

**TIMBER IDENTIFICATION AND HANDLING TOOLKIT**

# **HANDLING REFERENCE GUIDE**





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Rare and precious wood species grow naturally throughout Viet Nam and are an indispensable part of natural forest ecosystems.

The exploitation and illegal trade of these wood species has negatively impacted forest ecosystems, the conservation of genetic resources, and the environment. Overexploitation can lead to the extinction of a species, since recovery capacity is limited. The vitality of endangered, rare, and precious flora is under great pressure due to loss of habitat, environmental pollution, natural disasters, and climate change.

The trafficking of rare and precious wood species has become increasingly complicated, taking on a variety of forms. Controlling the situation remains challenging. Many international organizations have worked to conserve and prevent the exploitation and illegal trade of rare and precious timber on a global scale, such as TRAFFIC, WWF, and GIZ. Viet Nam is one of many parties to the United Nations Convention on Biological Diversity and the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES).

In recent years, the Government of Viet Nam has adopted a series of legal measures on forest protection, with an emphasis on rare and endangered flora. For the effective implementation of these policies, the government has prioritized the establishment of specialized law enforcement practices within bodies such as the forest protection department, environmental police, Customs, the border guard, and market surveillance authorities. However, these agencies are understaffed and not every staff member meets the necessary requirements and qualifications. In addition, equipment, tools and materials to support the protection of rare and endangered flora are inadequate.

The identification of timber species plays an essential role in the management of timber resources and the control of illegal trade. Timber identification requires specific professional skills and knowledge coupled with practical experience and toolkits such as this one, which include timber identification guides and reference documents.

This Handling Reference Guide was developed to enable law enforcement officials to analyze and identify 35 species of rare and valuable wood for which trade is regulated or prohibited. The guide aims to facilitate the inspection and control of transport, export, and import of wood to prevent the illegal trade of timber.

This guide includes the following sections: (i) Timber trade regulations in Viet Nam, (ii) Timber identification contacts, (iii) Handling regulated timber species, and (iv) Timber identification guide.

## 2.1 Related policies

### a) Laws:

- Law on Forest Protection and Development, adopted in 2004. A draft revision of the Law is currently under discussion.
- Law on Handling of Administrative Violations, adopted on 02 July, 2012.
- Law on Organization of a Criminal Investigation Agency, issued on 26 November, 2015.

### b) Government decrees on the management of endangered, rare, and precious forest fauna and flora

- Decree 32/2006/ND-CP dated 30/3/2006 on the management of endangered, precious, and rare forest fauna and flora
- Decree 160/2013/ND-CP dated 12/11/2013 on the criteria for species categorized as endangered, precious, or rare and the management plans for such species

### c) Government decrees on the export, import, and transit of wild, precious, and rare flora:

- Decree 11/2002/ND-CP dated 22/1/2002 on the management of export, import, and transit of wild fauna and flora
- Decree 82/2006/ND-CP dated 10/8/2006 on the management of export, import, re-export, introduction from the sea, transiting, breeding, rearing, and transplanting artificial, endangered, precious, and rare wild fauna and flora

### d) Government decrees on the handling of administrative sanctions in the field of forest management, forest development, forest protection, and forest product management:

- Decree 127/2013/ND-CP dated 15/10/2013 on regulations on the administrative penalties and the enforcement of administrative decisions in the field of Customs
- Decree 157/2013/ND-CP dated 11/11/2013 on the handling of administrative sanctions in the field of forest management, forest development, forest protection, and forest product management
- Decree 40/2015/ND-CP dated 27/4/2015 on amending and supplementing some articles of Decree 157/2013/ND-CP dated 11/11/2013
- Decree 41/2017/ND-CP dated 05/4/2017 amending and supplementing some of articles of the Decree on the handling of administrative violations in fisheries activities,



veterinary field, livestock breeds, animal feed; forest management; forest development, forest protection and forest product management

**e) Circulars and decisions from the Ministry of Agriculture and Rural Development (MARD):**

- Decision 04/2004/QD-BNN-LN dated 02/02/2004 on promulgation of the regulations on the exploitation of timber and non-timber forest products
- Decision 44/2006/QD-BNN dated 1/6/2006 on promulgation of the regulations on the management and stamping/marketing of tree-cutting and timber marking hammers
- Circular 88/2011/TT-BNNPTNT dated 28/12/2011 on the guidelines for the implementation of Decree 12/2006/ND-CP dated 23/01/2006 by the government, which regulates in detail the implementation of the Commercial Law on the international sale and purchase of goods; and service agencies' activities related to the sale, purchase, processing and transit with foreign countries' partners
- Circular 01/2012/TT-BNNPTNT dated 04/01/2012 regulating supporting documentation for legal forest products and control of the origin of forest products
- Circular 40/2015/TT-BNNPTNT on amending and supplementing some of articles from Circular 01/2012/TT-BNNPTNT dated 04/01/2012 regulating supporting documentation for legal forest products and control of the origin of forest products
- Circular 21/2016/TT-BNNPTNT dated 28/6/2016 on harvesting regulations on the exploitation and utilization of forest products
- Circular 04/2017/TT-BNNPTNT dated 24/02/2017 on the list of wild fauna and flora in the Annexes to the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) (in replacement of Circular 40/2013/TT-BNNPTNT dated 5/9/2013).

**f) Policies on endangered, precious, and rare wood species:**

- The Vietnamese government's policies regarding the management of endangered, precious, and rare wood species are stipulated in Article 3 of Decree 32/2006/ND-CP as follows:
- The government invests in the management and protection of endangered, precious, and rare species of wild plants and animals in special-use forests, and also invests in the care of confiscated endangered, precious, and rare species of wild plants and animals
- The government encourages, supports, and ensures the legitimate rights and benefits of organizations, households, and individuals who invest in the management, protection and development of endangered, precious, and rare species of wild plants and animals

**g) Priority policies on endangered, precious, and rare species:**

- Until now, no priority policies have been adopted to allow the processing, import, or export of any endangered, precious, and rare species of wood (as defined in the Decree 32/2006/ND-CP and the CITES list).

**Note:**

Legal documents can be found online at the following address <https://thuvienphapluat.vn/en/>

**2.2 Processing and Trading of Timber**

Endangered, precious, and rare timber species with high economic value are usually used for processing and trading. Wood products are categorized by the purpose of their use as follows:

GROUP A	GROUP B	GROUP C	GROUP D
wood used for high-quality, high-value furniture, fine arts, and spiritual pieces such as altars	wood used for the construction of large, high-value, long-lasting buildings	wood used for the production of incense or high-value essential oils	wood used for decoration, such as driftwood.

Only a few remaining species of rare and precious conifer species are exploited, processed, and traded, such as Himalayan cypress *Cupressus torulosa*, Chinese incense-cedar *Calocedrus macrolepis*, Fujian cypress *Fokienia hodginsii* and Chinese fir *Cunninghamia konishii*. They are suitable for the purposes of groups A, C and D.

Endangered, precious, and rare hardwood species are used for a variety of purposes, examples as follows:

GROUP A	GROUP B	GROUP C	GROUP D
<p> durable, beautiful wood species like Sua <i>Dalbergia tonkinensis</i>, Thailand rosewood <i>Dalbergia cochinchinensis</i>, Burmese rosewood <i>Dalbergia oliveri</i>, <i>Pterocarpus macrocarpus</i>, Sepetir <i>Sindora</i> spp., Go do <i>Azelia xylocarpa</i>;</p>	<p> durable, high-strength wood species like Lim xanh <i>Erythrophleum fordii</i>, Trai ly <i>Garcinia fagraeoides</i>, Nghien <i>Excentrodendron tonkinensis</i>;</p>	<p> wood species containing essential oils like Martaban camphor wood <i>Cinnamomum parthenoxylon</i>, Re xanh phan C. <i>glaucescens</i>, Gu huong C. <i>balansae</i>, Agarwood <i>Aquilaria crassana</i>;</p>	<p> roots and root-bases of rare and precious wood species.</p>

## Conservation status, source, use, and trade frequency of endangered, precious, and rare timber species in Viet Nam

No	Wood species	Scientific names	Conservation status	Source	Use category	Use and trade frequency
1	Chinese incense cedar	<i>Calocedrus macrolepis</i>	IIA	NF,IM	A,C,D	O
2	Bach xanh da	<i>C. rupestris</i>	IIA	NF	OP	S
3	Chinese fir	<i>Cunninghamia konishii</i>	IIA	NF	A,C	S
4	Himalayan cypress	<i>Cupressus torulosa</i>	IA	NF	A	S
5	Fujian cypress	<i>Fokienia hodginsii</i>	IIA	NF,IM	A,B	O
6	Chinese swamp cypress	<i>Glyptostrobus pensilis</i>	IA	NF	A	S
7	Du sam	<i>Keteleeria evelyniana</i>	IIA	NF	OP	R
8	Dalat pine	<i>Pinus dalatensis</i>	IIA	NF	OP	R
9	Thong pa co	<i>P. kwangtungensis</i>	IA	NF	OP	R
10	Chinese coffin tree	<i>Taiwania cryptomerioides</i>	IA	NF	A	R
11	Chinese yew	<i>Taxus chinensis</i>	IIA	NF	OP	R
12	Himalayan yew	<i>T. wallichiana</i>	IA	NF	A	R
13	Vietnamese golden cypress	<i>Xanthocyparis vietnamensis</i>	IA	NF	A	R
14	Go do	<i>Azelia xylocarpa</i>	IIA	NF,IM	A,B,D	O
15	Agarwood	<i>Aquilaria crassana</i>	CII	NF	C	O
16	Gu huong	<i>Cinnamomum balansae</i>	IIA	NF	A,C,D	S
17	Re xanh phan	<i>C. glaucescens</i>	IIA	NF	A,C,D	S
18	Martaban camphor wood	<i>C. parthenoxylon</i>	IIA	NF	A,C,D	S
19	Burmese rosewood	<i>Dalbergia oliveri</i>	IIA	NF,IM	A,B,D	O
20	Thailand rosewood	<i>D. cochinchinensis</i>	IIA	NF,IM	A,B,D	O
21	Trac day	<i>D. rimosa</i>	IIA	NF		O
22	Sua	<i>D. tonkinensis</i>	IA	NF	A,B	O
23	Mun soc	<i>Diospyros salletii</i>	IA	NF,IM	A	O
24	Lim xanh	<i>Erythrophloeum fordii</i>	IIA	NF,IM	B	O
25	Nghien	<i>Excentrodendron tonkinensis</i>	IIA	NF	B	O
26	Trai ly	<i>Garcinia fagraeoides</i>	IIA	NF	B	O
27	Thiet dinh	<i>Markhamia stipulata</i>	IIA	NF	B	S
28	Burma padauk	<i>Pterocarpus macrocarpus</i>	IIA	NF,IM	A,B,D	O
29	Gu mat	<i>Sindora siamensis</i>	IIA	NF,IM	A,B	O
30	Gu lau	<i>S. tonkinensis</i>	IIA	NF,IM	A,B	O
31	Verawood	<i>Bulnesia sarmientoi</i>	CII	IM	A,B	O
32	Spanish cedar	<i>Cedrela odorata</i>	CIII	IM		S
33	Brazilian rosewood	<i>Dalbergia nigra</i>	CI	IM	A	O
34	Red sandalwood	<i>Pterocarpus santalinus</i>	CII	IM	A	O
35	Purpleheart	<i>Peltogyne spp.</i>		IM	A,B	O

## 2.3 Import and export of endangered, precious, and rare timber

Endangered, precious, and rare timber and timber products are traded in many forms:

- **Round timber:** long logs, short logs, inclusive or exclusive of bark and sapwood
- **Sawn timber:** Post, board
- **Veneer:** Thin wood veneer for decoration of man-made wood board (particleboard, MDF, finger-joined lumber)
- **Wood chips:** Wood in small pieces used for incense production or the distillation of essential oils
- **Wood powder:** Powdered wood used for incense production
- **Wood in complex shapes:** Root bases, roots, full-advantage harvesting of tree parts.
- **Wood products:** High-value furniture and wooden fine arts

### Timber Imports:

- Wood species imported from Laos and Cambodia include rosewood *Dalbergia spp.*, Burma padauk *Pterocarpus macrocarpus*, Go do *Azelia xylocarpa*, Sepetir *Sindora spp.*, and Lim xanh *Erythrophloeum fordii* in the form of round timber, sawn timber, and wood in complex shapes.
- Wood species imported from India include Red sandalwood *Pterocarpus santalius* in the form of logs.
- Wood species imported from Latin America and Africa include Honduran Mahogany *Swietenia macrophylla*, Brazilian rosewood *Dalbergia nigra*, Verawood *Bulnesia sarmientoa*, Bubinga *Guibourtia spp.*, and Spanish cedar *Cedrela odorata* in the form of round timber, sawn timber, and veneer.

