPN can explore the area only for the purposes of scientific research, environmental education and ecotourism (in which case they are more similar to Integral Protection Conservation Units), provided a Management Plan is developed and applied, in which case zoning and management recommendations would be provided. The reference document on the subject is the Methodological Framework for the Development of Management Plans in Integral Protection Units (IBAMA, 2004).

Another experience pertains to Experimental Farms, which represent a very specific category of rural property. An experimental farm is defined by SANO et al. (1998 apud OLIVEIRA, ROSOT & GARRASTAZÚ, 2008) as a selected area to carry out tests or experiments related to agriculture, livestock or forest area management. OLIVEIRA, ROSOT & GARRASTAZÚ (2008) propose a Methodological Framework for Experimental Farms Management Plan and acknowledge the challenge of maintaining compatibility between the minimum essential information required in preparing a plan to use the property and the enormous heterogeneity of knowledge and information access faced by landowners in different regions of the country.

The design of EMBRAPA's management plan for experimental farms was structured in six phases: Organizational Structure, Definition of topics of interest for Environmental Management, Development of Geographic Information System (GIS), Zoning Proposal, Surrounding Characterization and Definition of Environmental Management Programs.

As mentioned earlier, based on benchmarks of environmental planning and management, on the adaptation of methods already developed for the preparation of management plans and on new instruments, the SLMP takes a step forward toward the appreciation and protection of Environmental Assets located within corporate properties.

Image 2. Wealth of vegetal species in Mata Atlântica

ENVIRONMENTAL ASSETS

The concept of Environmental Assets has been taking shape recently in scientific literature, and currently assumes different forms – according to different epistemologies – with incipient applications.

An asset, according to the Oxford dictionary, is "a person or thing that is valuable or useful". Within the knowledge area referred to as "Environmental Accounting", important conceptual and methodological development has occurred pertaining to the idea of Environmental Assets. In this area, "Environmental Assets" is understood to be a financial designation that can be transformed into accounting value with the use of monetary valuation tools.

To SOUZA et al (2001), Environmental Assets are all assets and rights allocated for or originated from environmental management activities, either in the form of working capital or fixed capital. The methods and forms of financial valuation are a major challenge within environmental accounting, particularly due to the lack of clear definition of environmental costs and to a methodological difficulty in calculating liabilities and effective environmental assets (Id., 2001).

It is worth mentioning that monetary valuation, which helps to identify Environmental Assets within Environmental Accounting, is not the objective of the Assets Program. The Assets Program may consider environmental assets that are valued in monetary terms, and also those whose valuation methodology is not defined by literature, but which also have a recognized value across the company and society, including, for example, the project's legal compliance.

When it comes to the Brazilian experience in integrated land management, the National Environment Program II stands out. This is a recent experience (2009 and 2014), which addresses the issue of integrated management of Environmental Assets. The program is aimed at strengthening the elements of the National Environmental System (SISNAMA) within the three levels of government and is divided into two components, one of which is the Integrated Management of Environmental Assets.

The "Integrated Environmental Assets" component aims to generate models of sustainable development involving the various productive sectors that have an impact on natural resources, since the environment is perceived as a "common good". In the aforementioned PNMA (2009) project, Environmental Assets are understood to be "environmental resources (such as water, air, soil and vegetation) that have a direct or indirect use and value in providing ecological services, and for purposes of production and consumption by society".

This definition of Environmental Assets used by these authors (PNMA, 2009) is similar to that adopted by the Assets Program and described in this document, which, in addition, includes the socio-cultural and corporate assets found within the property of a project and its environmental management system.

Therefore, as previously described in box 1, Environmental Assets are defined as follows:

Environmental Assets: are the natural and cultural elements associated with local ecosystems that have special or potential importance in the provision of ecosystem services that contribute to the project's legal compliance and good relationship with its surroundings. For these reasons they are considered strategic to the company, and in maintaining the wellbeing and improving quality of life.

It is important to add that Environmental Assets are not simply a set of ecosystem elements. Instead, these elements are organized in a structure that coincides with ecological processes (ecosystem functioning), and the variation in time and space of this combination defines the dynamics of the ecosystem. It is also important to emphasize that the concept of Environmental Assets also includes cultural and human aspects, from a social and environmental perspective, such as the historical and cultural heritage. In each case, the Environmental Assets to be considered in the SLMP are defined by local ecosystem functions, preferably to give representation to functions related to the fauna, flora, water resources, gas exchange, soil and socioenvironmental heritage.

The present document portrays seven pre-defined Environmental Assets and other complementary ones:

1) Carbon stock and sequestration;

2) Water resources;

3) Habitat;

4) Species richness;

5) Species of particular interest;

6) Cultural Heritage;

7) Complementary assets.

In addition to Environmental Assets, the SLMP also considers Corporate Assets, as defined bellow.

Corporate Assets: In the context of the SLMP, Corporate Assets refer to the group of tangible and intangible assets that guides the relationship of a particular company with its social and environmental heritage and its stakeholders, and that can be valuable for the company, depending on how its environmental management is performed.

The following are examples of Corporate Assets:

1) Integrated planning and management of the socioenvironmental heritage;

2) Environmental monitoring;

3) Property protection and surveillance;

4) Socioenvironmental projects;

5) Scientific research;

6) Recreation, tourism and environmental education, as shown in Figure 3.

As previously mentioned, such Environmental and Corporate Assets are being considered regardless of prior or subsequent valuation.

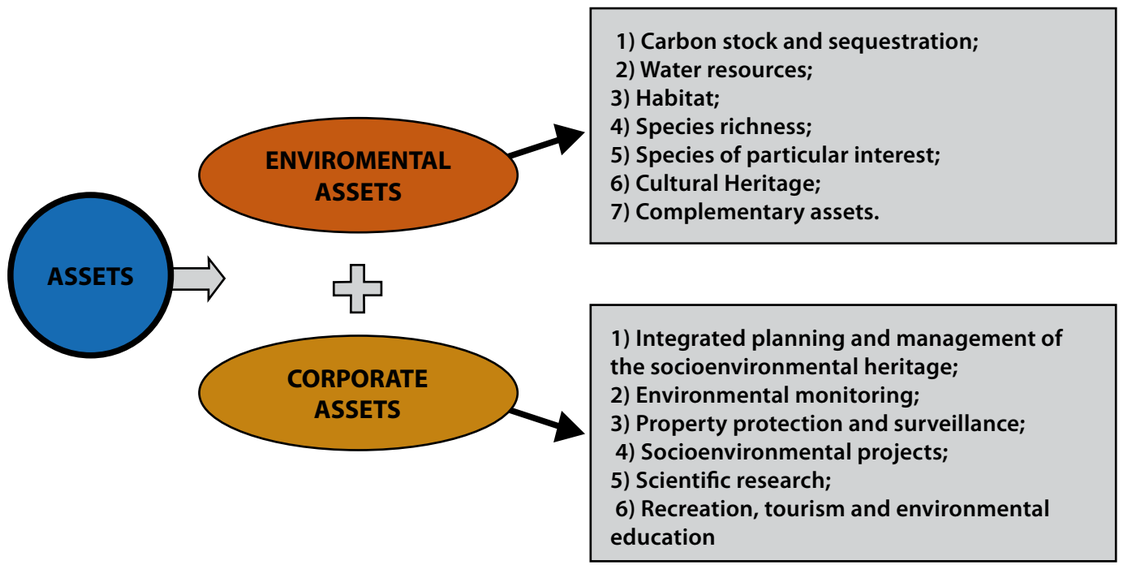

Figura 3. Ativos Ambientais e Institucionais

ENVIRONMENTAL ASSETS, NATURAL CAPITAL AND ECOSYSTEM SERVICES

The concept of Environmental Assets, as defined in the Asset Program, intersects with the concept of Natural Capital defined by the Millennium Ecosystem Assessment (MEA, 2005), which considers that Environmental Assets may have special or potential importance in the provision of ecosystem services to society.

According to the MEA (2005) and the Convention on Biological Diversity (CBD), the ecosystem approach to address environmental issues is a concise way to combine the integrated management of land, waters and living resources in a sustainable manner. In an anthropocentric view of the land area, ecosystems are understood as Natural Capital, i.e., those resilient ecosystems with ecological integrity that are capable of generating a service flow to human beings by maintaining their ecosystem functions, contributes to human well-being through the provision of services that meet society's needs (DE GROOT ET AL, 2002).

The Millennium Ecosystem Assessment (2003) proposes the use of the classification from DE GROOT ET AL (2002) to group ecosystem functions into four categories, the last three of which depend on regulation functions, according to Table 1.

Ecosystem services are defined by the MEA (2005) as the benefits that humans obtain from ecosystems. It is important to note that, in general, the relationship between the functions and services is not linear. Multiple factors may be necessary for the generation of a service, and one single function can facilitate the generation of different services. Translation of a function into a service specifically implies the identification of beneficiaries, types of use and space-time specification. Therefore, one should identify the spatial and temporal range for which a function has the ability to provide a service that can be used, leveraged and enjoyed.

Because of this intricate relationship, ecosystem functions and services should be jointly analyzed, so that the provision capacity of ecosystem services and the user need can be simultaneously evaluated.

Some studies indicate that the services may coincide in space in terms of scale (as it occurs with the recreational use of a forest) or not (such as provision of water, whose ecosystem function

Natural Capital: Natural Capital can be described as those ecosystems or set of attributes with ability to exert functions and thus provide services to society (MARTÍN-López et al., 2009), including, in its entirety, aspects of the social and environmental arena (DE GROOT, 2003). From this point of view, it is the basis that enables the sum of all the benefits that balanced ecosystems provide to humans, from the more tangible ones – such as drinking water, food and wood – to the more abstract ones – such as the spiritual and cultural value that natural environments have to various communities. These benefits are here understood as ecosystem services and are the result of an extremely complex system that includes biodiversity, ecosystem functions and dynamics of communities. This is a concept that sees natural resources within the logic of production.

Box 2. Definition of Natural Capital

1. REGULATION FUNCTIONS:	Capacity of ecological ecosystems to regulate essential processes (e.g., climate regulation, nutrient cycling control, water cycle control, etc.)	• Gas regulation • Climate regulation • Disturbance prevention • Water regulation • Water supply • Soil retention • Soil formation • Nutrient regulation • Waste treatment • Pollination • Biologic control
2. HABITAT FUNCTIONS	Provision of special conditions for maintenance of biodiversity	• Refugium function • Nursery function
3. PRODUCTION FUNCTIONS	Ecosystem's capacity to create biomass that can be used as food, fabric, etc.	• Food • Raw material • Genetic resources • Medicinal resources • Ornamental resources
4. INFORMATION FUNCTIONS:	Ecosystem's capacity to contribute to human well-being through knowledge, experiences and cultural relations with nature (e.g., spiritual, aesthetical, leisure, recreational experiences, etc.)	• Aesthetic information • Recreation • Cultural and artistic information • Spiritual and historic information • Science and Education

Tabela 1. Funções do Capital Natural. Fonte: DE GROOT et al (2002)

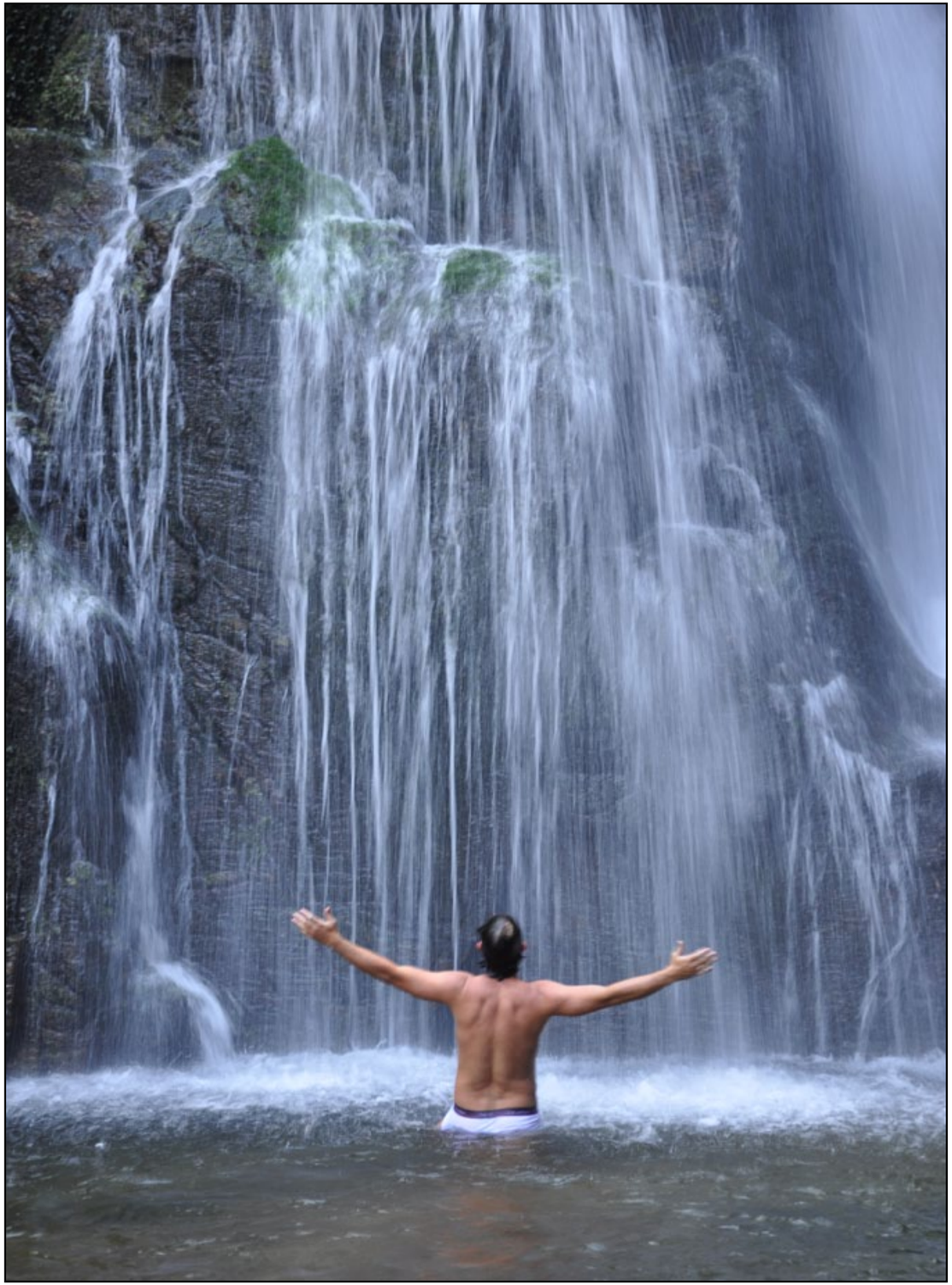

Image 3. Waterfall in catchment area for supply, Reserva Biológica de Tinguá/RJ

depends on a generalized scale, although the user benefits from it on a local scale) (FISHER ET AL, 2009).

