Biodiversity in Latin America and the Caribbean **Edited by:** MATÍAS MASTRANGELO · ANGELO ATTANASIO · IRENE TORRES UICN Latinoamérica21



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The Inter-American Institute for Global Change Research (IAI) is an intergovernmental organization with 19 Parties in the Americas that promotes transdisciplinary research and the enhancement of capacities to improve public aware-ness. The IAI also provides information to governments for the development of public policy, which is relevant for a global environmental change based on scientific excellence, international and intersectoral cooperation, and the open exchange of knowledge. As part of its strategic plan 2019–2044 (www. iai.int/pdf/en/Strate-gicplan-en.pdf), the IAI Directorate also hosts the Belmont Forum Secretariat.

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Index

7 ► PREFACIO

CHAPTER 1

10 - BIODIVERSITY STATUS IN LATIN AMERICA

- 11 What is the 'empty forest syndrome' and why it should concern us
- 15 Mining is turning the Amazon into a desert
- **19** ► The "green polar bears": The silent extinction

CHAPTER 2

23 - IMPORTANCE OF BIODIVERSITY FOR PEOPLE'S QUALITY OF LIFE

- 24 Why are several Andean countries suffering their major water crises at the same time?
- 28 Climate-biodiversity-water nexus: the protection of ecosystem services in South America
- 32 The vital role of soil diversity for sustainable agriculture
- 35 Biodiversity and Health: Thinking Broadly and Working Efficiently

CHAPTER 3

39 - TOWARDS MORE INCLUSIVE AND EFFECTIVE BIODIVERSITY CONSERVATION

- 40 Recuperating the meaning of 'life' in biodiversity conservation
- 44 What is Inclusive Conservation?
- 48 Why are indigenous lands key to conserving biodiversity and mitigating climate change?
- 52 Integrating knowledge for the conservation of Amazonian biodiversity

CHAPTER 4

56 - Perspectives for biodiversity conservation in Latin America

- 57 Will the new global biodiversity agreement be another failed effort?
- **61** Peace and Nature: Reflections from imperfection
- 64 > The region's potential to lead the transition to a sustainable blue economy
- 68 A story about lithium and asymmetric global transformations
- 72 International trade and biodiversity loss in Latin America: part of the problem and part of the solution?

76 ► POSTFACE



Preface

MATÍAS MASTRÁNGELO

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he diversity of genes, species, and ecosystems positively contributes to our well-being by providing us with healthy food and medicine, protecting us from extreme environmental changes, and offering opportunities for connection with nature and other people, among many other benefits. Despite the importance of biodiversity for our quality of life, species extinction and ecosystem degradation are progressing at an accelerated pace worldwide, particularly in Latin America and the Caribbean (LAC). According to the 2024 report from the Living Planet Index, LAC has seen a 95% decline in wild vertebrate populations over the last 50 years. Given the high dependence of LAC economies on their natural capital, the significant loss of biodiversity in the region brings about impacts and risks for its inhabitants, especially those with lower levels of material, economic, and social well-being.

In response to this, multiple initiatives from political action and scientific research have advanced efforts to halt and reverse this trend. From the multilateral policy level, the Kunming-Montreal Global Biodiversity Framework proposes targets and goals for realizaing effective and equitable conservation, sustainable use, and restoration of nature by 2030. From the science-policy interface, the intergovernmental scientific-normative platform on biodiversity and ecosystem services (IPBES) synthesizes knowledge to help countries make informed decisions. These global initiatives underscore the importance of integrating political action and scientific research at regional and local levels to help LAC recover its biodiversity and leverage it as a key element in achieving sustainable development.

In this context, the Inter-American Institute for Global Change Research (IAI), the International Union for Conservation of Nature (IUCN), and Latino-américa21 (L21) have teamed up to produce this compendium on Biodiversity in Latin America and the Caribbean. This publication aims to communicate to a broad audience informed opinions from science and local knowledge on the state and importance of biodiversity in LAC, as well as new perspectives and approaches for effective and inclusive conservation. L21 trained the authors of this compendium to effectively communicate their knowledge and experiences—built through their participation in IAI and IUCN programs and projects—to non-specialized audiences.

The IAI's mission is to promote regional cooperation, knowledge sharing, and capacity building for the sustainability of the Americas. To fulfill this mission, the IAI has funded numerous collaborative research programs and projects on global change in the Americas, many of which have focused on biodiversity. In fact, IAI-funded projects and programs have produced over 250 publications on biodiversity and ecosystem services in the past 10 years. Additionally, an evaluation conducted by the IAI and published in 2024 showed that biodiversity and ecosystem services are among the top priorities of the region regarding global change. This compendium was structured into four chapters according to these priorities.

The first chapter presents three articles that describe situations faced by ecosystems and their biodiversity in LAC and the world, clearly reflecting the magnitude and severity of the problem. The articles by Arcos and Garcia-Villacorta provide vivid images of the empty forests and biological deserts created through human activities in the most biodiverse biome on the planet: the Amazon. In line with the findings of the global IPBES assessment, these authors show that land-use changes driven by industrial agriculture, livestock, and mining are the main human activities causing biodiversity loss. Unlike the apparent absence of wildlife in an empty forest, Lasso de Paulis discusses other disappearances that we often overlook. The author draws attention to the vulnerability of wild plants to extinction by describing how land-use changes and insufficient scientific knowledge have created these green polar bears.

The second chapter includes four articles addressing the importance of biodiversity for human well-being. A concept that has changed our way of thinking about biodiversity conservation in recent decades is introduced: ecosystem services or, as Joly and Seixas define it, everything nature does to help us live a healthy life. This chapter shows that water scarcity in the Andean valleys, soil fertility loss in the Pampas plains, and the emergence of infectious diseases are closely related to biodiversity loss. Hofstede illustrates the vital role of Andean páramos in recharging water reservoirs supplying major cities like Quito and Bogotá. Perez-Harguindeguy and Fernandez-Catinot highlight the importance of soil microorganisms in forming organic matter that nourishes crops and pastures, sustaining food production. Finally, Willets underscores the multiple connections between biodiversity and human health.

The third chapter presents four articles challenging the foundations and prevalent practices in biodiversity conservation and advocate for deepening the path toward more equitable and inclusive forms of conservation. Anderson traces the worldviews, values, and practices underlying biodiversity conservation models over time. Just as the concept of ecosystem services helped articulate and communicate our material dependence on nature, Anderson and Camino argue the need to move beyond this economic and utilitarian view of nature toward a pluralistic valuation that includes the worldviews, values, and practices of Indigenous peoples and local communities. Laterra shows that inclusive conservation would be more legitimate, fair, and equitable and more effective, as Indigenous lands host high levels of biodiversity due to a centuries-old, harmonious coexistence between people and nature. Finally, Cunha, Campos-Silva, and Duarte Ritter discuss the importance and challenges of integrating local knowledge with Western science as a key aspect of inclusive conservation.

The final chapter presents five articles that address the opportunities and challenges LAC faces in advancing the conservation of its rich biodiversity. The first three articles demonstrate LAC's potential to lead this mission based on the emergence of innovative approaches, instruments, and experiences. Yanosky shows how successful cross-border conservation experiences in LAC align with the goals of the new Global Biodiversity Framework. Didier and Muñoz emphasize the synergy between biodiversity conservation processes and peacebuilding efforts. Faroni highlights the region's capacity to lead the conservation and sustainable use of the oceans. The last two articles state that the region will be able to seize these opportunities to the extent that it overcomes structural challenges, primarily related to its international position as a raw material supplier. Enrico illustrates how very distant regions are interconnected due to global trade in raw materials, meaning that environmental improvements on one side of the world may come at the cost of environmental degradation on the other side. These same relations lead Mastrángelo to question whether international trade in raw materials can be part of the solution to biodiversity loss in LAC.

CHAPTER 1

Biodiversity status in Latin America



What is the *empty forest syndrome* and why it should concern us

INTY ARCOS

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he loss of wildlife diversity and ecosystem fragmentation have triggered the phenomenon known as the empty forest or silent forest syndrome. It refers to forests that appear intact but have lost much of their wildlife, affecting ecological processes like pollination and seed dispersal, essential for survival. This biodiversity loss is widespread in Latin America and globally, and it continues to advance, primarily due to the expansion of the industry behind renewable energies.

The article Evidence of a seed dispersal crisis in Europe, recently published in the scientific journal Science, states that if frugivorous animals disappear, forest collapse would be inevitable, as over 85% of tree species in tropical rainforests depend on them for seed dispersal. In our region, studies like Estudio del síndrome de bosque vacío (Study of the empty forest syndrome) by Iván Bladimir Morillo show that in Latin American regions like the Andean Chocó—cloud forests in northwestern Ecuador—over 90% of medium and large vertebrates have disappeared. Throughout Latin America, up to 88% of tropical forests face the threat of defaunation, which has side effects not only on human communities that depend on wildlife for their livelihood but also on forests' capacity to store methane and carbon and maintain their ecological integrity.

Wildlife extermination has been caused by replacing forests with pastures for livestock, building roads without considering ecosystem connectivity, hunting, and urban expansion. Above all, it is due to deforestation for expanding crops like corn, soy, and others needed for biofuel production, building hydroelectric dams, forest fires, and extracting minerals required for the energy transition in the Global North.

FIGHTING CLIMATE CHANGE AT THE COST OF BIODIVERSITY

Forest fragmentation and desertification have been ongoing for decades, long before the emergence of renewable energies, and result from an extractive model and so-called development. Mining and monoculture have isolated natural areas, creating forest islands or isolated river channels incapable of sustaining healthy populations of wildlife and plants. Moreover, infrastructures like roads, urban developments, and hydroelectric dams subdivide ecosystems, blocking species movement and fragmenting habitats.

However, mining in the region's forests and jungles has gone from a low-impact artisanal activity to a large-scale industry. At the same time, monoculture for biofuel production continues to expand unchecked. This activity destroys large forest areas, fragments ecosystems and pollutes rivers with mercury, sulfuric acid, and other toxic chemicals, severely impacting biodiversity and the local communities that depend on these resources.

In this context, the concept of clean energy, although touted as a solution to climate change, fails to address the underlying problems of exploiting the planet's common goods, often mislabeled as natural resources. Renewable energies maintain an extractive logic and continue to impact new areas.

According to Mining Watch Canada, the copper demand boom could increase by 200% to 300% by 2050, mainly driven by vehicle electrification and renewable energies. Many untapped copper reserves are located in high-biodiversity regions like the Amazon and Chocó tropical forests.

WHAT IS BEING DONE?

The consequences of the empty forest syndrome have been under-researched. However, various regenerative initiatives have emerged to address this crisis, offering alternatives for reconnecting ecosystems. For example, permaculture, syntropic agriculture, and other strategies seek sustainability and the integral regeneration of degraded ecosystems. These proposals aim to restore biodiversity and lost ecological functions, promoting a more harmonious balance between human activities and nature.

Syntropic agriculture, developed by Ernst Götsch in Brazil in the 1980s, is a regenerative farming system that mimics the natural processes of ecological succession to restore degraded soils and increase biodiversity. This method, which promotes soil fertility and enhances biodiversity, is being replicated in various regions of Brazil and Latin America as a regenerative alternative to traditional agriculture.

 The empty forest syndrome is a reminder that ecosystems are not just resources to be exploited but living systems that require care and respect.



PHOTOGRAPH SOURCED FROM WWW.FREEPIK.ES

Permaculture, the sustainable farming system that seeks to harmonize food production with the environment by imitating natural patterns, has been adopted in several regions to restore lands degraded by mining and monoculture. In Colombia, the Permaculture Colombia Foundation has regenerated over 100 hectares in Antioquia affected by gold mining. In Brazil, the Cerrado Permaculture and Ecovillages Institute recovered over 50 hectares in Goiás after years of soy monoculture.

Another way to combat this problem is through community resistance. In the Amazon, indigenous peoples such as the Sarayaku, known for their firm resistance to oil exploitation, have established autonomous territories to conserve their natural resources. In Ecuador, citizen groups like Quito sin Minería and Yasunidos have promoted and won popular consultations proposing a new social and economic paradigm based on nature's rights.

However, one of the most effective responses to extractivism has been local governance. Based on voluntary conservation agreements, communities have led initiatives protecting the essential biological corridors for wildlife through democratic local and nationwide processes.

This environmental and civilizational crisis calls for more than actions to reverse the damage. We must rethink the concept of clean energy and question the logic of green extractivism, which continues to exploit the planet's resources under the promise of technological solutions to mitigate climate change. A paradigm shift is needed to deconstruct the extractive logic and embrace a regenerative vision of the relationship between humans and nature.

The empty forest syndrome is a reminder that ecosystems are not just resources to be exploited but living systems that require care and respect. Solutions to the environmental crisis must be based on degrowth, deceleration, ecosystem restoration, biodiversity regeneration, life revaluation, and the defense of nature's rights.

Instead of promoting clean energies that are neither environmentally sustainable nor socially just for communities and that perpetuate exploitation, we should invest in regenerative models that respect natural cycles and promote ecological justice and peace, which are currently scarce in humanity.