### Timber Exports:

- Viet Nam exports timber in the form of round timber, sawn timber, re-harvested timber products, woodchips, furniture, and fine arts made from both domestic timber and imported timber from Laos and Cambodia.
- China is the main recipient of timber from Viet Nam, especially rosewood *Dalbergia spp.*, Sua *Dalbergia tonkinensis*; Burma padauk *Pterocarpus macrocarpus*, Go do *Azelia xylocarpa*, Nghien *Excentrodendron tonkinensis*.

### Remarks:

Conservation status: "IA", "IIA" according to Decree 32/2006/ND-CP; "CI", "CII", "CIII" according to Circular 04/2017/TT-BNNPTNT;

Use category: "A", "B", "C" as described in section 2.2; "OP" is for other purpose

Source: "NF" is timber from natural forests; "IM" is imported timber;

Frequency: "O" often; "S" sometimes; "R" rare

# SOME PICTURES OF CONFISCATED ILLEGAL TIMBER AT BORDER GATES



**Picture 1.** Confiscated round timber and sawn timber



**Picture 2.** Confiscated sawn timber



**Picture 3.** Confiscated wood in complex shapes



**Picture 4.** Confiscated wood chips and powder



**Picture 5.** Confiscated furniture made by wood of group IA and IIA

## TIMBER IDENTIFICATION CONTACTS IN VIET NAM

### In Viet Nam, three CITES scientific bodies are involved in plant and wood inspection:

The Institute of Ecology and Biological Resources (IEBR) under the Viet Nam Academy of Science and Technology (VAST) carries out inspection of wood species listed in CITES.

Home A11, 18 Hoang Quoc Viet, Nghia Do, Cau Giay, Ha Noi

Tel: +84 (24) 38360870; Fax: +84 (24) 38361196

Website: <http://www.iebr.ac.vn/>

The Viet Nam Academy of Forestry Science (VAFS) under the Ministry of Agriculture and Rural Development regularly carries out timber inspections at the request of state management and law enforcement agencies including the police, the forest protection department, Customs, the border guard, and the coast guard.

Duc Thang, Bac Tu Liem, Ha Noi

Tel: +84 (24) 38389031; Fax: +84 (24) 38389722

Website: <http://vafs.gov.vn/vn/>

The Centre of Resources and Environmental Studies (CRES) under Hanoi National University carries out wood identification for research purposes.

19 Le Thanh Tong, Ha Noi

Tel: +84 (24) 8253506; Fax: +84 (24) 38262932

Website: <http://cres.vnu.edu.vn>

### 4.1 What is legal timber?

Timber being harvested, processed, transported, and traded in accordance with all current Vietnamese regulations is considered legal timber. The definition of legal timber used in this guide is in accordance with the framework of current Vietnamese law. See [Decree 32/2006/ND-CP](#) here.

**Legal wood harvesting** - refer to Article 6, Paragraph 1 of Decree 32/2006/ND-CP

**Legal transport and storage of wood and wood products** - refer to Article 7 of Decree 32/2006/ND-CP

- Full documentation proving the lawful source of exploitation must be presented (Article 6 of Decree 32/2006/ND-CP), or other legal documents on the handling of material evidence of violations (confiscation in administrative violations or criminal cases)
- Special transportation permits granted by provincial forest protection departments are necessary for transiting outside the provinces or governmental cities
- Traded woods and products must be stamped by timber hammer marks in accordance with regulations (Decision 44/2006)

**Legal wood sourced from planted forest** - refer to Article 8, Paragraph 2 of Decree 32/2006/ND-CP

- The exploitation, transportation and storage of endangered, precious, and rare timber and timber products that are bred and raised under artificial propagation operations must have a Certificate of Origin (CO) in compliance with the law on export, import, re-export and transit, introduction from the sea, artificial propagation, and breeding of endangered, precious, and rare species of wild plants.

### Legal import and export of timber listed in CITES

- Wood species listed in CITES Appendix regulated in Circular 04/2017 must have a permit from the CITES Management Authority.
- Viet Nam CITES Management Authority under the Ministry of Agriculture and Rural Development (MARD)  
2 Ngoc Ha, Ba Dinh, Ha Noi  
Tel: +84 (24) 37335676; Fax: +84 (24) 37346742  
Email: [cites\\_vn.kl@mard.gov.vn](mailto:cites_vn.kl@mard.gov.vn); [ngahtt.ln@mard.gov.vn](mailto:ngahtt.ln@mard.gov.vn)
- Southern Representative Office of Viet Nam CITES Management Authority



135 Pasteur Street, Ward 6, District 3, Ho Chi Minh City

Tel: +84 (28) 38218206; Fax: +84 (28) 39151120

Email: citesphianam@gmail.com; quan.tcln@gmail.com

**Legal processing of wood for trade** – refer to Article 9 of the Decree 32/2006/ND-CP

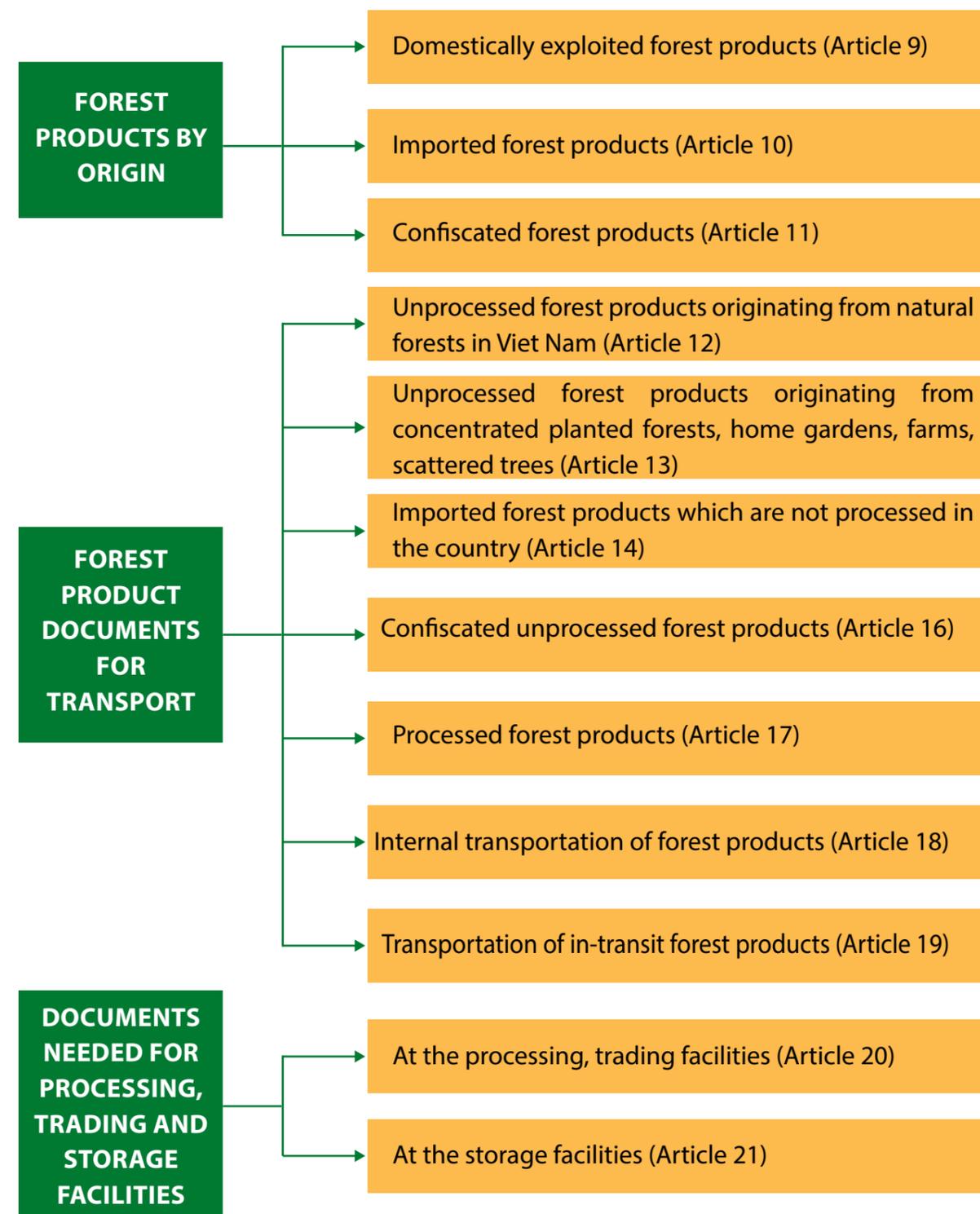
- Wood from species in Group IA that is confiscated by the government can become legally processed after being released in accordance with current regulations.
- Wood species in Group II from natural and planted forests with legal origins is legal to process.
- Organizations and individuals involved in processing and trading endangered, precious, and rare species for commercial purposes must obtain business licences for processing and trading as issued by local authorities.



