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The importance of large tropical forests and environmental security: perspectives on tropical forests in the Great Lakes region

João Carlos Marques Simões

Resumo

O estado atual do ambiente em África é profundamente preocupante. Pese embora, se trate de um continente com um rico património natural, África enfrenta uma severa crise ecológica. Na região da África tropical, as florestas são recursos de extrema importância não só local, como global, desempenhando entre outras funções, o papel de sumidouro de dióxido de carbono. Nesse sentido, é analisado o papel das pressões antropogénicas nas florestas dos Grandes Lagos africanos, discutindo-se desde as dinâmicas de conflitualidade regional até aos processos de degradação ambiental e desflorestação regional.

Palavras-chave: Burundi; Florestas; Grandes Lagos; República Democrática do Congo; Ruanda.

Abstract

The current state of the environment in Africa is deeply worrying. Despite being a continent with a rich natural heritage, Africa is facing a severe ecological crisis. In tropical Africa, forests are extremely important resources, both locally and globally, playing the role of carbon dioxide sink, among other functions. With this in mind, the role of anthropogenic pressures on the forests of the African Great Lakes region is analyzed, taking into account the dynamics of regional conflicts and the processes of environmental degradation and regional deforestation.

Keywords: Burundi; Democratic Republic of Congo; Forests; Great Lakes; Rwanda.

João Carlos Marques Simões
Doutorando em Relações Internacionais no Instituto Superior de Ciências Sociais e Políticas

0000-0002-7859-4668

1. Introduction

The 21st century has been the century of new threats. The international system is now facing a new type of threats (mainly unconventional threats), for which it is still largely unprepared.

This set of unconventional threats constitutes a set of polycrises, each of which is a polycrisis in itself. More specifically, it concerns climate change and its derivative phenomena, energy security and the transition to a green world, food security, new migratory flows, including climate-induced migratory flows, and also, to a large extent, disputes over resources and, finally, health security.

Most of these threats are closely related to the environment. And, in reality, it is only the environment that allows other traditional threats to exist, evolve, and change, since it is the environment's balance that allows life on our planet. For this very reason, it is important to understand how the environment is linked to security, an issue that will be analyzed in the course of our conceptual framework.

Forests are an important natural component, playing a vital role in sustaining life on Earth. According to Pereira (2014, p.13), "they cover approximately 1/3 of the land surface, contain about 70% of biomass, harbor a substantial portion of terrestrial biodiversity, influence the water balance and climate, and contribute to the balance of the biosphere through their role in the global carbon cycle".

Later, it will be demonstrated that forests are not only an important natural component with ecological functions. Wood, for example, has an important significance for humanity, from contributing as a fundamental element of construction to being an important fuel. But forests, specifically through wood, have also been at the root of the great socio-political revolutions of the last two centuries.

Forests are also a source of various other natural resources and goods, such as cork, mushrooms, fruits and plants, pastures, among many others. Despite their high value, forests face significant challenges. First and foremost is deforestation, because, as Pereira (2014, p.14) points out, "the history of humanity is a narrative of deforestation," since forests can be an obstacle to the movement of people and goods, vast areas of pasture and forest have been burned in the eternal struggle for human domination over nature (Williams, 2003). However, forests also face other challenges, such as climate change, global warming, and increasing demographic pressure, among others.

Forests also make important contributions to sustaining life on Earth through photosynthesis. Among the world's large green areas, some receive particular attention due to their size and importance, such as the Amazon rainforest and the forests in the African Great Lakes region. On the other hand, the current state of the environment in Africa is deeply worrying. Although it is a continent with a rich natural heritage, Africa faces a severe ecological crisis. In this regard, our goal is to analyze the geopolitical importance of the large tropical forests in the African Great Lakes region in relation to regional security in the context of human security.

The article is divided into five sections. The first section discusses the implications of environmental security, addressing the evolution of environmental awareness and the various risks faced by international society. The second section analyzes the global importance of large forests, while the third section analyzes the dynamics of insecurity and instability in the African Great Lakes region. In the fourth and fifth sections, the relationship between climate change and anthropogenic pressures on tropical forests is analyzed, with particular emphasis on African tropical forests.

As far as methodology is concerned, an exploratory and theoretical-descriptive qualitative approach is adopted, focussing on a case study and drawing on bibliographical sources

relating to the African Great Lakes region, particularly Rwanda, Burundi and the Democratic Republic of Congo. The article follows a transdisciplinary rationale, bringing together legal and geopolitical elements, as well as aspects of international relations.

2. Environmental security

Climate change is currently one of the greatest challenges facing the international community, occupying a prominent place on the international political agenda (Climate Change, 2014). In the decades following the Cold War, a new position emerged in the academic arena, as part of international security studies, which was called environmental security.

