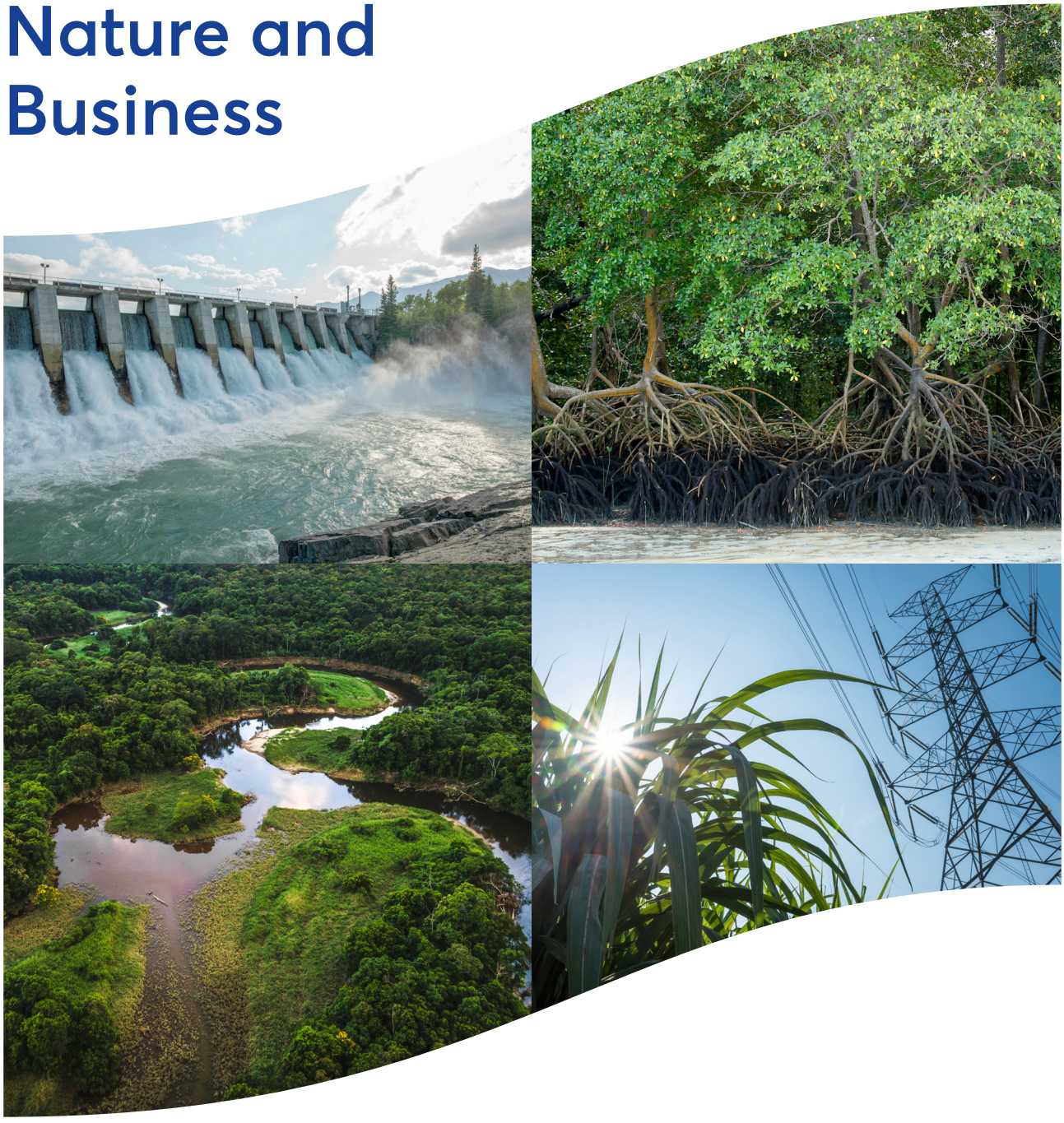
Firjan SENAI SESI IEL CIRJ

Bioeconomy, Nature and Business



NOV. 2023

Firjan
F523b Bioeconomy, nature and business / Firjan. – Rio de Janeiro: [s.n.], 2023.
24 p. : il.