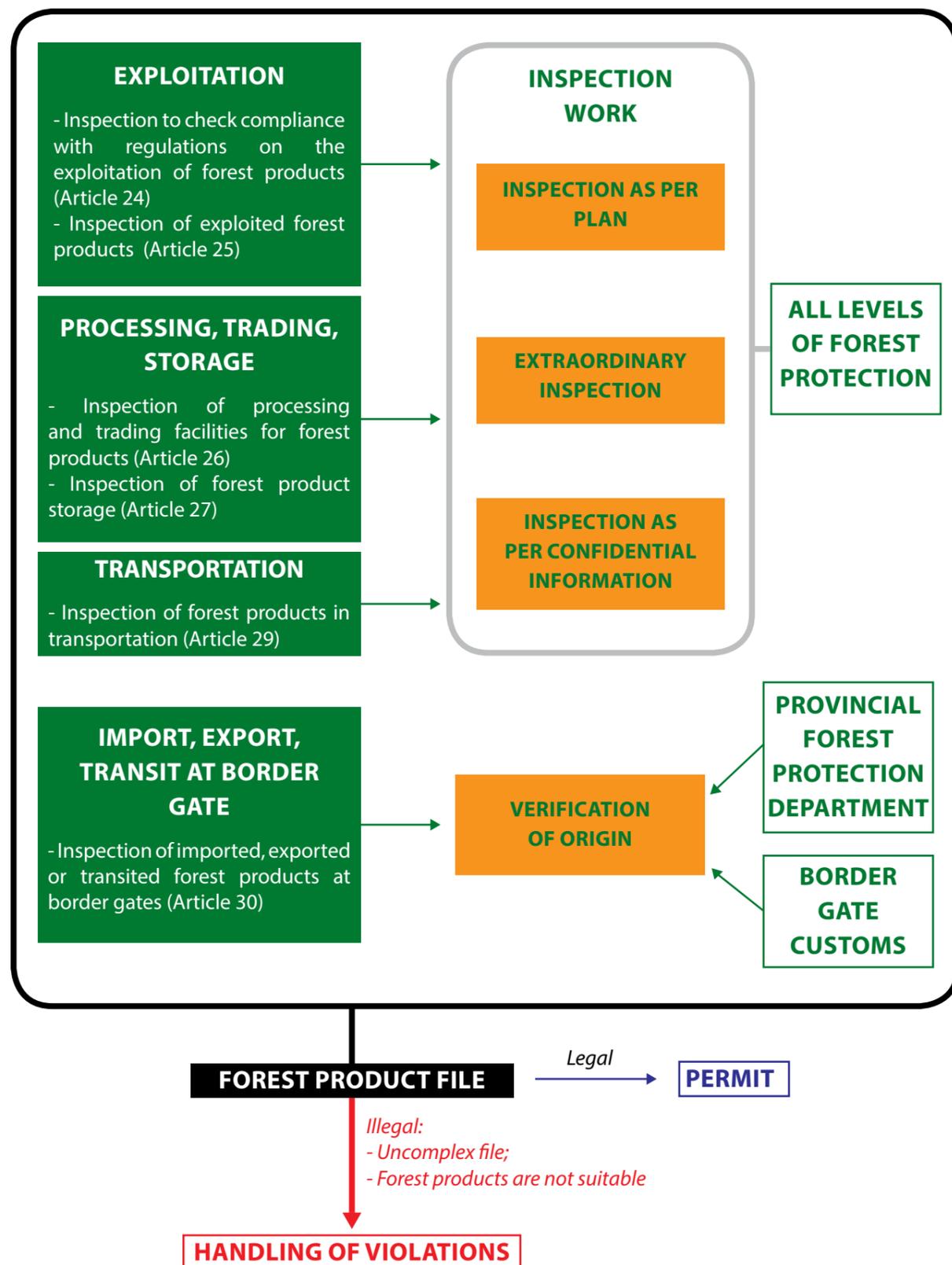
**4.2 What paperwork is needed?**

Please refer to the Circular 01/2012/TT-BNNPTNT dated 04/1/2012 for the paperwork needed to accompany forest products and prove the legal origin of those products.

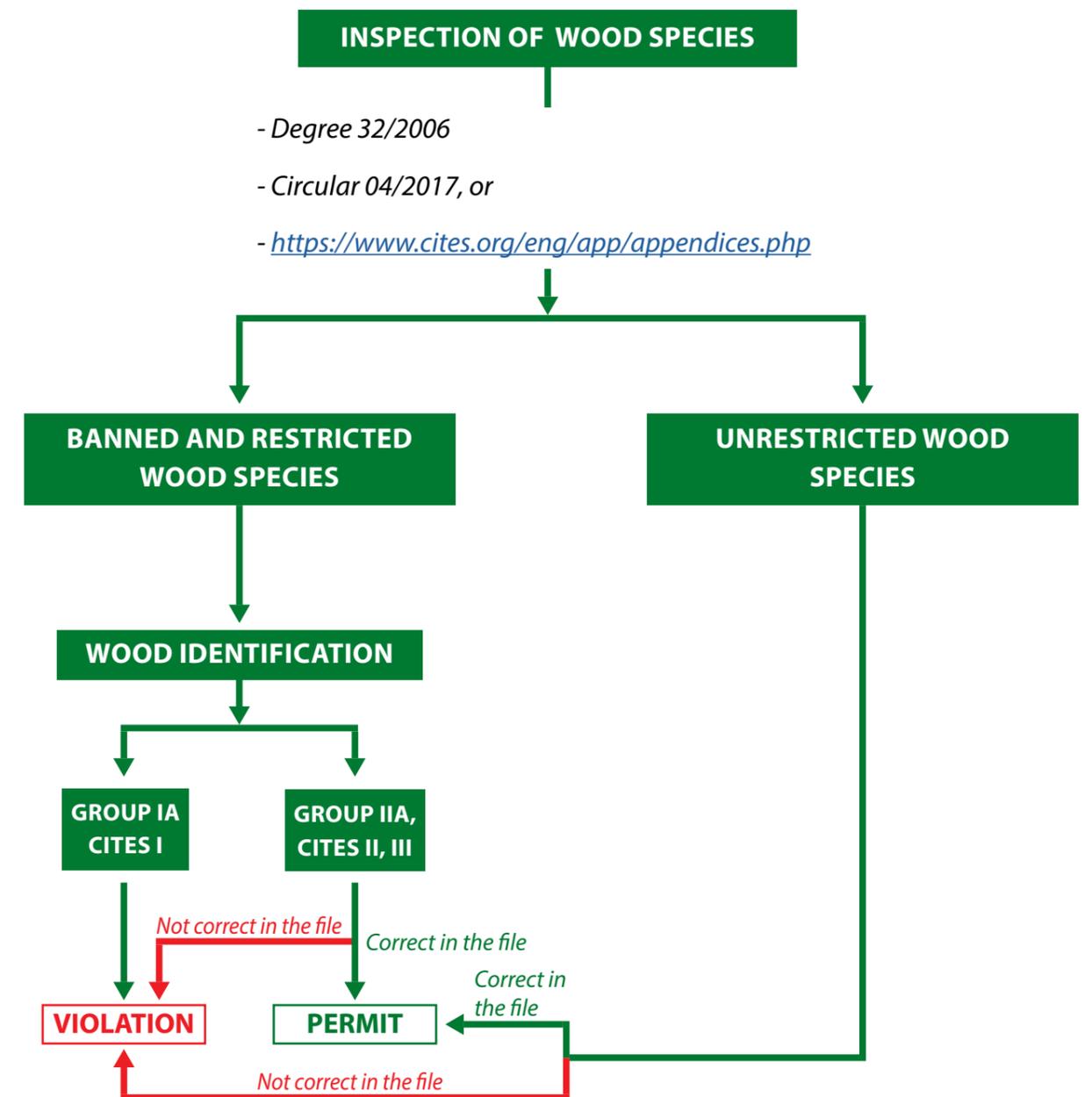
**Type of forest product (timber) dossiers/documents**



### 4.3 Verifying the origin of timber

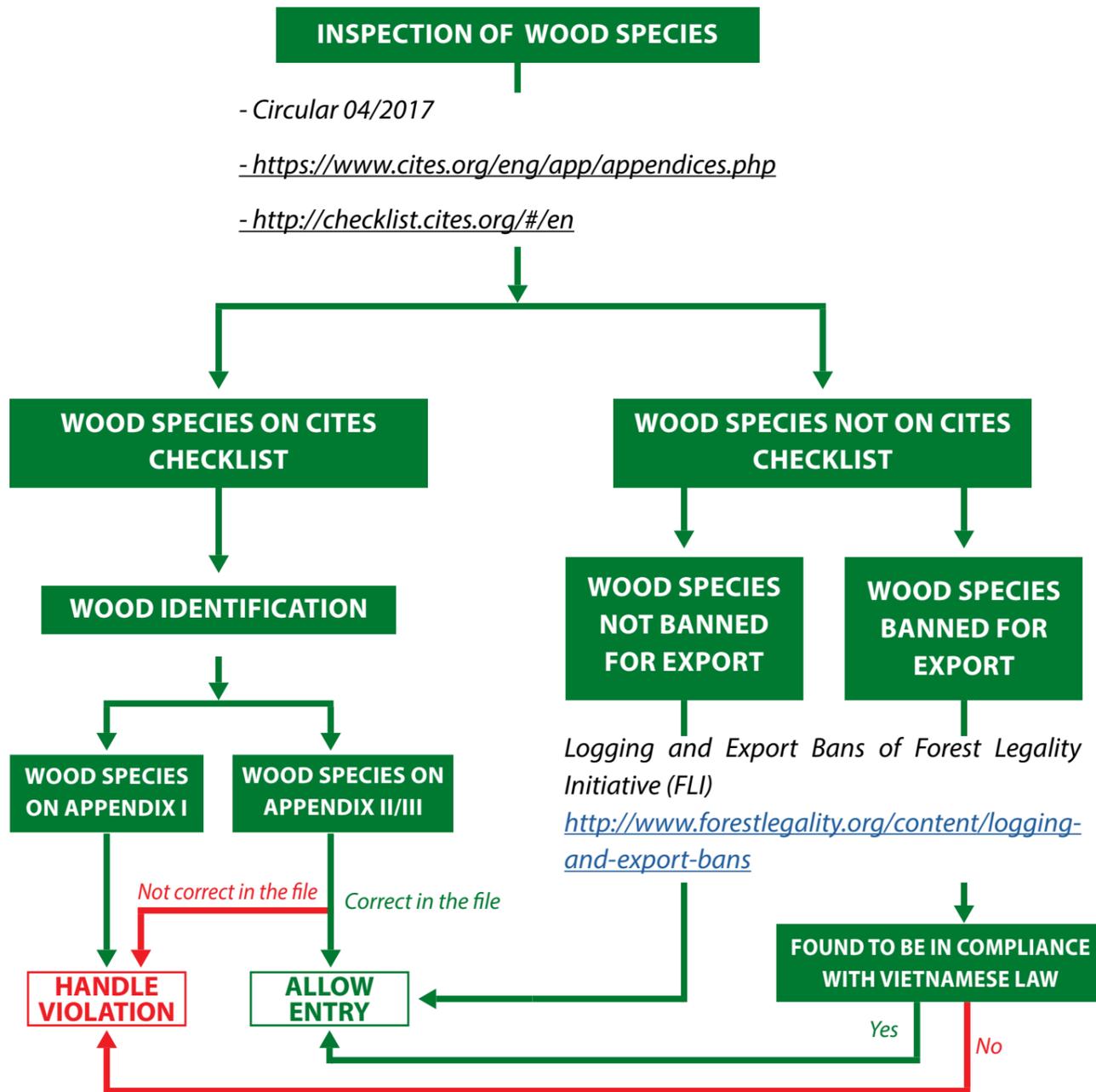


### 4.4 Timber inspection procedure within Viet Nam



**Note:**  
In case of difficulties in identification, please consult with the relevant plant and wood inspection agencies for support as described in section 3.

#### 4.5 Timber inspection at border gates



**Note:**

In case of difficulties in identification, please consult with the relevant plant and wood inspection agencies for support as described in section 3.



#### 4.6 Requesting assistance from examination experts

**Submitting a wood sample for examination:**

- Samples can be sent to plant and wood inspection agencies (as described in section 3) once the species, quantity and volume of timber has been identified. Any additional identification paperwork should be enclosed.