In this sense, the Strategic Plan for the 2011-2020 Aichi Targets of the Convention on Biological Diversity establishes goals and targets to preserve, restore and enhance the benefits derived from biodiversity and ecosystem services, as it recognizes the importance of preserving the integrity of ecosystem services provided by nature in order to ensure the provision of those services over time.

Therefore, the need for integrated management of a property stems from the importance of the integrity of the overall environmental system, which is greater than the sum of its parts (CHAMP et al, 2003; FARBER et al, 2006). It is essential to preserve the ability of Environmental Assets to continuously provide service flows that are essential to human well-being of present and future generations, which relates to the principle of sustainability. This close relationship between ecosystem integrity and environmental sustainability was popularized by PEARCE & TURNER (1990) when they pointed to the fact that "the stock of resources should be kept constant through time". Thus, as argued by EEKINS et al (2003), environmental sustainability relates to the ability to maintain ecosystem functions, as a way to, for example:

- prevent global warming and depletion of the ozone layer;
- respect the supporting capacity of ecosystems;
- use renewable resources responsibly;
- use non-renewable resources prudently;
- maintain biodiversity (especially species and ecosystems);
- apply the precautionary principle;
- respect standards of human health;
- conserve landscapes and scenic beauty.

Ecosystem Functions: Capacity of ecological structures and processes to provide services that satisfy human needs (DE GROOT, 1992).

Ecosystem Services: Products of ecological functions and the goods and services they provide that directly or indirectly contribute to human well-being, or have the potential to do so in the future (DAILY & FARLEY, 2004; MEA, 2005). The benefits that are generated from ecosystem functions include support services (such as formation of the fertile soil layer), provision services (e.g., continuous water supply by rainwater systems, or the provision of food and medicinal resources), regulation (e.g., carbon balance between atmospheric, terrestrial and aquatic reservoirs) and cultural services (for example, landscapes of aesthetic, spiritual / religious value).

Box 3. Definition of Ecosystem Functions and Ecosystem Services

SUSTAINABLE LAND MANAGEMENT PLAN

As already mentioned, the Sustainable Land Management Plan (SLMP) is a planning and decision making tool for land-based companies that encompasses the characterization, valuation, sustainable use and conservation of their environmental assets, and aims to contribute to the environmental compliance of the project, as a way of increasing its competitiveness within socially and environmentally the company's relationship with its surroundings and with society as a whole. The SLMP proposes an integrated management of the territory, using as tools the characterization of the Environmental Assets, Strategic Analyses, property Zoning and Action Proposals.

The SLMP must be contextualized within the company's vision for the current and future use of the property, with a focus on conservation and sustainable use of its Environmental Assets. For the purpose of this Methodological Framework, some of the aspects of the SLMP are listed below:

Image 4. The SLPM applies to distinct enterprises properties such as agricultural, mining and visitation areas

I. ADAPTATION TO LOCAL SPECIFICITIES

The SLMP must adapt to the local specificities of the property's environmental heritage and the property's vision. Therefore, its four instruments should generate proposals that are adapted to each local situation and particular conditions.

II. EMPHASIS ON UNDERSTANDING THE LAND AREA AND ITS PROCESSES

The SLMP should consider the land area for which the proposals for integrated management of relationships and processes will be made. Property zoning and physical interventions described in the SLMP are restricted to the delimitated area. The other proposals included in the Plan – especially with regard to social and economic objectives – should always consider the property's surroundings and the region where it is located.

III. SCIENTIFIC BASIS

The SLMP should adopt consistent scientific bases in a continuous search for reliable and updated bibliographical sources, and use precise terminology that meets the norms of scientific methodology.

IV. CONSERVATION, RESTORATION AND SUSTAINABLE USE OF BIODIVERSITY

Today, it is known that biodiversity is extremely important to any productive sector. In identifying biodiversity and other attributes of the property, the SLMP contributes to the conservation, restoration and sustainable use of biodiversity.

V. SUSTAINABLE DEVELOPMENT AS THE BASIS FOR ENVIRONMENTAL MANAGEMENT STRATEGIES

The SLMP should propose environmental management strategies in an integrated manner and based on sustainable development premises in its three core dimensions: Environmental, Social and Economic.

VI. ENVIRONMENTAL ASSETS AND COMPLIANCE

By identifying Environmental Assets and defining strategies, the SLMP should contribute to minimizing environmental liabilities and ensuring the project's environmental compliance.

VII. SLMP UPDATES Given that the conditions of both the environmental heritage and the company will change over time, the SLMP needs to be a dynamic instrument that can follow and discuss the processes that are taking place on the property. The SLMP has a temporary nature, which should be determined together with the company; it is recommended for the plan to be reviewed at least every five years. The SLMP revision implies:

- updating the Strategic Analysis, since business strategies may change over time;
- considering new conditions in the property's ecosystems that may require new lines of action;
- contemplating changes/updates in the legislation, among others. As the SLMP gradually evolves, knowledge about the property tends to increase – as well as the company's motivation to work on the area planning – while management means and actions tend to be limited to the adjustments necessary for the maintenance of the implemented actions (Figure 4).

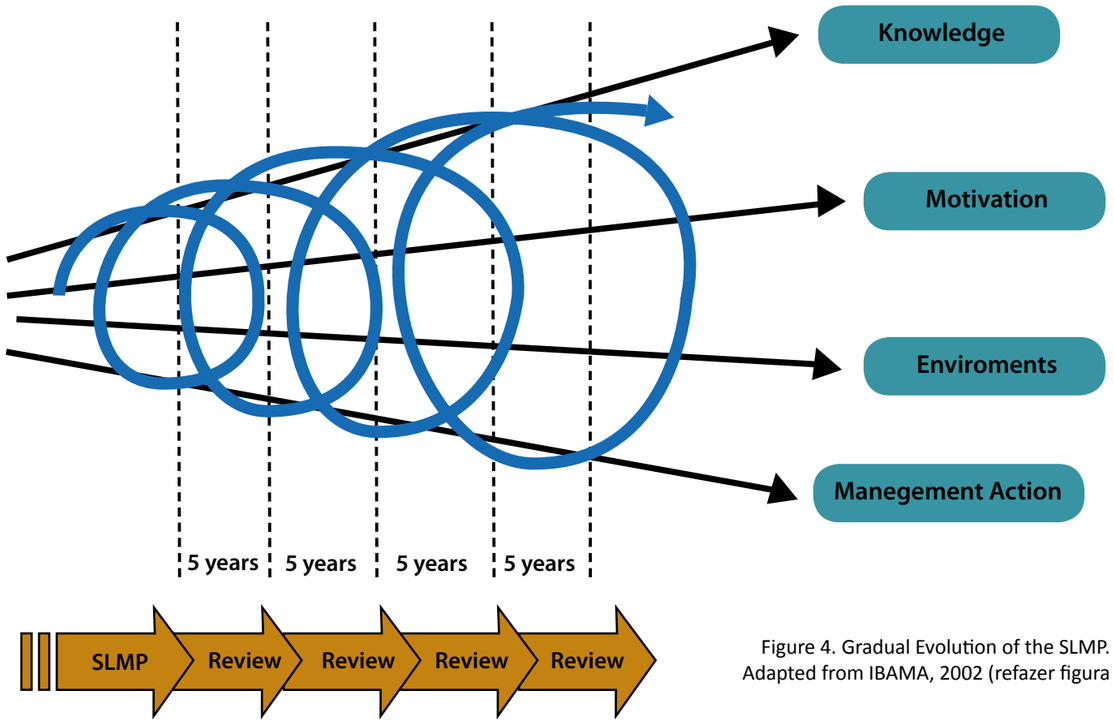

Figure 4. Gradual Evolution of the SLMP. Adapted from IBAMA, 2002 (refazer figura

OTHER MECHANISMS THAT ARE LINKED TO THE EVALUATION OF ENVIRONMENTAL ASSETS IN THE ORGANIZATIONAL CONTEXT

The definition of ecosystem as a structure of ecosystem services reached its peak of popularity with the launch of the Millennium Ecosystem Assessment (MA 2003), providing a scientific and political push for ambitious projects involving monetary valuation, cost-benefit analysis and environmental valuation. One such project is the "Natural Capital Project" (TALLIS ET ALL, 2011), which includes software models for "Integrated Valuation of Ecosystem Services and Tradeoffs" (InVEST), to assess the impact of ecosystem changes on various regions of the world. In its original form, the global initiative "The Economics of Ecosystems and Biodiversity" (TEEB) also provided for the creation of cost-benefit analysis of ecosystem services in decline due to loss of biodiversity, but these goals have been recently reformulated to recognize the limitations and complexities involved in this practice (WEGNER & PASCUAL, 2011).

The impact-dependency analysis takes place in a context where it is necessary to predict operational risks, such as quality reduction of production factors, increased scarcity or production factors costs, or other conditions that result in reduced productivity, fines, use of natural resources, fees, suspension of authorization or license, and damage to brand or image. On the other hand, it is also important to identify operational opportunities, such as lower-impact industrial processes, cost reduction initiatives, increased production efficiencies, new products to address new legislation, opportunities to shape government policies, and markets for certified products. One initiative that addresses this issue is the Business Ecosystems Training (BET), which was developed by the World Business Council for Sustainable Development (WBCSD) in collaboration with KPMG. Among other goals, the program establishes that, based on the impact-dependency analyses of ecosystem services, entrepreneurs can use tools for economic valuation of these services in order to make a decision; the program even has a guide to Corporate Ecosystem Valuation (CEV). Among the tools developed in this field are the NPI, NBM, Ibat, Biodiversity in GWT, ARIES, Costing Nature, InVEST, LEFT, MIMES, NatureServe Vista and Data Basin.

To perform the impact-dependency analysis, the company must identify the hierarchy of importance among ecosystem services, determining those with highest priority. For example, Box 4 presents some of the ecosystem services on which cement production depends.

WEGNER & PASCUAL (2011) recognize the benefits of cost-dependency analyses based on valuation, but they raise a few questions. For example, although species differ in their importance to ecosystem processes – it is almost impossible to identify all species that are important to the numerous systems and processes that human beings depend on – even important species themselves may depend on an unknown number of other species in their communities. In this sense, the arguments for conservation based on ecosystem functioning are often based on utilitarian justifications. There is no single reason that will convince all people to protect all species; however, the combination produces a strong case for the conservation of biodiversity (WEGNER & PASCUAL, 2011). The authors also add the issue of ecosystems being highly complex and interconnected, which means that even small changes in one component of an ecosystem can have major impacts on other components thus changing their arrangement and, therefore, the relative value of their services. In practice, ecological interdependence tends to be ignored in cost-benefit analyses (WEGNER & PASCUAL, 2011).

