THE AMAZON RAINFOREST AND BEYOND:
THE ROLE OF NATURE IN ADDRESSING CLIMATE CHANGE

Luís Roberto Barroso[1]

SUMMARY

I. INITIAL REMARKS

1. I want to thank the organizers of the World Economic Forum for the invitation and cordially greet the other participants of this panel. And I begin with an observation.

a) I am not an environmental scientist, climatologist, or even less an activist for environmental causes. I am a constitutional judge and a law professor.

b) However, I am a constitutional judge and a professor in a country in which the Constitution and legislation give special importance to environmental issues, including and notably to the Amazon, and to tackling climate change. The Judiciary in Brazil – and also the Supreme Court – rules on numerous issues on the subject.

c) For this reason, as a judge and as a professor who is interested in global issues, I have dedicated time to this subject, reading some of the leading authors on the topic and working to systematize knowledge in this area.

---

[1] President of the Supreme Court of Brazil. Professor at the University of Rio de Janeiro State. LL.M., Yale Law School. Senior Fellow at the Harvard Kennedy School.

2. There are three specific issues I would like to address: a) the importance of the Amazon, due to the environmental services it provides; b) the risks that the Amazon currently faces and the consequences of a world without the Amazon; and c) some paths to preserving the Amazon Rainforest.

3. Before moving on, I highlight some geopolitical data about the Amazon:

a) the Amazon or Amazon Basin occupies an area equivalent to about 40% of South America;

b) the region comprises the territory of 9 countries, but 60% of its extension is located in Brazil. Around 28 million Brazilians live in the so-called Legal Amazon; and

c) the region is home to a variety of peoples and cultures, including dozens of indigenous tribes (almost 200 distinct peoples), around 50 of which are isolated or have little contact with the outside world.

Part I

THE IMPORTANCE OF THE AMAZON TO BRAZIL AND TO THE WORLD

I. BIODIVERSITY

The Amazon is the largest tropical rainforest in the world and plays a critical role in the ecological balance of the planet, for multiple reasons. In the first place, for its extraordinary *biodiversity*, comprising the largest concentration of plants and animal species on Earth. It is needless to emphasize that deforestation leads to the extinction of species, with unpredictable systemic consequences for the environment.

II. ROLE IN THE WATER CYCLE

A second reason for the importance of the Amazon Rainforest is its role in the water cycle and rainfall regime, with impacts on the soil, atmosphere, rivers, and oceans, with implications across the South American continent. "Flying rivers" irrigate other river basins and bring rain to other regions of South America, especially to the Brazilian Midwest, the country's main agricultural production area.

⇒ The Amazon is home to 20% of the planet's total freshwater, which is discharged into the ocean.

III. CARBON ABSORPTION

Thirdly, the forest plays a very important role in mitigating global warming, absorbing and storing carbon dioxide through photosynthesis. It is easy to understand that, with deforestation, it not only stops absorbing carbon but also releases it back into the atmosphere. Moreover, reforestation of degraded areas increases carbon absorption by the forest.

⇒ In a nutshell: the Amazon is at the "confluence of at least three global systems that support life as we know it: biodiversity, freshwater, and carbon."[2] It is impossible to overstate its importance in mitigating global warming. In fact, it is impossible to achieve the goals of the Paris Agreement without ending deforestation in the Amazon and, more importantly, restoring large areas that have been degraded.

Part II

RISKS THE AMAZON IS FACING

I. ENVIRONMENTAL CRIMES

1. The Amazon is the victim of a wide range of environmental crimes. Environmental crimes are among the most lucrative forms of criminal activity. The main crimes committed in the region include:

a. *Deforestation* (the primary cause of deforestation in the Amazon Rainforest is the establishment of pastures for cattle ranching);

b. *Forest fires* (which allow for quick suppression of vegetation, clearing areas for cattle ranching and agriculture);

c. *Illegal logging and timber trade* (a significant portion of timber production is illegal, with estimates ranging from 40 to 80%);

---

[2] João Moreira Salles, *Arrabalde*, 2022, at 21. Translated from the original in Portuguese.

d. *Illegal mining* (the main consequence of illegal mining is not deforestation but the contamination of rivers with mercury); and

e. *Land grabbing* (a crime that is encouraged by successive laws that allow the regularization of publicly owned areas improperly appropriated).