**On-the-spot examination:**

- An on-the-spot examination should be requested from plant and wood inspection agencies (as described in section 3) when transporting samples is impossible due to oversized or large volumes of wood, or in complex cases.

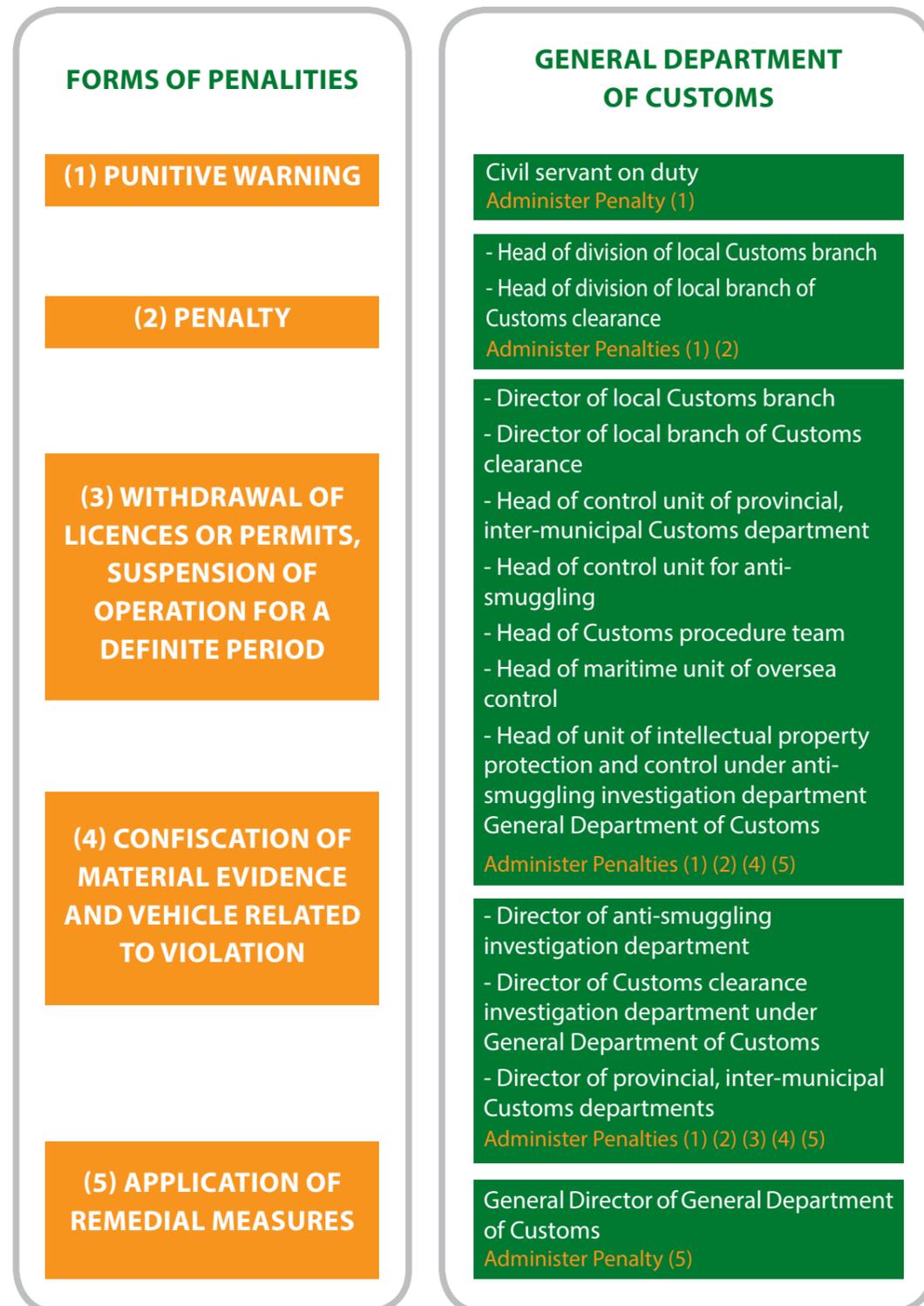
#### 4.7 Handling administrative violations

The Law on the Handling of Administrative Violations issued on 02/7/2012 is detailed in the two Decrees below:

- Decree 127/2013/ND-CP dated 15/10/2013 on regulating the administrative penalties and the enforcement of administrative decisions in the Customs field.
- Decree 157/2013/ND-CP dated 11/11/2013 on administrative sanctions for forest management, forest development, forest protection, and forest product management.

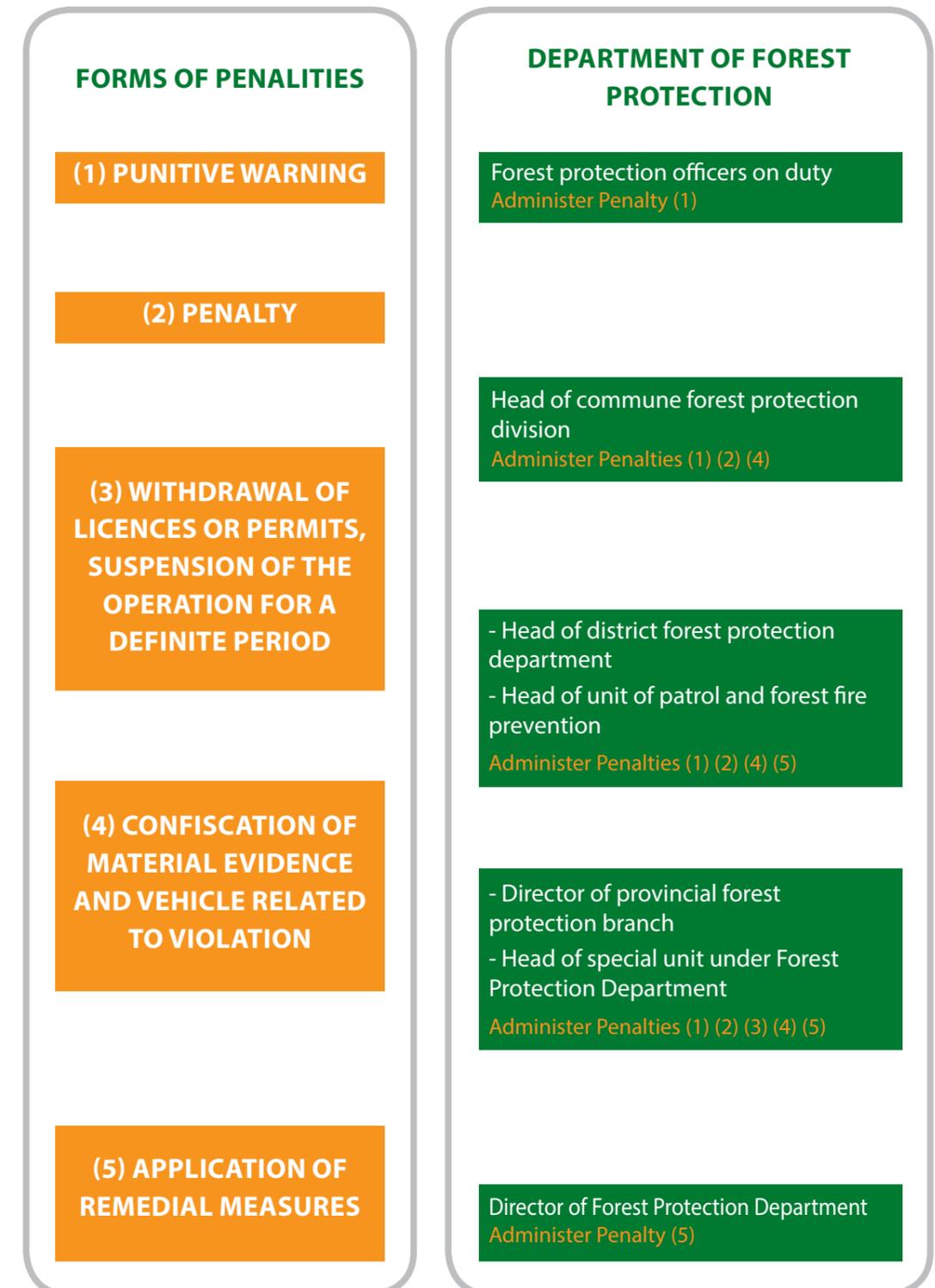
## How the General Department of Customs handles administrative violations

The most appropriate sanction and the right sanctioning authority to deliver it depends on the extent of the violation as detailed in Decree 127/2013/ND-CP.



## How the Department of Forest Protection handles administrative violations

The most appropriate sanction and the right sanctioning authority to deliver it depends on the extent of the violation as detailed in Decree 157/2013/ND-CP.



