

COLOMBIA

BIO



COLCIENCIAS



**TODOS POR UN
NUEVO PAÍS**

PAZ EQUIDAD EDUCACIÓN

COLOMBIA BIO

Colombia is considered the second most biodiverse country per square meter on the planet¹: 53% of its continental surface is covered by natural forests and it has 311 different types of marine and continental ecosystems². This fact notwithstanding, several factors such as the armed conflict have resulted in a lack of knowledge regarding large portions of the country, even within the academic community. Nevertheless, this narrative is changing. Colombia is consolidating peace-building agreements, which will allow the country to overcome one of the longest armed conflicts in history.

Learning about biodiversity leads to learning about preservation mechanisms and sustainable uses that will impact ecosystems at a smaller scale. For instance, using new materials such as biomass or bio-based materials³ that substitute fuel from non-renewable resources is a step towards sustainability. In this sense, biodiversity, an asset on which the country relies to face new economic and development tendencies cropping up in the new global scene, becomes enormously important; even more so if we take into account the country's potential.

There are several reasons why a country should learn about its biodiversity. There is a growing tendency to move away from non-renewable resources such as coal, oil, and natural gas. During the past years, the whole world has witnessed how using up these resources, among other destructive activities, has driven our planet to suffer global climate change, altering nature and greatly affecting the world and life as we know it. Consequently, the world has set its mind on accomplishing a more sustainable management of its natural resources. To reach this objective, we must thoroughly study these resources in order to provide alternative solutions to satisfy our needs.

The country now finds itself at a critical juncture that may lead to great opportunities. This is the right time to take advantage of the post-conflict momentum and reconcile with the environment and with the communities that were directly affected by the violence and fell victim to its effects. Peace will pave the way to exploration and greater knowledge of the country's biodiversity, focusing on rural areas where the conflict unfolded for more than half a century. Many of the forests and biodiverse habitats of the country are located in these areas, which is why it is essential to generate sustainable development options that are socially inclusive in the short and medium term.

We cannot deny that, throughout the country's history, there have been significant contributions made by different entities to gain greater knowledge of the Colombian territory's biodiversity. Nevertheless, today we can encourage this pursuit because we can now count on advanced technology for studying biodiversity at different levels, from microorganisms to large ecosystems. Additionally, we can rely on a great number of experienced researchers who specialize in different species⁴.

WHAT IS COLOMBIA BIO?

It is a project of national interest that arises from the need to recognize the enormous wealth that biodiversity represents for the country and how it is an active potential that we must seize. Its main objective is to provide conditions to meet, assess, conserve and promote effective use of biodiversity in the country, contributing to a sustainable and equitable development.

We have identified five basic aspects that must be addressed to reach this objective, which are listed below. This includes mobilizing researchers, institutions, and resources to form scientific data collection expeditions into the relevant areas. Research and development processes are also necessary to gain a deeper understanding of our biodiversity and, in turn, develop potential mechanisms and strategies for environmental preservation. Finally, we identified a need to coordinate institutions in order to build a clear and innovative regulatory framework that will ease the development of alternative projects. For this initiative to succeed there must be a change in mentality and this is why the project includes strengthening people's perception of biodiversity as Colombia's main and most valuable asset.

HOW?

As mentioned above, Colombia Bio will develop five components with the purpose of solidifying short-, medium-, and long-term activities. The first three components aim to articulate a vast biodiversity value chain in the country. The final two components provide the conditions for Colombia to become more competitive, as a result of sustainable use and enjoyment of its biodiversity. These five components are:⁵

1. Bio Expedition: increases knowledge on species in places that reveal information gaps, including levels of taxonomy, of which there are very few records in the country.
2. Bio Research and Development: leverages qualified research with a high added value, from bioprospecting to the development of bio-based products.
3. Bio Products: introduces a large product and service portfolio with high added value at a national and international level based on the country's biodiversity.
4. Mentality, Culture, and Communication: generates awareness in the Colombian population regarding the elements in the vast biodiversity value chain, and fosters appreciation for biodiversity itself.
5. Institutional articulation: performs a complete analysis of the value chain in order to issue recommendations that guide the country towards a more competitive and sustainable use of its biodiversity.

