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Biodiversity Bonds, a Mechanism for the Protection of Biodiversity. Case Study: Canton of Cuenca

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To myself, to my family, to Luca Prodan for accompanying me musically and to all those who have fought to love and protect nature.

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ABSTRACT

Biodiversity is the degree of variation of life in an ecosystem, where biotic and abiotic beings coexist; its importance stems from maintaining ecological balance, since it provides stability to ecosystems and the biological processes that sustain life on Earth; however, biodiversity is in constant decline, being affected by anthropic activities that generate negative consequences; where the exploitation of natural resources results in the loss of habitat, species, pollution and in an environment harmful to the development of life. Cuenca has a high biodiversity, such as the Cajas National Park, which must be protected to avoid the aggravating loss of biodiversity; therefore, protection and conservation procedures are necessary. Strategies to counteract biodiversity problems must be financed, which is why biodiversity bonds emerge as financial instruments that channel economic resources for projects that protect biodiversity. The methodology applied was based on a qualitative and triangulation approach. As results, it is recognized that, at the national level, biodiversity bonds are in an early stage for their issuance, so it was concluded that it is not the best option currently to finance the protection of biodiversity in the canton of Cuenca, so other financial mechanisms, such as environmental funds for conservation, were provided.

Keywords: Biodiversity Bonds, Biocentrism, Financing for Biodiversity, El Cajas National Park, Green Bonds.

Bonos de Biodiversidad, un Mecanismo para la Protección de la Biodiversidad. Caso de Estudio: Cantón Cuenca

RESUMEN

La biodiversidad es el grado de variación de vida en un ecosistema, donde seres bióticos y abióticos coexisten; su importancia parte de mantener el equilibrio ecológico, ya que provee estabilidad a los ecosistemas y a los procesos biológicos que sustentan la vida en la Tierra; sin embargo, la biodiversidad se encuentra en una constante disminución, siendo afectada por actividades antrópicas que generan consecuencias negativas; donde la explotación de los recursos naturales resultan en la pérdida de hábitat, especies, contaminación y en un entorno dañino para el desarrollo de la vida. Cuenca posee una alta biodiversidad, como el Parque Nacional Cajas, que debe protegerse para evitar la agravante pérdida de biodiversidad; por ello, son necesarios procedimientos de protección y conservación. Las estrategias para contrarrestar los problemas de biodiversidad deben ser financiadas, así surgen los bonos de biodiversidad como instrumentos financieros que canalizan recursos económicos para proyectos que protejan la biodiversidad. La metodología aplicada se basó en un enfoque cualitativo y de triangulación. Como resultados se reconoce que, a nivel nacional, los bonos de biodiversidad están en una etapa primeriza para su emisión, por lo que se concluyó que no es la mejor opción actualmente para financiar la protección de la biodiversidad en el cantón Cuenca, por ello se proporcionaron otros mecanismos financieros como los fondos ambientales para la conservación.

Palabras clave: Bonos de biodiversidad, Biocentrismo, Financiamiento para la Biodiversidad, Parque Nacional El Cajas, Bonos Verdes.

INTRODUCTION

Biodiversity is fundamental for the development of life on Earth, as it maintains the stability of ecosystems and biological processes. Human beings depend on it since it generates the different ecosystem services for the survival of our species and all the others for a correct functioning of life (Rosas et al., 2022), however, it is at risk since the exploitation of natural resources affects the diversity of species of flora, fauna and the regeneration of resources. Under this scenario, it is essential to implement strategies for the preservation, conservation, and protection of biodiversity; however, the measures that are applied to protect biodiversity require financial resources. From this point, the importance of developing programs and projects that protect biodiversity arises, and along with this, find mechanisms that channel financial resources for its financing, so biodiversity bonds are projected as a tool that contributes to the financing of the protection of biodiversity, for this reason, they will be analyzed in this research to determine what are the mechanisms for issuance in Ecuador and recognize whether these are effective in channeling resources towards the protection of biodiversity.

To address these issues, the theoretical, normative and practical foundations of biodiversity bonds as financial mechanisms to channel resources towards the protection of biodiversity are analyzed. International and national criteria, standards and cases are evaluated to know the development of the bonds and how to align them with a biocentric approach; as well as the feasibility of implementing biodiversity credits as a financial tool to protect the biodiversity of the Cuenca canton is analyzed, together, the information obtained is used to contrast theory and practice with respect to biodiversity credits and whether they are relevant for the fulfillment of SDGs 13 and 15.

Chapter 1 addresses the importance of biodiversity protection and how it faces the excessive loss caused by anthropogenic activities, so strategies to channel resources for the protection of biodiversity are analyzed, including green and biodiversity bonds, their definitions, characteristics, operation, historical background, advantages, disadvantages, and how they can be aligned to a biocentric approach. Chapter 2 sets out the international and national regulatory framework for the financing of biodiversity protection, analyzes three international standards that are applied globally for the issuance of bonds, which are: the ICMA green bond principles, the climate bond standard and certification system developed by CBI and the European green bond standard developed by the European Union. Likewise, the cases of implementation models from Romania, Colombia and Ecuador are analyzed. As

the last topic addressed in chapter 2, the situation of the canton of Cuenca and its biodiversity, its characteristics, risks, its protection actions, how these actions are financed and other instruments to finance the protection of biodiversity are analyzed.

Chapter 3 develops the methodology. The methodological approach is qualitative and triangulation, where the three main sources are: literature and national and international regulations, implementation models based on real cases and the territorial context, and as a third source, interviews with experts in the field.

Chapter 4 contains the results of the research to determine if Cuenca has optimal conditions for the application of biodiversity bonds.

CHAPTER 1
THEORETICAL FRAMEWORK

1.1 Importance of Biodiversity Protection and Conservation

The environmental crisis is the imbalance, extreme situations and uncontrollable problems that produce risk, threats and vulnerability to ecosystems, biodiversity, the ability to adapt to the environment and natural systems (Cordero, 2025). The global environmental crisis is understood as an impact on the natural environment, on the forms of life associated with ecosystems, which occurs worldwide. Its origin is anthropic in nature and in turn, also affects human beings (Carranza, 2022).

Ibáñez (as cited in Araujo Sánchez & Ayasanoa Charry, 2025) argues that the causes of the environmental crisis would be the uncontrolled increase in the global population, extractivist activities, the elimination of extensive forest lands, intensive agriculture, and environmental pollution, among others (Araujo Sánchez et al. 2025).

The loss of biodiversity is one of the consequences of the environmental crisis. This refers to the decrease in the variety of life in genes, species and habitats (Ihsan et al., 2024). The decline in biodiversity harms the stability of the different ecological mechanisms (Ellwanger et al. 2025)

Forest loss and climate change, as part of the planetary crisis, can exacerbate biodiversity loss by altering weather patterns, affecting natural habitats, and increasing the frequency and intensity of extreme events. There is evidence that climate change and biodiversity loss are interconnected processes (Valladares, 2023).

Haines-Young and Potschin (as cited in Rayees Afzal Mir et al., 2025) mention that biodiversity facilitates the provision of ecosystem services, tangible and intangible products and services provided by nature that underpin human existence, health, and socioeconomic development. These functions encompass both direct contributions, such as the provision of food, water, energy, and medicinal resources, and indirect regulatory services, such as carbon storage, pollination, climate moderation, and disease control that collectively influence human well-being. The complex interdependence between human society and biodiversity results in the degradation of natural systems.

Naaem (as cited in Rayees Afzal Mir et al., 2025) mentions that biodiversity loss often has cascading ecological effects, as species reductions reduce ecosystem stability, regulatory

controls, and decrease the stability of natural processes under expanding anthropogenic pressures.

1.1.1 Strategies for the Protection of Biodiversity

In the face of the growing environmental crisis and the accelerated loss of biodiversity, three currents have emerged to address it. Anthropocentrism, biocentrism and ecocentrism as ethical-philosophical currents, which interpret and explain how human beings relate to the environment and, based on them, the actions and measures that can be taken to defend the environment and address the environmental crisis.

Anthropocentrism, for example, is the belief that nature and other species are valued for their usefulness to humans and therefore should be conserved (Taylor et al., 2020). In the case of Biocentrism, it is proposed that non-human organisms have an intrinsic value, that is, a value apart from their usefulness for our own species (Taylor et al., 2020), for this reason they must be cared for and protected. Ecocentrism considers ecosystems in themselves to have value regardless of their usefulness to humanity, where nature, biotic and abiotic elements are considered a complete system with its own rights (Taylor et al., 2020).

1.2 Biodiversity Bonds as an Anthropocentric Tool

Anthropocentrism encompasses various orientations on how the relationship between humanity, technology and the environment is conceived. Within anthropocentrism, an orientation called environmentalism is developed. Its vision focuses on human well-being and addresses environmental problems through partial and corrective solutions, operating within the same productive framework, without promoting profound transformations in the way human beings relate to the environment. This position is identified with the principle of sustainable development and human dignity, a conceptual fusion that creates the principle of environmental anthropocentrism (Mantilla, 2015).

In this stream, environmental protection is justified in terms of human well-being, through practices based on sustainable development. Within anthropocentric environmentalism, market environmentalism is developed as a subcategory that proposes that environmental problems be solved through economic and market mechanisms, without slowing down growth.

Anderson and Leal (as cited in Karen Bakker, 2005) explain the term market environmentalism as a modality of resource regulation that promises both economic and

environmental ends through market mechanisms. It offers the fusion of economic growth, efficiency, and environmental conservation through the establishment of private property rights and the incorporation of environmental externalities through pricing. Environmental goods are considered to be allocated more efficiently if they are treated as economic goods, thus simultaneously addressing concerns about environmental degradation and inefficient use of resources (Bakker, 2005).

Market environmentalism is materialized through instruments such as green finance. Green finance has become a transformative mechanism that directs capital towards projects that generate environmental and social benefits, while preserving financial viability. Key instruments include green bonds, sustainability-linked loans and climate-focused investment funds, which facilitate investment in protection and environmentally friendly technologies (Erdoğdu et al., 2025).

Therefore, green and biodiversity bonds are anthropocentric tools typical of market environmentalism as they have their characteristics, which are environmental protection through financial instruments, continuing with the underlying production model.

1.2.1 Is there Alignment with a Biocentric Approach in Biodiversity Bonds?

The relationship between man and his natural environment has been the subject of several readings within the social sciences and specifically in the field of law, among them the anthropocentric and biocentric visions. The first is based on reason and the free will of the human being while the second focuses its interest on the concept of life in general. The relationship between human beings and their natural environment is one of the most debated topics in the fields of law, sociology, anthropology and philosophy, whose considerations generally conclude by condemning human beings and disqualifying anthropocentrism (Mejías et al., 2019).

Currently, the relationship between man and the natural environment tends to be reoriented along the path of reasonableness, understanding that anthropocentrism does not necessarily lead to an irresponsible attitude towards the environment, because while it is true that humanity has generated serious environmental impacts, it is also true that humanity itself has created various instruments to face the consequences of its own centrality, and without a doubt, the law is one of those anthropocentric instruments that has reacted energetically in defense of the environment (Mejías et al., 2019).

Burg (as cited in Mejías et al., 2019) mentions that law is a human institution intended to regulate legal relationships between people in conflict or in dilemmatic situations, therefore, it is impossible to build a legal system that is not anthropocentric; Any judicial or administrative action will always be conducted by human beings, even if it is done in the name of other natural beings. In fact, although there is formal recognition of the rights of nature, it cannot initiate a legal action or resolve a judicial conflict, nor be the true beneficiary of the satisfaction of its interests in justice, only humans are capable of fulfilling the functions related to the exercise of justice, so biocentrism can be considered a useful intellectual tool that tempers in some way The excesses of the anthropocentric vision (Mejías et al., 2019).

Angulo (as cited in Mejías et al., 2019) mentions that, based on the criticisms of anthropocentrism, he considers that biocentrism is the relevant principle for comprehensive protection of the environment; however, he also recognizes that both principles can coexist within the legal system.

The representatives of the current of biocentrism maintain that the solution would be to overcome or replace anthropocentrism with biocentrism or the right or equality between all living beings, this discussion with its nuances was projected to the national legal sphere but finally expressed in a reasonable way from the recognition of the rights of nature in the Constitution of Ecuador of 2008 which now share equal legal rank with the law of the entire population to live in a healthy and ecologically balanced environment in order to guarantee sustainability and good living, also called sumak kawsay (Mejías et al., 2019).

Based on the approaches presented where it is argued that both anthropocentrism and biocentrism can coexist, taking the Constitution of Ecuador as an example, it is possible to analyze whether financial instruments aimed at conservation, in this case green and biodiversity bonds, can be structured under biocentric criteria. Under the previously developed positions, biodiversity bonds can be partially aligned to a biocentric approach in a limited and conditional way in their use, criteria and governance; however, by design they are clearly anthropocentric.

Biodiversity bonds are not a biocentric proposal as such, since they operate in financial markets, which require the productive system for their existence and justify environmental protection for human well-being through resource management, which places them in anthropocentrism. However, while it cannot change ethical currents on its own, its regulatory

framework, its allocation criteria, the end of funding, and the way in which protection is justified might.

Under what conditions could a green bond finance actions consistent with a biocentric vision? Among the biocentric alignment scenarios we would have the use of the bond for strict conservation, where a biodiversity bond finances the conservation of ecosystems without productive use, ecological restoration without extractive purposes and the protection of species without economic valorization.

Another scenario is the justification based on intrinsic value, which refers to the fact that the regulatory framework of the bond establishes that nature must be protected for its intrinsic value, not for ecosystem services or for the benefit of humanity and not for future productivity, so that the ethical criterion of financing is biocentric even if the mechanism is anthropocentric.

If the end of investments is directed towards biocentric protection strategies, which prioritize the conservation of species and ecosystems for their intrinsic value, such as the creation of protected areas and the restoration of ecosystems, instead of directing exclusively to those that prioritize benefits for humans, such as renewable energies, it would result in a biocentric alignment.

It is important to note that transitions to sustainable production practices are necessary and are part of the strategies for the protection of biodiversity. However, if the objective is for biodiversity bonds to have a biocentric approach and not purely anthropocentric, these should not be the only strategies for the protection of biodiversity, nor to prioritize biocentric strategies since this would reverse the logic towards an anthropocentric approach.

Finally, in contexts where nature is a subject of rights, as in the case of Ecuador, and the projects financed seek to guarantee those rights, bonds operate as financial instruments at the service of a biocentric legal framework.

It is important to recognize that even though alignment is biocentric, nature as such is still quantified and managed, so alignment is instrumental and limited.

1.2.2 Alignment with Biocentric Strategies

From biocentrism, nature and its elements are considered to be subjects of rights, Ecuador is an example that its Constitution contemplates the rights of nature, as an alternative proposal to the utilitarian tradition that has been applied throughout history.

In the Organic Code of the Environment, within the glossary of terms, it determines that: *"Nature is the environment in which all forms of life are reproduced and carried out, including their components, which depends on the uninterrupted functioning of its ecological processes and natural systems, essential for the survival of the diversity of life forms."* (Asamblea Nacional del Ecuador, 2017, art. 10). The incorporation of nature as a subject of rights responds to a biocentric conception, which is based on the criterion that nature is a complex and integral system where man is one of its elements and as such they have interdependent relationships with the other elements that are part of it, therefore the relationship between man and nature can no longer be purely utilitarian (Bustos Cordero, 2019).