#### 4.8 Violations subject to criminal prosecution

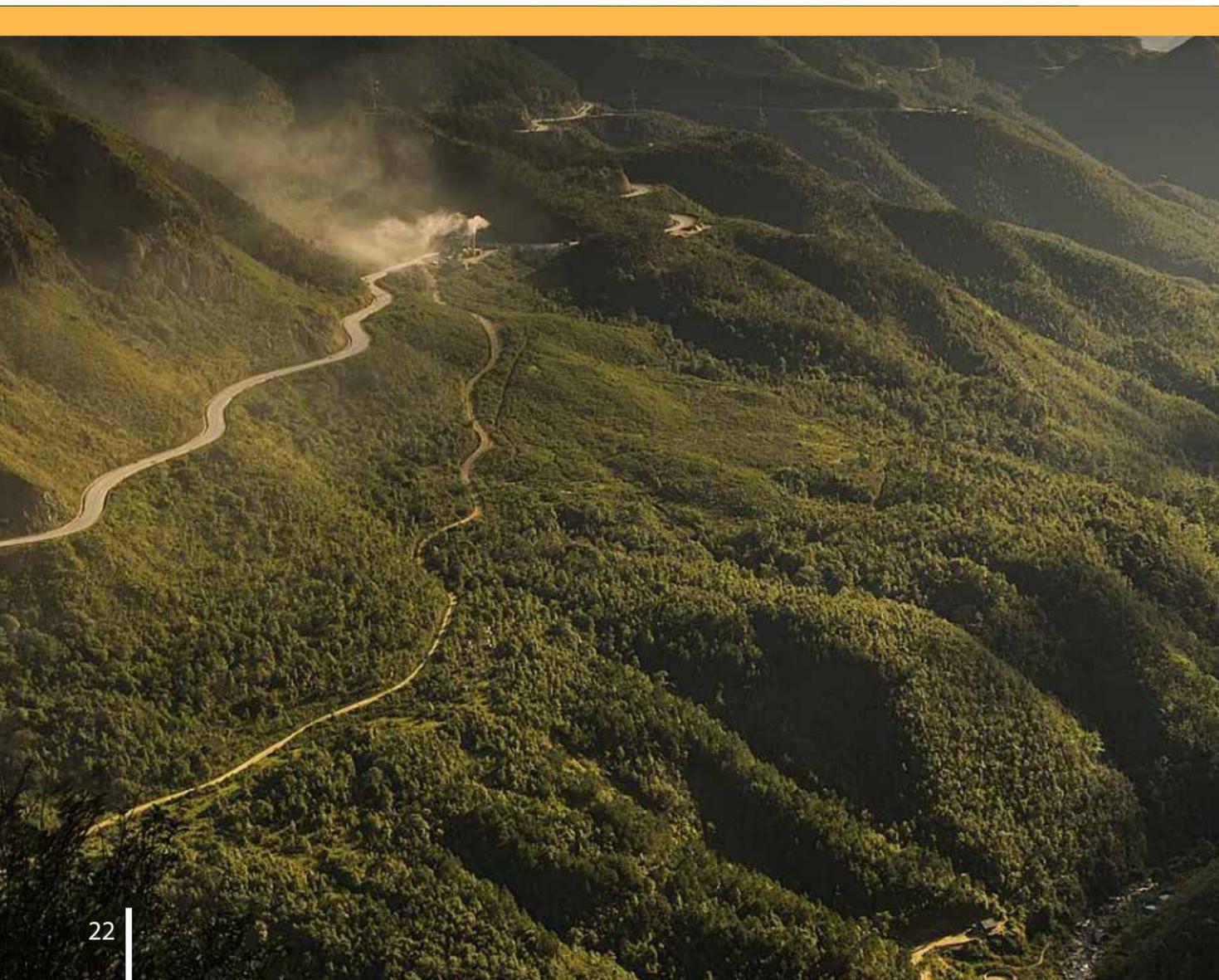
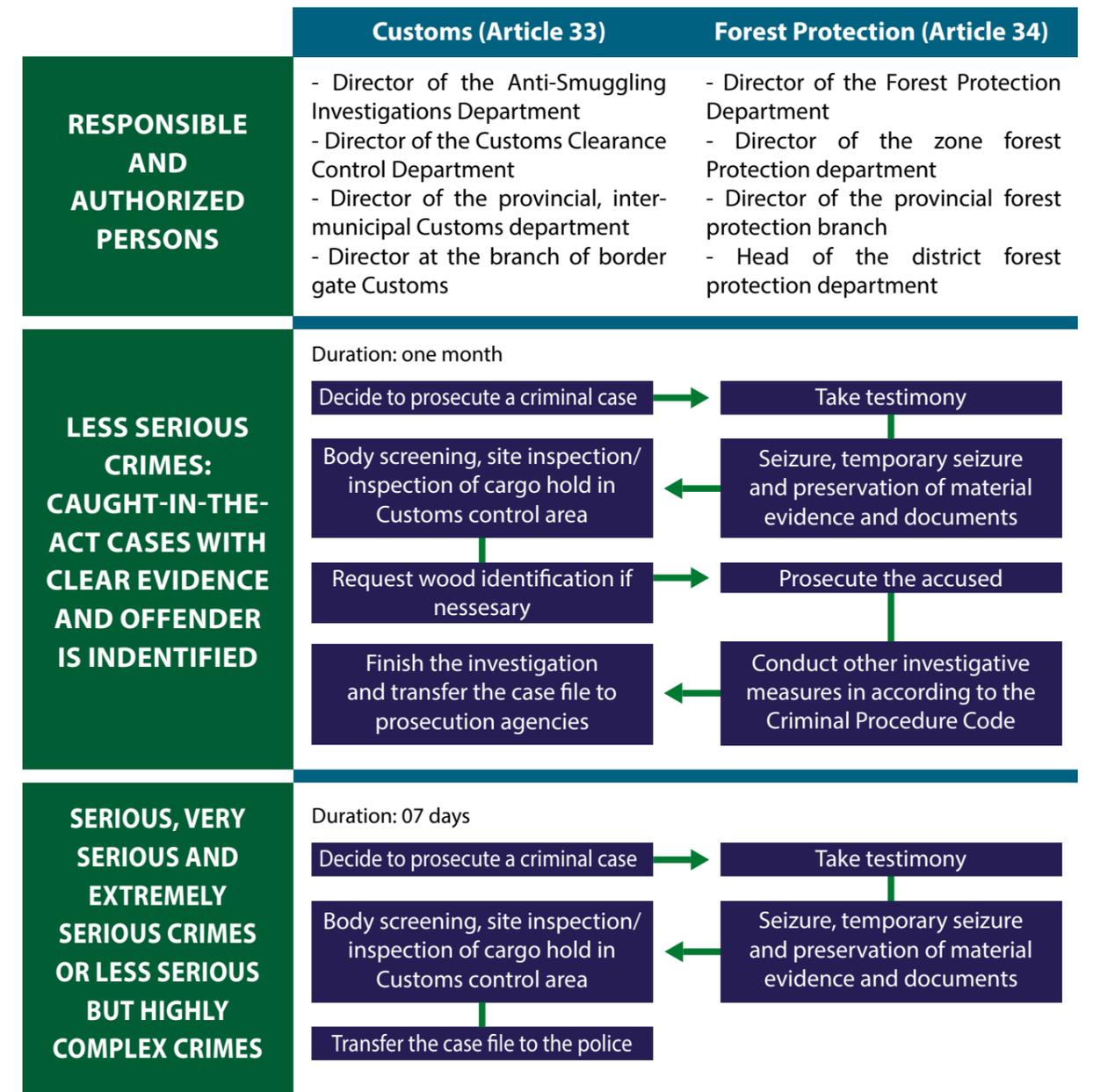
The following violations may be subject to criminal prosecution:

- Violations involving material evidence of a Group IA wood species which have consequences beyond the level of administrative punishment
- Illegal transportation or trade of timber that exceeds the maximum amount of administrative penalties
- Illegal exploitation, transportation, and trade of wood species of group IA, IIA, and ordinary timber when the maximum level of administrative sanctions for group IIA or ordinary timber has been exceeded.
- Violator has previously been administratively sanctioned and continues to commit the crime.



#### 4.9 Responsibilities of Customs and forest protection authorities in criminal investigations

Pursuant to the Law on the organization of a criminal investigation agency as issued on 26/11/2015





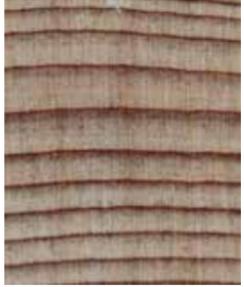
# 5 TIMBER IDENTIFICATION GUIDE

## 5.1 Definitions and terms used in wood identification

1	<b>CONIFEROUS WOOD/ SOFTWOOD</b>	Wood of gymnosperms or non-flowering plants. Most species have needle-shaped leaves. Gymnosperm species do not have vessels.
2	<b>BROAD-LEAVED WOOD/ HARDWOOD</b>	Wood of angiosperms or flowering plants. Angiosperm species always have vessels.
3	<b>UNIQUE FEATURES CAN BE OBSERVED ON THESE SECTIONS</b>	
4	<b>TRANSVERSE SURFACE</b>	The transverse or cross-sectional surface is a plane perpendicular to the wood grain or the axis of the trunk.
5	<b>TANGENTIAL SURFACE</b>	The surface parallel to the wood grain and on a tangent with the growth rings.
6	<b>RADIAL SURFACE</b>	The radial surface runs parallel to the stem and passes through the diameter or the wood ray.
7	<b>SAPWOOD AND HEARTWOOD</b>	On the transverse surface, the sapwood forms several outer growth rings with a lighter colour than the heartwood in the centre of the tree.
8	<b>ANNUAL RING</b>	The ring of wood formed each year of the tree's growth.

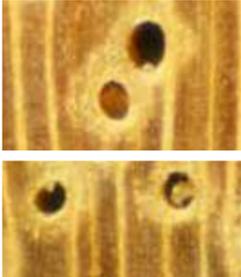
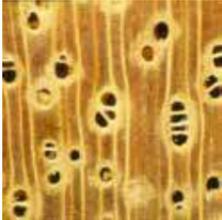
9	<b>GROWTH RING</b>	The wood ring formed in a growth period. The annual ring and the growth ring are sometimes the same but not always. In tropical regions, growth rings may not be an annual occurrence.
10	<b>GROWTH RING BOUNDARY</b>	Boundary between of two consecutive growth periods.
11	<b>WOOD COLOUR</b>	Colour of new air-dried sawn timber that can be observed by the naked eye in natural light.
12	<b>COLOUR STREAKS</b>	Dark streaks that create a pattern on the wood.  <i>Dark streaks on the tangential surface of Thailand rosewood (Dalbergia cochinchinensis)</i>
13	<b>ODOUR</b>	The smell of new air-dried sawn wood. Species in the genera <i>Cinnamomum</i> and <i>Cupressus</i> have distinct odours.
14	<b>WOOD GRAIN</b>	Wood grain is the pattern generated by the arrangement of the tree's cells. If the grain runs in one direction with few curls or waves and the wood is easy to split, it is called straight grain. If the wood is difficult to split because the grain is wavy, it is said to have an interlocked grain.
15	<b>WEIGHT AND HARDNESS</b>	When identifying wood, the officer may not have the equipment necessary to determine the wood's gravity. In that case, the officer can tap the wood with his/her fingernail. If the tapping leaves indentations, it is considered soft and light.

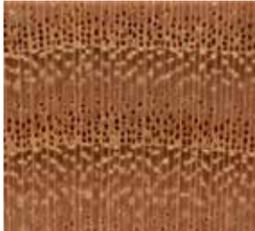
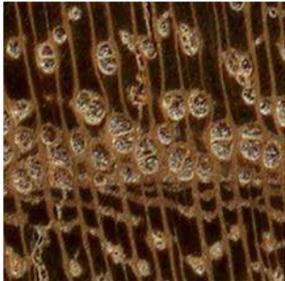


16	EARLYWOOD AND LATEWOOD	<p><b>Earlywood:</b> Earlywood appears at the beginning of the growing season and forms the light wood in each annual ring.</p> <p><b>Latewood:</b> Latewood forms at the later part of the growing season and forms the dark wood in each annual ring.</p>
17	TRANSITION FROM EARLYWOOD TO LATEWOOD	<p>In a growth ring, when the boundary between earlywood and latewood is very distinct, it is called an abrupt transition. When it is less clearly defined, it is called a gradual transition.</p> <div style="display: flex; justify-content: space-around; align-items: flex-end;"> <div style="text-align: center;">  <p><i>Abrupt transition - Chinese swamp cypress (G. pensilis)</i></p> </div> <div style="text-align: center;">  <p><i>Gradual transition Fujian cypress (F. hodginsii)</i></p> </div> <div style="text-align: center;">  <p><i>Transition abrupt and gradual Taiwan cunninghamia (C.konishii)</i></p> </div> </div>
18	AXIAL INTERCELLULAR (RESIN) CANAL	Resin canals are ducts that run along the trunks of conifers. They bordered by cells that secrete resin to seal up wounds.
19	GRAIN CONTRAST	Grain contrast refers to the difference in colour between the earlywood and the latewood. If the difference is very pronounced, the grain contrast is high. If the colours are similar, the grain contrast is low. Grain contrast only occurs on conifers.