1. Biodiversity. 2. Economy. I. Title.

CDD 333.95

Daisy Margareth Alcáçova de Sá Pimentel – CRB-7 # 4217

Issued by
Firjan – Industry Federation of the State of Rio de Janeiro

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NOV. 2023

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Message from the president

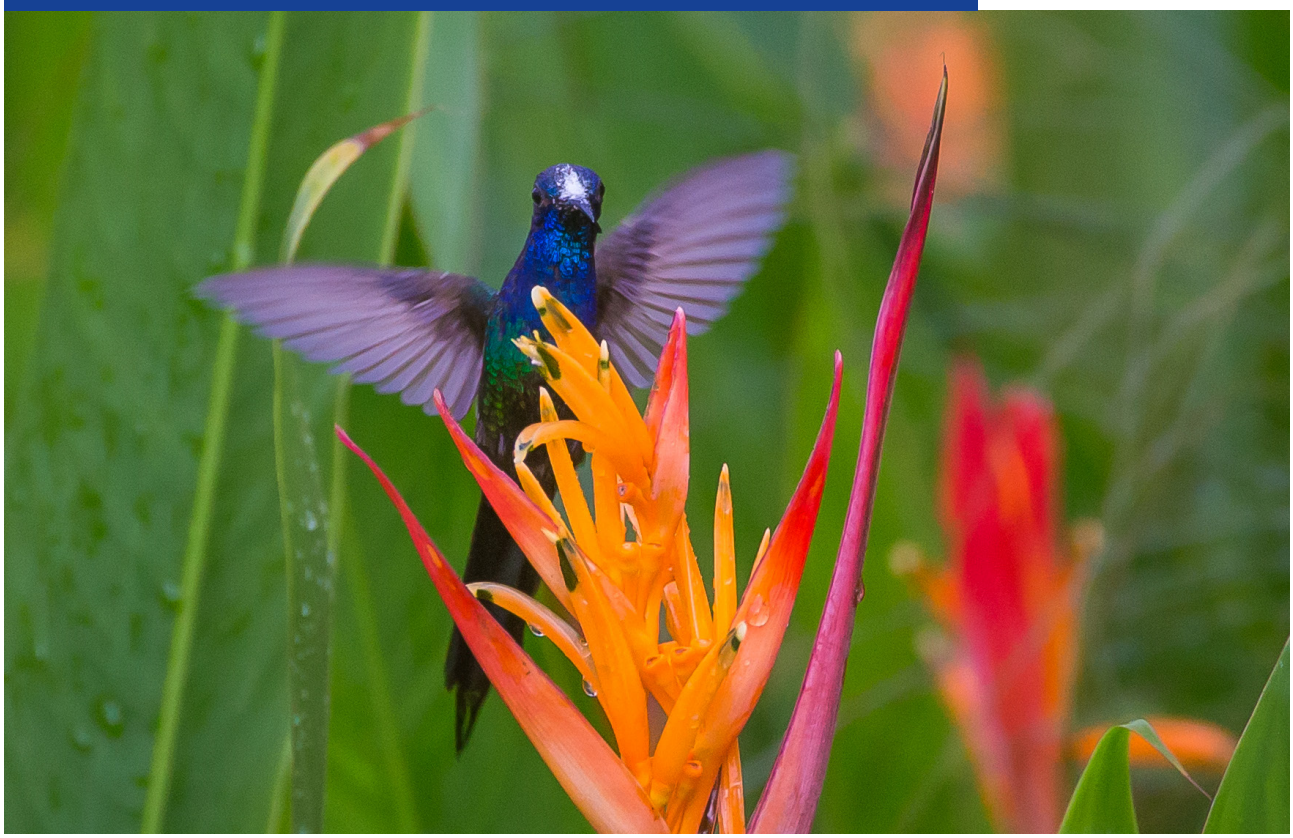
"Bioeconomy, Nature and Business" proposes an economic approach to biodiversity, exploring the connection between biodiversity and the production sector. Far from just considering the potential impacts on the natural environment, the publication highlights business gains achieved through a sustainable and responsible relationship, in which socio-environmental performance and business purpose are congruent. Brazil is a biopower, the most biodiverse country in the world. However, it is necessary to transform comparative advantages into competitive advantages. This is the challenge. Bioeconomy, a transformative agent, reveals the Brazilian vocation for bioindustry and is a fundamental part of the fight against climate change. I hope you enjoy the read.

Eduardo Eugenio Gouvêa Vieira
President of Firjan

Introduction

According to the World Economic Forum, half of the Gross Domestic Product (GDP) of the world depends on natural capital, something around 44 trillion Dollars. Because of the dependence of businesses on biodiversity and its associated services, the topic gains prominence through approaches strongly linked to the business sector and covered by environmental, social and governance (ESG) principles. Nature-based Solutions (NbS), Ecosystem-based Adaptation (EbA), Payment for Environmental Services (PES), green infrastructure for water security are examples that offer a pragmatic and material approach to this connection. The decision to simply meet legal requirements or map out a route strategically based on sustainability differentiates business as usual from those that are set out to go further. Routes outlined today will be measured in a few years and can guide a future in line with the demands of a society that has growing expectations from companies. In other words, there is no future for business as usual.

Ethics, ESG and biodiversity go hand in hand. Generating financial value at the same time as generating value for nature and people demystifies the outdated idea that business and socio-environmental performance are antagonistic. The increase in profits from businesses with a positive socio-environmental impact, for instance, speaks for itself and highlights a new mentality, with an important emphasis on the environmental, social and governance axes.
When it comes to sustainability, fragmentation by themes leaves out a series of pieces that compose a single puzzle. Creating bridges and overcoming the challenge of fragmentation optimizes the achievement of results that would not be achieved through isolated actions. Climate change, circular economy, energy transition, water security, corporate social responsibility, for example, are themes that, in line with biodiversity, bring to light new paths to be forged in favor of sustainability and business.



Hummingbird (*Eupetomena macroura*) e Pontedéria Papagaio (*Heliconia psittacorum*) in vertical filter, at L'Oréal Research and Innovation Center.

Number 1 in biodiversity

Brazil is privileged for its territorial extension and multitude of different biomes, which provide a wide diversity of its flora, fauna and other organisms. The country has the greatest biological diversity compared to others, holding 15 to 20% of the world's species, and belongs to the group of megadiverse countries - a concept used to refer to those that are home to around 70% of the world's biological diversity, according to data from the Brazilian Biodiversity Information System. **These numbers highlight the country's vocation for bioindustry, the potential of our natural capital and the challenge of transforming comparative advantages into competitive advantages.**

Furthermore, the country is highly culturally diverse, with over 200 traditional and indigenous communities, which have extensive knowledge on our fauna and flora, especially of their use and sustainable management. This denotes that all this wealth is not limited to genetic resources, but also related to the knowledge of indigenous and traditional populations regarding the properties and ways of utilizing these resources.

The use of associated traditional knowledge has extreme value for the industry, as it encourages innovation, reduces research time, and saves resources. Simultaneously, the use of traditional knowledge in resource management by the industry can stimulate and motivate conservation, sustainable use and even regeneration. It is crucial to keep in mind that sharing fairly and equitably the benefits resulting from the use of this knowledge is a key factor in the relationship established with interested parties.

Risks and competition

Impacts related to biodiversity and ecosystem services are risk factors for the production sector. However, it is a challenge to materialize how these risks affect companies. According to the World Economic Forum, three scenarios illustrate how nature-based risks affect companies, when:

1. Businesses **depend** directly on nature for their operations, supply chain performance, real estate asset values, business continuity and to ensure physical security.

