



# Strengthening the Legal Framework of Protected Areas in the Amazon to Combat Climate Change

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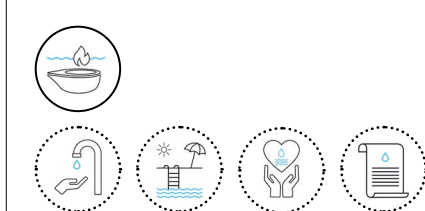
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*This article discusses the importance of increasing the percentage of protected areas and improving the efficiency of law enforcement in the Amazon rainforest. The Amazon's waters and forests are essential to the global ecosystem and both global and local climate changes are already having a significant impact on the region, as exemplified in 2023 by reduced precipitation in the region and extremely low levels of rivers like the Rio Negro. Yet, deforestation in the Brazilian Amazon is increasing, especially in those areas not protected by legal environmental legislation. Therefore, expanding legal protection is crucial for both global climate adaptation and the conservation of the natural and cultural heritage of water systems.*

**Keywords:** Amazon, protected areas, deforestation, climate change, drought



## KEY THEMES



< Fig. 1 Close-up view: Sand along the Rio Negro, exposed by extreme drought in the Anavilhanas region in October 2023 (Source: Reco Nunes, 2023).

## Introduction

This article presents Brazil's legal framework for protected areas. Focusing on the Brazilian Amazon, it argues for the need to increase the percentage of protected areas and improve the country's legal framework and law enforcement. Protecting the Amazon, the largest rainforest, river system and freshwater resource on the planet, is key to combating climate change.

This article highlights the role of officially designated Conservation Units and Indigenous Territories, part of the Brazilian National System of Nature Conservation Units (SNUC), in protecting the rainforest. This can be seen in satellite images, which show how the deforestation process has stopped around the polygons of these conservation areas. The satellite imagery also shows which Conservation Units and Indigenous Territories are under the most pressure from land-use change in the Amazon, which is linked to the expansion of agribusiness.

More than 30 per cent of Indigenous Territories in Brazil, most of them in the Amazon region, are waiting to be officially recognized under the SNUC (ISA 2018). It is crucial to speed up the process of creating a legal framework for these territories, which are vulnerable to deforestation.

The greatest threat to these areas is the expansion of large-scale agriculture and cattle ranching. Increased economic activity, combined with a lack of law enforcement and deforestation of the Amazon rainforest, could lead to an increase in the frequency and severity of extreme weather events worldwide (Harris et al. 2021). Climate change is also being felt strongly in the Amazon region, such as in the extreme drought of the Amazon River system in 2023. This article uses the case of the Rio Negro as an example of this process.

Because deforestation is directly linked to unprotected land, it is critical to expand protected areas, including aquatic ecosystems. Increasing the number of protected areas (and supporting their maintenance through law enforcement) will help conserve biodiversity and recognize and value the role of traditional communities, such as Indigenous and Quilombola, in controlling deforestation in their territories.

Legal frameworks are an important way to protect areas from extractive, mining and agribusiness activities. They can also help preserve traditional cultural practices and knowledge. Given the intensification of events related to climate change, protecting the Amazon's natural environment has become a global responsibility, which includes protecting the forest, rivers, cultural heritage and communities that depend on the forest. This will help conserve the natural environment for future generations and alleviate the effects of climate change globally.

We begin this article with an overview of the Amazon rainforest and watershed and present data on deforestation trends between 1985 and 2020. Then, we address the legal framework of the Brazilian system of protected areas, highlighting the crucial role of Conservation Units and Indigenous Territories in combating deforestation and therefore climate change. We use examples of Amazonian areas under the protection of the Brazilian national heritage system. We use UNESCO World Heritage Sites to demonstrate how measures for protecting natural and cultural heritage can help limit deforestation. Finally, we consider the case of the Rio Negro and the Anavilhanas National Park to illustrate the impact of climate change on protected areas. The article concludes with strategies and policy recommendations to support the protection of the Amazon rainforest.

