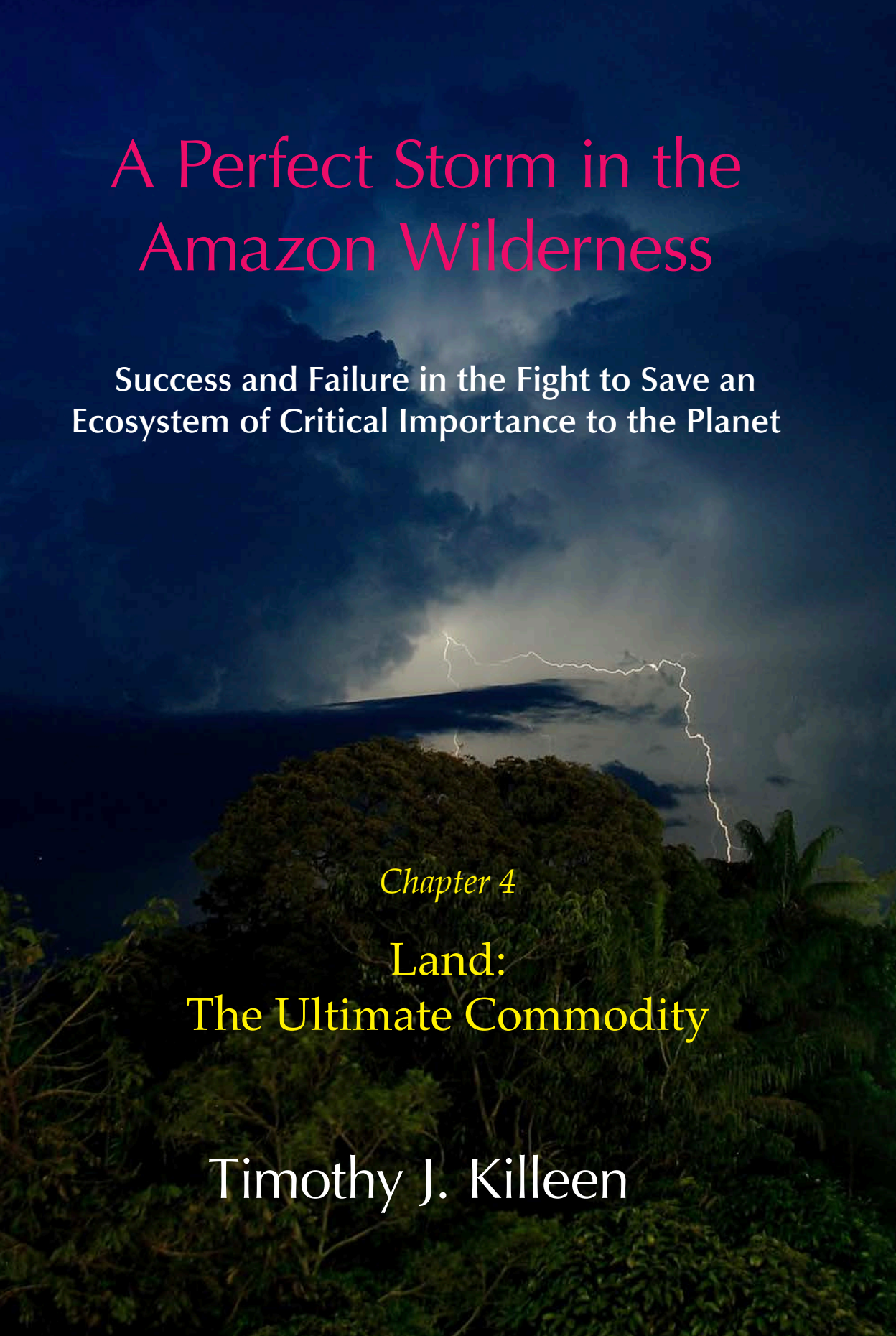

A Perfect Storm in the Amazon Wilderness

Success and Failure in the Fight to Save an Ecosystem of Critical Importance to the Planet

Chapter 4

Land: The Ultimate Commodity

Timothy J. Killeen

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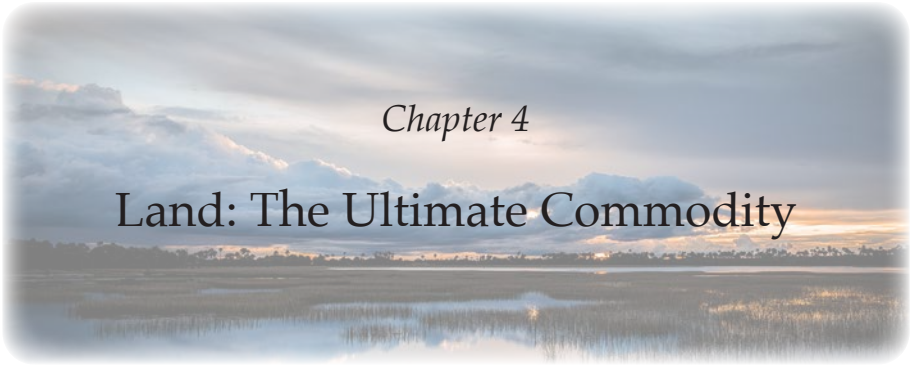

Chapter 4

Land: The Ultimate Commodity

New roads open wilderness landscapes to development, and commodity markets drive the expansion of the agricultural frontier. These two causes of deforestation are at the centre of deforestation policy discussions. A third factor – land values and their tendency to appreciate over time – is a synergistic product of these two phenomena. Understanding the dynamics of rural real estate markets is essential in devising policies to halt the advance of the conventional economy into the forest wilderness.

The agricultural frontier in the Pan Amazon is the product of centuries of cultural tradition and decades of economic policy. This phenomenon, which is central to the history of the Western Hemisphere, became a major disruptive force in the Pan Amazon only in the 1960s, when governments implemented programmes to occupy and develop their Amazonian hinterlands (Chapter 6). Unlike previous colonisation periods, such as the rubber boom of the nineteenth century, this latter period included initiatives to promote the mass migration of families into the region, which were combined with strategies to attract investment in market-based production systems. These policies were contingent on the offer of free, or nearly free, public land.

Access to land was conditional, however, and pioneers had to install a productive enterprise, which obligated them to replace natural vegetation with cultivated plants. Official policies have changed, but this practice continues to motivate individuals on the forest frontier, where people clear forest as a strategy to project ownership of land they view, rightly or wrongly, as their own. Most believe they are acting in the best interest of their families and their country by generating economic activity. They are aided and abetted by functionaries in agricultural ministries who implement outdated policies that facilitate the transfer of public lands to private individuals. Layered on top of (or underneath) this dysfunctional regulatory framework is a culture of graft, impunity and entitlement.

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The forest frontier continues to be invaded by migrant settlers and land grabbers (grileiros or traficantes de tierra), who use legal, extra-legal and illegal mechanisms to appropriate public land. The practice, which was once organised by the state, is still tolerated by some local and national authorities.

Rural real estate markets regard land as part commodity and part capital asset. As a commodity, its price is mediated by supply and demand: Parcels near to the forest frontier are less expensive because there is an available supply that can be acquired at low cost. As the forest frontier recedes, land appreciates in value because it becomes a more limited commodity. As a capital asset, properties increase in value with investment in on-farm infrastructure and perennial crops that generate cashflow over the short-term, such as coffee, cacao and oil palm, as well as timber species that pay a substantial dividend over the medium term.

Other considerations influence the price of land. If the soil is arable, land has additional value because farming is more lucrative than ranching. Forest remnants may or may not have commercial value, depending on whether they retain stands of hardwood timber. Despite their intrinsic value, degraded forests are viewed as 'unproductive' – unless they have been converted into 'productive land' dedicated to conventional agriculture.

All too frequently, landholders will first monetise the value of their timber and then use that capital to finance the conversion of the degraded forest into pasture or farmland.

The economics are straightforward: a pasture can support cattle and generate cash flow of ~ $US 200 per hectare annually, or $US 2,000 over ten years. This is a reasonable return on an investment that requires a rancher to clear the forest, build fencing and construct a water impoundment at a cost of about $US 500 per hectare. More importantly, the value of land itself will appreciate over time, reflecting both the improvement of on-farm infrastructure and the generally upward direction of real estate markets (see below). Similar economic calculations drive investment decisions on smallholder landscapes, where properties can experience a step-change in value with the establishment of a perennial crop like coffee, cacao or oil palm.

Pioneer families are active participants in rural real estate markets. They use their knowledge of soil, water and natural vegetation to develop additional landholdings that they sell to investors and newly arrived migrants. Some become frontier entrepreneurs who specialise in the acquisition and development of properties. Many are businesspeople who are 'improving' properties deforested during previous cycles of settlement. One of their main marketing tools – and a core service – is to complete the titling process. A certified legal title significantly enhances the market price of a property.

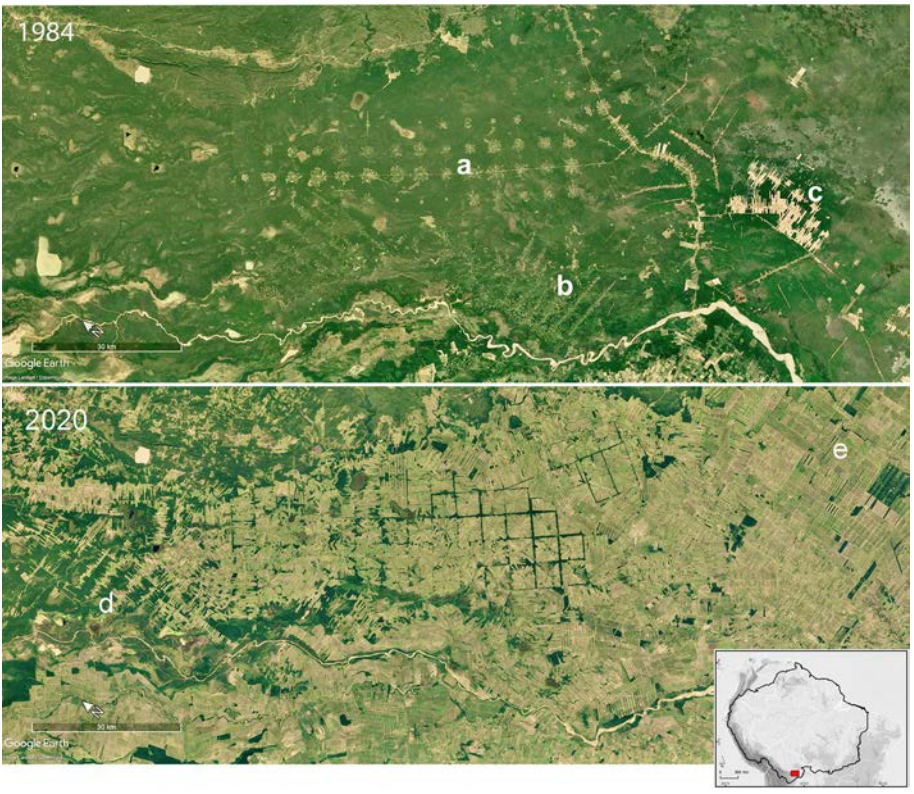
Unfortunately, legitimate real estate investors share the marketplace with unscrupulous individuals who invade public lands or displace families who have informally occupied them. Referred to as 'land grabbers' in the English-language media, in Brazil they are known as *grileiros* and in Spanish speaking countries as *traficantes de tierra.*[*]

The Distribution of Public Lands

Public lands have been, and continue to be, distributed via a variety of legal, quasi-legal and blatantly illegal mechanisms.[1] These mechanisms have evolved over time, but they can be broadly organised into four main categories:

1. *State-sponsored colonisation schemes:* This policy was predominant during the 1970s and 1980s and was managed by agencies with various names and acronyms (Table 4.1). Approaches varied among countries, but all targeted the rural poor and distributed landholdings between forty and 100 hectares. Some were organised via a communal tenancy regime while others ceded plots to individual families. Only Brazil

* They are called *grileiro*s because they would place forged titles and deeds in a box with a few crickets (*grilo* in Portuguese) to make them appear old.



Source: Google Earth

The settlement of the alluvial plain of Santa Cruz began in the 1960s with a state-sponsored scheme that settled Andean migrants in villages with radially organised landholdings (a). In the 1980s, they were joined by additional migrants, organised in sindicatos, who established their own settlements by building roads and appropriating public forest (b). Immigrants from Canada and Mexico purchased large estates from local intermediaries to create Mennonite colonies (c). All three types of settler now pursue intensive agriculture using technologies similar to industrial-scale corporate farms (e), while new migrants continue to settle a floodplain once zoned for conservation and forest management (d).

continues to distribute land among its citizens via projects organised by a national agency, or it did until 2017 when an audit led to a temporary suspension of its activities (see Chapter 6).

2. *Direct land grants or sales by the state:* This mechanism was widely used in Brazil over several decades but was most prominent in the

1970s when Amazonian development was a core policy of the military government.* The distribution of large landholdings led to the development of the agro-industrial model that dominates the economy of Mato Grosso, Eastern Pará and Tocantins. A similar phenomenon occurred in Bolivia, where military governments distributed land to influential families using the agrarian reform institution originally created to address land tenure inequality. Large land grants in Ecuador led to the establishment of two large-scale oil palm plantations in the early 1980s.† The most recent example comes from Peru, where an influential corporation obtained large tracts of natural forest in 2005 to establish that country's largest oil palm plantation.‡

3. *Privately sponsored colonisation schemes:* This type of land distribution is a variant of the previous mechanism in which the state would grant a concession to a private company or cooperative that would subdivide and resell plots to settlers (see Chapter 6). This method promoted a middle-class farm model based on properties that range from a few hundred to several thousand hectares. It was a common business model in central Mato Grosso between the late 1950s and the early 1980s. Mennonite immigrants have employed a variant of this scheme in Bolivia, where a group of families collectively purchase a large private property, which they subdivide among themselves to create a 'colony' of 100-hectare family farms. This system is being replicated in Peru and Colombia, where Mennonite immigrants have been accused of clearing forest on landscapes zoned for forest management.[2] Mennonites are not known to invade public lands, choosing instead to purchase land from intermediaries, a tactic that improves the probability they will obtain legal title.

4. *Spontaneous settlement and land grabbing*: The appropriation of public lands via informal and blatantly illegal processes is common on all the forest frontiers in both the Andean republics and Brazil. It can occur as a land rush when a new trunk highway is created through a pristine forest landscape, but more often it occurs over decades as

* The infrastructure development initiative, *Plano de Integração Naciona* (PIN), incorporated within its framework the *Programa de Redistribuição de Terras e de Estímulo à Agroindústria do Norte e Nordeste* (PROTERRA), the *Programa de Desenvolvimento do Centro-Oeste* (PRODOESTE) and the *Programa de Pólos Agropecuários e Agrominerais da Amazônia* (POLOAMAZÔNIA). Source: Girardi (2015).

† Palmeras del Río (10,000 ha) near Coca and Palmeras del Ecuador (9,500 ha) near Shushufindi.

‡ Palmeras de Shanuzi is a subdivision of the Grupo Palmas, which is a subsidiary of the Grupo Romero; apparently, the original land grant consisted of 7,000 hectares, but the company has acquired adjacent land to establish a plantation covering 17,000 hectares. Source: Dourojeanni (2013).

secondary road networks expand outward from a trunk highway. In the 1980s, governments facilitated this process via special initiatives created to respond to petitions from interest groups and regional governments.* Depending upon the social and political environment, it can lead to the proliferation of large properties or small landholdings or a mixture of both.

Obtaining a Certified Legal Title

Occupying a plot of land is the first, and perhaps easiest, step in the process of creating a legally constituted private property. In all eight Amazonian nations, a title or a certification of a title must be issued by an agency of the central government, which in most cases is a lineal descendant of the colonisation agencies of the 1960s and 1970s (Table 4.1). At the time, these agencies issued provisional titles because full tenure was contingent upon establishing a successful homestead. This negative legacy grew over decades as the rural economy expanded and the number of landholdings multiplied.† One key responsibility of these agencies was the compilation of a land registry, known as a 'cadaster', which functions as a documentary reference point for all legal transactions involving rural property.

The decision to delegate the task of title certification to a national rather than a local agency was a logical consequence of the distribution of public lands by the central government.‡ A national solution probably appealed to central planners who doubted the capacity of local (frontier) governments to manage a large and technically complex undertaking. Individual landholdings are incorporated into the national rural cadaster, but only after their spatial attributes and legal providence have been validated by public servants.

The failure to complete this process and consolidate national cadasters is a major driver of the lawlessness that defines frontier society. These agencies, whether by design or happenstance, oversee a chaotic system where fraud and graft facilitate the misappropriation of public lands. As such, it is a fundamental driver of deforestation. It is also a massive moral failure because the system has failed to provide millions of smallholders with legal title to their most important financial asset. Successive governments and multilateral agencies have organised multiple initiatives to reform

* Examples include the *Grupo Executivo das Terras do Araguaia/Tocantins* (GETAT) and *Grupo Executivo para a Região do Baixo Amazonas* (GEBAM). Source: Hecht and Cochburn (2010).

† Urban properties are managed by local governments, typically the municipality.

‡ The decision to include properties from long-settled landscapes in the national registry was driven in part by the agrarian reform process where central governments expropriated and redistributed properties.

and modernise these agencies and, most importantly, complete the task of determining land ownership in the Pan Amazon. They have all failed.

Historically, transactions involving land are recorded with a notary public, known as a *Cartório* in Brazil and as *Notaría de Fe Pública* in Spanish-speaking countries. These legal offices provide a more substantive service than their counterparts in than United States because they keep a legal copy of all contracts and transactions as well as validate certain legal principles common to contract law. This type of documentation provides the primary legal basis for most rural landholdings.

The agencies compiling national cadasters have protocols for validating landholdings and incorporating them into the national cadaster using a property's '*historial*', essentially a paper trail that documents its origin and previous transfers or subdivisions. These protocols open a door for fraud because land grabbers use them to invent a legal history or to clone another property's past with forged documents. Since land registries have massive backlogs of unprocessed land claims, it is often necessary to provide a cash payment to 'expedite' legitimate transactions. The practice of paying a bribe to process a legal transaction provides cover for land grabbers processing illegitimate documents.

The regulatory framework is further complicated by two distinct levels of land tenure: ownership and possession. As the terms imply, an owner (*proprietário*) holds a legal title to a property, while a possessor (*poseiduero*) lacks a legal document validating ownership but is occupying the property and using it for his or her economic benefit. Logically, ownership has more rights than possession, but a possessor is not devoid of legal protection, including the right to not be evicted from the property if he or she is utilising it according to principles referred to as a 'social and economic function'. There is an implicit assumption that possession will eventually be transformed into ownership; nonetheless, the lack of a clear legal title impacts a property's value in real estate transactions.

Insecure land title and corrupt systems also impact legitimate landholders. In Brazil, there is a long history of ranchers dispossessing smallholders and forest dwellers by inventing documents and then using violence to evict them from their homes. In Bolivia, squatters will invade a property if its owner is incapable of demonstrating clear title and lacks the economic resources to physically defend the property. On occasion, squatters are paid agents acting on behalf of a land grabber who is preying on a family perceived to be weak. Insecure land tenure is an invitation for bad actors to use force to obtain what does not belong to them.

Violence and Land

The adage 'possession is nine-tenths of the law' is not legally true, but the concept reigns supreme on frontier landscapes in the Pan Amazon. Land grabbers and peasant pioneers share a *modus operandi*: they occupy land that does not belong to them. Historically, this process was condoned by the state, and conflict occurred only when the two groups competed for the same territory – or when either group sought to steal land from forest communities. Smallholders have the advantage of numbers, while land grabbers use their political connections to formalise their claims and label their competitors as 'squatters'. In Brazil and Bolivia, ranchers use force to clear landholdings, usually by hiring thugs to beat the smallholders and destroy their belongings. The smallholders resist by organising themselves into peasant syndicates associated with the *Movimento Sim Terra* (MST) and the *Confederación Sindical Única de Trabajadores Campesinos de Bolivia* (CSUTCB). Resistance leads to an escalation of violence.

In Brazil, criminal land grabbers contract *pistoleiros* to murder *posseiros*[*] who stand in their way. The most famous incidents have involved activists who were assassinated for defending the rights of forest people and smallholder peasants, most notably Francisco Alves (Chico) Mendes, who was ambushed at his home in Xapuri, Acre, in 1988; and Dorothy Stang, who was executed in 2005 on a remote road near Anapú, Pará. These crimes led to high-profile public prosecutions and the incarceration of the men who pulled the trigger, as well as the ranchers who contracted their services. Unfortunately, it is more common for these mafia-style murders to remain unsolved and, even when identified, most perpetrators escape justice – the exact definition of impunity.

The *Comissão Pastoral da Terra* (CPT) has monitored rural violence in the Brazilian Amazon for more than four decades and has compiled a gruesome historical archive: *Massacres no Campo* lists 47 incidents and details the murder of 341 individuals.[3] More than half are identified as 'leaders' and more than seventy per cent are linked to disputes over land tenure between large-scale landholders and landless peasants. That total vastly underestimates rural violence, however, because it only includes clashes where at least three people died. Since 2011, the CPT has compiled more precise statistics that reveal that little has changed and the situation may be getting worse. In 2017, there were more than 980 separate incidents impacting more than 98,000 families; 56 people were killed, mostly landless *posseiros* occupying ranches deemed vulnerable to an organised occupation.[4]

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* A less derogatory term for squatter used by Brazilians to identify individuals and families that may have a legal right to occupy public lands. Source: Ferreira (1986).

The ongoing closure of the forest frontier has increased the pressure on consolidated landscapes in Southeast Pará and Southern Rondônia, where a new militant organisation, the *Liga de Camponeses Pobres* (LPT), has tapped into the discontent engendered by the inequities of land distribution. Large landholders increasingly use private security forces and police to enforce judicial evictions. The involvement of police, however, is no guarantee of a just or orderly process, as revealed in 2017 at the Fazenda Santa Lucia in the municipality of Pau D'Arco (Pará) where seventeen police officers were accused of executing ten *posseiros* in a court-ordered eviction process.* The most lethal municipalities are Anapú, Pará (16 dead), Vilhena, Rondônia (13 dead), Colniza, Mato Grosso (11 dead), Pau D'Arco, Pará (10 dead) and Porto Velho, Rondônia (10 dead).[5]

Although *posseiros* suffer the most violence, indigenous communities continue to be attacked on frontier landscapes where land grabbing is most prevalent, particularly along BR-163 in Pará and BR-230 in Amazonas. Communities suffering the highest levels of violence are in the heavily deforested regions of Maranhão, where nineteen indigenous men and women died while protecting their reserves from timber thieves.[6] Not even remote indigenous reserves are immune from violence, particularly the Munduruku and Yanomami communities, which must contend with the notoriously violent wildcat gold miners (see Chapters 5 and 11).

The plight of lowland indigenous communities in Peru and Bolivia is both more acute and very different when compared to Brazil. Although their national governments profess to support the territorial claims of native people, they have deployed security forces to violently suppress indigenous groups when they protest policies that threaten their territories. In 2009, the administration of Alain Garcia enacted laws that would have created a pathway for the privatisation of native landholdings. The resulting campaign of civil disobedience ended in a violent confrontation and the deaths of 33 individuals.† A similar skirmish occurred in Bolivia in 2011 when the government of Evo Morales attempted to obstruct a march protesting the

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* The disputed landholding was first occupied in 2010 by families associated with *Liga de Camponeses Pobres* (LCP). According to witnesses, the unarmed victims were tortured prior to their execution; subsequently, three witnesses were murdered. The policemen were jailed briefly but, as of September 2020, none had been formally accused of murder. Source: EJA – *Environmental Justice Atlas*. 2020. Land-grabbing and disputed cattle ranch in Pau-d'Arco, Pará, Brazil. https://ejatlas.org/conflict/land-grabbing-and-disputed-cattle-ranch-in-pau-darco-para-brazil

† The incident is known as the *Baguazo* (after the locality of Bagua). Fifty-two protesters were accused of plotting to kidnap and kill police officers; all were found innocent at trial. The Peruvian Congress rescinded the law that threatened communal landholdings, but the conflict over mineral rights remains unresolved (see Ch. 11).

construction of a highway through the *Territorio Indígena y Parque Nacional Isiboro Securé* (TIPNIS). Nobody died, but police beat and arrested dozens of men and women in a flagrant violation of their civil rights.*

Less newsworthy but more insidious are the invasions of communal landholdings adjacent to colonisation zones, usually by highland indigenous migrants who enjoy the tacit support of their national and regional governments. In Bolivia, this is portrayed as agrarian reform by the central government, which is distributing public land to settlers and land grabbers in the forests of Chiquitania and Guarayos (see below). In Peru, native communities are struggling to protect their communal landholdings from wildcat gold miners and illegal loggers operating with the collusion of regional authorities. At least 22 indigenous leaders have been assassinated since 2013; more than half were threatened prior to their murder and had requested protection from police.[7] The forest frontier in Ucayali and Huánuco (HML #40) is particularly dangerous due to the presence of criminal gangs dedicated to the production of cocaine, who have targeted leaders of the Cacataibo and Shinobo–Conibo ethnic groups.† As of March 2021, none of the assassins had been apprehended by the police, allegedly due to the complicity of local authorities in the production and commercialisation of illicit drugs.[8]

Violence and murder are endemic to the Colombian Amazon due to decades of civil war and an economy based on the production of illicit drugs. The peace process has brought an end neither to armed conflict nor to the scramble for land. Criminal gangs composed of ex-combatants now fight for control of the borderlands between Caquetá, Meta and Guaviare. The central government has been unable to assert control, and competing bands recruit peasants to clear the forest to establish coca fields and cattle ranches.[9] There are no specific statistics on land-related violence but, pre-

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* The incident, known as *Chaparina,* was a public relations disaster for the government, in part because citizens of Rurrenabaque overwhelmed the police escorting protesters for transport to their arraignment. The freed protesters completed their march to La Paz and the Brazilian construction company vacated the contract when the government failed to obtain the free, prior and informed consent of the communities that would be impacted by the highway (see below and Ch. 11).

† Five members of the Shinobo-Conibo were murdered (24 Apr. 2018), including an 81-year-old woman: Olivia Arévalo Lomas (source: https://www.frontlinedefenders.org/en); at least ten Cacataibo men have been murdered since 2020, including Arbildo Meléndez (12 Apr. 2020), Herasmo Gracia (25 Feb. 2021) and Yenes Ríos (20 Feb. 2021). Source: https://elpais.com/planeta-futuro/2021-03-16/que-hay-detras-de-los-asesinatos-de-lideres-indigenas-en-la-amazonia-peruana.html

sumably, it is a major cause of death in a region where the overall murder rate (32 per 100,000) is among the highest in the Americas.*

Rural Real Estate Markets

Mark Twain once said, 'Buy land, they're not making it anymore'. Samuel Clemens was a literary genius, but he was a notoriously poor investor.† Nonetheless, his observation on the intrinsic value of land is inherently true and explains, in part, the scramble for land in the Pan Amazon. Settlers, investors and politicians all know that the distribution of public lands will eventually end. The appropriation of public land no longer occurs on the consolidated frontiers, but it continues to plague the margins of agricultural frontiers and is the defining characteristic of forest frontiers. The ongoing creation of new landholdings, legal and otherwise, on the forest frontier impacts the price of land in more settled landscapes. Simultaneously, the demand for arable land in consolidated municipalities inflates the value of holdings on adjacent landscapes. Rural real estate markets reflect the dynamic of supply and demand across the entire development frontier.

In remote corners of the forest frontier, newly created homesteads and their associated land claims are typically hard to sell. Transactions are loaded with risk due to the dubious nature of deeds and the potential for squatters to invade properties. Risk is amplified by the threat of violence because settlers and land grabbers employ force to protect their claims. Both sell their land to risk-tolerant investors and later migrants and, in the process, create the market for rural real estate. Prices are low and rise slowly, but early-stage participants are confident that the region will eventually evolve into an agricultural frontier and reward them for their audacity and disregard for the law.

Properties on agricultural and consolidated frontiers are more valuable because of improved infrastructure and better access to markets. They also are located on landscapes with a more mature legal status, where holdings have been transformed into 'safe' investments. The jeopardy from bad papers has not disappeared, but due diligence and preventative legal action

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* The highest murder rate (per 100,000) in the Americas is El Salvador (49) and the lowest is Canada (1.6); the most lethal department in Colombia is the Valle de Cauca (51); in Brazil it is Pará (46). Sources: United Nations Office on Drugs and Crime, DANE and IBGE.

† Mark Twain (Samuel Clemens) made a fortune writing books, but lost a fortune on investments in an automated engraving process, a magnetic telegraph, a steam pulley and a watchmaker, as well as in a turn-of-the-century railroad stock bubble. He declared personal bankruptcy in 1894 and, although he eventually paid all his creditors, he did so by writing and not by investing. Source: *Encyclopedia Britannica*.

can mitigate the risk. More importantly, conventional production systems generate cashflow and a decent return on investment.*

Land investment must be viewed in the context of the domestic economies: all Amazonian nations have suffered severe bouts of hyperinflation within the living memory of anybody older than fifty.† Capital invested in landholdings might be illiquid during times of crisis, but it always recovers its value. The same cannot be said for savings held in bank accounts or stock markets subject to erratic, often confiscatory, government policies. The return on real estate is the best option for most Latin American investors

In Iberian cultures, a predilection for land also has strong cultural appeal, which motivates urban professionals to invest in rural properties. In Brazil and Bolivia, this is manifest in an avocation for *estancias* or *fazendas* that raise cattle, while in Peru, Ecuador and Colombia urban investors are attracted to *fincas* that grow coffee, cacao or oil palm. Absentee landlords, including physicians, lawyers and other professionals, are attracted by the appreciation and the preservation of capital, but they also bask in the prestige of being a farmer or rancher.

The connection between city and countryside includes working-class families whose forebears settled smallholdings in Rondônia and Pará or one of the colonisation zones in the foothills of the Andes. As they have in rural families everywhere, younger generations have migrated to the cities while keeping their attachment to the family homestead. Money flows in both directions: towards urban dwellers attending school or seeking medical attention but also back to the farm as a remittance that can be used to invest in land, livestock and plantations. Successful families expand their holdings by buying adjacent parcels or by appropriating more land from the forest estate. Land tenure maps show hundreds of thousands of small plots (see Annex 4.1 to 4.11), but an individual family often owns multiple parcels. Small farms tend to be unviable, at least with conventional production models, and consolidation is a market-based cure for unviable settlement policies.

Savings and investment by professional and working-class families is a factor in the appreciation of rural real estate and, indirectly, a driver of deforestation. A more immediate economic force causing the appreciation

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* Return on investment (ROI) is a standard metric that investors use when evaluating investment options; it includes both net revenues (profits) and capital appreciation (land value). Small differences (1–2%) will translate into very large differentials when compounded over several years.

† Bolivia (1984: 23,000%); Brazil (1994: 2,086%); Colombia (1985–1995: >25% annually); Ecuador (1985–2000: > 20% annually); Guyana (1991: 100%); Peru (1990: 7,481%); Suriname (1994: 125%); Venezuela (2018: 66,000%). Source: https://knoema.com/

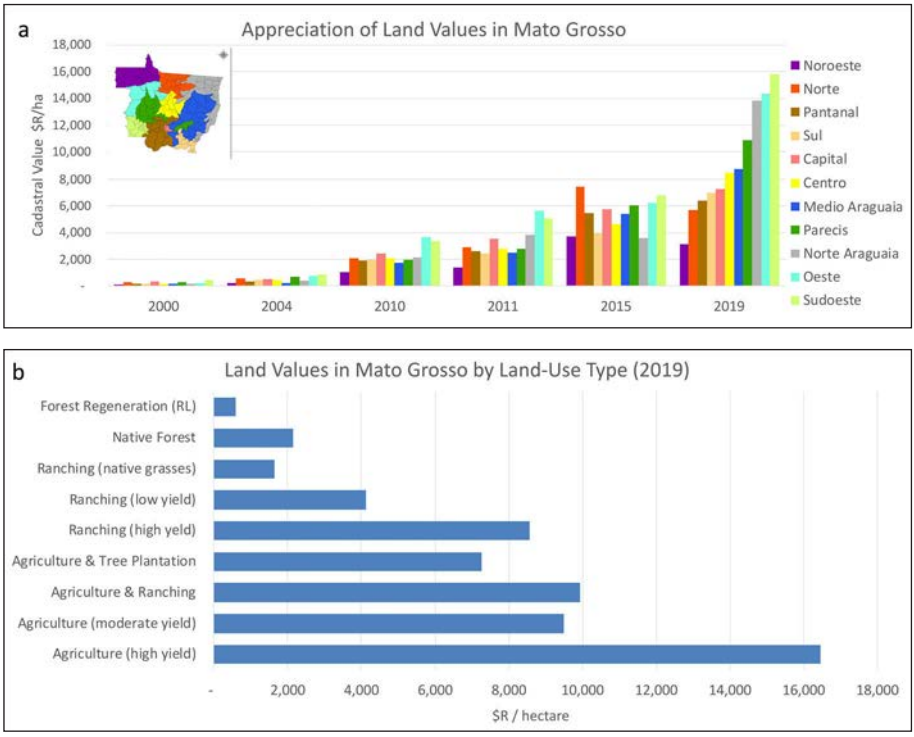

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Figure 4.1: The appreciation of land value in Mato Grosso reflects the expansion and profitability of its agro-industrial sector. (a) Values increased by about 10% annually between 2000 and 2012, and 25% and 50% between 2012 and 2020. (b) The most valuable land has soil and topography appropriate for industrial agriculture; the lowest market value is assigned to land set aside to comply with the Forest Code (RL: Reserva Legal).
Data source: INCRA (2019).

of land values is the extraordinarily lucrative business model pursued by industrial agriculture.

The impact of this type of agricultural production on land values is most evident in Mato Grosso (Figure 4.1). In 2019, mean land values in the municipalities dominated by massive corporate farms were about R$ 12,000 per hectare (*Parecis*). In contrast, properties in the northwest corner (*Noroeste*), where timber extraction and cattle raising predominate, had a mean value of R$ 3,100 per hectare. In both regions, however, the price of

land has exploded over the last twenty years with reported increases in market value between 2,500% (*Noroeste*) and 3,500% (*Parecis*).*

This level of asset appreciation is equivalent to the increase in the average value of farmland in the US Midwest between 1900 and 2000 – a century of growth in only twenty years! Increases in valuations at this rate are often indicative of a market bubble.† Perhaps. The recently reported gains in three of the sample regions (*Sudeste, Oeste* and *Norte Araguaia*) are occurring on landscapes considered to be expansion zones and are overpriced, at least when compared to the farmland in the original soy belt (*Parecis* and *Centro*). Market corrections are evident in the decrease in valuations between 2015 and 2019 in the northern expansion zone (*Norte*), which experienced a surge in prices simultaneous with the paving of BR-163 (see Chapter 2). Regardless, land in central Mato Grosso ($US 3,000 per hectare) is still affordable when compared to other regions that produce soy and maize, such as Paraná ($US 8,000 per hectare)[10] and Iowa ($US 18,000 per hectare).[11]

The appreciation of land is a core component of the business model of cattle ranchers across the Southern Amazon. Many operate on relatively thin margins that cause them to overgraze pastures and degrade soils; many have expanded operations by clearing small patches of forest annually over many years. The opportunity to sell can be a windfall. For example, a middle-class rancher in Alta Floresta with a 1,000-hectare property valued in 2000 at approximately R$ 300,000 ($US 190,000) could potentially sell that property in 2020 for R$ 5.7 million (~$US 1.1 million). The capital gains would be roughly equivalent to his net earnings over that same twenty-year period (see Chapter 3). After paying a capital gains tax, the rancher would have ample resources for a comfortable retirement or could avoid paying capital gains tax by purchasing another landholding. One option might be to buy a ranch on a forest frontier where land values remain affordable.

The appreciation of land creates positive feedback loops that benefit large-scale agriculture. Consider an agribusiness corporation with landholdings of 100,000 hectares operating in central Mato Grosso. The capital appreciation between 2000 and 2019 would surpass $US 250 million. Although the increase in value might not be monetised via a sale, its

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* Property values are reported by the regional office of INCRA based on a standardised methodology used to compensate parties involved in legal or administrative actions pursued by the state. They are allegedly significantly below (25–50%) actual commercial values.

† Farmland in the US Midwest saw bubbles in the early 1920s (post WWI) and 1970 (post farm reform) when mean farmland values increased about 10% per year for a decade then fell in the 1980s by about 25%. Source: USDA. https://www.nass.usda.gov/Publications/Trends_in_U.S._Agriculture/Land_Values/index.php

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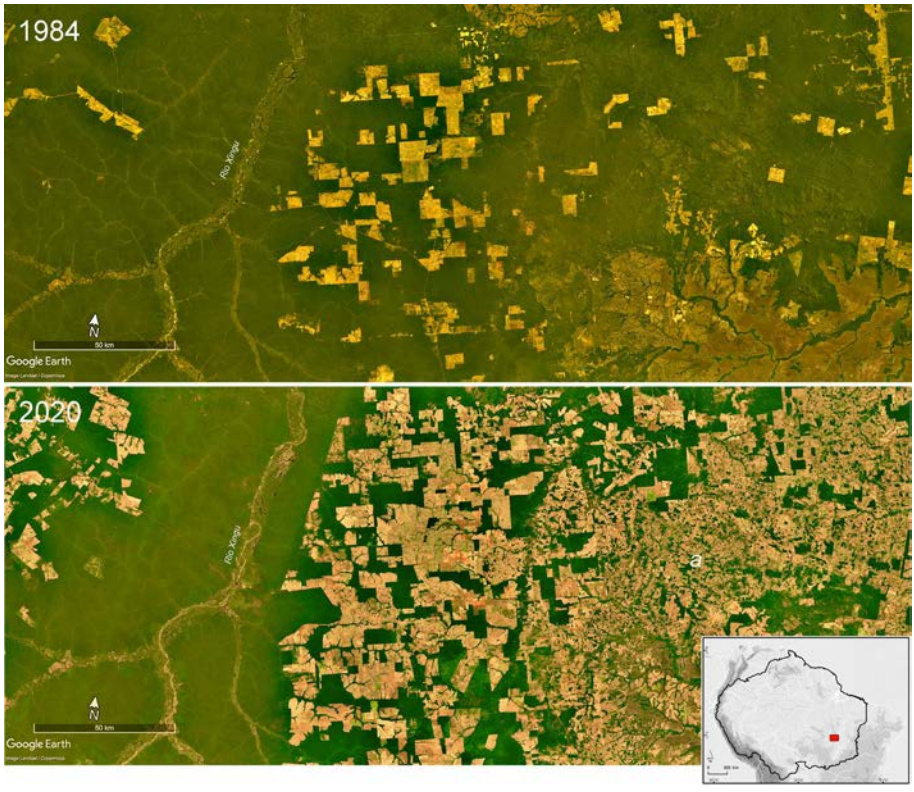
Deforestation not only occurs on the forest frontier but also on long-established landholdings, whose owners progressively create new pastures to expand their herds or to replace pastures degraded by overgrazing.

book value would be incorporated into a corporate balance sheet. Strong balance sheets are at the core of corporate finance because they reduce the cost of credit and attract new equity investors. Approximately ten per cent of the private landholdings in Mato Grosso (15,000 properties) encompass seventy per cent (46 million hectares) of the total area allocated to private landholdings (67 million hectares).[12] The appreciation in the value of those properties would sum to between $US 83 and 100 billion; that value, however, is dwarfed by the capital gains enjoyed by the plutocrats who acquired their properties at virtually no cost in the 1970s.

The increase in the cost of land has motivated agroindustry to develop alternative financial models for accessing land. Joint ventures between farmer-entrepreneurs and landholding ranchers are now common. The most common type of joint venture is a lease negotiated in terms of *sacos*



Source: Google Earth

Large-scale ranchers were well established by the 1980s on land acquired in northeast Mato Grosso state in the late 1970s. Influential investors acquired landholdings between 5,000 and 15,000 hectares at virtually no cost; several have consolidated these properties into even larger estates. Most retain significant areas of forest habitat but very few are in full compliance with the Forest Code. Small- and medium-scale ranchers settled the more heavily deforested landscape located to the East (a). The intact forest corridor along the Xingu River is the Parque Indigena de Xingu (PIX), the first large-scale indigenous reserve in the Amazon.

de soja (soy bags).* This stratagem mitigates risk from volatile commodity markets and exchange-rate fluctuations that can wreak havoc on a business enterprise with fixed costs measured in local currency. If the price of soy falls or the Brazilian currency weakens, the farmer is not locked into a contract based on a fixed monetary amount but instead shares the reduc-

* A *saco* (bag) is a traditional measure of bulk in Portuguese; its conversion to metric values (tonnes) depends upon the commodity, but in the case of soy is 60 kg.

tion in diminished revenues with the landholder. Ranchers can afford to be flexible because even reduced revenues are better than the proceeds from conventional beef cattle operations.

Ranchland is at a premium because sustainability protocols adopted following the Soy Moratorium (Chapter 3) limit the ability of landholders to convert native forest. This has inflated the value of pastures, including those adjacent to existing production landscapes, as well as those in more remote areas or along transportation corridors. Even highly degraded soils, the product of decades of overgrazing, can be attractive to a soybean farmer because the application of limestone ($CaCo_3$) or gypsum ($CaSO_4$), used to ameliorate soil acidity, also resolves the loss of fertility that limits the stocking rates of degraded pastures. Sophisticated farmers deploy technology to micromanage plant nutrient levels and use minimum tillage technology to rebuild soil organic matter; consequently, they view topography, soil texture and previous land use to be more important than the nutrient status of potential farmland. Essentially, ranchers are being paid to restore their degraded soils.

The interactions between ranchers and farmers are pulling more ranchland into the soy-maize production system, either permanently or periodically. Simultaneously, industrial farming is expanding onto municipalities in Rondônia, Pará and Tocantins. Even remote landscapes are being impacted, including in southeast Amazonas, Roraima and Amapá, where soy is being cultivated on savanna landscapes and previously deforested landholdings (Chapter 3). The economic boom in agroindustry is impacting the value of land across the entire region.

Agrarian Reform Agencies and National Land Registry Systems

Rural real estate markets in the Pan Amazon are regulated by institutions that are a legacy of the agrarian reform movements that played a prominent role in domestic politics during the last half of the twentieth century. Prior to World War II, the region was characterised by a quasi-feudal land tenure system, with ownership concentrated among affluent families of European extraction. In Bolivia, Peru and Ecuador, large estates were dependent on the labour of indigenous peasants (*campesinos*) with ancestral ties to the land, while in Brazil, Colombia and Venezuela, the rural labour force was composed of individuals with a contractual relationship with the landowner. The states of the Guiana coast were in the early stages of post-colonial rule, and the relationship between landlord and tenant was in a state of flux, but landless peasants were the majority in an economic system that was overwhelmingly rural.

Table 4.1: Land agencies that oversaw the distribution of public lands in the 1960s and 1970s (left column) and their descendants, now responsible for compiling national rural land registries.

