

CARR CENTER FOR HUMAN RIGHTS POLICY HARVARD KENNEDY SCHOOL

How To Save The Amazon:

The Reasons Why a Living Forest is
Worth More than a Cut-Down One

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Discussion Paper



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ABSTRACT: This paper highlights the importance of the Amazon for the global ecosystem, the retreat and the advance of deforestation in the area located within Brazilian territory, as well as the rising trend of environmental crimes, with special attention afforded to illegal logging, land grabbing and unauthorized mining activities, including in indigenous reserves. The article enumerates the governmental public policies that were successful in containing the destruction of the forest, and the setbacks they have suffered in recent times. The final part describes the forest exploitation models adopted thus far, which have had limited economic and social impact, and presents an alternative, currently under discussion, which combines the Fourth Industrial Revolution and the forest's bioeconomy. The text also identifies contributions that international stakeholders can offer to forest conservation efforts, such as financing mechanisms (REDD+) and sustainability certification requirements by markets that consume Brazilian exports and by financial institutions when evaluating companies who develop activities in Brazil's Legal Amazon (BLA).

Introduction

AMAZON: HUMAN SECURITY, SUSTAINABLE DEVELOPMENT AND CRIME PREVENTION

The following paper was drafted as reference for a presentation to be delivered by the first author at the XIV United Nations Congress on Crime Prevention and Criminal Justice, originally scheduled for April 2020 in Kyoto, Japan. The COVID-19 pandemic, however, led to the event's postponement. The main focus of the text is to identify the causes of deforestation in the Brazilian Amazon, as well as to overcome the indifference and lack of awareness concerning the seriousness of the situation that still permeate influential groups. After a brief geopolitical presentation of the Amazon region, the text will attempt to show the forest's imminent risk of perishing, the perverse mechanisms that are leading to its destruction and the possible paths to conservation.

The Amazon or Amazon Basin encompasses an area of around 7 million km², which corresponds to about 40% of South America¹ and 67% of the world's tropical forests². Approximately 5,5 million km² are of dense tropical forest. The region comprehends the territory of nine countries³, but about 60% of it is in Brazil. Around 27 million Brazilians live in the so-called Legal Amazon (BLA)⁴⁻⁵. As will be shown, the Amazon is the world's largest biodiversity reserve, with a

crucial influence in climate stability in Brazil and globally, due to carbon sequestration, its impact on rainfall patterns and its relevance as a source of fresh water that flows to the Atlantic Ocean, among other reasons. The Amazon is also the natural habitat to several peoples and cultures, including dozens of indigenous peoples, some of which are still uncontacted tribes⁶. Since the 1970s, there has been a fundamental duality in the debate concerning the treatment of the rainforest: the advocates of economic development, on one side, and the environmentalists, on the other. This work will analyze this tension, in search of a possible equilibrium between the two. From the outset, it is important to clarify that the authors consider deforestation a serious, undesirable practice, which negatively affects the region, the country and the planet.

The analysis undertaken in this paper is structured around three essential factors: human security, sustainable development and environmental crime prevention. The term *human security* constitutes a broadening and deepening of the notions of human dignity, fundamental rights and basic needs, enshrined especially after World War II⁷. In a nutshell, it is possible to say that three essential and complementary liberties give the notion of *human security* its concrete meaning: not living in fear, not being deprived of the basic means for survival and living with dignity⁸. The meaning of *sustainable development* has been polished over the last 50

1. Luiz C. Barbosa, *The guardians of the Brazilian Amazon Rainforest* 1 (Routledge ed., 2015).

2. The Amazon in numbers, IMAZON – Instituto do Homem e Meio Ambiente da Amazônia [Amazon Institute of People and the Environment], <https://imazon.org.br/imprensa/a-amazonia-em-numeros/> (last visited May 10, 2020).

3. Bolivia, Brazil, Colombia, Ecuador, French Guyana, Guyana, Peru, Suriname, and Venezuela.

4. The Brazilian government created the “Legal Amazon” (Amazônia Legal) concept to encompass the Northern States (Acre, Amapá, Amazonas, Pará, Rondônia e Roraima), and also Mato Grosso, Tocantins (Centre-Wet Region) and the eastern part of Maranhão (Northeast region). See Lei No 5.173, de 27 de Outubro de 1966, Diário Oficial da União [D.O.U.] de 31.10.1966 (Braz.); Lei Complementar No 124, de 3 de Janeiro de 2007, Diário Oficial da União [D.O.U.] de 4.1.2007 (Braz.). It is interesting to note that the region called “Legal Amazon” is not exclusively formed by the tropical rainforest biome, but also encompasses the “Pantanal” and savanna areas.

5. Superintendência do Desenvolvimento da Amazônia – SUDAM [Amazon Region Development Superintendence], *Amazônia Bulletin* 11 (2016), [http://www.sudam.gov.br/conteudo/menus/centraldeconteudo/boletimamazonia/\(Revisado_V2\).pdf](http://www.sudam.gov.br/conteudo/menus/centraldeconteudo/boletimamazonia/(Revisado_V2).pdf) (last visited Apr. 2, 2020).

6. Out of a total 170 indigenous peoples in the region, 46 of them are totally isolated or have limited contact with civilization. See Ricardo Abramovay, *Amazônia: por uma economia de conhecimento da natureza* 55 (Elefante ed., 2019).

7. Human security is a multidimensional concept, involving seven domains: (i) personal (physical integrity), (ii) economic (basic income), (iii) food (basic nutrition), (iv) health (protection against diseases), (v) community (protection of diversity and identity values), (vi) political freedoms (rights, freedoms and participation) and (vii) environmental (protection against environmental degradation). See United Nations Development Program, *Human Development Report* 3, 24-33 (Oxford University Press ed., 1994).

8. U.N Secretary-General, *In larger freedom: towards development, security and human rights for all*, UN Doc. A/59/2005 (May 26, 2005).

years in different international meetings and documents⁹. Since the classic definition in the 1987 Brundtland Report, it has been defined as the development that satisfies the needs of the present, without compromising future generations' ability to attend to their own needs¹⁰, guaranteeing an adequate balance between economic growth, environmental protection and social progress. It has, therefore, three pillars: social, environmental, and economic¹¹⁻¹². Finally, the main role of criminal law is to serve as deterrence, dissuading individuals from committing crimes due to the probability of punishment. The lack of adequate oversight and repression of environmental crimes offers wrong behavioral incentives, which contribute to the degradation of the Amazon.

The Current Situation: The Forest at Risk of Perishing

CLIMATE CHANGE

Since the First Industrial Revolution, in the mid-18th century, the Earth's temperature has been rising¹³, a phenomenon defined as global warming or, more broadly, as climate change¹⁴. Most scientists sustain that the climate change phenomenon is primarily caused by human activities¹⁵, even though there still are skeptics and deniers who argue otherwise¹⁶. The Intergovernmental Panel on Climate Change (IPCC), established in 1988 within the United Nations, with the goal of consolidating scientific knowledge on the phenomenon, estimates a probability of over 90% that human intervention

is responsible for global warming¹⁷. It is unquestionable that the planet is warming and several consequences can already be felt in different parts of the world, such as the melting of polar caps, the rising ocean levels, the extinction of species and a growing number of extreme weather events (such as hurricanes, floods, droughts and heat waves). The main cause of global warming are greenhouse gas emissions—which increase heat retention in the atmosphere—mostly a result of the use of fossil fuels¹⁸ and changes in the use and coverage of soil, combined with agriculture, cattle-raising, inadequate garbage management and deforestation¹⁹. This last point relates to the Amazon, whose forest area has been reduced by impressive levels in the last decades. Tropical forests have a fundamental role in climate mitigation, due to their capacity to retain carbon, as previously mentioned. Three core international instruments promoted by the United Nations have sought to directly tackle climate change: (i) the UN Framework Convention on Climate Change, adopted in 1992; (ii) the Kyoto Protocol, concluded in 1997 and in force since 2005; and (iii) the Paris Agreement, in place since the end of 2016. A general assessment of the results achieved by these instruments is scheduled for 2023. Nonetheless, it is already anticipated that the emission reduction goals will not have been achieved, and, furthermore, that they will have proven to be insufficient. This already challenging context is aggravated by the United States' decision to withdraw from the Paris Agreement. For all these reasons, in the 2020 edition of the World Economic Forum, in Davos, Switzerland, the main concern and discussions among political, economic and intellectual leaders focused on global warming, climate

9. Some historic milestones are the Club of Rome's 1972 meeting, the UN Earth Summit (Eco-92) that took place in 1992 in Rio, and the approval of the Sustainable Development Goals, in 2015.

10. World Commission on Environment and Development, U.N., *Our common future* (1987), <https://sustainabledevelopment.un.org/content/documents/5987our-common-future.pdf> (last visited Jul. 28, 2020).

11. Among the Sustainable Development Goals, approved by the UN members in 2015, Objective 15 establishes the following: "Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss".

12. Institutions like UNESCO suggest education as a fourth environmental pillar. *Sustainable development*, UNESCO, <https://en.unesco.org/themes/education-sustainable-development/what-is-esd/sd> (last visited Jan. 24, 2020).

13. Global temperatures have risen 1°C since the Industrial Revolution. According to estimates, by the end of this century, they will rise 3°C. That will surpass the 2°C limit and the 1.5°C voluntary target established in the Paris Agreement.

14. See Joseph Romm, *Is there a difference between global warming and climate change?*, The Years Project, <https://theyearsproject.com/ask-joe/difference-global-warming-climate-change/> (last visited Jan. 28, 2020) ("The terms climate change or global climate change are generally considered more scientifically accurate than global warming, as NASA explained in 2008, in part because the changes in precipitation patterns and in ocean level will probably have greater human impact than the temperatures alone").

15. *Scientific consensus: Earth's climate is warming*, NASA Global Climate Change, <https://climate.nasa.gov/scientific-consensus/> (last visited Jan. 28, 2020).

16. See 31,000 scientists say "no convincing evidence", Open Source Systems, Science, Solution, <http://ossfoundation.us/projects/environment/global-warming/myths/31000-scientists-say-no-convincing-evidence> (last visited Jan. 28, 2020); Brendan Demelle, *Top ten climate deniers*, Before the Flood, <https://www.beforetheflood.com/explore/the-deniers/top-10-climate-deniers/> (last visited Jan. 28, 2020).

17. Intergovernmental Panel for Climate Change – IPCC, *Climate change 2007: Synthesis report* (2007), https://www.ipcc.ch/site/assets/uploads/2018/02/ar4_syr_full_report.pdf (last visited June 12, 2020).

18. *What is the greenhouse effect?*, NASA Global Climate Change, <https://climate.nasa.gov/faq/19/what-is-the-greenhouse-effect/> (last visited Mar. 8, 2020).

19. Gensuo et al., *Land-climate interactions*, in *Climate Change and Land: an IPCC special report on climate change, desertification, land degradation, sustainable land management, food security, and greenhouse gas fluxes in terrestrial ecosystems* (2019), https://www.ipcc.ch/site/assets/uploads/sites/4/2019/11/05_Chapter-2.pdf (last visited June 12, 2020).

The consequences of a world without the Amazon are "catastrophic" for the planet.

change and biodiversity loss²⁰. Unsurprisingly, the star of the event, as highlighted by the media coverage, was the teenage Swedish activist Greta Thunberg, not the Heads of State present at the event. Climate change and sustainability are issues that are finally becoming part of the mainstream global agenda, with a direct impact over economic, financial, commercial and regulatory decision-making. Fossil fuel divestment is gradually becoming a global demand²¹. And growing voices advocate for a “new capitalism”, more humane, environmentally friendly and egalitarian²².

THE AMAZON RAINFOREST’S IMPORTANCE

It is estimated that the Amazon Rainforest’s existence dates back 55 million years²³, with reports of human presence for at least 11,200 years²⁴. As the main tropical forest in the world, it plays a critical role in the planet’s ecological balance for multiple reasons. First, due to its remarkable *biodiversity*, representing the biggest concentration of plants, animals, fungus, bacteria, and algae in the world²⁵. As intuitive, the clearing of forests leads to the extinction of species, with unpredictable systemic consequences over the environment²⁶.

A second reason for the Amazon Rainforest’s importance is its role in the water cycles and rain patterns, with wide

implications for the entire South American continent, through *evapotranspiration*²⁷ and the *attraction and transfer of humidity* from the oceans to the inland. *Evapotranspiration* occurs when trees and plants absorb water from the soil for photosynthesis²⁸ and cooling down. This water is released as vapor through leaf pores, transforming into clouds²⁹. In the process, there is great heat absorption from the surface, which cools down the atmosphere and, simultaneously, releases humidity. This humidity then produces rain clouds that, in turn, replenish the forest’s soil. In addition, the Amazon Rainforest attracts and transfers great amounts of humidity from the ocean to other regions through “flying rivers”: atmospheric vapor flows that connect areas that provide humidity to dry areas, contributing to the irrigation of other hydrographic basins³⁰.

Thirdly, the forest also plays a very important role in the mitigation of global warming, by absorbing and storing carbon dioxide through photosynthesis. As predictable, deforestation not only compromises the forest’s ability to absorb carbon, but also releases it back to the atmosphere³¹. Experts note, however, the inaccuracy of the belief that the Amazon is the “lung of the planet”. The forest, as a matter of fact, absorbs all the oxygen that it produces. That expression, technically, could be applied to the oceans’ algae, which perform a much more relevant role in the production of oxygen³².

20. Justin Worland, *How Davos became a climate change conference*, Time (Jan. 27, 2020), <https://time.com/5771889/davos-climate-change/> (last visited June 12, 2020).

21. Damian Carrington, *Greta Thunberg tells world leaders to end fossil “madness”*, The Guardian (Jan. 10, 2020), <https://www.theguardian.com/environment/2020/jan/10/greta-thunberg-tells-world-leaders-to-end-fossil-fuel-madness>; *What is fossil fuel divestment*, Fossil Free Divestment, <https://gofossilfree.org/divestment/what-is-fossil-fuel-divestment/> (last visited Jan. 28, 2020).

22. Former US Vice-President, Al Gore, declared that “The version of capitalism we have today in our world must be reformed. See Worland, *supra* note 24 (“It’s fitting, then, that the official theme of this year’s Davos gathering was “better capitalism”).

23. Robert J. Morley, *Origin and evolution of tropical rainforest* (Wiley eds., 2000).

24. 272 A. C. Roosevelt et al., *Paleoindian cave dwellers in the Amazon: the peopling of the Americas* 373 (1996).

25. The region holds an estimated 60.000 plant species (of which 30.000 superior plants and 2.500 tree species), 2,5 million arthropod species (insects, spiders, centipedes, etc.), 2.000 fish and 300 mammal species. See *National Integration, Regional Development and Amazon Committee*, Chamber of Deputies of Brazil, <https://www2.camara.leg.br/atividade-legislativa/comissoes/comissoes-permanentes/cindra/amazonia-legal/mais-informacoes-sobre-a-amazonia-legal> (last visited Jan. 21, 2019).