Soromenho-Marques (2007, p.429) explains that "as the name suggests, it is about the demand for a methodological and categorical compromise between environmental sciences, on the one hand, and a combination of disciplines from the classic areas of security, namely strategy and international relations".

Four factors contributed to the emergence of this new area: (i) the end of the Cold War; (ii) the release of resources; (iii) greater awareness of the global environmental crisis; (iv) and the fragmentation of the international political order.

The end of the Cold War enabled the introduction of new and more diverse concerns into the security agenda of states, but also into the international security agenda. But more than that, the end of the Cold War and the risks of nuclear war were followed by new threats that filled a risk vacuum left by the disappearance of the risks of conflict arising from the Cold War.

The release of resources is not limited to capital resources, but also includes scientific potential, which, as Soromenho-Marques (2007, p.432) points out, "has been directed towards other areas of research, namely in the field of studying the vulnerabilities of our planet, particularly on a global scale".

Greater awareness of the global environmental crisis has been made possible largely through what Soromenho-Marques (2007) refers to as the effect of catastrophe pedagogy. The same author states that

> the accumulation of global indicators of the environmental crisis (...) from acid rain to climate change, has drawn attention to the dangers posed to the stability of an already fragile and uncertain international system by the possible accumulation of symptoms of environmental degradation without an adequate response, with implications and consequences that are not only cross-border but effectively planetary (Soromenho-Marques, 2007, p.432).

The end of the Cold War also meant the breakdown of the existing international order, putting an end to the bipolarity that characterized the Cold War environment and thus allowing greater autonomy of action to states that had previously been relegated to a peripheral role.

In this sense, it is important to highlight some of the factors of human activity that have contributed to influencing the process of climate change, namely: (i) population; (ii) consumerism; (iii) industrialization; (iv) consumption of fossil fuels; (v) large-scale deforestation; among others. According to Rosa et al. (2015), these factors can be classified as anthropogenic drivers of climate pressure, that is, the set of economic, political, cultural, and social factors that directly or indirectly influence the environment.

Similarly, climate change gives rise to a significant set of crises of various kinds, thus taking the form of a polycrisis. Among its effects, the following are particularly noteworthy: (i) changes in precipitation and temperature patterns; (ii) climate-induced conflicts; (iii) climate-induced floods; (iv) climate-induced migrations; (v) scarcity; (vi) instability; (vii) increased intensity and frequency of natural disasters; (viii) degradation of agricultural production and food systems.

It should also be noted that different regions of the world are not all affected in the same way by climate change, nor do they all have the same level of resilience, vulnerability, and capacity to adapt. Several regions and states are more vulnerable to the effects of climate change. According to the IPCC, the average sea level is expected to rise by 6 centimeters per decade throughout the century, putting several states located in coastal regions such as China, India, Bangladesh, Mozambique, as well as most island states, particularly SIDS (Small Island Developing States), under direct threat (Simões, 2024). The next chapter continues with an analysis of the geopolitical value of the world's great forests.

3. The geopolitical importance of large forests

Forests are paradoxical organic structures. They are paradoxical in that, on the one hand, they are important actors responsible for sustaining life on our planet, but on the other hand, they are also important economic assets.

Gomes (2006) considers that the forest is simultaneously a macrosystem and a microsystem, referring to it as "a living machine that shelters small worlds for animal and plant species and provides refuge for humans in moments of leisure" (Gomes, 2006, p.142). This embodies what is essentially the multifunctional nature of forests (Gomes, 2017; Lopes, 2003; Molina, 1998; Pontes, 2020).

On this very issue, Molina (1998) highlights three essential functions. On the one hand, the ecological function of regulating the biosphere; on the other hand, the social function of recreation; and finally, the economic function of exploiting forest resources. It is important to note that the ecological, social, and economic functions are not limited to the examples presented.

So what are we talking about when we use the term forest? The forest is a renewable natural resource, which, as it was mentioned, is essential to the preservation of life on our planet (Oliveira, 2012).

From a legal point of view, forest assets are associated with a high degree of complexity, which is justified by the specific environmental conditions and the "differentiated approach taken in the various legal instruments that deal with them" (Lopes, 2003, p.60). Precisely for this reason, it should be noted that global forest distribution is not uniform, with some forest areas being denser and others less dense.

Therefore, it is understandable that regulations need to be adapted to different forest bodies, for example, as is the case internationally with the political imperative to protect tropical forests.

Why, then, is it important to talk about forests in the context of international relations? First of all, because they are one of the great guarantors of life on the planet, but also because, as Lopes (2003, p. 61) points out,

> their interaction with other environmental components, essential to an integrated and global consideration of the "environment," has contributed to the main problems affecting them, which have widespread spatial impacts, being debated in various forums for discussion and intervention.