Country	Land Reform Agency / Colonisation Institute	Current day successors
Brazil:	INCRA - Instituto Nacional de Colonização e Reforma Agrária (1971)	INCRA; Instituto Nacional de Colonização e Reforma Agrária
	INTERPA – Instituto de Terras do Pará (1975	
	INTERMAT– Instituto de Terras do Mato Grosso (1977)	
	ITERAM – Instituto de Terras e Colonização do Amazonas (1979); ITEAM – Instituto de Terras do Amazonas (2003); SECT – Secretaria de Estado das Cidades e Territórios de Amazonas (2016)	Núcleos Municipais de Regularização Fundiária (NMRF) & Secretaria das Cidades e Territórios (SECT)
	ITERTINS – Instituto de Terras do Tocantins (1989)	State land agencies: INTERMAT, INTERPA, SECT, ITERTINS, AMAPÁ-TERRAS. ITRON, ITERACRE
	AMAPÁ – TERRAS - Instituto de Terras do Estado do Amapá (2019)	
	ITRON – Instituto de Terras e Colonização de Rondônia (2019)	
	ITERACRE – Instituto de Terras do Acre (2001)	
Bolivia:	INRA: Instituto Nacional de Reforma Agrária (1954–present)	INRA: Instituto Nacional de Reforma Agrária
	INC: Instituto Nacional de Colonzación (1965–1992)	Ministerio de Desarrollo Rural y Tierras
Ecuador:	IERAC: Instituto Ecuatoriano de Reforma Agrária y Colonización (1964–1992)	SSTA: Subsecretaría de Tierras y Reforma Agrária (STRA) Ministerio de Agricultura y Ganadería
	INDA: Instituto Nacional de Desarrollo Agrario (1992–2010)	Regional Governments
Colombia:	INCORA: Instituto Colombiano de la Reforma Agrária (1992–2007)	Agencia Nacional de Tierras (ANT), Ministerio de Agricultura y Desarrollo Rural
	INCODR: Instituto Colombiano de Desarrollo Rural (2007–2015)	
Guyana:	The Land Registry	The Land Registry
Peru:	IRAC: Instituto de Reforma Agrária y Colonización (1963–1992)	(MIDAGRI= Ministerio de Desarrollo Agrario y Riego
	PETT: Proyecto Especial Titulación de Tierras (1992–2016)	Catastro Rural es parte del trabajo del MIDAGRI
	COFOPRI (2007) Organismo de Formalización de la Propiedad Informal	Regional governments
		Superintendencia Nacional de los Registros Públicos (SUNARP)
Suriname:		Management Instituut voor Grondregistratie en Land Informatie Systeem (MI-GLIS)
Venezuela:	Municipal land registries	Instituto Geográfico de Venezuela Simón Bolívar (IGVSB)

This inherent inequality was a political tinderbox that was exacerbated by the expanded influence of Marxist philosophies and the explosion of radical movements after Fidel Castro consolidated the Cuban Revolution. Governments throughout the region responded by enacting agrarian reform legislation. Unsurprisingly, these policies were unpopular with conservative elites seeking to protect their financial patrimony. The decades following the Cuban Revolution were dominated by military governments; these governments varied in their adhesion to the principles of genuine agrarian reform, but all seized upon a solution originally championed by Abraham Lincoln: colonise public lands on the frontier.*

Distributing public lands in wilderness areas was popular; better yet, it avoided the politically perilous measure of violating the property rights of the landowning elite. Governments created agrarian reform agencies as a response to claims for social justice, but they simultaneously delegated to these agencies the task of dispensing public lands in their Amazonian provinces (Table 4.1). The United States supported these initiatives via the newly created the United States Agency for International Development (USAID) and the Alliance for Progress, a programme launched by John F. Kennedy in 1961.[13] Ironically, legitimate concerns about social inequality in Latin America catalysed one of the great social and environmental disasters of the twentieth century: the invasion of indigenous lands and the deforestation of millions of hectares of tropical forest.

Brazil

Agrarian reform in Brazil was initiated by the *Estatuto da Terra* in 1964, a law that created two entities: the *Instituto Brasileiro de Reforma Agrária* to address the inequal distribution of land and the *Instituto Nacional de Desenvolvimento Agrário* to manage colonisation processes then getting underway.[14] In 1971, these two institutions were fused to create the *Instituto Nacional de Colonização y Reforma Agraria* (INCRA) as an autonomous entity within the Ministry of Agriculture. INCRA's administrative functions can be divided into three main categories: (1) the redistribution of land by agrarian reform, (2) the allocation of public lands through settlement programmes and (3) the creation and management of a national rural land registry. The first category has always been politically difficult, while the second has been beset with inefficiency and corruption. The third is INCRA's most important function because rural real estate markets, which mediate investment in agricultural production, depend on a functional land tenure

* The Homestead Act of 1862 was a policy enacted to win the support of the population during the Civil War; it provided settlers with 160 acres of public land if they completed five years of continuous residence and made basic improvements to the landholding.

system that guarantees property rights. A dysfunctional registry not only impedes investment, it undermines efforts to promote sustainable land use and combat land grabbing.

INCRA as an agrarian reform programme

INCRA was created in response to Brazil's long-standing inequality in the ownership of land. Statisticians use a metric known as the 'Gini Coefficient' to measure inequality. Usually, it is employed to evaluate wealth, but it can be applied to land ownership. In Brazil, the Gini Land Coefficient is 0.87, well above the regional average and among the highest in the world.* Despite INCRA's efforts to redistribute land and to populate the Amazon with small farmers, the concentration of land in Brazil has increased over the last half-century. This inequality, combined with rural poverty, nurtured peasant movements throughout the mid-decades of the twentieth century; these were consolidated in 1984 as a national organisation: *Movimento dos Trabalhadores Rurais Sem Terra* (MST). The MST currently has 1.5 million members, representing 370,000 families residing on approximately seven million hectares of encampments acquired by a combination of non-violent civil disobedience and legal combat.[15]

The demand for land and the political power of the MST has motivated successive administrations to embrace the first leg of INCRA's institutional mission. Since its founding, INCRA has redistributed ~4.3 million hectares, benefitting about 130,000 families in the consolidated rural landscapes in the South, Southeast and Central-West regions.[16] Those numbers are not large in the context of Brazil's rural land assets, however, and have not materially alleviated inequality of land ownership. The limited impact of these policies, which are largely achieved by the purchase or expropriation of private estates, explains the political importance of INCRA's second institutional pillar, which is largely dependent on the forest landscapes of the Legal Amazon.†

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* The Gini coefficient is a measure of equality that varies between 0.0 (total equality among all economic sectors) and 1.0 (total concentration of wealth in the highest economic strata). Gini coefficients on land tenure for the major regions of the World are: Latin America (0.79), Europe (0.57), Africa (0.56) and Asia (0.55); there are no published statistics for North America. See Guereña (2016).

† INCRA also has programmes in the Northeast region, where about 8 million hectares have been distributed to 127,000 families. Source: INCRA Instituto Nacional De Colonização e Reforma Agrária – INCRA (2020) Acervo Fundiario: http://acervofundiario.incra.gov.br/acervo/acv.php

INCRA as a colonisation institute

INCRA's approach to distributing public land has changed over time. Known as *terras devolutas*,* they were largely the domain of state governments until 1971, when the military dictatorship decreed that state land situated 100 kilometres either side of a national highway was the domain of INCRA.† This was the era of *Programa de Integração Nacional – PIN* when thousands of kilometres of roads were under construction (see Chapter 6).

The original law was based not on the highways that were under construction but on the proposed national highway system, including hundreds of kilometres of roads in remote regions that were never actually built. Pará, Mata Grosso, Amapá and Roraima relinquished about seventy per cent of their surface area, Acre lost about ninety per cent, and Rondônia and Tocantins‡ literally ceded all their territory to the central government. Only the state of Amazonas retained control over significant parts of its territory.[17] The newly obtained federal land bank was divided into subunits referred to as *glebas*,§ which are periodically opened for settlement, sold or allocated to a specific public category based on ecological, social and economic criteria.

In the 1970s, INCRA initiated its Amazonian settlement programme by organising *Projetos de Colonização* (PC) as part of the POLOAMAZONIA programme.¶ Between eight and twelve million hectares were allocated for distribution as fifty to 100-hectare holdings adjacent to highways under construction in Rondônia and Acre (BR-364), Roraima (BR-175), Mata Grosso (BR-163), Pará (BR-230) and Maranhão (BR-316).[18] The colonisation

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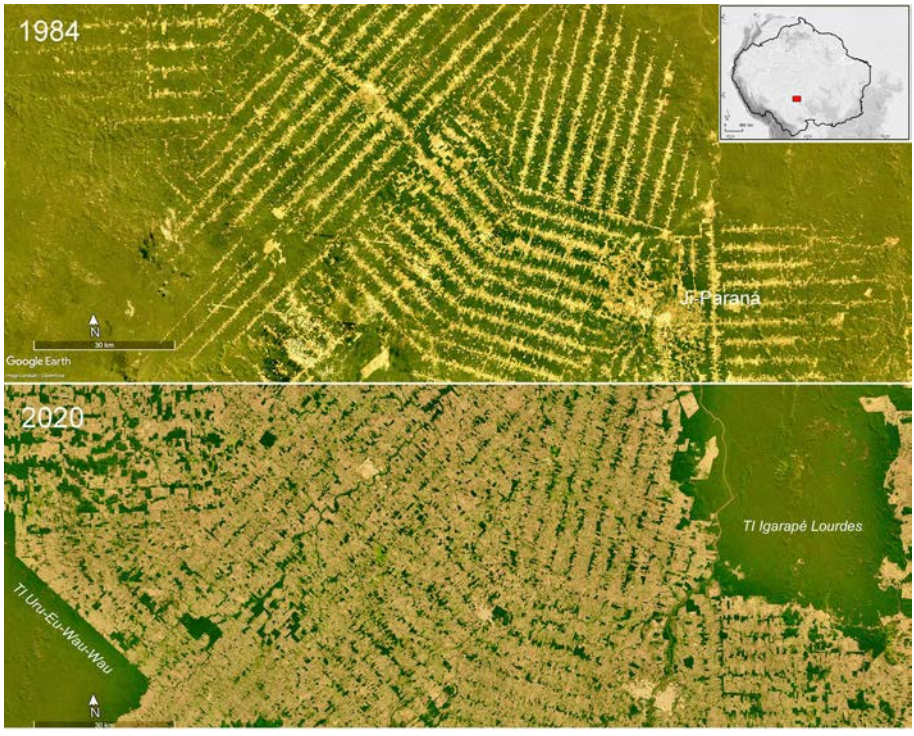
* The term *terra devolutas* roughly translates as 'returned land'; usage comes from the colonial period when the crown issued hereditary land grants to individuals with the stipulation that they be turned into productive enterprises within a given period of time. Most lands reverted to the state, as represented by the crown, which was succeeded by the Brazilian Republic and the Federal Union. Source: *Dictonário Ambiental*, https://www.oeco.org.br/dicionario-ambiental/27510-o-que-sao-terras-devolutas/

† Decreto-Lei nº 1.164, de 1º de Abril de 1971; it was modified by the Decreto-Lei nº 2.375, de 24 de novembro de 1987, which returned tuition over some of the previous land to back the states, particularly in the remote areas of Amazonas state where 'projected' highways have never been constructed.

‡ Tocantins was separated from the state of Goiás in 1988.

§ The term *gleba* has multiple definitions depending on context; it is derived from Latin for soil and in Portuguese can signify arable land, church land, state land and, in this context, land that has not been adjudicated for a specific purpose.

¶ There were three colonisation categories: *Projeto de Asentamentos Conjuntos* (PAC), *Projetos de Asentamentos Dirigidas* (PAD) and *Projetos de Asentamentso Rápidos* (PAR); the data from these settlements is excluded from most INCRA databases because land was deeded (albeit imperfectly) to individual families rather than members of an INCRA-sponsored settlement.



Source: Google Earth

Central Rondônia was settled by tens of thousands of settlers in the 1970s and 1980s on 50-hectare parcels distributed by INCRA in Projetos de Colonização (PC). The vast majority are small-scale livestock producers who retain the lowest proportion of remnant forest within the Brazilian Amazon (see Annex 4.7). The large blocks of remnant forest are indigenous territories.

programme was widely criticised because settlers were encouraged to migrate to remote landscapes and then left to fend for themselves. The land bank available to smallholders during the PC era had the capacity to accommodate about 120,000 families but INCRA succeeded in attracting only about 25,000 participants in the early stages of the programme.*

* The precise numbers are unknown because publicly available shapefiles that purport to show landscapes covered by the *Projetos de Colonização* are incomplete, particularly landscapes adjacent to BR-230 (Pará) and BR-364 (Rondônia). Most of these landscapes were not occupied during the first wave of settlement, but were settled in the subsequent decades with or without the intervention of INCRA. Source of data: INCRA (2020).

INCRA modified its procedures in 1984 and began taking a more coordinated approach to building pioneer communities, which were now referred to as *Projetos de Assentamento (PA).* Like the previous policy, these explicitly favoured landless peasants, but INCRA now provided extension support and subsidised credit, while facilitating the delivery of public services by federal, state and municipal authorities (Figure 4.2 a).

Over time, the system evolved to include state and municipal settlement projects.* The PA system remained in place until 2000, allocating ~25 million hectares that currently benefits ~433,000 families (Table 4.2).[19] Within these territories, each family was granted a provisional right-of-use contract (*Contrato de Concessão de Uso* [CCU]) for a fifty-hectare plot; after five years, these are converted into a permanent right-of-use contract (*Contrato de Concessão de Direito Real de Uso* [CCDRU]) and, eventually, a title deed (*Título de Domínio* [TD]).

PA landholders can be transformed into owners (*proprietários*) after they have paid INCRA a nominal sum for their land and liquidated outstanding debts from credit programmes. Theoretically, the entire settlement can be '*emancipada*' if fifty per cent of the inhabitants opt for title deeds and vote to dissolve their settlement. This requires them to set aside land for public utilities (schools, clinics. etc.) and comply with norms dictated by the Forest Code (see Chapter 7); it also ends their access to INCRA-subsidised credit programmes and technical assistance. A fast-track emancipation process was approved in 2018 and the option is being promoted by the Bolsonaro administration as part of its policy of privatising public assets and promoting a market economy.[20]

Following the shift in environmental and development policies at the turn of the millennium, INCRA modified its land allocation paradigm to create *Projetos de Assentamento Ambientalmente Diferenciado* (PAAD). Unlike their agriculturally-oriented predecessors, these settlements are predicated on the sustainable exploitation of timber and non-timber forest products, fish and wildlife.† The difference in management philosophy has led INCRA to create larger land units with less dense human populations. Shifting agriculture is tolerated, but the emphasis is on sustainable production models informed (theoretically) by a management plan based on technical criteria elaborated via a consensual process.[21] As of 2020, INCRA had accommo-

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* This category includes *Projeto de Assentamento Federal* (PA), *Projeto de Assentamento Estadual* (PE), *Projeto de Assentamento Municipal* (PAM), *Projeto de Assentamento Casulo* (PAC), *Reassentamento de Barragem* (PRB).

† This category includes *Projeto de Assentamento Agroextrativista* (PAE), *Projeto de Desenvolvimento Sustentável* (PDS), *Projeto de Assentamento Florestal* (PAF), *Projesto de Assentamenyo Colletivo* (PCC), *Projeto Descentralizado de Assentamento Sustentável* (PDAS), *Território Remanescentes Quilombola* (TRQ), *Reconhecimento de Assentamento de Fundo de Pasto* (PFP).

Source: Google Earth

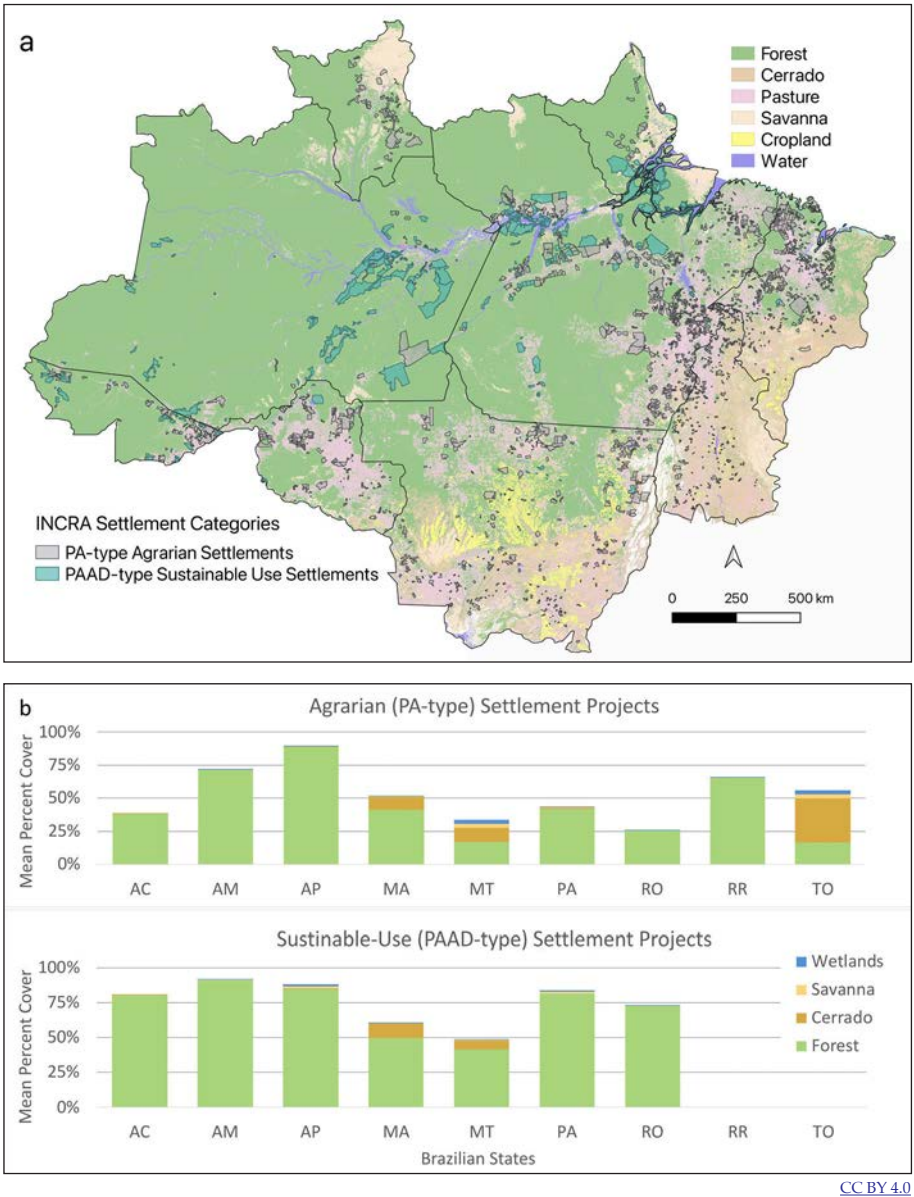
Southern Acre was settled in the 1970s and 1980s by pioneers who established homesteads along BR-317. Most are small- to medium-scale ranchers (white polygons) and many reside in INCRA sponsored PA-type settlements. The settlement zone is bounded to the north by the Reserva Extrativa Chico Mendes (blue polygon), a sustainable-use conservation unit populated by families reliant on the annual harvest of Brazil nuts; most have cleared small patches of forest to generate cash income from micro-scale livestock operations.

Data source: Google Earth and INCRA (2020).

dated ~127,000 families within PAAD settlements covering ~13.5 million hectares (Table 4.2). Unlike the individual plots allocated to residents in the PA settlements, however, these have a communal tenancy regime. In most cases, residents are immediately granted a permanent long-term concession (CCDRU) because INCRA is essentially recognising the prior use-rights of established communities. Beneficiaries are never granted a full legal title, although they may sell their long-term concession to individuals who meet the legal conditions for participating in INCRA sponsored land projects.* Concessions within both PA and PAAD programmes can be passed on to heirs at the death of the beneficiary.

The PAAD settlements are similar to multiple-use protected areas managed by the Instituto Chico Mendes de Conservação da Biodiversidade (ICMBio), an agency within the Environmental Ministry. INCRA 'recognises'

* Eligibility is defined in negative terms; petitioners cannot (i) be public servants; (ii) have participated in a previous land reform, land regularisation or land credit programme; (iii) own a rural property unless that property is insufficient to support a family; (iv) own or be a shareholder in a private company; (v) be under eighteen years of age; and (vi) have income exceeding three monthly minimum wages. Source: INCRA (2021), https://www.gov.br/incra/pt-br/assuntos/reforma-agraria/acesso-a-terra



CC BY 4.0

Figure 4.2: (a) The Instituto Nacional de Colonização y Reforma Agraria (INCRA) oversees two broad categories of settlement: agrarian communities (PA-type) established prior to 2000, and environmentally differentiated (PAAD-type) communities with sustainable-use management plans established after 2000. (b) Forest cover reflects category type but also geographic location.

Data sources: INCRA (2020) and MapBiomas (2021).

these conservation units within its institutional mission, which ensures their residents enjoy the same legal rights as beneficiaries in the agrarian reform settlements and have access to subsidised credit and key public services.* Because they are part of the protected-area system, they are subject to a greater level of scrutiny and, by many accounts, more institutional support.[22] They also enjoy a larger forest area to support their livelihoods, averaging about 500 hectares per family compared to only 100 hectares within the PAAD system. The difference in population density will be an important factor in determining whether these sustainable-use land-management units succeed in conserving the forest estate within their borders.

Forest monitoring programmes have identified the INCRA settlements as a significant source of deforestation. The earliest PC-landscapes in Rondônia and Mato Grosso have a mean forest cover of less than ten per cent although settlements with a similar history in Acre, Roraima and Pará retain between twenty and forty per cent. Similarly, PA settlements in eastern Pará have retained only vestigial areas of remnant forest (< 5%), while those in remote landscapes of Amapá and Amazonas retain as much as ninety per cent of their forest cover (Figure 4.2 b). Deforestation in PAAD settlements has been limited (0–10%), but is not insignificant. Forest conservation in both PA and PAAD landscapes is not necessarily a consequence of management criteria: remoteness, isolation and history also determine their fate as forest reserves. The annual deforestation rate within all the INCRA settlements fell from about 450,000 hectares between 2003 and 2005 to less than 70,000 hectares by 2015.[23]

INCRA as a regulatory agency

The third pillar of INCRA's institutional mission encompasses both administrative and legal aspects of land tenure and, as such, is the most important agency regulating rural real estate markets. Administratively, the institution is charged with collecting and organising the records of all rural properties in Brazil, including their creation and all subsequent sales, subdivisions and unifications. Legally, INCRA functionaries must review and verify that documents are legitimate and validate the spatial attributes of individual land parcels. This is a gargantuan task that would test the governance capacity

* Not all multiple-use categories qualify for INCRA accredited support – those that do include: *Reserva Extrativa* (RESEX), *Reserva de Desenvolvimento Sustentável* (RDS), *Floresta Nacional* (FLONA) and *Floresta Estadual* (FLOTU). Residents of *Área de Proteção Ambiental* (APA), a category used when there is a conflict concerning mineral exploitation or with private properties, are not eligible for the subsidised credit and services that come with INCRA's accreditation.

Table 4.2: The distribution of land via the settlement modes of INCRA and ICMBio within the Legal Amazon.

	PA system			**PAAD system**			**ICMBio system**		
INCRA Regional Office	Units	Families	Area (1,000 ha)	Units	Families	Area (1,000 ha)	Units	Families	Area (1,000 ha)
Pará-Belem	113	21,744	964	268	52,729	2,251	15	24,056	882
Pará-Marabá	511	71,806	4,656	18	27,439	27	-	-	-
Pará-Santarem	61	15,272	1,383	-	5,951	2,566	2	4,955	859
Pará-Altamira	39	12,787	1,252	-	-	921	4	2,252	2,728
Maranhão	1,007	125,868	4,117	14	1,349	61	4	1,603	214
Mato Grosso	528	75,380	5,214	13	1,539	112			
Acre	103	13,215	657	39	5,002	678	12	5,513	3,641
Amazonas	37	16,395	1,396	71	26,542	6,484	35	14,301	19,394
Rondônia	189	35,562	1,904	6	801	179,775	22	536	1,532
Amapá	32	8,248	1,567	21	5,042	175,698	1	1,409	502
Roraima	65	13,983	1,196	3	-	-	-	-	-
Tocantins	379	23,452	1,242	78	378	-	-	-	-
Total	**3,064**	**433,712**	**25,554**	**531**	**126,772**	**13,457**	**95**	**54,625**	**29,754**

Source: INCRA 2017.

of any country but is particularly challenging in a nation of continental dimensions undergoing a massive distribution of land.*

The decision to organise rural properties into a national land registry, *Sistema Nacional de Cadastro Rural* (SNCR), coincided with policies to transform the Amazon via migration and settlement. That task might have been completed automatically if the smallholder programmes, which distributed about twelve million hectares, had accurately and precisely recorded those transactions. Unfortunately, that did not happen. That missed opportunity

* In Europe, land registries are managed by national institutions, but countries are a fraction of the size of Brazil, and most properties enjoy centuries of historical records. In North America, the process is decentralised to the state or province for legal guidelines, while local jurisdictions manage the administrative tasks of record keeping and verification. At the national level, public and private databases are bottom-up compilations derived from thousands of systems.

was confounded by a collateral decision to facilitate a land rush that was occuring organically across the Southern and Eastern Amazon.

After about 1978, the military government became disenchanted by the smallholder settlement framework due to high overhead costs, low economic return and terrible public relations. Instead, they decided to expedite the transfer of public lands to corporations and influential families with the capacity to invest in productive enterprises at economies of scale. Over the next two decades, more than 100 million hectares of public land were transferred to large-scale landholders via a variety of legal and extra-legal operations.

The easiest way was to obtain a land grant from a government agency.* Sometimes these were disguised as a concession to organise a private colonisation project but were converted into a corporate estate. Another gambit was to cycle a small landholding through a series of transactions and to enlarge its dimensions at each stage. Many landholdings were manufactured out of whole cloth.[24] Questionable deeds were laundered by the *Fundo para Investimento Privado no Desenvolvimento da Amazônia* (FIDAM), a subsidiary of the *Superintendência do Desenvolvimento da Amazônia* (SUDAM),† which loaned money to corporate ranchers.[25] FIDAM required creditors to obtain documentation verifying their property rights from INCRA's regional offices or state agencies, all of which were staffed by individuals eager to facilitate the infusion of money into their jurisdictions.

The open collaboration of multiple state and federal agencies created a permissive environment that was exploited by speculators, who appropriated land that was sparsely populated by rubber tappers and indigenous communities. Tacit approval for fraudulent real estate transactions had been formalised in 1976 when the military government promulgated a land regularisation law that included a provision for conferring titles for properties that had been created via extra-legal procedures, if the current owners had purchased them in 'good faith'.[26] Each subsequent transfer of a property, or bank-mediated financial transaction, provided a layer of judicial security.

INCRA did not begin a serious effort to catalogue and review land tenure claims until about 1993, after which it launched periodic initiatives to consolidate the SNCR with increasing levels of electronic sophistication.[27] Landholdings deemed to be legitimate were incorporated into the SNCR

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* The institutions with the most power (and land) were the *Companhia Desenvolvimento do Estado de Mato Grosso* (CODEMAT), which was succeeded by the *Instituto de Terras do Mato Grosso* (INTERMAT); the *Grupo Executivo das Terras do Araguaia/Tocantins* (GETAT); and the *Instituto de Terras do Pará* (ITERPA). Source: Hecht and Cochburn (2010).

† SUDAM is a semi-autonomous federal agency (autarchy) which has existed in various permutations since 1944, and oversees development funds and programmes in Amazonia. See Ch. 6.

database, and owners were issued a *Certificado de Cadastro de Imóvel Rural* (see Text Box 4.1).

Text Box 4.1: Certificado de Cadastro de Imóvel Rural

> As the name *Rural Property Registration Certificate* implies, the CCIR is not a legal title residing within the *Cartorío* notary system; rather, the emission of a CCIR means that a landholding has passed through a due diligence process referred to as *regularização fundiária.* Brazilian law requires that a CCIR accompany legal contracts that 'transfer, lease, mortgage and dismember' a real estate asset; a CCIR is also routinely required by banks when approving a loan. A CCIR endows a property with *segurança jurídica* (legal certainty) and, in spite of claims to the contrary, effectively functions as legal title.

Following the restoration of democracy in 1985, civil society clamoured for legislative and legal action to combat land grabbing.[28] An exposé published by the national news magazine *Veja* in 1999 motivated the Cardoso administration to review the legality of unusually large Amazonian estates.[29] The INCRA secretariate in Manaus conducted an audit of landholdings greater than 10,000 hectares, identifying more than 2,900 holdings covering ~87 million hectares. Putative owners were required to provide documentation supporting their claims. The audit caused INCRA to rescind title for 63 million hectares.[30]

The scandal also motivated the creation of a congressional commission (*Comissão Parlamentar de Inquérito*), which investigated the illegal transfer of public lands in seven of the nine states of the Legal Amazon.* Referred to as the *CPI do Grilajem,* the probe identified an additional 37 million hectares of public forest that had been fraudulently obtained via transactions involving landholdings between 1,000 and 1.6 million hectares. [31] The report, which was published in 2003, provides a detailed account of the mechanics of land grabbing, the collusion of state functionaries and the complicity of magistrates who validated 24 million hectares in judicial hearings, including twelve million hectares in the name of a single individual.†

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* Tocantins and Maranhão were excluded.

† In Pará, the name Carlos Medeiros was used in dozens of timber-related transactions totalling 12 million hectares; it was apparently a fictious name used by at least five different individuals acting with a power of attorney, most commonly Flávio Augusto Titan Viegas. In Acre and Amazonas, a later-day rubber baron named Falb Saraiva de Farias amassed forest estates totalling 7 million hectares. Source: CPI – Comissão Parlamentar de Inquérito. 2003. Relatório da Comissão Parlamentar de Inquérito destinada a investigar a ocupação ae terras públicas na região Amazônica: https://www2.camara.leg.br/atividade-legislativa/comissoes/comissoes-temporarias/parlamentar-de-inquerito/51-legislatura/cpiamazo/relatoriofinal.pdf

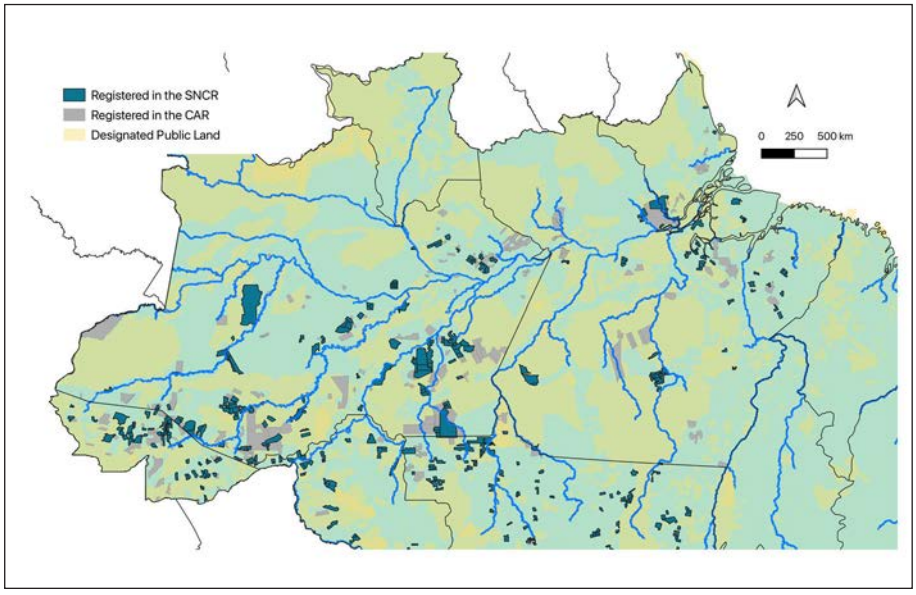

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Figure 4.3: In the early 2000s, the Brazilian state clawed back approximately 100 million hectares of illegitimate forest holdings following a congressional review of land claims in the Legal Amazon. There are still ~12 million hectares of private forest holdings greater than 10,000 hectares registered within the Sistema Nacional de Cadastro Rural (SNCR) and an additional 16 million hectares of claims registered in the Cadastro Ambiental Rural (CAR) that have yet to be adjudicated.

Data sources: INCRA (2021) and IMAFLORA (2019).

Administrative action by INCRA reverted some, but not all, of those landholdings. Legal action on the part of aggrieved landholders delayed resolution, particularly in Pará where timber companies continued to exploit landholdings while the judicial system evaluated their claims.[32] As of 2021, INCRA databases continued to list multiple forest properties larger than 100,000 hectares, including a 913,000 hectare estate that was impounded in 2004 following the congressional investigation (Figure 4.3).*

* INCRA revoked the title (CCIR) of the *Gleba Santa Rosa do Tenque* in 2004, based on a reevaluation of the documents submitted on behalf of the corporate owner: APLUB *Agro Floresta Amazônia S/A*. The company successfully appealed the decision in 2005 and went on to develop a timber management plan in 2016 that was approved by IBAMA and certified by the Forest Stewardship Council (FSC). That venture failed to attract investors, however, and the property was recently listed on the Brazilian real estate market for R$ 60 million. Sources: CPI – Comissão Parlamentar de Inquérito. 2003. Relatório da Comissão Par-

The findings of the commission led to investment in INCRA's capacity to manage the SNRC, including the development of a geospatially precise database: the *Sistema Nacional de Certifcação de Imóveis* (SNCI). Launched in 2003, the SNCI was a cumbersome system that relied on public servants to verify information and then incorporate the property into its digital catalogue. It was replaced in 2013 by the *Sistema de Gestão Fundiária* (SIGEF), which relies on the landholder (or consultant) to upload data via a web application that is subsequently verified by INCRA staff.

For some reason, presumably technical, the two systems have never been merged. The SNCI incorporated 15,330 properties and, as of June 2021, SIGEF housed ~142,000 (up from 73,000 in 2017).[33] To put this in perspective, the number of certified properties in 2020 represented only fifteen per cent of the rural landholdings enumerated by the IBGE agricultural census of 2017.[*] Nonetheless, the properties registered within the SNRC encompass sixty per cent of the total spatial footprint of all agrarian landholdings, another data point highlighting the unequal distribution of public land in the Legal Amazon.[†]

The deficiencies in the SNCR led to the development of parrallel cadasters.[34] The national tax authority relies on the *Cadastro Fiscal de Imóveis Rurais* (CAFIR). This database does not incorporate spatial attributes but does include large and mid-scale landholders who register in the system to pay taxes and, in the process, further legitimatise their holdings. In 2015, the government moved to unite the SNRC and CAFIR into a single registry: the *Cadastro Nacional de Imóveis Rurais* (CNIR).[35] Presumably, this is part of a broader strategy to improve tax collection, but like the CAFIR, the CNIR will include both *proprietários* and *poseidueros.* The CNIR will not issue a certificate of title regularisation (CCIR), which will remain the responsibility of INCRA; however, the CNIR will generate a document to be required for future property transactions which, if so, will effectively function as a type

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lamentar de Inquérito destinada a investigar a ocupação ae terras públicas na região Amazônica: https://www2.camara.leg.br/atividade-legislativa/comissoes/comissoes-temporarias/parlamentar-de-inquerito/51-legislatura/cpiamazo/relatoriofinal.pdf; *Tribunal Regional Federal da 1ª Região* (AMS 5665 AM 2004.32.00.005665-1) and OLX: https://am.olx.com.br/regiao-de-manaus/terrenos/fazenda-na-amazonia-913-000-hectares-644885176#

* The Instituto Brasileiro de Geografia e Estatística (IBGE) survey records holdings in 18 size classes ranging from 0 to > 10,000 hectares; Source of data: SIDRA – Sistema IBGE de Recuperação Automática (2021) *CENSO Agropecuario 2017*: https://sidra.ibge.gov.br/tabela/6780

† The estimate is derived from a model of land tenure compiled from 14 overlapping databases organised in the *Atlas Agropecuária – A Geografia da Agropecuária Brasileira*. Source: IMAFLORA (2019).

of deed.* Although authorised by legislation in 2001, the consolidation of the CNIR has taken on new impetus since the election of Jair Bolsonaro, and all landholders have been instructed to register by the end of 2022.[36]

Another parallel land registry is the *Cadastro Ambiental Rural* (CAR), created in 2009 as part of *Plano de Ação para a Prevenção e Controle do Desmatamento na Amazônia Legal* (PPCDAm), a highly successful cross-sectoral strategy to combat illegal deforestation (see Chapter 7). Registration in the CAR is obligatory but, in order to ensure its success, authorities and private sector stakeholders created multiple incentives to promote participation. Positive incentives include access to subsidised credit and the provision of technical assistance. Negative incentives include barriers for the commercialisation of crops and livestock that are enforced by commodity traders and meatpackers.† Companies use the CAR to monitor deforestation and (allegedly) exclude producers who illegally clear forest from their supply chains. Agrobusiness has aggressively promoted the CAR as a key component in its strategy to protect Brazil's overseas markets from consumer boycotts (see Chapter 3). Unfortunately, land grabbers are attempting to use the CAR to establish documentary history to support fraudulent claims, a strategy that may succeed, considering the Bolsonaro administration's support for expanding the agricultural frontier.

As a cadaster, the CAR has avoided the pitfalls of SNCR by accepting registration of all landholdings regardless of legal status and by ignoring conflicting land claims. Participants are expected to conform to environmental regulations; however, inscription provides a flexible (open-ended) pathway for coming into compliance with the Forest Code (see Chapter 7). Consequently, the response of landholders has been overwhelming, and the CAR provides an alternative depiction of the number and location of all land claims (Table 4.3 and Table 4.4).

The massive gap between the CAR (755,000 landholdings) and SNCR (135,000 landholdings) shines a spotlight on both the dysfunction and inequity in INCRA's programmes to formalise land tenure. The technical tasks associated with verifying the legal and geospatial attributes of a landholding require the services of a professional surveyor. Large-scale producers have self-financed this process because they can, but smallholders of limited means must wait until INCRA organises a campaign in their municipality. The dysfunction is evident in the municipality of Ariquemes (Rondônia), where hundreds of landholders lack CCIRs, even though the region was settled in the 1970s and 1980s (Figure 4.4).

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* A 'title' is declaration of ownership; a 'deed' is the registry of a real estate transaction; both are legal documents.

† Grain traders: ADM, Bunge, Cargill, Louis Dreyfus, Amaggi group and a few others from China and the EU (see Ch. 3); Meatpackers: JBS, Marfrig, Minerva.

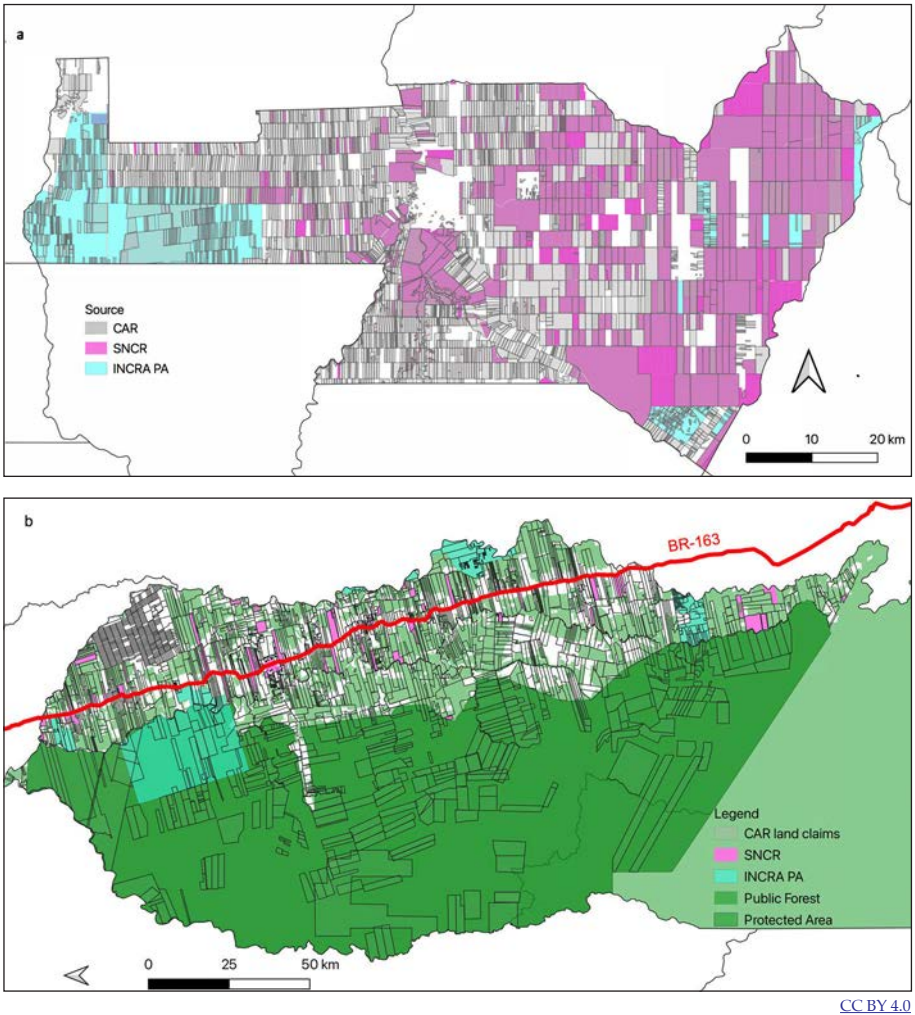

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Figure 4.4: The Cadastro Ambiental Rural (CAR) has allowed hundreds of smallholders to obtain an official registration for their properties in Arequimes municipality of Rondônia, which was settled in the 1970s (a). Unfortunately, the CAR also provides opportunities for land grabbers to document dubious land claims on the public forests adjacent to BR-163 in Novo Progresso municipality in Pará (b).

Data source: INCRA (2020) and SFB (2020).

Table 4.3: Summary statistics on rural landholdings in the Legal Amazon of Brazil. The IBGE data is from the agricultural census of 2017 and excludes forest properties; the CAR incorporates data for forest and agrarian landholdings, including many of dubious provenance; the INCRA-SNCR incorporates only those that have been verified for their spatial and administrative attributes, while excluding landholdings within INCRA PA-type settlements, which are included in both the IBGE and CAR databases.

	IBGE		**CAR**		**INCRA SNCR**		**INCRA Settlements**	
	number (x1,000)	hectares (x1,000)	number (x1,000)	hectares (x1,000)	number (x1,000)	hectares (x1,000)	number (x1,000)	hectares (x1,000)
Acre	37	5,211	36	6,172	1	3,156	20	1,173
Amapá	9	1,244	6	2,323	1	572	16	1,337
Amazonas	81	4,467	50	26,122	5	6,905	8	1,557
Maranhão	220	14,166	102	16,302	22	10,124	102	3,779
Mato Grosso	119	59,669	142	73,033	56	51,436	66	4,285
Pará	282	32,324	213	44,498	13	13,420	124	11,762
Rondônia	91	10,589	123	12,003	9	4,024	37	1,897
Roraima	17	2,986	10	4,259	2	1,069	15	1,259
Tocantins	64	17,155	73	17,762	25	13,470	24	1,283
Total	**919**	**147,810**	**755**	**202,474**	**134**	**104,176**	**413**	**28,333**

Sources: SIDRA (2021); CAR from IMAFLORA (2019); INCRA-SNCR and INCRA-PA from INCRA (2020).

The need to fast-track the *regularização*[*] of smallholder titles motivated the *Terra Legal* programme, which sent teams of surveyors to selected municipalities to accelerate the process for landholdings established prior to 2004.[†] The initial goal was to review and certify 300,000 smallholdings in 463 municipalities;[37] however, the programme collected data on only 117,000 landholdings and issued less than 23,000 CCIRs.[38] As of June 2021,

* This is the term used in Brazil to refer to the process whereby land titles are reviewed and certified; in Spanish-speaking countries, the preferred term is *saneamiento*; both terms reflect the perception that the *status quo* is 'irregular' or 'unclean'.

† Eligibility was limited to landholdings smaller than 15 '*modulos fiscales*', a standardised unit-area defined by Brazilian law that varies regionally – in the Amazon it is nearly always 100 hectares.