In turn, the SLMP, as a planning tool for land management and organization, aims to establish property zoning and action proposals to conserve natural and sociocultural heritage. Prioritizing the natural and cultural heritage from a monetary valuation standpoint is not part of the conceptual vision of the SLMP, since all identified Environmental Assets will be subject to conservation and/or sustainable use initiatives. Although the historical and cultural heritage doesn't constitute an ecosystem service that increases productive activity, for example, it carries intrinsic and ethical values of conservation and must be managed in a sustainable way as part of the area planning, which can effectively generate benefits for the company. The SLMP is based on the understanding that land owners have rights and duties; among those which should be highlighted is their commitment to environmental conservation, including the natural and cultural heritage, and to the well-being of their stakeholders. However, from a SLMP perspective such duties and commitments may turn into opportunities for corporate earnings

In the case of limestone mining for cement production, the main ecosystem services that support the production process or improve mining performance are described below:

- Maintenance of freshwater quality: a limestone quarry for cement production depends on its own impacts on freshwater, since that freshwater is used for pollution control systems and for its operations.
- Water flow regulation: water from surface runoff, in moving through the mining area, changes the normal water flow, impacting the local hydrology.
- Erosion control. Limestone mining for cement production depends on ecosystem services for erosion control, considering that maintaining upstream water quality is necessary for its production process.
- Purification and self-depuration capacity of the water system. Maintaining the self-depuration capacity of nearby ecosystems is also important for water quality assurance for stakeholders who depend on this resource.

These ecosystem services are mainly related to the conservation and sustainable use of the Environmental Assets "Water Resources", "Soil" and "Habitat". These will be considered Strategic Assets for the SLMP in the context of cement mining, which will seek to create strategies, proposals and zoning to allow conservation and/or restoration and sustainable use of these assets, to ensure the continuity of the ecosystem services.

Box 4. Example of Ecosystem Services on which cement production depends

in several aspects, such as those resulting from their positive relationship with neighboring communities and/or gains in corporate image.

Many of the tools mentioned above can be used in a complementary manner in the management of Environmental Assets, as they contribute to identify demands of conformity (liabilities and risks) and also allow for the economic valuation of these assets. Although the SLMP doesn't formally include these tools, they can be used where appropriate, for example, in an economic analysis, without invalidating the SLMP's proposals for integrated management.

Other tools for environmental planning should also always be considered in the preparation of the SLMP, such as a Municipal Master Plan of the town in which the work will be done (assuming the town has one), or even land area planning guidelines that might exist due to the considered area being located in a Buffer Zone around a Protected Area. Similarly, other land area plans and river basin plans might include legal issues that need to be addressed.

In addition, there are guidelines and best practices created by corporate subsectors, which need to be considered in the preparation of the SLMP. For example, in the case of cement mining, we can mention those defined by the Cement Sustainability Initiative (CSI), which is a global initiative whose purpose is to promote the sustainable development of the productive operation of cement, concrete and aggregates.

Also, the SLMP leverages many of the tools available within the company and, provided there is interest, incorporates them in a complementary manner. For example, in Box 5 we present a possible integration between an increasingly adopted tool by Mining, the Mine Closure Plan, and the SLMP.

An important mining management tool for the mining enterprises is the Mine Closure Plan. In Brazil, although there is no specific legislation for mine closure activities, various environmental laws place the responsibility on the entrepreneur for remediating environmental damage caused by mining activity. The Mine Closure Plan is a technical document that is a mandatory part of the Economic Exploitation Plan (PAE) of a mine, required and regulated (NRM-20) by the National Department of Mineral Production (DNPM).

A Mine Closure Plan is a management tool that provides long-term strategies aimed at reducing costs and minimizing risks and liabilities, in addition to maximizing the environmental responsibilities of a company. Its focus is to ensure physical and financial provisions for mine closure that are environmentally and socially acceptable. A Closure Plan, when prepared according to coherent environmental and business principles, can leverage regional development even in the post-closure phase of a project. Among the aspects included in a Mine Closure Plan are:

- Presentation of an executive plan for demobilization of facilities and equipment that make up the infrastructure of the mining project.
- Instructions regarding the destination for equipment and materials (either serviceable or unserviceable) resulting from dismantling and the proposed measures for topographical conformation and environmental and landscape recovery throughout the affected area.
- Details pertaining to measures for control and monitoring of the discharge of effluents, soil pollution, air and water resources, including the characterization of the parameters analyzed.
- Follow up and monitoring measures related to sterile and waste disposal and containment systems, slope stability and mass wasting, water table behavior and water drainage.
- Presentation of a report on occupational health conditions of workers over the life of the mining project and the physical and financial schedule of proposed activities.
- Plans for rehabilitation of surveyed, mined and impacted areas, or all areas whose biotic and/or abiotic factors have changed due to geological research and mining activities (NRM-21);
- Plans for topographical and landscape rehabilitation (landscape harmonization in order to minimize visual impact) of the impacted areas, considering the future use of the area and the technical and legal norms in place. Rehabilitation projects must be developed, implemented and supervised by legally qualified technicians (NRM-21).

The Mine Closure Plan has a temporary nature, which refers to a specific period of the mine life cycle – namely its closure – although the measures should be implemented starting at the current time. The SLMP, in turn, can be applied and updated at any stage of the mine life cycle, since it takes into account not only the mine but also all natural and cultural resources that are present on the property where it is located.

Another difference between the two management plans is the defensive and preventive approach adopted by the Mine Closure Plan (LIABILITIES AND RISK), with regard to caused and potential environmental damage, as opposed to the emphasis given by the SLMP to proactive strategies (ASSETS AND OPPORTUNITIES) for the use of environmental assets. This difference can be seen in the attributes diagnosed by each analysis because, while the first restricts evaluation to environmental liabilities and risks in the vicinity of the mining area, the second expands the analysis to include the entire property and its surroundings, listing their most significant socioenvironmental attributes.

Therefore, we conclude that the Mine Closure Plan and the SLMP have complementary approaches, the first emphasizing risk prevention and mitigation of environmental liabilities, and the second prioritizing the conservation and enhancement of the Environmental Assets in the entire property, thus including the identification of assets that contribute to mitigate liabilities and reduce risks. The Mine Closure Plan may be incorporated to the SLMP of a mining facility in that it predicts with a high degree of accuracy the fate of the various areas of the property within a specified future.

Box 5. Integration of the SLMP and the Mine Closure Plan

Methodological Development of the SLMP

The development of the SLMP encompasses three main phases described in table 2:

Phase	Procedure
1 - Planning	
Planning organization	Definition of the SLMP team
	Definition of the study area: properties and their surroundings
	Selection of Environmental and Corporate Assets to be analyzed
	Initial analysis and interviews to understand the context of the study area
	Consolidation of a work plan
2 - Diagnostics	
Elaboration of Socioenvironmental Diagnosis	Systematization of available information (secondary data)
	Preparation of preliminary Geographical Database
	Meeting to align information
	Characterization of Environmental and Corporate Assets
	Field survey (complementary primary data)
	Diagnosis consolidation
3 - Strategic Analysis and Propositions	
Preparation of the draft SLMP	Preparation of the draft Property Zoning
	Strategic Analysis
	Formulation of proposals per zone, per property and per corporate aspect
	Preparation of the draft SLMP
Validation Workshop	SLMP validation workshop
Preparation of the final SLMP	Preparation of the final SLMP

Table 2. Methodological phases of the SLMP preparation

This phase constitutes the preliminary stage in the organization of the work process. The company doesn't necessarily have to follow the order suggested here. However, it is important that Phase 1 procedures are fully implemented before Phase 2 – Diagnostics. Here are some important details:

1. DEFINITION OF THE SLMP TEAM

The company must determine the best composition for the SLMP team. The team may be composed of professionals from the company's workforce, if that is possible, or totally or partially formed by members external to the company. This will be called the SLMP team. We emphasize that it is important that the team has a multidisciplinary nature and that, to ensure smooth progress, it is essential for the SLMP team to be aligned with different decision-making levels of the company.

2. DEFINITION OF THE STUDY AREA: PROPERTIES AND THEIR SURROUNDINGS

The SLMP study area consists of the property chosen by the company, which may or may not host its operations. Other owned or leased properties are also included here. Therefore, the study area will consist of two parts:

- **Studied property.** Areas that are owned, leased or are under the possession of a company, whose local management is centralized in a unit.
- **Surroundings of the studied property.** In order to identify both the interrelations of

PHASE 1 – PLANNING

Environmental Assets beyond the border of the project, and the opportunities and threats to the conservation of the integrity of the property's socioenvironmental heritage, we must determine a surrounding area that will be subject to diagnostics and analysis on a smaller scale, prioritizing specific analysis of pressure vectors, environmental interactions and community relations. The surroundings will be initially comprised by the 5km envelopment area starting at the perimeter of the property, but should be designed according to its context, considering important variables such as protected areas, roads, preserved forests, and basin rivers, among others.

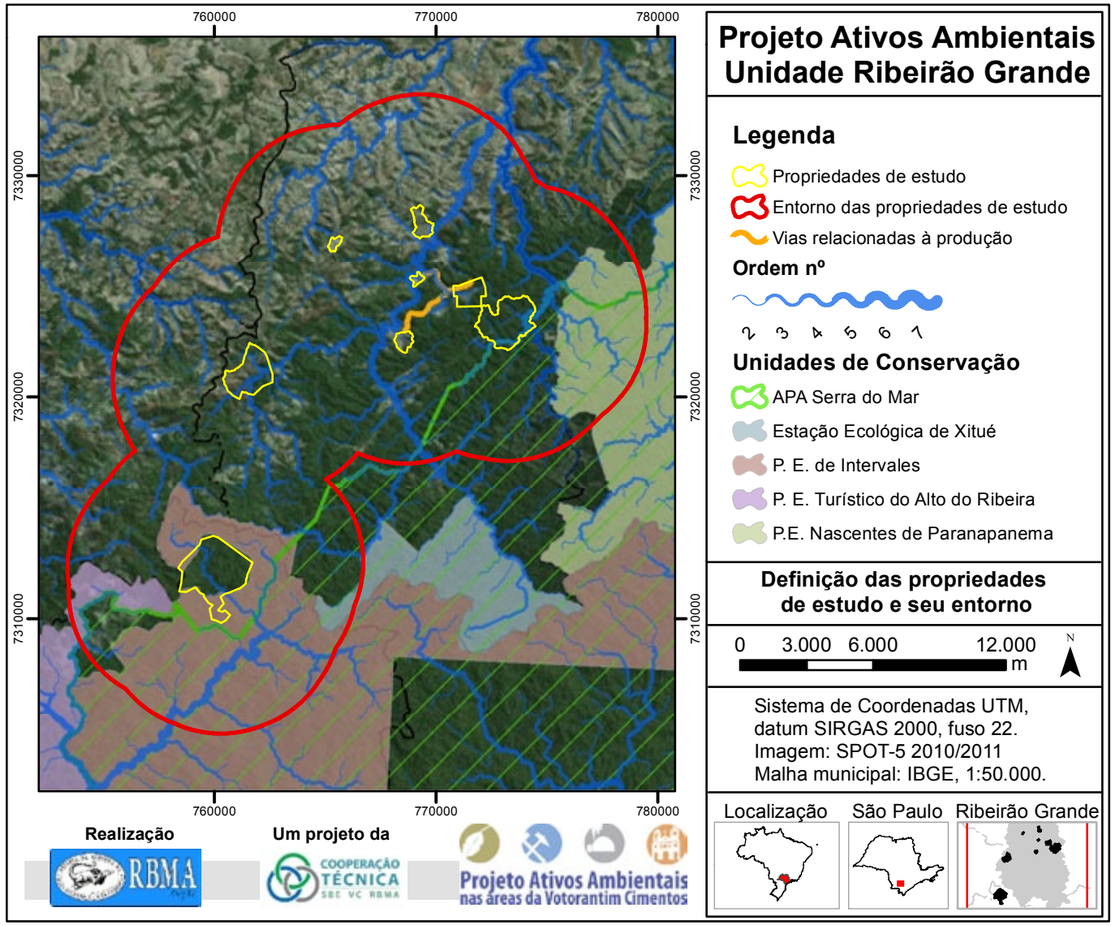

Figure 5. Study area of CCRG. In this case, as the properties are configured as an archipelago, the access pathways that participate in the productive process are considered as integrants of the study area in the SLMP.

3. SELECTION OF ENVIRONMENTAL AND CORPORATE ASSETS TO BE ANALYZED

Environmental Asset, but for the purpose of preparing the SLMP, Pre-Defined Environmental Assets and Complementary Environmental Assets should be considered.

The Pre-Defined Environmental Assets, are those assets which will necessarily have to be part of the SLMP and should not be replaced by others.

On the other hand, the Complementary Environmental Assets are those whose use is strategic for the preparation of the SLMP, depending on the specifics of the property and its surroundings. For example, a property located in proximity to the sea and mangrove areas may consider aspects of a fishery's resources as assets whose analysis is essential. Similarly, in the case of an agricultural project, the soil conservation asset, among others such as the presence of pollinators, is strategic for the company's Management Plan.

Some Environmental Assets may be strategic in light of their impact-dependency relationship with each production process. To define a set of Environmental Assets in each of these cases, impact-dependency tools may be useful.

