Chapter 6
Multiple and Intertwined Impacts of Illegal Forest Activities

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6.1 Introduction

There have been numerous country-level studies and attempts to quantify illegal logging and related timber trade. A few reports have offered some global assessments about illegal logging but they are fragmented and fail to provide a detailed assessment of the impacts of illegal forest activities (see Lawson and MacFaul, 2010; Lawson, 2014; Hoare, 2015). In addition, because of their nature, some illegal forest activities as well as their impacts are hard to estimate (Tacconi, 2007).

Our understanding of the impacts from illegal forest activities suggests that they are multiple and strongly intertwined across different social, economic, political and environmental dimensions. Largely, these impacts are linked to the type of actor (e.g. large-scale loggers, smallholders, small-scale chainsaw millers) involved in illegal activities, as well as where and how these activities occur, which leads to different impact trajectories, and ultimate impacts on the ground.

The assessment of impacts resulting from illegal forest activities is complicated due to several factors: firstly, in many instances there is no clear-cut boundary between impacts associated with legal versus illegal activities since both may lead to similar impacts. Secondly, the impacts of illegal forest activities establish complex interactions among each other, resulting in diverse synergies and trade-offs. Thirdly, often it is assumed that all the impacts of illegal forest activities are negative; however, in some cases, they can be positive, depending on the stakeholders' perspectives.

This chapter embraces the challenge of identifying and characterizing the multiple impacts resulting from illegal forest activities drawing on existing literature on the topic. Given the fragmented nature of existing data, we propose a framework to understand these impacts and their causal relationships along different impact trajectories. This framework identifies three dominant situations (and associated actors) under which illegal logging is practised, i.e. large-scale illegal logging operations, informal small-scale and artisanal production, and illegal forest conversion. We relate each of these situations to different types of impacts (i.e. direct, indirect and cumulative) occurring across different dimensions (i.e. social, economic, political and environmental), which determine different impact trajectories. In addition, in order to illustrate these impacts, we examine cases of illegal logging activities in several countries in Latin America, Central Africa and Southeast Asia. These different cases enable us to draw conclusions about the characteristics, magnitude and nature of impacts across different impact trajectories.

6.2 A Conceptualization of Impacts

The impacts of illegal forest activities are multiple and interconnected, and unfold at different scales as shown in Figure 6.1 for the different realms of illegal forest-related activities.

The upper portion of the diagram identifies the most typical situations under which illegal logging occurs. These different situations tend to co-exist in practice, and likely can adopt different forms depending on the context (Casson and Obidzinski, 2007). Each of these situations leads to relatively differentiated impacts, since each tends to be associated with certain logging and land use practices. The first situation is associated with large-scale industrial logging, often practiced by actors who may have formal access to forests but who also break regulations by making use of different illegal practices in planning, harvesting, marketing and processing of timber. The second is informal small-scale and artisanal chainsaw milling practised by a diversity of local forest users including smallholders, indigenous people, landless people, and other local actors whose livelihoods depend on timber extraction. Finally, the third situation is associated with illegal clearing of forests to other land uses, mainly agricultural land uses, and it often occurs in logged-over forests whose economic value is comparatively lower than agriculture.

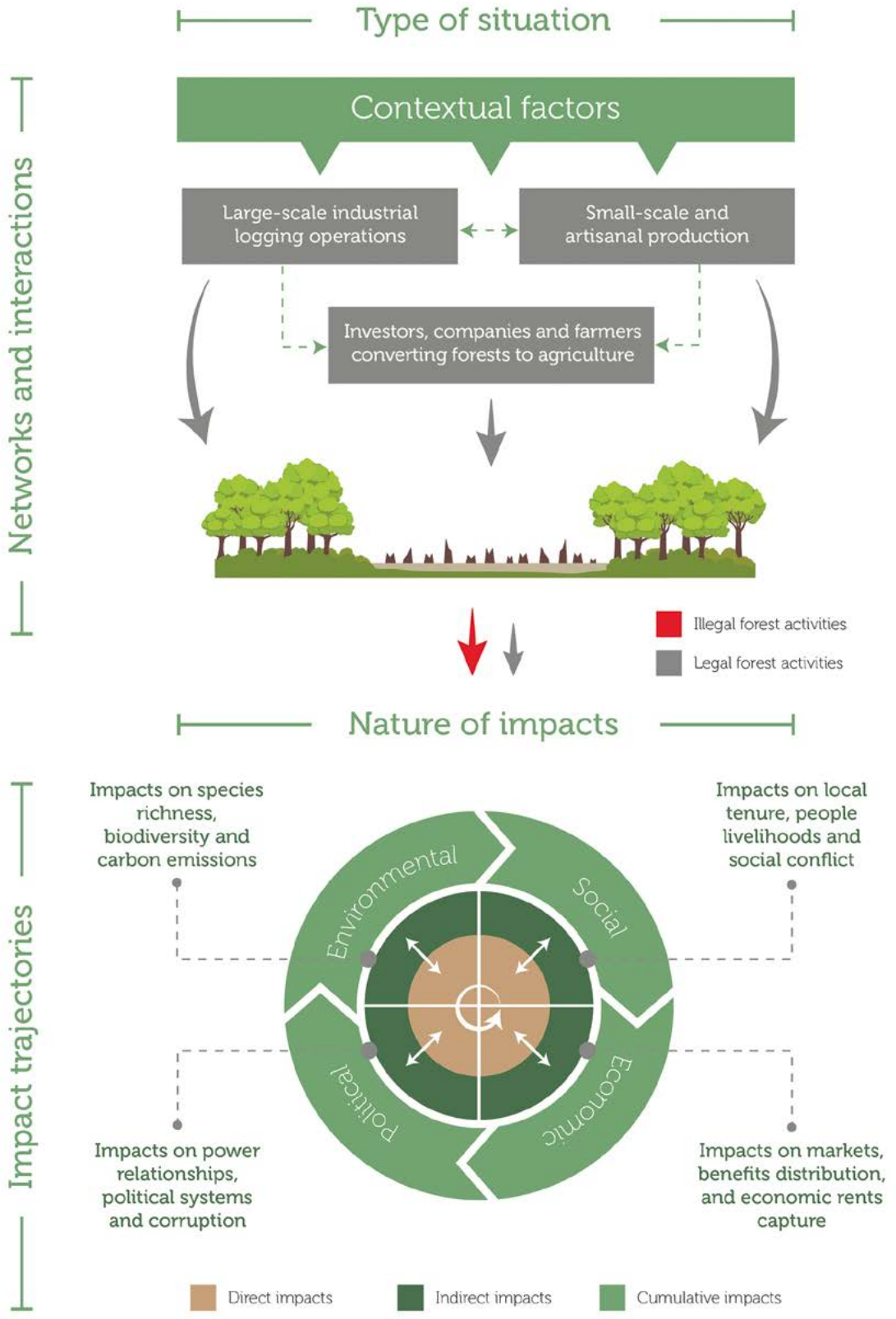
These different situations unfold in different contexts of market development and actor networks and interactions. Small-scale timber producers tend to be more strongly engaged with domestic markets and local intermediary networks (Molnar et al., 2007). In turn, large-scale logging tends to be connected strongly to networks supplying to regional and international niche markets, which tend to demand more valuable timber species (Cerutti and Lescuyer, 2011; Lescuyer et al., 2014). The type of interactions may differ as well since, in some cases, these market networks are relatively sporadic, while in others they are quite organized and stable over time (Kaimowitz et al., 2004; Pacheco, 2012). In addition, in many cases, the impacts from illegal versus legal forest activities are difficult to differentiate. We suggest that both legal and illegal practices may lead to similar types of impacts, although they may differ significantly in their magnitude depending on the intensity of human interventions in forests, and the quality of forests.

