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Re-imagining bioeconomy for Amazonia

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Inter-American Development Bank
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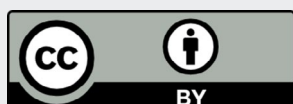
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IGARAPÉ INSTITUTE
a think and do tank



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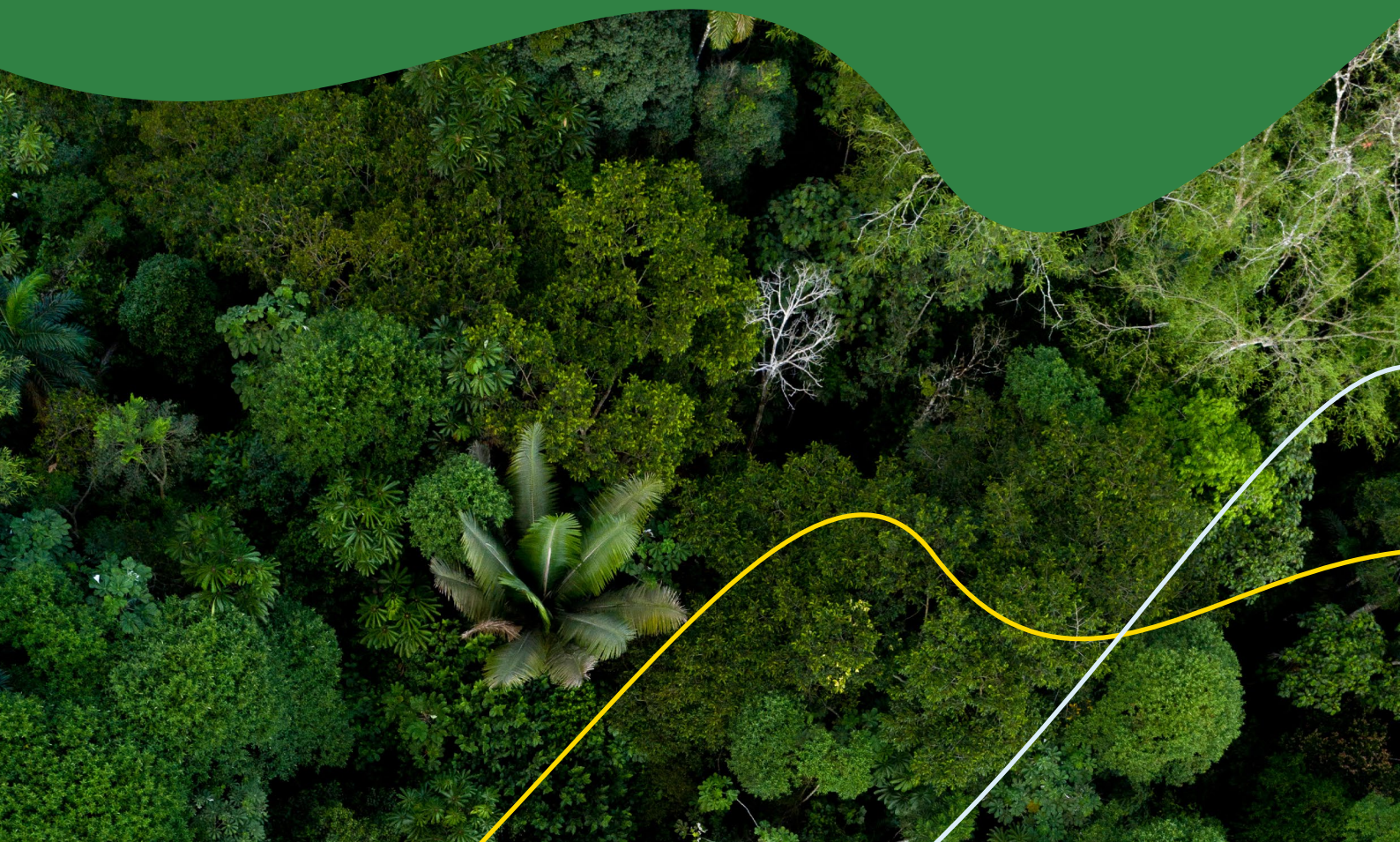
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EXECUTIVE SUMMARY

Record-breaking global temperatures and increasing frequency and intensity of extreme weather events underline the threat posed by the climate crisis. The Amazonia rainforest is widely regarded as one of several key bulwarks against global warming and a transition to a low-carbon future. Yet the world's largest tropical forest is experiencing intense ecological degradation due to intensive cattle ranching, large-scale farming, unsustainable mining, and a constellation of illegal activities. A paradigm shift is required in the economic model for the Amazonia and the people who live there. Put simply, it is critical that a higher value is attached to preserving a standing forest than one that is cleared. The “bioeconomy” offers a viable alternative precisely because of how it incentivizes ecological conservation while simultaneously generating economic opportunities based on the sustainable management of diverse natural resources.

There is no unified or shared definition of bioeconomy in the Amazonia. In North America and Western Europe, most definitions tend to emphasize economic growth and market competition with a particular focus on biotechnology to reconcile economic growth with environmental sustainability. Given that most resources available to support the development of the bioeconomy are aligned with interpretations from the Global North, “semantic asymmetries” between funders and countries and entrepreneurs in the Global South could impede access to vital investment, funding and support. Indeed, definitions exported from upper-income settings may not be fully commensurate or appropriate to regions such as the Amazonia, home to over 40 million residents. Amazonia's immense biodiversity and the presence of over 400 separate indigenous and other traditional communities, many of whom depend on its resources for livelihoods and subsistence, underline the imperative of localized approaches to understanding bioeconomy and capitalizing on its potential.





Scholars have highlighted the importance of research on bioeconomy that looks beyond North America and Western Europe and integrates the important scientific knowledge and practical experience of local actors. Based on surveys carried out across the Amazonia, this report maps the region's epistemic community working on bioeconomy. In the process, it considers the multiple definitions of bioeconomy and their distinct priorities and implications. Improving conceptual clarity between national and subnational governments, the private sector, civil society, and the donor community can help accelerate investment in a fashion aligned with the needs, priorities, and aspirations of local researchers and communities. The amplification of the region's bioeconomy hinges in large part on improving alignment across Amazonian stakeholders. It cannot be achieved by imposing external constructs but rather by fostering collaborative processes aligned with national policies and priorities while also respecting and integrating traditional knowledge.

A starting point for advancing Amazonia's bioeconomy is understanding how it is defined and locally perceived. The following assessment examines how the concept of bioeconomy is conceived by academics, researchers, entrepreneurs, public authorities, and civil society representatives across all eight Amazonian countries: Bolivia, Brazil, Colombia, Ecuador, Guyana, Peru, Suriname, and Venezuela. It is based on a literature review of peer-reviewed articles, policy reports and public policies, key informant interviews with subject matter experts, and a two-stage survey designed to assess stakeholder engagement with bioeconomy. The report confirms that bioeconomy activities across Amazonian countries currently conform to at least five basic principles:

- The use of biological resources and processes;
- The integration of science, technology, and innovation;
- The inclusion of ancestral and traditional knowledge;
- Investments intended to enhance value addition through improved processing and supply chain efficiencies; and
- A commitment to environmental sustainability, decarbonization, and the provision of environmental services, alongside the substitution of fossil fuel-based products with more sustainable alternatives.¹

¹The principles draw from recent work by the Inter-American Institute for Cooperation on Agriculture (IICA). Feeney, R., Felici, S., & Chavarria, H. (Eds.). (2024). Informe de situación y perspectivas de la bioeconomía en América Latina y el Caribe. IICA. <https://repositorio.iica.int/handle/11324/22104>

There is an emerging consensus across Amazonian countries around the importance of bioeconomy investments to simultaneously advance conservation and development goals. A review of legislation and public policy documents indicates a shared acknowledgment of the importance of sustainably managing and leveraging natural and native biodiversity. There also appears to be a growing recognition of the central role of technology and innovation in creating and enhancing value-added products and bolstering emerging economic sectors. Despite variations in terminology, this consensus reveals a growing regional commitment – at least in theory – to leveraging the Amazonia’s exceptionally diverse resources in a responsible manner. So far, it has been expressed in approvals of local strategies and plans for bioeconomy, although with limited allocation of public funds. These commitments are being reinforced by regional conferences and agreements, including at the highest level of government.

The assessment also observes several conceptual divergences about bioeconomy across Amazonia. Very generally, countries can be divided into four groups based on the level of engagement at the normative and research levels with bioeconomy frameworks and policies. Brazil and to some extent Colombia exhibit comparatively mature and articulated “bioeconomy” policies and programs while Ecuador and Peru tend to refer more to “biobusiness” or “bioenterprise” that nevertheless are adjacent to the bioeconomy agenda. Meanwhile, Bolivia and Venezuela have adopted unique approaches to enhance the trade and value chains of their biodiversity-based products. Bolivia avoids the term “bioeconomy” due to its association with environmentally harmful commercialization, which is not allowed by its constitution. Venezuela, on the other hand, concentrates on bio-inputs to promote self-sufficiency rather than broader bioeconomic sectors. Guyana and Suriname, in turn, appear to be at the very early stages of implementing strategies of “green economy” and “green growth” and stakeholders there are less engaged with the wider bioeconomy agenda.

Stakeholders consulted during the course of the assessment appear to be less concerned with developing a single unitary definition of bioeconomy. Rather, their focus is on ensuring a greater balance between extractivist and conservation priorities, ensuring that economic activities contribute to human well-being, and that ecological integrity is preserved wherever possible. Many experts emphasize that the bioeconomy must respect and integrate the rights and knowledge of indigenous peoples and local communities. Privileging their role as stewards across the region is regarded as critical for shaping an equitable and culturally-sensitive bioeconomy that maximizes benefit sharing and guarantees intellectual property rights.

The paper closes with a series of recommendations for further actions that promote cross-sector collaboration and regional cooperation to “leapfrog” bioeconomy opportunities. A central goal of the report is to showcase the diverse and evolving perspectives of bioeconomy in Amazonia. Surveys and outreach were intended not just to generate new insights, but also highlight the heterogeneous and dynamic community of researchers working on bioeconomy. The Inter-American Development Bank’s Amazonia Forever program is considering several next steps to help build the scaffolding of the region’s bioeconomy, including:

- Disseminating the study findings through multimedia materials, by integrating the survey data into the Amazonia Forever knowledge platform, and by facilitating dialogues with key stakeholders to ensure actionable insights.
- Expanding the bioeconomy knowledge network by linking research institutions, utilizing annual surveys to pinpoint and address knowledge gaps, and stimulating innovation with competitive challenges.
- Mapping the ecosystem of bioeconomy investors and entrepreneurs using surveys, developing pairing tools for efficient capital allocation, and establishing mentorship programs to foster entrepreneurial skills.
- Quantifying bioeconomy’s economic, social, and environmental value across the Amazonia to provide a compelling case for its prioritization and strategic investment, leveraging expert analysis to highlight its impact on regional development.

INTRODUCTION

Record-breaking global temperatures and increasing frequency and intensity of extreme weather events underline the threat posed by the climate crisis and the importance of taking decisive action. A critical bulwark against global warming is the Amazonia, the world's largest rainforest. Yet Amazonia is under relentless threats from a combination of intensive cattle ranching, monoculture farming, mining, and a dense cluster of environmental crimes. Protecting the ecological integrity of the region while meeting the needs of the people who live there is not just a regional, but an international priority. Fostering a thriving economy is essential preserving forest cover and biodiversity, but also ensuring the global transition toward a sustainable, low-carbon future.

Bioeconomy potentially offers an alternative model to steer away from an economy centered on extraction and unsustainable land-use to one that privileges sustainable growth and ecological stewardship. Realizing the potential of bioeconomy in practice, however, is tremendously challenging. It requires the design, development, and deployment of enabling policies, enforcing regulations, harnessing strategic investment, deploying new technologies, and building on local knowledge and capacities. Positively, there is growing enthusiasm and appetite for accelerating the bioeconomy, around the world and in parts of Amazonia.

Bioeconomy is understood differently by stakeholders across all eight Amazonian countries. In order to better understand areas of conceptual convergence and divergence, the Inter-American Development Bank (IDB) and Igarapé Institute conducted multi-method research to better understand how stakeholders from academia, government, the private sector and civil society understand the concept in theory, policy, and practice. The process involved a review of relevant literature from Amazonian-based institutions, analysis of regulations pertaining to bioeconomy, interviews with subject matter experts, and a two-stage survey of natural and social scientists and practitioners in three languages.

The study responds to calls for a research agenda on bioeconomy and bioeconomy-related issues and the participation of representatives from beyond North America and Europe. A goal is to stimulate a broader public debate that integrates the important scientific knowledge and practical experience of civil society actors from Amazonia itself.² The central objective of the assessment is to better understand how bioeconomy is conceived and perceived by researchers and practitioners across Amazonia precisely to inform more effective and efficient investment and support strategies. Indeed, there is a risk that if local interpretations are not appropriately considered, it could lead to the misaligned definition of national and subnational priorities and activities. A more informed understanding can potentially help resolve the contradiction that Amazonia, despite being the world's most biodiverse biome, is simultaneously one of the regions with the slowest pace of research and utilization of such biodiversity.

The report is divided into six sections. The first section considers the global backdrop of the bioeconomy debate, exploring its interpretation in upper-income settings and its evolution in Amazonia. Section two identifies relevant terminology and policies across all eight Amazonian countries. The third section considers five principles that undergird bioeconomy activities across the region, and analyzes their relevance for each country. Section four proposes a basic typology to classify bioeconomy-related activities in the region. The fifth section introduces regional perspectives on bioeconomy based on surveys conducted in 2023. The concluding section offers a number of recommendations for advancing bioeconomy in the Amazonia. Finally, the appendices provide additional information on the study methodology, the list of interviewees, in-depth country profiles and questionnaire outlines.

² Backhouse, M. et al. (2021). Contextualizing the Bioeconomy in an Unequal World: Biomass Sourcing and Global Socio-Ecological Inequalities. In M. Backhouse, K. Lorenzen, M. Lühmann, J. Puder, F. Rodríguez, & A. Tittor (Eds.), *Bioeconomy and Global Inequalities* (pp. 3–22). Springer International Publishing. https://doi.org/10.1007/978-3-030-68944-5_1



1. CONTEXT

Dramatic increases in global temperatures and the increasing intensity and frequency of extreme weather events are exposing the severity of the climate crisis. According to the planetary boundaries framework, the earth recently surpassed at least six of nine boundaries for systems that are considered to be crucial for maintaining a safe operating space for humanity.³ The world is entering uncharted territory and calls are growing for urgent and decisive measures in order to stay under the Paris Agreement global warming threshold of 1.5 degrees Celsius. A growing number of scientists believe that no new fossil projects can be sanctioned⁴ and that greenhouse gas emissions must fall by at least 43% by 2030 compared to 2019 levels, and at least 60% by 2035.⁵

Ensuring the integrity of the Amazonia rainforest may well determine the outcomes of efforts to support and sustain the necessary transition to a low-carbon future and avert planetary disaster. Despite recent improvements in reducing deforestation, however, the situation in many parts of the Amazonia is dire. Large sections of the rainforest are experiencing prolonged drought,⁶ declining precipitation⁷ and El Niño⁸ combining to accelerate biodiversity loss,⁹ exacerbate forest fires, and render vital riverways unnavigable. Several researchers contend that large swathes of the rainforest could be transformed into unrecognizable savannah-like ecosystems when deforestation and degradation of primary forests surpasses 20-25%.¹⁰ Alarming, the combined impact of deforestation and severe land degradation may have already affected 26% of forested Amazonia.¹¹

³Richardson, K. et al. (2023). Earth beyond six of nine planetary boundaries. *Science Advances*, 9(37), eadh2458. <https://doi.org/10.1126/sciadv.adh2458>

⁴International Energy Agency (IEA). (2021). Net Zero by 2050. IEA. <https://www.iea.org/reports/net-zero-by-2050>

⁵Cooper, N. (2023, March 20). Climate change: The IPCC just published its summary of 5 years of reports – here's what you need to know. *World Economic Forum*. <https://www.weforum.org/agenda/2023/03/the-ipcc-just-published-its-summary-of-5-years-of-reports-here-s-what-you-need-to-know/>

⁶Rodrigues, M. (2023). The Amazon's record-setting drought: how bad will it be? *Nature*, 623(7988), 675–676. <https://doi.org/10.1038/d41586-023-03469-6>

⁷Leite-Filho, A. T. et al. (2021). Deforestation reduces rainfall and agricultural revenues in the Brazilian Amazon. *Nature Communications*, 12(1), 2591. <https://doi.org/10.1038/s41467-021-22840-7>

