

Chapter 5

Organized Forest Crime: A Criminological Analysis with Suggestions from Timber Forensics

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5.1 Introduction: Illegal Timber as a Global Crime Question

It was only during the first decade of this century that illegal timber was recognised as a transnational crime problem by international law enforcement organizations and academic criminologists. In 2008 the World Bank asked INTERPOL to look at illegal logging from the perspective of international criminal justice. This led to INTERPOL's first project on illegal logging, the *Chainsaw Project*. The report states that:

"(...) due to a lack of resources, INTERPOL's potential to contribute to efforts combating illegal logging has not yet been fully exploited. Environmental crime and illegal logging specifically, has largely not been recognised by member countries and accordingly is not given high priority. Countries and international bodies must clearly express a will, and provide resources, before this situation is likely to change" (INTERPOL and World Bank 2010: 46).

Since 1992, INTERPOL has an "Environmental Crime Committee", a global network of experts advising and assisting it in the identification of environmental crime trends. In 2009, INTERPOL brought its activities on environmental crime together in the "Environmental Crime Programme". Initially, there were two people working in this programme, reflecting the low law enforcement priority of environmental crime within the only global law enforcement body.

In the context of growing attention to climate change, wildlife trafficking and environmental crime in general, INTERPOL received donations from countries and NGOs which allowed the expansion of its Environmental Crime Programme, such as through the International Consortium on Combating Wildlife Crime (ICWC). In 2012, with funding from Norway, the Project LEAF (Law Enforcement Assistance for Forests) started with the aim to combat illegal logging and organized forest crime (Stewart, 2014). In September 2012, after months of investigation in Latin America, North America and Europe, Project LEAF led to INTERPOL's first international operation against illegal logging across twelve Latin American countries. It resulted in the seizure of more than 50,000 cubic metres of illegally logged timber (Humphreys, 2016).

In 2013, INTERPOL's Environmental Crime Programme was renamed "Environmental Security Sub-Directorate". It reflected INTERPOL's higher priority given to environmental crime, and showed that environmental crimes are also considered as a security issue. By 2015, INTERPOL's Environmental Crime Programme had grown to almost forty people.

More funding also allowed for more research and knowledge. In 2012, UNEP and INTERPOL published a "Rapid Response Assessment" on illegal logging, tax fraud and the laundering of the world's tropical forests: *Green Carbon, Black Trade*. It estimated the value of the worldwide, annual illegal timber business at between USD 30 and 100 billion, representing between 10 and 30 percent of global timber trade (Nellemann and

INTERPOL Environmental Crime Programme, 2012). The range of the estimate reflects the poor state of knowledge.

Also in 2012, the World Bank published a well-documented study on illegal logging, including many suggestions for using the criminal justice system more effectively in order to prevent and combat illegal logging and forest crime. The authors correctly note that when the criminal justice system is discussed, the focus is generally on its failures, rather than its potential to help reduce and deter illegal logging (Goncalves et al., 2012). The study shows that the legal infrastructure already exists for taking a more punitive approach towards illegal logging and criminal timber networks.

In 2015, UNEP and INTERPOL published a second rapid response assessment on environmental crime: it signalled, that while in some tropical countries an estimated 50-90 percent of the timber is from illegal sources, "most illegally sourced and traded wood is either not considered or recognised as contraband by customs, or falsely declared as legally sourced and traded" (Nellemann et al., 2015: 61). In 2016, a third UNEP- INTERPOL Rapid Response Assessment was published, *The Rise of Environmental Crime* which identified environmental crime as the fourth largest criminal enterprise, after drugs smuggling, counterfeiting, and human trafficking (Nellemann et al., 2016). Of the eight identified categories of environmental crime, forestry crime was estimated to account for the largest illegal turnover, with the largest annual losses in revenues for governments estimated at between USD 9–26 billion per year (Nellemann et al., 2016).

All of the sources referred to so far, mention criminal involvements in logging and timber businesses. In the *Chainsaw Project* (INTERPOL and World Bank, 2010) it is suggested that illegal logging could be considered as a form of organised transnational crime, as defined by the UN Convention against Transnational Organized Crime (UNTOC). *Green Carbon, Black Trade* mentions that criminal elements, groups, gangs and cartels are involved in illegal timber extraction and trade (Nellemann and INTERPOL Environmental Crime Programme, 2012). UNEP- INTERPOL's 2015 report describes some of the recent (international) law enforcement successes against illegal timber in countries in different tropical regions: South and Central America, West, East and Southern Africa, and South East Asia (Nellemann et al., 2015; see also Humphreys, 2016). UNEP- INTERPOL's 2016 report, *The Rise of Environmental Crime*, refers to "large-scale corporate crimes concerning timber, paper and pulp involving large-scale deforestation" (Nellemann et al., 2016: 15).

Investigations from NGOs also identify criminal networks in the timber business. Particularly investigative NGOs such as the Environmental Investigation Agency (EIA), Global Witness and Greenpeace, published detailed reports about illegal logging and illegal timber. They revealed some of the timber traders and illegal timber networks and described the open or sometimes sophisticated ways in which illegal timber is traded (see e.g. EIA and Telapak, 2004; 2005; 2006; EIA, 2008; Global

Witness, 2002; 2012; Greenpeace, 2003; 2015; Khatchadourian, 2008).

Criminological publications on illegal timber only exist since a decade or so (Boekhout van Solinge, 2004; Green et al., 2007; Schloenhardt, 2008; Graycar and Felson, 2010) with work on illegal and otherwise harmful dimensions of illegal logging and deforestation in equatorial rainforests (Boekhout van Solinge, 2004; 2008a-c; 2010a-b) and on the existence of violence and corruption related to deforestation (Boekhout van Solinge, 2014b; 2016a-b). Evidence based on field research in Borneo and the Amazon, enabled a growing understanding of the networks involved in logging and deforestation as organized crime, or as criminogenic and violent business subcultures, such as when loggers and large landholders collude in orchestrating violence against people resisting illegal logging and deforestation (Boekhout van Solinge, 2014a-b). Other research explored the legal-illegal interfaces in tropical timber flows and described the social organization of timber flows as being on the edge between legality and illegality (Bisschop, 2012; 2013; 2015). Graycar and Felson (2010) applied the criminological concept of situational crime prevention to illegal timber.

This chapter addresses the question of illegal timber from the perspective of criminology, the academic science of crime. Criminology is a so-called ‘domain science’ rather than an academic discipline, with practitioners from a variety of disciplines, such as psychology, law and the social sciences. Criminology can be simply defined as the study of crime, but a more common definition among criminologists is that it considers crime as a social phenomenon. According to a much used definition by the famous criminologist Edwin Sutherland (1883-1950), it includes the process of making law, of breaking laws and the social reaction towards the breaking of laws (Sutherland et al., 1992).

