

Amazon the Past and the Future

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Received February 23, 2021; Revised May 22, 2021; Accepted May 25, 2021

I dedicated my whole professional life to science. More than half of a century the Amazon only entered in my agenda when I came to Brasilia to build plant genetic engineering at EMBRAPA/CENARGEN (The National Center of Genetic Resources and Biotechnology) in 1980 where I worked for twenty-two years. It called my attention initially that Brazil never tried to maintain the forest in situ to preserve our Biodiversity as we should, and, instead, following CGIAR (Consultative Group of International Agricultural Research), CENARGEN used cold room to accomplish this goal. CGIAR, funded by developed countries, established International Agricultural Research Centers all over the world except in Brazil and as a strategy never made use of in situ conservation to maintain the biodiversity where they are located. Not all species of the world biodiversity can be maintained in cold rooms unfortunately.

Brazil is a continental country. The fifth largest country in the world. Eight and a half million square kilometers. However, when one considers that the Amazon occupies 54% of the Brazilian territory and is waiting to be developed one cannot recognize Brazil as a continent. Since 1990, Amazon has been on the world's agenda. Today it continues to be so. In 1990 Brazilian President Collor de Mello promised to invest 50 billion US \$ dollars in the Amazon. Never disbursed this money in 1991 as State Secretary for the Ministry of Science and technology I went to Switzerland to establish PPG7 (The Pilot Program for Tropical Forests) with the best Brazilian ambassadors. We succeeded to convince the G7 countries to invest \$1.5 billion in the project. Jose Goldemberg, who was the Minister of Science & Technology in Brazil, said the money was not enough. He was right. After many years PPG7 produced modest results. In 1993 Lelio Viana Lobo the Air Force Minister convinced President Itamar Franco to establish the SIVAN/SIPAN. I was at the meeting that had other members of the National Security Council. The cost of the project approved by the President was 1.4 billion dollars. External credit. It was necessary but not enough to promote the sustainable development of Amazonia. Small projects. Today I see the recently USA President Joe Biden talking about 20 billion dollars of investment to be applied in the Amazon. He is closer to what is needed, but it will not be a

blank check. Amazonia to be developed needs a sustainable development project based on a Bioeconomy that will cost ten times more what we invested in Brasilia which has an estimated cost of two billion US\$ dollars. To develop Amazonia will be the largest project in the history of Brazil. A project of billions of dollars of external resources, which we will only do with a well-established Bioeconomy project. Brazil will never be a continental country without this project. The twenty-first century is designed to be the century of controversies. In this century the consumer will decide. Facts such as climate change, which, although it does not find global agreement, still gave rise to the Paris Protocol that has great acquiescence of nations, requires all important environmental commitments, and will mobilize resources of the order of 13.5 trillion dollars for countries that meet their commitments. Brazil has promised to zero illegal deforestation and reforest 12 million hectares in the Amazon by 2030. Most developed countries have made proposals for 2050. These same countries have created difficulties for Brazil because of deforestation in the Amazon. They prevent Brazil from exporting leather and many countries do not buy our soybeans for example because of deforestation. Still on the agenda of an Environmental Bioeconomy Program it should be considered that several populations disagree with technologies that emerged from the advances of Biology starting with genetic engineering, the process of gene editing, always concerned by the use of these technologies in humans. We will have controversy in the area of agriculture, in the area of health, in food and in the area of biodiversity among others. This context determines a growing regulatory effort in search of actions that enable biotechnology with

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Citation: de Castro LAB. (2022) Amazon the Past and the Future. *Proteomics Bioinformatics*, 4(2): 197-200.