These five pillars require physically mobilizing human resources at an international, domestic, and regional level. We will now take a detailed look into each point of the project strategy.

BIO EXPEDITION:

This phase entails a learning experience through exploration. 1,889 birds, more than 4,000 orchids, 2,000 species of marine fish, more than 3,000 butterflies, and 1,239 macrofungi are known and have been recorded within the explored portion of the territory. Now we must explore those areas with which we are unfamiliar in order to continue our discoveries. To do this, Colombia Bio brings together the best professionals and scientists who will embark on a new discovery adventure and guide us through a contemplative path, encouraging the analysis of and research into the fascinating natural wonders offered by every trail, community, species; in every stretch and stride.

Apart from bringing together the finest human resources, these expeditions will make use of the most advanced sampling techniques for studying new species and their genetic make-up. New technologies such as barcoding, camera traps, specialized underwater cameras, sound pick-up devices, and temperature sensors

will give us further insight into our biodiversity. Exploring microorganisms, where there is great genetic variability that can potentially be used in different sectors, is an excellent opportunity that Colombia offers, and we must take advantage of it. Marine environments have become unique places to learn about biodiversity with countless potential applications in different sectors of the economy. Similarly, the so-called agricultural landscapes where cocoa, coffee, palms, and bananas are farmed have shown great versatility and its biodiversity exhibits a large range of levels of complexity, in different taxonomic groups.

Within this context of opportunities, Colombia Bio seeks to expand the knowledge that we already have on biodiversity by setting up scientific expeditions that will expand our known inventory of fauna, flora, and microorganisms at taxonomic and genetic levels, both on land and in marine habitats. The goal of these “21st century expeditions” is to catalogue at least 5,000 species through 20 expeditions in the next two years to unexplored areas, post-conflict regions, marine habitats and agricultural landscapes⁶. Additionally, the expeditions would strengthen at least 20 biological collections that already exist in the country and increase the genetic library by sequencing at least 40,000 species of different taxonomic groups. The expeditions would set in motion the work of more than 800 local, national, and international researchers.

BIO RESEARCH AND DEVELOPMENT

In a changing planet such as ours, different technologies that give way to new and more efficient and environmentally friendly products are constantly being developed and used. An example can be found in the pharmaceutical industry. This economic sector often uses modern technology developed within the industry in a process that ranges from an initial diagnosis to several uses for different applications. Another clear example is vegetable biotechnology, which has been one of the quickest adapted technologies in agricultural history, from plague detection to mass propagation and acquisition of disease-free materials. These technologies are even present in construction, where biomaterials are utilized, including biopolymers and bioplastics (PUJ, 2014).

By learning about and understanding the country's and the world's current context, the project fashions a strategy in which research is a key tool for competing in the global market. The aim is to develop high-level scientific actions that generate value by designing proposals that contribute to the country's economic and industrial growth. This approach will generate products out of biodiversity,

prioritizing potential commercial applications and will include training highly prepared individuals through collective training exercises.

Efforts have focused on consolidating research and development initiatives that:

- Identify living organisms, genes, or derived products, that may potentially be used in goods and services in the health, agricultural, food, industrial, energy, and environmental sectors, through bioprospecting procedures in marine, coast, and continental habitats.
- Describe, characterize, and classify new species that may carry biological functions of interest, identified as a result of sampling in the habitats mentioned above.
- Develop technologies, validate, and give value to new products and processes based on living organisms, genes, or derived products found in Colombia's biodiversity, where potential commercial applications have been identified.