2. The destruction of the forest usually follows a consistent pattern: illegal timber extraction, fires, occupation by farmers and producers (cattle and soy), and attempts to legalize the illegally occupied public land. Cattle ranching accounts for approximately 90% of Amazon deforestation.

3. A worrying observation: environmental crimes are beginning to contaminate the political and economic environment of the Amazon. Timber loggers, miners, and land grabbers have gained political influence or even run for office.

II. OTHER CRIMES

In addition to environmental crimes, there are other related crimes:

1. The murder of forest defenders;

2. Corruption of public officials to turn a blind eye to crimes or to regularize illegally occupied properties;

3. Exponential increase in the number of homicides associated with illegal mining, illegal logging, and land grabbing.

On top of this, there is a problem that has been growing increasingly worse in recent times: the Amazon region has become relevant in international drug trafficking, with municipalities located along the water and road routes used by traffickers. In short: there is a risk of Brazil losing sovereignty over the Amazon, not to other countries, but to organized crime.

III. THE RISKS OF A WORLD WITHOUT THE AMAZON

1. Scientists believe that if deforestation reaches 20 or 25% (we are currently close to 17%), combined with current levels of global warming, there will be a tipping point, a point of no return, with irreversible "savannization" of a significant part of the

region.[3] The consequences of a world without the Amazon are "catastrophic" for the planet and for Brazil.

2. First of all, there will be a worsening of climate change due to the loss of its role in storing carbon. In addition to the increase in global warming, there will be a drastic reduction in rainfall, which is essential for Brazilian agribusiness and electric energy generation. [4] It is worth mentioning that there will be no powerful agribusiness without the Amazon.

3. Furthermore, water scarcity will also jeopardize the industry, the supply of populations, and life in cities. The loss of biodiversity will also bring unforeseeable consequences with the disruption of ecosystems and the risk of the emergence of new diseases.

Part III

SOME PATHS TOWARDS PRESERVING THE FOREST

I. COMMAND AND CONTROL ACTIONS

1. The first step towards preserving the forest is the resumption of command-and-control efforts, tackling illegal activities carried out in the region. These efforts had been substantially interrupted in the previous government, including the dismantling of agencies dedicated to environmental protection and the protection of indigenous communities.

2. In this regard, throughout the first year of the new government, the simple change in attitude towards environmental protection and the Amazon has already led to a

[3] According to the explanation I kindly received from Professor Carlos Nobre, the calculation of the tipping point is done as described below. There are three situations considered: 1. With deforestation alone and without any global warming, the tipping point would be 40% of deforestation; 2. If there is zero deforestation in the entire forest and only global warming, an increase of 4°C (four degrees Celsius) will reach the point of no return; 3. Deforestation and global warming occurring simultaneously, as in the current situation: the tipping point is reached if deforestation exceeds 20 to 25% of the forest and global warming reaches 2 to 2.5°C.

[4] João Moreira Salles e Bernardo Esteves, O mundo sem a Amazônia. *Revista Piauí*, 17 oct. 2019.

reduction of around 50% in deforestation compared to the levels of the previous year. This reveals that the political will to address the problem makes a major difference.

a) Experience proves the efficiency of law enforcement (surveillance and repression) against illegal activities.

b) Between 2005 and 2012, with the implementation of the Action Plan for the Prevention and Control of Deforestation in the Amazon (PPCDAm the acronym in Portuguese), which included command and control as one of its main components, deforestation dropped from 27,772 km^2 in 2004 to less than 4,600 km^2 in 2012.

c) This was the largest contribution made by a single country to mitigate global warming. Beginning in 2013, measures have been relaxed, and consequently, deforestation increased, peaking between 2019 and 2022.

3. However, command and control efforts alone are not enough to keep the forest standing. We need to provide dignified living conditions for the region's indigenous peoples and for the approximately 28 million people who live in the Brazilian Legal Amazon.