## **Overview of the Amazon Rainforest and the Deforestation Process**

The Amazon covers 944 million ha, occupying 47 per cent of South America, an area shared by nine countries, of which Brazil has the largest area (61.9 per cent, or 521.9 million ha), divided between nine federal states. As the world's largest rainforest, the Amazon is responsible for crucial global ecosystem services, including support for biodiversity, carbon storage, regulation of water cycles, and many more. As Brazil's largest biome, it covers 49.3 per cent of the country's territory. It also contains 20 per cent of the world's available water and mineral reserves. The Amazon rainforest is considered the most diverse biological reserve on the planet, possibly containing half of the world's biodiversity (IBGE 2024).

Over the past forty years, the Amazon has experienced massive deforestation, which continues at a rapid pace today. From 1985 to 2020, the Amazon lost 74.6 mha of native vegetation, of which almost 60 per cent occurred in Brazilian territory (Mapbiomas 2021). Deforestation in the Amazon region is mainly caused by anthropogenic activities, especially cattle ranching and agriculture, which account for 99 per cent of deforestation and put considerable pressure on the remaining forests and their watersheds (Mapbiomas 2022; Figueiredo, Cak and Markewitz 2020; Junior and Dziedzic 2021).

The Amazon River system is the largest watershed in the world, covering 7 million km<sup>2</sup> in Brazil, Bolivia, Colombia, Guyana, French Guiana, Peru, Suriname and Venezuela. About 4 million km<sup>2</sup> are in Brazil (Toda Matéria 2024). It covers the central and eastern areas of South America and is mostly tropical rainforest with great biodiversity (OAS 2005). The Amazon River, which flows approximately 7,100 km from Peru to the

Atlantic Coast of Brazil, is the longest, widest and deepest river in the world. The watershed includes 10 sub-watersheds, including the Negro, Solimões, Xingú and Madeira.

The Amazon basin holds 73.6 per cent of Brazil's accessible water, and it is strained by the increase in economic activities. Of all water consumed in Brazil, 79 per cent is used in agribusiness (Agência Nacional De Águas 2019). Beef cattle production affects the value of the water footprint, with the impact depending on the specific characteristics of each animal and the management solutions (Palhares, Morelli and Novelli 2021).

In addition to their considerable water use, agriculture and livestock farming use large amounts of fertilizer, which is a source of pollution. This has a major impact on water bodies and on the many communities that live around rivers and/or depend on fishing. Furthermore, mining activities, also responsible for river pollution, have increased by 1000 per cent between 1985 and 2021, impacting riparian communities and Indigenous territories especially (MapBiomas 2022).

For these reasons and many others, water and nature need to be protected (Catalão and Ribeiro 2023; Fantini 2020; Anand 2007). Although the United Nations General Assembly (2010) has recognized the human right to water and sanitation, including water justice and ethics, the effectiveness of these measures is still a matter of debate.

## **Legal Frameworks in Place for Brazilian Protected Areas**

Brazil has a binary legal system for protected areas, with two legal frameworks that are part of the National Environmental Policy. They

sometimes overlap to protect areas. The first is the Federal Forest Code, created in 1934, and updated several times before the enactment of the current legislation (12.651/12) of 2012. The second is the National System of Nature Conservation Units (SNUC), a federal law (9.985/00) created in 2000. Together, they protect the natural landscape, biodiversity, natural environment and bodies of waters under Brazilian jurisdiction, through the creation of protected areas or territories.

The main legal and practical difference between the two legislations is that SNUC areas must be created and regulated by law, whereas Forest Code areas, which exist throughout the country, don't need to be created and regulated because they are defined by geomorphological characteristics. Conservation Units must be created by the government at a particular level, such as municipal, state or federal. They are created when a specific conservation need is identified.