⁸Berenguer, E. et al. (2021). Tracking the impacts of El Niño drought and fire in human-modified Amazonian forests. *Proceedings of the National Academy of Sciences*, 118(30), e2019377118. <https://doi.org/10.1073/pnas.2019377118>

⁹Boulton, C. A., Lenton, T. M., & Boers, N. (2022). Pronounced loss of Amazon rainforest resilience since the early 2000s. *Nature Climate Change*, 12(3), 271–278. <https://doi.org/10.1038/s41558-022-01287-8>

¹⁰Lovejoy, T. E., & Nobre, C. (2018). Amazon Tipping Point. *Science Advances*, 4(2), eaat2340. <https://doi.org/10.1126/sciadv.aat2340>

¹¹Quintanilla, M., León, A. C., & Josse, C. (2022). The Amazon against the clock: a Regional Assessment on Where and How to protect 80% by 2025. *Amazonia for Life: protect 80% by 2025*. <https://apublica.org/wp-content/uploads/2022/09/amazonia-contra-o-relogio-um-diagnostico-regional-so-bre-onde-e-como-proteger-80-ate-2025.pdf>

¹²RAISG (Ed.). (2021). Amazonia under pressure. Instituto Socioambiental (ISA). <https://www.raisg.org/en/publication/amazonia-under-pressure-2020/>

¹³Nobre, C. A., et al. (2023). *Nova Economia da Amazônia*. World Resources Institute. <https://doi.org/10.46830/wriprt.22.00034>

Notwithstanding growing concern with sustainable deforestation, there is increasing pressure to clear Amazonia rainforest for extractive industries. The primary sources of deforestation are agriculture and cattle ranching (which account for 84% of deforestation), mining (which affects 17% of the surface area of the region), and oil blocks (which comprise 9.4% of the total area).¹² These deforestation risks are differentiated across the region, impacting each of the eight countries to greater and lesser degree (see Table 1). Yet the combined impacts of relentless forest clearance are potentially devastating. If the current development model continues unabated across the region, global emissions could expand five times the Paris targets by 2050, and 57 million hectares of forest – equivalent to the size of France – could be destroyed.¹³

Table 1. Amazonia area across the eight countries of the study

Country	Share of total Amazonia area	% of country occupied by Amazonia area. ¹⁴	Deforestation, 2001-2020 (km ²)	% of Amazonia area deforested, 2001-2020
Bolivia	9%	66%	39,239	8.35%
Brazil	63%	61%	440,031	10.76%
Colombia	6%	42%	23,004	5.21%
Ecuador	2%	52%	6,232	6.14%
Guyana	3%	100%	418	0.22%
Peru	12%	74%	29,806	4.08%
Suriname	2%	100%	689	0.50%
Venezuela	6%	51%	2,925	0.74%

Bioeconomy offers an alternative economic model to the extractivist approach that dominates the region. If implemented at scale, it could offer a potential paradigm shift to ensure the economic, social and environmental sustainability necessary for the more than 40 million people residing in the Amazonia.¹⁶ Indeed, the concept of bioeconomy holds promise for green growth that could incentivize ecological conservation alongside economic opportunity based on diverse natural resources and value-added products. According to several analysts, Amazonian countries are particularly well positioned to contribute to the global bioeconomy market, which is expected to reach US\$7.7 trillion by 2030.¹⁷ At the moment, however, Amazonian countries collectively stand to receive just 0.17% of the total value of the global bioeconomy market's potential.¹⁸ There are still major deficits when it comes to supporting socially- and environmentally-sustainable growth.¹⁹ At a minimum, fostering a more robust and resilient Amazonia bioeconomy will require blended finance, technical assistance, and the effective implementation of technology and innovation. Fortunately, there is a growing push to achieve these objectives in the region (Box 1).

¹⁴ Amazon area estimates calculated by IDB Amazonia Forever researchers using ArcGIS.

¹⁵ RAISG. (2022). Deforestación en la Amazonía al 2025: Pasado y Futuro de la Deforestación en la Amazonía (p. 107). https://infoamazonia.org/wp-content/uploads/2023/03/DEFORESTACION-AMAZONIA-2025_21032023.pdf

¹⁶ Hernández, E. L. (2023, June 6). Ocho países de la Amazonia con el poder de salvar el planeta. El País. <https://elpais.com/america/termometro-social/2023-06-06/ocho-paises-de-la-amazonia-con-el-poder-de-salvar-el-planeta.html>

¹⁷ World Business Council for Sustainable Development (WBCSD). (2020). Circular bioeconomy: The business opportunity contributing to a sustainable world (p. 74). <https://www.wbcd.org/content/wbc/download/10806/159810/1>

¹⁸ Nobre, C. A. et al. (2023). Nova Economia da Amazônia. World Resources Institute. <https://doi.org/10.46830/wriipt.22.00034>

¹⁹ Val, A. L. (2023, July 3). Personal communication [Online].

¹⁹ World Resources Institute (WRI) Brasil. (2023, July 10). Em documento aos governos da Pan-Amazônia, mais de 100 organizações propõem ações para fortalecer a bioeconomia na região.

Box 1. Momentum for growing the Amazonia bioeconomy

There is growing interest in cultivating a vibrant bioeconomy in the Amazonia. A recent expression of regional commitment was the Pan-Amazonian Bioeconomy Conference in Belém, Brazil, in July 2023.²⁰ The outcome declaration included 30 proposals to heads of state including achieving a sustainable economic future in which subsidies are reallocated away from harmful practices and towards bioeconomy activities that support indigenous, Afro-descendant, and traditional communities.²¹ The Declaration also included a call for the creation of a Pan-Amazonian financing platform and a regional fund to bolster ethical science and innovation in the bioeconomy sector, aiming to enhance the value of its products and services while fostering skill development.

A growing number of international and regional actors are expanding interest and engagement in bioeconomy activities across the region. In August 2023, the Amazonia Summit (Cúpula Amazônica) involved heads of state from across the region and catalyzed a strategic plan to harmonize regional development with nature conservation. This was followed by the formation of the Green Coalition (Coalizão Verde) by 19 banks²² and by a pledge of approximately US\$900 million to support micro, small, and medium-sized enterprises in the Brazilian Amazonia and create sustainable economic alternatives that preserve the forest.²³ Meanwhile, the Inter-American Institute for Cooperation on Agriculture (IICA) inaugurated the Latin American Bioeconomy Network to facilitate knowledge sharing among member countries, including key Amazonia nations such as Brazil, Colombia, and Ecuador, thus fostering a collaborative approach to bioeconomy development across the region.²⁴

Crucially, bioeconomy is understood differently across the eight countries that comprise Amazonia.²⁵ Indeed, the concept is neither universal nor fixed, and is constantly evolving through debate and discussion.²⁶ Several Amazonian countries have formulated national and sector-specific public policies to formally recognize and accelerate bioeconomy activities. However, competing definitions and interpretations persist within and across countries, each with implications for policy, investment, and local stakeholder engagement. On the one hand, ambiguities about what is (and is not) the bioeconomy can allow for flexibility and agility. On the other hand, they could sow confusion and drain the term of substance. There is a risk that bioeconomy could become all things to everyone, and thus easily mobilized for “greenwashing” and the exploitation of natural resources. The proliferation of definitions could likewise hinder attempts at regional cooperation, including with respect to countries’ access to lending and financing.²⁷

Ultimately, it is neither likely nor necessarily desirable for a single definition of bioeconomy to be devised and applied to a region as diverse and complex as the Amazonia.²⁸ However, a set of basic principles laying out the parameters of bioeconomy can facilitate collaboration across public, private and non-profit sectors. By sharpening clarity about how the bioeconomy is conceived and operationalized in the eight countries of Amazonia, it may be possible to forge not just bilateral but multilateral cooperation. A focus of this report, then, is to close the knowledge gap generated by competing definitions and interpretations, mitigate potential risks to sustainable investment, and ensure that the expansion of the Amazonia bioeconomy genuinely takes local perspectives into account.

²⁰ World Resources Institute (WRI) Brasil. (2023, July 10). Em documento aos governos da Pan-Amazônia, mais de 100 organizações propõem ações para fortalecer a bioeconomia na região. <https://www.wribrasil.org.br/imprensa/documento-governos-pan-amazonia-100-organizacoes-propoem-acoas-para-bioeconomia>

²¹ 1ª Conferência Panamazônica pela Bioeconomia. (2023). Carta aos Chefes de Estado e Ministros dos 9 Países Amazônicos. <https://drive.google.com/file/d/1cCbGPrlyUKOGbPqxW13CtOPgvanxm3r/view>

²² See <https://www.iadb.org/en/news/green-coalition-public-development-banks-aspires-mobilize-much-20-billion-amazons-sustainable>.

²³ Neumann, S. (2023, August 7). BNDES e BID anunciam R\$ 4,5 bilhões em crédito para micro, pequenas e médias empresas e pequenos empreendedores na Amazônia. Um S6 Planeta. <https://umsoplaneta.globo.com/financas/noticia/2023/08/07/bndes-e-bid-anunciam-r-45-bilhoes-em-credito-para-micro-pequenas-e-medias-empresas-e-pequenos-empresendedores-na-amazonia.ghtml>

²⁴ IICA. (2023, July 6). Se lanzó en Buenos Aires la Red Latinoamericana de Bioeconomía, con la misión de unir esfuerzos públicos y privados para impulsar el desarrollo sostenible en la región. <https://iica.int/es/prensa/noticias/se-lanzo-en-buenos-aires-la-red-latinoamericana-de-bioeconomia-con-la-mision-de>

²⁵ French Guiana, officially an overseas department of France, was not included in this study.

²⁶ D'Amato, D. et al. (2017). Green, circular, bio economy: A comparative analysis of sustainability avenues. *Journal of Cleaner Production*, 168, 716–734. <https://doi.org/10.1016/j.jclepro.2017.09.053>

²⁷ Pastor, C. (2023, September 4). personal communication [Online].

²⁸ Torres, D. A. P. (2022). Bioeconomia : oportunidades para o setor agropecuário (p. 286). Embrapa. <https://ainfo.cnptia.embrapa.br/digital/bitstream/item/241431/1/BIOECONOMIA-Oportunidades-para-o-setor-agropecuario-e-para-o-Brasil-ed-01-2022.pdf>



2. BIOECONOMY – DEFINITIONS

A wide range of scholars, advocates, practitioners, and public authorities have contributed to the conceptual development of bioeconomy over the past half century. The concept was first introduced in the 1970s by the Romanian economist Nicholas Georgescu-Roegen, who recognized that the finiteness of natural resources could render modern patterns of consumption and production unsustainable. He theorized that technological advances to streamline and adapt alternative production processes were essential. Georgescu-Roegen's thinking influenced the subsequent development of the contemporary global conversation on bioeconomy.

Multiple definitions of bioeconomy have proliferated over the intervening period (see Table 2 for a selection of definitions by prominent countries, blocs and organizations). Their particular emphasis on sustainability and resource utilization was shaped by different geographical, ecological, and socioeconomic contexts. In Western countries and bodies such as the European Union (EU) and Organization for Economic Cooperation and Development (OECD), bioeconomy policies have tended to prioritize biotechnology as a catalyst for economic growth, innovation, and sustainability. In Latin America, however, institutions such as the Economic Commission for Latin America and the Caribbean (ECLAC) and IICA have necessarily widened the scope of bioeconomy to account for the region's immense biodiversity as well as the intricate socioeconomic circumstances of local communities.

²⁹ Nascimento Neiva, K. et al. (2022). Bioeconomy: A Theoretical Essay on the dimensions of stakeholders conceptual approaches. *Ciência e Natura*, 44, e16. <https://doi.org/10.5902/2179460X67555>

³⁰ European Commission. (2007). *En Route to the Knowledge-Based Bio-Economy*. https://dechema.de/dechema_media/Downloads/Positionspapier/Cologne_Paper.pdf

Table 2. Selected global bioeconomy definitions

Institution/ Country	Year	Document / Policy	Description
EU	2007	En Route to the Knowledge-Based Bio-Economy (Cologne Paper)	Harness the potential of biotechnology, life sciences, and sustainable agriculture to drive economic growth, innovation, and environmental sustainability. ³¹
OECD	2009	The Bioeconomy to 2030: Designing a Policy Agenda	Evidence-based approach to biotechnology in agriculture, healthcare, and industry, alongside a wider perspective on how R&D funding, human resources, intellectual property, and regulations shape bioeconomy. ³²
EU	2012	Innovating for Sustainable Growth: A Bioeconomy for Europe	Promotes the efficient and sustainable use of biological resources while also fostering economic growth and competitiveness. ³³
United States	2012	National Bioeconomy Blueprint	Emphasizes the importance of biotechnology, advanced manufacturing, and sustainable practices in various sectors.
EU	2018	A sustainable bioeconomy for Europe	Advances the idea of a circular bioeconomy to minimize waste, foster sustainability, and strengthen bio-based sectors in the EU. ³⁴
IICA	2019	Bioeconomy and Production Development Program	Highlights the intensive use of knowledge and biodiversity resources to sustainably produce goods and services in all economic sectors. ³⁵
Global Bioeconomy Summit	2018	Communiqué	Defines bioeconomy as a sustainable economic system that utilizes biological resources and processes for innovative solutions to societal needs, focusing on responsible resource use, bio-industry growth, and environmental and social integration. ³⁶
ECLAC	2019	Towards a sustainable bioeconomy in Latin America and the Caribbean: elements for a regional vision	The first regional framework for Latin America outlines essential aspects of the bioeconomy, focusing on biodiversity, eco-friendly intensification, biotechnology, bioenergy, and enhanced agricultural value chains. It organizes bioeconomy products into three tiers: basic (e.g., farming), basic with added value (e.g., processed foods), and high added value e.g., biochemicals). ³⁷

The range of activities linked to bioeconomy has expanded over time. Bugge, Hansen, and Klitkou (2016) distilled the concept into three overlapping key visions: biotechnology, bioresource, and bioecology:⁴⁰

BIOTECHNOLOGY:

Promotes economic growth and job creation through research and development that drives new bio-based products to existing and new markets.

BIORESOURCES:

Advances the development of new processing chains for bio-based raw materials to replace fossil-based raw materials.

BIOECOLOGY:

Focuses on sustainability and ecological processes that optimize the use of energy and nutrients, preserve biodiversity, and prevent environmental degradation.

Scholars and policy makers from the Global South are redefining what is understood by bioeconomy and challenging the models advanced by developed countries and international organizations. The former are pushing back against approaches that prioritize growth and competition and place a premium on technology for balancing economic expansion with environmental sustainability and sharing the benefits with local communities.⁴¹ These tensions are relevant in Amazonia, an area teeming with untapped biomass and rich biodiversity that require safeguarding from the traditional

³¹ OECD. (2009). The Bioeconomy to 2030: Designing a Policy Agenda. OECD. <https://doi.org/10.1787/9789264056886-en>
³² European Commission. Directorate General for Research and Innovation. (2012). Innovating for sustainable growth :a bioeconomy for Europe. Publications Office. <https://data.europa.eu/doi/10.2777/6462>
³³ The White House. (2012). National Bioeconomy Blueprint (p. 48). https://obamawhitehouse.archives.gov/sites/default/files/microsites/ostp/national_bioeconomy_blueprint_april_2012.pdf
³⁴ European Commission. Directorate General for Research and Innovation. (2018). A sustainable bioeconomy for Europe: strengthening the connection between economy, society and the environment : updated bioeconomy strategy. Publications Office. <https://data.europa.eu/doi/10.2777/792130>
³⁵ IICA. (2019). Bioeconomy and Production Development Program (p. 44). IICA. <http://repositorio.iica.int/handle/11324/7909>
⁴⁰ Bugge, M. M., Hansen, T., & Klitkou, A. (2016). What Is the Bioeconomy? A Review of the Literature. *Sustainability*, 8(7), 691. <https://doi.org/10.3390/su8070691>
⁴¹ Ruiz, A. R. (2022). Economía para la vida y economías “otras”: una lectura crítica de la visión moderna de bioeconomía para un país en crisis estructural (caso Colombia). 9a Conferencia Latinoamericana y Caribeña de Ciencias Sociales, Mexico City. https://conferenciaclacso.org/programa/resumen_ponencia.php

extractive approaches to economic development and market-driven mindsets. If debates around contentious issues are ignored or glossed over – including in relation to competition between food production and biofuels or the negative impacts of land use changes – bioeconomy could lose potency as a credible alternative to the status quo.⁴²

Ultimately, the potential of bioeconomy in the Amazonia likely depends not on global agenda setting, but on regionally-specific considerations such as the livelihoods and well-being of people who live there. A priority, then, is not just ensuring environmental priorities, but also simultaneously maximizing economic and social sustainability. Achieving this balance is consistent with the Science Panel for the Amazon's (SPA) notion of "socio-bioeconomy," which recognizes the vast biological and cultural diversity of the Amazon.⁴³ Such insights are essential for developing bioeconomic models that are appropriately tailored for the region. To be sure, the definitions of what constitutes bioeconomy differ between and within countries of the Amazon. What is more, the terminology and basic concepts used to describe bioeconomy are also extremely diverse – Table 3 highlights various "branches" of bioeconomy. Likewise, the debate over the meaning of "sustainable development" is reflected in the various terms and definitions that advocate different approaches to balancing sustainability, responsible resource management and economic growth.