⇒ Next, I list some pathways to provide economic and social feasibility to the Amazon region.

II. POTENTIAL FOR AN EXPRESSIVE INCREASE IN THE PRODUCTION AND EXPORT OF FOREST PRODUCTS[5]

1. It is possible to significantly increase the production and export of forest products by competently entering global value chains. There is a relevant international market for these products, including açai, banana, pineapple, cocoa, pepper, nuts, vegetable oils, and fish.

2. Despite hosting one-third of the world's tropical forests, Brazil has a negligible share of the international market for forest-compatible products. Between 2017

[5] This topic draws on the ideas of Professor Salo Coslovsky, a professor at the School of Public Affairs at New York University, as discussed in João Moreira Salles' book "Arrabalde" (2022) and Míriam Leitão's book "Amazônia na Encruzilhada" (2023).

and 2019, this market generated nearly180 billion U.S. dollars, with Brazil's participation being less than 300 million.[6]

3. To enter this market competitively, labor, environmental, and sanitary standards must be respected, and qualified partners are needed for the logistics and international marketing of these products, ensuring they travel with adequate quality standards from the producer to the final distributor.

III. ADDING INDUSTRIAL VALUE TO FOREST PRODUCTS

1. Increasing the share in the international market for natural products does not exclude the importance of investing in technology and innovation for processing and adding value to these forest products, creating a more sophisticated bioeconomy, *bioindustrialization.*

2. This is the idea long held by Professor Carlos Nobre, focusing on the use of biological assets from the Amazon to produce pharmaceutical, cosmetic, and food products, as well as research into new materials and energy solutions. This knowledge-based economy requires resources both scientific and traditional.

3. An example of this is the project he is developing, called "Amazônia 4.0",[7] aimed at training local producer communities to add value to products such as cocoa and cupuaçu, transforming them into chocolate and cupulate (chocolate made from cupuaçu).

⇒ In short: the forest's bioeconomy should encompass industrialization, innovation, research, technology, and, of course, financial investments.[8]

IV. RESTORATION OF DEGRADED AREAS

1. Despite the exuberance of the forest, the soil in the Amazon is not in itself fertile. Therefore, deforested areas, three to five years, become degraded and unproductive,

---

[6] Míriam Leitão, *Amazônia na encruzilhada*, 2023, p. 345.

[7] For details on the project, *see* https://amazonia4.org.

[8] *See* in this regard, the study sponsored by WRI Brazil and The New Climate Economy, titled *Nova Economia da Amazônia* ("New Economy of the Amazon"), from June 2023.

and are often abandoned by their occupants. In the Legal Amazon there are 240 thousand Km^2 (square kilometers) of degraded or abandoned areas, which corresponds to the size of the state of São Paulo or the United Kingdom[9].

2. Much of these deforested areas can potentially be restored, returning the forest to its original state. As a result, these areas could once again provide relevant environmental services, including carbon storage. Incidentally, good news: it is estimated that there are 12 million hectares undergoing natural recovery in the Amazon biome. It is worth mentioning that this is not a reforestation project but rather nature alone reestablishing itself.

⇒ Here there is a point of interest to note: a mature forest, like the Amazon Rainforest, has a large amount of carbon stored, but it is no longer actively contributing to global warming mitigation. In other words: if it is cut down, it releases carbon into the atmosphere, but it no longer stores additional carbon. However, a restored forest would play this role and could potentially become an economic asset.

3. It is also possible to allocate these degraded or abandoned areas for agricultural or cattle ranching, with an effort to refertilize the soil. This would help avoid the pressure to expand new deforestation frontiers for the development of these activities. All this requires investment and technology, but the benefits would be visible.

V. INVESTMENT IN LOW CARBON AGROBUSINESS WITHOUT INCREASING DEFORESTATION

1. Agribusiness – including agriculture, cattle ranching, inputs, industrialization, and associated services – has become one of the main economic activities in the country and the Amazon, accounting for approximately 25% of the national GDP.

[9] João Moreira Salles, *Arrabalde*, 2022, at 17 e 354.