The SNUC defines Conservation Units as an area that includes environmental resources, including jurisdictional bodies of water, with significant natural characteristics. These can have different levels of restrictions on use – they can be integral protected areas or sustainable use areas. In the SNUC legislation, the Indigenous Territories and the Quilombola Territories are identified as Conservation Units that involve local and traditional communities as caretakers of the forest and its resources. On the other hand, the Forestry Code will protect, for example, Permanent Protected Areas (APPs), such as APPs of watercourses or hilltops. This means that in Brazil every river is protected by law as an APP, and some rivers could be covered by a second legal protection framework, for example as part of a SNUC unit.

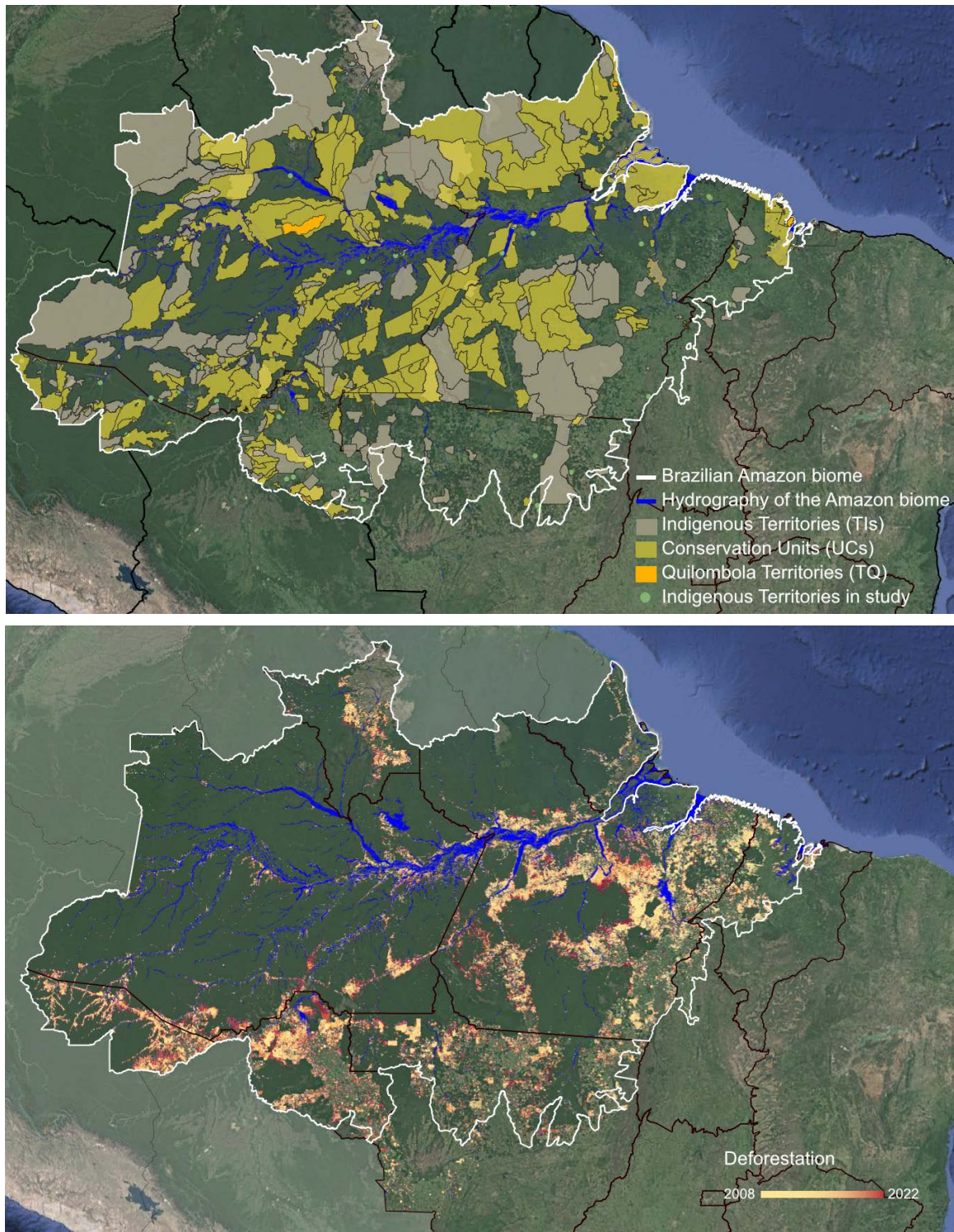
In terms of area, the SNUC will play an important role in the protection of the Amazon rainforest,