As noted in earlier chapters, this report distinguishes three different types of illegal logging: (1) informal logging, (2) illegal logging resulting from forest conversion and (3) other illegal forest activities, in particular criminal logging: large-scale illegal extraction, often selectively of a few valuable timber species, and operated by criminal networks. This chapter focuses solely on criminal logging, logging that is related to other crimes, and in which (organized) crime networks are involved. The term “organized forest crime” therefore seems appropriate (see Stewart, 2014). As will be shown, organized forms of forest crime can be found in illegal logging resulting from both forest conversion and other illegal logging activities.

Presenting a criminological perspective on illegal timber means in the first place that the actors and networks that are involved in the criminal types of logging will be analysed and typified, using criminological concepts as well as some theory. A criminological analysis also means that some mechanisms of illegal (timber) business will be discussed, such as the role of legal and illegal crime facilitators. A final aim of this chapter is to bring some criminological knowledge to the forest sector by giving some suggestions from the fields of criminology and

timber forensics for improving detection and prevention of illegal timber.

While illegal timber is the main focus, for completeness it is necessary to differentiate between illegal timber (which was logged or traded illegally) and conflict timber (where the timber proceeds are used for funding armed conflicts). Conflict timber is not necessarily illegal, as the example of Liberia showed in the late 1990s and first years of this century (see Box 5.1). A main difference between illegal timber and conflict timber is the motivation. While involvement in illegal timber is generally motivated by economic objectives, the involvement in conflict timber is usually, at least by some of the (central) actors, motivated by political, ideological or religious objectives, such as in the case of the Taliban (See Box 5.1 on conflict timber).

5.2 A Criminological Analysis of Criminal Timber Actors and Networks

This section considers some of the actors and criminal networks involved in illegal timber and how these actors and criminal networks can be characterised or typified in criminological terms.

In the *Oxford Handbook of Organized Crime*, Boekhout van Solinge (2014a) discussed case-studies of illegal exploitation of natural resources, notably timber, in a number of tropical countries, particularly the large and biodiverse equatorial rainforests of Brazil, the DRC and Indonesia. In all these cases, illegal timber exploitation was closely related to other illegal activities (Boekhout van Solinge, 2014a).

In West and Central Africa, especially during the armed conflicts in the DRC, Liberia and Sierra Leone, proceeds from the sale of timber and several other natural resources such as gold, diamonds and coltan were used to buy weaponry. A large variety of players was involved: state actors, businessmen, illegal entrepreneurs, military and rebels. More than anywhere else, natural resource exploitation in Africa has been connected to armed conflicts. This is probably best exemplified in the DRC, where the war officially ended in 2003 but still continues in some eastern parts of the country. This ongoing conflict is largely driven by exploitation of natural resources, in which states and corporations are involved. During the war, illegally-logged timber from the DRC was exported to the US, and European and Asian countries via Burundi, Rwanda and Tanzania (UNSC, 2000). However, as compared to tropical America and tropical Asia, criminal networks with a primary focus on timber seem to be less common in Africa. This may be because Africa has other, more lucrative natural resources available (notably, gold, coltan and diamonds) which are also easier to exploit and transport than timber.

In Indonesia, investigations by EIA and Telapak (2004; 2005; 2006) revealed the involvement of economic, political and military elites, as well as corrupt officials from the forestry sector and judiciary, Malaysian businessmen, brokers and banks and international logging companies. Tsing (2005) analysed how economic liberalization



These illegal logs were seized, while in transit, and impounded at district police offices, Riau, Sumatra, Indonesia. Photo © Sofi Mardiah for CIFOR

blurred the lines between public, private and criminal exploitation and noted that the “slippage back and forth between military and private enterprise” and the “fluidity between public and private,” made it difficult to distinguish between domestic, foreign, and government ownership, while the military had the advantage of having “the muscle to make the best deals” (Tsing, 2005: 34-37). This created an “authoritarian lawlessness that made resources free for those who could take them” and “violence became key to ownership” (Tsing, 2005: 34-37, 67-68). Over the last years however, significant improvements have been made in Indonesia, which has clamped down on corruption and financial crime (Hoare, 2015; Dermawan and Sinaga, 2015). People from higher ranks have also been targeted, such as a timber smuggler who was convicted to eight years’ imprisonment, with evidence showing that USD 127 million had passed through his account (Nellemann et al., 2015).

In the Brazilian Amazon, violent criminal timber networks – often described locally and in the media as “timber mafia”- have been active for years. Timber traders are involved and corruption is prevalent (Boekhout van Solinge, 2014b). Recent ethnographic and anecdotal evidence in Para state suggests that ipê (ironwood) is currently targeted by (corporate-)criminal loggers, because of high demand for it in Europe. While some of these networks solely focus on timber, collusion with large landholders is also common. Although most deforestation in the (Brazilian) Amazon has been caused by (illegal) expansions of cattle and later also soy farming, this land grabbing with false paper work (*grilagem*) is usually combined with, or preceded, by illegal logging. Both illegal logging and land grabbing in the Brazilian Amazon are particularly violent. It is not uncommon for loggers or large landholders - or acting in collusion - to use gunmen to threaten or kill opposition from local residents (Brooks, 2011; CPT, 2015; Boekhout van Solinge, 2010a; 2016a;

Monbiot, 1991). Between 2002 and 2013, Global Witness identified that almost half of all the murders of environmental and land defenders around the world occurred in Brazil - particularly in the states with most deforestation: Para and Mato Grosso (Global Witness, 2014).

In terms of victimization, the regions with the highest prevalence and incidence of violence against forest residents and other environmental protectors (civilians or staff of NGOs or CSOs) have been identified in the Brazilian Amazon (Global Witness 2014; 2016), while the region that stands out as having the highest victims among law enforcers and rangers is the DRC, particularly where rangers protect forests and wildlife against illegal logging for charcoal (Jenkins, 2008; Boekhout van Solinge, 2008b; Nellemann and INTERPOL Environmental Crime Programme, 2012: 29; Nellemann et al., 2015).

This quick overview shows that very different types of actors are involved in illegal timber activities, with overlaps and collusions between legal and illegal entrepreneurs, corporations, traditional criminals such as gunmen, as well as state actors, governmental agencies and countries’ elites (see e.g. Boekhout van Solinge, 2008a-c; 2014a; Straumann, 2014). Is it possible to typify, in criminological terms, some of these criminal networks, and is it justifiable to consider some of them as organized crime?