Corporate Assets originate from administrative, managerial and political elements of the company that create value when contributing to the conservation, restoration and sustainable use of Environmental Assets, its positive relationship with stakeholders and their entry into markets that are committed to sustainability. Six Corporate Assets can potentially be included in the SLMP:

1) Integrated planning and management of the socioenvironmental heritage;

2) Environmental monitoring;

3) Property protection and surveillance;

4) Socioenvironmental projects;

5) Scientific research;

Piciture 5. Visit of the SBE-VC-RBMA Cooperation team to Gruta dos Paiva in Iporanga, which by proposal of the SLMP, was developed for this area and is being destined by Votorantim Cimentos to the incorporation of Parque Estadual Intervales.

6) Recreation, tourism and environmental education.

Corporate Assets are part of a field that deserves to be acknowledged and evaluated within the organizational and managerial context of each company. The stronger these assets are, the more they might simplify the implementation of the SLMP, given that they reflect corporate policies directly related to the real possibility of planning for and managing Environmental Assets.

4. INITIAL ANALYSIS AND INTERVIEWS TO UNDERSTAND THE CONTEXT OF THE STUDY AREA

In organizing environmental planning, it is important to know, albeit preliminarily, the main bibliographic references and knowledge gaps that impact the study area. Sources that should be part of this preliminary evaluation include: environmental licensing documents of the project in question and of others nearby; environmental planning of protected areas in the vicinity and region; land information concerning the study area, and the already mentioned Municipal Plans/ Master Plans with regard to socioenvironmental issues. Evaluations that identify important opportunities and threats should also be included in order to help organize the plan.

5. CONSOLIDATION OF A WORK PLAN

In this phase we must define activities and organize them within a Work Plan that includes a timeline and financial schedule and considers previous and future steps. This Work Plan should include objectives, deadlines, products, costs as well as the project's financial transactions. After the preparation and approval of the SLMP, and once the priority actions are defined, new schedules and budgets should be drawn up for the implementation of each of the SLMP's proposals.

Image 6. Cooperation SBE-VC-RBMA work meeting with Sobradinho/DF plant team of Votorantim Cimentos for development of Environmental Assets Project and SLMP.

PHASE 2 – DIAGNOSTICS

1. FIELD RECOGNITION

We recommend an initial technical visit to the property, for a workshop involving area managers and employees, the SLMP team and, whenever possible, stakeholders, partners, municipal agents and other institutions of interest located near the property area. During the visit, the next steps to be included in the Plan should be discussed, and the following items should be identified: property history, developed activities, limitations to its maintenance, potential for development of activities within education, research, conservation of biodiversity, among others, and weaknesses of the area (e.g. erosion areas and impacts on surrounding properties). This identification is complemented by technical visits to some specific areas of the property. Another important aspect of field recognition is the identification of documents, maps, and photographic records of the study area, to assist in the analysis of secondary data.

2. SYSTEMATIZATION OF AVAILABLE INFORMATION

The first step in the preparation of an environmental diagnosis involves analyzing the information available, and gathering and integrating all existing secondary data, which is provided by the company's operating unit and also derived from reviewing specific technical and scientific literature. Among the documents to be consulted, one should include EIA/EIS, environmental and socio-cultural monitoring reports, Environmental Control Plans, Environmental Recovery Plans, Biodiversity Management Plan, Environmental Priorities, among others. This phase should provide the following information to the SLMP:

a) Diagnostics of corporate aspects:

- Compliance of Permanent Preservation Areas, Legal Reserve and Land Regularization;
- Project design with any predictions of expansion or closures;
- Characterization of the Environmental Heritage Integrated Planning developed by the company;
- Mitigating or compensatory measures, and other measures that impact environmental licensing conditions or Terms of Adjustment of Conduct (TAC);
- Required environmental monitoring performed by the company;
- Characterization of property protection and surveillance;
- Characterization of environmental projects undertaken by the company;
- Characterization of scientific research, visitation and environmental education initiatives carried out by the company.

b) Projects co-existing in the study area, like other projects that generate an impact – either positive or negative – on existing assets on the property.

c) Collection of secondary data pertaining to the physical environment:

- General characteristics of the regional climate;
- General characteristics of the geology, geomorphology and pedology of the entire study area (properties and surroundings);
- Considerations about the fragility of the physical environment;
- Characterization of the physical aspects related to the speleological, archaeological and paleontological heritage of the study area, including their overall conservation status and possibility of public use or use for research purposes;
- Analysis of National Department of Mineral Production (DNPM) processes in the study area, if available or whenever the project includes mining;
- General characterization of water resources, considering their physical, chemical and biotic aspects, especially:
  - Structure and degree of conservation of water resources;
  - Valuation of the significance of the volume of withdrawn and discharged water;
  - Evaluation of upstream and downstream water quality maintenance in areas impacted by the project;
  - Evaluation of biological vulnerability of the affected water body;
  - Identification of grants for intervention in water bodies;

d) Collection of secondary data pertaining to the biotic environment[1]:

- Characterization of the biome(s) in the area where the project is located;
- Characterization of the vegetation of the study area:
  - Identification of endangered and endemic species;
  - Identification of species with nutritional, medicinal, ornamental and raw material properties;
  - Evaluation of the phytosociology parameters of the vegetation, which informs whether its dynamics are stable, advancing or regressing;
  - Degree of conservation of the study area's vegetation through land cover mapping and evaluation of landscape connectivity;
  - Identification of unique ecosystems or ecosystems of particular interest, like islands, mangroves, caves, etc.;
- Characterization of the fauna of the study area: avifauna, herpetofauna and mammals;
  - Identification of species richness in the study area;
  - Identification of endangered and endemic species;
  - Identification of game species;
  - Identification of alien and invasive species.

e) Collection of secondary data pertaining to the anthropic environment[2]:

- Evaluation of land use and occupancy;
- Socioeconomics of town(s) within the study area;
- Characterization of the company's socioenvironmental interactions;
- Identification of pressure vectors and environmental damage in the study area;
- Identification of the Artistic, Cultural, Historical, Archaeological, Speleological and Spiritual heritage;
- Diagnostic of attractions with eventual use for public use and resources with attractive potential in the study area, with emphasis on those located within the property area.

f) Cartographic Material:

- Orthophotos and/or current satellite images with compatible resolution for mapping on a 1: 10,000 scale;
- Topographic base map containing at least features of rivers, roads and contours, in the most detailed scale available [3]

1 Data collection related to the studied property and surrounding areas, as described in "definition of the study area".

2 Data collection related to the studied property and surrounding areas, as described in "definition of the study area".

3 Official agencies make public surveys of Brazil in its entirety on a 1: 100,000 scale, 1: 50.000 of most of Brazil, and also 1: 25,000 and 1: 10,000 of some places. However, as the SLMP applies to private land-based companies, whenever surveys that are more detailed than those provided by public agencies are available, the preference will be for materials with greater detail, preferably on a 1: 10,000 scale for the interior of the properties and 1: 50,000 for the property surroundings.

- Thematic mappings;
- Digital terrain model;
- Property buildings;
- Other spatial information.

The existence of updated and consistent secondary data can provide a diagnosis that will enable the proper characterization of the Environmental Assets, as well as sufficiently subsidize the strategic analysis, zoning and proposals. When knowledge gaps with significant importance are identified, the SLMP team should try to develop complementary primary surveys. The higher the supplementation with primary surveys, the greater the accuracy of the SLMP. Some of these gaps can significantly weaken work development.

Finally, it should be noted that this diagnosis will also provide relevant information on contingent liabilities related to the studied project and the property in which it is located. As examples we can mention environmental nonconformity related to non-definition of the Legal Reserve or the irregular occupation of Permanent Preservation Areas, or the existence of erosive processes that compromise the quality of soil and water. The identification of these liabilities is important since at least a portion can be mitigated by the assets identified in the same property.

3. PREPARATION OF GEOGRAPHIC DATABASE

All spatial information – including satellite images, aerial photos, maps, and vector information – should be compiled in a Geographic Database. As previously mentioned, the time and UTM projection zones of the studied area – preferably datum SIRGAS 2000 – should be adopted. The scale used for studied properties should be detailed – we suggest a 1:10,000 scale for the study of the property area and a 1:50,000 scale for the study of the property surroundings. The Geographic Database should be organized at the beginning of the work process and fed throughout the development of the SLMP in order to support the characterization of the Environmental Assets, Strategic Analysis, Zoning and Action Proposals.

The Geographic Database must include:

- Detailed topographic base maps of the property area (might be less detailed for the property surroundings);
- Thematic base vectors (vegetation, soil science, geomorphology, geology, land use and occupation, land issues, fauna, water resources, historical, cultural and archaeological heritage, public use, caving, surveillance and protection, nearby conservation areas, legal compliance, monitoring, pressure vectors, DNPM Processes, etc.), and materials in raster format, such as satellite imagery and recent aerial photos, according to their availability.

4. MEETING TO ALIGN INFORMATION

Once the preliminary analysis of the available information and key data gaps has taken place, the SLMP team should schedule internal technical meetings, which should include different levels of company management, in order to refine the preliminary information and outline strategies and next steps.

5. CHARACTERIZATION OF ENVIRONMENTAL AND CORPORATE ASSETS

Next, each one of the selected environmental and corporate assets must be properly characterized. The requirements and procedures to such characterization is presented subsequently:

Image 7. Planning meeting in Xambioá/VC plant in state of Tocatins.

5.1. ENVIRONMENTAL ASSETS

ENVIRONMENTAL ASSET 1: Carbon Stock and Sequestration

Image 8. CO2 and water steam in cellulose factory

The issue of carbon balance is part of the dynamics of gas regulation related to the functions of natural capital "gas regulation" and "climate regulation". Life on Earth exists within a narrow range of chemical balance variation in the atmosphere and oceans, and any change in this balance may have positive or negative impacts on the environment and on social and economic processes. The chemical composition of the atmosphere and oceans is maintained by biogeochemical processes which, in turn, are influenced by many biotic and abiotic components of the natural ecosystem. Important examples of that are the influence of the natural biota on the processes that regulate CO2-O2 balance, as well as the maintenance of the ozone layer and the SOx regulatory levels (DE GROOT et al., 2002). The main services provided by the regulation of gases are the maintenance of clean air and disease prevention (e.g., skin cancer).

Carbon stock is understood to be the atmospheric carbon that is fixed by ecosystems. Terrestrial ecosystems, such as forests, grasslands, wetlands, etc., stock more carbon than the atmosphere and are vital in influencing climate change driven by carbon dioxide. In storing carbon in aboveground biomass, soil, belowground biomass and dead organic matter (the four carbon stock pools), ecosystems keep CO2 out of the atmosphere and contribute to sequestering part of CO2 excess. Young forests, growing at an accelerated rate, sequester larger volumes of carbon compared to mature forests (RIBEIRO, 2007). Mature forests in turn act as reservoirs, storing carbon even when they are not experiencing net growth.

The balance between carbon stock and sequestration follows an intrinsic dynamic, which also reflects changes in land use and occupancy. Carbon emissions can be caused by deforestation and by fossil fuels burning and chemical

ASPECTS OF CARBON BALANCE	RELATED PROCESSES	MEASUREMENT METHOD
Carbon Emission	Deforestation	Amount of lost vegetation cover, calculated by the change in land use and occupancy.
	Fossil fuels burning and chemical reactions involved in production processes	Monitoring of the organization
Carbon Sequestration Sequestro de carbono	Natural restoration of vegetation cover	Amount of vegetation cover in process of regeneration, calculated by the change in land use and occupancy.

Table 3. Processes related to carbon emission and sequestration

reactions involved in production processes, while carbon sequestration occurs with the fixation of atmospheric carbon by vegetation (Table 3). While carbon sequestration helps to increase the total carbon stock, deforestation decreases this stock.

For the development of the SLMP, the following estimates should be calculated:

a) amount of carbon currently stored in landscape;

b) amount of carbon sequestered over time based on the land use map and carbon/ha rates, as proposed by the ecosystem services modeling tool, InVEST (TALLIS et al, 2011).

In order to estimate carbon stock and sequestration, the following documents are necessary:

- Land use and occupancy map of the property (recent);
- Land use and occupancy map of the property (dated approximately 10 years prior to the recent map);
- Pedological map of the property;
- Carbon stored data (aboveground, soil, root systems and leaf litter in t C/ha) for each class of land use and occupancy, according to specific literature;
- Current carbon emission in the studied property[4]

The amount of carbon stored in the four types of pools should be accounted for, by using the land use and occupancy map and the pedological map of the property. According to Tallis et al (2011), after that, the total carbon stock of a property (four pools) will be indicated by:

$$Ct = Cab + Cbb + Cs + Cd$$

- Ct – Total carbon;
- Cab – carbon stored in aboveground biomass;
- Cbb – carbon stored in belowground biomass;
- Cs – carbon stored in soil;
- Cd – carbon stored in dead organic matter.

To calculate carbon sequestration, the same operation is performed to assess a previous date, resulting in the carbon stock of that date, considering that soil conditions of the property remain constant.

4 When available. Consider both direct and indirect emissions from productive processes.

Image 9. Vale's seedling nursery in mining units in Carajás/PA

Limitations of this method:

- This estimate assumes that no land use wins or loses carbon over time. In other words, it simplifies the cycle of carbon by not taking into account variations of carbon stock by intra-class land use.
- The more detailed the land use and occupancy map is, the more detailed the estimate will be;
- The estimate assumes that the process of carbon sequestration and loss is linear. However, most carbon sequestration occurs in a non-linear process, with higher sequestration rates during the first years.

