INDEX AND PERCENTAGE

An Accessible Method for Measuring Illegal Logging and Trade in Timber
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In recent years, the Peruvian government has been working to issue policies and regulations and to coordinate actions to enable progress toward the overarching goal of reducing timber illegality in Peru.

One challenge that remained, however, was to formally establish a methodology for quantifying illegality—among other reasons, to make it possible to monitor the impact of these government policies, regulations, and actions, and thus be able to gradually improve public policy decisions.

Against this backdrop, Index and Percentage | An Accessible Method for Measuring Illegal Logging and Trade in Timber, as part of the study “Estimating and Improving Timber Legality in Peru,” seeks to fill the gap, overcome existing challenges, and become a tool for better decision-making aimed at reducing—and ideally eliminating—illegal logging and illegal trade in timber.

The method used to calculate the Index involves comparing the volumes of timber the forestry industry reports having received (demand) with the logged volumes (supply) reflected in the local forest information system, forest transport permits (GTFs), or extraction reports. It is important to note that the production of clandestine timber—timber that enters the market without any type of permit for harvesting, processing, or transport, and therefore leaves no record—falls outside the scope of this study.

The first step was to determine timber supply and demand flows in the domestic market for a specific year, ensuring that reliable data were available. The next step involved adapting the methodology proposed by Navarro et al. (2010) in Diseño de un indicador de tala y comercio ilegal de madera en Nicaragua [Designing an Indicator of Illegal Logging and Trade in Timber in Nicaragua] for purposes of calculating an illegal logging and roundwood trade index for Peru. Next, the volume of unauthorized logging reported by OSINFOR for 2017 was subtracted from the volume of timber supply based on GTFs or extraction reports. The year 2017 was chosen because 2018 supply data were not yet available at the time of the study.

To determine wood supply flows, the study looked at nine regions: Loreto, Ucayali, Madre de Dios, Amazonas, San Martín, Huánuco, Pasco, Junín, and Cusco, which together accounted for over 98% of regional roundwood production in 2015. The timber demand study (CNF, 2019) looked at 12 regions (adding three coastal regions owing to their importance in terms of commerce and population). It was also considered important to separate timber flows by forest resource access mechanism (forestry license type).

One of the main findings is that if the volume of unauthorized logging reported by OSINFOR is not factored in, the illegal logging index comes to 1.41 for forest concessions and native and rural community permits, i.e., 29% of all timber extracted can be considered illegal. For the other types of forestry licenses, such as private property permits, local forests, and plantations, the illegal logging index goes up to 3.14, meaning that 68% of all extracted timber is illegal. Overall, for all license types, the illegal logging and trade index was 1.59 and the percentage was 37%.

These are not the only findings, however. This report, along with the other five that make up the study, provides information that will enable the Peruvian government to make better decisions and thereby achieve our country’s vast forestry potential.
List of tables and figures

| TABLE 1 | Summary of previous studies on illegality in Peru | 28 |
| TABLE 2 | Effective roundwood supply by region and forest resource access mechanism (license type) in Peru – 2017 | 47 |
| TABLE 3 | OSINFOR-reported unauthorized logging volume (m³r) in the Peruvian regions in the study – 2017 | 48 |
| TABLE 4 | Effective roundwood supply minus unauthorized logging volume, by forestry resource access mechanism (license type) in Peru – 2017 | 49 |
| TABLE 5 | Primary industry demand for roundwood (m³r) by forest resource access mechanism (license type) in Peru – 2017 | 50 |
| TABLE 6 | Illegal logging and trade in timber (ILi and IL%) in Peru based on volume of effective supply minus unauthorized logging, by forest resource access mechanism – 2017 | 53 |
| TABLE 7 | Illegal logging and trade in timber (ILi and IL%) by forest resource access mechanism in Peru – 2017 | 54 |
| FIGURE 1 | Illegality in Peru’s timber value chain – 2017 | 14 |
| FIGURE 2 | Continuum between legal and illegal forest production | 22 |
| FIGURE 3 | Flow of legal and illegal wood in Peru and scope of study – 2017 | 24 |

Acronyms and abbreviations

- **CEPLAN** Centro Nacional de Planeamiento Estratégico [National Center for Strategic Planning]
- **CITEmadera** Center for Productive Innovation and Technology Transfer – Wood
- **CNF** Cámara Nacional Forestal [National Forestry Chamber]
- **DANE** Departamento Administrativo Nacional de Estadística [National Administrative Department of Statistics]
- **FAO** Food and Agriculture Organization of the United Nations
- **GTF** Forest transport permit
- **IL%** Illegal logging percentage
- **ILi** Illegal logging index
- **INEI** Instituto Nacional de Estadística e Informática [National Institute for Statistics and Informatics]
- **INRENA** Instituto Nacional de Recursos Naturales [National Institute for Natural Resources]
- **ISIC** International Standard Industrial Classification
- **ITP** Instituto Tecnológico de la Producción [Technological Institute for Production]
- **m³** Cubic meter
- **m³r** Cubic meter of roundwood
- **MINAGRI** Ministry of Agriculture and Irrigation
- **MLEs** Medium-sized and large enterprises
- **MSEs** Micro and small enterprises
- **OSINFOR** Organismo de Supervisión de los Recursos Forestales y de Fauna Silvestre [Forest and Wildlife Resources Oversight Agency]
- **PCM** Presidencia del Consejo de Ministros [Office of the President of the Council of Ministers]
- **Pro-Bosques** USAID project
- **PRODUCE** Ministry of Production
- **RUC** Registro Único de Contribuyentes [Single Taxpayer Registry]
- **SERFOR** National Forest and Wildlife Service
- **SIF-AL** Sistema de Información Forestal – Aplicación Local [Forest Information System – Local Application]
- **SUNAT** Superintendencia Nacional de Aduanas y Administración Tributaria [National Superintendency of Customs and Tax Administration]
- **UF** Unaccounted-for flow
- **UL** Unauthorized logging
- **US$** United States dollars
- **USAID** United States Agency for International Development
- **USFS** United States Forest Service
Illegal logging and trade in timber are a threat to Peru's forests and pose unfair competition with the formal forest sector.
EXECUTIVE SUMMARY

This publication, as part of the study “Estimating and Improving Timber Legality in Peru,” aims to propose a straightforward, replicable methodology for calculating an index to assess the country’s illegal timber flows; i.e., the volumes of timber that come to be included in official records and statistics and can therefore be measured (Navarro et al., 2010; Pautrat and Lucich, 2006).¹

The Peruvian government has been working to issue policies and regulations and to coordinate actions designed to support the overarching goal of reducing illegality. However, it has not yet succeeded in formally establishing a methodology for measuring illegality quantitatively, which would enable the impact of this set of actions to be monitored.

The indicators used to estimate illegal logging and trade have been based on direct methods (some of them listed by Navarro et al., 2013), such as measuring the difference between timber supply and demand or comparing wood export and import data; or on indirect methods such as evaluating and analyzing official forest documentation and verifying this information through field supervision and/or compliance actions (e.g., by examining stumps in recently harvested areas). Other indirect methods involve surveying key informants in the forest sector, or comparing proportions of volumes of wood used in final goods.²

This study proposes a method for direct measurement, based on official records, of an ‘illegal logging and roundwood trade index’ tailored to the conditions in Peru’s forest sector. This method is used to calculate an index value (ILi) as well as the percentage of illegality (IL%) for the volume of timber leaving the forest and entering primary processing plants in Peru in 2017.

To determine timber supply flows, the study looked at nine regions,³ which accounted for more than 98% of regional roundwood production in 2015. It characterized and quantified not only potential supply (approved by the regional forest and wildlife authorities) but also effective supply (logged timber) in the Peruvian Amazon, based on information provided by those regional authorities or the National Forest and Wildlife Service (SERFOR) for 2017, particularly physical documentation consisting of forest transport permits (GTFs) or extraction reports.⁴

The timber demand study (National Forestry Chamber (CNF), 2019) looked at 12 regions (adding three more, from the coast, owing to their importance in terms of commerce and population)⁵ and included the development of a statistical design for administering 226 surveys to companies in the primary and secondary wood processing industries.

Lastly, because the demand study determined input and output volumes (in cubic meters) for each link in the timber value chain for 2018, those 2018 demand estimates had to be deflated to 2017 values (Solís, 2019) in order to be able to use the data from the 2017 supply study.⁶

The 2017 illegal logging and roundwood trade index values were calculated after subtracting the volume of unauthorized logging⁷ reported by the Forest and Wildlife Resources Oversight Agency (OSINFOR) for 2017 from the volume of timber supply as reflected in GTFs or extraction reports.

Notably, 42% of the effective supply, by volume, came from timber forest concessions, but this share went up to more than half (53%) when unauthorized logging (363,404 m³) was subtracted, as only 2% of all logging under this type of forestry license was unauthorized in 2017.⁸

The study offers two results. The first is the proposed methodology, used to determine the illegal logging and trade index (ILi) and the percentage of timber illegality (IL%), so that it can be replicated to calculate these indicators in future years or in other regions of Peru, if deemed necessary.

The second consists of the illegal logging and trade indicators themselves:

Index (ILi):
- With the volume of timber removed without authorization subtracted from effective supply – 1.59

Percentage (ILi):
- Illegal portion as a percentage of total demand – 37%

This study also calculated an index for each forest access mechanism (título habilitante – forestry license). The results presented distortions that will require further investigation or more detailed studies, since the volume of demand obtained from surveys was lower than the supply reflected in GTFs, extraction reports, or reported unauthorized logging.

INDEX AND PERCENTAGE: An Accessible Method for Measuring Illegal Logging and Trade in Timber

Peru has developed a method for direct measurement, based on official records, and has updated its Illegal Logging and Roundwood Trade Index.
In theory, this would reveal a surplus of legal timber from these types of licenses (Navarro et al., 2010). However, it could also mean that during the fieldwork stage, the volumes for a given license might have been improperly recorded in other categories such as ‘Not determined.’ For instance, there was a distortion in the case of forest plantations, because when the volume reported by OSINFOR as unauthorized logging was subtracted, supply became negative (which is not possible in reality).

These results may also have to do with the accuracy and reliability of current record control, storage, and maintenance, and of on-paper tracking of reports and databases, etc., by the regional and national forest authorities.

The method of using the difference between supply and demand presents weaknesses, however, owing to potential discrepancies in data sources. For supply, for instance, there are statistical errors relating to record control, storage, and maintenance. For demand, the weaknesses have to do with the use of survey data and the accuracy, validity, completeness, openness, and honesty of responses. For these reasons, the index should be used with caution (Navarro et al., 2010).

Among its main recommendations, the study underscores the need to enhance the reliability and validity of data through better collection and storage of information (GTFs, extraction reports, operations logbooks), mainly on the part of the regional authorities in the three traditional forestry regions (Loreto, Ucayali, and Madre de Dios). Also needed is greater sector transparency, for both supply and demand flows, to allow easier, more effective application of the proposed methodology.

Also recommended is 100% supervision of all forestry licenses under which harvesting has occurred, which would help significantly reduce the amount of illegal timber leaving the forest. In 2017, OSINFOR conducted supervision visits for 21% of the total number of licenses with active logging. As field supervision is costly, licenses could be selected for visits based on a sampling design.