Table 4.4: Summary statistics on rural landholdings in the Legal Amazon of Brazil. The IBGE , CAR and INCRA–SNCR data as in Table 4.3. The IMAFLOR model combined data from the CAR and SNCR database, but excludes landholdings within the INCRA–PA system, thus undercounts the number of small holdings by about 413,000 and 28.3 million hectares (see Annex 4.1 to 4.9)

	IBGE		**CAR**		**INCRA–SNCR**		**IMAFLOR Model**	
Size class (hectares)	number	hectares (x1,000)	number	hectares (x1,000)	number	hectares (x1,000)	number	hectares (x1,000)
< 100	735,863	18,365	534,064	20,714	66,263	2,792	396,530	6,069
100–500	118,558	26,573	158,229	32,569	58,900	16,839	311,225	12,908
500–1,000	16,813	12,610	26,641	19,144	16,370	13,230	135,969	27,673
1,000–10,000	19,770	64,631	34,893	81,998	19,969	50,159	69,085	80,553
10,000–50,000	1,318	25,632	1,409	26,287	791	14,781	2,282	16,046
50,000–100,000	-	-	92	6,375	44	2,953	1,230	22,803
> 100,000	-	-	69	15,387	17	3,526	158	21,022
Total		**147,810**	**755,397**	**202,474**	**162,354**	**104,280**	**916,479**	**187,073**

Sources: SIDRA (2021); CAR and IMAFLOR model from IMAFLORA (2019); INCRA (2020).

none of these recently registered properties has been incorporated into the SIGEF databases available via INCRA's public portal.*

Although the *Terra Legal* system failed significantly to increase the inscription of smallholders in the SNCR, it demonstrated how a wall-to-wall effort can resolve potential conflicts among neighbours and achieve impacts at scale by engaging an entire community. That experience will be replicated in *Titula Brasil*, an initiative launched in 2021 by the Bolsonaro

* Terra Legal was organised outside of INCRA via the *Secretaria Extraordinária de Regularização Fundiária na Amazônia Legal* (SERFAL) and the *Secretaria Especial de Agricultura Familiar e do Desenvolvimento Agrário* (SEAD)/ *Casa Civil* (i.e., the president's office). The programme was funded by the German government and terminated in 2019; its functions and databases were transferred to INCRA. Source: A. Borges (27 Nov. 2020), TCU aponta lentidão na legalização de terras, *Terra, Noticias*: https://www.terra.com.br/noticias/brasil/politica/tcu-aponta-lentidao-na-legalizacao-de-terras,0cd955783b4bcb176a885243b150216dpzo8skel.html

Source: Google Earth

The forest landscape adjacent to BR-319 south of the Amazon River near Manaus is largely intact forty years after the construction of this federal highway; nonetheless, numerous land claims have been regularised (white polygons) and more have been inscribed into the Cadastro Ambiental Rural (red polygons).

Data source: Google Earth and INCRA (2020).

administration, that will delegate most of the administrative and technical tasks of property mensuration to the newly created *Núcleos Municipais de Regularização Fundiária (NMRF)*. These offices are meant to function as decentralised units of INCRA and, like *Terra Legal*, prioritise assistance for smallholders.

The *Titula Brasil* programme will first target the approximately 430,000 households that are resident in the INCRA's 3,000 PA-type settlements; however, these municipal offices will be open to other small and mid-sized landholders. According to the IBGE agricultural census, there are at least 680,000 landholdings smaller than 100 hectares in the Legal Amazon,[39] while data derived from the CAR indicates the number located outside the PA system might be as large as 500,000.[40]

The Lei de Grilagem

The effort to resolve the backlog in the regularisation of small farms collides, unfortunately, with the fight to end land grabbing. Congressional representatives affiliated with conservative groups often referred to as the *banca ruralista*[*] have consistently pushed for a regulatory approach that would

* Also known as the *bancada BBB*, which stands for *bala* (bullets), *boi* (cattle) and *biblia* (bible) – see Ch. 6.

issue CCIRs to thousands of medium- and large-scale ranchers with problematic land tenure documents. Previous policy initiatives, particularly a land law passed in 2009, included measures that would recognise the legality of landholdings settled in the 1990s and 1980s, when land acquisition rules were laxly enforced.[41] Environmental and social advocates characterised the law as an amnesty, however, and insisted that it incorporate a *quid pro quo.* Consequently, the law included measures to limit the size of landholdings eligible for an expedited process to 1,500 hectares and set cut-off dates to exclude lands illegally occupied after 2004.

In 2016, an executive order by the Temer administration modified the regularisation protocols by moving the cut-off date to 2009 and expanding the size of the landholding eligible for an expedited process to 2,500 hectares.[42] The rules were modified again in 2019 by the Bolsonaro administration, first by an executive order that evolved into a legislative act known by its critics as the *Ley da Grilagem*.* Critics contend that the recent (and proposed) changes represent another amnesty for past infractions and open the door for another round of land grabbing.[43] Like all legislative proposals, the final version will depend upon last-minute negotiations but, as of August 2021, opponents point out multiple deficiencies: [44]

1. Extends the cut-off date for the expedited resolution of land claims to 2014 (rather than 2009).
2. Includes provisions to auction illegal landholdings that allow rejected applicants to participate and, in certain cases, make bids prior to the public auction.
3. Limits on-sight verification for environmental compliance for landholdings greater than 1,000 hectares (rather than 400 hectares).
4. Condones illegal deforestation by relying on (seldom enforced) future commitments to remediate past infractions (*Termo de Ajustamento de Conduta – TAC*).†
5. Weakens the ability for INCRA to recover (claw-back) landholdings that fail to comply with environmental regulations (see #4 above).

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* *Projeto de Lei nº 510/2021,* https://www25.senado.leg.br/web/atividade/materias/-/materia/146639

† *Termo de ajustamento de conduta* (TAC) is an agreement between a public entity (prosecutor's office or regulatory agency) and a person or legal entity to correct a violation of a collective right protected by law (e.g., environmental or consumer). It is an extrajudicial measure used to resolve conflicts without resorting to legal action. In case of non-compliance, the public entity can demand the execution of the TAC without the need to file a public civil action to seek remediation or compensation. Source: https://comunicacao.mppr.mp.br/2020/08/21443/Termo-de-Ajustamento-de-Conduta.html

6. Facilitates land grabbing as a business model by allowing individuals to submit multiple applications to INCRA to regularise a landholding.
7. Inappropriately rewards speculators by extending discounts (ranging from fifty to ninety per cent of the appraised value of the land) that were originally intended only for residents within INCRA PA-like settlements.
8. Creates a mechanism for the ongoing distribution of public lands by sale or auction that would open a door for the further privatisation of public lands.

Proponents of the reorganisation of INCRA protocols argue that it is necessary to impose order on the chaos of the land-tenure system while providing economic justice to hundreds of thousands of rural families. Opponents contend that the law represents (another) amnesty for past illegal activity that will foster future abuse. Moreover, they contend that none of the proposed changes are needed to expedite the regularisation of smallholder properties and, instead, suggest investing in the capacitation of INCRA staff and the provision of a budget commensurate with the size of the task – which all parties agree is very large and long overdue.

Underlying the debate are two opposing philosophies about the future of development in Amazonian Brazil. On the right, economists and political scientists view land as a financial asset and believe the regularisation of private property will stimulate investment and create economic growth. On the left, social and environmental advocates view access to land as a human right, and seek to ameliorate the inequality that defines Brazilian society and conserve biodiversity and protect indigenous and traditional cultures in the Amazon (Annex 4.1 to 4.10).

Bolivia

Bolivia was a leader in the agrarian reform movement in South America. A defining moment in its modern history was the national revolution of 1952, which started as an uprising against the feudal system that bound indigenous communities to estates owned by wealthy families. The revolutionary government created the *Instituto Nacional de Reforma Agraria* (INRA) in 1958 to provide legal status to the lands occupied and claimed by indigenous peasants. The revolution largely occurred in the Andean highlands and eventually led to the proliferation of extremely small (micro) landholdings that motivated many *campesinos*[*] to migrate to urban areas or the eastern lowlands. Large estates in the Bolivian Amazon avoided confiscation but

* In Andean countries, indigenous peasants from the highlands self-identify as *campesinos*.

their owners were forced to bequeath a fraction of their properties to the indigenous communities upon which they depended for labour.*

In 1965, Bolivia established the *Instituto Nacional de Colonización* (INC) to foster the migration to the lowlands and, in the process, created a parallel and overlapping bureaucracy for granting land titles. Both agencies distributed land in the Bolivian Amazon to the growing stream of indigenous migrants from the Andean highlands. Organised colonisation projects in the 1970s created smallholder landscapes in the Chapare, Cochabamba (HML # 32); Alto Beni, La Paz (HML #33); and San Julián, Santa Cruz (HML #31).

Japanese immigrants also arrived in the 1960s and established colonies in Santa Cruz at Yapacaní (HML #32) and Okinawa (HML #31), landscapes with unusually fertile soils uniquely suited for the cultivation of irrigated rice. Mennonites settled south of the city of Santa Cruz in the 1970s, initiating a process of colonisation on the alluvial plain of the Río Grande (HML #31) that eventually extended to Chiquitania (HML #29) and the Guarayos regions (HML #30). These foreign migrants were welcomed by both military and civilian governments because they brought practical knowledge that aligned with government policy to develop the agricultural economy of Santa Cruz. The main beneficiaries of that policy, however, were *Cruceño* families who used their influence to acquire millions of hectares of public forest.[45]

The 1980s and 1990s were characterised by the adoption of neoliberal economic policies imposed on Bolivia by multilateral agencies.† One of the most far-reaching decisions was the closure of unprofitable state-owned mines that led to another round of mass migration, this time by indigenous miners who joined their *campesino* peers in the lowlands to start a new life as small farmers. About half moved to the Chapare region and took up the cultivation of coca.[46] They brought with them a tradition of union activism that would define the political struggles of the first decade of the twenty-first century (see Chapter 6).

In 1992, the INC was merged into INRA, which was reformed to protect property rights as part of the ongoing programme to create a market economy. Codified by the *Ley INRA* of 1996, the reformed land-tenure system included provisions for the regularisation (*saneamiento*) of land titles

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* An estancia with an indigenous *rancho* within its boundaries would excise that village and its associated slash-and-burn farmland and pass ownership to the village as a communal holding. The estancia would continue, however, to rely for manual labour on its inhabitants, who continue to view the owner as their *Patrón*.

† 'Structural adjustment' was the euphemism that the World Bank and International Monetary Fund used when obligating developing countries to adopt the economic reforms – including trade liberalisation, deregulation, fiscal discipline and privatisation – embodied in the so-called Washington Consensus.

and the compilation of a national land registry.* Like most of the structural adjustment policies of the 1990s, it included provisions to safeguard the ancestral claims of indigenous communities (see Chapter 11).

The World Bank and other multilateral agencies supported the land-titling process† while financing investments in infrastructure (see Chapter 2) and land-use planning (see below). International commodity traders created local subsidiaries, provided affordable credit and incorporated the expanding agricultural frontier into their global supply chains (see Chapter 3). Inexpensive land, fertile soils and an accommodating government attracted investors from North America, Argentina and Brazil. The soybean boom was well under way by the year 2000, which fostered a rise in real estate values similar to that experienced by the soybean landscapes of central Mato Grosso. On the alluvial plain near San Julián (HML #31), mean annual prices for farmland increased by six per cent between 1990 and 2000, by fifteen per cent between 2000 and 2010 and by seven per cent between 2010 and 2020.[47]

While the boom in agriculture was getting underway, Bolivia was also transforming its forest sector following a playbook designed by forest ecologists eager to implement sustainable forest management via the private sector. The centrepiece of that strategy consisted of thirty-year concessions covering approximately 6.5 million hectares awarded to companies that promised to pursue sustainable forest management (see Chapter 7).[48] Bolivia was viewed as an experiment where democratic reform and a market economy would promote sustainable development and social justice. The citizens of Bolivia, however, had a different vision for the future of their country.

Estado Plurinacional de Bolivia

In 2005 Bolivia elected Evo Morales in a landslide victory that gave his political party, the *Movimiento al Socialismo* (MAS), the first congressional majority since the restoration of democracy in 1986. Key to his electoral success was a platform based on indigenous rights and their demand for *tierra y*

* The process of *saneamiento* should: (1) reconcile conflicting claims to a landholding; (2) issue title to a valid claim; (3) annul invalid claims; (4) validate imputed properties that meet criteria of social and economic function (FES, by its Spanish acronym); (5) issue a certification that a property meets FES criteria; (6) revert to the state land claims that do not meet the FES. Properties that have been *saneada* are registered in the national rural cadaster. Source: http://www.inra.gob.bo/InraPb/paginaController?cmd=contenido&id=6561

† The World Bank: National Land Administration Project (P0061907) $US 20 million in 1995; the IDB: the Land Regularization and Legal Cadaster project (BO0221) $US 22 million; USAID contributed funds for land tenure review for the Chapare region. However, most costs have been borne by the Bolivian state with an annual budget of about $US 10 million. See *Fundación Tierra*: http://www.ftierra.org/

Source: Google Earth

The Bolivian government completed the verification and validation (saneamiento) of tens of thousands of small farms (white polygons) in the coca-growing region of the Chapare in a five year period between 2007 and 2012, thus demonstrating that technical competence and political will can resolve long-standing backlogs of tenure review.

Data source: Google Earth and INRA (2018).

territorio, which attracted the overwhelming support of lowland indigenous nations (see Chapter 11) and the Quechua- and Aymara-speaking people of the Andean highlands. Evo Morales and his indigenous allies rewrote the constitution, changed the name of the country and began to dismantle the institutional framework imposed on Bolivia by the Washington Consensus.* One of the first items on the legislative agenda was a reform of the *Ley INRA* with an emphasis on the rights of communities and smallholders.†

Communal land tenure is common to indigenous cultures and the previous regime had started the process of recognising *Territorios Comunitarios de Origen* (TCO).‡ This tenure category largely benefitted ethnic groups that inhabited remote lowland landscapes in the tropics and pastoral communities on the arid plains of the Altiplano. However, scant progress had been made in formalising titles for communal landholdings on agrarian landscapes where most indigenous families actually lived. The Morales administration made agrarian populations a priority and proceeded to demarcate the boundaries around thousands of village landholdings in the

* The first administration of Evo Morales also renationalised the oil and gas industry, telecommunications and the electrical utility sector. Source: Farthing (2019).

† Ley N° 3545 *de Reconducción de la Reforma Agraria* (28 de noviembre de 2006).

‡ The Constitution of 2006 changed the official designation of this category of communal reserves to *Territorio Indígena Originario Campesino* (TIOC), but the original term persists in both the academic and popular press.

Andean highlands. In Chiquitania (Santa Cruz), this consisted of formalising the land grants conferred by large-scale landholders to their indigenous tenants in the 1960s and 1970s.* In Northern Bolivia, INRA used the communal (*campesino*) system to distribute land to communities of forest-dwelling families who had settled the region during the rubber booms of the 1890s and 1940s (See Annex 4.11).

Concurrently, the Morales administration responded to the claims of hundreds of thousands of indigenous families who had migrated to the lowlands over the previous forty years. Although they had voted for a socialist government, these families wanted full legal title to their small farms. INRA began to review and approve land titles at an unprecedented pace; between 2006 and 2015, INRA processed and validated hundreds of thousands of small farms, vastly exceeding the dismal record of the consulting companies that had been contracted during the first phase of the land tenure regularisation process (Table 4.5).†

Despite its anti-capitalist rhetoric, the socialist government did not attempt to impose a far-reaching agrarian reform, although there were a few high-profile attempts to confiscate large-scale estates. Resistance from civil society in Santa Cruz and an (alleged) agreement with business magnates muted attempts to change the land tenure regime in Bolivia's most productive and valuable landscapes. Agribusiness is too important for the health of the domestic economy.[49]

The Ley INRA of 2009 include a limit on properties larger than 5,000 hectares and provisions that allow the state to claw-back properties that do not meet the criteria of having a '*función económico - social*'(FES). In other words, owners must 'use the land or lose the land'. Large-scale owners manage these requirements by subdividing their landholdings while hiring agronomists, foresters and lawyers to maintain the documents required to demonstrate FES. Medium-scale producers, however, can fall prey to predatory functionaries seeking to extort a bribe, or unscrupulous land grabbers who invade properties with significant forest assets or problematic documents.

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* Between 1996 and 2005, INRA recognised 550 communal landholdings (2 million hectares), compared to ~8,700 (7.2 million hectares) between 2006 and 2015. Source: Colque et al. (2016).

† Between 1996 and 2005, INRA validated 19,500 properties < 500 hectares (67,000 hectares); in contrast, between 2006 and 2015, the agency certified more than 358,000 (3.1 million hectares). Source: Colque et al. (2016).

Table 4.5: The distribution of land in the Bolivian Amazon.

	Number	Area (ha)	%	% Agrarian
Private Properties				
Small-scale (< 100 ha)	377,802	3,852,050	3.6%	9%
Medium-scale (100–2,500)	3,148	1,667,651	1.6%	4%
Large-scale (>2,500)	1,374	3,091,530	2.9%	7%
Communal Lands				
Agrarian properties	8,921	9,176,971	8.6%	21%
Amazonian estates	901	2,977,144	2.8%	
Indigenous territories - TCO (Amazonian)	440	22,998,273	21.5%	
Public Lands				
Protected Areas	35	15,522,327	14.5%	
Forest Estate (ex-concessions)	93	11,327,956	10.6%	
Unknown				
Under review (agrarian and private)		26,867,679	25.2%	60%
Undefined		14,555,048	13.6%	
Total Agrarian (farm and rangeland)		44,655,881	41.8%	
Total		106,751,722		

Data source: Colque et al. 2016.

A coalition created by a demand for land is splintered by a competition for territory

The political movement that brought Evo Morales to power incorporated a latent conflict between highland and lowland indigenous communities. The lowland nations are intent on recuperating their ancestral territories, which had been appropriated by families of European extraction or, more recently, allocated to timber companies as long-term forest concessions. The promise of recovering these lands was the reason lowland indigenous groups overwhelmingly supported Evo Morales in 2005. In contrast, highland indigenous groups believe they have a constitutional right – as Bolivian citizens – to settle unoccupied public lands, particularly the forest concessions that were rescinded in the early days of the Morales' administration. The highland and lowland indigenous groups are competing for the same land.

This conflict is manifest in the evolving self-identity of the Andean migrants, who for decades referred to themselves as *colonizadores*.* Since about 2000, however, they have self-identified as *interculturales*, a term that recognises their status as indigenous people who have left their ancestral homeland. They are politically powerful, in part because they maintain familial and commercial ties with a large population of urban migrants, but also because they have organised militant syndicates skilled in the tactics of economic blockade. They exercise their electoral power by demanding that INRA, which is controlled by the central government, distribute land via settlement associations affiliated with the *Confederación Sindical de Comunidades Interculturales Originarios de Bolivia* (CSCIOB) or the *Confederación Sindical Única de Trabajadores Campesinos de Bolivia* (CSUTCB).

The alliance among the highland and lowland indigenous groups was fractured in 2011 when the Morales administration announced its intention to build a highway through the *Territorio Indígena y Parque Nacional Isiboro – Securé* (TIPNIS). The proposed highway ignored several legal precepts, including the requirement to obtain 'free prior and informed consent' (FPIC) for the highway project from the Moxeño, Trinitario, Yuracaré and Tsimane peoples who have held communal title to the reserve since 1990 (see Chapter 11).[50] The official justification for building the road was to integrate two regions of the country, but the inhabitants of TIPNIS know that it would also trigger a land rush by the coca-growing farmers of the Chapare, who have already colonised the southern sector of their reserve (HML #32).

The attempt to build the highway revealed that Evo Morales would not honour his campaign promises to lowland indigenous groups when it conflicted with the interests of the more numerous and politically assertive *interculturales*.† The *Confederación de Pueblos Indígenas del Oriente Boliviano* (CIDOB) expressed solidarity for the tribes native to the TIPNIS, an action that coincided with a slow-down in the titling process for the TCO reserves for ethnic groups affiliated with CIDOB (Figure 4.5).[51] Simultaneously, INRA administrators ignored requests by Chiquitano and Guarayos organisations for the restitution of ancestral territories that had been incorporated into

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* The association of smallholder farmers in the Bolivian lowlands was founded in 1971 as the *Confederación Sindical de Colonizadores es de Bolivi*a (CSCB); the organisation changed its name in 2008 to *Confederación Sindical de Comunidades Interculturales de Bolivia* (CSCIB) and again in 2013 to the *Confederación Sindical de Comunidades Interculturales Originarios de Bolivia* (CSCIOB). It represents approximately 2.5 million small farmers. Source: García Yapur et al. (2014).

† Evo Morales is himself a member of the *interculturales*; he was born in the Altiplano community of Orinoca (Oruro), but moved to the Chapare region as a boy, where he became active in the campesino syndicates that represent the interests of the region's coca farmers. Source: Harten (2011).

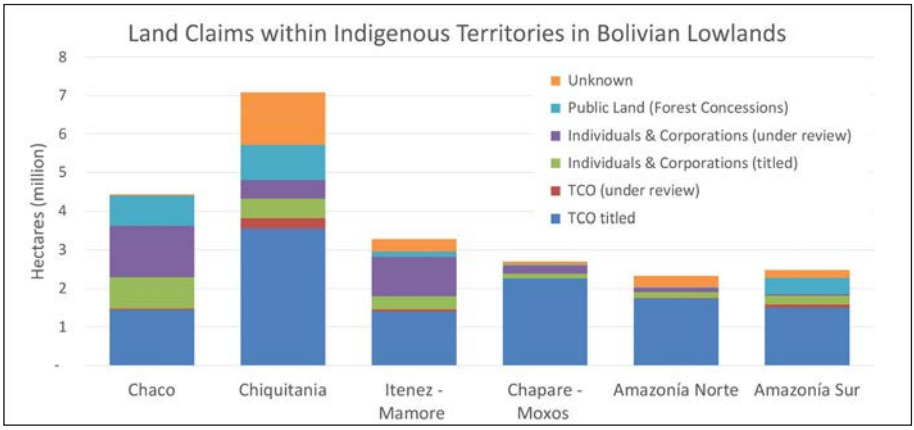

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Figure 4.5: The Instituto Nacional de la Reforma Agraria (INRA) of Bolivia must adjudicate conflicting claims within the territories claimed by lowland Indigenous nations in 1996. The most conflictive are in Chiquitania and Chaco regions and the flooded savannas of Iténez–Moxos, where ranchers of European descent have long-standing land claims that are recognised by the county's judicial system. The subregions used in the analysis correspond to cultural regions rather than administrative jurisdictions: Santa Cruz (Chaco and Chiquitania), Beni (Iténez–Mamore) Beni/ Cochabamba (Chapare–Moxos), Pando (Amazonia Norte), La Paz/Beni (Amazonia Sur).

Data sources: Colque et al. (2016) and INRA (2018).

forest concessions in the 1990s (Annex 4.11). Instead, they began distributing land to associations affiliated with the *interculturales*.*

The conflict between the indigenous groups is part of the shifting political coalitions that have defined recent elections. Although they lost power at the national level, *Cruceño* elites still dominate local and regional governments and now support the territorial demands of Chiquitano and Guarayos communities. This regional coalition is advocating for the creation of multiple-use protected areas controlled by local jurisdictions, which would allow timber extraction by the region's indigenous and non-indigenous inhabitants. Implicit in this political manoeuvring are strategies focused on the demographics of Santa Cruz and the fear (aspiration) that an expanding population of *interculturales* will lead to the electoral success of the political party associated with Evo Morales.[52]

* Between 2011 and 2020, INRA approved between 1,400 and 2,000 settlement communities in northeast Santa Cruz; allegedly, the distribution has favoured intercultural migrants rather than the Chiquitano inhabitants. Source: Zegada (2019).

Overlaying the ethnic and political conflicts is the ever-present spectre of corruption, which permeates almost all land transactions and involves unscrupulous individuals within every stakeholder group. This includes land grabbers, military officials and leaders of campesino syndicates that use their political connections to obtain large-scale landholdings for resale to corporate farmers and Mennonites.[53] Even lowland indigenous leaders have been tempted to participate in the political melee, most notably when the government created a parallel slate of indigenous leaders within CIDOB that supported their attempt to violate the TIPNIS.[54]

The expansion of the agricultural frontier

INRA has done a fairly competent job of processing the huge backlog of land claims, but there is no indication that any government will end the distribution of public land. Over the last twenty years, INRA has issued title to thousands of landholdings within two forest reserves specifically created to ensure the long-term management of timber resources. The first to be dismembered was El Choré and the same process is underway within the Guarayos Reserve, even though it enjoys dual status as a TCO and forest reserve. A third forest reserve, Bajo Paraguá, is at the centre of the competition between Chiquitanos, *Interculturales* and local politicians. Recent statements by INRA functionaries indicate they view land claims by settlers as having precedence over efforts to create municipal protected areas within forest reserves.

The jockeying for land reflects a broad consensus that expanding the agricultural frontier is in Bolivia's national interest. This includes all major political parties, the central and regional governments, the agribusiness sector, ranchers and intercultural settlers.[55] These policies originated in the administration of Evo Morales (2005–2019), which approved five laws between 2013 and 2019 that facilitated access to public lands, legalised landholdings appropriated during previous administrations and opened the door to deforestation and the use of fire.[*] These policies were embraced by the transitional government of Jeanine Añez and the administration

* *Ley 337, de Apoyo a la Producción de Alimentos y Restitución de Bosques* (2013). This law provided amnesty to landholders who did not file forest-clearing permits between 1996 and 2011. The beneficiaries were largely smallholders (76%) but also medium-scale properties (11%), agroindustry (7%) and even lowland indigenous communities (4%). *Ley 741, Ley de Autorización de Desmonte hasta 20 hectáreas* (2015). The law authorises landholders to clear up to 20 hectares of forest per year; clearing land is essential to establish property rights for new land claims. *Ley 1098, de Aditivos de Origen Vegetal* (2018). A biofuel measure that proponents claim will add $US 480 million in revenue and create 27,000 direct and indirect jobs. *Ley 1171 de Uso y Manejo Racional de Quemas* (2019). This measure gave smallholders the legal right to use fire as a management tool without seeking a permit from local authorities. *Decreto Supremo N° 3973* (2019). This 2001 executive decree eliminated the need to obtain a forest-clearing permit on

Source: Google Earth

In 2000, the Bolivian state reaffirmed the status of two forest reserves, El Choré and Guarayos, created in 1969 in areas once rich in mahogany. The most remote sections remain intact due to heavy flooding, but the scramble for land has overwhelmed all attempts to protect the reserves, including large areas that were claimed by the Guarayos indigenous people as part of their TCO.

of Luis Arce Catacora, who was elected in October 2020 as the candidate endorsed by Evo Morales.

The controversial policies led to a spike in wildfires in 2018 that coincided with a review of the Interamerican Development Bank (IDB) project that financed INRA's land tenure programme.* Among its findings were: (1) the agency had issued no new titles for indigenous communities; (2) the ongoing distribution of public lands had generated new social and environmental conflicts; and (3) the disregard for national laws and environmental regulation violated the IDB's policies.[56] The IDB halted disbursements of

landscapes located within 41 million hectares of Permanent Forest Reserves (Decreto Supremo 26075).

* IDB Project BO-LT113, *Programa de Saneamiento de Tierras II*; $US 60 million loan + $US 40 million in matching funds from the Bolivian government. Source: https://www.iadb.org/en/project/BO-L1113

funds in 2018 and is awaiting actions by INRA to address the concerns documented in the monitoring report.[57]

Peru

The agrarian reform process in Peru began in 1964. Originally a cautious effort targeting the more egregious examples of peasant exploitation, it was dramatically expanded by a left-wing military government in 1969. Between 1970 and 1975, more than 15,800 landholdings, covering slightly more than nine million hectares, were confiscated and redistributed to more than 370,000 *campesino* families.[58] The original owners were to be compensated by the sale of sovereign bonds, but hyperinflation in the 1980s forced the government into default and the outstanding debt continues to be the object of legal action.* The original plan by the military government was to form producer-owned collectives that empowered communities to assume control of their land while preserving the economies of scale. This idea was not embraced by the peasants, however, who divided the land among themselves while managing tenure communally according to traditional highland customs.

The military regime ended in 1980 with the election of Fernando Belaunde, an advocate of Amazonian development and the original proponent of the *Carretera Marginal de la Selva* (see Chapter 2). Among his first actions was to create the *Instituto Nacional de Desarrollo* (INADE), an autonomous agency affiliated with the Ministry of Agriculture; INADE organised *Proyectos Especiales*, which included settlements in the tropical lowlands, irrigation systems on the coast and mechanised agriculture in the highlands.[59] The six lowland projects were analogous to the colonisation projects in Brazil that distributed land adjacent to highways then under construction, largely, as in Bolivia, to indigenous migrants from the Andean highlands.

The government reportedly deforested 615,000 hectares in anticipation of the arrival of settlers; however, only ~125,000 hectares were occupied by the first wave of colonists.[60] Over the next decade, a steady stream of migrants flowed into the tropical forest of the foothills (*Selva Alta*) and piedmont (*Selva Baja*). The estimated rate of deforestation between 1980 and 1990 exceeded 250,000 per year,[61] approximately twice the annual rate

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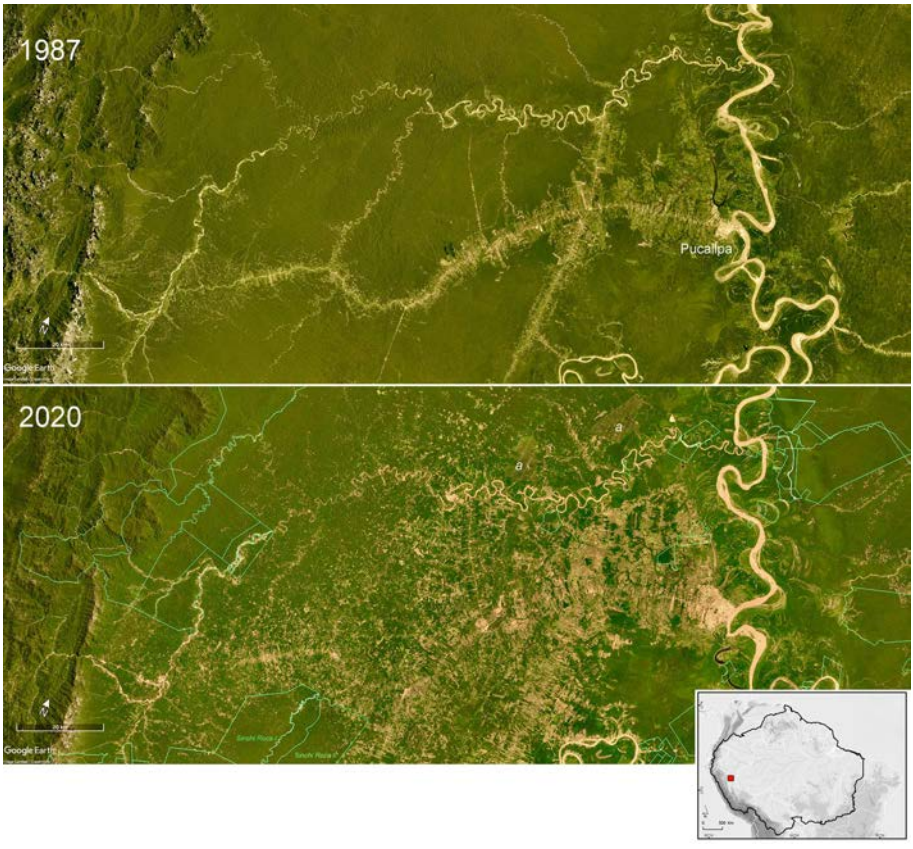
* The Tribunal Constitutional (TC) in 2001 determined that the bonds should be paid based on a calculation of their 'real value' but did not indicate a method of calculating that value until 2013, when it dictated that an inflation index selected by the Ministry of Economy and Finance should be used. Bondholders rejected the settlement, arguing it was equivalent to less than 1% of the bonds' real value and continue to litigate their cause in both US and Peruvian courts. Source: APJBA – *Alianza por el Pago Justo de los Bonos Agrarios* (30 Aug. 2021): https://bonosagrarios.pe/preguntas-frecuentes-sobre-el-pago-de-bonos-agrarios/



Source: Google Earth

The piedmont between the Andean foothills and the port city of Pucallpa on the Ucayali River was opened for colonisation with construction of the Carretera Federico Basadre in the 1980s. Most landholdings have yet to be validated (saneamiento) and incorporated into the national cadaster, including two large oil palm plantations established in 2013 and 2014 (a). Communal landholdings of indigenous communities (green polygons) are under pressure from migrants and land grabbers.

documented between 2000 and 2020.[62] The rural population of Amazonian jurisdictions surged from three to four million inhabitants, approximately double the rate of growth of previous and subsequent decades.[63] These years also saw an explosion in the cultivation of coca across the Peruvian Amazon, as well as the rise of the *Sendero Luminosa* and the *Movimiento Revolucionario Túpac Amaru* (see Chapter 6).

In 1992, the government of Alberto Fujimori created the *Proyecto Especial de Titulación de Tierras* (PETT) to regularise the titles for all Peruvian landholders. As in Bolivia, this coincided with policies emanating from multilateral agencies to foster a market economy and provide *seguridad*

jurídica to landholders.* The PETT included safeguards to protect and recognise the communal lands of indigenous people, which in the vernacular of Peru included both highland groups (*comunidades campesinas*) and lowland tribes (*comunidades nativas)*. The process was coordinated with other programmes to create a system of forest concessions (see Chapter 7)† and organise a protected-area system (see Chapter 12). The objective was to allocate the public lands among the various stakeholders of the Peruvian nation (see Annex 4.12).

The land tenure regularisation (*saneamiento*) process has been subject to periodic administrative reforms. This included a decentralisation decree in 2003, which passed the implementation to regional governments (*Gobiernos Regionales* – GORE), and an anti-corruption drive that transferred the programme back to the central government in 2007. In 2008, the PETT was fused into the *Comisión de Formalización de la Propiedad Informal* (COFOPRI),‡ a high-profile programme created to formalise property rights in the country's volatile urban barrios. This agency had the technical capacity to compile a digital cadaster, but devolved the administrative responsibilities back to the *Ministerio de Agricultura y Riego* (MINAGRI).[64] In 2014, MINAGRI delegated field operations to regional governments in a renewed effort to decentralise the administrative functions of the state (see Chapter 6).[65] In 2018, MINAGRI assumed full responsibility from COFOPRI for the compilation and management of a national rural land cadaster, which is known as the *Sistema Catastral para Predios Rurales* (SICAR) and managed by the *Dirección General de Saneamiento de la Propiedad Agraria y Catastro Rural* (DIGESPACR).

Despite the administrative shuffling, the land tenure project maintained a level of institutional continuity because the government leveraged its investments with loans from the IDB via the *Proyecto de Catastro, Titulación y Registro de Tierras Rurales* (PTRT).§ Executed as three consecutive projects

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* Unlike in Bolivia and Brazil, Peruvian land law does not condition long-term tenure on the demonstration of a social and economic function, instead endowing owners with property rights typical of a market-oriented liberal democracy. Source: Fort (2007).

† Concessions have been granted for timber extraction (75%), conservation (12%), NTFP/wildlife, ecotourism (1.2%) and reforestation (1%); concessions are governed by 20-year or 40-year contracts, which include a clause renewal. Source: SERFOR – Servicio Nacional Forestal y de Fauna Silvestre (2017) Las Concesiones Forestales, http://www.serfor.gob.pe/portal/wp-content/uploads/2017/07/mapa-concesiones-24-07-2017.pdf

‡ Now known as the *Organismo de Formalización de la Propiedad Informal* (COFOPRI), it was established in 1996 to address the problem of urban property titles; it is now part of the *Ministerio de Vivienda, Construcción y Saneamineto.*

§ PTRT1, $US 36 million, approved in 1996 (PE0037); PTRT2, $US 46.7 million; approved in 2005 (PE0107); and PTRT3, approved in 2014, $US 81 million (PE-

over 25 years, the communal component has benefitted from strong oversight from civil society and the participation of indigenous organisations.* In spite of numerous setbacks, the PTRT has succeeded in establishing a nationwide system to register rural properties, certify their titles and incorporate them into a cadaster.†

Predios comunales (indigenous landholdings)

The demarcation and regularisation of communal landholdings is well advanced; nonetheless, significant hurdles impede the completion of the process.[66] As of August 2021, the ministry had registered the landholdings of more than 5,680 *comunidades campesinas*, covering 21 million hectares on the coast and in the highlands. Unfortunately, 25 per cent have yet to be fully validated by DIGESPACR, apparently due to litigation stemming from the agrarian reform of the 1970s.

In the lowlands, SICAR has registered the claims of 1,950 *comunidades nativas* covering ~13 million hectares; about two-thirds have received a validated title while the remainder are awaiting resolution of bureaucratic or legal obstacles (Figure 4.6a). Organisations representing indigenous communities report that there are at least 500 additional villages seeking 'recognition', an administrative stage that is a prerequisite for soliciting a title for communal lands.[67] Progress has been stymied by the conflicting land claims of other stakeholders. A survey conducted in 2017 enumerated 2,703 communities of which 808 (30%) reported some kind of land conflict. These included conflicts with other communities (45%), private landholdings (27%) or individuals within their own community (24%), as well as with timber (14%), petroleum (7.3%) and mining companies (5%), and with wildcat miners (1.6%).[68]

The process of distributing land is further complicated because the state must resolve conflicts among its own institutions. For example, approximately twelve million hectares of the forest estate are unavailable to communities because they have been leased as a concession for a determined period of time (see Chapter 7). Similarly, protected areas created in

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L1026); IDB – Interamerican Development Bank (2014) Land Regularization and Administration Projects: https://publications.iadb.org/publications/english/document/Land-Regularization-and-Administration-Projects-A-Comparative-Evaluation.pdf

* *Instituto del Bien Común* (IBC), *Asociación Interétnica para el Desarrollo de la Selva Peruana* (AIDSP) and *Confederación Campesina del Perú* (CCP); *Confederación Nacional Agraria* (CAN).

† Peru has created a decentralised system of public registries: *Superintendencia Nacional de los Registros Públicos (SUNARP)* that manages a nationwide database covering four legal categories: properties, legal entities (e.g., corporations), natural persons (e.g., powers of attorney), and contracts and assets (such as vehicles). Source: https://www.gob.pe/sunarp

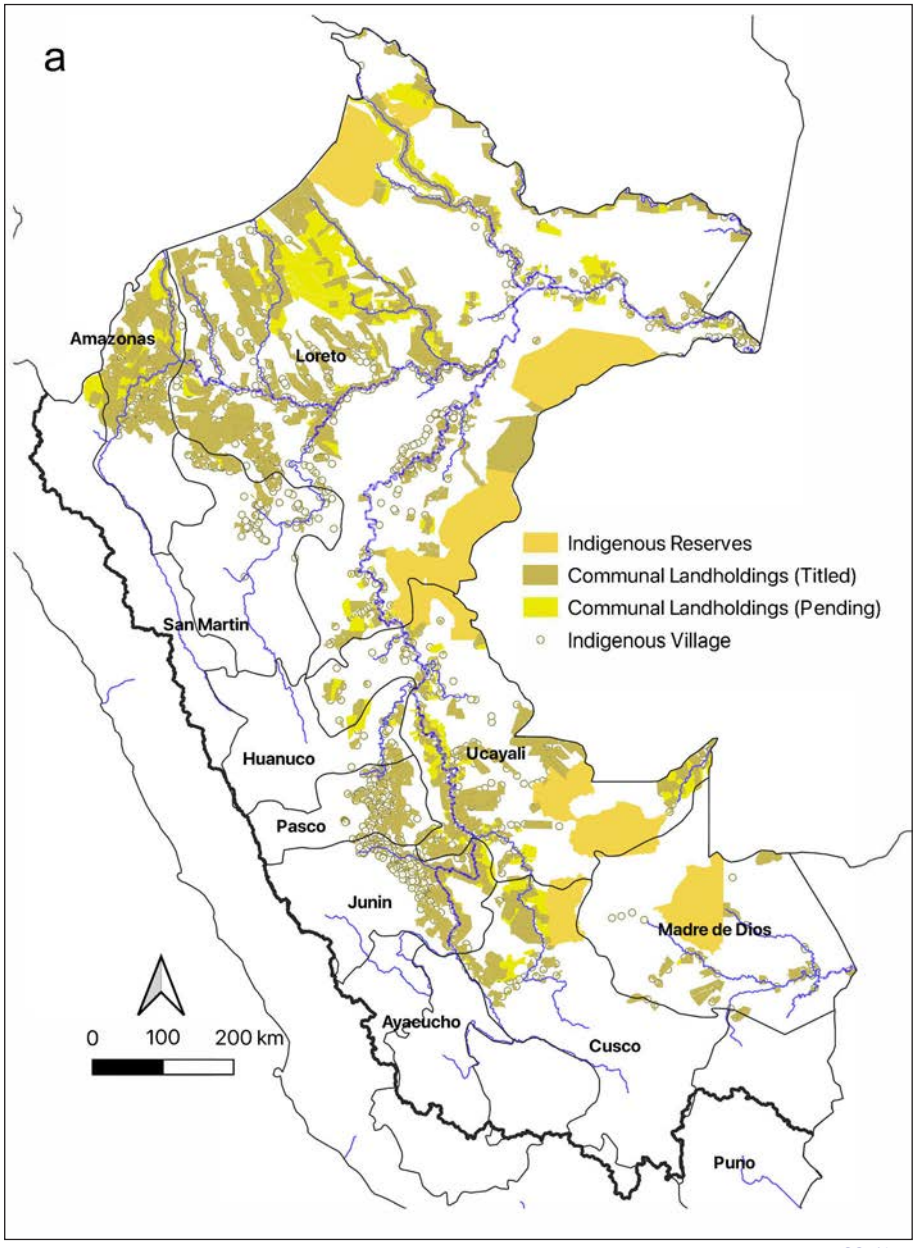

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Figure 4.6a: Peru has recognised the territorial rights of ethnic indigenous groups via landholdings linked to individual communities. Many villages are yet to have their land claims adjudicated. The state has also created several Indigenous Reserves to protect groups living in voluntary isolation.

Data source: IBC (2020).

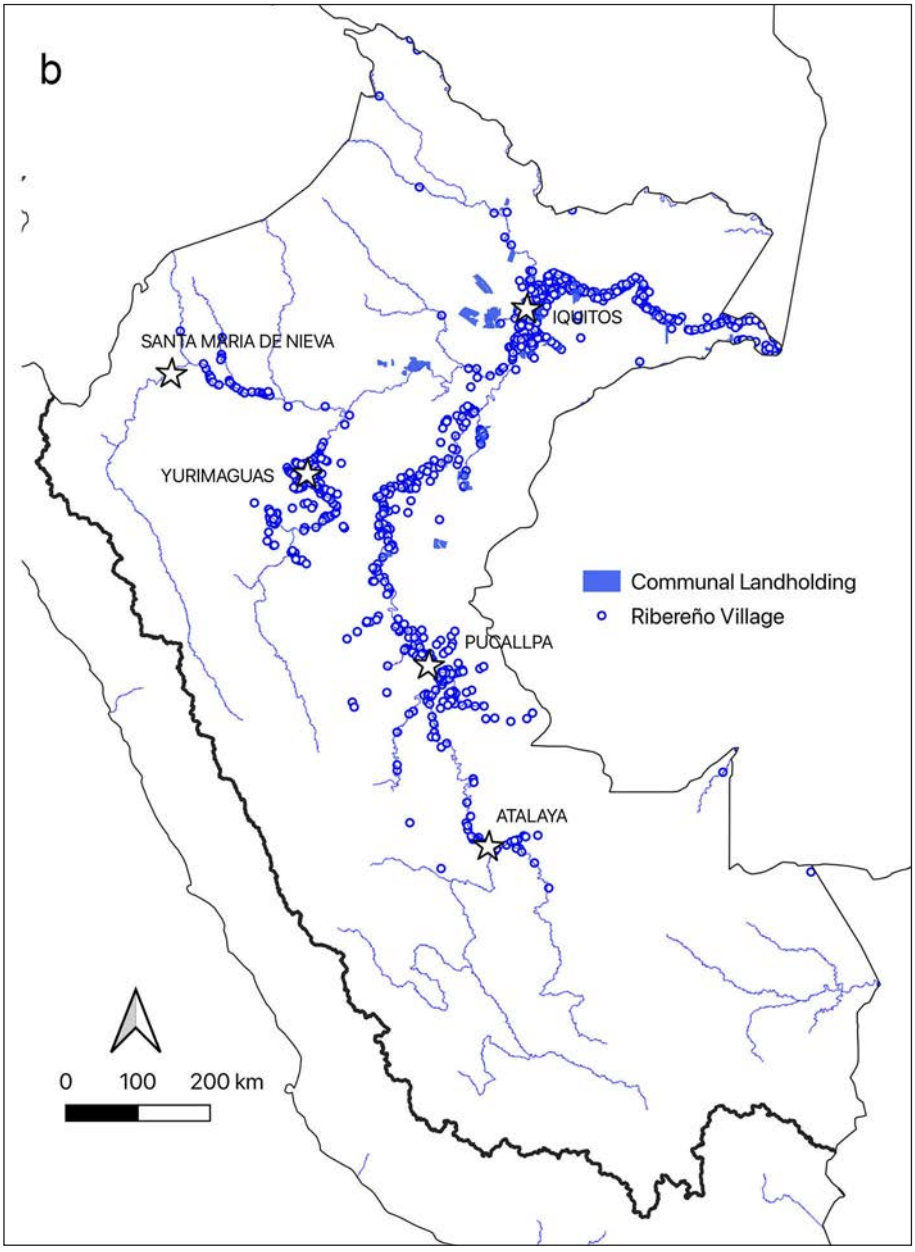

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Figure 4.6b: Hundreds of villages on the Amazon, Ucayali and Marañon rivers are populated by communities with no specific ethnic affinity but who self-identify as Ribereños; the Peruvian state has only recently begun to recognise their right to the land adjacent to their riverside communities.