Internationally, and in fact, to a large extent similar to other areas of international environmental law, it is only recently that the ecological dimension of forests has been recognized, since until recently (20th century) the prevailing idea was that natural resources were infinite and subject to centuries of excessive exploitation (Gomes, 2006, 2018; Gomes et al., 2021; Gomes & Leong, 2023).

Special mention should be made of Principle 4 of the 1972 Stockholm Declaration, which marks the beginning of a cycle of utopianism in international environmental law and reflects concern for the ecological dimension of forests and the finitude of natural resources, insofar as it includes the "preservation of forest resources in the weighing of economic development

factors" (Gomes, 2006, p.142).

The utopia of Stockholm was followed by the pragmatism of Rio from 1992 onwards, where, precisely taking into account the pessimistic analysis of the global environmental scenario, forests, faced with worsening desertification and the degradation of the ozone layer, were given a new and reinforced role (Gomes, 2006). Regarding these two factors, it is also important to take into account that forests are both hydrological fixers and carbon dioxide sinks, which is why this phase of international environmental law resulted in the Convention on Biological Diversity and the Framework Convention on Climate Change (Gomes, 2006).

It is believed that we still lack a conceptual definition of "forests." In line with Pereira (2014), we start from the idea that there will be general agreement if we consider forests to be ecosystems dominated by trees, the latter being the distinguishing feature from other ecosystems.

Even so, the adoption of a comprehensive conceptual proposal such as the one identified here raises other problems. The definition of forests as a collection of trees may not have a universal interpretation. Take, for example, the case of the cork oak forest. It is certainly considered a forest in Portugal, but would communities from different regions accustomed to different forest landscapes have the same perception of forests? Probably not.

In order to dispel conceptual ambiguities, we refer to two other conceptual proposals, one put forward by the FAO and the other by the UNECE (United Nations Economic Commission for Europe).

Regarding these proposals, Pereira (2014, pp. 15-16) states that

> forests are ecosystems with tree canopy cover exceeding 10% of the land area, which must be at least 0.5 hectares in size. Trees are woody plants that have a stem (trunk) made of wood (or compact woody tissue) and can reach a height of 5m at maturity. This definition includes forests with low tree density (such as montados in Portugal). Artificial stands and young plant communities that have not yet reached the aforementioned dimensions are also considered forests, as well as land whose tree cover has been recently cut but which is located within forest areas.

Consequently, forests are important environmental components. The environment can be analyzed fundamentally through three lines of reasoning. Gomes (1999) talks about the broad meaning, the narrow meaning, and the indeterminate meaning of the environment.

Regarding the broad meaning of the environment, Gomes (1999) states that we must integrate both cultural and natural assets, thus placing factors such as air, water, flora, among others, on the same level as factors such as natural heritage, landscape, or monumental heritage.

The same author adds that "the environment would thus be constituted by the set of natural resources (renewable and non-renewable) and by human actions that have nature as their support or framework" (Gomes, 1999, p.47).

This is a deeply anthropocentric perspective, found in Giannini (1971, 1973, 1976), which integrates the environment into the category of cultural assets. According to this perspective, natural assets are in themselves totally marginal, depending on human action to be integrated into civilizational processes, as Gomes (1999) points out.

In line with Giannini's perspective (1971), Antunes (1998, p.56) states that "we can speak of a unitary category of cultural assets, which includes the environment, since there can be no cultural identity or cultural heritage without the preservation of the environment in which it is incorporated and in which man historically fulfills himself".

From this perspective, nature, as the collective of natural assets, is protected with a view to making natural assets profitable as a means of satisfying the vital needs of human beings, in line with the demands of their standards of living.

In turn, with regard to the narrow meaning of the environment, it is considered to be only the collective set of renewable and non-renewable natural resources, as well as the interactions that occur between these resources (Gomes, 1999).

The environment in a narrow sense is an approach that devalues the capacity of natural resources to satisfy human needs, with natural resources therefore having an autonomous dignity, "which man should respect and promote, because he is part of it as a member of the biotic community" (Gomes, 1999, p.47).

With regard to the environment in an indeterminate sense, Gomes (1999) considers that this is a perspective that sees the environment as an indeterminate descriptive concept, meaning that the environment should be seen, as an open and variable reality depending on the time period and the heterogeneity of environmental components and the relationships established between them.

As Gomes (1999, p.49) points out, "presenting the environment as an indeterminate concept and referring its determination to physical, cultural, economic, and scientific factors is equivalent to leaving room for the adoption of either a broad or a narrow meaning, depending on the — anthropocentric or ecocentric" underlying the environmental legal system under analysis.

It is also important to take into account that the environment is composed of biotic and abiotic components, being closely linked to human culture, its social, political, and economic values, among many others. Thus, biotic components are seen as the set of living organisms, such as fauna and flora. Abiotic components, on the other hand, are those that, although not alive, influence biotic components chemically, physically, and physically-chemically, such as water, air, soil, energy, temperature, pressure, climate, among others.