2. Activities cause **negative impacts**, such as loss of customers and markets, regulatory changes, or legal actions that affect financial performance.

3. Damage to nature triggers **disruption** to society and the markets in which companies operate, generating physical risks and financial losses.

In 2022, the United Nations Conference on Biodiversity (COP 15) was held in Montreal, Canada. At this COP, a historic agreement was established to guide the fight against biodiversity loss and promote ecosystem restoration, called the Kunning-Montreal Global Biodiversity Framework.

The Global Biodiversity Framework aims to address biodiversity loss, restore ecosystems and protect indigenous rights.

The agreement has four objectives and 23 targets to be achieved by 2030. Goal 15 calls on the private sector to monitor, assess and disclose its risks, dependencies and impacts on biodiversity through its operations, supplies and value chains, and portfolios.

Learn more on: UNEP

Not acting is also a decision. The increase in population, food production, energy generation, life expectancy and profits are strongly supported by nature and associated ecosystem services. Therefore, violating planetary limits beyond the capacity of natural systems prompts us to deal with inflection points, which certainly will affect business.

But, after all, what are ecosystem services associated with biodiversity?
Associated ecosystem services are the benefits that human beings obtain from ecosystems, regardless of human activity. They can be subdivided into:

SUPPLY SERVICES: reffer to the direct supply of goods or products, such as food, water, raw materials for energy generation, genetic resources for the production of pharmaceuticals and cosmetics, and fibers for the textile sector.

SUPPORT SERVICES: these are essential for the existence of other services, such as fertilization and soil formation, nutrient cycling, pollination, biodiversity maintenance and seed dispersal.

CULTURAL SERVICES: are the non-material benefits directly obtained from ecosystems, which refer to tourist, spiritual, aesthetic, educational and recreational benefits.

REGULATORY SERVICES: are the benefits that arise from the regulation of ecosystem processes, such as: the regulation of climate and of the water cycle, waste decomposition, pest and disease control, flood control, erosion control, landslide control and air purification.

Identifying business interfaces as main causes for the direct impact on nature is an important guide for companies that base their strategy on sustainability.
According to the Intergovernmental Platform on Biodiversity and Ecosystem Services (IPBES), five anthropogenic drivers of biodiversity loss accounted for more than 90% of these losses over the last 50 years.
These drivers are:

1. Change in land and sea use.
2. Use and exploitation of natural resources.
3. Pollution.
4. Climate change.
5. Invasive exotic species.

Identifying which human actions cause the most damage is an important step in decision-making. After all, the understanding that companies impact and depend on natural capital is an important driver of actions.
However, the integration of natural capital in business management encompasses not only risks - economic, physical, market, regulatory or reputational - but also benefits and opportunities.
According to this perspective, it is appropriate to explore the connection between nature and business, focusing on the economic benefits of biodiversity and associated ecosystem services, as well as the different strategies for incorporating natural capital into business operations.

Climate resilience

Climate resilience can be described as a set of initiatives and strategies that allow adaptation, in natural or man-made systems, to a new environment, in response to current or expected climate change, according to the Brazilian Climate Change Policy. It is an adaptive capacity of systems, which respond, reorganize, or transform themselves, to maintain their essential function, identity and structure (as well as biodiversity when it comes to ecosystems).

Climate change impacts natural systems in the most varied ways, and these systems tend to absorb, integrate, and manage these changes, establishing a new balance, instead of working back to reestablish initial conditions.

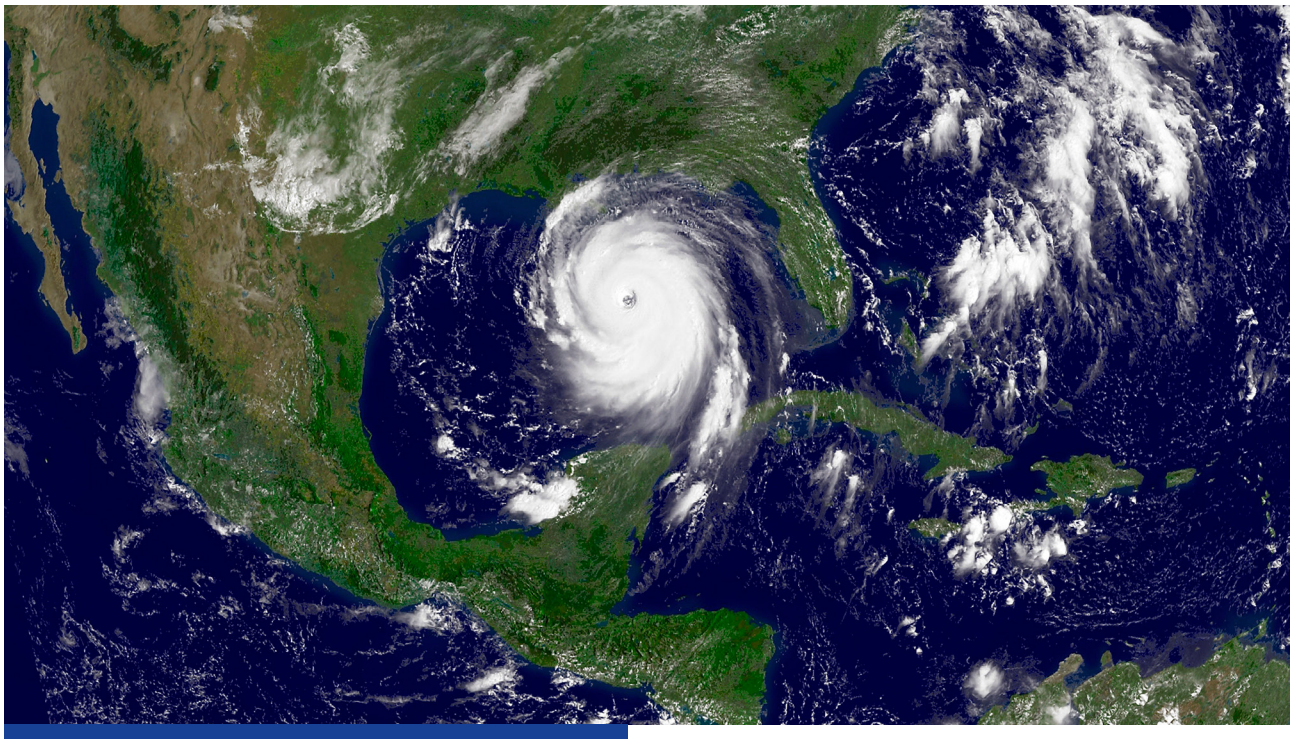
Climate resilience is directly related to climate change, and actions and efforts must include social, economic, technological, and political strategies. The implementation of these strategies seeks to reduce the climate vulnerability to which many natural systems and communities are exposed.