20	AXIAL PARENCHYMA	<p>Axial parenchyma cells store nutrients in trees. They are generally greater help in identifying hardwoods than softwoods. Axial parenchyma can be observed with a magnifying glass because they contain a coloured deposit, usually reddish-brown.</p> <p>When parenchyma cells are scattered throughout the wood's surface in little to no apparent order, they are called <b>diffuse parenchyma</b>.</p> <p>When the parenchyma cells are arranged in a ring or line that runs parallel to the growth rings, they are called <b>zonate parenchyma</b>.</p> <div style="display: flex; align-items: center;">   <div style="margin-left: 10px;"> <p><i>Left: Diffuse parenchyma in growth ring zone Vietnamese golden cypress (X. Vietnamensis)</i></p> <p><i>Right: Zonate parenchyma in a ring parallel to the growth rings Fujian cypress (F. hodginsii)</i></p> </div> </div>
21	VESSELS AND PORES	<p><b>Vessel:</b> An organization of many tubular cells successively into longitudinal tubules.</p> <p><b>Pore:</b> Round, oval, or polygonal hole at the cross section of the vessel shown on the transverse surface.</p>
22	SMALL PORES	Pores that are difficult to see clearly with the naked eye.
23	RING-POROUS WOOD	In an annual ring, the earlywood pore is much wider and forms clear, wide rings or bands along the earlywood zone.
24	DIFFUSE-POROUS WOOD	There is no difference in the size of pores in earlywood and latewood.

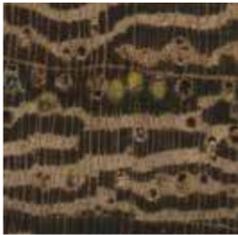


<p>25</p> <p><b>SEMI-RING-POROUS WOOD</b></p>	<p>The pores in the earlywood are larger than the pores in the latewood but the decrease is gradual and the pores do not form clear rings.</p>  <p><i>Ring-porous European Ash (Fraxinus excelsior)</i></p>  <p><i>Diffuse-porous Dinh (Markhamia stipulata)</i></p>  <p><i>Semi-ring-porous Butternut (Juglans cinerea)</i></p>
<p>26</p> <p><b>SOLITARY PORES</b></p>	<p>On the transverse surface, pores generally occur as single, solitary openings.</p>
<p>27</p> <p><b>EXCLUSIVELY SOLITARY PORES</b></p>	<p>When 90% or more of the pores in a wood sample are solitary.</p>
<p>28</p> <p><b>PORES IN SHORT MULTIPLES</b></p>	<p>Two or three adjacent pores sharing a middle wall. On the transverse surface, multiple pores are similar to solitary pores with several segments arranged radially.</p>
<p>29</p> <p><b>PORES IN LONG RADIAL MULTIPLES</b></p>	<p>A chain of four or more pores.</p>  <p><i>Solitary pores</i></p>  <p><i>Multiple pores</i></p>  <p><i>Solitary pores and short multiple pores Lim xanh (E. fordii)</i></p>

<p>30</p>	<p><b>PORES IN DIAGONAL AND/OR RADIAL PATTERNS</b></p>
<p>31</p>	<p><b>PORES IN TANGENTIAL OR/AND WAVY BANDS</b></p>
<p>32</p> <p><b>PORES CLUSTERS</b></p>	<p>Pores are bordered by other pores on both the vertical (radial) and horizontal (tangential) sides.</p>  <p><i>Pores in diagonal and/or radial pattern Jarrah (Eucalyptus marginata)</i></p>  <p><i>Pores in tangential and/or wavy bands Elm (Ulmus spp.)</i></p>  <p><i>Pores clusters Coffee tree (Coffea spp.)</i></p>
<p>33</p>	<p><b>PORES OF TWO DISTINCT DIAMETER CLASSES, WOOD NOT RING-POROUS</b></p>
<p>34</p> <p><b>TYLOSES</b></p>	<p>Tyloses are bubble-like structures that grow into open pores, and in some cases, completely stop-up the pores of the heartwood.</p>  <p><i>Tyloses (left) Black Locust (Robinia pseudoacacia)</i></p>



**35 DEPOSITS IN HEARTWOOD PORES**



Pores are filled with coloured gums, resins, or other deposits, which are commonly white, yellow, reddish-brown, or black.

*Deposit (yellow) (right) Panga Panga (Millettia stuhlmannii)*

**36 PARENCHYMA** Axial parenchyma

**37 VASICENTRIC PARATRACHEAL PARENCHYMA**



The paratracheal parenchyma forms a ring or circle of cells surrounding the pore.

*Vasicentric paratracheal parenchyma Koa (Acacia koa)*

**38 LOZENGE-ALIFORM PARENCHYMA**



The paratracheal parenchyma surrounding the pore takes on a diamond or elongated oval shape.

*Lozenge-aliform parenchyma Merbau (Intsia bijuga)*

**39 ALIFORM PARENCHYMA** Vasicentric paratracheal parenchyma with short appendages of parenchyma extending from one or both sides of the pore.

**40 WINGED-ALIFORM PARENCHYMA**



Vasicentric paratracheal parenchyma with wings of parenchyma extending from one or both sides of the pore.

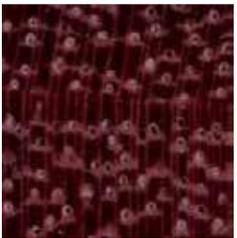
*Parenchyma winged-aliform and confluent Ramin (Gonystylus spp.)*

**41 CONFLUENT PARATRACHEAL PARENCHYMA**

When parenchyma extends outward and makes contact with the parenchyma from neighbouring pores.

**42 UNILATERAL PARENCHYMA**

The parenchyma covers only one side of the pore in a semi-circular fashion.

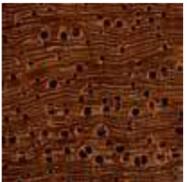



*Parenchyma confluent (left) Marblewood (Zygia racemose)*

*Unilateral parenchyma (right) Purpleheart (Peltogyne spp.)*

**43 CONFLUENT TANGENTIAL PARENCHYMA BAND**

**44 DISCONTINUOUS TANGENTIAL PARENCHYMA BAND**



*Parenchyma bands Narra (Pterocarpus indicus)*

**45 SCALARIFORM PARENCHYMA**

The parenchyma occurs in slightly narrower intervals than the rays, appearing like rungs on a ladder.

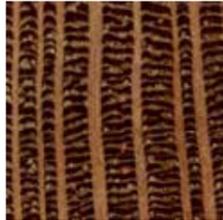
**46 RETICULATE PARENCHYMA**

Both the parenchyma and rays occur in thin, closely spaced bands forming a net or grid-like pattern.

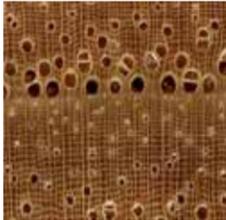


47 **PARENCHYMA IN MARGINAL OR IN SEEMINGLY MARGINAL BANDS**

Banded parenchyma occurs along the growth ring boundary. Parenchyma bands can act as growth ring indicators in some diffuse-porous woods where the annual growth boundaries would be otherwise indistinguishable.



Scalariform parenchyma  
Leopardwood  
(*Flindersia maculosa*)



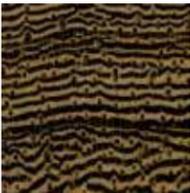
Reticulate Parenchyma  
Bitternut Hickory  
(*Carya cordiformis*)



Parenchyma in marginal bands  
Ovangkol (*Guibourtia ehie*)

48 **PARENCHYMA BAND LARGER THAN RAY**

49 **PARENCHYMA BAND LARGER THAN PORES**



Parenchyma band larger than pores  
Pheasantwood (*Senna siamea*)

50 **RAY**

The organization of cells that channels nutrients between the pith, the sapwood and the cambium. On the transverse surface, rays appear as more-or-less straight, evenly spaced radial (vertical) lines.

51 **STORED RAYS**

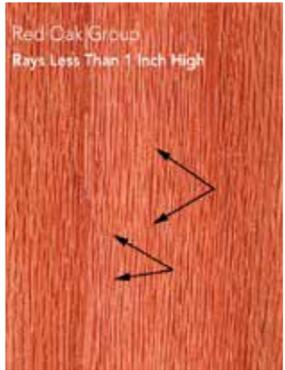
On the tangential surface, the rays tend to be aligned in horizontal or diagonal tiers.

52 **RAY'S OF DISTINCT SIZES**

On the tangential surface, there is a distinct difference in the width and height of the rays.



Stored ray (left) Lim Xanh  
(*Erythrophloeum fordii*)



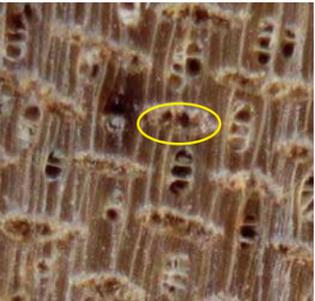
Rays in different sizes (right)  
Red oak (*Quercus rubra*)

53 **WIDTH OF RAY LARGER THAN VESSEL LUMINA**

54 **COLOUR OF RAY SIMILAR TO WOOD COLOUR**

55 **INCLUDED PHLOEM**

The cells of the phloem fall in short tangential bands. This feature is particularly pronounced in Tram *Aquilaria crassna*.





## 5.2 Description Form

- The description form is used to compare the structural features of the wood sample and those mentioned in the guide.
- Column A shows the sequence number of the characteristic described in Section 3.2. for reference as needed.
- Column B is used to mark the features observed on the wood sample.

### SOFTWOOD DESCRIPTION FORM

#	DESCRIPTION	A	B
1	Sapwood colour distinct from heartwood colour	7	
2	Growth ring distinct	8, 9	
3	Heartwood yellow, light	11	
4	Heartwood brown - reddish		
5	Heartwood gray - dark		
6	Odour of wood distinct	13	
7	Wood light and soft	15	
8	Transition from earlywood to latewood abrupt	17	
9	Transition from earlywood to latewood gradual		
10	Axial resin canals present	18	
11	Grain contrast	19	
12	Axial parenchyma diffuse	20	
13	Axial parenchyma arranged in a ring parallel to the growth rings		

#### Notes:

Column A: Number of term or definition for reference

Column B: To mark if this feature is observed on wood sample

### HARDWOOD DESCRIPTION FORM

#	DESCRIPTION	A	B	#	DESCRIPTION	A	B	
<b>GENERAL FEATURES</b>				23	White deposits in heartwood pores	35		
1	Distinct heartwood and sapwood by colour	7		24	Coloured deposits in heart wood pores			
2	Growth ring distinct	8 & 9		<b>AXIAL PARENCHYMA</b>				
3	Heartwood light, yellow	11		25	Paratracheal parenchyma vasicentric	37		
4	Heartwood pink-brown, red-brown				26	Parenchyma lozenge-aliform	38	
5	Heartwood gray, dark, black				27	Parenchyma aliform	39	
6	Wood with colour streaks	12		28	Parenchyma winged- aliform	40		
7	Wood with distinct odour	13		29	Paratracheal parenchyma vasicentric confl.	41		
8	Wood grain interlocked	14		30	Unilateral parenchyma	42		
9	Wood heavy and hard	15		31	Tangential parenchyma band confluent	43		
<b>PORES</b>				32	Parenchyma in discontinuous band	44		
10	Small porous lumina	22		33	Parenchyma scalariform	45		
11	Wood ring-porous	23		34	Parenchyma reticulate	46		
12	Wood-diffuse-porous	24		35	Parenchyma in marginal	47		
13	Wood-semi-ring-porous	24		36	Parenchyma reticulate	48		
14	Solitary pores	26		37	Parenchyma band larger than pore lumina	49		
15	Exclusively solitary pores	27		<b>RAYs</b>				
16	Pores in short multiples	28		38	Stored rays	51		
17	Pores in radial long multiples	29		39	Rays of diffent distinct sizes	52		
18	Pores arrangment in diagonal / radial pattern	30		40	Ray width larger or similar to pore lumina	53		
19	Pores in wavy tangential bands	31		41	Ray colour similar to wood colour	54		
20	Pores in cluster	32		<b>OTHER FEATURE</b>				
21	Pores with 2 different sizes, but not ringporous	33		42	Include phloem	55		
22	Tyloses present	34						