The adoption of a biocentric approach to biodiversity conservation allows us to rethink the relationship between human beings and nature, overcoming utilitarian visions typical of anthropocentrism. Conservation policies and strategies based on biocentrism seek genuine protection of ecosystems and species, not for the purpose of their exploitation or future use, but in recognition of their right to exist and maintain themselves.

Ceballos et al. (as cited in Raven et al., 2020), conclude that we have already entered the world's Sixth Great Extinction. Dan Janzen (as cited in Raven et al., 2020) said: "If we don't save it now, we won't be able to save it later", under these premises it is necessary to study, understand and save the biodiversity that constitutes the backbone of natural systems (Raven et al. 2020).

Concern about the state of biodiversity must result in protective measures, which are aimed at the prevention, reduction and elimination of environmental degradation. Conservation is the practice of managing natural resources to prevent their overexploitation, with the aim of guaranteeing resources available for future generations, while satisfying the needs of the current population and preservation refers to maintaining ecosystems and species without direct human intervention, avoiding their alteration (Mahanayak, 2024).

The creation of protected areas, the restoration of ecosystems and the promotion of sustainable production practices are strategies to avoid the loss of biodiversity. Protected areas are important for safeguarding biodiversity from both natural and anthropogenic threats as they conserve natural habitats, protect resources and prevent anthropogenic activities within them (Zeng et al., 2022).

In ecological restoration projects, degraded areas are restored and ecological functions such as water regulation, nutrient cycling, and carbon storage are restored. Efficient and effective ecological restoration counteracts the negative consequences of habitat destruction and degradation for biodiversity and the functioning of natural ecosystems (Atkinson et al., 2022). As mentioned above, these strategies can be recognized as biocentric if they are aligned with the principles of protection intrinsically and with the legal principles for the application of the rights of nature as prevention, precaution and in dubio pro natura (Bustos Cordero, 2019).

On the other hand, sustainable production practices seek a balance between productive and economic activities and environmental protection, reducing the impact of these activities and promoting the rational use of natural resources. One example is sustainable and resilient agri-food systems to protect and restore biodiversity. However, the achievement of these goals depends on functional and sustainable management practices, supported by scientific evidence and adaptable to different environmental contexts (Knapp et al. 2023). This argument is considered anthropocentric as mentioned above because it is a solution that continues to promote the productive system and there is no structural or profound change as such, however, the transition to productive practices despite having limitations should not be discarded, nor prioritized over practices that are biocentric.

The creation of protected areas, the restoration of ecosystems and the promotion of sustainable productive practices require political, technological and economic approaches. In the political case, there is a link between political regimes and biodiversity conservation, being an interdisciplinary issue since political decisions determine laws and regulations that regulate the use of natural resources (Rydén et al., 2020).

All these measures and approaches need financing because, without economic resources, neither policies nor technology can be sustained in the long term. In economics, markets cannot manage the efficient provision of public goods because those who did not pay for them cannot be excluded from receiving them, which means that markets provide an

insufficient amount of public goods relative to what is necessary for economic efficiency (Heal, 2020). Many of the benefits of biodiversity are public goods (Heal, 2020), for example, pollination services are available to all; Bees do not check to see if an orchard owner has paid for their services. Forests absorb CO_2 from the atmosphere and, in doing so, benefit everyone, regardless of whether they paid for the forest or not (Heal, 2020).

In terms of external costs and benefits that refer to a transaction between a buyer and a seller that generates costs or benefits for a third party that is not directly involved in the transaction. Markets lead to inefficient outcomes when there are external costs or benefits. Biodiversity conservation generates external benefits: the conservation of tropical forests generates benefits that have an impact on many non-conservationists; in fact, everyone; However, the economic incentives to conserve these forests are too scarce and markets do not allocate enough resources to their conservation (Heal, 2020).

A third dimension of the relevant market failure as it relates to biodiversity is the lack of well-defined property rights: markets can only manage the purchase and sale of goods and services efficiently if the ownership of those products is clear, so that, when a sale occurs, There is no ambiguity about who sells and who buys, who pays and who receives (Heal, 2020). However, for many environmental goods and services, this is not the case: no one owns the atmosphere, nor the birds that fly in it, nor the oceans, nor the fish that swim in them, in fact, most of the biodiversity is not owned by anyone, so no one has a financial interest in conserving it; however, it should not be ignored that, in politics, under the jurisdiction of each country, biodiversity is the responsibility of the State (Heal, 2020).

For all of the above, there is a need to mobilize economic resources to finance biodiversity protection measures, which is why financial instruments have emerged, including green bonds and biodiversity bonds.

1.3 Green and Biodiversity Bonds: Definition, Characteristics, Operation and Historical Background.

Bonds are marketable securities that are traded on the stock exchange for the long term. The issuer of the bonds agrees to pay a fixed amount of interest over a certain period of time and to repay a fixed amount at maturity. Bonds are also known as Fixed Income Securities, Fixed Investments, or Debt Financing (Paiano, 2023).

A bond is considered a promissory note that can be issued by corporations, a municipality, a state, among others. Bond investors lend their money to bond issuers. Bond

investors are lenders rather than stock investors, who are owners. Bond issuers agree to repay the money they borrowed with interest. These instruments can generate protective covenants, such as the obligation of the bond issuer to continue doing business and to make payments on time (Paiano, 2023). Historically, international bond issuance has provided an avenue for cross-border capital flows (Benzie, 1992).

As a general rule, if a company offers securities publicly, including corporate bonds, it must provide a disclosure document to potential investors. This document is usually filed with the regulatory authority. In addition, there are periodic and ongoing disclosure obligations if the securities issued are listed on a public market (The Organization for Economic Cooperation and Development, 2025).

Green bonds are bonds issued by municipal entities, the private sector, or multilateral institutions (such as the World Bank) to finance projects with environmental or climate impact. For example, they can be issued to finance projects related to renewable energy and energy efficiency, clean public transport, pollution prevention and control, conservation, sustainable water and wastewater management, and sustainable buildings. In general, green bond projects seek to generate substantial net benefits for the climate or the environment (Municipal Securities Rulemaking Board, 2018).

Projects that do not focus primarily on climate usually contribute to the conservation and/or sustainable and efficient management of natural resources; reduce waste or pollution; and, in general, improving environmental quality, contributing to sustainable living or the protection of biodiversity, for example, biodiversity bonds are a specific subcategory within green bonds focused on the protection, restoration and sustainable use of biodiversity (Municipal Securities Rulemaking Board, 2018).

The Green Bond market originated mainly from the demand of investors, who were looking for assets related to positive social and environmental impacts, taking into account the environmental crisis we have faced in recent decades. Interest in green finance increased and gave rise to environmentally sustainable projects. Different organizations worldwide and mainly the United Nations Organization have consolidated global agreements to fight against climate change, biodiversity loss, soil desertification, among others. These different agreements have generated a transition towards green finance (Guaigua Vizcaino et al., 2021).

The first issuance of green bonds took place in 2007, when the European Investment Bank (EIB) used this instrument under the name of "Climate Awareness Bond", for an amount of 600 million euros to finance environmental projects (Guaigua Vizcaino et al., 2021). This issuance was followed by other multilateral development banks such as the African Development Bank (AfDB) or the World Bank, initiating a market that was soon joined by private issuers and public entities, thus expanding the number of green investors and projects (Guaigua Vizcaino et al., 2021).

Biodiversity Bonds contribute financially to the protection of biodiversity by mobilizing capital that can be private, public or mixed towards exclusive conservation actions. The process begins when a state, a public body, financial entity or environmental institution, identifies the need to finance protection, conservation or restoration actions and then structures the bond defining the amount to be issued, its term, interest rate, exclusive destination of the funds and the eligibility criteria of the projects, it is important the frameworks that are used to ensure their transparency where reports that support them are included.

1.3.1 Advantages and Disadvantages of Applying Green Bonds

The importance of green bonds lies in the protection of "natural capital", since their issuance promotes the preservation and improvement of a country's ecosystems and natural resources. This statement is supported by evidence that indicates that a higher volume of green bond issuance is associated with significant improvements in the levels of protection of ecosystems and biodiversity, especially in countries with low and medium levels of environmental protection, where the impact of these instruments is more relevant (Tamula et al., 2024).

To recognize the advantages that green bonds provide, it is important to mention that there is a substantial gap between the financial resources necessary for the conservation of biodiversity, ecosystem services and the funds currently available, so green bonds act in the face of this financial gap by channeling resources towards environmental projects. While some green bonds can be used to finance protected areas, evidence also suggests the positive effect of green bonds on biodiversity with respect to reducing emissions, helping to slow biodiversity loss and ecosystem recovery (Horn et al., 2026).

Another finding is that the volume of green bonds issued increases significantly with greater environmental awareness. This is not an intrinsic advantage of bonds, however, it

does enhance and mobilize this awareness towards the financing of environmental initiatives. Finally, the volume of green bonds issued is positively related to the ecological budget, reduces the ecological footprint and is associated with greater biodiversity in subsequent years, resulting in the strengthening of environmental protection (Horn et al., 2026).

Green bonds have disadvantages and limitations that must be considered. It has been revealed that there is no significant impact on the reduction of greenhouse gas emissions from the issuance of green bonds, nor conventional bonds, even after the introduction of net-zero carbon policies (Zhou & Kythreotis, 2024). It is important to take into account that there is not enough information on the impacts of green bonds, which is a relevant limitation (Zhou & Kythreotis, 2024). Nonetheless, this finding remains significant and deserves attention, suggesting that carbon reduction policy has not put enough pressure on bond issuers to finance projects that reduce emissions (Zhou & Kythreotis, 2024).

For entities that issue both conventional and green bonds, they do not demonstrate the same level of environmental benefits, suggesting that only those that focus exclusively on green bonds can achieve significant environmental gains(Zhou & Kythreotis, 2024). This finding raises the possibility that entities that issue both green and conventional bonds may engage in behavior contrary to environmental protection under the guise of green bonds, which is considered *greenwashing*. Other findings indicate that bond issuers from high-income countries perform better in reducing CO_2 emissions. This discrepancy is attributed to stricter carbon reduction requirements in high-income countries and increased investment in resources and technologies (Zhou & Kythreotis, 2024).

Finally, entities that exclusively issue green bonds outperform those that issue conventional bonds in terms of ESG (Environmental, Social, and Governance) ratings, assessments that measure how well a company, project, or financial instrument manages risks and impacts on environmental, social, and governance dimensions, financing costs, and CO_2 emissions management, thus achieving both economic and environmental benefits. Conversely, entities that issue both green and conventional bonds tend to have a higher CO_2 emissions intensity compared to those that issue only conventional bonds, suggesting that, for dual bond issuers, the issuance of green bonds can serve as a form of greenwashing as already mentioned above (Zhou & Kythreotis, 2024).

The disadvantages and limitations of green bonds show that they do not constitute a sufficient structural solution for the protection of nature and biodiversity. Its effectiveness depends on external conditions such as the regulatory framework, the level of environmental commitment of the issuers and the socioeconomic context, which limits its ability to guarantee real and long-term environmental results. It is pertinent to point out that the way in which green bonds are conceived and applied directly influences their results since, when the priority is economic and nature is understood as "natural capital", the protection of nature and biodiversity are in the background or, as mentioned above, in greenwashing. From a biocentric perspective, it is revealed that the protection of nature and biodiversity cannot depend exclusively on financial instruments, it requires comprehensive, ethical and regulatory bases that recognize their value beyond their economic utility.

CHAPTER 2
STATE OF THE ART

2.1 International and National Regulatory Framework for the Financing of Biodiversity Protection.

2.1.1 International Normative Framework

At the international level, agreements and organizations have focused on the preservation, conservation and protection of biodiversity.

The 1992 Convention on Biological Diversity (CBD) is an international instrument that addresses in its objectives: the conservation of biological diversity, the sustainable use of its components and the fair and equitable sharing of benefits arising from the utilization of genetic resources (Convention on Biological Diversity, 2011). Article 9 mentions that parties shall encourage users and providers to channel benefits towards the conservation of biological diversity and the sustainable use of its components (Convention on Biological Diversity, 2011, art. 9).

The Convention on Biological Diversity is a commitment by the nations of the world to conserve biological diversity, use biological resources sustainably and equitably share the benefits arising from the use of genetic resources. It is the first global agreement to comprehensively address all aspects of biodiversity: genetic resources, species and ecosystems. The Convention entered into force on 29 December 1993, just eighteen months after it was opened for signature at the 1992 United Nations Conference on Environment and Development in Rio de Janeiro. As a first step to facilitate the implementation process, the International Union for Conservation of Nature (IUCN), an international organization dedicated to the conservation of natural resources, presented a Guide to the Convention on Biological Diversity, which aims to promote a greater understanding of the text of the Convention and its possible implications. The Guide explains the Convention and highlights some of the scientific, technical and legal aspects underlying it (Glowka et al., 1994).

Before the adoption of the Convention, there were normative references in the international environmental field such as the Ramsar Convention on Wetlands (1971) or the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES, 1973). While these agreements represent significant advances in environmental protection, their scope was limited and fragmented by focusing on specific ecosystems, species or

activities without offering a comprehensive and comprehensive legal framework that jointly addressed genetic resources, species and ecosystems.

Biodiversity became a global problem in the mid-1980s, under pressure from converging forces: the growing danger of species extinction and changes in both the theory and practice of nature conservation, but also the expansion of genetic engineering and the intrusion of industrial interests into areas from which they had hitherto been excluded (Boisvert & Caron, 2002). These elements have contributed to the development of utilitarian perceptions of nature, reduced to a set of resources thanks to the new technologies that have made its extensive economic exploitation possible (Boisvert & Caron, 2002).

The development of the Kunming-Montreal Global Biodiversity Framework, which was created with the need for a balanced and strengthened implementation of all the provisions of the Convention, was adopted by all CBD member countries on 19 December 2022, due to the alarming ongoing loss of biodiversity and the risk this poses to human well-being (Convention on Biological Diversity, 2022).

The Framework aims to channel, facilitate and drive urgent and transformative action by governments, subnational and local governments with the participation of the whole of society to halt biodiversity loss and achieve the outcomes it sets out in its vision, mission, objectives and targets. In this way, it contributes to the objectives of the Convention (Convention on Biological Diversity, 2022).

The Kunming Framework gives legitimacy and international support to financial instruments as an option for countries to channel resources to biodiversity protection. In Goal 19, it mentions that international financial resources, domestic resource mobilization, working with private financing, promoting blended finance, incentivizing private sector investment in biodiversity and promoting innovative schemes such as payment for ecosystem services, green bonds, biodiversity offsets and credits must be increased (Convention on Biological Diversity, 2022, art. 19).

The Kunming-Montreal Global Biodiversity Framework (KM-GBF) is part of a series of global frameworks of the CBD and is the result of a "decade of biodiversity", where, through the Aichi Targets (a set of five targets divided into 20 targets, launched in 2010), it was intended to halt global biodiversity loss by 2020. However, while the Aichi Targets identified the drivers of biodiversity loss in order to reconcile them, reduce pressures on biodiversity and safeguard diversity at all levels, as well as the services provided by healthy

habitats, and to focus on implementation pathways; none of the Aichi Goals were successfully completed (Hughes, 2023).

