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ENVIRONMENTAL CRIME IN THE AMAZON BASIN:

A Typology for Research, Policy and Action

Adriana Abdenur, Brodie Ferguson, Ilona Szabo de Carvalho, Melina Risso and Robert Muggah

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ENVIRONMENTAL CRIME IN THE AMAZON BASIN:

A Typology for Research, Policy and Action

Igarape Institute¹

Abstract

There is considerable conceptual and practical ambiguity around the dimensions and drivers of environmental crime in the Amazon Basin. Some issues, such as deforestation, have featured prominently in the news media as well as in academic and policy research. Yet, the literature is less developed in relation to other environmental crimes such as land invasion, small-scale clearance for agriculture and ranching, illegal mining, illegal wildlife trafficking, and the construction of informal roads and infrastructure that support these and other unlawful activities. Drawing on a multi-disciplinary review of the literature and key informant interviews, this paper introduces a preliminary typology intended to account for the diverse categories of environmental crime and their extensive impacts across the countries of the Amazon basin. The aim is to provide a general framework that helps advance future research on these issues, while simultaneously providing greater clarity to policy makers, law enforcement agencies, civil society actors, and companies interested in curbing environmental crime.

¹ The contributors to this paper include Adriana Abdenur, Brodie Ferguson, Ilona Szabo de Carvalho, Melina Risso, and Robert Muggah. Credit is also due to several expert reviewers including Camilla Aguiar, Daniel Rico, Izabella Teixeira, Gabriela Cabral, Natalie Unterstell, Rafael Benke, Steven Dudley, and Stewart Davyth.

Introduction

The Amazon basin is at risk. In Brazil, after nearly a decade of decelerating deforestation during the mid-2000s and early 2010s, the rate of forest clearance and degradation has surged once again. The Brazilian National Institute of Space Studies (INPE) reported an 85 percent increase in deforestation in the Amazon from 2018 to 2019, and by mid-2020, deforestation had already risen a further 34 percent over 2019 levels. Government authorities in countries such as Brazil, Bolivia, Colombia, Ecuador, Guyana, Peru, Suriname and Venezuela often explain the phenomenon as resulting from individuals and small-scale actors pursuing livelihood strategies. However, extensive research by environmental campaigners² has shown that environmental degradation in the region is more often the result of well-organized activities carried out by a wide variety of actors, both legal and illegal, at multiple scales.

There are several ways in which different types of illegal or illicit human activities lead to vast socio-environmental harm in the Amazon. Yet despite decades of study, the knowledge base is fragmented and dispersed. For the most part, research has focused on specific modalities such as land invasion, clearing of forest for agriculture and ranching, illegal mining, illegal wildlife trafficking in isolation of one another. There has been no clear effort to adopt a comprehensive approach that accounts for multiple forms of environmental crime. As a result, knowledge about the drivers, the dynamics, and the impacts of the activities driving deforestation in the Amazon across multiple domains remains fragmented and often unavailable to researchers and decision-makers.

Still missing from the debate on environmental crime is a general framework or typology that accommodates the vast array of human activities causing extensive socio-environmental harm. Such a framework is important not only in guiding future research on this topic, but also in providing conceptual clarity to policy makers, law enforcement agencies, civil society actors, and private groups committed to curbing the environmental and societal harms underway in the Amazon basin. By clarifying discrete categories of environmental crime, scholars, policy-makers and practitioners can better distinguish the differences, similarities, and interconnections between activities and actors contributing to widespread damage in the region. In turn, such an exercise can help advance applied research and the design of more effective responses for curbing and preventing environmental crime.

This paper proposes a preliminary framework to understand the scope and scale of environmental crime in the Amazon basin. First, it provides a review of the state of deforestation across the Amazon basin including the principle drivers and key responses from a wide range of actors. Second, the paper proposes a typology of the main categories of environmental crime that contribute to widespread socio-environmental damage in the region. Finally, the paper reviews several potential applications for the typology, both for research purposes and for enhancing environmental law enforcement in the Amazon. The typology will be used to guide a multi-year environment crime mapping project overseen by the Igarape Institute and partners such as Interpol and InSight Crime.

² See, for example, <https://amazon.org.br/en/slide/environmental-laws/> and Rajao et al (2020).

Threats to the Amazon Basin

Despite having been populated by indigenous communities for thousands of years -- communities that deeply affected the rainforest ecology -- the Amazon Basin has historically been viewed by government leaders and policymakers as a vast, empty space whose development requires encouraging people to settle the land, and clearing it of original vegetation (Becker 1991). As a result, there is a long history of systematic environmental destruction in the region -- as well as socioeconomic harm -- that dates back to the colonial era. This legacy extended to the establishment of political borders in the nineteenth century and the rubber boom of the 1900s, and multiple waves of urbanization. More systematic occupation and forest clearing intensified starting in the mid-twentieth century with the construction of major infrastructure projects, such as roads, bridges, and hydropower dams. Over the past twenty years, the expansion of the agribusiness frontier into the Amazon has created new pressures on the environment and local communities.

Deforestation and forest degradation

Covering over 670 million hectares, the Amazon basin encompasses the largest rainforest in the world -- more than 40% of all such vegetation -- and is the source of 20% of the global water supply. It supports multiple ecosystems and houses at least 10% of the planet's known biodiversity. It is also one of the biggest carbon sinks; some 90-140 billion metric tons of carbon are stored in Amazon rainforests. The region encompasses parts of eight countries: Bolivia, Brazil, Colombia, Ecuador, Guyana, Peru, Suriname and Venezuela, plus French Guyana, which is an

overseas territory of France. Although parts of the basin remain heavily forested, the region also includes major cities as well as smaller towns and scattered settlements. Overall, the basin has an estimated population of 34 million (WWF 2020).