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sustainability, a new concept emerges that of bioeconomy. It must be admitted that when biotechnology developed it left aside aspects of sustainability with honorable exception of the Asilomar Conference in the seventies of the past century, concerned with the use of technology in humans through gene therapy, today fully possible and safe using Adeno Associated Virus. There are no rules and laws for many advances in biology in Brazil and in fact in the whole world. Science moves faster than laws are adopted. Brazil needs through an Environmental Bioeconomy Program to be prepared to deal with this cast of controversies through a background of important laws. Biology has progressed intensely in recent years and frequently technologies for the application of these advances do not occur to serve as the basis for their safe use neither for the environment nor for human and animal health. This is not a new suit. In 1975 at the Asilomar Conference a moratorium was established mainly in view of the possibility of using viral vectors for genic therapy. Forty-five years later it is possible to safely do genic therapy using Adeno Associated Virus as vectors but we do not have adequate legislation for the use of this technology in Brazil that begins to arrive in the global pharmaceutical market. When Dolly's event happened, our biosecurity law prevented the manipulation of embryos. Today animal reproduction laboratories do the same technology as assisted reproduction in humans routinely. We now have a more serious issue because although Carpentier in Germany and Doudna in the United States won the Nobel Prize for chemistry for its advances in gene editing based on technology known as CRISPR CAS 9, we have no laws

allowing the safe use of this technology. A researcher from China was banned from science because he used technology without its regulation. Its research made possible through gene editing that a gene is essential for HIV to access the immune system was modified. As result children of mothers with HIV were born healthily. The world spends billions of dollars annually on HIV research but statistics show that the pathology is not decreasing. Gene editing will allow mosquitoes to compete with malaria vectors in California in the near future, reducing the focus of this serious disease in developing countries. There are other advances not yet covered by appropriate legislation, anywhere. An example is the technology called Transcriptome mining that will make possible the use on an industrial scale molecule of the secondary metabolism of Brazilian Biodiversity that has the possibility of functioning in cancer therapy among other diseases. The law regulating access to genetic resources of biodiversity 2015 does not prevent the export of tons of copaiba oil or jaborandi pilocarpine but hinders and often impedes the necessary exercise of science to enable the sustainable development of Brazilian biodiversity. Laws are missing in Brazil and the laws that exist do not satisfy the use of the science we have exercise to promote the adequate sustainable use of the Brazilian biodiversity. We are still discussing in the Supreme Court about genetic engineering and the world is dealing with synthetic biology.

There are facts and fakes that are said about the Amazon. A fact is that we deforested an area larger than Germany in the last four decades [1] (Figure 1).