In some cases, such as in the DRC, where there was involvement of states, illegal timber exploitation and trade can be considered as “State crimes” as defined by Green and Ward (2004): state organizational deviance involving the violation of human rights. Practical examples can also be found of the broader concept of “governmental crimes”: crimes committed in a governmental context by individuals or organizations for economic or political gain (Friedrichs 2004). Examples of “corporate crime” - which refers to illegal offences committed by employees or corporations to promote corporate interests (Clinard and Quinney 1973; Clinard and Yeager, 1980; Friedrichs, 2004) - can also be identified. Depending on the type of actors dominating timber schemes, criminological hybrid concepts also seem to apply to the timber business, such as “state-corporate crime” (Michalowski and Kramer, 2006; Zaitch et al., 2014) or “state-organized crime” (Chambliss, 1989).

Ruggiero (1996) stressed that the difference between corporate crime and organized crime is actually difficult to make. Criminologist Alan Block emphasized that “organized crime is a social system and a social world. The system is composed of relationships binding professional criminals, politicians, law enforcers, and various entrepreneurs” (Block, 1983: vii). Block’s definition of organized crime is useful and applicable to some criminal timber networks as we understand them from the various studies and reports that were referred to in the Introduction of this chapter.

The United Nations Convention against Transnational Organized Crime (UNTOC) of 2000, the only international convention that deals with organized crime, does not contain a precise definition of “transnational organized crime.” It does contain however a definition

Conflict timber

Conflict timber refers to timber trade that is related to armed conflicts, the most direct way being that the proceeds of timber sales are used to buy weaponry. Conflict timber is not necessarily illegal. The term conflict timber was first coined in 2001 by a UN panel of experts investigating the illegal exploitation of natural resources in the Democratic Republic of the Congo (DRC). A 2002 Global Witness report, *The Logs of War*, which described cases in Cameroon, DRC, Liberia, Myanmar and Zimbabwe, was also instrumental in raising awareness. In more recent years, the eastern part of the DRC has remained under close observation for cross-border trade of natural resources, especially given the presence of the UN Stabilization Mission MONUSCO (United Nations Organization Stabilization Mission in the DRC) and various attempts made at pacifying and stabilising the area. While evidence of harvesting and production of timber and charcoal indeed exists, as well as of the cross-border trade with neighbouring countries such as Uganda or Rwanda (Lescuyer et al., 2014), only scattered evidence exists of the financial mechanisms behind such trade. Yet, according to informal discussions held with MONUSCO officials in the area, it is believed that organized crime and armed groups remain the major culprits managing (and deriving profits from) this trade (see also Nellemann et al., 2015).

In 2002, during the UN summit on Biological Diversity in The Hague, environmental activists chained themselves to a ship transporting timber from Liberia's largest logging company, owned by a Dutch multimillionaire timber entrepreneur. They claimed the timber was connected to arms' trafficking. The timber itself however was legal, as the then President of Liberia, Charles Taylor, had liberalised Liberia's logging laws. The timber proceeds allowed Taylor to stay in power. When the UN Security Council introduced timber sanctions against Liberia in July 2003, Taylor resigned a month later (Boekhout van Solinge, 2008b). In recent years, Liberia's forest sector has made much progress, with the country signing in 2011 a Voluntary Partnership Agreement within the Forest Law, Enforcement and Trade (FLEGT) Action Plan of the EU.

A more recent case of allegedly conflict timber, raised in 2015 by Global Witness, concerns the Seleka's coup d'état in the Central African Republic (CAR), which occurred in March 2013 (Global Witness, 2015). CAR has also recently signed a VPA with the EU, and timber remains one of the country's major exports and sources of income for the government in power. Financial flows (taxes to the central government during the coup as well as many informal payments along roads or around logging concessions to guarantee their protection from militias) did not stop during the coup. As a consequence, Global Witness argues that such timber should be considered as conflict timber, "given the substantial payments made by the industry to the Seleka, [...] where the sale of timber funded the commission of serious violations of human rights, violations of international humanitarian law or violations amounting to crimes under international law." (Global Witness, 2015: 5).

Afghanistan and Pakistan, with Taliban involvement in the timber business, are less well known cases of conflict timber. In 2007 the Taliban took control of Pakistan's Swat Valley, near Afghanistan. Logging became a resource revenue for the Taliban and in 2007 alone, more deforestation occurred than in the previous twenty years. After two years, 15 percent of Swat forests had disappeared. In some parts, 70 percent of the forest was logged (Khan, 2010). In 2009, the Pakistani army drove the Taliban out of Swat, which stopped the large-scale illegal exploitation of Swat's natural resources. Pakistan's immense floods of 2010, which made millions homeless, were severely worsened by the deforestation in Swat.

of "organized criminal group": "a group of three or more persons that was not randomly formed; existing for a period of time; acting in concert with the aim of committing at least one crime punishable by at least four years' incarceration; in order to obtain, directly or indirectly, a financial or other material benefit" (United Nations General Assembly, 2000). Transnational crimes cover not only offences committed in more than one State, but also those that take place in one State but are planned or controlled in another. Also included are crimes in one State committed by groups that operate in more than one State, and crimes committed in one State that have substantial effects in another State.

Academic criminologists often find the UNTOC definition too general; indeed many of the cases studied around illegal timber that Boekhout van Solinge (2014a) analysed seem to fit into this definition. In the scientific organized crime literature two rival notions of organized crime can be distinguished: one that understands organized crime as a set of stable organizations illegal per se or whose members systematically engage in crime, and the other that considers organized crime

as a set of serious criminal activities mostly carried out for monetary gain (Paolo and VanderBeken, 2014).

In the North American literature on organized crime there is general consensus that "organized crime functions as a continuing enterprise that rationally works to make a profit through illegal activities, and that it ensures its existence through the use of threats or force and through corruption of public officials to maintain a degree of immunity from law enforcement" (Albanese, 2005: 9). The private use of violence in public places is considered important or crucial by some authors for determining whether there is question of organized crime (e.g. Blok, 1974; 2008; Fijnaut et al., 1998). Interestingly, an earlier UN definition of 1990 included these violent aspects, stating that the criminal activities of tightly or loosely organized associations "often involve offences against the person, including threats, intimidation and physical violence" (United Nations, 1990: 5).

As the famous sociologist Max Weber formulated about a century ago, monopoly on the use of legitimate violence is a key characteristic of a functioning state. When this monopoly is not in the hands of the state, it

undermines its power and it can no longer play its role as enforcer of law and order (Acemoglu and Robinson, 2013). This power vacuum left by the state opens the door for other groups as networks to take control; it is under these circumstances that organized crime can flourish. “All things considered, it appears that organized crime tends to flourish in divided, conflict-riddled communities in which government is weak and/or corrupt almost as a matter of course, and therefore becomes part of the problem rather than part of the solution” (Fijnaut, 2014: 87).