Mining is turning the Amazon into a desert

ROOSEVELT GARCÍA-VILLACORTA

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magine an arid, desolate and, barren landscape, ; this is what the planet Mars looks like. For mMany scientists, and other entrepreneurs like Elon Musk believe that, Mars could, in the future and with a lot of effortwork, be terraformed:, as the action of modifying a hostile environment to make it habitable for human beings is called. Now, wWhat if I told you that, right now, we are turning our Amazon, through an activity like gold mining, into a Martian landscape through gold mining? This is happening at great speed at this very moment and at great speed.

THE AMAZON, THE LUNGS OF THE WORLD, IS BECOMING **TURNING INTO A DESERT**

Gold mining in the Amazon is not a new phenomenonnew, but its environmental impact has intensified in the last two decades. Large areas of Amazon rainforest have been deforested and soilsthe Amazon rainforest have been deforested, and soils have been destroyed due to mining, leaving behind a devastated landscape that resembles a desert. This reverse terraforming process not only eliminates biodiversity, but also eliminates biodiversity and profoundly alters soil structure and fertility almost instantaneously, rendering it incapable of natural regeneration.

Mining degrades the soil in multiple ways. First, it destroys the surface layer rich in organic matter where the mineral, also known as "black gold" or "topsoil", is found. This surface layer is crucial for soil fertility, water water-holding capacity and other processes essential for plants. This organic matter is a fundamental component for the functioning of terrestrial ecosystems to function, as it feeds the soil microbiome, a complex community of microorganisms that includes bacteria, fungi and other organisms that break down organic matter and recycle nutrients. Without these processes, soils lose their ability to self--repair and become barren, unable to support the biodiversity of flora and fauna.





VINÍCIUS MENDONÇA/IBAMA. CC-BY-NC-2.0

This process is leavingleaves indelible traces in the region, profoundly altering habitats, and giving rise to what scientists call "new ecosystems". A new ecosystem is an environment profoundly modified by human activity, where native flora and fauna species are largely absent, while the soil and natural cycles have been profoundly significantly disturbed. The impact of gold mining currently occurring in the region, pushes the state of Amazonian ecosystems, as we know it, pushes the state of Amazonian ecosystems back millions of years into the past.

Many sites impacted by mining in the Amazon are rapidly accumulating mountains of compacted rocks and vast expanses of sand from the soil scouring of soils. By 2023, an estimated 1.3 million hectares —about the size of Puerto Rico—were impacted by gold mining in the Amazon basin. In addition, the use of mercury and other chemicals used to in the process of extracting the coveted mineral contaminates the soil and nearby bodies of watercourses, aggravating the ecological and environmental health crisis that already affects 34.1 million people, including 2.7 million Indigenous people distributed among 511 Indigenous groups that inhabit the region. Illegal mining has invaded 370 Indigenous territories, while legal concessions cover 1,131 territories in six countries (Brazil, Bolivia, Colombia, Ecuador, Peru and Venezuela).

In an attempt to regulate illegal mining, the governments of Brazil, Colombia, Ecuador, Bolivia, Peru, and Venezuela have declared vast areas as mining "corridors" or "arcs" in whereich formal gold mining is permitted. The remedy,

however, seems to be worse than the disease, since the governments in power have not implemented strict environmental monitoring or legislation, let alone the applied cation of adequate restoration methodologies for its restoration. Withiln this context of the legalization of mining in the Amazon, the overlapping of legal mining concessions with indigenous territories, natural reserves, national forests and agricultural lands has fostered social conflicts, criminality, and illegal mining invasions. Thus, instead of creating the necessary conditions for the sustainable development of the Amazon, governments have facilitated the development of activities that destroy are destructive to life and biodiversity.

MITIGATION AND SOLUTIONS: REVERSING REVERSE **TERRAFORMING**

Although the damage caused by gold mining is considerable, there is still hope. There are various strategies and technologies that Various strategies and technologies can help mitigate the effects of desertification and restore the ability of soils to regenerate. One technique is ecological restoration with a focus on recovering soil functionality through the cultivation of native species that absorb nitrogen from the air—known as legumes—the use of microorganisms to rehabilitate the soil microbiome, and the incorporation of organic matter from other non-impacted sectors to improve soil quality. Restoration and rehabilitation practices must consider the ecological conditions of each sector of the impacted landscape and the mining technologies prevalent in each area to adapt restoration protocols according to the existing mining waste.

On the other hand, advances in biotechnology could provide more effective solutions to restore soils and the microbiome. Using bioengineering techniques to design specific solutions to recover degraded soils is an option that needs to be explored. The development of cover species and microorganisms with the ability tothat can fix heavy metals, restore organic matter, fix nutrients and improve soil structure can accelerate the recovery process of impacted ecosystems.

Preventiong of illegal mining and the application of applying good soil management practices are essential strategies to prevent the problem from continuing. The regulation of this activity can significantly reduce the environmental impact with the implementation of by implementing less destructive methods for gold extraction in legalized areas, thus avoiding desertification. For example, legal concessionaires could implement the storage of "topsoilopsoil storage" in their management practices, for its later reincorporation into the impacted areas once the extraction activity has been completed. The adoption of Adopting these environmentally responsible methodologies can be incentivized with tax reductions and other legal and administrative initiatives.

However, the fundamental solution to combat desertification and loss of ecosystem services caused by gold mining is based on a shift to agro-ecological practices and sustainable use of the standing Amazonian forest. Governments

must prevent the expansion of miningmining expansion into new areas of the Amazon and invest in sustainable agricultural systems, such as agroecology and agroforestry. These changes include encouraging the development of industries and bioeconomies that use the biodiversity of the standing forest and in which local communities play a key role in value chains.

Conclusion

While scientists strive to understand how we might terraform Mars to make it habitable for humans, gold mining in the Amazon is creating large-scale biological deserts, transforming ecosystems critical to the planet and local communities into inhospitable landscapes. This process of reverse terraforming should make us reflect on the impact of our actions are having on the Amazon and the urgent need to restore or rehabilitate what we are destroying.

While technologies and strategies to mitigate the effects of desertification by gold mining exist, or can be developed, their effective implementation will depend on regional and global commitment to preserve these ecosystems. As with the terraforming of Mars, the challenge of restoring the Amazon requires an ambitious and collaborative approach. But unlike the effort it would take to transform the red planet, we have the capability tocan turn the tide and restore life to the Amazon on our own planet today.

The green polar bears: The silent extinction

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illions of years ago, a meteor wiped out 75% of the planet's species, including the dinosaurs. Today, we are in the midst of another mass extinction, but this time, the meteor is us: humans. A mass extinction occurs when many species from various kingdoms disappear in multiple regions over a short geological period. Currently, the extinction rate is a thousand times higher than without human intervention.

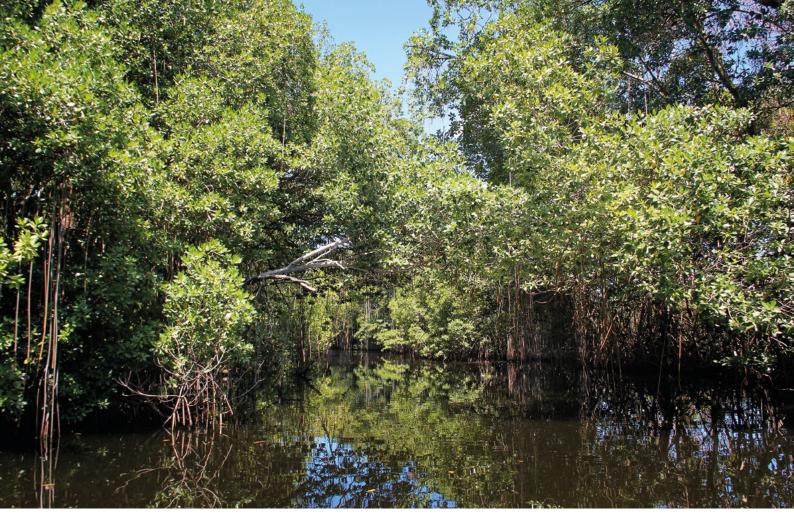
When considering endangered species, we quickly visualize polar bears, jaguars, or whales. But do we ever think of plants? Probably not, and there's a term for this: plant blindness. This inability to see and emotionally connect with plants they aren't furry and don't look at us with cute eyes—makes us forget that nearly twice as many plant species have already disappeared compared to mammals or birds. It is time to change the narrative and recognize the polar bears of the plant kingdom before it is too late.

THE ESSENTIAL, UNNOTICED SERVICES OF PLANTS

Why should we care? Simple: imagine a world without chocolate or coffee. Imagine a party without tequila or rum. Think of a landscape without plants. Or without music! Yes, the material used to make guitars, maracas, and drums comes from plants. Imagine going without food or, even more seriously, without oxygen. All of that would be a world without plants. And many of them, like cacao, are already at risk due to climate change and deforestation.

This extinction storm threatens to eliminate foods and products we cherish, such as chocolate and coffee and will lead to the homogenization of global flora. This will result in the loss of ecosystems and essential services that plants provide.





PHOTOGRAPH SOURCED FROM WWW.FREEPIK.ES

Plants, often without us noticing, provide us with a vast array of services. Mangrove forests, for example, protect us from hurricanes and storms. Forest trees absorb water from the soil and release it as vapor, creating flying rivers that transport the water needed for rain to reach our crops, lakes, and reservoirs. Moreover, flowers support communities of pollinators, without which we would be unable to grow the fruits and vegetables we consume. Plant roots hold the soil in place, reducing erosion, and their leaves provide shade and absorb carbon from the atmosphere, helping regulate the climate.

We truly only know the tip of the iceberg because we only have a good understanding of the species we use, and they represent just one eighth of the approximately 400,000 plant species that have been discovered. Not to mention the species we have yet to discover, living silently in forests and possibly disappearing before we even know about them. Some scientists estimate there could be around 100,000 species waiting to be discovered. Some of them may have the potential to cure cancer or even hold the key to surviving on other planets, but we risk losing them without even knowing.

THE IUCN RED LIST: A BIODIVERSITY BAROMETER

Determining how many species have become or are at risk of becoming extinct is a monumental challenge. Many species have only been collected a couple of times; they are stored in herbariums, which is how we know they exist. But we know very little about their status in the wild, their vulnerability to climate change, or the condition of other species they depend on. At this very moment, an excavator could be destroying the last individuals of a unique plant species. It's a race against time.

This is where the Red List of Threatened Species of the International Union for Conservation of Nature (IUCN) comes in, working as a barometer of biodiversity. Just as a barometer measures changes in atmospheric pressure to forecast storms, this list measures the status of the planet's species, alerting us when the pressure of extinction is rising. However, only about 71,000 plant species of the nearly 400,000 on Earth have been assessed. That means only 18% have been evaluated. Of that tiny group of evaluated plants, around 27,000—or 38%—are under some threat category. In other words, the barometer indicates that we are already in the midst of a storm.

The functioning of ecosystems depends on the interaction of many species. Losing some can trigger chain extinctions if other plants or animals rely on them. Trying to save just one species or a few is like trying to save a patient by only caring for the heart and kidneys but letting the liver and lungs die. In the long term, that strategy does not work.

COCOBOLO: A SPECIES ON THE BRINK OF DISAPPEARING DUE TO **OVEREXPLOITATION AND ILLEGAL TRAFFICKING**

Only a small fraction of the flora has been assessed in Latin America. In countries like Argentina and Chile, less than 10%; in most countries, less than 25%. Even so, several nations have over 1,000 threatened species. It is imperative to accelerate studies to find out which other species are at risk.

One example in the region is cocobolo (Dalbergia retusa), whose reddish and veined wood has been used to make fine furniture, crafts, and even musical instruments. Cocobolo has been intensely exploited due to the high demand for its valuable lumber—one tree can cost up to \$10,000. Additionally, the expansion of agriculture and livestock farming has significantly reduced its habitat: the dry forest. It is estimated that over 80% of cocobolo populations have been lost. If urgent actions are not taken, this species could disappear.