The lower part of the diagram examines the impacts of illegal forest activities. Key research on impacts of illegal logging (see: Tacconi, 2007; Contreras-Hermosilla, 2002; Contreras-Hermosilla, 2005) tends to cluster impacts across four main dimensions: social, economic, political and environmental, which are included in the above framework. This framework however, classifies the nature of impacts based on their causal relationships: direct, indirect and cumulative. It is noteworthy that the literature on illegal logging and related timber trade has largely neglected these different causal relationships. While the direct impacts are easier to observe and measure, the indirect impacts are less evident, although they can also be derived from direct. In turn, the cumulative effects are more difficult to determine due to time lags and more complex causal relationships between direct and indirect impacts, as well as other contextual factors.

Finally, the framework presented here, embraces the concept of impact trajectories. These impact trajectories are defined as the sequence of events resulting from

A framework to characterize the impacts of illegal forest activities

Figure **6.1**



Source: Authors' elaboration

different human interventions on the forests, influenced by a set of contextual or mediating factors, that determine specific direct impacts across multiple dimensions (i.e. social, economic, political and environmental). These direct impacts have, in turn, indirect implications on these same dimensions. The sequence of events leads ultimately to other more complex interactions affecting the contextual factors shaping the decision-making process of actors. Each impact trajectory, therefore, is associated with specific illegal forest activities and social actors. These different trajectories interact with each other depending on specific contextual conditions.

6.3 Main Impacts across Four Dimensions

Natural forests have usually been logged using destructive conventional techniques, and remnant forests are likely to be further degraded due to fire, as well as edge and isolation effects (Finegan, 2015), which makes it more likely that they will be converted to agriculture (Chomitz, 2007). It is assumed that legal logging conducted under regulations that promote sustainable forest management (SFM) has a less destructive effect on forests than illegal logging, but in many situations SFM refers only to selective low impact logging (Sist et al., 2014). The differential effects between illegally and legally-harvested timber, are largely unknown since legal logging also affects forest ecosystems, although their impacts will largely depend on the management system under which harvesting takes place (Sist et al., 2012). Increasing demand for timber may continue to stimulate additional destructive logging and increase vulnerability to forest conversion, stimulated by a perceived lack of value of the degraded ecosystem (Putz and Romero, 2015).

Table 6.1 presents a synthesis of impacts from illegal forest activities following the different dimensions and categories of impact that were introduced in our analytical framework. This synthesis draws on key literature that directly or indirectly assesses these impacts (Contreras-Hermosilla, 2002; Contreras-Hermosilla, 2005; Putz et al., 2008; Edwards et al., 2014). The direct impacts of illegal logging and related timber trade are the most evident, yet they trigger several indirect impacts, which do not always follow linear causal relationships. Moreover, causal linkages are affected by complex interactions within and across the different dimensions. Furthermore, these impacts affect and are influenced by others factors, outside of the forest sector, resulting in broader cumulative societal and environmental impacts.

Social impacts

The social impacts of illegal forest activities tend to be contradictory. One main factor that makes many instances of small-scale logging illegal is that many forestry laws still do not recognize customary use rights (Colchester, 2016). Smallholders, indigenous people and other traditional communities often tend to benefit from conducting their timber extraction operations outside of the law,

Private property sign. Photo © Fotolia: jkrajsek

in order to avoid the costs of complying with otherwise cumbersome regulations. This also indirectly contributes to enhancing their local decision- making processes, maintaining institutions to manage the forest under their control, and capturing economic benefits that otherwise would be appropriated by other actors. Nonetheless, the same environment that allows this to happen also generates several other long-term effects that eventually hurt local forest users, affecting the more vulnerable groups, e.g. women and indigenous peoples. Illegal logging tends to put pressure on timber from smallholders and community lands, resulting in a loss of high-value species and local income, which are crucial for supporting local livelihoods. In some cases, threats on forests controlled by local people may fuel situations of land conflict, which can even result in violence.

Economic impacts

The economic impacts of illegal forest activities are manifold. Illegal logging tends to distort timber markets since it provides cheap wood to growing urban markets. This has negative effects on benefit distribution along the supply chain since it tends to undervalue the available timber stocks and pays relatively lower remuneration to local people, thus prompting an unequal distribution of the monetary benefits obtained from logging. It also leads to significant losses for the state due to the evasion of forest fees. Increasing depletion of timber stocks leads to a progressive reduction in the economic value of the remaining forests vis-à-vis other land uses, which acts as an incentive for forest conversion to agriculture. Furthermore, illegal logging constitutes a high risk to investors, thus ultimately reducing local access to affordable long-term sources of finance, and making forest-based activities unattractive financially. Illegal logging contributes to reduce the volume of public investment, and reproduces asymmetric, distorted and untransparent timber markets. Some positive impacts are that illegal logging enables local people to capture the economic rents from forests, and allows them to respond in flexible