As criminal or organized crime networks are involved in forest crimes - not only in illegal logging itself, but also in logging-related crimes such as violence and corruption - the term “organized forest crime”, as employed by Davyth Stewart (2014), head of INTERPOL's Environmental Crime Programme, is indeed appropriate. In this chapter, organized forest crime is defined as the illegal exploitation of forest or forest products/resources by organized criminal groups or criminal networks that ensure their activities through the use of threat or force and through corruption of public officials in order to maintain a degree of immunity from law enforcement.

5.3 Facilitators of Organized Forest Crime

Immunity from law enforcement is thus basically what organized (forest) crime is about. For the professional law breaker, this allows for the upscaling of illegal business activities: more business hours (sometimes 24/7) and larger quantities.

Criminologists are often interested in the interplay between the illegal underworld and the legal upperworld, such as through so-called “facilitators of crime”. Traditionally, these facilitators mostly have a legal background, such as lawyers (Levi et al., 2005; Nelen and Lankhorst, 2008). There are also however, other kinds of facilitators, providing crucial services for groups of offenders, for example money exchangers, money launderers, document forgers, and financial and legal advisers (Kleemans, 2014). For international trafficking, facilitators are ideally found among people who work at airports or large harbours, where they can ensure that illegal cargo or people are not controlled. People in high(er)-ranked, management or central positions of the law enforcement system are also ideal facilitators because they can influence which, and how many, staff members work when and where.

In the commodity chain of criminal timber entrepreneurs, two phases seem to be crucial: the illegal harvesting of trees and giving a legal appearance to the illegally-harvested timber. In both phases, both illegal and legal facilitators of crime are needed.

5.3.1 Illegal Facilitators

During and after the illegal tree felling (as well as during transport), criminal loggers might face serious obstacles, in the form of protest from local residents, or in the form of controls by inspectors or law enforcers. During this phase

violence might be used by security guards of the logging operation. This violence is usually directed against leaders of forest or riparian communities. It is also often directed against environmental activists/defenders, or against law enforcers or environmental inspectors. In some countries these “security guards” are hired violent criminals or gunmen while in other countries or regions they are military, policemen, militia or rebels.

Other illegal facilitators that were found in the illegal timber business are for example forgers of logging permits and timber certification, and hackers who can facilitate “legalising” quantities of illegal timber (Lawson and MacFaul, 2010). Once a window of opportunity has been opened to legality, large quantities can be put through the system. This is true for illegal drugs that can go through some (air)ports when certain people are (not) working, and it applies to illegal timber with a legal appearance. The amount of illegal Amazonian timber that was given a legal appearance by hackers who had broken into the digital governmental timber control system, was estimated at 500,000 cubic metres. As was described in a newspaper in the Amazonian harbour city of Santarem - regionally known as an (export) hub for illegal timber- this quantity of “legalized” timber was so large that some 14,000 trucks would have been necessary for its transport. It also reported that the regional office of the Environmental Inspection agency IBAMA had been closed by the Federal Police and that the houses of IBAMA agents had been searched (Sousa, 2014; Boekhout van Solinge, 2014b).

5.3.2 Legal Facilitators

In order to understand illegal phenomena, it is always informative to consider during which phase of the illegal commodity chain most profit can be made as it is in this phase that most investments, such as through bribery, can also be made.

Applied to illegal timber, it is probably in the shift from illegal to “legal” where most profit can be made, especially if illegal timber can be made ready for “legal” export. A crucial phase therefore for organized crime groups involved in illegal timber is to give the timber a legal appearance. People who can arrange this are the necessary intermediaries between the illegal and the legal worlds. If legal facilitators – e.g. politicians or environmental inspectors - are aware of their crucial role as facilitators, some become pro-active and require payments from timber traders (Boekhout van Solinge, 2014b).

In illegal timber, as with many other illegal businesses, middlemen are the ones make most profits, as EIA (2008) showed for illegal merbau from Indonesian Papua and Nellemann et al. (2016) for illegal rosewood from West Africa. Boekhout van Solinge (2008c) described a large timber trafficking scheme in Borneo's interior, where meranti timber that was illegally logged in an Indonesian national park was smuggled to nearby Malaysia. Malaysian businessmen were paid between 10-20 euros for one cubic metre of meranti, while on the international market it could sell for 200 euros. (see picture(s) by Tim Boekhout van Solinge).



Large-scale timber trafficking from Indonesia to Malaysia in the interior of Borneo. Meranti timber that was illegally logged in Indonesia's Betung Kerihun National Park is waiting to be trafficked to nearby Malaysia (Sarawak).

Photo © Tim Boekhout van Solinge

In some countries, timber traders are also politicians, or they have family, friends or business relations who are politicians. When these patterns are observed, there is the risk of collusion, a secret alliance between for example timber businessmen and politicians. Collusion is often accompanied by corruption, illegal behaviour by people in positions of power or authority. In some countries timber traders have gained so much wealth that they are called timber barons or timber tycoons; the best known cases being found in Indonesia and Malaysia (EIA, 2008; Straumann, 2014). A culture of corruption can develop when people in high positions are involved in large-scale timber extraction that is facilitated by corruption or collusion as this encourages rule-breaking behaviour among business people and officials in lower positions.

5.3.3 Opportunity Structures

The well-known expression “resource curse” refers to the paradox whereby countries that are rich in natural resources experience less development on average than countries without those resources (Sachs and Warner, 2001). Kolstad and Søreide (2009) identify corruption as the main reason why resource-rich countries perform relatively badly in economic terms. Countries are more likely to suffer from a resource curse when they have poor institutions, notably those responsible for governing the private sector by the rule of law, and those that hold politicians accountable for using public resources (Kolstad and Søreide, 2009). The crucial role of functioning institutions for a country's economic prosperity was described comprehensively by Acemoglu and Robinson (2013) in their book *Why Nations Fail?*

Opportunity structures are not only present on the supply side in vast forests where institutional presence may be low, but they exist actually all along the

Box
5.2

Illegal logging in the Russian Federation

Russian forests cover 891 million hectares, approximately half of the country's territory (Federal Statistical Service, 2015). This enormous forest resource (over 83 billion m³) represents around a quarter of the world's timber reserves (Akim et al., 2014). A significant proportion of Russia's forest resources is located in the Far Eastern region of Russia, one of the Earth's most biologically valuable ecoregions (Olson and Dinerstein, 2002), and in Siberia.