The above will be carried out through alliances with universities, and domestic and foreign companies. The main objective is to generate at least 100 pre-commercially developed and validated prototypes, 10 spin-offs, and file at least 150 patent requests for bio-based and non-bio-based products and/or processes. Additionally, there is an initiative to set up a national network of omic sciences⁷, made up by institutions, research groups, and laboratories that possess the necessary technological tools and human talent for the country to advance in basic and applied research in life sciences. Likewise, a great proof of concept fund will be designed and set up using government resources, resources from the private sector, and risk venture capital, which will enable sustainable financing for researchers that take on ambitious projects, from bioprospecting to bio-based and non-bio-based product development.

R&D processes will be promoted and strengthened to generate value added non-biobased products, developed with a high component of Science, Technology, and Innovation (CTel for its acronym in Spanish) via other non-biotechnological mechanisms that lay the foundations for a chemical or physical transformation, focusing on natural extracts and ingredients for the cosmetic, food, and pharmaceutical industries. Products include functional foods and enhanced crops that originate naturally, which contribute to good health and are environmentally friendly.

BIO PRODUCTS

It is estimated that, in Colombia, between 30% and 38% of the plants have some economic application known to local communities. In the Southern Amazon region of Colombia (Putumayo, Caquetá, and Amazonas), which represent more than 10 million hectares with exploitable Non-Timber Forest Products (NTFPs) potential, there is significant economic projection, with a Net Annual Value between USD \$47 and USD \$300 per hectare⁸. The Humboldt Institute (2008) stated that the biocommerce product market moved around USD \$25 million per year, the natural ingredient sector for the pharmaceutical industry being the most dynamic, with approximately USD \$10 million and a growth rate of 50% over the past three years. This context, added to a growing world tendency towards conservation and sustainable use of natural resources, creates a unique opportunity for the country, which should be exploited.

Colombia Bio has taken action and has developed a strategy that will: 1) strengthen the connection between knowledge generators and knowledge seekers by promoting joint projects that add value to production through research; 2) train personnel for the business-knowledge interphase, aligning the language between science and the productive sector; and 3) stimulate research and development applied to industries that exhibit high potential for growth, through the articulation of foreign companies with domestic research groups.

An information management tool will be implemented to identify university research groups, research centers, technological developments, and companies that develop bio-based products. Subsequently, a diagnosis of each initiative will be carried out to strengthen the business model and aid in technical set-up for entering the market, generate added value through CTel, optimize and accelerate the business strategy, or update the business.

Furthermore, a portfolio of at least 100 bio-based products ready to be marketed will be launched. These products will be the result of joint efforts between the academic sector and the productive sector. At least 300 researchers will also receive training in innovation and business skills.

Simultaneously, in coordination with the Vice-minister of Tourism, a local government assistance proposal will be drafted, to develop scientific tourism. The purpose of this proposal is to offer scientific tourism in the regions within the framework of the Nature Tourism initiative of the country.

Finally a strategy for luring research and development units from different multinational companies will be set up, in order to trigger research applied to industries with high potential for growth.

MENTALITY, CULTURE, AND COMMUNICATION

The Colombian population is aware of the enormous natural wealth of their country. Nevertheless, this wealth is not seen as a global advantage and is therefore not valued or exploited, nor are its natural resources preserved. In this sense, Colombia Bio wants to take a step towards sensitizing the country and the world, and bring them closer to understanding biodiversity as Colombia's strongest asset and to imagine how this may become a differential advantage compared to other countries in the world. During the next three years, messages will be transmitted to more than ten million Colombians, using social networks and traditional media outlets, following creative and modern schemes, thanks to which Colombians and the rest of the world will begin talking about biodiversity.

We also wish to reach the youngest generations. We know that the future of this country lies in the hands of children and teenagers, and we believe that if they learn about biodiversity and understand how its preservation and enjoyment can help develop their country, they may become leaders who help generate a better future. With this in mind, we intend to invite 10,000 children from Colciencias's Ondas program to get involved in research projects based on their local biodiversity. Hence, Colombia Bio will act as a seed that spreads its roots and reaches Colombians of all ages and generations, and brings about a greater sense of appropriation and appreciation for biodiversity.