A summary of the different types of impacts across four dimensions Table 6.1

Impacts	Dimensions			
	Social	Economic	Political	Environmental
DIRECT	Loss of high-valuable tree species and local income key to local livelihoods	Low remuneration to labour and under-priced forest stocks	Behaviours opposing to the implementation of clear procedures	Stimulates forest clearing to agriculture (and other) land uses
	Lack of social control on forest assets eroding local institutions functioning	Unequal capture of monetary-benefits among social groups	Judiciary allows for law transgressions, and lack of authority	Forest degradation in terms of decrease of stocks, species erosion and loss of structure
	Logging and forest clearing facilitates the justification of property rights to land (access and management rights)	Local people, including poor and unemployed, derive incomes, and can respond in flexible ways to market demand	Resources that otherwise would be captured by corrupted officials are retained by local users	Depletion of the species with greater commercial value, with impacts on ecological integrity
INDIRECT	Increased pressures on customary and smallholder lands, mainly in those with higher-value timber stocks	Reduction in the economic value of remaining forests vis-à-vis other agricultural land uses	Resources from illegal logging feed into political patronage systems that reinforce asymmetric powers	Reduction of forest-interior specialist species richness and changes in forest composition with prevalence of less valuable species
	Land and resource conflicts that results in loss of resources and violence, often linked to other illicit activities	High investment risks constrain finance, perpetuating low yields and high percentage of residues	Increased lack of transparency, and erosion of command-and-control systems, and law enforcement	Water pollution, soil degradation, fires and carbon emissions
	Developed local mechanisms to control local forests use, built by smallholders, indigenous and other communities	A portion of investments from revenues originated from illegal activities are retained upstream the value chain	Extended social networks based on illegal/informal transactions providing social/market services	Some locally-controlled forests contribute to maintain the provision of forest goods and services
CUMULATIVE	Livelihood loss and displacement of forest-based sources of income	Loss of state revenues, reducing the volume of public resources	Weak institutions with a higher prevalence of corrupt behaviours	Biodiversity loss associated with habitat erosion and destruction
	Diminished resilience capacity to adapt to economic change and climate change	Persistence of market imperfection, and unfair competition in the timber markets	Stimulate links with other illicit activities (e.g. drug trafficking, smuggling, mining)	Changes in climate variability and extremes of weather and climate-related events
	Local actors fulfil their consumption needs from forest-based rents, which pay for a wide range of local social services	Appropriation of forest-based economic rents, a portion of which is retained in the producing zones	Political power from local actors tend to counterbalance decision-making from the national level	Reduced resilience of the forest ecosystems to adapt to climate variability over time

Source: Author's elaboration with inputs from Contreras-Hermosilla (2002; 2005), Edwards et al. (2014), Nellemann and INTERPOL Environmental Crime Programme (2012), Putz et al. (2012), Tacconi et al. (2003) and Tacconi (2007).

ways to shifting market demands. Furthermore, it provides additional sources of capital to local actors that may translate into productive investments and social services.

Political impacts

Illegal forest activities contribute to weaken the political systems governing forests by perpetuating corrupt behaviours and practices in the different processes regulating forest use and conversion. Illegal logging fosters a vicious cycle of poor governance (corrupt individuals gain power through illegal revenues and then may support poor governance to maintain revenues and acquire more power). It fosters interests that work against the implementation of regulations and procedures to sanction

Aerial view of the Amazon rainforest, near Manaus the capital of the Brazilian state of Amazonas. Brazil.
Photo © Neil Palmer/CIAT for CIFOR

more efficiently law transgressions. The economic gains generated through illegal logging also contribute to reproduce relatively extended political patronage systems to continue profiting from illegal logging and forest conversion. Illegal logging contributes to increase misappropriation of public resources, and interestingly efforts to combat corruption have contributed to reduce the power of corrupt networks, embedded in the political systems.

Environmental impacts

The environmental impacts from illegal forest activities are more evident. Forests provide a number of goods and services, such as timber, carbon stocking, biodiversity, and soil and water protection that are lost when illegal logging and unsustainable cutting take place, or when forests are converted to agriculture. Illegal logging is naturally associated with predatory logging techniques (Blaser et al., 2011). Some studies show that predatory logging, also known as conventional logging can involve twice higher damage than planned logging also known as Reduced Impact Logging (RIL) (see Putz et al., 2008 for a literature review).

Carbon stocks are reduced on average to 76 percent of primary forest levels (range 47-97 percent) in selectively logged tropical forests (Putz et al., 2012). In addition, the composition of species changes as disturbance-tolerant edge species invade and interior specialist species decline (although species richness often remains at similar levels to those in unlogged primary forest), and there is increased water run-off and severe soil erosion, particularly along skid trails and roads (Edwards et al., 2014). Some of these goods and services will return to levels found in unlogged primary levels within a few decades if illegally-logged forests are left to regenerate (e.g. soil run-off); but others will remain in a reduced state over much longer time-scales, especially recovery of over-exploited key timber species (Edwards et al., 2014).

If illegally-logged forests are subsequently burned or converted to agriculture, the goods and services provided by even heavily logged forest are eroded far more extensively (Edwards et al., 2014). For a few years after tropical logging, there is an elevated risk of fire as canopy gaps allow sunlight to reach the forest floor (Siegert et al., 2001). Fire reduces carbon stocks, degrades biodiversity value, and causes further tree mortality (e.g. Barlow et al., 2003). Fire also makes further fire events more likely, with increasingly severe consequences for carbon stocking and biodiversity of repeat fires, potentially driving a transition from tropical wet forest to fire-dominated woodland. The conversion of logged forest to farmland results in a rapid loss of carbon, biodiversity and increase in water runoff and soil erosion.

Cumulative impacts

There are several cumulative impacts from illegal forest activities, yet these are more difficult to determine and can be contradictory. For example, pressures on local customary lands, along with other social factors affecting local rural economies, can exacerbate the loss of local livelihoods and erode the local resilience capacity to adapt to both economic shifts and climate change (German et al., 2010). It can also have the opposite effect, of facilitating access to economic rents by local populations when they are able to exclude third parties and use the timber commercially (Cronkleton et al., 2009). Illegal logging also fosters corruption and patronage systems that weaken the state regulatory and judiciary institutions to sanction criminal behaviours (Varkkey, 2012), and tends to reinforce the influence of local elites. It may also be linked to other criminal networks (e.g. drug trafficking, smuggling, mining) that contribute to funding national and regional conflicts, thereby exacerbating them (Nellemann et al., 2016). Moreover, threats such as climate change, species' introductions, landscape fragmentation and fire, as well as shifts in economic and governance systems, also impact the future of forests that will vary along gradients of biodiversity, novelty of composition, structure, and permanence (Putz and Romero, 2014).

There are different trade-offs between the impacts described. Most important are that while illegal logging activities lead to destructive practices that degrade forest resources over time, they also tend to generate economic benefits in the production zones, although only a portion of these benefits are captured locally, and a major portion benefit actors downstream of the value chain, and corrupt public officials. This also applies to local extraction of forest resources (mainly timber) through operations conducted often outside of the law, which may increase the pressures on forests, thus contributing to forest degradation. Local control of forest resources may also complement local income streams. Often, logged-over forests tend to be converted to agriculture; while this amplifies the negative environmental impacts due to complete forest removal, this can also have positive economic multiplier effects.

6.4 Impact Trajectories across Different Situations

Distinguishing the effects of legal versus illegal logging is complicated. In spite of this, this section examines the impacts of different types of illegal forest activities, noting limitations concerning empirical evidence, validity and comparability. Key evidence available from some select countries in Latin America, Central Africa and Southeast Asia is also presented.