Hirsch (as cited in Hughes, 2023) mentions that throughout this "decade of biodiversity", we have witnessed an acceleration of biodiversity loss in many parts of the world, increased deforestation, the implementation of infrastructure, and levels of overexploitation of various wild species, considered the greatest threat to the future survival of many species.

As a consequence, the new Biodiversity Management Framework (KM-GBF) includes a "theory of change", which aims to understand the underlying drivers of diversity loss and develop targets aligned with these mechanisms (Hughes, 2023). The "theory of change" aimed to address the drivers of biodiversity loss and to integrate methods to reduce and halt biodiversity loss across sectors. One challenge with Aichi's goals was that many were difficult, or even impossible, to measure. Therefore, the new objectives are: -Specific, Measurable, Ambitious, Realistic, Timebound (SMART)-, specific, measurable, ambitious, realistic and time-bound, to ensure that success can be measured and leads to measurable conservation improvements. The CBD plans to meet every two years through the COPs. The 15th Conference of the Parties to the Convention on Biological Diversity (COP15), scheduled for Kunming, was preceded by COP14, held in Sharm-El-Sheikh, a city in Egypt, in 2018, where the "Sharm-El-Sheikh to Kunming Action Agenda" was launched, to lay the groundwork for KM-GBF. Within the framework of this Action Agenda, organizations (countries, companies, etc.) were able to commit to facilitating the reduction of biodiversity loss at all scales (Hughes, 2023).

Finally, the Framework receives this name because COP15 took place in two phases, starting in Kunming and concluding in Montreal, where the final text was formally adopted. The Kunming-Montreal Global Framework represents a new cycle of global biodiversity governance under the Convention, built on the explicit recognition of the limits of the previous approach and the need for more operational and measurable targets.

2.1.2 National Regulatory Framework

At the national level, the Constitution of Ecuador, in Article 259, mentions that, in order to protect biodiversity, the central State and the decentralized autonomous governments will adopt sustainable development policies (Constitution of the Republic of Ecuador, 2008ª, art. 259). This article makes the central State and the GADs responsible for

guaranteeing the protection of biodiversity through policies and standards for the proper management of ecosystems. It is complemented by articles 395 which recognize environmental principles such as sustainable models that conserve biodiversity and the natural capacity of ecosystems, environmental management policies and the participation of people in all activities that generate environmental impact. Article 400 recognizes biodiversity as a responsibility of the State. In addition to these articles, others together create instruments for environmental protection and management (Constitution of the Republic of Ecuador, 2008a).

In the 2017 Organic Environmental Code, it also endorses investment in biodiversity protection. Article 405 mentions that the State will allocate the necessary economic resources for the sustainability of protected areas (National Assembly of Ecuador, 2017, art. 405).

For its part, the Regulation to the Organic Environmental Code is the administrative instrument that develops the necessary regulations for the application of the Organic Environmental Code, establishes procedures, criteria and obligations that govern environmental management in Ecuador. Among its functions, it operates the provisions of the Code in areas such as the management of projects and activities with environmental impact, environmental management instruments, environmental incentives and responsibilities of the subjects of control. The framework established by this regulation makes the implementation and control of instruments such as the Sovereign Green Bond Framework viable within the national legal system (President of the Republic of Ecuador, 2019).

The Sovereign Green Bond Framework of the Government of Ecuador, effective June 29, 2023, is a financial policy and environmental governance instrument created by the Ecuadorian State, through a joint agreement of the Ministry of Economy and Finance, the National Secretariat of Planning and the Ministry of the Environment. Water and Ecological Transition (current MAE). which defines the guidelines under which the country can issue bonds to finance projects with environmental benefits. It is a binding regulatory instrument since it is contained in a ministerial agreement, and it is a framework of reference aligned with international capital market standards, such as the ICMA Green Bond Principles. The Green Bond Framework sets out the obligations that the Government of Ecuador must meet for any issuance of Green Bonds to investors and the market, including the exclusive allocation of resources to eligible projects with environmental benefits; project evaluation

and selection processes; management and traceability of funds obtained and the obligation to report periodically on the use of resources and the environmental impacts associated with the projects financed (Ministry of Economy and Finance et al., 2023).

The Ministry of Economy and Finance (MEF), as issuer of the bonds, may issue Green Bonds exclusively to finance eligible green projects or refinance public debt with the aim of allocating resources for the financing of green projects. The Bonds must comply with the provisions of Ecuador's current legal regulations for public debt and the types of projects or activities eligible for financing, established in this Framework and that are aligned with the Green Bond Principles 2021 of the International Capital Markets Association (ICMA); which are voluntary guidelines recognized in international capital markets structured around the use of funds, evolution process, project selection, resource management and transparency through periodic reporting, the Sustainable Development Goals (SDGs), sustainable development agenda, and the Nationally Determined Contribution (NDC), which is a national climate plan, committing to reduce emissions and adapt to national climate change under the Paris Agreement (Ministry of Economy and Finance et al., 2023).

The Framework includes transparency and accountability mechanisms through annual reports on the use of funds and evaluations that certify compliance with environmental objectives (Ministry of Economy and Finance et al., 2023).

The Sovereign Green Bond Framework of the Government of Ecuador was formally established through the Interministerial Agreement issued on June 29, 2023 by the Ministry of Economy and Finance, the National Secretariat of Planning and the Ministry of the Environment, Water and Ecological Transition. This agreement provides that the Framework document is an integral part of the instrument and defines that the Ministry of Economy and Finance, in coordination with SNP and MAATE, must implement technical mechanisms and procedures necessary for the effective use of resources, project selection, management and reporting with an initial validity of 3 years (Ministry of Economy and Finance, 2023).

2.2 International Standards

The issuance of green bonds has required the development of international standards that guarantee credibility, transparency and environmental consistency of this financial instrument. These standards arise in response to the need to avoid *greenwashing* practices and to ensure that the resources raised through green bonds are effectively allocated to projects with verifiable environmental benefits. Various international organizations,

financial institutions and regulatory entities have developed regulatory frameworks, voluntary principles and certification schemes that guide the structuring, issuance, management and reporting of green bonds, becoming fundamental references for sovereign, corporate and investor issuances in international financial markets.

2.2.1 Green Bond Principles

The Green Bond Principles (GBP) are a set of voluntary frameworks with the stated mission and vision to promote the role that global debt capital markets can play in financing progress towards environmental and social sustainability. The principles outline best practices for the issuance of bonds for environmental purposes through global guidelines and recommendations that promote transparency and disclosure, underpinning market integrity. The principles also raise awareness of the importance of environmental and social impact among financial market participants, which ultimately seeks to attract more capital to support sustainable development (International Capital Market Association, 2025a).

The GBP seeks to support issuers in financing environmentally sound and sustainable projects that foster a net-zero economy and protect the environment. The issuance aligned with the GBP must provide transparent green credentials, in addition to an investment opportunity. By recommending that issuers report on the use of Green Bond funds, the GBP promotes a step-change in transparency that makes it easier to track funds earmarked for environmental projects, while seeking to improve understanding of their estimated impact. The GBP provides high-level categories for eligible Green Projects, in recognition of the diversity of current perspectives and continued development in understanding environmental issues and consequences, and, where necessary, refers to other entities that provide complementary definitions, standards and taxonomies to determine the environmental sustainability of projects. GBP encourages all market participants to use this basis to develop their own sound practices, referencing a broad set of complementary criteria as appropriate (International Capital Market Association, 2025a).

The GBP is collaborative and consultative in nature, based on contributions from Members and Observers of the Principles, as well as the wider community of stakeholders. It is updated as needed to reflect the development and growth of the global green bond market. GBPs are generally coordinated by the Executive Committee with the support of the International Capital Market Association (ICMA) Secretariat. In addition to GBP, the principles offer approaches that reflect sustainability commitments at issuer level, which

may complement or be an alternative to a focus on the use of funds. Such commitments can be expressed through Sustainability-Linked Bonds, as well as issuer-specific strategies and disclosures, as recommended by the Climate Transition Finance Handbook when communicating transition plans aligned with the Paris Agreement. Appendix II provides an illustration of the products and related guidance covered by the principles (International Capital Market Association, 2025a).

The GBP recommends a clear process and disclosure of information for issuers, which investors, banks, underwriters, arrangers, placement agents and others can use to understand the characteristics of any Green Bond. The GBPs emphasize the required transparency, accuracy, and integrity of the information that issuers will disclose and communicate to stakeholders using key fundamental components and recommendations.

The four fundamental components for alignment with GBP are:

1. Use of Funds
2. Project Evaluation and Selection Process
3. Fund Management
4. Reports

Recommendations for greater transparency are external reviews (International Capital Market Association, 2025).

2.2.2 Climate Bonds Standard and Certification Scheme

The Climate Bonds Standard and Certification Scheme, developed by the Climate Bonds Initiative (CBI), is another of the most relevant international reference implementation models for green bond certification. This standard is based on scientific and sectoral criteria aligned with the goals of the Paris Agreement, particularly limiting global warming to 1.5°C, and sets out rigorous requirements for project eligibility, independent verification, and ongoing monitoring (Climate Bonds Initiative, 2025).

The Climate Bond Certification Standard and Scheme is a voluntary labelling system for investments, and now also for entities, that addresses the challenge of climate change and is consistent with the objectives of the Paris Agreement. The Scheme was launched in 2012 by the Climate Bonds Initiative (Climate Bonds), a non-profit organization that works to mobilize global capital for climate action (Climate Bonds Initiative, 2025).

The Standard was initially designed to foster confidence in the climate change credentials of green bonds and other debt instruments, and to facilitate investment decision-

making. Certification under the Standard confirms that debt instruments, assets or entities comply with the assessment frameworks and criteria required by the Climate Bond Standard (CBS). The Standard is based on transparently developed scientific criteria (Climate Bonds Initiative, 2025).

2.2.3 European Green Bond Standard

The European Union has developed its own regulatory framework to regulate and strengthen the green bond market within its jurisdiction. In its statement of 14 January 2020 entitled "Investment Plan for a Sustainable Europe. European Green Deal Investment Plan", the establishment of a standard for environmentally sustainable bonds was announced in order to further increase investment opportunities and facilitate the identification of environmentally sustainable investments through clear labels. In its conclusions of 11 December 2020, a legislative proposal for a standard for green bonds was presented. (European Parliament & Council of the European Union, 2023).

Environmentally sustainable bonds are one of the main instruments for financing investment related to environmentally sustainable technologies, energy and resource efficiency, as well as environmentally sustainable transport and research infrastructure. Financial and non-financial entities, as well as non-corporate entities, such as governments, can issue such bonds. The various existing initiatives for environmentally sustainable bonds do not contain common definitions of environmentally sustainable economic activities, preventing investors from easily identifying bonds whose revenues align with or contribute to the environmental goals set out in the Paris Agreement (European Parliament & Council of the European Union, 2023).

Issuers wishing to use the designation 'European Green Bond' or 'EuGB' should follow the same rules across the Union in order to increase market efficiency, reducing discrepancies and thus the costs of assessing such bonds for investors. To facilitate comparison and combat money laundering, optional sustainability disclosure templates should be provided for both marketed and environmentally sustainable bonds and sustainability-linked bonds (European Parliament & Council of the European Union, 2023).

Regulation (EU) 2020/852 mentions enabling and transitional activities that are considered environmentally sustainable under certain conditions. In accordance with Regulation (EU) 2020/852, and in order to provide investors with clear, quantitative, detailed and common definitions, the criteria set out in that Regulation should be used to determine

whether an economic activity is considered environmentally sustainable. Proceeds from bonds using the designation 'European Green Bond' or 'EuGB' should be allocated to economic activities that are environmentally sustainable and therefore aligned with the environmental objectives set out in Regulation (EU) 2020/852 in order to meet the necessary criteria to be environmentally sustainable (European Parliament & Council of the European Union, 2023).

It should be possible to use the proceeds of such bonds to finance such environmentally sustainable activities. Therefore, it is necessary to specify the categories of assets and expenses that can be financed with the proceeds of the European Green Bonds (European Parliament & Council of the European Union, 2023).

Green bond standards establish a set of rules, principles, or technical criteria applicable to multiple issuers to guide and harmonize bond issuance practices. Three ways of structuring international standards were found, where each one focuses its standardization in the legal field, in the market and in the technical field and certifications. In this context, the European Union focuses on the legal field by establishing in the European Green Bond Standard through a binding regulation, ICMA focuses on the market by operating as a self-regulatory mechanism for the main capital market participants, whose Green Bond Principles function as de facto standards. The Climate Bonds Principles (CBI) focuses on the technical and specialized certification field through the Climate Bonds Standard and Certification Scheme, which defines detailed scientific criteria and a formal certification system. Together, these standards are three ways in which the structure for green bond issuance can be directed.

2.3 Implementation Models:

Green bond implementation models refer to the set of institutional mechanisms, technical instruments, and operational practices through which States implement the international standards applicable to bonds. The model's fit metrics are to assess the impact of the financial strategies applied (Rahmiyati et al., 2025). The implementation models encompass governance, project selection, resource management, transparency and accountability mechanisms associated with the issuance of green bonds. Green bonds are based on sustainable finance principles, which translate the consideration of environmental, social and governance aspects into investment areas (Rodrigues Loiola et al., 2025). Within the implementation models are sovereign green bonds issued by a State, sovereign green

bonds are guided by green bond frameworks as fundamental technical instruments through which States structure and formalize the application of international standards in the financial field, in this case, in bonds.

In 1972, a report by the Club of Rome introduced for the first time, in a document entitled "The Limits to Growth," the idea that some important natural resources are rapidly being depleted (Mihai et al., 2021). The debates that arose from the limits of growth highlighted the tensions between economic growth, the availability of natural resources and the carrying capacity of ecosystems. This resulted in the foundations of the concept of sustainable development that was consolidated in the international agenda, which is materialized in the 2030 Agenda for Sustainable Development, being a global commitment to balance economic growth with environmental protection and social well-being.

2.3.1 Romania case

In the case of Romania's sovereign green bond implementation model, as an EU member state, it is committed to the United Nations (UN) 2030 Agenda for Sustainable Development. Romania addresses the 2030 Agenda for Sustainable Development through its National Strategy for Sustainable Development 2030 (SNDDR 2030) and its National Action Plan for the implementation of the SNDDR 2030. The Romanian government intends to use green bonds to finance crucial expenditures for the transition to a low-carbon economy and promote the SDGs. Its Sovereign Green Bond Framework outlines the criteria and governance process established by the Government for the issuance of sovereign green bonds, in accordance with market best practices (Government of Romania, 2023).

To facilitate the issuance of green bonds, the Government has adopted Government Decision No 100/2013. 353/2023 to amend and complete the relevant methodological standards. This allows for the incorporation of provisions that allow the issuance of green, social or sustainability bonds in national and international markets and the hiring of external assessors to meet market requirements (Government of Romania, 2023).

The Framework is in line with the Green Bond Principles (GBP), administered by the International Capital Markets Association (ICMA) and published in June 2021. The Framework adopts the four main components and key recommendations of the GBPs, which are: Use of Funds, Project Evaluation and Selection Process, Management of Funds, Reporting and External Review.