26. In a recent interview to BBC News World, biologist Sean B. Carroll remembered pioneer investigations conducted by Robert Paine, Jim Estes and Mary Power, mentioned several examples of unexpected and hidden connections between creatures and nature, which highlight the importance of the so-called key species in biodiversity conservation. Among examples from different ecosystems, starfish, marine others, certain kinds of river fish, whales and wolves. Some are predators, others are prey, but they are all essential to the conservation of other species. See Dalila Ventura, *La banda de científicos que descubrió las reglas que rigen la vida en el planeta y puso de cabeza nuestra visión del mundo*, BBC News Mundo (Jan. 12, 2020), <https://www.bbc.com/mundo/noticias-51012368>.

27. Evapotranspiration is the combination of two processes in the water cycle: water evaporation from the soil, and the vegetation and plant transpiration, which frees vapor to the atmosphere.

28. As a simple and brief explanation, photosynthesis transforms solar energy into chemical energy. The process requires sunlight, water and carbon dioxide. Plants (and some other organisms) absorb and combine these three elements, producing sugar (glucose) and oxygen. See *What is photosynthesis?*, Smithsonian Science Education Center (Apr. 12, 2017), <https://ssecc.si.edu/stemvisions-blog/what-photosynthesis>.

29. Esprit Smith, *Human activities are drying out the Amazon: NASA study*, NASA Global Climate Change (Nov. 5, 2019), <https://climate.nasa.gov/news/2928/human-activities-are-drying-out-the-amazon-nasa-study/>.

30. See Antônio Donato Nobre, *O futuro climático da Amazônia: Relatório de avaliação científica* 18 (ARA & CCST-INPE & INPA eds., 1st ed. 2014).

31. Large terrestrial areas covered by forest are also attributed a role in preventing hurricanes and other extreme weather events. See *Id.* at 19-20.

32. Tim Boekhout Von Soligen, *Deforestation crimes and conflicts in the Amazon*, 18 *Critical Criminology* 263, 270 (2010).

RETREAT AND ADVANCE OF DEFORESTATION

Up to the 1960s, the Brazilian Amazon Rainforest remained mostly untouched. The situation started to change in the turn of the 1960s to the 1970s, with the increase of deforestation mainly attributable to governmental initiatives, such as the construction of roads and infrastructure, the creation of incentives for colonization and agricultural subsidies³³. It was still a period of scarce environmental awareness. Between 1970 and 1990, 7,4% of the forest was deforested, with a loss equivalent to 303,712km², bringing the forest area down from 4,100,000km² pre-1970, to 3,796,288 km²³⁴. Deforestation increased progressively until reaching its peak in 2004, when an area of 27,772 km² was cleared³⁵. That same year, the ambitious Plan for the Prevention and Control of Deforestation in the Legal Amazon (PPCDAm) was launched, with initiatives in institutional, legal and political fields³⁶. The plan was implemented in different stages, with measures that included (i) monitoring of deforestation rates through live satellite images, (ii) effective oversight to prevent illegal logging and other infractions, (iii) actions to combat illegal land grabbing³⁷, (iv) creation of designated conservation areas (forest reserves), (v) demarcation of indigenous lands and (vi) suspension of subsidized credits for producers who did not have ownership titles over their land or did not respect environmental legislation³⁸.

PPCDAm has had remarkable results: between 2004 and 2012, deforestation decreased by more than 80%, to less than 4.600km²³⁹. During this period, Brazil was the country that most contributed to the mitigation of climate change⁴⁰. A fact worth mentioning is that deforestation is significantly smaller in demarcated indigenous reservations⁴¹. Another noteworthy point is that effective governmental action, with political will, coordination and visibility – including in the media – greatly increased the perception of risk of non-compliance with environmental legislation⁴².

The success of these measures encouraged the belief that Brazil was moving towards the ideal stage of zero net deforestation⁴³. Unfortunately, however, in 2013, the commitment to enforcing the measures put forth by the PPCDAm started to wane, and deforestation levels rose, reaching 7.536km² in 2018⁴⁴. In 2019, deforestation rose yet again, reaching almost 10.000 km². In total, the accumulated deforestation of the last 50 years adds up to 800.000 km², which amounts to 20% of the Brazilian Amazon⁴⁵. Deforestation usually follows a pattern: illegal logging, burning, illegal land grabbing by farmers and producers for cattle-raising and agricultural activities (soybeans), followed by attempts to legalize land ownership. In the southeast

33. Danielle Celentano et al., *Welfare outcomes and the advance of the deforestation frontier in the Brazilian Amazon*, 40 *World Developments* 850 (2012).

34. Rhett A. Butler, *Calculating deforestation figures for the Amazon*, Mongabay (Apr. 24, 2018), https://rainforests.mongabay.com/amazon/deforestation_calculations.html.

35. PRODES – *Monitoramento do Desmatamento da Floresta Amazônica Brasileira por Satélite*, INPE – Instituto Nacional de Pesquisas Espaciais [National Institute of Space Research], <http://www.obt.inpe.br/OBT/assuntos/programas/amazonia/prodes> (last visited Feb. 9, 2020).

36. See João Paulo Ribeiro Capobianco, *Governança socioambiental na Amazônia brasileira na década de 2000* (2017) (Ph.D. dissertation, University of São Paulo) (on file with author).

37. The original term in Portuguese is “*grilagem de terra*” and is traditionally associated to the phenomenon by which private parties illegally take over public or third-party land, usually through the fabrication of fake documents and associated to other crimes to protect the illegally-acquired land.

38. See Ministério do Meio Ambiente [Ministry of the Environment], *Plano de Ação para a Prevenção e Controle do Desmatamento na Amazônia Legal (PPCDAm)*, <https://www.mma.gov.br/informma/item/616-prevenção-e-controle-do-desmatamento-na-amazônia> (last visited Feb. 9, 2020); *Máfias do Ipê*, Human Rights Watch (Sep. 17, 2019), <https://www.hrw.org/pt/report/2019/09/17/333886>; *Rainforest Máfias*, Human Rights Watch (Sep. 17, 2019), <https://www.hrw.org/report/2019/09/17/rainforest-mafias/how-violence-and-impunity-fuel-deforestation-brazils-amazon>; Capobianco, *supra* note 40, at 33.

39. PRODES – *Monitoramento do Desmatamento da Floresta Amazônica Brasileira por Satélite*, INPE – Instituto Nacional de Pesquisas Espaciais [National Institute of Space Research], *supra* note 39.

40. Kaluan Bernardo, *Desmatamento na Amazônia é ideológico, diz economista Ricardo Abramovay*, TAB (Jan. 2, 2020), <https://tab.uol.com.br/noticias/redacao/2020/01/02/desmatamento-na-amazonia-e-ideologico-diz-economista-ricardo-abramovay.htm>.

41. Human Rights Watch, *Máfias do Ipê*, *supra* note 42. Only 1.3% of deforestation of the Brazilian Amazon takes place in indigenous lands. See Ricardo Abramovay, *Amazônia: por uma economia do conhecimento da natureza* 55-56 (Elefante ed., 2019).

42. Capobianco, *supra* note 40, at 140.

43. Beto Veríssimo, *Let's cut Amazon deforestation to zero. Here's how*, *Americas Quarterly* (Nov. 9, 2015), <https://www.americasquarterly.org/fulltextarticle/lets-cut-amazon-deforestation-to-zero-heres-how/>.

44. PRODES – *Monitoramento do Desmatamento da Floresta Amazônica Brasileira por Satélite*, INPE – Instituto Nacional de Pesquisas Espaciais [National Institute of Space Research], *supra* note 39.

45. Veríssimo, *supra* note 47. The official figures on deforestation refer to areas where the forest was completely cleared and do not consider degraded areas, which would mean a significantly higher figure.

part of the forest, studies suggest that the dry season is becoming longer and hotter because of anthropogenic activities⁴⁶. Scientists evaluate that if deforestation reaches 40% of the forest area, we will arrive at an irreversible tipping point, with a significant portion of the region heading towards becoming a savanna-like area⁴⁷. The consequences of a world without the Amazon are "catastrophic" for the planet and for Brazil. Besides the increase in global warming, there will be a drastic reduction in rainfall levels, which, in the Brazilian context, are essential for agribusiness and electric power generation⁴⁸. The water shortage would also impact the industry, the supply of basic needs and urban life.

The Path to Devastation: The Perverse Dynamics of Forest Destruction

ENVIRONMENTAL CRIMES

Environmental crimes are currently listed among the most lucrative forms of transnational criminal activities, having the low risk of punishment as an aggravating factor⁴⁹. There is no single definition for this kind of criminal activity. For the purposes of this paper, an environmental crime can be defined as an illegal conduct or activity that is harmful to the ecosystem, either because it negatively affects the environment (soil, air and water) or biodiversity (flora and fauna), or because it contributes to the depletion of natural resources (organic or inorganic, such as fish, wood and minerals)⁵⁰. In recent years, a new branch of criminology, known as *green criminology*, has developed⁵¹. Environmental crimes, when practiced at a large scale, rely on well-structured criminal organizations and networks comprised

of economic agents ranging from producers, intermediaries to buyers. These crimes are often connected to other illegal activities, such as money laundering, corruption of government officials, smuggling and slavery. It is important to note that not all environmentally harmful activities are criminal – although they are regulated and may eventually lead to administrative sanctions. Three examples of such non-criminal activities, which have significant environmental impact: the general use of fossil fuels, energy generation in thermoelectric power plants, and sanitary landfills.

Nonetheless, there are also numerous environmental crimes contemplated in laws of different countries, including Brazil⁵². Below is a description of the main ones, with a focus on their impact on the Amazon region:

DEFORESTATION AND BURNING

Deforestation is a crime in itself⁵³, although, as will be shown, it may be associated with several other crimes. It is the main environmental wrongdoing practiced in the Amazon area, according to courts' criminal lawsuit records⁵⁴. Several factors lead to deforestation, including urbanization, exploration by the timber industry and the production of firewood and coal (the latter is more significant in African forests)⁵⁵. However, the main cause of deforestation in the Amazon Rainforest is cattle-raising, through the clearing of areas for conversion into pastures. Though to a lesser degree, agriculture also contributes to deforestation. Some crops that have been or still are associated with this crime are soybeans, rice, and sugarcane in some regions. Despite severe legislation, deforestation occurs both in public and private lands, as well as in indigenous reserves and conservation areas, though

46. Armineh Barkhordarian et al., *A Recent Systematic Increase in Vapor Pressure Deficit over Tropical South America*, 9 Scientific Reports 1, 12 (2019).

47. Carlos Nobre et al., *Land-use and climate risks in the Amazon and the need of a novel sustainable development paradigm*, 113 PNA 10759 (2016). In fact there are two tipping points: the destruction of 40% of forest cover or a temperature increase around 4° C.

48. João Moreira Salles & Bernardo Esteves, *O mundo sem a Amazônia*, Piauí magazine (Oct. 17, 2019).

49. *Environmental crimes are on the rise, so are efforts to prevent them*, UN Environment Programme, (Sep. 21, 2018), <https://www.unenvironment.org/news-and-stories/story/environmental-crimes-are-rise-so-are-efforts-prevent-them>. It ranks fourth among criminal activities in the world, behind drugs, counterfeiting and human trafficking, with an estimated annual income between US\$ 91 billion and US\$ 259 billion.

50. Elements to this definition can be found at *Strategic Report: Environment, Peace and Security – A Convergence of Threats*, 2016, INTERPOL-UN Environment, www.interpol.int (last visited Feb. 22, 2020).

51. See Michael J. Lynch & Paul B. Stretesky, *Green Criminology*. In Francis T. Cullen e Pamela Wilcox, *The Oxford Handbook on Criminological Theory* (Oxford University Press ed., 2012). See *What is green criminology?*, International Green Criminology Working Group, <https://greencriminology.org/about-green-criminology/> (last visited Feb. 22, 2020).

52. In Brazil, environmental crimes are defined in Lei No 9.605, de 12 de Fevereiro de 1998, Diário Oficial da União [D.O.U.] de 13.2.1998 (Braz.), which establishes the following types: (i) crimes against the fauna, (ii) crimes against the flora, (iii) pollution and other crimes, (iv) crimes against urban organization, and (v) crimes against environmental governance.

53. Lei No 9.605, de 12 de Fevereiro de 1998, Diário Oficial da União [D.O.U.] de 13.2.1998 (Braz.).

54. Research conducted by the authors on the Superior Court of Justice database, on the wording "crime\$ adj2 ambient\$ e (AM ou RO ou RR ou PA ou MT ou AC ou TO)", between Jan 2, 2010 and Jan 2, 2020. Along the same lines, see Áurea Siqueira de Castro Azevedo & Thiago Almeida Vieira, *Análise dos crimes ambientais registrados nas regiões do Baixo Amazonas e Tapajós, Pará, no período de 2012 a 2015*, 45 Desenvolvimento e Meio Ambiente 254, 262 (2018).

55. UN Environment Programme, *supra* note 53.

to lesser extent, as previously noted⁵⁶. The shortcomings in inspection, repression and enforcement of judicial decisions contribute to this phenomenon.

Burnings are, in most cases, causes or consequences of deforestation. Most of them are of criminal nature⁵⁷, for the purpose of killing native vegetation to clear areas for cattle-raising and agricultural activities⁵⁸, causing severe impact over the forest and people's health⁵⁹. In 2019, the situation became extremely serious, with a significant increase in the number of fires in comparison to previous years⁶⁰. Under a great deal of national and international criticism, including accusations of having offered undue incentives and being complacent to criminal forest fires, the Brazilian Federal Government launched Operation Green Brazil, which mobilized more than 9 thousand men and women, both civilian and military, coordinated by the Defense Ministry. Official data shows a partial success of the operation in counteracting the crisis⁶¹.

ILLEGAL LOGGING AND TRADE

According to court records⁶², illegal logging and trade is the second most common crime in the Amazon region⁶³. Even though illegal logging itself is not the main cause of deforestation, it is usually the first step to several other criminal or illegal activities harmful to the forest. The most

significant of them is the unlawful grabbing of public lands, for sale in allotments and subsequent use in agriculture or cattle-raising activities. The extraction of the largest and most valuable trees by illegal loggers exposes the soil and forest to sunrays, drying up the vegetation and increasing the risk of fires, deliberate or natural⁶⁴. The loggers launder the illegal timber through fraudulent documents, which give them a legal appearance⁶⁵. In other words: because licensed logging areas do not have their production capacity accurately monitored, they allegedly "produce" significantly more timber than their real capacity. As a result, hiding their unlawful origin, illegal logging products gain access to international markets, such as the European Union, the United States and China. It is estimated that illegal logging accounts for 80% of timber production in Brazil⁶⁶. Some even compare this market to that of drug trafficking⁶⁷.