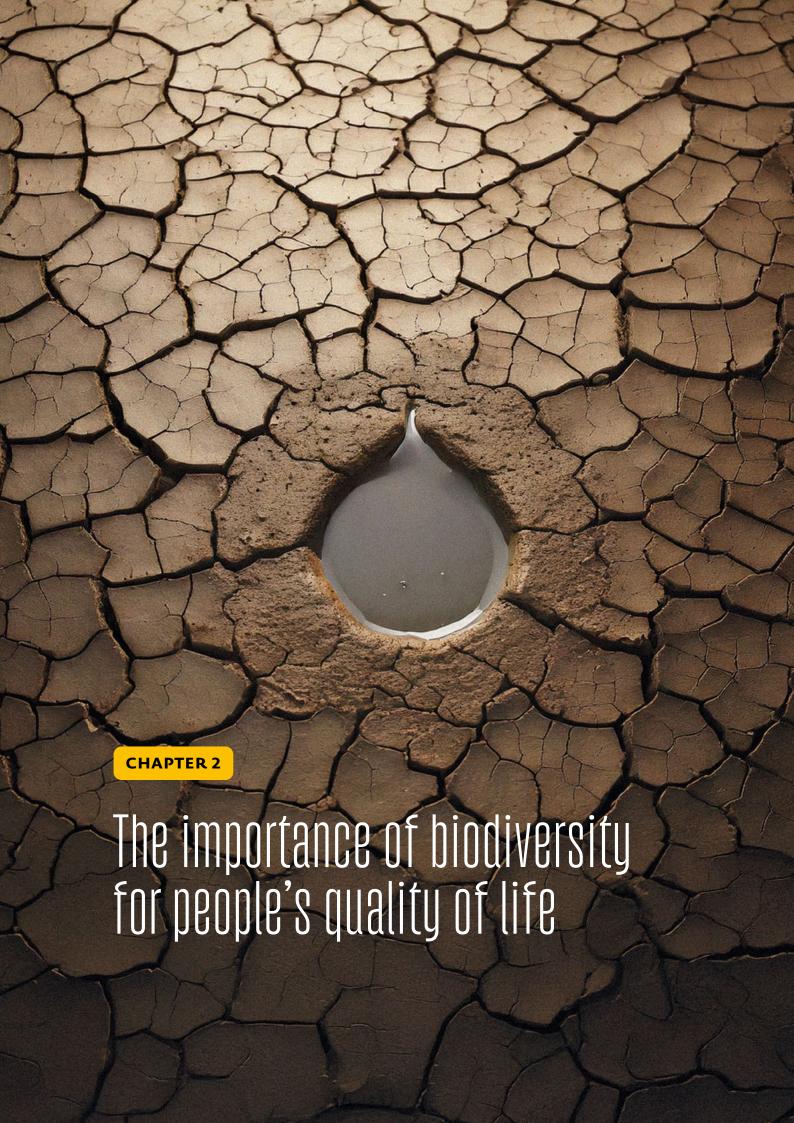
In an effort to prevent the overexploitation of cocobolo, it has been classified as critically endangered on the IUCN Red List and protected under CITES Appendix II, which regulates its trade. This means a special permit is required to export its wood. However, illegal logging and trade continue to threaten the species. For example, in Panama, criminal networks are dedicated to trafficking it. Between 2020 and 2022, around 3,000 cocobolo logs were seized, and in 2023,

300. A couple of months ago, four containers of illegal wood were confiscated. Who knows how many more trees are trafficked undetected? It is clear that cocobolo forests are still being emptied.

SAVING THE GREEN POLAR BEARS BEFORE IT'S TOO LATE

In light of the extinction crisis we are facing, it's clear that we need a combination of strategies to ensure the long-term preservation of our green polar bears. It is crucial to regulate the exploitation and trade of commercially used species. Scientific research is urgent for species we do not know or use. Botanists must explore under-studied areas to document or discover species we do not yet know and help assess those we do. The state must protect them. Ecologists need to examine their needs and relationships with other species to understand how to protect them.

Preserving species in botanical gardens and seed banks—our Noah's Arks is key to restoring them if they disappear. We cannot reverse extinction without education, research, and community and government support. It is in our hands to decide whether we continue being the meteor or become guardians of biodiversity.



Why are several Andean countries experiencing their greatest water crises simultaneously?

ROBERT HOFSTEDE

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his year, Colombia and Ecuador are experiencing the worst water crisis in their history. In the Colombian capital, drinking water is cut off every nine days for a full day, and in Ecuador, there are power cuts—generated mainly with water resources—for up to 10 hours a day. The reason is as simple as dramatic: water reservoirs supplying hydroelectric plants and drinking water have run dry. How have two countries in full economic growth reached such an extreme situation? Much has to do with climate change, but even more with the poor management of a vital natural ecosystem: the Andean páramo.

WHAT IS THE ANDEAN PÁRAMO?

The ecosystem known as páramo is found above the forest limit (generally at 3,500 meters above sea level) in the Northern Andes (Venezuela, Colombia, Ecuador, and Peru), with smaller extensions in Costa Rica and Panama. At this altitude, the climate is wet and cold, which has led to the development of an open ecosystem dominated by grasses, shrubs, a diversity of small herbs and spectacular growth forms such cushion bogs and giant rosettes, including the emblematic frailejones (big monks) and enormous bromeliads. This ecosystem is the habitat par excellence to the most characteristic animals of the Andes: the spectacled bear, the mountain tapir and the Andean condor. This richness and uniqueness of the flora and fauna make the páramo the most diverse high mountain ecosystems in the world.

The páramo covers around four million hectares, corresponding to less than 5% of the surface area of the countries that comprise it. However, its economic and social importance is proportionally much larger. The high tropical mountains in the latitudes of the páramo are usually covered with fog and receive much rain. This makes the páramo humid, and a large biomass of (tussock) grasses covers the soil.



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Once the leaves of this layer of plants die, they are incorporated into the soil, and the organic matter accumulates, given the slow decomposition caused by the low temperatures. The dense vegetation and organic soil make the entire ecosystem behave like a sponge, retaining much of the abundant rainfall and distributing it to wetlands, streams, and rivers, thus forming the basis of the water system of an essential part of South America. This ecosystem service ensures the ecological balance far beyond the mountainous zone, and it is no exaggeration to say that without the paramo, the inter-Andean valleys, the Amazon forest and the Pacific rainforest would not be as we know them.

The role of the páramo in providing water for the continent is fundamental not only from an ecological perspective but also socially and economically. Over half the population of the Northern Andes, including the entire population of Bogotá and Quito, draws water directly from the páramo, which is so pure that it needs almost no treatment to become safe drinking water. Both countries mainly generate hydropower from water from the high mountains. Also, the Andean agriculture of flowers and potatoes, and even the extensive rice and vegetable crops on the northern desert coast of Peru, are irrigated with water from paramos through canal systems measuring over 100 km in length.

 The parámo ecosystem has received limited attention from the Andean society and government for decades. Meanwhile, countless uncontrolled agricultural activities, such as poorly planned potato crops, overgrazing and associated burning of vegetation, have devastated the natural páramo...

What is the cause of the water crisis IN THE NORTHERN ANDES?

Recent anomalies in rainfall patterns caused by global warming and more irregular El Niño and La Niña phenomena than before have contributed to this year being extremely dry throughout the Andean Mountain Range. This lower volume of water in the form of rain and fog in the paramo has, in turn, translated into less water distributed to streams, rivers, and reservoirs for drinking water and hydropower. This has led to the depletion of the mountains' water reserves, leading to cuts in Colombia and Ecuador's basic public services.

However, climate change is not the only culprit, as it has only accelerated the crisis. The parámo ecosystem has received limited attention from the Andean society and government for decades. Meanwhile, countless uncontrolled agricultural activities, such as poorly planned potato crops, overgrazing and associated burning of vegetation, have devastated the natural páramo vegetation and eroded its black and organic soils, damaging the natural sponge in the high mountains.

Additionally, farmers in the high Andes, marginalized by government institutions, have been unable to apply sustainable practices to their farms and have been forced to go further up into the páramo to find more land for their crops and animals. Finally, economic investment projects such as metal mining, road construction and hydropower plants have contributed to degradation of the páramo. This environmental destruction has been the real cause of parámos losing their capacity to regulate water in the Andes, and climate change is just one factor accelerating this crisis.

A CHANGE OF COURSE

In the last decade, the problems affecting the paramo have become visible after many warnings made by academia and NGOs and thanks to the uprisings of rural Andean communities to defend their territory and water, especially against mining. Today, a large part of the Andean people are aware of the relationship

between the páramo and access to water and that it is necessary to take care of the water towers with its natural sponges. Finally, the paramo attracts the attention of the political system and society.

Is it too late? Have we lost the battle against environmental degradation? Fortunately not. The public sector, rural communities, academia, and NGOs are making efforts and investing resources to manage the paramo sustainably. Over half of this ecosystem is already included in different forms of conservation, and the remaining part is under specific legislation to protect it. Now, compensation is given to farmers who decide to protect or restore their land, and there are more and more environmentally friendly initiatives based on sustainable agriculture or ecotourism.

We are on the right track; however, we still need a pact among all sectors of society to recognize the collective and individual responsibility to strategically manage water and energy resources, to support the rural inhabitants of the high mountains to be allies in environmental management, and to give the paramo the status it deserves: a fundamental ecosystem for the future of the Andes.

Climate-biodiversity-water nexus: the protection of ecosystem services in South America

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n recent years, major and historical-record wildfires have devastated regions worldwide, including Australia in 2019-2020, Canada in 2023, and more recently, Brazil, other countries in South America, and California in the US. In Brazil, fires in the Amazon and the Pantanal—the world's largest tropical wetland—destroyed over 20 million hectares in 2024, while in Bolivia, at least 4 million hectares burned. Climate change makes atmospheric conditions hotter and drier, which increases the risk of fires, causing the tragic loss of human lives, severe economic damage, and massive loss of biodiversity, with the destruction of countless plant and animal species and other forms of life.

No scientific evidence indicates that the trend of climate change will reverse in the coming years. On the contrary, it will continue, likely leading to water and food shortages, the disappearance of native forests, fewer bees to pollinate crops, and fewer natural places for us to enjoy. In other words, the acceleration of climate change and resulting fires worldwide has a massive impact on biodiversity loss and quickly erodes ecosystem services, such as the regulation of quantity and quality of freshwater used for human well-being.

Ecosystem services, which are the benefits that nature provides to people, or in simpler terms, everything that nature does to help us have a healthy and comfortable life, depend on the conservation, sustainable use, and restoration



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of nature. A future with declining ecosystem services is one of decreased quality of life and increased inequity, as food, energy, and water scarcity will be the rule and not the exception. The already vulnerable populations in rural and urban areas will suffer the impacts of ecosystem services loss disproportionately. In a few decades, climate change is expected to be the major driver of biodiversity and ecosystem services loss, leading to what is known as climate injustice. Natural disasters intensified by climate change, such as hurricanes and floods, in Latin America and the Caribbean, have tripled in the last 50 years. Disasters can reduce GDP by up to 0.9 percent in lower-income countries in the continent, while in the Caribbean, they can destroy 3.6 percent of the GDP. Climate change will also drive the migration of 17 million people by 2050.

In addition to reducing consumerism (the high level of consumption of goods and services beyond essential needs) and using fossil fuels, nature-based solutions are among the best options we have in hand as a global society to fight climate change. They consist of actions that use nature and natural processes to solve environmental problems, for example, by restoring or protecting forests to have clean water or absorb carbon to fight climate change. These solutions can improve the environment while benefiting people, making communities healthier and more resilient to challenges like climate change.

An example of a nature-based solution is the ongoing initiative known as the Extrema Water Conservancy Project in the Brazilian municipality of the same name. It is regarded as a successful Payment for Ecosystem Services (PES) model, where local farmers and landowners are compensated for protecting and restoring forested areas that protect water sources. The project started in 2005 and has gained attention over the years for its role in increasing water availability for surrounding urban areas, including the São Paulo metropolitan area. This initiative has restored over 5,000 hectares of forest, safeguarding biodiversity and improving water availability for the São Paulo metropolitan area.

Located in the state of Minas Gerais, Extrema prioritizes water conservation in the Piracicaba, Capivari, and Jundiaí (PCJ) River Basin. The project offers financial incentives—about USD 70 per hectare annually—to rural landowners for restoring degraded areas, protecting springs, and adopting sustainable practices like agroforestry. To date, it has benefited over 2,500 families, improved agricultural conditions, and enhanced ecosystem services such as water filtration and drought resilience.

Key actions under this project include planting over 80 native tree species to restore riparian zones and improve the water cycle, rainwater harvesting, erosion control, sustainable agriculture, and using satellite imagery and field inspections to ensure compliance with environmental targets.

The initiative relies on municipal leadership, grassroots involvement, and a bottom-up governance model, fostering trust and long-term participation. It integrates advanced technologies such as remote sensing, satellite imagery, GIS (Geographical Information Systems), and smart irrigation systems for efficient resource management.

The Extrema project has similarities and differences with PES initiatives in other countries. For example, Costa Rica's PES has compensated landowners for reforestation, biodiversity conservation, and water protection since the 1990s. The Extrema Project also uses the same models of financial incentives funded by environmental service users (e.g., hydropower companies) to promote sustainable practices. Unlike the former, which operates nationally, the Extrema project is more localized and focused on a specific basin (the Jaguari River Basin). The project also emphasizes direct collaboration with other municipalities within this basin, promoting a better regional governance approach.

Ecuador's Water Fund provides funding for conservation projects in the Andes to protect water sources for urban consumption. Both this and the Extrema initiatives leverage downstream beneficiaries to fund upstream conservation. The latter includes extensive reforestation and agroforestry efforts, while Quito's model focuses more on maintaining existing ecosystems through community engagement and education.

China's Sloping Land Conversion Program compensates farmers for converting degraded croplands into forests or grasslands to combat erosion and improve water retention. This and the Extrema projects are similar in addressing water security through reforestation and erosion control, targeting vulnerable

landscapes. Yet, Extrema strongly emphasizes local stakeholder engagement and integrates traditional agricultural practices, while China's SLCP operates more as a top-down policy.

These comparisons highlight the critical role of Extrema's project in the Climate-Biodiversity-Water Nexus and its potential to serve as a model for water-stressed regions like Nairobi or Cape Town, where urban water demand strains fragile basins.

The Extrema Water Conservancy Project demonstrates how localized, community-centered efforts can address the interconnected challenges of climate change, biodiversity loss, and water scarcity. Scaling up such initiatives globally can enhance resilience against extreme weather, such as wildfires, promote ecosystems, and promote equitable access to resources.