The development of resilient structures can reduce the impact caused by the side effects brought on by natural disasters and by changes in ecosystem services, water, and food insecurity.

Some examples include resilient infrastructure, agricultural practices, and economic development, making natural systems more resilient to heat and cold waves, droughts, coastal flooding and sea level rise, cyclones and strong winds, among other adverse events.

Implementing Nature-based Solutions in a systemic way contributes to mitigating impacts and adapting systems to disasters associated with climate change, strengthening the resilience of natural systems, and protecting vulnerable communities and cities.

These solutions represent an important contribution to the achievement of the UN Sustainable Development Goals (SDGs) as they generate several benefits for people, the economy, and the environment through specific objectives, such as the improvement of water security; sustainable agriculture, cities and communities; infrastructure innovation; decent work; and action against global climate change.



Nature-based Solutions (NbS)

Working with nature and not against it is an intelligent and effective way to obtain results, especially for the productive sector. After all, in a sophisticated way, nature has accumulated billions of years of experience in providing ecosystem services.

According to the International Union for the Conservation of Nature (IUCN), Nature-based Solutions (NbS) are actions that use natural or modified processes and ecosystems to address society's most pressing challenges, such as water supply risks, floods, landslides, and food insecurity. In other words, they are actions inspired or based on nature that generate benefits for biodiversity, human well-being, and socioeconomic development.

NbS hold the potential to address the most urgent challenges of our time: water supply, sanitation, urban drainage, waste treatment, protection against natural disasters, mitigation, and adaptation to climate change. They are important developers and drivers of economic sectors, such as construction, sanitation, infrastructure and specially the strengthening of the production chain, reducing costs, improving processes, increasing efficiency, **simplifying operations, and even simplifying the environmental licensing process.**

According to the IUCN, for a solution to be considered Nature-based, it must meet 8 principles:

1. Address society's challenges.
2. Be based on scale and consider interfaces and stakeholders.
3. Result in benefits for biodiversity and ecosystem integrity.
4. Be economically viable.
5. Abide by inclusive, transparent, and empowering governance processes.
6. Equitably balance the trade-offs between achieving its primary objective and the continuous provision of multiple benefits.
7. Adopt adaptive management in response to uncertainties, enabling the exploitation of ecosystem resilience.
8. Be sustainable in the long term and aligned with the legal framework, in accordance with national and sectoral policies.

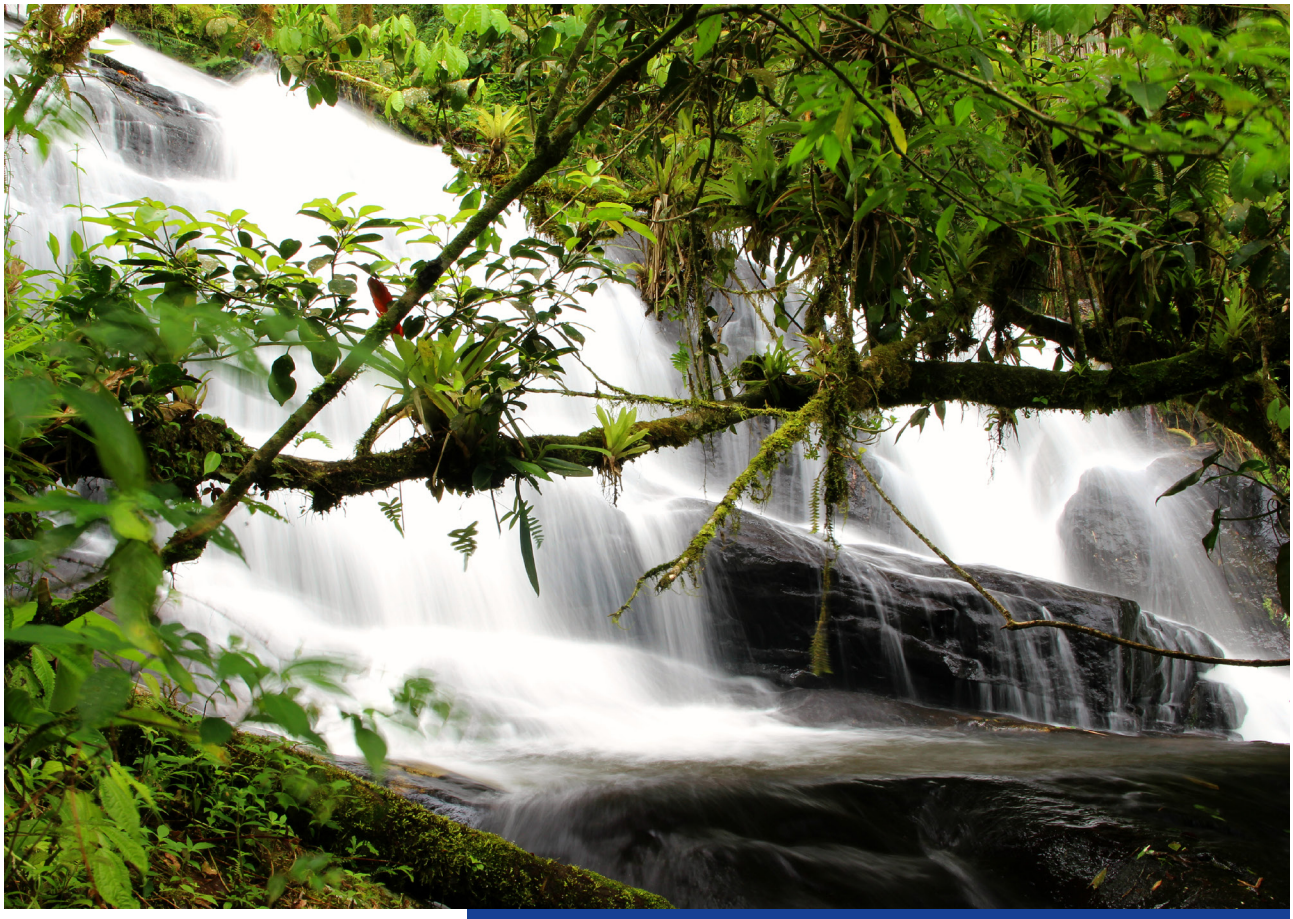
Often, adopting Nature-based Solution requires reflecting upon the ways in which green (natural) and gray (traditional) infrastructure, **together**, represent the best cost-benefit. It does not antagonize the different types of infrastructure; it plays on their complementarity. For example, to adapt nature-based technologies to urban environments requires piping, concrete, waterproofing, filters, ditches, tanks, pumps, aerators, valves, pumping stations, and other traditional structures that are widely known and essential for the system's functionality.