However, the Amazon is also the site of unmatched deforestation and degradation. According to some estimates, more than a quarter of the Amazon biome will be without trees by 2030 if the current rate of deforestation persists (WWF 2020). This scenario is alarming not only due to the vast socio-environmental impact caused by deforestation, but also because of the resulting greenhouse gas emissions from deforestation and associated activities, such as forest fires. In 2019, satellites that detect heat signatures in Brazil issued more than 109,000 fire alerts in the single week from August 13-20, representing a nearly two-fold increase in fires over the prior year. Such wildfires released an estimated 392 million metric tons of carbon dioxide in Brazil in 2019 alone (Davidson 2020). Activities such as urbanization and waste generation are likewise important drivers of observed methane emissions in the Amazon. As a result, the rainforest is now believed to be releasing more carbon than it absorbs.

Although Amazon deforestation rates decreased over the past decade, there has been an especially sharp uptick in deforestation rates in recent years, with sharp increases in both 2019 and 2020. With the largest share of the basin in its territory, Brazil is responsible for approximately half of the deforestation in the region. In 2019, for example, Brazil lost at least 770,000 hectares (the equivalent of 12,187 square kilometers) of native vegetation in the Amazon (MapBiomass 2020). Andean countries -- especially Bolivia and Peru -- have also registered a significant rise in their rates of deforestation, especially in their forested Amazonian regions.

Deforestation continues to be a major concern elsewhere in the region. Colombia experienced a surge in deforestation following the signing of the 2016 peace agreement between the Colombian government and the Revolutionary Armed Forces of Colombia (FARC) guerrilla. Specialists have argued that, during the conflict, the FARC controlled many of the country's protected areas, and that their presence in those places served as a deterrent to deforestation -- a barrier to natural resource extraction that was lifted once the peace deal was struck (Prem, Saavedra and Vargas 2020). Peru experienced record levels of deforestation with the expansion of illegal gold mining in its Amazon provinces (MAAP 2019). Illegal extraction is also believed to be driving deforestation in Venezuela, although reliable data are not consistently available (Romero 2019).

Most deforestation hotspots in the Amazon basin cluster in places where infrastructure is built, especially near large transport corridors (such as the massive BR-230, known as Transamazônica, which was inaugurated in the 1970s) that allow access into areas that were previously off-limits due to dense vegetation and remoteness. Deforestation is also rife around major energy projects such as hydroelectric dams and reservoirs (Barber et al 2014). There are literally hundreds of dams across Brazil, including 80 large structures developed over the past half century. Especially since the early 2000s, however, as Brazil's agribusiness frontier shifted north, the Amazon basin has seen a rise in deforestation related to cattle ranching and agriculture (IBGE 2015).

Recent reports indicate that deforestation rates in the Amazon basin are increasing within the context of the COVID-19 pandemic, as groups and criminal networks feel emboldened by the lack of state attention and official discourses promoting land invasions in the Amazon (Kimbrough, 2019). In turn, deforestation facilitates the spread of the pandemic in the region as more groups move deeper into forested areas, some of them carrying the disease and exposing vulnerable local populations, including indigenous communities and other traditional forest peoples (ISA 2020).

Socio-environmental impacts of human activity

The destruction of the Amazon biome has widespread consequences, not only for local communities but also -- due to the importance of the rainforest to the climate system -- more broadly for South America and beyond (see Makhijani 2019, Salles and Esteves 2019). Deforestation causes changes to the region's water cycle in ways that are associated with increased floods and droughts (Souza et al 2019). In addition to greenhouse gas emissions, deforestation can lead to loss of nutrients in the soil that derive from the breakdown of tree leaves, as well as increased flooding due to inadequate water absorption by trees. Biodiversity is also affected in significant ways. The number of species drops precipitously, and the entire ecosystem is affected. According to one study, the combined effects of climate and deforestation could cause a drop of up to 58% in Amazon tree species richness (Gomes, Vieira, Salomão and Steege 2019). Even "selective logging," through which a relatively small number of trees is felled, negatively impacts a broad gamut of Amazon species, including insects (França et al 2017).

The economic costs of this destruction are considerable. According to a study by economists and agricultural engineers, Amazon deforestation would lead to a fall in rainwater and agricultural losses of USD\$422 million, as well as other social and economic losses resulting in as much as a USD\$3.5 trillion loss over thirty years. Conversely, the economic benefit of leaving the Amazon rainforest in its 2019 state would be USD\$8.2 billion annually (Strand et al 2018). These figures indicate that long-term costs far outweigh the short-term benefits that may accrue from deforestation. There is, in fact, very little medium to long-term economic benefit from continued deforestation.

Amazon deforestation affects livelihoods and income-generation activities, especially for traditional peoples of the forest, such as indigenous, quilombola (Afro-descendant), and fishing communities along the rivers of the basin. Tree felling negatively impacts soil nutrition, damaging local agricultural practices, and pollution and contamination affect fishing catches, also enhancing food insecurity (Tregidgo et al 2020). Deforestation causes negative health impacts, including the emergence and re-emergence of human infectious diseases, such as malaria, Zika, chikungunya, and yellow fever, even as increased malnutrition makes local populations less resilient to disease (Ellwanger, 2020). In illegal mining hotspots, mercury levels are extremely high not only among fish and other animal species, but also within the human population (Gonzalez, Arain and Fernandez 2019). Where explosives, machinery and dredging boats are used for illegal mining, these activities cause lasting damage to riverbeds, with consequences for the health and livelihoods of communities even hundreds of kilometers downriver (RAISG 2014).

Human activities entailing widespread environmental destruction in the Amazon also generate social tension, crime and violence. Many environmental crimes fuel other types of criminal activities, such as arms trafficking, people smuggling, child slavery, and sexual exploitation and forced prostitution (Watts 2017). There is also a strong association of violent crime, including homicides, with areas where environmental crimes and deforestation are rampant. Many of the most violent cities in Latin America, including Altamira and Novo Progresso (both in the Brazilian state of Pará, a major environmental crime hotspot), are economies largely based on environmental crime. These activities are also strongly associated with violent attacks on environmental defenders (Human Rights Watch 2019, Muggah and Franciotti 2019, Global Witness 2018). Disputes over natural resources may also fuel armed conflict in the Amazon, such those involving Colombian guerrilla groups or Venezuelan networks (Rendon 2020).