Illegal logging gives way to forest degradation, a phenomenon that is somewhat different from deforestation. It is the gradual impoverishment of the forest, as a consequence of the selective extraction of the most valuable trees. Because satellite monitoring only detects areas that have been fully cleared, forest degradation is not always identified, despite its severe impact on the ecosystem. Many of these trees are a natural habitat to different birds, insects and mammals, and

56. In privately owned areas, the so-called portions of permanent conservation must preserve the forest cover in its entirety, and in the other areas, if located in forest regions, the legal requirement is to preserve 80% of the original forest cover. See Lei No 12.651, de 25 de Maio de 2012, Diário Oficial da União [D.O.U.] de 28.5.2012 (Braz.).

57. Lei No 9.605, de 12 de Fevereiro de 1998, Diário Oficial da União [D.O.U.] de 13.2.1998, arts. 451(Braz.) ("To set fire on woods and forests. Sanction – two to four years of imprisonment, and fines").

58. See Joe Barlow et al., *Clarifying the Amazon's burning crisis*, Global Change Biology 1 (2019); and Mariana Vick, *Quais as causas e os tipos de queimadas na Amazônia*, Nexo (Nov. 19, 2019), <https://www.nexojornal.com.br/expresso/2019/11/19/Quais-as-causas-e-os-tipos-de-queimadas-na-Amazônia>. Three kinds are identified: (i) post-deforestation, when the remaining cover is left to dry and then burned to prepare the land for cattle-raising or agriculture; (ii) for agricultural and cattle-raising purposes, in the case of cattle-raisers, to destroy remaining weed, and farmers, including indians and traditional peoples, through clearing and burning methods; (iii) forest fire, when burning gets out of control and invades the forest.

59. Lilian Rose Lemos Rocha, *Desmatamento e Queimadas na Amazônia* (Juruá ed., 2017).

60. According to the National Institute for Space Research – INPE, between August 2018 and July 2019, 9,762 square kilometers of forest were destroyed, a 29,5% increase compared to the previous 12 months. See *A estimativa da taxa de desmatamento por corte raso para a Amazônia Legal em 2019 é de 9.762 km²*, INPE – Instituto Nacional de Pesquisas Espaciais [National Institute of Space Research] (Nov. 18, 2019), http://www.inpe.br/noticias/noticia.php?Cod_Noticia=5294. The burning spots grew 30% compared to 2018, according to INPE. See *Focos de incêndio na Amazônia sobem 30% em 2019 na comparação com 2018, diz Inpe*, INPE – Instituto Nacional de Pesquisas Espaciais [National Institute of Space Research] (Jan. 8, 2020), <https://br.reuters.com/article/idBRKBN1Z800N-OBRT>.

61. "Data collected after 40 days of Operation Green Brazil show that 1700 fires were controlled, 73 people were detained and 237 infraction notices distributed, resulting in R\$ 55 million in fines". See *Operação Verde Brasil combateu 1,7 mil focos de incêndio*, Ministério da Defesa [Ministry of the Defense] (Oct. 3, 2019), <https://www.defesa.gov.br/noticias/61430-operacao-verde-brasil-combate-quase-2-mil-focos-de-incendios>.

62. Research conducted by the authors on the Federal Regional Tribunal for the 1st Region database, on the wording: "crime\$ adj2 ambient\$ e (AM ou PA ou MT)". Research was limited to the States of Pará, Mato Grosso and Amazonas, between Jan 1, 2010 and Jan 1, 2020.

63. Lei No 9.605, de 12 de Fevereiro de 1998, Diário Oficial da União [D.O.U.] de 13.2.1998, arts. 45, 46 and sole paragraph (Braz.).

64. Scott Wallace, *Inside the faltering fight against illegal Amazon logging*, National Geographic (Aug. 28, 2019), <https://www.nationalgeographic.com/environment/2019/08/brazil-logging/>.

65. See Human Rights Watch, *Rainforest Mafias*, supra note 42.

66. See INTERPOL-UN Environment, supra note 54. There are even estimates with higher figures. See Elaíze Farias, *Amazônia em chamas: 90% da madeira exportada é ilegal, diz Polícia Federal*, Brasil de Fato (Sep. 16, 2019), <https://www.brasildefato.com.br/2019/09/16/amazonia-em-chamas-90-da-madeira-exportada-sao-ilegais-diz-policia-federal/>.

67. See Soligen, supra note 36, at 265.

Environmental crimes are among the most lucrative forms of transnational criminal activities, having the low risk of punishment as an aggravating factor.

their extraction may lead to the extinction of these species, causing damages throughout the biological chain⁶⁸. Illegal logging involves criminal networks capable of managing the extraction, processing, and sale of large amounts of timber. In addition, they have the power to corrupt government officials and to employ armed militias⁶⁹⁻⁷⁰. This criminal activity entails social and political consequences: some towns have up to 20 sawmills, responsible for the employment and livelihood of hundreds of workers and their families. Furthermore, local politics is also contaminated, since many of those involved are elected as mayors, town council members and state assembly representatives⁷¹.

ILLEGAL MINING ACTIVITIES

Illegal mining activities, especially of gold, are a reality in almost all of the States of the Brazilian “Legal Amazon”, and are often disguised under the Brazilian name “*garimpo*”, which defines areas of informal mining⁷². In reality, while there are still a few individual miners, who rely on outdated techniques and tools, gold mining nowadays involves heavy machinery of high financial cost and harmful to

the environment, including rafts, dredging equipment and hydraulic excavators⁷³. Mining contributes less to deforestation in comparison to other human activities, such as cattle-raising and logging. Nonetheless, a recent study concluded that, between 2005 and 2015, it was responsible for about 10% of the forest coverage loss in the Brazilian Amazon⁷⁴. More than 90% of the deforestation occurred in illegal mining sites, *i.e.*, unauthorized by the Brazilian government. There are currently 450 illegal mining areas in the region⁷⁵, several of which even have clandestine airplane landing runways⁷⁶. There is no effective control mechanism in place to distinguish legal from illegal mining activities. Unsurprisingly, in 2019, gold became the main export product in the State of Roraima, which has no legally operating mines⁷⁷.

Beyond deforestation and the scars left on the soil, there are other serious problems associated to illegal mining. One of them is river pollution, due to the use of mercury, contaminating the water and the fish consumed by local populations⁷⁸. Another problem is the invasion of protected areas and, especially, of indigenous land, such as those

68. *In the Amazon, destruction is far bigger than we can see*, ISA – Instituto Socioambiental [Social-Environmental Institute] (Nov. 22, 2019), <https://www.socioambiental.org/pt-br/noticias-socioambientais/na-amazonia-a-destruicao-e-muito-maior-do-que-conseguimos-ver>.

69. See Human Rights Watch, *Rainforest Mafias*, *supra* note 42.

70. A symbolic episode occurred in the city of Espigão do Oeste, in the State of Rondônia, on July 4, 2019, when a tank truck carrying fuel for helicopters used in environmental inspections was attacked and set on fire, at the command of local loggers. See Wallace, *supra* note 68.

71. See Human Rights Watch, *Rainforest Mafias*, *supra* note 42.

72. Despite the lack of precise legal definitions, “*garimpo*” can be characterized as a mining activity conducted by individuals, without previous research and resorting to rudimentary instruments and techniques, within a limited area. Mining, on the other hand, can be defined as an industrial activity, based on previous research and occurring at a much larger scale, in general, conducted by specialized companies.

73. Ministério Público Federal [Federal Prosecution Office], *Mineração ilegal de ouro na Amazônia: marcos jurídicos e questões controversas* 8 (MPF ed., 2020).

74. Laura J. Sonter et al., *Mining drives extensive deforestation in the Brazilian Amazon*, 8 Nat Communications 1013 (2017). See Zoe Sullivan, *Mining activity causing nearly 10 percent of Amazon deforestation*, Mongabay (Nov. 2, 2017), <https://news.mongabay.com/2017/11/mining-activity-causing-nearly-10-percent-of-amazon-deforestation/>.

75. Ana Ionova, *Illegal gold rush causing ‘irreversible damage’ to rivers in the Brazilian Amazon*, Mongabay (Dec. 20, 2019), <https://news.mongabay.com/2019/12/illegal-gold-rush-causing-irreversible-damage-to-rivers-in-the-brazilian-amazon/>.

76. *Campeã de requerimentos minerários, Terra Indígena Yanomami sofre com explosão do garimpo*, ISA – Instituto Socioambiental [Socio-environmental Institute] (Mar. 21, 2019), <https://www.socioambiental.org/pt-br/blog/blog-do-monitoramento-blog-do-rio-negro/campea-de-requerimentos-minerarios-terra-indigena-yanomami-sofre-com-explosao-do-garimpo>.

77. *Garimpeiros ilegais avançam na Amazônia brasileira*, Associação Mineira de Defesa do Meio Ambiente (Sep. 3, 2019), <https://www.amda.org.br/index.php/comunicacao/informacoes-ambientais/5699-garimpos-ilegais-avancam-na-amazonia-brasileira>.

78. According to the World Health Organization, mercury is a highly toxic metal, and poses significant threats to intrauterine life and to the initial years of child development. It can seriously harm the nervous, immune, digestive, and respiratory systems, as well as vision. The Minamata Declaration, incorporated into Brazilian law, requires restrictions on its production and use. See Ministério Público Federal [Federal Prosecution Office], *supra* note 77, at 173-174.

belonging to the Yanomamis (in the States of Roraima and Amazonas), the Kayapós and Munduruku (both in the State of Pará)⁷⁹, where there are a couple thousand illegal miners operating. The Army has a fundamental role in the protection of these areas and, whenever it retreats, illegal invasions advance⁸⁰. Illegal mining in indigenous areas leads to river silt ups, land conflicts, criminal activities, diseases and prostitution⁸¹. The Brazilian Constitution allows for the exploration of mineral resources in indigenous lands, but conditions it to prior approval of a general regulating law, which has never been enacted. The Brazilian President proposed legislation on this matter to Congress in the beginning of 2020⁸², but it was met with skepticism and criticism from political, indigenous and environmental leaders⁸³.

POACHING AND ANIMAL TRAFFICKING

Poaching and wild animal trafficking ranks third or fourth among the most lucrative illicit activities in the world, only behind drug and arm trafficking, and almost tied with human trafficking⁸⁴. According to an estimate by the World

Economic Forum, the illegal trade of wild animals has a value of between US\$ 7 billion and US\$ 23 billion⁸⁵. As for Brazil, it has one of the richest fauna diversities in the planet. Among us, approximately 38 million animals are taken away from Brazilian forests and woods per year, in a business with a value of around US\$ 1 billion annually⁸⁶. Federal Police raids in the State of Amazonas seized, only in 2018, more than three tons of illegal poaching, hundreds of terrestrial animal species and thousands of ornamental fish⁸⁷. Animal trafficking has several consuming markets, which include: (i) private collectors, who search for rare or close to extinction animals; (ii) scientific purposes, most notably the production of medicines; (iii) sale in pet shops; and (iv) production of commercial goods, such as leather, skin, cosmetics and *souvenirs*⁸⁸. Besides the risk of disease dissemination⁸⁹, the removal of animals from their natural habitat threatens species with extinction and may impact the ecosystem's natural balance, by removing both predators and prey, compromising nature's cycles⁹⁰. Poaching and animal trade are crimes that currently face low oversight and light sentences⁹¹⁻⁹².

79. See João Fellet & Camila Costa, *Imagens mostram o avanço do garimpo ilegal na Amazônia em 2019*, BBC News (Jul. 25, 2019), <https://www.bbc.com/portuguese/brasil-49053678>. The Amazon Geo-Referenced Socio-Environmental Information (Raisg) identified illegal "garimpo" activities in 18 Brazilian indigenous lands.

80. See ISA – Instituto Socioambiental [Socio-environmental Institute], *supra* note 80 ("Between 6.000 and 7.000 illegal miners – garimpeiros – are extracting gold from Yanomami territory, in Northern Brazil (...) Illegal mining ... surged ... after the Army closed their bases on the Uraricoera and Mucajá rivers...").

81. See Fellet & Costa, *supra* note 83.

82. *Projeto do governo viabiliza exploração de minérios em terras indígenas*, Câmara dos Deputados [Chamber of Deputies] (Fev. 6, 2020), <https://www.camara.leg.br/noticias/634893-projeto-do-governo-viabiliza-exploracao-de-minerios-em-terras-indigenas/>.

83. Debora Álvarez, *Com 400 dias de governo, Bolsonaro avança sobre terras indígenas e áreas de preservação*, Huffpost Brasil (Fev. 9, 2020), https://www.huffpostbrasil.com/entry/bolsonaro-contr-a-ambiente_br_5e3efe0bc5b6bb0ffc12166e.

84. According to the United States' Government State Department. See Charles Bergman, *Wildlife trafficking*, Smithsonian Magazine (Dec. 2009), <https://www.smithsonianmag.com/travel/wildlife-trafficking-149079896/>. According to a 2014 UN document, it would rank fourth, after human trafficking. See *Wildlife crime worth USD 8-10 billion annually, ranking it alongside human trafficking, arms and drug dealing in terms of profit: UNODC chief*, U.N. Office on Drugs and Crime (May 13, 2014), <https://www.unodc.org/unodc/en/frontpage/2014/May/wildlife-crime-worth-8-10-billion-annually.html>.

85. Wolfgang Lehmacher, *Wildlife crime: a \$ 23 billion trade that's destroying our planet*, World Economic Forum (Sep. 28, 2016), <https://www.weforum.org/agenda/2016/09/fighting-illegal-wildlife-and-forest-trade/>.

86. Giulia Bucheroni, *Onde está a fauna brasileira? Panorama do tráfico de animais revela futuro preocupante*, G1 (Jun. 24, 2019), <https://g1.globo.com/sp/campinas-regiao/terra-da-gente/noticia/2019/06/24/onde-esta-a-fauna-brasileira-panorama-do-traffic-de-animais-revela-futuro-preocupante.ghtml>; and *Tráfico de animais silvestres*, Renctas, Ambientebrasil (Sep. 27, 2019), <http://www.renctas.org.br/ambientebrasil-traffic-de-animais-silvestres/>.

87. *PF e INPA promovem curso sobre perícia em tráfico de animais silvestres da Amazônia*, INPA – Instituto Nacional de Pesquisas da Amazônia [Amazon Research National Institute] (Dec. 4, 2018), <http://portal.inpa.gov.br/index.php/ultimas-noticias/3355-pf-e-inpa-promovem-curso-sobre-pericia-em-traffic-de-animais-silvestres-da-amazonia>.