Data source: IBC (2020).

the 1980s and 1990s, before there was clarity as to the priority of indigenous claims, impede the state's ability to grant legal title to long-established communities. Management guidelines guarantee inhabitants' access to natural resources, but unlike their peers on nearby landscapes, indigenous inhabitants of a national protected area do not have communal property rights.Below-ground mineral resources are a major source of contention: while they legally belong to the state, their exploitation is contingent upon the consent of local indigenous communities (see Chapter 6).

These limitations are particularly vexing for the approximately 750 villages inhabited by about 35,000 families who self-identify as *comunidades ribereña*s (Figure 4.6b). These forest-dwelling people have a mixed heritage that includes an indigenous legacy but lacks an ethnic affinity due to intermarriage and deculturisation (see Chapter 6). They reside along all the major rivers but are most densely settled near Iquitos. Often, *Ribereños* coexist and share resources with ethnic communities, particularly along the southern border of the *Reserva Nacional Pacaya Simiria.* Recently, the regional government of Loreto (GOREL) used the *comunidad campesina* protocol to formalise the status for 64 landholdings covering ~376,000 hectares.

Karol Moraes / Shutterstock.com

Hundreds of riverside villages in the Peruvian Amazon are inhabited by families who self-identify as Ribereñas. Most are descended from immigrants and survivors of indigenous communities that were disrupted during the rubber boom of the nineteenth century. Because they lack a specific ethnic heritage, they have not benefitted from the state's programme to allocate communal landholdings to native communities.

Near Pucallpa (HML #41) and Yurimaguas (HML #44), both *comunidades nativas* and *comunidades ribereñas* must compete for land and resources with an expanding population who self-identify as *colonos*. As in Bolivia. they come from a highland culture where communal landholdings are the norm, but on the forest frontier of the Peruvian Amazon, they have embraced private property as their pathway to prosperity.

Predios rurales (private landholdings)

Regularising land tenure on landscapes where private property predominates is more challenging than on landscapes occupied by communal landholdings. In part, this is due to their greater number, but the task is further complicated by the limited resources of their owners and the chaotic nature of frontier landscapes.[69] The *Censo Nacional Agropecuaria* of 2012 enumerated about 3.7 million private properties in all of Peru and the first two phases of the PTRT programme registered approximately two million of these landholdings into what would eventually become the SICAR database [70] The overwhelming majority are located on the coast or in the highlands, where PTRT technicians and regional authorities have succeeded in the *saneamiento* of about 75 per cent of all private properties.[71]

Unfortunately, the limited technical capacity of the regional offices in lowland provinces, exacerbated by administrative reshuffling that preceded the implementation of PTRT3, has impeded progress in Amazonian jurisdictions.[72] A comparison of data compiled by the agriculture ministry (MINAGRI) and the census (INEI) are broadly similar (Table 4.6); however, an inspection of spatial data available in the public domain reveals that tens of thousands of farmsteads have not been incorporated into either database (See Annex 4.12). It is difficult to know with any level of precision how many smallholdings actually exist in the region, but 'back of the envelope' estimates suggest that the number of farmsteads in the region is well over 500,000, implying that the process of *saneamiento* is less than 25 per cent complete. When the other departments with tropical provinces are considered, that number might approach one million.*

Unfortunately, many farmsteads are destined to persist as illegal or informal holdings for the foreseeable future. In the Huallaga Valley (HML #42 and HML #43), settlers have invaded forest concessions on the upper slopes of both the upper and lower valley. These cannot be legally regularised without a modification of the legislative and regulatory framework governing the forest estate. The most conflictive landscapes are the agri-

* In addition to the five regions that are wholly part of the lowland tropics (see Table 4.6), there are four regions composed of both the montane and lowland tropics (Cuzco, Huánuco, Junín, Pasco) and three that are largely covered by highland ecosystems with a small area with tropical climates (Ayacucho, Cajamarca, Puno).

Table 4.6: The number of private landholdings in five Amazonian departments of Peru.

Region	CNA (2012)[i]	MINAGRI (2016)[ii]	SICAR (2020)[iii]	Land Use Model [iv]
Amazonas	69,125	60,044	17,450	75,000
Loreto	67,003	24,044	5,079	138,000
Madre de Dios	6,602	14,249	11,036	44,000
San Martin	91,137	157,668	64,451	158,000
Ucayali	25,325	30,804	23,774	99,000
Totals	259,192	286,809	121,790	505,000

i IV Censo Nacional Agropecuario (2012) Instituto Nacional de Estadísticas e Informática, Cuadro No. 051, *Unidades agropecuarias y superficie de las parcelas*. http://censos.inei.gob.pe/cenagro/tabulados/

ii MINAGRI – Ministerio de Desarrollo Agrario y Riego (2016). MINAGRI asume administración de la información nacional referida a saneamiento y titulación de predios rurales, y de comunidades campesinas y nativas. https://www.midagri.gob.pe/portal/present-catastro-rural

iii SICAR (2020). Summary data from shape file downloaded from https://www.geogpsperu.com/2020/10/mapa-de-predios-rurales-descargar.html

iv Total historical deforestation reported by *Geobosque* divided by an assumed mean size of 10 hectares of deforestation per landholding. http://geobosques.minam.gob.pe/geobosque/view/descargas.php

cultural frontiers that surround the eastern terminus of Peru's three major Amazonian highways: the *Interoceanico Norte* (HML #44), the *Interoceanico Central* (HML #40 and HML #41) and *the Interoceanico Sur* (HML #27). On all three landscapes, settlers are expanding outward from long-established agrarian landscapes and, in the process, invading both indigenous lands and forest concessions. The SICAR system was specifically designed to exclude this type of blatant illegality, and these landholdings should be excluded from the cadaster regardless of (corrupt) attempts by local authorities to include them.

Land grabbers are using the SICAR system to launder unallocated forest lands from the state. The most egregious examples are large-scale oil-palm plantations in San Martin, Loreto and Ucayali (see Chapter 3). Some of these plantations have passed through a legal adjudication while others have been declared illegal. Regardless, the perpetrators have not suffered any significant penalty via the criminal justice system, while the plantations continue to operate and expand.

The SICAR system is being used to create smallholdings carved out of unallocated public lands via deliberately planned development projects designed to appeal to local constituencies. For example, the system shows a string of (~50) contiguous land parcels on several tributaries of the Ucayali River. Hopefully, this is an effort to recognise the property rights

Source: Google Earth

The national rural cadaster shows two types of land claim on the east bank of the Ucayali River, near Pucallpa in the Peruvian Amazon: (a) irregularly shaped holdings along a tributary with long-established communities and (b) blocks of uniformly-sized parcels on upland landscapes not associated with any specific village or community.

of *Ribereña* families and not the actions of *traficantes de tierra*. In the Madre de Dios region, the SICAR system shows ~250 identical plots adjacent to two regional highways that transect the gold mining landscapes west of Puerto Maldonado.

The west bank of the Ucayali Valley has attracted land speculators and immigrant settlers. The region has long been viewed as an expansion zone for agriculture and several blocks of forest have been claimed and registered in the SICAR system. The region was the focus of a proposed investment by Grupo Palmas, Peru's largest operator of industrial oil palm plantations (see Chapter 3).[73] The company abandoned its plans in 2017 following a legal battle and public relations scandal;[74] however, the fate of these landholdings has yet to be resolved and they were not included in a corporate programme to support forest conservation announced in 2021.*

Evidence of accelerating change was highlighted by the arrival of Mennonite farmers in 2020, establishing the first colony of this type in Peru

* In 2017, the Grupo Palmas abandoned plans to develop oil palm plantations at two localities: Tierra Blanca and Santa Catalina (14,000 ha at Sarayacu, Ucayali, Loreto) and the Manatí and Santa Cecilia (10,000 hectares at Indiana, Maynas, Loreto). As of 2021, only the Indiana properties had been allocated to a forest conservation initiative. Forest Conservation Fund (2021) Maniti Promise Forest, https://www.fundforests.org/maniti-promise

Source: Google Earth

The west bank of the Ucayali Valley has attracted land speculators and immigrant settlers. Several blocks of forest have been claimed and registered in the national rural land register (a; b; c), while Mennonite farmers have purchased land from intermediaries whose holdings do not (yet) appear in the national rural cadaster (d; f). Access to the area is being facilitated by logging roads that connect to the port cities of Orellana and Sarayacu (arrows); eventually, they will link to the national road system via Huimbayoc. The region includes two forest blocks (g; h) ceded in 2013 to one of Peru's largest corporate entities (Grupo Romero), which abandoned plans to establish oil palm plantations in 2017 (see text).

Data source: Google Earth and SICAR (2020).

and providing further evidence of the disfunction of the SICAR system.[75] Mennonites are astute and experienced in the dark arts of rural real estate markets in Latin America; they are unlikely to risk their investment capital without a deed documenting the legality of the landholding. Environmental journalists have reported that these types of legally dubious transactions

are being approved by local authorities but not reported to DIGESPAC, the agency within MINAGRI charged with updating the SICAR system.[76]

The piedmont landscapes located west of the Ucayali River will eventually connect with the national highway system, which will trigger more speculation in land and deforestation in previously remote areas. This ongoing development demonstrates the potential for local governments to expand the agricultural frontier by approving timber contracts, facilitating road construction and issuing land grants without the intervention (or knowledge) of central authorities.

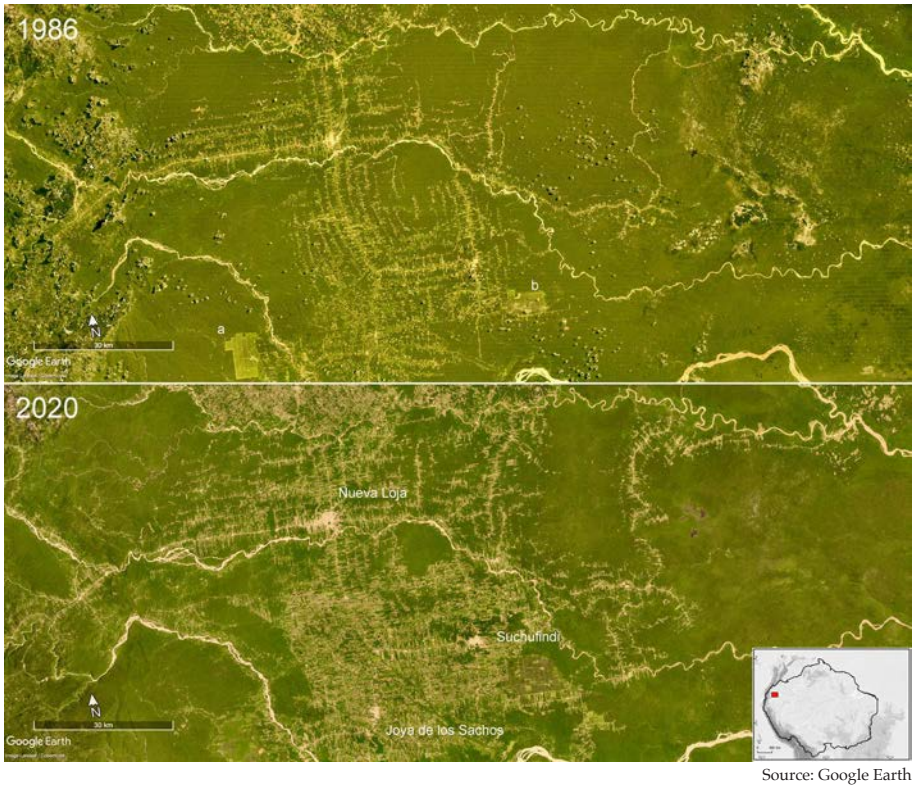
Ecuador

The sharecropping system that defined land tenure in the Ecuadorian highlands prior to agrarian reform was known as the '*huasipungo*', a Quechua word that describes the relationship between landlords and tenant farmers. The end of this feudal system had a radically different outcome when compared to Peru and Bolivia, however, because landowners preempted the confiscation of their lands by expelling tenant farmers. [77] Owners mechanised farm operations and turned to contract labour, while thousands of peasant families were evicted from their homes. Some moved to urban centres, but many chose to migrate to the agricultural frontiers in the tropical lowlands of the Amazon and the Pacific coast.[78]

The official effort to promote settlements in the Ecuadorian Amazon began in 1957 when the democratically elected government created the *Instituto Nacional de Colonización* (INC). In 1964, a military government enacted the *Ley de Reforma Agraria y Colonización*, which merged the *INC* into the newly created *Instituto Ecuatoriano de Reforma Agraria y Colonización (IERAC)*.[79] Between 1964 and 1994, IERAC distributed about five million hectares of land with support from USAID and the Alliance for Progress; about 1.8 million hectares were located in the five Amazonian provinces.[80] Land was distributed in forty-hectare plots, which suggests that about 45,000 families acquired plots in the Amazon during this thirty-year period.

Unfortunately, the IERAC did not provide homesteaders with documents that were equivalent to a legal title because ownership was contingent upon residency and evidence of development. Settlers were provided with a provisional deed that required future administrative action to be converted into a full legal title. The IERAC did not incorporate this information in a national archive; instead, the information was preserved in 'folders' housed at their regional offices.

In 1994, a new law replaced IERAC with the Instituto Nacional de Desarrollo Agrario (INDA), and, as in Peru and Bolivia, a major objective was to introduce market economics into the rural economy as part of 'structural readjustment' policies. The law centralised the land titling process in



Source: Google Earth

The Ecuadorian provinces of Succumbios and Orellana were opened to settlement in the 1960s with the discovery of oil. By the 1980s, the distribution of 40-hectare landholdings was well advanced, as was the establishment of two large-scale oil palm plantations (a; b). The frontier has essentially been closed, but deforestation continues around the margins of the settlement zone and within individual landholdings.

Quito and in 2002 was supported by an IDB-financed initiative to create a digital database.* This initiative had only limited success, however, and by 2010 a total of 700,000 'folders' were waiting to be processed when INDA was dissolved and its functions were transferred to the *Subsecretaria para Tierras y la Reforma Agraria* at the Ministry for Agriculture.[81]

The responsibilities of the new agency had been fundamentally changed, however, because the constitution of 2008 devolved administrative

* IDB – Interamerican Development Bank; Project EC-0191: Land Titling and Registration in 2001 @ $15 million; it was not actually a fully funded initiative but a pilot project to design and test a digital cadaster.

authority over land tenure back to municipal governments.* Nonetheless, the law tasked the national government with the responsibility of compiling and maintaining a digital database, which led to the creation of a national cadaster known as SIGTIERRAS. The IDB supported the effort with another loan that incorporated the experiences of the previous decade's pilot project.†

The land tenure process is now managed by the *Autoridad Agraria Nacional* (AAN), a new entity with an expanded portfolio of obligations that was created by the *Ley de Tierras* of 2016.‡ This far-reaching legislative act seeks to ameliorate inequality of land tenure in Ecuador and establishes limits on the maximum dimensions for properties: 200 hectares for the highlands, 500 hectares for the coast and 1,000 hectares for the Amazon. It also provides the ANN with the power to confiscate properties that are larger than these dimensions or do not meet criteria regarding social and economic function.[82] In spite of its populist appeal, the land law generated criticism because it did not incorporate specific protocols for resolving the claims of lowland indigenous communities.[83]

Although their territorial rights are enshrined in the constitution and codified by the *Ley de Tierras*, there are only a handful of fully demarcated indigenous entities. As in other countries, these can be organised into two broad categories: communal landholdings associated with one (or a few) villages on frontier landscapes and large reserves extending across wilderness landscapes with several isolated villages. The indigenous territories shown in maps prepared by civil society organisations show both types of tenure categories (Annex 4.13). Most territories have been established by presidential decree, but only a few of the village landholdings have been formalised and demarcated. Most represent claims presented to the government. Their final size and exact boundaries are awaiting the land tenure review process that has been underway for at least two decades.

As in Peru and Brazil, the land regularisation (*saneamiento*) process in Ecuador is being organised using field campaigns that target specific municipalities in order to maximise the participation of property owners and achieve wall-to-wall coverage. As of October 2017, the AAN had registered 1.4 million rural properties in 59 municipalities, a significant number but only a fraction of those awaiting regularisation in the nation's 221 municipalities.[84] Incomplete as it may be, this number dramatically

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* In Ecuador, municipalities are referred to traditionally as *cantóns,* but in the constitution they are referred to as *Gobiernos Autónomos Descentralizados Municipales.*

† IDB – Interamerican Development Bank: Project EC-L1071: National System for Rural Land Information and Management and Technology in 2010 @ $US 90 million, plus $US 38 million in matching funds. The project was closed in 2018.

‡ *Ley Organica de Tierras Rurales y Territorios Ancestrales*, 14-mar.-2016: https://www.gob.ec/regulaciones/ley-organica-tierras-rurales-territorios-ancestrales-1

overturns previous estimates about the number, size and distribution of rural properties in the country.

The agricultural census of 2000 enumerated a total of 850,000 *Unidades de Producción Agropecuaria* and reported that about seventy per cent had obtained legal title. Although they are more than twenty years old, these statistics have been reproduced in subsequent reports and used to guide policy.[85] Preliminary results from the IDB pilot project registered about 2.7 million parcels and suggested that about sixty per cent were lacking secure title.[86] The results from the second IDB project would place the number of landholdings between four and five million.[87] The most recent survey found that ~75% of the landholders hold some kind of legal document that supports their possession, although fewer than a quarter of them had registered their property with regional land offices.[88]

The regularisation process, which has been carried out in three of 41 municipalities in the Ecuadorian Amazon, likewise shows that previous assumptions underestimate their number and overestimate their dimension (Table 4.7). For example, the number of landholdings registered in a single municipality was greater than the number reported by the census for the entire province.* The discrepancy may be caused, in part, by an expansion of the agricultural frontier; however, most of the difference can be explained by the subdivision of existing properties. The original distribution in the 1970s averaged between forty and sixty hectares; in contrast, the *predios* registered in SIGTIERRAS averaged between ten and twenty hectares, indicating that many have been legally subdivided, probably via inheritance, into smaller units.†

The census of 2000 reported a total of 46,000 farmsteads in Amazonian Ecuador covering a total of 2.5 million hectares (~27% of the total area). Nonetheless, the total area identified as human modified landscapes (see Chapters 1 and 2) spans approximately 3.9 million hectares. Assuming the mean size of a private landholding lies between twenty and forty hectares, then there should be between 75,000 and 150,000 landholdings that need to be registered, validated and incorporated into SIGTIERRAS.

The resolution of indigenous lands is likewise unfinished. Their claims for communal landholdings sum to ~2.5 million hectares distributed across more than 4,000 communal landholdings. Only 85 have actually been

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* Succumbios Dept. (7,300) versus Lago Agria Munic. (16,578); Orellana Dept. (4,948) versus Coca Munic. (9,239); Morona Santiago Dept. (4247) versus Sucúa Muncip. (5,410). Source of Departmental data: INEC – Instituto Nacional de Estadística y Censos 2002. Censo Nacional Agropecuario 2000: https://www.ecuadorencifras.gob.ec/censo-nacional-agropecuario/

† The census also records functional enterprises, enumerated as *unidades productivas agropecuarios*, which could be composed of multiple properties managed under a common enterprise or operator.

Table 4.7: Land tenure in three municipalities in Amazonian Ecuador.

	Lago Agrio Succumbios		**F. Orellana (Coca) Orellana**		**Sucúa Morona - Santiago**	
	number	area (ha)	number	area (ha)	number	area (ha)
Private Properties	16,578	227,217	9,239	219,534	5,410	53,279
Communal Land-holding	21	25,960	19	305,509	45	16,109
Indigenous Reserve	1	10,000	1	75,000	1	5,000
Protected Areas	1	15,000	1	90,204	1	15,000
Other		37,549		13,000		
Total		**315,726**		**703,247**		**89,388**

Source: SIGTIERRAS (2017) *Catastro Rural en el Ecuador*. Ministerio de Agricultura y Ganadería del Ecuador (MAG) Quito: http://www.sigtierras.gob.ec/publicaciones/

demarcated and issued a legal title, all within the three municipalities that benefitted from the SIGTIERRAS project, which confirmed that indigenous claims often overlap with private properties. This was particularly the case in Morona-Santiago, where Shuar families have laid claim to individual landholdings using the legal options available to them in the decades before the state started recognising communal landholdings.

The state has the infrastructure in place to resolve this longstanding administrative obligation to its rural citizens. The ANN has offices in all five provincial capitals and an online application where property owners can self-register their landholdings. Hopefully, the IDB will finance a third phase of the SIGTIERRAS project that will allow the government to complete the task.*

Colombia

The unequal distribution of land in Colombia is the root cause of that nation's violent history. Multiple policy initiatives spanning decades have failed to resolve the problem. The first agrarian reform law was promulgated in 1936, but it only motivated landowners to protect their assets by converting tenant farmers into contract labour.[89] A backlash to land reform eventually led to a civil war between 1948 and 1958 when the two major political parties battled for power during a period referred to as *La Violencia.* Subsequently, a coalition government pursued a renewed effort at agrarian reform with

* The SIGTIERRAs project received a favorable review, and the IDB funded a technical support consultancy to prepare a phase 2 proposal, which was completed in 2021. See https://www.iadb.org/en/project/EC-T1382

the creation of the *Instituto Colombiano de la Reforma Agraria* (INCORA) in 1961. This initiative established clear criteria for the expropriation of land and instituted mechanisms to indemnify landowners. As in other countries, it had the support of the Alliance for Progress and promoted colonisation programmes within the Amazon. This effort also failed and contributed to the formation of the guerilla armies and decades of violent conflict.

A third agrarian reform in 1994 was based on a market-based approach for redistributing land by providing subsidies so peasant farmers could purchase land from large estates. This followed the precepts of the Constitutional reform of 1991 and coincided with the legal decrees in 1995 that recognised the rights of indigenous and traditional people. INCORA was replaced in 2003 by *Instituto Colombiano de Desarrollo Rural* (INCODER), which diversified its mission by sponsoring the sustainable development of *campesino*, indigenous and Afro-Colombian communities. These initiatives also failed to resolve the long-standing grievances linked to land tenure and rural poverty, a task that was essentially rendered impossible by the violence that consumed the country for another 25 years.[90]

The competition for territory between leftist guerrillas and their equally violent paramilitary competitors has enormously compounded the problem of land tenure. Both sides dispossessed legitimate landowners, either by direct confiscation or forced sale at gunpoint. Land theft created a legacy that plagues the national economy because investors are unwilling to commit resources to a productive enterprise if there is the risk of forfeiture due to illegitimate title. The most conspicuous attribute of this legacy, however, is the massive number of displaced people, estimated at five million in 2020.[91] Small farmers were particularly vulnerable, and the violence greatly aggravated the inequity in the distribution of land.[92] In 2015, civil society organisations estimated that seventy per cent of the country's small farmers hold only 2.7 per cent of its arable land while 68 per cent was controlled by only 0.5 per cent of all landholders.[93]

This legacy was supposed to be addressed via the Colombian Peace Process. The final agreement is a long and complex document that covers a multitude of complex and thorny issues. The first chapter deals with land, and the first section of that chapter outlines a pathway for providing fair and equitable access to land.[*] Land issues were treated first because unequal access to land sparked the conflict, and fifty years of war magnified that injustice. The agreement goes further, however, because it also recognises that resolving land-related discord and uncertainty of land tenure is essential for closing the agricultural frontier and conserving the natural patrimony of Colombia.

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* *Acuerdo Final para la Terminación del Conflicto y la Construcción de Una Paz Estable y Duradera.* See full text at: http://www.eltiempo.com/contenido/politica/proceso-de-paz/ARCHIVO/ARCHIVO-16682558-0.pdf

The agreement created a process entitled the *Reforma Rural Integral (RRI)*, which is to be implemented by two institutions: *ANT*, a clearing-house for all issues related to land tenure, and *Agencia de Desarrollo Rural* (ADR), which will foster investment and provide technical support.* The RRI has four major components:[94]

1. Provide land to displaced families using land seized from criminals or acquired by purchase.
2. Formalise rural land tenure and grant free land to low-income families via a territorial-based process.
3. Establish an agrarian judicial system to resolve all property disputes.
4. Organise and execute a modern land registry (cadaster).†

Resolving land tenure in the Colombian Amazon is essential for the success of the peace process. The region was at the centre of the conflict and one of the last bastions of the *Fuerzas Armadas Revolucionarias de Colombia* (FARC). During the war, FARC maintained a logistical corridor that spanned three national parks in the foothills of the Andes (Los Picachos, Tinigua, Macarena) and the crown jewel of Colombia's protected area system in the Amazon lowlands, Serranía de Chiribiqueta. The landscapes surrounding the three montane reserves attracted tens of thousands of peasant farmers who cultivated coca under the auspices of FARC. The government tried to assert control via police action but made no real attempt to control land use in the buffer zones (*Distritos de Manejo Integral*)‡ that surrounded the four protected areas.

The peace process has stimulated long-suppressed investment in adjacent agricultural landscapes in Meta, Caquetá and Guaviare, which has stimulated a scramble for land across the forest frontier that separates these agrarian landscapes from the wilderness areas of the Colombian Amazon. The area is now riddled with roads where land grabbers collude with ex-combatants who employ settlers to clear forest to establish both coca farms and cattle pastures across an 'arc of deforestation' more than 500 kilometres long.[95] The short-term cash flow is being driven by illicit drugs,

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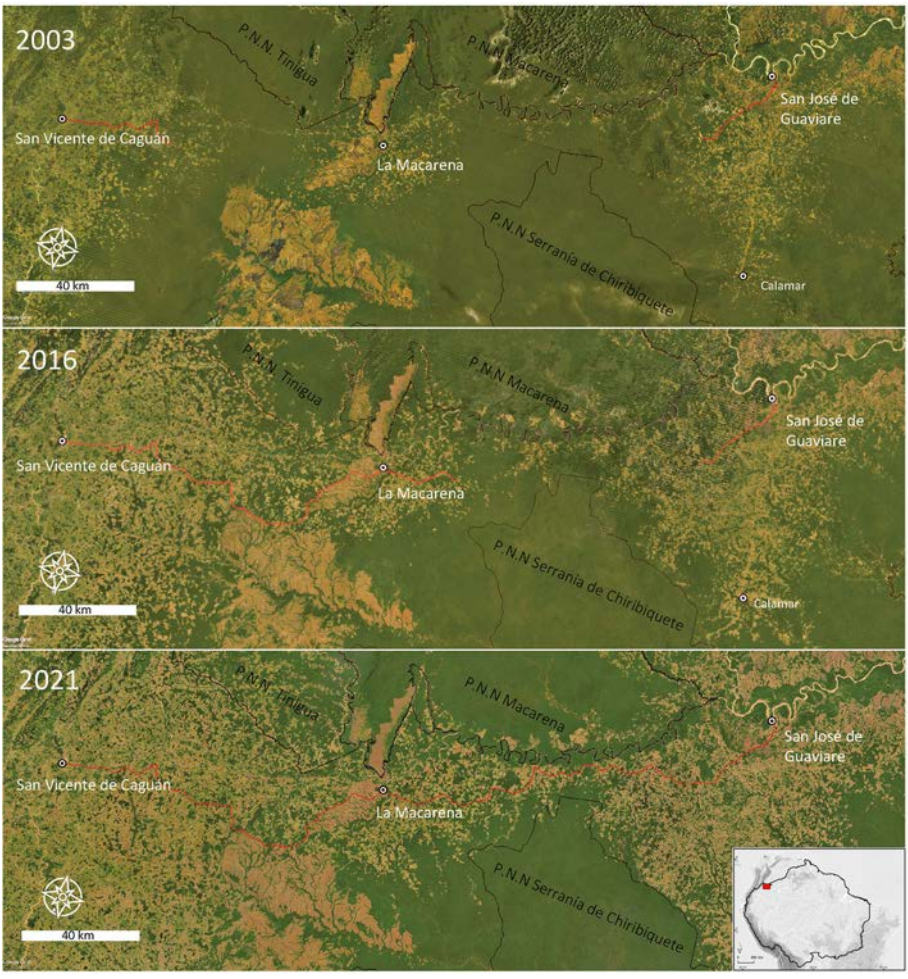
* See http://www.adr.gov.co/index.php and http://www.agenciadetierras.gov.co/

† There are an estimated 3.7 million rural properties in Colombia, and less than 5% have clear legal title. Although 48% of the known landholdings have been incorporated into a preliminary version of the national cadaster, an unknown number has yet to be enumerated. The World Bank has financed P162594, Multipurpose Cadaster Project @ $US 100 million (2019) and P172972, Additional Financing for the Multipurpose Cadaster Project @ $US 42.9 million (2020): https://projects.worldbank.org/en/projects-operations/projects-home

‡ DMI Ariari Guayabero, DMI Macarena Norte and DMI Macarena Sur.



Source: Google Earth

The forest corridor between Chiribiquete and Macarena national parks in the Colombian Amazon was gradually deforested and fragmented between 2003 and 2021. Settlers and land speculators originally accessed their claims via the river system while developing an informal road network, which eventually linked the towns of San Vicente de Caguán, La Macarena and San José de Guaviare.

but the medium-term speculation is now quite clearly focused on land and the rapidly expanding cattle industry (see Chapter 4).

This dynamic will persist until the central government or regional authorities establish the rule of law and the presence of the administrative state. Until that happens, land grabbers and campesino settlers will continue to appropriate state lands within the last habitat corridor connecting the lowland forests of the Amazon with the montane forests of the Andean Cordillera.

Venezuela and the Guianas

Historically, agrarian reform was never a major political issue in any of the countries on the Guiana Shield. Because of its oil wealth, the rural poor of Venezuela flocked to the cities to enjoy the benefits of subsidised housing, transport and food. Agrarian reform became a priority only when the government of Hugo Chavez sought to transform the nation via a socialist revolution. A new land tenure regime in 2010 led to the confiscation of several million hectares of private estates. Most of these actions occurred in non-Amazonian regions, and colonisation of Amazonian wilderness has never been pursued as a deliberate policy (Annex 4.15).

Land tenure in Guyana and Suriname reflects their shared colonial history and the legacy of Crown lands, which were transferred to the republican governments upon independence in the 1960s.[96] Agrarian landscapes are restricted to the coastal provinces where tenure is a combination of freeholders and leaseholders on public lands.[97] The former are few in number and include both family farms and plantation estates, while the latter include cooperative societies of small farmers who operate as independent producers. Away from the coast, both governments enjoy a near-monopoly on land tenure, managed via concessionaire systems governing both minerals (Chapter 5) and timber (Chapter 8).

In Guyana, the state owns approximately 73 per cent of the national territory, freeholders control twelve per cent and indigenous villages hold communal title to about fifteen per cent of the country, mostly in the interior.[98] In Suriname, the state holds title to more than 95 per cent of all land, despite demands by Maroon* and indigenous communities for the recognition of their territorial rights (Annex 4.16). Failure to accede to these requests was one of several causes of a civil war that plagued the nation between 1986 and 1991, which was followed by an extended period of political stagnation that allowed successive governments to ignore their demands – despite multiple rulings by the Inter American Court of Human Rights (see Chapter 11). In 2016, the government finally made a commitment to resolve all outstanding issues; however, as of January 2022, the final details had yet to be finalised.

Land Use Planning: An Aspirational Tool with Mixed Results

Regulating land tenure is not the only power available to the state for influencing how people use land. Land-use planning and land-use zoning are two closely related mechanisms that Pan Amazonian nations wield to foster sustainable development on their forest and agricultural frontiers. Like policies governing infrastructure, agriculture and land tenure, these

* Maroons are a traditional people of mixed African and indigenous heritage living in Suriname and French Guiana.

technical programmes have evolved in response to the shifting economic and social forces within countries, as well as to the prescriptions from multilateral agencies and civil society groups seeking to protect the biodiversity of the Amazon Forest.

In the 1970s and 1980s, most land-use planning programmes used a methodology developed by the United States Department of Agriculture (USDA) that identifies optimum land use based on climate and soil and stratifies regions and landscapes into categories ranging from full protection to intensive agriculture. Known in the United States as Land Capability Classification, in Latin America it has been promoted by USAID as *Capacidad de Uso Mayor de la Tierra* (CUMAT). A similar system developed by the *Instituto Interamericano de Cooperación para la Agricultura* (IICA) and sponsored the Food and Agriculture Organisation (FAO) was known as a *Zonificación Agro Ecológica* (ZAE). The technical details and output from these studies were of very high quality, but they suffered from one fundamental defect: they did not include a participatory process, which caused them to overlook economic trends already underway and customary uses that might not coincide with the best technological option for land use.

These limitations quickly became apparent, and the ZAE framework was modified and renamed as *Zonificación Ecológica Económica* (ZEE), which uses technical analysis as a baseline but incorporates additional social and economic criteria. Most importantly, it included a participatory process to ensure the aspirations of different stakeholder groups are considered, including indigenous and traditional communities, but also small farmers and agroindustry. All the Pan Amazonian countries have embraced some variant of the ZEE methodology and have enacted it into their regulatory processes to govern land-use planning (recommendations) and regulatory frameworks (zoning).*

The effectiveness of these studies is decidedly mixed. Settlers and corporate farmers have used the technical components to inform their investments, but most deforestation is driven by infrastructure development (see Chapter 2), demand for commodities (see Chapter 3) and land speculation. Nonetheless, the ZEE process coincided with programmes to create protected area systems (see Chapter 12) and has supported territorial claims by indigenous communities (see Chapter 11). Governments, NGOs and multilateral institutions continue to invest in these studies, arguing they are essential for discovering a path towards truly sustainable development.

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* Bolivia: *Plan de Uso del Suelo* (PLUS); Brazil: *Zoneamento Ecológico e Econômico* (ZEE); Colombia: *Plan de Ordenamiento Territorial* (POT); Ecuador: *Planes de Desarrollo Ordenamiento Territorial* (PDOT); Guyana: National Land Use Plan (NLUP); Peru: *Zonificación Ecológica Económica* (ZEE); Suriname: *Bestemmingsplannen*; Venezuela: *Plan Nacional de Ordenación del Territorio* (PNOT).

The ZEE in the Brazilian Amazon

The history of the ZEE in Brazil began in 1981 when Congress passed the National Environmental Policy Act, which recognised 'environmental zoning' as a regulatory tool for promoting the rational use of soil and the protection of ecosystems. This was followed in 1990 by the formation of a working group to review the different methodologies and establish a standard approach for the Legal Amazon. The responsibility was transferred to the states in 1994 and incorporated as a key component of the *Programa Piloto para Proteção das Florestas Tropicais (PPG7)*.* The methodology was formalised as a regulatory procedure via presidential decree in 2002, at which time the government established a federal commission to coordinate the process (*Comissão Coordenadora do Zoneamento Ecológico-Econômico do Território Nacional* – CCZEE) and convened a working group to accelerate its implementation (*Consórcio ZEE Brasil*). In 2000, the ZEE was incorporated into the constitutionally mandated four-year, state-level, strategic planning process (*Plano Plurianual* – PPA).†

In 2010, the Ministry of the Environment published a Macro ZEE (1:1,000,000) of the Legal Amazon derived from preliminary state-level studies that provided the first official vision of the future of the Legal Amazon. (Figure 4.7).[99] The Forest Code of 2012 reinforced the importance of the ZEE by stipulating its use for the implementation of key provisions and obligated the state to produce a more detailed version (1:250,000).

As of October 2021, Acre, Pará and Rondônia had completed final versions that have been approved by federal authorities, while Maranhão, Tocantins and Roraima had draft versions under review. Amazonas and Amapá have completed studies for selected sub-regions that are most exposed to land-use change and land grabbing.‡ The classification criteria

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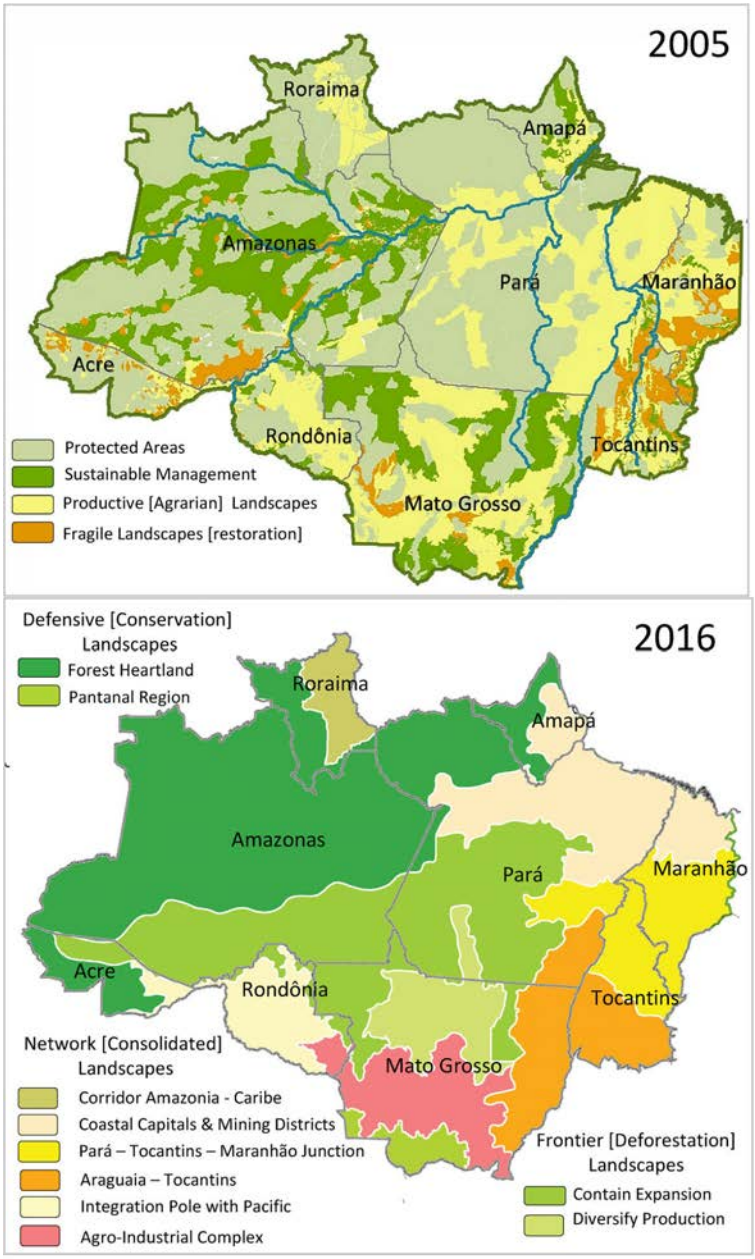
* The acronym PPG7 was used because the $US 450 million programme was financed by seven advanced economies: Germany (43%), EU (24%), UK (7%), USA (5%), Japan, Netherlands and France. See: Kohlhepp (2018).

† CCZEE (*Comissão Coordenadora do Zoneamento Ecológico-Econômico do Território Nacional*) is composed of twelve cabinet ministries. See: http://www.mma.gov.br/informma/item/7596. *Consórcio ZEE Brasil* (*Grupo de Trabalho Permanente para a Execução do Zoneamento Ecológico-Econômico)* is composed of two ministries and fifteen autonomous agencies and technical institutes. See: http://www.mma.gov.br/informma/item/10407. PPA *(Plano Plurianual)* is a medium- to long-range strategic planning process for activities and investments and establishes the budget for government actions and investments in infrastructure and productive activities. http://www.planejamento.gov.br/servicos/faq/planejamento-governamental/plano-plurianual-ppa/o-que-eacute-o-ppa

‡ Amazonas: Purus, Madeira, Baixo Amazonas; Amapá: Sul do Amapá. MINAM – Ministerio do Meio Ambiente 2016. O Zoneamento ecológico – económico na Amazônia Legal, Trilhando o caminho do Futuro: https://antigo.mma.gov.br/images/arquivo/80253/ZEE_amazonia_legal.pdf



CC BY 4.0

Figure 4.7: (Top) A draft of the Macro ZEE for the Legal Amazon prepared from a harmonised version of state-level ZEE (1:1,000,000). (Bottom) The final official version promulgated by the Temer administration in 2016, stratifying the region into three major (Defensive, Frontier and Network) and ten minor categories.

Data sources (both maps): MMA (2009) and MMA (2016), with additional material from SIAGEO Amazônia (2021).

generally fall into one of three categories: (1) consolidation of existing production landscapes; (2) sustainable use of natural resources; and (3) protected areas and indigenous land.* The first category always includes landscapes where large-scale agriculture and ranching predominate, but can include small-scale farms (Maranhão, Rondônia and Pará) or forest-based livelihoods near major highways (Acre and Amazonas).

The second category typically contains landscapes that support forest-based livelihoods, including those within PAAD-type INCRA settlements, but also privately held forest estates (Amazonas and Roraima) and smallholding communities (Mato Grosso). The third category includes conservation units in all jurisdictions, including those that support forest-based livelihoods and, in some cases, cattle ranching.† Several versions also recognise fragile areas requiring special management (Mato Grosso, Amazonas) and provide for an accelerated process to review and resolve issues related to land tenure (Acre, Roraima). The differences reflect the idiosyncrasies of individual states and the social and economic heterogeneity of the Brazilian Amazon.

The ZEE process is viewed favourably in Brazil, where it impacts both federal and state planning, such as the PPA investment process and environmental review overseen by the environmental protection agency. The first iteration of the ZEE coincided with a parallel effort to protect large swathes of the Amazon and provided technical criteria and legal support for the creation of dozens of conservation units and indigenous territories. For example, fourteen conservation units and indigenous territories were created in Acre after the completion of its preliminary ZEE, while a total of 44 such entities were set aside in Pará.[100] Conservation initiatives would have occurred independently but, by integrating them in a multi-sector analysis with explicit considerations for alternative land uses, the Brazilian state has avoided many future conflicts.[101]

The ZEE documents support efforts to halt or slow deforestation by providing geographic clarity as to which landscapes are off-limits for agricultural development while acting as a legal benchmark that reduces opportunities for land grabbing (Figure 4.8). Public sector financial entities, such as the *Banco do Brasil*, are obligated to review investment projects and

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* Both Tocantins and Maranhão have adopted a different framework that stratifies their state into geographic subregions based on their biophysical attributes, which are then characterised by development potential. Source: Maranhão: http://www.zee.ma.gov.br/ and Tocantins; https://zee.seplan.to.gov.br/

† There are 13 categories of conservation units, including forest management for non-timber forest products: *Reserva Extrativa* (RESEX), *Reserva de Desenvolvimento Sustentável* (RDS), *Floresta Nacional* (FLONA) and other areas that include a broad range of land use and allow inholdings: *Área de Proteção Ambiental* (APA). See Chs 8 and 12).

ensure they comply with the provisions of the regional ZEE. These plans have widespread public support – except in the state of Mato Grosso – because the public consultation incorporated stakeholder aspirations.