The environmental criminals

While not all environmentally harmful activities, including deforestation, are illegal, the vast majority of the tree-cutting taking place in the Amazon is carried out illegally. A 2020 report indicates that as much as 99 percent of deforestation in Brazil results from illegal activities (MapBiomas 2020). The legal status of a particular activity depends on the legal definitions of what constitutes environmental crime, and this varies across countries. In Colombia, for instance, land grabbing is considered an environmental crime, whereas in Brazil it is a crime against property, albeit one that typically entails environmental crimes such as illegal deforestation (Orozco 2015). This means, among other things, that penalties range from small fines to imprisonment. Yet owing to weak enforcement, the vast majority of penalties are ignored (Insight Crime 2020).

The legal status of human activities in the Amazon basin can also change over time. An activity that was legal five years ago can become an illegal activity when a law or decree is passed, and vice versa. This is the case with land grabbing in Brazil, which is often practiced with a sense of impunity owing to the repeated amnesties that have been granted to offenders (Brito and Barreto 2020). In some places, there is also great ambiguity in the legal status of certain activities, some of which are deemed to be “irregular” (for instance, a legalized gold digging cooperative whose license has expired) -- a legal limbo that reflects the sometimes fluid categorization of such activities in the region. Disputes over these legal boundaries are at the heart of many major political struggles in and over the Amazon, including recent efforts by the government of Jair Bolsonaro to legalize gold digging (Fernandes and Uribe 2020).

There are also distinctions in the legality of actors involved in these activities, and complex ways in which legal and illegal actors are intertwined. In many areas of the Amazon, criminal networks -- groups of individuals

who organize themselves and specialize in one or more of these activities -- finance, organize, and execute actions that lead to widespread socio-environmental damage. They are frequently financed with resources generated through legal businesses, and their actions are facilitated by corrupt government officials, including law enforcement actors, notary clerks, and politicians (Human Rights Watch 2019). The proceedings from these activities are typically laundered, whether locally or abroad, through a variety of methods that range from purchase of farms to mixing of illegally sourced gold with legally extracted gold that is exported as far as India and UAE. These groups also adopt the use of new technologies, from social networks and crypto currencies to drones and satellite technologies, so as to facilitate their activities and evade law enforcement.

However, otherwise legal actors are also involved in activities that cause widespread deforestation and other socio-environmental impacts. Economic sectors such as energy and infrastructure contribute towards deforestation both directly and indirectly. The need to open up space for installations, transportation and logistics leads to loss of forest cover, and there are frequent examples of environmental crimes committed by major infrastructure projects. For instance, the region's largest hydroelectric dam project, Belo Monte (in the Brazilian state of Pará) stands accused of causing far more environmental damage than was originally foreseen, and authorized, in its development plans; environmental experts have also noted that environmental impact assessments are crucial yet inadequate (Ritter et al 2017, Muggah 2015). At the same time, such large-scale initiatives may cause further socio-environmental damage insofar as they attract large numbers of migrants, who may be left without adequate sources of income once short-term employment dries up (Kolhepp 2002).

The lack of a continuous and constructive state role, especially with respect to the provision of public services, is especially

glaring in border areas, small towns and settlements in the interior, as well as in the marginalized peripheries of large Amazon cities. However, the extent of socio-environmental damage across much of the Amazon in recent decades is not simply the result of the historically weak presence of the state. In fact, much deforestation in the Amazon has been proactively encouraged by the state in order to incorporate forested areas, and their inhabitants, into the extractivist economic model. This vision of the Amazon as a vast empty land that must be occupied in order to be developed, and that posits a hard dichotomy between development and preservation of the forest, dates back to at least the mid-20th century but has found continuity among governments of different political orientations. The failure of Amazon states to develop sustainable and inclusive visions for their rainforests, based on the valuing of local knowledge, has fuelled criminal activity and contributed towards socio environmental harm in the region (Abramovay 2019).

External actors also shape human activities in the Amazon. Especially since the 2000s, rising demand -- both nationally and from abroad -- has encouraged economic activities whose perverse dimensions result in the destruction of the Amazon biome and harm to its populations, such as extensive agriculture and ranching. Growing demand for beef, particularly from China, increases the incentives for actors based in the Amazon basin to destroy tree cover in order to open up land for beef, soybeans and other grains (Faleiros 2019). Recent increases in the global price of gold, especially against the backdrop of local currency declines in many of the Amazon countries, have been shown to fuel a "new gold rush" in the region (Salomon 2020). The range of actors involved in socio-environmentally harmful activities in the Amazon thus varies in terms of legal status, type of activity, mode of organization, geographic reach, and size.

Responses from state and non-state actors

Despite the incentives introduced and sustained by some political and economic interests to ramp-up deforestation and degradation in the Amazon, there are several examples of interventions that have yielded positive results to limit environmental destruction. Even Brazil, where deforestation and forest fires reached record levels in 2019 and 2020, was once touted as a “success story” in fighting illegal deforestation in the mid-2010s. In a comparison of the data from 2013 to the average for the period 1996-2005, a group of scientists detected a 70% drop in Brazil’s deforestation rates, along with a reduction of over two-thirds of the emissions resulting from deforestation (Correa 2014).

At least three developments led to the significant decrease in deforestation in the Brazilian Amazon in the 2000s and 2010s. First, a series of new protected areas were created starting in the mid-1990s, including indigenous lands and sustainable use units, which were then expanded in the 2000s. The Federal Prosecution Service (MPF) adopted a more assertive posture, filing suits that reinforced the execution of laws and strengthened forest monitoring systems. Second, the private sector implemented a number of innovations against illegal deforestation. Starting in 2006, signatories of the Soy Moratorium committed to refrain from purchasing grains produced in recently deforested areas of the Amazon. The beef sector followed suit, starting in 2009. Third, as payment for ecosystem services programs (e.g. carbon markets) gained traction globally, subnational governments became more proactive. Amazon state and city governments promoted new ways to curb tree clearing and called on the federal government to be more proactive. These factors were reinforced by international cooperation agreements, such as that between Brazil and Norway, that created new incentives for developing countries to curb emissions through innovative financing (Calixto 2016).