88. See Bucheroni, *supra* note 90; and Renctas, Ambientebrasil, *supra* note 90.

89. Avian flu and Ebola vírus, among others. See Özgün Emre Can, Neil D'Cruze & David W. Macdonald, *Dealing in deadly pathogens: Taking stock of the legal trade in live wildlife and potential risks to human health*, 17 *Global Ecology and Conservation* 515 (2019), <https://doi.org/10.1016/j.gecco.2018.e00515>; D.A. Travis, R.P. Watson & A. Taue, *The spread of pathogens through trade in wildlife*, 30 *Rev. Sci. Tech.* (2011), https://www.researchgate.net/publication/51540851_The_spread_of_pathogens_through_trade_in_wildlife.

90. For example: "Along with the impact on the fauna, the whole ecosystem is seriously affected by the traffic cycle. The reduction of species that feed on certain seeds favors dominance by some trees, and the absence of certain agents affects flora species reproduction. Therefore, the whole forest structure is altered". See Bucheroni, *supra* note 90.

91. In Brazil, the basic sanction is from six months to a year in prison, and fines. Lei No 9.605, de 12 de Fevereiro de 1998, Diário Oficial da União [D.O.U.] de 13.2.1998, art. 29, caput, §4º, §5º (Braz.).

92. The Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) has been in place since 1973 and regulates trade of species. However, its enforcement is exceedingly difficult and very seldomly are countries sanctioned for violation of the convention. See Rachel Fobar, *What is the Convention on International Trade in Endangered Species?*, National Geographic (Jul. 3, 2019).

OTHER CRIMES

CRIMES AGAINST FOREST DEFENDERS

Brazil has one of the highest homicide rates of forest defenders⁹³, including indigenous people, traditional forest inhabitants, slave descendants known as *quilombolas*, environmentalists and human rights advocates⁹⁴. They are constant victims of land owners (frequently land grabbers), miners, loggers and hitmen⁹⁵. According to the Pastoral Land Commission, linked to the Catholic Church, more than 300 people have been murdered during the last decade, in the context of disputes over the use of the land and natural resources in the Amazon region⁹⁶. Two martyrs of this struggle were the rubber tapper leader, Chico Mendes, killed in 1988, in the State of Acre, and the American missionary, Dorothy Stang, murdered in the State of Pará in 2005.

ILLEGAL GRABBING OF PUBLIC LANDS

The invasion and takeover of public lands, especially in forest areas, has been a consistent trend in the Amazon region. As pointed out, after a selective extraction of trees, and the elimination and burning of the remaining plant cover, public lands are converted into pastures and plantations. Next, the invaders attempt to legalize land ownership, by dividing the area into smaller plots of land, which are easier to legalize according to Brazilian law, or by simply issuing fake ownership deeds, in collusion with registry offices and public officers.⁹⁷ The private appropriation of public lands, without the supervision of government entities responsible for land control, such as the National Institute of Colonization and Agrarian Reform (INCRA), has relevant political, social, economic and environmental repercussions, considering that approximately 45% of the Amazon's territory has not been officially allocated, neither for agrarian reform, nor for environmental conservation purposes⁹⁸. According to data

from the Amazon Environmental Research Institute (IPAM), 30% of the deforestation in the Amazon, between January 1 and August 20 of 2019, occurred precisely in non-allocated areas, which are the targets of invaders⁹⁹. In 2001-2002, a parliamentary inquiry committee of the Brazilian Chamber of Deputies identified some of the goals of illegal takeovers: resale, use of the land as loan guarantees or as payment for fiscal and social security debts, or even undue requests for compensation for agrarian reform or creation of conservation areas¹⁰⁰. To complete this tragic trend, from time to time, the Government forgives these invasions and allows for legalization of the private appropriation of public lands, as will be further analyzed.

BIOPIRACY

Biopiracy is a new name to an old problem, that goes back to colonialism, but now with a technological facet. It consists of a number of activities and behaviors, which include not only the unauthorized extraction and smuggling of fauna and flora species, but especially, in the case of the Amazon, the non-consensual appropriation of traditional knowledge of indigenous peoples and forest dwellers. In the latter, the purpose is to patent chemical substances or active principles native to the region or whose initial knowledge was acquired and developed by local communities. In practice, it means privatizing or monopolizing something that, at least in part, is a collective good belonging to others. In other cases, it means registering natural forest products as trademarks. There is no question about the criminal nature of illegal trade of fauna. The same is not true, however, in the cases of undue appropriation of traditional knowledge of native populations, which is a greater challenge since there is no specific law classifying the conduct as a crime¹⁰¹. There are several examples of biopiracy worldwide¹⁰². In relation to the Amazon, two of them have become famous: the smuggling of

93. Brenda Brito et al., *Stimulus for land grabbing and deforestation in the Brazilian Amazon*, 14 *Environmental Research Letters* 1, 1 (2019).

94. Patrícia Mara Cabral Vasconcellos, *Vozes da exclusão: os assassinatos de defensores de direitos humanos na Amazônia*, 7 *Revista Interdisciplinar de Direitos Humanos* 77 (2019).

95. *A Que Preço? Negócios irresponsáveis e o assassinato de defensores da terra e do meio ambiente em 2017*, Global Witness (Jul. 24, 2018), <https://www.globalwitness.org/en/campaigns/environmental-activists/a-que-pre%C3%A7o/>.

96. See Human Rights Watch, *Rainforest Mafias*, *supra* note 42.

97. IPAM – Instituto de Pesquisa Ambiental da Amazônia [Amazon Environmental Research Institute], *A Grilagem de Terras Públicas na Amazônia Brasileira* (IPAM ed., 2006).

98. See *id.* Although new conservation units have been created, no relevant changes have occurred since then.

99. *Amazônia em Chamas: onde está o fogo - Nota técnica*, IPAM – Instituto de Pesquisa Ambiental da Amazônia [Amazon Environmental Research Institute] (Aug. 20, 2018), <https://ipam.org.br/bibliotecas/nota-tecnica-amazonia-em-chamas/>. According to the study, the 30% corresponds to deforestation and burning in “public forests not allocated and with no records”.

100. Rep. of Comissão Parlamentar de Inquérito [Parliamentary Committee of Inquiry], Câmara dos Deputados [Chamber of Deputies] 353-357 (Dec. 28, 2001), <https://arisp.files.wordpress.com/2009/08/relatorio-cpi-da-grilagem.pdf>.

101. It is true that the 1992 Convention on Biological Diversity attempted to secure a fair and equitable sharing of the benefits arising from genetic resources from local biological diversity. The convention, however, does not have norms of criminal nature and its practical effects are still limited.

102. As examples: (i) andiroba, Amazon tree, had its oil and the extracts of its fruit patented by the French company Yves Roche and by the Japanese company Masaru Morita; (ii) *copaíba* had some of its elements patented by the US company Aveda and by the French company Technico-flor; (iii) *espinheira santa* (*Maytenus ilicifolia*) has a patented medicine by Japanese company Nippon Mektron; (iv) *jaborandi* was patented by the German pharmaceutical company Merk. See David Augusto Fernandes, *Soberania permanente e a proteção ambiental*, 70 *Rev. Fac. Direito UFMG* 227, 242 (2017).

rubber tree seeds, back in 1876, with a devastating effect over the local economy¹⁰³; and the registration, in Japan, of the *Açaí* trademark, a typical regional fruit. The trademark was eventually voided¹⁰⁴. A similar situation also occurred with the fruit *Cupuaçu*, which also had its international trademark voided¹⁰⁵. More recently, there has been a movement towards a consensus that one of the best forms of tackling biopiracy is through investments in local scientific and technological research. This point will be developed further.

SLAVERY, HUMAN TRAFFICKING AND RECRUITING

Contemporary slavery in Brazil, especially in the Amazonian agricultural frontier, benefits from a limited offer of regular jobs and the great number of unskilled workers in the region. A common practice implemented by farmers is the use of agents called *gatos*, who recruit unskilled rural workers in situations of economic vulnerability and take them to remote areas¹⁰⁶. Frequently, the job offer claims to provide benefits that are never fulfilled – such as meals, salary and lodging –, and, in practice, convert workers into debtors, by forcing them to acquire products and services from their employer. The *gatos* and the employers resort to physical violence, emotional harassment and even confinement as ways to keep employees under their abusive control¹⁰⁷.

THE REGULARIZATION OF LAND INVASIONS, CORRUPTION AND IMPUNITY

As mentioned, one of the primary incentives for deforestation in the Amazon comes from the Federal – predominately – and State Governments themselves¹⁰⁸. The observation is based on the dynamics of invasion-regularization of public lands. The situation is the following: the areas that are not privately owned and have not been designated as indigenous reserves or conservation areas, are public property, also referred to as non-designated areas. Part of these public property areas are occupied by settlements created by the Government for land

reform purposes, designated to small farmers. As a matter of fact, due to the lack of oversight and legislation enforcement, the conservation obligations imposed by the law for the use of these lands are not obeyed and the levels of deforestation in these settlements are high¹⁰⁹. Nonetheless, the most serious threat comes from the illegal grabbing of public lands, with the invasion and privatization of public areas in the Amazon Rainforest, frequently through the use of violence towards indigenous tribes or forest dwellers. There are two problems in governmental policies that contribute to this reality. The first one: the lack of oversight and enforcement allows these areas to be invaded, initiating a vicious cycle that leads to deforestation – illegal logging, burning and soil occupation. The second one: under pressure from land grabbers who are politically well-connected, the Federal Government, from time to time, pardons the criminal acts of these invaders and allows for the regularization of the appropriation of public land.

Examples of this practice include Laws n. 11,952/2009, during the presidency of Luis Inácio Lula da Silva, and n. 13465/2017, during the presidency of Michel Temer, and also Provisional Measure n. 910, issued on December 11, 2019, by current President Jair Bolsonaro. The president of the National Institute of Colonization and Agrarian Reform (INCRA) was fired for opposing this policy¹¹⁰. These laws are part of an old Brazilian logic where wrongdoings gradually become the *status quo* and are then followed by legalization attempts. More than merely legitimizing the appropriation of public lands, these practices translate into incentives for the continuity of the practice, fostering the vicious cycle of invasion, deforestation and posterior legalization. The referenced 2019 Provisional Measure, similarly to previous laws, allows for the acquisition of these lands through payments set at amounts significantly below market value, causing losses amounting to billions of Brazilian Reais to the Federal Government. It also fosters new invasions, for it confirms the expectation that these lands will eventually be legalized¹¹¹.

103. Bruno Reinert de Abreu et al, *Difficulties in the control of environmental crimes in the Amazon*, 6 International Journal of Advanced Engineering Research and Science 31, 32 (2019).

104. See Fernandes, *supra* note 106.

105. Renata Campos Nogueira et al., *Patenting bioactive molecules from biodiversity: the Brazilian experience*, 20 Expert Opinion. Ther. Patents 145, 151-152 (2010).

106. Código Penal [C.P.] [Criminal Code] arts. 149, 149-A, 207 (Braz.).

107. International Labor Organization – ILO, *Perfil dos principais atores envolvidos no trabalho escravo rural no Brasil* 16-17 (OIT ed., 2011); Maria Cristina Cacciamali & Flávio Antonio Gomes Azevedo, 3 Dilemas da erradicação do trabalho forçado no Brasil. In: *Mercado de trabalho no Brasil : novas práticas trabalhistas, negociações coletivas e direitos fundamentais no trabalho* 943-948 (Ltr ed., 2003); International Labor Organization – ILO, *Combatendo o trabalho escravo contemporâneo: o exemplo do Brasil* 48-53 (OIT ed., 2010).

108. Regularization laws of invaded lands, upon payment of insignificant amounts, were passed by State legislative bodies of the States of Pará, Mato Grosso and Amazonas. Brenda Brito, *Governo não deve premiar os ladrões de terra na Amazônia*, El País Brasil (Sep. 9, 2019), https://brasil.elpais.com/brasil/2019/09/09/opinion/1568042120_747554.html.

109. IPAM – Instituto de Pesquisa Ambiental da Amazônia [Amazon Environmental Research Institute], *Desmatamento nos assentamentos da Amazônia: histórico, tendências e oportunidades* 41-111 (IPAM ed., 2016).

110. Shanna Hanbury, *Pressão para legalizar terra desmatada na Amazônia derruba chefe do INCRA*, Mongabay, (Oct. 3, 2019), <https://brasil.mongabay.com/2019/10/pressao-para-legalizar-terra-desmatada-na-amazonia-derruba-chefe-do-incra/> (“According to the media, General João Carlos de Jesus Corrêa was fired for opposing Bolsonaro government’s plans to facilitate the regularization process of around 750.000 land ownership deeds”).

111. Brito et al., *supra* note 97, at 2.

The most serious threat comes from the illegal grabbing of public lands, with the invasion and privatization of public areas in the Amazon Rainforest, frequently through the use of violence towards indigenous tribes or forest dwellers.

After arson fires destroyed a fuel truck in a region known as Espigão do Oeste, the Brazilian Institute of the Environment and Renewable Natural Resources (IBAMA) reacted by organizing a large field operation to repress illegal loggers and their sawmills. A total of 35 IBAMA officers, 50 policemen and an army troop of 100 men partook in the operation. As they approached the region of the attack, after leaving the capital of the State, Porto Velho, one of the officers saw, in social media, an interview with one of the leaders of the illegal loggers discussing the sting operation, meant to be confidential. It became clear that someone from within the institutions responsible for protecting the forest had leaked the information¹¹². This is, in fact, another problem: corruption – and politicization – of public officials responsible for environmental protection and, very frequently, of public registry officials, accused of forging documents and ownership deeds. There is also relevant criticism concerning the Judiciary's conduct¹¹³.

Impunity is the general rule when it comes to crimes related to deforestation of the Amazon. According to a Human Rights Watch report, out of 300 murders recorded by the Pastoral Land Commission since 2009, only 14 were taken to trial¹¹⁴. That is: forest defenders, such as indigenous people, local dwellers, human rights activists, environmentalists, missionaries and even IBAMA agents are constant targets of crimes that are never investigated. Meanwhile, public registry officials responsible for fraudulent ownership records and deeds are rarely prosecuted¹¹⁵. Illegal loggers pay bribes to obtain fake documents attesting that their timber was extracted from certified areas and the public officials who receive these illegal advantages usually escape legal punishment as well. Only a small percentage of the fines imposed by IBAMA for environmental violations is effectively

collected¹¹⁶. The legalization instruments just mentioned above are an additional wrong. In this grave context of government leniency, corruption and impunity, the Amazon Rainforest is left defenseless.