Here, we plea for your support for policies replicating transformative solutions like Extrema, guaranteeing more sustainable practices in your community, such as restoration of native vegetation, recycling and composting programs and rainwater harvesting. Sharing success stories can inspire collective action for a sustainable future.

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The vital role of soil diversity in sustainable agriculture

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he smell of wet earth is unmistakable and evokes something in all humans. But why do we like that smell so much? Probably because it's more than just a scent—it's the aroma of active soils, rich in organic matter, fertile, and full of life. This smell, characteristic of biologically healthy soil, results from geosmin, a compound certain bacteria produce. Even with our limited sense of smell, we could detect its aroma if just one spoonful of geosmin were dissolved in 200 Olympic-sized swimming pools.

Although we often imagine soil as mere handfuls of inert dirt, healthy soils are home to millions of organisms. A few grams of soil can contain vast biodiversity, including fungi, bacteria, animals, plants, and more. In fact, soils harbor more than half of all species on the planet. The interaction between these organisms, their waste, and the minerals in the soil results in organic matter—the material that sustains the many benefits soil provides to people.

Organic matter allows plants to grow and provide food, giving soil its structure and regulating water flow by facilitating rain infiltration and preventing rivers from drying up during dry seasons. Additionally, organic matter contains more carbon than the atmosphere and all the world's vegetation combined. Therefore, creating new organic matter is a key strategy in combating climate change. The carbon from the atmosphere that organic matter incorporates into the soil can remain trapped there for hundreds or even thousands of years, helping to mitigate climate change. However, if organic matter is lost, its carbon is released into the air, contributing to climate change.



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Since the origins of agriculture around 12,000 years ago, human activity has often negatively impacted soils and their organic matter. Today, soil organic matter has decreased in nearly every part of the world due to deforestation, the expansion of farmland, agricultural practices, and urban development. These transformations have led to the loss of approximately 116 billion tons of carbon from the soil on a global scale—an amount equivalent to the world's total carbon dioxide emissions over ten years.

Latin America is no exception to this pattern. The region has experienced organic matter losses averaging between 5% and 15%. However, areas converted for intensive agriculture or livestock production have seen even more dramatic losses—between 40% and 75%. This is the case, for example, in the Atlantic Forest and certain parts of the Cerrado and Amazon in Brazil, the Chaco and Pampas regions of Argentina (as well as Paraguay and Uruguay), and the Andean and Orinoco regions of Colombia.

But how can we restore lost organic matter? To answer this question, we must first understand how it forms. Until a few years ago, we believed that organic matter was primarily composed of highly complex substances. It consists of simple substances that decompose quickly (such as soft leaves and fine roots) and complex substances that decompose slowly (such as tough leaves, wood, and thick roots). Simple substances can decompose and release their nutrients within months, but some can also bind to small soil minerals, becoming trapped for millennia. Thus, simple substances provide nutrients and stability in the short and long term. Meanwhile, complex substances decompose over years or decades, supplying nutrients and soil structure in the medium term since they are not bound to soil minerals.

To recover lost organic matter and maintain healthy, fertile soils, we must integrate diverse materials in the soil—both slow- and fast-decomposing. This requires a shift in certain agricultural management paradigms, mainly rethinking the widespread reliance on monocultures. Until just a couple of centuries ago, farmers cultivated multiple species in their fields. Since the mid-20th century, however, most production has specialized in monocultures (single-species crops like soy, wheat, or corn). This model aims for greater efficiency and profitability but depletes soils of much more organic matter (and nutrients) than it replenishes. As a result, many soils have lost their ability to produce food or can only do so with the help of fertilizers, herbicides, and other inputs, having lost the organic matter that made them fertile and stable.

In response to this issue, traditional practices have been revived and integrated with modern science in recent decades. This includes agroecology, agroforestry, and the use of cover crops. These practices allow soils to receive litter and roots from various species, fostering more abundant and diverse soil organism communities and generating diverse organic matter. They also protect soils from erosion and excessive sun exposure by covering them with vegetation—offering protection against climate change, particularly in extreme temperatures, rainfall, and droughts.

For example, in the Colombian Amazon, cacao cultivation integrated with fruit trees and native forest species maintains more fertile soils and improves the functioning of degraded pastureland soils by up to 40%. In Latin America's mountainous regions, agroforestry not only conserves soil organic matter but also helps preserve biodiversity and supports the livelihoods of local farmers. Even in the grassland regions of southern Latin America, where monocultures like soy dominate, incorporating cover crops such as oats could help recover the organic matter lost due to monocultures.

Soils are the silent foundation of our societies and shape our cultures. Their fertility nourishes us, and their stability protects us. Soil is more than just a resource; it reflects our relationship with nature. Understanding their function—especially the essential role of organic matter and the organisms that form it—is key to rethinking how we manage ecosystems. Only by doing so can we ensure that soils continue to provide life and well-being for future generations.

Biodiversity and health: Thinking broadly and working efficiently

LIZ WILLETTS

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ature is fundamental to the health of people and communities. However, practical health interconnections do not immediately come to mind when policymakers raise the word biodiversity. Our systems for managing ecosystems and those for managing public health are so separate that integrated work can seem perplexing, if not daunting.

Biodiversity—the layers of flora and fauna species, species relationships, and ecosystems—must be considered broadly. The diversity of these beings, their interactions, and their habitats make nature valuable to our health and well-being. It takes a composition of different roles provided by plants, animals, fungi, and other species to ensure a healthy environment and ecosystems. If we want our policies to shift to broadly capture the value of biodiversity, ecosystem and public health departments need to join forces.

The Pan American Health Organization (PAHO) reports that 13-19% of the regional burden of disease is due to environmental factors. As in other regions, this number is well known to be underestimated. For instance, some diseases presenting in adulthood and older stages of life can result from childhood exposures or cumulative exposures over many years and are difficult or impossible to attribute. Environmental factors that negatively influence complex signaling pathways of specific organs, like the renal system, reproductive system, or cognition in the brain, are even more challenging to measure. Science may also not yet have the tools to do so. Even the most equipped countries cannot track specific exposures to environmental degradation. Even if they do, some countries may lack the laboratories, tests or expertise needed to assess for associated diseases.

Our food systems show us how important it is to join forces and start thinking broadly about biodiversity and health.





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Tamales are an ancestral food that continues to be enjoyed across the Americas today, but foodways are changing. In Guatemala, the preparation process for a tamal centers on combining corn masa with herbs, beans, or other ingredients and wrapping it into a tidy packet using a banana leaf or corn husk, which is then boiled in a layered pot. This practice is passed down through female relatives and depends on access to local ingredients, plants, and traditional food and ecological knowledge. However, alternate preparation using plastic materials is becoming more common.

The vein of a leaf or husk has been used to tie the packet to keep it from falling apart in a boiling pot before it is unfolded to be eaten. But now plastic twine might take that role. Plastic bags are also used to replace banana leaves to cover tamales when layered in the pot to cook. The reason given is that leaves and husks might have gotten slightly more expensive and harder to find in the market. But what is the cost of the exposure to the chemicals leaking out of the plastic into the food? What will the damage be from pouring out the leftover water from the pot to the ground and soil, which can lead to even more exposure for people and insects, birds, pets, and others?

This problem is multidimensional. What changes the local availability of banana leaves and corn husks? What causes shifts in the traditional food practice and replaces knowledge of using natural materials with synthetic ones? Are there any local or national regulations for using and disposing of plastic, including heating or burning it? Is there an understanding among ecosystem managers To tackle the tamal dilemma and other environmentalhealth challenges in our daily lives, we need more systems thinking and more systems thinkers on biodiversity and health. Governments, education, and health institutions need to normalize collaboration between experts on ecosystem and public health.

and public health officials that plastic leaks harmful and forever chemicals and negatively impacts the health of humans and other species? Is anyone educating women about plastics in food practices? Are ecologists and biodiversity experts tracking microbiome, habitat, or species change from contamination?

Multidimensional problems are opportunities for governments to come together on intersecting issues. Approaching environment-health problems with both fields of expertise and ministries of government means solutions will be shared. It is a way to think broadly about the environment and biodiversity while working efficiently for health.

Biodiversity is a significant economic, social, and environmental asset for all countries and encompasses complex interactions from gene to planetary scale. It warrants a dedicated position for systems thinkers on health interlinkages in national government. In many countries and subnational and local governments, the department that looks at environmental degradation differs from the department that looks at health impacts. This needs to change.

Some countries in the Americas are starting to find a path forward on intersecting issues. For example, Antigua and Barbuda's Ministry of Health, Wellness and the Environment focuses on providing universal access to health care and protecting the environment by "ensuring environmental protective services are effectively and efficiently delivered under international, regional and national standards." Other countries are developing tools to assess some environmental threats. Fifteen countries of the Americas (Argentina, Barbados, Bolivia, Brazil, Canada, Colombia, Guatemala, Honduras, Jamaica, Mexico, Nicaragua, Paraguay, Peru, Trinidad and Tobago, and the U.S.) have recent (2023-2024) Environmental Health Score Cards analyzing air, water, climate, chemicals, radiation, and occupational hazards. Conservation donors could consider ways to supplement these with a biodiversity category.

The education sector is also looking at how to advance intersections on biodiversity and health. A recent mapping of higher education institutions assessed integrated research, partnerships, and networks worldwide on six biodiversity and health interlinkages (ecosystem services (e.g., pollination, food security and availability, nutrition, water and air quality), climate change adaptation

and disaster risk reduction, the human microbiome, traditional medicine/pharmaceuticals, spiritual, cultural and physical well-being, and emerging infectious diseases). The findings show Latin America and the Caribbean rank 5th amongst six regions with initiatives. Yet, whereas North America ranked first, it primarily focused on just two of the six interlinkages reviewed (ecosystem services and climate change adaptation) and had limited initiatives related to other interlinkages. As noted in the mapping assessment, topics closely related to biocultural diversity and traditional ecological knowledge, such as spiritual, cultural and physical well-being, the human microbiome and traditional medicines/pharmaceuticals, were not well represented by most institutions. Higher education institutions in Latin America and the Caribbean, home to approximately 500 different ethnic groups, 50 million Indigenous people, and nearly 450 languages, could see this as an opportunity to inform an important gap.

To tackle the tamal dilemma and other environmental-health challenges in our daily lives, we need more systems thinking and more systems thinkers on biodiversity and health. Governments, education, and health institutions need to normalize collaboration between experts on ecosystem and public health. And this is the rationale and aim of the Global Action Plan on Biodiversity and Health, adopted by 196 countries in November 2024. Mobilizing worldwide action that reflects humanity is part of nature, not above it" will take work. But it could start with an action as simple as protecting the integrity of how we make our essential foods at home.



CHAPTER 3

Towards more inclusive and effective biodiversity conservation

Recuperating the meaning of life in biodiversity conservation

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t is increasingly evident that the environmental crisis encompasses species extinctions and climate change, as well as the erosion of cultural diversity, the loss of personal and societal experiences with nature, and the unequal distribution of contamination and environmental degradation among social groups. Following the Sustainable Development Goals and the Kunming-Montreal Global Biodiversity Framework, we can even say there is an international consensus on the fact that we face a values crisis, which carries with it the challenge of recuperating a more holistic meaning of the life we want to conserve.

CREATING A NEW PARADIGM

Beginning in the 1980s, conservation was guided by the concept of biodiversity, a term coined by USA biologists to express the diversity of life. This idea was innovative at the time, expanding the focus of conservation beyond more charismatic species, for being either showy or large, and including genetic variability, trophic interactions, and ecosystem heterogeneity. Yet, it largely maintained an approach based on intrinsic value (e.g., nature's importance for itself) and biophysical measures (e.g., number of species, hectares of habitat). Then, in the 1990s, ecological economics emerged with the concept of ecosystem services, highlighting nature's monetary and utilitarian value (e.g., means to a human end).

However, treating conservation exclusively from ecological or economic perspectives can cause injustice towards Indigenous peoples and local communities. Given inequitable access and distribution of nature's contributions to people, these social groups have often suffered environmental policies as colonial impositions. Furthermore, it is well documented that excluding people from decisions harms their implementation of practical management instruments.



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Since the 2000s, different initiatives have promoted more plural approaches. In particular, the Intergovernmental Platform on Biodiversity and Ecosystem Services (IPBES) has advanced in this line, even challenging the validity of the terms in its name. With academic and political input from the Global South, particularly Latin America, IPBES recognizes that biodiversity, nature and ecosystem services are rooted in Western culture. For example, in its common usage, nature is associated with the material world, including plants, animals, and processes where humans have not intervened.

In stark contrast, ethnoecological studies demonstrate that for most of the 1,000 languages still spoken in the Americas, there is no distinction between that which is natural and that which is social, instead conceiving one sphere of interconnected life, as evidenced by Venezuelan Egleé Zent's work together with the Jotï who inhabit the Amazon. The Andean cosmovision is another example, conceptualizing the Pachamama based on a different relationship: it is not merely another word for nature. Instead, it understands nature as an individual, which implies different responsibilities, like to one's mother. In this sense, IPBES also has broadened the concept of ecosystems goods and services, with its strong economic and utilitarian connotations, and coined nature's contributions to people (NCP) to be more amenable to other worldviews, knowledge systems, cultures, and languages with a more relational and contextual perspective.

WHAT ASPECTS ARE STILL LACKING?