Notwithstanding measures to curb illegal deforestation, some political, economic, and criminal actors adapted to the policy changes, exploiting loopholes to circumvent monitoring -- especially as state oversight receded from 2016 onward. The reversal in deforestation is also associated with rollbacks in the role of the state and the dismantling of governance structures and agencies responsible for monitoring and responding to climate change, environmental protection, and the well-being of traditional forest populations, especially indigenous peoples (Vick 2020). In order to drive deforestation rates downward, scientists and activists have called for additional measures, such as the collection of a rural tax; the closure of markets to illegally produced beef; limiting credit to law-abiding actors; innovation through the adoption of new technologies and more effective operations by law enforcement; and the adoption of sustainable methods that incorporate knowledge of the forest (Calixto 2016, Abramovay 2019, Zero Deforestation Working Group 2017).

Yet environmental crimes are still relegated to secondary status by the Amazon basin’s states and other stakeholders. Law enforcement, criminal justice and military institutions across the region basin focus heavily on illegal drug trafficking, which reinforces the widespread impunity in environmental crimes. Environmental task forces are few and far between, and when they do exist, they tend to focus narrowly on one or two types of environmental crime, such as illegal logging and wildlife trafficking, at the expense of other activities. When cases are prosecuted -- which is rare -- convicted offenders are let off with small fines. This impunity helps to fuel the cycle of land invasions, forest clearing, and the establishment of activities that further pollute and contaminate the biome (Human Rights Watch 2019).

As a result, law enforcement actions against environmental crimes in the Amazon are inconsistent and reactive instead of preventive. In some parts of the region, such as border posts featuring a more permanent presence of military or police forces, operations may be

more effectively carried out. In general, however, investigative capacity and coordination among public entities is weak, and operations tend to focus on the individual or groups hired to carry out activities rather than the networks of actors involved. Despite recommendations by international organizations such as UNODC and Interpol to focus on flows of illicit financing for such activities (Interpol 2015), law enforcement in the Amazon basin tends to criminalize the individuals executing the plans rather than those that orchestrate them. Finally, legal changes can render such operations moot, for instance when agencies such as Brazil's IBAMA are forbidden to destroy gold diggers' equipment, which leads to the immediate resumption of illegal activities as soon as law enforcement leaves the area of operation (Ministério Público Federal 2020).

Throughout the countries of the Amazon basin, legal safeguards exist to ensure that private sector actors properly assess, account for, and mitigate the socio-environmental impacts of their operations. A good example of this is the requirement that companies carry out environmental impact assessments, though enforcement remains weak. There is also a wide range of voluntary efforts by public, private, and civil society organizations to promote transparency in supply chains involving Amazon-sourced products, though there is little evidence that such initiatives are having their intended impacts. A report by Imazon analysed the overlay of meat-packing plants of large companies with incidents of deforestation, risk of deforestation and embargos, and identified significant risks that are not being mitigated (Imazon 2018). In the last year alone, some 251 global investors with \$17.7 trillion in assets have called on companies to meet their commodity supply chain deforestation commitments or risk losing access to international markets (Kimbrough 2020).

A recurring challenge relates to coordinating environment crime prevention measures and maximising cooperation between government

agencies and in partnership with private and non-state partners. Even at the domestic level, government bodies seldom collaborate effectively in addressing environmental crimes. Despite some innovations, such as the creation of an Amazon Task Force in Brazil (Ministério Público Federal 2020b), weak political will to boost forest conservation efforts in the Amazon has impeded more effective joint action among prosecutors and other actors in law enforcement. There is also insufficient collaboration between government bodies and non-governmental bodies, even as the number of organizations based in the Amazon states engaged in the effort to curb deforestation has grown.

At the international level, the resurgence of the discourse of national sovereignty, which has historically been strong in the region, has meant that regional initiatives such as the Amazon Treaty Cooperation Organization (ATCO) exist mostly on paper. With the exception of periodic regional meetings, there are still comparatively few dedicated efforts to promote joint efforts to tackle environmental crime. For its part, the Organization of American States (OAS) has a mission in Colombia to support the peace process and has worked on specific issues such as sustainable transboundary water management (OAS 2005), but does not address security or environmental issues in the Amazon systematically.

Some international organizations have focused on building the capacity of regional law enforcement, criminal justice systems and customs agencies. For example, Interpol has an office in Buenos Aires, but its small staff working on environmental crimes (especially forestry issues) that provide support to the region's states on law enforcement yet cannot cover the entire region, nor address in detail all types of activities leading to large-scale deforestation. UN entities such as UNODC, despite important advances in strengthening customs capacity³, have come under criticism from far-right nationalist politicians and pundits. Joint operations across international borders,

³ See, for example, the LEAP Programme, a recent collaborative initiative between UNODC, INTERPOL and RHIPTO to support law enforcement in reducing tropical deforestation.

and even across national borders, are exceptions rather than the rule. Given the transnational nature of many environmental crimes, these gaps in coordination and cooperation undermine the effectiveness of most responses.

These gaps and weaknesses have been laid bare by a broader crisis of multilateralism, including attempts to weaken or undermine the Paris Climate Agreement and other international regimes to protect the environment, such as biodiversity treaties. Non-compliance by national governments, including Brazil -- even as subnational

states seek new leading roles in addressing sustainability -- represents another hurdle in cooperation for climate action in the Amazon. Ultimately, the fragmented nature of responses to environmental crime across the Amazon basin is exacerbated by a lack of conceptual clarity about what constitutes such crimes to begin with. Greater conceptual clarity is needed not only so that research on these activities, their drivers and their impacts can advance, but also so that stakeholders may overcome the “silo effect” and shape more effective collaboration.

Typology of environmental crime

In this section, we present a typology of activities which, though not illegal in and of themselves, are commonly associated with multiple dimensions of illegality and socio-environmental harm in the Amazon basin. Activities are categorized according to economic sectors based on the primary economic motive for participating in the activity. To facilitate more standardized comparisons by sector and activity, we include the activities' corresponding codes in the North American Industry Classification System (NAICS) as well as the Brazilian National Classification of Economic Activities (CNAE) (IBGE 2007, US Office of Management and Budget 2017). Likewise, we assess impacts on natural capital and ecosystem services according to the Common International Classification of Ecosystem Services (CICES) and social impacts within the framework of the United Nations Sustainable Development Goals (Haines-Young and Potschin 2018, United Nations 2015).