COVER	AMOUNT (T C/HA)	REFERENCE
Mature Seasonal Semi decidual Forest	83.84	Ribeiro et al (2009)
Seasonal Semi deciduous Forest at mid stage of regeneration	53.25	Ribeiro et al (2009)
Seasonal Semi deciduous Forest at initial stage of regeneration	19.5	Ribeiro et al (2010)
Tidal River Plain with Mangroves	76.09	Carvalho e Fonseca (2004)
Eucalyptus Reforestation (about six years)	71.13	Paixão et al, 2006.
Shrubby vegetation	3.5	Tiepolo, Calmon & Feretti (2002.
Herbaceous vegetation with isolated bushes	0.8	Tiepolo, Calmon & Feretti (2002).

Table 4. Estimates of carbon stock per land cover types

SOIL	CARBON DATA PER VEGETATION TYPE (T C/HA)		
Type of soil	Seasonal Semi deciduous Forest	Initial/pioneering formation	Mangroves
Seasonal Semi deciduous Forest in medium stage of regeneration	53.25	59.8	No data
Seasonal Semi deciduous Forest in initial stage of regeneration	19.5	59.2	90.5

Table 5. Estimates of carbon stock per soil and vegetation types cross-analysis

ENVIRONMENTAL ASSET 2: Water Resources

Image 10. Dam in Mata Atlântica in Juquiá/SP river basin which integrates areas of Parque Estadual de Jurupará and Reserva Votorantim "Legado das Águas"

Environmental Asset 2: Water Resources relates to the Natural Capital functions "water regulation" and "water supply". The "water regulation" function has to do with the influence of natural systems on the regulation of hydrological flows on the Earth's surface – which is distinct from the "disturbance prevention" function, since it has to do with maintenance of normal conditions of watersheds, and not the prevention of extreme events. The related ecosystem services are irrigation and natural drainage, regulation of the water channel flow, and the provision of water transportation. Water regulation is very important, considering that both excessive and decreased runoff can cause serious problems. The "water supply" function refers to water filtering, retention and storage, especially rivers, lakes and aquifers. The filtering function is often performed by soil vegetation and biota. Retention, stock and stock capacity depend on the topography and groundwater characteristics that are part of the ecosystem. Water supply also depends on the role of the ecosystem in the water cycle, and emphasizes the support capacity more than the water flow through the ecosystem.

To characterize the Environmental Asset "Water Resources", we should consider the importance of evaluating the water structure and its degree of conservation and water quality maintenance, as well as the significance of the volume of withdrawn water and the biological vulnerability of the water body – the latter two criteria being adapted from the Global Reporting Initiative (GRI, 2010). The criteria are presented in Table 6.

CRITERIA	INDICATORS/INTERPRETATION
Structure and degree of conservation of water resources *	• Conservation of the riparian forest; • Number of preserved springs; • Order of the rivers in the area; • Drainage density of water bodies; • Significance of water withdrawn by volume.
Significance of water disposal	• If it is superior to 5% or more of the annual average volume of the water body; • If the discharges are known to cause or have a high probability of causing significant impacts on the water body and its habitats; • If the water bodies into which the water is disposed are known to be sensitive due to their size, function, or status as a rare system, threatened or at risk (or because of the support they provide to a particular species of plant or animal threatened by extinction), or, if there is any discharge in conservation areas.
Water quality maintenance	• The basic conditions are the physical and chemical parameters set by CONAMA - Resolution No. 430 - Article 16. Additionally, the analysis of the amount of upstream/downstream collection points should not reveal significant changes.
Unmet preservation condition	• Any withdrawal from a wet area included in the Ramsar list or any other area nationally or internationally proclaimed as preserved, regardless of the withdrawal volume, according to GRI (2010).
Biological vulnerability of the affected hydrous body	• Will be considered vulnerable water bodies which experts define as particularly sensitive because of size, function, or status as a rare system, threatened or at risk (or because of the support they provide to a particular species of plant or animal threatened by extinction), according to GRI (2010).

Table 6. Critérios de avaliação do Ativo Ambiental Recursos Hídricos

* It will be considered significant when the volume of water withdrawn corresponds to an average of 5% or more of the annual average volume of a given water body, in accordance with the GRI (2010).

** The classification (hierarchy) by STRAHLER (1964) should be used to determine the order of the rivers, where smallest channels without tributaries are considered first-order; second-order channels are formed from the confluence of two first-order channels, and only get first-order tributaries; third-order channels are formed from the confluence of two second-order channels and can receive second- and first-order tributaries; fourth-order channels are formed from the confluence of third-order channels and can receive lower orders tributaries, and so on.

ENVIRONMENTAL ASSET 3: Habitat

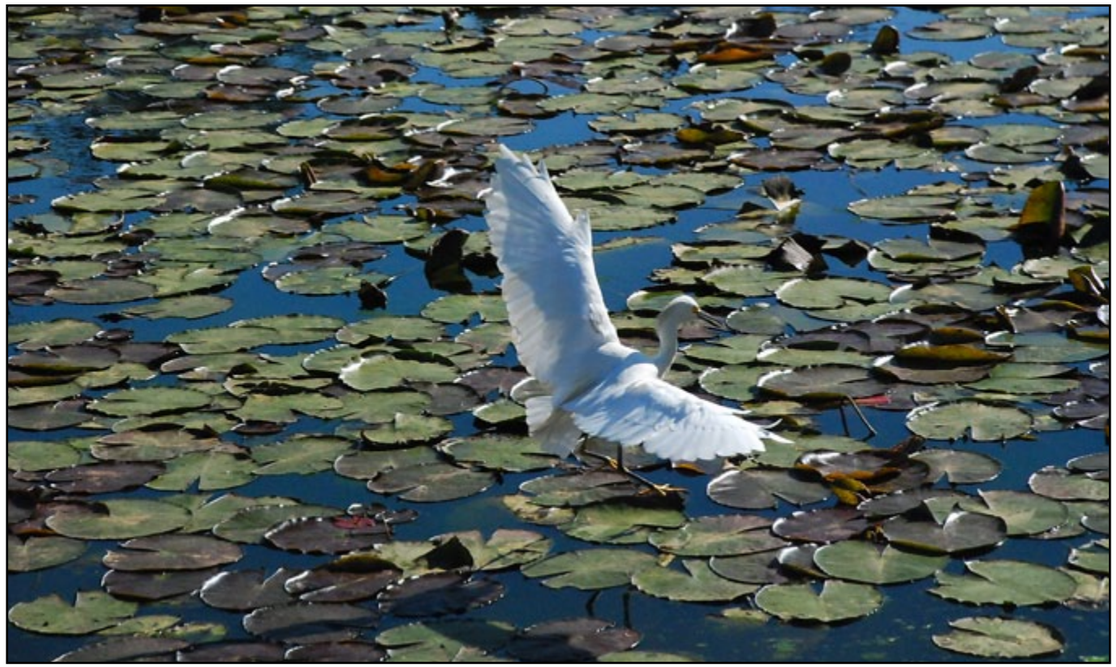

Image 11. Lakes and wetlands have special importance for both endemic and migratory species.

Environmental Asset 3: Habitat relates to the "habitat" function (sub-function: "refugium" and "nursery", by DE GROOT, 2002). Natural ecosystems provide space for species of wild animals and plants. Maintaining the health of habitats is a necessary precondition for all ecosystem services, directly or indirectly (DE GROOT et al., 2002). By providing space for plants and wildlife, both residents and migrants (as in the case of migratory species), natural ecosystems are essential for the maintenance of biological and genetic diversity on Earth. To maintain the viability of this stock of genetic information (through evolutionary processes), it is essential to preserve the integrity of natural ecosystems, particularly in view of the lack of knowledge regarding the nursery services of many ecosystems.

All indicators of habitat integrity should be considered in the evaluation of this Environmental Asset: a) the dynamics of the vegetation based on phytosociological or other parameters; b) size and connectivity of the patches of fragments of each type of native vegetation in relation to matrix areas or protected areas; c) degree of conservation of vegetation fragments and d) existence of unique or particularly fragile natural ecosystems (salt marshes, mangroves, wetlands, nesting places of migratory birds, nurseries, etc.).

The reference for the set of descriptors here presented are forest habitats, specifically the Mata Atlântica. Necessary methodological adjustments should be made when studies are conducted in other biomes. These descriptors help to establish the best scenario for the property's Environmental Asset "Habitat": one where there is the greatest amount of preserved forest and mature and stable succession dynamics, connected to larger patches through functional ecological corridors and with unique and properly maintained ecosystems. The four aspects to be analyzed are detailed in Table 7.

CRITERIA	INDICATORS
Phytosociological parameters of vegetation, monitored over time	• Dynamics of the vegetation community (initial, mid, advanced and climax secondary succession stages); • Percentage of species in late succession stage.
Degree of conservation of the landscape and property vegetation	• Percentage of the area with natural habitats in more advanced successional stages (mid/late), both in the property and the landscape.
Habitat connectivity - ecological corridors	• Location and contiguity/disconnection of the larger habitat patches, especially those larger than 100 hectares* • Habitat continuity assessment – from potential ecological corridors at least 200 meters wide**, to large habitat patches and/or protected areas; • Presence of significant resistance to the flow of the fauna***
Existence of unique or particularly fragile ecosystems or habitats	• Places of special interest to wildlife, which may include landing points for migratory birds, breeding and nursery grounds, mating, oviposition and nesting points, sensitive habitats, among others.

Table 7. Criteria for the evaluation of Environmental Asset 3: Habitat

* Patches larger than 100 hectares potentially harbor a significant number of species of the majority of small animals of the Rainforest (BIERREGAARD & DALE 1996).

** In general, the most significant edge effects occur in the first 100 meters (LAURANCE et al. 2002), implying that corridors of less than 200m are formed essentially by environment edges and are therefore greatly disturbed. As a result, more strictly forestal species require corridors at least 200m wide. In the Mata Atlântica, METZGER ET AL. (1997, 1998) apud METZGER (2010) found that corridors only 30m wide have very limited ability to maintain biodiversity.

*** Very significant resistance to the flow of fauna is defined as a set of features such as large rivers, roads, consolidated urban areas, and industrial areas. Moderately significant resistances are, for example, small roads, farmland, reforestation, and anthropogenic field areas of small extent.

ENVIRONMENTAL ASSET 4: Species Richness

Image 12. Toucan feeding on the Palmeira Jussara (Euterpe edulis) seed, key-species of Mata Atlântica.

The evaluation of Environmental Asset "Species Richness" demands the identification of wildlife species, preferably of avifauna, mammals and herpetofauna groups. Obviously, if the property in question is located, for example, in coastal areas, lakes or have bodies of water where fishing is possible, the identification of fish populations is recommended as part of the development of the SLMP. The following are the criteria for the evaluation of the study area.

- Species that are expected at the location and according to the property's environments must be found. If uncharacterized habitats or habitats under the process of recovery are present, the property must be monitored until the vegetation is restored and the expected fauna is present;
- The number of species recorded during the monitoring time must remain the same or increase;
- The number of specimens of endangered species previously recorded must remain the same or increase [5];
- The number of specimens of endemic species previously recorded must remain the same[6];
- Selecionar uma espécie chave capaz de indicar os processos cinegéticos na região, e monitorar sua abundância na propriedade.

All conditions should be monitored and compared over time; the five conditions must be met simultaneously. The identified attributes may, for example, justify the proposal of one or more restrictive zone in the area zoning, in order to secure a habitat area within the property that enables the support of wildlife populations.

5 Endangered species are the species listed in endangered flora and fauna lists of the State of the study area, as well as national and international lists.

6 Endemic species are the species listed in endemism lists of the biome of the region or location of the study area.

ENVIRONMENTAL ASSET 5: Natural Resources of Particular Interest

Image 13. Jabuticabeira, a native species of Mata Atlântica of great environmental and cultural importance

Species of particular interest in a particular place are defined in accordance with man's interactions with nature through knowledge and concepts developed by a given community about biology, within their system of beliefs and myths (HANAZAKI, LEITÃO-FILHO & BEGOSSIAZER, 1996). Although many of them are natural resources of particular interest to man, such as a waterfall, for this instrument we propose GROOT's (2002) approach that considers the ecosystem functions "food", "raw material", "medicinal resources" and "ornamental resources", with respect exclusively to plant resources for direct use.

Therefore, it is important to contextualize the plant species of interest within the ethnobotany of the study area, in order to identify a list of species of interest with probable occurrence in the study area. This set of species identified from specific literature will be compared with the plant species that occur on the property, thus accounting for existing species of particular interest. The following are the four groups of species of particular interest.

• Species of interest as food

Although most foods are currently derived from cropland and domesticated plants and animals, a substantial part of the world population's diet continues to come from wild plants and animals (De GROOT et al., 2002). Natural ecosystems are often abundant sources of edible plants. These species are related to the function of natural capital "food".