Table 3. Selected "Branches" of Bioeconomy

Branch	Description
Agro-bioeconomy	Emphasizes intensive biomass production from planted forests and commercial agriculture, with a focus on monocultures and minimal reliance on biodiversity. This approach can threaten ecosystem diversity without responsible land management. In terms of climate change, bioeconomic products could cut emissions by replacing fossil fuels, but the push for mass production risks deforestation and resource depletion. Moreover, these monoculture systems are often vulnerable to climate change, presenting a challenge for sustainability. ⁴⁴
Blue bioeconomy	Taps into renewable aquatic life forms like algae, sponges, jellyfish, and microorganisms to produce a diverse array of products, processes, and services. ⁴⁵
Circular bioeconomy	Economy driven by the forces of nature that represents a fresh economic approach that prioritizes the utilization of renewable natural resources and aims to drastically reduce waste. This model seeks to phase out a wide range of non-renewable, fossil fuel-derived products. ⁴⁶
Computational bioeconomy	Use of advanced computational biology and bioengineering methods to tap into the information held within Amazonia's rich biodiversity. Guarantee fair distribution of tropical countries' biological data to transform various sectors and potentially establish thriving bio-based export markets. ⁴⁷
Forest-based bioeconomy	Forest stewardship with a focus on native forest cultivation, moderate reliance on biodiversity, and the aim to mitigate CO ₂ emissions. ⁴⁸
Knowledge-based bioeconomy	Turns life science insights into innovative, sustainable, and competitive products. ⁴⁹
Restorative bioeconomy	Focus not just on preserving and restoring ecosystems, but also on enhancing community involvement and ensuring that the rewards are equitably shared among all value chain stakeholders. ⁵⁰
Socio-bioeconomy	Combination of activities that sustain productive and multifunctional landscapes and preserve cultural diversity. This approach enhances the economic and social value derived from the Amazonia's rich biodiversity and agricultural variety. It encompasses a wide array of ecosystem services by protecting and rehabilitating forest and aquatic ecosystems, as well as through the varied cultivation and processing of indigenous plants (such as fruits, nuts, and medicinal herbs), fish, and other resources. ⁵¹
Sustainable bioeconomy	Not only pursues environmental goals like reducing carbon emissions but also strives for economic growth through the creation of new jobs, products, and markets. Additionally, it addresses political objectives, including reduced dependency on the imports of processed resources and goods. ⁵²

⁴² Rodríguez, J. (2022). Mapeo y Promoción de Bioemprendimientos comunitarios en los países donde se implementa el Proyecto Amazonia 2.0 (p. 54). UICN. <https://www.iucn.org/sites/default/files/2023-08/producto-no.-3-mapeo-y-promocion-de-bioemprendimientos.pdf>

⁴⁴ Uma Concertação pela Amazônia. (2021). Uma agenda pelo desenvolvimento da Amazônia. <https://arapyau.org.br/wp-content/uploads/2021/10/uma-agenda-pelo-desenvolvimento-da-amazonia.pdf>

⁴⁵ European Commission. Directorate General for Maritime Affairs and Fisheries, & EUMOFA. (2018). Blue bio-economy: situation report and perspectives. Publications Office. <https://data.europa.eu/doi/10.27771/053734>

⁴⁶ Palahí, M. et al. (2020). Investing in Nature as the true engine of our economy: a 10-point Action Plan for a Circular Bioeconomy of Wellbeing. EFI. https://efi.int/sites/default/files/files/publication-bank/2020/EFI_K2A_02_2020.pdf

⁴⁷ Castilla-Rubio, J., & Val, A. (2022, September 8). Como criar uma bioeconomia computacional inclusiva. Valor Econômico. <https://valor.globo.com/opinia0/coluna/como-criar-uma-bioeconomia-computacional-inclusiva.ghtml>

⁴⁸ Uma Concertação pela Amazônia. (2021). Uma agenda pelo desenvolvimento da Amazônia. <https://arapyau.org.br/wp-content/uploads/2021/10/uma-agenda-pelo-desenvolvimento-da-amazonia.pdf>

⁴⁹ European Commission. (2007). En Route to the Knowledge-Based Bio-Economy. https://dechema.de/dechema_media/Downloads/Positionspapier/Cologne_Paper.pdf

⁵⁰ Bastos Lima, M. G., & Palme, U. (2022). The Bioeconomy–Biodiversity Nexus: Enhancing or Undermining Nature's Contributions to People? *Conservation*, 2(1), 7–25. <https://doi.org/10.3390/conservation2010002>

⁵¹ Garrett, R. et al. (2023). Supporting sociobioeconomies of healthy standing forests and flowing rivers in the Amazon. Science Panel for the Amazon. https://www.theamazonwewant.org/wp-content/uploads/2023/08/PB-Bioeconomy-en_approved.pdf

⁵² Flórez Zapata, N., Murcia López, M., & Arce Castellanos, L. (2022). El guáimaro, una oportunidad bioeconómica y regenerativa para el Bosque Seco Tropical y sus comunidades. Instituto de Investigación de Recursos Biológicos Alexander von Humboldt. <http://repository.humboldt.org.co/handle/20.500.11761/35976>. The term "sustainable" relates to long-term economic growth alongside environmental wellbeing since the concept of ecological sustainability is already inherent to all branches of bioeconomy.

Alongside the bioeconomy are related concepts related to the “greening of the economy” that are promoted by international organizations and some governments and industry players (see Table 4). Critics of concepts such as green growth, the green economy, green business, and the circular economy contend that these models favor economic growth at the expense of environmental and social sustainability.⁵³ They argue that such frameworks remain focused on resources without fully accounting for ecological impacts and may perpetuate social inequalities. A recurring concern is the overreliance on technological solutions and the marginalization of valuable traditional and indigenous knowledge. Moreover, these approaches are often perceived to be fragmented, short-term, and market-centric, failing to properly address the issues of ecological overshoot and intergenerational equity.

Adjacent concepts such as the ecological economy, regenerative economy, and indigenous economy are gaining traction. These approaches purportedly take a holistic view, focusing on long-term goals and social inclusion to drive systemic change. The aim is to foster a balance between human economic activities and the natural environment. These viewpoints can potentially be compatible with certain aspects of “bioeconomy,” but also differ in significant ways. For instance, Bolivia leans towards an indigenous economy model and the philosophy of “Living Well (Buen Vivir)”. This perspective, along with other decolonial economic ideas, are particularly influential in Bolivia, Colombia, and Venezuela. Stakeholders in these countries are exploring bioeconomy strategies through frameworks such as “social and solidarity economics” and “economies for life.”

Table 4. Green economic concepts that intersect with bioeconomy

Concept	Description
Bio-based economy	Economy powered by biomass instead of fossil fuels. ⁵⁴
Circular economy	Seeks zero waste and pollution, promotes material reuse, and supports natural system restoration. ⁵⁵
Doughnut economics	Frames a “safe space” for humanity, bounded by an inner circle of essential needs and an outer ecological limit, within which sustainable and equitable development can occur. ⁵⁶
Ecological economics	Blends ecology and economics to shape policies that ensure ecological sustainability, equitable resource use, and the smart stewardship of natural and social resources. ⁵⁷
Eco-innovation	Refers to the development and implementation of innovative products, processes, services, or practices that reduce environmental harm and the negative impacts of resource consumption. ⁵⁸
Economies for Life	Emphasizes cooperation and mutual support, and valorizes a wide array of economic systems beyond mainstream models.
Green economy	Promotes sustainable and inclusive growth by cutting emissions, curbing pollution, enhancing energy and resource efficiency, protecting biodiversity, and driving job creation and economic opportunity.
Green growth	Promotes economic advancement while preserving the natural resources and environmental services essential for our well-being.
Green industry	Sustainable growth through green investments in the public and private sectors. ⁶²
Green or sustainable business	Implement eco-friendly and ethical business methods aligned with CSR and ESG standards. ⁶³

⁵³ Eickhout, B. (2012). A strategy for a bio-based economy (p. 52). Green European Foundation. https://gef.eu/wp-content/uploads/2017/01/A_strategy_for_a_bio-based_economy.pdf

⁵⁴ Eickhout, B. (2012). A strategy for a bio-based economy (p. 52). Green European Foundation. https://gef.eu/wp-content/uploads/2017/01/A_strategy_for_a_bio-based_economy.pdf

⁵⁵ Ellen MacArthur Foundation. (n.d.). What is a circular economy? <https://www.ellenmacarthurfoundation.org/topics/circular-economy-introduction/overview>

⁵⁶ Doughnut Economics Action Lab. (n.d.). About Doughnut Economics. <https://doughnuteconomics.org/about-doughnut-economics>

⁵⁷ Costanza, R. (2019). Ecological Economics 1. In *Encyclopedia of Ecology* (pp. 258–264). Elsevier. <https://doi.org/10.1016/B978-0-12-409548-9.11124-8>

⁵⁸ European Commission. (n.d.). Eco-Innovation at the heart of European policies. https://green-business.ec.europa.eu/eco-innovation_en

⁵⁹ Ruiz, A. R. (2023). Economía, bioeconomía, economías “otras” y economías para la vida: conceptos y reflexiones base para una agenda de investigación. In A. R. Ruiz (Ed.), *Bioeconomía: Miradas múltiples, reflexiones y retos para un país en crisis estructural. Un libro sobre economías diversas, y economías “otras” para la vida* (pp. 323–348). Centro Editorial – Facultad de Ciencias Económicas, Universidad Nacional de Colombia. https://www.researchgate.net/publication/373330971_Bioeconomía_Miradas_múltiples_reflexiones_y_retos_para_un_país_complejo_Un_libro_sobre_economías_diversas_y_economías_otras_para_la_vida

⁶⁰ United Nations Environment Programme (UNEP). (n.d.). Green Economy. <https://www.unep.org/regions/asia-and-pacific/regional-initiatives/supporting-resource-efficiency/green-economy>

⁶¹ OECD. (n.d.). Green growth and sustainable development. <https://www.oecd.org/greengrowth/>

⁶² United Nations Industrial Development Organization (UNIDO). (n.d.). Green Industry initiative. <https://www.unido.org/our-focus-cross-cutting-services-green-industry/green-industry-initiative>

⁶³ International Labour Organization (ILO), & German Development Cooperation (GIZ). (2022). Green Business Guide. ILO. https://www.ilo.org/wcmsp5/groups/public/---ed_emp/---emp_ent/---ifp_seed/documents/publication/wcms_882794.pdf

Table 4. Green economic concepts that intersect with bioeconomy

Concept	Description
Inclusive green growth	Seeks to harmonize short-term economic development and poverty reduction with long-term environmental sustainability in developing countries. ⁶⁴
Indigenous economy	Seeks to tap into the knowledge, practices, values, and principles of indigenous communities to sustainably manage biodiversity and support a variety of economic activities, such as production and trade, that provide collective benefits to both indigenous and non-indigenous groups. ⁶⁵ This strategy aligns with the concept of Sumak Kawsay or “Buen Vivir,” emphasizing quality of life over economic growth. ⁶⁶
Orange economy	Covers innovative and creative industries like culture, design, and communications, highlighting disruptive tech and new business models. ⁶⁷
Regenerative economics	Proposes a nature-inspired circular economy model that emphasizes fairness, holistic wealth innovation, adaptability, community empowerment, and respect for local uniqueness. ⁶⁸
Social and solidarity economics	Promotes community-driven resource management and fair labor to improve quality of life sustainably rather than focusing on private profit. ⁶⁹
Sustainable consumption and production	Strives to meet human needs and improve well-being with minimal environmental footprint, emphasizing resource efficiency, reduced toxicity, and lower waste and emissions throughout a product's life cycle to conserve resources for future generations. ⁷⁰

Box 2. Indigenous approaches to bioeconomy

There is growing appreciation of the importance of traditional and indigenous knowledge for conceptualizing bioeconomy internationally and in Amazonia. Although many indigenous communities might not explicitly employ the term “bioeconomy,” their home-grown economic systems centered around the sustainable use of biodiversity have much to teach about how to live in harmony with the Amazonia rainforest. Indeed, indigenous communities often apply distinct concepts of wealth and prosperity that are more intimately connected to the earth and less aligned with materialistic or consumerist values.

The indigenous bioeconomy is not defined exclusively by its products, but also by the social technologies and ancestral knowledge that have been passed down across generations. Sustainable production, aligned with the pace of village life and in harmony with nature, seeks to promote collective well-being. Notwithstanding a lack of official statistics on the size of this market, bioeconomy is a crucial source of food security, trade and income generation for indigenous communities. Examples include coffee produced by the Paiter-Suruí, the Yanomami mushroom, the Baniwa pepper, graphics printed on clothing made by the Yawanawa people and a variety of products and techniques that have become popular in Brazilian culture, such as tapioca, beiju, açai and buriti wine.⁷³

⁶⁴ World Bank. (2012). Inclusive Green Growth: The Pathway to Sustainable Development. The World Bank. <https://doi.org/10.1596/978-0-8213-9551-6>

⁶⁵ Cotacachi, D., & Tejerina, V. (2023, August 9). Bioeconomía indígena: Forjando un futuro sostenible en la Amazonía. Hablemos de Sostenibilidad y Cambio Climático. <https://blogs.iadb.org/sostenibilidad/es/bioeconomia-indigena-forjando-un-futuro-sostenible-en-la-amazonia/>

⁶⁶ Forest Trends, & Accelerating Inclusion and Mitigating Emissions (AIME). (2016). Las 2 esferas de la Economía Indígena. <https://acervo.socioambiental.org/sites/default/files/documents/i6d00032.pdf>

⁶⁷ Restrepo, F. B., & Márquez, I. D. (2013). The Orange Economy. IDB. <https://publications.iadb.org/publications/english/document/The-Orange-Economy-An-Infinite-Opportunity.pdf>

⁶⁸ Fullerton, J. (2015). Regenerative Capitalism: How Universal Principles and Patterns Will Shape Our New Economy (p. 120). Capital Institute. <https://capitalinstitute.org/wp-content/uploads/2015/04/2015-Regenerative-Capitalism-4-20-15-final.pdf>

⁶⁹ Coraggio, J. L. (2020). Economía social y economía popular: Conceptos básicos. Instituto Nacional de Asociativismo y Economía Social (INAES)/ Ministerio de Desarrollo Productivo. <https://www.argentina.gob.ar/sites/default/files/coraggio.pdf>

⁷⁰ UNEP. (n.d.). Sustainable consumption and production policies. <https://www.unep.org/explore-topics/resource-efficiency/what-we-do/sustainable-consumption-and-production-policies>

⁷¹ Cotacachi, D., & Tejerina, V. (2023, August 9). Bioeconomía indígena: Forjando un futuro sostenible en la Amazonía. Hablemos de Sostenibilidad y Cambio Climático. <https://blogs.iadb.org/sostenibilidad/es/bioeconomia-indigena-forjando-un-futuro-sostenible-en-la-amazonia/>

⁷² Apurina, F. (2023, May 25). personal communication [Online].

⁷³ Amazon Concertation (2024) Indigenous bioeconomy: ancestral knowledge and social technologies. São Paulo: Arapyaú, https://concertacaoamazonia.com.br/wp-content/uploads/2024/02/Volume-3_Bioeconomia-indigena_ING-1.pdf

The Coordinating Body of Indigenous Organizations of the Amazonia Basin (COICA) is a prominent voice in re-imagining sustainable economic opportunities in Amazonia. Representing 511 indigenous peoples across all eight Amazonian countries, COICA is instrumental in amplifying the indigenous perspective and advocating for economic approaches that integrate social dimensions and honor the spiritual significance of these territories. At the First International Forum on Bioeconomy and Amazonian Peoples in 2023, COICA led the definition of principles that provide the foundation for indigenous economy:

- Self-sufficiency
- Solidarity
- Reciprocity
- Collectivity
- Partnership
- Equitable distribution of benefits
- Protection of biodiversity
- Protection of traditional knowledge
- Fair trade
- Gender equity⁷⁴

Across Amazonia, indigenous communities, frequently in partnership with civil society organizations, are actively engaged in creating and strengthening sustainable value chains that respect ecological balance and aim to maintain the integrity of the rainforest for future generations. The integration of indigenous knowledge and values into bioeconomy is not simply a matter of environmental stewardship but also of social justice and cultural preservation. It is crucial that these perspectives be included in the ongoing development and implementation of bioeconomic models to ensure that they are truly inclusive, equitable, and reflective of the diverse values and needs of all stakeholders, particularly those of indigenous communities.