There are two types of illegal timber: laundered or ‘legalized’ timber and also ‘clandestine’ timber. Laundered timber is ‘legalized’ with some sort of forged document at some point in the value chain. Clandestine or informal timber flows, in contrast, can arrive at any point in the chain – or even reach the final consumer – without any supporting documentation or records (FAO & ITP/CITEmadera, 2018).

It could be inferred that the consumption of clandestine timber has to do with the number of informal companies in Peru’s forest sector. It would be advisable to explore developing a methodology for the informal sector and, potentially, conduct a study to estimate totally clandestine timber flows. This would make it possible to measure illegality rates that factor in this component, especially in secondary processing. It would also help clear up any distortions resulting from this first application of the method.

Finally, it is important to consider what is being sought with the implementation of public policies, and to what extent they should be used to reduce the indicators (index and percentage) of illegality in the forest sector. A benchmark or target for lowering the latter indicator could be the annual rate of informality in the Peruvian economy as a whole, which, according to INEI data, was 19% in 2014 (National Center for Strategic Planning (CEPLAN), 2015).
An Accessible Method for Measuring Illegal Logging and Trade in Timber

FIGURE 1
Illegality in Peru's timber value chain - 2017

- **Legal logging supply**: 1,324,739 m³r
  - Unauthorized logging as reported by OSINFOR (363,404 m³r) has been discounted

- **Extraction from unauthorized areas** (unlicensed forest)

- **Unauthorized extraction** (licensed forest)*

- **Domestic market**: Invoices and sales slips without information enabling traceability

- **Export**: Avoiding oversight by OSINFOR, selecting destinations by SIGO color

- **Laundred flow**

- **Clandestine flow**

- **Transport (roundwood)**
  - Fraudulent GTFs**, camouflaged logs, trucks avoiding checkpoints

- **Transport (sawn wood)**
  - Shipping documents without information enabling traceability

- **Primary industry**
  - False yields, failure to track stocks, mixing of timber

- **Secondary industry**
  - Forms of illegality similar to primary industry

- **Secondary demand (recorded)**: 1,079,420 m³r

- **Index based on legal logging**: 1.59 (37%)
  - Illegal laundered timber, based on legal logging: 781,140 m³r
  - Primary demand (recorded): 2,105,879 m³r

*Includes violations of forest management and other regulations.

**Includes purchase/sale of valid GTFs, doctored GTFs (cloning, reuse), GTFs with false information (volumes, logging areas, species), etc.
There is what might be called ‘laundered legal timber’ and also clandestine timber, which is never ‘legalized’ using any sort of forged document at any point in the value chain, and can therefore arrive at any point in the chain – or even reach the final consumer – without any supporting documentation.

An indirect method used in Peru in 2006 and 2018, based on the Input-Output Matrix prepared by Peru’s National Institute for Statistics and Informatics (INEI), to calculate the volumes of wood consumed as inputs for final goods. These were then compared with official national statistics on production (Pautrat, L., and Lucich, I., 2006, and Superintendencia de Banca y Seguros, 2018).

Under the following forest access mechanisms: (i) timber forest concessions, (ii) native community permits, (iii) local forests, (iv) private property permits, and (v) forest plantations (less than 1% of total supply in 2017).

The 2018 study on the timber industry in Peru conducted by the Food and Agriculture Organization (FAO) and the Technological Institute for Production (ITP)/CITEmadera presents the roundwood output (m³) of 24 regions for 2000, 2008, 2010, and 2015. The timber supply baseline study (USAID Pro-Bosques, 2019) determined the volume of supply for nine regions, including the Peruvian Amazon regions, which accounted for more than 98% in 2015; it also found that Peru has over 73 million hectares of forest, 94% of which are in the Amazon. The other 15 regions (coastal and highland) not covered in the supply study were not included in 2017, since it was not possible to extrapolate the supply data and because their supply of timber from natural forests is very low.

USAID Pro-Bosques, 2019

The scope of the timber demand study included 12 regions, adding three coastal regions owing to their importance to the timber sector: Lima, La Libertad, and Arequipa. Together, they accounted for 93% of sales and 81% of Peru’s population in 2015 (FAO & ITP/CITEmadera, 2018).

USAID Pro-Bosques (2019) used 2018 as the reference period for the data gathered in the timber demand surveys. To adjust those data to 2017, year-on-year growth in the forest sector from 2017 to 2018 had to be discounted. As Peru does not have precise GDP estimates for the forest sector, the Gross Value Added (at constant 2017 prices) for the ‘Agriculture, hunting and forestry’ industry as reported by INEI for 2017 and 2018 was used instead. A growth rate of 7.54% was calculated and then discounted from the preliminary 2018 estimates to adjust them to 2017.

The volume of timber logged by license holders sanctioned for a given offense, after compliance efforts found that it came from the extraction of unauthorized trees pursuant to Law 27308 (from 2009 to 2017) under the offense of ‘facilitating’ the extraction, transport, processing, or sale of illegally extracted forest resources via a concession contract, management contract, permit, or authorization for forestry use, or Law 29763, under the offense of ‘using’ documentation issued or approved by the competent forest authorities to conceal the logging, transport, processing, storage, or sale of forest resources or products extracted without authorization (PCM et al., 2021). Volume data available at https://observatorio.osinfor.gob.pe/Estadisticas/Home/Reports/

The government’s forest resource oversight agency (OSINFOR) officially declared that 363,404 m³ (22% of total logged volume) involved some degree of illegality in 2017.

Use of the ‘operations logbook for sustainable forestry licenses’ became mandatory on March 2, 2020, while use of the ‘operations logbook for primary processing of timber forest products and byproducts’ became mandatory as of August 1, 2020.

For 2015, the National Superintendency of Customs and Tax Administration (SUNAT) reports formality rates of 55% in primary processing and 23% in secondary processing.
CONCEPTUAL AND REFERENCE FRAMEWORK

HARMONIZING DEFINITIONS AND CONCEPTS

The Peruvian forest sector

Peru ranks ninth in the world and second in South America in terms of forest area

128 million hectares 72.1 million ha of Amazon forest 17.5 million ha of permanent production forests (BPPs) (for sustainable timber harvesting)

56% of Peru’s territory

9.3 million ha of BPPs 3.7 million ha of BPPs 1.9 million ha of BPPs

LORETO UCAVAYI MADRE DE DIOS

17.5 million ha of permanent production forests (BPPs) (for sustainable timber harvesting)

18% of Peru's territory

128 million hectares 72.1 million ha of Amazon forest 56% of Peru’s territory

Mechanisms for legal forest access

- Forest sector authorities
  - SERFOR: National Forest and Wildlife Service
    - National authority tasked with the management of forest and wildlife resources.
    - Lead agency of the National Forest and Wildlife Management System.
    - Establishes the regulatory, technical, and administrative framework and promotes market access and improved conditions for sector competitiveness.
  - Regional governments
    - Regional forest and wildlife authority for their territory.
    - Control and monitor forest and wildlife resources in their region.

- OSINFOR: Forest and Wildlife Resources Oversight Agency
  - Agency tasked with oversight and enforcement of sustainable harvesting and conservation of forest and wildlife resources in the forests to which the government grants legal access through a range of mechanisms.

- Forest plantations
  - For private property
  - For native or rural communities
  - Ecotourism concessions
  - Conservation concessions
  - Non-timber concessions
  - Timber concessions

- Forest plantation concessions

- In agroforestry recovery zones
- In residual forests

- Use contracts
- Local forests

- Natural forests

- MINAM, 2015b

17.5 million ha of permanent production forests (BPPs) (for sustainable timber harvesting)

56% of Peru’s territory

128 million hectares 72.1 million ha of Amazon forest 56% of Peru’s territory

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17.5 million ha of permanent production forests (BPPs) (for sustainable timber harvesting)
Before measuring illegal logging and trade in timber, certain concepts relating to timber flows in the market and the scope of the study need further clarified.

Legal and illegal timber

Although the term “legal timber” is widely used, defining it and categorizing it is not simple. A definition would have to take into account legislation, stakeholders, forest access mechanisms, production and processing methods, and the setting, among other elements (PCM et al., 2021).

Some countries use a definition like that of Honduras: “Timber is considered legal when its origin and subsequent harvesting, transport, sale, processing, and export are consistent with all applicable laws and regulations in Honduras for domestically harvested timber and with the laws and regulations of the harvesting country for imported wood”.

It is not simple to conceptualize illegal timber either, as indicated in Concepts, Definition and Classification of Illegality in the Timber Value Chain, which is part of this same study: “... no clear definition of ‘illegal logging’ currently exists within Peruvian law. Having a definition, however, is of vital importance, and when one is ultimately developed, it will have to be accepted by all stakeholders.”

Although the term “laundered timber” is widely used, defining it and categorizing it is not simple. A definition would have to take into account legislation, stakeholders, forest access mechanisms, production and processing methods, and the setting, among other elements (PCM et al., 2021).

Some countries use a definition like that of Honduras: “Timber is considered legal when its origin and subsequent harvesting, transport, sale, processing, and export are consistent with all applicable laws and regulations in Honduras for domestically harvested timber and with the laws and regulations of the harvesting country for imported wood”.

It is not simple to conceptualize illegal timber either, as indicated in Concepts, Definition and Classification of Illegality in the Timber Value Chain, which is part of this same study: “... no clear definition of ‘illegal logging’ currently exists within Peruvian law. Having a definition, however, is of vital importance, and when one is ultimately developed, it will have to be accepted by all stakeholders.”

Illegal timber enters the market without any type of permit for harvesting, processing (e.g., no Single Taxpayer Registry (RUC)), transport, or sale, and leaves no record (Navarro et al., 2013). Clandestine, or informal, timber flows can arrive at any point in the value chain – or even reach the final consumer – without any supporting documentation (e.g., an invoice).

The following figure will help to clarify these concepts:

**FIGURE 2**
Continuum between legal and illegal forest production

Source: Adapted from Richards et al. (2003); cited by Navarro et al. 2010.
An illegal logging and roundwood trade index was not calculated for secondary processing, for two reasons: (i) the secondary industry demands processed wood (sawn or chainsawn boards, planks, or cants) so, in theory, all of it would have some degree of processing (by the primary industry); and (ii) the findings for secondary processing yielded volumes of wood demand, in roundwood equivalent, that were lower than the primary processing volumes.

In 2017, according to the demand study (CNF, 2019), the primary industry processed all timber with legal documentation. Part of this flow (51%) was then processed formally by registered secondary facilities (with a RUC number), while the rest was processed clandestinely by informal secondary facilities (without a RUC number). This fact could be explained by the high rate of informality in this link in the value chain.

According to Bascopé-Sarué (2010), a distinction must be drawn between the “potential” and “effective” supply of timber. The potential supply of legal timber is the volume in cubic meters of roundwood (m³) approved for logging in commercial harvest permits/plans. The effective supply of legal timber, on the other hand, is the “volume in cubic meters of timber extracted based on harvest permits/plans for which the logging taxes have been paid. The volume of roundwood authorized for transport must be recorded in timber transport permits (GTFs), based on commercial logging permits/plans.”

For purposes of this study, effective supply is the volume recorded in GTFs or in extraction reports of the local forest information system (SIF-AL) at the district, region, forest, or country level.