Image 14. Urucum, a species widely used in traditional Brazilian cuisine and indigenous body painting

• Species of interest as raw material

This group of species is related to the function of natural capital "raw material", and includes renewable resources such as wood and fiber for construction or craft, and biochemical or biodynamic compounds (such as latex, gums, resins, oils, greases, tannins, dyes and hormones) for all kinds of industrial purposes. Nature also provides many energy resources such as fuel, organic matter, animal traction and biochemical (such as hydrocarbons, ethanol, etc.), as well as food for animals (pasture and leaves).

• Species of interest as medicinal resources

Nature contributes to the maintenance of human health in many ways: by providing chemical compounds that can be used as drugs and medicinal product or that can be used as models to synthesize these drugs in laboratories. Species with known medicinal function and probable occurrence in the study area can be identified by consulting specific literature.

• Species of interest as ornamental resourcesOrnamentais

The use of plants for ornamental purposes is extensive and varied. Nature provides many types of materials that can be used for ornamental purposes, such as in clothes, ornaments (wood and other resources) and interior decoration and landscaping.

ENVIRONMENTAL ASSET 6: Cultural Heritage

Image 15. Capela Santo Antônio (1800) and Casarão do Antigo Engenho do Retiro (1701) in Laranjeiras/SE plant lands of Votorantim Cimentos

Cultural Heritage is classified into Historical, Cultural and Environmental attributes, and is understood as a set of materials and/or intangible assets that depict the history of a society and its relationship with the environment. The assets that comprise the cultural heritage are considered "manifestations or significant testimony of human culture" and are undeniably essential for shaping the cultural identity of a people. Strictly in relation to the natural heritage, its importance rests on safeguarding material resources and traditional knowledge through various forms of use of these resources in an essential relationship to guarantee the way of living of certain societies in their interaction with nature (ZANIRATO & RIBEIRO 2006).

Within the SLMP, the Environmental Asset "Cultural Heritage" encompasses the following:

- Aesthetic information: they are attractive features of the landscape that inspire contemplation, provide a sense of well-being and of sensory experience because of their aesthetic composition.
- Recreation: natural and/or cultural spaces, appropriate for leisure and tourism activities.
- Historic-cultural, artistic and spiritual information: is the set of natural and/or cultural landscape elements that have intrinsic historic-cultural, artistic and spiritual values (e.g., cave paintings, folklore activities, buildings and religious temples, museums, historical, archaeological and paleontological sites, among others).

The Environmental Asset "Cultural Heritage" is identified in table 8.

CRITERIA	INDICATOR/INTERPRETATION
Historical sites	Any site or structure with recognized historic value, included or not in the records of official authorities of heritage conservation.
Archeological sites	Any site or structure with recognized archeological value, included or not in the records of the official authorities of heritage conservation.
Cultural spaces and events	Pilgrimage paths, riding routes, places of worship and activities represented by traditional festivals and mystical religious practices. Also includes caves, waterfalls and mountains used for religious events or landscape references that are historical and cultural symbols.
Spaces for artistic events	Scenery or inspirational sites for artistic activities such as film, photography, painting, sculpture, music, dance, architecture, etc.; artistic workshops or studios of any kind or works of art present on site (sculptures, buildings or paintings).
Natural sites	Spaces in the landscape of exceptional value from the point of view of science, tourism or conservation activities, with aesthetic, recreational, cultural or spiritual characteristics.

Table 8. Items for the characterization of Environmental Asset 6: Cultural Heritage

ENVIRONMENTAL ASSET 7: Complementary Assets

Complementary Assets are those whose use is strategic for the preparation of the SLMP, due to particularities of the property and its surroundings.

Some Environmental Assets may be strategic in view of their impact-dependency relationship with each production process. Impact-dependency tools may be useful in helping to define such a set of Environmental Assets in each case.

Image 16. Mangroves, ecosystems that provide numerous ecosystemic services (protection of water resources, nursery of marine species, production of firewood and tannin, etc).

5.2. CORPORATE ASSETS

Following the characterization of Environmental Assets, the next step is the characterization of Corporate Assets. As explained before, the Corporate Assets originate from the administrative, managerial and political elements of the company that represent value by enabling the conservation, restoration and sustainable use of its Environmental Assets. Each of the Corporate Assets included in the preparation of the SLMP are listed below.

CORPORATE ASSET 1: Integrated Planning and Management of the Socioenvironmental Heritage

This asset portrays the organization's effort and commitment to performing the planning and management of its environmental heritage in a permanent and integrated manner. This is not a legal requirement for companies, but it increasingly represents a great advantage for the management of socioenvironmental heritage and is becoming a market differentiator. The implementation of the SLMP in the company's properties is an important contribution to this Corporate Asset.

CORPORATE ASSET 2: Environmental Monitoring

Environmental Monitoring may be a Corporate Asset to the extent that it represents an organization's effort beyond the minimum stipulated for the licensed project. Some aspects that might be considered, among others, are: monitoring frequency and effectiveness, systematic performance of preventive and corrective measures, and transparency in the process.

CORPORATE ASSET 3: Property Protection and Surveillance

The protection and surveillance of property resources are important in the context of the SLMP as they represent the organization's efforts to ensure the property's innate and ecological integrity, which includes maintenance of water systems and preservation of fauna, flora and its cultural attributes – in other words, its Environmental Assets.

Some indicators may point to the effectiveness of protective and surveillance actions, such as identifying the number of degradations to the environmental heritage and the existence of pressure vectors against the property's environmental heritage. In Table 9 we list a set of indicators of the most significant pressure vectors, which don't exclude other unforeseen events in a property.

Image 17. In the planning of their properties, companies should always promote the engagement and benefits to the surrounding communities.

PRESSURE VECTOR	INDICATOR	FREQUENCY OF EVALUATION
Hunting	• Abundance of individuals from a number of game species • Evidence of hunting (traps, utensils, etc.)	Any evidence should be recorded internally by the unit
Invasion of property	• Evidence of property invasion	
Fire	• Internal record of fire	
Cattle invasion (sheep, goats, cattle and horses)	• Evidence of cattle invasion	
Littering	• Evidence of improper disposal of garbage inside the property, by third parties or company employees	
Vandalism	• Evidence of acts of vandalism to the property's natural and cultural heritage	
Irregular extracting	• Evidence of resource extraction from the area (like plants, fiber, fruits, etc.), by third parties or employees themselves	
Presence of domestic animals (dogs and cats)	• Direct observation or observation by camera trapping of footprints or feces	
Presence of trails	• Indication of trails	
Fishing	• Evidence of fishing gear, camera trapping	

Table 9. Indicators of a property's pressure vectors

CORPORATE ASSET 4: Socioenvironmental Projects

This Corporate Asset has to do with the organization's efforts to develop environmental initiatives that involve its employees, surrounding communities or other social groups. It includes all Social Responsibility initiatives promoted or supported by the company that are not required by the project's environmental licensing and that meet the interests and demands of their target audience.

CORPORATE ASSET 5: Scientific Research

Production of scientific knowledge generates, by definition, benefits to society, either directly or indirectly. Natural ecosystems provide almost unlimited opportunities for studying nature and conducting scientific research. The Corporate Asset Scientific Research has to do with the organization's efforts to facilitate and promote the realization of such activities within their property, which may include, for example, agreements with educational and research institutions, support to scientific research in several areas of knowledge, and systematization of research priorities to be conducted within the property.

Image 18. Butterflies diversity in showcase of the Centro de Pesquisas da Reserva Natural Vale, in Linhares / ES

CORPORATE ASSET 6: Recreation, Tourism and Environmental Education

Natural ecosystems have significant value as a place where people can rest, and enjoy recreation and new experiences. Through their aesthetic qualities, natural environments provide opportunities for recreational activities such as hiking, cave exploration, camping and swimming. Natural areas are also important references for environmental education.

This Corporate Asset includes:

a) potential areas for the realization of leisure, recreational, environmental education and ecotourism activities (both with respect to attributes needed to perform such activities and with regard to viability of access and safety);

b) investment, infrastructure and tourist facilities.

Among other aspects we should consider:

- Points of interest for public use;
- Guest access to points of interest;
- Supporting facilities to the public (museums, visitor centers, exhibits, and special facilities);
- Financial support to welcome tourists and for environmental education;
- Tourism management and operation in the region;
- Potential public and private partnerships;
- Presence of other attractions and/or consolidated itineraries in the surroundings of the property.

Image 19. Ecotourism and Environmental Education in the hydroelectric dam area of Furnas in Rio Grande in Minas Gerais

6. FIELD SURVEY (COMPLEMENTARY PRIMARY DATA)

After the environmental diagnosis of secondary data is concluded, it is of paramount importance to integrate data and information in order to minimize gaps. This process involves specialized services. The product delivered by expert teams should rely on an integrated critical analysis of the data, indicating management strategies, management proposals, threats and opportunities in managing the Environmental Assets.

7. SOCIOENVIRONMENTAL DIAGNOSIS CONSOLIDATION

After the conclusion of the work by specialized teams, we must consolidate the Socioenvironmental Diagnosis, which should include:

- Environmental zoning of the property;
- Strategic analysis;
- Proposals for asset management and management of the studied land area.

Images 20, 21, 22, 23 and 24. Field surveys are fundamental for the identification and characterization of the Environmental and Sociocultural Assets to be considered in the SLMP.

PHASE 3 – STRATEGIC ANALYSIS AND PROPOSITIONS

Once the Diagnostic phase is complete, the SLMP team has the resources and the means necessary to work on a preliminary draft of the Management Plan. This phase of preliminary preparation of the document includes six steps, as shown in Figure 6:

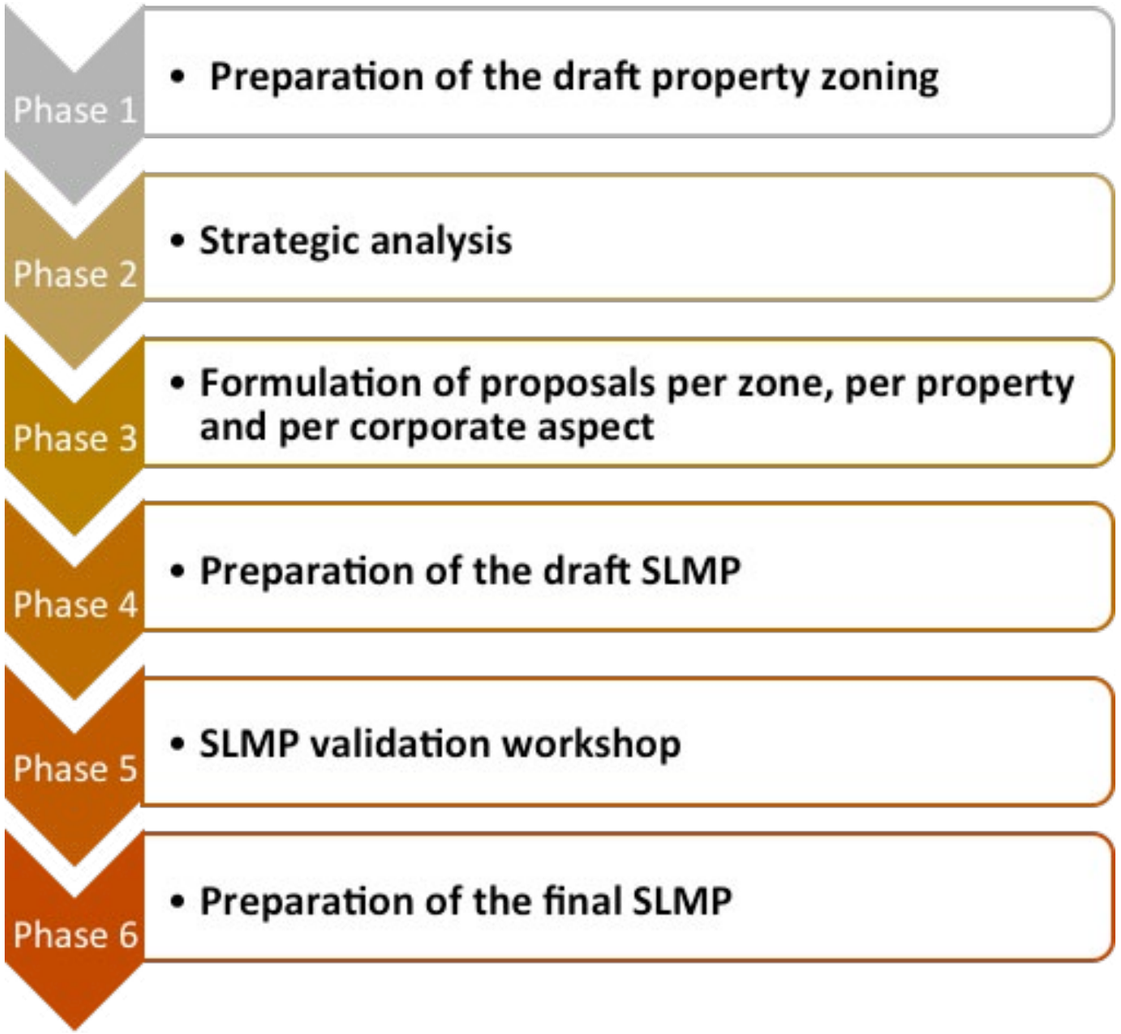

Figure 6. Phases that make up PHASE 3 – Strategic Analysis and Propositions

1. PREPARATION OF THE DRAFT PROPERTY ZONING

Zoning is an environmental planning tool that establishes specific zones, justified by criteria that define land uses, activities and differentiated processes.