⇒ Incidentally, the growth of agribusiness and its international competitiveness is clear proof that investment in technology has a critical impact on productivity and relevance of any economic sector.[10]

2. On the other hand, agribusiness, especially cattle ranching, contributes significantly to global warming, both through the direct emission of greenhouse gases (particularly methane) and deforestation (release of CO_2). Methane emissions are a natural product of the digestive process from cattle and cannot be avoided through technological means. Therefore, the alternatives to address the impact of agribusiness on climate change include combating deforestation and improving the use of the soil.

3. Livestock farming, as noted earlier, is responsible for around 90% of deforestation in the Amazon Rainforest. This surge must be avoided, and the deforestation that has already occurred should be addressed through the restoration of degraded pastures and forest recovery focused on the bioeconomy. Better use of the soil through intensive cattle raising – which requires more capital and employs more people – generates greater productivity with less demand for land.

4. Agriculture also needs to transition to low-carbon production and strategic land use, employing alternative planting techniques and technology. This involves changes such as rainwater harvesting, no-till farming, composting, etc.[11] To achieve this, small-scale farmers and, above all, family farming, must have access to credit support and technical assistance.

5. Here, there is a significant point to be explored: the positive correlation between deforestation control and increased productivity. At the end of Fernando Henrique's presidency and during the first two terms of Lula's presidency, a "border closure" policy was adopted, primarily through the creation of conservation units and

---

[10] In the specific case of agribusiness, its advancement is often associated with the creation of Embrapa – Brazilian Agricultural Research Corporation – in the 1970s.

[11] For a survey of low-carbon practices, *see* "WRI Brasil and The New Climate Economy, *Nova Economia da Amazônia*, from June 2023, at 133.

effective enforcement. The difficulty of opening new pasture and crop areas forced producers to become more competent.

⇒ The result was that while deforestation was reduced by more than 80%, agricultural production in the Amazon increased by 37%.[12]

6. It should be noted that the global consumer market will increasingly demand certifications and traceability, rejecting production that come from deforestation or has high greenhouse gas emissions. Adapting to this reality is in the best interest of agribusiness itself.

VI. LEGAL INDUSTRIAL MINING, SUPPORTED BY SOCIAL IMPACT ASSESSMENT

1. The Amazon is home to some of the world's largest mineral reserves on the planet. Its exploitation is a controversial topic, which requires an analysis without radicalism. An important initial observation is that, within the current constitutional and legislative framework, mineral exploitation on indigenous lands is strictly prohibited.

2. A second observation is that mining, while not entirely harmless, has much less impact on the rainforest than other activities, such as cattle ranching, agriculture, logging and – this deserves highlighting – wildcat mining (artisanal mining, garimpo in Portuguese). Research reveals that less than 1% of all deforestation in the Amazon can be directly attributed to mining.[13]

⇒ Wildcat mining, as already noted, is much more detrimental to the forest due to the use of mercury, that pollutes rivers and contaminates native populations. This is not the case with industrial mining, which thus presents itself as a less harmful alternative. Preventing the exploitation of mineral wealth is not easy, and it is better that it is done legally.

3. Furthermore, there are mineral resources that are essential in the energy transition and the construction of infrastructure for a low-carbon economy. The Amazon

---

[12] João Moreira Salles, *Arrabalde*, 2022, at 160-163.

[13] João Moreira Salles, *Arrabalde*, 2022, at 350.

holds reserves of global expression in relation to some of them. The World Bank itself has proposed ways to mitigate deforestation and other negative impacts of mining.[14]

⇒ In view of this, legal and regulated mining, preceded and supported by the necessary environmental and social impact studies, along with appropriate preventive and remedial measures, can contribute to the region's wealth. However, the taxation model currently in place brings few benefits to the states in the region and their populations. This is a point that can be reconsidered.

VII. LEGAL TIMBER EXTRACTION WITH RESPONSIBLE FOREST MANAGEMENT

1. Illegal logging is often the initial chapter in the deforestation process, an environmental crime that often goes unpunished. Nearly 40% of logging in the Amazon is illegal.[15] What's worse: its commercialization often involves fraud, false documentation, and corruption of public authorities.