6.4.1 Large-scale Industrial Logging Operations

Large-scale industrial logging operations have been shrinking recently in the Amazon and Southeast Asia, but continue to expand in Central Africa. Forest concessions are the most common way for logging companies, with capital and operational and logistical capacity, to undertake large-scale operations and to access forest resources legally. However, even logging companies with legal access to forests may break forestry regulations. In the absence of public forestlands, logging companies and associated actors also access timber illegally through unofficial joint ventures with medium and small enterprises that they support technically or financially, through agreements with smallholders and communities, or buying timber from informal sawyers. It is not uncommon for timber companies to place pressure on public forests or protected areas, and in some cases on smallholders and community lands.

Direct impacts

Large scale logging operations directly impact on the forest condition by removing timber species with a higher commercial value (e.g. Meranti in Kalimantan, Merbau in Indonesian Papua, and Mahogany and Ipê in the Brazilian Amazon) (Grogan et al., 2014; Verissimo et al., 1995). They also erode forest structure via direct felling and residual damage to unharvested trees, such that logged-over forests tend to be shorter in stature, lacking the largest emergent trees, and in the shorter-term, with a fragmented canopy that allows sunlight to penetrate changing the forest microclimate to a hotter and drier environment. The introduction of RIL in large-scale logging has often reduced the intensity of timber harvesting thus it may have reduced residual tree damage when compared to conventional methods. However, at higher logging intensities, this effect is lost (Putz et al., 2008).

Forests under forest management plans are twice as efficient as those without plans, but these operations have little trickle-down effect on surrounding smallholders and generate local employment only for a limited number of people (Lescuyer et al., 2012). Large-scale industrial operations that use illegal practices tend to generate more spillover effects on local economies through jobs and sourcing of timber from small-scale and informal timber operations, but only some sporadic cash income for local loggers and chainsaw millers selling to those companies. Furthermore, workers employed in large-scale operations are often employed only sporadically and companies tend not to fully comply with social obligations (Lescuyer et al., 2012). In addition, employment generated by timber companies tends to be poorly remunerated, but those incomes may still be important in view of limited alternative employment opportunities and the depressed state of small-scale farming (Richards et al., 2003).

Furthermore, rapid depletion of commercial timber species reduces the long-term economic potential of forestry, making alternative economic activities attractive, especially conversion to farmland, either through legal or illegal means. Moreover, the development of roads, and other infrastructure, tends to stimulate local land markets, also prompted by the arrival of immigrant farmers willing to expand cash-crop agriculture (Gardner, 2014). Since production of agricultural crops tends to lead to

Box 6.1

Large-scale operations in forest concessions in the Peruvian Amazon

In accordance with the 2000 Forestry Law, about 581 concessions were granted in the Peruvian Amazon over a total area of 7.3 million hectares, 12.4 percent of the country's forests, with sizes ranging from 5,000 to 50,000 hectares. Forest concessions should follow sustainable management operations through the adoption of a forest management plan, which identifies the trees to be removed, specifying the area in a period of five years. Once the Forest Management Plan (FMP) is approved, the concessionaire develops an annual operational plan for each year of operation (or harvest), which specifies the location of each tree to be extracted. The main loopholes in the concession system are: 1) issuance of fake timber transport permits (TTP) to launder timber from other unauthorized cutting areas of other concessions and 2) substituting species to inflate the volumes of some species to be allowed to process permits of species with higher economic value. The concession system, therefore, has largely served to generate legal documents that are sold on the black market, fostering illegality.

Besides the production of fake TTPs, an institutionalized system of bribes also allows for the legalization of illegal timber. According to anecdotal evidence, when logs from concessions arrive at the ports, each loaded boat pays USD 180 in bribes to the local police. Once timber is loaded onto trucks, the TTPs are handed out to the local authority at the technical offices where technicians verify the species, and bribes of USD 20 per truck are paid to avoid setbacks. If the timber is transported as logs, no further procedure is needed, but the TTPs need to be exchanged at the technical office if the timber has been processed, which represents an extra payment. If the TTP passes the technical revision, trucks are allowed to travel to Lima. Usually, wood passes through eight checkpoints. In each of these checkpoints, USD 100 are paid as bribes to avoid extensive control. Each truck pays up to an estimated USD 1,000 on its way to the end- market.

Source: Author's elaboration based on Cossio et al (2011), EIA (2012), Finer et al., (2014), Mejía et al. (2015) and Muñoz (2014).

higher profits and is associated with lower operational risks when compared with logging, even when the latter is conducted illegally, it becomes more attractive for investors to develop agriculture rather than to invest in forest management (Lawson 2014). Formerly logged forest is thus much more likely to be cleared than is unlogged primary forest, according to research both in the Amazon and Southeast Asia (Edwards et al., 2014).

Indirect impacts

Large-scale operations tend to have several indirect impacts. The main social impacts are the pressures that they generate on local communities since they often operate on lands where customary rights tend to prevail. Because of the forest operations, local populations are constrained in their rights to access those forests, which in some cases can result in social conflict and violence (Molnar et al., 2011). The granting of legal access rights to large-scale operations through forest concessions has not necessarily reduced contested rights existing over lands occupied by logging companies. The persistence of large-scale logging tends to degrade and improve access to relatively large areas of forest, which in turn increases illegal hunting for bushmeat and international wildlife trade, especially of large-bodied vertebrate seed dispersers, and other habitat disturbances (including fire), thus reducing the capacity of the forest ecosystem to regenerate (Rayden and Essono, 2010; Vermeulen et al., 2009). In addition, large-scale illegal logging tends to lead to important losses of state revenue through tax evasion and underreporting of timber stocks and production which are widespread illegal practices (KPK, 2015; Finer et al., 2014).

Many forests have undergone significant degradation associated with large-scale logging, and in some cases those forests are degraded beyond recovery. Two meta-analyses each considering over 100 scientific studies (Gibson et al., 2011; Putz et al., 2011) demonstrate the complex relationships between the loss and degradation of forests and resultant biodiversity impacts. As a general rule, Gibson's analysis (2011) demonstrated that human disturbances reduce biodiversity in tropical forests, with all taxonomic groups being negatively affected, although some – such as mammals – less so than others. The type of disturbance is also determining, with birds being more affected by conversion to agriculture, while plants, by burning of forests. Unsurprisingly, generalist species fare better than specialists, with subsequent changes in species composition (but maybe less changes in terms of species richness) (Putz et al., 2011). Of all disturbance types, selective logging appears to be associated with the lowest level of adverse biodiversity impacts (Gibson et al., 2011).