The zones that are proposed in a SLMP should consider several territorial planning and environmental planning tools at the municipal, state, regional or federal level, such as: Municipal Master Plans, Ecologic-Economical Zoning, Coastal Management Plans, Watershed Plans, Conservation of Priority Areas (MMA and others), Biosphere Reserves, among others. Here, we propose general criteria for zoning, which will be implemented according to the specific characteristics of each area.

Zoning in a SLMP includes 7 types of zones:

1. Natural Zone;
2. Extensive Use Zone;
3. Recovery Zone;
4. Buffer Zone;
5. Operational Use Zone;
6. High Impact Operational Use Zone;
7. Operational Expansion Zone.

All types of zones don't need to necessarily be part of the territorial zoning of every property, but rather whenever they are appropriate or strategic for each case. Zones, defining criteria and compatible uses are described in Table 10.

All criteria are described thereafter, emphasizing that other zoning criteria may be added to the Plan.

Image 25. The property zoning should also consider the various tools of applicable legislation, such as the "Forest Code" and the Hydrographic Basin Plans

ZONE	DEFINING CRITERIA	COMPATIBLE USES*
Natural Zone	Zone that contains unchanged or slightly modified areas, i.e., areas that have a higher degree of integrity and in which there is great representation of Environmental Assets, with great potential for environmental conservation. Its primary function is to act as a biodiversity matrix and protect ecosystem integrity, maintaining its functionality, its environmental assets and associated ecosystem services. It must have exceptional characteristics, such as rare species, endangered species, sites with greater environmental fragility (wetlands, slopes, sandy soils, banks of watercourses, etc.), unique patches of vegetation, elevations, and other characteristics that require maximum protection.	Research, monitoring, protection and infrastructural work for these activities.
Extensive Use Zone	Zone consisting of natural areas with attributes that justify public use of the property, allowing for low-impact environmental changes. Its function is to promote environmental conservation and encourage visitation activities related to environmental education, scientific tourism, ecotourism, recreation, leisure and others alike.	Research, monitoring, protection, environmental education and low-impact visitation, as well as infrastructural work and equipment to support activities, such as: visitor centers, trails, signs, belvederes, cafeterias and accommodations.
Recovery Zone	Areas with significant environmental change. Once the environment has been recovered, this area should be reclassified as one of the permanent areas.	Activities for the recovery of degraded ecosystems, prioritizing natural recovery, environmental protection, environmental education and low-impact visitation.
Buffer Zone	Zone that serves either to minimize negative impacts from inside the property (e.g., noise, dust, changes in the landscape, where applicable) or those generated in the neighborhood and that could either threaten the Environmental Assets of a property, or conflict with the use and occupation of its surroundings. The length and width of the Buffer Zone should be evaluated in each case, depending on the penetration capacity of the external impact into the company's property and vice versa.	Scientific research, environmental monitoring and protection and other activities.
Operational Use Zone	This zone will house all services, administrative infrastructure and supporting activities related to the project, as well as the property's parking area and operational access routes.	Infrastructure needed for administration and operation, inspection and maintenance activities, and other services related to the project.
High Impact Operational Use Zone	This is the area within the property in which the most impactful operational activities are performed. Using cement mining as an example, this zone includes the area of the factory, mining area (active or inactive), deposit of sterile waste and other related activities. It also houses activities related to waste management, clinker production, fuel storage and handling, storage and preparation of raw materials, flour preparation, cement preparation and power supply.	Structures and processes that correspond to high-impact operational activities, according to the regulations and proposals for specific activities.
Operational Expansion Zone	Area allocated to the company's future operational expansion – according to the company's internal planning – duly licensed by competent authorities.	Temporary uses, preferably without infrastructure consolidation in view of the need for its displacement at the start of the planned expansion. As an example we can mention temporary activities such as short-term agricultural activities, deposits of raw materials, or research or recovery of the ecosystems that will eventually be modified.

* In addition to the compatible uses indicated in this Methodological Framework, the uses of each zone should be validated/supplemented during the Integrated Planning Workshop, and must comply with standards and recommendations established for each zone.

Table 10. SLMP zones, defining criteria and compatible uses

DEFINING CRITERIA PER ZONE

Zoning criteria take into account relations, processes and functions of the components of an environment, and support the preservation of the environmental heritage – especially the Environmental Asset – reconciled with the productive activity developed on the property.

Zoning criteria should be first evaluated separately, through the creation of thematic maps, and then together.

SLMP's defining criteria are based on various instruments of land management, with emphasis on IBAMA's Methodological Framework (2002), which establishes the following criteria: degree of habitat conservation, species richness or diversity, transition areas, environmental susceptibility, presence of archaeological and/or paleontological sites, potential visitation, infrastructure, and presence of people. These criteria were adapted to this framework, to which Areas of Particular Interest for the Conservation

of Water Resources, Access and Operational Expansion Planned for the Future and Pressure Vectors were added.

Degree of habitat conservation

The criterion for zoning according to degree of habitat conservation indicates conserved areas that should be included in the Natural Zone in order to ensure less human intervention. This criterion has to do with land cover, whose type will depend on the ecosystem analyzed in each study area. In general, it is recommended that land cover classes that are home to ecosystems considered rare, intact, preserved, natural or of particular interest are considered part of the Natural Zone. Additionally, properties that house high species richness, species at risk of extinction or endemic species may need a Natural Zone extensive enough to house the wildlife that uses the property habitats or the unique natural flora that can be found there.

It is recommended that altered formations identified in initial and subsequent stages be considered part of the Recovery Zone.

Environmental susceptibility

There are several criteria for assessing environmental susceptibility, land slope being one of them. Land slope can be assessed according to the percentage of the slope intervals, considering that:

- Steep slopes indicate high vulnerability to erosion;
- Grades lower than 5% are flat areas that are very fragile due to the dynamic processes of sedimentation and drainage.

Slope grades and their classification into different types of zones should be evaluated case by case, considering that when the ground is very fragile it should be considered part of the Natural Zone.

Environments of special interest to wildlife

Each environment of special interest to wildlife should be surrounded by an enveloping area (of variable radius, according to its importance and vulnerability), the extent of which should preferably be placed within the Natural Zone. Included in this category are unique environments such as islands, mangroves, salt marshes, or environments of particular interest for conservation, such as waterfalls and habitats of rare and/or endemic species. The area surrounding caves should have a radius of 250 meters, as required by specific legislation.

Areas of particular interest for the conservation of water resources

Areas of particular interest for the conservation of water resources should include at least the Permanent Preservation Areas defined by Law No. 12,727/12 amending the Brazilian Forest Code, and other related legal acts, such as CONAMA Resolution No. 303/2002. That means, there must be a 50-meter radius area around water springs and 30-meters around rivers up to 10 meters wide. Such limited areas should preferably be part of the Natural Zone.

Artistic, cultural, historical, archaeological, speleological and spiritual heritage

For listed assets, we should consider the enveloping area criterion as defined by the National Historic and Artistic Heritage Institute (IPHAN) (or corresponding state or municipal agency), which is subject to occupation and intervention constraints. In the case of the State of São Paulo, for assets that were listed before October 2003 the radius of this area should be 300 meters (State Decree 13,426 of 3/16/1979, article 137), and for assets listed after this date the enveloping area is regulated on a case by case basis (State decree 48,137 of 10/07/2003). Each location should identify the legal acts that regulate the enveloping area for the protection of cultural heritage.

For zoning purposes, non-listed artistic, cultural, historical, archaeological or spiritual sites should be surrounded by an enveloping area of 50 meters in radius and speleological sites, as mentioned before, by an area of at least 250 meters in radius, and should preferably be part of the Natural Zone.

Presence of administrative infrastructure for low or high impact operational use

The presence of infrastructure indicates the type of zone, according to its main functions.

Access Roads

Whenever there are access roads, the type of zone should be assessed case by case. For example, if its main use is touristic, the access route may be considered as an Extensive Use Zone; if it is mainly used for monitoring and protection, it can be part of the Natural Zone. Most access roads, however, will be part of zones related to the operation of productive activities.

Potential Areas with Tourist Appeal

Attractions and resources with potential tourist appeal should be part of the Extensive Use Zone. In cases in which attractions are not regularly visited or require further evaluation of environmental vulnerability, or whenever touristic activities are not part of the plan, the aforementioned resources should be included in the Natural Zone.

Operational Expansion Planned for the Future

Operational Expansion Zones are those:

- With consolidated licensing;
- That show the company's interest in future areas of project expansion, but whose environmental licensing are not yet completed.

Pressure Vectors

Pressure Vectors also contribute to refining the zoning of the property. All identified pressure vectors (example: Table 9. Indicators of a property's pressure vectors) should be analyzed in order to identify areas that are more susceptible to pressure and to inform management strategies. For that, a map of all compiled pressure vectors – both primary and secondary – should be created and organized according to the date of their identification. Pressure vectors are closely related to the delineation of the Buffer Zone, in that:

- The buffer zone serves to minimize the impacts that originate from within the property towards its perimeter;
- The buffer zone also serves to minimize the impacts that originate outside the property area towards its interior;

Artistic, cultural, historical, archaeological, speleological and spiritual heritage

As mentioned before, each of these criteria must be assessed individually, followed by the integration of the themes in order to outline the combined map and the proposed zoning.

For that, the maps should be overlaid in a Geographical Information System environment and their components must be analyzed in an integrated manner. The product of this process should be a combined zoning map, from which the limits of the zones should be determined, considering:

a) Limits identified in the field (railways, roads, rivers and others with equivalent visibility);

b) The continuity of areas served by access roads;

c) Natural boundaries such as watersheds and others.

Image 26. Burns and deforestation are among the most serious pressure vectors for the Environmental Assets.

2. SISTEMATIZAÇÃO DAS INFORMAÇÕES DISPONÍVEIS (DADOS SECUNDÁRIOS)

As part of the preparation of the Sustainable Land Management Plan, a Strategic Analysis must be performed (as defined in Box 6) using, especially, the characterization and diagnosis of the Environmental and Corporate Assets, in a way that ensures benefits both for the company and for society.

The Strategic Analysis enables us to:

a) consolidate the property's vision (social and environmental functions, legal constraints and productive goals);

b) identify possible scenarios for the management of the property with possible adjustments to the proposed zoning, and

c) consolidate management proposals (projects, activities, rules and recommendations) and identify and select those that are strategic or priority.

Aiming to streamline the Strategic Analysis from the property's vision, some guiding questions are suggested:

- **"Where are we now?"**
- **"Where do we want to be in the future?"**
- **"Where is the environment taking us?"**

In order to support decision-making with regard to the proposals – strategic and/or priority – the SLMP uses the SWOT matrix as a management tool. Its primary function is to enable the choice of an appropriate strategy – to achieve determined goals – based on a critical evaluation of internal and external property environments (SAW; TOWERS and TORRES, 2004, p. 28).

For the consolidation of the strategic analysis, the SLMP's Methodological Framework outlines four steps, which require integration with the various sectors involved in the management of the study area in an Integrated Planning Workshop, as described below:

STEP 1 – Construction of the property's vision

Step 1 focuses on the integrated analysis of:

- Legal conditions;
- Socioenvironmental functions, and
- Productive goals of the property.

STEP 2 – Construction of the SWOT matrix

This step entails the completion of the SWOT matrix. It enables the integration of the external and internal vision of the property and is characterized by the elements that are listed below and summarized in Figure 7:

- **Strengths:** Phenomena or conditions inherent to the company which contribute to or promote the fulfillment of the vision that has been determined for the property.
- **Weaknesses:** Phenomena or conditions inherent to the company which compromise or hamper the fulfillment of the property's vision.

STRATEGIC ANALYSIS: Integrates the strategic management of organizations and encompasses strategic thinking and analysis of the organization itself. Aims to draw medium and long term management strategies to ensure the sustainability of the organization, as well as equate the opportunities offered by the environment and understand the competencies of the organization. Various tools and techniques have been created to facilitate strategic analysis of organizations, including the SWOT analysis. (PORTER, M. 1986).

Box 6 – Definition of Strategic Analysis

		INTERNAL ANALYSIS	
		S **Strenghs**	**W** **Weaknesses**
EXTERNAL ANALYSIS	**O** **Oportunities**	**SO (maxi-maxi)** Make the most out of the strengths to make the best use out of the identified opportunities	**WO (mini-maxi)** Develop strategies that minimize the negative effects of weaknesses while making the most out of emerging opportunities
	T **Threats**	**ST (max-mini)** Make the most out of the strengths to minimize the effect of detected threats	**WT (min-mini)** Strategies should minimize or overcome weaknesses and, as much as possible, address the threats

Figure 7. SWOT Matrix. Adapted from Bicho de Baptista (2006).