Demand, for this study, refers to the volume of wood entering industrial facilities, for either primary or secondary processing, and which is intended for the manufacture of various wood products with different levels of value added.

FIGURE 3 Flow of legal and illegal wood in Peru and scope of study – 2017
According to the FAO & ITP/CITEmadera study on the timber industry (2018), domestic roundwood production was 1.7 million m³ in 2015. During the 2000-2015 period, annual production hit a peak of 2.4 million m³ in 2008, with levels trending downward thereafter.

According to the same study, reported timber sales totaled US$1.385 billion in 2015, with exports totaling US$150 million and imports US$315 million for that year. The local market consumes 90% of domestic output, with demand coming chiefly from the construction sector, mainly for homes, offices, restaurants, hotels, and shopping centers.

The 2018 FAO & ITP/CITEmadera study also reported a total of 24,495 formal forestry companies in 2015:

- Of these, 96% were microenterprises, with 29% of sales, while medium-sized and large companies made up 0.26% of businesses and accounted for 41% of sales.
- In terms of distribution, the study reported that 61.8% of businesses and 79% of sales for 2015 were concentrated in Ucayali, Loreto, and Madre de Dios.
- Of primary processing companies, 77.5% were in Lima, while sales were concentrated in Ucayali (32%) and Lima (27%). Lima was home to 26% of secondary processing companies (especially furniture manufacturers) and accounted for 80.8% of sales.

The most robust indicators used for estimating illegal logging and trade have been based on direct methods (some listed by Navarro et al., 2013), such as measuring the difference between timber supply and demand or comparing wood export and import data.

The difference between timber supply and demand is calculated by comparing the volumes of timber the forestry industry reports having received with the logged volumes reflected in the SIF-AL, GTFs, or extraction reports. The key assumption is that timber that is authorized for logging and is transported with a GTF (effective supply) must go through industry facilities for processing. Any difference between the two volumes can therefore serve to estimate the extent of illegal logging and trade (Navarro et al., 2013).

Indirect methods are also used, such as evaluating and analyzing official forest data and verifying those data through field supervision and/or compliance actions, surveys of key informants in the forest sector, or a comparison of the percentage volume of wood used in final goods.

In 2018, the indirect method of comparison with the percentage volume of wood used in final goods (known as an Input-Output Matrix) was used. A sector assessment of money laundering and terrorist financing risk exposure in Peru’s timber sector by the Financial Intelligence Unit under Peru’s Superintendency of Banking and Insurance (SBS) estimated the volume of illegal timber production based on the monetary value of final goods produced and the proportion of that value that corresponded to the use of wood (INEI 2007 Input-Output Matrix).
The assessment found that the volume of illegally produced timber topped 1 million m\(^3\) per year, or about 41% of total timber output. In monetary terms, the illicit flows associated with this illegal production amounted to S/467 million (US$155 million) per year over the previous five years (SBS, 2018).

Table 1 provides a summary of studies on illegality in Peru from 2003 to 2017.

### TABLE 1
**Summary of previous studies on illegality in Peru**

<table>
<thead>
<tr>
<th>ENTITY</th>
<th>METHOD</th>
<th>MOST RECENT YEARS MEASURED</th>
<th>PERCENTAGE/RATE OF ILLEGALITY</th>
</tr>
</thead>
<tbody>
<tr>
<td>World Bank, Pautrat, L. &amp; Lucich, I. (2006). Maroni Consultores SAC</td>
<td>The difference was calculated between the volume of sawn wood produced according to the records of the National Institute for Natural Resources (INRENA), whose information source was the logging operations that extracted the timber from the forest, and the volume produced by sawmills (ISIC class 2010), estimated based on the index of physical volume for this industry generated by the Ministry of Production (based on their industry production surveys) and the 1994 Input-Output Table published by INEI.</td>
<td>2003</td>
<td>56%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2004</td>
<td>45%</td>
</tr>
<tr>
<td>Superintendency of Banking and Insurance (2018). Apoyo Consultoria</td>
<td>Based on the monetary value of final goods produced using wood as an input, the proportion of that value that corresponds to the use of wood was calculated (INEI 2007 Input-Output Matrix), thus obtaining the monetary value of the wood used for the manufacture of these final goods. To translate this value into a quantity of wood, the average price of wood was calculated. This resulted in an indirect indicator of the amount of wood used, from which official timber production as reported by SERFOR was subtracted in order to obtain the amount of wood unaccounted for—hence, illegal timber. This excess production of wood was added to the unauthorized volume of timber reported by OSINFOR, i.e., timber already identified as illegal.</td>
<td>2015</td>
<td>65%</td>
</tr>
<tr>
<td>Center for International Environmental Law (2017)</td>
<td>Analysis of 855 certificates of visual inspection of wood export shipments, issued by SERFOR's Forest and Wildlife Technical Administration at the Callao seaport during 2015: 2,364 GTFs corresponding to 347 licenses for different harvest mechanisms, with 67 exporters from Peru and 186 companies importing from other countries (exports to USA: 42.39% of GTFs) having participated in the transport and commercialization of this wood.</td>
<td>2015</td>
<td>Only 33% of forest management plans used to log this timber were reviewed by OSINFOR. Of these, 51% are on the SIGO &quot;red list.&quot;</td>
</tr>
<tr>
<td>Center for International Environmental Law (2019)</td>
<td>Analysis and systematic study of 1,024 GTFs – part of the total number issued during the months of June, July, and August 2017 by different forest and wildlife authorities.</td>
<td>2017</td>
<td>44% of forest management plans were reviewed by OSINFOR. Of these, 58% are on the SIGO &quot;red list.&quot;</td>
</tr>
</tbody>
</table>

### Notes

13. Honduras is implementing a Forest Law Enforcement, Governance and Trade (FLEGT) Voluntary Partnership Agreement to foster the legality of forest products and to eliminate illegal logging. The annexes to the agreement contain the main commitments undertaken by the Government of Honduras and the European Union. "Annex II: Legality Tables" and "Annex V: Legality Assurance System for Honduran Forest Products" are the backbone for verification of the legality of the country's forest products. Available at http://fdsf.hn/wp-content/uploads/2017/03/GUIA-SALH.pdf

14. For 2015, SUNAT reports formality rates of 55% in primary processing and 23% in secondary processing.

15. A regional forest authority document containing information such as: contract number, forestry license holder, authorizing resolution number, authorized (annual) operating plan, authorized area (ha), authorized volume by species (m\(^3\)), logged volume by species (m\(^3\)), and remainder (m\(^3\)).

16. In theory, in a market economy such as Peru’s, the market is in equilibrium, and therefore demand, sales, and supply are equal.

17. An indirect method used in Peru by Pautrat and Lucich in 2006 and by the SBS in 2018, based on the INEI Input-Output Matrix, to calculate the volumes of wood consumed as inputs for final goods. These were then compared to official country statistics on production (Pautrat, L. & Lucich, I., 2006, and Supervisionenda de Banca y Seguros, 2018).
The methodology used to conduct this study involved, first, adapting the methodology for domestic market timber supply and demand flows; second, determining the flows for use in the methodology proposed by Navarro et al. (2010) for purposes of estimating an illegal logging and roundwood trade index; and lastly, calculating both the index and percentage for 2017, as 2018 supply data were not yet available at the time of the study.

Supply information was gathered directly from regional government files, while demand data were obtained from sector business surveys, which included questions related to industry activities that occurred during 2018, given that 2017 information would have been more difficult for respondents to remember.

Supply and demand
To gather primary information on supply, USAID Pro-Bosques (2019) engaged a consultant to determine the volume of timber supply in the Peruvian Amazon in 2017.

Information sources
To establish timber supply and demand flows, the study used secondary sources in addition to primary information sources. These secondary sources analyzed were official statistics produced primarily by the following entities:

- Regional forest and wildlife authorities
- OSINFOR
- SERFOR
- SUNAT, mainly for 2017 timber and wood product exports and imports
- Other entities

Studies and analyses prepared by the international organizations and private entities mentioned in the conceptual framework were also used as references.

Data on approved and logged volume were obtained from the SIF-AL as well as GTFs and extraction reports for the following forest access mechanisms: (i) timber forest concessions, (ii) native community permits, (iii) local forests, (iv) private property permits, and (v) forest plantations (less than 1% of total supply in 2017).

In addition, the USAID and USFS Forest Service FOREST program engaged two consultants to estimate supply and demand for wood in each link in the value chain in Peru for 2018:

- The first designed and administered a survey to estimate demand (2018) using a statistically determined sample;
- The second provided statistical advisory services to ensure the rigor of design of the estimates of timber supply (2017) and demand (2018) in the forest value chain.

For purposes of determining timber demand, the study looked at 12 regions (adding three coastal regions owing to their importance in terms of commerce and population): Lima, Loreto, Ucayali, Madre de Dios, Amazonas, San Martin, Huánuco, Pasco, Junín, and La Libertad. A total of 226 surveys, broken down as follows, were adminis-
Measuring illegal logging and trade in timber

estimates to adjust them to 2017.

Calculation of the annual illegal logging and roundwood trade index was based on the methodology presented by Navarro et al. (2010) in Diseño de un indicador de tala y comercio ilegal de madera en Nicaragua [Designing an Indicator of Illegal Logging and Trade in Timber in Nicaragua], but adapted to the conditions and characteristics of the Peruvian forest timber sector and applied to the difference between timber supply and demand.

In determining the index, the unauthorized logging volume reported by OSINFOR for 2017 was subtracted from the volume of timber supply according to GTFs or extraction reports.

It is important to note that OSINFOR does not conduct supervision visits for 100% of forestry licenses granted in Peru, and the visits that it does conduct do not follow a statistical design that would allow for any inference or extrapolation to other licenses. In 2017, for example, 1,019 licensed forests were identified as having logged timber, of these, OSINFOR visited 214.

To obtain the difference between timber supply and demand, the volume of demand reported in the domestic timber processing industry surveys (CNF, 2019) was used, after being adjusted to 2017 by Solís (2019).

For analysis purposes, it was considered important to separate timber flows by forest resource access mechanism, in order to calculate separate indices and percentages of illegal logging and trade in timber—not only total values (consolidating all types of licenses)—as well as two subtotals: (i) forest concessions (timber + non-timber) and native and rural community permits—the two most important mechanisms in terms of logged volume, and (ii) private property permits, local forests, plantations, and others in the “not determined” or “other” categories that may have been recorded incorrectly during the data processing stage for the supply and demand studies.

To calculate the index and percentage of illegal logging and trade, timber flows were separated by forest resource access mechanism and then totaled, with a subtotal for forest concessions and community permits, the two most important license types in terms of logged volume.
18. Junín and Pasco are grouped together as ‘Selva Central’ in the USAID Pro-Bosques timber supply study (2019).
20. CNF, a legal entity with specific experience with the Peruvian Amazon and the timber value chain and its social, environmen-
tal, economic, and regulatory context. It has networks across Peru’s major timber-producing regions.
21. The survey model was taken from a study by Santamaría et al. (2018), adapting it to the particularities of the sector in Peru.
22. David Solís, a PhD economist and statistician with experience in forestry issues.
23. The scope of the timber demand study included 12 regions, with three coastal regions not included in the supply study added
together their importance to the timber sector: Lima, La Libertad, and Arequipa. Together, they accounted for 93% of sales
and 81% of Peru’s population in 2015 (FAO & ITP/CTEmadera, 2018).
24. The following steps are required: a. Review the fact sheet for each facility to determine its installed capacity: b. Review
capacity utilization rate (annual). If there is no annual report, look at a sample of the population by category of daily
installed capacity utilization rate (annual). If there is no annual report, look at a sample of the population by category of daily
processing (large, medium, small); c. Determine business variables (total volume processed, yields, and target market); d. Determine “unaccounted-for flow” (laundered timber) through interviews to obtain information about the target market for these facilities.
25. Use of the “operations logbook for sustainable forestry licenses” became mandatory on March 2, 2020, while use of the “opera-
tions logbook for primary processing of timber forest products and byproducts” became mandatory as of August 1, 2020.
The study’s main results are presented below.