Important environmental services are also degraded by intensive logging. Carbon storage is reduced, and may take several decades to recover to unlogged forest levels (Bonnell et al., 2011; Huang and Asner, 2010). Nevertheless, rates of carbon sequestration in heavily logged forests are much higher than those in unlogged forest essentially due to natural regeneration (e.g. Berry et al., 2010; Gourlet-Fleury et al. 2013). Furthermore, Southern Amazonian forest logged with RIL recovered 100 percent of original above-ground biomass in only 16 years (versus 77 percent for conventional logging) (West et al., 2014). In Indonesian Borneo, there was a 10-fold increase in water runoff from skid trails and roads, resulting in a 100- to 3,000-fold increase in soil loss compared to forested control plots (Hartanto et al., 2003). Despite the initial pulse of erosion and sediment runoff, several years after logging total soil runoff (including skid trails) was similar to that of primary forest (Douglas, 1999).

Cumulative impacts

Large-scale illegal logging, in its different illegal facets, leads to cumulative impacts. It does so by affecting livelihoods not only by excluding local people from forest areas, but also due to limited distributive effects at the local level. It also contributes to the loss of state revenue, which along with inefficient fiscal systems of state revenue capture, results in less income for producing zones, thus diminishing their capacity to use economic rents from forests for social and productive investments. Large-scale illegal logging, in the context of weak accountability, also fosters corrupt behaviours and networks, which in some cases link with other illicit activities. Forest degradation, along with destruction of habitats, also leads to biodiversity loss, and has impacts on climate change. Finally, carbon emissions from large-scale logging have an important role in driving global climate change, while it is plausible that degradation via intensive illegal logging will reduce the resilience of logged-over forests to adapt to climate change, especially under more frequent drought events that may increase fire risk.

A logging area in Gunung Lumut, East Kalimantan, Indonesia. Photo © Jan van der Ploeg for CIFOR

6.4.2 Informal Small-scale and Artisanal Production

The involvement of multiple local forest users conducting small-scale and artisanal logging is growing over time, and in many cases has surpassed the contribution of large-scale

logging timber operations. Local forest users are a large and heterogeneous group, with different types of tenure rights, including indigenous people, smallholders and other traditional people. These groups undertake different types of forest management, while increasingly engaging in commercial timber operations. A minor portion conducts its operations collectively, while a majority undertakes small-scale logging individually; some also carry out individual chainsaw milling. Most of these operations occur outside of the law or informally.

There are many situations, like in Latin America, of flawed forest legislation that does not give procedural rights to farmers without land titles, including indigenous communities (Pacheco et al., 2011). While formal property rights were recognized in favour of smallholders and communities, they have to follow relatively cumbersome regulations, often inspired by large-scale industrial logging operations, which make it difficult for them to access harvesting and transport licences. As a result, they tend to use their forests without permits or outside of the formal system (Pacheco et al., 2008).

In the Congo Basin countries, informal small-scale chainsaw milling supplies important domestic and regional markets, and provides jobs and income. This sector has undergone rapid development to meet the demand for cheap timber in Central African countries and other nearby countries (Chad, Nigeria, Uganda, Rwanda and Angola), as well as the interests of stakeholders all along the chain of custody (Lescuyer and Cerutti, 2013). This situation nevertheless differs from country to country (see Box 6.2). It is noteworthy that community forestry was also promoted in some of these countries (e.g. Cameroon, Gabon, Democratic Republic of the Congo, Central African Republic (CAR)) although it has not yielded the expected results since it faces multiple regulatory constraints (Julve et al., 2013), and does not seem to substantially conserve forest resources (Bruggeman et al., 2015).

Informal, small-scale or artisanal logging in Indonesia is linked to furniture-making industries and local infrastructure development, which involve a significant number of smallholders and small- and medium-scale enterprises (SMEs). Most do not have a fixed location and move frequently, depending on the availability of raw material and business opportunities (Obidzinski and Kusters, 2015). While these small-scale timber businesses are thought to be associated with furniture and souvenir making in Java, Bali and Sulawesi, small-scale logging also plays a vital part in generating the raw material for infrastructure development (roads, bridges etc.). It is clear that virtually all local timber demand for infrastructure development and civil construction (offices, housing etc.) comes from undocumented sources. Invariably, these sources are small-scale loggers.

Box 6.2

The contribution of chainsaw milling in Central African countries

In Cameroon and the DRC, informal chainsaw milling accounts for 57 percent and 87 percent respectively of total timber production, and supplies rapidly growing domestic markets. In Gabon, small-scale chainsaw milling covers 23 percent of needs, due to lower domestic demand. In CAR, this proportion reaches 34 percent, due again to limited demand and to the lower quality products supplied to markets by formal companies. In addition to the volume of timber it produces, the informal timber sector also provides thousands of jobs in Central African countries. In Cameroon, around 45,000 people find their main employment in this sector, which is more than three times the number of direct jobs provided by the industrial timber sector (13,000). These jobs include operators, transporters and prospectors in rural areas, as well as traders and handlers in cities (around 4,000). In the cities of Congo, the CAR and Gabon, more than 1,000 people have jobs directly linked to the sale of small-scale timber production. It is noteworthy that the success of the small-scale chainsaw milling sector is due to its acceptance both by urban consumers, who gain access to low cost materials (prices are three to four times lower than those of industrial timber), and by rural stakeholders, who see it as a significant source of income. Indeed, despite its informality and the illegal levies made on operators, small-scale chainsaw milling is a profitable activity. The profit margin stands at almost 12 percent in Cameroon, the CAR and the DRC, and reaches 18 percent in Congo, and even 30 percent in Gabon.

Sources: Authors' elaboration based on Lescuyer et al. (2014) and Eba'a Atyi et al.(2016)

Direct impacts

The small-scale logging sector is important for employment and rural livelihoods. It employs vast numbers of people on a part-time and a full-time basis thus making significant contributions to rural incomes and livelihood security (Mejía and Pacheco, 2014). The sector often constitutes only a complementary source of income for smallholders and indigenous communities and is also a source of income for urban elites. Some government officials also benefit by demanding informal payments from small-scale chainsaw millers and transporters before authorizing them to continue their activity (Lescuyer et al., 2012). Smallholders and indigenous people may also benefit from carrying out informal timber operations as it may enhance their control of forests and secure their tenure rights. In turn, this helps them to capture economic benefits that otherwise would be captured by external actors, including local elites (Lescuyer et al., 2013).

The effects of small-scale timber operations on forest condition are uncertain. Some argue that community-managed forests have lower and less variable annual deforestation rates than protected forests (Porter-Bolland et al., 2012), and that the volumes harvested through illegal logging tend to be lower when compared to legal timber operations (Mejia et al., 2015). Thus, given the small-sized plots and relatively low-intensity harvest of smallholders, forest extraction tends to erode forest resources slowly over time. Nonetheless, impacts on long-term timber revenues could be similar to those of large-scale

timber operations if smallholders, indigenous people and chainsaw millers opt to log selectively a few highly valuable timber species. This often happens in contexts of growing market pressure (Cano et al., 2015; Mejía et al., 2015). Nonetheless, much of the milling of these groups is carried out using chainsaws in situ and carts, small tractors and river rafts for transport. If no (or few) roads are opened, this will likely threaten the few targeted tree species, but overall have a low impact on forest structure, a short-term impact on wildlife hunting (i.e. during but not after harvest), and thus limited impact on the successional trajectory of the remaining forests.