Having clarified the concepts of environment and forest, we are left with the third initial concept we set out to analyze: the concept of tropical forest. So what is a rainforest? Plotkin (2020) leads us to consider that rainforests are a mixture of reality and imagination, with diverse flora and fauna that contribute to their aesthetic depth. They are located in the tropics, more specifically between the Tropic of Cancer and the Tropic of Capricorn, and are hot, humid, and characterized by intense rainfall (Allaby, 2006).

The tropics are mainly covered by ocean water, which affects the conditions in which tropical forests grow. And even though the tropics are known for heavy rainfall, tropical forests cover a much smaller area than it would be expected (Allaby, 2006).

Tropical forests are spread across five regions: (i) America and the Caribbean; (ii) Africa and Eastern Madagascar; (iii) India, Malaysia, and other parts of Asia; (iv) Australia; (v) and some islands in Oceania and Hawaii. Even within these regions, however, the distribution of forests is not equitable, with around 57% of these forests found in the Americas, around 25% in Asia, around 18% in Africa, and the remainder divided between Australia and the islands of Hawaii and Oceania (Allaby, 2006).

In addition, although these areas are partly covered by tropical forests, not all of them are the same. According to Allaby (2006, p.5) "rainfall is intense and distributed fairly evenly throughout the year in Central America, the Amazon Basin, the Congo Basin, eastern Madagascar and much of Southeast Asia. These are the areas where tropical rainforest" often referred to as tropical rainforest occurs.

The next chapter will analyse the dynamics of insecurity and instability in the African Great Lakes region, as pre-existing factors of instability and insecurity can interact with climate change and environmental degradation to exacerbate a situation of risk and potential crisis or conflict.

4. Insecurity and instability in the African Great Lakes region

The Great Lakes region is located in the Rift Valley in East Africa and has some of the deepest lakes in the world, including the territory of several states: (i) Burundi; (ii) Ethiopia; (iii) Malawi; (iv) Mozambique; (v) Kenya; (vi) the Democratic Republic of Congo; (vii) Rwanda; (viii) Tanzania; (ix) Uganda); (x) Zambia. The various lakes can be grouped into four groups: (i) lakes that flow into the White Nile; (ii) lakes that flow into the Zambezi; (iii) lakes that flow into the Congo; (iv) closed basin lakes. Let's focus on the specific case of the tropical forests of the Democratic Republic of Congo, Rwanda and Burundi. These three states are part of the Nile River basin, but the dynamics related to the Nile's water regime will not be discussed here.

The Great Lakes region has been characterized by recurrent and lengthy conflicts, fostered by the politicization of identity, the internationalization of conflicts, high civil participation in highly violent practices, and the colonial legacy, which has generally contributed to a scenario of political instability throughout the continent (Bernardino, 2008; Pavia, 2021, 2024; Shyaka, 2008). The causes and dynamics of conflicts in the Great Lakes region are complex and diverse, ranging from challenges associated with ethnic divisions, unequal access to natural resources and unequal access to land itself, the internationalization of conflicts, to the erosion of democratic institutions. When ethnic diversity is considered as a driver of political violence, it should be kept in mind that this factor must be integrated into a broader analysis, since it alone should not be sufficient to trigger conflicts. Furthermore, ethnic heterogeneity is not a condition that necessarily condemns a society to violence, just as ethnic homogeneity does not guarantee peace. Even so, the artificial demarcation of borders in various African states, which brings together different and sometimes rival ethnic groups, has been found to be a major driver of political violence (Pavia, 2021, 2024).

In the specific cases of Rwanda, Burundi, the Democratic Republic of Congo and Uganda, conflicts have been motivated by ethnic differences rather than ideology, as well as the ability of leaders to fracture societies and hostile ethnic groups against each other, for example in the case of conflicts between Hutus and Tutsis.

Access to land is also an important driver of conflict in the Great Lakes region. According to Kanyangara (2016) "in Rwanda, unequal access to land is one of the structural causes of poverty that was exploited by those responsible for the genocide. Limited access to land, exacerbated by its unequal distribution, and similar insecurity (...) have been described as key aspects of the 'structural conflict'".

In Burundi too, for example, the unequal distribution of land is a major factor in insecurity, contributing to widespread poverty and disagreements with the government and sections of the national elite.

Similarly, in the Democratic Republic of Congo, land is a major issue for a number of reasons. Firstly, because "insecure or insufficient access to land in many parts of the East is a significant factor in the impoverishment of thousands of people in rural areas and is a 'structural' cause of conflict" (Kanyangara, 2016), and secondly, the contested purchase and extension of agricultural concessions in the Ituri and Masisi regions have also been identified as sources of violence. Finally, the most recent conflicts themselves have contributed to a change in patterns of access to land, firstly through the forced displacement of communities, but

also through changes in the level of authority of administrative leaders (Kanyangara, 2016).