- First is the suggested method for estimating an illegal logging and roundwood trade index based on the methodology proposed by Navarro et al. (2010 and 2013), which could potentially be replicated in future years or in other regions of Peru.
- Second are the results of the studies to determine effective timber supply from licensed forests and primary forestry industry demand in Peru for 2017.
- The third result offered by the study are the index and percentage themselves, calculated for 2017.

As previously stated, identifying the difference between timber supply and demand is a direct, replicable method for estimating illegal logging and trade (as an index and as a percentage). This generally requires the following:

- First, the timber supply and demand flows need to be established for a specific year, ensuring that both supply and demand data are available and reliable.
- Second, the geographic unit needs to be specified—district, department, region, forest, or the country as a whole.
- The illegal logging and roundwood trade index and percentage are then calculated for that specific geographic unit.

Ideally, the study area would be a closed system, without leaks, in which timber authorized for logging must go through industrial facilities for processing. We know, however, that wood and wood products could come from outside the system, e.g., via unregistered imports or cross-border commerce via blind spots along the border (smuggling), or when transnational corporations (e.g., agroexporters) that span country borders move inputs within their estates (Navarro et al., 2014).

Peru is considered to have few leaks, given that the demand study found that 74% of demand by volume is met by domestic output, and that 93% of timber and wood product sales by volume go to the domestic market. Additionally, major timber smuggling was ruled out because demand centers such as Lima, Arequipa, Trujillo, and Piura are not border cities, and most imports enter through the port of Callao.

THE METHOD

Determining forest supply

The following are the stages involved in obtaining annual volumes of roundwood supply:

1 Annual potential (approved) supply

Includes the following activities:

- Collecting official data from information systems (e.g., SIF-AL) and recording it in a database. The Peru timber supply baseline study (2019), to consolidate and process the retrieved information, developed and used a list of required information, an Excel template with macros, and an ad hoc database structure (Potential Timber Supply Database Structure).
- Data cleaning, exploration, and analysis in the potential supply database. In this substage:
  - To ensure the quality of the information entered into the database, the consistency of those data with data from extraction reports, as well as authorizing resolutions issued by the regions, was verified case by case.
  - Data were aligned and standardized with respect to the scientific and common names of species, along with synonyms, pursuant to Executive Board Resolution 143-2016-SERFOR-DE, as well as to type of user and forest access mechanism (license type).
  - The forest species reported were classified by category and designation according to the official list of forest spe-
cies. (Executive Board Resolution 241-2016-SERFOR-DE, Methodology for Determination of the Value of Natural Timber for Harvest Fee Payment).

Data were processed to calculate the potential authorized volume and tables and graphs were created for every level of analysis.

2 Annual effective (logged) supply

Effective supply was estimated following the same process as for potential supply, with the following additional activities:

- Collecting official data from information systems (e.g., SIF-AL) and recording it in a database. For the supply study in Peru, data for Loreto, Ucayali, and Madre de Dios were extracted, cleansed, and merged, using the following SIF-AL reports:

  - Log List: Excel file with comprehensive historical data for 2016, 2017, and 2018

- In some cases, depending on the circumstances on the ground and the potential limitations of the information system reports, physical GTFs were retrieved from regional headquarters or district offices in timber producing areas (data archeology). To safeguard this information and facilitate future viewing, such documents (GTFs, extraction reports, log lists) are converted and stored in an electronic format (JPEG or PDF).

- Intake, organization, and coding of GTFs for subsequent data entry and recording in the effective supply database.

- Input of GTF information into the database: data entry and recording. In Peru’s case, the data from the “list of required information” were incorporated into an Excel database using a template programmed with macros for uploading GTF information using nomenclature codes as well as standard recording rules.

- Database review and cleaning prior to classification. For Peru, the data were organized by location (region or field office), license type, and name of company or license holder issuing the GTF. The data retrieved were year, GTF number, regional forest and wildlife authority or field office, date of issue, resource origin (license type), contract number, full name of license holder, resolution number, type of management plan, location (region, province, district), product owner, RUC number, consignee, transport type, source GTF number, data entry person’s initials, product scientific name, product commercial name, product type, and product volume. Digital GTFs were organized in a supporting documentation folder in the Excel database.

- Adjustment or, potentially, incorporation of timber with some degree of illegality into the supply database:
  - Statistics on seizures of illegal timber resulting from enforcement operations conducted by the country’s official authorities and personnel (forest or non-forest, such as the National Civil Police’s Nature Protection Division in the case of Guatemala).
  - Some countries have forest resource oversight agencies (OSINFOR in Peru) tasked with monitoring sustainable harvesting and conservation of resources and the environmental services provided by the forests to which the government provides access through various mechanisms. The Peru supply and demand studies used unauthorized logging volume data as reported by OSINFOR for the forest access mechanisms evaluated in 2017.

- Calculation of the volume of effective supply by subtracting timber reported as having some degree of illegality (if applicable or available) from the volume recorded in GTFs or extraction reports.
Determining demand
As previously mentioned, two options are available for deter-
mining legal roundwood demand:
1. Review the records of each primary processing facility in the
country’s districts, departments, regions, or forests (San-
tamaria, 2010), which in Peru would be the primary pro-
cessing facility operations logbook.
2. Design a survey of a statistically based sample, to determine
the volume demanded by the forest industry (the method
used in this case).

There are four stages involved in obtaining annual volumes of
demand for wood: 1. Desk research or use of a statistically
based sample; 2. Fieldwork and deployment (organization,
planning, and survey administration); 3. Entry of survey infor-
mation into a database; and 4. Determination of the volume of
wood demand from the forest industry for the year under study.

Desk research or use of a statistically based sample
This stage consists of gathering official data from (i) information
systems (SIF-AL and others) and recording them in a database.
The primary processing facility operations logbook was not yet
fully implemented in Peru, however, so timber demand flows
were obtained based on (ii) surveys of a statistically-based sam-
ple of companies doing business in the industries of interest
in 2019 (CNF, 2019). This involved the following:46

- Establishing the model for determining the minimum sam-
ple size to estimate country-level timber demand. For the
Peru study, taking into account the International Standard
Industrial Classification (ISIC) used by SUNAT, the forest
value chain links studied were: (i) Forest management and
plantations: Forestry and logging (ISIC 0200); (ii) Primary
processing: sawmilling and planing of wood (ISIC 2010) and
manufacture of veneer sheets (ISIC 2021); and (iii) Secondary
processing: manufacture of wooden containers (ISIC 2023),
manufacture of other wood products (ISIC 2029), manufact-
ure of builders’ carpentry and joinery (ISIC 2022), and manu-
ufacture of furniture (ISIC 3910). The companies operating
in the forest sector were grouped by size based on sales:

To express variance ($\sigma^2$) and sampling error ($E$) in relative
terms, formula 1 was modified as follows:

\[ n_1 = \frac{Z_{1-\alpha/2}^2 \cdot \sigma^2}{E^2} \]  Formula 1

Where:
- $n_1$ = Estimated minimum sample size
- $\alpha$ = Significance level of the estimation model.
- $Z$ = Coverage factor associated with a confidence
  level of 95% [1 - $\alpha$] for the study, assuming normal
  distribution
- $CV$ = Coefficient of variation for national demand
  in the MSE segment. A maximum CV of 30% is
  assumed, as the aggregate CV estimated from
  aggregate data obtained from SUNAT for MSEs
  is 22.94% and according to the literature, a CV
  above 20% indicates low precision (DANE, 2008)
- $\%E$ = Percent error. For the study, the maximum
  percent error estimated was at 6% (Gutierrez, 2015)

Formula 2 was applied to determine the sample size and
selection by link and region for all MSEs, regardless of
whether they were primary or secondary facilities. The
sample size determined was 186 MSEs, distributed among
the regions according to the proportion of the population
in each. Samples were distributed systematically, with
fixed selection intervals within the population of primary
and secondary processing MSEs for each region, and the
following survey administration criteria were set:

- MSEs were ordered alphabetically and by sales range.
- The selection interval (SI) was estimated:

\[ SI_i = \frac{N_i}{n_i} \]  Formula 2

Where:
- $N_i$ = Total population of MSEs in region $i$
- $n_i$ = Sample of MSEs in region $i$

- A starting number (SN) between 1 and the SI was
  randomly selected.
- The individuals and companies to be surveyed were
  those in the following positions:
  - Selectee 1 = SN
  - Selectee 2 = SN + SI
  - Selectee 3 = SN + 2(SI)
  - Selectee 4 = SN + 4(SI)

- Priority levels are assigned amongst the sample units
to be surveyed to maintain randomness within each sales
range.
- Designated primary sample units are ‘Priority 1’
- If it is not possible to survey a Priority 1 unit, the Priority
  2 company is selected.
- The exercise is repeated until the survey is successfully
administered to the sample.
- If the designated substitutes for the group
corresponding to a given sales range are exhausted, the
group of companies with a lower sales range is selected
and the exercise is repeated.
- If the designated substitutes for the group
corresponding to the lower sales range are exhausted,
the group of companies with a sales range higher than
that of the first group is selected and the exercise is
repeated.

- For the sample size estimate and associated selection
of MSEs, as indicated earlier, the population was adjusted
to 117 companies. A RUC filter was applied to ascertain
the SUNAT status of each company in 2019—active or
not active. Additionally, each company was visited in
order to verify, in person, that operations were active.
The verified active population ended up reduced to
74 companies. It should be noted that in practice, there
are forestry and logging companies in this group (MLEs)
that not only supply, but also process and sell forest
products. It was therefore decided to include and evalu-
ate them as part of the population for this segment
using probability analysis (CNF, 2019).

INDEX AND PERCENTAGE: An Accessible Method for Measuring Illegal Logging and Trade in Timber
Once the population was verified as being active according to both SUNAT and field visits in 2019, formula 2, representing the population, was applied to determine the MLE sample size and selection by link and region. This included all links: forest management (forestry) and primary and secondary processing. The sample size determined for MLEs was 42 companies; the same survey administration criteria listed above for the MSE population were applied.