NbS in rural environments also imply impacts on the urban environment. After all, there is a connection between nature and the productive sector, which is not always evident. The supply of water used by industries, for example, comes from sources that depend on preserved forests, often located kilometers from where business takes place. Therefore, water management goes far beyond company walls. Industries depend on nature. They depend not only on quantity, but also on quality and regulation of supply, especially in a scenario where climate events will become more extreme and increasingly frequent.

In the context of climate change mitigation, NbS play a leading role in addressing the most urgent challenges, especially carbon capture through forests. NbS are considered by the most important global environmental forums to be one of the main ways of offsetting carbon emissions, both in terms of environmental benefits and revenue generation.

Natural Infrastructure for Water Security

Reservoirs and water treatment plants are essential for managing human supply and for supplying the productive sector. However, they are not responsible for providing water. We attribute production to the conservation of healthy ecosystems and forests and to biodiversity.
This natural infrastructure provides ecosystem services essential to water security, responsible not only for the quantity of water, but also for its quality and regulation of supply, avoiding peaks of scarcity or overflow.
To talk about natural infrastructure for water security is to talk about nature and the management of natural capital. Evidently, when we talk about water security, several actions are necessary, such as combating losses, efficiency in water use, management of internal processes and reuse. Natural infrastructure must be considered in this regard, as it provides a structuring and long-term solution, in a context where demand is growing, supply is decreasing and in which there is an urgency to balance this scale, as climate events tend to become more frequent and extreme.
Green infrastructure complements gray infrastructure. It can create solutions even before water reaches treatment plants, helping to reduce costs and pollution, to increase process efficiency, eliminating steps, reducing dependence on chemical products, delivering greater simplicity in operations, in addition to being a strong ally in the treatment of effluents.



Ecosystem-based Adaptation (EbA)

Around the world, different approaches have been adopted to help human populations adapt to climate change. Amongst them is Ecosystem-based Adaptation (EbA).

The concept of EbA was presented at the 10th Conference of the Parties (COP 10), in 2009 by the UNFCCC, in the context of the United Nations Convention on Biological Diversity (CBD), which defined it as follows:

"Ecosystem-based Adaptation is the use of biodiversity and ecosystem services as part of an overall adaptation strategy to help people adapt to the adverse effects of climate change."

Protected natural ecosystems are crucial for climate resilience and have a greater capacity for resistance and recovery when affected by extreme climate situations.

Ecosystem-based Adaptation combines adaptation to climate change with the management of natural areas. It is one of the existing adaptation strategies, which can be combined with others, with the objective of mitigating and adapting to climate change through the maintenance and recovery of environmental services, and the conservation of biodiversity.

It is a people-focused approach that seeks to reduce the vulnerability of communities, providing opportunities for conservation, recovery, and sustainable use of ecosystems to generate environmental services.

Payment for Environmental Services (PES)

Payment for Environmental Services (PES) is an economic instrument that rewards and encourages rural producers, who take care of nature and contribute to the supply of water, which includes the supply for companies as well. It is a value-adding component, because in addition to environmental improvement, it brings about an important increase in quality of life, as it contributes to the quantity and quality of water for human supply and also for companies, in addition to generating employment and income, protecting forests, conserving biodiversity and storing carbon.

From an economic standpoint, payment for environmental services is a voluntary transaction, with free negotiation between payer and provider, allowing payments to be made by different actors, such as: the private sector, the public sector, the third sector, by individuals and legal entities, both national and international.

Different payment methods can be used, such as: monetary or non-monetary; direct payment; social improvements to rural and urban communities; compensation linked to REDD (Reduction of Emissions from Deforestation and Forest Degradation); Green Bonds; free-lease agreements; and the environmental reserve quota (CRA).

In 2021, a Brazilian Federal Law (Lei n° 14.119) was enacted, establishing the National Policy for Payment for Environmental Services. It stands out for its guiding and incentive nature, complementing the command-and-control instruments for nature conservation. It makes a positive contribution to productive activities, whether by encouraging the definition of metrics related to ecosystem services linked to business, or by contributing to projects aimed at water security. Furthermore, it contributes to the generation of new businesses, as it allows the private sector to act not only as a financier, but also as a provider of environmental services and as project manager.