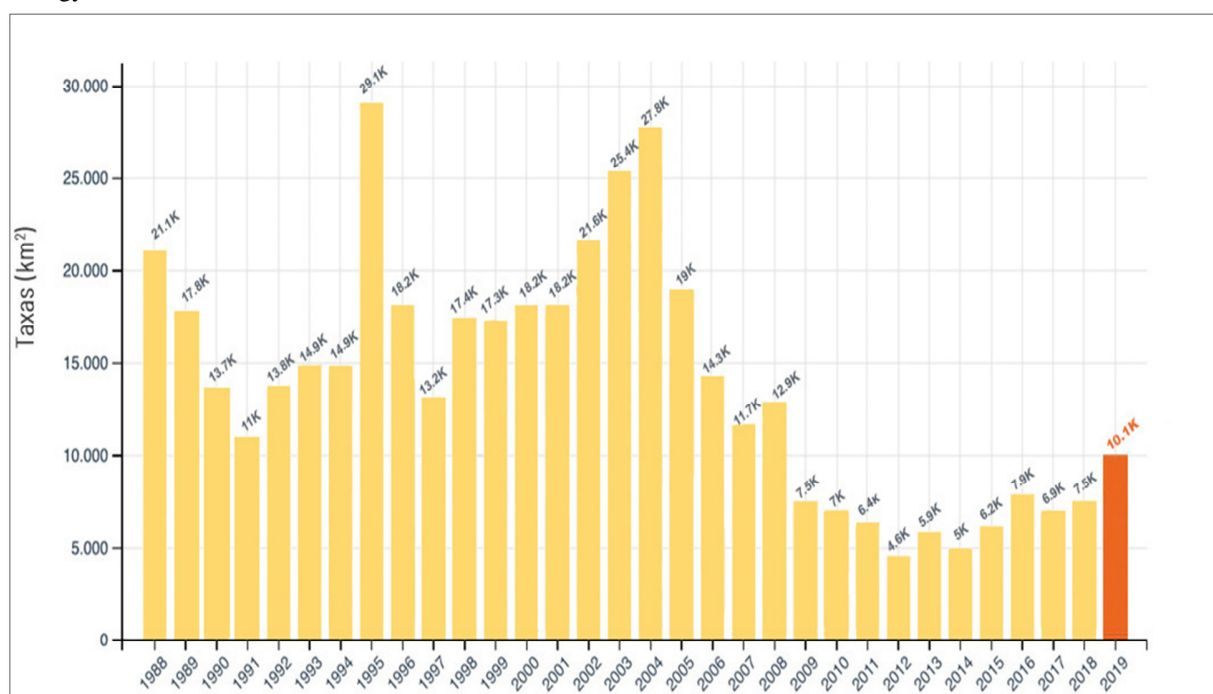


Figure 1. Deforestation in the Amazon from 1988 to 2019 in square kilometers.

A fake is the 70% of the soybean we export comes from the Amazon [2]. Evaristo de Miranda that is the Head of Embrapa Territorial is probably the best expert in this subject said in its interview to Mercado e Companhia. He said about agriculture in the Amazon: "There are 500 cities in the Amazon and close to 29 million people there. We have 1 million of farmers and what they produce is irrelevant for the GNP of the Country but it is fundamental for the survival of this population because they are the small farmers that feed the population of the region" He also mentioned about fire losses comparing Brazil to Argentina, Uruguai and Paraguai. Another important topic. Loss of forest to fires is happening systematically in many countries. Particularly in the California of the USA, Australia and Portugal recently. It is criminal in many cases but also results from climatic changes that are gradually giving rise to extreme events like storms that bring rays together. Of course, criminal fires must be treated heavily by specific

laws that are missing in Brazil. To learn these facts, it is important that we become aware how Brazil occupies its territory which is shown in **Figure 2**.

I will use the numbers to explain what is in **Figure 2** which is in Portuguese. Brazil preserves 66.3% of its territory and uses 30.2% to the Agriculture and Animal Husbandry. From the area .to produce food and feed only 7.8% is used to produce all the crops we use and export. 13.2% is occupied with planted pasture and 8.0% with native pasture Included in the 66.3% of the area preserved in the Brazilian territory 25.6% belong to farmers that cannot use this area to crops. This year Brazil will use roughly 60 million hectares to produce close to 140 million tons of grain. 8.0% is native pasture. Out of the 66,3 preserved 13.8% is indigenous land. 10.4% constitute Integral Conservation Units. 16.5% is native vegetation in land that is not included in the so-called CAR system (Rural Record System). Very little, 1.2% is planted forests and 3.5% is infrastructure occupied by cities.