Land disputes are therefore generally understood to be one of the main challenges to sustainable peace. According to Le Billon (2001), it is possible to distinguish between two types of conflicts over access to natural resources. On the one hand, conflicts arising from disputes between two or more states over natural resources located in shared border regions and, on the other hand, conflicts arising from the illegal exploitation of natural resources in order to finance regional conflicts.

With regard to unequal access to natural resources and their overexploitation, it is worth recalling the idea of the natural resource curse, or the paradox of abundance. (Campos et al., 2018; Sachs & Warner, 1995; Veríssimo & Xavier, 2014).

This paradox portrays the idea that countries and/or regions endowed with an abundance of natural resources, be they forest resources or other types of natural resources, tend to show lower economic growth, as well as worse development results, when compared to countries endowed with fewer natural resources.

This theoretical framework has often been applied to the states of the Global South, in particular those of Latin America and sub-Saharan Africa, which are generally endowed with a great diversity of natural resources, but still have lower economic growth and less development than other regions with fewer resources, for example the Asian Tigers (Campos et al., 2018; Pamplona & Cacciamali, 2017; Sachs & Warner, 1995).

However, the relationship between internal instability, weak economic growth and development, and the abundance of natural resources is not entirely straightforward. Bastos and Ferreira (2013) compare the cases of two sub-Saharan African states, Nigeria and Botswana, showing that both are rich in different natural resources: Nigeria in oil, and Botswana in diamonds. The latter has managed to escape the curse of natural resources, showing significant internal stability and positive economic performance

As mentioned earlier, pre-existing factors of insecurity and instability can interact with climate change and environmental degradation to exacerbate a situation of risk and potential crisis or conflict. For this reason, in the following chapter it will be discussed the relationship between climate change and anthropogenic pressure factors in large tropical forests.

5. Climate change, anthropogenic activities and the great tropical forests

Biodiversity hotspots such as lakes, coral reefs and forests, among others, are fundamental to terrestrial sustainability and the maintenance of life on Earth. However, climate change, particularly of an anthropogenic nature, and its effects constitute risk and pressure factors that jeopardize these same biodiversity hubs.

It is also important to take into account that different regions and ecosystems have different degrees of sensitivity, vulnerability and resilience to climate change. Santos (2018, p.167) considers that "the degree to which a given natural or social system is affected positively or negatively by climatic stimuli characterizes its sensitivity to climate change". These same natural and social systems also have distinct traits when it comes to their ability to adapt to the effects of climate change.

To a large extent, it is the combination of the social and natural systems of the various states that determine their sensitivity, vulnerability and capacity to adapt. In fact, in line with Santos (2018), it is possible to consider that the development of these systems is inversely proportional to vulnerability and directly proportional to adaptive capacity, insofar as, as the same author states, "the lower human and material resources of less

developed countries decrease their adaptive capacity, making them more vulnerable to climate change than countries with advanced economies" (Santos, 2018, p.167).

In tropical Africa, the tree is a fundamental element of the entire environmental system. Forests are important ecosystems with high biodiversity. Despite the knowledge of the significant importance of forests, they

> continue to be cut down at a truly mind-boggling and drastic rate: currently, every 10 seconds, an area of rainforest equivalent to the size of a football field is lost, which in turn corresponds to the annual deforestation of an area equivalent to the size of England. As a result, little more than 20% of the forest cover that existed after the last glaciation (Würm) remains on the globe, that is, after the beginning of the current period, the Holocene (Anthropogenic) (Paiva, 2018, p.109).

It was mentioned earlier that human history has been characterized by the continued practice of deforestation, making it clear that there is a relationship, a link between forests, humans, and deforestation.

As Pereira (2014, p.25) points out,

> man's activities have been one of the main factors in deforestation. The repeated felling or destruction of trees at shorter intervals than the time needed for regeneration leads to deforestation. Overexploitation of wood resources, such as to obtain arable land, or space for grazing, or for urban and defense purposes, for example, have been justifications for deforestation.

As mentioned above, for a large part of human history, environmental resources were seen as unlimited (Gomes, 2018), so environmental awareness only really began to develop in the 20th century (Gomes, 2018; Gomes & Leong, 2023).

Even so, despite increased environmental awareness and a vast body of national and international environmental legislation, forest destruction continues to be a reality in various regions of the world today, such as the Amazon, Africa and Southeast Asia.

There are many factors contributing to forest decline and deforestation, from overpopulation and underdevelopment, to cutting down trees for the timber industry, overgrazing, fires and plowing for arable land (Ramade & Caquet, 1995).