Under this Framework, the Government may issue green bonds, the funds of which will be allocated exclusively to Eligible Green Projects, described in the section on Use of Funds. There is a list of green projects that can be chosen for funding, as well as a list of projects that cannot be chosen for funding (Government of Romania, 2023).

The Government of Romania has adopted Government Decision No. 547/2023 to establish an Inter-Ministerial Committee for the governance, monitoring, evaluation and selection of projects/expenditures aimed at protecting the environment and combating climate change. The objective of the Committee is to monitor and approve key decisions related to green bonds issued under this Framework. The Committee is chaired by the Minister of Finance and representatives of ministries (Government of Romania, 2023).

All projects are subject to environmental impact assessment in accordance with Law No 292/2018 on the assessment of the impact of public and private projects on the environment. The evaluations are an adequate study of protected natural areas and conservation of natural habitats, flora and fauna. The impact study also includes a chapter that addresses the social impact and the impact on the health of the population (Government of Romania, 2023).

Ministries will identify and develop an initial list of potential green projects/expenditures based on the eligibility criteria. Each project will include indicators to better define its environmental impact. On a monthly basis or as required, the Committee will evaluate the submitted projects to ensure their compliance with the Framework. The Directorate-General for Finance and Public Debt of the Ministry of Finance, with the collaboration of the Inter-Ministerial Committee and other relevant government departments and ministries, will monitor the remaining Eligible Green Projects that can be financed in the following year through another issuance (Government of Romania, 2023).

The Directorate General of Finance and Public Debt of the Ministry of Finance will be responsible for the issuance of the green bonds and will manage the allocation of an amount equivalent to the net proceeds of its green bonds through a portfolio approach (an aggregate basis for multiple green bonds). The Directorate-General for Finance and Public Debt of the Ministry of Finance shall be responsible for the preparation and coordination of post-issuance allocation and impact reports, with the contribution of the Inter-Ministerial Committee and other relevant government departments and ministries. The following reports will be made available to Green Bond investors (Government of Romania, 2023).

An Allocation Report will be made available to investors annually until full payment of the bond which will include information on: total amount allocated to Eligible Green Projects, total amount allocated by category of Eligible Green Project, total remaining unallocated amount and breakdown of refinancing against new financing. An annual Impact Report on the expected environmental and/or social impacts of Eligible Green Projects will be made available to investors until full allocation (Government of Romania, 2023).

In the event of material changes, the issuer shall inform investors in a timely manner. Finally, it incorporates an external review mechanism with the aim of reinforcing the credibility, transparency and alignment of the instrument with international standards. First, S&P Global Ratings; a global credit rating and rating agency that assesses the solvency of companies, governments and debt, providing scores and ratings that indicate the risk of financial default for investors and markets, conducted a Second Party Opinion (SPO), through which it assessed the Framework and confirmed its compliance with the Green Bond Principles (GBP) of the International Capital Market Association (ICMA). This pre-issuance review allows investors to have an independent assessment of the Framework's structuring to recognized standards in the international green bond market (Government of Romania, 2023).

In addition, the Romanian government established a commitment to periodic post-issuance verification. Starting one year after the issuance of the green bond and on an annual basis, and until the funds are allocated in full or in a timely manner in case of substantial changes, a verification report on the allocation of resources will be requested. This report will be prepared by an independent external review provider and will be intended to confirm that the funds obtained have indeed been allocated to Eligible Green Projects, as established in the Framework. In line with the principles of transparency and accountability, the resulting verification reports will be published on the official website of the Romanian Ministry of Finance, thus ensuring public access to relevant information on the use of resources from green bonds (Government of Romania, 2023).

This Framework is structured through a regulatory instrument for the issuance of sovereign green bonds, carries out operational actions that are based on international green bond standards, administrative procedures, reporting mechanisms and external review.

2.3.2 Colombia Case

In the case of Colombia's implementation model, in the Sovereign Green Bond Framework of the Republic of Colombia, the country is committed to sustainable growth and development, including medium and long-term objectives such as the 2030 Agenda. These goals have motivated the country's leadership in the international agendas of biodiversity, climate change and disaster risks, among others, also recognizing physical, human and natural capital as pillars of sustainable growth. That is why Colombia orients its actions by establishing goals in adaptation and mitigation of climate change, seeking to consolidate processes that facilitate a balance between economic growth and development, the well-being of the population and the conservation of the environment, so that the country's natural wealth is appropriated as a strategic asset of the Nation. in turn enhancing the mobilization of resources, in a transition towards a resilient, sustainable and low-carbon economy (Ministry of Finance and Public Credit of Colombia, 2021).

The Government of Colombia is preparing the Reference Framework for the issuance of sovereign green bonds (Green Bond Framework) in 2021, to channel resources towards green investments and expenditures of the Nation, increase the country's competitiveness on a path of development resilient to climate change that allows it to achieve low-carbon growth and in line with the commitments acquired in international agreements. At the same time, these investments and expenditures contribute to the SDGs, as well as to various public policies and sectoral strategies of the country, several of which are included in the PND 2018-2022 and its Pact for Sustainability: Produce by conserving and conserve by producing (Ministry of Finance and Public Credit of Colombia, 2021).

The National Government uses three main sources of indebtedness: the issuance of public debt securities in the domestic capital market through long-term and short-term TES Treasury Securities, the issuance of public debt securities in the international capital market through the placement of global bonds and loans with multilateral and bilateral development banks. The financing strategy is based on a wide diversification of sources, borrowers, strategic alliances and local and foreign investors (Ministry of Finance and Public Credit of Colombia, 2021).

In line with the above, the Colombian Government is advancing in the issuance of green bonds as a public policy tool, which allows channeling resources towards green initiatives that generate sustainable economic growth, promotes the participation of other

Colombian issuers in the green bond market and expands the investor base in the capital markets. attracting more and more socially and environmentally responsible investors to the country (Ministry of Finance and Public Credit of Colombia, 2021).

In this way, Colombian sovereign green bonds will expose in the markets Colombia's commitment to the use of sustainable finance mechanisms aimed at the conservation of ecosystems and biodiversity; contribute to the development of a green bond market that seeks a greater diversification of the investor base and with potentially more competitive financing costs for public and private issuers; the alignment of financial incentives; social and environmental factors for the different actors, such as the government, the private sector, investors, multilateral banks and international cooperation agencies (Ministry of Finance and Public Credit of Colombia, 2021).

Article 4 of Law 2073 of 2020 delegated to the Ministry of Finance and Public Credit (MHCP) the definition of the Reference Frameworks for Public Debt Bonds for the Financing of Sustainable Development. The MHCP will be in charge of preparing and adopting, by means of an administrative act, the reference frameworks for the issuance of thematic public debt bonds on behalf of the Nation, such as green bonds, social bonds, sustainable bonds, blue bonds and all those bonds of a similar nature, related to expenditures to promote sustainable development that are contemplated in the General Budget of the Nation (PGN)(Ministry of Finance and Public Credit of Colombia, 2021, art. 4).

The Framework is the document that accompanies the issuance of the sovereign green bonds of the Republic of Colombia, establishes the procedure before and after the issuance and has the following purpose: to define the activities to be carried out by the MHCP, the National Planning Department (DNP) and the Ministries or entities, in the procedure before and after the issuance of green bonds of the Republic of Colombia. in accordance with its functions it is; facilitate the identification of Eligible Green Expenditures; to establish the criteria for the availability of the information necessary for the preparation of the Placement and Association Reports, as well as the Results and Impact Report; This Framework applies to current and future sovereign green bonds issued in both the local and international capital markets, which in turn must comply with the Public Credit standards already established in Colombia for the issuance of public debt bonds. The MHCP, through the General Directorate of Public Credit and the National Treasury (DGCPTN), will be the entity in charge of leading the formulation and updating of the Framework as necessary, with the collaboration of the

DNP, the MADS and the IDEAM (Ministry of Finance and Public Credit of Colombia, 2021).

The payments of principal and interest on the issuances made under this Framework will be charged to the debt service of the General Budget of the Nation (PGN), under the execution of the DGCPTN. Investors in bonds issued under this Framework do not assume any risk related to the specific projects indicated in the green portfolio accompanying each issuance. Colombia's Green Bond Framework is aligned with the International Capital Markets Association (ICMA) 2021 Green Bond Principles (GBP), which is why it is presented under the following components: Use of resources, Evaluation and selection process of Eligible Green Expenditures, Resource management and Reporting In addition, the Framework has been reviewed by an independent external reviewer Vigeo Eiris, a leading global research and rating agency that assesses the environmental, social and governance sustainability performance of companies, provides data, analysis and assessments that help investors manage risk and encourage responsible investment, in line with the recommendations of the Green Bond Principles (Ministry of Finance and Public Credit of Colombia, 2021).

They contain a section on eligible green expenditures, criteria for the classification of eligible green expenditures, possible types of eligible green expenditures, exclusion criteria, green expenditure evaluation and selection process, resource management, partnership placement reports, results and impact reports and the external review that has second-party opinions provided by Vigeo Eiris, part of Moody's ESG Solutions, verification requested by MHCP and external certification. The Government of Colombia reserves the right to request the certification of its green bonds, considering this request on a case-by-case basis before issuance (Ministry of Finance and Public Credit of Colombia, 2021).

2.3.3 Ecuador Case

In the case of the Republic of Ecuador, the implementation model of green bonds is developed from a structure between international standards of green bonds, internal institutional arrangements and the administrative and financial procedures adopted by the State to channel resources to environmental projects.

Within this implementation model, the Green Bond Framework of the Government of Ecuador constitutes the central instrument for the operationalization of these standards and procedures, which is based on the NDP "Plan for the Creation of Opportunities" 2021-2025,

the Nationally Determined Contributions (NDCs) to the UNFCCC Paris Agreement and the country's institutional plans. This Green Bond Framework was prepared by the Ministry of Economy and Finance in April 2023, in collaboration with the Undersecretariat of Climate Change of the Ministry of the Environment, Water and Ecological Transition and the National Planning Secretariat. The following ministries and secretariats were consulted during the drafting process of the Framework: Ministry of Energy and Mines, Ministry of Public Health, Ministry of Transport and Public Works, National Planning Secretariat, and the Ministry of Agriculture and Livestock (Ministry of Economy and Finance of Ecuador et al., 2023).

The Green Bond Framework establishes the obligations that the Government of Ecuador must comply with for any issuance of Sovereign Green Bonds. The Ministry of Economy and Finance (MEF), as issuer of the bonds, will coordinate with the National Planning Secretariat (SNP); currently absorbed by the Presidency of the Republic after institutional restructuring, and the Ministry of Environment, Water and Ecological Transition (MAATE); currently integrated with the Ministry of Energy and Mines, as responsible for national environmental and climate policy, and the corresponding public entities, to ensure the implementation of the Framework in an adequate manner. Through this Framework, the MEF will be able to issue Green Bonds exclusively to finance eligible green projects or refinance public debt under better conditions with the aim of allocating resources for the financing of eligible green projects (Ministry of Economy and Finance of Ecuador et al., 2023).

The Bonds must comply with the provisions of the current legal regulations of Ecuador for public debt, as well as for the issuance and placement of securities. The Framework may be updated by the MEF, in coordination with the corresponding public entities. This Framework has been developed following the highest standards in the market. The eligible categories set out in this Framework are aligned with the International Capital Markets Association's (ICMA) 2021 Green Bond Principles and the Sustainable Development Goals (SDGs) and NDC. The four central components of these principles are detailed: Use of resources, Project evaluation and selection process, with an exclusion list section, Resource management, environmental and social risks, Monitoring and reporting of resource allocation, and impact reporting (Ministry of Economy and Finance of Ecuador et al., 2023).

Finally, it has an independent external audit where the Government of Ecuador, through MEF, commits to hire an independent external auditor to ensure that the Allocation

and Impact Reports are aligned with the Framework, a process that will be carried out at least in the first annual report of each bond, in which the Government of Ecuador, through the MEF, you will seek to obtain a second opinion of this Framework from a third-party provider. In the event that any of the sections of the Green Bond Framework are amended in the future, the Government undertakes to obtain a new second-party opinion to ensure the transparency of its issuances (Ministry of Economy and Finance of Ecuador et al., 2023).

Overall, the implementation model adopted by Ecuador integrates international standards, national planning, inter-institutional coordination and external verification mechanisms, allowing the State to channel financing to green projects under transparency criteria.

In conclusion, Romania, Colombia and Ecuador take international standards such as the ICMA Green Bond Principles as a reference; however, these principles are adapted according to the institutional organization of each country. In Romania, the implementation of the bonds focuses on a governance scheme with the participation of government institutions and the formal committee that are responsible for the evaluation, selection and monitoring of projects; its implementation model is linked to the environmental regulations of the European Union and the European standards of Green Bonds. In Colombia, the implementation model focuses on the management of the country's public debt and budget, so that it incorporates bonds as an instrument of financial policy under the responsibility of the Ministry of Finance and sectoral entities, where it seeks to diversify the sources of financing. Ecuador is based on a model oriented to environmental policy and the National Development Plan, working together with the institutions in charge of environmental and economic policy. The 3 cases have a common basis, which is international standards and their own Sovereign Green Bond Framework; however, when implementing the green bond models, each has its own means to do so.

2.4 Green Bond and Biodiversity Application Cases

2.4.1 Romania Case

Laws have been adopted to achieve emission reduction targets, such as the law on the decarbonization of the energy sector, approved on 30 June 2022, or the hydrogen law, which came into force on 23 July 2023, which seeks to increase the country's energy production capacity and strengthen energy security. Thus, meeting the targets set by Romania's National Emissions Reduction Plan (NRP) to regulate the hydrogen market in Romania. The

Romanian government intends to use green bonds to finance crucial expenditures to facilitate the transition to a low-carbon economy and promote the SDGs (Government of Romania & Ministry of Finance, 2023).

The economic transition comes at a cost and requires significant upfront and ongoing investments, both public and private. To access capital market financing, the Ministry of Finance incorporated green, social, and sustainability bonds into its public financing strategy, by modifying existing government decisions. This decision enabled the issuance of sovereign green bonds under the Romanian Green Bond Framework, activating in practice the previously defined mechanisms for project evaluation and selection, resource management, and reporting and verification systems. The resources obtained through these issuances are allocated exclusively to eligible green projects, supervised by the inter-ministerial committee and with their respective allocation and impact reports in accordance with the ICMA Green Bond Principles (Farah Hussain & Abhishek Joseph, 2025).

Romania's October 2025 funding allocation results describe that the resources obtained went towards clean transport, renewable energy and energy efficiency, sustainable water and wastewater management, and environmental protection and climate adaptation, in line with the country's Sovereign Green Bond Framework aligned with the ICMA Green Bond Principles. According to the reports to investors, 100% of the funds obtained were allocated to eligible categories, incorporating impact indicators related to the reduction of greenhouse gas emissions, the increase in renewable energy capacity and the improvement of basic environmental services. The use of periodic allocation and impact reports and an independent external review is also mentioned (Romanian Ministry of Finance, 2025).