2. Timber, however, is an essential raw material for a wide variety of products necessary for modern life. These include paper, packaging, diapers, surgical masks, furniture, laminate flooring, as well as various other uses, ranging from the textile to the pharmaceutical industries. In other regions of the country, the industry of cultivated trees has generated income, jobs, and had an impact on the trade balance.[16]

3. With the necessary precautions and prevention, compliance with the legislation, and proper oversight, legal timber extraction is possible and desirable, through concessions, permission, or state authorization in undesignated public areas. All of this

---

[14] *See* WRI Brasil e The New Climate Economy, *Nova Economia da Amazônia*, de junho de 2023, at 141 e 146.

[15] "Imazon: Nearly 40% of illegal timber extraction in the Amazon is unauthorized, reveals unprecedented research. September 30, 2022." Available at https://imazon.org.br/imprensa/quase-40-da-extracao-de-madeira-na-amazonia-nao-e-autorizada-mostra-pesquisa-inedita/.

[16] *See* Relatório IBA – Indústria Brasileira de Árvores, *Relatório Anual – 2023* (IBA - Brazilian Tree Industry IBA , Annual Report – 2023). Available at https://iba.org/datafiles/publicacoes/relatorios/relatorio-anual-iba2023-r.pdf.

must be done through responsible forest management, with selective harvesting and replanting.

VIII. GREEN TOURISM

1. Green tourism, ecotourism, or sustainable tourism is an important economic alternative for the Amazon. The region, with its natural beauty, rich biodiversity, and indigenous and traditional communities, attracts a great deal of interest and fascination around the world.

2. Indeed, tourists can observe wildlife (monkeys, sloths, tropical birds, alligators, jaguars), go on hikes in the forest, bird watch, and enjoy recreational fishing. They can also have the opportunity to interact with local indigenous communities, contributing to their sustainability, purchasing handicrafts and learning about their traditions and cuisine.

3. Investments are also needed to improve hotel and transport infrastructure, notably water transport. Effective international marketing can transform the region into a much more relevant tourist destination than it is today.

⇒ Naturally, the ideas of sustainability, environmental preservation, and respect for local communities are indispensable here as well. Basic sanitation, responsible waste management, and environmental education must be part of the project, which requires appropriate regulation and planning.

IX. PAYMENT FOR ENVIRONMENTAL SERVICES

1. As noted, the preservation of biodiversity, the water cycle, and carbon storage make the Amazon one of the largest providers of environmental services on the planet. The world is, in fact, a *free rider* of these benefits.

2. At the recent COP 28, Brazil proposed a payment system for environmental services.[17] Naturally, the forest must become self-sustainable, providing conditions for the survival of its population – that is the ideal formula. But even developing a sustainable bioeconomy costs money.

3. For this reason, fostering compensation mechanisms so that developing countries with forests can properly maintain them is of global interest and the right thing to do. Many countries, in their path to development, destroyed their forests. It wasn't good for the planet. Therefore, it is fair for other countries, especially those responsible for the largest volume of emissions, to contribute to the preservation of the remaining forests.

CONCLUSION

1. In the present context, Brazil cannot compete to become a global industrial or technological leader. Although we must invest to catch up in these two areas, it is neither an easy nor an immediate project.

2. But Brazil has full potential to become a major environmental leader in the world. In addition to having predominantly clean energy, especially electricity – through water, which powers hydroelectric plants –, we also have vast potential for renewable energy, such as solar, wind, and biomass. We are advancing in the energy transition[18].

3. Above all, we have the Amazon and the indispensable environmental services it provides to all of humanity. We need to know how to preserve it, ensure sustainability for the people of the region, and gain international recognition, including financial support, for the merit of successfully carrying out such tasks.

---

[17] Rainforests provide a public good. The world should pay to conserve them. *The Economist*, 29 December 2023.

[18] Brazil, however, is an important global oil producer and must use a relevant part of the revenue generated to fund the energy transition to renewable sources, such as solar generation and second-generation biofuels. These are essential steps towards decarbonizing the economy. See the study sponsored by WRI Brazil and The New Climate Economy, *New Economy for the Brazilian Amazon*, published in June 2023, at 32.