Despite the economic added value of using forests, and/or the condition of economic dependence on forest resources, deforestation has a number of negative impacts, which have a profound impact on human beings and their safety, starting with the destruction of habitats and the loss of biodiversity, which is fundamental to human survival. Furthermore, as Seitz (1995, p.209) points out, deforestation "can lead to land erosion, can harden the soil and can make freshwater supplies irregular (...) Sometimes deforestation leads to too much water in the wrong places", potential consequences that can accentuate the effects of pre-existing factors of instability and insecurity and thus contribute to the triggering of crises and conflicts

There is also the danger that deforestation will contribute to accelerating global warming. According to Seitz (1995, p.211), "trees that are burned after being cut down (...) release carbon dioxide into the atmosphere. The great rainforests have been found to contain an enormous store of carbon and have been described by some as the lungs of the Earth, absorbing carbon dioxide and releasing oxygen". Consequently, deforestation, by accelerating global warming, contributes to generating negative effects of its own, which jeopardize environmental and human security in particularly vulnerable regions.

It is mainly in developing states, particularly in the Global South, that forest security remains drastically at risk. Poverty, which manifests itself through economic dependence on forests, is at the heart of the problem of deforestation, as is the case with hunger crises and the population explosion in the Global South.

And while development may be the key to reducing poverty and, consequently, the risks to forests, it can also, as mentioned, be a source of risk, leading to the destruction of forests through economic exploitation.

Another important issue to consider relates to efforts associated with REDD+ (Reducing Emissions from Deforestation and Forest Degradation+). REDD+ was established by the United Nations Framework Convention on Climate Change (UNFCCC) as a mechanism to combat global warming and climate change, succeeding the previous RED and REDD concepts. Since then, many REDD+ projects have been established in several developing countries with abundant forests, many of them in Africa (Flanery et al., 2019; Mbatu 2016, 2019; Mbatu & Eliamini, 2025; Pistorius, 2012).

According to Mbatu and Eliamini (2025), "following the initial draft reports on the UNFCCC REDD+ framework, scholars and forestry practitioners began to focus on Africa and the social, economic, cultural and political vulnerabilities and insecurities of readiness and implementation initiatives on the continent" (p.2). Since then, the literature on how REDD+ projects are developed in Africa and the challenges they present has grown significantly. However, this is an issue that will be discussed further below.

REDD+ reached its current configuration in 2008 during COP14, although the programme formally emerged in 2007, even though informal negotiations on "avoiding deforestation" had been ongoing for over a decade. Since 2007, the programme has undergone changes and expanded its scope, shifting from a focus on reducing emissions (RED) to a focus on reducing emissions from deforestation and degradation (REDD) in 2007 at COP13, and finally shifting to a focus on reducing emissions from deforestation and degradation, plus conservation activities, sustainable management and increasing forest carbon stocks (Mbatu & Eliamini, 2025; Pistorius, 2012).

In the following chapter, this discussion on the nexus between anthropogenic pressure and climate change is continued, applying what has been developed thus far to the specific case of tropical forests in the Great Lakes region.

6. Perspectives on tropical forests in the Great Lakes region

As discussed above, there is a particular interest in the region covered by the Democratic Republic of Congo, Rwanda and Burundi. The massive deforestation in these three states has profound impacts on the region's rainfall regimes, climate and biodiversity (Yohannes, 2008).

These three states cross the tropical rainforest region of Africa. In fact, the Democratic Republic of Congo and Gabon represent two of the nine states that have 80% of the world's tropical forests (Yohannes, 2008).

It is also important to highlight the significance of the Rwenzori Mountains, located on the border between the Democratic Republic of Congo and Uganda. According to Yohannes (2008, p.146), these mountains "covered by a variety of high-altitude cloud forests, are both important climate regulators and food sources. Acting as hydrological towers at the equator, these mountains intercept air and force it to precipitate, "and are therefore referred to by locals as" rain givers".

However, human penetration and deforestation of these ecosystems has jeopardized the services provided by these mountains and their wet forests, which are considered as important as the flow of the Nile itself.

Deforestation in this region began several centuries ago, with the arrival of farmers and pastoralist communities who began deforestation processes to obtain land for cultivation and grazing.

In addition, most of this area was off the slave labor trade routes, so there was a gradual increase in population density in the region, due to the displacement of communities seeking refuge. By the middle of the 20th century, this region had one of the highest rural population densities in Africa.

The increase in population density, accompanied by a consequent increase in the area of cultivated land, has contributed to a significant decline in forest area. By 1980, excluding wildlife conservation reserves and areas set aside for environmental protection, most of the available land in Rwanda and Burundi was being used for human agriculture and pastoralism.