2.4.2 Colombia Case

In the case of Colombia, being the second most biodiverse country in the world, Colombia has committed to preserving 30% of its territory as a protected area, reducing greenhouse gas emissions by 51% by 2030 and moving towards a carbon-neutral economy by 2050 (Farah Hussain, 2022).

It has recently enacted and is implementing four laws to achieve these goals: the Environmental Crimes Law, enacted on July 29, 2021, the Energy Transition Law, enacted on July 10, 2021, and the Climate Action and Decarbonization Law, enacted on December 22, 2021. In line with these national policies and strategies, the government is pushing an agenda based on the aforementioned laws, to protect natural resources, mitigate the social

and economic impacts of climate change, and facilitate the country's achievement of its Sustainable Development Goals by establishing measures that support resource mobilization through green finance, including the development of green bond markets through public-private partnerships (Farah Hussain, 2022).

In 2021, Colombia issued its first sovereign green bonds, becoming the first emerging economy to place these securities through local auctions in local currency. These financial innovations drive the development of the local green bond market; they improve transparency, liquidity, efficient pricing; and diversify the country's local bond investor base (Farah Hussain, 2022).

The results report of Colombia's 2021 sovereign green bond issuance made it possible to finance projects aimed at mitigating and adapting to climate change, including renewable energy, sustainable transport, efficient water management, biodiversity conservation and restoration of strategic ecosystems. In accordance with the Sovereign Green Bond Framework and official reports, the resources obtained were allocated according to previously defined eligible categories, with monitoring mechanisms, allocation reporting and environmental impact indicators. The process was characterized by a clear institutional structure led by the Ministry of Finance and Public Credit, as well as by the incorporation of external reviews that guarantee alignment with international standards, strengthening the transparency and credibility of the instruments as an environmental financing tool at the sovereign level (Ministry of Finance and Public Credit of Colombia, 2021a).

2.4.3 Ecuador Case

In Ecuador there is a current case of the use of biodiversity bonds. The project consists of the issuance of a biodiversity bond by the Bolivarian Bank. One of the main investors is IDB Invest, which financed an amount of 50 million dollars (Banco Interamericano de Desarrollo, 2025).

Another participant is the Dutch Business Development Bank (FMO) which will co-invest up to 20 million dollars in the biodiversity bond issued by the Bolivarian Bank. Other co-investors will participate with subscriptions of up to $100 million. The bond funds will be used to promote environmental sustainability and the conservation and protection of ecosystems, thus contributing to SDG 13 (FMO, 2025)

The analysis describing the criteria of the Banco Bolivariano's biodiversity bonds, prepared by IDB Invest, states that it must be ensured that all subprojects financed through

the issuance of the biodiversity bond comply with the bond framework, the IDB Invest Exclusion List, and local environmental and social regulations. In addition, the Bank will develop and implement procedures to strengthen the application of Performance Standard 6 (Biodiversity Conservation and Sustainable Management of Living Natural Resources), imposed by the International Finance Corporation (IFC) (Banco Interamericano de Desarrollo, 2025).

In the case of Ecuador, to date no allocation or environmental impact reports derived from green sovereign emissions or the Bolivarian bank have been published, which limits the empirical analysis of results and shows that the instrument is in an initial phase of implementation.

2.5 The Canton of Cuenca: Its Biodiversity

2.5.1 Geographical and Demographic Characterization of the Canton of Cuenca

The province of Azuay is located in the south of the Republic of Ecuador and is made up of 15 cantons, including the canton of Cuenca, located in the northwest of the province. Part of the jurisdictional limits of the canton of Cuenca are part of the provincial boundaries delimited to the north by the province of Cañar, to the west by the province of Guayas, to the south by the cantons of Santa Isabel, San Fernando and Girón of the province of Azuay and to the east by the cantons of Sigsig, Gualaceo and Paute of the province of Azuay (Municipal Decentralized Autonomous Government of the Canton of Cuenca, 2024b). Its territory extends between the Western Cordillera and the inter-Andean valley of the Andes, presenting high mountain landscapes such as paramo and valleys (Municipal Decentralized Autonomous Government of the Canton of Cuenca, 2015).

It extends over 366,480 hectares, surrounded by a mountainous environment that defines its geography and climate, with altitudes that vary between 2,350 and 4,450 meters above sea level. Its strategic position in the Ecuadorian Austro makes it a key node of connectivity and regional development, housing more than half a million inhabitants (Municipal Decentralized Autonomous Government of the Canton of Cuenca, 2024b).

Climate

The predominant types of climates are the semi-humid mesothermal equatorial that occupies 52% of the surface of the Canton territory and the high mountain equatorial that covers 34.4%. The semi-humid equatorial mesothermal climate is characterized by irregular

temperatures, being higher in the months of March and September; The months of June and July coincide with the lowest averages. The equatorial high mountain climate is always located above 3,000 m in altitude. The average temperature depends on the altitude, but fluctuates around 8 °C (Municipal Decentralized Autonomous Government of the Canton of Cuenca, 2015).

Based on the calculation of the spatial distribution of temperature of the canton of Cuenca. The result of the interpolation indicates that in the canton of Cuenca the temperature ranges between 5 and 26 °C (Municipal Decentralized Autonomous Government of the Canton of Cuenca, 2024b).

Ecosystems

The ecosystems of the area are classified by: evergreen shrub, paramo grassland, montane evergreen forest of the Western Cordillera of the Andes and grassland (Municipal Decentralized Autonomous Government of the Canton of Cuenca, 2024b).

Flora

The canton of Cuenca has different plant formations; these characteristics are strongly linked by biotic and abiotic factors as a result of historical processes, specialization of living beings, relationships between species, altitudinal levels, slopes, climatic conditions, barriers and geographical formations. These factors allow us to understand the dynamics of ecosystems and microhabitats in the territory (Municipal Decentralized Autonomous Government of the Canton of Cuenca, 2024b). All the conditions and interactions that occur in the canton make up a wide diversity of flora. The most representative flora species of the canton belong to the Asteraceae family (Municipal Decentralized Autonomous Government of the Canton of Cuenca, 2024b).

A large part of the surface of the cantonal territory is made up of moorland, located in a cold area above 2,900 meters above sea level; in the direction of the western mountain range. To allow us to approach its structure, a large part of its extension is dominated by grasslands of the genus Calamagrostis sp., Gynoxys sp.; moor of pads and some patches of polylepis (paper tree) adjacent to mountain barriers (Municipal Decentralized Autonomous Government of the Canton of Cuenca, 2024b).

The special characteristics of this area show how the biodiversity of flora varies. In these páramos they maintain high degrees of endemism, which is recorded for approximately 81 species of endemic flora. It is estimated that the diversity of flora in the canton can vary

from 2,000 to 2,500 species, among which 81 are classified as endemic, 1,850 native and 100 introduced approximately (Municipal Decentralized Autonomous Government of the Canton of Cuenca, 2024b).

Fauna

The fauna of the canton of Cuenca is highly diverse because its territory has a wide altitudinal range that goes from 20 meters above sea level in the coastal areas of the parishes of Chaucha and Molleturo to the highest area with 4560 meters above sea level located in the Cajas National Park. This geographical variation means that the canton has a great diversity of ecosystems, this being one of the reasons why the canton of Cuenca and the Cajas National Park are the nucleus of the Macizo del Cajas Biosphere Reserve (Municipal Decentralized Autonomous Government of the Canton of Cuenca, 2024b).

The greatest diversity is represented by the group of birds. Corresponding to the general analysis of biodiversity, there is greater species richness in ecosystems that contain different altitudinal levels, such as the area of Molleturo and Chaucha. Groups of micromammals, reptiles, amphibians, fish, invertebrates and macroinvertebrates; they are usually present in specific habitats; Each of these groups of the canton's wildlife play important roles in the food chain such as pollinating bats, birds (barn owl) regulating pests of the genus Ratus, macroinvertebrates, fish (preñadilla) as indicators of water quality and among others (Municipal Decentralized Autonomous Government of the Canton of Cuenca, 2024b).

Protected Areas

The natural environment of the canton represents more than 73% of its surface and is oriented towards the conservation of natural resources. This territory includes the National System of Protected Areas (SNAP), Water Recharge Areas, Conservation and Sustainable Use Areas (ACUS), Protected Forests, Areas of Environmental and Landscape Interest, watercourses (rivers, streams and lakes), and archaeological and heritage sites of high historical value. In 2013, Cuenca was designated as a "Macizo del Cajas Biosphere Reserve", an area that includes the Cajas National Park as a conservation nucleus, with more than 786 lagoons and a unique biodiversity (Municipal Decentralized Autonomous Government of the Canton of Cuenca, 2024b).

Water Recharge Areas are areas of water interest or water catchment, their purpose is the conservation of natural areas and their environmental recovery for future water supply (Municipal Decentralized Autonomous Government of the Canton of Cuenca, 2024).

In the case of Protective Forests, they are the natural or cultivated plant formations and wildlife present; which can be in the public or private domain, must be conserved for their diversity of ecosystems and the areas with the greatest ecological value with the possibility of being recognized in the SNAP as Areas of the Subsystem of protected areas of the Decentralized Autonomous Governments, Community and Private with the respective Management Plan (Municipal Decentralized Autonomous Government of the Canton of Cuenca, 2024b). At the same time, they are also part of the Water Recharge areas, their main vocation is for the purposes of strict conservation of the ecosystem, recovery, restoration, care of wildlife, scientific-cultural activities and projects or activities related to the integrated management of watersheds. (Municipal Decentralized Autonomous Government of the Canton of Cuenca, 2024).

It is important to take into account that the protection of biodiversity is linked to various factors that contribute to it, such as rivers. Rivers and their banks are home to much of the world's biodiversity, as well as some of the areas with the highest biological productivity (Municipal Decentralized Autonomous Government of the Canton of Cuenca, 2024).

2.5.2 Threats to the Biodiversity of the Canton of Cuenca

Climate Change

Climate change manifests itself through phenomena such as rising global temperatures, extreme weather events, melting glaciers, and ocean acidification. These changes have devastating consequences for ecosystems, biodiversity, and human communities. At the heart of this phenomenon are greenhouse gases (GHGs), whose anthropogenic emissions are altering our planet's climate balance. Greenhouse gases, such as carbon dioxide (CO2), methane (CH4), and nitrogen oxides (NOx), are essential for maintaining the Earth's temperature. However, human activities, such as the burning of fossil fuels, deforestation and intensive agriculture, have dramatically increased the concentrations of these gases in the atmosphere (Municipal Decentralized Autonomous Government of the Canton of Cuenca, 2024b).

CO2 emissions from burning coal, oil and gas account for the highest concentration of gases in the atmosphere, followed by methane released in agricultural and waste decomposition processes. According to the emissions inventory of the Cuenca canton, base year 2021, total CO2 emissions amount to 1142 kilotons per year. Of this value, 66.3% corresponds to vehicular traffic, 20.1% to industries and 13.0% to the use of domestic Liquefied Petroleum Gas (LPG). The per capita generation of CO2 in the Canton of Cuenca in 2021, for a population of 596,101 inhabitants, amounts to 1.91 tons per inhabitant per year. Methane (CH4) emissions amount to 4997 tons per year, of which 95.8% is generated in landfills. N2O emissions amount to 100 tonnes per year, of which 83.3% is generated by vehicular traffic (Municipal Decentralized Autonomous Government of the Canton of Cuenca, 2024a).

Risks and Anthropogenic Activities

Anthropic risks are actions carried out by human beings without vision and technical criteria on a territory. These risks can directly or indirectly affect ecosystems and the population in general; especially when in the proceedings particular interests prevail over the general one. Among these risks, some of the following interventions are cited, which can generate negative effects: Incompatible activities in unsuitable areas, exposure of settlements, infrastructures or provision of services in areas that present some risk when prevention criteria are not used, mining activity in incompatible areas or that compromises the environmental services required by the population, actions or interventions without analysis, studies and authorizations, activities that generate pollution without management and control, unplanned road and road openings, interests in fragmenting and changing land uses and modification of the natural conditions of an ecosystem, such as deforestation (Municipal Decentralized Autonomous Government of the Canton of Cuenca, 2024b).

According to the Ministry of the Environment, Water and Ecological Transition, currently called the Ministry of Environment and Energy, it can be detected that the parishes of Molleturo and Chaucha are the ones with the greatest risk of contamination are exposed by metal mining activity at the points indicated (Municipal Decentralized Autonomous Government of the Canton of Cuenca, 2024b). With regard to the parishes of Turi, Quingeo, Chiquintad, Octavio Cordero and Nulti they are more related to non-metallic mining and arid and stone material. And the Llacao parish is related by a hydrocarbon point (Municipal Decentralized Autonomous Government of the Canton of Cuenca, 2024b).

It is important to mention that pollution can be at different levels in the Canton due to other anthropic activities such as: the informal opening of roads, the use of agrochemicals in incompatible areas, emissions from the automotive and industrial fleet, arson, discharges and fillings next to water sources (rivers and streams) due to more detailed anthropic activity or some other infraction. From this analysis, it is visualized that 24.91% of the cantonal territory would be defined by incompatibilities, conflicts of uses due to aspects of processes of consolidation of human settlements and advance of the agricultural frontier in areas where the vocation of the soil is for conservation (Municipal Decentralized Autonomous Government of the Canton of Cuenca, 2024b).

2.5.3 Protection, Conservation and Preservation of the Biodiversity of Cuenca

The threats identified, including climate change, urban expansion, mining and other anthropic activities, show that the biodiversity of the canton of Cuenca faces risks that require concrete institutional action.

The Convention on Biological Diversity (1992) established the system of protected areas, spaces where species, ecosystems and genetic wealth are preserved, conserved, protected and controlled. Article 8 of the Convention states that: *"Each Contracting Party shall, to the extent possible and as appropriate, establish a system of protected areas and regulate or manage biological resources important for the conservation of biological diversity, whether within or outside protected areas, to ensure their conservation and sustainable use"* (United Nations, 1992, art. 8).

In Ecuador, the system of protected areas is articulated through the National System of Protected Areas (SNAP), an administrative system commissioned by the central government. Article 405 of the Constitution states*: "The national system of protected areas shall guarantee the conservation of biodiversity and the maintenance of ecological functions. The system will be made up of the state, decentralized autonomous, community and private subsystems, and its stewardship and regulation will be exercised by the State."* (Constitution of the Republic of Ecuador, 2008b, art. 405). The central government, through the Ministry of Environment and Energy, exercises the stewardship, planning, regulation, management, control and sanction of protected areas in Ecuador. The Cajas National Park and the Quimsacocha Recreation Area are protected areas that are part of the SNAP and are within the state subsystem.

Decentralized subsystem of protected areas

The SNAP is structured into 4 subsystems: state, decentralized autonomous, community and private.

The Decentralized Autonomous Governments are responsible for the decentralized autonomous subsystem. GADs may designate local conservation areas called Conservation and Sustainable Use Areas (ACUS). Ministerial Agreement 83 (2016), Procedures for the Declaration and Management of Protected Areas, in Article 7 mentions that an ACUS is: *"An area created by decentralized autonomous governments, communities or private owners, of local importance, whose purpose is the conservation of biodiversity and the development of sustainable activities to guarantee the maintenance of ecosystem services that benefit human life. Areas of Conservation and Sustainable Use of Biodiversity are those properties owned by decentralized autonomous governments, communities or natural or legal persons, which contribute to the conservation of biodiversity. An ACUS may remain under this category or may choose to become a protected area declared within SNAP by the National Environmental Authority, subject to compliance with the corresponding requirements."* (Ministry of Environment and Energy, 2016, art. 7).