Currently, illegal logging is one of the most acute problems facing Russia's forest sector although to date, no effective method has been adopted to assess the amount of illegal logging in the Russian Federation. This is due to a number of factors including: a lack of definition of illegal logging in Russian legislation; the use of different methods for the measurement and accounting of wood; a lack of transparency in forest use; and corruption within forest control bodies. As a consequence, estimates of losses from illegal harvesting differ considerably and are unreliable. They vary from 10 percent, the estimate of the Federal Forestry Agency (2013), to around 50 percent (Office of the Prosecutor General, 2014) and 30-60 percent by the EIA (2013).

Illegal logging and timber trade are the breeding ground for corruption and organized crime. The Chairman of the Constitutional Court V. Zor'kin (2010) warned against the possibility of transformation of Russia from a criminalized to a criminal state. He further cautioned that statistics portraying a drop in organized crime are misleading as they demonstrate a failure to detect and register them rather than an actual reduction in crime (Zor'kin, 2010).

China receives 96 percent of the precious wood exported from Russia's Far East. Estimates by the EIA (2013) suggest that at least 80 percent of these exports consist of illegally-logged old-growth timber, often from protected areas, stolen with the use of fake documents and official seals that have been received from bribed forest officials. Chinese organized crime groups are involved in harvesting and export of timber in the Russian Far East (Lelyukhin, 2012). Criminal groups manage big forest plots in Khabarovsk and Primorsky krajs, Amur and Chita oblasts bordering with Northern China. According to estimates, Chinese triads are exporting around 1.5 million cubic metres of Russian timber worth at least USD 300 million (Lelyukhin, 2012).

commodity chain, including in transit and destination countries. Because forest crimes - and wildlife crimes - are currently not a priority for most countries, they often remain overlooked and poorly understood (UNODC, 2012).

Criminologist Lieselot Bisschop (2015) analysed the social organization of illegal timber trade focusing particularly on the legal-illegal interfaces, the role of trade hubs like important timber importing ports, and the facilitating role of transit countries like China and Singapore. Bisschop was told by policymakers that some

major actors in the international timber business (notably in Asia) do not exercise necessary due diligence for their supplies. She also found that in a destination port such as Antwerp (the principal destination harbour in the EU for West and Central African timber) inspections were mostly paper inspections and illegal timber detection had a low priority. Her research took place before the EU Timber Regulation took effect.

Since March 2013, the EU Timber Regulation (EUTR) makes it an offence to place illegal timber on the market. In 2016, the European Commission (2016: 9) noted that EU member states “have not reported any closed investigation cases for violation of the prohibition obligation.” Greenpeace (2014; 2015) on the other hand presented case studies claiming that it had traced illegal timber from Brazil and the DRC entering the EU which, in the case of Congolese timber unloaded in Antwerp, led to wood confiscations in Germany.

In March 2016, the first public actions were taken in EU countries: authorities in Sweden and the Netherlands notified companies that imported timber from Cameroon and Myanmar may be subject to sanctions (Saunders, 2016). The EUTR is likely to be increasingly enforced and improved (such as through the EUTR Guidance Document of February 2016), but the scale of the EU’s timber imports from countries and regions that are known to have high levels of illegal logging suggests that ample opportunities still exist for exporting illegal timber to a destination market like the EU.

From the perspective of effective law enforcement, it would seem more logical for customs to be directly involved in the EUTR enforcement. Controls are more precise and effective when they happen when the freight and bill of lading are together and when (forensic) verification techniques can be employed to see whether they correspond, rather than afterwards, via documents or during an (announced) inspection at a timber company, as is still common EUTR practice.

In that respect, enforcement in the United States via the Lacey Act seems to have more power and uses more (forensic) investigation techniques. Large fines have been issued such as in the case of the Lumber Liquidators (several millions); and in the case of Gibson guitar a (monetary) penalty of USD 300,000. Despite the apparent stricter and more effective legislation and enforcement in the United States as compared to the EU, “large volumes of likely-illegally-sourced wood continue to be imported into the United States” (Lawson, 2015: 15).

The general low level of involvement of police, judiciary and customs in destination markets can also be identified as a crime opportunity structure. Timber crimes do not earn as much official scrutiny or media coverage, or spark the same degree of public alarm as more traditional or better known global crime issues like the trafficking in drugs, humans or arms (Naim, 2007). International policymakers have generally been reluctant to consider illegal timber as a crime issue. For years, illegal timber was primarily treated as an economic or trade issue, and secondly as an environmental issue. Only since a decade or so, it is also being perceived as an international crime problem.

Because illegal timber is primarily considered a trade issue - and only secondarily as an environmental issue, and more recently as a crime and law enforcement issue - ministries of economic affairs or agriculture, and possibly environmental ministries, are usually responsible for policy implementation rather than the ministry of justice. It is consequently no surprise that seeking agreements with timber trade organizations is generally preferred over mobilising law enforcement agencies and applying their technical (forensic) and criminal investigation techniques.

UNEP-INTERPOL’s most recent report on environmental crime estimates that in 2016 the total financial resources currently available for environmental crimes at the primary global institutions (e.g. CITES, INTERPOL, World Customs Organization (WCO) and UNODC) responsible for reducing the global illegal trade probably amounts to around USD 20 million. In comparison with, for example, US domestic and international drug law enforcement –which is around USD 2 billion (Nellemann et al., 2015)– prevention and enforcement of illegal timber are still clearly given low priority.

Large profits can be made in the illegal timber business, as various cases show. This is combined with the observation that (organized) forest and timber crimes are still given relatively low priority in destination, transit and exporting countries (UNODC, 2012). If one adds to this the lack of real, verifiable (corporate) transparency in timber commodity chains (Dauvergne and Lister, 2011; Bisschop, 2013), one can only conclude that many opportunities still exist for logging and trading timber illegally. As such, the large levels of illegal timber on the international market, in both absolute and relative terms, are well explained by the criminological “Crime Opportunity Theory”.

5.4 Criminological Tools

As defined in the introduction, the domain of criminology includes the process of making and breaking laws, and the social reaction towards the breaking of laws. This section explores what can be done to better detect, limit and prevent criminal and organized forms of timber exploitation and trade.