An activity such as small-scale gold mining, for example, is commonly associated with multiple social and environmental impacts, including loss of biomass, contamination of soils and waterways, interpersonal violence, and land tenure violations. Such mining may be legal or illegal in a given jurisdiction based on existing legislation, whether the miner has obtained proper permits, and whether any negative impacts have been properly assessed and mitigated. We use the framework presented in Annex 1 to examine the various dimensions of illegality around any given activity in Table 1. The illegality framework builds upon elements presented in Forest Trends' (2018) assessment of illegal forest conversion globally, as well as a desk review of existing environmental legislation in the countries of the Amazon basin.

Category	Sector (NAICS/ CNAE)	Economic Activity	Example(s) of Illegality	Actor(s)	Ecosystem Impacts (CICES)	Societal Impacts (SDGs)	Potential Indicator(s)
Rural Property	53.1 / 681	Land speculation	Illegitimately occupying or settling rural land in order to demonstrate tenure, acquire title, or secure other rights or benefits	Individual	Loss of biomass, climate regulation, air quality regulation, water regulation, biodiversity loss	SDG 5.2, SDG 16.1, SDG 1.4, SDG 1.5	Number of new land title requests; number of new CAR registrations; number of overlapping or conflicting CAR registrations
Agriculture, Livestock and Forestry	11.3 / 022	Selective logging	Selective extraction of trees, including protected or endangered species, in prohibited areas and/or without proper permits	Individual; industrial; organized crime	Loss of biomass, genetic resources, climate regulation, water regulation	SDG 5.2, SDG 16.1, SDG 1.4, SDG 1.5	Proportion of forested area harvested on protected areas; hectares of protected/ unauthorized area subjected to selective logging
	11.21 / 014	Cattle ranching	Cutting and burning of native vegetation for livestock farming beyond legal limits or within prohibited areas and/or lacking proper tenure	Individual; industrial	Loss of biomass, climate regulation, air quality regulation, water regulation, biodiversity loss	SDG 5.2, SDG 16.1, SDG 1.4, SDG 1.5	Number of hectares dedicated to ranching; number of new hectares dedicated to ranching
	11.1 / 011	Industrial agriculture	Large-scale, intensive production of crops on areas beyond legal limits and/or using improper methods	Industrial	Loss of biomass, climate regulation, air quality regulation, water regulation, biodiversity loss	SDG 5.2, SDG 16.1, SDG 1.4, SDG 1.5, SDG 3.9	Number of hectares dedicated to agriculture; number of new hectares dedicated to agriculture
	11.1 / 011	Small-scale agriculture	Small-scale cutting and burning of native vegetation beyond legal limits or within prohibited areas and/or lacking proper tenure	Individual; organized crime	Loss of biomass, climate regulation, air quality regulation, water regulation, biodiversity loss	SDG 5.2, SDG 16.1, SDG 1.4, SDG 1.5, SDG 3.9	Number of reported fire incidents; number of hectares of protected/ unauthorized area burned
	11.1 / 0128	Drug cultivation	Cultivation of plants like coca, marijuana, and other intoxicants or hallucinogens often classified as controlled substances	Individual; organized crime	Loss of biomass, climate regulation, air quality regulation, water regulation, biodiversity loss, contamination of soil	SDG 5.2, SDG 16.1, SDG 1.4, SDG 1.5, SDG 3.9	Number of new hectares cleared within protected areas; number of new hectares cleared on public lands; number of new hectares cleared on private lands
Wildlife	11.4 / 023	Wildlife trade	Trafficking in plants and animals taken from the natural environment or raised under controlled conditions in undesignated areas or without permits	Individual; organized crime	Loss of food, genetic resources, ornamental resources, cultural resources; biodiversity loss	SDG 5.2, SDG 16.1, SDG 1.4, SDG 1.5	Reported incidents of wildlife trafficking; number of convictions of wildlife trafficking; people's perception of the prevalence and impact of wildlife trade
	11.4 / 017	Hunting	Overhunting, or hunting of protected or endangered species, in undesignated areas or above established limits	Individual; organized crime	Loss of food, genetic resources, biochemical and natural medicines, ornamental resources, cultural resources, biodiversity loss	SDG 5.2, SDG 16.1, SDG 1.4, SDG 1.5	Reported incidents of hunting activity; number of convictions for illegal hunting; people's perception of the prevalence and impact of hunting activities
	11.4 / 031	Fishing	Overfishing, or fishing of protected or endangered species, in undesignated areas or above established limits	Individual; organized crime	Loss of food, genetic resources, ornamental resources, cultural resources, biodiversity loss	SDG 1.4, SDG 1.5	Reported incidents of fishing activity; number of convictions for illegal fishing; people's perception of the prevalence and impact of fishing activities