The Policy highlights the need to build a culture where business management reaches beyond the walls of institutions, since production chains are dependent on ecosystem services, which can represent either profits or losses. The private sector is faced with the opportunity and urgent need to incorporate the valuation of natural capital into its business strategy.

When promoting conservation and recovery actions for native vegetation, as well as conservation of urban remnant patches, recovery, and restoration of plants in degraded areas, sustainable management of agroforestry systems and conservation of landscapes of great scenic beauty, one must consider their potential to contribute to the fight against climate change.

Bioeconomy – a different outlook on nature and business

To approach the bioeconomy, it is important to understand that there is no single, finished concept. According to the WRI (World Resources Initiative), bioeconomy is an emerging term, still in dispute, with multiple definitions, that has been standing out in the economic, political and scientific agendas.

Proposed in 1970 by economist Nicholas Georgescu-Roegen, the concept of bioeconomy gained notoriety in 2017 as a solution for mitigating greenhouse gas emissions and energy transition, without necessarily focusing on the conservation and promotion of biodiversity. Organizations such as the OECD (Organization for Economic Cooperation and Development) and the EU (European Union), for example, used the term to speak of energy transition and the replacement of fossil fuels with biological inputs.

The term bioeconomy gained momentum when used in European economic policies, which allows for the assumption that it was not designed with biodiversity conservation in mind nor for biodiverse countries. However, according to the World Economic Forum, bioeconomy depends on biodiversity as its driving force. Thus, a paradox emerges when one considers bioeconomy without consideration to the aspect of biological diversity or when it is reduced to merely a linear economic approach regarding the use of resources. This paradox is even more enhanced when highly diverse biomes are involved.

Furthermore, the bioeconomic approach can differ depending on the context in which it is applied. For example: economic activities carried out in degraded areas will have different rules and possibilities than those carried out in forests, where innovation must go hand in hand with conservation, with the rights of traditional/indigenous populations and with the promotion and protection of forests.

As bioeconomy is a term that is still in development, different concepts point to different approaches:

Biotechnology Bioeconomy	Bioresources Bioeconomy	Bioecological Bioeconomy
Use of intensive technologies in science, research, product and process development, followed by commercialization in a linear model, such as carried out in access to genetic heritage and the production of drugs that uses feedstack that comes from biodiversity.	Use of products provided by nature is driven by innovation and the balance between economic growth and sustainability, with collaborative interaction between sectors in a less linear model. It is highly dependent on scientific research and development. Based on biomass, without focusing on the economic potential that can be provided by biodiversity, with greater attention to standardization and productivity, such as economic forestry.	Strong commitment to sustainability, promotion of biodiversity and associated ecosystem services, prevention of soil degradation, circular approach to processes, use of energy, matter and waste, as well as focus on research, innovation, productivity gains, cost reduction and social justice, such as technologies applied to Nature-based Solutions (NbS).

Source: World Resources Institute (WRI)

For Firjan, bioeconomy is a sustainable economic approach, aimed at different sectors and centered on the use of biological-based resources, processes or technologies.

Bioeconomy is strongly linked to circular economy, energy transition and combating climate change, which strongly contribute to the transition to a low-carbon economy. In this context, renewable energies, such as biofuels/biomass, bioproducts, biomaterials, chemicals of biological origin, valuing standing forest, in addition to green technologies such as Nature-based Solutions, place Brazil in a promising position as a biopower within the international context and a strong candidate to take on the role of a global leader in bioeconomy.

Bioeconomy is an essential pillar in the era of neo-industrialization, as bio-based products and processes play a crucial role in the ESG agenda, due to their contribution in the achievement of the SDGs. Current global trends point to the growth of sectors such as sustainable aviation fuel (SAF), green diesel (HVO - Hydrotreated Vegetable Oil), sustainable and low-carbon hydrogen and agroforestry systems, which contribute to the maintenance of forests.

Identifying opportunities and the potential of bioeconomy is a positive factor for competitiveness in the private sector. In a megadiverse country, an economic model based on science, technology, innovation, and the sustainable use of biological resources plays an important role in transforming comparative advantages into competitive advantages, as mentioned previously.

Success cases

SENAI Institute of Innovation for Green Chemistry

SENAI Institute of Innovation for Green Chemistry brings forth innovative solutions for industries through applied research. It operates in lines of research that enhance the development of processes and products according to market's demands. Furthermore, it promotes sustainable growth of the industry in green chemistry as an accelerator of innovation. The Institute works on research, development, and innovation (RD&I) projects in the most diverse sectors, focusing on industries that need green chemistry solutions. It works with innovation projects in bioeconomy, such as the reuse of urban solid waste to produce sustainable biofuels, development of new bioproducts from waste from the Amazon pulp, oil and butter sectors. In partnership with a startup incubated at the Institute, it has optimized the production process of a

sponge that absorbs oil present in water, produced from palm waste, which has become one of the main products designed for this purpose globally.

Action Gestão Ambiental

Action Gestão Ambiental treats sanitary effluents, from different sources, through a physical-biological system using aeration ponds. During the process, microorganisms are oxygenated by aerators, which consume the organic load. A pond, which hosts fish that act as bioindicators, is part of the system. The effluent treatment station is monitored by specialists who, daily, carry out analysis to control and monitor the efficiency of the process. The reused water, rich in nutrients, which results from the treatment process, is released into the water body. Part of it is directed to fruit fertigation. It also contributes to the circular economy, as organic and family farming from the same area are also benefited.

Source: Action Environmental Management

AmBev

The Watersheds & Forests program is one of AmBev's most ambitious initiatives within the Water Platform. Its mission is to collaborate with the recovery and preservation of important watersheds in Brazil. Through a comprehensive diagnosis of each basin, it brings together a series of partners and draws up a local plan with efforts that include environmental education, ecological restoration, conservation practices and PES. It currently operates in seven regions of Brazil. The main areas of activity of Watersheds & Forests are: forest restoration and conservation; soil conservation and use, access to water, rural sanitation; training and environmental education. In the state of Rio, it operates in the Guandu Hydrographic Basin, in partnership with the Watershed Committee and The Nature Conservancy (TNC).