Despite these advances, work remains to institutionalize plural valuations of nature, with their ecological, monetary, sociocultural, and health aspects. Historically, conservation debates were predominantly academic and took place in the

Global North, but the implications were always seen worldwide in environmental policies. Today, more inclusive conservation includes ideas with a seal from the South. For example, the Kunming-Montreal Global Biodiversity Framework not only seeks to conserve 30% of the planet's surface area by 2030 (known as the 30x30 Target), but this must be achieved with equitable governance systems that recognize the multiple values and worldviews regarding nature. Now, we are confronted with the challenge of implementing this paradigm shift, and COP16, held from 21 October to 1 November 2024 in Cali, Colombia, is precisely where a new monitoring system is negotiated for National Biodiversity Strategies and Action Plans (NBSAPS) to institutionalize inclusive conservation meaningfully.

LATIN AMERICA'S ROLE

Latin America stands out and has a privileged role in these processes. It has lead-

Latin America stands out and has a privileged role in these processes. It has leading thinkers creating conceptual spaces that include diverse voices, or what Colombian Arturo Escobar calls the pluriverse, in contrast to Western perspectives of assuming only one way of thinking-making the universe. Furthermore, the region has nourished grassroots socio-political processes related to Indigenous, peasant, and Afro-descendent initiatives, whose leaders have achieved high government positions in countries like Colombia and Brazil.

Furthermore, from Latin America, we see the effect of the Pope from the South leading the Catholic Church, who proposed a different relationship with nature in the Laudato Si, or via the first Latin American environmental treaty, called the Escazú Agreement, which assures access to information, participation, and justice in environmental issues and is a relevant example for the rest of the world.

Notwithstanding the above, despite the region's potential in co-constructing this new paradigm, Latin America continues to be the most dangerous continent for environmental defenders, with 85% of the murders globally, according to the 2023 report from Global Witness. This ongoing tragedy demonstrates that despite its socio-environmental leadership, there is still much to do to recover the meaning of life in all territories.

Fortunately, though, there are numerous allies, and we find complementary ways of life in regions as diverse as Japan, where the concept of satoyama refers to integrated cultural-ecological landscapes, sub-Saharan Africa, where ubuntu relates the individual to others and the physical surroundings, or New Zealand, where a new political definition of national well-being has been developed to include the Māori worldview guided by the principles of kotahitanga (work in a coordinated way), tikanga (make decisions aligned with correct values), manaakitanga (increase the power and agency of others via respect and care) and tiakitanga (stewardship). It seems that the search for living well has similar manifestations worldwide.

At the end of his speech before the Río+20 Summit, then Uruguayan president José Mujica affirmed that "when we fight for the environment, we have to remember that the first element of the environment is called human happiness." He then went on to cite Roman, Greek, and Aymara philosophers. These words evidence Latin America's potential to rethink conservation. The region should now take advantage of this opportunity to integrate biological and cultural diversity and combine ancestral and Western worldviews.

A new paradigm based on equity, diversity, inclusion, and justice for conservation's multiple voices will allow us to reconsider what living well is. In this way, we will be better prepared to address the extinction of species and the erosion of nature's contributions to people and confront the loss of experiences with nature and the threat to cultural diversity. This values crisis calls for recovering a more holistic meaning of life.

What is inclusive conservation?

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e are facing an unprecedented environmental and climate crisis. A significant portion of the remaining natural ecosystems in the world is located in the territories of Indigenous Peoples and local communities (IPLCs). However, conservation efforts have historically excluded IPLCs, disregarding their knowledge, wisdom, and the land management practices they have maintained for generations. By focusing on threatened species and ecosystems, conservation has often been reduced to a biological exercise, failing to consider the economic, political, and cultural dynamics that shape the future of ecosystems.

THE INDIGENOUS VISION OF NATURE

Our perception of nature is shaped by culture and worldview. The Indigenous perspective does not view culture and nature separately. The land and its ecosystems and biodiversity are integral to a community's identity, history, and daily social, subsistence, and spiritual practices. It is not merely a resource to be exploited but a living space where relationships of reciprocity and respect are woven, recognizing humans as part of an interconnected whole. This knowledge and its associated management practices manifest in diverse ways and are just as threatened as biodiversity and ecosystems.

Throughout history, human societies have interacted with and shaped their environment through cultural practices. Many landscapes we now consider pristine have been, or continue to be, shaped by IPLCs. For example, in the Chaco region, highly threatened native grasslands were historically maintained through Indigenous cultural and subsistence practices. Similarly, the semi-nomadic movements of Indigenous groups influenced the landscape's dynamics and,



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when settling there temporarily, altered the populations of hunted and gathered species. More importantly, these communities maintained water sources, allowing surface water to remain even after they moved on. In a region with a prolonged dry season, these water sources would otherwise disappear quickly. Thus, landscapes, dynamics, and diversity were intrinsically linked to Indigenous practices. Ignoring IPLCs as part of nature when considering conservation is a mistake.

Despite growing evidence of the importance of IPLCs in conservation, dominant perspectives have erased their role and imposed exclusionary models, leading to social conflicts, authoritarian measures, and even human rights violations. Globally, over a million people have been expelled from their homes to create protected areas. In Argentina, for example, El Impenetrable National Park was established on the lands of the Wichí Nueva Población community. Lacking formal land ownership, the community lost free access to the area and the ability to practice subsistence hunting, which worsened food insecurity and eroded their cultural heritage.

This raises important questions: For whom is conservation implemented? At whose expense? With what authority and based on whose knowledge?

By prioritizing conservation models that exclude IPLCs, we violate rights and perpetuate power concentration and extractivism in these territories. Assuming that the only valid method of knowledge is dominant science disregards ancestral knowledge—an essential ally in addressing the environmental crisis.

Some IPLC practices may be unsustainable, but the solution is not to exclude them or reinforce narratives contributing to their marginalization. Instead, scientists, governments, decision-makers, NGOs, and other stakeholders must work together as equals, ensuring their participation is authentic, meaningful, and binding. This does not mean IPLCs should bear the sole responsibility for conservation. Using the previous example, the Nueva Población community should not have their practices unilaterally prohibited. Instead, they should take part in data collection and analysis to collaboratively determine the best ways to prevent species extinction.

CONSERVATION WITH SOCIAL INCLUSION

Conservation with social inclusion is an approach that recognizes IPLCs as central actors and has been gaining traction in recent decades. For instance, in 2003, the International Union for Conservation of Nature (IUCN) created a new category of protected areas that allows IPLCs to inhabit or manage them. Today, the success of protected areas is measured not only by their impact on biodiversity but also by their respect for IPLC rights and well-being.

Many organizations are increasingly prioritizing IPLC welfare, including platforms like IPBES, the United Nations, and the Convention on Biological Diversity. In fact, a study found that 86 conservation initiatives led by at least 68 Indigenous groups across 25 countries generated sociocultural, political, and ecological benefits, including improved livelihoods, strengthened governance, and species and habitat recovery. Indigenous peoples have established protected areas autonomously or through partnerships, sometimes with state support.

Despite these advances, inclusive conservation faces significant challenges, such as restrictive laws based on exclusionary paradigms, private interests, corruption, ignorance within government agencies, limited funding, and structural discrimination. Legal reforms and efforts to promote equity in conservation are necessary. IPLCs should not be relegated to subordinate roles such as providing ecotourism services, cooking for tourists, or merely collecting data for scientists. They are the rightful stewards of vast territories that contain the last remaining natural ecosystems. Their knowledge is unique; working with them could be the key to addressing the environmental crisis.

 Conservation cannot be defined solely by the scientific community, NGOs, or governments—it must be built collectively, with environmental justice and territorial rights as core principles. In this framework, IPLCs must be recognized as legitimate protagonists in managing their lands.

Beyond the environmental crisis, humanity faces new challenges, such as global leaders and political sectors that deny this crisis and scientific evidence, as well as setbacks in women's rights, immigrants, and diverse communities. In this context, conservation must urgently shift toward a model based on integration, respect, science, and IPLC knowledge. Otherwise, we risk reinforcing an exclusionary paradigm that is gaining ground worldwide.

Conservation cannot be defined solely by the scientific community, NGOS, or governments—it must be built collectively, with environmental justice and territorial rights as core principles. In this framework, IPLCS must be recognized as legitimate protagonists in managing their lands. Conservation science and practice must embrace the complexity of socio-ecological systems, understanding that sustainability is not just about ecosystem management but also political, social, cultural, and economic factors.

Thus, adopting an ethical framework for conservation is crucial—one where IPLCs are included from the start and treated as equals. Their knowledge, practices, and rights are essential for biodiversity protection. Ecosystem integrity cannot be ensured without considering the people who inhabit and depend on these environments. Conservation must also be about empathy, cultural diversity, and human rights.

To ensure our survival, we must rethink our relationship with the environment and recognize that biological and cultural diversity are interdependent. In the end, each of us is also part of nature.

Why are indigenous lands key to protecting biodiversity and mitigating climate change?

Pedro Laterra

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iodiversity conservation and climate change mitigation have become priorities on the global agenda, driving the creation of new protected areas and heavy investment in environmental projects. However, the current conservation model is marked by a profound paradox: alongside these priorities and investments, insufficient consideration is given to the deterioration and progressive loss of Indigenous territories, as well as to violence, inequality, and the lack of recognition of the rights of those who have coexisted with nature for centuries.

Respecting Indigenous peoples' rights over their territories leads to effective and just nature-based solutions that promote both climate change mitigation and biodiversity conservation, as well as Indigenous peoples' well-being. Their carbon storage capacities are maintained because of the integrity that generally characterizes the ecosystems in these territories.

These contributions of Indigenous territories to planetary health are linked to their peoples' worldviews, values, and ways of life. This is the case of the good living of the Quechua people (Sumak Kawsay) in various Andean countries, or the good living of the Guaraní people (Teko Porâ) in Paraguay, southern Brazil and northern Argentina, as well as the Mapuche worldview in southern Chile and Argentina, and that of numerous Amazonian native peoples.

In fact, it is no coincidence that the social and cultural disintegration of Indigenous peoples and the ecological integrity of their territories occur at the same time, both in the name of development and (legal and illegal) economic interests or due to pressures from impoverished populations (Indigenous or non-Indigenous). Beyond the exterminations or forced displacements in colonial times,



YASUNÍ NATIONAL PARK. PHOTOGRAPH SOURCED FROM WIKIPÉDIA

the dispossession of Indigenous peoples from their lands continues to advance in different Latin American countries. The Maya in Mexico, the Awajún and Wampis of the Peruvian Amazon, the Miskitu in Nicaragua, the Mbä-Guarani in Paraguay and Brazil, the Mapuche in Chile and Argentina, among many others, are struggling to defend their ancestral territories. Despite legal advances such as acquiring collective property titles, these peoples' livelihoods continue to be threatened, giving way to the expansion of extractive industries.

DISPOSSESSION AND DEGRADATION

Dispossession of Indigenous peoples from their lands can also occur in the name of conservation, a phenomenon known as green grabbing, fortress conservation, or colonial conservation. In Latin America, these tensions appear in cases such as the Yasuní National Park in Ecuador, the Manu National Park in Peru, the Maya Biosphere Reserve in Mexico and the Lanín National Park in Argentina.

The displacement of Indigenous peoples by dispossession and the resulting transformation of natural or semi-natural ecosystems for grazing fields, crops, and forestry are just the tip of the iceberg. The degradation of their territories' geographic, ecological, cultural and social integrity is as frequent as it is barely visible. This not only impacts the dignity of Indigenous peoples but also generates a vicious cycle of poverty, environmental deterioration and blocked access to funding.

NOT ALL IS LOST

Indigenous territories still hold a substantial portion of the least modified landscapes and ecosystems on the planet, and we know that many Indigenous peoples profess respect for nature that goes far beyond our best conservationist discourses. According to research such as that led by Stephen Garnett, published in Nature Sustainability, and others that have followed in the same vein, Indigenous peoples manage or have rights to over a quarter of the planet's land area, significantly more than other protected lands, and a third of the world's intact forests are found within Indigenous lands. This makes them crucial areas for climate change mitigation as rates of forest loss remain significantly lower on Indigenous lands compared to others, albeit with wide variations between countries.

Why is conservation investment on Indigenous lands not commensurate with their key role in biodiversity conservation? The lack of investment is due to several constraints that vary from case to case: weak legal status of land tenure; diversion of funds to other activities; conflicts with development policies; inefficient administration of funds; restrictions on access to aid and compensation programs; lack of control mechanisms to prevent illegal exploitation of resources and encroachment on Indigenous lands; and above all mistrust, in both directions.

TOWARDS SOLUTIONS BASED ON INDIGENOUS TERRITORIAL JUSTICE

It is essential to establish new forms of collaboration between Indigenous communities and other local and global actors so that Indigenous territorial claims and global concerns about biodiversity loss and climate change converge.

To be viable and sustainable, such solutions based on Indigenous territorial justice must differ from the old asymmetric formulas, where Indigenous peoples and territories appear in agreements as politically correct paragraphs but are often relegated to the discursive realm without materializing in concrete actions. Most efforts to identify and develop business opportunities to drive nature-based solutions are based on logics, languages and technical bodies that do not necessarily address these realities.