Category	Sector (NAICS/ CNAE)	Economic Activity	Example(s) of Illegality	Actor(s)	Ecosystem Impacts (CICES)	Societal Impacts (SDGs)	Potential Indicator(s)
Energy and Mining	21.1 / 072	Small-scale mining	Small-scale extraction, processing and trading of minerals without appropriate permissions and/or mitigation measures	Individual; organized crime	Contamination of soil, air, water and food, loss of biomass, destruction of riverbeds	SDG 5.2, SDG 16.1, SDG 1.4, SDG 1.5, SDG 3.9	Number of existing mines; number of new mines; hectares of existing and new mines; social and conventional media mentions; proximity to indigenous territories and vulnerable communities
	21.1 / 072	Industrial mining	Industrial extraction, processing and trading of minerals without appropriate permissions and/or mitigation measures	Industrial	Contamination of soil, air, water and food, loss of biomass, destruction of riverbeds	SDG 5.2, SDG 16.1, SDG 1.4, SDG 1.5, SDG 3.9	Number of existing permits; number of new permits requested or issued ; number of new mines detected; proximity to indigenous territories and vulnerable communities; volume of legal gold exports
	21.2 / 06	Oil and gas	Extraction, processing, and trade of oil and natural gas without appropriate permissions and/or mitigation measures	Industrial	Contamination of soil, air, water and food; loss of biomass	SDG 1.4, SDG 1.5, SDG 3.9	Number of existing oil & gas projects; number of new oil & gas projects; number of hectares converted for to oil & gas; proximity to indigenous territories and vulnerable communities; social and conventional media mentions
Utilities	22.1 / 35	Utilities	Development of energy infrastructure projects without appropriate permissions and/or mitigation measures	Industrial	Contamination of soil, air, water and food, loss of biomass	SDG 1.4, SDG 1.5, SDG 3.9	Number of existing renewable energy projects; number of new renewable energy projects; number of hectares dedicated to renewable energy; number of hectares converted; proximity to indigenous territories; social and conventional media mentions
Roads and Construction	23.7 / 421	Transportation infrastructure	Construction and maintenance of installations to facilitate the movement of people and goods throughout a territory	Industrial; organized crime	Loss of biomass, climate regulation, air quality regulation, water regulation, biodiversity loss	SDG 1.4, SDG 1.5, SDG 3.9	Number of existing hectares dedicated to transportation infrastructure; number of new hectares attributable to transportation infrastructure
	23.6 / 4121	Housing and urban growth	Unauthorized and/ or unmitigated urban and rural construction to provide shelter and services to local or temporary populations	Individual; industrial	Loss of biomass, climate regulation, air quality regulation, water regulation, biodiversity loss	SDG 1.4, SDG 1.5, SDG 3.9	Number of existing hectares dedicated to residential use; number of new hectares attributable to residential use
	23.6 / 4122	Commercial and industrial development	Unauthorized and/or unmitigated real estate development to provide products or services for commerce or business	Industrial	Loss of biomass, climate regulation, air quality regulation, water regulation, biodiversity loss	SDG 1.4, SDG 1.5, SDG 3.9	Number of existing hectares dedicated to commercial/ industrial use; number of new hectares attributable to commercial/industrial use

The combined framework thus goes beyond the concept of “environmental crime” to encompass a broad range of organized human activities that are changing the landscape, societies, and climate of the Amazon basin. Some of these activities take place primarily in rural areas, whereas others are more common in urban or peri-urban areas. The participants involved can range from isolated individual actors to highly organized legal and illegal organizations at different geographical scales. Activities are organized according to several broad categories detailed below.

Land speculation

The first category refers to modes of occupation of rural land, including illegal land grabbing -- which often takes place in public or collectively owned land, such as protected areas, indigenous reserves, and community held lands. Across much of the Amazon, current systems of land ownership are extremely complex, often characterized by conflicting interests over land tenure and land use. When land is invaded by individuals or small groups of squatters in search of a subsistence livelihood, these invasions tend to have limited impact and scale, typically under three hectares (Madeiro 2019). In contrast, large-scale land invasions are often carried out in highly organized fashion and require equipment such as chainsaws, fertilizers and seeds, all of which in turn demand substantial resources. The organized criminal groups that specialize in land invasions generally feature local leaders, but financing for these activities is not necessarily local. In many cases, the funding comes from individuals and businesses based in metropolitan areas inside and outside a given country. In 2019, Operation Ojuara, led by the Brazilian Federal Police against large organized land invasions in the northern state of Acre, found that one illegal group received funding from a prominent businessman in Minas Gerais, in the Southeast of Brazil. Another operation, Operação Máfia da Tora, carried out in 2017, discovered that groups

in the state of Rondônia were financed by residents of Santa Catarina, in the south of the country (Madeiro 2019).

In some cases, land invaders then sell extraction rights to illegal loggers, using the revenues to fund the conversion of forest into pasture and agricultural fields. The low cost of legalizing medium and large properties in Brazil, many of them created through land invasions, creates further incentives for subsequent land invasions (Imazon 2018). Insecure property rights are among the main challenges in curbing deforestation caused by land invasions (Oliveira 2008). The land legalization process across much of the Amazon is rife with fraudulent documents and false registrations. This is especially true of indigenous and other protected lands, as well as “undesigned” lands (areas that lack formal legal designation). According to one study, 23% of the Brazilian Amazon is composed of public lands that have been illegally registered as private (Azevedo-Ramos and Moutinho 2018). There is also evidence of widespread collusion between land grabbers, notaries, politicians and actors within the state (Ministério Público Federal 2018). Political groups in the capital cities actively lobby to provide amnesty for land invaders in the region. Those who lead land invasions often end up becoming powerful political actors, capable of influencing mayors and congressmen, and sometimes are able to pressure monitoring agencies to appoint their allies to key posts in order to guarantee the impunity of these crimes (Madeiro 2019).

While part of the land that is invaded becomes the site of income-generating activities, such as ranching or agriculture, land also has a symbolic value, conferring social status to property owners. This is reflected in the fact much of the land in the Amazon that is invaded is then allowed to lie fallow for many years, indicating widespread land speculation that is often independent of other income-generating activities, and that may be led by people who

do not even reside in the Amazon region. According to one survey, almost a quarter of all land deforested between 1988 and 2014 in the Brazilian Amazon was simply abandoned (MapBiomass 2020). Sometimes the invasion of a plot of land is carried out by one person or by a group, while the trees are cut down by a different group. Elsewhere, the land becomes the object of speculation and is often sold to individuals who do not reside in the Amazon.

Agriculture, livestock and forestry

The agriculture, livestock and forestry category encompasses agriculture (both industrial and small-scale), ranching, logging, and drug cultivation -- activities that are common in invaded lands that do not remain fallow. Except for logging, these activities frequently follow forest fires that are set in the invaded land to clear space for these activities. They are driven by unsustainable consumption, both from within the Amazon states and from outside the region. Over the past decade, as demand for Amazon commodities such as beef and soy has grown (especially from Asia and Europe), transnational agribusiness conglomerates based in South America and outside the region have invested more heavily in Amazon land, sometimes without appropriate monitoring of supply chains. The cultivation of soybeans -- now the top export for both Brazil and Bolivia -- has expanded rapidly, especially as the opening of roads in the Amazon, such as BR-163, cheapens transportation of the grains.