2 Fieldwork and deployment

Fieldwork consists of two main activities: (i) organization and planning, and (ii) survey administration. For the specific case of Peru (CNTF, 2019):

- **ORGANIZATION AND PLANNING**
  - Involved two stages:
    - **Stage 1 (June to July 2019):** Design survey administration tools and training. These are specific to the links in the value chain: (i) forest management (and plantations), (ii) primary processing, and (iii) secondary processing; and designed so as to ensure proper procedures in interviewing and in recording data and the study's results and variables (Santamaría, 2010). These tools include link-specific surveys and an interviewer's manual. Once the surveys are designed, tested, and validated, the managing team and the interviewers assigned to each area receive training.
    - **Stage 2 (July to October 2019):** Plan field work for survey administration. This consists of planning deployment in order to ensure geographical coverage and logistical organization, and encompasses the following steps:
      - **STEP 1:** Select priority 1 companies (considered the 'primary' companies).
      - **STEP 2:** Select the largest possible number of substitutes based on sampling methodology criteria (region, sales range, spatial distribution).
      - **STEP 3:** Check the SUNAT status of selected companies.
      - **STEP 4:** Create a map using the Google Maps application server for Lima and the regions. For Lima, group districts into macro-territories and create map layers:
        - **Northern Lima:** Comas, Puente Piedra, Ventanilla, San Martin de Porres, Carabayllo, Independencia, Los Olivos, Santa Rosa, Ancón, Canta, P. P., Vé specta, Barranca, Chancay, Aucallama, Santa María, Caleta de Carquín, Puerto Supe, Paramonga, Pachagana, Huaral, Huilmay, Suyán, Barranca, Gorgor, Huacho, Huaral, Supe, Pativilca, Oyón.
        - **Eastern Lima:** Ata, El Agustino, La Molina, Santa Anita, Lurigancho, Matsuaca, Chaclacayo, Cieneguilla, Santa Eulalia, San Mateo, Ricardo Palma.
        - **Southern Lima:** San Juan de Miraflores, Lurín, Villa María del Triunfo, Villa El Salvador, Pachacamac, Punta Hermosa, Punta Negra, San Bartolo, Santa María del Mar, Pucusana, Chica, San Antonio, Santa Cruz de Flores, Mala, Asia, Quilmán, Imperial, San Vicente de Cañete, Lunahuaná.
        - **Central Lima:** San Isidro, San Borja, Miraflores, San Luis Magdalena de Mar, Barranca, Breña, Jesús María, Pueblo Libre, La Victoria, San Juan de Lurigancho, Lima, Rimac, Lince, Chorrillos, Surquillo, Surquillo, Carmen de la Legua, Callao, Bellavista, San Miguel, La Perla.
      - **STEP 5:** Georeference companies on the regions and territories (Lima) map, indicating their name and address.
      - **STEP 6:** Form territory-specific work teams and print surveys.
      - **STEP 7:** Identify and trace routes for trips into the field to ensure coverage and success, starting with Priority 1 (primary) companies.
      - **STEP 8:** Code and file the survey and supporting photographic evidence.
      - **STEP 9:** Administer the survey according to the Interviewer's Manual, continually validating the information by comparing volumes and revenues. Ensure that the information provided by the respondent in the field is consistent.

- **SURVEY ADMINISTRATION.**
  - In this stage, it may be found that companies' situations in terms of their activities have changed since the time of the initial visit, with the situations varying depending on the segment to which a company belongs. The following steps must be ensured during survey administration:
    - **STEP 1:** Visit each company, beginning with Priority 1 (primary) companies.
    - **STEP 2:** Once at a company, if no person senior enough to provide credible information is present, schedule the interview for a specific date.
    - **STEP 3:** Validate the company's status. Communicate the findings to the coordinator for that area.
    - **STEP 4:** Administer the survey according to the Interviewer's Manual, continually validating the information.

3 Entry of survey information into an Excel file database

A user interface macro is created in Excel (called a "data entry mask") to ensure proper recording. The database will need to be reviewed and cleansed.

4 Determination of the volume of wood demand from the primary processing industry* and the secondary processing industry* during the year chosen for the study

It should be noted that the wood demand flows used to calculate the illegal logging and roundwood trade index were obtained from surveys administered to companies doing business in the industries under study in 2019. However, given that the supply data are for 2017 and the demand surveys asked for 2018 data (since it would be difficult for respondents to remember what had happened two years prior), the data on volume of forestry industry timber demand reported for 2018 were adjusted to 2017 (Solís, 2019).

It bears mention that the results of the timber demand study are auditable, insofar as the calculations followed a standardized procedure that can be used to replicate the findings (Solís, 2019). Additionally, in order to ensure comparability with future timber demand studies in Peru, the State (statistical software) programming codes and Excel worksheets were delivered to FOREST (CNTF, 2019).
Model for calculating the illegal logging and roundwood trade index

As mentioned earlier, the methodology for calculating annual illegal logging and trade in timber was based on a proposal by Navarro et al. (2010). That paper offers three formulas for the calculations in question:

1. **“Unaccounted-for flow” (UF):**
   This formula identifies the difference between total industry demand (\(D_T\)) for wood and the effective supply (\(S_e\)), i.e., the volume that is not explained by legal logging (laundered timber).

\[
UF = D_T - S_e
\]

2. **Illegal logging as an index (IL):**
   This formula expresses illegal logging as an index that is obtained by relating the total amount of wood demanded by industry to the effective supply.

- When the index is equal to one (IL = 1), there is no illegal logging, since industry demand is equal to the legal supply coming out of the forest.
- An index greater than one (IL > 1), however, is considered to mean that illegal logging does exist, as industry demand exceeds the legal supply of timber from the forest.
- Conversely, if the index is below one (IL < 1), one could assume that there is a surplus of legal wood.

It should be specified that this study found that an index of less than one could also mean, for instance, that when the surveys were administered, inaccurate information was provided regarding the volumes associated with certain licenses, or that information was incorrectly entered into the database, or placed in other categories such as “Not determined.” Another explanation is that legal flows coming out of the primary processing industry may have been acquired by buyers who then route them to informal (without a RUC number) secondary processing facilities. Such findings would necessitate further research or more detailed studies.

3. **Illegal logging as a percentage:**
   This formula conveys the proportion of illegal wood—labeled “unaccounted-for flow” (UF)—in relation to all industry demand for wood, i.e., the illegal portion in relation to total demand.

\[
IL\% = UF / D_T \text{ or also } (D_T - S_e) / D_T
\]

The formulas are as follows:

1. \(UF = D_T - S_e\)
2. \(IL = D_T / S_e\)
3. \(IL\% = UF / D_T\)

Where:
- \(IL\) = illegal logging index
- \(IL\%\) = illegal logging percentage
- \(S_e\) = effective supply of legal wood for commercial use, by volume (m\(^3\)/yr)
- \(D_T\) = total demand for wood from the forest industry (primary or secondary), by volume (m\(^3\)/yr)
- \(FNC\) = unaccounted-for flow in the industry, by volume (m\(^3\)/yr)

It is important to use consistent numerical units. In other words, in order to compare or relate industry players, if a volume is expressed as roundwood volume (m\(^3\)), it has to be compared to roundwood volume or roundwood equivalent. Secondary processing facilities demand sawn wood or cants (expressed in m\(^3\)), so this must be converted into a roundwood measure (m\(^3\)/yr) if the intention is to compare or relate primary and secondary facilities.

Additionally, timber flows for different forestry resource access mechanisms can be analyzed to calculate a separate index and percentage of illegal logging and trade in timber for each or for subgroups, not only at an overall level (combining all types of licenses). It should be recalled, however, that during the stages of supply and demand data collection and processing, volumes for some forestry licenses may be recorded incorrectly or placed in different categories such as “not determined” or “other.”
Limitations in calculating the illegal logging and roundwood trade index

To calculate demand for the illegal logging index, the study used sampling, as opposed to reviewing control documents from each primary or secondary processing company in the country’s forests, districts, departments, or regions. A number of supply- and demand-related constraints will have to be overcome to make this indicator of illegal logging and trade more consistent.

Navarro et al. (2010) discuss a number of the limitations encountered when Nicaragua’s index was being calculated, along with some ways to address them. They indicate, in general terms, “this was done by means of sampling [supply and demand] rather than tallying official statistics and data, and therefore the index should be used with caution.” In their experience, they found:

- With respect to the supply estimate:
  - A lack of information on the total number of transport permits used at the district level compared to the number of transport permits received by the forest authorities in central offices.
  - Administrative constraints in terms of uploading data into the forest information system.
  - Poor reliability of the reports generated by the forest information system.
- Variations in the volumes reported on transport permits, making it impossible to extrapolate based on a sample.
- A lack of crossovers between forest authorities and industry to curb permit “recycling” (i.e., using one more times to harvest or transport timber).
- With respect to the demand estimate:
  - The information provided in the periodic reports submitted by the forest authorities is self-reported. There is no way to corroborate it using other sources.
  - Formats for reporting volumes going into and processed by industry vary.
  - The actual number of secondary processing facilities (woodworking shops and furniture manufacturers) in the country is unknown.
  - There is no way to draw a distinction between unaccounted-for flows of legal timber from plantations and illegal timber from forests.

With respect to supply, the method also showed weaknesses in terms of estimating volumes authorized for harvest: (i) under- or over-estimation of volumes of standing timber authorized to be logged or brought to market; (ii) volume of authorized timber that was used on property for logging-related work (e.g., for roads, bridges, or piers) or wood cut, but not sold; (iii) volume of timber authorized, but not harvested, that remained part of the forest’s inventory, or cut but not sold in the market, in a same period or calendar year (Navarro et al., 2013); and (iv) different formulas used to calculate the cubic volume of roundwood.

On the demand side, there are: (i) volumes of timber used on property (domestic use) that are not accounted for; (ii) volumes sent directly to other consumers like woodwarehouses, furniture makers, building sites, industrial facilities that use firewood, or farms; (iii) incomplete and unreliable reports of actual consumption by industry, perhaps due to a lack of, or inconsistencies in, available information or the data collection tool (e.g., surveys in 2017); (iv) in terms of the forestry industry, “unaccounted-for timber flows” from the forest to industry and/or other markets (Del Gatto et al. 2007, FECAFOR et al. 2003, and Lazo et al. 2002, cited by Navarro et al., 2013).

The data from the supply and demand studies, whose methodology was described in previous sections, yielded the following results in terms of effective supply from licensed forests and demand from the primary forest industry in Peru in 2017.

### Timber supply recorded in GTFs or extraction reports

<table>
<thead>
<tr>
<th>REGION</th>
<th>TIMBER FOREST CONCESSIONS</th>
<th>NATIVE COMMUNITY PERMITS</th>
<th>LOCAL FORESTS</th>
<th>PRIVATE PROPERTY PERMITS</th>
<th>PLANTATIONS</th>
<th>N/D</th>
<th>OTHER</th>
<th>TOTAL (m³ r)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Loreto</td>
<td>112,446</td>
<td>294,898</td>
<td>84,950</td>
<td>155,604</td>
<td>452</td>
<td>9,117</td>
<td>60</td>
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<tr>
<td>Ucayali</td>
<td>237,909</td>
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<td>3,656</td>
<td>18,364</td>
<td>5,851</td>
<td>559,302</td>
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<tr>
<td>Madre de Dios</td>
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<td>559,302</td>
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<td>Huánuco</td>
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<td></td>
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<td>20</td>
<td>2,103</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>San Martín</td>
<td>1,479</td>
<td>18</td>
<td>1,497</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other</td>
<td>N/D</td>
<td>N/D</td>
<td>N/D</td>
<td>N/D</td>
<td>N/D</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total (m³ r)</td>
<td>710,050</td>
<td>620,977</td>
<td>84,950</td>
<td>178,528</td>
<td>22,610</td>
<td>67,677</td>
<td>3,353</td>
<td>1,688,144</td>
</tr>
</tbody>
</table>

| Percentage (%) | 42% | 37% | 5% | 11% | 1% | 4% | 0% | 100% |

Source: Prepared by the authors based on the Peru legal timber supply baseline study (USAID Pro-Bosques, 2019). Note: The supply from other regions was considered minimal (close to zero) and was not determined (N/D).