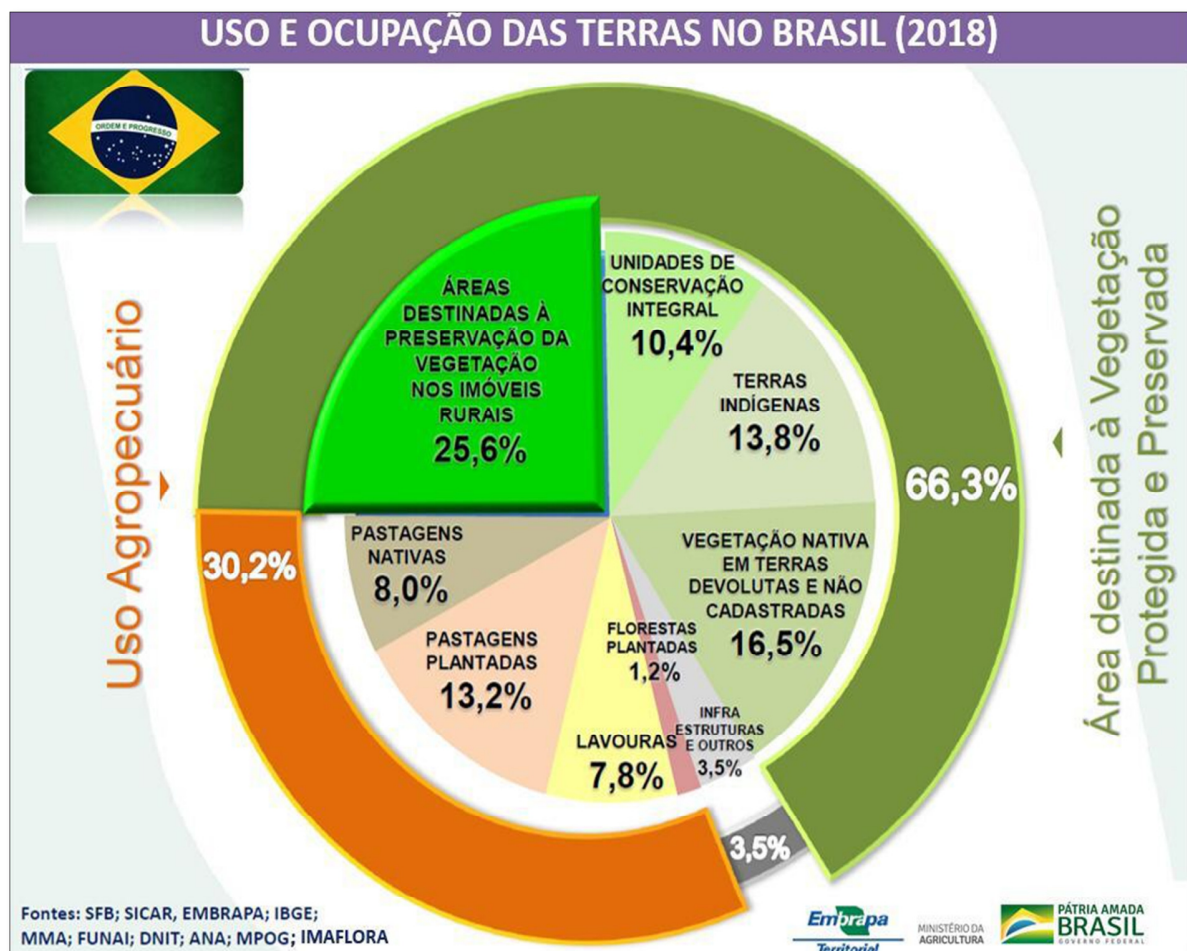


Figure 2. Use and occupation of land in Brazil.

We need an adequate legal framework to deal with the degradation not only of the Amazon but of all other biomes.

We have only 17% of the Cerrado left. Only 50% of the Caatinga vegetation left. 4% of the Mata Atlântica, 50% of

the Pampa not to speak about the ocean [1]. This is Bioeconomy: Sustainable use of Biotechnology and an adequate legal framework to assure that sustainability is maintained. Brazil as said before promised to the Paris Protocol that we will stop illegal deforestation until 2030 not only that Brazil will reforestate 12 million hectares. The cost was calculated and published [5]. During fourteen years the cost will be from 6 billion US\$ to 8.6 billion US \$. Considering all together perhaps we will need more money than Mr Biden announced but less than Collor de Mello promised but has not disbursed. One should not forget though that in adaption to deforestation and fires we have other problems in the Amazon such as smuggle that is hard to control and the look for gold (“garimpo”) using mercury that pollutes the rivers attempt against human health Finally NGOS are buying land in the Amazon with foreign money in strategic areas. To mention just one example an NGO called “Opção verde” (no site in Portuguese) purchased more than half of the Coari territory rich in petroleum and gas [6]. Coari has 58 thousand square kilometers. Indeed, a complex scenario.

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