5.4.1 Clearly Defining the Crime Issue: Serious Crime or Organized Forest Crime

The more professional and criminal forms of illegal timber trade should be treated as what they are: serious crimes that are committed by members of (transnational) organized crime networks. Formal acknowledgement of this fact actually offers more law enforcement possibilities. When a crime phenomenon falls into the category of serious crimes or organized crime, the law enforcer’s “tool box” can be opened because serious crimes allow the use of advanced investigation techniques such as phone tapping, financial investigations, controlled deliveries, etc. The overviews by Goncalves (et al. 2012) and

Dismantling an organized timber network in Brazil: Operation Clean Timber (Madeira Limpa)

While there has been a strong reduction in deforestation in the Brazilian Amazon due to increased enforcement and the implementation of different policies (Nellemann et al., 2016), the situation is far from being under control. Criminal timber networks often use gunmen to intimidate, threaten or kill local or environmental protest by leaders of forest and riparian communities that resist illegal logging. Global Witness (2014) noted that 25 years after the murder of Chico Mendes, Brazil is the most dangerous place to be an environmental and land defender. Recent law enforcement and criminal investigation by Brazil's Federal Police and Federal Prosecutor in Santarem (Pará) reveal some of the ways in which criminal logging networks operate.

In August 2015, Brazil's Federal Police and Federal Prosecutor in Santarem started a criminal case against a large illegal timber network. Fraudulent timber credits and transport documents gave a legal appearance to illegally logged timber, particularly ipê, massaranduba and angelim vermelho. A large timber exporting company in Santarem that owned several sawmills, coordinated the illegal timber scheme. Over a dozen people were arrested and put in prison: timber traders, a document forger and several (high ranking) civil servants.

Corrupt officials were found at different government levels:

- Federal level: at the Environmental Inspection Agency (IBAMA), and at the Institute for Colonisation and Agrarian Reform (INCRA);
- State level: Para's state Finance Agency (SEFA) and Para's Environmental and Sustainability Secretariat (SEMAS);
- Municipal level: Municipal Environment Secretariat (SEMMA).

Among those arrested were a high-ranking super intendant of INCRA, a politician and a municipal secretary for the environment. For a detailed description see Greenpeace (2015) or see the Brazilian media coverage of "Madeira Limpa", for example by Brazil's commercial television network Globo.

In November 2015, the lead author of this chapter visited communities where the criminal loggers had been operating. One community leader had been threatened and later attacked after travelling several times to the prosecutor's office in Santarém (a whole day's trip by motorised transport) to report illegal logging activities. Contacts between affected communities and prosecutors had been established by a project on Conflict and Cooperation over Natural Resources, funded by the Dutch Organization of Scientific Research (NWO), which the lead author coordinated (Boekhout van Solinge, 2016a-b). At different hotspots of illegal logging he was told that the criminal and violent loggers selected valuable trees such as ipê, as these would fetch a good price in Europe. Several months after the initial enforcement operations, several (high ranking) civil servants who acted as crucial facilitators of the illegal timber scheme, were still in prison. In 2016, he heard that other criminal loggers had arrived in the area.

UNODC (2012) can function as guides for criminal justice procedures such as, for example, bilateral and multi-lateral police and justice collaboration aimed at suppressing international timber networks.

An important condition for being considered a serious crime is that the offence is penalized accordingly by legislation. The Convention on Transnational Organized Crime prescribes that "an offence does not qualify as 'organized crime' if the maximum prison penalty is lower than four years, which often applies to environmental crimes" (Spapens et al., 2016: 2).

When international (e.g. by INTERPOL (Stewart, 2014)) or regional investigative operations are done, they can yield significant results (see Box 5.3).

Although crime interventions in the field of environmental crime in general are complicated (Spapens and Huisman, 2016), the current (albeit limited) forest law enforcement capacity could be used most effectively. Technology can be of help, especially in vast forested areas. Moreover, law enforcement capacity can be used more effectively by focusing on identifying central actors of illegal timber networks, as well as, crucial facilitators, those who are difficult to replace and who can therefore be considered as the essential, but also weak, link in the criminal network.

Public policies and public-private initiatives can reduce some of the opportunity structures that currently still exist in favour of illegal timber trade. For example, preventive anti-corruption policies can be developed for certain vulnerable and criminogenic professions and



Dollar banknotes, handcuffs and judge gavel
Photo © Fotolia: aruba2000

certain governmental agencies. Administrative law can be used for withdrawing certain permits.

Illegal facilitators, especially those that in some areas regularly or structurally use threats and violence against forest residents or others and thereby de facto control the monopoly on violence, should be prioritised because they challenge the authority and legitimacy of the state and rob the country and its people from natural resources.

5.4.2 Situational Crime Prevention

Since several years some Western, particularly European, countries are experiencing a reduction in crime, the so called “crime drop”. One of the main criminological explanations for this decline is that it has generally become more difficult to commit certain crimes (Van Dijk et al., 2012). Based on the crime opportunity theory, various governments put policies in place such as situational crime prevention (Clarke, 1997). “Central to this enterprise is not the criminal justice system, but a host of public and private organizations and agencies” (Clarke, 1997:2). Situational crime prevention is mostly used in Western countries and urban settings, and commonly combined with social activities, such as surveillance and response to crime by people, including households and security personnel (Ekblom, 2006). Situational crime prevention is also employed in the field of wildlife, such as described by Lemieux (2014) for the prevention of poaching in Uganda.

Situational crime prevention can also be applied to organized crime (Bullock et al., 2010), as well as to illegal

logging and related corruption (Magrath et al., 2007; Graycar and Felson, 2010), particularly in areas that are vulnerable to illegal logging. This vulnerability can be caused by the abundance of certain valuable species, by certain geographical and logistical advantages for (illegal) timber, and it can be explained by the criminal opportunities: lack of control, low governmental presence, a culture of corruption, etc.

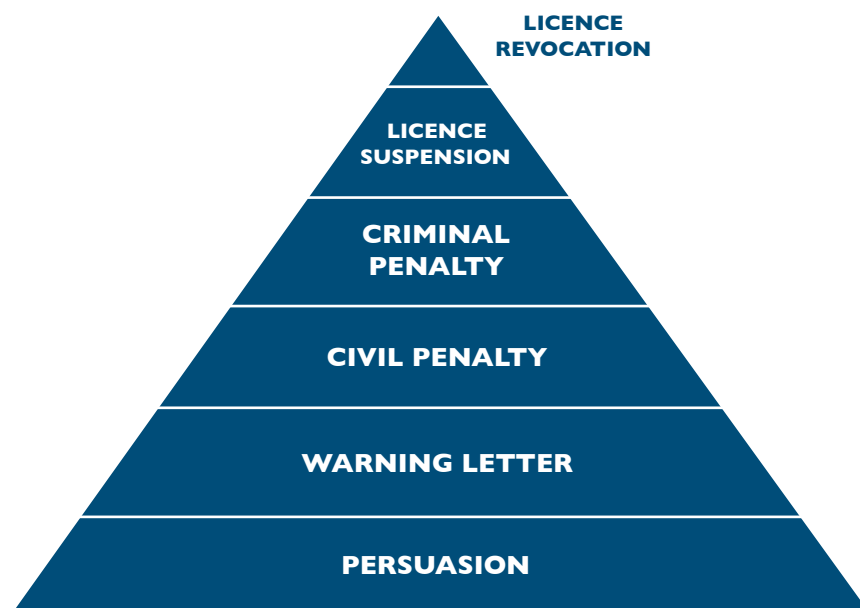
As (forest) crime can be concentrated in certain areas (‘hotspots’) or happens more at certain hours (‘hot times’, such as log transports during the night), specific situational prevention strategies can be developed and put in place. Situational crime prevention can be combined with crime mapping and “techno prevention” - crime prevention with the help of technology. In forests, the social dimension of situational crime prevention is most logically implemented by working with the people who are already present, such as forest residents, who generally (but not always) have a direct stake in keeping the forest intact.