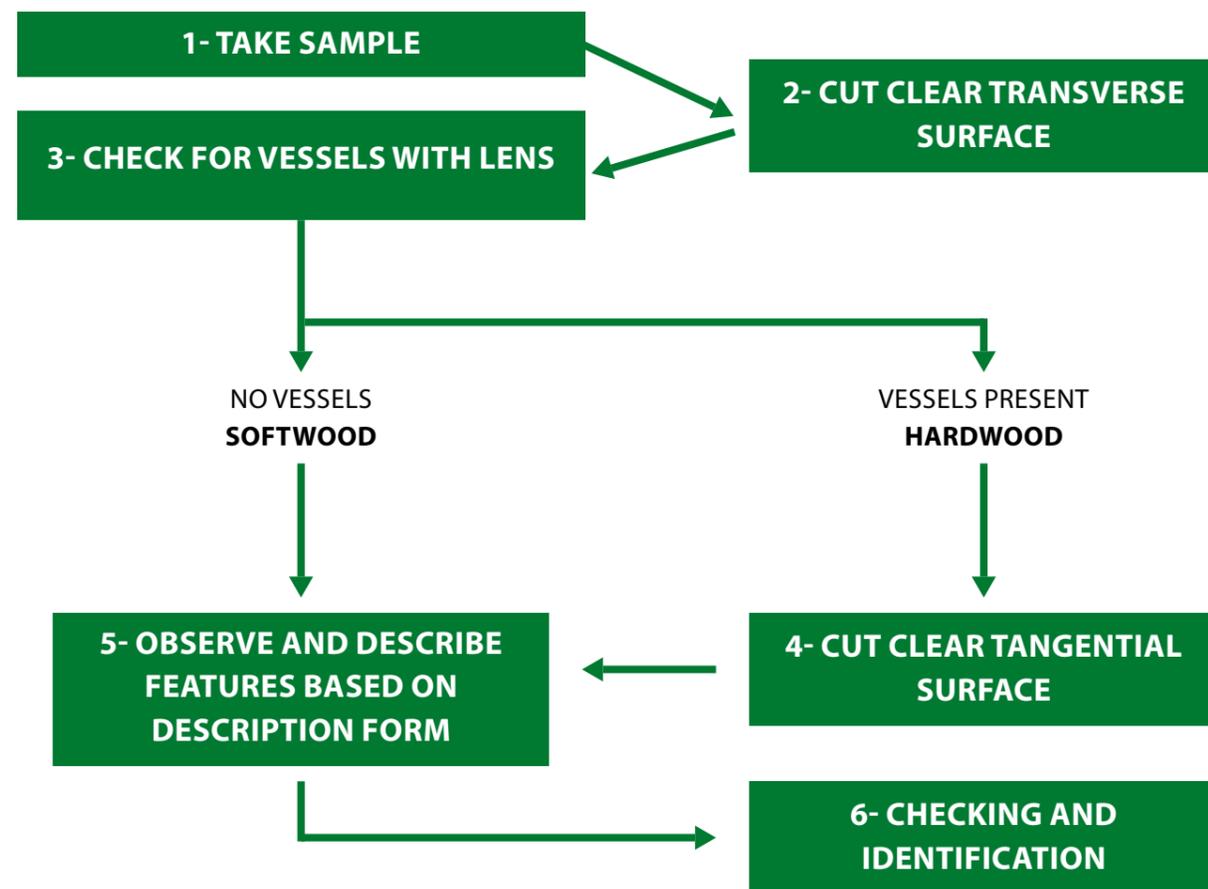
#### Notes:

Column A: Number of term or definition for reference

Column B: To mark if this feature is observed on wood sample



### 5.3 Sampling and identification process



1

### SAMPLING

- 1) Sample in clean unblemished location. Do not sample in compromised locations, e.g where wood has been scratched, dented, or disturbed by termites.
- 2) Make sample size of the transverse service as large as possible. Aim for 5 cm x 5 cm and 5-10 cm in length.
- 3) Take samples from different locations in the timber and from different logs and boards if possible.
- 4) Ensure the sample is not crushed.
- 5) Make sure to collect sapwood if it is present.
- 6) Enter the code number on the sample or sample package.

#### Attention:

Record all pertinent details, such as the wood odour, the presence of sapwood and heartwood, oil flecks on the cross section of logs, or whether the sapwood has been cut off.

Some wood species have a characteristic odour, such as Fujian cypress *Fokienia hodginsii*, Chinese incense-cedar *Calocedrus macrolepis*, Martaban camphor wood *Cinnamomum parthenoxylon*, Burma padauk *Pterocarpus macrocarpus*, and Sua *Dalbergia tonkinensis*. If you are familiar with the odour, you can skip the examination with the identification key and just compare it with the wood description sheet.



<p>2</p> <p><b>CUT TRANSVERSE SURFACES</b></p>	<p>1) Use a handsaw to trim two planes perpendicular to the grain at two ends of a sample.</p> <p>2) Use a sharp knife to trim a smooth, flat surface on the cross planes of the sample.</p> <p><b>Attention:</b></p> <p>Be careful when cutting with a sharp knife!</p>
<p>3</p> <p><b>OBSERVE AND VERIFY THE PRESENCE OF VESSELS</b></p>	<p>If no vessels ---&gt; <b>STEP 5.</b></p>
<p>4</p> <p><b>CUT TANGENTIAL SURFACES</b></p>	<p>If no tangential surface is present, it should be made using a knife in longitudinal direction along the tangent line to the growth ring.</p> <p>Use a sharp knife to trim several surfaces for observation.</p>
<p>5</p> <p><b>OBSERVE AND DESCRIBE BASED ON DESCRIPTION FORM</b></p>	<p>1) Use the correct description form for softwood or hardwood.</p> <p>2) Observe the sample in sufficient lighting conditions, preferably under natural light.</p> <p>3) First observe with the naked eye, then with the lens.</p> <p>4) Observe the features of the sample in the order they are printed on the description form. Mark on the description form which features are apparent.</p> <p><b>Attention:</b></p> <p>Wet samples are usually difficult to make observations from, so wait for the sample to dry.</p> <p>Sometimes it is necessary to sweep water on the viewing surface to make it easier to observe parenchyma or rays.</p> <p>When you need to check the odour of wood, cut tangentially.</p>

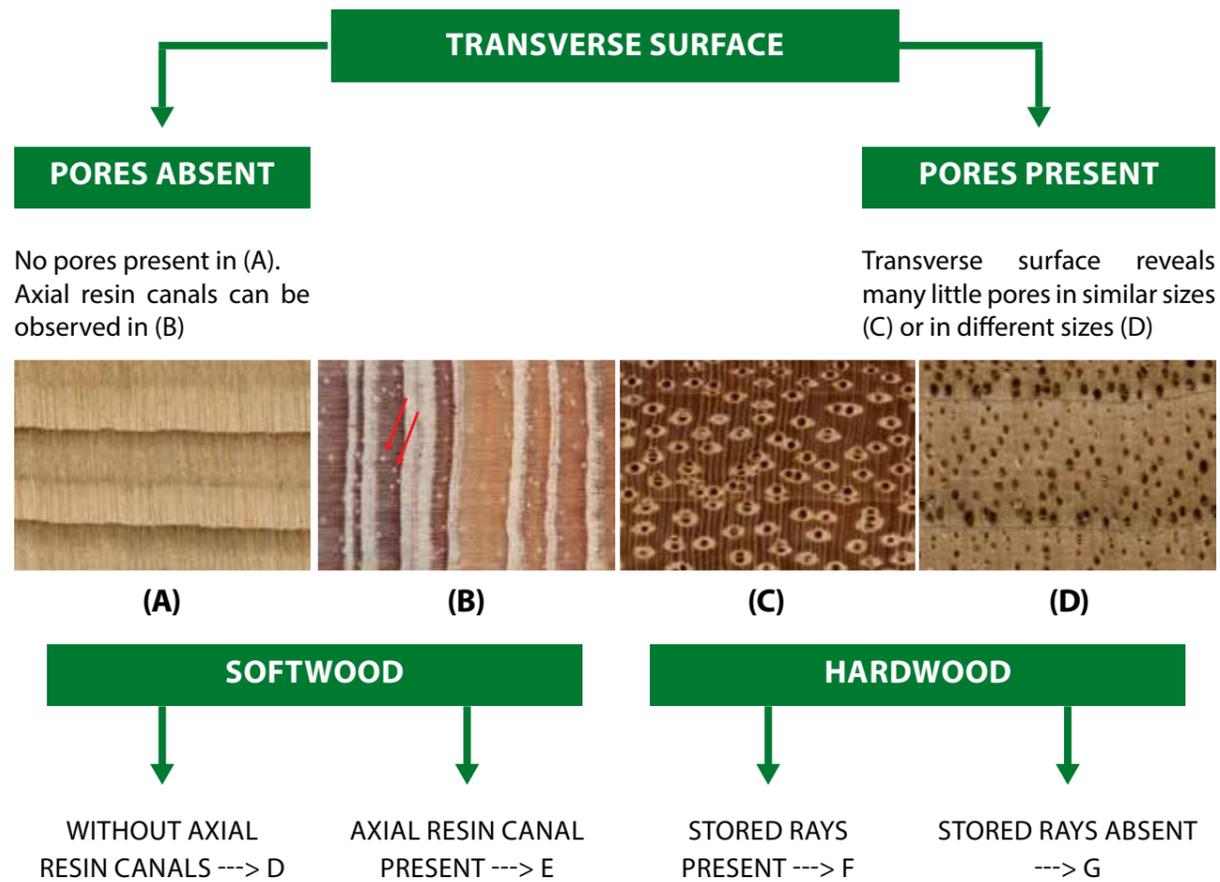
<p>6</p> <p><b>CHECKING AND IDENTIFICATION</b></p>	<p>1) Use the identification key to determine the species.</p> <p>2) Collate results with description form.</p> <p>3) Check any suspicious features on the sample.</p> <p><b>Attention:</b></p> <p>Sampling from wood products is often difficult or impossible, as sampling affects the quality and value of the product. When it is only possible to take small samples, it is necessary to take as many samples from as many parts of the product as possible.</p> <p>Sampling often requires the use of a sharp square point knife. If sampling is not possible, cut a transverse and a tangential surface to help identify the wood. Take a snapshot of the wood for observation as necessary.</p>
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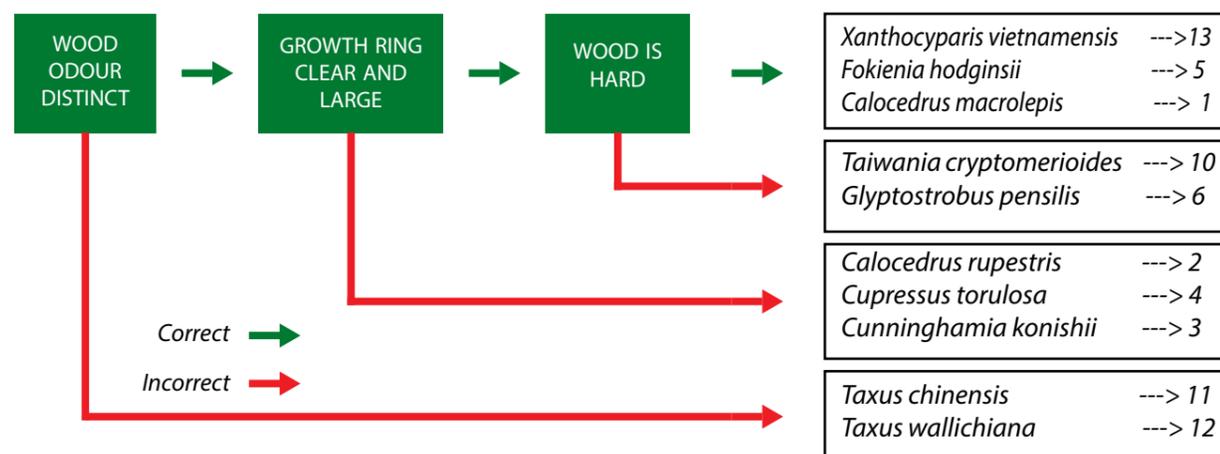
## 5.4 IDENTIFICATION KEY

Note that the number listed with the species refers to its page on the Identification Field Guide included in the toolkit.