Anthropogenic pressures on the forests were to increase with the development of agricultural production for export. In fact, in 1960, around half of the forests in Rwanda's northern volcanic region were made available for pyrethrum production. Other forest regions in Rwanda were made available for tea production. While in the Democratic Republic of Congo, forest regions were made available for the exploitation of quinine and coffee.

During the 20th century, particularly between the 1960s and the 2000s, there was a great deal of deforestation in the Great Lakes region. For example, during this century Rwanda's forest area fell from 30% to 7% and Burundi's forest area fell from 6% to 2% between 1976 and 1997.

In addition, Butler (2020) identifies some of the main traditional and current drivers of deforestation and forest degradation in the Democratic Republic of Congo: (i) small-scale subsistence agriculture; (ii) deforestation for charcoal and firewood production; (iii) urban expansion; (iv) mining; (v) and in the case of forest degradation, industrial logging.

But the drivers of deforestation and forest degradation in the Democratic Republic of Congo do not stop there. Constant political violence and intensive hunting practices and trade in what is commonly referred to as "bushmeat" also contribute to deforestation and forest degradation

In this scenario, forest degradation and deforestation are threats to the local and regional socio-ecological balance, an aspect which, as Chamard (1995) recalls, was proven by the desertification of parts of the Sahara and Sahel during the drought of 1968.

The current ecological crisis in Africa can only be seen as an accumulation of unresolved local crises that occurred during the second half of the 20th century. The seemingly never-ending population increase and, in particular, the legacy of colonial policies based on a market economy logic based on export agriculture, have contributed to "peasant horticultural crops being relegated to the background and pushed onto more fragile lands" (Bessis, 1995, p.373)

The environmental vulnerability of the Great Lakes region is deeply intertwined with demographic pressures, climate variability, and disputes over access to, control of, and exploitation of natural resources, among other factors. Beyond subsistence agriculture and fuelwood use, the exploitation of minerals such as coltan and cobalt, essential materials for global industries, particularly renewable energies and digital technologies, links deforestation to international supply chains. Thus, forest loss in Central Africa cannot be seen merely as a local environmental issue but as part of a global political economy of resources.

This interconnection also extends to the field of health, since deforestation and habitat fragmentation, and increased bushmeat hunting raise the risk of zoonotic disease transmission, as evidenced by outbreaks of Ebola and other epidemics in forested regions. Consequently, environmental degradation in Central Africa is directly tied to global health security.

At the social level, deforestation disproportionately affects different social groups, particularly vulnerable groups such as women and children in rural areas who depend on forests for fuelwood, food, and water. As forest resources diminish, women and children are forced to travel longer distances for basic needs, intensifying gender inequalities and undermining community resilience.

Efforts to address deforestation have been framed through initiatives such as REDD+ (Reducing Emissions from Deforestation and Forest Degradation), international conservation projects, and the African Union's Agenda 2063. However, these measures often face tensions between conservation, national sovereignty, and local development needs (Gizachew et al., 2017). Regional bodies like the East African Community (EAC) and the Economic Community of Central African States (ECCAS) provide platforms for transboundary cooperation, yet their effectiveness is limited by political instability and competing economic priorities.

In view of the region's environmental vulnerability, it is therefore necessary to try to restore the least degraded ecosystems and reforest forest areas that have been sacrificed to the detriment of economic income. In addition, human resources must be mobilized in order to increase and guarantee the protection of nature and the preservation of biodiversity, as well as ensuring food security for local populations. In essence, priority must be given to promoting the deep-rooted construction of sustainable and lasting economic and social development logics, which are consequently based on principles of intergenerational ethics.

It should also be noted that deforestation and the scarcity of other natural resources increase the potential for regional conflict. This is an environmental multiplier threat associated with a pre-existing escalation of tensions. In other words, the environmental insecurity that stems from the degradation of ecosystems leads to an increase in political, economic and social pressures that might otherwise remain dormant.

With regard to REDD+ in the region, the programme faces significant challenges in East Africa, particularly from the illegal trade in forest products, which threatens protected areas and conserved tree plantations, many of which originate and are traded from the Democratic Republic of Congo (Cavanagh et al., 2015; Mbatu & Eliamini, 2025). It is also important to note here that obstacles to the success of REDD+ programmes are often associated with pre-existing factors of instability, which contribute to the perpetuation of behaviours that undermine the sustainability and protection of forests, such as poverty, agricultural expansion, changing consumption patterns and increased consumerism, market failures, external debt, as well as various other issues associated with the incapacity and inefficiency of government infrastructure (Mbatu & Eliamini, 2025). Additionally, other factors such as restrictions on forest access, land tenure complexity, exclusion and non-community participation in REDD+ project implementation, contextual inequality in benefit sharing, and new government structures introduced at the local level may contribute to the development of conflicts associated with REDD+ projects. (Alusiola et al., 2021; Awung & Merchant, 2020; Chomba et al., 2016; Lord, 2025; Nketiah et al., 2023; Poudyal et al., 2020; Satyal et al., 2020; Schmid, 2023; Soliev et al., 2021).