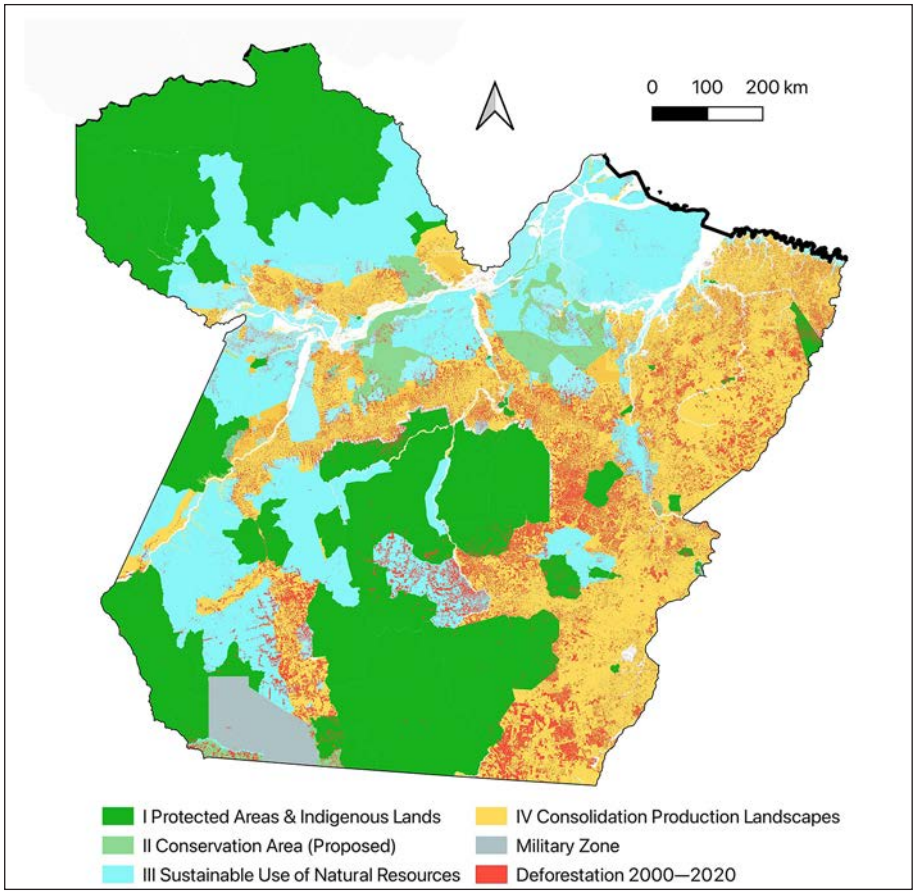

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Figure 4.8: Deforestation in Pará state since 2000 in relation to the Macro ZEE of 2012. Category I covers conservation units and indigenous lands that severely restrict economic activities. Category II areas were identified as appropriate for sustainable use but were listed in 2012 as undesignated public land. Category III includes PAAD-type (forest and riparian) INCRA settlements and sustainable use conservation units, including several that allow private inholdings. Category IV includes PA-type (agrarian) INCRA settlements, private landholdings and undesignated public lands. Although much of the documented deforestation is illegal, it has been largely restricted to landscapes zoned for development (consolidation of productive activities).

Data sources: SEMAS (2012) and RAISG (2021).

Table 4.8: The major categories and subcategories of the ZEE of Mato Grosso proposed in 2018.

1. Areas for Agricultural Uses with Protection of Water Resources	
1.1. Mechanised Agriculture	Upland (flat) landscapes, appropriate for large-scale agriculture; important for aquifer recharge; private forest reserves (*Areas Permanente de Proteção* (APP) & *Reserva Legal* (RL) subject to environmental regulation).
1.2. Agriculture and Livestock	Upland (variable) landscapes; aptitude from mechanised agriculture to cultivated pasture in areas susceptible to erosion; important for aquifer recharge; extensive forest remnants that require management; potential for mineral extraction.
2. Areas for Diversified Use	
2.1. Family Agriculture	Characterised mainly by tenure and size of landholding; upland (variable) landscapes; aptitude from agriculture to cultivated pasture in areas susceptible to erosion; important for aquifer recharge; extensive forest remnants that require management; potential for mineral extraction.
2.2. Forestry and Agriculture in the Forest Landscapes	Predominantly forest cover; appropriate for exploitation of timber and non-timber products with management plans; includes area with pasture/livestock, family agriculture and agroforestry; potential for mineral extraction.
2.3. Extensive Livestock, Tourism and Fishing in Wetlands	Wetlands subject to seasonal flooding in three watersheds (Araguaia, Paraguai, Guaporé); aptitude for low-density grazing on natural grasslands; important wild fisheries, biodiversity and scenic beauty; potential for a diversity of tourist markets.
2.4. Livestock and Reforestation in Fragile Environments	Upland landscapes dedicated to cattle ranching based on cultivated pasture, soils often rocky and susceptible to erosion; scenic beauty; mineral potential, including limestone and precious stones.
3. Protected Areas	
3.1. Existing Protected Areas	Indigenous lands: Traditionally occupied by ethnic people over many years, dependent upon a forest livelihood. Quilombo lands: Home to long-established quilombo communities. Conservation Units: territorial entities established by federal, state and municipal jurisdictions recognised for biodiversity and ecological importance.
3.2. Proposed Protected Areas	The creation of new or the modification of existing protected areas, including indigenous territories and quilombo landholdings and conservation units.

Source: SEPLAG – Secretaria de Estado de Planejamento e Gestão (2018). *Dispõe sobre o Zoneamento Socioeconômico Ecológico do Estado de Mato Grosso—ZSEE/MT, e dá outras* providências: http://seplag.mt.gov.br/index.php?pg=ver&id=6304&c=117&sub=true

The environmental secretariat of Mato Gross completed a detailed ZEE in 2008, but its provisions were vehemently opposed by agribusiness. The release of the ZEE coincided with international boycotts that targeted the state for its deforestation-linked production systems (see Chapter 3). The zoning plan would have further complicated the sector's image by labelling the farms established in the previous decade as unsustainable,

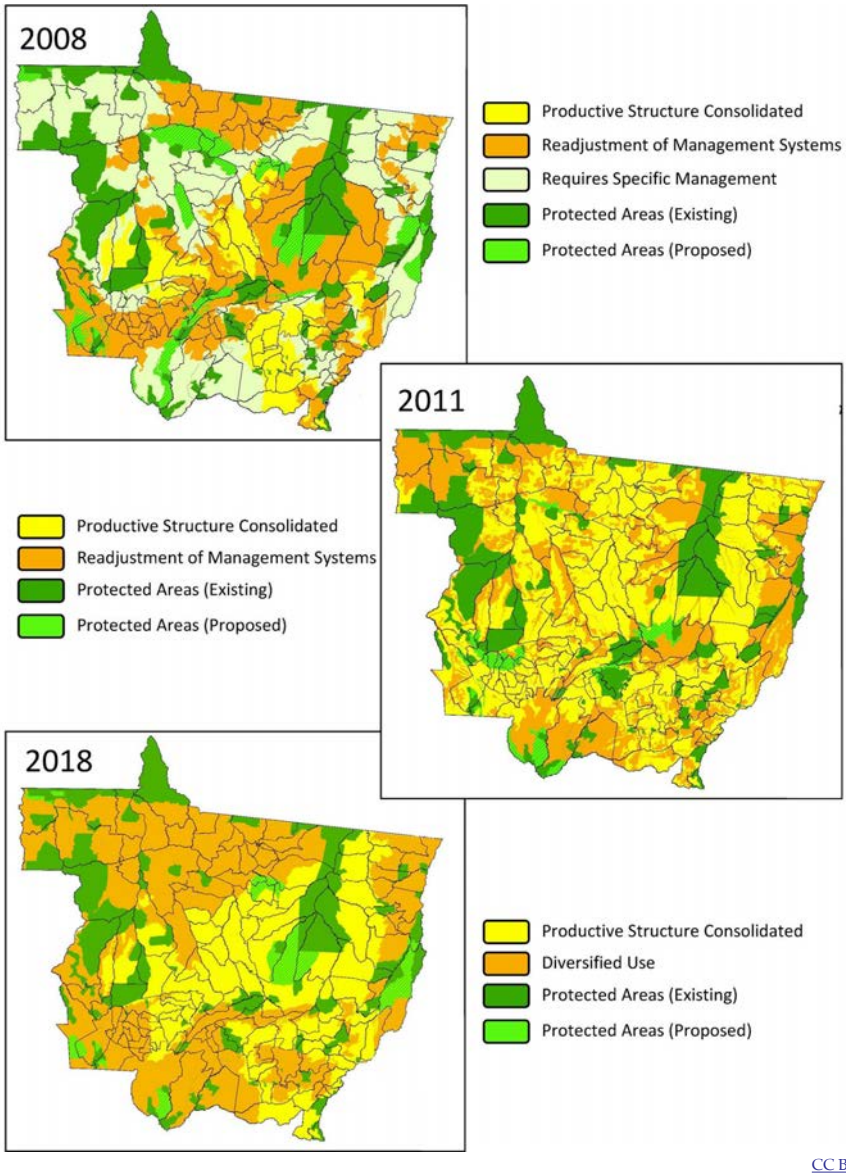

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Figure 4.9: Three versions of the Zoneamento Socioeconômico e Ecológico (ZSEE) for the state of Mato Grosso: 2008, the version prepared by the state environmental agency but rejected by the state legislature; 2011, the revised version approved by the state legislature but declared invalid by the Supreme Court; 2018, another revised version prepared by state authorities but opposed by the state's agricultural sector.

Data sources: SEPLAN (2018), with additional information from Schönenberg et al. (2015) and the Fórum Mato-Grossense da Agropecuária (2021).

particularly those on the upper watershed of the Xingu River. It also would have curtailed the future expansion of the soy-maize production model onto previously deforested pastures on the northern tier of municipalities and in the valley of the Araguaia near the border with Pará (Figure 4.9).

The state legislature commissioned an alternate study and approved a radically different version in 2011. The revised study did not adhere to federal guidelines, however. It was challenged in court by the public prosecutor and was rejected by the CCZEE in 2012.[102] The state government, which is obligated by law to promulgate a ZEE, initiated another study that produced a third version in 2018 that essentially split the difference between the two previous iterations (Table 4.8).

The third version has been rejected by institutions representing farmers, ranchers, lumber companies and manufacturers.* Critics contend that the zoning provisions would threaten the livelihoods of thousands of rural families because they would: (1) label ~20% of the existing farmland as nonsustainable; (2) limit the potential of ~ 69% of existing pastureland to be converted to intensive agriculture; and (3) create environmental obstacles for ~78% of the proposed bulk transport systems.[103] The state legislature created a special commission in June of 2021 to review the proposal.[104]

The Andean Amazon

Land-use maps and their explicit recommendations are most relevant on pioneer landscapes that are in the flux of change. Recommendations can provide sound information and support an expanding agricultural production system; more often, however, they are ignored in a frenzy of land speculation. This is, unfortunately, the case in Bolivia, Peru and Colombia.

Bolivia

One of the most notable examples of zoning with positive and negative outcomes is the *Plan de Uso de Suelos* (PLUS) of Santa Cruz, Bolivia.† The PLUS identified the productive capacity of the alluvial plain located east of the Río Grande, which was legally deforested over the following decade to create a soybean production landscape known as the 'eastern expansion zone'.[105] That same document classified a similarly flat alluvial landscape located to the north and west of the Río Grande as inappropriate for intensive agriculture due to poor drainage. Nonetheless, this seasonally flooded

* *Fórum Agro MT, Federação das Indústrias de Mato Grosso* (FIEMT), the *Centro das Indústrias Produtoras e Exportadoras de Madeira do Estado de Mato Grosso* (CIPEM) and *Aprosoja Mato Grosso*. Source: *AproSoja/MT*: http://www.aprosoja.com.br/comunicacao/release/setor-produtivo-pede-a-al-novo-estudo-do-zoneamento-socioeconomico-e-ecologico

† The PLUS was a component in the Eastern Lowlands Project of the World Bank; P006152 @ $US 35 million + $US 20 million in counterpart funds.

wetland was settled by farmers who drained the marshes to create a second soy production district known as the 'northern expansion zone'. These two landscapes have made Bolivia into the ninth largest soybean producer in the world (HML #31).

The PLUS was part of a larger strategy to promote sustainable development in the neoliberal phase of Bolivia's recent history (1986–2005). It incorporated an element of *quid pro quo,* with multilateral agencies supporting the expansion and diversification of the rural economy by promoting intensive agriculture via deforestation on arable soils and forest conservation by creating protected areas and indigenous reserves. In between these two extremes were land-use classifications that could be managed for cattle farming (via deforestation) or timber management (via logging). Land adjacent to roads was zoned for *Uso Agrosilvopastoral* while more remote areas were zoned for *Uso Forestal Ganadero Reglamentado,* both of which are different versions that mixed agriculture, cattle ranching and forest exploitation. Landholders ignored the PLUS and developed their properties according to their capacity to mobilise financial capital. In Chiquitania (HML #29) most have adopted the Brazilian beef production model, while those in Guarayos (HML #30) are cultivating field crops.

Laws enacted in the 1990s obligated Bolivian municipalities to downscale the PLUS recommendations via a *Plan Municipal de Ordenamiento Territorial* (PMOT). Revenue sharing and decentralisation policies promoted the compilation of PMOTs; most were abandoned prior to completion, although some have led to the creation of municipal protected areas.[106] The information and recommendation from the PLUS / PMOT regulatory system were meant to be implemented on individual landholdings via a *Plan de Ordenamiento Predial* (POP). The original objective of the POP protocol was to ensure that forest corridors and river margins were protected as conservation easements. Landholders were motivated to complete the study because it is required to regularise land tenure (see above). Most landholders contracted consultants who provided desktop documents that met the administrative requirements of the forest authority; however, the implementation of conservation measures remained at the discretion of the property owner.

The lack of government commitment to forest conservation on private property was revealed in 2013 with the *Sembrando Bolivia* programme, which is central to the government's goal of expanding the agricultural footprint from three to ten million hectares. As part of that process, the agrarian reform agency (INRA) used the POP system to fast-track the regularisation of land tenure on properties deforested between 1996 and 2013 (later extended to 2017). The Bolivian forest authority* approved POPs

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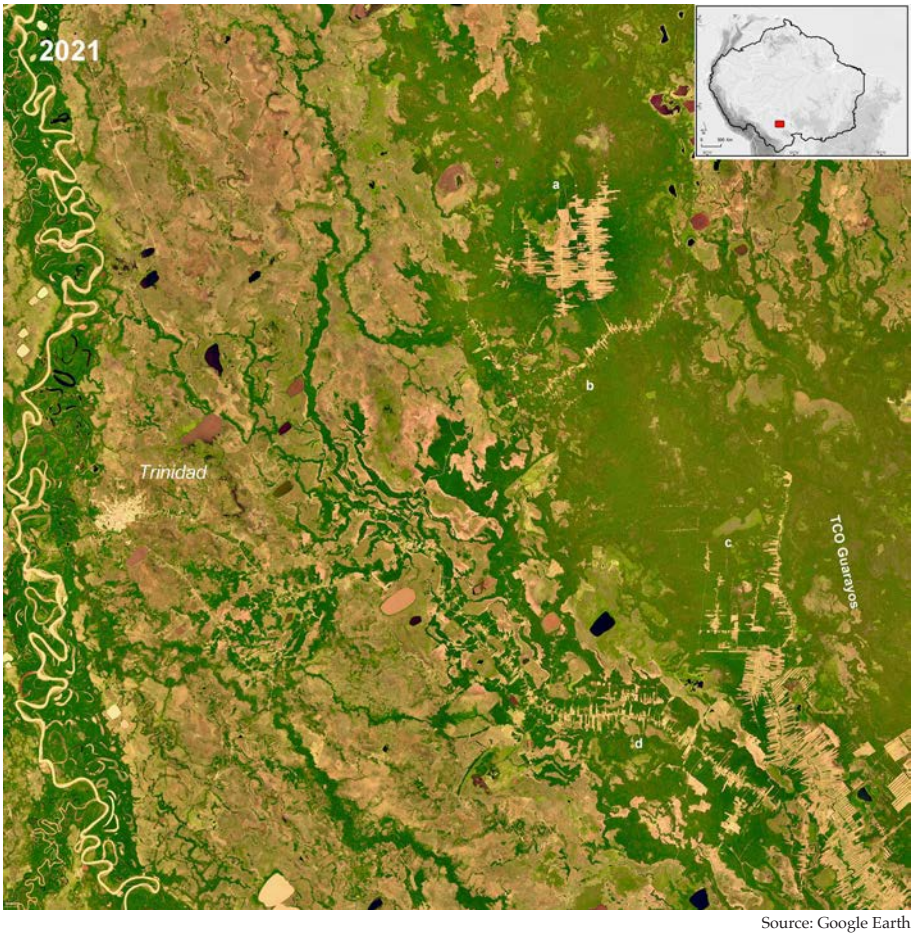
* *Autoridad de Fiscalización y Control Social de Bosques y Tierra* (ABT).



Source: Google Earth

The potential for intensive agriculture is limited on the seasonally flooded savannas south east of Trinidad, the capital of Beni Department, but upland forests are being converted to agriculture by Mennonites (a) and indigenous migrants who self-identify as Interculturales (b, c, d).

covering 850,000 hectares and issued new forest-clearing permits for 154,000 hectares.[107] Ironically, this land planning instrument, originally intended to foster forest conservation, was used to promote deforestation to expand agricultural production in the Bolivian Amazon.

Another example of the government's use of land-use zoning regulations to promote agricultural expansion is the recent modification of the PLUS for the Department of Beni.[108] The original version (PLUS Beni 2002) reflected the traditions of cattle ranching on the Llanos de Moxos and the forest livelihoods of its indigenous people. The revised version (PLUS Beni

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Mennonite immigrants first came into Bolivia in the 1970s. As their population expanded, their colonies cleared approximately 900,000 hectares of forest to pursue a variety of production models including intensive agriculture, dairy and livestock. Their holdings, typically about 100 hectares, are characterised by the absence of remnant forest. These tight-knit communities pool their capital resources to purchase lands from intermediaries and are attracted to frontier landscapes where land is inexpensive.

2019) has made several substantive changes, including the recognition of the agro-industrial production zone along the highway from Santa Cruz (HML #30) and a new deforestation frontier being settled by Mennonites and *Interculturales* east of Trinidad.[109] These landscapes were zoned for forest management in the 2002 version but have been reclassified for a type of agroforestry (*agrosilvopastoril)* in the revised plan. If history is a guide, however, these settler groups will soon be cultivating row crops.

Several lowland ethic groups will be impacted by the 2019 version. Sirionó and Baure communities inhabit the forest landscapes adjacent to the new settlement zones east of Trinidad, while the reclassification of 500,000 hectares to allow '*agrosilvopastoril'* will impact dozens of Moxeño and Movima communities on the highway west of Trinidad.[110] The PLUS Beni 2019 also changes the classification of approximately two million hectares in the north, where Cerrado savannas are deemed amenable for intensive cattle management. This previously remote area is now accessible by an IIRSA sponsored trunk highway that connects its ranchlands with urban markets in La Paz (see Chapter 2). This area is surrounded by Caviñeno, Cayubaba, Chacobó and Tacana communities that have large territories (TCOs) in the adjacent forest landscapes.

Peru

Peru embraced the ZEE in 1996 as a pillar in its strategy to manage national development. This was soon followed by a pilot project funded by IDB and USAID in 2000 to develop a ZEE for Madre de Dios. Implementation guidelines published in 2004 included a mandate to develop them in coordination with regional (macro-ZEE) and local (meso-ZEE) governments. A flurry of studies was completed between 2005 and 2015, but lack of financial support has left the task unfinished. As of 2021, seventeen of 24 regional governments have developed and published a Macro ZEE, but only one has been completed since 2015. Fortunately, this includes most Amazonian jurisdictions (Amazonas, Cuzco, Huánuco, Madre de Dios, San Martin and Ucayali). Loreto has yet to complete a macro-ZEE, but has developed detailed meso-ZEEs for its most populated provinces.*

The Peruvian system, like Brazil's and Bolivia's, groups land-use into several major zones: (a) productive, (b) protected, (c) recuperation, (d) special and (e) urban/industrial.[111] It differs from the Bolivian and Brazilian systems by placing less emphasis on tenure or land-use, and more on underlying biophysical attributes. For example, long-settled agrarian landscapes in the Andean foothills (*Selva Alta*) are zoned for recuperation, reflecting their degradation by erosion caused by steep inclines and extreme precipitation.[112] Similarly, drainage is major determining factor in restricting development on riparian landscapes, regardless of whether the land has been cleared or not.[113]

Another major difference is the treatment of indigenous lands. The most common type, *comunidades nativas*, are zoned for forest management, agroforestry and subsistence agriculture (a), rather than for protection (b). This reflects their status as communal landholdings, which are open to development, rather than as territorial reserves, which are classified as a protected zone; these include *Reservas Comunales*† that were created as dual-status protected areas and *Reservas Territoriales*‡ that have been created to protect indigenous groups in voluntary isolation.

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* The Amazonian jurisdictions have enjoyed the support of the *Instituto de Investigaciones de la Amazonia peruana* (IIAP), which has led the development of three macro-ZEES: Amazonas, Madre de Dios, San Martín; seven Meso-ZEEs: Aguaytia (Ucayali), Nanay, Pastaza-Motona, Alta Amazonas (Loreto), Tocache, Alto Mayo (San Martín), Tahuamanu (Madre de Dios), Satipo (Junín), Selva Huániuco (Huanuco) and the Valle del Río Apurimac (Ayacucho); and two Micro-ZEES: Shabilo (Ucayali) and Iquitos Nauta (Loreto). Source: IIAP (2021): http://terra.iiap.gob.pe/macrozee-mdd.html

† Yanesha, Chaya Nain, Tuntanain, Amarakaeri, Ashininka Machiguena, El Sira, Purús, Sierra del Divisor. Source: RAISG (2021).

‡ Madre de Dios, Kugapakori, Nahua, Nanti, Yavarí-Tapiche, Yavarí Mirim, Napo Tigre. Source: RAISG (2021).

The ZEE is a technical document that provides information and recommendations, but it is not a legally binding land-use plan. Rather, it is the first step in the labyrinthian process of developing a *Plan de Ordenamiento Territorial* (POT), which requires seven additional *Estudios Especiales*: (1) disaster and climate change risk analysis, (2) documentation of past and ongoing land-use change, (3) a description of natural ecosystems, (4) an assessment of land tenure, (5) an analysis of the regional economic dynamic, (6) an evaluation of the nature and status of ecosystem services and (7) an assessment of the institutional capacity of the pertinent jurisdiction.[114]

All of this information is synthesised in yet another study entitled *Diagnostico Integral del Territorio* (DIT) prior to the promulgation of the POT, which is a binding regulatory document that can constrain (or foment) specific types of land use. As of October 2021, no ZEE had been used to initiate a process to formulate a POT in any part of Peru.[115]

The compilation of the ZEEs has improved the potential for sustainable development of the Peruvian Amazon. The information is of very high quality and is readily available to most stakeholders via government websites. The public consultation process would appear to have been fairly comprehensive and democratically organised. Nonetheless, their impact on guiding development and conservation has been limited.

The Peruvian ZEEs were not used to design the protected area systems, which largely occurred independently and, in most cases, prior to the compilation of the regional ZEE. Neither have they been used to regulate mineral exploitation or investments in infrastructure, although they have undoubtedly had a positive influence on the preparation of the environmental impact studies (see Chapter 6). The ZEE documents show the chaotic nature of land-use on private properties while providing a snapshot of the ongoing scramble for public lands. A comparison of maps prepared in the mid-2000s with recent satellite images in Aguaytía (Ucayali) reveals that land zoned for forest management has been converted into an industrial-scale oil palm plantation surrounded by dozens of small agricultural fields.

It is, perhaps, more accurate to think of the Peruvian ZEEs as a depiction of the *status quo* combined with the aspirational recommendations of technocrats trained in the methodologies of sustainable development. The actual decisions are made by local politicians in control of the regional offices of the forest service, the land tenure agency and the environmental agency, who routinely ignore the recommendations of the ZEE as they promote conventional development initiatives in their jurisdictions (Figure 4.10).

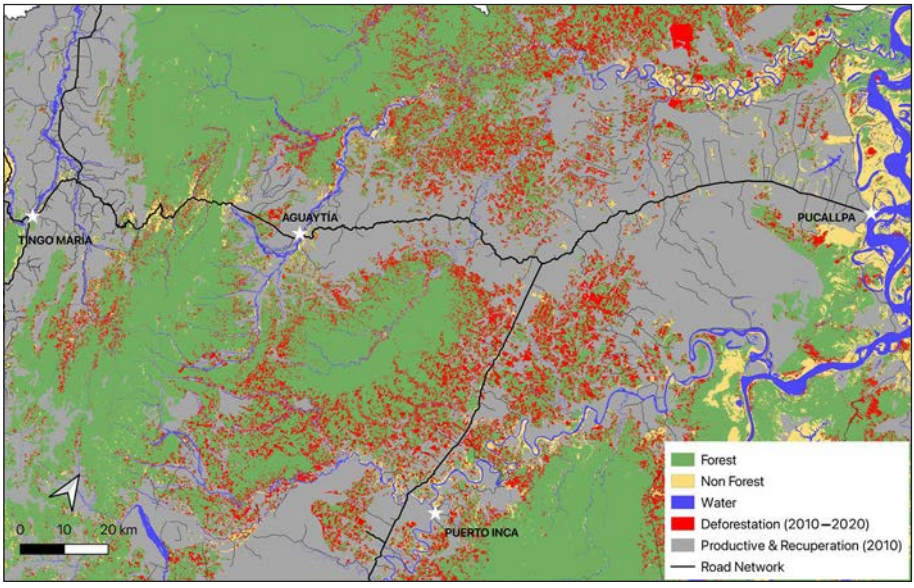

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Figure 4.10: The ZEE prepared for Ucayali and Huánuco Regions in Peru sought to freeze the agricultural frontier at its maximum extent in 2010 (grey), but deforestation (red) continued to expand at the expense of land that was zoned for conservation and forest management.

Data sources: IIAP (2010) and RAISG (2021).

Ecuador

The territorial planning framework in Ecuador is known as the *Plan de Desarrollo y Ordenamiento Territorial* (PDOT). It is one component in an ambitious effort to articulate a *Plan Nacional de Desarrollo* (PND), which is being implemented via a constitutionally mandated policy to decentralise the administrative functions of the state.* The PDOT is a process that is highly participatory and multi-sectoral, as well as re-iterative, since it is designed to be updated in future decades. The goal is to create a legally-binding framework that will promote (or constrain) the economic activities supported by an autonomous regional government at three scales: Provincial, Cantonal and Parochial. The PDOT incorporates three main elements:

1. Strategic Diagnosis: an analysis of the current situation using biophysical and socio-economic information. The PDOT has all the compo-

* The decentralisation and planning process is coordinated by the *Secretaría Nacional de Planificación* (SENPLADES), a high-level executive agency chaired by the vice president of Ecuador. Source: https://www.planificacion.gob.ec/

nents of a ZEE but also includes data on demographics (migration, stakeholder groups), finance and economics (GDP/sector), land tenure, infrastructure (energy, transport, communications), threats from climate change and governing capacity.

2. Proposal: a vision of the future based on strategies implemented over the short, medium and long-term, which is built around an aspirational land-use plan (*Categorías de Ordenamiento Territorial*) and policies to achieve sustainable growth and conservation outcomes.
3. Management Model: programmes and proposals to be implemented by the autonomous government, including a participation plan and a monitoring component to evaluate progress and set the stage for the next iteration of the PDOT.[116]

The PDOT planning framework borrows concepts from various planning methodologies, such as a strategic environmental evaluation, and, as such, provides one of the most comprehensive frameworks for guiding a sustainable development in the Pan Amazon.[117] The process, formally initiated in 2016, has compiled an impressive amount of information at all three scales that is freely available via government portals. It is not without its shortcomings, however. The *Plan Nacional de Desarrollo* is organised around a jurisdictional scheme that assigns the six Amazonian provinces into five different autonomous regions. Logic and tradition argue for a legal and administrative framework that coordinates governance among Amazon jurisdictions. Fortunately, that approach continues to prevail in other programmes, such as the *PROAmazonía*[*] and *Fondo Común del CETA (Circumscription Territorial Especial de la Amazonia)*.[†]

PROAmazonía is a joint project of the ministries of agriculture and the environment and has coordinated the recent development of the PDOTs. More importantly, it provides technical assistance to promote sustainable production and biocommerce.[118] Land-use planning is important, but it must be accompanied by programmes that motivate landholders to reform

* The project is jointly administered by the ministries of the environment and agriculture with financing from the Green Climate Fund ($42 million), the Global Environment Facility ($US 12 million) and the Ecuadorian state ($US 35,000), with contributions from civil society, academia and the private sector ($US 10 million). Source: UNDP (2020) 'Sustainable Development of the Ecuadorian Amazon: integrated management of multiple use landscapes and high value conservation forests': https://erc.undp.org/evaluation/evaluations/detail/12449

† The trust fund receives contributions from mineral royalties and revenues from state-owned enterprises operating in the Amazon; between 2018 and 2020, it distributed $US 500 million dollars to the local and regional governments of the region. Source: *Secretaria del CTA* (2021): https://www.secretariadelamazonia.gob.ec/mas-de-500-millones-de-la-ley-amazonica-desde-su-promulgacion/

their business models and reward forest communities. The *Fondo Común del CTEA*, a trust fund that distributes royalties, is the principal source of capital for public investment in physical and social infrastructure.[119]

Colombia

The government of Colombia is renowned for its capacity to develop conceptually coherent programmes for the challenges that beset the country. The programme to implement a modern land-use plan was adopted as a national strategy in 1997, and by 2003 all of the country's municipalities had a POT.* The relatively rapid compilation of these studies is due to Colombia's unique system of environmental management, which depends upon an institution known as a *Corporación Autónomo Regional*. The CAR are regional regulatory agencies, broadly organised around watersheds, that advise sub-national departmental and municipal governments on natural resource management (see Chapter 7). Most were established and consolidated in the 1970s and over decades have compiled a knowledge base and institutional capacity unsurpassed in the Pan Amazon.

There are three CARs in the Colombian Amazon,† and all have conducted dozens of POTs to support the regulation of land use within strategic watersheds and wetlands that provide socially and economically important ecosystem services to urban areas. They have also completed similar documents at the department scale, referred to as *Agenda Ambiental* (Caquetá, Putumayo, Amazonas) that are similar in content and format to a ZEE (see Annex 4.14). More recently, the government of Caquetá invested in a strategic evaluation entitled *Directrices de Ordenamiento Territorial,* which is similar to the three-part scheme used in Ecuador (Diagnosis / Proposal / Management).[120] As commented previously, the challenge in Colombia is not access to information or capacity but the inability to establish the presence of the state on lawless landscapes.

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* These are prepared at three scales. In addition to the POT, there are also *Planes de Ordenamiento Departamental (POD)* and *Planes Estratégicos Metropolitanos de Ordenamiento Territorial* (PMOT). Source: DNP - *Departamento Nacional de Planeación* (7 june 2016) *A partir de hoy, 100 municipios y 25 departamentos le apuestan a ser territorios modernos*: *DNP*. https://www.dnp.gov.co/DNP/Paginas/acerca-de-la-entidad.aspx

† CORPOAMAZONIA: *Corporación para el desarrollo sostenible del sur de la Amazonía* (Putumayo, Caquetá and Amazonas); CORPOMACARENA: *Corporación para el desarrollo sostenible de la Macarena* (Caquetá, Meta and Guaviare); CDA: *Corporación para el Desarrollo Sostenible del Norte y Oriente Amazónico* (Guainía, Vaupes and Guaviare) https://www.minambiente.gov.co/entidades-adscritas-al-ministerio/

The Countries of the Guiana Shield

While the Andean republics have invested in land-use planning with limited success, the nations of the Guiana Shield were latecomers in the effort to plan development of their forested hinterlands. Fortunately, the agricultural and infrastructure drivers of deforestation have been weak or absent historically.

In 2013, Guyana completed a National Land Use Plan (NLUP), the first comprehensive review of the nation's renewable natural resources since independence. It is essentially a national-scale ZEE and combines information from multiple sources to identify development options based on potential land use. It incorporates an explicit effort to consider future climate change and was an integral part of the agreement between Guyana and Norway to develop a Low Carbon Development Strategy (LCDS).* The NLUP includes a section dedicated to a REDD+ mitigation programme† via forest management and identifies the need to shift agricultural production and populations away from the coastal plain due to rising sea levels.

Part of the motivation for the NLUP was a strategy to link its port facilities with the agricultural landscapes in Roraima, Brazil, via a highway,‡ and a need to revitalise the economy to reduce the loss of human resources from emigration (see Chapter 5). Many of the issues that motivated the LCDS have become less germane, however, because of the discovery of offshore oil and gas reserves. The future influx of royalty revenues and investment should lessen fiscal pressures that might motivate a future government to unsustainably exploit the nation's hardwood stocks or convert marginal soils to plantation agriculture.[121]

Suriname has a land-use history similar to Guyana's, with development concentrated on the coast, but it has yet to conduct a comprehensive

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* The LCDS was launched by a Memorandum of Understanding (MoU) that committed Norway to provide Guyana up to $US 250 million by 2015 for avoided deforestation, contingent upon certain performance indicators, one of which was the NLUP. While generally considered a successful initiative, the LCDS is essentially irrelevant since the discovery of oil offshore in 2015. See: https://www.lcds.gov.gy/ and http://www.worldoil.com/magazine/2017/june-2017/columns/offshore-in-depth

† Reduced Emissions from Deforestation and Forest Degradation (REDD+) is a UN-backed framework to mitigate climate change; the "+" refers to the emission reductions from sustainable management of forests and carbon sequestration via reforestation. REDD+ finance includes direct payments to countries or via the exchange of 'carbon credits' monetized on international carbon markets. The concept was formalised in 2009 and has functioned for more than a decade via voluntary carbon markets.

‡ IIRSA / COSIPLAN, API Project: Boa Vista - Bonfim - Lethem - Linden - Georgetown Road, Guianese Shield Hub: GUY09 (Lethem - Linden Road); GUY42 (Boa Vista - Bonfim Road and GUY43 (Linden - Georgetown ROAD). See: http://www.iirsa.org/proyectos/detalle_proyecto_api.aspx?h=15

study of its land resources.[122] This will soon change due to an ambitious new effort to reform the country's environmental legislation being led by the Ministry of Spatial Planning, Soil and Forest Management: *Project Onze Natuur op 1* (Our Nature is One), a development initiative that will consider the value of natural capital when considering development options.[123]

The most difficult challenge in both Guyana and Suriname are the small and medium-scale gold miners exploiting selected landscapes with gold-bearing rocks (see Chapter 5). Although it is unlikely that a land-use planning document will change the nature of those activities, which are regulated by different agencies, the public forum in which land issues are discussed is often dominated by debates about the mining sector.

Land-use on the Venezuelan sector of the Guayana Shield exists in two broad categories: (1) Areas Under a Special Administrative Regime (ABRAE) and (2) everything else (see Annex 4.15). The ABRAE system was established in 1984 and includes the national protected area system (national parks, monuments, biosphere reserves and wildlife reserves/sanctuaries/refuges), forest reserves, cultural monuments, select hydrological basins, tourist attractions, frontier zones and even farm land.[124] About 55 per cent of the Venezuelan Amazon has been designated as an ABRAE, mainly as national parks (6) or natural monuments (22).* In addition, there are a massive hydrological reserve and six large forest reserves, only one of which is being exploited for timber.† Deforestation linked to agriculture is essentially nonexistent, and there are no conspicuous reports of land grabbing for agricultural development, although gold miners appropriate state lands with the consent of military authorities who have administrative authority over mining landscapes.

Presumably, some type of study preceded the construction of the Guri Hydropower facility in the 1960s; however, the first formal land-use study wasn't completed until 2004.[125] That plan was narrowly focused on biophysical features of the watershed and ignored the mining sector; it also lacked a participatory process.[126] Spurred by several power-management crises linked to water levels in the lake, the government initiated an evaluation and planning process in 2008.[127] Like most recent government initiatives, there is no evidence this project ever advanced beyond the planning stage. Any effort to improve land-use zoning in the Caroni watershed will be forced to contend with the massive gold rush that has overwhelmed the region, a development that highlights the real challenge of any land-use plan: it will not be effective if there is not the political will to enforce it.

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* The national monuments are all *tepúis* (tepuyes), table mountains renowned for their endemism.

† Reserva Forstal: Río Caura, Sigapo, La Paragua; Reserva de Biosfera Alto Orinoco- Casiquiare; Reserva Productor Sur de Bolivar. Only the Reserva Forestal Imataca has active timber concessions.

Undesignated Public Land

One of the objectives of the ZEE process was to assist the nations of the Pan Amazon to allocate their public lands among different constituencies and stakeholder groups. The group with the highest public profile, at least in recent years, is the indigenous people who have organised a highly successful campaign to assert their territorial rights and formalise their claims to their ancestral territories. They are joined in their quest for land rights by tens of thousands of local communities, known variously as *Caboclos*, *Ribereñas, Quilombolas, Maroons, Seringueros* and *Castañeros*, that also rely on the forest and aquatic habitats for their livelihoods. They are competing for land with other societal groups that have economic, demographic and political power, including the ranching sector, large and small farmers and the timber industry. The competition for land is influenced by the interests of mining companies and the oil and gas industry, who have separate rights to below-ground resources, but are concerned that access to those natural resources can be constrained by whomever controls the surface rights.

The multi-decade campaign to prepare ZEEs and formally designate the precise physical borders of public land has succeeded in limiting the expansion of agriculture, particularly in Brazil and Ecuador, and to a lesser extent in Bolivia and Peru. The sharp forest boundaries between indigenous territories and adjacent agrarian landscapes (with several notable exceptions) demonstrates that settlers and land grabbers will not occupy territory they cannot eventually claim as private property.* The ongoing scramble for land is largely occurring on landscapes that have been tacitly identified as expansion zones and highway corridors, many of which were assigned a category of land-use in a ZEE that is purposely vague (see Table 4.8 and Figure 4.8)

Environmental advocates are factually correct when they (a) state that deforestation on these landscapes is illegal and (b) accuse the individuals involved as misappropriating state lands.[128] Regardless, elected officials and government functionaries, either by action or inaction, facilitate settlement on these landscapes which have been zoned for development. It is widely assumed that these lands will be occupied by somebody using some kind of legal or extralegal mechanism. Public forest must be formally designated and managed — or it will pass to the private sector, which increases the probability they will be cleared or degraded.

How much undesignated land is left in the Pan Amazon? Government agencies maintain a running tally by compiling the various land tenure categories managed by their agencies.[129] Those estimates are imprecise,

* This behaviour does not hold true for timber thieves or wildcat gold miners who have no long-term interest in acquiring title since their activities are inherently short-term.

however, because of the deficiencies in land tenure registries and the ongoing appropriation of public land. Moreover, what is perceived as public land varies, particularly when it comes to indigenous or communal territory, which may or may not be considered as a protected area. Likewise, the degree of protection differs depending upon the type of economic activity, which may or may not be allowed, and some protected areas coexist with private inholdings.

The amount of land that remains to be formally designated provides an approximate estimate of the land available for conservation and development (Figure 4.11). The mathematical exercise used to make that estimate also provides a snapshot of the existing distribution of land among major stakeholder groups (Figure 4.12).

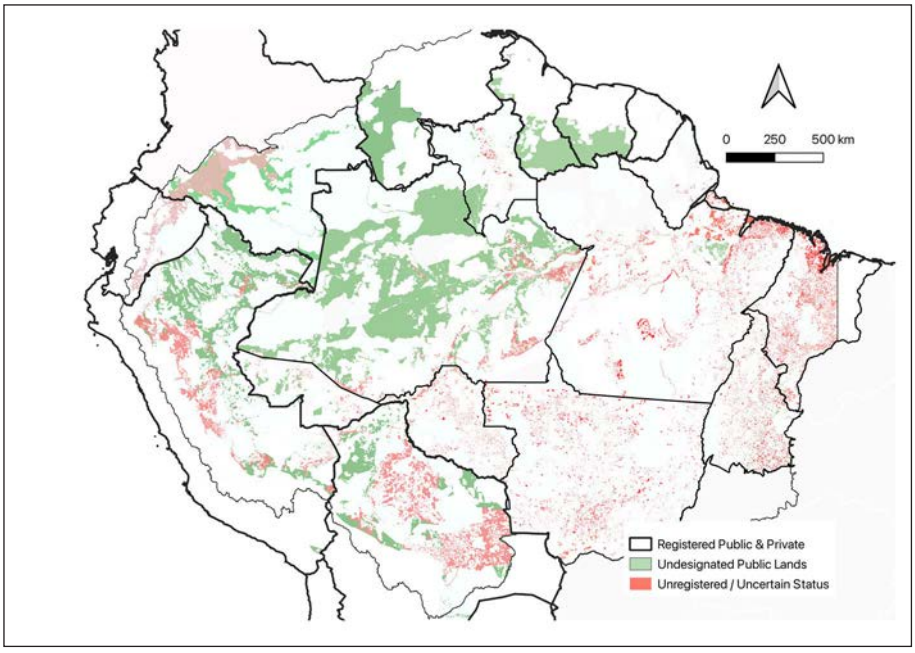

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Figure 4.11: The approximate distribution of undesignated public lands in the Pan Amazon. The green areas are ~92 million hectares of public lands not yet legally encumbered or physically settled by pioneers. Pink areas are ~47 million hectares of putatively state land located on landscapes with large backlogs of unregularised land holdings. The white space represents land deeded as private property or formally designated as a protected area, indigenous land or sustainable use management unit. See Annex 4.1 to 4.16 for jurisdiction-specific graphics, maps and sources.

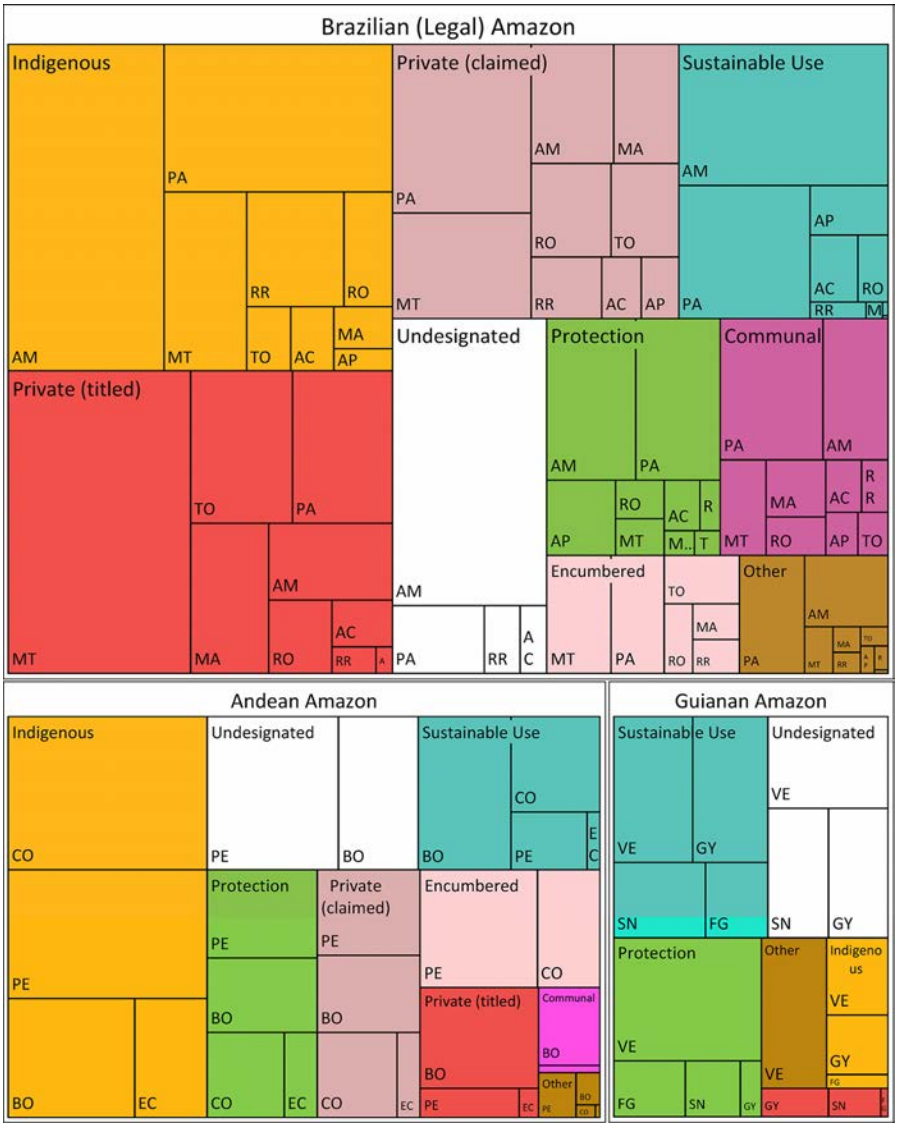

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Figure 4.12: The relative proportion of nine major land tenure categories in the Pan Amazon, stratified by jurisdiction based on a harmonised comparison of classification systems unique to each country: Brazil: Acre (AC), Amapá (AP), Amazonas (AM), Maranhão (MA), Mato Grosso (MT), Pará (PA), Rondônia (RO), Roraima (RR), Tocantins (TO); Bolivia (BO); Colombia (CO); Ecuador (EC); French Guiana (FG); Guyana (GY); Peru (PE); Suriname (RN); and Venezuela (VE). See text for explanation of classes. See Annex 4.1 to 4.16 for jurisdiction-specific graphics, maps and sources.