THE DRAMATIC DETERIORATION OF BRAZILIAN ENVIRONMENTAL POLICY

Empirical evidence shows that effective government oversight, with personnel, equipment, and political will, is a decisive factor in tackling deforestation, primarily because forest destruction is usually associated with other illegal practices and outright "banditry"¹¹⁷. The historic reduction in deforestation between 2004 and 2012 was a direct result of strict oversight combined with effective field operations, leading to detentions, product and equipment seizures and fines¹¹⁸. That is: environmental policies of command and control were crucial to discontinue the cycle of violence and destruction¹¹⁹. Also relevant for this effort were the improvements in the monitoring and sharing of information – consequently able to offer better guidance for field operations –, the creation of conservation areas and the demarcation of indigenous lands. The allocation of public lands to conservation units and indigenous tribes also works as an effective deterrent against land grabbing, since those areas lose commercial value because it is impossible to obtain ownership deeds over them¹²⁰. It was precisely the loosening of these measures and oversight that allowed deforestation to significantly escalate, starting in 2013.

The situation worsened even further in 2019, with a 30% increase in deforestation compared to the previous year, totaling an area of 9.762km²¹²¹. Environmental organizations, forest protectors and scientists attribute this increase

112. Scott Wallace, *Inside the faltering fight against illegal Amazon logging*, National Geographic, (Aug. 28, 2019), <https://www.nationalgeographic.com/environment/2019/08/brazil-logging/>.

113. Rep. of Comissão Parlamentar de Inquérito [Parliamentary Committee of Inquiry], *supra* note 104, at 358-363. Even though it is a diagnosis made in 2001, the pathologies remain the same. Paulo Barreto & Marília Mesquita, *Como prevenir e punir infrações ambientais em áreas protegidas na Amazônia?* (IMAZON ed., 2009).

114. See Human Rights Watch, *Máfias do Ipê*, *supra* note 42, at 5-6. See Human Rights Watch, *Rainforest Máfias*, *supra* note 42.

115. Rep. of Comissão Parlamentar de Inquérito [Parliamentary Committee of Inquiry], *supra* note 104, at 358-363. Even though it is a diagnosis made in 2001, the pathologies remain the same.

116. *Arrecadação de multas administrativas, onde consta que entre 2005 e 2009, menos de 1% das multas aplicadas pelo IBAMA foram efetivamente recolhidas*, Tribunal de Contas da União [Federal Audit Court], https://portal.tcu.gov.br/tcu/paginas/contas_governo/contas_2009/Textos/Ficha%204%20-%20Arrecadacao%20de%20Multas.pdf. The situation has not improved over time. See Bárbara Libório, *Por que o IBAMA arrecada só 5% das multas ambientais que aplica*, Aos Fatos (Jan. 31, 2019), <https://aosfatos.org/noticias/por-que-o-ibama-arrecada-so-5-das-multas-ambientais-que-aplica/>.

117. Abramovay, *supra* note 45, at 11.

118. Capobianco, *supra* note 40, at 118.

119. Abramovay, *supra* note 45, at 11.

120. Capobianco, *supra* note 40, at 120.

121. Instituto Nacional de Pesquisas Espaciais – INPE [National Institute of Spatial Research], *supra* note 39. News from a previous period indicate a much higher volume. See AFP, *Desmatamento na Amazônia aumenta 85,3% em 2019, aponta INPE, Veja* (Jan. 14, 2020), <https://veja.abril.com.br/brasil/desmatamento-na-amazonia-aumenta-853-em-2019-aponta-inpe/>; *Desmatamento na Amazônia cresce 85%*, DW (Jan. 14, 2020), <https://www.dw.com/pt-br/desmatamento-na-amazonia-cresce-85-em-2019/a-52006186>.

Empirical evidence shows that effective government oversight, with personnel, equipment, and political will, is a decisive factor in tackling deforestation.

to the new Government's behavior¹²², indicating, among several other criticisms, public statements by high-ranking authorities signaling a lack of interest towards environmental protection¹²³, associated to concrete measures which substantially debilitated the public policies aimed at preventing and controlling deforestation¹²⁴. These signals, according to the environmental organizations, were read by illegal loggers, miners and land invaders as a green light for even more daring unlawful conduct¹²⁵.

Some of the criticized measures include: (i) the extinction of the Forest and Climate Change High-Level Office within the Ministry of the Environment (MMA)¹²⁶, (ii) the extinction of the Environment, Energy, Science and Technology Office

of the Ministry of Foreign Affairs¹²⁷, (iii) the firing of several State superintendents of the Brazilian Institute for the Environment and Renewable Natural Resources (IBAMA)¹²⁸ and their replacement with individuals allegedly not committed to the environmental cause¹²⁹; (iv) the reduction in the number of members in the National Council for the Environment (CONAMA), with a direct negative impact on the representativeness of non-governmental organizations (NGOs), States and civil society¹³⁰; (v) the transference of the Brazilian Forest Service to the Ministry of Agriculture, Livestock and Food Supply (Ministry of Agriculture)¹³¹, the government entity responsible for the protection of conflicting interests; (vi) the transference of the authority to demarcate indigenous lands from the National Indian Foundation (FUNAI) to the Ministry of Agriculture¹³²; (vii) the open hostility towards NGOs that work in cooperation with forest protectors¹³³; and, finally, (viii) the extinction of the Amazon Fund Steering Committee, who was responsible for establishing the criteria for and the monitoring of the use of the fund's resources¹³⁴. This last measure deepened the diplomatic crisis between Brazil, on one side, and Germany and Norway, on the other, the two most important donor countries for conservation initiatives in the Amazon region, leading to the suspension of donations, after these two countries had dedicated billions of Reais to the conservation cause.

122. See Human Rights Watch, *Máfias do Ipê*, *supra* note 42, at 10 ("Government Bolsonaro has conducted aggressive actions to limit the country's ability to enforce its environmental laws"); according to Greenpeace Brazil campaign coordinator on public policy, "the government has an agenda of dismantling institutions and destroying the environment". See Ana Beatriz Rosa, *Em primeiro ano, governo Bolsonaro expõe despreparo para lidar com questões ambientais*, Huffpost (Jan. 2, 2020), https://www.huffpostbrasil.com/entry/meio-ambiente-bolsonaro_br_5e0366e8e4b0b2520d119974; researcher Carlos Nobre stated that "the environmental agenda does not interest anymore, as it did in 1992, and during the following governments, from several different political parties".

123. As examples, public statements by the President about abandoning the Paris Agreement, the possible extinction of the Ministry of the Environment, as well as the country's refusal to host, in 2019, the UN Conference on Climate Change (COP-25). See, respectively: Megan Darby, *Brazil: Bolsonaro threatens to quit Paris climate deal*, *Climate Exchange News* (Aug. 14, 2018), <https://www.climatechangenews.com/2018/08/14/brazils-bolsonaro-threatens-quit-paris-climate-deal/>; Ana Laura Stachewski, *Bolsonaro mantém Ministério do Meio Ambiente, mas esvazia pasta*, *Época Negócios* (Jan. 22, 2019), <https://epocanegocios.globo.com/Brasil/noticia/2019/01/bolsonaro-mantem-ministerio-do-meio-ambiente-mas-esvazia-pasta.html>; Pedro Rafael Vilela, *Bolsonaro defendeu não realizar COP-25 no Brasil*, *Agência Brasil* (Nov. 28, 2018), <https://agenciabrasil.ebc.com.br/politica/noticia/2018-11/bolsonaro-defendeu-nao-realizar-cop-25-no-brasil>.

124. *Ministério do Meio Ambiente reduz verba de combate à mudança climática*, *Exame* (May 7, 2019), <https://exame.com/brasil/ministerio-do-meio-ambiente-reduz-verba-de-combate-a-mudanca-climatica/>.

125. Abramovay, *supra* note 45, at 13 ("Since January 2019, the federal government has been sending signs that are locally interpreted as a green light for the grabbing of public lands and as halts to government initiatives to combat those criminal practices").

126. Decreto No 9.672, de 2 de Janeiro de 2019, *Diário Oficial da União* [D.O.U.] de 2.1.2019 (Braz.).

127. Decreto No 9.683, de 9 de Janeiro de 2019, *Diário Oficial da União* [D.O.U.] de 10.1.2019 (Braz.).

128. Portarias No 107 a 127, de 28 de Fevereiro de 2019, *Diário Oficial da União* [D.O.U.] de 28.2.2019 (Braz.).

129. Bárbara Forte, Diana Carvalho & Paula Rodrigues, *O que significam as demissões de autoridades do Ministério do Meio Ambiente*, *Ecoa/UOL* (Mar. 3, 2020), <https://www.google.com.br/amp/s/www.uol.com.br/ecoa/ultimas-noticias/2020/03/03/o-que-significam-as-demissoes-de-autoridades-do-ministerio-do-meio-ambiente.amp.htm>.

130. Decreto No 9.806, de 28 de Maio de 2019, *Diário Oficial da União* [D.O.U.] de 29.5.2019 (Braz.).

131. Decreto No 9.667, de 2 de Janeiro de 2019, *Diário Oficial da União* [D.O.U.] de 2.1.2019 (Braz.).

132. Medida Provisória No 870, de 1º de Janeiro de 2019, *Diário Oficial da União* [D.O.U.] de 1º.1.2019 (Braz.), converted into Lei No 13.884, de 18 de Junho de 2019, *Diário Oficial da União* [D.O.U.] de 18.6.2019 (Braz.). The provisional measure, in this specific part, was not approved by Congress. An attempt to reinstate it was ruled unconstitutional by the Federal Supreme Court.

133. See Human Rights Watch, *Rainforest Mafias*, *supra* note 42, at 5-6.

134. Decreto No 9.759, de 11 de Abril de 2019, *Diário Oficial da União* [D.O.U.] de 11.4.2019 (Braz.).

In an apparent shift in policy, in February 2020, the Government moved the National Council of the Legal Amazon from the jurisdiction of the Ministry of the Environment to the Vice-Presidency. The Council, among other tasks, coordinates the several Ministries and governmental bodies that handle the environmental efforts, as well as drafts policy proposal and initiatives related to preservation, protection and sustainable development in the Legal Amazon. We will have to wait to find out if the country will recover from the damage caused to its international reputation on this issue and drastically reduce deforestation, so that zero net deforestation can be reintroduced to the public debate¹³⁵.

A Few Paths Towards Conservation: A Living Forest is Worth More Than a Cut-down One

THE SHORTCOMINGS OF THE DEVELOPMENT MODELS ADOPTED THUS FAR

Two diametrically opposite models of handling the Amazon Forest have prevailed since the 1970s to date. The first one can be called *development-oriented*, and promotes the clearing of forest areas for economic activities such as cattle-raising, agriculture, logging, mining and reservoirs for hydroelectric plants. This approach does not consider the serious consequences of destructing the Amazon biome¹³⁶. The second can be called *environmentalist*, and focuses on keeping the forest intact, with the designation of vast preservation areas,

either as indigenous reserves or conservation units¹³⁷. Neither of these two models has been able to realize the Amazon's economic and social potential. The region, in fact, represents 8% of the country's GDP and has some of the worst human-development indexes in the country¹³⁸. Starting in midst 2000s, there was a belief in the development of a hybrid model, able to conciliate economic activities with forest preservation¹³⁹. Nonetheless, deforestation rates continued to rise¹⁴⁰. Currently, a new concept coined as third way or *Amazon 4.0* has been gaining strength, and it advocates for the development of a forest economy, sustainable and fair to local communities¹⁴¹. The three models are analyzed below.

THE DEVELOPMENT-ORIENTED MODEL: FOREST CLEARING FOR ECONOMIC EXPLOITATION

The effective occupation of the Amazon area started in the mid-1960s, driven mostly by a geopolitical concern: the need to integrate the forest to national territory, populating it and introducing State presence. The underlying objective was to ensure the country's sovereignty over the forest and its natural resources¹⁴². From then on, the Government created incentives for farmers and workers from different parts of Brazil to settle in the Amazon. The measures included tax incentives, loans in favorable conditions and cheap land¹⁴³. Roads were built to enable the transportation of production, with the inevitable occupation and deforestation of their margins and impacts over the ecosystem. Gradually, what has come to be known as the "arc of deforestation" developed, marked by intense forest suppression and large hotspots¹⁴⁴. Some leaders still

135. Decreto No 10.239, de 12 de Fevereiro de 2020, Diário Oficial da União [D.O.U.] de 12.2.2020 (Braz.).

136. A biome is a geographical space with common features in climate, vegetation, fauna, altitude and other factors. According to the Ministry of the Environment, Brazil has six different biomes: Amazon, Caatinga (arid lands), Cerrado (savanna), Atlantic Forest, Pampa and Pantanal. *Biomass*, Ministério do Meio Ambiente [Ministry of the Environment] (Mar. 16, 2020), <https://www.mma.gov.br/biomass.html>.

137. Ministério do Meio Ambiente [Ministry of the Environment], Plano de Ação para a Prevenção e Controle do Desmatamento na Amazônia Legal, Primeira Fase (2004), https://www.mma.gov.br/images/arquivo/80120/PPCDAM_fase1.pdf.

138. Veríssimo, *supra* note 47 ("In 1970, when deforestation started to accelerate, the region was responsible for 8% of the country's GDP. Today, 45 years later, after all that has happened in terms of deforestation, cattle-raising, farming, mining and the creation of cities, the region still responds to the same proportion of 8% of Brazil's GDP").

139. Ministério do Meio Ambiente [Ministry of the Environment], *supra* note 141.

140. Nobre et al., *supra* note 51.

141. According to Beto Veríssimo, *Bases para um blue print desenvolvimento sustentável na Amazônia*, Mimeo 5-6 (2020), the development cycles in the Amazon can be divided as follows: Amazon 1.0 (old extractive practices); Amazon 2.0 (Agriculture and cattle-raising); Amazon 3.0 (Agriculture and forest systems and tourism); and Amazon 4.0 (Bioeconomy and environmental services).

142. Bertha K. Becker, *Revisão das políticas de ocupação da Amazônia: é possível identificar modelos para projetar cenários?*, 12 *Parcerias Estratégicas* 135, 135-136 (2001).

143. Dennis J. Mahar, *Desenvolvimento econômico da Amazônia: uma análise das políticas governamentais* 107-169 (IPEA/INPES ed., 1978); and Anna Luiza O. de Almeida, *Colonização dirigida na Amazônia* 20-25 (IPEA ed., 1992).

144. The Arc of Deforestation – or Densely Populated Arc – includes the Western part of Maranhão State, Tocantins, parts of Pará and Mato Grosso, the whole State of Rondônia, the South of Amazon State, and Acre. The arc concentrates the highest deforestation levels in the Amazon, nearing 75% of its total area. It was started with new highways Belém-Brasília and Cuiabá-Porto Velho and grew with the expansion of the highway infrastructure, which pushed deforestation deeper into the forest. See i, ISA – Instituto Socioambiental (Dec. 17, 2019), <https://www.socioambiental.org/pt-br/noticias-socioambientais/novo-arco-do-desmatamento-fronteira-de-destruicao-avanca-em-2019-na-amazonia>.

believe that deforestation is equivalent to progress¹⁴⁵. It is important to note, however, that the Amazonian soil is not, in general, a rich soil, and it relies on the forest cover and the climate for its own preservation¹⁴⁶. Among the criticisms made to the integration process that took place in the Amazon, is, besides environmental degradation, the creation of large rural properties (*latifundio*)¹⁴⁷ and the lack of legal requirements that at least part of the gains be locally reinvested¹⁴⁸.