Valuable experiences that could be recovered, systematized, improved and adapted to different contexts have been described across the world. One example is the Kayapó Project in Brazil, which has enabled the Kayapó people to implement forest monitoring and sustainable natural resource management programs in partnership with international NGOs and the Brazilian Government. Other examples are payments for environmental services promoted by the Mexican Government through the National Forestry Commission for the benefit of Indigenous peoples and the Life Plans promoted by the Colombian Government for the U'wa and other Indigenous communities. Furthermore, valuable lessons have even been learned from FAO's REDD+ (Reducing Emissions from Deforestation and Forest Degradation) projects.

However, to incorporate these solutions effectively and sustainably, it is necessary to strengthen mechanisms to protect Indigenous rights, guarantee their participation in decision-making and ensure an equitable distribution of resources for conservation.

There is still a significant gap between recognized rights and the reality they live in their territories. Although titling Indigenous lands is a first step, it does not always guarantee an adequate protection of their rights. In many cases, the participation of these peoples is limited to consultation, information, or signing agreements when their feedback on conducts and commitments is essential.

Changing this reality requires reducing the inequalities of these communities in terms of access to education, health care, justice, essential technologies, and authorities. And just as gender inequalities are gaining space within international support programs, it is crucial to allocate a proportion of funds to finance solutions based on Indigenous territorial justice.

FINAL CONSIDERATIONS

Recognition and respect for these territories mean much more than a formula for reducing significant transformations and replacing biodiverse ecosystems. If we want to integrate Indigenous peoples into conservation agendas, it is crucial to avoid falling into reductionist stereotypes that limit them to the role of guardians of nature. These views, while well-intentioned, can obscure the complexities of Indigenous cultures and ultimately fail when separating nature-based solutions from nature-based solutions and Indigenous territorial justice.

True inclusion implies respecting the diversity of visions and allowing Indigenous peoples to be the protagonists of their development without imposing conservation models on them. Aligning Indigenous territorial justice and nature-based solutions depends on forging free and virtuous connections that guarantee respect for their rights and their fundamental role in managing their territories.

Integrating knowledge for the conservation of amazonian biodiversity

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he Amazon is the biome of superlatives. As the world's largest tropical forest and often described as one of the most diverse ecosystems on the planet, it remains largely unexplored by science. However, much of what is unknown to academic researchers is deeply familiar to traditional peoples, such as riverine communities, Indigenous groups, and rubber tappers, who have accumulated ecological knowledge about the ecosystems they inhabit. This knowledge is reflected in how they can sustainably identify species, manage natural resources, and understand ecological interactions. Many of these practices contribute to biodiversity conservation by preventing exploitative practices and promoting the natural regeneration of degraded areas.

Traditional peoples have an essential role in defending their territories and natural resources against illegal activities such as deforestation and mining. They ensure the sustainable management of resources and actively participate in environmental policies, reinforcing the importance of traditional knowledge in the conservation of the Amazon. Therefore, envisioning a sustainable future requires a dialogue of knowledge without hierarchies, strengthening complementarities.



AMAZON. PHOTOGRPAPH BY NEIL PALMER/CIAT - FLICKR

This relationship, however, faces challenges. Many riverine inhabitants might meet the arrival of scientists with skepticism, especially when their knowledge is treated as secondary. Their understanding of water cycles, fauna, and flora is often considered merely empirical. On the other hand, researchers usually lack the training needed to integrate this knowledge. However, an increasing number of studies show that this integration is essential for improving conservation strategies.

There are specific examples demonstrating how this integration can be fruitful. The dwarf tapir (Tapirus kabomani), officially discovered by science in 2013, had been known to local populations for centuries. The same happened with ornamental fish from the Xingu River and the fungi used in Yanomami basketry. Another example is the community-based management of the pirarucu (Arapaima gigas). By directly observing the fish emerging to breathe, local communities developed a precise counting method to ensure sustainable fishing. This has enabled the recovery of wild populations and created social benefits such as income generation, food security, and a stronger social organization.

How to bring together different knowledge from THE PERSPECTIVE OF A COASTAL SCIENTIST

Maria Cunha, one of the authors of this article who moves between the worlds of science and extractivism—a traditional practice of sustainably harvesting natural resources such as fruits, seeds, resins, and fish for personal use, trade, or industrial purposes—, believes that the relationship between riverine communities and academic scientists is marked by a complex dynamic of knowledge exchange, mutual understanding challenges, and processes of recognizing traditional knowledge.

This interaction takes place in territories where empirical knowledge, built through direct experience with the natural environment, meets systematized scientific knowledge. For riverine inhabitants, the territory is not just a physical space but a place of belonging and identity formation. Every river, stream, forest, and water cycle carries cultural and practical significance. Knowledge of fishing techniques, land management practices, and the use of medicinal plants is passed down through generations and is based on careful observation of natural cycles.

When academic scientists enter these territories, the encounter can be both enriching and challenging. Many riverine inhabitants initially perceive a sense of distance, whether due to the use of technical language or methodological approaches that sometimes disregard local knowledge. When traditional knowledge is denied or underestimated, many riverine inhabitants feel invisible. However, their accumulated experiences and knowledge, passed down through generations, should not be considered irrelevant, as they have ensured a harmonious coexistence with biodiversity for centuries and millennia.

This sense of devaluation can lead to distrust, resistance, and even isolation from researchers, creating barriers that hinder the sharing of valuable information about the territory, the sustainable use of natural resources, and the dynamics of local life. The emotional impact of this denial goes beyond frustration—it affects community pride, collective self-esteem, and their sense of belonging.

On the other hand, when scientists show a genuine interest in learning, listening, and integrating this knowledge into their studies, an environment of mutual exchange emerges, where academic and traditional knowledge complement each other, forming a powerful confluence, as thinker Nego Bispo would say. This creates a space where science does not merely observe but also listens, understands, and values local voices.

Thus, riverine inhabitants cease to be seen as mere objects of study and instead become protagonists in the production of knowledge, reaffirming the importance of their practices, narratives, and ways of life. Both scientists and communities benefit from this shared heritage, building bridges that respect the diversity of knowledge and strengthen the commitment to cultural and environmental preservation.

Despite progress, challenges remain regarding the power asymmetry between academics and communities, as well as the need for greater institutional recognition of the value of local knowledge. Academic institutions must respect and strengthen this knowledge, acknowledging it as essential to scientific knowledge production. Research approaches must be designed in a way that communities recognize them as a means to enhance and add value to what they already know.

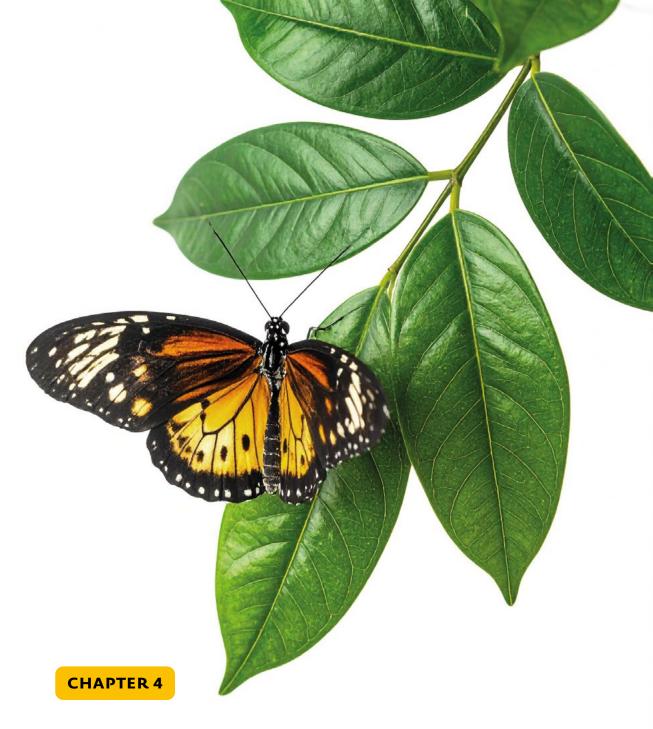
Even unintentionally, research can reproduce colonial practices when it appropriates knowledge without considering the impact on those who share it. One must always ask: Does my research empower or silence? Does it value or render invisible? These questions are fundamental in building a dialogue that fosters a strong relationship between both parties, as knowledge of the territories is perhaps the key ingredient for a fairer and more sustainable Amazon.

TRADITIONAL KNOWLEDGE AS A FOUNDATION **FOR CONSERVATION**

Conservation in the Amazon will only be effective if it includes local communities as protagonists. This means actively integrating them into decision-making and territorial management processes. Successful experiences in community-based management demonstrate that conservation is not just an environmental issue but also a social and cultural one.

It is essential to overcome the stereotype that communities are merely passive guardians of biodiversity. They are active agents and bearers of social technologies that are crucial for balancing sustainable use and preservation. Valuing these practices strengthens both conservation and social justice. Many researchers believe that conservation results from projects, but the Amazon teaches us that it must be a way of life. The protection of biodiversity is closely linked to the quality of local life.

In the face of growing challenges, integrating traditional and scientific knowledge is a necessity. Investing in partnerships that amplify community voices is essential to ensuring that conservation is truly collaborative. After all, there is no way to preserve the Amazon without the people who inhabit it.



Perspectives for biodiversity conservation in Latin America

Will the new global biodiversity agreement be another failed effort?

ALBERTO YANOSKY

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ollowing the failure to meet the biodiversity conservation targets that the international community had set out to achieve by 2020—the Aichi Targets—in 2022, at the end of the 15th Conference of the Parties to the United Nations Convention on Biological Diversity (COP15), considered the most important biodiversity conservation event in the world, the Kunming-Montreal Global Biodiversity Framework was adopted. This framework is a landmark agreement seeking to halt and reverse biodiversity loss.

WHAT HAPPENED TO THE AICHI BIODIVERSITY TARGETS?

In recent years, the international community recognized that biodiversity loss and climate change are mutually reinforcing. Ecosystem degradation can exacerbate climate impacts, while biodiversity can enhance efforts toward disaster risk reduction (DRR), sustainable development, and climate change mitigation and adaptation goals.

However, the international community did not meet the Aichi Targets, which were part of the Strategic Plan for Biodiversity between 2011 and 2020 to halt biodiversity loss. None of these targets were fully achieved, nor was there alignment with the Sustainable Development Goals (SDGs). This shows that the world's governments have not made sufficient progress in addressing the global biodiversity crisis.



PHOTOGRAPH BY DIEGO AZEVEDO/IBAMA

WHAT IS THE KUNMING-MONTREAL GLOBAL BIODIVERSITY FRAMEWORK?

In this context, this new global framework was introduced, setting goals and targets to halt and reverse biodiversity loss by 2030 and ensure that humanity can live in harmony with nature by 2050. These are specific targets for conservation, restoration, financial mobilization, and the integration of biodiversity considerations into economic activities globally.

The first target of the Kunming-Montreal Global Biodiversity Framework seeks to protect 30% of land and sea by ensuring that at least 30% of the world's terrestrial and marine areas are conserved through effective, equitably managed, ecologically representative and well-connected protected area systems. The second goal seeks to restore 30% of degraded habitats, focusing on restoring ecosystem functions and services. The third goal is to reduce harmful subsidies by USD 500 billion annually. The fourth objective is to reduce food waste by half, and the fifth is to harmonize financial flows, i.e., to ensure that resource mobilization supports biodiversity conservation and sustainable use.

These targets, also known as the 30x30 targets, essentially seek to ensure that by 2030, at least 30% of terrestrial, inland water, marine, and coastal areas, especially areas of particular importance for biodiversity and ecosystem

 One example that requires particular attention is the cooperation between Colombia and Venezuela to protect the Orinoco grasslands, or Pampas del Sur, a landscape shared by southern Brazil, Uruguay, Argentina, and Paraguay. These grasslands are poorly protected, and their biodiversity and ecosystems are threatened.

functions and services, are conserved and effectively managed. This would be achieved through ecologically representative, well-connected, and equitably governed protected area systems and other conservation measures, recognizing, where appropriate, Indigenous and traditional territories.

A compelling case is the Madidi-Tambopata Binational Great Landscape Program implemented by the Wildlife Conservation Society (wcs) since 1999. This is a territory shared by Bolivia and Peru with just over 14 million hectares, which includes eleven national protected areas, two managed areas that provide effective biodiversity conservation, and Indigenous territories and communities of ten different groups, where native peoples help to meet global goals and ensure legal recognition and management of their ancestral territories. Bolivia also contributes to the Nembi Guasu Landscape, which seeks, through local management, to achieve sustainable use of the territory while contributing to these global goals.

Under this framework, landscapes, seascapes, and oceanscapes must be integrated. In addition, it is essential to ensure that any use of these areas aligns fully with conservation objectives and recognizes and respects the rights of Indigenous peoples and local communities. The aim is to address the root causes of environmental loss: economic activities, particularly in key sectors such as monoculture, livestock, forestry, extractive industries, and infrastructure.

Although the commitment and agreements are in place, some countries increase their conservation areas simply with legal documents or decrees, creating new protected areas without the necessary support and local leadership. Or they choose to expand the marine area under a conservation status. However, in neither case proper implementation and local governance are in place to ensure these conservation areas are effectively managed. Increasing the area or land in other schemes, such as Indigenous territories, implicates a commitment to the administration and management of these areas.

WHY NOW?