as the existing Conservation Units cover a large part of the rainforest. In addition, the Forestry Code provides an extra layer of protection for watercourses throughout the Brazilian territory, including the Amazon rivers. The SNUC also protects and regulates the Indigenous Territories and Quilombola Territories, as mentioned above.

Conservation Units and Indigenous Territories are territorial designations that strongly combat deforestation and support the conservation of biodiversity in Brazil. Both are legally established by public authorities, and include federal, state, district and municipal protected areas. There are more Indigenous Territories than Quilombola Territories in the Amazon rainforest. In the state of Amazonas, for example, there are 8 officially recognized Quilombola Territories and 164 Indigenous Territories (Oliveira and Matta 2022).

In terms of the administration of those areas, the Indigenous Territories are coordinated and protected by FUNAI - the National Indigenous Foundation, which protects Indigenous culture, territories and forest areas. There are also many non-governmental organizations that support the Indigenous Territories. Among the Conservation Units, the federal areas are managed by the Chico Mendes Biodiversity Institute (ICMBio), while the other areas are managed by state and municipal environmental agencies.

However, even with a binary legal framework of protected areas, this system is failing to adequately protect the Amazon rainforest. The primary reasons are a lack of law enforcement and a weak legal framework, which will be discussed in more detail in the next sections of this article.



^ Fig. 2 Indigenous Territories and Conservation Units play a vital role in combating deforestation expansion in the Brazilian Amazon biome area (Source: Donoso, 2024, using data from Mapbiomas, FUNAI, Agência Nacional De Águas and the Brazilian Environmental Ministry).

### **The Vital Role of the Conservation Units and Indigenous Territories in Combating Deforestation**

The Amazon biome is present in nine of Brazil's states: Acre, Amazonas, Amapá, Pará, Roraima, Rondônia, Mato Grosso, Tocantins and Maranhão, with Amazonas having the largest share. Some of the states also contain other biomes, such as the Cerrado and the Pantanal. Rondônia has 99 per cent of its territory covered by the Amazon biome, while Mato Grosso has 54 per cent, Maranhão 34 per cent and Tocantins 9 per cent (IBGE 2004).

Considering deforestation, Rondônia, Mato Grosso and Pará stand out. Rondônia has lost more than 34.3 per cent of its native vegetation area and Mato Grosso has lost 29.4 per cent. Both states also share the highest percentage of vegetation loss within state Conservation Units. This reflects the expansion of agribusiness, which state policies have favored: In Mato Grosso, one of the national leaders in meat and soy production, only 3.5 per cent of the state is protected under the SNUC legislation. In Rondônia, also a relevant state for meat production, Conservation Unit status protects only 8.6 per cent of the state and the expansion of cattle ranching continually threatens to further reduce the protected areas; as exemplified in the Jaci-Paraná protected area (Wenzel, Hofmeister and Papini 2021; Wenzel and Isensee e Sá 2018).

The Indigenous Territories represent 22.5 per cent of the Brazilian Amazon. Of a total of 676 Indigenous territories in Brazil, 67.8 per cent are legally designated as Indigenous Territories. The other 32.2 per cent of the territories are waiting for legal recognition, and this process depends on the political support of the federal government (ISA 2018). In Amazonas, approxi-

mately 27 per cent of the state's territory is protected as Conservation Units.

Deforestation rates in the Amazon Conservation Units and Indigenous Territories are lower than those in unprotected areas. However, they still face increasing pressure from agricultural expansion along with an inadequate territorial protection structure and a lack of surveillance (fig. 2).