El Cajas National Park

The Cajas National Park, located northeast of the city of Cuenca, is a national and international natural heritage; since it was declared a national park on November 5, 1996 and as a RAMSAR Wetland in 2002, a habitat where 230 lagoons, montane humid forests, sub-Andean forests and Andean humid forests coexist. Around 152 species of birds have been identified, of which 10 are endemic, 38 species of mammals, which represents 78% of the Andean fauna, and 18 species of amphibians and reptiles (Municipal Decentralized Autonomous Government of the Canton of Cuenca, 2024a).

This declaration recognizes the importance of these ecosystems as fundamental in the global conservation and sustainable use of biodiversity, with important functions such as the regulation of the continental phase of the hydrological cycle, aquifer recharge, stabilization of the local climate, intrinsic values such as biological resources, fisheries and water supply; attributes such as refuge of biological diversity and cultural heritage (Municipal Decentralized Autonomous Government of the Canton of Cuenca, 2024b). This massif is the most important water resource for the populations of southern Ecuador, supplying the city of Cuenca and nearby towns such as Baños, Sayausí, Checa, Chiquintad, Migüir, Molleturo,

Soldados, Chaucha, Tarqui, Cumbe and Victoria del Portete, as well as other cantons of the province of Azuay, such as Girón and San Fernando (ETAPA EP, 2024).

In the case of El Cajas National Park, its stewardship, planning, regulation, management, control and sanction measures are the responsibility of the current Ministry of Environment and Energy, however, in 2010 an Agreement was signed where only the management of the Cajas National Park was delegated to the GAD of Cuenca, despite the fact that the State continues to be responsible for the area. delegates its management to the GAD for better territorial control.

Delegation Agreement for the management of the Cajas National Park

In the Delegation Agreement for the management of the Cajas National Park signed on March 17, 2010, the National Environmental Authority, currently the Ministry of Environment and Energy, delegated to the Municipality of Cuenca the management of the Cajas National Park with the aim of optimizing its protection and management (Ministry of the Environment & Decentralized Autonomous Municipal Government of the Canton of Cuenca, 2010).

The National Environmental Authority, current Ministry of Environment and Energy, and the GAD of Cuenca participate in this Agreement, with ETAPA as the authority that manages the Cajas. The richness of the Cajas National Park has allowed the Decentralized Autonomous Government (GAD) of the canton of Cuenca, through its Public Company ETAPA EP, an entity in charge of administering and managing the area, together with the Ministry of Environment and Energy to carry out adequate management, resulting in participatory work (Ministry of the Environment, 2018).

ETAPA, being responsible for providing the drinking water service in Cuenca, is included in the Agreement, taking into account that the water consumed comes from the Cajas National Park, in this sense, the Ordinance of Constitution, Organization and Operation of the Municipal Public Company of Telecommunications, Drinking Water, Sewerage and Sanitation of Cuenca - ETAPA EP (2010) mentions in article 3: *"STAGE EP is responsible for the environmental management related to the provision of services developed by the Company. It is also responsible for the administration and management of those natural or artificial areas and systems that, due to their importance for the preservation of water resources or of any other nature, are entrusted to it by the Municipality*

or other State institutions (Municipal Decentralized Autonomous Government of Cuenca, 2010, art. 3)*"*

Committee for the Conservation and Restoration of the Cajas Massif

In November 2024, the canton of Cuenca faced an environmental emergency caused by simultaneous fires in forests and moorlands in areas of water recharge and high biodiversity. A total of approximately 6,500 hectares of fragile ecosystems were consumed by fire (ETAPA EP, 2024a).

The affected areas include water recharge areas in the Tomebamba and Yanuncay river basins, as well as biodiverse ecosystems such as the forest of the Americas and Arquillo. Of the burned area, 2,139 hectares are within the Cajas National Park, although only 1,211 hectares have potential for restoration. This emergency highlighted the need to implement technical strategies to conserve and restore sensitive ecosystems that provide essential environmental services for Cuenca and its population. (ETAPA EP, 2024a). In response to the critical situation of the Cajas National Park, the Committee for the Conservation and Restoration of the Cajas Massif was created.

The objectives of the Committee are to be in charge of developing, coordinating and managing the different strategies and plans for the Conservation and Restoration of ecosystems affected by negative impacts that include forest fires, land use change, ecosystem alteration, among others, within the Cajas Massif. The members of the Committee are public, private, academic and civil participation institutions, which are the Municipal Decentralized Autonomous Government of the Canton of Cuenca, ETAPA EP, local universities; being the University of Azuay representing the 4 universities of the City of Cuenca (UCACUE, UCUENCA, UDA, UPS), Fund for the Protection of Water (FONAPA) and Nature and Culture International (NCI) representing NGOs (ETAPA EP, 2026).

In the resolution of the creation of the Committee for the Conservation and Restoration of the Cajas Massif within the canton of Cuenca, it is mentioned that the Committee will work on strengthening the governance and management of the Cajas Massif, implementing an innovative, sustainable and participatory inter-institutional management model that guarantees effectiveness in the management, governance and financing of conservation and restoration in accordance with the established competencies (Municipal Council of the Canton of Cuenca, 2025).

2.6 Strategies and Requirements for the Protection of Biodiversity in Cuenca

2.6.1 Strategies for the conservation of biodiversity in Cuenca: Financing

The canton of Cuenca, due to its strategic location, framed in the western mountain range, has a unique natural heritage, since a variety of ecosystems are manifested ranging from the extreme cold, through the subtropical to reach ecosystems of tropical climate and with them the coexistence of animal and plant species that have been adapting to each of these expressions of nature; generating a wealth in terms of biodiversity.

The Canton is home to natural ecosystems that stand out for their biological diversity, including rich flora and fauna. These ecosystems act as refuges for species and contribute to the preservation of biodiversity. Natural ecosystems and the presence of wild flora and fauna, including endemic species, are of vital importance for human well-being and the Canton as a whole. These ecosystems provide a series of tangible and intangible benefits that impact various aspects, among others, they are: maintaining ecological balance, climate regulation, natural ecosystems with high biodiversity are more resilient to climate change and can help mitigate its effects. Within the canton of Cuenca, in the area of the Cajas National Park, there are endemic species in both flora and fauna (Municipal Decentralized Autonomous Government of the Canton of Cuenca, 2024a).

In 2013, Cuenca was designated as a "Macizo del Cajas Biosphere Reserve", an area that includes the Cajas National Park as a conservation nucleus, with more than 786 lagoons and a unique biodiversity (Municipal Decentralized Autonomous Government of the Canton of Cuenca, 2024b)

The protection of biodiversity in the Canton of Cuenca is recognized through legal and administrative instruments that allow operating in terms of environmental management in the territory, for example, the Constitution of Ecuador and the Organic Code of the Environment are the normative instruments, the Ministry of Environment and Energy, and the GAD of Cuenca, through ETAPA EP, it is the administrative authorities, which create a scenario for the development of strategies for the conservation of biodiversity.

The conservation actions of the Cajas National Park, as well as its financing, since it was delegated to the municipal GAD of the canton of Cuenca, have been mostly the responsibility of ETAPA EP. ETAPA EP is where the funding for the protection of biodiversity in the Canton comes from and specifically for the protection of the Cajas

National Park. ETAPA, being a municipal public company and being in charge of providing basic services such as drinking water, sewage, sanitation, internet and fixed telephony, its income results from the provision of these services (ETAPA, 2016). ETAPA EP manages all the stages and processes of the integral water cycle, from its origin, the protection of sources in water recharge areas to their return to the riverbed (ETAPA EP, 2024b). This cycle includes the protection of water recharge areas such as the Cajas National Park (ETAPA, 2026), therefore, ETAPA has the responsibility of financing the protection of areas that are sources of water recharge.

Committee for the Conservation and Restoration of the Cajas Massif: Financing.

With regard to the financial management of the Committee, mention is made of the importance of coordinating the management, strategies and investment plans of the funds obtained and allocating them to the achievement of the objectives of the initiative (ETAPA EP, 2024a).

Most of the funding comes from the members that make up the Committee, being public institutions such as the GAD of Cuenca and ETAPA, private, academic institutions such as the University of Azuay representing the 4 universities of the City of Cuenca (UCACUE, UCUENCA, UDA, UPS), civil participation, the Fund for the Protection of Water (FONAPA) and Nature and Culture International (NCI) representing the NGOs (ETAPA EP, 2026).

The implementation of the Work Plan requires an estimated investment of USD 2.5 million, of which 75% will come from contributions from Committee members and 25% from external sources and donations. To guarantee its effectiveness, the need for solid inter-institutional coordination, the formation of strategic alliances with local and national entities, the participation of the community in conservation and prevention work, as well as the capture of sustainable financing that ensures its continuity over time, is emphasized (Gobierno Autónomo Descentralizado Municipal del Cantón Cuenca, 2026).

In addition to this, other forms of financing for the protection of biodiversity are implemented in the Canton of Cuenca. FONAPA is one of the five Water Funds operating in Ecuador (FONAPA, 2021). Water Funds are financial and governance mechanisms that contribute to water security through nature-based solutions and sustainable watershed management. The Fund for the Conservation of the Paute River Basin (FONAPA) was created in 2008 in order to contribute to the conservation, protection, preservation and

recovery of the water resources and ecological environment present in the Paute River basin (FONAPA, 2021).

FONAPA has a structure made up of a Board and Board of Directors, a Technical Secretariat and a Resources Administrator. The administration of resources is carried out by the National Financial Corporation (CFN), which is responsible for making the investments and transactions required for the operation of the Fund (FONAPA, 2021). FONAPA is a wealth fund, which refers to the fact that it is a set of assets invested in the long term, whose initial capital remains intact while its returns are used to finance projects (FONAPA, 2021).

Over time, more constituents joined and as the sources of financing increased, the model was no longer only patrimonial, it began to manage other types of funds such as an extinguishing fund, where the financing has a specific purpose such as a project and revolving funds, which come from ordinances of the municipal GAD, these funds allow the capital to be used continuously, The available funds are renewed upon payment, the amount is released and available for use again, resulting in a continuous flow of money. These resources are allocated according to municipal planning based on the Annual Investment Plans of the municipalities (FONAPA, 2021). FANAPA's financial model is based on the destination of the contributions it currently receives. All the contributions that FONAPA receives must be used to increase the equity capital of the fund (not to current expenses) and to generate financial returns (FONAPA, 2021).

The Socio Bosque program is a program created by the Ministry of the Environment, currently the Ministry of Environment and Energy; it is a form of financing that acts in the protection of biodiversity that was developed with the purpose of conserving and protecting forests, moors and other native plant formations; their ecological, economic and cultural values; and reducing deforestation rates and their associated greenhouse gas emissions (Ministry of the Environment, 2016). The Ministry of Environment and Energy manages the corresponding financing mechanisms for the implementation of Socio Bosque, which are invested exclusively in activities and projects that meet the objectives indicated in the program agreement (Ministry of the Environment, 2008).

In 2017, ETAPA EP, partners of the Socio Bosque program, parish GADs, owners of properties adjacent to the area and communities met for the creation of the Management Committee for the protection of the connectivity area between the Cajas National Park and Quimsacocha (Ministry of the Environment of Ecuador & ETAPA EP, 2017). To finance

the protection of the Cajas National Park, the use of alternative funds that the Ministry of Environment and Energy offers through its programs such as Socio Bosque has also been granted (Ministry of the Environment of Ecuador & ETAPA EP, 2018).

2.6.2 Financing biodiversity protection: other instruments

When analyzing bonds as a mechanism to direct economic resources towards the protection of biodiversity, it is necessary to take into account other options, since these instruments are not the only way to channel money and should not be the only source of financing for the protection of biodiversity. Other practices for managing funds towards biodiversity protection are discussed below.

Financing mechanisms for biodiversity play an important role at all spatial scales at which biodiversity provides public benefits. At the local-national level, for example, municipalities do not usually support the existence of protected areas on their territory, with exceptions where an intrinsic motivation or considerable potential for nature tourism comes into play (The Organization for Economic Cooperation and Development, 2013).

In Brazil, therefore, to help distribute the costs of conservation among a broader set of beneficiaries than those of a particular municipality, fiscal policy was reformed to include environmental indicators as a means of distributing revenues from the Imposto sobre Circulação de Mercadorias e Serviços (ICMS), a tax on goods and services, to the municipalities (The Organization for Economic Cooperation and Development, 2013).

Similar problems arise in the relationship between national and international levels of governance, since, while some of the public benefits provided by biodiversity are global in scope, the costs of conservation and sustainable use tend to be borne at the local or national level. Examples of instruments that enable international financial transfers are Payments for Environmental Services (PES), Reducing Emissions from Deforestation and Degradation (REDD) and Official Development Assistance (ODA) (The Organization for Economic Cooperation and Development, 2013). This indicates that while some biodiversity-specific policy instruments can mobilize resources directly, it is also important to consider other sources of financing (for example, for climate change and development) available to contribute to the achievement of biodiversity objectives, and to examine the extent to which biodiversity can also be expanded (The Organization for Economic Cooperation and Development, 2013).

Of the six "innovative financial mechanisms" classified by the CBD (payment for ecosystem services, biodiversity offsets, environmental tax reform, green commodity markets, biodiversity in international development finance, and biodiversity in climate finance), The first three are definitely in the category of economic instruments (The Organization for Economic Cooperation and Development, 2013). Markets for green products are underpinned by the use of information tools, such as ecolabels. These allow consumers to make better-informed decisions about the goods and services they purchase. Green markets can generate income indirectly through premiums for biodiversity-friendly attributes and investments in conservation measures and sustainable use of biodiversity by producers (The Organization for Economic Cooperation and Development, 2013).

In order to understand other forms of financing for the protection of biodiversity, in addition to biodiversity bonds, it is necessary to analyze other financial instruments taking as a reference the cases of other countries, so the cases of Chile and Mexico will be taken into account, in order to identify the financial instruments implemented for the conservation of their biodiversity.

Table 1

Instruments for financing the protection of biodiversity. Chile Case

Country	Instrument	Function
Chile	Environmental subsidies and subsidies	Economic transfers from the State aimed at supporting projects, activities or companies that incorporate environmental criteria that contribute to the conservation of biodiversity.

Source: (Díaz González, 2024) prepared by author

Table 2

Instruments for financing the protection of biodiversity. Mexico Case

Country	Instrument	Function
México	Environmental Funds	Mechanisms that channel resources for biodiversity conservation, forest management, protected areas, climate change mitigation, and species protection.
	Payment for Environmental Services (PES)	Payments made to landowners or communities for conserving ecosystems that provide environmental services such as water or carbon sequestration.
	Official Development Assistance (ODA)	Resources from international cooperation, donations or multilateral organizations that finance biodiversity conservation projects.
	Public Environmental Fund (FAP)	Fund that channels national and international resources towards conservation projects, sustainable use of biodiversity and adaptation to climate change.
	Sustainable Fund	Financial mechanism designed to direct resources towards sustainable development projects with environmental and biodiversity objectives.