To achieve this goal, holistic solutions are required to ensure that biodiversity considerations are integrated into countries' economic and development planning. To this end, the framework promotes regional and international cooperation, recognizing that many biodiversity-rich ecosystems are transboundary. Achieving the objectives of the Global Framework that affect Latin America's diverse ecosystems, such as forests, grasslands, mangroves, and wetlands, requires collaboration among the different countries in the region.

One example that requires particular attention is the cooperation between Colombia and Venezuela to protect the Orinoco grasslands, or Pampas del Sur, a landscape shared by southern Brazil, Uruguay, Argentina, and Paraguay. These grasslands are poorly protected, and their biodiversity and ecosystems are threatened.

Unlike the Aichi Targets, the new Global Biodiversity Framework 2030 is designed to be achievable, with measurable outcomes, and aligned with global sustainability frameworks such as the SDGs and the Paris Agreement. It is these alignments that give hope for reversing biodiversity loss.

As such, this new framework is a critical opportunity to mobilize diverse actors, including policymakers, financial institutions, and companies, to reverse nature's loss through conservation, sustainable use, and equitable sharing of biodiversity benefits.

Peace and nature: Reflections from imperfection

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OP16 held in Cali, Colombia, between October 21 and November 1, 2024, had the motto Peace with nature. The intention was to address the relationship between biodiversity conservation and peacebuilding, avoiding antagonizing between the two concepts and overcoming a solely rational approach that excludes the links we have with nature food and water supply, medicine, and spiritual connection, among others—and renders invisible our total dependence on it for our survival.

With its motto, COP16 brought to the fore discussions and reflections on biodiversity conservation that are still under construction and have been addressed by the field of study called environmental peacebuilding. This concept refers to integrating environmental management in conflict resolution or transformation processes. The development of environmental peacebuilding studies has revealed gaps in knowledge for understanding and designing strategies that address the complex relationship between peace and nature, namely, overcoming the vision of nature from a purely economic perspective, recognizing the inequalities and power relations that give rise to conflicts; the impact of peacebuilding strategies on ecosystems; and measuring the effectiveness of these processes.

Thus, discussions on peace, the environment, and conflict have established that conflicts have systemic and structural causes. Hence, the need to understand their origin and the role of nature in these contexts. Only in this way can strategies be designed and implemented to de-escalate violence and transform society-nature relationships at different levels (interpersonal, community, institutional).



TATACOA DESERT, COLOMBIA. PHOTOGRAPH SOURCED FROM WWW.FREEPIK.ES

The elements above are key to helping achieve the goals established in the Kunming-Montreal Global Biodiversity Framework (GBF), as they draw attention to the impossibility of making progress in the conservation and sustainable use of biodiversity without simultaneously addressing the social inequities that generate conflicts, opening effective spaces for participation and broadening the vision of what we consider to be nature.

COP16 opened the door to continue thinking about how to design and implement strategies that integrate peace and nature and bring other sectors into the discussion. To do this, we must recognize the lessons learned from the experiences we have had so far.

In Colombia, the reflections on the implementation of the Peace Agreement—still in progress—and the current peace dialogues have shown the relevance of the role of nature in the processes of reparation, truth and non-repetition, and in creating the economic conditions for the reincorporation to civil life of former combatants and victims of the conflict. This also includes the damages nature has sustained due to the armed conflict.

An example is the process of returning to the territory of the Resguardo Yaguara II community, supported by the Humboldt Institute, which highlighted how building peace with nature requires innovative approaches focused on the peaceful coexistence of people and nature. Another is the recognition of natural entities (territories or rivers) as victims of the conflict within the framework of

the transitional justice processes carried out by the Special Jurisdiction for Peace in Colombia (IEP) and the work of former ex-combatants in bioproduction or sustainable tourism enterprises.

These experiences show the need to harmonize the different environmental agreements and bolster intersectoral coordination. For example, the Escazú Agreement, a tool to achieve the goals established in the GBF, seeks to guarantee access to information, effective participation, access to justice and the recognition and protection of human rights defenders in environmental matters. Without ensuring these access rights, it is impossible to de-escalate violence, build peace, and think of other ways of relating to nature that result in biodiversity conservation while guaranteeing the lives of those who protect it.

Colombia's experience searching for peace shows that it is essential to recognize the interdependence between people and nature, build trust between actors in conflict and heal the social fabric. All of the above implies establishing collaborative ties among multiple actors based on dialogue among diverse knowledge systems. In this context, facilitating access to information becomes key for equitable participation in decision-making, thus reducing historical asymmetries.

In short, Peace with nature requires a flexible approach that avoids the trap of strict conservation that excludes people and exacerbates socio-environmental conflicts. It is a matter of establishing effective cooperation between the state and communities based on trust, respect, and recognition of diversity. Recalling the principles of the Paris Declaration on Aid Effectiveness, such as ownership and results-oriented management, is vital to charting a joint course that promotes environmental peace and a sustainable and harmonious vision of the future.

The region's potential to lead the transition to a sustainable blue economy

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atin America and the Caribbean (LAC) is home to 19% of the world's marine ecoregions. Bathed by the Caribbean, the Atlantic, the Antarctic, and the Pacific, these waters play a central role in regulating the global climate. They are among the largest reservoirs of marine biodiversity on the planet. They are also home to 25% of the world's marine biodiversity.

Brazilian and Caribbean mangroves are nurseries of life, storing billions of tons of carbon in the soil and trees, including leaves, trunks and roots, known as blue carbon. These ecosystems can store up to four times more carbon per hectare than tropical forests and act as natural barriers against tropical storms, protecting coastal communities. In the Pacific, the Humboldt Current, one of the world's most productive currents, is responsible for around 20% of the world's fish catch, supporting the economies of Chile and Peru. In Brazil alone, the blue economy amounts to approximately 20% of the GDP and stands out as a strategic sector.

However, ocean acidification, caused by increased absorption of atmospheric CO₂ by seawater, threatens organisms such as corals, crustaceans and mollusks and affects essential biological processes such as reproduction, shell and skeleton formation, chemical signaling and feeding behavior. Millions of tons of plastic, agricultural fertilizers and pesticides pollute the ocean while overfishing and habitat loss threaten marine ecosystems. These cumulative pressures



PHOTOGRAPH SOURCED FROM WWW.FREEPIK.ES

compromise biodiversity, ecosystem services, and the livelihoods of millions of people, triggering a domino effect on marine life and key sectors such as tourism and fisheries, which are the region's economic pillars.

In addition, deep-sea mining, which lacks effective international regulation and is driven by the growing demand for rare minerals, can release toxic sediments and heavy metals. This activity occurs in a complex environment, where impacts spread in several directions, affecting both the seabed and the ocean currents that connect different regions of the planet. At the same time, offshore oil exploration and transport, essential for global trade, increase the risks of oil spills and the introduction of invasive species and pathogens.

Climate change increases challenges to biodiversity, but its effects also compromise economies and human lives. Throughout the region, coastal and island communities face a dangerous combination of impacts, including warming oceans, rising sea levels, heat waves, extreme storm surges, torrential rains and flooding, tornadoes, hurricanes and coastal erosion. These phenomena threaten the survival of those who inhabit these territories and jeopardize economic pillars such as tourism and port infrastructure, which shakes the entire productive chain of the region.

 This model prepares a transition to harness the natural capital of the Global South and provide essential ecosystem services, ensuring the livelihoods of millions of people and the planet's health. Will Latin America and the Caribbean be victims of an imminent collapse or leaders of transformation?

CLIMATE AND BIODIVERSITY CRISES NEED A BLUE PLANET

The Intergovernmental Oceanographic Commission of UNESCO has collaborated with 23 countries in the region to implement Marine Spatial Planning (MSP), a public process of analysis and organization of human activities in marine areas. In a politically negotiated manner, MSP seeks to reconcile ecological, economic and social objectives, which are essential for global ocean governance and for meeting the goals of international agreements, such as those on climate and biodiversity.

Nature-based solutions (NBS), such as ecosystem restoration and regenerative economy initiatives, are essential to reverse the collapse of marine ecosystem services and ensure socioeconomic sustainability.

Integrating PEM and SBN offers a transformative pathway to align climate and biodiversity goals, accelerating efforts to map, restore and sustainably manage marine and coastal ecosystems and promoting climate resilience and biodiversity conservation.

FINANCIAL MECHANISMS AND OPPORTUNITIES

About 23.2% of Latin America and the Caribbean (LAC) marine areas are under some form of conservation. Still, expanding and effectively implementing marine protected areas is crucial to balance economic growth and biodiversity conservation.

Initiatives such as Ecuador's recent debt-for-nature agreement, which uses blue bonds to earmark USD 12 million annually for conservation in the Galápagos Islands, highlight the potential of innovative financing mechanisms. Over 20 years, the initiative will mobilize USD 450 million, establishing a promising model for the region.

Blue bonds have emerged as powerful instruments for financing environmental conservation and sustainable development, aligning preservation with sovereign debt reduction. Examples such as the Eastern Tropical Pacific Marine Corridor, which connects protected areas in Costa Rica, Panama, Colombia and Ecuador, demonstrate how multilateral collaborations strengthen ecological connectivity and conservation.

In Brazil, mangroves, Amazonian reefs and the world's largest rhodolith bank highlight the country's potential for blue carbon initiatives and biodiversity credits. In addition, the Abrolhos and Vitória-Trindade region, a candidate for biosphere reserve status, reaffirms its potential for blue bonds and reinforces Latin America's position as a guardian of unique and strategic ecosystems on the planet.

Payment for environmental services policies can include traditional communities and Indigenous Peoples in biodiversity conservation, integrating them into national and regional plans and strategies. These initiatives promote regenerative economics and socio-environmental justice and recognize the active role of these communities in nature conservation. They can also support Nationally Determined Contributions (NDCs) and the implementation of National Biodiversity Strategies and Action Plans (NBSAPS).

THE BLUE FUTURE OF LATIN AMERICA AND THE CARIBBEAN: **COLLAPSE OR INNOVATION?**

The increasing vulnerability of marine wealth to global pressures demands urgent and coordinated action. With strong governance and public-private partnerships, Latin America and the Caribbean can potentially lead the transition to a sustainable blue economy. The expansion of marine protected areas and the use of innovative financial instruments strengthen biodiversity conservation, energize the regional economy, and integrate national and regional plans that are aligned with global agreements, such as those on climate and biodiversity.

This model prepares a transition to harness the natural capital of the Global South and provide essential ecosystem services, ensuring the livelihoods of millions of people and the planet's health. Will Latin America and the Caribbean be victims of an imminent collapse or leaders of transformation?

Telecoupling: A story about lithium and asymmetric global transformations

LUCAS ENRICO

Biologist. Researcher and professor at the Multidisciplinary Institute of Plant Biology (CONICET) and the National University of Córdoba, Argentina. He studies the effects of land use on ecosystem services and the interrelationships at different scales between biodiversity, food, water, health, and climate change.

apo got up and looked out the window. The Baltic Sea was calm as always at dawn. Many years had passed since the mornings with skies polluted by smog. The social and environmental transformation here had been a success, and everyone contributed to it. Aapo looks proudly at his new electric car. He has been part of this transformation for 10 years, ever since the government promoted the transition from fossil fuels to renewable energy sources. By 2030, the entire vehicle fleet will be electric, powered by lithium batteries, a harmless element with no consequences for the environment. At least, for his.

On the other side of the world, when Amaru wakes up, he also looks out the window. The Puna is calm at dawn. Soon, he will set off with his herd of llamas in search of food. Finding food and water in the nearby wetlands has become harder, and wires now restrict his old trails. In the distance, the smoke from buses signals the arrival of workers at the lithium mines. In his village, there is a new school, a new sports field, and soon there will be a clinic. But despite the improvements, Amaru and his people feel that, along with the lithium, part of their life and environment is being taken away.

Our immediate world encompasses only a few dozen or hundreds of kilometers, and we tend to think that what we do impacts only our immediate surroundings. However, in a globalized world, our decisions can affect remote points on the planet with which we are not in direct contact. The volumes of materials and species we exchange on a global scale have an unprecedented impact. Sciences have been studying these flows of matter and energy between distant places—telecoupling—and their environmental and social consequences.



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An electric vehicle like Aapo's, made in Europe or Asia, includes parts of very diverse origins. Its batteries are made from plastics and common metals, but to operate, they need the lightest of all metals, lithium. Lithium is a simple element but challenging to obtain and process. Much of the lithium used today in batteries is found as lithium chloride dissolved in the salt flats of the Andes. To extract it, it is necessary to process large quantities of brine there through procedures that require evaporating vast volumes of water, even using fresh underground water. Water is a vital and critical resource in the arid environments of the Andes, with extreme weather conditions and unique biodiversity. To obtain the lithium for Aapo's car battery, it was probably necessary to use the water now missing from Amaru's Puna. Without that water, the unique biodiversity of those wetlands and the animals' food, which are essential for supporting his family and the identity of his community, are also gone.

LITHIUM: FROM WHERE AND TO WHERE?

The South American Puna region where Amaru lives is part of the famous lithium triangle, which spans parts of Bolivia, Chile, and Argentina and holds more than 60% of the world's lithium reserves. This has attracted the attention of multinational companies (due to its economic value) and local and foreign governments (due to its strategic value). While its exploitation brings significant economic revenue to these countries, it also represents high risks for the environment and

social and ecological justice, which means that people can remain in their own healthy environments. Lithium extraction is extractivist, meaning there is an intensive appropriation of natural resources that are then exported to global markets. Chile, Argentina, and Brazil are among the top five lithium producers, with Bolivia close to joining this list.