In addition to governments, multilateral, philanthropic, and civil society organizations are also developing approaches to conceptualize the bioeconomy. Frameworks and priorities advanced by funding organizations are particularly important since they can set the terms for the allocation of resources and shape the trajectory of development programs and projects. Table 5 highlights the activities of four influential organizations, and shows how they tend to emphasize the sustainable utilization of natural biological resources. The emphasis on areas such as sustainable agroforestry, nature tourism, and non-timber forest products effectively delineates the contours of economic activities they deem worthy of investment – activities that are expected to simultaneously foster economic growth, enhance quality of life, and ensure ecological preservation. The significance of these organizations' conceptualizations of bioeconomy lies in their potential to influence real world outcomes. Their visions and priorities, through the mechanism of financial support, can either align with or diverge from the local definitions and understandings of bioeconomy held by the countries and communities within the Amazonia.

⁷⁴ Cotacachi, D., & Tejerina, V. (2023, August 9). Bioeconomía indígena: Forjando un futuro sostenible en la Amazonía. Hablemos de Sostenibilidad y Cambio Climático. <https://blogs.iadb.org/sostenibilidad/es/bioeconomia-indigena-forjando-un-futuro-sostenible-en-la-amazonia/>

Table 5. Examples of Bioeconomy definitions for selected funding organizations

Branch	Description	Key Areas
Bezos Earth Fund	Among other things, the Brazilian Amazonia initiative promotes “forest-protecting economies” that harness indigenous wisdom and the region's rich biodiversity. ⁷⁵	<ul style="list-style-type: none"> • Forest products • Carbon markets • Sustainable tourism • Agro-ecology
Green Climate Fund	The Amazon Bioeconomy Fund defines bioeconomy as “any economic activity based on the use of natural renewable biological resources, from both land and ocean, to obtain food, materials, and energy in a sustainable way without compromising their availability for future generations.” ⁷⁶	<ul style="list-style-type: none"> • Sustainable agroforestry • Cultivation of native palms • Production of non-timber natural forest products • Growth of native species timber • Aquaculture • Community-led nature tourism
Governors' Climate and Forests Task Force	A pilot project in Brazil and Peru aims to foster sustainable development and economic growth in the Amazonia to enhance living standards while preserving the region's forests. ⁷⁷	<ul style="list-style-type: none"> • Forest products • Carbon markets • Sustainable tourism • Agro-ecology
Global Environmental Facility World Bank	The Amazon Sustainable Landscapes Program seeks to ensure that “agriculture lands, forests, and freshwater habitats are sustainability managed and restored, providing economic, social, and cultural, inclusive well-being.” ⁷⁸	<ul style="list-style-type: none"> • Value chains and “nature-based biodiversity businesses”
IDB and Amazonia Forever Program	The proposal for the Establishment of the Seed/Transitory Ordinary Capital Strategic Development Program For Sustainable Development In the Amazon states that “the bioeconomy encompasses diverse economic sectors and value chains under a paradigm of maintaining or increasing the natural capital on which the sector is centered, rather than altering, devaluing and depleting it.” ⁷⁹ Moreover, bioeconomy might also be defined as “any economic activity from both land and ocean, to obtain food, materials, and energy in a sustainable way without compromising their availability for future generations.” ⁸⁰	<ul style="list-style-type: none"> • Design, development, production, and use of biological products and processes • Innovation and technology • Sustainable management practices for agricultural products, livestock and forests

The congruence between the macro-level perspectives of funding bodies and the micro-level realities of the Amazonian stakeholders is a critical factor in the effective expansion of the region's bioeconomy. It is through this “semantic symmetry” that initiatives can be both locally relevant and globally responsible, ensuring that the bioeconomy evolves not as an externally-imposed paradigm but as a collaborative endeavor that respects and integrates indigenous knowledge, national policies, and regional development goals. Therefore, it is imperative that the visions of funding organizations are not developed in a vacuum but rather in concert with the aspirations and practical wisdom of the local actors, thereby fostering a bioeconomy that is not only sustainable and inclusive but also reflective of the multifaceted dimensions of human and ecological well-being.

⁷⁵ Bezos Earth Fund. (n.d.). Brazilian Amazon. <https://www.bezosearthfund.org/initiatives/brazilian-amazon-rainforest>

⁷⁶ Green Climate Fund. (2021). FP173: The Amazon Bioeconomy Fund: Unlocking private capital by valuing bioeconomy products and services with climate mitigation and adaptation results in the Amazon. <https://www.greenclimate.fund/sites/default/files/document/funding-proposal-fp173.pdf>

⁷⁷ Governors' Climate and Forests Task Force. (2023). Bioeconomy in Amazonia: Pilot Project for the GCF Task Force in Brazil and Peru. <https://www.gcftf.org/wp-content/uploads/2023/07/SHORT-GCF-Task-Force-in-Brazil-and-Peru.pdf>

⁷⁸ World Bank. (n.d.). Amazon Sustainable Landscapes Program. <https://www.worldbank.org/en/programs/amazon-sustainable-landscapes-program/overview>

⁷⁹ See <https://www.iadb.org/document.cfm?id=EZIDB0000577-1039411543-8>

⁸⁰ IDB (2021) A call for an integrated framework for the bioeconomy in Latin America and The Caribbean region. <https://blogs.iadb.org/sostenibilidad/en/a-call-for-an-integrated-framework-for-the-bioeconomy-in-latin-america-and-the-caribbean-region/>. Please note that the bioeconomy definition within the IDB might vary depending on the context and time.



3. AMAZONIA BIOECONOMY – OFFICIAL POLICIES

The laws, policies and regulations of Amazonian countries provide insight into the direction of bioeconomy priorities and practices, including how they relate to development pathways. In some cases, governments have adopted sophisticated definitions of bioeconomy while in others, they avoid the concept entirely. When a government opts to use a different term this could indicate that public debate and acceptance are still in an early stage or that bioeconomy is not regarded as an ideal concept to guide policy. Table 6 offers a comparison across countries of the terminology used in the most recent and relevant legislation and policies. Although wording may differ across countries, there appears to be shared recognition of the need to sustainably manage and leverage native biodiversity, as well as the role of innovation in creating value-added products and strengthening emergent sectors of the economy.

The eight countries spanning Amazonia can be roughly divided into four groups in accordance with the degree of adjacency or proximity to bioeconomy frameworks and policies. The first group, comprising Brazil and Colombia, features comparatively robust and articulated bioeconomy policies and programs. Both countries have rapidly evolving productive sectors that are pursuing scientific and technological priorities, while also harnessing the valuable experiences and contributions of traditional communities. The second group includes Ecuador and Peru, two countries that are positioned more closely to the bioeconomy agenda, but currently apply terms such as “bionegocios” (bio-businesses) and “bioemprendimientos” (bio-enterprises), respectively. That being said, Ecuador is close to publishing a comprehensive proposal for a national bioeconomy policy.

Meanwhile, the third group includes Bolivia and Venezuela that have adopted unique approaches to enhance the trade and value chains of their biodiversity-based products. Bolivia avoids using the term “bioeconomy” due to its association with environmentally harmful commercialization, which is not allowed by its constitution. Venezuela, on the other hand, concentrates on bio-inputs to promote self-sufficiency rather than broader bioeconomic sectors. The fourth group is composed of Guyana and Suriname and is characterized by incipient sustainable development strategies that emphasize alternative concepts like “Green Economy” and “Green Growth,” closely aligned with low-carbon strategies.

Table 6. Country-level definitions of bioeconomy or related terms (as of December 2023)

Country	Most relevant term	Description	Related entity in government
Bolivia	New industries (Nuevas industrias)	Use of technology to transform renewable resources into high-value products like phytochemicals, biofuels, and essential oils, while also advancing steel, lithium, and petrochemical sectors to bolster market presence in line with constitutional guidelines. ⁸¹	Ministry of Productive Development and Plural Economy
Brazil	Bioeconomy (Bioeconomia)	Economic activities centered on biodiversity, which foster innovative solutions for the use of natural resources, aiming to shift towards a sustainable development model focused on societal well-being and the productive conservation of the environment. ⁸²	Ministry for Integration and Regional Development
Colombia	Bioeconomy (Bioeconomía)	Production, use, and preservation of biological resources – as well as the associated knowledge, science, technology, and innovation – to deliver information, products, processes, and services across all economic sectors. A sustainable economy should efficiently manage biodiversity and biomass to create new value-added products and processes through knowledge and innovation. ⁸³	Ministry of Science, Technology and Innovation
Ecuador	Bioenterprise (Bioemprendimiento)	Public, private, academic and civil society initiatives that employ sustainable practices to recognize the value of native biodiversity and preserve the country's natural heritage. ⁸⁴	Ministry of Environment, Water and Ecological Transition
Guyana	Green Economy	Sustainable resource management to protect biodiversity and traditional practices, support low-emission forest management, and explore the potential for a special economic zone to boost sustainable, high-value “green” exports. ⁸⁵	Ministry of the Presidency
Peru	Biobusiness (Bionegocio)	Sustainable use of local biodiversity to enhance investment and trade in accordance with the Convention on Biological Diversity, driving local economic growth with value-added products and strategic partnerships, while ensuring competitiveness and social and economic equity in global markets. ⁸⁶	Ministry of Environment
Suriname	Greening and Green Growth (Vergroenen en Groene Groe)	Sustainable management of water, forest, and biodiversity resources, along with public-private partnerships to boost the non-timber forest product industry and enhance access to global markets. ⁸⁷	Minister of Finance and Planning
Venezuela	Biocommerce (Biocomercio)	Activities related to the harvesting, producing, processing, and commercialization of goods and services from local biodiversity – based on tenets of conservation, sustainable use of resources, equitable distribution of benefits, and respect for local and indigenous communities' knowledge. ⁸⁸	Asamblea Nacional

⁸¹ Ministerio de Desarrollo Productivo y Economía Plural. (2022). Plan Sectorial de Desarrollo Integral para Vivir Bien – Sector Industrial 2021-2025. <https://produccion.gob.bo/wp-content/uploads/2023/10/RM-137.2022-DICTAMEN-23-PSDI-SECTOR-INDUSTRIAL-2021-2025.pdf>

⁸² Ministro de Estado da Integração e do Desenvolvimento Regional (2023). Portaria no 3.717, de 30 de novembro de 2023. <https://pesquisa.in.gov.br/imprensa/servlet/INPDFViewer?jornal=515&pagina=116&data=04/12/2023&captchafield=firstAccess>

⁸³ Gobierno de Colombia. (2020). Bioeconomía para una Colombia Potencia viva y diversa: Hacia una sociedad impulsada por el Conocimiento. https://minciencias.gov.co/sites/default/files/upload/paginas/bioeconomia_para_un_crecimiento_sostenible-qm_print.pdf

⁸⁴ Ministerio del Ambiente, Agua y Transición Ecológica. (2019). Acuerdo Ministerial No 034: lineamientos para el fomento del bioemprendimiento. <https://www.ambiente.gob.ec/wp-content/uploads/downloads/2019/08/Bases-para-presentaciA%CC%83%C2%B3n-de-propuestas-dentro-de-la-Convocatoria-2-del-FFF-en-Ecuador.pdf>

⁸⁵ Government of Guyana. (2019). Green State Development Strategy: Vision 2040. <https://faolex.fao.org/docs/pdf/guy199315.pdf>

⁸⁶ Ministerio del Ambiente. (2020). Resolución Ministerial N.º 046-2020-MINAM. https://cdn.www.gob.pe/uploads/document/file/522975/RM_046-2020-MINAM.pdf

⁸⁷ National Assembly of Suriname. (2021). Multi-Annual Development Plan 2022-2026 of the Republic Suriname. <https://observatorioplanificacion.cepal.org/sites/default/files/plan/files/MOP-2022-2026-Volledig-FINAL-DNA-approved-Engels.pdf>

⁸⁸ Asamblea Nacional de la República Bolivariana de Venezuela. (2018). Ley de Gestión de la Diversidad Biológica. <https://faolex.fao.org/docs/pdf/ven89953.pdf>



4. AMAZONIA BIOECONOMY – PRINCIPLES

The adoption of an overly rigid definition of bioeconomy could be counterproductive when it comes to fostering more sustainable economic activities in Amazonia. Rather than forcing a universal definition, the report recommends a more flexible and inclusive approach, one that conceptualizes bioeconomy as an amalgamation of activities aligned with a set of fundamental principles. Such a perspective allows for a wider and more inclusive approach that can accommodate the dynamic and evolving nature of bioeconomic activities across the region.

In order to account for the diversity of approaches and definitions of bioeconomy in Amazonia, the assessment draws on a useful framework proposed at the Global Bioeconomy Summit (2018)⁸⁹ and particularly by IICA.⁹⁰ Given the importance of recognizing the presence and contributions of indigenous and traditional communities in the region, this study adds an additional principle that explicitly cites ancestral knowledge as an integral part of the Amazonia bioeconomy. The key principles included in the framework are:

- Use of biological resources and processes;
- Integration of science, technology, and innovation;
- Inclusion of ancestral and traditional knowledge;
- Investments that enhance value addition through improved processing and supply chain efficiencies; and
- Environmental sustainability, decarbonization, and the provision of environmental services, alongside the substitution of fossil fuel-based products with more sustainable alternatives.

Based on the research conducted for this study, each country within Amazonia exhibits varying degrees of engagement with respect to the five principles.⁹¹

⁸⁹ Global Bioeconomy Summit. (2018). Global Bioeconomy Summit Communiqué. <https://www.bioekonomierat.de/media/pdf/archiv/international-gbs-2018-communicue.pdf>

⁹⁰ Feeney, R., Felici, S., & Chavarria, H. (Eds.). (2024). Informe de situación y perspectivas de la bioeconomía en América Latina y el Caribe. IICA. <https://repositorio.iica.int/handle/11324/22104>

⁹¹ See Appendix 5 for a detailed review of the initial evidence on bioeconomy principles in each country, based on an assessment of current documents, literature, and expert interviews. The Igarapé Institute advises local experts to closely evaluate these results and suggests holding regional workshops to assess the current use of bioeconomy principles in the Amazon nations.

USE OF BIOLOGICAL RESOURCES AND PROCESSES

The concept of sustainable use of biodiversity or natural resources is a foundational element of bioeconomy across the nations studied.

BRAZIL: The National Bioeconomy and Sustainable Regional Development Strategy (BioRegio) highlights the “use of natural resources” as a foundation for sustainable development.

COLOMBIA: Biodiversity serves as the foundation for Colombia’s bioeconomy, along with the necessity to maintain the sustainability of genetic material for the growth of the bioenergy sector.

ECUADOR: Policies highlight the “sustainable utilization of native biodiversity.”

PERU: Bio-businesses center around the sustainable use of biodiversity resources. Similarly, due to the country’s significant focus on circular economy and green growth, there is a substantial emphasis on the reuse of organic or inorganic waste.

VENEZUELA: mentions “native and biological diversity” as key components.⁹²

BOLIVIA: emphasizes the “use of renewable natural resources.”⁹³

GUYANA: The Green State Development Strategy underscores the importance of managing natural resource wealth.

SURINAME: The Multi-Annual Development Plan 2022-2026 cites the “sustainable management of water, forest, and biodiversity resources.”

INTEGRATION OF SCIENCE, TECHNOLOGY, AND INNOVATION

The emphasis on the role of science, technology and innovation varies across the eight Amazonian countries.

BRAZIL: Demonstrates a strong commitment to integrating science, technology, and innovation into bioeconomy with substantial support from government entities such as the Ministry of Science, Technology, and Innovations (MCTI) and public research organizations like Embrapa. The country’s considerable investments developing research and development for tropical agriculture, for example, could play a role in shaping a “culture” of innovation.

COLOMBIA: The “bioeconomy mission” is entirely led by the Ministry of Sciences with support from the SINCHI Institute (Instituto Amazónico de Investigaciones Científicas).

ECUADOR: The Amazonia is not currently integrated into the country’s science, technology, and innovation system. For example, the Idearium platform does not show any registered and accredited spaces for innovation and technology transfer in the region.⁹⁴

PERU: A Research and Innovation Agenda for Biocommerce (AIIB) was established in 2012 to guide and coordinate R&D activities, and the National Council of Science, Technology and Technological Innovation (CONCYTEC) also collaborates on the National Research Agenda on Climate Change.⁹⁵ Moreover, the Peruvian Amazon Research Institute (IIAP) has been working with SINCHI, a Colombian research institute, to develop genetic inventories in the Amazonia.