Source: (Sosa & Ivanova, 2025) prepared by author

CHAPTER 3
METHODOLOGY

The methodology focuses on a qualitative and triangulation approach. Qualitative research seeks to understand phenomena, exploring them from the perspective of the participants in a natural environment and in relation to their context (Hernández Sampieri et al., 2014). The qualitative approach collects and analyzes data to reveal new questions in the interpretation process; The investigative action moves dynamically in both directions: between the facts and their interpretation. The qualitative approach mainly seeks the "dispersion or expansion" of data and information (Hernández Sampieri et al., 2014).

Qualitative Research according to Watson et al., (as cited in Barraza Macías A, 2023) consists of detailed descriptions of situations, events, people, interactions, and behaviors that are observable. It incorporates what participants say, their experiences, attitudes, beliefs, thoughts, and reflections, as expressed by themselves (Barraza Macías, 2023). The characteristics of qualitative research according to Cook et al. (as cited in Barraza Macías A, 2023) are the understanding of social action from the actors' frame of reference and that all perspectives are valuable according to Taylor et al. (as cited in Barraza Macías A, 2023) (Barraza Macías, 2023).

On the other hand, according to Medina Romero et al. (as cited in Esquivel Grados J et al., 2025) in the research process, triangulation is a strategy that implies, from qualitative research approaches, resorting to the comparison and combination of different data sources, but which also extends to different methods and researchers. and even multiple theories to confirm and validate the results of research around a given phenomenon (Esquivel Grados & Reyes Alvarado, 2025).

Rodríguez et al. (as cited in Esquivel Grados J et al., 2025) note that it is a "confrontation technique and comparison tool for different types of data analysis with the same objective that can contribute to validating a survey study and enhance the conclusions derived from it (Esquivel Grados & Reyes Alvarado, 2025).

In this framework, the methodology for this research is developed under a qualitative and triangulation approach that involves the use of 3 main sources.

The first source corresponds to the literature and regulations, at the international and national level. At the international level, instruments such as the Convention on Biological Diversity (1992) and the Kunming-Montreal Global Framework (2022) are analyzed,

establishing global guidelines for the protection of biodiversity and its financing. At the national level, the provisions of the Constitution of Ecuador (2008), the Organic Environmental Code (2017) and the Sovereign Green Bond Framework of the Government of Ecuador (2023) are analyzed. International standards for green bonds are studied, such as the ICMA Green Bond Principles, the Climate Bonds Standard and Certification Scheme and the European Green Bond Standard (ICMA, 2025b).

In the second source, the cases of the bond implementation models are analyzed taking Romania, Colombia and Ecuador as a reference in order to identify the institutional and operational structure for the issuance of green bonds, the implementation models contribute to the application of the bonds in three scenarios: International, Latin American and National. The cases of concrete application of green and biodiversity bonds are examined through the official reports and technical reports of Romania, Colombia and Ecuador, which are taken into account to analyze the effectiveness of the bonds and contrast the theory of these financial instruments with their practical implementation, the official reports are necessary to know the results and how effective the bonds have been as a tool to channel resources towards the protection of nature and biodiversity. Finally, the territorial context of the Canton of Cuenca is incorporated from the Development and Territorial Planning Plan (PDOT) period 2023 - 2027, which includes the characteristics of the biodiversity of Cuenca, the threats to biodiversity and the administrative mechanisms of environmental protection such as the operation of the decentralized autonomous subsystem of protected areas, the Delegation for the Management of the Cajas National Park and the Committee for the Conservation and Restoration of the Massif of the Cajas.

The third source is interviews. The qualitative research interview seeks to understand the world from the subjects' perspective, unravel the meaning of their experiences, and discover their lived world before scientific explanations. The qualitative research interview is a space for the construction of knowledge. An interview is literally an exchange of views between two people who are talking about a topic of common interest (Kvale, 1996).

The three sources analyzed complement each other resulting in a qualitative methodological approach based on triangulation where the first source establishes the legal, political framework and standards that support the use of green and biodiversity bonds, the second source examines the implementation and cases of the bonds in addition to contributing with the territorial context of the canton of Cuenca and the third provides information on feasibility, limitations and opportunities of the bonds in Cuenca through

interviews. The integration of these three sources allows us to contrast between theory, practice and technical appreciation of the effectiveness of biodiversity bonds as a tool to direct resources to the protection of the biodiversity of the Canton of Cuenca.

3.1 Participants

The participants in the interviews correspond to experts linked to two fields of knowledge: experts in sustainable financial instruments, who enrich information on the design, structure and implementation of green bonds; and experts in biodiversity and environmental conservation with experience in management, research and formulation of policies and conditions for the protection of biodiversity in Cuenca.

Participants were selected based on their professional experience, technical knowledge and participation in issues related to sustainable financial instruments or biodiversity conservation. 5 semi-structured interviews were conducted, 3 of them with biodiversity experts and 2 with bond experts.

In the field of biodiversity, the institutional position of interviewee 1, being an environmental engineer, thanks to his position and experience, information on the procedures for the protection of biodiversity was obtained from ETAPA. In the case of interviewee 2, a natural resources technician from the cantonal authority, he collaborated with us on how the Decentralized Autonomous Government of Cuenca manages the protection of biodiversity. Interviewee 3, ETAPA's biodiversity technician, contributed to the barriers that ETAPA has for the protection of biodiversity.

In the field of bonds, interviewee 1, a professor of Financial Law and a lawyer, contributed to the regulatory and structural limitations that exist in Cuenca for the development of bonds. Interviewee 2, a professor of Economics, provided information on the development of the bonds at the international and local level.

3.2 Instruments

The main instrument for collecting information is semi-structured interviews with experts in sustainable financial instruments and experts in biodiversity, constituting the qualitative method that allows analyzing the evaluations of the participants and contrasting theory with practice.

The two types of interviews are made up of sub-themes, in the case of interviews for biodiversity experts the sub-themes are: Biodiversity Status, Biodiversity Problems,

Management and Protection and Biodiversity Bonds. In the case of interviews with bond experts, the sub-topics are: Financial instruments, biodiversity bonds and structure of biodiversity bonds. It is mentioned that for both types of interviews, a question was included on how biodiversity credits can be structured or applied in a way that has a biocentric direction.

Table 3
Biodiversity Interviews and Biodiversity Bonds

Axle	Profile	Interviews
Biodiversity	Experts in biodiversity and environmental conservation with experience in management, research and formulation of policies and conditions for the protection of biodiversity in Cuenca. **Interviewee 1**: Environmental Engineer. **Interviewee 2**: Biologist and Natural Resources Technician. **Interviewee 3**: Biodiversity technician.	• Biodiversity indicators. • Level of protection of biodiversity in Cuenca. • Threats to biodiversity. • Factors that hinder the effective protection of biodiversity. • Strategies for the protection of biodiversity. • Actors and their participation in conservation, intrinsic value of biodiversity in protection strategies. • Biodiversity Bonds. • Redirecting biodiversity credits in a biocentric way.
Biodiversity Bonds	Experts in sustainable financial instruments that enrich information on the design, structure and implementation of green bonds. **Interviewee 4**: Professor of financial law. **Interviewee 5**: Economist.	• Financial instruments to finance environmental initiatives. Appropriate contexts for thematic bonds. Advantages and disadvantages of biodiversity bonds. Effective requirements and indicatorsStructures for directing biodiversity credits in a biocentric approach.

Source: Interviews prepared by the author

3.3 Procedure

The methodological procedure of the research was developed in three main phases to develop triangulation and link it to the specific objectives of the study.

The first phase found in the theoretical framework was the analysis of biodiversity and biodiversity bonds.

In the second phase, state of the art, the cases of implementation of green bonds were analyzed through the review of official reports, technical reports and documents from Romania, Colombia and Ecuador. The territorial context of the Cuenca canton was also analyzed through the Territorial Development Plan (PDOT) related to local biodiversity and institutional mechanisms for environmental protection.

In the third phase, semi-structured interviews were conducted with experts in sustainable financial instruments and experts in biodiversity, which resulted in the procedure of these 3 phases a contrast of theory to practice of how biodiversity bonds are structured and operated, and whether possible the issuance of sovereign green bonds to finance the protection of biodiversity in the Canton of Cuenca.

CHAPTER 4
RESULTS AND DISCUSSION

4.1 Viability of Biodiversity Bonds for Protection and Conservation of Cuenca

Throughout this research, it was analyzed whether biodiversity bonds have the capacity to contribute financially to the protection of biodiversity in the canton of Cuenca; these instruments have a series of conditions for their mission to be fulfilled, for this, first the state of biodiversity in the canton of Cuenca and the problems that exist for biodiversity were investigated. The canton of Cuenca, thanks to its climate and its diverse ecosystems, which have given rise to an important variety of flora and fauna, has developed its richness in biodiversity. However, this biodiversity presents risks because it is not protected at an adequate level.

In the case of the canton of Cuenca, the risks that exist for biodiversity recognized by the participants in the interviews are: expansion of the agricultural frontier, forest fires, indiscriminate logging, opening of roads and also climate change, such as the drought that occurred in 2024 (Interviewee 1, personal communication, February 20, 2026).

Despite the fact that the Cajas National Park has greater control, it is also exposed to risks such as forest fires or land use change (Interviewee 2, personal communication, February 25, 2026). Conservation is not limited to protected areas, but also to their surroundings since, if a territory does not have connectivity with others at an ecological level, this can result in its loss, and this is a case that occurs in the Cajas. Another risk to Cuenca's biodiversity is in the political part, it is not specified what should be protected or how to allocate resources (Interviewee 3, personal communication, February 26, 2026).

There are factors that hinder the effective protection of biodiversity, such as the economic problem, as the interviewees state: *"in the environmental part, it is still not a priority in many instances in our canton, therefore, the amount of resources that should be allocated to protect biodiversity are not allocated, this precisely causes a lack of personnel, lack of inputs, lack of instruments, lack of resources that weaken control, surveillance and follow-up, including research."* (Interviewee 1, personal communication, February 20, 2026).

Taking into account all these risks that affect the biodiversity of Cuenca, strategies have been identified to protect its biodiversity, among these strategies we find, for example,

> *"The ETAPA company, which has had the delegation of being able to take care of the Cajas National Park and other areas of responsibility of ETAPA, which are an example at the national and international level of an adequate management of protected areas, because, apart from the fact that these areas are protected, the focus that ETAPA has is precisely to integrate the different territories and situations that the Cuenca canton has, dividing it into watersheds to protect the integrity of the watersheds, this is interesting because the approach is quite effective, not only resources are allocated to these areas, but to the integrity of the entire basin. This is an effective factor that exists in Cuenca. Despite the limitations, because it is not perfect, there is a certain inter-institutional articulation that is reflected in the Committee for the Conservation and Restoration of the Cajas Massif, where it was possible to bring together representatives of almost all the actors in the territory of the Cuenca canton to protect the water sources. Another very effective management case is the FONAPA Trust, where through this Trust the resources are managed so that they can be well invested in our territory, because the Cuenca canton is part of the Paute River basin"* (Interviewee 1, personal communication, February 20, 2026).

Another strategy carried out for the protection of biodiversity in the canton of Cuenca is the joint work between ministries and decentralized autonomous governments with the participation of their respective institutions, as is the case of ETAPA and its joint work with the GAD of Cuenca and the Ministry of the Environment.

> *"Within the Environmental Management Commission as such, joint work has been carried out, this issue of disciplinary relationship, between the Ministry of the Environment, the police, the CGA in educational campaigns, in control operations and now in the formulation of this new regulatory body that allows greater control in the management of biodiversity and projects as well. And also this issue of the projects that are being managed within the municipality, which is precisely for the issue of first generating information on what is available in Cuenca to be able to take care of it"* (Interviewee 2, personal communication, February 25, 2026).

A complementary strategy for the protection of biodiversity in the canton of Cuenca mentions a surveillance and control system in protected areas through patrols and the establishment of sanctions for environmental offenders.

"It is considered that one of the most effective strategies has been the processes of creation and management of patrols. Despite the weaknesses of recent years, where efforts have been weakened, the issue of the creation and management of patrols continues to be a super important and super powerful tool. It is not for nothing that the Cajas National Park has a national reputation, even internationally. The very fact of asking that the park not be managed as a natural park, for example, was at the time a very important manifesto of appropriation of the management of the territory, of responsibility with the territory and with those who live in it. Maintaining character is still a declaration of political will" (Interviewee 3, personal communication, February 26, 2026).

As mentioned above, all these strategies require financing, which to date is not sufficient for the strategies for the protection of the biodiversity of the canton, so mechanisms are required to channel resources towards biodiversity, from this point the bonds have been considered to be that mechanism.

Biodiversity bonds are aligned with SDG 13 since, by financing the protection of biodiversity, it contributes to mitigating climate change since forest conservation captures CO2 and therefore there is a reduction in emissions, in the case of SDG 15, biodiversity bonds finance the protection of biodiversity, the conservation of natural areas, the restoration of soils and the protection of species, so biodiversity bonds contribute to the fulfillment of these two SDGs in theory, however, in practice, there are still many factors to take into account for these objectives to be met.

"The environmental bond, the thematic bond as such, which is one of the instruments that is being used the most to date, however, the bonds require a lot of corporate transparency and others. It is not such a simple situation if we can talk about the weaknesses of the bond structures. It is not so easy to come out with a thematic bond, a social bonus, an environmental bond, a biodiversity bond, because you have to have a very strong comprehensive financial structure. and that takes time" (Interviewee 4, personal communication, February 24, 2026).

"At the level of Cuenca, Ecuador, very little has been seen in the application of green financing mechanisms, however, if one analyzes at the global level, at the international level, much greater efforts have been made, because there are green bonds, there are blue bonds, etc. Everyone ends up with the goal, or has the goal of

financing some sustainable project. In Cuenca, particularly, there is the case of Banco del Austro" (Interviewee 5, personal communication, March 2, 2026).

In Ecuador and specifically Cuenca *"we have a spectacular element to take into account as the contribution that all corporate, social, business, public and other structures should have for protection, which is the issue of the savings banks"* (Interviewee 4, personal communication, February 24, 2026). At the national level, the issue of green and biodiversity bonds is new and nascent, in the international and Latin American arena the use of green bonds has been taken into account, it is considered that one of the reasons for this boom is environmental responsibility that motivates companies to invest to have certifications that guarantee being *ecofriendly* or that invest in sustainable or environmental protection projects since this gives them more advantages in market standards (Interviewee 4, personal communication, February 24, 2026).

In the interviews, a similar point was reached in the two topics, which is that Cuenca and Ecuador are not currently in conditions for the issuance of sovereign biodiversity bonds, however, it is important to mention that, in Ecuador, the private sector also has and there are cases of green bond issuances, blue and biodiversity. Its major limitations include the lack of economic investment in biodiversity protection projects and in all the structuring that a bond entails, the lack of a strong system and organization for the creation and issuance of the biodiversity bond in the political-regulatory sphere and the predominance of a system that is based on the economy that results in *greenwashing (*Interviewee 4, personal communication, February 24, 2026).