### INDEX AND PERCENTAGE: An Accessible Method for Measuring Illegal Logging and Trade in Timber
**Recorded timber supply minus unauthorized logging**

The results obtained after subtracting the unauthorized logging volume reported by OSINFOR from the timber volume recorded in GTFs or extraction reports are presented below.

First, Table 3 presents the data on unauthorized logging obtained from a web query of 2017 statistical reports from OSINFOR’s Management Information System (SIGO). The reports show that Loreto accounted for 92% of the unauthorized logging volume in 2017. In terms of forest access mechanisms, most of the volume was concentrated in local forests (40%), native community permits (31%), and private property permits (20%).

It is worth pointing out that timber forest concessions accounted for 42% of effective supply by volume in 2017, but only 2% of total unauthorized logging in that year.

**TABLE 3**

<table>
<thead>
<tr>
<th>REGION</th>
<th>Timber Forest Concessions</th>
<th>Native Community Permits</th>
<th>Local Forests</th>
<th>Private Property Permits</th>
<th>Plantations</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Loreto</td>
<td>4,823</td>
<td>105,689</td>
<td>144,209</td>
<td>55,863</td>
<td>N/D</td>
<td>334,034</td>
</tr>
<tr>
<td>Ucayali</td>
<td>2,547</td>
<td>4,059</td>
<td>381</td>
<td>6,887</td>
<td>N/D</td>
<td>114,209</td>
</tr>
<tr>
<td>Madre de Dios</td>
<td>278</td>
<td>11,123</td>
<td>11,401</td>
<td>463</td>
<td>N/D</td>
<td>23,450</td>
</tr>
<tr>
<td>Selva Central</td>
<td>584</td>
<td>3,992</td>
<td>155</td>
<td>5,675</td>
<td>N/D</td>
<td>23,506</td>
</tr>
<tr>
<td>Huánuco</td>
<td>4,563</td>
<td>4,896</td>
<td>155</td>
<td>5,875</td>
<td>N/D</td>
<td>23,450</td>
</tr>
<tr>
<td>Amazonas</td>
<td>3,878</td>
<td>1,997</td>
<td>198</td>
<td>224</td>
<td>N/D</td>
<td>23,450</td>
</tr>
<tr>
<td>Cusco</td>
<td>224</td>
<td>224</td>
<td>224</td>
<td>224</td>
<td>N/D</td>
<td>23,450</td>
</tr>
<tr>
<td>San Martín</td>
<td>105</td>
<td>93</td>
<td>93</td>
<td>93</td>
<td>N/D</td>
<td>23,450</td>
</tr>
<tr>
<td>Total (m³)</td>
<td>7,753</td>
<td>114,209</td>
<td>144,301</td>
<td>73,635</td>
<td>N/D</td>
<td>363,404</td>
</tr>
<tr>
<td>Percentage (%)</td>
<td>2%</td>
<td>31%</td>
<td>40%</td>
<td>20%</td>
<td>6%</td>
<td>100%</td>
</tr>
</tbody>
</table>


**Table 4** features the supply volumes with the unauthorized logging values subtracted. This brings the effective timber supply down from 1,688,144 m³ to an adjusted value of 1,324,740 m³ for 2017. A total of 363,404 m³ (21.5% of logged volume) were officially reported by OSINFOR as involving some degree of illegality in 2017.

Now, 89% of the total effective supply comes from two access mechanisms: timber forest concessions, whose share is up from 42% to more than half (53%), and native community permits, with 36%, followed by private property permits, where the percentage drops to 8%.

For local forests, the effective supply adjusted for unauthorized logging is negative in 2017. This could mean, for instance, that there was timber extracted without authorization or documentation (illegal surplus) that was detected by OSINFOR but was not reflected in official documents (GTFs). Another possible explanation is that the timber supply study, during the stages of collecting official SIF-AL data or searching for and gathering available GTFs, did not obtain all the volume recorded on GTFs, due to the loss of documents or other reasons.

**TABLE 4**

<table>
<thead>
<tr>
<th>VOLUME (m³)</th>
<th>Timber Forest Concessions</th>
<th>Native and Rural Communities Permits</th>
<th>Local Forests</th>
<th>Private Property Permits</th>
<th>Plantations</th>
<th>N/D</th>
<th>OTHER</th>
<th>TOTAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>In GTFs or extraction reports (A)</td>
<td>710,049</td>
<td>620,977</td>
<td>84,950</td>
<td>178,528</td>
<td>22,610</td>
<td>67,677</td>
<td>3,353</td>
<td>1,688,144</td>
</tr>
<tr>
<td>OSINFOR-reported unauthorized logging (UL)</td>
<td>7,753</td>
<td>137,715</td>
<td>144,301</td>
<td>73,635</td>
<td>363,404</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total: GTF or report volume minus UL</td>
<td>702,296</td>
<td>483,262</td>
<td>-59,351</td>
<td>104,894</td>
<td>22,610</td>
<td>67,677</td>
<td>3,353</td>
<td>1,324,740</td>
</tr>
<tr>
<td>UL/A (%)</td>
<td>1.1%</td>
<td>22.2%</td>
<td>169.9%</td>
<td>41.2%</td>
<td>21.5%</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Source: Prepared by the authors based on the Peru legal timber supply baseline study (USAID Pro-Bosques, 2019) and SIGO web query on January 9, 2020. Effective supply adjusted for unauthorized logging (A-UL). N/D: Not determined.
Demand for wood

Total wood demand in 2017 from the primary and secondary industry came to 2,105,879 m³ of roundwood and 1,079,420 m³ of roundwood equivalent, respectively (Solís, 2019). Table 5 presents the figures obtained from the surveys of primary facilities, broken down by forest resource access mechanism and by region. Of the total reported industry demand for timber, 56% is processed in Ucayali, Loreto, and Madre de Dios. Only 8% is reported by companies registered in Lima. The most important types of access mechanism are timber concessions (46%) and native community permits (33%).

**TABLE 5**

<table>
<thead>
<tr>
<th>REGION</th>
<th>TIMBER FOREST CONCESSIONS</th>
<th>NON-TIMBER FOREST CONCESSIONS</th>
<th>NATIVE COMMUNITY PERMITS</th>
<th>LOCAL FORESTS</th>
<th>PRIVATE PROPERTY PERMITS</th>
<th>PLANTATIONS</th>
<th>OTHER</th>
<th>TOTAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Loreto</td>
<td>69,917</td>
<td>0</td>
<td>94,363</td>
<td>10,122</td>
<td>64,104</td>
<td>0</td>
<td>0</td>
<td>238,505</td>
</tr>
<tr>
<td>Ucayali</td>
<td>392,633</td>
<td>0</td>
<td>285,349</td>
<td>6,642</td>
<td>12,695</td>
<td>0</td>
<td>0</td>
<td>715,617</td>
</tr>
<tr>
<td>Madre de Dios</td>
<td>219,987</td>
<td>4,998</td>
<td>423</td>
<td>0</td>
<td>2,256</td>
<td>0</td>
<td>0</td>
<td>227,664</td>
</tr>
<tr>
<td>Lima</td>
<td>19,106</td>
<td>0</td>
<td>1,771</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>147,772</td>
</tr>
<tr>
<td>Junín</td>
<td>1,254</td>
<td>0</td>
<td>63,592</td>
<td>5,303</td>
<td>5,239</td>
<td>557</td>
<td>0</td>
<td>75,945</td>
</tr>
<tr>
<td>Cusco</td>
<td>38,438</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>38,438</td>
</tr>
<tr>
<td>Arequipa</td>
<td>24,639</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>33,315</td>
</tr>
<tr>
<td>La Libertad</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>32,790</td>
</tr>
<tr>
<td>Huánuco</td>
<td>3,636</td>
<td>0</td>
<td>715</td>
<td>2,486</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>6,898</td>
</tr>
<tr>
<td>Pasco</td>
<td>0</td>
<td>0</td>
<td>700</td>
<td>1,702</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>2,402</td>
</tr>
<tr>
<td>San Martín</td>
<td>946</td>
<td>0</td>
<td>887</td>
<td>460</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>2,293</td>
</tr>
<tr>
<td>Amazonas</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1,030</td>
</tr>
<tr>
<td>Other regions</td>
<td>197,492</td>
<td>1,606</td>
<td>236,643</td>
<td>0</td>
<td>50,842</td>
<td>3,995</td>
<td>71,756</td>
<td>562,334</td>
</tr>
<tr>
<td>Total (m³r)</td>
<td>968,048</td>
<td>6,604</td>
<td>694,504</td>
<td>16,764</td>
<td>139,847</td>
<td>9,234</td>
<td>270,879</td>
<td>2,105,879</td>
</tr>
<tr>
<td>Percentage (%)</td>
<td>46%</td>
<td>0%</td>
<td>33%</td>
<td>1%</td>
<td>7%</td>
<td>0%</td>
<td>13%</td>
<td>100%</td>
</tr>
</tbody>
</table>

Source: Prepared by the authors based on survey of primary processing companies (CNF, 2019).
Note: Includes MSEs and MLEs. Demand adjusted to 2017 by Solís (2019) based on year-on-year growth of 7.54%.

Timber demand from the primary industry was **2,105,879 m³** and demand for wood from the secondary industry came to **1,079,420 m³** in roundwood equivalent.
THE ILLEGAL LOGGING AND ROUNWDWOOD TRADE INDEX FOR PERU IN 2017

For analysis purposes, it was considered important to separate timber flows by forest resource access mechanism, in order to calculate separate indices and percentages of illegal logging and trade in timber—not only total values (consolidating all types of licenses)—as well as two subtotals: (i) forest concessions (timber + non-timber) and native and rural community permits, the two most important mechanisms in terms of logged volume, and (ii) private property permits, local forests, plantations, and others recorded in the “not determined” or “other” categories during the data processing stage for the supply and demand studies.**

Effective supply adjusted for unauthorized logging

When the unauthorized logging volume identified by OSINFOR for each resource access mechanism in 2017 is subtracted from the effective supply (volume in GTFs or extraction reports), the overall index (IL %) comes to 1.59 and the overall percentage of illegality (II %) is 37%.

For forestry concessions and native and rural community permit mechanisms, the index (IL%) goes from 1.25 to 1.41 and the percentage of illegality (II%) is 37%.