Indirect impacts

The states are the main losers in the persistence of small-scale informal logging as well as with the development of small-scale chainsaw milling, which goes against their strategy of formally managing and taxing forest resources. In addition to foregone tax revenue, small-scale chainsaw milling could compromise their efforts to sustainably manage forests. While benefits are appropriated locally, they are rarely invested in the local forest sector, or in enriching the forests, or in modernizing the SMEs. In addition, the persistence of these informal systems also occurs via illegal payments to public officials and to control systems, which allow relatively well developed intermediary networks to transport the timber to markets (Mejia et al., 2015). These payments fuel local corrupt systems that work against smallholders and chainsaw millers who do not have the resources to process their permits, and are vulnerable to asymmetric interactions with intermediaries (who also provide the capital to finance the timber extraction).

Transporting logs along the river Indonesia.
Photo © Sophie Furnival/CIFOR

Furthermore, once valuable timber species are exhausted, small-scale timber extraction and chainsaw milling tend to put pressure not only on indigenous and smallholder lands but also on surrounding lands, which can include public forests, agroforestry zones and, in some cases, protected areas. This is also influenced by the process of social expansion of frontiers dominated by smallholders, whereby immigrants looking for new lands to occupy move into these areas. Ultimately, this leads to negative effects on forests and a lack of incentives for conservation (Chomitz, 2007). It also accelerates the expansion of agricultural frontiers with a growth of subsistence, cash crops or mixed production systems to the detriment of forests. While some smallholders are able

Box 6.3

Forest conversion to pulp and paper, and oil palm plantations in Indonesia

In Indonesia, by far the most widespread illegal practice associated with forest conversion is under-reporting of commercial timber stocks (KPK, 2015). This helps the companies, on the one hand, to minimize forestry taxes due to the government, and on the other hand, to maximize returns on the sale of timber. As the government is progressively addressing this problem, there is an increasing tendency among oil palm companies to forgo timber profits and focus exclusively on oil palm. If the concession contains commercial timber stocks, the company is required to obtain a timber utilization permit (IPK), a forest clearing permit and pay appropriate taxes. Many companies resort to bulldozing over the timber and burying it in the ground in order to avoid the necessity of dealing with the forestry authorities, an illegal practice. The underreporting problem has had a hard impact on the government's ability to collect forestry revenues. According to KPK (2015), between 2003 and 2014, the government recorded only 23 percent of timber volumes that were actually extracted and lost between USD 6.5 to 9 billion as a result.

A large proportion of forest allocated to forest concessions in the past has been reclassified for plantation development. With 35 million hectares of forest land allocated to industrial timber plantations (HTI) and oil palm estates, these two commodities have been the leading drivers of deforestation in Indonesia and a major source of timber (Casson et al., 2014). While large-scale oil palm plantations drive most of the forest conversion, increasingly smallholders are expanding their plantations, currently contributing to 42 percent of total palm oil supply (Directorate General of Estates, 2014). Oil palm expansion has led to significant impacts on CO2 emissions (Carlson and Curran, 2013), mainly due to expansion into peatlands. Between 1990 and 2009/2010 net CO2 emissions, from land use change due to oil palm plantations, peat fires and peat oxidation, increased from 92 to 184 Tg CO2 yr-1 in Indonesia, Malaysia and Papua New Guinea (Agus et al., 2013). Between 2007 and 2010, the total area of industrial scale oil palm agriculture on peatlands increased by over half a million hectares, from 1.6 to 2.15 million hectares. Some 0.2 million hectares of this expansion was in Malaysia—nearly all of it in Sarawak—and the rest was divided more or less evenly between Sumatra and Kalimantan (Miettinen et al., 2013).

to expand their assets, and become capitalized farmers, the vast majority is not able to exit the poverty trap due to a limited access to land (Coomes et al., 2011). Logging by smallholders presumably has far lower impacts on biodiversity, carbon emissions, runoff and soil erosion than does intensive, large-scale logging, especially if road networks are not created (Edwards et al., 2014).

Cumulative impacts

The cumulative impacts of informal small-scale and artisanal timber production are contradictory. On the one hand, this type of timber operation contributes to supporting the livelihoods of smallholder-dominated landscapes under relatively diverse livelihood strategies, which occasionally rely on timber extraction. On the other hand, while most of the benefits remain in the production zones, they are not necessarily invested in agriculture or forestry, and a portion of those benefits still finance corrupt networks that reproduce themselves at the expense of informal timber extraction, thus inhibiting the upgrade of the timber value chain and SMEs. While informal small-scale and artisanal timber production produce a lower impact on biodiversity and carbon emissions in comparison to large-scale logging, much of it depends on the spatial scale and intensity of the timber operations.

6.4.3 Illegal Forest Conversion to Agriculture

A portion of logged-over forests tends to be converted to other land uses, mainly agriculture, and to a lesser extent, mining and urban expansion. This conversion takes place in three ways: the first is large-scale mechanized clearing driven by agri-business for the expansion of large-scale intensive plantations (e.g. soybean, oil palm) that primarily supply export markets. The second is land clearing in smallholder farmer plots, who convert forests as part of their traditional agricultural systems for meeting subsistence needs, supplying domestic markets with staple crops (e.g. manioc, rice) or international markets with high-value tree crops (e.g. cacao, coffee). The third is medium-scale landholders, with traditional systems (e.g. traditional ranching) that embrace extensive production systems.

A portion of timber supplied to domestic and international markets originates from forests converted to agriculture. This proportion varies greatly over time and across countries. For example, this situation has changed recently due to the drastic reduction of illegal land clearing in Brazil, which is currently mainly associated with smallholders (Godar et al., 2014). Conversely, land clearing continues in Indonesia due to the development of plantations (Margono et al., 2014). The situation is less clear in other tropical countries since deforestation has tended to grow in the Andes-Amazon countries (Coca-Castro et al., 2013), and pressures on land have been expanding in Western and Central Africa (Feintrenie, 2014). In the latter regions, while most past deforestation was driven by smallholders, increasing pressure has been placed by large-scale investments

Aerial view of growing oil palm plantation near Douala, Cameroon. Photo © M. Edliadi for CIFOR

involving foreign investors and new multi-national holdings in the region (Gerber and Veuthey, 2011; Feintrenie, 2014). An important but unknown portion of these forest clearings is likely undertaken outside of the law, thus can be considered as illegal forest conversion.