Cattle ranchers in Brazil and Bolivia have been razing forest to meet beef demand in China (Faleiros 2019). A 2019 report showed that Brazil's annual beef exports, estimated at 1.4 million tonnes, generate 65,000 to 75,000 hectares of deforestation each year, most of it (52%) in the Amazon. Of this total, 22,000 hectares were attributed to exports to China (Trase 2019). Despite pressure to make the supply chains more transparent, practices such as "cattle laundering" have spread as

meat companies fail to properly ensure that they are not buying cattle from farms involved in illegal deforestation.

Wildlife hunting and trade

Wildlife activities in the Amazon include trade in protected or endangered species as well as traditional hunting and fishing, and they are carried out by a broad gamut of actors and involve a variety of species. Wildlife trafficking has become a multi-billion dollar industry; according to one estimate, this type of illegal trade extracts 38 million animals (excluding fish and invertebrates) annually in Brazil alone (Schleeter 2015). Many trafficking groups are European, North American and Asian and collaborate with local suppliers. Some of the key species being trafficked within and from the Amazon are birds, reptiles, and mammals.

In parts of the Amazon basin, wild species are often trapped by indigenous people, who are then encouraged to sell the animals or their parts. The wildlife is then transferred to brokers, via boatmen, farmers and truck drivers, who pass it on to traffickers with connections to major groups operating both within the region and internationally. Some of this wildlife is exported to Europe, Asia, and North America -- where high profits are made -- through key harbors and airports, while some is consumed locally. There are reports of wildlife trafficking being masked as scientific or conservation efforts, with falsification of certificates attesting that the animals were born in captivity, which permits them to be imported or exported. Wildlife trafficking can have far-reaching environmental and societal ripple effects, potentially leading to ecosystem collapse (Ibid.).

Energy and mining

The Amazon features sizeable potential for mineral assets, namely iron ore, gold, copper, tin, nickel, bauxite, and manganese (Santos 2002). Mining has taken place in the region for centuries at different scales using a variety of extraction methods, but rising metals prices have led to epidemic levels of illegal extraction in the Amazon basin. The activity is carried out by several different types of actors, operating at different scales and with very different impacts. These are by and large separate productive chains, although in some areas there are overlaps between the categories (Abdenur et al. 2019).

The rapid expansion of gold digging seen in the Amazon during the 2010s is in part a result of the rise in global gold prices. In November 2019, for example, one ounce of the mineral sold for USD\$1,464, around six times the price of the previous decade. Soaring gold prices create additional incentives for gold prospecting and mining in the Amazon, especially through methods that can rapidly expand extraction. According to official estimates, 30 tonnes of gold per year are produced in the Tapajós River basin alone, generating R\$4.5 billion in non-declared gains -- financial returns that are six times the size of those obtained through legal gold mining in the same region (Ministério Público Federal 2019). In some places, gold diggers form cooperatives that often operate within a grey area between formal and informal, sometimes transitioning between these broad legal categories as permits are granted or expire (Coelho et al 2017). In contrast, organized illegal mining is carried out by highly structured and hierarchical groups, with extensive planning and division of labor.

There is also large-scale industrial mining carried out by major companies, some of which may act illegally. The profitability of Amazon mining means that the region's governments often provide major tax incentives

for large-scale projects as part of broader development schemes. These projects can extrapolate limits set through environmental laws, causing widespread illegal deforestation and contamination. In Peru, for example, several companies have been investigated by the country's national justice system for their links to illegal mining in Madre de Dios, Cusco and Puno; for crimes such as the purchase of gold of illegal origin; the use of shell companies; questionable financial transactions; and laundering of money and assets.

In addition to causing deforestation, illegal mining can be highly contaminating and polluting, particularly when mercury is used to separate the mineral from the soil. Mercury and other toxic materials have a strong effect on the quality of food supply and on human health, since it accumulates throughout the food chain. In Colombia, alarming levels of mercury used in illegal mining has been found in water sources used for human consumption (Díaz-Arriada 2014). At the same time, money laundering for illegal gold mining has become more sophisticated. Monitoring of gold's origins is difficult, and outdated legislation (including allowing hand-written receipts) makes it easy to cheat the system. Another increasing trend is the involvement of illegal armed groups, especially guerrillas and paramilitary groups based in Colombia and Venezuela, in illegal gold mining. In the last few years, illegally mined gold has displaced cocaine trafficking as a key funding source for some of these groups (Global Initiative Against Transnational Organized Crime 2016).

Utilities

The category refers to the development of energy infrastructure projects, which often takes place without appropriate permissions and/or mitigation strategies. The abundance of water in the Amazon has made it an attractive region for major electric power generation projects, and some of the region's states depend heavily on hydropower. For instance,

it provides around two-thirds of Brazil's electricity; around 31.6% of the hydropower generated in 2019 went to the industrial sector, including major mining operations in the Amazon and elsewhere (another 4.7% went to agribusiness).

Amazon states have historically opted to build large-scale energy infrastructure projects in the Amazon, in part due to the simplistic view of the rainforest as a vast "empty" space. Such dams destroy rainforest and inundate forested areas with river water, changing river courses and making them less navigable. They alter water chemistry and affect fish passage, also endangering species whose habitats are vulnerable to fragmentation. Numerous dams are under construction in the Amazon Basin. The largest is the Belo Monte dam in the Brazilian state of Pará, the third largest in the world, which has greatly surpassed its expected environmental impact in the Xingu River region.

The Belo Monte dam, which cost USD\$9.5 billion to build and became fully operational in 2019, has experienced reduced seasonal flows in the Xingu River due to climate change and upstream deforestation. Thousands of indigenous and other traditional communities were forced to abandon their homes and lifestyles, with fishing no longer a viable means of subsistence. Other large dams are under construction, and yet more are planned (for instance at Jirau, in the Brazilian state of Rondonia), with dozens more planned in the Andes, especially in Ecuador and Peru. The Brazilian government is planning to build more than 60 large dams in the Amazon over the next 20 years.