Source: AmBev

Assessa

Assessa develops and produces ingredients derived from Brazilian biodiversity and other sustainable botanical sources for cosmetic product formulators. The company is a pioneer in the development of water extraction and the use of biocatalysis and biotransformation to obtain products. In its "Green Beauty" strategy, the company focuses on the different processes throughout the production chain, from the origin of products, for which it establishes criteria for obtaining ingredients from renewable sources and tracks the raw materials used in production, all the way up to consumption and disposal. Assessa is also the promoter of social action, with it being at the forefront of the use of tropical algae of sustainable origin to create cosmetic ingredients, whose raw material is obtained from fishing communities in remote areas of the Brazilian coast, free from pollution, where the majority of those involved are women to whom the profit obtained represents an important complementary source of income.

Source: Assessa

Braskem

Braskem, a pioneer in the production of thermoplastic resins from renewable sources, launched the first plastic from renewable sources produced on an industrial scale in 2010, a polyethylene made from sugar cane, I'm green™ bio-based. Sugarcane captures CO_2 from the atmosphere and products produced with I'm green™ bio-based polyethylene store CO_2, thus contributing to the mitigation of climate change. Bio-based plastic is an alternative to fossil fuels, reducing greenhouse gas emissions throughout the production chain. The polyethylene resins in the portfolio share the same characteristics as conventional ones, eliminating the need for investment in new plastic processing machinery, since it can be recycled alongside traditional polyethylene in existing recycling systems.

Source: Braskem

Boticário Group for Nature Protection Foundation

Created by the Boticário Group for Nature Protection Foundation, the Viva Água Guanabara Bay Movement is the result of a collective construction alongside the public, private and third sector in the state of Rio, led by the Foundation, Firjan and Inea. Its efforts focus on the conservation and recovery of natural ecosystems and the transition to a regenerative economy by supporting entrepreneurship with positive socio-environmental impact and creating innovative financing mechanisms with a focus on SbN for water security and marine coastal resilience. The movement launched a private philanthropic fund, the Viva Água Fund, with an initial contribution of R$1.5 million to structure a financial ecosystem to support initiatives and businesses in the territory. In the search for innovative solutions for ecological restoration, it launched the Viva Água Lab, which resulted in three initiatives, which received funding of R$ 800 thousand; Natureza Empreendedora, an acceleration program that strengthened 25 businesses with positive socio-environmental impact; and the Consílio das Águas, which amplifies cooperation between small and mid-sized companies. The Humanize Institute, Guanabara Bay Watershed Committee and IDG are also part of the Movement, in addition to an impact network composed by 18 other institutions.

Source: Boticário Group for Nature Protection Foundation
Credits: Suzanna Tierie

Greenpeople

For its juice production, Greenpeople uses fresh fruit throughout its production chain. They purchase part of its vegetables from local producers and use cold extraction and pressurization methods. They practice upcycling by reusing the fruits and vegetables leftover from the juice pressing process to produce crackers and teas. In partnership with local farms, the organic waste is used for composting and animal feed. They also partner with food and cosmetics companies to transform fruit and vegetable waste into ingredients and raw material for cosmetics. The company is part of Firjan's plastic circularity program, in which all plastic use is compensated through recycling.

Source: Greenpeople

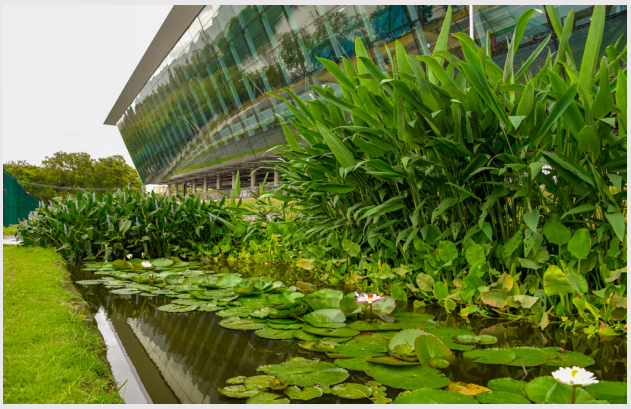
Let's Fly

Let's Fly uses larvae of the Black Soldier Fly (*Hermetia illucens*), which feeds on organic waste, transforming larvae into energy. As they contain antimicrobial peptides that eliminate bacteria that could potentially harm animal or human health, the larvae can be consumed fresh by fish, birds, and reptiles; dried; in oil form; or in the form of protein flour. Considered a superfood, the Let's Fly product has high nutritional power and a high concentration of high-quality proteins and fats. It can be used in the manufacture of ingredients for pet food, as well as for replacing traditional sources of protein that put pressure on the natural environment. It is also rich in phosphorus, calcium, lauric acid, omega 3 and chitin. In addition to animal feed, it can be used in the production of fertilizers, cosmetics, biofuel, and even human food, if specific regulations are met.

Source: Let's Fly

L'Oréal

The L'Oréal Research and Innovation Center, in Rio de Janeiro, treats its industrial and sanitary effluents in a system called Wetlands, which uses different species of plants, combining treatment and landscaping. This is an NbS technology, designed by Phytorestore, which does not use chemical additives and does not generate contaminated waste, such as the slit characteristically generated by conventional systems. Effluent degradation begins in the root zone, which has microorganisms that transform pollutants into elements that nourish plants without contaminating them. The system is odor-free and uses gravity to move the water throughout the system, which saves energy and enables the reuse of water without discharging it into the receiving body. This NbS uses species with characteristics suitable to local climate, and which are necessary to obtain the appropriate parameters, at the same time as it creates an ideal and attractive environment for the occupation of the flora and fauna,



Source: L'Oréal Research and Innovation Center

in a manner integrated with its surroundings, creating an environment that both restores biodiversity and is a space for coexistence. Because it does not use chemical additives and only requires simple maintenance, the technology has reduced operating costs when compared to conventional effluent treatment systems, which, in turn, allows for the simplification of environmental licensing.