### **Amazonian Territories Protected by National Heritage and UNESCO World Heritage Designations**

Water and the rainforest in the Amazon region are systemically connected to the global climate. Since the 2000s, watersheds in the Amazon region, like that of the Rio Negro, have been protected by national heritage and UNESCO World Heritage designations. However, these areas are still experiencing the consequences of climate change.

The Central Amazon Conservation Complex is a UNESCO World Heritage site due to its rich biodiversity and natural environment. The protected area includes the Jaú National Park and the Anavilhanas National Park, an archipelago of river islands, both located in the state of Amazonas (UNESCO n.d.), in the watershed of the Rio Negro. This watershed covers an area of approximately 690,000 km<sup>2</sup>, or 11 per cent of the Amazon basin. The Rio Negro is one of the largest rivers in the world, famous for its natural heritage. The region is characterized by a landscape of rivers and sandy beaches during the dry season and flooded forests during the rainy season. In addition, more than 17 archaeological sites have been identified along the banks of the Rio Negro.

The Brazilian Institute for Historical and Artistic National Heritage (IPHAN) is responsible for the



^ Fig. 3 The Brazilian Rio Negro and the Anavilhanas National Park (Source: Verônica Garcia Donoso, 2024).

protection of Brazil's material and non-material heritage, including that of the Amazon region. The protection effort in the Amazon region has been intensified since 2000 with the expansion of the legal framework for protected areas, taking into account the cultural elements of riparian and Indigenous communities (IPHAN 2007).

River water is sacred to many Indigenous communities in the Amazon. For this reason, some water-related landscapes in the Brazilian Amazon are protected, such as the Lauaretê waterfall, a sacred place for the Indigenous communities of the Uaupés and Papuri Rivers (Federação das Organizações Indígenas do Rio Negro 2013–2015). The confluence of the Negro and Solimões rivers in the city of Manaus was also declared a Cultural and Natural World Heritage Site by IPHAN in 2010. The Rio Negro, with its dark and transparent waters, meets the Solimões River, with its muddy waters, and they

run side by side for 10 km before merging to form the Amazon River. The traditional agriculture system of the Rio Negro was designated cultural heritage by IPHAN in 2010.

The waters of the Rio Negro are formed by several rivers, including the Uaupés, Içana, Curicuriari, Marié and Xié. This is a vast region that reaches the borders of Colombia and Venezuela (fig. 3). Currently, 23 million ha of rivers and forests form the socio-environmental territory of the Rio Negro, 65 per cent of which has Conservation Unit status, including nine Indigenous Territories. About half of this area has been declared a Ramsar site, an international convention that recognizes the environmental importance of river areas. This socio-environmental territory has around 33,600 inhabitants, with more than 80 per cent of the total population living in Indigenous Territories. Some Indigenous communities are in riparian areas, while others



are inside the forest. Across this rich territory, connections between people depend heavily on the river (Scolfaro and Dias 2021).

### **Climate Change, Protected Territories and the Drought of 2023**

Alterations in the hydrological cycles of the Amazon are associated with shifts in the global climate, and these alterations are exacerbated by human activities in the Amazon. These activities include the clearing of forested areas.

In the latter half of 2023, the Brazilian Amazon experienced extreme weather events, which hit the state of Amazonas especially hard. These events prolonged and intensified the dry season and raised temperatures in the region, significantly impacting local communities, biodiversity, transportation, energy production and health (Mazzini 2023; Oliveira 2023). The reasons for this extremely dry weather are multiple and interconnected. They include the increase in global temperatures, high temperatures in the North Atlantic, a stronger El Niño event due to increased ocean temperatures, global heating and rainforest degradation due to slash-and-burn agriculture.