⁹² Estado Plurinacional de Bolivia. (2012). Ley Marco de la Madre Tierra y Desarrollo Integral para Vivir Bien. <http://www.planificacion.gob.bo/uploads/marco-legal/Ley%20N%C2%B0%20300%20MARCO%20DE%20LA%20MADRE%20TIERRA.pdf>

⁹³ Ministerio de Desarrollo Productivo y Economía Plural. (2022). Plan Sectorial de Desarrollo Integral para Vivir Bien – Sector Industrial 2021-2025. <https://produccion.gob.bo/wp-content/uploads/2023/10/RM-137.2022-DICTAMEN-23-PSDI-SECTOR-INDUSTRIAL-2021-2025.pdf>

⁹⁴ Secretaría de Educación Superior, Ciencia, Tecnología e Innovación. (n.d.). Idearium. <https://www.idearium.gob.ec/>

⁹⁵ Grupo de Investigación e Innovación en Biocomercio. (2012). Agenda de Investigación e Innovación para el Biocomercio 2012-2021 (p. 23). Consejo Nacional de Ciencia, Tecnología e Innovación Tecnológica (CONCYTEC). <https://servicio.indecopi.gob.pe/portalctpi/archivos/docs/articulos/2-2015-1/Agenda%20de%20Investigacion%20Ambiental.pdf>

BOLIVIA: Still in the early stages of developing a science and innovation system centered on bioprospecting and the creation of bioproducts or bioservices, with current innovations primarily emerging from public companies.⁹⁶

VENEZUELA: The advancement of agricultural bio-supplies, such as biocontrol agents and biofertilizers, is a significant driver of innovation, largely propelled by academic institutions.⁹⁷

GUYANA: Fossil fuel foundations and companies have made notable investments in sustainable employment and conservation, although this raises questions about their influence in the ongoing development of the bioeconomy.⁹⁸

SURINAME: Limited development, though the Center for Agricultural Research in Suriname (CELOS) is an important promoter of research, including inventories of non-timber forest products (NTFPs).

INCLUSION OF ANCESTRAL AND TRADITIONAL KNOWLEDGE

Most bioeconomy policies and programs underline the protection of communities:

BRAZIL: Public debate around bioeconomy places significant emphasis on social and cultural diversity and ensuring the equitable distribution of profits derived from Amazonian resources to local communities. A goal is to honor and integrate the unique knowledge of these communities into various value chains.

COLOMBIA: Work conducted by SINCHI focuses on reinforcing collaborations and advancements with indigenous communities in the Amazonia.

ECUADOR: The forthcoming Bioeconomy Policy will underscore the importance of promoting social inclusion, reducing regional inequalities, and ensuring the equitable sharing of benefits from increased productivity.

PERU: Law 27811 mandates Prior Informed Consent from indigenous peoples before their collective knowledge is utilized for scientific, commercial, or industrial applications.

VENEZUELA: Article 120 of the Constitution specifically states that “the use of natural resources in indigenous habitats by the State will be carried out without harming their cultural, social, and economic integrity.

BOLIVIA: High appreciation for local knowledge. Bolivia has ratified the Convention for Biodiversity and the Cartagena Protocol (2003), but it is not a part of the Nagoya Protocol. It is one of the few countries that opposes treating biodiversity as a commodity, and its role has been highlighted in various global forums.⁹⁹

GUYANA: Recognition of the validity and value of traditional indigenous knowledge, particularly regarding the preservation and utilization of the country’s key natural resources, such as forests.

SURINAME: Recognition of both the need to strengthen land rights for indigenous and Maroon communities and the potential contributions these groups can make to sustainable and culturally-sensitive tourism.

⁹⁶ Sánchez, J. I. P., & González, G. C. (2017). Identificación del potencial de los países de América Latina para transitar hacia una bioeconomía basada en el conocimiento. XVII Congreso Latino-Iberoamericano de Gestión Tecnológica. Gestión de la innovación para la competitividad: Sectores estratégicos, tecnologías emergentes y emprendimientos, Mexico City. https://www.uam.mx/altec2017/pdfs/ALTEC_2017_paper_510.pdf

⁹⁷ Fundación Servicio para el Agricultor (FUSAGRI), & IICA. (2022). Caracterización del sector bioinsumos agropecuarios en Venezuela (p. 44). FUSAGRI. https://www.fusagri.com/publication/bioinsumos-venezuela/bioinsumos_Venezuela_FUSAGRI-IICA.pdf

⁹⁸ Business Wire. (2018, July 2). ExxonMobil Foundation Invests US\$10 Million in Guyana for Research, Sustainable Employment and Conservation. <https://www.businesswire.com/news/home/20180702005264/en/>

⁹⁹ Pacheco, D. et al. (2013). Bolivia en el Convenio sobre Diversidad Biológica. Viceministerio de Relaciones Exteriores Dirección General de Relaciones Exteriores. <https://www.cancilleria.gob.bo/webmre/sites/default/files/libros/10%20Bolivia%20en%20el%20convenio%20sobre%20diversidad%20biologica.pdf>



INVESTMENTS THAT ENHANCE VALUE ADDITION THROUGH IMPROVED PROCESSING AND SUPPLY CHAIN EFFICIENCIES

All Amazonian countries have prioritized the conservation and sustainable use of biodiversity. There is likewise a widespread recognition of the importance of social inclusion, job creation, and the fair distribution of benefits, which are essential for achieving economic and social sustainability.

BRAZIL: A wide range of actors are actively working on solutions for converting biomass into high-value bioproducts.

COLOMBIA: The Ministry of Science is focused on creating high-value products through collaboration with research institutions, universities, and Amazonian communities.

ECUADOR: The focus on bio-entrepreneurship often results in developments being limited to short-term strategies and sectors with little added value, such as fresh and processed foods, and services like tourism. Programs like Innovando Amazonía aim to encourage productive diversification, responsible and sustainable use of both renewable and non-renewable resources.¹⁰⁰

PERU: NGOs and international partnerships are key to strengthening vital supply chains, but their projects are limited and lack the capacity to grow into regional development plans. Although the government supports initiatives involving science and technology, Amazonia's participation in innovation is still limited.

BOLIVIA: The government's efforts to produce value-added products are channeled through two state-owned enterprises: EBA (Bolivian Food and Derivatives Company) and EMAPA (Food Production Support Company). Additionally, there is a focus on the local level and international cooperation to develop "prioritized territorial productive complexes," a preferred concept over value chains.

VENEZUELA: Boasts a robust network dedicated to developing biocontrol agents and biofertilizers, which is particularly crucial given the country's current crisis and resource scarcity.

GUYANA: Promotes biofuels as part of its renewable resources strategy, with less emphasis on the development of high-value bio-based products.

SURINAME: Modest development in the exploitation of non-timber forest products, supported primarily by the nation's sole university. This reflects a more limited engagement in the bioeconomy compared to its regional neighbors.

¹⁰⁰ Notably, Colombia, Ecuador, and Peru have launched initiatives to support and advance the development of bio-based products. These include calls for bio-challenges and startup pitches, such as MAPBIO 3.0 in Colombia, Innova Amazonía in Ecuador, and BioInvest and Biomatch in Peru.



ENVIRONMENTAL SUSTAINABILITY, DECARBONIZATION, AND THE PROVISION OF ENVIRONMENTAL SERVICES, ALONGSIDE THE SUBSTITUTION OF FOSSIL FUEL-BASED PRODUCTS WITH MORE SUSTAINABLE ALTERNATIVES

A growing priority for governments, businesses and civil society groups is strengthening supply and value chain efficiencies.

BRAZIL: Emphasis on environmental sustainability and decarbonization by offering environmental services and promoting the replacement of fossil fuel-derived products.

COLOMBIA: The Colombia BIO strategy revolves around Green Businesses (activities that generate positive environmental impacts and also incorporate good environmental, social, and economic practices), and Green Productivity (transition towards a knowledge-based, productive, and sustainable economy).

ECUADOR: According to the Bioeconomy Pact, the Ecuadoran bioeconomy will be “based on the ‘conservation, use, and sustainable management of biodiversity and agrobiodiversity, to transition towards a productive development model that is resilient, competitive, cooperative, and diversified, towards a model that generates dignified employment, social inclusion, and an equitable distribution of benefits.’”

PERU: The push to promote bio-businesses aims to implement sustainable management and enhance the value of natural resources and ecosystem services.

BOLIVIA: Bioeconomy-related efforts are guided by the constitutional principle of sustainably utilizing natural resources and biodiversity, as well as maintaining environmental balance.

VENEZUELA: The Biodiversity Management Law suggests that utilization should occur “under principles of ecological sustainability and bioethics, respecting cultural values and considering the fair and equitable participation of the population in the benefits derived from them.”

GUYANA: The “green agenda” envisions an enduring, resource-efficient economy focused on sustainability, low carbon emissions, and resilience.

SURINAME: Strategies for the sustainable use of biodiversity and its preservation are closely linked to low-carbon development measures.

5. AMAZONIA BIOECONOMY – TYPOLOGY

It is possible to develop a basic typology to classify the bioeconomy across Amazonia. The framework proposed here draws from available literature and interviews with experts from across all eight countries. To be sure, the appearance of a given sector in the typology does not necessarily mean that it is present in all eight Amazonian countries. Rather, it implies that, if and when implemented correctly, the activity could be considered within the scope of the Amazonia bioeconomy. Despite the absence of formal standards for “correct” implementation, the criteria advanced by indigenous organizations at the 2023 International Forum on Bioeconomy and Amazonian Peoples offer insights into activities that would not align with an environmentally- and socially-responsible bioeconomy including investments that:

- Cause deforestation, biodiversity loss, or negatively impact the livelihoods of indigenous peoples (e.g. monoculture farming);
- Develop and market products without fair and equitable sharing of benefits with the communities involved;
- Commercially exploit indigenous identity and knowledge without recognition of collective intellectual property rights;
- Pollute the water, soil, and air;
- Weaken indigenous governance and the integrity of their territories;
- Promote labor exploitation;
- Exacerbate economic inequality and gender disparities; and
- Proceed without consultation and full participation of indigenous peoples.



¹⁰¹ Community involvement encompasses local participation at all stages of the value chain, from the use of resources from indigenous territories, the contribution of community labor at various stages, fair compensation for forest product collection (e.g. in the case of Amazon nuts), and recognition of traditional knowledge

Table 7 presents key sectors, alongside a provisional assessment of the geographic distribution of these activities across the Amazonian countries. The development of each sector within the typology of a country's bioeconomy is delineated through an analysis of relevant policy documents, reports, and interviews, concerning the nation's bioeconomic strategies. This analysis is further enriched by the data gathered from survey responses.

Table 7. Typology of activities included in the Amazonia bioeconomy

Category	Sub-category	Description	BO	BR	CO	EC	GY	PE	SR	VZ
Sustainable agriculture, livestock and/or fishing	Sustainable agriculture, livestock, fishing	Agroforestry, organic farming, rotational grazing, and sustainable fishing help preserve natural resources, cut greenhouse gas emissions, and boost local economies.	x	x	x	x	x	x	x	x
	Agricultural bio-inputs, biofertilizers, and biopesticides	Derived from sustainable sources, these eco-friendly alternatives to chemical fertilizers and pesticides enhance soil health and crop yields, and manage pests with fewer environmental side effects.	x	x	x	x	x	x	x	x
	Genetically Modified Organisms	GMOs could play a role in the Amazonia bioeconomy if used carefully and responsibly, addressing agricultural issues like pest resistance and climate adaptability.		x	x					
Sustainable timber and non-timber forest products	Sustainable timber	Sustainably sourced timber, acquired via methods like selective and reduced-impact logging with longer rotation cycles, can help to preserve forest ecosystems and their biodiversity.	x	x	x	x	x	x	x	x
	Non-timber forest products (NTFPs)	Goods derived from forests that do not involve the extraction of timber, including fruits, nuts, resins, medicinal plants, and other biological materials.	x	x	x	x	x	x	x	x
Energy generation	Biogas	Produced through the anaerobic decomposition of organic waste, such as agricultural residues, manure, and municipal waste.	x	x	x	x	x	x	x	
	Bioethanol and Biodiesel	Bioethanol, made from sugary or starchy crops, and biodiesel, derived from oils or fats, are both plant-based fuels. Sustainable farming practices are essential to prevent deforestation and protect biodiversity when growing these biofuel feedstocks.	x	x	x	x	x	x		

Table 7. Typology of activities included in the Amazonia bioeconomy (Continuation)

Category	Sub-category	Description	BO	BR	CO	EC	GY	PE	SR	VZ
Biomechanicals, biomaterials, and pharmaceutical product	Healthy foods	Bio-fortified and functional foods tap into the nutritional richness of Amazonian plants and animals, and may be enriched with extra nutrients or have properties that promote health.	x	x	x	x	x	x	x	x
	Green chemistry and industrial biotechnology	Utilizes biological processes or by-products to create bio-based materials such as bio-ingredients, bio-products, bio-plastics, and bio-textiles.	x	x	x	x		x		
	Bio-pharmaceuticals	Includes new drugs, recombinant vaccines, and industrial enzymes that leverage Amazonia biodiversity for innovative health and medical applications.	x	x	x	x		x		
	Bio-cosmetics	Natural and potentially safer alternatives to conventional cosmetic products.	x	x	x	x		x		x
Services from biological resources and environmental conservation	Ecosystem services	Reflects the intrinsic value of the Amazonia's ecosystems and the importance of their conservation. Examples include reforestation, hydrological cycle maintenance, climate control, biodiversity utilization and valorization, bioprospecting, carbon capture, and payment for environmental services.		x	x	x	x	x	x	
	Biomedical therapies	Leverages biodiversity to develop gene therapies, regenerative treatments, medical technologies.		x	x					
	Biodesign, bio-construction, and biologically inspired solutions	Emulates nature to enhance sustainability and efficiency in building and infrastructure design.		x	x			x		
	Sustainable fashion and gastronomy	Draws from local materials and seasonal products to create unique products and experiences.	x	x	x	x		x		



6. SURVEY OF BIOECONOMY RESEARCHERS AND PRACTITIONER

There is a diverse and growing community of researchers and practitioners working on bioeconomy related issues across the Amazonia and around the world. One of the goals of the IDB-supported research was to map the epistemic networks of natural and social scientists engaged in bioeconomy issues in each of the eight countries. A “territorial” approach was considered vital, not least to identify local capillaries of research and capacity. In order to better understand the individual actors and networks, the IDB and Igarapé Institute designed and disseminated an online survey, informed by both the principles and typology described in previous sections.

The voluntary survey was conducted in two stages to a wide constellation of stakeholders spanning academic, civil society, government and the private sector (see Appendix 3). The first phase collected information from 1,020 self-selecting respondents from all eight countries (and others around the world), all of whom were invited to participate in a second survey to refine insights. A map highlighting the distribution of respondents to the first survey is included below (see Figure 1). A follow-up survey was administered to 953 respondents requesting that they offer more detail about their specific bioeconomy-related activities (Appendix 4). The second survey applied a series of filtering questions to confirm their active role in the Amazonia bioeconomy and adherence to at least one of the five core principles identified in previous sections.

¹²¹ The first questionnaire contained 13 questions and was sent out to a representative – but not generalizable – sample of thousands of bioeconomy practitioners across Amazonia. The Igarapé Institute alone sent personalized invitations to 1,169 individuals, 342 (29%) of which responded to the first questionnaire.

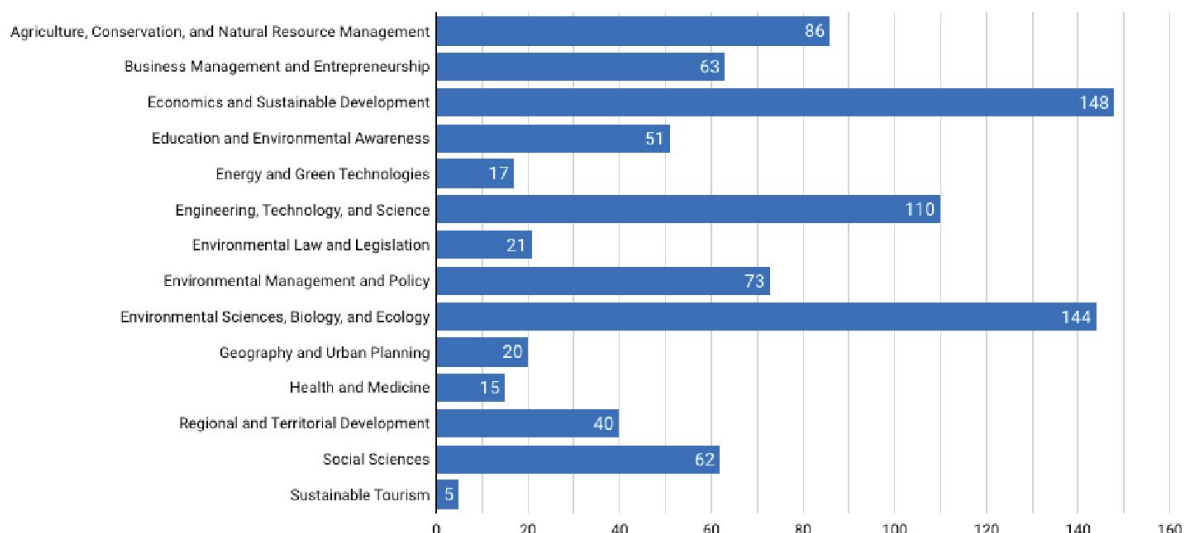
¹²² Furthermore, given the emphasis of the surveys on the views of people from Amazonia itself, 886 respondents qualified for Questionnaire 1, and 243 respondents qualified for Questionnaire 2.