The truth is that agribusiness consolidated itself as the country's main economic activity¹⁴⁹, with a significant portion of production originating in the Amazon. The figures are impressive: Brazil is the main global exporter of soybeans, providing for about 30% of the worldwide output¹⁵⁰. Approximately 58,5% of this production is sold in international markets, and 12% comes from the area of the Amazon biome¹⁵¹.

As for animal husbandry, the country has the world's largest cattle herd and is responsible for providing approximately 15% of the world's consumption of beef¹⁵². Well: around 40% of the herd and a significant part of the slaughterhouses are located in the Legal Amazon¹⁵³, and 20% of the national beef production is exported¹⁵⁴. Estimates indicate cattle-raising activities as responsible for about 80% of deforestation in the Amazon¹⁵⁵. In reality, however, there is no necessary relation between the expansion of agribusiness and deforestation: when the rate of forest deforestation decreased by 80% (between 2004 and 2012), the sector's results almost tripled¹⁵⁶. And this was not only due to a price increase in international markets. Studies also indicate that agribusiness productivity in the Amazon is lower than that of other regions¹⁵⁷ and that it can be substantially increased, within the current available area, through investment, technology and adequate management¹⁵⁸.

145. On that regard, Assuero Doca Veronez, president of the Acre State Agriculture Federation, stated that "deforestation is equivalent to progress for us, even if it may shock people", and added that "Acre does not have mining or tourist potential, but it does have the best lands in Brazil. The only problem of this land is its standing forest". *Amazonas, Acre e Rondônia querem o seu próprio matopiba*, Amazônia: notícia e informação (Mar. 9, 2020), <https://amazonia.org.br/2020/03/amazonas-acre-e-rondonia-querem-o-seu-proprio-matopiba/>.

146. Nobre et al., *supra* note 51; Mahar, *supra* note 147, at 122-127.

147. Mahar, *supra* note 147, at 160 ("The tax incentives allowed a few corporations to buy large areas of land at very low costs and were responsible for the creation of great properties with public money").

148. Mahar, *supra* note 147; Almeida, *supra* note 147, at 122-127.

149. *PIB do agronegócio brasileiro*, CEPEA – Center of Advanced Studies in Applied Economic, <https://www.cepea.esalq.usp.br/br/pib-do-agronegocio-brasileiro.aspx> (last visited Mar. 18, 2020).

150. Marcelo C.C. Stabile. et al., *Solving Brazil's land use puzzle: Increasing production and slowing Amazon deforestation*, 91 Land Use Policy 104362, 104362 (2019), <http://doi.org/10.1016/j.landusepol.2019.104362>. According to the UN Food and Agriculture Organization, in January 2018, the amount of soybeans produced in Brazil responded for 34% of its global production. Food and Agriculture Organization of the United Nations, <http://www.fao.org/faostat/en/#compare> (last visited Apr. 1, 2020).

151. FEBRABAN – Federação Brasileira dos Bancos [Brazilian Bank Federation] & FGV EAESP – Centro de Estudos em Sustentabilidade [Center of Sustainability Studies], *Instituições Financeiras e a Gestão do Risco de Desmatamento* 28-36 (2018). http://mediadrawer.gvces.com.br/publicacoes-2/original/103_instituicoes_financ.pdf.

152. Stabile et al., *supra* note 154.

153. FEBRABAN – Federação Brasileira dos Bancos [Brazilian Bank Federation] & FGV EAESP – Centro de Estudos em Sustentabilidade [Center of Sustainability Studies], *supra* note 155, at 13-37; Barreto et al., *IMAZON – Instituto do Homem e Meio Ambiente da Amazônia* [Amazon Institute of People and the Environment], *Os frigoríficos vão ajudar a zerar o desmatamento na Amazônia?* (2017), <https://imazon.org.br/PDFimazon/Portugues/livros/Frigorificos%20e%20o%20desmatamento%20da%20Amaz%C3%B4nia.pdf> (last visited Mar. 5, 2020).

154. FEBRABAN – Federação Brasileira dos Bancos [Brazilian Bank Federation] & FGV EAESP – Centro de Estudos em Sustentabilidade [Center of Sustainability Studies], *supra* note 155, at 13-37. According to the study, 81% of the production is consumed domestically and 19% exported. China, Egypt, Russia and Iran are among the main external markets.

155. Ministério do Meio Ambiente [Ministry of the Environment], *supra* note 141 ("Cattle-raising is responsible for about 80% of all cleared areas in 'Amazônia Legal'"). An IMAZON study sustains that "cattle-raising remains as the leading force in the occupation of cleared areas in the Amazon, occupying between 75% and 81% of the total cleared area between 1990 and 2005". See Barreto et al., *IMAZON – Instituto do Homem e Meio Ambiente da Amazônia* [Amazon Institute of People and the Environment], *A Pecuária e o desmatamento na Amazônia na Era das Mudanças Climáticas* 20 (2008), <https://imazon.org.br/publicacoes/a-pecuaria-e-o-desmatamento-na-amazonia-na-era-das-mudancas-climaticas/>.

156. Nobre et. al., *supra* note 51, at 10760.

157. A study conducted in 2016 estimates that the agricultural production of the Amazon responds for 14,5% of the sector's total output, with the use of 750.000 square meters of cleared areas; São Paulo State, in comparison, responds for 11,3% of the output with a much smaller area used, 193.000 square kilometers. Nobre et. al., *supra* note 51.

158. Stabile et al., *supra* note 154, at 4.

The economic logic that favors deforestation is also present among the low-income population, comprised of small farmers and agrarian reform settlers. These groups are negatively impacted by low yields, caused by a lack of basic infrastructure, limited access to technology, to technical assistance and to markets. As a result, they remove forest covers, promote burnings, exhaust soils and then move to new areas. It is estimated that agricultural settlements are responsible for about 30% of deforestation in recent years¹⁵⁹. Tackling deforestation promoted by this social group depends on the implementation of public policies that assist production and/or create economic alternatives with income opportunities. In their current situation, their struggle is for survival, where the short-term logic prevails. Even though deforestation and burnings (or even illegal logging and mining) rapidly exhaust the soil, they are the available instruments for immediate subsistence¹⁶⁰. As seen, therefore, there is an economic logic to forest destruction and until it is overcome, the pressure on the Rainforest will subsist.

THE ENVIRONMENTALIST MODEL: EMPHASIS ON MAXIMUM FOREST CONSERVATION

In contrast to the previous, there is a second model of Amazon occupation, with a primary focus on the conservation of the forest, its fauna, flora, rivers, peoples and traditional cultures. For this end, the model proposes the creation of areas subject to high levels of regulation and protection, so that the larger part of the Amazon biome is perpetually conserved. The creation of large conservation units – including national parks, biological reserves, national forests and environmental protection areas – and the demarcation of indigenous lands are methods for implementing this strategy. The conservation units, regulated by a law enacted in 2000, can be (i) of *full conservation*, aimed at keeping ecosystems free of any changes caused by human intervention¹⁶¹; or (ii) of *sustainable use*,

allowing for the exploitation of nature's goods in a manner that ensures perpetuity of the resources and the environmental processes, in a socially fair and economically viable manner¹⁶². The conservation units protect biodiversity, the *habitat* and the lifestyle of the forest's traditional communities, while preserving the Amazon biome's economic potential.

The indigenous lands formally belong to the Federal Government but, according to the Constitution, indigenous communities are entitled to the areas that they have traditionally occupied, so that it is the Federal Government's responsibility to demarcate and protect these areas¹⁶³. In general, indigenous peoples' use of resources is compatible with their traditional culture, which values the sustainable exploitation of natural resources and the protection of nature. As already noted, the exploitation of hydraulic resources and hydroelectric potential, as well as the search for and exploitation of mineral resources in indigenous lands, depend on previous congressional authorization, the consultation of the interested communities and a guaranteed participation in the revenues¹⁶⁴. The demarcation of these areas limits the uncontrolled advance of economic activities. As of 2019, there were 723 areas designated as indigenous land in Brazil, where 424 of them were located in the Amazon. In terms of size, 98% of this territory is located within the Legal Amazon, representing 23% of its total area¹⁶⁵. The demarcation of indigenous lands legitimately occupied by native populations serve justice and utilitarian purposes: it protects the life and immemorial rights of these communities and contributes to environmental conservation, which benefits the entire humankind. Nonetheless, there are strong critics of these demarcation policies¹⁶⁶.

In 2004, in response to the increase in forest deforestation and under international pressure, Brazil launched the Plan for the Prevention and Control of Deforestation in the Legal

159. See *id.* In October 2019, settlements were responsible for 32% of deforestation. See IMAZON – Instituto do Homem e Meio Ambiente da Amazônia [Amazon Institute of People and the Environment], Sistema de Alerta de Desmatamento (2019), <https://imazon.org.br/wp-content/uploads/2019/12/SAD-Outubro-2019.pdf>.

160. Studies highlight the fact that deforestation brings about an initial push for local economies and provides job opportunities. This “boom”, however, is followed by a “bust”, since the initial growth is not sustainable in the long run. Anyhow, this paper focuses on the fact that the initial immediate impact on income opportunities to poor communities may be enough to promote the logic behind deforestation. Therefore, it is essential to build sustainable economic options for these communities. See Celentano et al., *supra* note 37, at 850-864; Ana S. L. Rodrigues et al., *Boom-and Bust Development Patterns Across the Amazon Deforestation Frontier*, 324 Science 1435, 1435-1437 (2009).

161. Lei No 9.985, de 18 de Julho de 2000, Diário Oficial da União [D.O.U.] de 19.7.2000, art. 2º, I and arts. 8º to 13 (Braz.). The integral protection conservation units are composed of ecological stations, biological reserves, national parks, natural monuments, and wildlife refuges, each one of them with specific features.

162. Lei No 9.985, de 18 de Julho de 2000, Diário Oficial da União [D.O.U.] de 19.7.2000, art. 2º, I and arts. 14 to 21 (Braz.). The conservation units of sustainable use are composed of areas of environmental protection, areas of relevant environmental interest, national forests, extractive reserves, fauna reserves, sustainable development reserves and natural patrimony reserves.

163. Constituição Federal [C.F.] [Constitution] art. 231 (Braz.).

164. Constituição Federal [C.F.] [Constitution] art. 232 (Braz.).

165. *Localização e extensão das terras indígenas*, Povos Indígenas do Brasil (Feb. 21, 2019), https://pib.socioambiental.org/pt/Localização_e_extensão_das_TI's.

166. Among them, current President Jair Bolsonaro. See Marcelo Oliveira, *Bolsonaro: país tem “indústria de demarcação” e reservas indígenas abusivas*, UOL (Feb. 11, 2020), <https://noticias.uol.com.br/meio-ambiente/ultimas-noticias/redacao/2020/02/11/bolsonaro-demarcacoes-abusivas-amazonia-terras-indigenas.htm>.

Amazon (PPCDAm)¹⁶⁷, with the declared goals of continuously and consistently reducing deforestation and creating the conditions for a model of sustainable development in the Legal Amazon. The plan was structured in four stages, centered around four axes: (i) land and territorial planning; (ii) environmental monitoring and control; (iii) fostering of sustainable production activities; and (iv) economic and regulatory instruments. In its first stage, between 2004 and 2008, the land and territorial planning effort had the greatest success, with the creation of more than 25 million hectares of federal conservation units and the homologation of 10 million hectares of indigenous lands¹⁶⁸. In the second stage, between 2009 and 2011, the monitoring and control axis had the greatest impact in reducing deforestation, as a result of an effective monitoring system and the agility of integrated operations of inspection and repression of organized crime in the region, involving IBAMA, Federal Police and Federal Highway Police, the National Public Safety Guard and support from the Army¹⁶⁹. In 2009, Brazil also approved the National Policy on Climate Change (PNMC), through which it voluntarily committed to nationally reducing between 36,1% and 38,9% of its projected carbons emissions by 2020¹⁷⁰.

Although all four axes were meant to be implemented simultaneously, the first two stages of the PPCDAm performed better and were aligned with the environmentalist model of forest conservation.

THE HYBRID MODEL: A DIFFICULT BALANCE

The third axis of the PPCDAm—fostering sustainable production activities—focuses on the development of economic activities compatible with the conservation of a balanced environment. It is the middle ground that attempts to attend to the urgent socio-economic needs of local producers and workers, but also to forest protection. As mentioned, the first two stages were successful in containing deforestation. As a result, the demands for economic alternatives for the local populations strengthened, given

that the repression of illicit activities also results, to a certain extent, in the disruption of their sources of subsistence. The evaluation report of the third stage implementation (2012-2015) highlighted the success in curbing deforestation, but acknowledged a low degree of success in the axis focused on sustainable development, emphasizing that this is an essential factor to ensure that the reduction in deforestation persisted in the long run¹⁷¹. Unsurprisingly, from 2015 onwards, with the country's economic downturn, deforestation levels started to rise again, gradually increasing in 2016, 2017 and 2018. In 2019, there was a 30% increase in comparison with the previous year¹⁷², affecting even indigenous lands and conservation units¹⁷³.

The main public land categories in the Amazon are the conservation units, the indigenous lands, the agrarian reform settlements and the non-allocated lands. As for the privately owned areas, in general, there is an obligation to respect the legal reserve and permanent conservation areas. The main economic activities in the region are animal husbandry, agriculture and *extractivism*, the process of extracting natural resources, including timber, from the Earth to sell in the world market. The main challenge is conciliating these activities with forest and environmental conservation. For such, the third stage of the PPCDAm's focus on fostering sustainable economic activities had as its declared objectives: (i) to promote the viability of supply chains that offer alternatives to deforestation¹⁷⁴; (ii) to foster good agriculture and cattle-raising practices, including replacement of fire use; (iii) to increase production and trade of timber extracted from sustainable forest management projects, increasing the public concession areas; (iv) to promote sustainable productive activities in settlements and family farming units¹⁷⁵. Because cattle-raising is the main economic activity in the region and also the most important cause of deforestation, it is crucial to increase productivity per hectare¹⁷⁶ and to recover degraded soil, in order to reduce the need to clear new areas for cattle or agriculture. According to experts, almost 70% of the cleared lands are underused and there are millions of abandoned

167. Plano de Ação para Prevenção e Controle do Desmatamento na Amazônia Legal (PPCDAm), Ministério do Meio Ambiente [Ministry of the Environment] (Sep. 23, 2016), <http://redd.mma.gov.br/pt/PT/ACOMPANHAMENTO-E-A-ANALISE-DE-IMPACTO-DAS-POLITICAS-PUBLICAS/PPCDAM>.