South American lithium is used by China and Northern Global countries to produce batteries for the energy transition. As with other raw materials exported from South America, the economic profits for the country and local communities are minimal, instead absorbing high environmental costs or liabilities. These include the drying up of wetlands (Puna wetlands, the Altiplano, or Atacama), loss of biodiversity and landscapes that form part of local identity, climate changes, and harm to human and environmental health.

Chile, the second-largest lithium producer from salt flats, is already experiencing socio-environmental consequences. The Atacama Salt Flat is sinking at a rate of one to two centimeters per year, and groundwater levels have dropped by up to 10 meters compared to historical levels. Additionally, the excessive use of freshwater from surrounding deep aquifers has consequences that will undoubtedly be critical in the future due to the region's arid conditions, with less than 25 mm of annual rainfall. Today, lithium extraction entails, undoubtedly, mortgaging the future of these strategic water reserves. Similar problems are currently being observed in Argentina.

HOW TO ACHIEVE A JUST ENERGY TRANSITION GLOBALLY?

Aapo tries to do his part, but at the same time, unknowingly, he is contributing to catastrophic consequences for Amaru and the socio-ecosystems of South America. The companies manufacturing his car and the governments planning the energy transition only considered the here and now. Unfortunately, South American governments did the same. Taking advantage of the historical moment when an abundant resource reaches high market values, these governments see an excellent opportunity for foreign currency income. The situation also exposes an asymmetry of forces and negotiating capacities for the sustainable use of common natural resources. There are even disputes between North America and Asia over control of South American lithium.

 We need policies of this kind to develop global thinking, focused not only on trade but also on preserving biological and cultural diversity, equality of rights, and the health of the planet's socio-ecosystems. A planet that both Aapo and Amaru are part of.

What is the solution? First, we must ensure that lithium extraction is a socio-environmental sustainable process. For that, we still need to develop techniques that enable extraction without negative consequences. Additionally, South American countries, which primarily export raw materials, must participate in the transition to sustainable mobility at higher stages of the value chain, at least in battery production. Lastly, the actors who develop these transitions must be aware of the consequences of telecouplings and interrelations at each stage of the product life cycle (production, use, and final disposal). This requires communication about the origin of each vehicle component, including the traceability of the methods of material acquisition.

In 2023, the European Union approved a regulation on deforestation-free products (EUDR), an innovative political measure with direct implications for the governance of global commodity chains. It involves traceability, where certain goods, such as meat or grains, must certify that their production did not involve deforestation in the country of origin. Similar regulations could be applied to lithium imported into the European Union to produce batteries or cars. While it will take time to assess the effectiveness of these measures, they could become a significant first step. We need policies of this kind to develop global thinking, focused not only on trade but also on preserving biological and cultural diversity, equality of rights, and the health of the planet's socio-ecosystems. A planet that both Aapo and Amaru are part of.

International trade and biodiversity loss in Latin America: part of the problem and part of the solution?

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hat do a German eating his traditional sausages, a Frenchman tasting his typical cheeses, and an Italian wearing his famous leather shoes have in common? Through their consumption and customs, all of them have a share of responsibility, whether they are aware of it or not, in the accelerated loss of biodiversity in the dry forests and savannas of central South America.

The South American Gran Chaco extends across Argentina, Paraguay, Bolivia, and Brazil, covering more than one million square kilometers, an area equivalent to France and Germany combined. Despite extending over latitudes where other continents have only deserts, this region was, until 30 years ago, covered by hardwood forests, savannas and wetlands. These ecosystems are capable of absorbing large amounts of greenhouse gases from the atmosphere and are home to a rich biological and cultural diversity.

Accelerated Deforestation

Since the mid-1990s, the benefits that the ecosystems of this vast region provided to society have been vanishing at an accelerated rate due to deforestation for the expansion of commercial agriculture and cattle ranching. In fact, the South American Gran Chaco holds the sad record of being one of the most deforested regions in the world.

This phenomenon is driven by landowners in Argentina, Paraguay, Bolivia and Brazil, who replace forests and savannas with soybean and corn monocultures or pastures for cattle.



EXTENSIVE LIVESTOCK FARMING IN THE BAJO CHACO. PHOTOGRAPH BY PEER V. / WIKIPEDIA

A large part of the grains, meat, hides, and tannin produced in the South American Gran Chaco is exported to Asia and Europe (around 60% and 20%, respectively). This is made possible by a well-oiled supply and export chain of raw materials, which only a few multinational companies control.

THE RAW MATERIALS ROUTE

These biodiversity-damaging trade connections are usually invisible to society. Fortunately, initiatives such as Trase Earth now make it possible to trace the path these raw materials take from the place where they were produced to the country where they are consumed. This non-profit initiative was founded by the Stockholm Environment Institute and Global Canopy in 2015 to empower civil society and governments in the search for deforestation-free raw material supply chains.

Within Europe, Spain and Italy are the leading importers of soybeans and corn from the Argentine Chaco, although the most significant volume of these grains travels to the Middle East and Southeast Asia. Both in Europe and Asia, they are mainly used to feed confined cows, pigs, and chickens. Thus, Old World artisanal products such as German sausages or French cheeses are made from grain-fed animals whose production generates high environmental and social costs in the New World.

 Can a change in the rules of international commodity trade reverse this situation? To do so, we must first identify who has the power to transform international trade and then determine whether they have sufficient incentive or pressure to do so. It is up to them to make international trade part of the solution to biodiversity loss rather than continuing to be the main driver of the problem.

The manufacture and purchase of shoes, handbags, and luxury car upholstery in Europe also drive biodiversity loss in the South American Gran Chaco. The European Union imports two thirds of the leather produced in the Paraguayan Chaco, with Italy being the primary importer, with 25,000 tons of leather per year. To make matters worse, these leathers are tanned with tannins extracted from the Quebracho tree, the main hardwood tree species in the Chaco forests. At the beginning of the last century, the English decimated the quebrachales (as the Quebracho tree's forest is called). Since the early 2000s, an average of 30,000 hectares of quebrachales in the Argentine Chaco have been cut down annually by Italian companies to extract tannin for leather tanning.

THE RESPONSIBILITY OF CONSUMERS AND PRODUCERS

What are European consumers and South American producers doing to halt the accelerating biodiversity loss in the Gran Chaco? Actions, including those of their governments, are diverse and depend on three key factors.

First, they depend on how those responsible perceive the biodiversity loss they cause. Argentina's large landowners manage their fields in the Gran Chaco from their offices in Buenos Aires, thousands of kilometers away. From there, they do not see the bodies of wild animals burned in the fires they ordered to clean the land and plant corn, soybeans or pastures. The same happens with the Germans, who enjoy their sausages made from pigs fed with grain from deforested and burned fields.

Second, some producers and consumers manage to perceive the negative consequences of their decisions but still fail to change their logic. This is the case of many producers who today see how the soils of their fields are degraded, and what used to be a forest became a desert in a couple of decades, but continue to expand deforestation, blinded by extraordinary short-term profits. By speculating on the land price, a landowner can acquire forested land in the Bolivian Chaco at USD 100-250 per hectare and then sell each deforested hectare for USD 2,500.

Third, those driving biodiversity loss in the Gran Chaco may want to reverse the damage caused by their production or consumption decisions. Still, they do not always succeed in effectively contributing to the solution. For example, an Italian who becomes aware that a brand of shoes in his country uses leather tanned with tannins from the illegal logging of Chaco's Quebracho trees may choose to buy another brand. However, the decision of a few conscious buyers will not be enough for Italy to stop importing leather and tannins from deforested areas.

TRANSFORMING INTERNATIONAL TRADE

Fortunately, a growing number of European consumers perceive that their consumption decisions negatively impact the other side of the world. Many of them care and are willing to support import regulation policies. So much so that the European Union is promoting a regulation requiring its member countries to cease importing grains and meat from deforested areas after 2020, such as the Gran Chaco and other regions of South America.

Unfortunately, the entry into force of this EU regulation planned for 2025 has been postponed in response to lobbying by multinationals such as Bunge, Cargill and JBS or by the Argentine Rural Society and the European People's Party, among others. This stance clearly demonstrates that many South American producers, multinational exporters and European consumers are still not willing to stop the accelerated loss of biodiversity caused by their actions, even if this puts their own business and the welfare of society at risk.

Due to the current rules of international commodity trade, we have producers blinded by extraordinary profits on one side of the world, causing invisible environmental damage to consumers on the other side of the world. Can a change in the rules of international commodity trade reverse this situation? To do so, we must first identify who has the power to transform international trade and then determine whether they have sufficient incentive or pressure to do so. It is up to them to make international trade part of the solution to biodiversity loss rather than continuing to be the main driver of the problem.

Postface

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his compendium results from a significant collective effort to address key aspects of biodiversity in Latin America and the Caribbean. It was compiled under the leadership of the Inter-American Institute for Global Change Research (IAI), the International Union for Conservation of Nature (IUCN), and Latinoamérica21 (L21). The work offers readers a variety of thematic axes, tackled by twenty specialists who drew on current scientific evidence to promote reflection on the crucial role of biodiversity on Earth. Considering and analyzing these issues is essential, especially for decision-makers. Given the current relevance of the proposed approaches, the material provided is expected to help foster debate, which can be enriched and updated alongside the development of new knowledge and perspectives.

The various perspectives on biodiversity presented in this publication highlight the need to use a multifocal and transdisciplinary approach to think about this and other environmental issues if the goal is to find solutions beyond the status quo.

Most of the time, solving biodiversity loss in Latin America and the Caribbean is not a technical issue but an ethical one. Much of the content presented here accounts for effective technical and engineering solutions in this regard across different fields. However, as one of the authors, Christopher Anderson, emphasizes, "the root of the problem lies not in the lack of solutions, but in the crisis of values that humanity is facing."

In line with this idea, it is challenging to imagine that a human being who cannot respect the ethnic, religious, age, or gender diversity —among other things—of a member of their own species can behave respectfully towards individuals of other species, over whom they likely feel superior. It is urgent to address this crisis without further delay, rejecting magical solutions and shifting the narrative: rather than thinking about what the environment can do for us, we should focus on creating solutions that allow us to return to nature everything we have taken from it. To achieve this, we may need to stop thinking about the outside and start searching for alternatives within our daily actions, from our family and work environments, and our society as a whole, as well as through our influence on the public agenda and policy-making.

"Finally, it is worth mentioning that several of the authors in this compendium provide alternative views for rethinking biodiversity, such as the importance of producing and disseminating quality information (a challenge in the era of fake news), which promotes integrated, not segmented, perspectives."

Another point to highlight is the disproportionate anthropocentrism through which we consider the biodiversity crisis, as evidenced in the language and how we refer to the environment and its ecosystems. "Humanity is part of nature; it is not above it," Liz Willetts clearly reminds us in her article on the tamale dilemma. We talk about environmental services, natural resources, sustainable mining, and even plan strategies to compensate for irreparable environmental losses (which we call impacts). We also announce the need to protect certain species when only a few individuals remain, using criteria of abundance and scarcity that have little to do with the intrinsic value of life.

Therefore, it is imperative to review the teleological approach (nature exists to help us) and human supremacy to avoid incorrect diagnoses. As Inty Arcos notes in his article on the empty forest syndrome, we must promote a new paradigm that "deconstructs the extractivist logic and embraces a regenerative vision of the human-nature relationship."

If we truly believe that our duty as inhabitants of Earth is to conserve the planet for future generations, as we often express (both personally and within organizations), we must implement new strategies to contribute to nature and its forms of life so that they can carry out the functions that define them as such. For them to live, simply. And this is not a utopia. There are already hands planting flowers around crops so that pollinators —which are increasingly scarce due to the widespread use of pesticides— can feed and transport pollen.

In this regard, some judges have diverted their decisions from purely economic or political approaches, prioritizing new perspectives and preserving life. Such is the case of the court that, in 2024, granted legal personhood to a river like the Machángara in Ecuador to protect it from pollution, ordering its cleanup. Or the Argentine judge who declared the orangutan Sandra, born in captivity, a sentient being in 2019, granting her a habeas corpus to facilitate her transfer from a Buenos Aires zoo to an ape sanctuary that would ensure her well-being. More recently, a verdict in Punta Tombo, in the Argentine province of Chubut (2024), sentenced a businessman to prison for animal cruelty and the destruction of native vegetation after he knowingly destroyed land inhabited and used by Magellanic penguins for breeding.

Finally, it is worth mentioning that several of the authors in this compendium provide alternative views for rethinking biodiversity, such as the importance of producing and disseminating quality information (a challenge in the era of fake news), which promotes integrated, not segmented, perspectives. Or the need to honor environmental education, as various laws in several countries in the region have done, as well as support research and oppose the budget cuts that our governments often approve.

We must promote (and demand, when appropriate) access to information and social participation within a framework of true justice. In this sense, the Escazú Agreement, the first environmental agreement in the region, provides several possibilities for protecting and conserving ecosystems and biodiversity in the region. Ultimately, the commitment of each one of us and the organizations is the essential driving force to generate and sustain profound changes that prioritize the value of life.