Figure 1. Map of respondents to Survey 1 (n = 1,020)



The first survey generated responses from a wide variety of bioeconomy stakeholders in the Amazonia (see Figure 2). Expertise in economic and sustainable development account for the largest percentage of respondents (17%), followed by specialization in environmental sciences, biology, and ecology. At the country level, “environmental sciences, biology, and ecology” were the disciplines most commonly cited in Bolivia and Brazil. In contrast, respondents from Colombia, Ecuador and Peru were more likely to have expertise in “economics and sustainable development.” Suriname and Guyana registered very small sample sizes, making it difficult to draw comparative conclusions from the survey data gathered from each of these countries.

Figure 2. Thematic priorities identified in Survey 2 (n = 855)



The second survey revealed considerable variation in the types of organizations and individuals involved in bioeconomy-related activities (Figure 3). Indeed, the largest share of respondents were affiliated with academic institutions such as universities (27%), followed by non-governmental organizations and think tanks (26%), private companies (19%), and government agencies (12%). In terms of the sector(s) in which respondents claimed to operate, conservation, entrepreneurship and research were most heavily represented (Figure 4). As areas of focus, respondents were most commonly focused on timber and agriculture industries, followed by bioservices (Figure 5).

Figure 3. Organization type (n = 243)

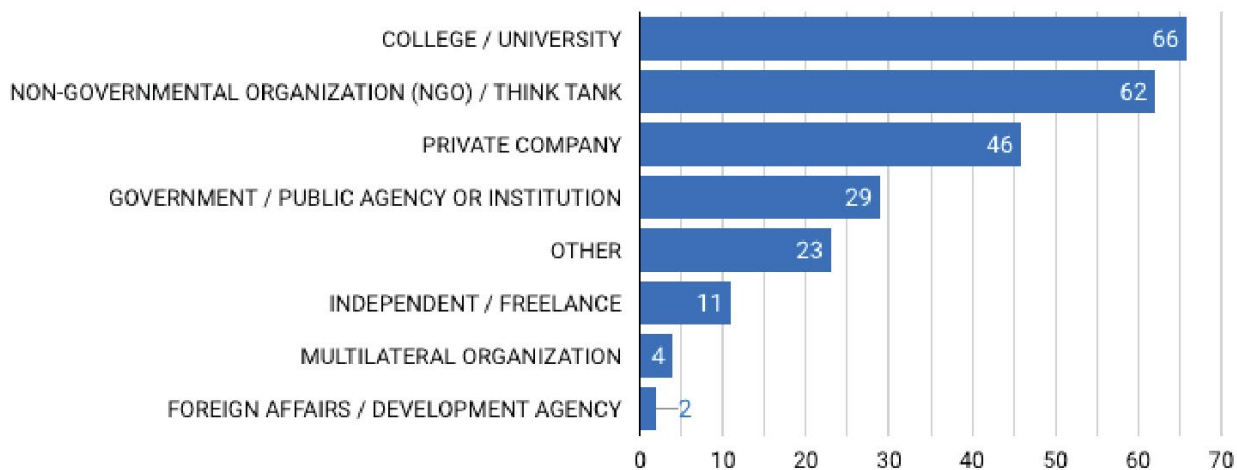


Figure 4. Which of the following sectors best describe your bioeconomy-related activities in Amazonia? (n = 243)

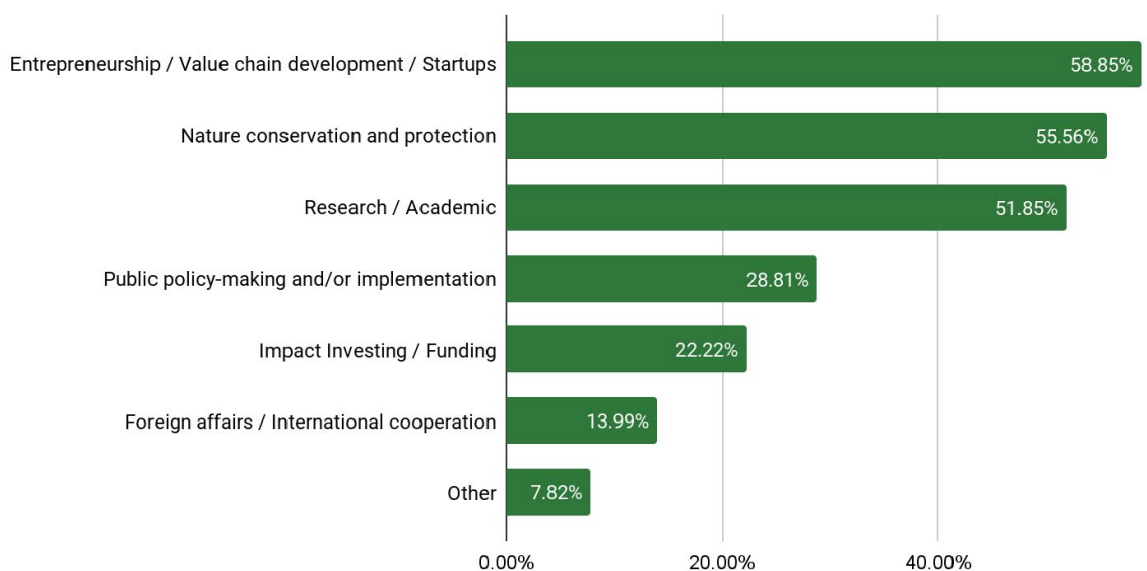
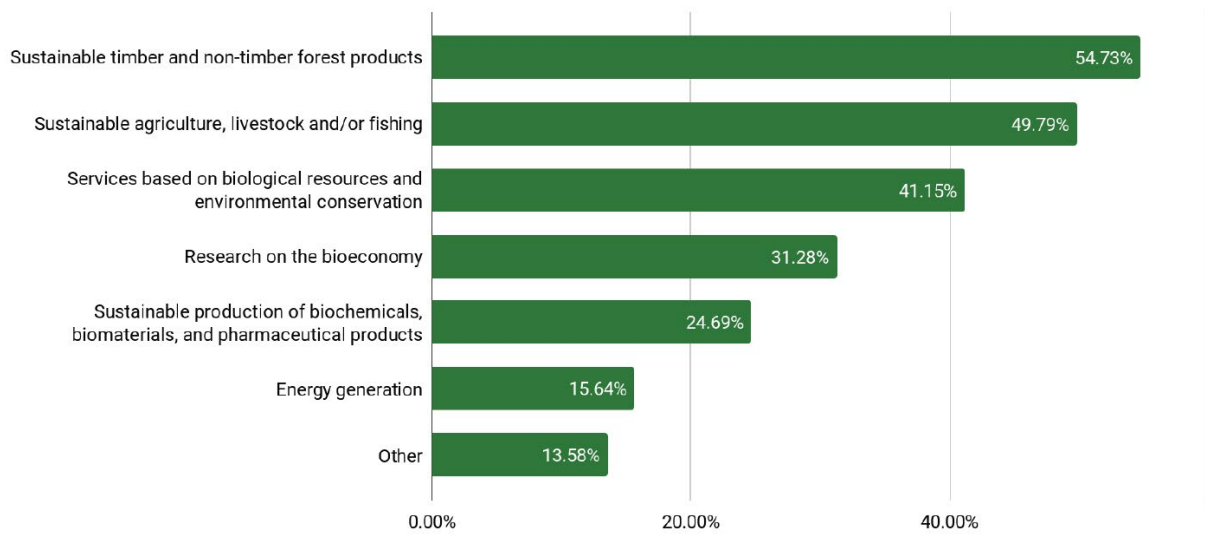
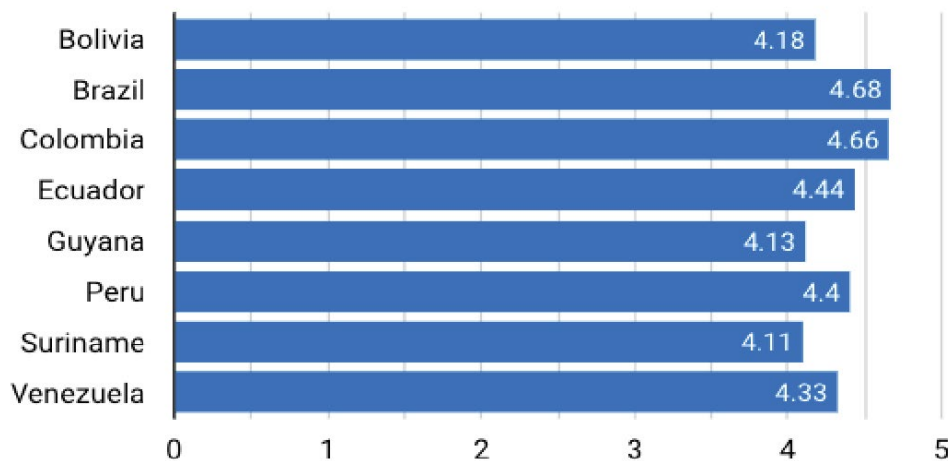


Figure 5. Which of the following focus areas best describe your bioeconomy-related activities in Amazonia? (n = 243)



A significant majority of the respondents described the bioeconomy as highly relevant to their professional activities (see Figure 6).¹⁰⁵ Respondents to the first survey in Colombia and Brazil reported the highest levels of relevance, likely reflecting these countries' relative progress in developing a formal bioeconomy. Respondents in Suriname and Guyana reported a lower relevance on average, which is likely because the bioeconomy concept is not as widely used in both countries. Similarly, Bolivia and Venezuela have adopted alternative concepts to the economy that align more closely with their general development philosophies.

Figure 6. Relevance of the bioeconomy to your work (n = 886)



As noted above, most respondents ascribe a high priority to strengthening research capacity, developing interdisciplinary partnerships, enhancing research institutions, and ensuring local participation (see Table 8). By contrast, establishing a common definition of the bioeconomy was considered to be a lower order priority. Stakeholders might perceive a shared definition as either unattainable or non-essential for advancing their work in policy, value chain development, or research. The highest average scores were observed in Colombia, Ecuador, and Peru, where governments are actively working to establish national bioeconomy policies.

¹⁰⁴ The first questionnaire asked respondents to rate the relevance of the bioeconomy to their professional activities, on a scale of 1 (Irrelevant) to 5 (Highly relevant). The feedback revealed a high degree of significance, with 90% of respondents rating the relevance as either "4" or "5".

Table 8. Perceived priority of bioeconomy-related action items

Action item	Average Level of Priority								
	Overall	BOL	BRA	COL	ECU	GUY	PER	SUR	VEN
n	886	78	345	135	116	8	147	9	48
Develop common definition of "Bioeconomy"	4.0	3.7	4.0	4.2a	4.1	3.3		3.9	3.9
Strengthen research capacities	4.3	4.0	4.5	4.5	4.4	4.0	4.3	4.1	4.2
Develop partnerships between private sector and scientific community	4.4	4.0	4.5	4.5	4.4	4.1	4.4		4.3
Enhance sustainability of research institutions	4.3	4.0	4.4	4.4	4.4	4.0	4.3	4.2	4.3
Ensure participation of local communities in bioeconomy growth	4.5	4.1	4.7	4.3	4.5	4.5	4.5	4.8	4.4

Respondents from Brazil and Colombia tended to stress the importance of enhancing research capacities and fostering private sector-scientific community partnerships (see Table 8). This emphasis could reflect a higher proportion of academics and researchers within the survey's participants from these countries. Alternatively, it may point to the more advanced bioeconomy policies in Brazil and Colombia, as well as their readiness, both institutionally and politically, to capitalize on such cross-sector collaborations. The comparatively low scores for Bolivia and Venezuela could reflect the strong role of the state in bolstering the bioeconomy in these countries.

A consistently high priority across all countries was the involvement of local communities in the growth of the bioeconomy, reflecting a recognition of the critical role local stakeholders might play during the different stages of the economic activities, depending on their nature and context. However, Bolivia's lower average rating on this priority may indicate a more complex debate around the suitability of economic development and growth for local communities within the region, potentially revealing a nuanced view on the perceived compatibility between income generation and environmental stewardship. Taken together, these insights reflect the complex interplay of policy, research, and community engagement as critical components in the advancement of the Amazonia bioeconomy.

Most respondents to the second survey claimed that the term "bioeconomy" was aligned with local and cultural contexts in which they worked. Indeed, almost three quarters (73%) answered in the affirmative, albeit with slight variations by country (see Figures 7 and 8). Respondents who responded negatively had the opportunity to explain their reasoning, and the results shed further light on the status of the term in each context (see Table 9).

Figure 7. Is the term “bioeconomy” aligned with the local and cultural contexts in which you operate in Amazonia? (n = 243)

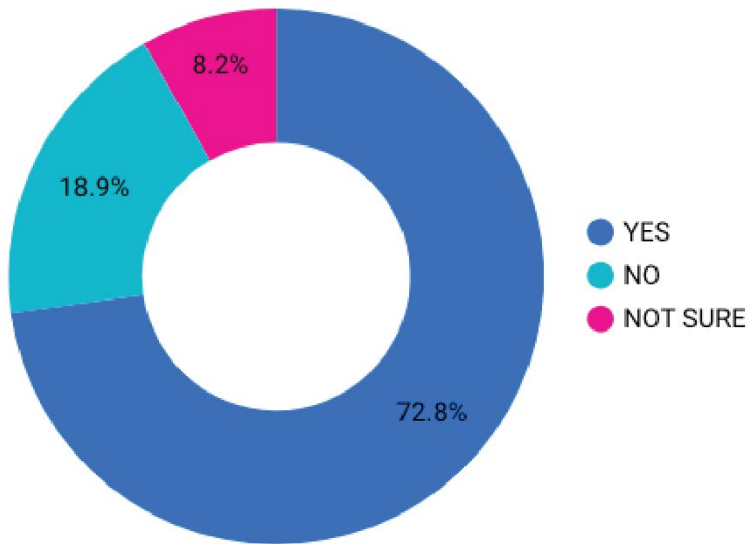


Figure 8. Is the term “bioeconomy” aligned with the local and cultural contexts in which you operate in Amazonia? (By country)

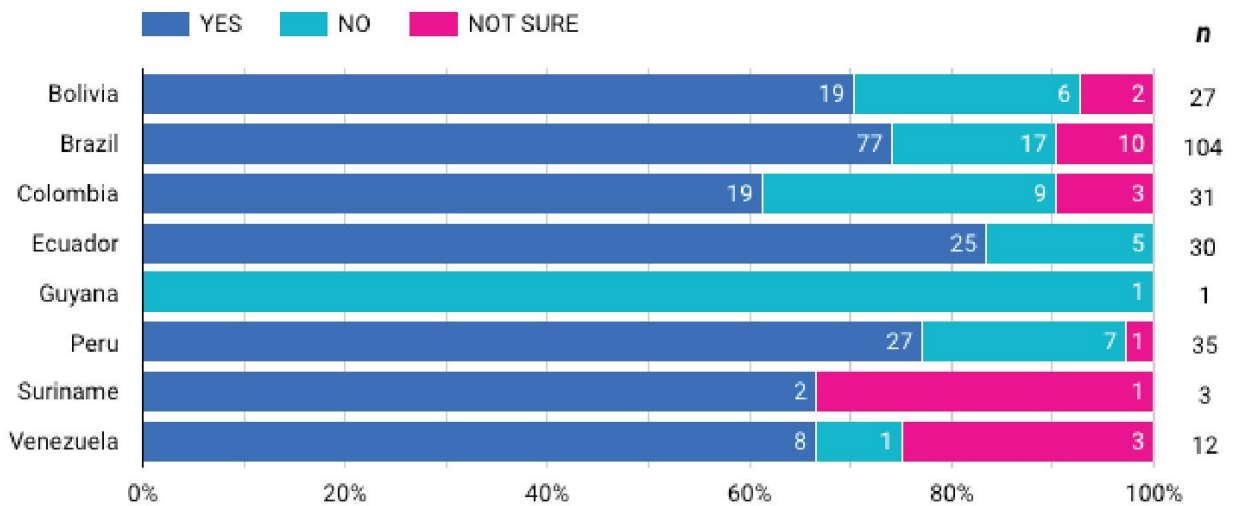
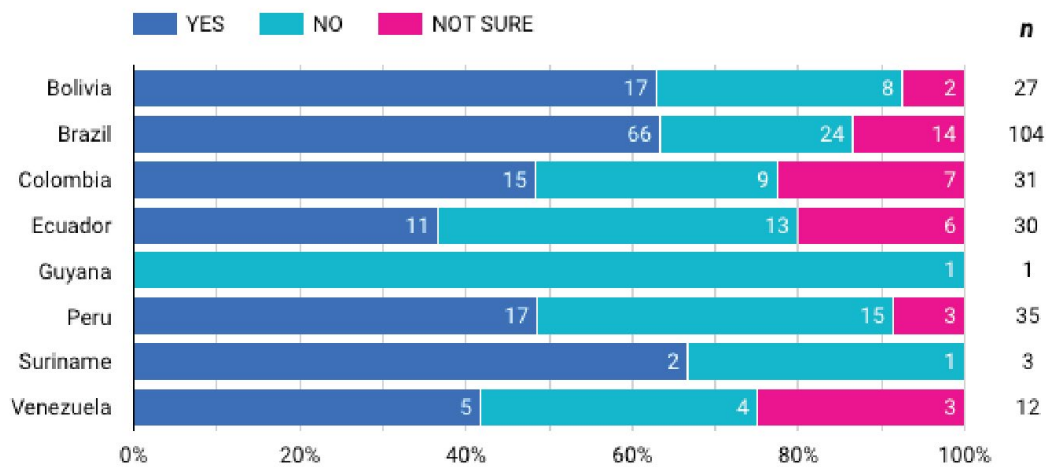