Private denotes large and small landholdings registered in a national cadaster (Bolivia, Brazil, Peru, Ecuador) or landscapes zoned for agricultural activities (Colombia, Guyana, Suriname, French Guiana). It includes large-scale forest estates (Amazonas and Acre) included in the national cadaster of private properties (SNCR) but excludes forest holdings in the *Cadastro Ambiental Rural* (CAR). This category is stratified into landholdings that have been titled (regularised) and claimed (title pending review).

Communal denotes private lands held by a communal title and public lands where tenure or the permanent right-of-use has been deeded to non-ethnic communities in Brazil, Bolivia and Peru. This includes: (a) INCRA-sponsored settlements that benefit forest dwelling communities (PAAD-type) and (b) pioneer farmers (PA-type) in Brazil; (c) *Castañera* forest communities in Northern Bolivia and *Campesino/ Interculturales* pioneer farmers in Santa Cruz, Beni and La Paz; and (d) *Ribereña* communities in Peru.*

Indigenous denotes communal landholdings deeded to specific communities, as well as state lands where permanent use-rights have been granted by law or decree to one or more ethnic peoples. These can be small or large, but are specific for indigenous groups with a specific ethnic heritage. It includes protected areas that enjoy a dual status as indigenous reserves and those created to protect indigenous groups living in voluntary isolation.

Protection denotes national and regional protected areas established with the primary goal of conserving biodiversity and natural ecosystems, typically referred to as 'indirect use' (IUCN Categories I, II and II). Those with dual status as indigenous territories are excluded to avoid double accounting.

Sustainable-Use denotes public lands allocated to the sustainable management of timber and non-timber resources and include both national and regional protected areas, as well as forest concessions in Peru, Bolivia, Venezuela, Guyana and Suriname. Excluded from this category are multiple-use protected areas with privately held inholdings (e.g, *Areas Natural de Manejo Integrado* and *Áreas de Proteção Ambienteis*) and communal landholdings dedicated to sustainable management.

Other denotes urban areas and public lands that have been registered within cadasters; they include military properties, infrastructure and their associated rights-of-way, rivers, lakes and water ways and urban areas.

Encumbered denotes putatively state lands in areas with unresolved land tenure; many (perhaps most) are occupied by a possessor (*poseiduero*) who has yet to have his or her title validated and registered in the national ca-

* Although the agrarian settlements are legally communal, they are functionally private smallholdings and may (probably) eventually be split up and distributed amongst their inhabitants.

daster. These were identified by subtracting the total area from registered properties in cadasters from the total area within polygons defined as 'Human Modified Landscapes' (see Chapter 1).

Undesignated denotes all other public lands, estimated by subtracting the above categories from the total area of each jurisdiction as defined by administrative criteria (Bolivia, Brazil, Colombia, Venezuela) or by the approximate tree-line on the eastern slope of the Andes (Bolivia, Colombia, Ecuador, Peru).

This large-scale accounting shows there are still significant areas of public land that await to be allocated as protected area, indigenous reserve or open to some type of sustainable development. It also highlights the dimension of the challenges in resolving land tenure on frontier landscapes. Insecure and uncertain land tenure are directly linked to the deforestation crisis. The ability of land grabbers and settlers to appropriate state lands is made possible by the incomplete nature of land registries. The forest frontier will only be closed when all legal properties enjoy fully certified titles and all public lands are clearly demarcated and assigned a management category.

Source: Google Earth

The land claims (green polygons) registered in the Cadastro Ambiental Rural (CAR) along BR-230 in Southeast Amazonas state reflect the ongoing speculation for land along Brazil's most active settlement and deforestation frontier.

Land Sparing Versus Land Sharing

The creation of protected areas and indigenous reserves offers the best hope for conserving the biodiversity of the Amazon; however, the management of the human modified landscapes will determine whether society protects the ecosystem services essential for the economic health of the continent. Models predict that an ecological tipping point will be crossed when about 25 per cent of the region's forests have been converted to agriculture – just a few percentage points above the current level of eighteen per cent.[130] When (if) that tipping point is crossed, the decline in atmospheric water recycling will lead to a catastrophic decline in rainfall across the farmlands of South America, including those in the Southern Amazon, but also in Central Brazil, Paraguay, Bolivia and Northern Argentina (see Chapter 1 and Chapter 10).

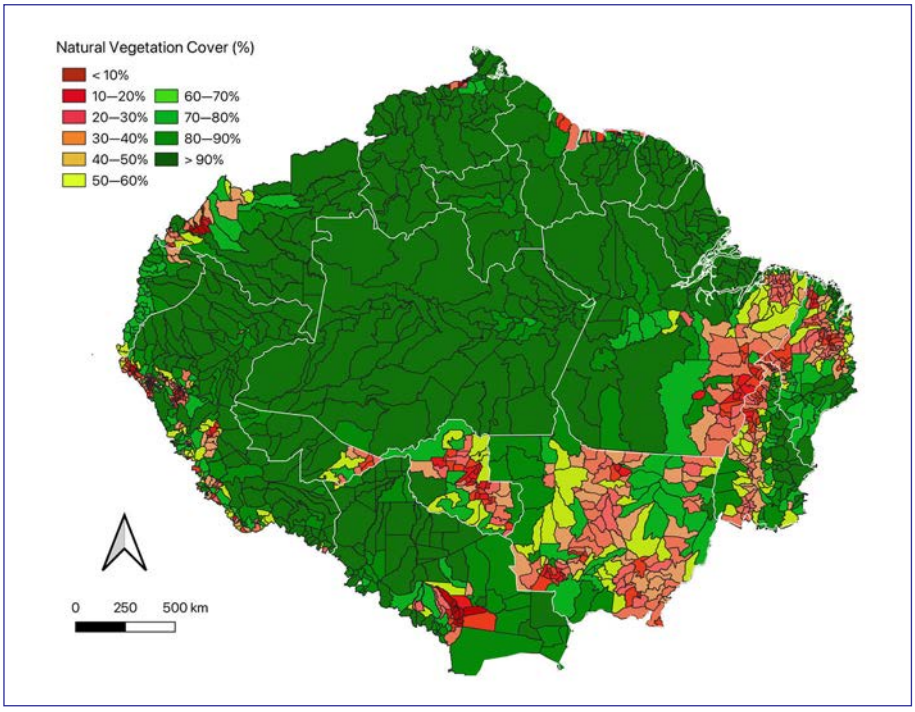

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Figure 4.13: The loss of native vegetation, mainly forest but also Cerrado scrubland, has degraded atmospheric recycling of the Southern Amazon. Models forecast that precipitation sufficient to support a rainforest ecosystem declines dramatically once forest cover falls below 60%, a situation that has already impacted more than 600 municipalities in the Pan Amazon (yellow and red polygons).

Data sources: MapBiomas (2021) and RAISG (2021).

The predicted tipping point at ~25% deforestation is a basin-wide metric; however, large parts of the Southern Amazon passed that metric approximately twenty years ago. Dozens of municipalities in Pará, Mato Grosso and Rondônia have lost more than forty per cent of their original forest cover (Figure 4.13). Those landscapes are now both hotter and drier.[131] It could be worse. Producers still benefit from water recycled in the Central Amazon and, as more upwind landscapes are deforested, these will cease to provide this precipitation subsidy. When that happens, the farmers and ranchers of Mato Grosso will be forced to adapt to a new reality.

Some producers will migrate into landscapes less susceptible to precipitation declines, a process already underway as farmers expand northward, attracted by cheap land and lower logistical costs (see Chapter 3). Most will use new drought-resistant cultivars and adopt management practices that conserve soil moisture. Some will seek to use irrigation technology (see below). There will also be pressure – and incentives – to change how they use the land.

Some academics advocate for a 'land-sparing' approach that relies on technology to intensify production on existing production landscapes to reduce the demand for new cropland. Others contend that a 'land-sharing' approach that diversifies production systems is needed to conserve ecosystem services. Both tactics have a place in a coherent development strategy, but their social, economic and environmental impacts vary depending on the perspective of the observer and the scale of the evaluation.

The growing recognition in financial markets that climate change is an existential threat to global society has created a demand for investments that comply with criteria defined as Environmental, Social and Governance (ESG). Among the most common are 'green bonds' that purport to fund business ventures that reduce greenhouse gas emissions, sequester carbon and conserve forest and biodiversity. Simultaneously, public and private commitments to eradicate deforestation from commodity supply chains have focused attention on the agricultural economy of the Southern Amazon. If financial analysts and media pundits are to be believed, the Southern Amazon will soon receive billions of dollars of private and public capital that, hopefully, will transform the business models that have long threatened the Amazon. As usual, the devil will be in the details.

Sustainable intensification: The soy-beef nexus in the Brazilian Amazon

All multi-stakeholder initiatives organised to eliminate deforestation from commodity supply chains include programmes to increase producer productivity.* They are presented as a 'carrot' to farmers and ranchers being

* Multistakeholder initiatives include the Roundtable for Sustainable Palm Oil (RSPO), Round Table for Reasonable Soy (RTRS), Global Roundtable for Sus-

coerced to limit (end) the expansion of their industry via deforestation. The logic is simple: a ten per cent increase in yield can offset a ten per cent reduction in the (future) area under cultivation. This is certainly true at the global scale but less so at local and regional scales. The numbers speak for themselves.

The total soy harvest in Mato Grosso increased from 18 million tonnes in 2008 to more than 35 million tonnes by 2020.[132] Twelve per cent of this increase came from improved agronomic practices (intensification); the rest was due to an expansion of land under cultivation (extensification).* Agribusiness advocates argue that the expansion of cropland (in this instance) was also a form of sustainable intensification because it occurred via the conversion of degraded pastures rather than by expansion into forest. Some assert that law enforcement and market incentives have succeeded in eliminating deforestation from the soybean supply chain.† This happy story, however, has a more nuanced explanation.

The degraded pastures were supplied by ranchers who had accrued a large surplus of under-utilised pasture due to massive deforestation of previous decades. Due to overgrazing, a very large portion (~ 60%) had been degraded.[133] Soil restoration is a significant investment‡ but is much less expensive than clearing forest.§ Soy growers chose growth via pasture conversion because it was the most cost-effective option. Ranchers benefited because they were able to monetise an underperforming asset, either via a sale or by renting their land to a farmer for a determined period of time (~5 years). Those that opt for a lease recover an appreciated land asset with restored soils and renovated pastures.

Approximately five million hectares of pasture were converted to cropland in Mato Grosso between 2008 and 2020; nonetheless, the total area of cultivated pasture remained constant at ~21 million hectares. The

tainable Beef (GRSB), Bonsucro; see Chapter 3.

* About ten million hectares of soy were cultivated in Mato Grosso in 2020 with about equal parts from the conversion of pasture and Cerrado savanna. The conversion of Cerrado vegetation has an impact similar to deforestation, and environmental advocates eventually succeeded in incorporating its conservation into sustainability protocols. The moratorium on expanding via Cerrado conversion has increased the demand for pasture and reinforced the economic and political alliances among ranchers and soybean farmers.

† Government sponsored initiatives include the *Plano de Ação para Prevenção e Controle do Desmatamento* (PPCDAm) launched in 2004 by the administration of Luiz Inácio Lula da Silva and in the *Produzir, Conservar e Incluir* (PCI) in Mato Grosso initiated in 2015 as part of Brazil's commitment to the Paris Agreement.

‡ Forest, Cerrado and pasture soils all require agricultural lime (calcium carbonate) to resolve acidity and aluminum toxicity; applications of macro (NPK) and micro-nutrients optimise plant health and productivity.

§ Clearing forest costs ~ $US 1,000 more per hectare compared to the conversion of pasture.

conversion of pasture was offset by new deforestation on the forest frontier and within forest remnants on consolidated landscapes. Simultaneously, the cattle herd expanded from 26 to 32 million head, which translates into an improvement of the mean stocking rate from 1.3 head per hectare to 1.5 head per hectare.[134] Grazing management is only one aspect of beef productivity and the industry also invested in genetics, animal health and nutrition, which has further increased the productivity of its supply chain (see Chapter 3)

Both the beef and soy industries have expanded their production by intensification: soy farmers have increased yields and expanded onto pasture while ranchers have increased stocking rates and improved animal health. Claims that they have avoided deforestation are inaccurate, however, because intensive cropping displaced cattle ranching in an industry that continues to expand via deforestation. In the vernacular of natural resource economics, this is called indirect land-use change, while carbon accountants refer to it as leakage.[135] Environmental advocates label it as greenwash.[136]

Eventually, all the pastureland suitable for annual crops, estimated at about ten million hectares, will be occupied by farmers. Mato Grosso's ranchers will need to double stocking-rates to maintain current levels of beef production if they hope to avoid future deforestation. They will probably attain that level of productivity;* however, other factors will influence whether they expand their spatial footprint. As mentioned previously, the appreciation of land is an integral part of a rancher's business model. Intensification tends to improve profit margins, which provides producers with more capital and, like businessmen everywhere, most will use that capital to expand operations.[137] It may be true that the supply and demand for commodities is a zero-sum equation at the global scale, but it is certainly not true at the local or regional scale

Meat-packing companies and commodity traders intend to use ESG finance to eliminate deforestation from their supply chain. Perhaps. They will use satellite imagery to monitor land use and ear tags embedded with block-chain-coded chips to document the origin of a cow.[138] It is not clear, however, how technology can resolve the issue of indirect land-use change or detect cattlemen who trade calves via informal markets. Investors should pay close attention to the Key Performance Indicators (KPI) used to evaluate whether their creditors meet ESG criteria – or not.

Irrigation: A problematic intensification strategy

The agro-industrial farms of Mato Grosso are among the most efficient on the planet; they benefit from abundant rainfall and a long rainy season,

* This is feasible because ranchers in São Paulo and Paraná average about 3.5 head per hectare: Source: Arantes et al. (2018).

which allows them to plant and harvest two crops per year. They do not operate without risk, however. Both crop cycles fail during periodic droughts (1985, 1991, 1993, 2009, 2016),* and the second harvest is often constrained by limited soil moisture at the end of the rainy season. The recent decline in mean annual precipitation, the consequence of climate change and deforestation, manifests largely in a delay in the onset of the rainy season.[139] Farmers must wait until it rains to seed their crops, a delay that reverberates through the subsequent first harvest (typically soy) and the sowing of the second crop (typically maize) and its eventual harvest, which is known as the *safrinha*.† The gradual (non-tipping point) decline in precipitation has increased the probability of poor maize yield.[140]

Some producers are using centre-pivot irrigation systems to manage the risk of dryland farming; the number has grown from fifty in 2000 to more than a thousand in 2021.‡ The original motivation may be to alleviate drought stress during the *safrinha* (May, June, July), but precision water management can increase yields during both crop cycles by ensuring optimum soil moisture during key stages of plant development (seedling, flowering and grain filling). Once the investment is made, producers use the equipment throughout the year. Some are planting a third crop.[141]

Irrigation circles were observed on approximately 1.5 per cent (150,000 hectares)[142] of the area under intensive cultivation in 2020 (ten million hectares).[143] Most producers are pumping water directly from rivers or from small impoundments on upstream watercourses. Expansion has been most notable on the headwaters of the Teles Pires (Tapajós) and Río das Mortes (Araguaia), followed by the Juruena (Tapajós) and Alto Xingu.

Irrigation systems are regulated by the state environmental authority *Secretaria de Estado de Meio Ambiente do Mato Grosso* (SEMA) in coordination with a state water council (*Conselho Estadual de Recursos Hídricos de Mato Grosso* – CEHIDRO) and basin-specific governance committees. Current guidelines stipulate that surface water removals should be limited to seventy per cent of minimum waterflows (Q_{95})§ and no individual stakeholder can take more twenty per cent of that total.[144] Current levels of take-off are well within those guidelines, but the ongoing rate of expansion (ten per cent annually) will eventually outstrip surface water supplies. Long before

* Basin-scale droughts are triggered when cyclical dipole systems in the Atlantic and Pacific Oceans coincide to suppress atmospheric waterflows from the Atlantic Ocean into the Amazon (see Ch. 10).

† The Portuguese term *safrinha* translates as 'small harvest' because it is small in comparison to the first crop cycle.

‡ The largest number are located in the municipalities of Primavera do Leste (193), Sorriso (176) and Novo Ubiratã (84).

§ The minimum waterflow is defined as Q_{95}, a water flow metric (m^3/s) that was exceeded 95% of the time within the specific flow record; it is roughly equivalent to a dry season flow in a permanent watercourse.

Source: Google Earth

Satellite images reveal that farmers are extracting surface water directly from watercourses and small impoundments in the headwaters of the Tapajos and Xingu watersheds. Some are using solar energy to power their systems, which might make them eligible for green bonds and other forms of ESG investment.

that happens, producers will start exploiting the groundwater resources of the Parecis Aquifer, a massive reservoir in the sandstone rock formations that overlay the Amazon Craton (Figure 4.14).*

Information on both surface and groundwater resources was used by the national water agency (*Agência Nacional de Águas e Saneamento Básico* – ANA) when preparing the *Atlas Irrigação*, a national planning document that has mapped the nation's irrigation potential.[145] According to that document, Mato Grosso has the water resources necessary to irrigate 3.9 million hectares of cropland, an area equivalent to ~40% of the total area under cultivation in 2020.[146] Of that total, about 500,000 hectares would depend upon groundwater resources, while the remainder would be extracted from the region's rivers (Figure 4.15).

* The *Sistema Aquífero do Parecis* (SAP) has a horizontal surface area of between 200,000 to 300,000 km^2. It is composed of two subsystems: a confined aquifer (static level: 15 m; mean flow: 23 m^3/hour; mean thickness: 80 m) and non-confined aquifer (static level: 17 m; mean flow: 50 m^3/hour; mean thickness: 93). Source: Silva (2013).

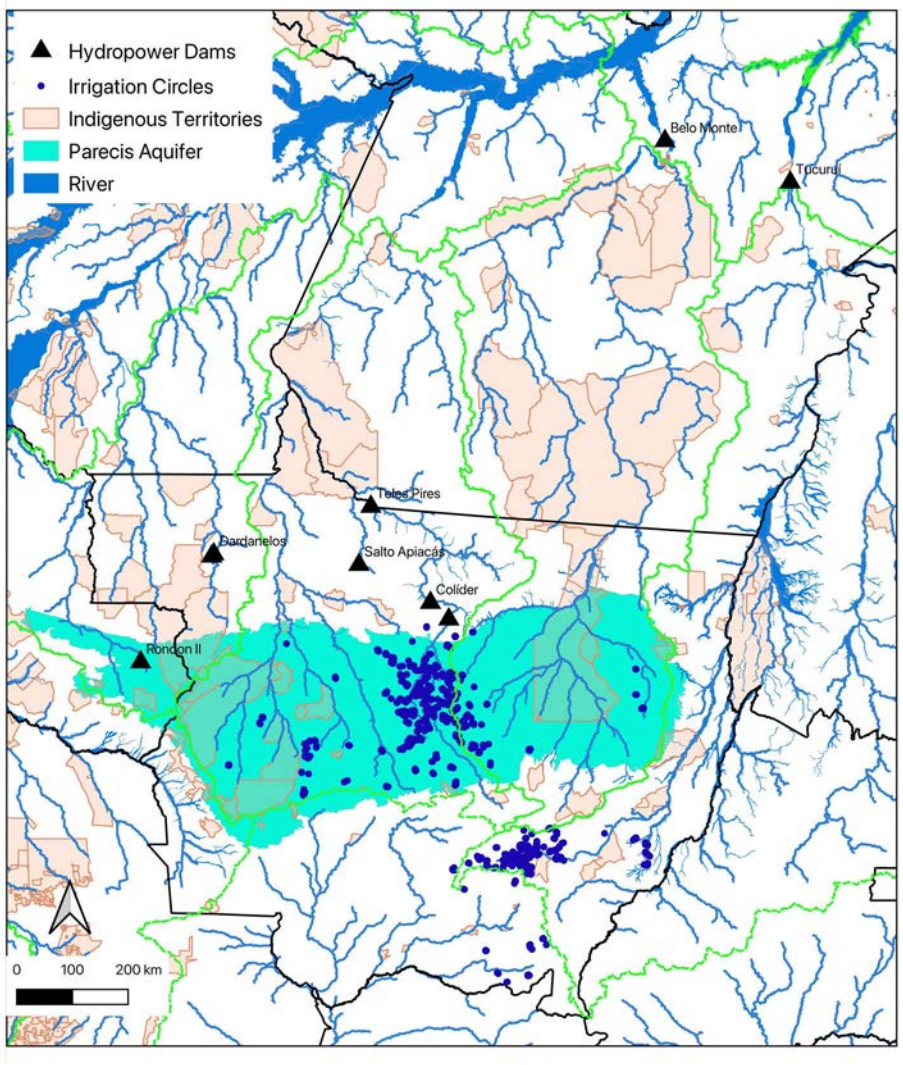

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Figure 4.14: The use of centre-pivot irrigation systems has increased from less than twenty in 2010 to more than 1,000 in 2020. The systems use surface water extracted from the headwaters of the Tapajos, Xingu and Araguaia basins. The expansion of these systems risks the hydraulic regimes that power four hydropower facilities with a combined capacity of 2.0 GW of electricity generation and key ecosystem services that sustain the indigenous fisheries of the middle Tapajos River.

Data sources: ANA (2021), RAISG (2021) and Pereira et al. (2014).

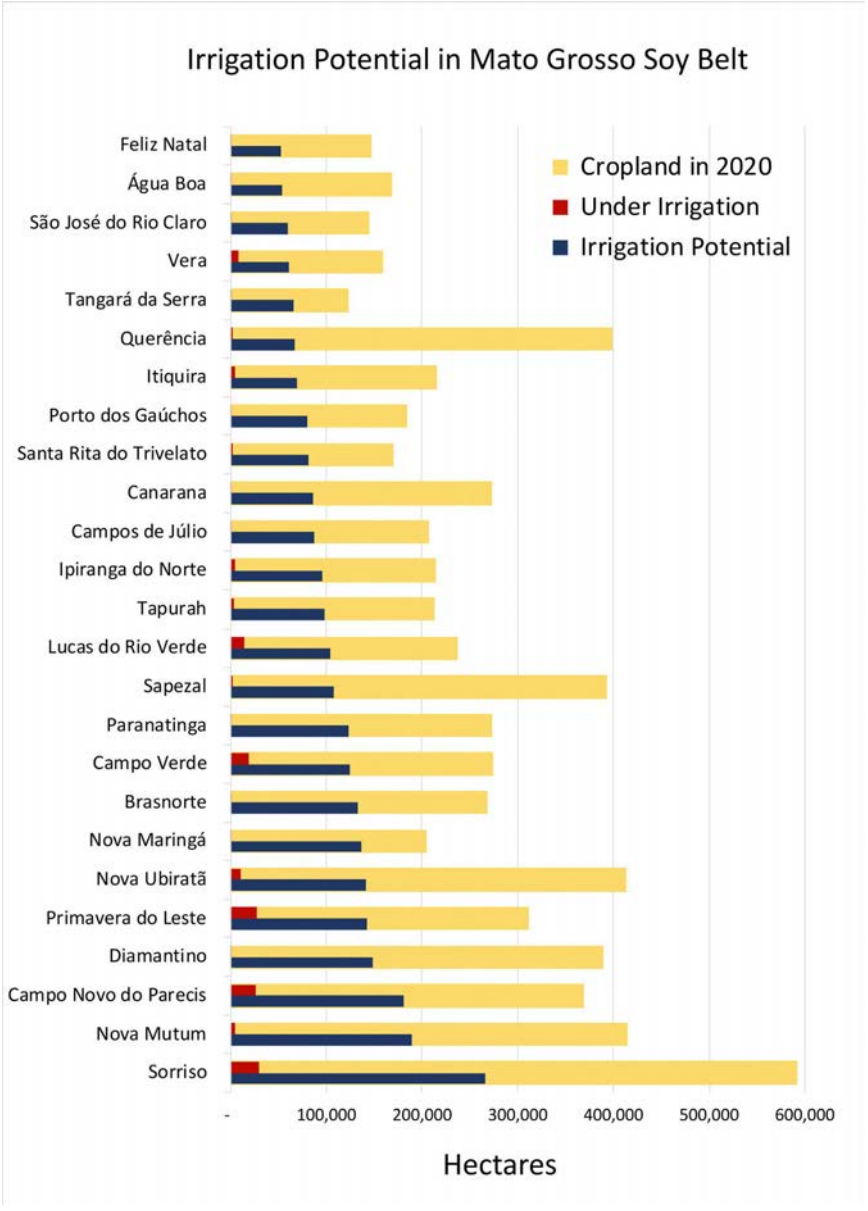

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Figure 4.15: Although irrigation has been growing at 10% annually since 2010, it still represents only a small fraction of both the projected potential and the current crop area. According to projections by the national water agency (ANA), the combined surface and groundwater resources could support 3.9 million hectares of irrigation agriculture — 40% of the current area under intensive cultivation in 2020.

Data sources: ANA (2021) and MapBiomas (2021).

Ironically, irrigation at that scale would partially compensate for the decline in rainfall caused by deforestation because it would enhance evapotranspiration and convection over agrarian landscapes. Simultaneously, however, industrial-scale irrigation would disrupt the seasonal waterflows that support the biodiversity and ecosystem function on the upper Tapajós, Xingu and Araguaia watersheds.[147] Climate change and deforestation have already caused a significant decline in precipitation over the Southern Amazon;[148] nonetheless, waterflows in those rivers have maintained historical levels because of an increase in runoff from deforested landscapes.[149] As irrigation systems multiply, these waterflow subsidies will disappear and, if the Southern Amazon passes a deforestation-induced climatological tipping point, the impacts on downstream ecosystems and communities will be catastrophic.

If (when) that occurs, agribusiness will scramble to install irrigation systems. If history is any guide, they will use all the available surface water and overexploit the Parecis Aquifer – unless regulatory authorities act pre-emptively to limit irrigation. That may be difficult, however, because the current 35-year span of the current permit system is based on historical climate data that overestimates future water resource availability. The current regulatory framework has been questioned by hydrologists, who contend surface water abstractions should be limited to twenty per cent of the total water volume during any specific temporal period.[150] Removals from the aquifer are more complicated to measure and regulate because they are based on balancing the recharge rate with the rate of extraction.* The recharge rate in the future is unknown.

As surface water abstractions in the Tapajós basin increase, they will threaten the economic viability of four hydropower facilities.† Simultaneously, the riparian habitats and Munduruku communities on the middle Tapajós will suffer from reduced water flows, particularly if dam operators mitigate reduced waterflows by retaining a greater share of water. On the Xingu, the river corridor is protected by the *Parque Indígena do Xingu* (PIX), home to sixteen different ethnic tribes (see Chapter 11), but the headwaters are located entirely on private land. The much-debated provisions of the Mato Grosso ZEE (see above) could potentially limit the expansion of centre-pivot systems, because it expressly identifies landscapes that are important for the management of the water resources of the Amazon.‡

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* Water reserves have been estimated at between 2.89 $x10^{12}$ to 1.13 x 10^{13} m^3; hydrologists estimate that between 8 and 12% of the total aquifer could be sustainably exploited (extraction = recharge). Source: Silva (2013).

† Sinop, Colider, Teles Pires, São Manoel; see Ch. 2.

‡ Category 1.2 (*Agricultura e Pecuaria*) 'areas of hydric importance as headwaters and recharge zones for the Amazon, Tocantins-Araguaia and Paraguai hydrographic regions.' Source*: Dispõe sobre o Zoneamento Socioeconômico Ecológico do Estado de Mato Grosso* – ZSEE/MT, http://seplag.mt.gov.br/index.php?pg=ver&id=6304&c=117&sub=true

As of October 2021, there was no evidence that green bonds were financing irrigation agriculture in the Brazilian Amazon. This situation will change in the near future because irrigation projects are eligible under ESG standards[151] and figure prominently in discussions about climate change adaptation.[152] Solar energy powers irrigation systems at multiple locations in Mato Grosso, and the ongoing expansion of the maize-based biofuel industry is being financed by green bonds.* Assertions that these operations are compliant with ESG criteria must, eventually, be reconciled with their long-term impact on water flows on aquatic ecosystems of the Tapajós, Xingu and Araguaia rivers and the livelihoods of indigenous communities on those rivers.

Other crops for which irrigation technology is employed at scale are rice in Tocantins (100,000 hectares), coffee in Rondônia (43,000 hectares) and oil palm in Pará (25,000 hectares). Irrigation technology has been installed in an unknown area, perhaps as large as 10,000 hectares, as part of a new business model to cultivate açaí in plantations (see below).[153] Centre-pivot irrigation systems have been introduced on the alluvial plain of Santa Cruz but they have not been widely embraced, despite the considerable drought risk that characterises that region.[154]

Conservation agriculture and agroforestry

There are three fundamental rules of financial planning: (1) save continuously, (2) invest in a diversified portfolio of assets and (3) exercise patience via a long-term strategy. This common-sense advice is at the heart of Conservation Agriculture (CA), a land-management philosophy that seeks to reconcile the technologies of modern agriculture with the time-worn practices of organic farming. These include multi-crop systems that minimise risk from weather, pests and markets, and the spatial and temporal rotation of crops. When integrated, these practices will increase soil organic matter (carbon), which improves the water holding capacity and the nutrient status of soils. Agroforestry systems are particularly advantageous because deep-rooted perennials contribute to evapotranspiration, which supports regional rainfall, while individual farmers benefit by reducing energy and labour costs, as well as locking in a long-term revenue stream.

Agribusiness is not unsympathetic to common-sense advice, and most farmers have diversified their choice of crops and adopted minimum

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* *FS Bioenergia,* the largest maize biofuel processor in Brazil, issued $US 550 million in green bonds in 2020 to finance the construction of ethanol refineries in municipalities that are also leading in the expansion of centre-pivot systems: Primavera do Leste, Sorriso, Novo Mutum, Lucas do Rio Verde and Campos Novo de Parecis. Source: https://www.fs.agr.br/

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Land-use intensification (land sparing) is a strategy embraced by corporate farms because it usually maximises profitability on a per hectare basis. Top: Tree plantations provide an attractive return when calculated over several decades, while supporting landscape-scale evapotranspiration essential for maintaining regional rainfall regimes. Bottom: Minimum tillage techniques reduce soil erosion, increase soil organic matter and improve water-use efficiency.

tillage technologies.* Nonetheless, they almost invariably choose industrial commodities (soy, maize, sorghum, sunflower, cotton) and genetically engineered varieties designed for use with herbicides. Plantations are almost always composed of exotic species (eucalyptus, pine or gmelina). A few corporate entities have allocated a portion of their land to an integrated production model known as ILFP (*Integração Lavoura-Pecuária-Floresta),* a type of industrial agroforestry that seeks to optimise the benefits from three major production systems (row crops, livestock, tree farms). Nonetheless, the overwhelming majority of large-scale farmers are enamoured with (addicted to) the financial returns from monoculture, and they are not likely to change their business models.

Ranchers might be more prone to changing land-management practices because they have a surplus of under-utilised land that has suffered from poor management, as evidenced by their use of joint ventures with farmers as a strategy to restore degraded pasture. Nonetheless, cattlemen (and women) belong to a conservative cultural tradition that is notoriously resistant to change. They will adopt new technologies but only after there is a clear demonstration of economic benefit – preferably one they can observe on a neighbour's landholding. A solid majority are in violation of the Forest Code,† and many have made a legal commitment to come into compliance via a mechanism known as a TAC (see above).[155] Most have not followed through on these commitments because of weak enforcement mechanisms, but that may change if future ESG finance obligations force reforms onto beef supply chains.

Conservation agriculture, agroforestry and reforestation are key components of *Agricultura de Baixo Carbono* (Table 4.9), an innovative finance programme managed by Banco Nacional de Desenvolvimento Econômico e Social (BNDES). The bank has a long and unfortunate history of funding infrastructure projects in the Amazon (see Chapter 2), but it has the financial power to influence development, at least with the corporate sector. In 2021, BNDES announced it would float green bonds on international capital markets in collaboration with the Interamerican Development Bank

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* A central tenet of conservation agriculture that avoids the mechanical manipulation (ploughing) of top soil. Variants include no-till (*plantio direto*), minimum till (the use of discs but not ploughs) and strip till. The goal is to maximise straw on the soil surface to avoid erosion and slow the decomposition of roots to foster the formation of humus.

† According to Soares-Filho et al. (2014), the forest liabilities in the Amazon Biome are estimated at 899,000 hectares of APPs (Permanent Protection Areas) and 7.2 million hectares of RL (legal reserve), but 56% of the RL liabilities do not need to be restored and can be compensated through mechanisms such as the Environmental Reserve Quota (Law No. 12,651/2012) or via commercial plantations.

Table 4.9: The loan programmes managed via the Agricultura de Baixo Carbono programme of the Banco Nacional de Desenvolvimento Econômico e Social.

Loan Type	Business Model / Investment Projects
ABC Recuperação	Restoration of degraded pastures
ABC Orgânico	Organic agricultural production practices
ABC Plantio Direto	Direct planting systems (no-till or minimum-till systems)
ABC Integração	Crop-livestock, crop-forest, livestock-forest or crop-livestock-forest integration systems and agroforestry systems
ABC Florestas	Implantation and management of commercial forests, including those destined for industrial use or the production of charcoal
ABC Ambiental	Regularisation of rural properties in accordance with Forest Code, particularly the restoration of *RL* and *APP*; restoration of degraded areas; and sustainable forest management
ABC Tratamento de Dejetos	Manure and waste treatment systems from animal production for energy generation and composting to reduce methane emissions
ABC Dendê	Zero-deforestation oil palm plantations, particularly those established on degraded pastures
ABC Fixação	The cultivation of species that support the biological fixation of nitrogen
ABC Manejo dos Solos	Soil conservation, including the correction of soil acidity and fertility using agricultural lime ($CaCO_3$)
ABC Bioinsumos.	Biological control pest management and the transformation of biofertilizer

Source: BNDES: https://www.bndes.gov.br/wps/portal/site/home/financiamento/produto/programa-abc

(IDB); some of those resources would be used to fund projects dedicated to ABC-like investments.[156]

An opportunity for smallholders

Smallholders should be more willing to diversify their production systems and adopt practices that increase resilience. Mitigating risk is integral to their livelihoods because crop failure can lead to hunger and bankruptcy. Smallholders exist in all parts of the Pan Amazon, including within jurisdictions dominated by large landholders (Figure 4.16). As such, improving the sustainability of smallholders would yield multiple benefits, ranging from the stabilisation of the regional climates to ameliorating the inequality that defines the rural economy.

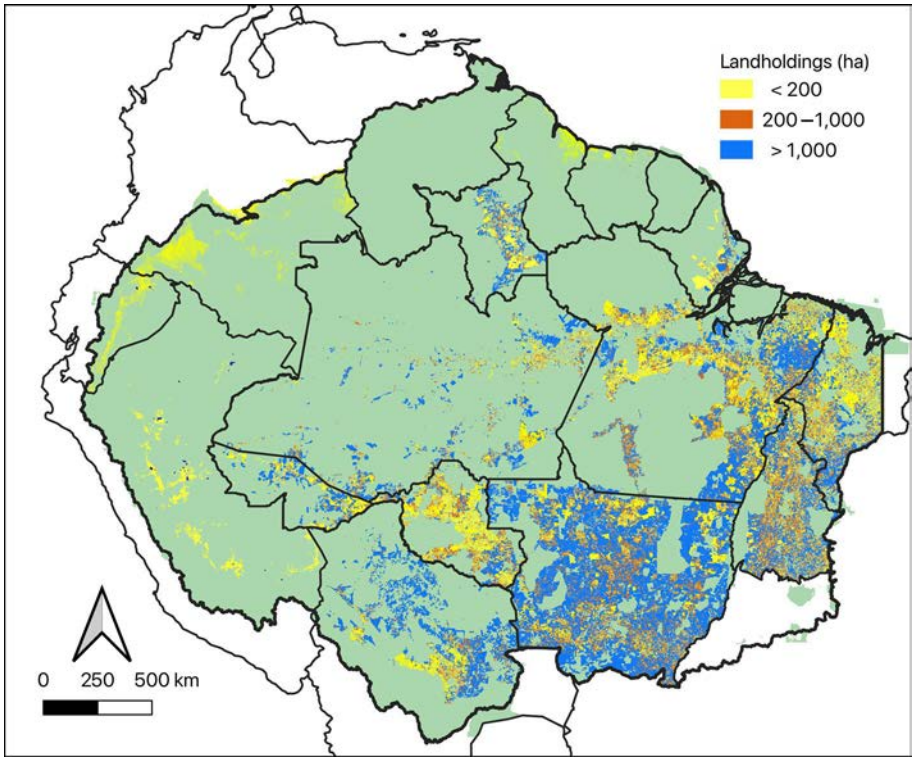

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Figure 4.16: Policies that help smallholders invest in tree-based production systems could restore evapotranspiration on strategically located landscapes in the Pan Amazon. See Annex 4.1 to 4.16 for jurisdiction-specific graphics, maps and sources.

The potential is greatest in Peru and Ecuador, where small farmers occupy more than ninety per cent of previously deforested landscapes. Most grow basic foodstuffs for household consumption and for sale to domestic consumers, as well as large number who cultivate coffee and cacao for international markets, including a subastantial minority that receive a premium for adopting organic practices. Oil palm is expanding because it provides a steady stream of income on a monthly basis, while the concept of zero-deforestation palm oil is gaining currency within producer associations (see Chapter 3). Livestock operations are primitive, but producers are adept at adopting new technology, as evidenced by the ongoing expansion of aquaculture (see Chapter 8). Recruiting the small farmers of the Andean piedmont to pursue climate-friendly production has a good probability of success, because it aligns with their own experiences, traditions and aspirations.

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Agroforestry is a land sharing production model where tree crops are grown in combination or rotation with annual crops; when combined with forest conservation, these systems tend to be more resilient to drought, pests and market volatility while providing greater ecosystem services when compared to land intensification schemes.

Bolivia is similarly well-positioned to implement policies that benefit small family farms, which occupy ~35% of the agricultural landscapes created by deforestation. Like their peers in Peru and Ecuador, Bolivian smallholders are accomplished farmers engaged in commercial agriculture and open to innovation. Many have been enticed into the soy monoculture model, but they will respond to other options if they are economically competitive (see Chapter 3). The situation is more complicated in Colombia, where rural peasants have been coopted by drug cartels, land grabbers and cattle ranchers. Most would welcome a less onerous livelihood, but that will require peace and the establishment of the rule of law.[157]

It will be challenging to engage the smallholders of Brazil because their land has been captured by the Brazilian beef industry. These producers are more accurately described as small ranchers rather than small farmers. Their avocation for livestock also explains the relatively low proportion of secondary forest on their properties (Figure 4.17). Tropical farmers have

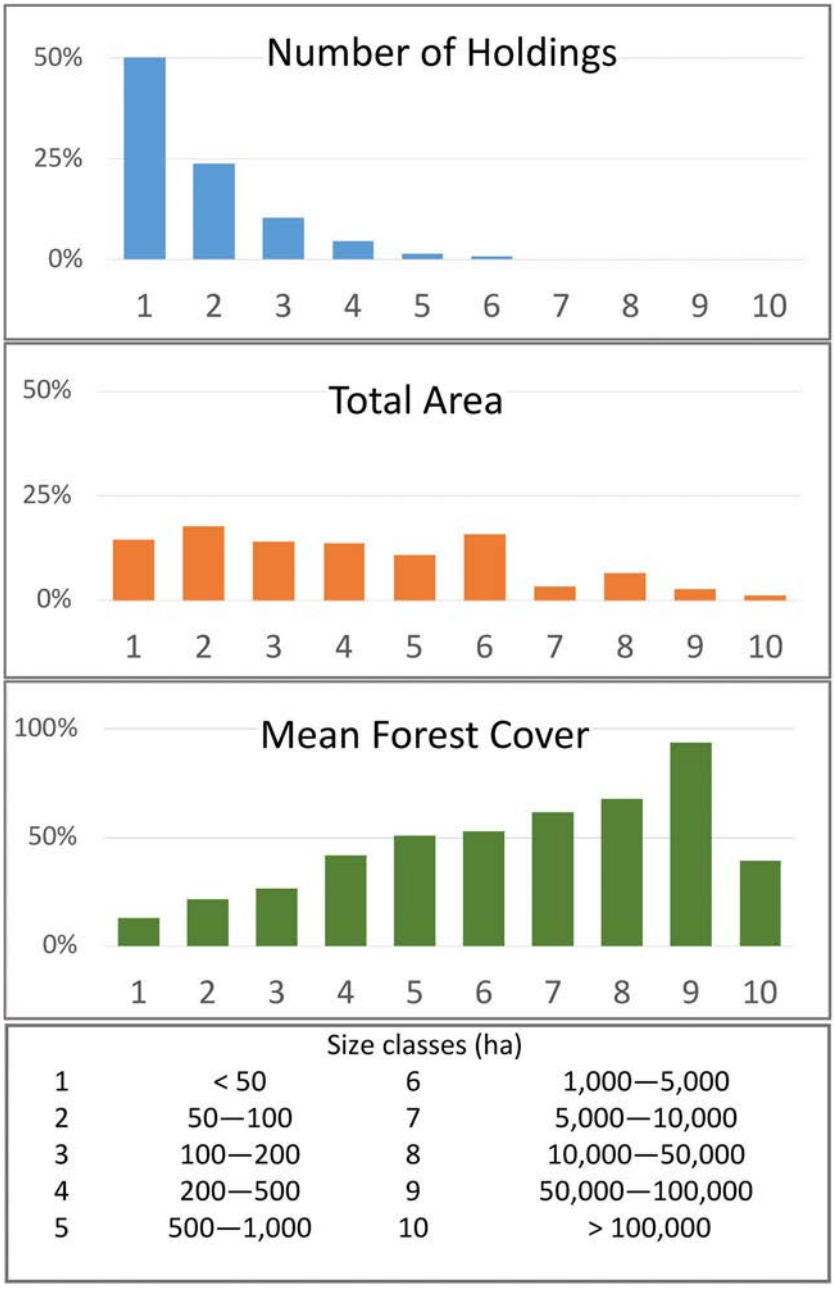
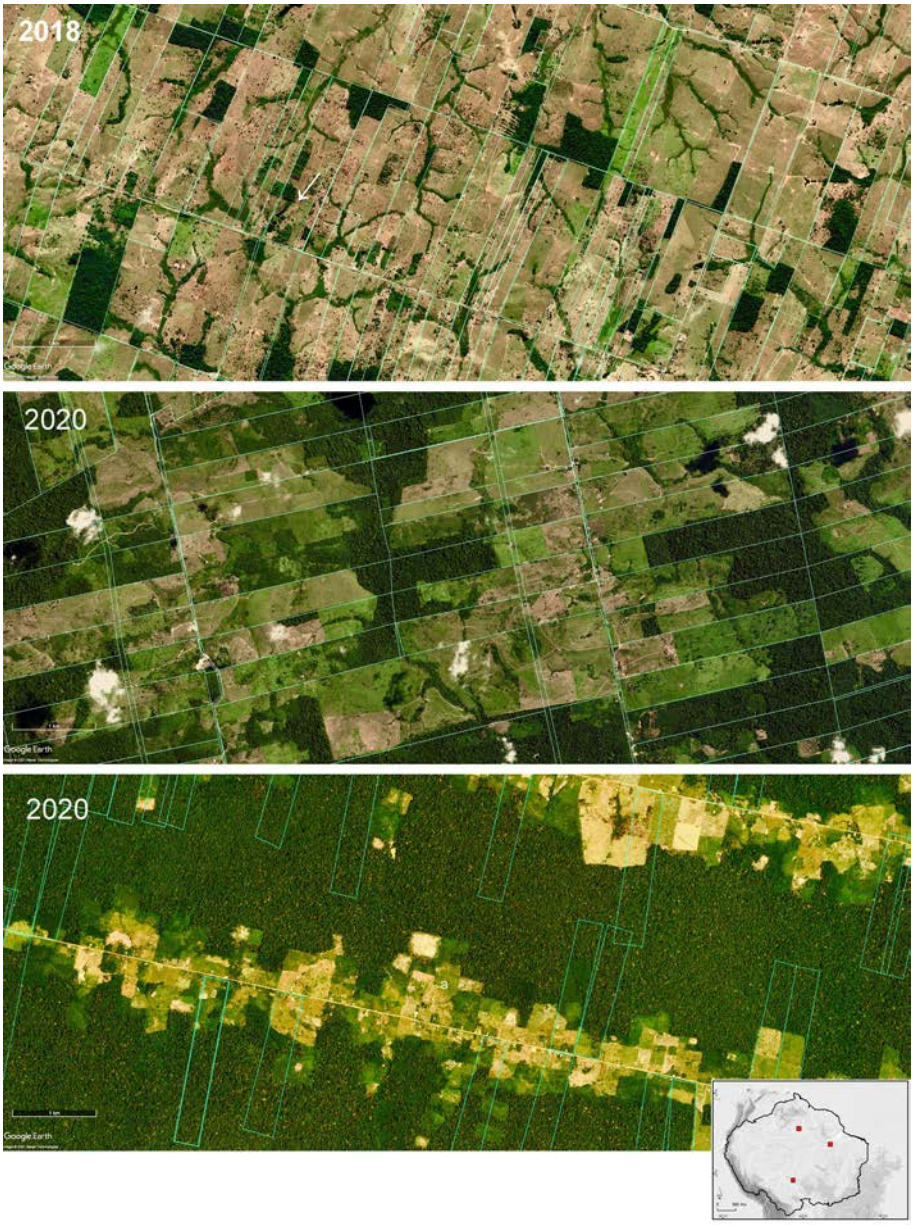


Figure 4.17: Rondônia has the largest population of smallholders in the Brazilian Amazon. As a group, they also have the lowest forest cover of any landholder. See Annex 4.10.