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TABLE 7
Illegal logging and trade in timber (IL_i and IL_%) by forest resource access mechanism in Peru – 2017

<table>
<thead>
<tr>
<th>FOREST RESOURCE ACCESS MECHANISM (LICENSE TYPE)</th>
<th>TOTAL DEMAND (DT) FROM PRIMARY FOREST INDUSTRY (m³)</th>
<th>EFFECTIVE SUPPLY (SE) MINUS IL_i (m³ Y)</th>
<th>INDEX (IL_i) = DT/SE</th>
<th>PERCENTAGE (IL%) = UF/DT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Forestry concessions (timber + non-timber)</td>
<td>974,652</td>
<td>702,295</td>
<td>1.39</td>
<td>28%</td>
</tr>
<tr>
<td>Native and rural community permits</td>
<td>694,504</td>
<td>483,262</td>
<td>1.44</td>
<td>30%</td>
</tr>
<tr>
<td>Subtotal</td>
<td>1,669,156</td>
<td>1,185,558</td>
<td>1.41</td>
<td>29%</td>
</tr>
<tr>
<td>Private property permits</td>
<td>139,847</td>
<td>104,894</td>
<td>1.33</td>
<td>25%</td>
</tr>
<tr>
<td>Local forests, plantations, other, or not determined</td>
<td>296,876</td>
<td>34,288</td>
<td>8.66</td>
<td>88%</td>
</tr>
<tr>
<td>Subtotal</td>
<td>436,724</td>
<td>139,182</td>
<td>3.14</td>
<td>68%</td>
</tr>
<tr>
<td>Total</td>
<td>2,105,879</td>
<td>1,324,739</td>
<td>1.59</td>
<td>37%</td>
</tr>
</tbody>
</table>

Effective (logged) supply is the volume reflected in GTFs or extraction reports. According to OSINFOR, 363,404 m³ were logged without authorization: local forests (40%), native community permits (31%), rural community permits (7%), private property (20%), forestry concessions (2%).

Negative flows can mean:
- During stage 2 (fieldwork and deployment, when the surveys are administered), or when the survey data were being entered into the database, the volumes for the different forestry licenses may have been misreported or recorded incorrectly or in other categories such as “not determined” or “other,” the latter being the more likely scenario.
- Demand was estimated based on respondent statements and not on records of each primary processing company in the scope of the study (primary processing facility operations logbook).

Lastly, an illegal logging and roundwood trade index was not estimated for secondary processing, for two reasons: (i) the secondary processing industry demands processed wood (sawn or chain-sawn boards, planks, or cants) from the primary industry; and (ii) the findings for secondary processing yielded volumes of wood demand, in roundwood equivalent, that were lower than in primary processing.

As stated earlier, in 2017 the primary industry processed the entire flow of timber reflected in legal documents (2,105,879 m³ of legal and laundered roundwood). A portion of this flow (31%) was then processed formally (1,079,420 m³ of roundwood equivalent) by the formal secondary industry (facilities registered in the RUC). The assumption is that the rest was processed informally by unregistered secondary facilities, i.e., facilities not in the RUC.

It must be stressed once again that the above demand figure does not represent all of Peru’s secondary processing industry demand, as it only includes companies and individuals doing business formally (paying taxes); i.e., companies and individuals that have a RUC number. For 2015, SUNAT reported a formality rate of 23% among companies and individuals doing business in this link of the timber value chain (Solís, 2019). Further research or more detailed studies are needed.

Care should be taken when comparing the results obtained with this direct method for calculating indicators of illegal logging and trade in timber with other calculations based on different methodologies and parameters. In the case of Peru, the indicator resulting from the indirect method used in 2006 and 2018, based on the INEI Input-Output Matrix, very likely reflected both legalized/laundered and clandestine (informal) timber. The direct method offers tangible points of reference for discussing and potentially addressing the problem of illegal logging, as well as specific estimates that can be evaluated and tested by others, and possibly improved over time with application of the method and the recommendations proposed for Peru.
This involves comparing the volumes of timber that the forestry industry reports having received (demand) with the logged volumes (supply) recorded in the SIF-AL, GTFs, or extraction reports. The key assumption is that timber authorized for logging and transported with GTFs (effective supply) must go through industry facilities for processing, so the two quantities should be equal. A difference between the two volumes can therefore serve to estimate the extent of illegal logging and trade (Navarro et al., 2013).

For more details on each of the stages of the process for Peru in 2019, see USAID Pro-Bosques (2019). Peru timber supply baseline. Contribuciones Técnicas Series No. 2. Lima, Peru. 33 pp.

Potential supply equals the volume of timber reflected in the forest management plans submitted by the licensee and authorized for harvest via a resolution issued by the regional or national authorities, depending on the area (USAID Pro-Bosques, 2019).

Effective supply equals the volume of timber logged and transported from the licensed forest of origin and identified in the GTF by the licensee. The GTFs gathered are for timber in its natural state, and are issued at the point of origin by the licensee to a recipient (USAID Pro-Bosques, 2019).

Elimination of duplicate GTFs reported by the SIF-AL and validation of recorded information against the log list report, by licensee (USAID Pro-Bosques, 2019).

A technique applied in forestry in order to retrieve information and document formats that are stored physically and digitally (USAID Pro-Bosques, 2019).

GTF coding using the following nomenclature: “Region/Field Office/Mechanism/Name of company or license holder/GTF number” (USAID Pro-Bosques, 2019).

A table or matrix was created with observations/identified cases versus recording rules. For example, Obs.1. Information on GTF has accents and upper and lower case letters, Rule 1. Enter GTF information without accents, all caps. Obs.2. No issue date recorded on GTF, Rule 2. Review seals and complete with earliest review date (USAID Pro-Bosques, 2019).

Validation of recorded information to eliminate data entry errors. For the timber supply study this involved: (i) 1:1 verification of consistency between the information recorded in the database and the information recorded on the GTFs received, to eliminate typing errors; (ii) verification of consistency between database data and the original GTF; and (iii) analysis of volume extremes—20 highest and 20 lowest for each region—to validate accuracy and consistency of data (USAID Pro-Bosques, 2019).

The volume of timber logged by license holders sanctioned for a given offense, after compliance efforts found that it came from the extraction of unauthorized trees pursuant to Law 27108 (from 2009 to 2017) under the offense of “facilitating” the extraction, transport, processing, or sale of illegally extracted forest resources via a concession contract, management contract, permit, or authorization for forestry use, or Law 29763, under the offense of “using” documentation issued or approved by the competent forest authorities to conceal the logging, transport, processing, storage, or sale of forest resources or products extracted without authorization (PCM et al., 2021). Volume data available at https://observatorio.osinfor.gob.pe/Estadisticas/Home/Reportes/

OSINFOR does not currently conduct supervision visits for all forestry licenses. In 2017, OSINFOR covered 21% of the total number of contracts (1,019) under which timber was logged (USAID Pro-Bosques, 2019).

The following steps are required: a. Review the fact sheet for each facility to determine its installed capacity; b. Review facility-issued annual or other reports on processing to determine monthly demand for roundwood, species, and installed capacity utilization rate (annual). If there is no annual report, look at a sample of the population by category of daily production/processing (large, medium, small); c. Determine business variables (total volume processed, yields, and target market); d. Determine “uncontrolled flow” through interviews to obtain information about the target market for these facilities.

45. For more details on each of the stages for Peru in 2019, see CNF (2019). Consulting services for survey administration and sys-
USFS FOREST, 33 pp.
46. Legal (registered) roundwood theoretically goes through two types of processing facilities: primary facilities, which demand 
roundwood, and secondary facilities, which demand processed (sawn or chain-sawn) wood.
47. Use of the "operations logbook for sustainable forestry licenses" became mandatory on March 2, 2020, while use of the 
"operations logbook for primary processing of timber forest products and byproducts" became mandatory as of August 1, 
2020.
48. Probability sampling technique that divides the total population into three different subgroups or strata.
49. USAID Pro-Bosques, 2019
50. (i) SUNAT: 62 companies with annual sales over 1,700 Peruvian tax units (UITs); (ii) TOP 10K: 32 companies with more than S/10.5 
million in sales in 2017; (iii) ADEX: 9 timber export companies in 2017; and (iv) SERFOR: 14 timber export companies in 2018.
51. The SUNAT database did not have the addresses of individuals with a business publicly available via the website. This 
prompted an information request to be routed through the Office of the President of the Council of Ministers to SUNAT to 
obtain the addresses of all businesses active as of July 2019 with the aim of locating the target respondents and their poten-
tial substitutes.
52. The study had two statisticians providing advice during the national survey design, administration, and systematization 
process (CNF, 2019).
55. A classification table, or matrix, was created with forest sector company status and description. For example: Changed busi-
ness activity. Discontinued operations. Does not belong to study. Surveyed, Refused to respond, Disregarded, Not found, To be 
scheduled, Inactive according to SUNAT (CNF, 2019).
56. Units of volume in the database were standardized based on the following conversion factors: one cubic meter equals 424 board 
feet; the roundwood-to-sawn wood yield is 52% (INRENA, 2005); and to convert the volume of sawn wood into m³, that volume 
is divided by 0.52 (CNF, 2019).
57. According to Supreme Decree 018-2015-MINAGRI, primary processing is the first transformation process undergone by forest 
and wildlife products and by-products in their natural state.
58. According to Supreme Decree 018-2015-MINAGRI, secondary processing is the transformation process undergone by forest 
and wildlife products and by-products from a primary processing facility for purposes of obtaining value added. This concept 
includes the processes that are not included in the definition of primary processing.
59. The reference year for the information gathered through the timber demand surveys was 2018. Accordingly, to adjust those data 
to 2017, year-on-year growth in the forest sector from 2017 to 2018 had to be discounted. As Peru does not have precise GDP 
estimates for the forest sector, the Gross Value Added (at constant 2017 prices) for the "Agriculture, hunting and forestry" indus-
try as reported by INEI for 2017 and 2018 was used instead. A growth rate of 7.54% was calculated and then discounted from the 
preliminary 2018 estimates to adjust them to 2017.
60. The data compiled on timber demand derives from self-reporting (official data taken from information systems, or eventually 
the primary processing facility operations logbooks) and from data gathered via surveys, which can be biased when using a 
statistically determined sample. To the extent possible, validity testing is recommended to help ensure the reliability of these 
estimates.
61. Official cubic scaling is done using the Smalian formula, but commercially the Doyle log rule tends to be used. Work in the field 
revealed that the Smalian formula is used for timber with voluntary forest certification.
A total of 28,877 GTFs for 2017 were available in print and/or digital format (14,521 from Madre de Dios; 8,601 from Ucayali; 3,966 from Loreto, and 1,789 from six other regions) (USAID Pro-Bosques, 2019).

USAID Pro-Bosques, 2019

https://observatorio.osinfor.gob.pe/Estadisticas/

Regarding the retrieval of information and forms stored physically and digitally, the Peru timber supply baseline study explained: “...an analysis of GTF continuous (sequential) numbering found that there were GTFs whose print versions were no longer at the forest authorities' offices, and that it would therefore be impossible to retrieve them (at this point, 15,431 GTFs had been successfully retrieved). Given the situation, the complete SIF-AL databases for Loreto, Ucayali, and Madre de Dios (together more than 97% of supply) were then used, enabling a total of 28,887 GTFs (15,431 physical GTFs and 13,446 digital GTFs) to be retrieved. It should be noted that this reflects 100% of GTFs found at forest authority offices and in their systems.” As to data archeology, used only in these three regions, it explains: “…it was verified that there was no evidence in either the physical or the digital system of the use of, or movement of volumes under, GTFs for which there was no physical or digital version.” (USAID Pro-Bosques, 2019).