Table 9. Perceived misalignment of the term “bioeconomy,” by country

Country	n	Sample of Responses
Bolivia	6	“Bioeconomy” is not a well-known concept, particularly among indigenous communities, and faces challenges due to past associations with illicit trade. It is critical to foster inclusive dialogue, respect indigenous rights, and integrate disaster risk reduction into bioeconomy-like strategies to ensure equitable and sustainable development.
Brazil	16	The term “bioeconomy” is perceived as being co-opted by “green capitalism” and as not adequately reflecting the income-generating activities that promote the well-being of forest peoples based on ancestral knowledge that allows for a harmonious existence with nature. There is a call for a broader or alternative concept, such as “sociobioeconomy,” that encapsulates the traditional knowledge and perspectives of indigenous and local communities, and addresses the lack of understanding and appreciation for the true value of the forest and its socio-environmental services.
Colombia	8	The term “bioeconomy” is not widely recognized, with a low awareness of the connection between biology, conservation, and economy within relevant professional communities. There is skepticism regarding the concept’s potential as a “new salvation for the Amazonia, with concerns that it does not adequately involve local communities and may sideline traditional ecosystem management and indigenous agricultural systems. Furthermore, while the bioeconomy is an emerging process in Colombia, particularly in Amazonia, there are significant gaps in policy clarity, normative frameworks, and the development of necessary technology for sustainable management by local communities, emphasizing the need for initiatives to integrate the relationship between indigenous peoples, ecosystem conservation, and cultural identity.
Ecuador	4	“Bioeconomy” is seen as an educational and commercial term introduced by external actors, which is not fully understood by the indigenous population, who associate bioeconomy with communal well-being rather than its conventional meaning. There is recognition that the social dimension is not adequately represented in the current bioeconomy framework, leading to the development of alternative definitions such as “sociobioeconomy” or “indigenous economy,” with a need for national efforts to contextualize bioeconomy within local territories.
Guyana	1	Bioeconomy is relatively unfamiliar to local residents, yet there is a strong existing awareness of the importance of wildlife and environmental conservation. To bridge this gap, there is a recognized need to increase awareness about the bioeconomy and how it aligns with the values and practices of the local population.
Peru	7	Understanding of bioeconomy varies – it is well comprehended by those with higher education but remains disconnected from the practices of ancestral cultures like the Inka. Indigenous organizations favor the concept of an “indigenous economy” that better reflects their cultural and biological realities, while the term “bioeconomy” is rarely used locally and requires increased awareness and integration by both state and private sectors to emphasize sustainable interactions with biological resources.
Suriname	0	[No responses]
Venezuela	1	Although bioeconomy is still new, it could be implemented through the processing and transformation of Amazonian biodiversity through local entrepreneurship initiatives.

Just over half (55%) of respondents to the second survey confirmed the existence of other terms instead of “bioeconomy” that they would use to describe their work in Amazonia (Figure 9). This finding highlights the diversity of perspectives across and within all eight countries, even in a country like Brazil where the bioeconomy debate is more advanced and specific “bioeconomy” policies are becoming more common. This reinforces the idea that a culturally-relevant and locally-supported bioeconomy in the region will rely on a nuanced understanding of the multiplicity of opinions and visions held by key stakeholders.

Figure 9. Are there other terms instead of “bioeconomy” that you would use to describe your work in Amazonia?



While there are many shared ideas about bioeconomy-like concepts and strategies, there are also various ways it is described across the region. Table 10 summarizes responses by country, revealing a spectrum of terms that extend beyond “bioeconomy” and which collectively underscore a commitment to sustainability and the integration of traditional and ecological knowledge into economic practices. Notable alternatives include “sociobioeconomy,” which appears in several countries, and concepts related to green and circular economies, which emphasize resource sustainability and cultural integration. This linguistic diversity reflects a region-wide movement towards economic models that honor cultural identities and prioritize the preservation of the Amazonia’s rich biodiversity, whether or not they are specifically referred to as “bioeconomy”.

Table 10. Alternative terms to the bioeconomy, by country

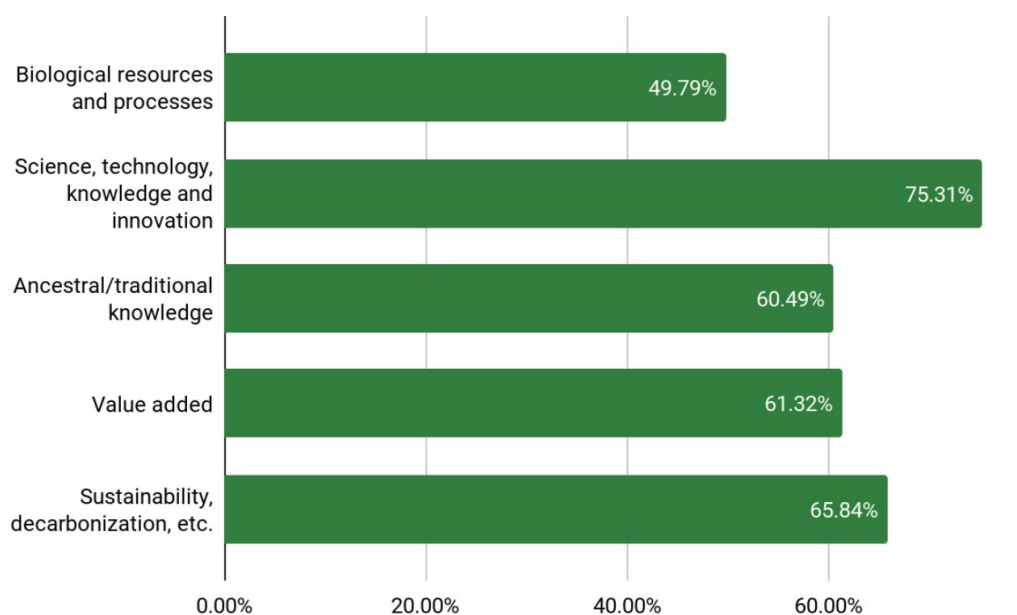
Country	n	Summary of Responses
Bolivia	17	Respondents favor terms that emphasize sustainability and ecological integration, with “economía verde” (green economy), “economía circular” (circular economy), and “biocultura” (bioculture) being prominent. These terms highlight a holistic approach that includes sustainable resource management, cultural dynamics, and local economic activities, often linked to conservation and the sustainable use of forest resources.
Brazil	59	The term “sociobioeconomía” (sociobioeconomy) emerges as a recurrent alternative to “bioeconomy.” Other common terms include “sociobiodiversidade” (sociobiodiversity), “economía verde” (green economy), and “economía sustentável” (sustainable economy), all of which emphasize sustainable development, conservation, and the integration of traditional knowledge with modern practices. “Biotechnology” also appears several times.
Colombia	15	Alternative terms include “sociobioeconomía” (sociobioeconomy), “economías bioculturales amazónicas” (Amazonia biocultural economies), “negocios verdes” (green business) and “economía ecológica” (ecological economy), all highlighting a commitment to sustainable development, cultural value chains, and the incorporation of indigenous knowledge and conservation principles in regional development
Ecuador	11	Terms such as “economía sostenible” (sustainable economy), “economía indígena” (indigenous economy), and “economías del bosque” (forest economies) are used to describe the integration of economic activities with environmental and cultural sustainability in Amazonia. These terms reflect an emphasis on ancestral agricultural systems, sustainable development, biotechnology, and circular economic models that align with biodiversity conservation and equitable benefit sharing.
Guyana	0	[No responses]

Table 10. Alternative terms to the bioeconomy, by country (Continuation)

Country	n	Summary of Responses
Peru	17	Respondents cite concepts like "economía circular" (circular economy) and "desarrollo sostenible" (sustainable development) as alternatives to "bioeconomy." These terms are complemented by references to indigenous knowledge and practices, such as "bionegocios" (bio-businesses), "economía indígena" (indigenous economy), and "Buen vivir con la Amazonía" (good living with the Amazonia), which emphasize the harmonious use of natural resources, cultural identity, and environmental protection.
Suriname	2	Respondents used the phrases "assessment, valuation, conservation, and sustainable use of biological resources," and "local economy and sustainable income generation."
Venezuela	5	Respondents use terms such as "economía sostenible" (sustainable economy) and "bioemprendimiento" (bio-entrepreneurship), and also reference "productos artesanales locales" (local artisanal products) and "agroforestería" (agroforestry).

Several common and shared principles emerged from surveys of bioeconomy researchers (see Figure 10). Specifically, when asked which bioeconomy principles were most relevant to their work, respondents strongly endorsed science, technology, and innovation, highlighting the critical role these elements play in the bioeconomy’s development within Amazonia. Also, the survey revealed a significant recognition of ancestral and traditional knowledge, emphasizing the importance of integrating this longstanding wisdom into bioeconomy frameworks.

Figure 10. Principles involved in bioeconomy-related activities in the Amazonia (n = 243)





The survey also asked respondents to share key challenges faced in their work related to the bioeconomy. Across the region, the following obstacles came up frequently:

- Proximity and impact of illicit and criminal activities, such as illegal deforestation, wildcat mining, selective timber extraction and drug trafficking, are all contributing to the expansion of the agricultural frontier;
 - The lack of availability and access to funding to support research and value chain development, including innovative technology and the implementation of improved processing methods to add value to bioeconomy products;
 - Limited and uneven engagement and partnerships across sectors, from academia to government;
 - The high costs of doing business in Amazonia, in part due to logistical challenges in accessing communities and distributing products to markets, due to large distances and insufficient infrastructure (electricity, Internet, etc.);
 - Increasingly volatile weather patterns due to climate change which are undermining the integrity of projects and presenting new risks to partners and beneficiaries;
 - The widespread shortage of qualified workforce with the necessary human capital and know-how to sustain commercial bioeconomy initiatives, compounded by limited technical assistance; and
 - The limited fair and equitable distribution of benefits arising from bioeconomy value chains
- Respondents also indicated objectives and goals for their bioeconomy-related activities in the region. Common responses from across all countries included:
- Enhance land management processes for environmental governance – among other initiatives, this includes reducing waste, ensuring efficient water use and mitigating illegal deforestation and other destructive activities;
 - Identify and pursue new business partners, sources of funding and technical assistance, as well as markets;
 - Increase the involvement of indigenous and traditional communities in the development of bioeconomy policies and projects; and
 - Continue research to develop new bioproducts and methods of production that add value and promote quality of life for local communities

Taken together, the surveys signaled a broad array of perspectives concerning the definition and conceptualization of the bioeconomy in Amazonia. To be sure, this heterogeneity likely reflects the diverse professions and areas of expertise among individuals involved in bioeconomy-related activities. Such a diverse range of opinions points to the intricate and layered character of the bioeconomy itself, which includes biological, geographic, ecological, business, economic, sociological, and ethnographic dimensions.

Although there is no single definition of the bioeconomy, it is also the case that the diversity and flexibility of the concept constitutes a virtue. Indeed, its applicability across various domains and distinct regional settings provides certain advantages. Embracing this diversity can also help foster more inclusive dialogue and collaborative action with stakeholders, ensuring that the bioeconomy is shaped by a broad spectrum of insights and experiences, ultimately contributing to a holistic and sustainable development paradigm for the Amazonia.

7. A WAY FORWARD

The potential to scale up a bioeconomy within Amazonia is influenced by a myriad of factors that can either facilitate or impede its development. There are diverse challenges related to amplifying bioeconomy research and market development, including issues such as mistrust between the public sector, indigenous communities and the private sector; limited interaction between researchers and companies; the inability of researchers to protect their intellectual property; insufficient resources for research and development (R&D); and a lack of laboratory equipment and related infrastructure. A non-exhaustive list of suggestions are noted below that could potentially address these and related impediments.

INCENTIVES FOR RESEARCH AND ENTREPRENEURSHIP IN UNDER-INVESTIGATED AREAS

The expansion of the bioeconomy presents an opportune moment to develop strategic financial mechanisms to bolster science, research, and innovation. A key element in this financial ecosystem is the forging of robust public-private partnerships that align bioeconomic initiatives with the broader objectives of sustainability and climate change mitigation. Moreover, leveraging tax incentives and venture capital could provide the necessary financial impetus to drive bioeconomy projects forward.

By offering incentives and crafting financial products specifically tailored to support innovation, governments and financial institutions can help mitigate some of the risks inherent in pioneering bioeconomy ventures. Furthermore, the simplification of restrictive regulations can create a more agile and responsive business environment that is attractive to long-term, risk-tolerant investors. Such investors are essential for providing the patient capital required to realize the full potential of bioeconomic projects while also recognizing and valuing intellectual property.





CROSS-SECTOR COLLABORATION

Countries across Amazonia could and should address fragmented bioeconomy governance structures through enhanced cooperation among diverse entities including government agencies, academic institutions, civil society organizations, and businesses. Such multidisciplinary alliances are instrumental for creating effective policies and strategic plans that foster green and sustainable development.

For instance, stronger connections between research entities and the private sector promise to catalyze the Amazonia bioeconomy. Currently, many businesses – domestic and international – overlook the potential of innovations like biofibers for manufacturing and other sectors. This gap highlights the need for a coordinated strategy that benefits not only companies and investors seeking credible and actionable evidence, but also research institutes facing funding limitations. Such a collaborative effort would foster a well-structured bioeconomy market, ready for investment and innovation, aligning academic research with practical business applications.

Moreover, Amazonia faces the dual challenge of mitigating “brain drain” — the emigration of skilled individuals to other regions or countries — and training and upskilling a qualified workforce. The bioeconomy could boost investments in education and research that retain local talent and attract global expertise. This would be particularly significant for countries like Guyana and Suriname, that currently have a modest bioeconomy presence.

FOCUS ON IMPACT RATHER THAN NARROW FINANCIAL METRICS OF SUCCESS

A critical aspect that is often overlooked in development work is the need for comprehensive frameworks to evaluate the success of investments beyond mere financial metrics. There is room to explore the design and implementation of a multi-dimensional evaluation approach for bioeconomy projects, given the multi-faceted nature of their potential impacts. This approach should encompass not only economic considerations but also environmental, social, and cultural impacts.

The establishment of robust metrics to quantify and assess the broader impacts of bioeconomy investments could be incorporated into decision-making processes. This entails supporting the valuation of environmental benefits, such as carbon sequestration and biodiversity preservation, alongside social and cultural factors, like community resilience and cultural heritage preservation.

It should also emphasize the importance of Key Performance Indicator (KPI) systems and Monitoring, Reporting, and Verification (MRV) mechanisms to track progress and ensure accountability. By advocating for incentive structures that align with these diverse metrics of success, including both public policies and private sector initiatives, this holistic approach can contribute significantly to shaping bioeconomy strategies that address sustainability, equity, and resilience.

Prioritize bioeconomy **within governmental ministries** as a sector

The challenges in Amazonia are both complex and urgent, and national governments must act quickly, seek synergies, and make significant investments to bring about meaningful change.

National ministries play a crucial role in this task. For instance, ministries of environment could focus attention and resources on setting up Amazonia biodiversity banks as a key step towards the conservation and sustainable utilization of natural resources. These banks would store genetic material and enable researchers to study and responsibly utilize the region's rich biological diversity. Another important effort would be to incorporate this information into a regional platform, or at least facilitate knowledge-sharing between countries.