168. Ministério do Meio Ambiente [Ministry of the Environment], *supra* note 42. Member States in the region added 25 million hectares of conservation units.

169. See *id.*

170. Lei No 12.187, de 29 de Dezembro de 2009, Diário Oficial da União [D.O.U.] de 30.12.2009, art. 12 (Braz.)

171. CEPAL, IPEA & GIZ, Avaliação Independente do Plano de Ação para Prevenção e Controle do Desmatamento na Amazônia Legal: PPCDAm 2007-2010 (2011), http://repositorio.ipea.gov.br/bitstream/11058/884/1/IPEA_GIZ_Cepal_2011_Avaliacao%20PPCDAm%202007-2011_web.pdf

172. PRODES – Monitoramento do Desmatamento da Floresta Amazônica Brasileira por Satélite, *supra* note 39.

173. INPE – Instituto Nacional de Pesquisa Espaciais [National Institute of spacial reaserch], *supra* note 64.

174. Production supply chains involve all stages in production and trade until a raw material reaches the consumer. In agriculture, it is composed of the following: acquisition of seeds and other products, planting, crop management, harvesting, transportation, storage, processing, and sale. See Luiz Antônio Machado Vial et al., *Cadeias produtivas – Foco na cadeia produtiva dos produtos agrícolas* (2009), <https://ensur2009.paginas.ufsc.br/files/2015/09/CADEIAS-PRODUTIVAS-UNISINOS.pdf>.

175. Ministério do Meio Ambiente [Ministry of the Environment], Plano de Ação para Prevenção e Controle do Desmatamento na Amazônia Legal, Terceira Fase 71 (2013), https://www.mma.gov.br/images/arquivo/80120/PPCDAm/_FINAL_PPCDAM.PDF.

176. Cattle-raising still underperforms and presents low yields. Its rate in the Amazon is quite low, between 0,5 and 1 animal per hectare. *Id.*, at 65.

hectares. With the help of technology, the area that has already been cleared is more than enough to sustain, for the next decades, farms, mining activities and even hydroelectric power projects¹⁷⁷.

Creating incentives for sustainable activities (with land regularization, technical assistance and enhanced access to technology), social awareness concerning the negative impacts of fire (soil degradation, emission of greenhouse gases and high risk of causing forest fires), improving soil use, recovering degraded areas and reoccupying abandoned lands are some measures that can be adopted to curb deforestation in the Amazon, along with monitoring, oversight and repression of criminal activities. Nonetheless, as the abovementioned data shows, the hybrid model has been unable to deter the economic dynamics of destruction. Forest conservation will require, therefore, beyond all the already mentioned efforts, bold, creative and original solutions, which demand, among other things, appreciation of local knowledge and heavy investments in science and technology.

A NEW DEVELOPMENT MODEL: THE FOURTH INDUSTRIAL REVOLUTION AND THE FOREST BIOECONOMY

Throughout history, the Amazon has lived with low impact economic activities, such as non-timber forest productions – including *açaí*, *babaçu*, rubber and Brazil nut, among others – and also high impact activities, such as agribusiness, logging and mining. The truth is that there has been no significant improvement in the economic, social, and human development levels in the region, even though deforestation has reached around 20% of the total forest area. In this context, scientists devoted to studying the Amazon have been reflecting on new ideas to solve old challenges, betting on the use of new technologies to promote efficiency in the production of goods and services generated from the Amazon's natural resources, with a primary focus on creating supply chains beneficial for local populations and small producers.

It is worth recollecting that, until the end of the 20th century, the world lived through three major industrial revolutions: the first one is mainly represented by the advance of the use of steam; the second, of electricity; and the third, the internet, the worldwide web that connects billions of people around the globe in real time¹⁷⁸. A fourth revolution is already underway¹⁷⁹, resulting from the fusion of information technology with biotechnology, in a world marked by the advance of artificial

Even the most reluctant producers to associating themselves with environmentally sound practices answer to economic incentives.

intelligence and its byproducts, such as the internet of things, drones, self-driving cars, robotics, nanotechnology, 3-D printing, among many other. The use of these innovations to reimagine a new economic model for the Amazon has been considered the path to the future and the region's redemption.

Bioeconomy is an economic model that prioritizes sustainability. It relies on breakthroughs in the fields of technology and biological sciences, with a view to reducing the dependency on non-renewable resources and to facilitating low carbon and low environmental impact production processes¹⁸⁰. The major breakthrough occurred when it became possible to read and copy the code of life – DNA – and also to edit it¹⁸¹. Currently, techniques involving genetic biology are present in several domains, ranging from therapies and pharmaceuticals to agricultural crops, animal food, fuels, leather, vaccines, plastic and a wide array of products. The global language, which had already migrated from the analog to the digital, has now reached the genetic code¹⁸². In this context, a new paradigm for sustainable development emerges, founded on bioeconomy. The application of this new paradigm to the Amazon, combining the knowledge of the region's biodiversity with the possibilities of Industry 4.0, has been advocated by the acclaimed Brazilian climatologist Carlos Nobre in different articles published in Brazil and abroad, as

well as in a presentation at the 2020 World Economic Forum, in Davos. The paragraph below summarizes some of his ideas. The relative restraint in deforestation rates, especially between 2004 and 2012, opened a window of opportunity to structure a "third path" for development in the Amazon, a middle ground between the extremes of keeping the forest untouched or continuing to clear it. This new approach, entitled forest bioeconomy, consists in using the knowledge obtained through science, technology, innovation and strategic planning to develop new pharmaceutical products, cosmetics and food, as well as to research new materials and energy solutions. As an example, the plants in the Amazon

177. Veríssimo, *supra* note 47.

178. See Luís Roberto Barroso, *Revolução tecnológica, crise da democracia e mudança climática: limites do direito num mundo em transformação*, 5 Revista Estudos Institucionais 1262, 1277 (2019).

179. Klaus Schwab, The fourth industrial revolution (Crown Business ed., 2017). Klaus Schwab, *The fourth industrial revolution: What it means and how to respond*, World Economic Forum (2016), <https://www.weforum.org/agenda/2016/01/the-fourth-industrial-revolution-what-it-means-and-how-to-respond/>.

180. OCDE, The bioeconomy to 2030: designing a policy agenda (2009), <http://www.oecd.org/futures/long-termtechnologicalsocietalchallenges/thebioeconomyto2030designingapolicyagenda.htm> (“From a broad economic perspective, the bioeconomy refers to the set of economic activities relating to the invention, development, production and use of biological products and processes”).

181. Harvard Business Review – Brasil & Confederação Nacional da Indústria – CNI, Bioeconomia: uma agenda para o Brasil 6 (CNI ed., 2013).

182. *Id.*, at 8.

have biochemical secrets, such as new molecules, enzymes, antibiotics and natural fungicides, that can be synthesized in labs to generate value-added products¹⁸³. There are also examples of native fruits, such as *açaí* and *cupuaçu*¹⁸⁴. Both have already been the target of undue appropriation attempts of their names and uses¹⁸⁵. *Açaí*, by the way, has become an important item in Brazilian exports, and its production benefits over 300,000 local farmers and generates US\$ 1 billion annually for the region's economy. It is in this context that the concept of Amazon 4.0 is discussed, with the purpose of aggregating the full potential of the Amazon's social and biological diversity – fauna, flora and traditional knowledge – with the new technologies and possibilities of the fourth industrial revolution. The idea is to transform the natural resources into value-added goods, that are produced and consumed in sustainable ways. This entire process should also have the fair concern of bringing substantial benefits to local communities¹⁸⁶.

As intuitive, all of these proposals require education, science, technology and attracting human resources from other parts of Brazil and from elite international institutions to the region. People who are willing to join the long-standing efforts of private and public institutions such as the INPA – Amazon National Research Institute, ISA – Socio-Environmental Institute, INPE – National Institute of Space Research, IMAZON – Amazon Institute of People and the Environment and CENSIPAN – Operations and Management Center of the Amazonian Protection System, among many others. It is precisely this local limitation for knowledge production, due to low investments and the resulting lack of research institutions and personnel, that hinders the full realization of the region's potential¹⁸⁷, especially in a world where knowledge, information and technology are the most valuable assets. The most important goal, therefore, should be producing top-notch and wide-ranging knowledge, in areas such as digital technology, biological sciences, genetic studies, development of raw materials and others.

Government financing, start-ups, new research centers, public-private partnerships, social and private entrepreneurs, investors and companies can contribute to bring about something similar to what happened at the Silicon Valley, in

California. State of the art science to tackle big problems¹⁸⁸. Does it sound too ambitious? But, if the Amazon is vital to humankind, why should we settle for less? In that regard, a document published in the end of 2019 by a group of Brazilian and foreign scientists, proposed the creation of a Science Panel for the Amazon (SPA), to include researchers of public and academic institutions, from the Amazonian countries and from around the world. According to the document, the panel must also include representatives of local cultures, who have traditional knowledge of the forest¹⁸⁹.

In a nutshell, the greatest protection against forest destruction is to develop an economic logic for its preservation, rather than its clearing down, either because its preservation generates income to local populations, either because it generates substantial economic benefits for the entire country, or, still, because it enables biotechnological breakthroughs that benefit humankind as a whole. When this goal is achieved, the forest will be safer. If this goal is not achieved, there will be no police apparatus capable of containing the forest's destruction.

INTERNATIONAL ENGAGEMENT

International engagement can also be an important factor in containing deforestation and fostering economic and environmental sustainability in the Amazon. In the first place, developed countries must acknowledge their historic responsibility in the destruction of their own forests, as well as their significant role in climate change. Therefore, it is fair that they contribute by financing programs and projects that reduce greenhouse gas emissions, and providing technical assistance, to prevent developing countries from following the same destructive path. Secondly, a large part of the Amazon's agricultural, animal husbandry, timber and mineral outputs are consumed by international markets, which means that they can influence the behavior of domestic producers, demanding sustainable production practices. Finally, in the third place, the international financial market can contribute by incorporating environmental considerations in their risk and viability assessments on projects in search of financing or stock placements. The three alternatives for international engagement in combatting deforestation are examined in the following paragraphs.

183. In the same sense, see: an interview with Thomas Lovejoy, World Bank (May 22, 2019), <https://www.worldbank.org/en/news/feature/2019/05/22/why-the-amazons-biodiversity-is-critical-for-the-globe> ("Every species in this incredibly biodiverse system represents solutions to a set of biological challenges -- any one of which has transformative potential and could generate global human benefits").

184. Ismael Nobre & Carlos Nobre, Projeto "Amazônia 4.0": definindo uma terceira via para a Amazônia, 2 Futuribles em Português 7, 8-13, 15 (2019); Nobre et. al., *supra* note 51, at 10759-10760, 10764-10765.

185. As already mentioned, besides the case of *açaí*, *cupuaçu* also had its name and use patented in Japan, the United States, and the European Union. These patents were later voided. See Nogueira et al., *supra* note 109, at 7.

186. Nobre & Nobre, *supra* note 188; Nobre et. al., *supra* note 51, at 10759-10760, 10764-10765.

187. Adalberto Luis Val, BNDES, Caminhos para manter a floresta de pé. Amazônia em debate: oportunidades, desafios e soluções 32 (2010), https://web.bndes.gov.br/bib/jspui/bitstream/1408/1906/2/Amaz%C3%B4nia%20em%20debate_oportunidades%2C%20desafios%20e%20solu%C3%A7%C3%B5es%20final-A_P.pdf ("I would like to remind you that the Amazon responds for 8% of Brazil's GDP, but accounts for just 2% of the science and technology investments").

188. Nobre et. al., *supra* note 51, at 10765 ("It has become vital and indeed urgent to instigate a real scientific, high-tech, and innovation revolution in the Amazon").

189. Scientists of the Amazon Countries and Global Partners, Scientific Framework to save the Amazon 11 (2019), <https://www.conservation.org/docs/default-source/brasil/ascientificframeworktosavetheamazonfinalversion.pdf>.

Forest conservation will require bold, creative and original solutions, which demand, among other things, appreciation of local knowledge and heavy investments in science and technology.

FINANCING AND TECHNICAL ASSISTANCE TO CURB DEFORESTATION: CDM AND REDD+

Two initiatives stand out when it comes to promoting sustainable development in emerging countries through financing and technical assistance. The first one is the Clean Development Mechanism (CDM), which relates to the UN Framework Convention on Climate Change and the Kyoto Protocol. This instrument established that developed countries would assist projects aimed at reducing emissions in developing countries. Specifically, these projects would generate Certified Emission Reductions units, that could be traded in the global market, in order to raise funds for environmental protection. The CDM was meant to last until 2020. However, it was criticized for, among other things, its inability to bring about meaningful environmental impact, mostly due to the fact that developed countries used the mechanism to buy their way into continuing their own emissions above agreed limits¹⁹⁰.

The second initiative, seemingly intended to replace CDM, is the system of Reducing Emissions from Deforestation and Forest Degradation (REDD+)¹⁹¹. The mechanism aims at training and financing projects in developing countries that strive to curb deforestation or to recover degraded forests, through which a compensation is paid to these countries based on their performance in achieving these ends¹⁹².

The Paris Agreement incorporated REDD+ and developed countries were urged to collectively contribute to raise US\$ 100 billion a year to finance REDD+ initiatives, in order to help emerging countries meet their greenhouse gas emission reduction targets¹⁹³. Two important international initiatives for the financing of REDD+ were the World Bank's Forest Carbon Partnership Facility (FCPF) and the UN-REDD Programme, a joint project of the United Nations and the Food and Agriculture Organization (FAO)¹⁹⁴. A few developed countries also instituted bilateral programs in support of REDD+, such as Norway and Germany. However, current financing for REDD+ is insufficient for reduction initiatives¹⁹⁵: the resources available are predominately state funded and there is an urgent need to create the incentives for the market to contribute as well¹⁹⁶.

In 2008, Brazil launched the Amazon Fund¹⁹⁷, focused on the financing of REDD+ initiatives, and, by 2018, had received approximately R\$ 3.4 billion in donations. Of this amount, 93.8% was provided by the Government of Norway, 5.7% by the Government of Germany and 0.5% by Petrobras, Brazil's publicly-held oil and gas company¹⁹⁸. In 2009, the country approved its previously mentioned National Policy on Climate Change (PNMC)¹⁹⁹. In 2010, it also committed to an 80% reduction in deforestation rates in the Amazon, in comparison with the average rates recorded between 1996 and 2005²⁰⁰.