In theory, the secondary processing industry demands sawn wood or cants. To convert to roundwood, an equivalent of 424 board feet per cubic meter and a conversion factor of 0.52, taken from SERFOR guidelines, were used. In addition, demand was adjusted from 2018 to 2017 on the basis of a year-on-year growth rate of 7.54%.

See figure on forest resource access mechanisms in Concepts | Definition and Classification of Illegality in the Timber Value Chain (PCM et al., 2021).

USAID Pro-Bosques, 2019, and CNF, 2019

To convert to roundwood, an equivalent of 424 board feet per cubic meter and a conversion factor of 0.52, taken from SERFOR guidelines, were used. In addition, demand was adjusted from 2018 to 2017 on the basis of a year-on-year growth rate of 7.54%.
CONCLUSIONS

REGARDING TIMBER SUPPLY AND DEMAND FLOWS AND CALCULATION OF THE INDEX AND PERCENTAGE OF ILLEGAL LOGGING AND TRADE IN PERU

The main conclusions regarding timber supply and demand flows for 2017 are:

1. The legal timber supply volume is 1,324,739 m³ when the unauthorized logging volume reported by OSINFOR for the forest access mechanisms analyzed in 2017 is subtracted from the volume recorded in GTFs or extraction reports.

2. Of the total supply reflected in GTFs or extraction reports, 87% came from the three traditional forestry regions (Loreto, Ucayali, and Madre de Dios). Supply from the other regions was considered to be minimal and was not determined. Additionally, 79% of the effective supply came from two forest access mechanisms: timber forestry concessions (42%) and native community permits (37%).

3. The flow of illegal timber (unaccounted-for flow) was estimated at 781,140 m³ for 2017. Half of this amount, 363,404 m³, was reported as unauthorized logging by OSINFOR in 2017, 92% of it in the region of Loreto. Most of the unauthorized volume came from three types of access mechanisms: local forests (40%), native community permits (31%), and private property permits (20%).

4. The category of forestry license that contributed the most to the total logging volume is timber forestry concessions (whose share of total supply jumps from 42% to 53% when the 363,404 m³ of unauthorized logging are subtracted), and just 2% of total logging in this category was unauthorized in 2017.

5. Timber demand, according to the primary processing industry surveys, amounted to 2,105,879 m³ of roundwood. In secondary processing, the volume was 1,079,420 m³ in roundwood equivalent, meaning that the volume declared in the secondary industry surveys was lower than for the primary industry; a portion of that flow was processed formally (51% in roundwood equivalent) while the rest was processed informally by unregistered secondary facilities (without a RUC number). This situation could be explained by the high informality rate in this link in the value chain (77% in 2015).

6. Of the timber demanded by the primary industry, 56% was processed in Ucayali, Loreto, and Madre de Dios. Companies registered in Lima accounted for only 8%. The two most significant types of access mechanisms were timber forestry concessions (40%) and native community permits (33%).

7. It is evidently possible for negative unaccounted-for flows to occur with this method. According to Navarro et al. (2010), “one could assume the existence of oversupply of legal timber.” Specifically, the negative flows from local forests and private property permits, as well as the small flows from plantations (which should not happen), may be explained by the possibility that during the demand study, in stage 2 (fieldwork and deployment, when the surveys are administered), or when the survey data were being entered into the database, volumes for the different forestry licenses may have been misreported or recorded incorrectly or in other categories such as “not determined” or “other,” the latter being the more likely scenario. Demand was estimated based on self-reporting, which requires trust, accuracy, and honesty on the part of respondents, and not on each primary processing company’s central documents (e.g., primary processing facility operations logbook).
The main conclusions regarding calculation of the illegal logging and roundwood trade indicators for 2017 are:

1. The illegal logging and roundwood trade index (IL) obtained when reported unauthorized logging volume is subtracted from the effective supply amounts to:
   - 1.59 overall.
   - 1.41 for the subgroup consisting of forestry concessions and native and rural community permits. The index for timber forestry concessions is 1.39, but native and rural community permits have the higher index, at 1.44. This difference is explained by the fact that of the 363,404 m$^3$ of unauthorized logging volume reported by OSINFOR, 2% came from concessions and 20% came from these communities.
   - 1.22—slightly lower—for the subgroup consisting of private property permits, local forests, plantations, and the categories “not determined” or “other.”

2. The percentage of illegal logging and trade in timber (IL%) (effective supply minus unauthorized logging) is:
   - 37% overall.
   - 29% for forestry concessions and native and rural community permits combined.
   - 68% for private property permits, local forests, plantations, and the categories “not determined” or “other.”

3. The negative flows for some resource access mechanisms cause distortions. The most interesting distortion is in the case of local forest management contracts. Recorded supply is only 84,950 m$^3$, yet OSINFOR reported 144,301 m$^3$ in unauthorized logging. This makes the supply negative (which is not possible in reality). Then, upon applying the formula, the unaccounted-for flow turns out to be greater and thus the percentage not only flips from negative to positive but increases to 454%. The volumes for the different forestry licenses may have been misreported or recorded incorrectly or in other categories such as “not determined.” This is also true for forest plantations, which have a negative flow.
The main recommendations with regard to calculating timber supply and demand flows and the illegal logging and roundwood trade index are:

- In order to be able to determine the volume of timber that is actually legally extracted from the forest through the different access mechanisms, it would be advisable and ideal to have 100% supervision of all forestry licenses under which harvesting has occurred. This would significantly reduce the amount of illegal timber. Failing that, since field supervision is costly, visits should follow a sampling design that would allow inferences as to the status of all timber harvested under each license type to be made, in order to then estimate the average amount of illegal (laundered) timber leaving natural forests and ending up in the marketplace.

- Data reliability and validity could be enhanced through better collection and storage of information (GTFs, extraction reports, operations logbooks) on the part of the regional authorities in Loreto, Ucayali, and Madre de Dios. Also needed is greater sector transparency, for both supply and demand flows, to allow easier, more effective application of the proposed methodology.

- The contacts established with different stakeholders in the forest value chain and the technical capabilities developed during this study should be used to facilitate the collection and validation of information on timber supply and demand in the forest sector and its respective subsectors. For instance, according to the demand study (Solís, 2019), “with the information available, it was possible to estimate secondary processing industry demand for panels and sheets. In total, forest sector company demand for panels and sheets is about 390,074 m³. The MSE segment accounts for nearly all of this sum, with 388,519 m³. Lima accounts for 42.74% of demand for panels and sheets in Peru. These figures suggest that a significant portion of MSEs are supplementing domestic wood with imported inputs in furniture manufacturing in Peru.”

- For the next demand study, a special effort should be made to include all of Peru’s regions in the study area when it comes to the secondary processing industry, for the following reasons (Solís, 2019): (i) approximately 25% of total demand for wood comes from the regions not included in the 2019 demand study; and (ii) the secondary processing industry behaves quite differently from the primary processing industry.

- It could be a mistake to infer that informal wood consumption has to do with the formality rate among companies engaged in the activities that make up Peru’s forest sector. This issue should be thoroughly addressed, and given its complexities, doing so may necessitate methodological advances or sizeable investments to make it feasible. Development of a methodology for the informal sector therefore ought to be explored, followed by a study to estimate clandestine wood flows. This would make it possible to calculate an illegality index that includes this component, which is especially important for secondary processing, in view of the high informality rates in this subsector, and will also help clear up any distortions resulting from this initial application of the method.

- The official authorities responsible for the definitions relating to illegal logging and trade in timber, legal versus illegal timber, primary versus secondary processing facilities, types of forest products, etc., should continue to fine-tune them, since this will improve accuracy when applying this methodology.

- Lastly, it is important to consider what is being sought with the implementation of public policies, and to what extent the indicators (index and percentage) of illegality in the forest sector should be reduced through their implementation. A benchmark or target for lowering this indicator could be the annual rate of informality in the Peruvian economy as a whole, which, according to INEI data, was 19% in 2014 (CEPLAN, 2015).

The following are the main recommendations for overcoming the methodology’s limitations, already reported by Navarro et al. (2010 and 2013), but placed in context for Peru:

- A system should be implemented for tracking the approved forest inventory (in the operating plan), the volume harvested, and the volume transported under GTFs. The chain of custody should be monitored by the forest regent, who, along with a forest authority representative, would be responsible for crosschecks. The forest regent’s report should include a balance sheet and data digitized in a format compatible with the forest information system. These data should be reviewed and approved by the individual designated by the forest authority before being uploaded into the information system. As part of the review process, the information system should run routine crosschecks that indicate to the reviewer whether the submitted documentation has to be verified as well as whether a field audit is potentially needed.

- The GTF forms for roundwood and squared wood (from natural forests and forest plantations) need to be improved. There must be sufficient space to issue one GTF per trip. In addition, a procedure for checking GTFs should be created, with the forest information system providing alerts when...
the GTFs received show values that fall below the minimum or exceed the maximum volume per trip (for Peru, by either truck or boat).

- Use of the forest information system by agencies responsible for forest management, control, and monitoring, and by forest regents and district and municipal forest authority employees should be improved. Management plans, permits, regent reports, and GTFs should be integrated.

- To curb GTF ‘recycling,’ the forest information system must be able to crosscheck timber source and industry GTFs (inventory in the log yard vs. sales). This would ensure proper use of GTFs as well as credibility in the timber chain of custody.

- The forest information system should feature additional tools to enable the generation of reports, analyses, and statistics concerning the supply of wood.

- A routine should be created to include other inflows and outflows of wood in the forest information system, like records of auctioned wood (not included in the 2019 supply and demand studies).

- Forest sector and other authorities (e.g., regional and municipal governments, SUNAT, Ministry of Production [PRODUCE], etc.) should coordinate to take a census of forest sector-related companies and businesses and improve registries, at least for the strategic regions in terms of supply (Loreto, Ucayali, and Madre de Dios) and demand (these three, plus Lima, Arequipa, San Martín, and Huánuco).

- A standard datasheet (model format) should be utilized to keep standardized forestry industry records (operations logbooks) and improve how they are used. Improvements suggested by Santamaría (2010) include standardizing a consolidated form for reporting roundwood/timber processed per year and by species and the entries for each business variable: form, source and origin, use, and market.

- Industry data (e.g., from operations logbooks) should be uploaded into the forest information system so crosschecks can be done against the legal supply of wood. With the assistance of other authorities associated with the forest sector (e.g., SUNAT and PRODUCE), a registry should be created wherein each processing facility has a unique code. By doing this, a chain of custody can be drawn from forest to industry, and the GTFs would help to better monitor this. GTFs should include the facility code and indicate the wood’s destination. This would make monitoring easier and enable the system to compare supply volumes with demand volumes.

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71. Use of the “operations logbook for sustainable forestry licenses” became mandatory on March 2, 2020, while use of the “operations logbook for primary processing of timber forest products and byproducts” became mandatory as of August 1, 2020.

72. For 2015, SUNAT reports formality rates of 55% in primary processing and 23% in secondary processing.
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LEGAL BASIS


CONCEPTOS
Definición y clasificación de la ilegalidad en la cadena de valor de la madera
INDEX AND PERCENTAGE

An Accessible Method for Measuring Illegal Logging and Trade in Timber

Presidencia del Consejo de Ministros
Jirón Carabaya Cdra. 1 s/n, Palacio de Gobierno
Cercado de Lima, Lima - Perú

www.gob.pe