Additionally, ministries of science and technology might consider allocating resources for the acquisition of laboratory equipment and the creation of research and development funds that would foster innovation and scientific advancement essential for unlocking the bioeconomic potential of Amazonia. This would complement the incentives for research in under-investigated areas.

A DE-RISK TERRITORIES FOR THE BIOECONOMY

Environmental crimes are fueling illegal deforestation and threaten the viability of a productive bioeconomy in Amazonia. A variety of factors, including irregular land tenure, uneven law enforcement, access to valuable natural resources, and a network of roads, airstrips and ports are enabling land grabbing, selective logging, illegal mining, and other related offenses. Predicting the incidence of environmental crime could help enhance forest and biodiversity protection and expand the bioeconomy.

Several initiatives are underway in Brazil to monitor and forecast forest fires and deforestation, including tools developed by MapBiomass, the Federal University of Minas Gerais (UFMG) and IMAZON. Researchers are also increasingly using machine learning models to estimate the spatial dimensions of deforestation. However, there is currently no method or tool to predict environmental crimes.¹⁰⁷

An experimental pilot could be created to test a predictive method for estimating the risk of selected environmental crimes. A scalable tool would use a convolutional neural network approach to address spatio-temporal patterns of these crimes, including a forecasting model, hotspot alerts for environmental authorities, and a series of public-facing reports to strengthen testing and replication. Moreover, it could also feature a web-based geo interface to calculate risks and potential losses.

¹⁰⁷ Muggah, R. and Smith, P. (2024) New technologies to map environmental crime in the Amazon, Mongabay, 12 April, <https://news.mongabay.com/2024/04/new-technologies-to-map-environmental-crime-in-the-amazon-basin-commentary/>



CONCLUSIONS

The report reveals a complex mosaic of definitions, institutions, and actors, each contributing to a multifaceted understanding of what constitutes bioeconomy in Amazonia. The diversity of interpretations, shaped by unique geographical, ecological, and socioeconomic factors, underscores the challenge of reaching a singular definition of the bioeconomy that could apply uniformly across the Amazonia. Indeed, the findings reinforce the notion that striving for a common definition may be less important than fostering the growth and development of the bioeconomy in its various manifestations throughout the region.

The Amazonia, with its stunning biodiversity, is a testament to both the potential and the perils of bioeconomic development. The promise of sustainable growth, leveraging the region's vast biological resources, is as compelling as it is complex. It requires a delicate balance between exploitation and conservation, ensuring that economic activities not only contribute to human well-being but also preserve the ecological integrity upon which such a bioeconomy fundamentally depends.

There are significant scientific and technological delays in the region despite its enormous untapped potential. Immediate action is required to avoid missing out on valuable economic opportunities associated with Amazonian biodiversity and biological resources, especially since rapid advancements in synthetic biology and computational biology may render natural alternatives increasingly less lucrative.

Integral to the advancement of the Amazonia bioeconomy is the need to honor and incorporate the rights, traditions, and knowledge of the indigenous peoples and other local communities. As stewards of the region, they will make pivotal contributions to a bioeconomy that is equitable and culturally sensitive. The future of the Amazonia bioeconomy will require the ability to navigate the intricacies of benefit sharing and intellectual property rights, ensuring that the pursuit of economic opportunities does not devolve into conventional, business-as-usual scales and methods of production.

Furthermore, recognizing the disparity in bioeconomic engagement among the countries within the Amazonia is crucial. Each nation's distinct political, social, and intellectual landscape calls for tailored approaches to bioeconomic expansion. In some cases, this may mean setting aside the term "bioeconomy" to achieve meaningful dialogue and progress with governments and local stakeholders.

The Amazonia bioeconomy represents a dynamic frontier that demands nuanced and locally-relevant strategies. As we look to the future, its Amazon bioeconomy will be measured not just by economic metrics, but by its ability to harmonize human development with the intrinsic value of the region's natural heritage. The vision should be one of symbiotic growth, where economic advancement, environmental stewardship, and social inclusivity come together to forge a sustainable and prosperous future for all who call the Amazonia home.

TO THIS END, WE RECOMMEND THE FOLLOWING COURSES OF ACTION:

1. SOCIALIZE FINDINGS AND CONSOLIDATE STUDY FINDINGS

The production and distribution of accessible and readable multimedia materials that synthesize the outcomes from this study are essential. These materials should cater to the interests and needs of bioeconomy decision-makers and stakeholders, ensuring that key insights are not only accessible but also actionable. Technical meetings with IDB country offices should be held to provide staff with specific and relevant information to enhance their strategy, communication and collaborative efforts with local governments and other points of contact.

Survey data should also be integrated into the IDB's Amazonia Forever knowledge platform in order to allow for a clearer depiction of the stakeholders dispersed throughout the region and bolster ongoing efforts to foster a robust bioeconomy research network. The geospatial representation of these data can serve as a powerful tool for understanding the dynamics of the bioeconomy within the Amazonia and identifying areas for support and collaboration.

Furthermore, convening targeted roundtable discussions in selected countries could catalyze deeper engagement with the research outcomes, and involve additional voices that help to promote a thorough and nuanced understanding of the bioeconomy within different national contexts. This work could be done in collaboration with other key institutions like Inter-American Institute for Cooperation on Agriculture (IICA), the Stockholm Environment Institute (SEI), GIZ and the Economic Commission for Latin America and the Caribbean (ECLAC).

Finally, the research findings should be shared with the main international funders of bioeconomy initiatives in the Amazonia, in order to ensure "semantic symmetry" and avoid misalignment that leads to missed opportunities for support and funding.

2. EXTEND AND EXPAND BIOECONOMY NETWORKS IN AMAZONIA

In order to facilitate knowledge sharing, collaboration and partnerships, the IDB could work to build out research communities across universities and institutes in Amazonia. For instance, annual surveys could dynamically expand these groups and help to transform gaps in the current knowledge base into priority areas for development. Commissioned products and periodic seminars on relevant topics could support ongoing debate and discussion, effectively widening the network and ensuring that it drives progress in the bioeconomy.

Additionally, challenges and competitions could be designed to generate knowledge in under-researched areas or to pioneer new vanguard and emergent areas within the bioeconomy. Such competitions can stimulate innovation and attract new talent to the field, thereby contributing to the overall growth and long-term viability of the bioeconomy in the region.



3. MAP BIOECONOMY INVESTORS AND ENTREPRENEURS IN AMAZONIA

Through new surveys, the IDB could arrive at a deeper understanding of the ecosystem of bioeconomy investors, producers and entrepreneurs. This assessment could collect information on the geographical distribution of relevant actors, measure capital investments, and evaluate other pertinent factors that contribute to the vitality of the bioeconomy.

As a next step, a pairing tool or algorithm could be developed to match potential investors with producers, thereby significantly enhancing the efficiency and effectiveness of capital allocation. Such a tool would help to consolidate situational awareness about the bioeconomy ecosystem, as well as to ensure that high-integrity players are at the forefront of development initiatives.

Directed mentorship and training programs could also be created to promote venture mentalities and technical skills, particularly in financial management, budgeting, and human capital. A small network of “champions” – individuals or organizations with demonstrated success in the bioeconomy – could serve as mentors, providing invaluable guidance and inspiration for a new generation of entrepreneurs.

4. QUANTIFY THE VALUE OF THE BIOECONOMY IN ALL EIGHT AMAZONIAN COUNTRIES

A compelling quantitative case for the Amazonia bioeconomy is essential for effective advocacy amidst the powerful economic activities of mining, forestry, agribusiness, and cattle ranching. This involves demonstrating the substantial economic benefits delivered by the bioeconomy, not just in capital investment and revenue but also in job creation, community well-being, and the dividends reaped from climate and nature conservation.

The IDB could play a pivotal role in this regard by expanding its research to reinforce the economic argument for the bioeconomy across the region, building upon the World Resources Institute’s important work in Brazil. This would involve not just traditional economic indicators, but also an examination of how the bioeconomy contributes to the Human Development Index (HDI) and other measures of societal progress. It would leverage ongoing work by the IDB such as the OPEN IEEM Platform,¹⁰⁸ developed in collaboration with Stanford University and the Nature Capital Lab.¹⁰⁹ The findings from this research would provide the foundation for a strategic communications campaign that raises awareness and support for the bioeconomy among key stakeholders in industry, government and civil society.

To achieve this, a specialized team of econometricians and experts could be assembled to conduct thorough evaluations of the bioeconomy’s direct and indirect impacts, including investment, revenue, employment, and HDI enhancement. Such an approach would not only provide a clearer picture of the bioeconomy’s potential in each country, but also offer actionable insights to policymakers and business leaders looking to invest in the region’s sustainable future.

¹⁰⁸ <https://openieem.iadb.org/#/home>

¹⁰⁹ <https://www.iadb.org/en/news/iadb-launches-natural-capital-lab-incubate-public-private-solutions-conservation>



Appendix 1. METHODOLOGY

The study adopted a multi-method approach, integrating both qualitative and quantitative research techniques to illuminate the complexities surrounding the conceptualization and operationalization of the bioeconomy within Amazonia. The investigation began with an extensive review of existing literature, which provided a global context and honed in on the specificities of knowledge production in the eight Amazonian countries.

A rapid scoping review was conducted, encompassing sources in English, Spanish, and Portuguese to ensure a comprehensive capture of relevant studies. This process helped to develop key questions and laid a solid foundation for subsequent phases of the research. Online interviews were then conducted from May to October 2023 with a diverse group of key informants from Amazonia, including academics, government officials, entrepreneurs, and civil society representatives (Appendix 2). Informants were identified through the literature review and expanded via snowball sampling, where initial interviewees recommended additional points of contact.

Subsequently, a two-stage survey (see Appendices 3 and 4) was created using the ArcGIS Survey123 platform. The first questionnaire collected basic information from researchers, such as name, title, expertise, location, and research focus. The second questionnaire inquired into their specific bioeconomy-related activities and perspectives on the concept. Survey invitations were sent to individuals and organizations identified during the research process, with additional outreach conducted through public LinkedIn groups and pre-existing IDB mailing lists.

The methodological approach was designed to be comprehensive and flexible, aiming to capture the multi-sector and interdisciplinary nature of the bioeconomy in the Amazonia. By combining literature reviews, interviews, and surveys, the study sought to arrive at a detailed understanding of the bioeconomy's current state and future possibilities in the region.



Appendix 2. LIST OF INTERVIEWEES

Bolivia

Name	Organization
Ana Heredia	World Conservation Society (WCS)
Cándido Pastor	Conservation International (CI)
Fernanda González	Conservation International (CI)
Génesis Nava	German Development Cooperation (GIZ)
Isabel Limachi	German Development Cooperation (GIZ)
Janys Saavedra	Independent Consultant
Jorge León Quiroga Canaviri	Higher University of San Andrés (UMSA)
Mónica Moraes Ramírez	Higher University of San Andrés (UMSA)
Natalia Saba	Foundation for Productive and Financial Development (PROFIN)
Pamela Cartagena	Center for Research and Promotion of Peasantry (CIPCA)
Rob Wallace	World Conservation Society (WCS)
Ruth Delgado	Friends of Nature Foundation (FAN)

Brazil

Name	Organization
Adalberto Luis Val	National Institute for Amazonian Research (INPA)
Benno Pokorny	German Development Cooperation (GIZ)
Francisco Apurinã	Independent Consultant
Jacques Marcovitch	University of São Paulo (USP)
Juan Carlos Castilla-Rubio	SpaceTime Labs
Marco Aurelio Da-Ré	Foundation for Reference Centers in Innovative Technologies (CERTI)
Maria Sylvania Saes	University of São Paulo (USP)
Paulo Reis	Manioca
Paulo Simonetti	Institute for Conservation and Sustainable Development of the Amazon (IDESAM)
Ricardo Abramovay	University of São Paulo (USP)
Salo Coslovsky	New York University / Amazônia 2030

Colombia

Name	Organization
Alexander Rincón Ruiz	National University of Colombia (UNAL)
Belén Ojeda	Global Green Growth Institute (GGGI)
Claudia Marcela Betancur	Biointropic
Cristian Rivera	Global Green Growth Institute (GGGI)
Edwin Javier Ramírez Roldán	Independent Consultant
Gina Ayala	National Department of Science, Technology and Innovation of Colombia (Colciencias)
Juliana Erika Cardona Jaramillo	Amazonian Scientific Research Institute SINCHI
Katia Méndez Naranjo	Biointropic
Manuela Montoya Castrillón	Alexander von Humboldt Biological Resources Research Institute
María Soledad Hernández Gómez	Amazonian Scientific Research Institute SINCHI
Nathalia Flórez	Alexander von Humboldt Biological Resources Research Institute
Orlando Ramirez	Colombia Productiva – Ministry of Commerce
Raquel Oriana Díaz Salcedo	Amazonian Scientific Research Institute SINCHI
Sandra Manzano	Colciencias
Natalie Charlotte Cortés Rendon	Regional Bioeconomy Research Co-Laboratory (Colibri Unibagué)
Viviana Cuarán	Colombian Agricultural Research Corporation (Agrosavia)
Viviana Zamora	German Development Cooperation (GIZ)

Ecuador

Name	Organization
Adriana Rivas	Escuela Superior Politécnica del Litoral (ESPOL)
Andrea Palacios	German Development Cooperation (GIZ)
Ariel Osvaldo Silva	Bioeconomía Ecuador
Francisco Prieto	National Biodiversity Institute (INABIO)
Jorge Rodríguez Rodríguez	Litoral Polytechnic School (ESPOL)
Juan Manuel García	Universidad Técnica Particular de Loja (UTPL)
María Fernanda Sánchez	German Development Cooperation (GIZ)
Maria Jose Moyano Lucio	German Development Cooperation (GIZ)
Omar Malagón	Universidad Técnica Particular de Loja (UTPL)
Pablo Larco	Sustainable Environmental Investment Fund (FIAS)
Pablo Sánchez	National Biodiversity Institute (INABIO)

Guyana

Name	Organization
Camilo Garzón	Stockholm Environment Institute (SEI)
Juanita Gómez	Stockholm Environment Institute (SEI)
Jey Kundu	Caribbean Agricultural Research and Development Institute (CARDI)
Marcelle Chan-A-Sue	Conservation International Guyana
Monica Trujillo	Stockholm Environment Institute (SEI)
Preeya Rampersaud	Conservation International Guyana
René Edwards	Conservation International Guyana
Thomas B. Singh	GREEN Institute / University of Guyana

Perú

Name	Organization
Alan Fairlie	Pontifical Catholic University of Peru (PUC-Peru)
Alejandra Muñoz	German Development Cooperation (GIZ)
Carmen Rosa García Dávila	Research Institute of the Peruvian Amazon (IIAP)
Dennis del Castillo Torres	Research Institute of the Peruvian Amazon (IIAP)
Isabel Castañeda	German Development Cooperation (GIZ)
Juan Loja	Amazon Conservation Association (ACCA)
Manuel Layseca	Development Finance Corporation (COFIDE)
Margarita Céspedes	German Development Cooperation (GIZ)
Paula Paredes	German Development Cooperation (GIZ)
Valeria Lévano Torres	Pontifical Catholic University of Peru (PUC-Peru)

Suriname

Name	Organization
Ben D'Leon	Amazon Conservation Team (ACT-Suriname)
Gwendolyn Smith	Green Growth Suriname
Lindsay Goossens	Green Growth Suriname
Mayra Esseboom	Centre for Agricultural Research in Suriname (CELOS)
Monique Pool	Green Heritage Fund Suriname
Rudi van Kantén	Tropenbos Suriname

Venezuela

Name	Organization
Aimé Tillett	Independent Consultant
Alexis Araújo	Universidad Nacional Experimental de los Llanos Occidentales Ezequiel Zamora (UNELLEZ)
Douglas Rodríguez Olarte	Universidad Centroccidental Lisandro Alvarado (UCLA)
Judith Rosales	Central University of Venezuela (UCV)
Luis Jiménez	Phynatura
Luis López Méndez	Fundación Servicio para el Agricultor (FUSAGRI)
Luis Salas Rodríguez	Wataniba Amazon Socio-Environmental Working Group
María Oliveira-Miranda	Wataniba Amazon Socio-Environmental Working Group
Richard Sarmiento	CEPAI Amazonas
Vilisa Morón Zambrano	Simon Bolivar University (USB)
Wilmer Díaz	Universidad Nacional Experimental de los Llanos Occidentales Ezequiel Zamora (UNELLEZ)

Regional

Country	Name	Organization
Chile	Adrián Rodríguez	Economic Commission for Latin America and the Caribbean (ECLAC)
Costa Rica	Hugo Chavarría	Inter-American Institute for Cooperation on Agriculture (IICA)

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