190. Urvashi Narain & Klaas Van 't Veld, *The clean development mechanism's low-hanging fruit problem: When might it arise, and how might it be solved?*, 40 *Environmental and Resource Economics* 445 (2008), <https://doi.org/10.1007/s10640-007-9164-x>; Srikanth Subbarao & Bob Lloyd, *Can the Clean Development Mechanism (CDM) deliver?*, 39 *Energy Policy* 1600 (2011), <https://doi.org/10.1016/j.enpol.2010.12.036>; Axel Michaelowa & Frank Jotzo, *Transaction costs, institutional rigidities and the size of the clean development mechanism*, 33 *Energy Policy* 511 (2001), <https://doi.org/10.1016/j.enpol.2003.08.016>.

191. There is an essential element that differentiates REDD+ and CDM. On the Paris Agreement Framework, all countries have their own emission targets to achieve, while the Kyoto Protocol established that the developed countries had a previously defined target and resorted to the carbon credits as an additional instrument to surpass them. Sandra Greiner et al, *Moving towards next generation carbon markets: observation from article 6 pilots*, Climate Focus and Perspectives (2019).

192. REDD was originally an instrument directed at reducing deforestation and forest degradation. Later, sustainable management of forests, conservation and increase in carbon stocks (REDD+) were added.

193. Draft of the decision to adopt the Paris Agreement, items 54 e 115. See United Nations, Framework Convention on Climate Change, Adoption of the Paris Agreement (2015).

194. María Eugenia Recio, *Dancing like a toddler? The Green Climate Fund and REDD+ International rule-making*. 28 *RECIEL* 122, 132 (2019).

195. See *id.*

196. Virgílio Viana, *Financing REDD: How Government Funds Can Work with the Carbon Market*, IIED Briefing (2009).

197. Decreto No 6.527, de 1º de Agosto de 2008, Diário Oficial da União [D.O.U.] de 4.8.2008 (Braz.). The Fund promotes the financing of initiatives of prevention, monitoring and combatting deforestation and promotion of conservation and sustainable practices in the "Amazônia Legal".

198. Fundo Amazônia, Fundo Amazônia – 10 Anos: Relatório de Atividades 2018 27-31 (2018), http://www.fundoamazonia.gov.br/export/sites/default/pt/galleries/documentos/rafa/RAFA_2018_port.pdf.

199. Lei No 12.187, de 29 de Dezembro de 2009, Diário Oficial da União [D.O.U.] de 30.12.2009 (Braz.).

200. Decreto No 7.390, de 9 de Dezembro de 2010, Diário Oficial da União [D.O.U.] de 10.12.2010, art. 6, §1º, I (Braz.). The legal clause was incorporated by Decreto 9.578, de 22 de Novembro de 2018, Diário Oficial da União [D.O.U.] de 23.11.2018 art. 19, §1º, I, (Braz.) which consolidated the normative framework of the National Fund on Climate Change.

In 2015, it established its REDD+ National Strategy (ENREDD+)²⁰¹ and created its REDD+ National Commission (CONAREDD+)²⁰². As a result, the Amazon Fund became eligible for access to payments for REDD+ results achieved by Brazil and recognized by the UNFCCC. The country's story, therefore, was becoming a success story of fundraising and strengthening of credibility concerning Brazil's management and employment of those resources. However, the surge in deforestation in the Amazon region in 2019, the burnings and the disagreements with the Brazilian Federal Government led to the suspension of funding from the aforementioned donor countries²⁰³.

DEMANDS FROM CONSUMER MARKETS: PRODUCTS NOT ASSOCIATED TO DEFORESTATION

A second important contribution for Amazon preservation can come from consumer markets for Brazilian exports. As already mentioned, a significant portion of the country's agriculture and cattle-raising production is directed to international markets, with relevant impact on Brazil's GDP. In this context, international consumers' rejection of products associated to deforestation can be effective in discouraging environmentally harmful behaviors. In fact, a successful experience known as Brazil's Soy Moratorium, proves the point. In 2006, Greenpeace organized a campaign nominally denouncing soy industry corporations—responsible for technical assistance, financing and production purchase—complicit with Amazon deforestation²⁰⁴. The complaints led to a negotiation which resulted in an agreement between agrobusiness entities, environmental NGOs and the

Government to refrain from buying soybeans from these areas after July 2006. The large corporations in the industry yielded in face of the risk of reputational damages before a growingly environmentally conscious consumer market. Studies show a staggering reduction in deforestation associated to the production of this commodity²⁰⁵.

The campaign also served as a model for the celebration of a similar agreement, a couple of years later, with large companies involved in the production and export of Brazilian meat. This second agreement, celebrated by Greenpeace, became known as *G4 Zero Cattle Agreement*, and required the companies to commit to have zero deforestation in their supply chains²⁰⁶. A study on the impacts of the agreement over the cattle-raising industry shows that it effectively led to a reduction in deforestation undertaken by its direct suppliers.²⁰⁷ Both campaigns demonstrate that consumer markets of a given product have the power to interfere with its production process and provide incentives for the adoption of responsible environmental practices²⁰⁸. Monitoring only direct suppliers, however, is not enough. The oversight must extend to the entire production chain, in order to avoid that suppliers involved with deforestation sell their products to those who are compliant, “laundering” contaminated products. Lack of appropriate monitoring of indirect suppliers can promote a deceitful perception of engagement in combatting deforestation²⁰⁹. One of the instruments frequently used for this oversight is certification²¹⁰. Anyhow, the examples just mentioned illustrate the effectiveness of control actions over the supply chain. While there may be international initiatives in this domain, it is important to strengthen them, demand the

201. Ministério do Meio Ambiente [Ministry of the Environment], ENREDD+ : Estratégia nacional para redução das emissões provenientes do desmatamento e da degradação florestal, conservação dos estoques de carbono florestal, manejo sustentável de florestas e aumento de estoques de carbono florestal (2016), http://redd.mma.gov.br/images/publicacoes/enredd_documento_web.pdf.

202. Decreto No 8.576, de 26 de Novembro de 2015, Diário Oficial da União [D.O.U.] de 27.11.2015 (Braz.) (substituted by Decreto No 10.144, de 28 de Novembro de 2019, Diário Oficial da União [D.O.U.] de 29.11.2019 (Braz.), currently in place).

203. Heloísa Negrão, *Após Alemanha, Noruega também bloqueia repasses para Amazônia*, El País (Aug. 16, 2019), https://brasil.elpais.com/brasil/2019/08/15/politica/1565898219_277747.html; Vanessa Barbosa, *Noruega suspende repasse de mais de R\$ 130 milhões ao Fundo Amazônia*, Exame, (Aug. 19, 2019), <https://exame.abril.com.br/brasil/noruega-suspende-repasse-de-mais-de-r-130-milhoes-ao-fundo-amazonia/>.

204. Greenpeace International, *Eating up the Amazon* (2006), <http://www.greenpeace.org/usa/wp-content/uploads/legacy/Global/usa/planet3/PDFs/eating-up-the-amazon-executiv.pdf>.

205. Holly Gibbs et al., *Brazil's Soy Moratorium*, 347 *Science* 377 (2015).

206. The initiative followed raids ordered by the Federal Prosecution Office against cattle-raising operations and slaughterhouses linked to deforestation. Those actions and their repercussions led to an agreement through which slaughterhouses committed to monitoring their supply chains and not to purchase from providers involved with deforestation. See National Wildlife Federation (NWF) e Gibbs Land Use and Environmental Lab (GLUE). *A Path Towards Zero Deforestation Cattle*, *Zero Deforestation Cattle*, <http://www.zerodeforestationcattle.org/#/home> (last visited Mar. 5, 2020).

207. Holly K. Gibbs et al., *Did Ranchers and Slaughterhouses Respond to Zero-Deforestation agreements in the Brazilian Amazon?*, 9 *Conservative Letters* 32, 32-42 (2016).

208. Along the same lines, Daniel Nepstad et al., *Slowing Amazon deforestation through public policy and interventions in beef and soy supply chains*, 344 *Science* 1118 (2014); Christian Brannstrom et al., *Compliance and market exclusion in Brazilian agriculture: analysis and implications for “soft” governance*, 29 *Land Use Policy* 357 (2012).

209. FEBRABAN – Federação Brasileira dos Bancos [Brazilian Bank Federation] & FGV EAESP – Centro de Estudos em Sustentabilidade [Center of Sustainability Studies], *supra* note 155.

210. Daniel Nepstad et al., *Globalization of the Amazon Soy and Beef Industries: Opportunities for Conservation*, 20 *Conservation Biology* 1600 (2006).

oversight of indirect suppliers, make the risks of restriction of products associated with deforestation believable and sanction irregular suppliers²¹¹.

CRITERIA FOR FINANCIAL INSTITUTIONS: DEFORESTATION AS A DEPRECIATION FACTOR AND RISK

The same logic applies to financial markets. Financial actors may contribute to the existing predatory model of production by being indifferent to the environmental issues, or they may be the agents of a historic change in paradigm. Agribusiness needs funding for its operations. These funds can be obtained through loans, sale of shares, IPOs, or other instruments. Financial institutions influence the decisions concerning investments and business models, by deciding whether or not to take environmental considerations into account²¹². It is important to note that there is a growing awareness that financial investments may be adversely affected by environmental problems or reputational damages caused to companies involved with deforestation²¹³. The possibility that consumer markets will impose restrictions over these products is a clear example. Holding financial institutions accountable for supporting illicit activities is also a possibility²¹⁴.

Some financial institutions have already started to incorporate environmental risk analysis in their investments. The Bank of Norway, for instance, removed from its investment portfolio the companies that failed to adjust to certain environmental standards²¹⁵. Along the same lines, the International Finance Corporation, the World Bank's financial branch, included environmental considerations in its performance assessment criteria²¹⁶. This sort of concern has also been addressed by Brazilian financial institutions. In fact, there are parameters for verifying environmental compliance in agribusiness financing and also specific requirements for companies located in the Amazon biome²¹⁷. As mentioned, the analysis must not be limited to the company or its direct suppliers. It must consider the entire production chain, include indirect providers, and establish conformation standards and good practices that, when disrespected, lead to the denial of funding or sanctions.

Even the most reluctant producers to associating themselves with environmentally sound practices answer to economic incentives. If environmental compliance of their entire chain

becomes a condition without which they will not be able to finance their activity, the tendency is that they will adjust their behavior to this new reality. Therefore, a third possibility for international engagement in fighting deforestation in the Amazon is the creation of global standards of environmental performance, to be considered by financial institutions when evaluating public offerings, shareholder transactions, financing or any other business involving agents who have, in their supply chain, companies who act in the Amazon biome. Even if observing these standards is not mandatory, their endorsement as good practices and the engagement of institutions may generate important reputational incentives and contribute to the creation of a new environmental paradigm²¹⁸.

Conclusion

Climate change, global warming and the extinction of species are threatening challenges of our times, with serious implications over the future of humankind. The Amazon has a critical role in tackling these problems and contributing to the Planet's environmental equilibrium, due to its extraordinary biodiversity, its impact on the water and rain cycles, as well as in carbon sequestration, fundamental to the mitigation of global warming. Its conservation is of vital importance for Brazil and the world.

The Brazilian Amazon, which corresponds to 60% of the forest's total area, reached a peak in deforestation and degradation rates in 2004, with 27.772 Km² of forest cover destroyed. From then on, however, a growing environmental consciousness led to an extraordinary reduction in deforestation, which in 2014 was limited to 5.012 Km². The end goal must be zero net deforestation. However, after 2015, destruction rates started to rise again, reaching almost 10.000 Km², primarily due to the weakening of governmental impetus for monitoring, oversight and repression of illicit activities involving the forest. The main environmental crimes in the Amazon are deforestation, burnings, illegal logging, and mining. The grabbing of public lands is also a serious problem.

The occupation of the Amazon Forest, from the beginning of the 1970s until now, occurred in two opposing and conflicting ways: on one hand, economic activities such as agriculture, animal husbandry and mining, combined with

211. As examples of international initiatives, see initiatives of the Consumer Goods Forum (CGF), of the Tropical Forest Alliance (TFA), as well as the NY Declaration on Forests and the Amsterdam Declaration Partnership. See National Wildlife Federation (NWF) and Gibbs Land Use and Environmental Lab (GLUE). Zero Deforestation Cattle, *supra* note 210.

212. Jan Fichtner et al., *Hidden power of the Big Three? Passive index funds, re-concentration of corporate ownership, and new financial risk*, 19 Business and Politics 298 (2017).

213. Victor Galaz et al., *Why ecologists should care about financial markets*, 30 Trends in Ecology & Evolution 571 (2015).

214. Bert Scholtens, *Why Finance Should Care About Ecology*, 32 Trends in Ecology and Evolution 500 (2017), <https://www.sciencedirect.com/science/article/abs/pii/S0169534717300915>.

215. Galaz et al., *supra* note 217.

216. See *id.*

217. FEBRABAN – Federação Brasileira de Bancos & FGV EAESP – Centro de Estudos em Sustentabilidade, *supra* note 155, at 52-67.

218. Financial institutions may also give incentives to instruments like the green bonds, financing tools for projects that generate environmental benefits and/or support sustainable activities. See OECD, *Mobilizing Bond Markets for a Low-Carbon Transition*, Green Finance and Investment (2017).

large infrastructure projects, were fostered by a vision that associated development with deforestation; on the other, full conservation of the largest portion of the forest, implemented through the establishment of conservation units and the demarcation of indigenous lands, where economic activities are either prohibited or highly regulated. Neither of these models was able to realize the region's full economic, social and environmental potential: the first, for being based on a logic of clearing forest cover, and, the second, for not being able to contain the expansion of deforestation.

The forest bioeconomy, economic model which prioritizes sustainability, is currently conceived as a new paradigm for the Amazon's economic and social development, due to its low impact on the environment. Bioeconomy relies on breakthroughs in technological and biological sciences, combining the region's biodiversity and traditional knowledge with the so-called 4.0 Industry, which results from the fourth industrial revolution. This prospect opens promising possibilities for new pharmaceuticals, cosmetics and food, as well as for research of new materials and energy solutions. This new model requires substantial investments in research, science, and technology, attracting human resources of excellence – Brazilian and international –, and efficient mechanisms for financing and incentives, with public and private partnerships. An important stimulus for this new approach will be the attitudes and demands of consuming markets and financiers concerning environmental sustainability of the products that they consume and finance, impacting the cattle-raising, soybean and timber industries in the region, avoiding new deforestation, and creating incentives for adequate forest management.

There is an underlying social and economic logic to forest destruction. It is perverse, yet powerful. To defeat it will require an alternative model, capable of conciliating sustainable development, human safety, and citizen support. Ignorance, unattended basic human needs, and State neglect are the Amazon's enemies. Science, social inclusion, and environmental awareness will be its saviors.

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