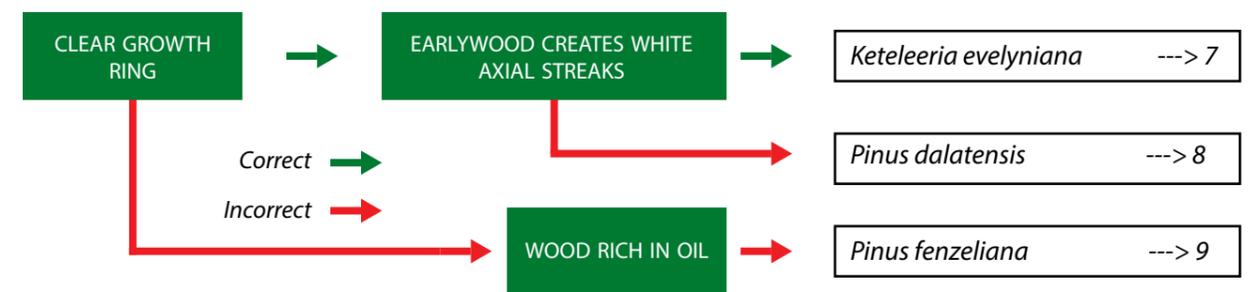
### Identification key to distinguish between hardwood and softwood



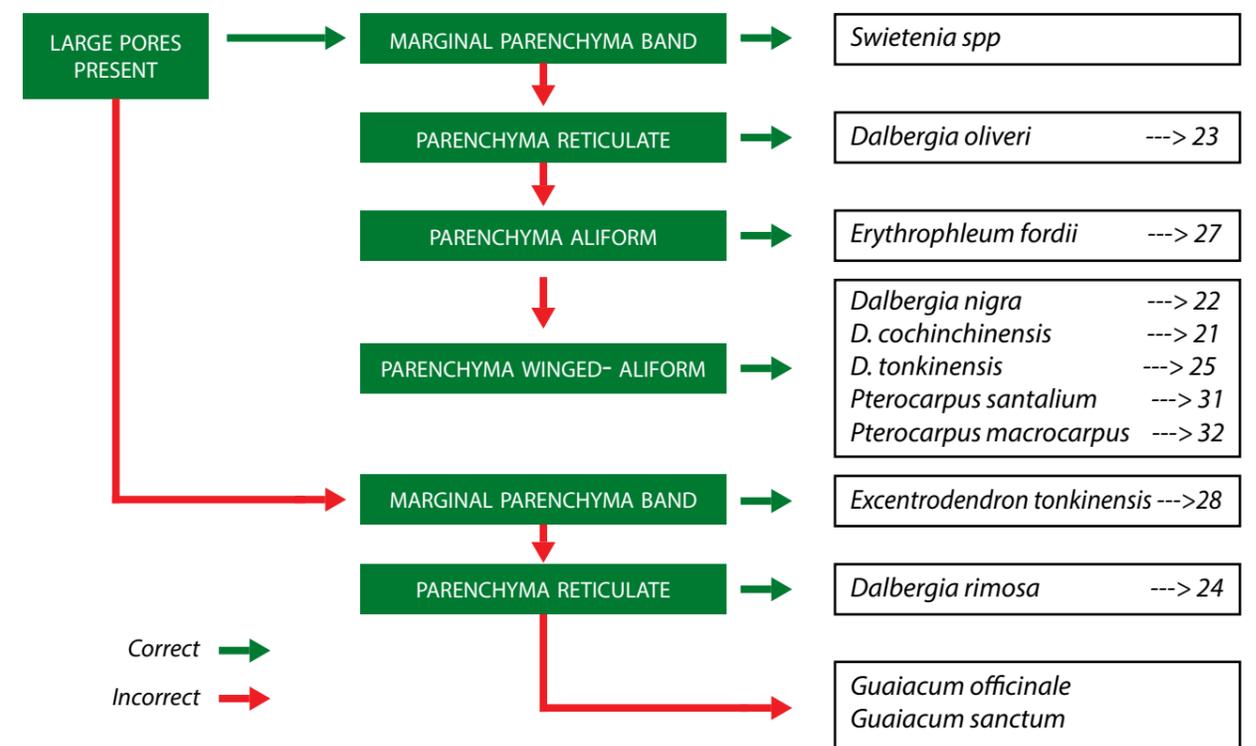
### Identification key for softwood without axial resin canals



### Identification key for softwood with axial resin canals

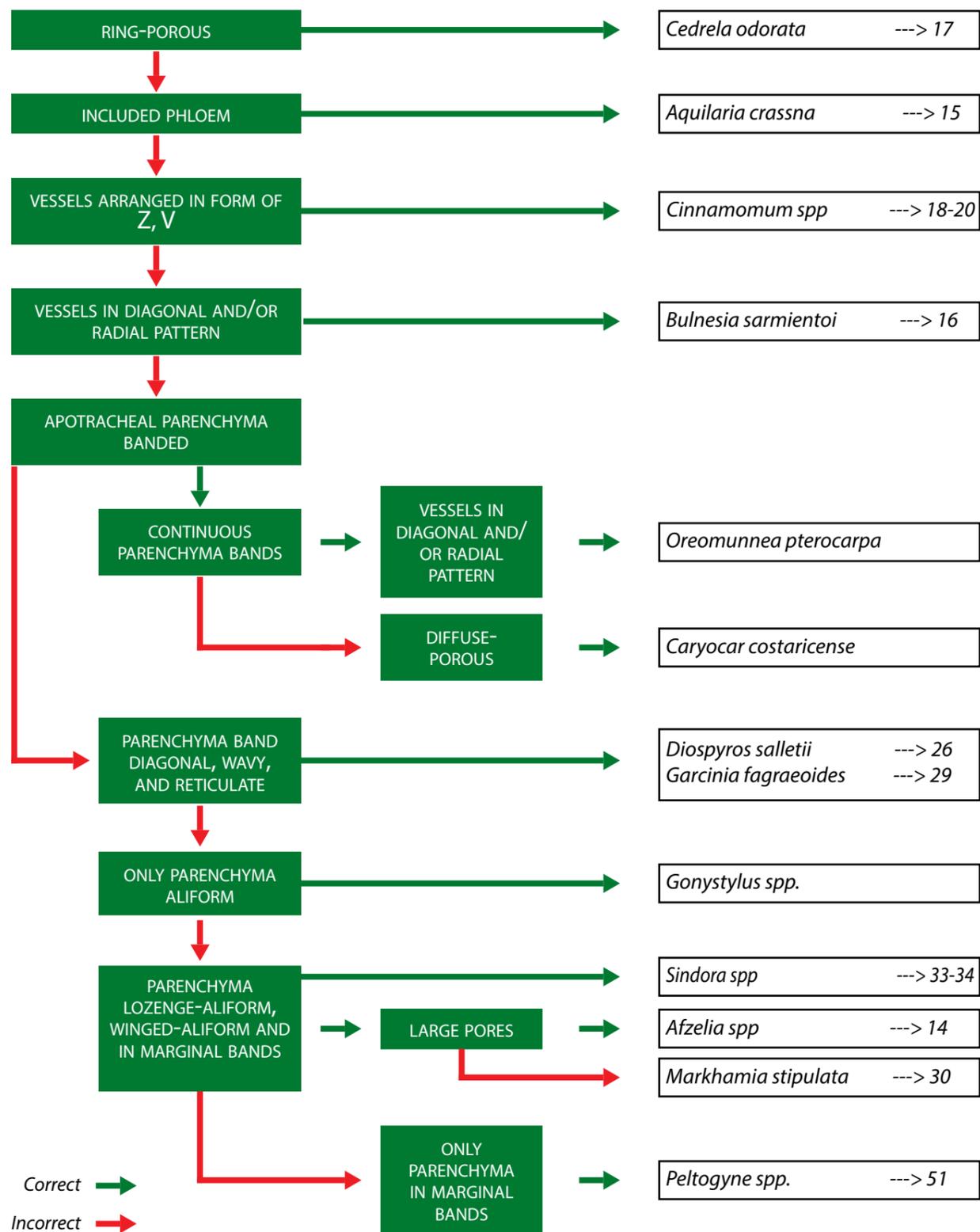


### Identification key for hardwood with stored rays





### Identification key for hardwood without stored rays



### 5.5 How to use the Identification Field Guide

Each description sheet contains basic information about the wood species:

- Information on plant taxonomy: Vietnamese species name, common name, scientific name, wood type (softwood or hardwood)
- Information on conservation status: Group IA or IIA under Decree 32/2006; CI (Appendix I) or CII (Annex II) or CIII (Appendix III) of CITES;
- Information about wood anatomy, including images of the transverse and tangential sections emphasizing important characteristics.
- Numbers corresponding to the anatomical features of the wood are listed at the bottom for computer searches.
- A description form is used to identify the wood species and can also be employed as a learning material with which to practice wood identification.

Vietnamese name of wood species		Scientific name of wood species		Wood group according to conservation status		Plant branch: SW = Softwood; HW = Hardwood	
Cam lai		<i>Dalbergia oliveri</i> Prain		IIA		HW	
Plant family: Fabaceae							
Common names: Burmese Rosewood							
Distribution: Vietnam, Myanmar, Thailand, Cambodia, Laos							
Trade product: Round timber, Sawn timber, Furniture							
Picture of cross surface				ANATOMICAL FEATURES : Sapwood and heartwood distinct (1); Wood pink brown, reddish brown (4); Streaks present (6); Grain interlocked (8); Wood heavy, hard (9); Diffuse-porous (12); Solitary pores (14); Short multiples porous (16); Colored deposits (24); PAR vasicentric (25); PAR winged- aliform (28); Tang. PAR band confluent (31); PAR reticulate (34); Stored rays (38);			
Picture of tangential surface				OTHER FEATURE: Sapwood is used			
				SIMILAR SPECIES:			
				-1-4-6-8-9-12-14-16-24-28-25-31-34-38-			
Anatomical feature codes							



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## Websites:

- <http://delta-intkey.com/>
- <http://delta-intkey.com/citesw/en/>
- <http://www.wood-database.com/> (source of some descriptions and photos)



**This Handling Reference Guide is part of the  
Timber Identification and Handling Toolkit and was developed by  
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