Data sources: IMAFLORA (2019) and MapBiomas (2021).



Source: Google Earth

The proportion of remnant forest on smallholdings (blue polygons) in Brazil varies greatly. Top: In Teixeirópolis (RO), degraded pastures cover ~90% of the area and watercourses lack forest corridors. Middle: In Altamira (PA), remnant forest is more abundant and pastures are less overgrazed, but there is little evidence of agroforestry systems. Bottom: In São Luis (RR), native forest predominates and forest fallow is prominent (a), but ongoing deforestation continues to reduce forest cover.

forest fallows but ranchers just convert everything to pasture. They also tend to consume remnant forest over time. Municipalities dominated by small ranchers in Acre, Rondônia and Pará are all characterised by a superabundance of pastures and an almost total absence of other production systems.

Fortunately, there are exceptions that show a different pathway for smallholders in Brazil. Municipalities near urban areas are a major source of basic foodstuffs and tropical fruits.* Region-wide, this production represents about eighty per cent of non-beef revenues, far greater than the value reported for cash crops that are grown in regions with specific programmes to support producers: coffee (Rondônia), cacao (along BR-230 in Pará), oil palm (northeast Pará) and black pepper (more widely in Pará). As in the Andean Amazon, aquaculture could revitalise the smallholder sector; however, it requires a significant capital investment and know-how that is different than traditional livestock systems. Small ranchers cannot shift to aquaculture without extension assistance and access to credit.

The potential to revitalise smallholder production could benefit from the expanding market for *açaí,* the most valuable food commodity in Amazonian Brazil (after soy and maize). Most of the current harvest originates from intensely managed natural populations located within communal territories.† Global demand will soon outstrip the capacity of natural populations and, eventually their consumers will pressure for changes in supply chains currently reliant on child labour and the over-exploitation of natural populations.[158] When this happens, the *açaí* industry will shift to cultivated plantations.‡ Fortunately, EMBRAPA has developed a technological package for cultivating *açaí* on upland landscapes using irrigation technology, and middle-class farmers near Belem have been cultivating the palm for more than a decade. The transition to cultivation, which is inevitable, could revitalise smallholder landscapes across the Central Amazon. The production model could also be exported to the high rainfall areas in the Andean Amazon.

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* Cassava, rice, beans, bananas, pineapple, citrus watermelons, passion fruit, papaya; excludes soy, maize, sorghum, cotton and oil palm, as well as industrial production of rice and sugar cane. Source: SIDRA – Sistema IBGE de Recuperação Automática (2021) Produção Agrícola Municipal: https://sidra.ibge.gov.br/pesquisa/pam/tabelas.

† *Projeto de Assentamento Agroextrativista* (PAE), Projeto de Desenvolvimento Sustentável (PDS); *Reserva Extrativa* (RESEX), *Reserva de Desenvolvimento Sustentável* (RDS).

‡ In 2019, gross revenues were reported as $US 900 million but are projected to reach $US 2.5 billion by 2025. North America is the largest market (greater apparently than Brazil), while the fastest growing market is Asia Pacific where consumers from China are renowned for their avocation for health food. Source: Market data forecast (April 2021), https://www.marketdataforecast.com/market-reports/acai-berry-market

The success of *açaí* has highlighted the potential of other palm fruits with unique nutritional value or an innate capacity to produce large volumes of vegetable oil. Most have nascent markets based on the exploitation of natural populations but are also candidates for domestication and incorporation into agroforestry systems (see Chapter 8). In the western Amazon, this includes *Oenocarpus bataua*[*] and *Mauritia flexuosa*,[†] which, like *açaí*, are adapted to high rainfall areas and marsh habitats. In the Southern Amazon, *Acrocomia aculeata*,[‡] a savanna species adapted to upland soils could easily be integrated into beef production operations for large and small ranchers (see Text Box 4.2).

Text Box 4.2: The Macaúba Palm

Acrocomia aculeta is a single-stem palm native to the dry forest and Cerrado savannas of the Southern Amazon; it is also a common constituent of secondary vegetation and cultivated pastures. The fruit and seeds are rich in fats and have been consumed by indigenous people for millennia. The species has potential as an industrial crop because its fruits and seeds can be processed into edible vegetable oils or used as a feedstock for the manufacture of consumer goods and biofuels. Pilot projects have been underway in Brazil for more than two decades, including one rated 'best in the world' by the Forest Investment Program (FIP) of The World Bank. That project successfully integrated macaúba's cultivation into cattle ranches as a 'silvopastoral' system (a type of agroforestry). EMBRAPA estimates that Brazil has more than 32 million hectares of degraded pastures that are appropriate for the cultivation of macaúba. If it were cultivated only in degraded pastures, with iron-clad proof that its cultivation did not stimulate indirect land-use change, it would qualify as a sustainable aviation fuel (SAF). In 2030, the projected demand for SAF has been valued at $US 30 billion, but the total addressable market for aviation fuel in 2020 was $300 billion. Presumably, the ranchers of the southern Amazon could be convinced to embrace a zero-deforestation production strategy for a global market that is complimentary to the production of beef.

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* Common names: *Ungurahui, Bataua*; *Majo* (Bolivia); *Palma seje* (Venezuela); *Patauá* (Portugués). Source: d'Eeckenbrugge and Ferla (2000).

† Common names: *aguaj*e (Perú), *burití* (Brasil), o *morete* (Ecuador), *palma de moriche* (Venezuela, Bolivia, Colombia), *palma real* (Bolivia). Source: d'Eeckenbrugge and Ferla (2000).

‡ Common names: *macauba* (Brazil, Argentina Paraguay), *corozo* (Venezuela, Colomvia), *totaí* (Bolivia), macaw palm (English). Source: d'Eeckenbrugge and Ferla (2000).

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The Macauba palm. (See Text Box 4.2)

Reforestation and Restoration

One of the benefits of agroforestry and plantation forestry is the ability of tree crops to capture and store carbon in their above-ground biomass. Although they must be renovated (cut down and replanted) at approximately twenty-year intervals, agroforest and plantation landscapes can sequester ~20% of the carbon stored in a natural forest.* Even more carbon can be captured via the restoration of natural habitat; there are ~10 million hectares of land that should never have been cleared because it was legally protected by the Forest Code.[159] Presumably, this land will eventually be reforested, and hundreds of initiatives are underway to facilitate that outcome.† It is not, however, an inexpensive proposition.

Brazilian foresters have developed models that reflect the cost and benefits of different reforestation strategies. Passive restoration approaches, which rely on natural ecological succession, are less expensive and function well for lands that retain a certain level of vegetative cover (shade and soil organic matter). Active approaches, which employ soil amendments, nurseries, weed control and periodic culling, are more expensive; however, they allow the landowner to manipulate tree populations to favour native hardwoods (silviculture) and obtain a comfortable financial return – if the landholder can afford to wait three decades (Figure 4.18). Investments in reforestation and restoration must be protected from fire and grazing, particularly during the early years of their establishment. This is an additional cost but also a long-term commitment that may not accompany all passive approaches focusing on natural systems.

According to hydrological models, tropical landscapes need to retain about sixty per cent of their canopy cover to maintain the atmospheric recycling that supports historical levels of precipitation. This would require the reforestation of approximately fifteen million hectares in the most heavily denuded municipalities of the Southern Amazon. A reforestation programme of this magnitude would require at least a decade to implement, if not longer, and demand a total budget of between $US 20 billion (passive) to $US 100 billion (active).

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* The proportion depends on time scales and natural disturbance. Primary forest in the Amazon varies between 100 and 300 tons C per hectare, while plantation forests harvested at 20-year intervals have a mean carbon density of about 50 tons C per hectare.

† *Aliança pela restauração na Amazônia* has identified 2,773 forest restoration initiatives in the Brazilian Amazon, totaling 113,500 hectares. The largest number were agroforestry systems (59%), but ecological restoration covered the largest spatial areas. Civil society organisations are leading the way, but companies account for 52% of the total area under restoration. See: https://aliancaamazonia.org.br/

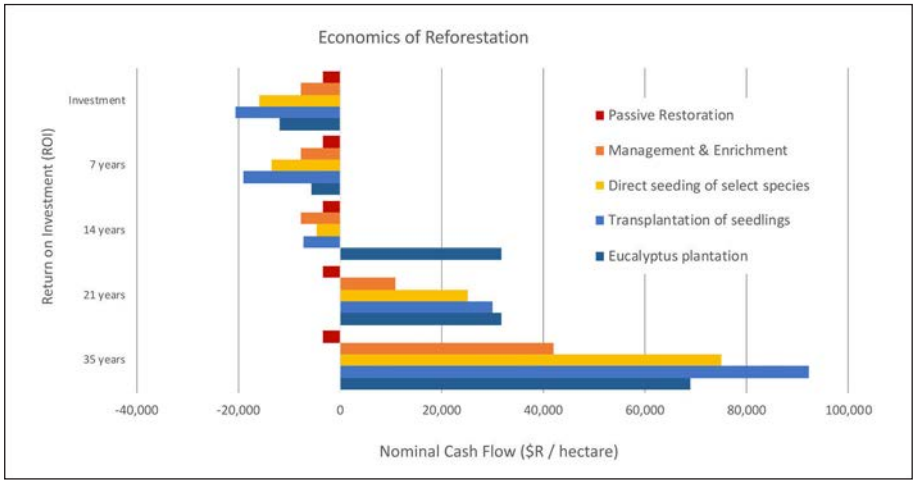

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Figure 4.18: The financial return from reforestation and plantation forestry depends on the capital outlay associated with different management options and the value of native hardwood timber. Passive restoration is the least expensive, but silvicultural interventions dramatically improve the return on investment if the landholder can wait decades to monetise the investment. Eucalyptus plantations are culled at seven years and are harvested and replanted every fourteen years.

Data source: Instituto Escolha (2021)

Large-scale ranchers and farmers can access the ESG finance necessary to realise an investment of this magnitude, but they will only do it if they are forced to comply with the Forest Code. Most will use passive methods wherever possible, particularly on land that is off-limits to any future economic exploitation (*Áreas de Proteção Permanente*). They will use active protocols on landscapes that allow them to recover their costs (*Reserva Legal*) and many will opt for cultivating commercial (exotic) species in monocultural plantations, which is allowed in some instances (see Chapter 7). This type of forest investment will be eligible for loans that have been underwritten by green bonds or, perhaps, via direct equity investments for investors with an appetite for an illiquid long-term asset.

Smallholders are not likely to attract investment in reforestation from private capital markets. However, local and regional jurisdictions could access climate finance via carbon markets and use those funds to subsidise programmes that target this constituency. Environmental advocates tend to favour reforestation schemes and offer landholders a modest stipend as a

form of payment for ecosystem services.* Regardless of the fate of climate finance linked to carbon markets, however, agroforestry systems will be more popular among small ranchers and farmers in need of a reliable source of income.

Agroforestry systems can cost between $US 1,500 to $US 2,000 per hectare but would require a parallel investment in logistical systems to collect and process a diffuse supply chain scattered across thousands of smallholdings, particularly for a production system based on vegetable oil subject to spoilage (see Text Box 4.2). Investments to create a tree-based production system on approximately half of the denuded landscapes of central Rondônia would require at least $US 10 billion, which translates into ~$US 100,000 for each small farm in Rondônia.

Rebalancing the Tipping Point in the Southern Amazon

The threat of climate change has highlighted the importance of the Amazon Rainforest in the global carbon cycle, while underscoring the fragility of its atmospheric water recycling system. Deforestation risks pushing that system past a 'tipping point', which would trigger a collapse in precipitation across the South American continent. Ominously, some climate models project the Southern Amazon could pass this critical threshold even if the region's inhabitants agree to end all future deforestation.

If a loss of forest cover tips the atmospheric scale towards drought, then an increase in tree cover should rebalance the ecological fulcrum. Support for reforestation is universal, but it is actually more difficult than stopping deforestation. Clearing a forest generates revenues over the short term, while restoring a forest is extraordinarily expensive and inherently slow. Moreover, the word 'reforestation' means different things to different people: an ecologist uses the term to describe the restoration of a [quasi] natural ecosystem, while some foresters use it describe commercial tree plantations. Both concepts are valid and both must be harnessed to rebalance the tipping point in the Southern Amazon.

Amazonian societies have never asked for a handout, but their representatives have stated, repeatedly, the need for economic incentives to reward forest conservation and reforestation. Environmental economists have long predicted that carbon markets would provide those incentives, but they have failed, repeatedly, to materialise. Carbon offsets are being

* The agreement announced at COP26 should expand demand for corporations seeking nature-based carbon offsets; unfortunately, it did not resolve the arcane accounting issues that characterise REDD+ projects. Fortunately, it is supportive of jurisdictional approaches that are being developed and tested in the Pan Amazon. Source: C. Streck, (2021) What Does the Article 6 Rulebook mean for REDD+? https://www.ecosystemmarketplace.com/articles/what-does-the-article-6-rulebook-mean-for-redd/

promoted again following the agreements at COP26 in 2021, and they may succeed finally in ending the modern era of deforestation. Unfortunately, subsidies based on offsets are unlikely to change the economic logic that constrains tree planting at the scale and speed necessary to rebalance the tipping point.

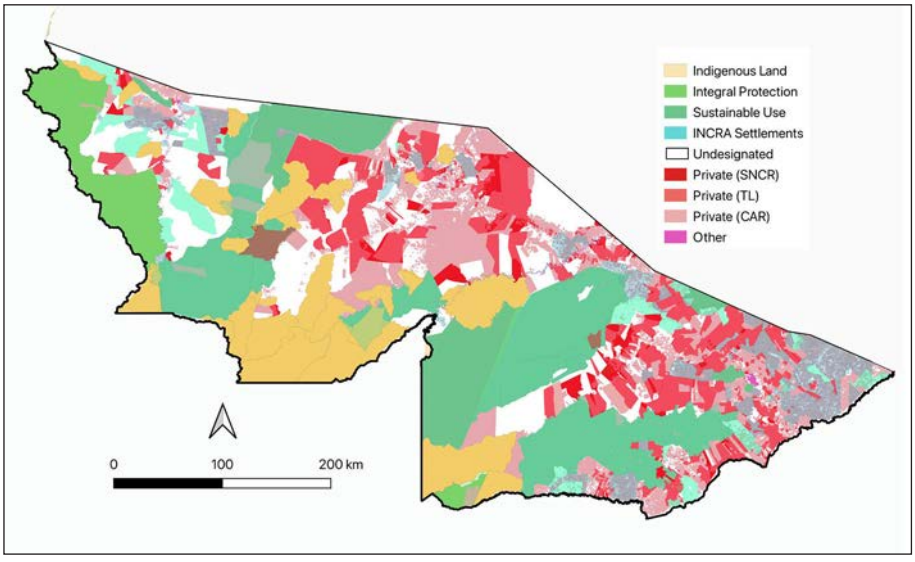
Amazonian producers, large and small, grow commodities for global and national markets. They are not likely to abandon their conventional production systems for reforestation projects that are overly reliant on regulatory subsidies, particularly if they take two or more decades to provide substantive revenues. The farmers and ranchers of the Southern Amazon might, however, use climate finance to invest in tree-based systems to produce green commodities that provide solid returns over the medium-term. Commodity markets have driven the deforestation of the Amazon. Markets for green commodities can drive its reforestation.

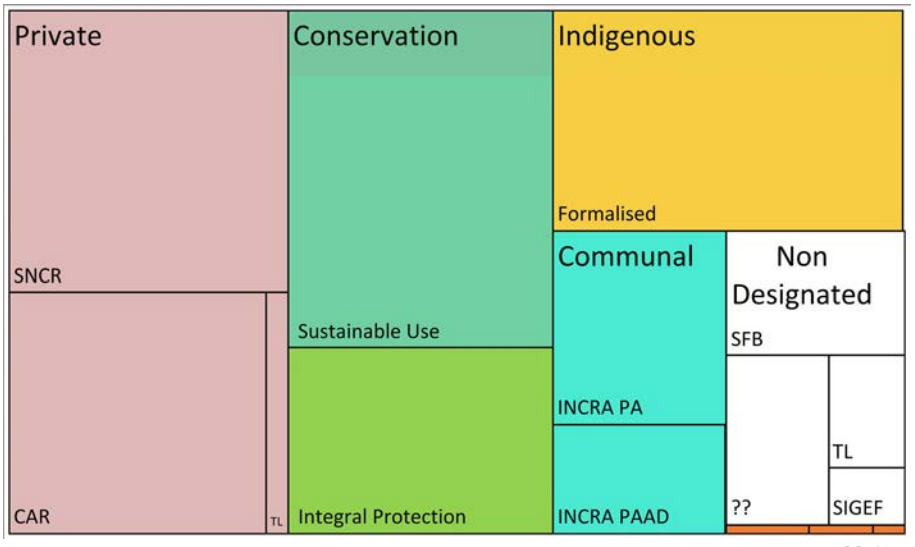
What defines a green commodity? A green commodity must be absolutely and verifiably carbon negative. It cannot rely on a carbon offset to reach neutrality. Its production must actually sequester carbon. There can be no leakage or indirect land-use change. If it originates in the Amazon, its production must respond to the inequality that defines land ownership and provide governance mechanisms to prevent cheating and ensure transparency within its supply chain.

The key to rebalancing the tipping point in the Southern Amazon is to discover business models that provide landholders with an economic return that is demonstrably superior to conventional production systems. The goal, simple in concept but difficult to implement, is to make planting trees more profitable than clearing forest. Tree-based production systems established on the previously deforested landscapes in the Southern Amazon can meet that criterion.

Annex 4.1: Acre

In Acre, relatively large forest holdings (registered in the SNCR) and claims (registered in the CAR) jointly represent the largest category of land tenure. Most inhabitants in INCRA PA-type (agrarian) settlements have registered their landholdings in the CAR database as individual landholdings.





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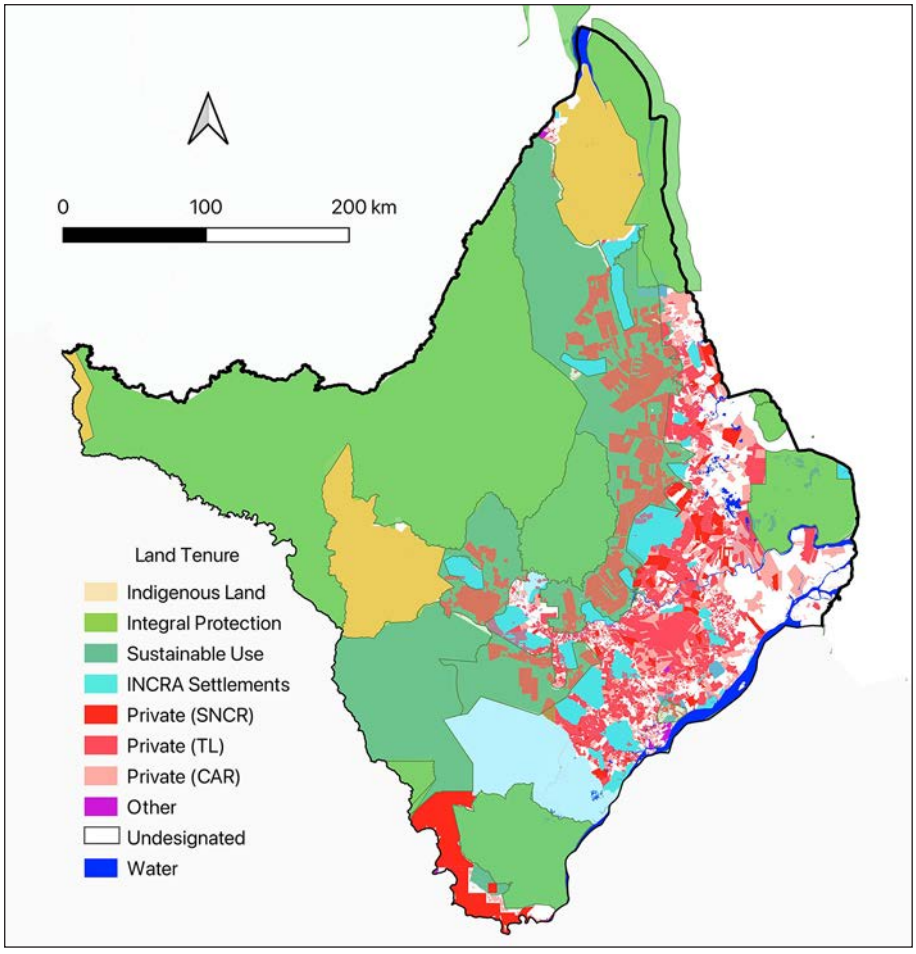
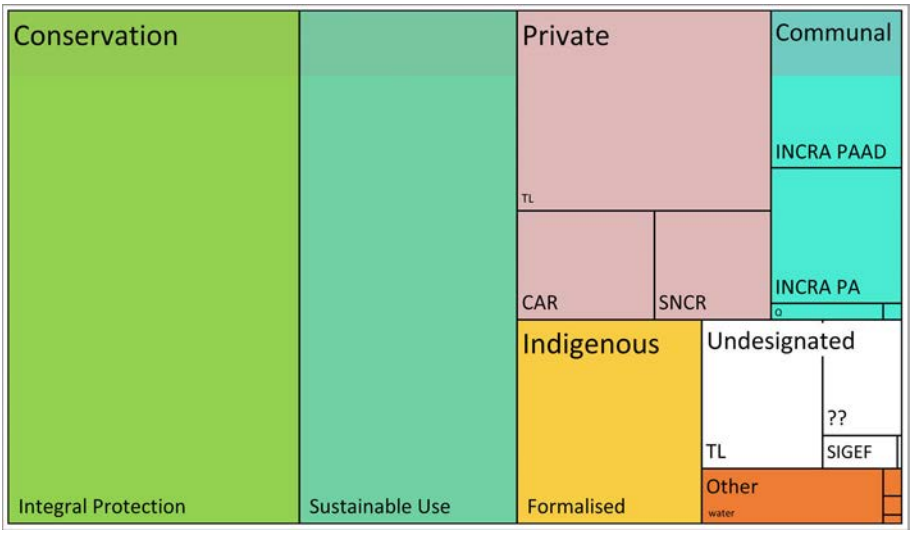
Data sources: INCRA (2020) and IMAFLORA (2019).

Annex 4.2: Amapá

Amapá is the only state in the Brazilian Amazon where Conservation Units incorporate more forest than Indigenous Land. The Terra Legal (TL) programme registered 1.6 million hectares of landholdings, more than five times that previously registered in the SNCR; approximately 43% are located within the Floresta Estadual do Amapá, a sustainable use protected area.



Annex 4.3: Amazonas



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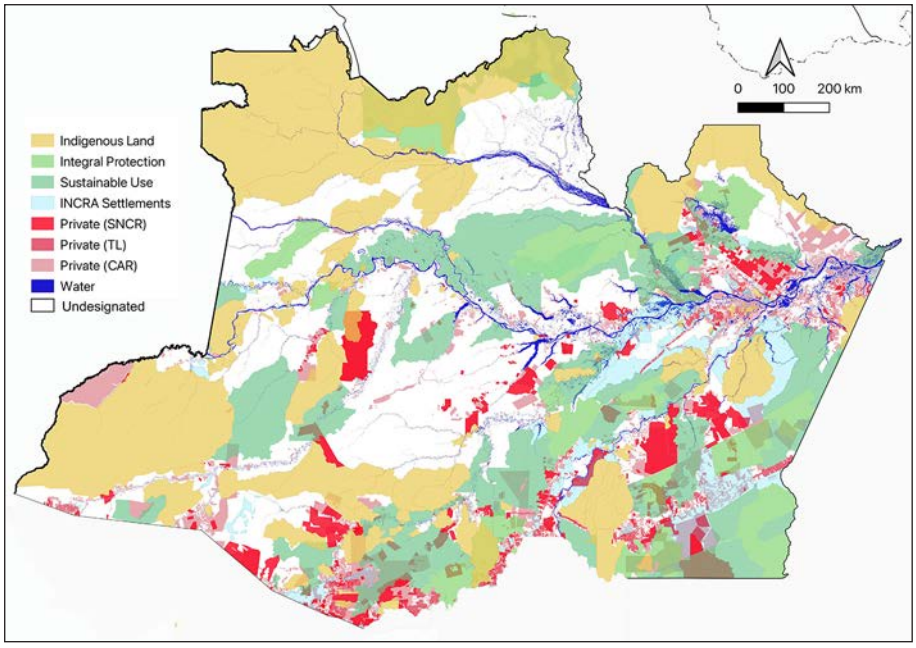
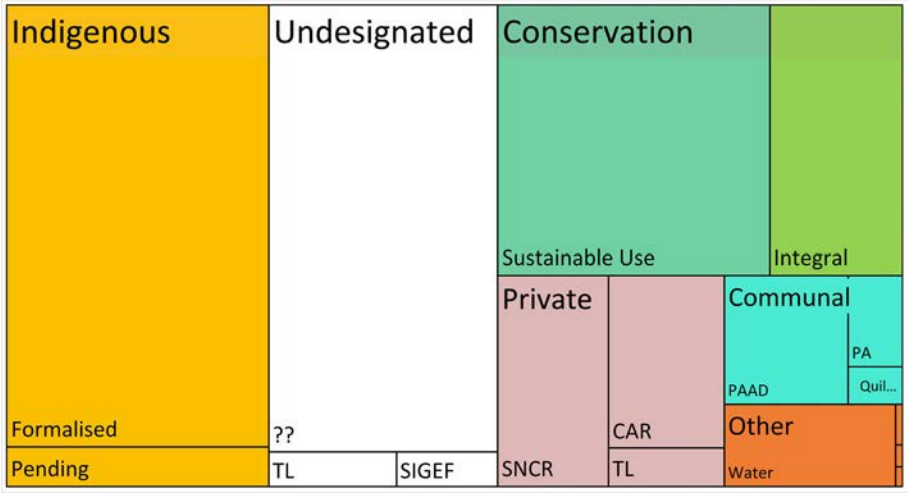
Amapá Land Tenure
Data sources: INCRA (2020) and IMAFLORA (2019).

Annex 4.3: Amazonas

In Amazonas state, large forest estates represent the greatest area of private holdings and claims in both the certified (SNCR) and environmental (CAR) cadasters. Most INCRA projects are PAAD-type settlements similar to ICMBio conservation units (RESEX, RDS, FLONA), managed for the sustainable use of forest and aquatic resources. Approximately 31% (37.2 million hectares) has yet to be allocated into a specific land use category.





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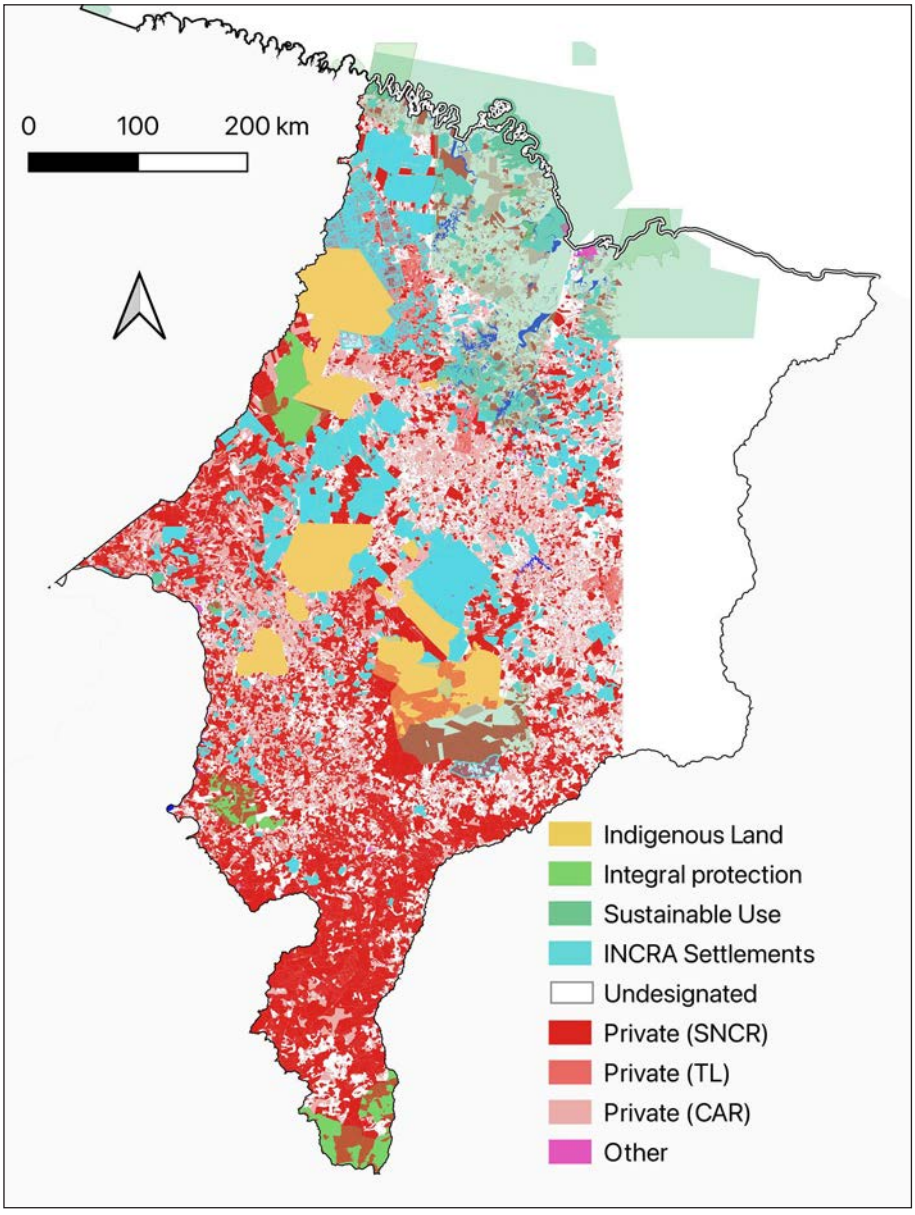
Data sources: INCRA (2020) and IMAFLORA (2019).

Annex 4.4: Maranhão

The limited number of conservation units and indigenous territories in Maranhão are surrounded by agrarian landscapes. The greatest concentration of certified landholdings are located in the intensive agricultural landscapes of the Cerrado Biome in the southern sector of the state.



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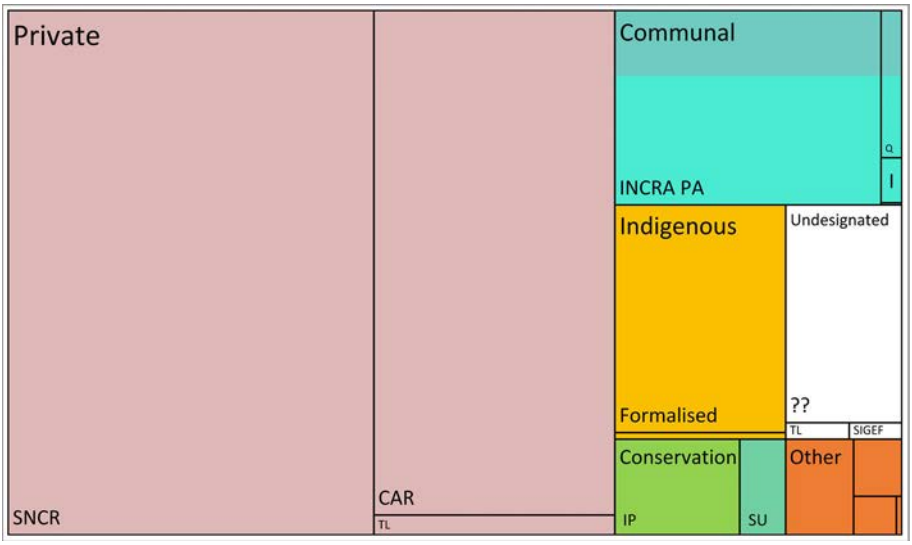

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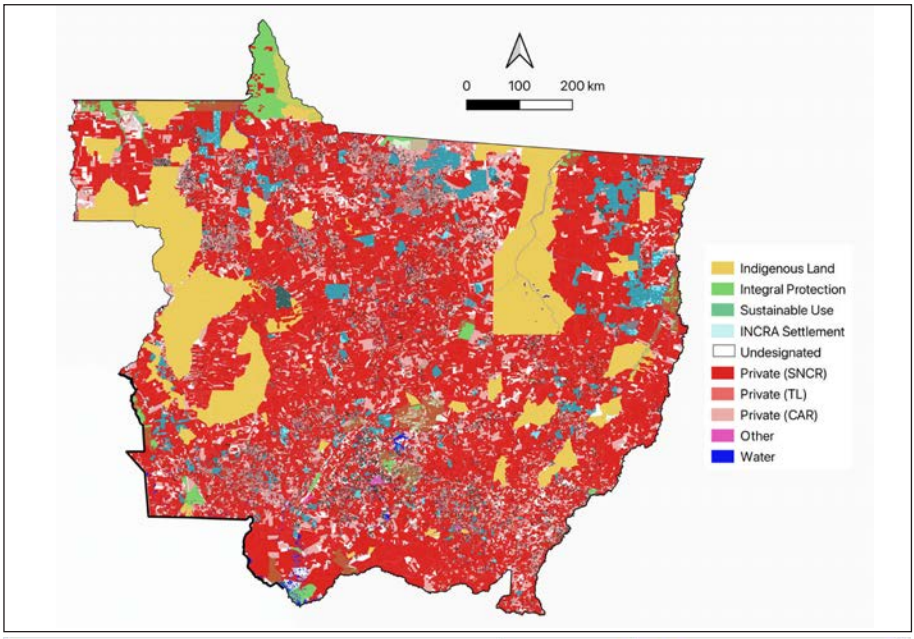
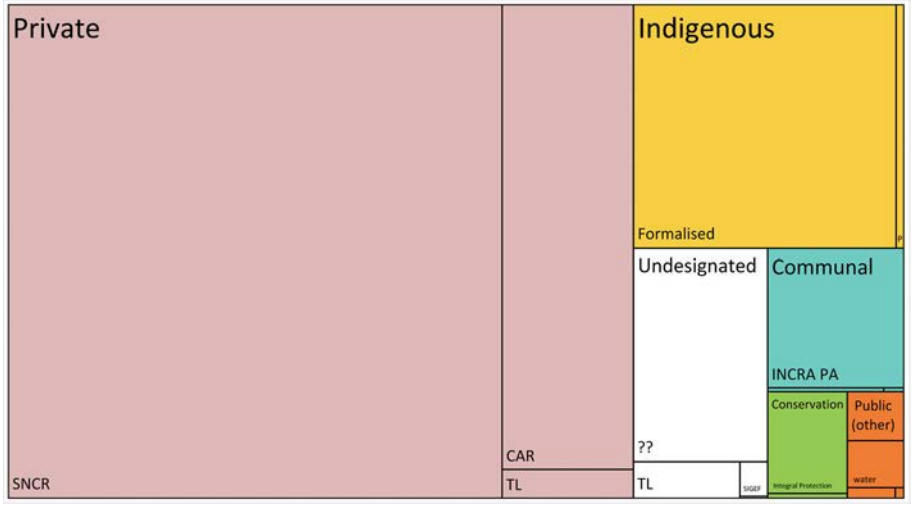
Maranhão Land Tenure.
Data sources: INCRA (2020) and IMAFLORA (2019).

Annex 4.5: Mato Grosso

The tenure regularisation process is well advanced in Mato Grosso. Landholdings certified by the SNCR cover a greater area than those registered only in the CAR. The state is notable for its scarcity of conservation units and the importance of indigenous territories for the long-term conservation of natural forest; approximately 53% of remnant natural forest is located within privately held landholdings. Most of the undesignated land is probably claimed or occupied by individuals who have not registered their holdings in either the CAR or the SNCR.





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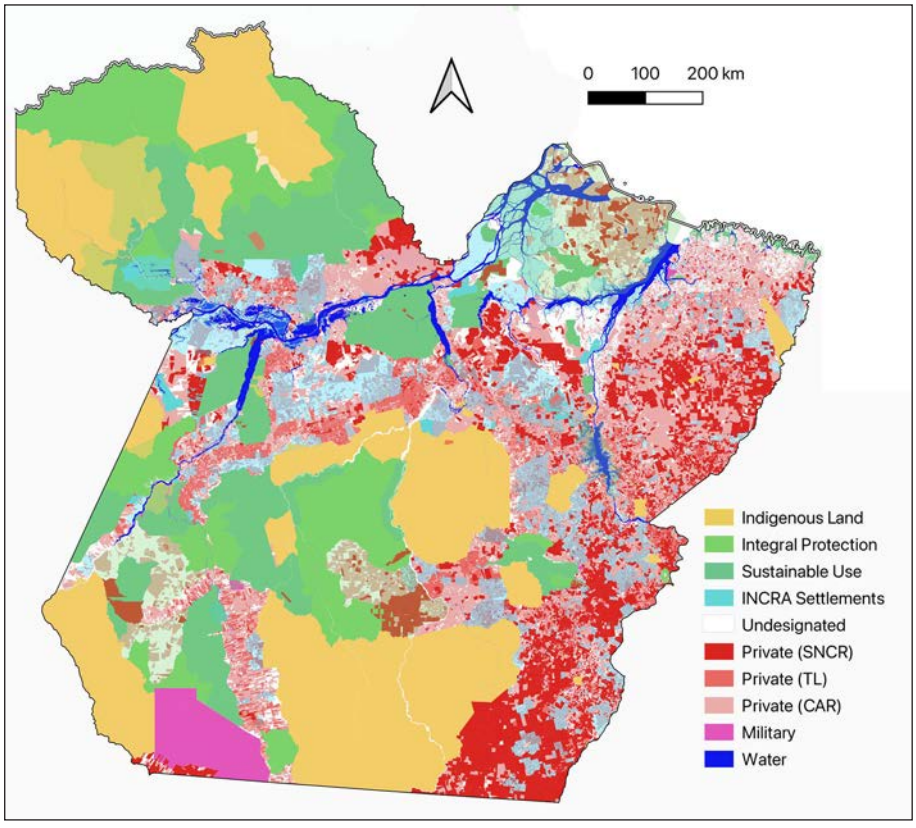
Data sources: INCRA (2020) and IMAFLORA (2019).

Annex 4.6: Pará

There is a large gap in the title regularisation process in Pará due to: an abundance of smallholdings; the presence of numerous medium- to large-scale cattle ranches claiming lands within Sustainable Use Conservation Units; and the dubious claims of land grabbers and settlers on public land on frontier landscapes zoned for settlement.



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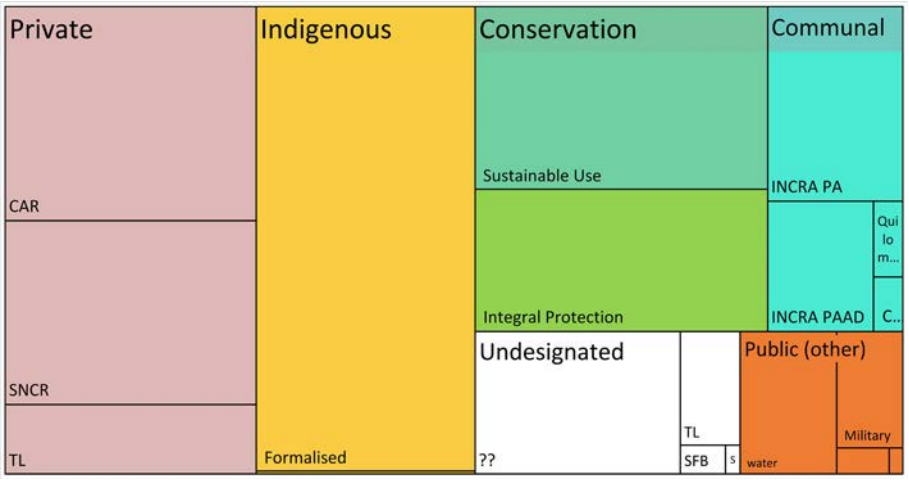
Annex 4.6: Pará



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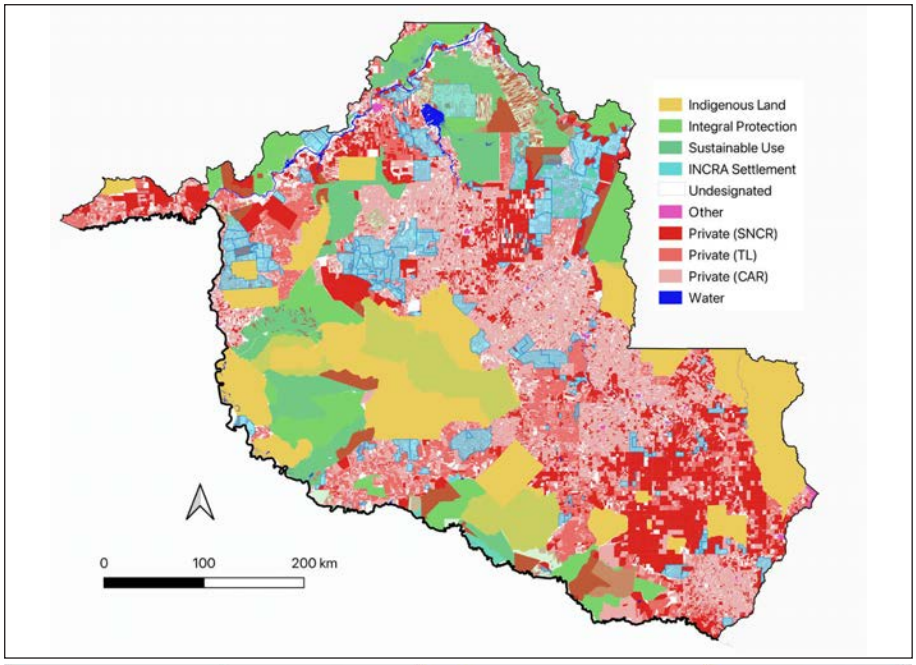
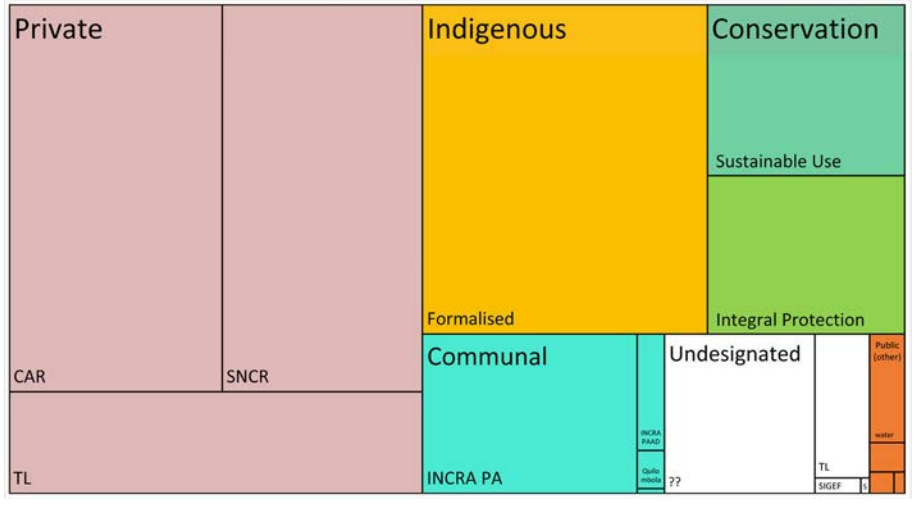
Pará Land Tenure
Data sources: INCRA (2020) and IMAFLORA (2019).