Madre Frutos

Madre Frutos is a social enterprise, initiated and maintained by the Sinal do Vale Institute with active participation of the local community, comprised especially of women. Sinal do Vale is a center for regeneration of people, communities and ecosystems located in the Baixada Fluminense in Rio de Janeiro. The social enterprise collects, processes and sells green jackfruit-based products, promoting sustainable jackfruit management, food security and female empowerment in the community by hiring women, many of them heads of families. As the jackfruit tree is an exotic species in the Atlantic Forest Biome, with around 100 to 500 seeds and a high germination and propagation rate, its sustainable management promotes the protection of local biodiversity. With high nutritional value, the fruit, when

Source: Madre Frutos

not yet ripe, has a neutral and versatile flavor, resembling different types of animal meat, and represents an important alternative for the food industry.

Mancha Orgânica

Operating in the paint and toy sector, Mancha Orgânica creates and produces products free of toxic components, heavy metals and petroleum derivatives. Mancha's 100% vegetable-based paints uses pigments from Brazilian biodiversity, are water-based and extracted from seeds, fruits, roots, leaves and flowers, respecting the aspects of circular economy, from harvest to final destination. The company currently holds seven color options: urucum red; saffron yellow; matte green; hibiscus lilac; cocoa brown; butterfly bean blue; and beetroot pink. The paints can be used for artistic purposes, such as painting on canvas, wood, and paper, and are mainly aimed at children. They stimulate cognitive and sensory-motor development with their natural aromas and textures. Finally, the product also contributes to environmental education, by highlighting animals (mascots) in a state of vulnerability and the country's main biomes. As a biotechnology company, Mancha Orgânica also offers sustainable alternatives for sectors that have a demand for innovation in pigments, such as textiles, packaging, and cosmetics.

Source: Mancha Orgânica

OceanPact

Sponsored by OceanPact, Guanabara Verde is a project carried out by Guardiões do Mar in partnership with Mar Urbano Institute to restore mangroves in the Guapimirim Environmental Protection Area, in the Guanabara Bay. In terms of climate resilience, mangroves are essential in the adaptation to extreme weather events, the protection of coastal areas and impacts mitigation, in addition to playing an important role in carbon sequestration. Furthermore, Guanabara Verde has carried out the restoration of 12.2 acres, planting 30.5 thousand trees. It also plays an important role in environmental education, by highlighting the high productivity of mangroves, their role as a "nursery of the sea", that is, as an area of shelter, reproduction, development and nutrition for various species, in addition to the provision of resources and ecosystem services essential to economic activities.

Source: OceanPact

Niterói City Hall

Orla Piratininga Alfredo Sirkis Park (POP) uses Nature-based Solutions NbS to treat the river and rainwater that flow into Piratininga Lagoon, Niterói. The water from the three urban watersheds that flow into the lagoon, Cafubá, Arrozal and Jacaré, is intercepted before it reaches the lagoon by wetland systems consisting of a spillway, sedimentation basin and wetlands. Through phytoremediation, the wetlands prevent sediments, pollutants, and nutrients from reaching the lagoon. The Park's proposal also includes other types of NbS such as biovalets, restoration of native vegetation, protection of wetlands, maintenance of ecological corridors, requalification of drainage channels, as well as urban requalification of the surroundings of the Piratininga Lagoon. Human use and quality of life are also the focus of the POP works, with the insertion of a landscaping element, consolidating an important social aspect to the park, through the implementation of cycle paths, walking trails, parks for senior citizens, children's playgrounds, contemplation piers, fishing piers, viewpoints, leisure areas, sports courts, a gym, children's toy area, and an Eco Museum with a revival of local history.

Source: Niterói City Hall

Porto do Açu

The circular economy project compost organic waste generated by the company's operations, previously sent to landfills, and the fertilizer produced is used to restore the surrounding *restinga*, replacing the use of conventional fertilizers. In addition to eliminating the disposal of organic waste in landfills, the project also contributes to facing another major environmental challenge in the country, the conservation of its *restinga* forests remnants in the Private Natural Heritage Reserve – Reserva Caruara. The project demonstrates leadership in promoting sustainable waste management and creating opportunities to save resources for other projects in the port complex, increasing ESG performance.

Source: Porto do Açu

VideVerde

In the context of circular economy, research and innovation, VideVerde transports and composts organic waste transforming it into compost, which they use in their organic food culture and commercialize. Composting occurs on an industrial scale, which uses waste collected from large enterprises, such as airports, hospitals, industries, restaurants, large companies, supermarkets, and shopping centers. The process creates the option for composting organic material in 60 days, a process which, comparatively, would take several years in traditional landfills. Earthworms are not used for composting, but rather microorganisms that degrade organic waste. For transparency purposes, the customer is charged per kilogram of waste.

Source: VideVerde

Final remarks

The success cases presented highlight efforts already carried out by the productive sector and offer pragmatism and materiality to the economic approach to nature and biodiversity, considering the different aspects of sustainability, such as circular economy, the fight against climate change, water security and socio-environmental impact and socio-environmental vulnerability management. We hope that this publication will be a guide and inspiration for other initiatives that seek to balance financial priorities and the socio-environmental aspects of companies.

Topics such as: risks and competition; climate resilience; Nature-based Solutions; natural infrastructure for water security; Ecosystem-based Adaptation; Payment for Environmental Services and bioeconomy set the tone of the publication and play an important role in business. In face of the climate emergency, this publication is an important milestone and argues for biodiversity as a solution in a regenerative economy and for the neo-industrialization of Brazil, in addition to being an instrument that aims to stimulate and motivate industries to incorporate nature into business strategies.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