- **Opportunities:** External phenomena or conditions which contribute to or promote fulfillment of the property's vision.
- **Threats: :** External phenomena or conditions which compromise or hamper the fulfillment of the property's vision.

STEP 3 – Definition of action proposals

The third step entails the development of action proposals – strategic or priority – to enable projects, activities, development of standards and recommendations in order to facilitate the conservation and sustainable use of the environmental and corporate assets previously identified, with emphasis on maximizing the strengths and opportunities identified by the SWOT analysis performed in Step 2.

STEP 4 – Prioritization of action proposals

The fourth step refers to the prioritization of the proposed strategic or priority actions. To guide management actions, the proposed actions will be treated according to their priority, which is evaluated by criteria of relevance and viability as explained below in Table 11:

- Relevance: the relevance scale considers 1) the extent to which the strategy seeks to repair critical situations, considering the relationship of the enterprise with the company or the fulfillment of its legal conditions; 2) if the strategy has a multiplying effect, impacting multiple targets simultaneously with a high cost-benefit ratio; and 3) if the strategy presents special opportunities for the company at the present time.
- Viability: the viability scale determines if the implementation of a strategy will require minor or major changes to the company's routine, little or great organizational and/or financial efforts, and if it can be more or less easily inserted into the environmental management chain.

		Relevance Scale		
		High (1)	Medium (2)	Low (3)
Viability Scale	High (1)			
	Medium (2)			
	Low (3)			

Table 11. Scale of relevance and viability of the SLMP strategies

The strategies will be ranked according to a scale of relevance (high, medium and low) and viability (high, medium and low). The prioritization of the strategies will be indicated according to the color classification shown in Table 11, where blue indicates the high-priority strategies that should be part of the company's initial environmental management plan. Purple indicates medium-priority strategies and red indicates low-priority strategies.

3. FORMULATION OF PROPOSALS PER ZONE, PER PROPERTY AND PER CORPORATE ASPECT

This step encompasses the development of the action proposals, which include projects, activities, rules and/or recommendations for the management of the land area. For that, we must integrate the vocation of the property with the identified assets, its zoning map and the direction resulting from the strategic analysis.

SLMP's proposals must be divided into three groups:

1. Proposals per property zone;
2. Proposals per property;
3. Proposals per corporate aspect.

4. PREPARATION OF THE DRAFT SLMP

As mentioned at the beginning of Phase 3 – Strategic Analysis and Propositions, at this point we must prepare the draft SLMP, which should include:

- Characterization of the Environmental and Corporate Assets;
- Property Zoning;
- Strategic Analysis;
- Consolidation of Action Proposals (projects, activities, rules and/or recommendations).

5. SLMP VALIDATION WORKSHOP

Upon completion of the previous phase, the team should organize a workshop to validate the draft SLMP, including the proposed zoning for the property, the directions resulting from the strategic analysis and the action proposals.

6. PREPARATION OF THE FINAL SLMP

The preparation of the final version of the SLMP should take into account the adjustments and directions resulting from the SLMP validation workshop. The preparation of the document involves the consolidation of the final text and final mapping.

Image 27. Rural landscape of sugar region in Alagoas, showing the preserved Permanent Preservation Area (APP) as an asset of the companies properties

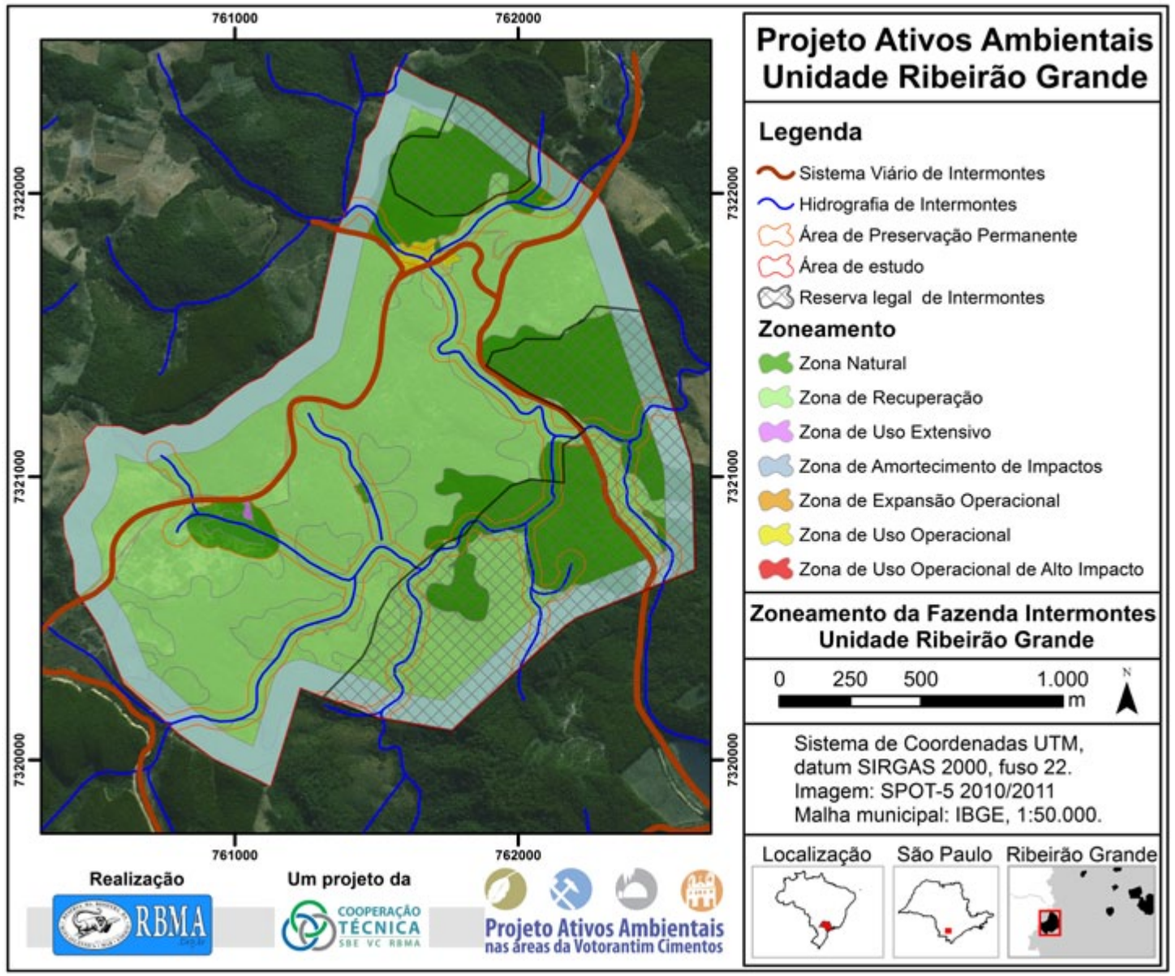

Figure 8. Fazenda Intermontes Zoning - Ribeirão Grande Plant / SP - Votorantim Cimentos

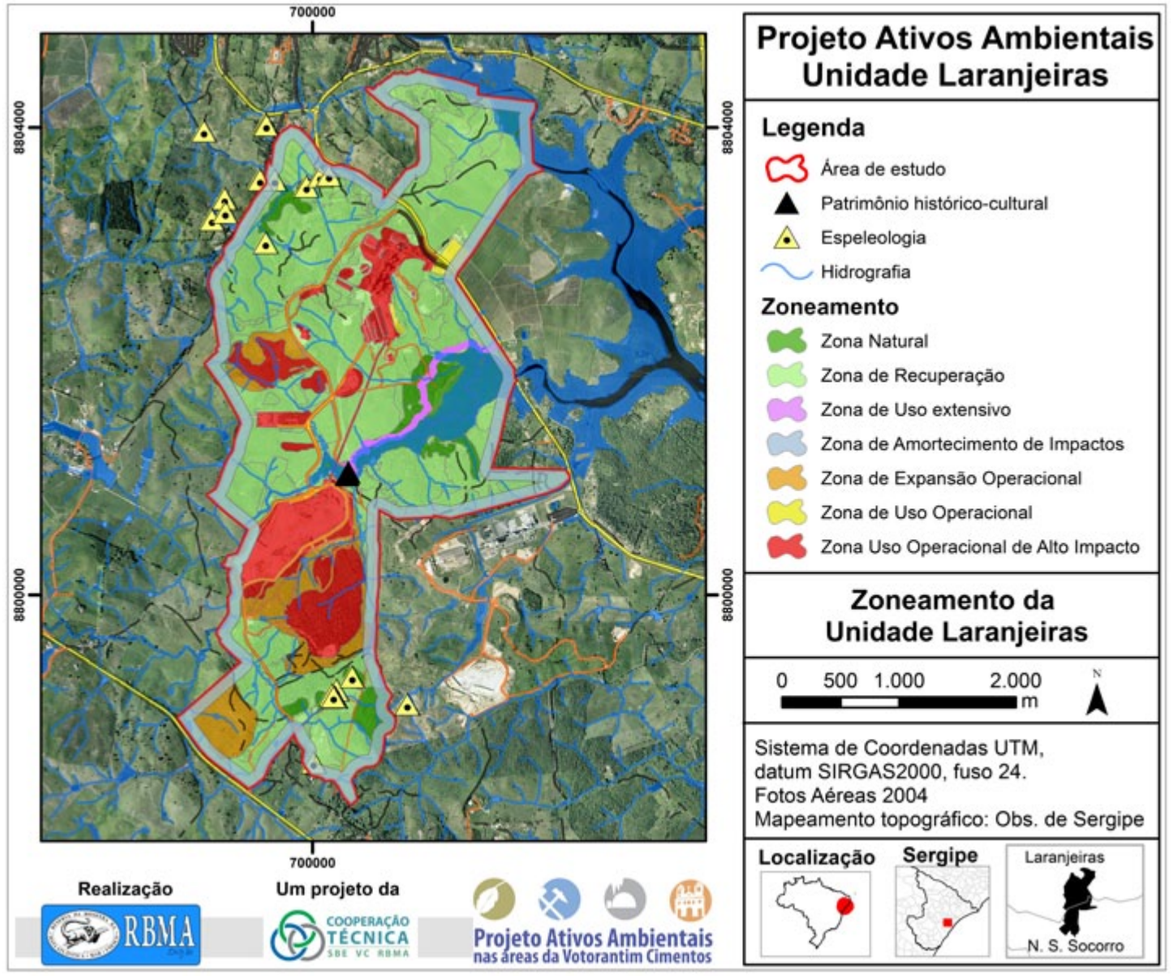

Figure 9. Zoning of Laranjeiras Plant / SE - Votorantim Cimentos

SLMP UPDATES

Given the dynamic nature of the SLMP, this instrument should be reviewed at least every five years, in order to update information such as the results of the unit's environmental monitoring, possible changes in the company's strategic planning and operational expansions, among other relevant situations.

To evaluate the effective implementation of the SLMP, in addition to specific indicators for each Environmental Asset, pressure vectors and other elements indicated in the Plan, performance and result indicators must be considered. These include:

Performance indicators

- The SLMP has been incorporated into the company's strategic planning;
- Resources for the implementation and monitoring of the SLMP have been foreseen annually in the company's budget
- Targets are being met according to established deadlines;
- The SLMP is being reviewed according to established deadlines.

- **Result indicators**
- Effective implementation of the Action Proposals;
- SLMP integration by company employees;
- Improvement of company's reputation within society;
- Achievement of the expected benefits;
- Progress in the conservation and sustainable use of environmental assets.

In figures 8 and 9, it is observed the final configuration of the zoning in two properties of VC according to its SLMP. The first one is the Fazenda Intermontes, destined especially for the forest restoration. The second area shows the zoning of the Laranjeiras Plant, which includes all the manufacturing and operational parts of the enterprise and important conservation areas as well.

FINAL CONSIDERATIONS

As a dynamic tool for the planning and management of land-based enterprises, it is important that the SLMP is integrated into the strategic planning of the organizations and their environmental policies, that it can assist companies in making decisions about their properties and that human and financial resources are provided for its effective implementation.

We should also ensure the participation and involvement of various company areas and employees, as well as the engagement of the communities surrounding the project, both in the formulation and in the implementation of the Action Proposals contained in the SLMP.

Finally, it is important to highlight that the implementation of the SLMP, in addition to contributing to the positive management of properties and their environmental assets, may become a company's differentiating asset from a social responsibility standpoint, therefore generating important and positive momentum for its image.

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TERRITORIAL MANAGEMENT PLAN SUSTAINABLE (SLMP) is a planning and making tool decision-making for companies territorial basis that aims to characterization, recovery, use of sustainable development and conservation of Environmental Assets, objectifying to contribute for environmental compliance of the enterprise, to expand its competitiveness in the most demanding from the social point of view environment and promote a permanent enhancement of the company in relationship with its surroundings and with society as a whole.

This work is an initiative of the Technical Cooperation between Mata Atlântica Biosphere Reserve (RBMA), Votorantim Cimentos (VC) and Brazilian Speleological Society (SBE).

Realization:

COOPERAÇÃO TÉCNICA SBE VC RBMA

RBMA