Annex 4.7: Rondônia

In Rondônia, landholdings registered in the SNCR are concentrated in areas dominated by large to medium-sized estates. Most smallholdings have not been regularised, although the vast majority are registered within the CAR, as are the individual holdings within the INCRA PA-type settlements. The most conflictive landscapes are in the North where settlers are invading sustainable-use conservation units; undesignated public lands are occupied by individuals with plausible claims to ownership.





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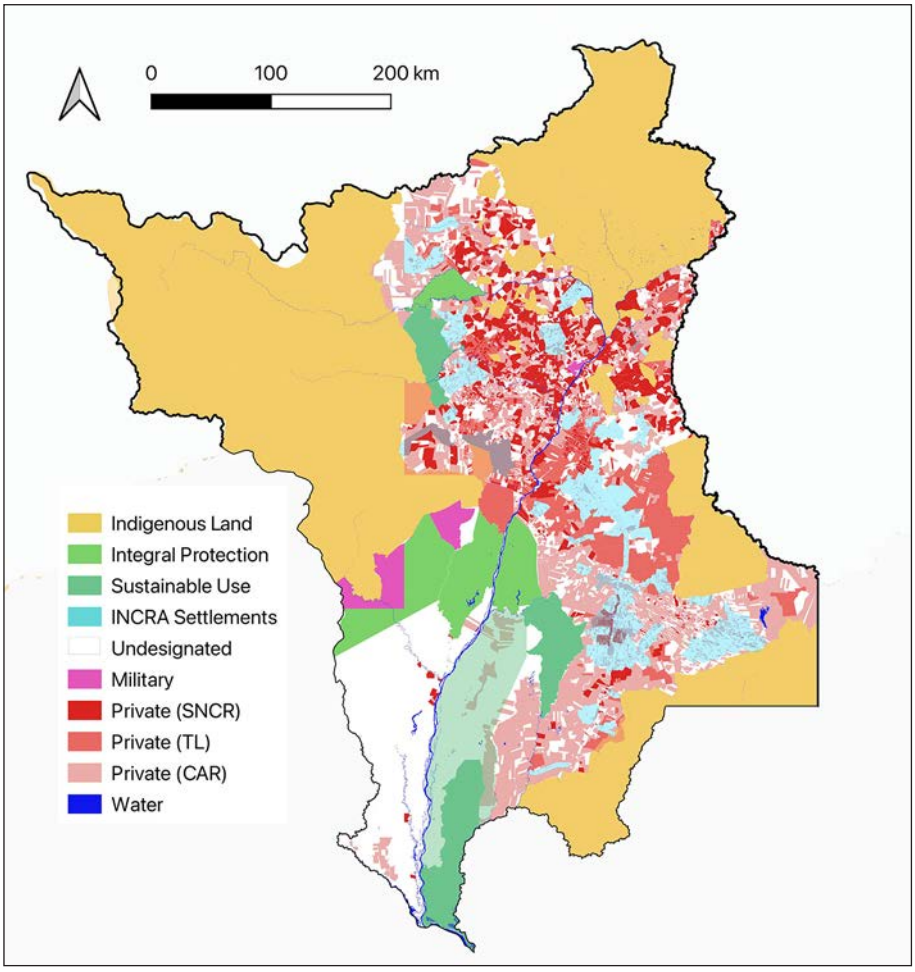
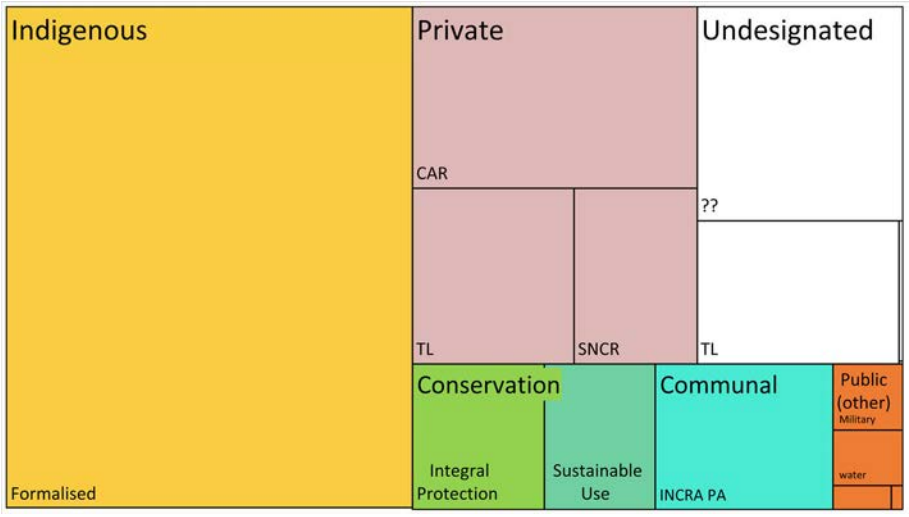
Data sources: INCRA (2020) and IMAFLORA (2019).

Annex 4.8: Roraima

Indigenous Territories are the largest land tenure category in Roraima. The regularisation process has advanced for larger holdings on the savanna landscapes but less so in the smallholder landscapes in the southern municipalities, where inhabitants of INCRA PA-type settlements are also registering their holdings in the CAR system. The holdings registered by the Terra Legal (TL) process are largely forest properties with low levels of deforestation.





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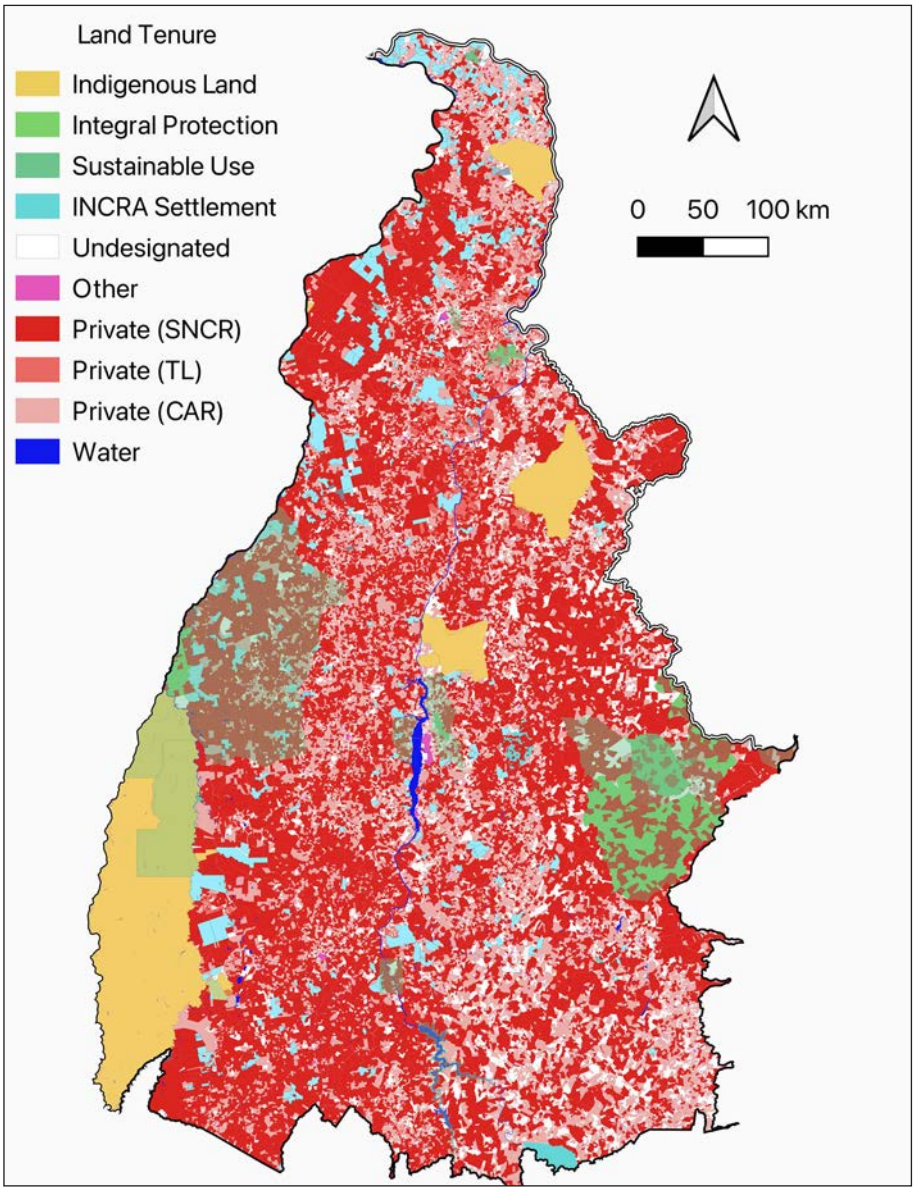
Roraima Land Tenure
Data sources: INCRA (2020) and IMAFLORA (2019).

Annex 4.9: Tocantins

Private landholdings registered within the SNCR are the largest category in Tocantins, in part due to the predominance of medium- to large-scale estates on Cerrado landscapes that were settled in the 1960s and 1970s. Most (all) of the conservation units have inholdings within their boundaries.



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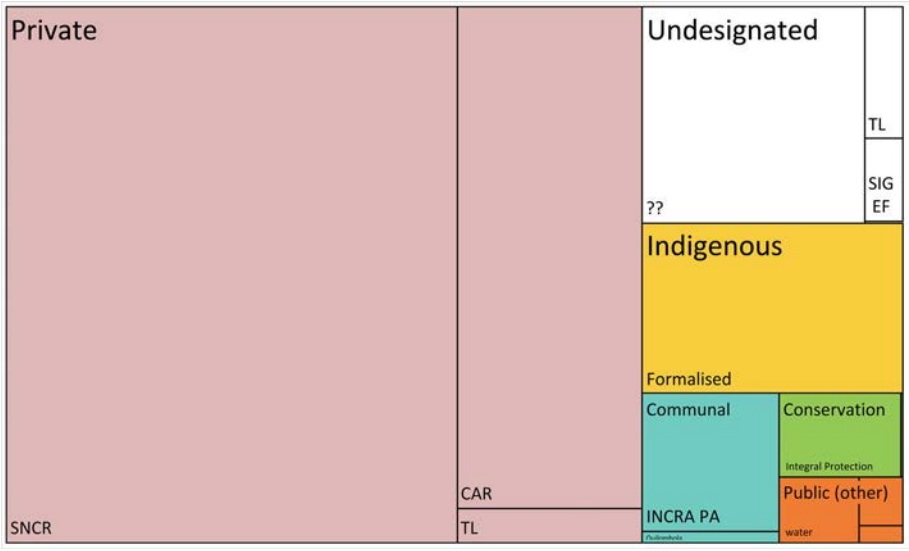

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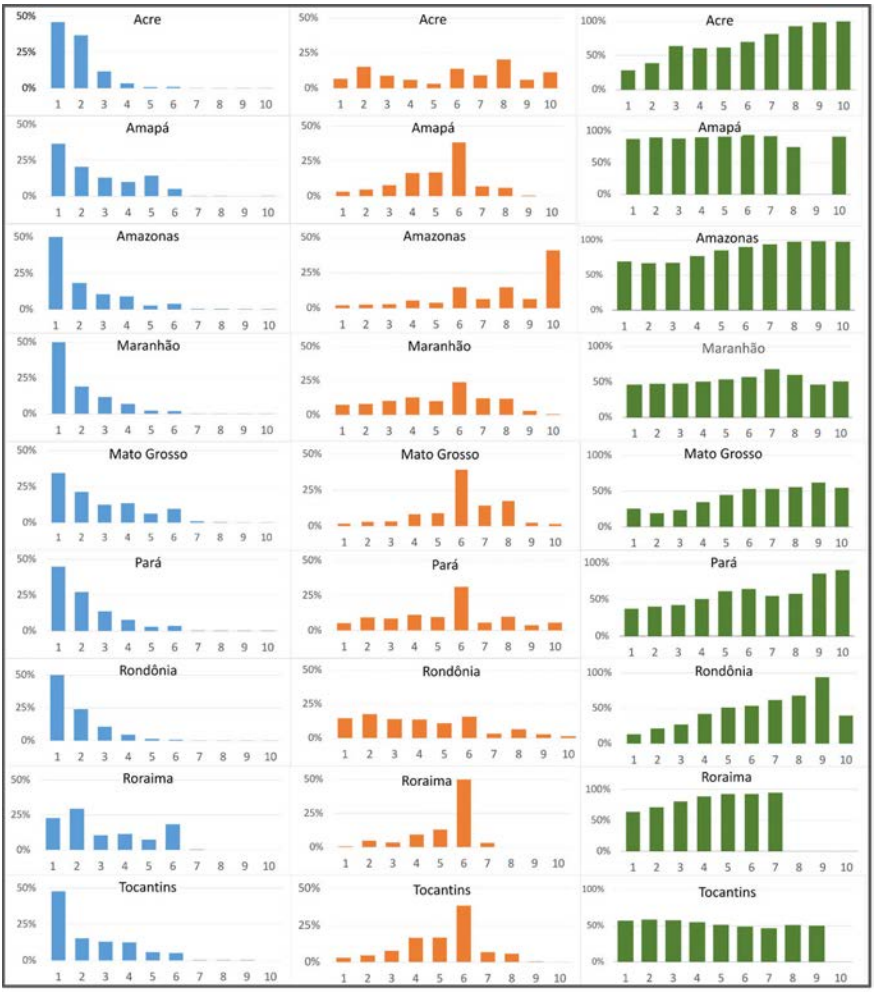
Tocantins Land Tenure
Data sources: INCRA (2020) and IMAFLORA (2019).

Annex 4.10: Land Tenure Metrics for Private Landholdings in the Brazilian Amazon

Inequality in land tenure is evident when comparing the number (left column) and surface area (middle column); only Rondônia and Acre have relatively egalitarian patterns of land tenure. Smallholdings retain much less remnant forest when compared to medium and large-scale estates (right column); the disparity is particularly noticeable in Rondônia, Pará, Acre and Mato Grosso.



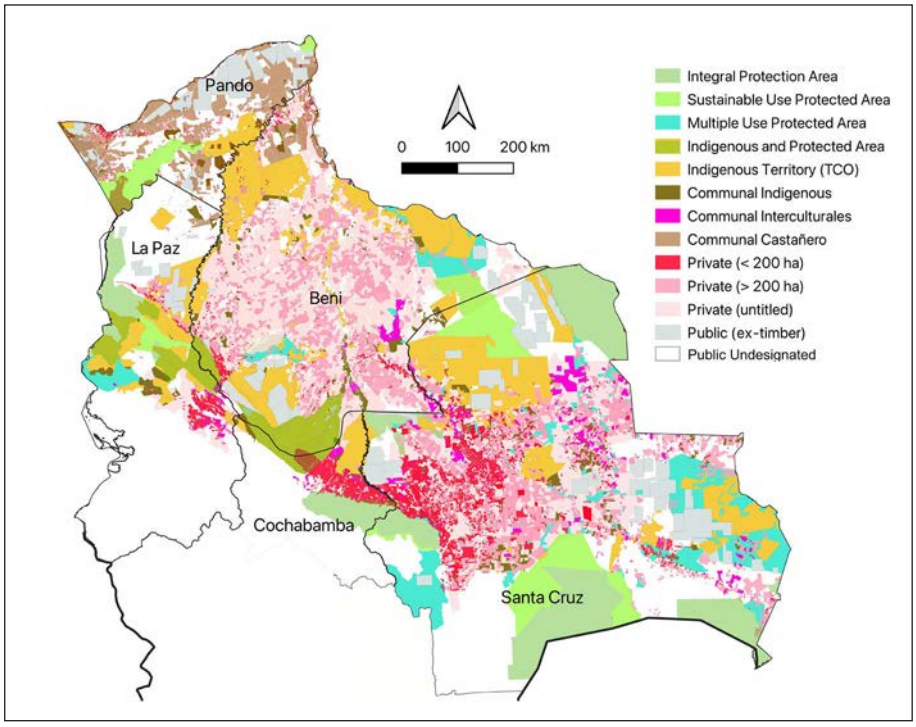
Size classes (ha)			
1	< 50	6	1,000—5,000
2	50—100	7	5,000—10,000
3	100—200	8	10,000—50,000
4	200—500	9	50,000—100,000
5	500—1,000	10	> 100,000

CC BY 4.0

Data sources: IMAFLORA (2019) and MapBiomas (2021).

Annex 4.11: Bolivia

In Bolivia, the land tenure review process (saneamiento) has prioritised smallholders and communal landholdings in the northern part of the country (Castañeros). Recent land grants to settler syndicates with residents that self-identify as Interculturales will probably be redistributed as smallholdings. A backlog of medium and large-scale landholdings is awaiting review, particularly on the savanna landscapes in the Department of Beni. Undesignated lands include forest blocks that were granted as 30-year timber concessions in the late 1990s; most have been clawed back by the state and are viewed by many as a land bank for eventual distribution and settlement.



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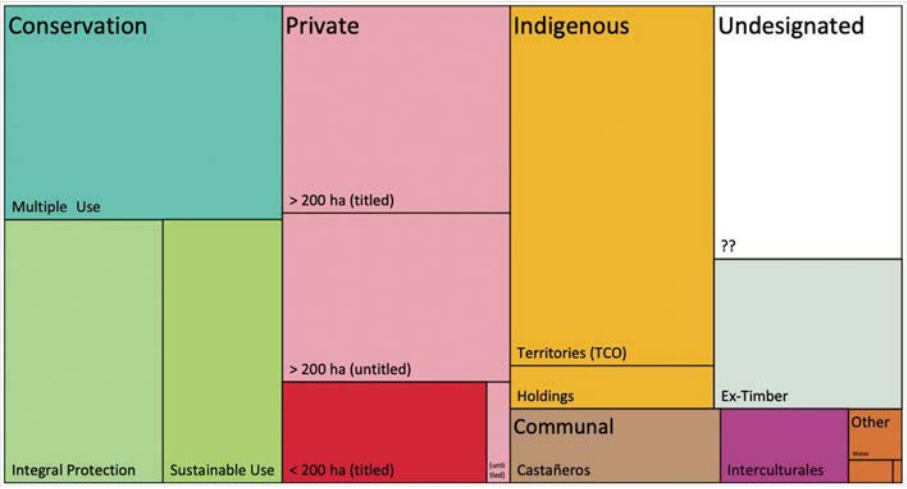
Annex 4.11: Bolivia



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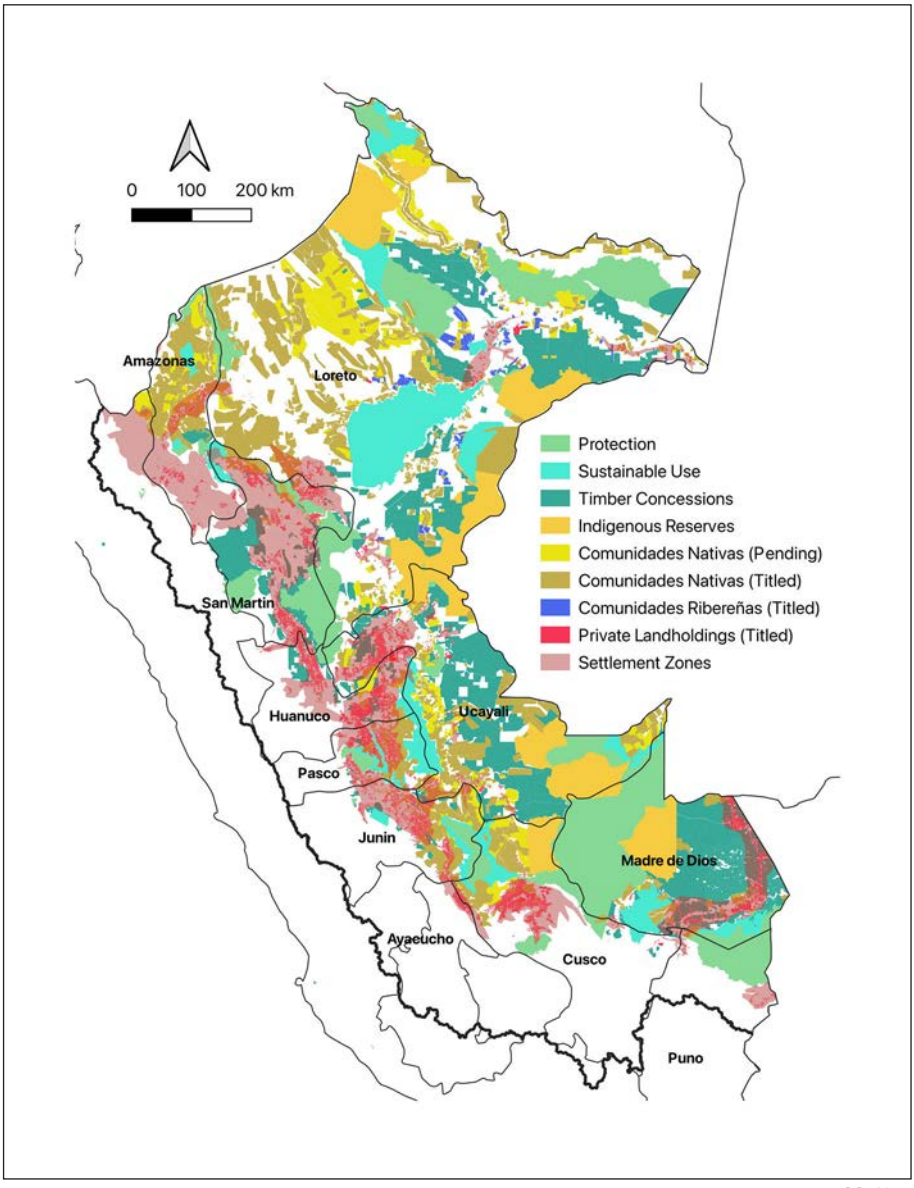
Bolivia Land Tenure

Data sources: Colque et al. (2016) and INRA (2018).

Annex 4.12: Peru

The distribution of landholdings in the Peruvian Amazonian is the most egalitarian in the Pan Amazon, but less than 25% have passed through the title review process. The country has the second largest area of undesignated public lands, a source of contention and competition among the timber sector, settlers, indigenous groups and ribereña communities.



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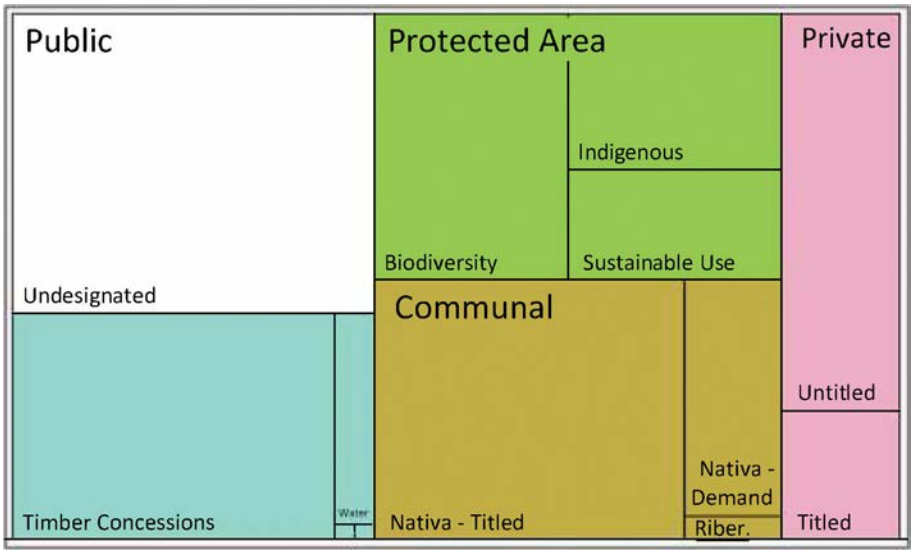
Annex 4.12: Peru



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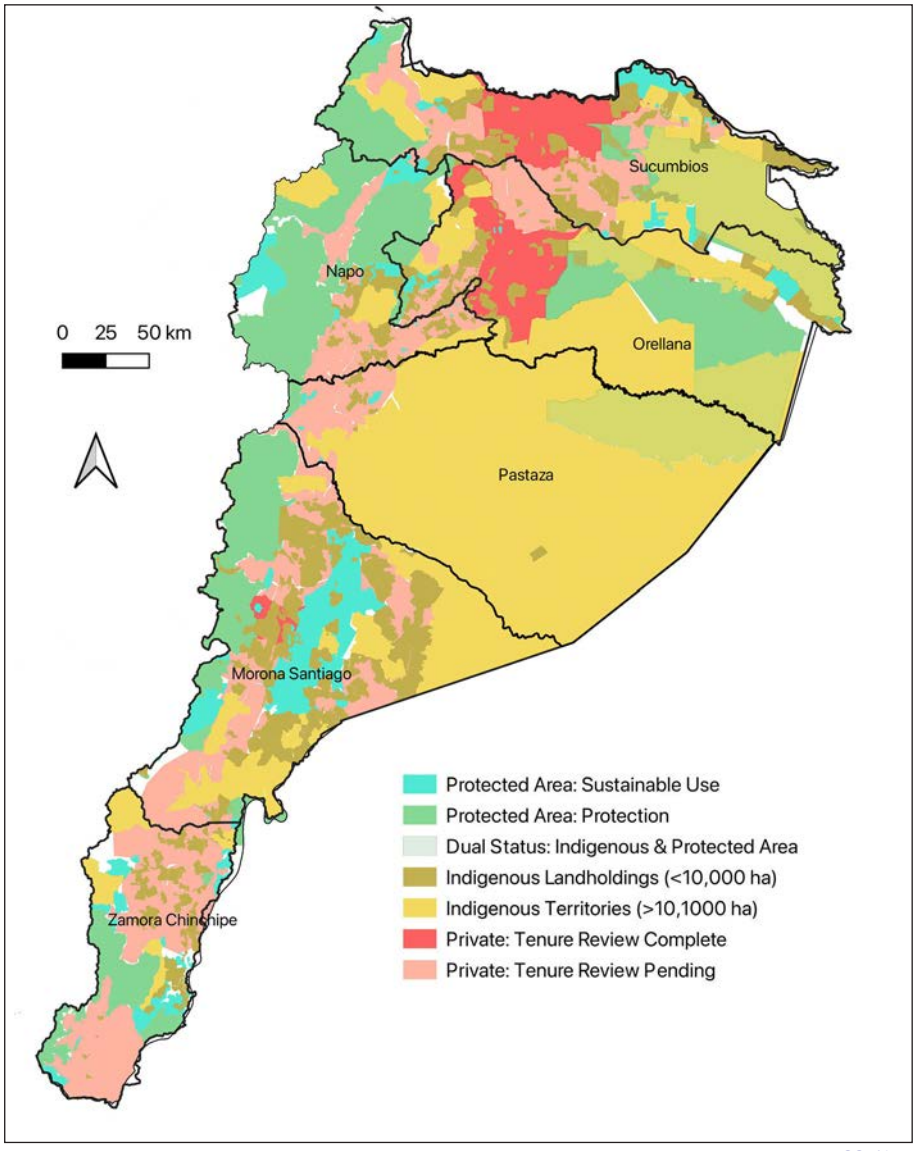
Peru Land Tenure
Data sources: IBC (2021), SICAR (2020) and RAISG (2021).

Annex 4.13: Ecuador

Ecuador has essentially closed its Amazonian provinces to new settlement, but agriculture and deforestation continues to expand along the margins of the existing agrarian landscapes. Most landholders hold a title, but the title review process has only advanced through three of 47 municipalities (cantones). There are two types of indigenous territories: landholdings surrounded by private properties and large reserves that span 'wilderness' landscapes.



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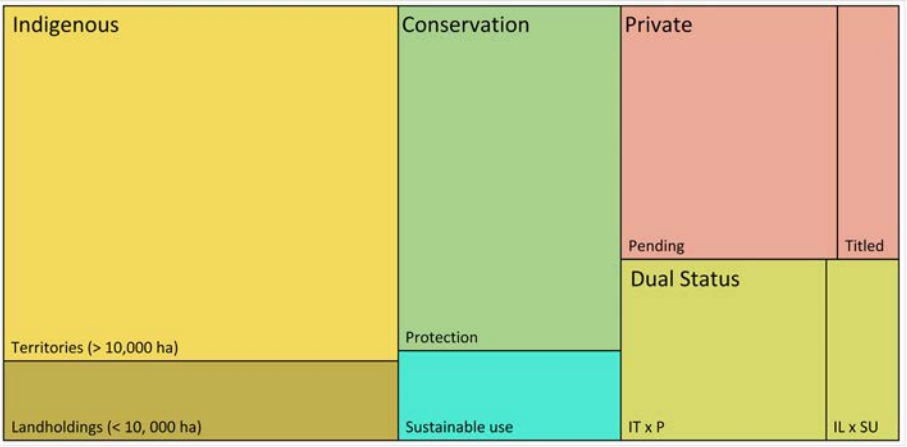
Annex 4.13: Ecuador



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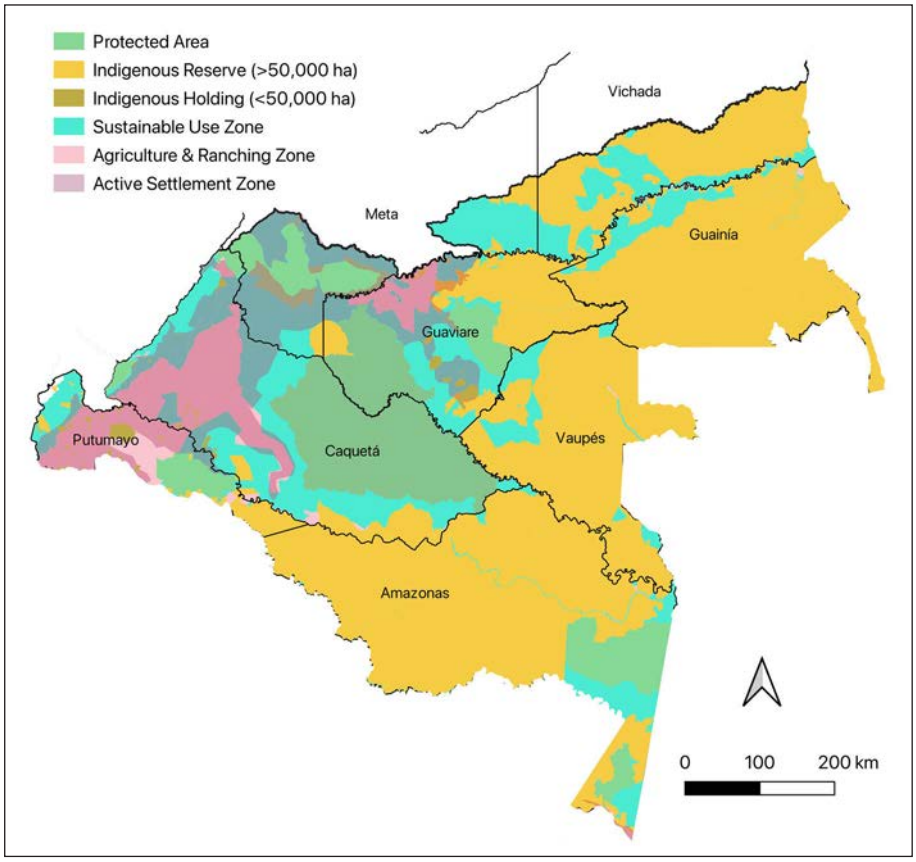
Ecuador Land Tenure
Data source: RAISG (2021).

Annex 4.14: Colombia

Most of the Colombian Amazon region was declared a 'Forest Reserve' in 1969 but only areas that have been reallocated into a specific indigenous reserve or protected area enjoy a (limited) level of protection from settlers and land grabbers. There is an active forest frontier that extends along the Andean piedmont through Putumayo, Caquetá and Guaviare Departments. The number and size of land holdings is unknown because there is no organised land registry at any scale.



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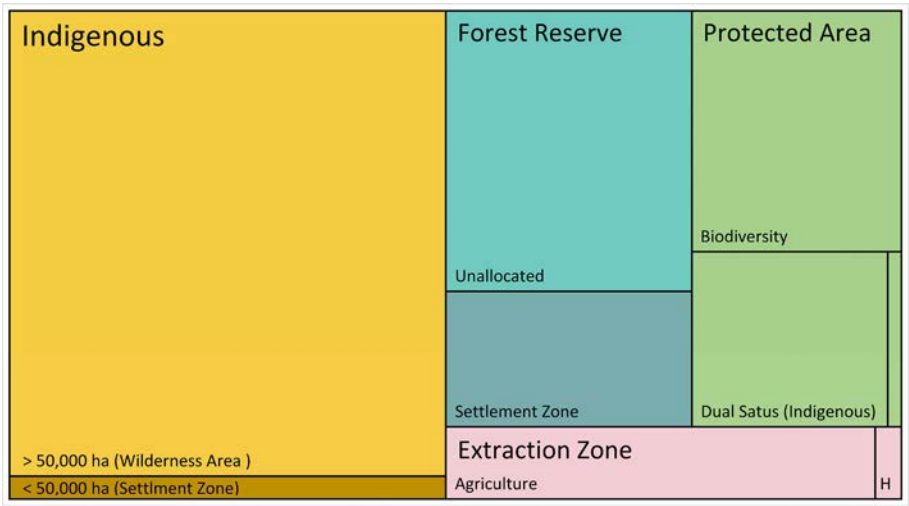
Annex 4.14: Colombia



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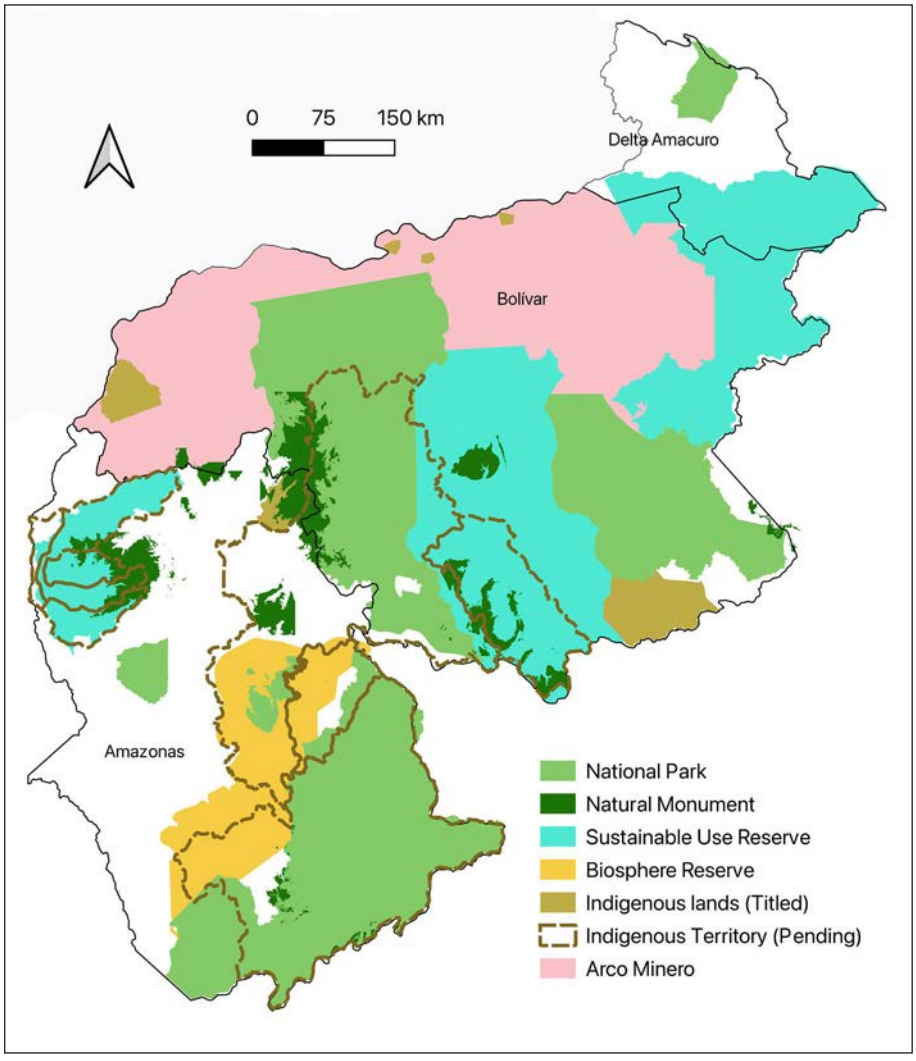
Colombia Land Tenure
Data sources: SINCHI (2016) and SIAT-AC (2020).

Annex 4.15: Venezuela

Venezuela was a pioneer in establishing a protected area system, whose Natural Monuments category provides protection to dozens of tepuye mountains. The process to formalise the territorial rights of indigenous communities halted following the death of Hugo Chavez in 2014. There is no agricultural frontier but wildcat miners roam widely across the region. The country has the third largest component of undesignated public lands in the Pan Amazon.



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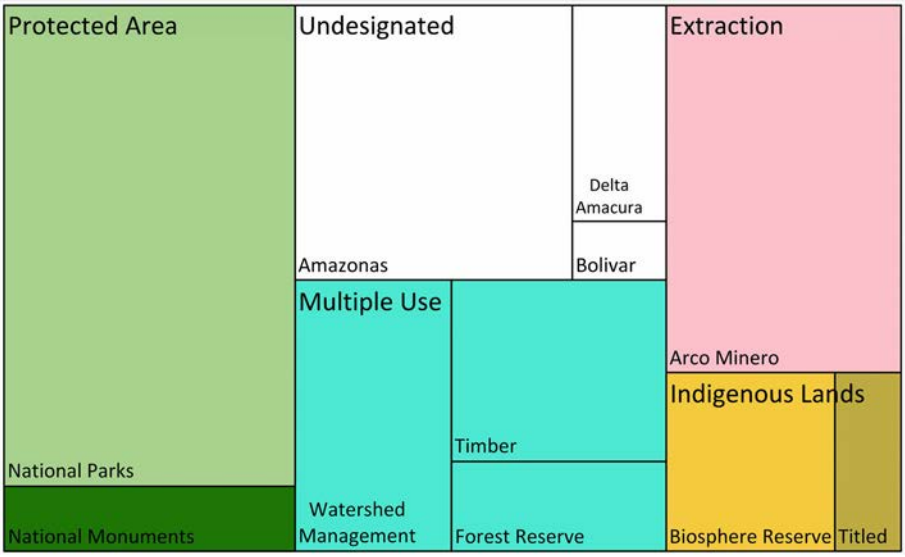
Annex 4.15: Venezuela



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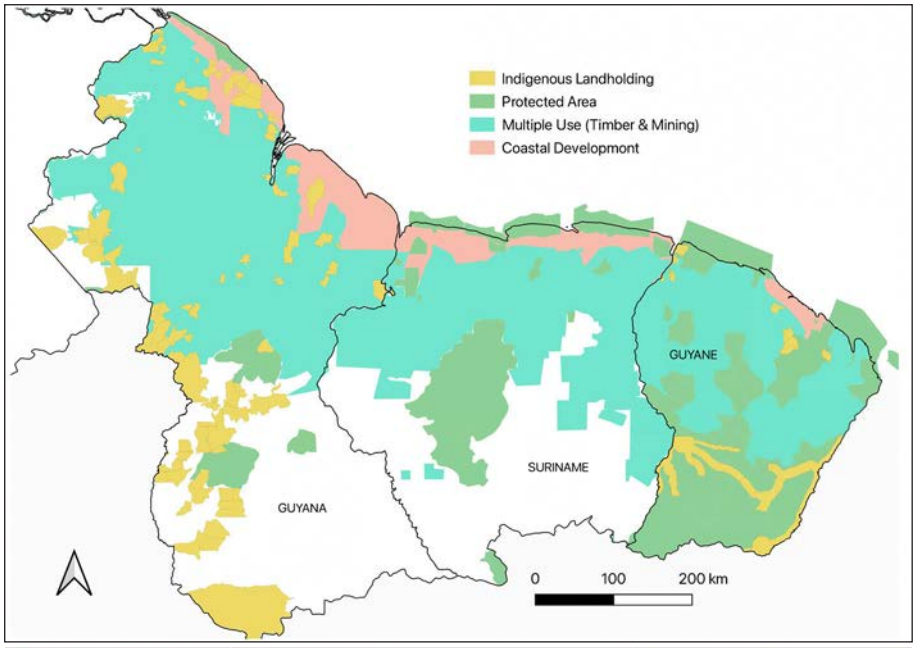
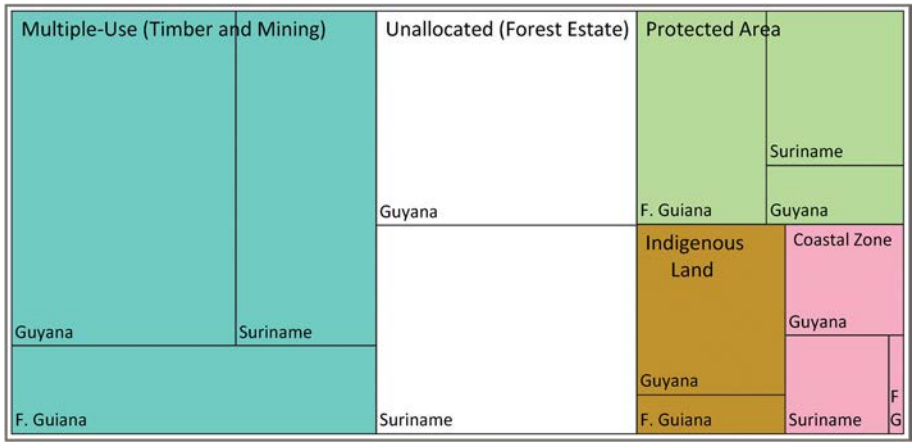
Venezuela Land Tenure
Data sources: MPPEA (2020) and RAISG (2021).

Annex 4.16: The Guianas

Guyana and Suriname have similar patterns of land tenure, with private landholdings (freeholds and leaseholds) on the coast and current timber and mining concessions located in the northern half of their territories. Guyana has recognised the territorial rights of individual villages, but as of January 2022, Suriname had yet to formally recognise the territorial rights of its indigenous citizens. The southern regions of both countries (combined) encompass about 13.6 million hectares of undesignated public forest. France has allocated all the territory in French Guiana to integral protection or sustainable use, while recognising the use-rights of its indigenous people.





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Data sources: RAISG (2021), The Guyana Forest Commission (2020) and Government of Suriname (2018).

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