Roads and construction

Roads and other forms of infrastructure development have a long history of enabling environmental degradation in what had been previously inaccessible regions of the Amazon. Barber et al. (2014) found that 95 percent

of deforestation in the Brazilian Amazon occurred on land less than 5 kilometers from a road or navigable river. Some roads may be constructed entirely illegally, for example, in order to access areas for illegal logging, while others may be properly planned and authorized, yet fail to mitigate socio-environmental impacts. While roads cause deforestation directly through the opening up of space, their most significant impact results from making forested areas accessible to settling and economic activity. More than 50,000 kilometers (30,000) miles of roads were built in the Amazon in just three years (Ahmed, Souza Jr, Ribeiro and Ewers 2013). A study of 75 planned road projects found that those planned roads -- which would add up to 12,000 kilometers of roadway in Colombia, Peru, Ecuador, Bolivia and Brazil -- have not been assessed for environmental or economic impacts. Seventeen of those projects are in violation of environmental regulations or indigenous rights (Vilela et al 2020).

At the same time, urbanization continues at a rapid pace in many parts of the Amazon. Of the 19 Brazilian cities that the latest census indicates have doubled in population from 2000-2010, 10 are in the Amazon. Altogether, the region's population climbed 23 percent from 2000 to 2010, while Brazil as a whole grew just 12 percent (Romero 2012). New immigrants typically settle on the outskirts of cities where they may clear forested land in order to build their dwellings. The emergence and rapid expansion of small and medium sized cities, as well as the mushrooming of small settlements -- especially along rivers and roads -- frequently entails environmental damage and societal impacts (Sathler, Monte-Mór and Carvalho 2009).

Conclusions

The typology is intended to provide conceptual clarity that can assist in future research, law enforcement practices, and policymaking around human activities in the Amazon with widespread environmental and societal impacts. With respect to research, there is clearly a need to unpack the entire cycle of activity in each of the types of illegal activity -- financing, organization, execution -- as well as their links to money laundering and corruption. In addition, the links between illegal activities and legal ones must be clarified through case studies and comparative research. Although the framework offers a comprehensive, holistic view of destructive criminal activities in the Amazon Basin, more fine-grained research is needed to cover their variation and complexity across different settings in the region.

The potential overlaps across categories, criminal activities, and impacts merits further investigation. For instance, in medium or large scale wildcat mining sites, other criminal activities -- including the trafficking of weapons, people smuggling, and illegal gambling -- are commonplace and that drug trafficking networks invest in illegal extraction. Such overlaps are likely to vary widely across the Amazon, according to the local context, law enforcement, and capacity of the actors involved. There is also a need to examine the complex interactions between legal and illegal activities, as well as the way in changing legal boundaries, including the gray zone referred to as "irregular" activities, contribute to violent disputes.

The typology can also support law enforcement, criminal justice and customs actors to better understand the drivers of deforestation and thus to develop more effective and targeted strategies. This is particularly important because so much law enforcement in the Amazon basin remains narrowly focused on specific activities such as illegal trafficking, to the detriment of other environmental crimes. By better

understanding the full cast of actors involved in these practices, including legal actors such as companies, as well as the dynamics and impacts of these activities, law enforcement can better map, analyze, and act to curb hotspots of environmental crime, whether in urban areas or heavily forested ones.

Finally, by shedding light on the broad range of activities that are leading to vast socio-environmental damage in the Amazon, the typology can also help guide policymakers, practitioners and campaigners identify major gaps and weaknesses in law and practice and prioritize investment. A more fulsome treatment of environment crime can support a comprehensive approach to law enforcement, forest conservation, and sustainable development in the Amazon basin. With respect to local and national actors, having a better grasp of the full range of activities driving deforestation in the region can help improve coordination among law enforcement agents at the federal, state and municipal levels.

But the typology is also useful for international cooperation arrangements, whether bilateral or multilateral. Many of the illegal activities identified in the typology tend to cluster near international borders and feature transnational dynamics. Hence, it offers a point of departure for knowledge exchange and the design of collaborative solutions for curbing and preventing environmentally harmful activities in the Amazon, as well as the design of a more sustainable vision for the region.

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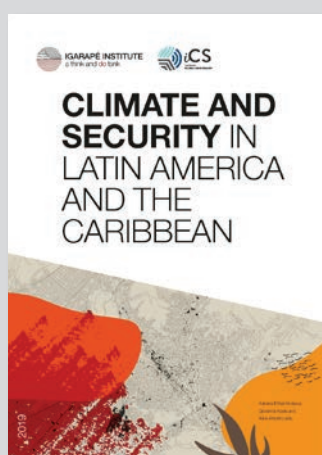
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Annex 1: Dimensions of Illegality

Category	Activity
Zoning, Planning and Policy	Failure to ensure new laws and/or regulations are consistent with existing legal frameworks and are constitutional.
	Failure to implement inclusive and transparent processes for land planning and development.
	Manipulating the zoning process in order to open up areas for exploitation, such as in HCVAs and/or indigenous lands.
	Failing to confirm pre-existing rights when granting ownership or usufruct rights.
	Intentional occupation of and claim to public, private, or indigenous owned land (land grabbing).
Licenses, Permits and Authorizations	Fraud in Environmental and Social Impact Assessment (ESIA), including assessment, mitigation, monitoring and reporting.
	Failure to ensure fair and transparent licensing and permitting processes that minimize conflicts of interest.
	Fraud in surveys of harvest volume and/or value (e.g., timber).
	Misrepresentation of concession boundaries, including APPs and HCVAs.
	Providing false information to communities and/or use of coercion over consent.
Operations	Clearing or harvesting in authorized areas but without proper licenses.
	Clearing or harvesting endangered species, in APPs, HCVAs or other off-limit areas.
	Clearing or harvesting beyond the legal or authorized maximum.
	Use of machinery or pollutants without proper licenses.
	Illegal use of fire (arson).
Finance	Tax fraud and/or false or misleading financial reports.
	Misrepresentation during audits and certifications.
	Improper transfer pricing between jurisdictions.
	Underpayment of taxes, royalties, or fees.
	Money laundering.
Monitoring and Enforcement	Failing to inspect, monitor, and/or indict offenders.
	Manipulating evidence, witnesses, or court processes.
	Violating judicial independence.
	Failure to set penalties commensurate with the severity of the crime.
	Failure to enforce penalties.

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Rio de Janeiro - RJ - Brasil
Tel/Fax: +55 (21) 3496-2114
contato@igarape.org.br
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