In this sense, conflicts associated with the implementation of REDD+ programmes, according to Mbatu and Eliamini (2025), can take on various scales, ranging from social-political structure conflicts, regional dynamics of REDD+ conflicts, and multi-level REDD+ conflicts.

Starting with regional levels of REDD+ conflicts, we can talk about conflicts that occur at the local level, between communities (mainly rural) that are heavily dependent on forest resources for their livelihoods, involving issues such as shared benefits, lack of community involvement in projects (e.g. in the Democratic Republic of Congo), or restrictions on access to forests (Cavanagh &

Benjaminsen, 2014; Mbatu & Eliamini, 2025; Samndong, 2018). Conflicts that occur at the national level and, as such, concern disputes between local communities and governmental policies, insofar as national policies and strategies for forest management can exacerbate local conflicts by reducing community access rights. On the other hand, these conflicts may also result from competition among national priority sectors, such as forest conservation, energy production, or agricultural expansion (Kemerink-Seyoum et al., 2018; Mbatu & Eliamini, 2025; Rahlao et al., 2012; Scheba & Rakotonarivo, 2016). Furthermore, although less common, conflicts that manifest in a transboundary manner cannot exclude the possibility of national interests from different States entering into a competitive dynamic (Cavanagh et al., 2015).

Accordingly to Mbatu and Eliamini (2025)

> due to economic interests, ecological concerns, and governance issues, the implementation of REDD+ initiatives in Africa has resulted in conflicts with a strong regional component, putting the interests of the local populace at odds with environmental preservation" (p.8), furthermore "in Central Africa, conflicts brought on by political instability have an impact on the implementation of REDD+. For instance, while implementing REDD+ projects, the Democratic Republic of the Congo lacks good governance because of conflicts (Mbatu e Eliamini, 2025, p.8).

Consequently, the implementation of REDD+ projects in Africa reveals the occurrence of multilevel conflicts, insofar as we can often observe the overlapping of various levels of conflict.

Finally, with regard to the socio-political structure of REDD+ conflicts, these are conflicts that encompass power dynamics, governance arrangements, community exclusion, the territorialization of state control, and the militarization of conservation. They therefore result from a combination of exclusionary practices, power imbalances, and unmet community expectations (Mbatu & Eliamini, 2025).

Now, this typology of conflict can be organized in another way, dividing conflicts into vertical and horizontal ones. The former refer to conflicts between different levels of actors and authority, which may occur between citizens/communities and the government, or between different levels of governmental administration. The latter refer to conflicts that arise from competing uses of the same resource – for example, between energy production and agriculture – as well as conflicts between non-state actors, such as different communities, or between state actors due to competing national interests. Thus, we can say that issues such as competition among national priority sectors, conflicting national interests, or competition between rural communities dependent on natural resources for their livelihoods constitute horizontal conflicts. Meanwhile, issues related to access restrictions or disputes between local communities and governmental policies may constitute vertical conflicts.

7. Final remarks

Africa's colonial past has left deep scars on its political systems, the legacy of various unresolved environmental and population crises, various political, social and ethnic conflicts, among others, are all factors that have contributed to deepening human insecurity and Africa's ecological crisis.

Africa's abundance of natural resources has the potential to promote regional development, yet in most cases there are lower levels of economic growth and development than in other regions with fewer resources.

In tropical Africa in particular, the tree is an important asset in the environmental system, not only because in general it contributes to the subsistence of life on the earth's surface, guaranteeing a vast regional biodiversity, but also because it contributes to the livelihoods of many households and is seen as an important economic asset.

However, human beings are avid predators of natural resources, feeding their evolution and industrialization through their exploitation and, in many cases, jeopardizing the fragile and important eco-sociological balance.

Climate change has profound impacts on ecosystems, and ecosystems, such as forests, have the potential to impact climate change, not least because of their role as a carbon dioxide sink. The accelerated deforestation taking place in several forests, some of them in tropical Africa, is jeopardizing this important function.

Consequently, a number of other risks arise from this, including the potential for a reduction in the presence of other natural resources, contributing to the deepening of a situation of human insecurity across several communities in tropical Africa.

The scarcity of natural resources as well as environmental degradation has the potential to lead to various types of disputes, and although "environmental wars" do not generally occur, this does not mean that communities with different priorities will clash over the control and exploitation of the same resources, or that different border states will not clash politically and diplomatically over cross-border resources.

Environmentally induced instability does not in itself trigger conflicts. Rather, it leads to an exacerbation of pre-existing local, regional or potentially international tensions, which can develop into a larger-scale conflict and eventually contribute to the degradation or total loss of the resource in question.

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