INSTITUTIONAL ARTICULATION

We know that if we stand together we will be stronger than if we act individually and this is why part of the project's strategy is to create alliances and a work network to analyze in depth the ways in which we can optimize the use and enjoyment of our biodiversity. Every action will thus have a greater reach and we will ensure transcendence.

By working hand in hand with institutions, researchers, companies and law firms with experience in this subject matter, we will be able to analyze the entire value chain for a sustainable use and enjoyment of our biodiversity. Subsequently, regulatory recommendations will be put into practice making the country more competitive. A comparative institutional and regulatory analysis including other countries will be carried out to obtain true indicators on where we stand in this area, as well as an objective reference point for the recommendations. The idea is that, in the end, these recommendations will be adopted by the Executive Committee of the National Competitiveness System and of the National Science, Technology and Innovation System, which will extend the recommendations to their respective institutions.

HOW WILL WE BRING THE WORLD CLOSER TO COLOMBIA BIO?

Colombia Bio is an ambitious project that needs to gain importance in international spheres and receive support from the global community, using knowledge and resources. To accomplish this, the following steps will be taken: 1) Alliances will be formed and agendas will be set up with highly qualified institutions, universities, and international research centers who will support the project with their knowledge and experience, developing Colombia Bio's strategies and activities. 2) A resource finding strategy will be designed for projects involving biodiversity, backed by the Presidential International Cooperation Agency, which will provide important resources to implement Colombia Bio's activities. 3) An international advisory council will be set up. This council will be made up by people positioned at the highest levels (political, scientific, media), who will offer recommendations based on their knowledge and experience, in order that that Colombia may become a bio-economy by 2025.

CONCLUSION

Colombia Bio is also an opportunity to build the country, write its history, and change the future of new generations. It is an opportunity for the country to understand and assume that biodiversity is our greatest asset and, as such, we must learn about it to be able to enjoy it and use it in a sustainable way. Discovering the secrets that nature hides in the depths of its forests, in agricultural landscapes, and in its

seas will allow us to reconcile with nature with humility, admiration, and respect. We will have a chance to become fascinated with its shapes, smells, colors, and flavors and promise to take care of it from an understanding of its complexities. By backing greater knowledge of our biodiversity we are ensuring a country with a better future.

(Endnotes)

1The Convention on Biological Diversity defines biodiversity as: the variability among living organisms from all sources including, inter alia, terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are part; this includes diversity within species, between species and of ecosystems (CBD, 2014).

2With a continental area of 1,141,748 km² and a maritime area of 928,660 km², Colombia has the highest bird and orchid biodiversity, and the second highest plant, amphibian, fresh water fish, and butterfly biodiversity worldwide (SiB Colombia).

3It is estimated that those commodities will decrease by 60% in 2050.

4One of the tools we now have is biotechnology, which has accelerated since the 80s with groundbreaking applications drawing from living organisms. This has led to the development of new products or processes for different purposes and sectors of the economy (agriculture, health, cosmetics, energy, environment, etc.)

5Colombia BIO is one of the National and Strategic Interest Projects (PINE for its acronym in Spanish) of the Executive Committee of the National Competitiveness, Science, Technology, and Innovation System. The project is intended to continue for 10 years.

6They will implement new techniques to inventory taxonomic levels that have yet to be thoroughly described in the country, such as: arthropods, fungi, and microorganisms. New applications could also be derived from them by bioprospecting processes.

7In fields such as systematics, functional genomics, proteomics, metabolomics, phenomics, system biology, and synthetic biology, among others.

8Information take from: *Amazonía desde adentro* □ *Aportes a la investigación de la Amazonia Colombiana*. Capítulo: oferta de productos (2007).