There is still debate on the extent to which agricultural development in the tropics is a direct driver of deforestation and to what extent it merely takes over areas previously degraded by commercial logging or small-scale encroachment, or lands already opened for other agricultural land uses. Moreover, other difficulties arise when assessing the legal technicalities of forest conversion. For example, in Indonesia, the forestry law does not consider clearing of natural forest cover in industrial forest concessions (HTI) as deforestation. Such tree cover is considered temporary "destocking", there is no need for timber utilization permits, and timber that is from natural forest clearance is not differentiated from harvested pulpwood (Obidzinski and Kusters, 2015). Also, concessions for oil palm are granted for the conversion of all forestland granted for oil palm development - with the exception of riparian forests and areas deemed inappropriate for planting - thus areas not converted can be claimed back by the state (Daemeter, 2015). In the Brazilian Amazon, 75 percent of the landholding has to be maintained as legal forest reserve (Soares-Filho et al., 2014).

Direct impacts

Illegal forest conversion leads to a complete removal of forests, replacing them with agricultural crops, high-value tree crops, or agroforestry systems, depending on whether agricultural expansion is driven by agribusiness or smallholder farmers. There are several direct impacts of forest conversion. Main environmental impacts are negative, due to forest degradation which leads to net carbon emissions, destruction of habitat for wildlife, and impacts on water provision and soil erosion, depending

on which agricultural practices are utilized (Lambin and Geist, 2006). Carbon stocks are dramatically reduced via conversion, resulting in net carbon emissions (Asner, 2009; Galford et al., 2011). The effects on carbon emissions are largest when converting peatlands to oil palm, and pulp and paper plantations, as in Indonesia (see Box 6.3). In addition, if clearance drives the fragmentation of remaining forests, then edge and isolation effects can reduce carbon stocks and biodiversity value over time in persisting forest patches (Laurance et al., 2002; Magnago et al., 2016).

Logging-facilitated conversion of forest to agriculture leads to severe biodiversity loss: there is a substantial loss of species richness (Gibson et al., 2011), underpinned by a large change in community composition from forest dwellers to edge and non-forest species. There is also a substantial decay of ecosystem functions when logged forest is converted. For example, large production forests retain more insectivorous and seed-dispersing birds, and nocturnal and dung-rolling beetles than do oil plantations (Edwards et al., 2013; Edwards et al., 2014). This will influence ecosystem processes, with implications for plant growth and biogeochemical cycling. Furthermore, forest conversion drives increased runoff, especially during tropical rainstorms, with greatly reduced evapotranspiration, 100–800 percent increases in annual water flow (Bruijnzeel, 2004), peak flows 185 percent higher and water levels rising nearly twice as quickly than under forest cover (Douglas, 1999). In cases where small-scale timber production does facilitate forest conversion, then the resulting impacts on biodiversity and ecosystem services will depend on the area cleared and the permanency of clearance (e.g., permanent monoculture versus slash-and-burn shifting agriculture).

Agribusiness and smallholder farmers benefit from forest conversion: the former since expanding agriculture contributes to expand their profits; the latter since that enables them to develop income streams that have positive impacts on their livelihoods (Angelsen and Wunder, 2003). Smallholder farmers depend on farming systems and cash crops to generate income. Agribusiness tend to embrace large-scale crop plantations (e.g. soybeans, oil palm), which are capital-intensive since they require higher levels of inputs, while smallholders tend to opt for high-value tree crops (e.g. cocoa, coffee), even though they only capture a small portion of the value that is created in these value chains (Arias et al., 2013).

It is noteworthy, that agricultural development in forest frontiers contributes to increase the value of land. Frequently, land is the main asset of farmers and it is used as collateral. Forest conversion to agriculture also contributes to generate local employment; this is much lower when the emerging land use is large-scale capital-intensive agriculture (e.g. soybean) or extensive ranching, and can be higher in the case of oil palm plantations that require labour for cleaning, applying fertilisers and harvesting, among others. In addition, forest clearing driven by smallholders expands labour-intensive farming systems. Another direct impact of agricultural expansion is production of crops that supply the domestic food markets or meet the supply of global food and feed industry. Some agricultural crops (e.g. palm oil) also provide raw material for multiple industrial uses.

Indirect impacts

Forest clearing associated with the development of large-scale plantations tends to lead to negative social impacts but also has positive economic multiplier effects. On the one hand, agricultural expansion may lead to social conflict, when concessions for agri-business development are granted in opaque or irregular circumstances, as in several countries in Central Africa (Assembe-Mvondo et al., 2015), or when legislative and customary land rights are ignored when the concessions are granted. This in turn affects customary tenure rights (Schoneveld, 2013) and negatively impacts on the livelihoods of minorities, particularly if mechanisms are not put in place to compensate or rebuild those livelihoods (German et al., 2010). On the other hand, plantations have important multiplier effects in other sectors (e.g. services) and trigger significant economic growth in frontier areas, leading to infrastructure development and expansion of market networks, and logistics and processing facilities.

However, this can be problematic when new roads are built, opening up new forest areas and resulting in an influx of immigrants trying to obtain a piece of land and establish themselves in these frontier areas. Smallholders seize the opportunity of existing infrastructure and logistics to get involved in value chains as has been the case with beef cattle in the Brazilian Amazon (Pacheco and Poccard-Chapuis, 2012) and oil palm in Indonesia (Cramb and McCarthy, 2016). There are also processes of land re-concentration. For example, as large areas of land for oil palm plantations are increasingly difficult to come by, plantation developers often resort to crowd-sourcing of land from village communities and individual families. In this way, they purchase hundreds of small land parcels that add up to thousands of hectares (Budidarsono et al., 2012). There have also been land re-concentration in the Brazilian Amazon, particularly in already established agricultural frontiers (Pacheco, 2009).

Cumulative impacts

The most important cumulative impacts of illegal forest clearing are related to people's livelihoods and climate change as a result of large-scale plantations. The development of crop plantations contributes to the accumulation strategies of agribusiness, but it also has contradictory impacts on livelihoods. On the one hand, large-scale plantations displace local people, thus contributing to increase the vulnerability of some local social groups, generally indigenous populations. On the other hand, agribusiness development tends to integrate some more capitalized farmers in the supply chain, thus improving their wellbeing over time. This also leads to contradictory impacts in the economy with illegal clearing leading to tax evasion, but also agricultural expansion creating important spillover effects in the rest of the economy.

Environmental impacts of clearance tend to concern climate change and biodiversity, with clear cumulative effects on global carbon emissions and biodiversity loss as a result of agricultural expansion by both agribusiness and smallholder farmers. Additionally, the conversion of large tracts of logged forest will likely exacerbate climate change impacts via altering local temperature and rainfall patterns (Makarieva et al., 2014). Local and regional climates are largely driven by cycles of rainfall, evaporation, and cloud formation within tropical forest biomes. The loss of forest cover can disrupt this cycle, reducing the number of rainy days and increasing interannual variability in rainfall (Webb et al., 2005). In the Amazon, for instance, large-scale areas without tree cover have higher temperatures and lower rates of evapotranspiration, resulting in less rainfall (Spracklen et al., 2012).