5.4.3 Community Forest Watch Supported by (GPS) Technology

A major limitation of the surveillance of vast forests with many valuable trees is the low level of law enforcement presence. It can happen that a single public prosecutor is responsible for law enforcement and the rule of law in an area the size of France. This is for example the case of the state prosecutor in Brazil’s West Para, responsible for (agricultural) land conflicts. As much illegal logging (as well as illegal mining and land grabbing) takes place

The enforcement pyramid

Figure 5.1



Source: Ayres and Braithwaite (1992)

in this large area, it is simply impossible to effectively enforce the law.

Much of today's forest monitoring is done with the help of satellites. While satellites are extremely useful, forest crimes such as (selective) illegal logging, small-scale land grabbing and violence against community leaders are not detected by satellites. They stay under the radar because they happen under the tree or cloud cover, or because they occur on a small scale in remote places without mobile phone reach or internet connections. As is known from military operations, intelligence from the ground, collected by locals, is essential for knowing what is really going on, and who is going where. In Indonesia for example, civil society has been given a formal role in monitoring the forest legality system.

In different forests around the world, relatively different small projects are ongoing with forest communities making use of GPS technology. This technology is usually used for land demarcation, map making and land tenure claims. GPS and other technology however can also be used to collect evidence of illegal logging and timber trafficking routes. When there is trust between law enforcement actors and (leaders of) forest communities, GPS pictures and other intelligence from the ground can be communicated to law enforcement and criminal justice agencies (see also Stewart, 2014).

One such project of GPS-supported community forest watch has started around some hotspots of criminal logging in the Brazilian Amazon (Boekhout van Solinge, 2016b). Local residents use water proof GPS cameras to collect evidence of illegal logging, illegal timber transports, and also land grabbing. As several public prosecutors became part of an academic/NGO network that was formed during a previous scientific project, contacts were established between public prosecutors and leaders of communities where criminal logging is prevalent and violent. Communities that collect GPS-referenced pictures of illegal logging and deforestation now know that public prosecutors are receptive to using them to collect proof. A project like this can be considered as a forest version of the urban crime prevention programme "Neighbourhood Watch".

Forest watch networks can be ideally combined with crime mapping and situational crime prevention. People in forest areas know where the big centenarian trees sought by illegal loggers can be found. They also know which timber species the illegal loggers are after; such as today rosewood in Africa, meranti or merbau in Asia, and ipê in the Amazon. Locals often know where illegal timber transports are going or who is in control. While this may entail the risk of being controlled and exploited by local elites, there are also (always) communities and community leaders that clearly want to preserve the forest (Boekhout van Solinge, 2008c; 2016a-b).

5.4.4 Addressing Corporate Crime

Criminology distinguishes two main models in the case of rule- or law-breaking behaviour by private actors such as corporations: the "cooperation" model and the "sanctioning" (or "deterrence") model. The cooperation

model is based on compliance, the sanctioning model on deterrence and criminalization.

Cooperation is generally preferred by private actors (the regulated) and governmental institutions (the regulators); both wish to keep the costs as low as possible, as well as maintain good relations between regulator and regulated (Van den Heuvel, 1993).

The influential criminologist John Braithwaite who wrote much about corporate crime, stated that selecting between cooperation or deterrence basically comes down to the type of actors and their attitude. "When there is a willingness to do the right thing in the business community, a punitive-adversarial regulatory style is simply not the best strategy for maximizing compliance. Punishment is the best strategy when good will is wanting" (Braithwaite, 1989: 130).

In some parts of the Amazon where logging and related corruption and violence are common, Boekhout van Solinge (2014b) identified the existence of a violent business subculture, a variation of John Braithwaite's (1989) description of business subcultures: businesses resisting law enforcement by forming oppositional and criminogenic business subcultures. When in certain timber exporting and processing regions or countries such a criminogenic timber sector seems to exist and where law-breaking behaviour is almost the norm (see also Goncalves et al., 2012), one can speak of a business subculture, and law enforcement measures seem inevitable.

In developing public and private policies for limiting illegal timber trade, countries and their law enforcement and inspection agencies might be inspired by the "Enforcement Pyramid" (see Figure 5.1) by criminologists Ayres and Braithwaite (1992), which is already employed in a number of countries. When necessary, there can be an escalation to more punitive sanctions. For further criminological suggestions, see also Bisschop (2015) and two recent books on transnational environmental crime and enforcement (Spapens et al., 2016; Elliot and Schaedla, 2016).

5.5 Forensic Tools for Better Governance and Criminal Timber Investigations

Methods based on intrinsic characteristics of the wood itself are a crucial addition to existing legislation aimed at combatting illegal logging and the associated trade.

5.5.1 Overview and Applicability of Forensic Tools

Two sets of forensic tools have been developed for this purpose. Dormontt et al. (2015) present a thorough overview of the field and the recent UNODC report provides practical guidelines (UNODC, 2016). The first set of methods aims to verify the claimed timber species; these are tools to identify species based on wood characteristics (Box 5.4). Some of these methods – e.g., wood anatomy – have a long history of development, are broadly applied in timber verification and have been used in law enforcement (Gasson, 2011).

Box
5.4

Four methods to verify species claims

1. **Wood anatomy.** Wood anatomical analysis is a fast and low cost method applied by many frontline officers when fraud is suspected (Dormontt et al., 2015). This method requires expertise, is based on visual characteristics of wood and generally adequate to distinguish timber at the genus level (Gasson, 2011), which can be sufficient to distinguish CITES- from non-CITES-listed species.
2. **Metabolic profiles.** The classification of timber based on metabolic profiles produced by advanced mass spectrometry is a relatively recent development (McClure et al., 2015). These profiles are like “chemical barcodes” of timber and can be compared to reference profiles from known taxonomical identity. The method is generally capable of distinguishing timbers at the species level (Lancaster and Espinoza, 2012).
3. **Near-infrared spectroscopy (NIRS).** NIRS is the measurement of the wavelength and intensity of the absorption of near-infrared light by a sample. This method is already widely applied in timber quality control, but could also be used to verify species claims (Braga et al., 2011).
4. **DNA barcoding.** DNA barcoding compares profiles of unknown samples to those with known taxonomical identity. DNA barcoding can also differentiate between closely-related species and is the standard for species identification (Lowe and Cross, 2011).