On November 30, 2023, the World Meteorological Organization (2023) published a report announcing that the year had been the warmest on record. Temperatures rose approximately 1.40 degrees Celsius above the pre-industrial baseline of 1850–1900. The report also noted the lowest recorded levels of sea ice in the Antarctic, and intense fires in many parts of the world, including Hawaii, Canada and southern Europe, alongside numerous extreme weather and climate events globally.

The extreme dry season experienced in Brazil's Amazon in 2023 served as a stark indicator of

the impact of climate change. This was not the first instance of a longer and intensified dry season in the Amazon, a trend that has been escalating annually. The year 2023 saw the Amazon River reaching its lowest water level in 121 years of record-keeping, revealing vast stretches of riverbed sand (fig. 4). This led to higher water temperatures in rivers and lakes, along with an increase in wildfires. The consequences for biodiversity and local communities were profound, resulting in the death of numerous river dolphins and fish and the isolation of forest and riverside communities.

### **Conclusion**

Scientists predicted this extreme drought in the Amazon region, along with many other extreme weather events around the world. The Intergovernmental Panel on Climate Change (IPCC)'s AR6 Synthesis Report (2023), emphasizes that despite progress in climate discussions globally, we are still not implementing changes quickly enough. It is crucial to reduce greenhouse gas emissions to limit global heating before 2030 and to devise effective mitigation and adaptation measures. The report emphasizes the need to combat deforestation, preserve forests and expand renewable energy sources in Brazil.

The primary causes of deforestation are the expansion of agriculture and ranching, illegal logging, fires and unregulated mining. Anthropogenic activities, such as pesticide use in agriculture, solid waste dumping, inadequate wastewater treatment in populated areas and illegal mining activities that release mercury into river water, cause water pollution. A robust legal framework for SNUC is essential to safeguard the rainforest, as it provides legal protection against extractive, mining and agribusiness activities.

Although the link between deforestation and



^ Fig. 4 Sand along the Rio Negro, exposed by extreme drought in the Anavilhanas region in October 2023 (Source: Reco Nunes, 2023).

climate change is well-established, there is a stronger emphasis on theory than on action in combating these issues. Deforestation is often driven by economic interests, resulting in a lack of long-term perspective in resource management. Addressing urgent environmental problems requires global and local action, institutional frameworks and technical capacity. A shared national and international vision is critical, particularly in the case of the Amazon region.

Strategies to support the protection of Amazonian Conservation Units include involving local communities, supporting the use of remote

sensing techniques, strengthening and expanding environmental inspection bodies such as ICMBio, and improving the situation of environmental inspectors through higher salaries and career advancement. Two of the main federal institutions in charge of environmental inspection, Ibama and ICMBio, need additional inspectors working throughout the country (El País 2019; Pajolla 2024).

Enhancing environmental agencies and increasing the number of inspectors in the Amazon are crucial steps to forest protection. Unfortunately, these efforts depend on governmental backing since recruitment typically occurs through pub-

lic competitive exams. Moreover, employing remote sensing technologies, like satellite imagery, is vital for enforcing legal sanctions on products derived from illegal activities, thereby intensifying anti-deforestation efforts. Local communities must also be involved in efforts to tackle deforestation.

Because deforestation happens most often on unprotected land, expanding protected areas in the Amazon is critical. This includes increasing the protection of water-related landscapes. In addition, increasing the number of Conservation Units, Indigenous Territories and Quilombola Territories (and supporting their maintenance through law enforcement) should help conserve biodiversity, while recognizing and valuing the importance of traditional communities in controlling deforestation. Protected areas are key because the legal framework protects territories from extractive, mining and agribusiness activities. It also protects traditional and cultural practices and knowledge.

### Policy Recommendations

- Speed up the process of legal recognition of the Indigenous Territories – 30 per cent of the Brazilian Indigenous Territories are still waiting to be made official.
- Strengthen law enforcement to avoid the vulnerability of the Indigenous Territories by increasing the number of independent environmental inspectors; expand the use of new technologies like remote sensing for land-use analysis, with the engagement of local communities directly involved in the protection of Indigenous Territories and Quilombola Territories.

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