6.5 Conclusions

This chapter sought to assess the impacts from illegal forest activities by drawing on existing literature. Fragmented data is a challenge and there is still no comprehensive global assessment spanning different geographies that structures, condenses and evaluates the impacts of illegal logging. Nonetheless, the framework that we offer here advances this discussion by: 1. linking explicitly the impacts of illegal logging to the specific situations under which it takes place; 2. distinguishing different causal relationships and interactions among impacts from illegal logging, and 3. identifying both negative and positive impacts from illegal logging (see Table 6.2). These three aspects were neglected in the analyses of illegal logging to date. In addition, we argue that the impacts from illegal versus legal logging are hard to separate, since the two tend to co-exist, and legal logging also leads to significant impacts. Furthermore, in some cases legal regulations may increase the pressure on forests, particularly when compared with timber extraction undertaken informally.

The main conclusions of this review are that, while impacts are inextricable linked, they differ depending on the type of situation driving them, and the scale of the associated operations. Large-scale industrial logging tends to be more regulated when accessing public forests, mainly through concession systems, but logging companies also contravene regulations in multiple ways, which leads to diverse positive and negative impacts, depending on the standpoint. In addition, it is difficult to generalize the widespread impacts of small-scale and artisanal timber extraction and milling that have developed widely across the tropics as they constitute a very heterogeneous group of actors having in common the fact that most of their timber operations are conducted outside of the laws or informally. The main impacts of informal small-scale logging depend on the type of forest management practised and the number of smallholders involved, as well as the intensity of timber harvesting. Finally, the impacts of illegal forest conversion are highly variable depending on whether conversion is to develop large-scale plantations or more traditional small-scale farming systems.

While direct impacts of illegal logging are easier to discern and quantify, the indirect impacts are less evident. Illegal forest activities impact directly on tenure rights, local jobs and income, timber markets, and rents capture, as well as leading to timber depletion and forest loss. Several negative impacts (e.g. forest encroachment, species loss, precarious jobs, illicit appropriation of public resources) can be highlighted but some positive ones such as local generation of employment and income for the rural poor also need to be considered, as illegal logging can enable local people to capture benefits that otherwise would be appropriated by others. There are several indirect impacts, transmitted through the market structures or political systems that tend to amplify the indirect impacts of logging, mainly increasing pressures on customary lands and conflicts, reduction in the economic value of forests and high-risks to investors, patronage systems and corruption that erode the effectiveness of law enforcement. Interestingly, many other factors – outside of the forest sector – generate cumulative effects that lead to the loss of people's livelihoods and erosion in the resilience of local actors, along with state revenue loss, and long-term impacts of biodiversity loss and climate change.

Undoubtedly, there are several synergies and trade-offs among the different types of social, economic, political and environmental impacts, but their analysis is outside the scope of this chapter. A more refined analysis of trade-offs, and winners and losers, is necessary across the different geographies in which there is still significant illegal logging, as well as the differential impacts of illegal versus legal logging and forest conversion.

Some main outstanding gaps with regards to impacts of illegal forest activity are:

- More knowledge is needed on the modus operandi of illegal timber networks, primarily about the evolving nature of illegal timber extraction and trade, which tend to adopt different strategies to circumvent the law and reproduce their operations.
- There is a continued need to refine information on commercial standing stocks and actual production, and land use trajectories exploring the link between forest intervention and forest conversion. Better use of emergent remote sensing for real-time monitoring and verification is particularly important.
- Information gaps remain on the dynamics of the small-scale logging sector, which is expanding. The size of the small scale sector, as well as its market and financial connections with actors upstream in the value chains are still unknown.
- There is a very limited quantification of the environmental impacts of large- and small-scale illegal logging versus those of legal logging systems, which is vital for understanding the conservation values of illegally-logged lands.
- There are major gaps of fairly fundamental information on the impacts of forest conversion, especially related to the impacts from conversion on primary versus degraded forests, and actual social and biodiversity impacts.

- More understanding is required of the indirect and cumulative impacts from illegal logging and related timber trade, in order to develop policy mechanisms to address them and to mitigate their negative impacts in the longer term.

Understanding better the social and political interactions among actors involved in illegal logging can contribute to better identify leakage and laundering effects, so that more effective monitoring of these processes can be put in place.

A synthesis of some key effects across three different type of situations of illegal forest activities

Table 6.2

Impacts			Large-scale industrial logging operations	Informal small-scale and artisanal production	Illegal forest conversion to agriculture
Nature	**Dimensions**	**Types**			
DIRECT	Social	Enhance social control	Low (−)	High (+)	Low to high (−/+)
		Securing tenure rights	Low (−)	High (+)	High (+)
	Economic	Remuneration to local labour	Low (−)	High (+)	Low to high (+)
		Local capture of benefits	Low (−)	High (+)	Low to high (−/+)
	Political	Local elite capture	High (−)	Low (−)	Low to high (−/+)
		Misappropriation of resources	High (−)	Low to high (−)	High (−)
	Environmental	Forest clearing to agriculture	High (−/+)	Low (−/+)	High (−)
		Loss of key timber species	High (−)	Low to high (−)	High (−)
INDIRECT	Social	Pressure on local lands	High (−)	Low (−/+)	High (−)
		Land conflict and violence	High (−)	Low (−)	High (−)
		Local mechanisms of forest control	Low (−)	High (+)	Low (−/+)
	Economic	Reduction in forest value	High (−)	High (−)	High (−)
		Risks for secure investments	High (−)	High (−)	Low (+)
		Benefits retained locally	Low (−/+)	High (+)	Low (−/+)
	Political	Fuel patronage systems	High (−)	Low to high (−)	Low to high (−)
		Loss of command and control authority	High (−)	High (−)	High (−)
	Environmental	Reduction in species richness	High (−)	Low to high (−)	High (−)
		Habitat destruction	High (−)	Low to high (−)	High (−)
CUMULATIVE	Social	Livelihood loss	High (−)	Low (−)	Low to high (−)
		Diminished resilience capacity	Low to high (−)	Low to high (−)	Low to high (−)
	Economic	Loss of state revenue	High (−)	Low to high (−/+)	Low to high (−/+)
		Unequal appropriation of forest rents	High (−)	Low (−)	Low to high (−)
	Political	Prevalence of corrupt behaviours	High (−)	Low to high (−)	Low to high (−)
		Links with other illicit activities	Low to high (−)	Low to high (−)	Low (−)
	Environmental	Biodiversity loss	High (−)	Low to high (−)	High (−)
		Climate change	Uncertain	Uncertain	High (−)

Source: Authors' elaboration. Low and High propensity of impact. Impact can be (+) positive, (−) negative and (−/+) contradictory.

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