Across methods, important differences exist in accuracy, costs and experience required to perform verification.

The second set of methods is used to verify the claimed geographic origin of the timber (Box 5.5). In contrast to species identification methods, these recent methods have not been used extensively so far and have, to our knowledge, not yet been used in criminal prosecutions.

5.5.2 The Need for Reference Databases

Forensic tools that use chemical or genetic properties to verify the geographic origin of timber, require the existence of reference databases. These databases need to contain values of chemical or genetic properties of wood from a known geographic origin and, importantly, these values and their geographic origin need to be trustworthy.

For genetic characteristics such databases necessarily need to be species-specific, i.e. one database for each botanical species or timber variety. For chemical characteristics, such species-specific databases are the best option because isotope values may differ between tree species, even for the same patch of forest. Obviously, databases need to be based on representative samples for the timber variety: covering the entire geographic range of the tree species, representing all areas within that range and with a sufficiently large amount of samples (>100).

Building high-quality reference databases requires financial investments, time and patience, but if done well,

it will certainly be rewarding. Forensic methods have for example already successfully been applied to reveal the international supply chain of ivory and to locate poaching hotspots (Wasser et al., 2015). In a similar way, forensic tools may be used to expose international timber trafficking and increase supply chain transparency of timber as a whole.

5.6 Conclusions

It is only since a decade that illegal logging and the consequent (international) trade have been recognised as a global crime problem by international law enforcement agencies and (academic) criminologists.

In this chapter we argued that organized crime and professional criminal networks are (also) involved in the illegal timber trade. These networks have connections to the legal upperworld and to the illegal underworld. Some forms of organized illegal logging and organized forest crime can be considered as (transnational) organized crime, considering the fact that some of these organizations are immune from law enforcement, by their use of threats and violence, combined with corruption or collusion. In some parts of the world, organized forest crime is particularly violent. Violence is used against forest residents, environmental defenders, and law enforcement personnel.

Focusing on the prevention and detection of opportunity structures –or illegal windows of opportunity– such as so-called facilitators of crime, some of whom are found at or near the interface of the legal and illegal, can help to improve effective law enforcement. Moreover, as resources for preventing and detecting forest crimes are

Box
5.5

Three methods to verify geographic origin

1. **Tree rings.** Time-series of ring width measurement of timber samples are compared to reference data from known geographic origin (Sass-Klaassen et al., 2008) or to climate data to verify the most probable origin. First tests for tropical timber suggest that this modified approach may work at a country to regional scale.
2. **Chemical properties.** The fraction of stable isotopes in timber is determined by the growing conditions of the tree. Analyses of stable isotopes have shown promising results for temperate (Horacek et al., 2009) and tropical timbers. This method provides a reliable and cost-effective means to verify the origin of timber at regional to country scale.
3. **DNA.** DNA microsatellites and SNPs (single nucleotide polymorphisms) are standard tools for differentiation of populations within species because genetic differences between trees increase with geographic distance. Degen et al. (2013) showed that microsatellites can be used to correctly trace back mahogany samples to their country of origin.

still limited, creativity combined with new collaborations may be required. For example, situational crime prevention can be applied to organized forest crime, especially when collaborations are sought with forest communities, particularly those that have shown to have a stake in forest preservation.

Prioritising serious or organized timber crime, particularly those groups or networks that have a certain degree of immunity from law enforcement, would help reduce opportunities for criminal timber trade. These types of networks should be dealt with accordingly, such as by using advanced investigative methods, which now are only occasionally employed.

More work could go into ensuring that sanctions for forest crimes are being executed, such as ensuring that fines are paid. And as Goncalves et al. (2012) noted, it is also time for the high-level law breakers, rather than the low-level ones, to be targeted by the criminal justice system. Moreover, logging permits should be withdrawn after serious or repeated offences.

This chapter also summarized the many methods, practices and tools from criminology and timber forensics that can be used to better prevent and detect organized timber crime by organized criminal timber networks. The suggestions from 5.4 (criminology) and 5.5 (timber forensics) can be used for improving both the detection and prevention of illegal timber appearing on the market. While a range of timber identification tools exist, they are as yet only used in a few countries or regions in crime prevention or criminal investigations.

In order to address some of the criminal timber networks and to limit their opportunities, international (bilateral) police and justice cooperation is needed. Criminal investigations are rare, but if they happen they clearly yield results as national and international cases show. This suggests that more national and international criminal investigations (bilateral and multilateral) are needed, just like is done in other serious and organized crime areas with international trafficking routes. A current condition for international police and justice cooperation under the umbrella of the UN Convention against Transnational Crime is that offences are punishable with a minimum of four year imprisonment. In order to increase international police and justice cooperation, some environmental and/or forest laws may need to be adapted for this purpose (see e.g. UNODC, 2012).

Knowledge Gaps

1. In-depth criminological studies on criminal timber networks are sparse. There have been no criminological analyses with research methods such as interviews and judicial dossier analysis. Interviews can be done with law enforcers but also with convicted timber traders (just like criminologists do with other illegal entrepreneurs) and corrupt officials.
2. Commodity chains are still not very transparent. Securing independent verification of legality and sustainability would be necessary.
3. Anecdotal evidence exists that loggers in the Amazon use satellite phones and use “hit and run” tactics, after

valuable trees have been identified. Better understanding of the techniques of criminal loggers would be necessary and appropriate technology developed or applied to better detect and prevent them.

4. Methods are needed to better engage forest communities (in a safe fashion) in situational crime prevention and possibly also in detecting and reporting on forest crime.
5. There is anecdotal evidence of cocaine smuggling in logs, timber investments by drugs criminals, or criminal logging networks also being involved in other illegal activities. Research is needed to clarify and describe overlaps between illegal economies.
6. Improved understanding is required of the dynamics of the legal and illegal market with regard to certain crime prone timber species that are targeted by criminal timber networks, such as today rosewood in Africa, ipê in the Amazon, and (earlier?) meranti and merbau in South East Asia.
7. An assessment of the effects of timber sanctions, such as in the case of Liberia and Myanmar, is necessary.
8. Research is needed to extract high quality DNA from timber.

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