Among the difficulties that exist for the application of green bonds and biodiversity, in the institutional and regulatory part it is considered "*basic necessary conditions, which have to be regulatory, an ideal regulatory framework and within these regulatory conditions, it should focus on this public policy to promote the use of these financing instruments"* (Interviewee 4, personal communication, February 24, 2026).

> *"That the State is a regulatory shadow and that it does not constrain and prevent things from flowing since Ecuador has very strict normative and regulatory structures, which, instead of supporting or motivating the use of these instruments, they want to prevent them, it is good that it is regulated, but not based on the fact that it constrains everything and does not allow you to make your own decisions, that is one of the problems for which the ideal regulatory framework does not refer*

to overprotection or over-interventionism by the state, but rather to a balance between regulation and permissibility, coordination or ideal institutional conditions that allow a link between the public and the private from the entities of the Ministry of the Environment and that these public structures are in a certain way empathetic with the processes and have this luck of co-responsibility in the process being a source of support, the way forward is for this joint work to be reflected in public policy and in the private actor" (Interviewee 4, personal communication, February 24, 2026).

Within the structuring of the bonds and specifically for them to have a biocentric direction, they need:

> *"Priority ecological indicators, determining that financing for endangered species, the protection of key ecosystems, also, for example, without neglecting the human being, talking about the participation of scientists, the scientific community, academia and local communities as well, which are also of direct influence on the application of the product, the evaluation of ecological well-being, not only financial; strong institutions with suitable regulations are required, as well as metrics or products that can evidence or leave evidence through reliable environmental evidence and metrics and also generate financiers who are interested in sustainability"* (Interviewee 4, personal communication, February 24, 2026).

"The key structuring of a biodiversity bond is first of all to have clear projects, to have clear objectives. Unlike the other bonds, for example, which need a risk rating and to check future flows, that type of bond is completely different. It is to have clear objectives so that it is sellable to investors and that in the process it complies with what was agreed" (Interviewee 5, personal communication, March 2, 2026)

The country's regulations are necessary for the development of a bond in the event that they are sovereign; Another necessary factor is the investors, those who will lend the money for the issuance and to ensure the transparency of the use of the resources it is necessary to have controls during and after the project, including external reviews, which entail an investment. (Interviewee 4, personal communication, February 24, 2026).

In order for the bonds to have a biocentric approach, it has been concluded that the projects that are chosen to channel the resources from the bonds must be projects that are aligned with environmental principles and the rights of nature, that recognize the intrinsic

value of nature and that do not focus only on the transition of renewable energies as an example. that although these energies are necessary and must be implemented, investment should not be reduced only to these.

Transparency in biodiversity bonds is an issue of great importance, since, in international standards we find the principles of green bonds that mention: for this transparency to be complied with, reports are necessary while the project is being carried out and reports and reports at the end of the project, another recommendation of the principles of green bonds is that for greater transparency there must be external reviews (ICMA, 2025b).

However, these recommendations do not materialize if there is no team in the middle that must be paid to carry out the work of the reviews, which implies more money and that the investment in the bond is greater (Interviewee 4, personal communication, February 24, 2026), it is also important to take into account that these recommendations are not enough since as a result of the interviews for transparency it takes place in a context such as Ecuador and specifically in Cuenca; there must be joint work, knowledge and education on the part of public and private institutions and even citizens in terms of environmental protection since the risks experienced by nature are the result of economic, social, political and cultural systems (Interviewee 3, personal communication, February 26, 2026).

The possibilities of managing and guaranteeing that the funds are channeled to the conservation of the biodiversity of Cuenca have been analyzed. The first step is to focus on the area you are looking to protect, such as the Cajas. The second step is to take into account the issuance process, where it is not only reduced to the structuring and issuance of the bond, it is necessary to communicate with the lenders and expose the project, it is also necessary to know that Ecuadorian law establishes the obligation for there to be institutional investments such as social security, the insurance of the Armed Forces, to mention a few that are institutional investors and have the obligation to buy this type of financial assets (Interviewee 4, personal communication, February 24, 2026).

Importance is also attached to the project's objectives being clear and demonstrating viability and sustainability over time, since the key point is that these resources are used efficiently (Interviewee 5, personal communication, March 2, 2026). When looking for financing with environmental responsibility, in the way it is valued, it is the result of that financing, what is the environmental impact that this financing had, for example, if we are

talking about a forest restoration, we must measure how many hectares were restored and also analyze if there was a long-term impact, based on NGO structures or private structures that are dedicated to the analysis of the environmental impact generated by certain situations on biodiversity (Interviewee 4, personal communication, February 24, 2026).

Within the conditions, an ideal regulatory framework is necessary, in which these regulatory conditions must focus on public policy to promote the use of these financing instruments, where the state is a regulatory factor and not one that prevents the development of the bonds, also the coordination of institutions that allow a link between the public and private sectors and determine and evaluate whether the progress of the objectives is being met in the short, medium and long term (Interviewee 4, personal communication, February 24, 2026).

Another objective of this research was to analyze whether there is the possibility that biodiversity bonds have a biocentric approach or direction, however, it was concluded that the bonds are not the most viable, since in addition to the barriers that were mentioned above, there are also situations where at the end of a project there is no follow-up and its activities stop when they should be long-term. Another situation that makes bonds not the most viable option is that it requires a greater inclusion of environmental professionals in the regulatory design and execution of environmental projects since more non-environmental profiles predominate, which results in technical and interdisciplinary shortcomings and decision-making on environmental issues without the necessary bases or knowledge for it (Interviewee 3, personal communication, February 26, 2026).

As a result of the analysis of the international and national regulatory framework, contrasting it with the cases and finally with the interviews, Cuenca is considered a great focus of investment in biodiversity due to its nature, the natural resources that are located in the area, species and ecosystems, however, the issuance of green and biodiversity bonds have not yet been sufficiently developed due to economic factors, political and especially environmental. However, the issuance of bonds is already a fact in the country, despite the fact that they are in a stage and early experience, in the national regulatory framework policies must still be strengthened in terms of environmental protection and investment in these instruments for their operation, taking into account the international and Latin American cases, there is a reference of how the bonds are structured, which are formed through the principles of green bonds as the most used, with all this in mind it is still necessary to take into account the reality of the country where productivity is prioritized

more than the intrinsic value of nature, which results in little investment and financing in protection, the weakening of public policies on environmental protection, generating a gap between the theory and practice of biodiversity bonds in the canton of Cuenca and in Ecuador.

Faced with this situation regarding the issuance of biodiversity bonds to finance policies, programs and projects for the conservation of biodiversity in Cuenca, it has been necessary to identify other financial instruments to invest in the protection of biodiversity, such as environmental or biodiversity funds, since these finance continuous processes and prevent that at the end of a project, they are not maintained in the long term, they are also considered to have a biocentric approach since the bonds respond to terms and profitability, a financial and economic approach. By focusing on environmental or biodiversity management and protection, the resources will be used only for that purpose, reducing the risk of image washing. Finally, the funds as another advantage have the diversification of sources of financing since they can come from international cooperation, donations, the state and the private sector and no longer depend on an investment or co-investors as it is in the case of bonds, however, for these to work the participation of professionals in the environmental field within the funds is necessary.

CONCLUSIONS

Biodiversity bonds are an innovative alternative to direct resources towards the protection of biodiversity. However, the application of this financial tool is new at the national level and it is recognized that its structuring requires several factors for its proper functioning, economic, political and regulatory factors, which are not yet properly aligned for the correct development of biodiversity bonds.

Green bonds and biodiversity bonds can be issued by public or private entities or multilateral institutions to finance projects with environmental impact or that protect biodiversity. They contribute financially to the protection of biodiversity by mobilizing capital that can be private, public or mixed towards actions, strategies or measures that protect biodiversity, all this is developed through a procedure that begins when a financial or environmental entity or institution identifies the need to finance protection actions, then the bond is structured defining its amount to be issued, its term, interest rate and the destination of the funds to present it to investors or in this case lenders.

To ensure that the funds are channeled to the conservation of biodiversity in Cuenca, it is important that there are reports of the environmental impacts prior to the issuance of a bond and subsequently, based on the principles of green bonds, additionally, it is required to have the certification of the Climate Bonds Standard and Certification System. To ensure investors are confident when investing in a bond, external and independent reviews are necessary to ensure transparency in the channeling of bonds. For the structure of the bonds to have a biocentric direction, ecological indicators are necessary to prioritize and determine financing for strategies that protect biodiversity for its intrinsic value, such as the creation and financing of protected areas, conservation areas, and regeneration areas.

The viability of the implementation of the bonds in the case of the canton of Cuenca is not very promising currently, since before developing the issuance of bonds there are certain aspects that must be taken into account, such as the lack of public policies that encourage the use of these financial tools by the private and public sector. It should also be taken into account that for the issuance of the bonds it is necessary to have a base capital that will serve for the development of the issue and the participation of experts in environmental matters to develop it. In addition, it should not only focus on the technical and economic field if what is sought is that these bonds are aligned with the intrinsic value of nature. In this context, the implementation of bonds is limited by conditions that influence their

structuring, in addition, to orient them towards biocentrism, a different approach is necessary.

The effectiveness of biodiversity bonds depends largely on external conditions such as the regulatory framework, the level of environmental commitment of the issuers and the socioeconomic context. In Ecuador, the issuance of green, biodiversity and blue bonds are in an initial stage, there are currently private entities that issue these bonds in addition to the fact that the country has a framework of Sovereign Green Bonds effective from 2023. However, there are limitations for the correct development of the bonds at the national level due to the lack of economic investment in biodiversity protection projects, in addition to the fact that a large investment is needed for the structuring that a bond entails, as well as the lack of a system and organization for the creation and issuance of biodiversity bonds. therefore, biodiversity bonds are not considered the most effective mechanism, currently, to channel financial resources towards the protection of the biodiversity of the Cuenca canton.

Given this situation, the need for other financial instruments that allow investment in the protection of biodiversity is evident, such as environmental funds, which have as their main objective investment in projects with environmental impacts rather than an economic interest, as would be the case with bonds.

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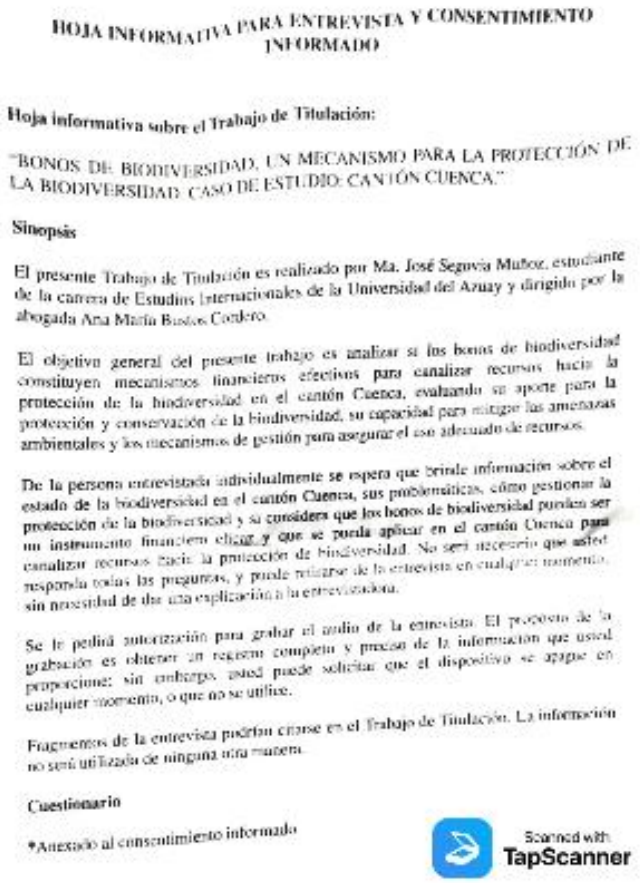
APPENDICES

Appendix 1
Interviews

https://github.com/mjsegovia-dot/Entrevistas-y-respuestas/blob/39a4bdc9c6f39976e0d36ef6966c325dcc97b02f/Entrevistas

Appendix 2
Informed Consent:



HOJA INFORMATIVA PARA ENTREVISTA Y CONSENTIMIENTO INFORMADO

Hoja informativa sobre el Trabajo de Titulación:

"BONOS DE BIODIVERSIDAD, UN MECANISMO PARA LA PROTECCIÓN DE LA BIODIVERSIDAD. CASO DE ESTUDIO: CANTÓN CUENCA."

Sinopsis

El presente Trabajo de Titulación es realizado por Ma. José Segovia Muñoz, estudiante de la carrera de Estudios Internacionales de la Universidad del Azuay y dirigido por la abogada Ana María Bustos Cordero.

El objetivo general del presente trabajo es analizar si los bonos de biodiversidad constituyen mecanismos financieros efectivos para canalizar recursos hacia la protección de la biodiversidad en el cantón Cuenca, evaluando su aporte para la protección y conservación de la biodiversidad, su capacidad para mitigar las amenazas ambientales y los mecanismos de gestión para asegurar el uso adecuado de recursos.

De la persona entrevistada individualmente se espera que brinde información sobre el estado de la biodiversidad en el cantón Cuenca, sus problemáticas, cómo gestionar la protección de la biodiversidad y si considera que los bonos de biodiversidad pueden ser un instrumento financiero eficaz y que se pueda aplicar en el cantón Cuenca para canalizar recursos hacia la protección de biodiversidad. No será necesario que usted responda todas las preguntas, y puede retirarse de la entrevista en cualquier momento, sin necesidad de dar una explicación a la entrevistadora.

Se le pedirá autorización para grabar el audio de la entrevista. El propósito de la grabación es obtener un registro completo y preciso de la información que usted proporcione; sin embargo, usted puede solicitar que el dispositivo se apague en cualquier momento, o que no se utilice.

Fragmentos de la entrevista podrían citarse en el Trabajo de Titulación. La información no será utilizada de ninguna otra manera.

Cuestionario

*Anexado al consentimiento informado

CONSENTIMIENTO INFORMADO PARA ENTREVISTADOS

Yo, Ma. José Segovia Muñoz, como autora de este Trabajo de Titulación, deseo asegurarme de que las personas entrevistadas estén completamente informadas sobre su participación en este proyecto. Por favor, indique si está de acuerdo con las siguientes afirmaciones y, de ser el caso, acéptelas. Si no está de acuerdo con alguna afirmación y/o requiere aclaraciones, hágalo saber.

- ☐ He leído y comprendido la hoja informativa del Trabajo de Titulación.
- ☐ Se me ha dado la oportunidad de hacer preguntas sobre el Trabajo de Titulación.
- ☐ Estoy de acuerdo en participar en una entrevista personal.
- ☐ Estoy participando de forma totalmente voluntaria.
- ☐ Entiendo que puedo negarme a responder cualquier pregunta, sin necesidad de explicar el motivo.
- ☐ Entiendo que puedo retirarme de la entrevista en cualquier momento, sin necesidad de explicar el motivo.
- ☐ Autorizo que se grabe el audio de mi entrevista.
- ☐ Autorizo que se tomen notas durante la entrevista.
- ☐ Entiendo que mis palabras pueden ser citadas en el Trabajo de Titulación.
- ☐ Entiendo que la información proporcionada será utilizada exclusivamente para fines académicos.

Nombre: _____

Firma: _____

Fecha: _____